Model 2020
ProBalancer Analyzer
User Manual

ACES Systems/TEC Aviation Division

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Contact ACES Systems

General

For general information regarding ACES Systems products and services, contact one of the international representatives listed at: http://www.acessystems.com/worldreps.htm.

Technical Support

For technical support please use the contact information found at: http://www.acessystems.com/contact.htm. If you require assistance with an operational problem with the analyzer, please have as much detailed information as possible available before contacting ACES Systems. The support staff will answer questions about the operation and care of your equipment, assist you in troubleshooting a problem, and help you overcome common application difficulties whenever possible. If it becomes necessary for your equipment to be returned to us for any reason, you will be issued a return number during the technical support contact.

Feedback

ACES Systems depends on information from our customers to continue the attributes of quality, dependability and simplicity associated with our products. We invite you to contact our Technical Support office using the information found at: http://www.acessystems.com/contact.htm.

Warranty

The ACES Systems' Model 2020 ProBalancer Analyzer 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 analyzer 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). The original manufacturer may cover individual accessories not manufactured or assembled by TEC 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 re-validate your warranty. Warranty is limited to supplying Purchaser with replacement or repair of any unit or accessory item 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 cost to the factory will be borne by the Purchaser. Warranty shall not apply to any product that, in the judgment 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 cost 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. Warranty is expressly in lieu of any and all other warranties or representations, expressed or implied, and of any obligations or liabilities of TEC to the Purchaser arising from the use of said products, and no agreement or understanding varying or extending the same will be binding upon TEC unless in writing, signed by an authorized representative of TEC. TEC reserves the right to make changes in design or additions to, or improvements in, products at any time without imposing any liability on itself to install the same in any product manufactured or supplied prior thereto.

Calibration and Certification

Your ACES Systems equipment is calibrated and certified effective the date of shipment. TEC requires the unit to be calibrated by TEC or a TEC authorized service 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) are also required 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. A permanent record of your calibration is maintained by TEC. For information about calibration services please visit:
http://www.acessystems.com/returnprocess.htm and/or
http://www.acessystems.com/servicecenters.htm.

NOTE
The annual calibration is required in order to comply with the terms of the 5-year warranty. See “Warranty” in this section for details.

Chapter 1
Introduction

(Revision 3, August 2012)

The ACES Systems' Model 2020 ProBalancer Analyzer is a versatile analyzer that automates the task of propeller balance, provides automated rotor track and balancing adjustments or provides raw data for use with polar charts, and performs vibration surveys.

Engine, airframe, propeller, or rotor-specific setups can be loaded and stored into the analyzer by the user, then recalled to automatically configure the analyzer for the task at hand. These "Setups" store influence coefficients, which the analyzer updates with each use to minimize the number of required runs for balancing propellers or rotors.

The analyzer is capable of true, two-channel simultaneous data acquisition and provides full graphic-spectrum capabilities.

The Model 2020 ProBalancer Analyzer allows you to print spectra and balance jobs directly to a serial printer, and with the use of a serial-to-parallel converter, to a parallel printer for inclusion in aircraft records or as file copies. Survey spectra and balance reports can also be transferred directly to a personal computer for storage, trending, or manipulation for inspection or troubleshooting purposes.

Overall, the analyzer is designed as a lightweight, portable unit with accuracy and ease of use as primary design goals.

The subsequent chapters of this manual explain the functions and features of the analyzer, supporting information, and troubleshooting. The instructions found in this manual will cover the operation of the Model 2020, Model 2020 TURBO, and Model 2020 HR. Where there is a difference in operation or function, the Model applicability will be identified in parentheses following the text.

The remainder of this chapter presents tips on effectively using the manual.

1.1 - 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 that if not heeded, may result in the damage or faulty operation of equipment.

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

1.2 - Conventions

The following are writing conventions used throughout the manual to describe certain concepts.

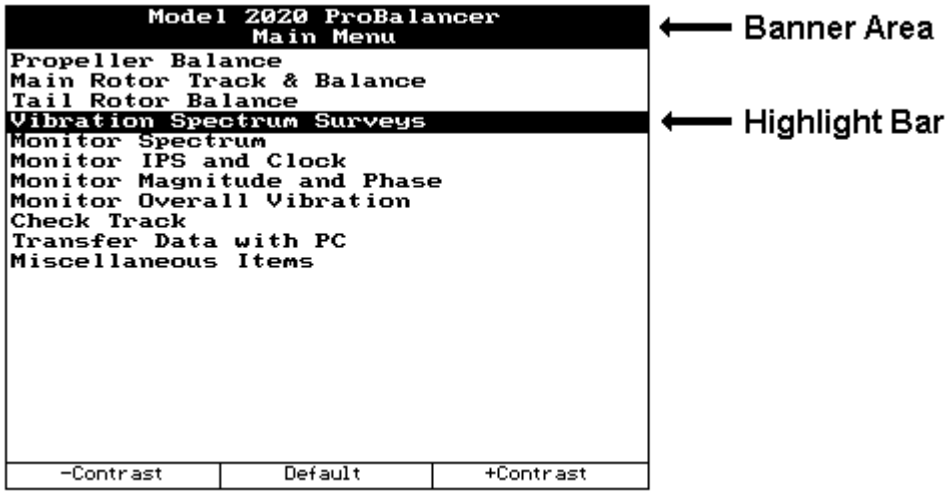
1. This manual indicates keys/keystrokes in square brackets. For example: [ENTER], [CLR], [5], [F1].

2. The term “select,” as used in this manual, means to highlight the item on the current menu by using the arrow keys [⇓] [⇑] [⇐] [⇒], then press the [ENTER] key.

3. The term “Setup,” as used in this manual, means the complete set of information entered into the analyzer and electronically stored in the analyzer’s memory for the purpose of completing a balance, vibration analysis, or track function. This stored information may then be recalled from a “Setup” menu presented for the various functions to rapidly configure the analyzer based on the information contained in the “Setup”.

4. The term “Job,” as used in this manual, means the stored “Setup” information plus the collected balance, vibration, track, and/or spectral data, and recorded corrective action taken (if applicable) to correct an undesirable condition. In other words, it is a record of the analyzer configuration, acquired data, computed data, and user entered data used in the course of completing the maintenance task.

5. The “Banner” is the uppermost portion of the screen display, which defines its relationship to the currently-running analyzer function. The “Highlight Bar” is the darkened bar (controlled by the use of the arrow keys, [⇓] and [⇑]) used to identify and select the current menu item. (See figure below.) These screens and their selection options are referred to as “banner screen menus” throughout the text of this manual.



6. The term “field” as used in this manual refers to an area that requires input. Fields appear on various screens as areas delineated by boxes with either pointed ends (< >) or square ends ([ ]). Data is entered into the data field ([ ]) by using the keypad to type data. Data is entered in the “Toggle” field (< >) by using the [⇒] [⇐] keys to “toggle” or move among the selections that are preset for the field.

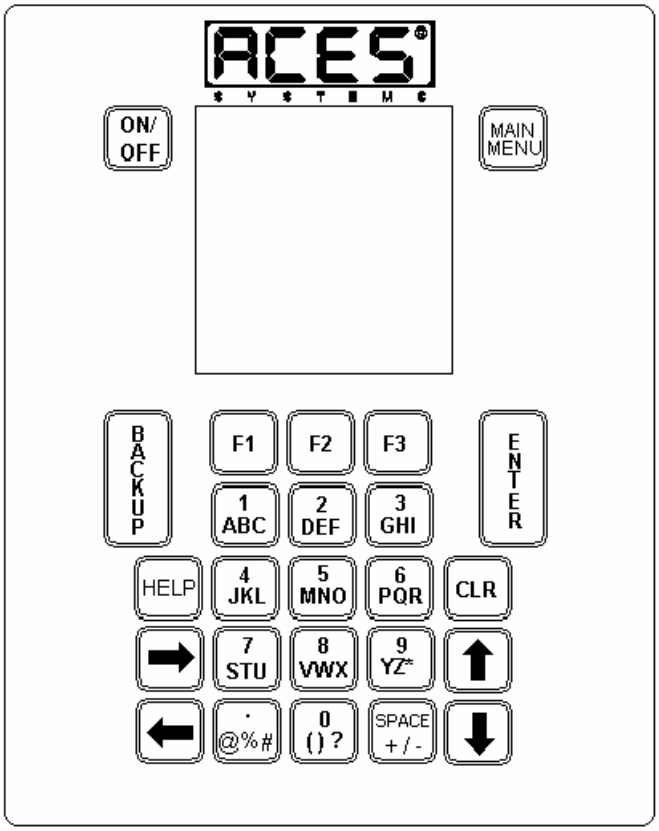
7. The term “Tracker,” as used in this manual refers to the ACES Systems’ Model 540, the Model 540-2 Optical Tracker, or the Model 550 TraX™.

8. The screen captures used in this manual have been taken from the 2020 HR for clarity.

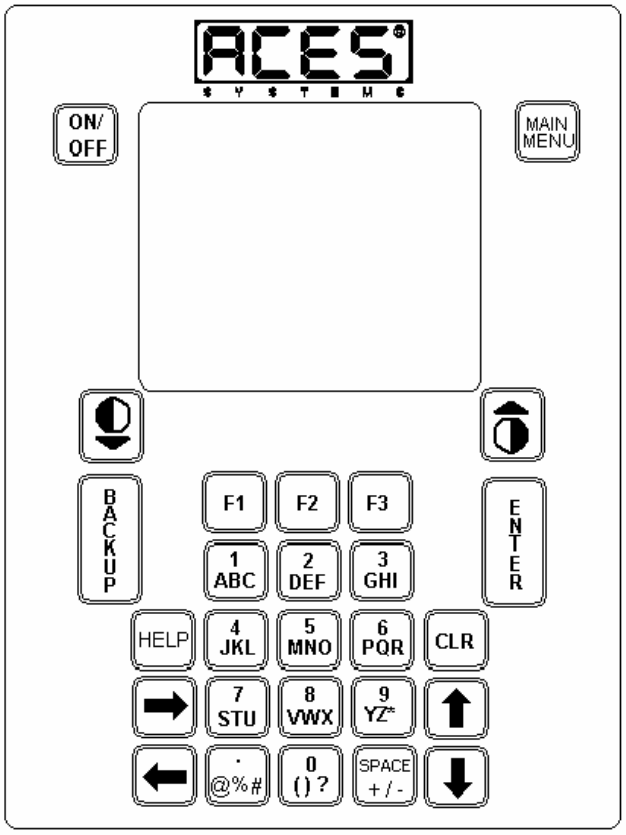
Chapter 2
Analyzer Description

(Revision 3, April 2006)

This chapter gives you a brief tour of the analyzer. It describes the various keys and their functions, the input and output ports, and the standard accessories supplied with the analyzer. Optional accessories are discussed later in the chapter in Section 2.5, Optional Equipment.



Model 2020 and
Model 2020 TURBO



Model 2020 HR

2.1 - Keypad

The Model 2020 and Model 2020 TURBO analyzer keypad consists of 25 function keys. The Model 2020 HR analyzer keypad consists of 27 function keys. (See Chapter 3, "Using the Model 2020 ProBalancer Analyzer" for keypad operation.)

Located at the top left of the analyzer keypad, the [ON/OFF] key, when pressed once and released, turns the analyzer power on or off. The analyzer incorporates a power conservation function. If no activity (keystroke) occurs within ten minutes following the [ON] keystroke, the analyzer will automatically shut off. If activity does occur within ten minutes, the analyzer remains on for thirty minutes with no activity before automatically shutting off. As long as a keystroke is detected at least once every thirty minutes thereafter, the analyzer remains powered until the [ON/OFF] key is pressed to turn power off, or the battery's charge expires.

The [MAIN MENU] key is used as a means to quickly return to the main menu (the first menu that appears when the analyzer is powered on) without the necessity of multiple steps. When pressed momentarily then released, this key produces the same action as turning the analyzer power off, then back on. The key may be used to escape screens where [BACKUP] will consume too much time for the user. Pressing the [MAIN MENU] key causes all in-progress functions to cease and incomplete balance or survey data to be lost in whole or in part. Holding the [MAIN MENU] key down for more than two seconds will turn the analyzer off.

(Model 2020HR Only) Contrast keys allow for changes to the existing screen contrast from any screen. Pressing the left-hand key will cause less contrast between the text and background. Pressing the right-hand key will cause more contrast between the text and background.

The [BACKUP] key allows the user to back up one step in the current running procedure to make corrections or immediate changes. The [BACKUP] key is also used to escape an active screen where no other options for exit are available. Data may be lost or overwritten when using the [BACKUP] key in certain screens.

Three function keys ([F1], [F2], and [F3]) are located directly below the analyzer's screen. Three small rectangular boxes on the screen directly above the keys define their use as it corresponds to each screen. The purpose of each key may change from screen to screen. If any of the screen boxes are blank, the box's corresponding key has no function in that screen.

The [ENTER] key is pressed to accept data or a menu selection and set that selection into motion. The key is used in survey and balance procedures to proceed to the next step.

Pressing the [HELP] key allows you to access guidance and/or examples of information which can be entered into the current field.

The ten alphanumeric keys (0 through 9 / A through ?) are used to input alphanumeric values into the analyzer. A single press followed by a two-second delay returns the numeric value (first character) of the key. Two rapid presses followed by a two second delay returns the second character (first of the three alpha characters) of the key. Three or four rapid presses followed by a two-second delay returns the third or fourth (second or third alpha) characters of the key, respectively. For example, if you want to type the letter “N” which is the third character on its corresponding key, press the key three times rapidly, and then stop for two seconds. The letter “N” should appear on the screen. In order to enter multiple characters found on the same key, press the [⇒] to bypass the two second waiting period and progress directly to the next character.

The [CLR] key is used to clear input in the current field.

The four arrow keys (up, down, left, and right) are used to select, move between fields and positions within a field, or highlight menu items on screen. They are also used in various functions to "toggle" between choices, to increase or decrease screen values and graphic display sizes, and to change the field value or cursor position.

The symbols key (**. @ % &**) has multiple functions. The “.” is used for placement of a decimal in fractional numbers such as 98**.**6. The other characters on this key are used as they would be in normal text such as “54 grams @ 230 degrees” or “3**%** error,” or “Left **&** Right propellers.” To type any of the symbols on this key, follow the same procedure described in the preceding paragraphs that is used for the alphanumeric keys.

The [SPACE] key has multiple functions also. The characters can be used as normal text in a text field. To type any of the symbols on this key, follow the same procedure described in the preceding paragraphs as used for the alphanumeric keys. The (-) character can be used to represent the removal of weight in a balance solution screen. A single press of this key, while in a weight entry field, will display the (-) character.

2.2 - Screen

The full graphics Liquid Crystal Display (LCD) screen is how the analyzer communicates with the user. In computer terminology, the screen is the "graphical user interface." The screen displays messages, menus, selection lists, graphic illustrations, and survey plots.

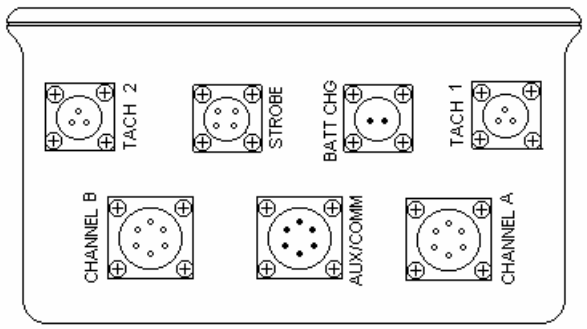
(Model 2020 and Model 2020 TURBO) The display is 2.6 inches high by 2.6 inches wide. It is an adjustable-contrast, backlit LCD with a 192 x 192 dot-matrix display. The backlight is turned on automatically when analyzer power is turned on. Screen contrast is controlled by pressing one of the function keys ([F1] for less contrast and [F3] for more contrast) on the main menu screen, which is the first menu screen displayed after the analyzer is turned on.

(Model 2020 HR) The display is 2.4 inches high by 3.1 inches wide. It is an adjustable-contrast, LCD screen with bright white LED backlighting. Screen resolution is increased to a 320 x 240 high resolution dot-matrix display. The backlight is turned on automatically when the analyzer power is turned on. Screen contrast is controlled by dedicated contrast keys on the keypad and can be adjusted whenever the analyzer power is on.

NOTE

If the analyzer is exposed to extremes in temperature, either heat or cold, the LCD may darken or lighten to a point that it cannot be clearly read. (Model 2020 and Model 2020 TURBO) If this occurs, press the [MAIN MENU] key and adjust the contrast to compensate for the change by pressing the [F1] key for –Contrast or the [F3] key for +Contrast. (Model 2020 HR) From any screen, press the dedicated contrast keys to compensate for the change. If this fails to return the LCD to a viewable state, remove the unit to an ambient room temperature of 65 – 85 degrees F. The LCD should return to its previous state in approximately 30 minutes.

2.3 - Input and Output Ports



There are seven input/output ports on the end panel of the analyzer, as shown in the figure above: two "CHANNEL" (vibration channel) inputs (velocity or acceleration), two "TACH" (tachometer) inputs, one "BATT CHG" (battery charge) input, one "AUX/COMM" (auxiliary/communication) input/output, and one "STROBE" input/output port.

2.3.1 – CHANNEL Ports

The two vibration inputs will accept acceleration, velocity, or displacement sensor signals. Both inputs are six-pin MS socket connectors. The default configuration for a two-plane balance on a single engine is "CHANNEL A" for the front sensor and "CHANNEL B" for the rear sensor. These default values can be changed as necessary by the user within the SETUP function. Either of the two channels may be defined as the input for a single plane balance job. The six-pin connector enables the analyzer to provide sensor power as required by the sensor being used.

2.3.2 – TACH Ports

The "TACH 1" and "TACH2" inputs are three-pin female receptacle connectors. They will accept either a raw tachometer speed reference signal or a Transistor-Transistor Logic (TTL) level speed signal. Power (+12V) is provided on one pin of the tachometer connector to power optical speed sensors such as the Phototach or LASETACH®.

2.3.3 – BATT CHG Port

The "BATT CHG" (Battery Charge) port is used in conjunction with the battery charger supplied with the analyzer. Your analyzer will come with either a 110V or 220V charger according to your geographical requirements. The Model 2020 ProBalancer containing a Lead Acid Battery uses a two-pin connector for the battery charging circuit. The Model 2020 ProBalancer containing a Nickel Metal Hydride Battery uses a three-pin connector for the battery charging circuit.

WARNING
When using the 220V lead-acid battery charger, do not leave the battery attached (on charge) for a period of more than 24 hours. To do so may result in damage to the battery and/or analyzer.

WARNING
The protective cap on the "BATT CHG" port must remain in place during periods when the charging unit is not connected. The pins of the charging input are active at all times and may be shorted by unintentional contact with a conductor if the cap is not in place.

2.3.4 – AUX/COMM Port

The "AUX/COMM "or Auxiliary and Communications port is a 6-pin MS type male connection used for serial communications between the analyzer and a personal computer or modem. The port is also used as a serial printer port. With an optional serial-to-parallel

converter, the port may also be used for printing to a parallel printer. Additionally, this port is used to connect an ACES Systems' Optical Tracker.

2.3.5 – STROBE Port

The "STROBE" port is for connection of a strobe light for manual, visual tracking of rotor or propeller blades. The analyzer provides a trigger for the strobe through this port. Power (28V DC) for the strobe must be provided from outside the analyzer, usually from a ship's power source. The strobe and necessary cables are available as optional equipment from ACES Systems.

2.4 - Standard Equipment

When you purchase a Model 2020 ProBalancer Analyzer, several accessories come with the analyzer as standard equipment. These items are described in the following paragraphs.

2.4.1 – Battery

The primary power source for the analyzer is its internal battery. There are two types of battery used in the Model 2020 ProBalancer Analyzer. As with any battery, age, usage, and environmental conditions may eventually necessitate battery replacement. We do not recommend you change the battery yourself because of the possibility of damage to other components. Contact ACES Systems for details about return and replacement of the internal battery.

2.4.1.1 – Lead Acid Batteries

The first battery style is a camcorder, RB-85 type 12-volt lead acid battery rated at 2.3 Amp hours. This means that a fully charged battery will supply power at the rate of 2.3 Amps for one hour or at the rate of 1 Amp for 2.3 hours. Typically, a fully charged battery will provide power for 8 hours of continuous analyzer operation while powering all four available sensors. Power is proportionally increased with the use of fewer sensors and accessories. A minimum of 4 hours charging time is required for a full charge.

NOTE

The battery must always be stored in a charged state. Leaving the battery in a discharged condition during storage causes sulfation, a condition that makes the battery difficult, if not impossible, to recharge.

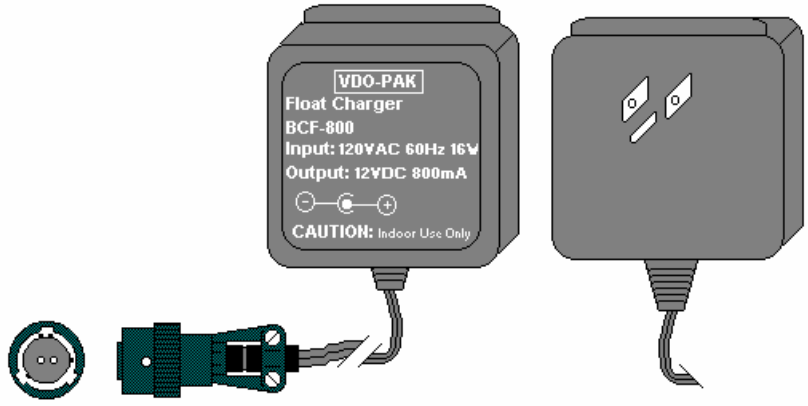
2.4.1.2 – Nickel Metal Hydride Batteries

The second battery style is a 12-volt Nickel Metal Hydride (NiMH) battery rated at 4.5 Amp hours. This means that a fully charged battery will supply power at the rate of 4.5 Amps for one hour or at the rate of 1 Amp for 4.5 hours. Typically, a fully charged battery will provide power for 16 hours of continuous analyzer operation while powering all four available

sensors. Power is proportionally increased with the use of fewer sensors and accessories. Charging time will be determined by the analyzer's internal smart charging circuitry.

2.4.2 - Battery Charger

The analyzer's internal battery must be charged periodically. This is accomplished using the battery charger included as standard equipment with your analyzer and shown in the figure below (or similar).



2.4.2.1 Lead Acid Battery Chargers

The 12-Volt DC battery charger is a standard float-type charger commonly used to charge lead-acid, camcorder-type, batteries. The charger has an input of 120VAC, 60Hz, 16W. The output is 12VDC, 800mA. The charger has a three-prong (grounded) outlet connector built into the charging unit which plugs directly into a wall outlet. On some chargers, a red LED indicator light (not shown in the figure below) built into the charger head indicates when a charge is being supplied. On some chargers, a display of Red, Yellow and Green LED's will indicate the charging state as explained on the data tag on the charger itself. The cord is a standard, 16-gage electrical appliance cord that is 6 feet long. The connector is an MS, two-pin female, quarter turn lock type constructed of aluminum alloy and coated with olive drab chromate for corrosion protection.

2.4.2.2 – Nickel Metal Hydride (NiMH) Battery Chargers

The 12-Volt DC battery charger is a float-type charger commonly used to charge Nickel Metal Hydride batteries. The charger has an input of 100-240VAC, 50/60Hz, 2A. The output is 19VDC, 3.1A 60W maximum. The 110V input cord has a three-prong (grounded) "Type B" connector which plugs directly into a 110V wall outlet. The 220V input cord has a two-prong "Type C" connector which plugs directly into a 220V wall outlet. Connection to a 220V wall outlet may require the use of an adapter. The output cord is a standard, 16-gage electrical appliance cord that is 6 feet long. The connector is a three-pin female, threaded-lock type constructed of aluminum alloy and coated with olive drab chromate for corrosion protection.

2.4.2.3 - Charging the Battery

To charge the battery, do the following.

1. Place the analyzer near an indoor AC electrical outlet where it can remain undisturbed for at least four hours.

WARNING
When using the 220V lead-acid battery charger, do not leave the battery attached (on charge) for a period of more than 24 hours. To do so may result in damage to the battery and/or Analyzer.

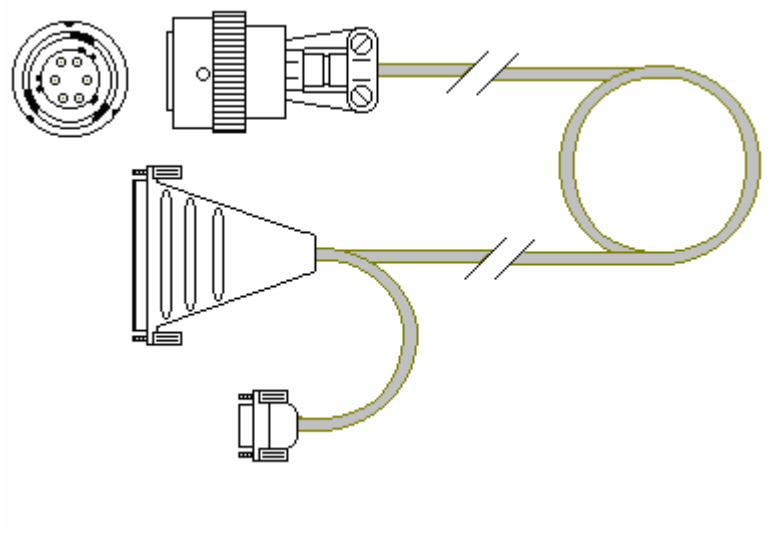
2. Remove the protective cap from the "BATT CHG" port of the analyzer and connect the MS connector of the battery charger.

3. Plug the charging unit into a 120VAC, 60Hz (or 220VAC 50 Hz for the 220V chargers using appropriate adapters as necessary) outlet and note that the red LED indicator light on the charger head illuminates (if so equipped), indicating an in-progress charge.

NOTE
The red LED indicator light does not exist on any 220V chargers or certain models of the 110V charger.

4. Leave the analyzer connected to the charger for a minimum of four hours. (The 120V lead-acid charger may remain connected continuously without harm to the analyzer, battery, or charger.) The red LED indicator light will blink when charging is complete (on models equipped with an LED).

5. When charging is complete, unplug the charger from the AC outlet and disconnect from the analyzer. Replace the protective cap on the analyzer's "BATT CHG" port. Place the charger in a safe place for future use.



2.4.3 - Communications/Printer Cable

The analyzer comes with a communications/printer cable for data transfer with a personal computer or a printer. The cable has both a standard DB25F and a DB9F connector at one end and an MS 6-pin socket connector at the other. This cable is configured to connect directly to your analyzer at the 6-pin "COMM" port at one end and to a standard DB25M or DB9M pin for connection to a printer, computer, or interface.

Once connected to a personal computer, you can transfer data to and from the analyzer for use with *AvTrend,* ACES WinFlash, or ACES Comm software available from ACES Systems.

If connecting to a serial printer, you may require the 25-pin gender changer, which comes with your analyzer (For further printing instructions, see Chapter 14, "Printing".) Once connected to a printer, you can print completed jobs, setups, spectra, etc.

2.4.4 - Carrying Case

The analyzer carrying case is constructed of expanded ABS plastic. The case is durable and protects its contents from the elements when closed and latched. Clean the case with a mild soap solution and coat with an ARMOR ALL® (ARMOR ALL is a registered trademark of the Clorox Company.) type protectant to preserve appearance. The case has a limited lifetime warranty from the original manufacturer. The case is airtight when the purge valve is closed (turned clockwise to its limits). If the case is transported between the varying pressure altitudes, such as those which occur during air travel, the case may be difficult to open due to pressure differential. If there is a pressure differential between the exterior and interior of the case, open the purge valve by turning it counterclockwise. This will allow the pressure to equalize and ease the task of opening the case.

2.4.5 - User Manual

This user manual is current when you receive it with the analyzer. To verify that your manual is current, visit our web site at www.acessystems.com or call ACES Systems at the number listed in the front of this manual.

2.5 - Optional Equipment

Because the Model 2020 ProBalancer Analyzer is so diverse in its capability, many accessories such as helicopter-specific sensor mounts, blade tracking devices and numerous vibration sensors are available for use with it.

For rotary wing applications, contact ACES Systems directly to inquire about available accessories for your particular needs. Because of the diversity of this application, many accessories are available that are too numerous to list concisely in this manual.

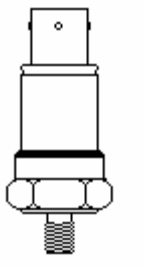
Unlike rotary wing applications, most propeller balancing applications use common accessories, so ACES Systems has assembled a propeller balancing kit, described below, which can be purchased with the Model 2020 ProBalancer Analyzer.

2.5.1 - Propeller Balancing Kit

The propeller balancing kit contains all the necessary items to complete a single-engine, single-plane propeller balance. If your requirements are multiple-plane balance on a single-engine or multiple-engines balancing, additional equipment will be required. The items in the propeller balancing kit are described below.

2.5.1.1 – Manual, *ACES Systems Guide to Propeller Balancing*

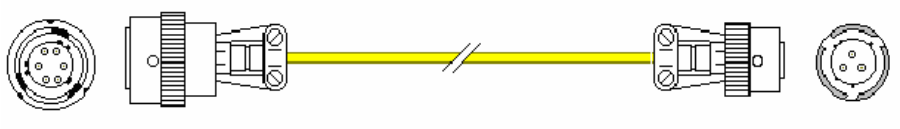
The *ACES Systems Guide to Propeller Balancing* provides procedures and practices for completing an FAA-approved propeller balance job in lieu of airframe or propeller manufacturers' written instructions. The guide includes instructions on installing vibration sensors, photo tachometers, and reflective tape; information on selecting the proper trim weights, attaching trial weights, attaching permanent weights; and other hints for simplifying the balance job. The guide does not provide information on using the analyzer. Review this user's manual for detailed information on the analyzer's operation.



2.5.1.2 - 991D-1 Accelerometer

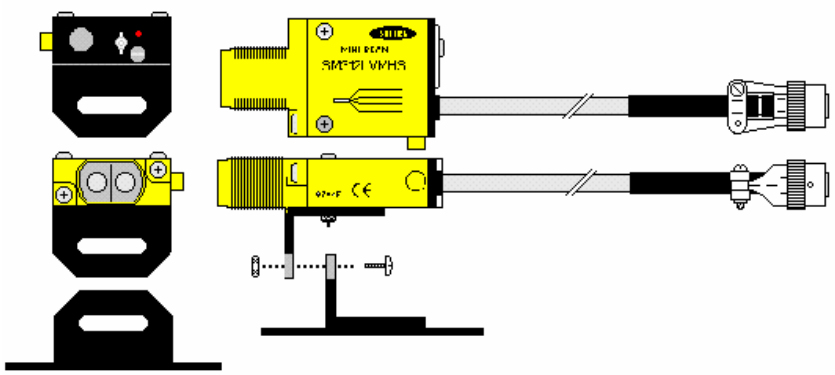
Although the Model 2020 will support a full range of vibration sensors, the 991D-1 accelerometer (see the illustration above) was selected as the standard for use with the analyzer due to its rugged construction, accuracy, cost, and range of operation. A single sensor is supplied with the propeller balancing kit. Additional sensors can be purchased separately.

The output of the 991D-1 accelerometer is 20 mV per g. The 991D-1 is pre-programmed in the analyzer's sensor setup list. The operating temperature range is -50 to + 120 degrees C. The three-pin connector is a MIL-C -26482, and the mating connector is a Bendix PT06-8-3S. The mounting stud is 1/4 x 28. Although the sensor is rugged, it can be damaged when dropped on hard surfaces. Use care when installing the sensor, as you would with other electronic components.



2.5.1.3 - 991D-1 Sensor Cable

The 991D -1 sensor cable, shown above, is a 25-foot (50-foot optional) shielded and Teflon-coated four-conductor cable. The three-pin MS female connector on one end of the cable mates to the 991D -1 sensor. The six-pin MS male connector mates to one of the two (CHANNEL A or CHANNEL B) available vibration-input ports on the analyzer. Contact ACES Systems for other sensor, cable, or adapter options.

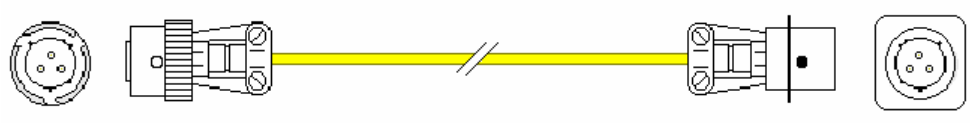


2.5.1.4 - Phototach

The Phototach is a short-range optical sensor used in acquiring speed and phase angle data. Its optimum range is 12 to 18 inches from the target (reflective tape, 3M 7610). It is supplied with a three-inch by three-inch base. An optional camera type swivel mount is available from ACES Systems.

Hardware (screw, nut, and washers) for assembly of the supplied mount is contained in the tackle box which is also supplied with the analyzer. The three-pin MS connector attaches directly to the Phototach cable. Other speed/phase sensors that can be used with the analyzer

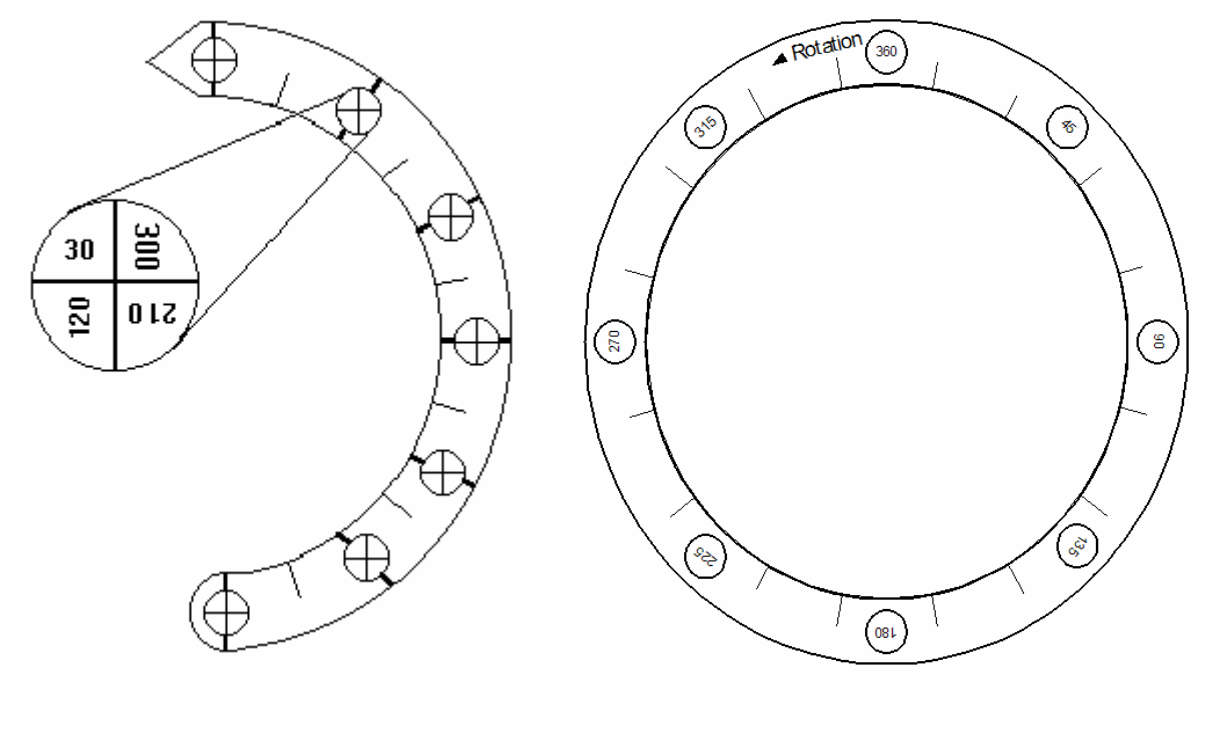
can be purchased separately. They include the ACES Systems' LASETACH®, Magnetic Interrupter, or specific-application speed interfaces. Call ACES Systems for further information.



2.5.1.5 - Tachometer Sensor Cable

The tachometer sensor cable connects the analyzer to a Phototach, an ACES Systems' LASETACH®, or an interface for optional speed sensors such as a magnetic pickup or pulse generator. The cable is a three-wire shielded cable, insulated in a bright yellow, petroleum-resistant jacket. Attached to one end of the cable is a female three-pin bulkhead type socket connector. On the opposite end of the cable is a male three-pin, quarter-turn-locking MS connector. The connectors are constructed of aluminum alloy with olive drab chromate coated for corrosion resistance. The male end connects to the tach input of any ACES Systems' analyzer/balancer or to the female end of another cable of the same type. The opposite (female, bulkhead) end will accept another 10-320-0126 cable for extension or connect to an aircraft or sensor interface. There is a 50-ft. and a 25-ft. variant of this cable. The 25-ft. cable was built generally for propeller balancing applications that normally require less distance to the sensors. When using this cable to connect to older versions of the Phototach, LASETACH®, or to any other speed-sensing device, an interface appropriate to the application may be required. New-design LASETACHs® with the part number 10-100-1300 and new-design Phototachs with part number 10-100-1773 have a socket connector that connects directly to the bulkhead connector end of this cable.

2.5.1.6 - Propeller Protractor



The propeller protractor is designed to measure angles in a typical propeller/spinner assembly. As illustrated in the figure above left, each of the seven circles on the protractor contains four angles. The angle at each circle location can be determined by reading the upright number (for example the 30 degree location in the illustration). The circles are located at 30-degree increments with unmarked 15-degree incremental lines between them. Since the Model 2020 can be configured to calculate solution angles relative to the vibration sensor or reflective tape, both methods are presented here.

The propeller protractor pictured above right is a complete circle. This is divided into five-degree increments. Every 30 degrees, the angle is identified by text. Every 45 degrees, the angle is printed in a circular identifier. Place the propeller protractor over the spinner with the proper direction of rotation side facing you as indicated by the text and an arrow. Since the Model 2020 can be configured to calculate solution angles relative to the vibration sensor or reflective tape, both methods are described in more detail below.

2.5.1.6.1 - Using the Propeller Protractor

For correct use of the protractor when measuring **relative to the vibration sensor**, do the following:

WARNING
Always ensure mag switches are off prior to any movement of the propeller

1. Rotate the propeller with the reflective tape until it is directly in front of the Phototach.

2. With the propeller in this position, place the protractor over the spinner with the pointed end pointing in the direction of rotation (forward looking aft) and one of the 360 degree points aligned with the position of the vibration sensor.

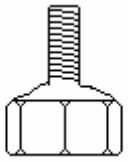
3. Read the numbers in the circles, and then interpolate values of the unmarked incremental lines to locate the desired angle.

For correct use of the protractor when measuring **relative to the reflective tape:**

1. Place the protractor over the spinner with the pointed end pointing in the direction of rotation (forward looking aft) and one of the 360 degree points aligned with the position of the reflective tape.

2. Read the numbers in the circles, and then interpolate values of the unmarked incremental lines to locate the desired angle.

NOTE
If the angle is out of range for the position of the protractor, rotate the protractor 90 degrees (right or left as appropriate) at a time until you can read the correct angle.

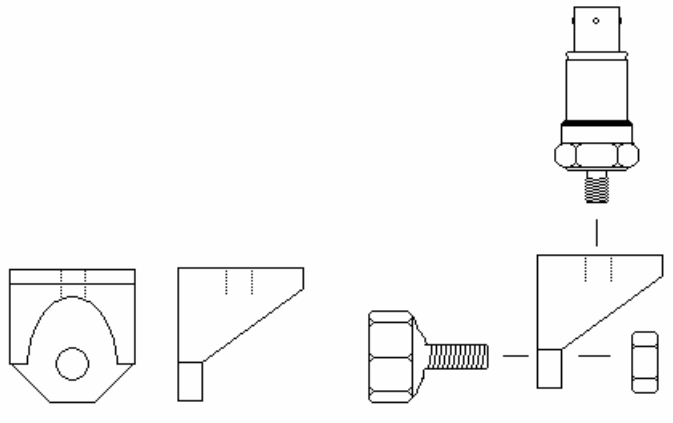


2.5.1.7 - Case Bolt Adapter Set

An eight-piece case bolt adapter set with nut sizes 1/4 to 7/16 NF and NC threads is included in the propeller balancing kit. The stud portion has 1/4 x 28 threads. To use the bolts/nuts during a typical propeller balance, select the adapter from the set to match the case bolts of a typical opposed engine. Attach the adapter nut end to the exposed case bolt threads then slide the right angle mount over the stud end and secure with the supplied nut. You will require two sets of the adapters for dual-engine balancing.

2.5.1.8 Tackle Box

A multi-compartment, high impact plastic, tackle box is included with the propeller balancing kit. The box has ample storage space for vibration sensors, vibration sensor mounts, and the case bolt adapter set. It may also serve as storage for AN washers used as balance weights.



2.5.1.9 – Right-Angle Sensor Mount

The right-angle sensor mount shown in the left portion of the illustration above is made of anodized aluminum and designed to be mounted directly on the engine case bolt or to the case bolt adapter, shown in the right portion of the illustration above. The mount has a 1/4 x 28-threaded hole for the vibration sensor and a 1/4 unthreaded hole for the case bolt adapter stud.

2.5.1.10 - Gram Scale

A scale with approximately a 200-gram capacity is included with the propeller balancing kit for weighing the washers or trim weights used in balancing. Read the operating instructions enclosed with the scale carefully prior to its use.

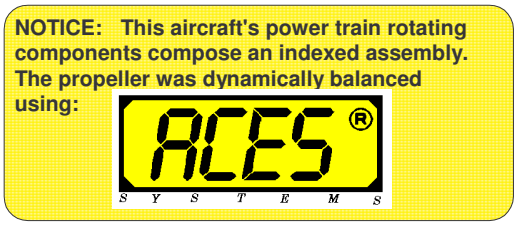
2.5.1.11 - Video Tape, *Using the Model 2020 ProBalancer Analyzer*

An instructional videotape is included with the balancing kit. The video provides basic instructions on equipment setup and analyzer operation. Refer to this manual for detailed instructions or call ACES Systems Customer Support at the number listed at the front of this manual if you have questions not addressed in the video.

2.5.1.12 - Reflective Tape

The reflective tape supplied with the propeller balancing kit is used as a tach trigger for the Phototach to generate a once-per-rev pulse used in speed readings and balancing calculations. The reflective tape (3M 7610) supplied with the propeller balancing kit was selected because of its excellent reflective quality and performance under varied operating conditions. Using a lower quality tape will cause inaccurate tachometer readings or unreliable phase information. The tape is manufactured by the 3M company and is the only tape we recommend for use with the system. Contact ACES Systems for replacement tape. (See Chapter 15, “Equipment and Accessory Setup and Troubleshooting” for additional information for high RPM)

2.5.1.13 - ACES Systems Balance Placard



A placard similar to the one shown above is included in the propeller balancing kit. This or a similar placard should be attached to the spinner bulkhead upon completion of balancing to show that the propeller has been dynamically balanced and is indexed to the crankshaft of the engine.

Chapter 3
Using the Model 2020 ProBalancer Analyzer

(Revision 3, April 2006)

3.1 – Entering Data

Data is entered into the analyzer in one of two ways: directly by typing data using the keypad or indirectly by selecting from preset options. The methods of inputting data are described in the following two sections.

3.1.1 - Using the Keys

The Model 2020 and Model 2020 TURBO analyzer keypad has 25 function keys, 12 of which are multiple-character, alphanumerically labeled.

The Model 2020 HR analyzer keypad has 27 function keys. Two screen contrast keys have been added to simplify screen contrast adjustments.

The multiple-character labeled keys, 1ABC through SPACE +/- will generate each of the characters on the label and insert it into the current field position of the analyzer screen.

To generate the first character, on an alphanumeric key, press the key one time, then pause for two seconds. The character should appear on the screen. To generate the second character on an alphanumeric key, press the key twice rapidly, then pause for two seconds. The character should appear on the screen. Repeat this process for each letter on the key, with the number of times you press the key equivalent to the character's position on the key. You may use the [⇒] key to bypass the two second waiting period and progress directly to the next position in the field.

For example, to type the number “5”, press the key once, wait for two seconds. The number “5” should appear on the screen. To type the letter “N”, press the key three times rapidly, and then wait for two seconds. The letter “N” should appear on the screen.

The insert position of the character being typed is indicated on screen by the cursor. The cursor may be moved to any position in the current field using the left or right arrow keys. If placed in an existing text string, a key stroke of any alpha numeric character key will insert the character into the string at the current cursor position and move existing text to the right one character position.

3.1.2 - Filling in Fields

Data is entered into areas of the screen called fields.

Some fields are represented by boxes with pointed ends (< >). These fields are called “toggle” fields because you must use the [⇐] [⇒] keys to toggle, or move, between several preset selections available in the field. After a selection is made, use the [⇓] [⇑] key to exit the field and any associated changes will take place to the information displayed on the screen.

Some of the fields are represented by boxes that have square-ends ([ ]). The square-end boxes are text entry boxes. You must enter or edit text in these boxes using the keys as described in the previous section. If you wish to change text already in place in these fields, place the cursor in the field you wish to change then press the [CLR] key once for each character in the field you wish to remove and replace.

Use the [⇑] and [⇓] keys to move from field to field.

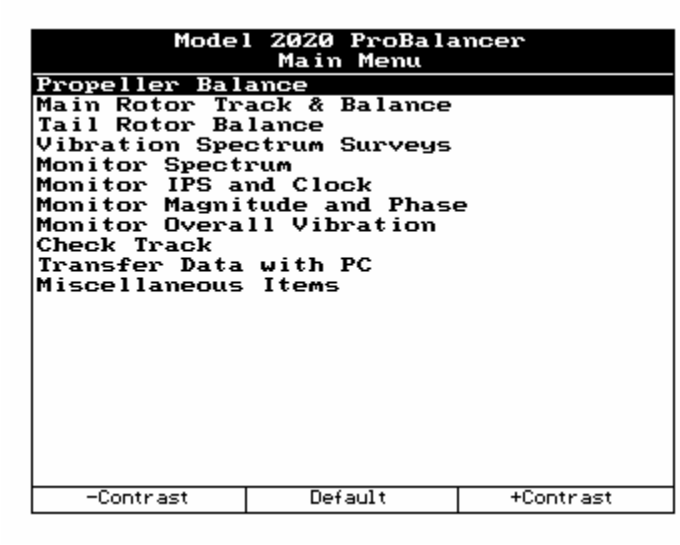
3.2 - Loading a Setup

A “Setup” is a group of instructions defined by you, the user, and stored in the analyzers’ memory for rapid analyzer configuration. This group of instructions combined with certain optional information and analyzer-calculated data allows the analyzer to be custom-configured for virtually any engine/airframe combination in a matter of seconds following initial entry of the information.

Steps in the process of loading and using various setups are explained throughout Chapters 4 through 14 of this manual which address each of the main categories of the analyzer’s functions. All of the main categories of the analyzer’s functions are accessed from the analyzer’s main menu and directly correspond to selections on this menu.

3.3 - Main Menu

The main menu is the first menu to be displayed when the analyzer is turned on. (See the following figure.) From this menu you may access all functions of the analyzer by using the available menu choices. Chapters 4 thorough 14 of this manual describe each main menu item selection, the function of each item, and the general steps necessary to perform each function.



3.3.1 Setting the Screen Contrast

The screen contrast may be adjusted to compensate for changing ambient light and temperature conditions.

NOTE
If the analyzer is exposed to extremes in temperature, either heat or cold, the LCD may darken or lighten to a point that it cannot be clearly read. If this occurs, press the [MAIN MENU] key and adjust the contrast to compensate for the change by pressing the [F1] key for –Contrast or the [F3] key for +Contrast. If this fails to return the LCD to a viewable state, remove the unit to an ambient room temperature of 65 – 85 degrees F. The LCD should return to its previous state in approximately 30 minutes.

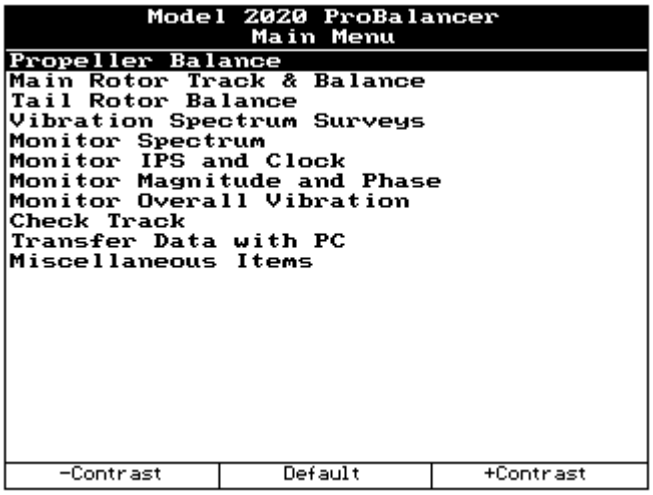
Screen contrast is controlled by pressing one of the function keys ([F1] for less contrast and [F3] for more contrast) on the main menu screen, which is the first menu screen displayed after the analyzer is turned on.

Screen contrast on the Model 2020 HR may also be adjusted from any screen using the contrast keys located on the keypad. Pressing the left-hand key will cause less contrast between the text and background. Pressing the right-hand key will cause more contrast between the text and background.

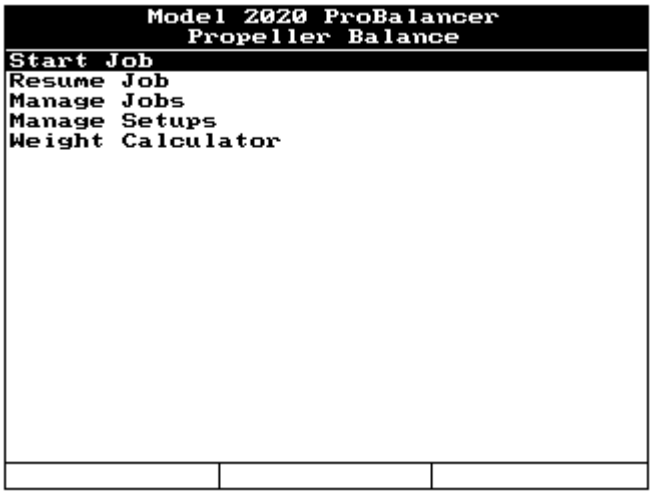
Chapter 4
Propeller Balance

(Revision 5, Aug 2012)

"Propeller Balance" is an analyzer function that is accessed from the analyzer's Main Menu banner screen as shown in the illustration below. Selecting this function from the main menu brings up the "Propeller Balance" banner screen menu (also shown below). Each of the listings on this banner screen menu is an option within the function. Descriptions of each of these options follow, along with the information required to complete the menu screens within the options, and the steps necessary to perform propeller balance function.

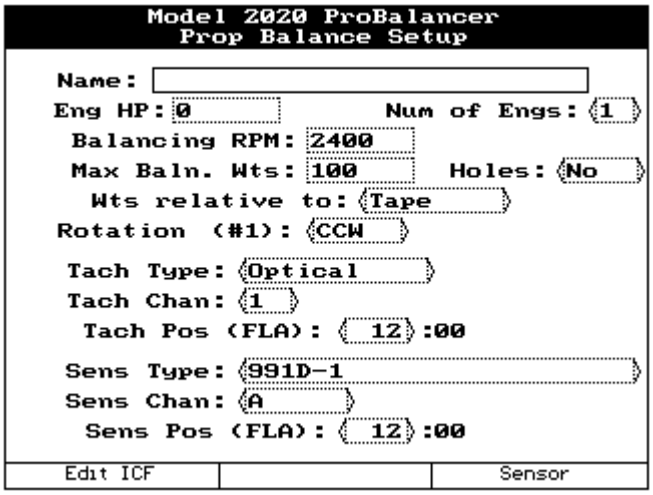


4.1. – Start Job

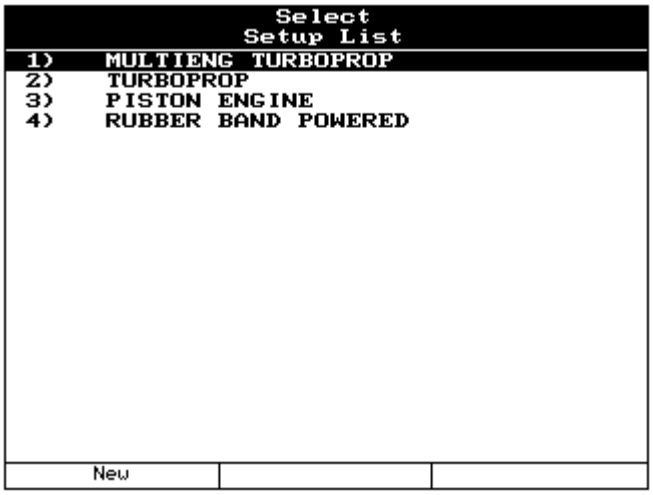


Selecting “Start Job” from the “Propeller Balance” banner screen allows you to begin a new propeller balance job. When you select this option, one of three screens will appear depending on whether you are: 1) Starting a new job with no setups previously defined in the analyzer’s memory; 2) Starting a new job with previously defined setups available in the analyzer’s memory; or 3) Resuming an incomplete job being held in the analyzer’s memory.

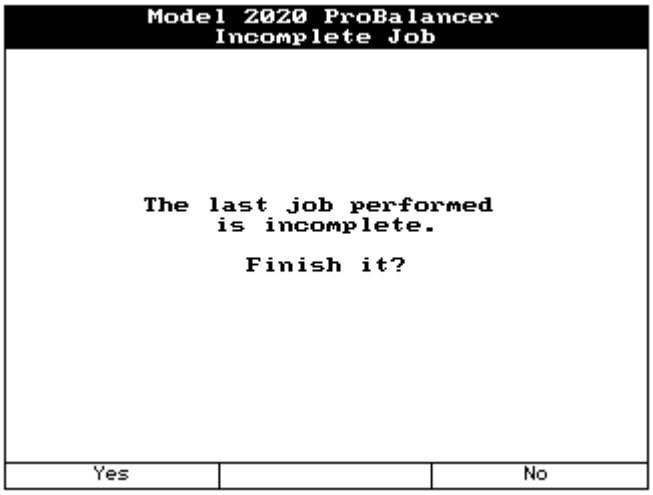
If you are starting a new job with no setups previously defined in the analyzer’s memory, the screen will automatically display the Prop Balance Setup banner screen shown below. See section 4.1.1 for step-by-step instructions on completing the Prop Balance Setup.



If you are starting a new job with previously defined setups available in the analyzer’s memory, the screen will automatically display the Select Setup List banner screen similar to the one shown below. The actual setup names will be those which you have entered into your analyzer.



If you are resuming an incomplete job being held in the analyzer's memory, the opportunity to do so is presented immediately following the "Start Job" selection. The screen displays the message as shown below. If you press the [F1] "Yes" key, the analyzer will return you to the last logical in-progress step of the job. If you press the [F3] "No" key, depending on your circumstances, the analyzer will return one of the two screens shown above.



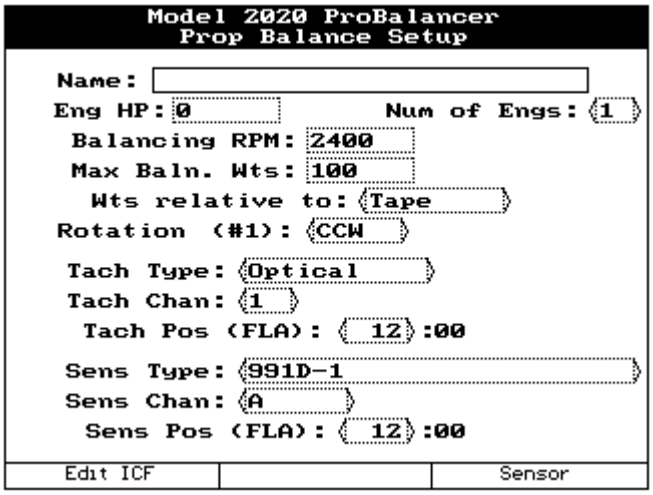
4.1.1. – Prop Balance Setup

The "Prop Balance Setup" banner screen allows you to define and store a propeller balance job. The "Prop Balance Setup" banner screen displays fill-in and selection fields. The fill-in fields have squared off ends ([ ]). These fields are filled in using inputs from the analyzer keypad. The selection fields have pointed ends (< >). These fields have two or more preset values that are selected by using the [⇒] and [⇐] keys. Navigate between the fields on this screen using the [⇓] and [⇑] keys. (Refer to Chapter 3, "Using the Model 2020 ProBalancer Analyzer" if you are unfamiliar with using the keypad or inputting data.)

Complete the “Prop Balance Setup” screen per one of the following examples, either Propeller Balance Setup *Without* Enhanced Performance Software (EPS) Upgrade or Propeller Balance Setup *With* EPS Upgrade depending on whether you have the software upgrade installed in your analyzer. (For information on Enhanced Performance Software contact ACES Systems at the telephone number listed at the front of this manual.)

4.1.1.1. – Propeller Balance Setup Without EPS Upgrade

To complete the “Prop Balance Setup” banner screen (as shown below), do the following:



1. In the “Name” field, enter a name for this setup using the keypad. (Refer to Chapter 3, “Using the Model 2020 ProBalancer Analyzer” if you are unfamiliar with using the keypad.)

   The name you choose will aid you in differentiating this setup from other stored setups should you choose to review or print it at a later time. The name should be one of your choosing which you will easily recognize and associate with this setup such as “Cessna 150,” “King Air, ” or “T-6 TEXAN II.”

2. Using the [⇓] key, move down to the “Eng HP” field. Enter the rated horsepower of the engine using the keypad. Any numeric entry between 1 and 5000 will be accepted.

3. Using the [⇓] key, move to the “Num of Engs” field. Use the [⇒] key to “toggle” between the choices in this field to select the number of engines being balanced with this setup. The field choices include 1 and 2 engines.

4. Move to the “Balancing RPM” field using the [⇓] key. Using the keypad, enter the actual propeller RPM at which you intend to balance. If no manufacturer recommendation is available, refer to the *ACES Systems Guide to Propeller Balancing* included with your Model 2020 analyzer. A low cruise RPM is usually best. This field will accept any numeric value, however, the value in this field must be within +/- 200 RPM of the actual propeller speed or a “HIGH”/“LOW” error message will be displayed during data

acquisition and data collection will be prevented. See Chapter 15 for additional information on troubleshooting Tach readings.

5. Using the [⇓] key, move to the "Max Baln.Wts" field. Enter the maximum total trim balance weight (in grams) allowed for this installation. If the manufacturer doesn't specify a weight, refer to the *ACES Systems Guide to Propeller Balancing*. Acceptable values are numeric entries between 0 and 9999.

6. Using the [⇓] key, move to the "Wts relative to" field. Select "Tape" or "Sensor" using the [⇒] key. If using predetermined weight locations, select "Tape." Decide if you wish to measure angles from the reflective tape or the vibration sensor as an index point. The field choices are Tape or Sensor. (Refer to the Chapter 2, Analyzer Description for a detailed explanation of how to use the Propeller Protractor and the referencing tape or sensor.)

7. Move down to the "Rotation (#1)" field using the [⇓] key. Using the [⇒] key, Select CW (Clockwise) or CCW (Counter-Clockwise) for the rotation of the propeller as viewed standing Forward of the propeller Looking Aft toward the tail of the airplane (FLA).

8. Using the [⇓] key, move to the "Tach Type" field. Using the [⇒] key, select the type of tachometer you are using.

   Tach Type selections for this field include:

   "Optical" - Includes the Phototach and LaseTach. This is the only selection that will provide power to a Tach device.

   "Mag (Lo)" - A magnetic interrupter with an output of 120mV or greater. This selection is used for clean Tach signals with a low noise floor.

   "Mag (Hi)" - A magnetic interrupter with an output of greater than 3 volts and less than 5 volts. This selection provides isolation from erratic signals containing electrical noise above 120 mV but less than 3 volts.

   "Monopole" - A monopole type pickup with an output of 120mV or greater.

   "Tach Gen" - A one to three pole tachometer generator with an output of 390mV or more. (This type of input is normally used for synchronous vibration surveys and not for a once per rev signal used to calculate phase angles in balancing.)

NOTE

Analyzers with a serial number greater than 40000 contain an "auto gain" Tach circuit. The tach type selection is only necessary to the point that the "Optical" selection provides power to the Tach. All other modes will attempt to gain the Tach signal to a level that can be read by the analyzer.

9. Using the [⇓] key, move to the "Tach Chan" field. Using the [⇒] key, select "TACH 1" or "TACH 2" according to the analyzer's tach input channel you intend to use. The default for single sensor input is TACH 1.

10. Using the [⇓] key, move to the “Tach Pos (FLA)” field. Using the [⇒] key, select the tach position. The tach position is determined by standing Forward of the propeller Looking Aft (FLA) toward the tail of the aircraft. From this viewpoint, determine the approximate clock position (1:00 to 12:00) of the tachometer pickup.

CAUTION

Sensors connected to Channel A and Channel B must be of the same type. Using different sensors during the same job will cause erroneous readings and problems achieving good balance results.

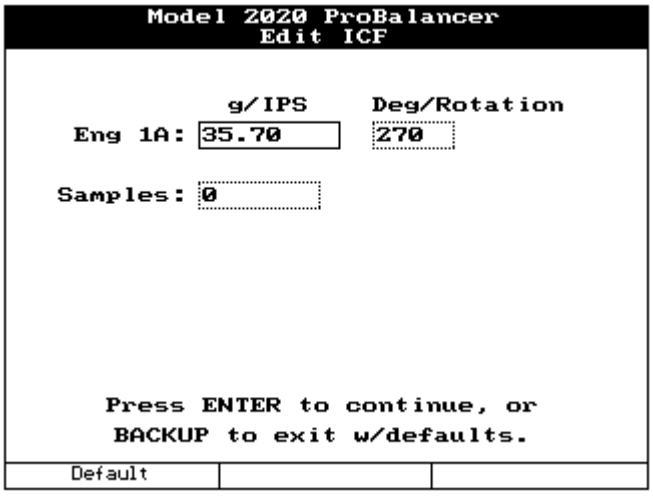
11. Move down to the “Sens Type” field using the [⇓] key. Select the sensor type from the available options using the [⇒] key.

12. Move to the next field, “Sens Chan” using the [⇓] key. Select sensor channel “A” or “B” according to which of the analyzer’s input channels you intend to use. The default for single-sensor input is Channel A. Use the [⇒] key to make the selection.

13. Using the [⇓] key, move to the “Sens Pos (FLA)” field. Using the [⇒] key, select the vibration sensor position. The sensor position is determined by standing Forward of the propeller Looking Aft (FLA) toward the tail of the aircraft. From this viewpoint, determine the approximate clock position (1:00 to 12:00) of the sensing axis of the vibration sensor.

4.1.1.1.1. – Edit ICF

The “Edit ICF” (which corresponds to the [F1] key) selection appears at the bottom left of the “Prop Balance Setup” banner screen. Press the [F1] key if you wish to define the Influence Coefficients for this setup. The following “Edit ICF” banner screen is displayed.



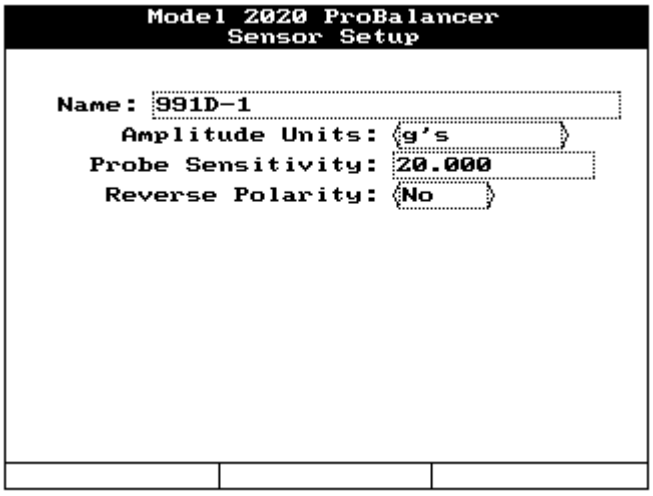
If you do not have ICF information for the balance setup, press the [F1] “Default” key. This sets the ICF at the default for the known conditions. The ICF default value is added automatically when the Setup is created. The user may use this key at any time to reset the ICF to default. If an ICF has been calculated by the analyzer and stored from previous runs,

the “Samples” field displays the number of samples included in the calculation. (The Samples field is a display-only field and cannot be edited by the user.)

When satisfied with the displayed ICF, press [BACKUP] to return to the “Prop Balance Setup” banner screen.

4.1.1.1.2. – Sensor Setup

Pressing the [F3] “Sensor” key from the “Prop Balance Setup” banner screen displays the “Sensor Setup” banner screen shown below. The information on this screen should correspond to the sensor you selected for this setup in Step 11 of Section 4.1.1.1 above.

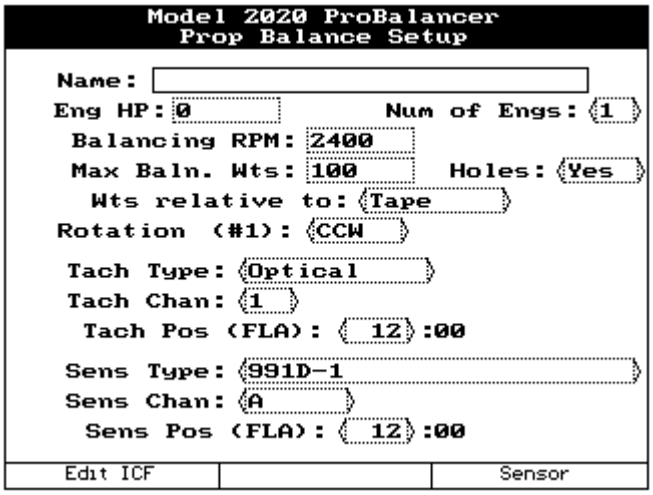


This is an information-only screen for use in verifying the parameters of the vibration sensor you have chosen. You may not edit or otherwise enter information on this screen. If this sensor does not possess the specifications you require for this setup, you may enter a new sensor in the “Sensor Setup” screen, or choose another sensor from the existing list. Press [BACKUP] or [ENTER] to exit this screen and return to the “Prop Balance Setup” banner screen.

When all fields are completed to your satisfaction, press the [ENTER] key to accept and store the setup. The analyzer will display the message, “Store this new setup?” If you choose to store this new setup in the analyzer’s memory, press the [F1] key for “Yes,” otherwise press [F2] for “No.”

4.1.1.2. – Propeller Balance Setup With EPS Upgrade

To complete the “Prop Balance Setup” banner screen (as shown below), do the following:



1. In the “Name” field, enter a name for this setup using the keypad. (Refer to Chapter 3, “Using the Model 2020 ProBalancer Analyzer” if you are unfamiliar with using the keypad.)

   The name you choose will aid you in differentiating this setup from other stored setups should you choose to review or print it at a later time. The name should be one of your choosing which you will easily recognize and associate with this setup such as “Cessna 150,” “King Air, ” or “T-6 TEXAN II.”

2. Using the [⇓] key, move down to the “Eng HP” field. Enter the rated horsepower of the engine using the keypad. Any numeric entry between 1 and 5000 will be accepted.

3. Using the [⇓] key, move to the “Num of Engs” field. Use the [⇒] key to “toggle” between the choices in this field to select the number of engines being balanced with this setup.

4. Move to the “Balancing RPM” field using the [⇓] key. Using the keypad, enter the actual propeller RPM at which you intend to balance. If no manufacturer recommendation is available, refer to the *ACES Systems Guide to Propeller Balancing* included with your Model 2020 analyzer. A low cruise RPM is usually best. This field will accept any numeric value, however, the value in this field must be within +/- 200 RPM of the actual propeller speed or a “HIGH”/“LOW” error message will be displayed during data acquisition and data collection will be prevented. See Chapter 15 for additional information on troubleshooting Tach readings.

5. Using the [⇓] key, move to the “Max Baln.Wts” field. Enter the maximum total trim balance weight (in grams) allowed for this installation. If the manufacturer doesn’t specify a weight, refer to the *ACES Systems Guide to Propeller Balancing*.

6. Move to the “Holes” field using the [⇓] key. This field appears as a function of the EPS (Enhanced Performance Software). Using the [⇒] key, select “Yes” if there are nutplates, predrilled holes, or otherwise predetermined locations for adding trim balance weights. Otherwise, select “No”.

7. Using the [⇓] key, move to the "Wts relative to" field. Select "Tape" or "Sensor" using the [⇒] key. Decide if you wish to measure angles from the reflective tape or the vibration sensor as an index point. Refer to the Chapter 2, Analyzer Description for a detailed explanation of how to use the Propeller Protractor and the referencing tape or sensor. The actual hole entries will be made as described in Section 4.1.1.2.3 Step 5 below.

8. Move down to the "Rotation (#1)" field using the [⇓] key. Using the [⇒] key, Select CW (Clockwise) or CCW (Counter-Clockwise) for the rotation of the propeller as viewed standing Forward of the propeller Looking Aft toward the tail of the airplane (FLA).

9. Using the [⇓] key, move to the "Tach Type" field. Using the [⇒] key, select the type of tachometer you are using.

   Tach Type selections for this field include:

   "Optical" - Includes the Phototach and LaseTach. This is the only selection that will provide power to a Tach device.

   "Mag (Lo)" - A magnetic interrupter with an output of 120mV or greater. This selection is used for clean Tach signals with a low noise floor.

   "Mag (Hi)" - A magnetic interrupter with an output of greater than 3 volts and less than 5 volts. This selection provides isolation from erratic signals containing electrical noise above 120 mV but less than 3 volts.

   "Monopole" - A monopole type pickup with an output of 120mV or greater.

   "Tach Gen" - A one to three pole tachometer generator with an output of 390mV or more. (This type of input is normally used for synchronous vibration surveys and not for a once per rev signal used to calculate phase angles in balancing.)

NOTE

Analyzers with a serial number greater than 40000 contain an "auto gain" Tach circuit. The tach type selection is only necessary to the point that the "Optical" selection provides power to the Tach. All other modes will attempt to gain the Tach signal to a level that can be read by the analyzer.

10. Using the [⇓] key, move to the "Tach Chan" field. Using the [⇒] key, select "TACH 1" or "TACH 2" according to the analyzer's tach input channel you intend to use. The default for single sensor input is TACH 1.

11. Using the [⇓] key, move to the "Tach Pos (FLA)" field. Using the [⇒] key, select the tach position. The tach position is determined by standing Forward of the propeller Looking Aft (FLA) toward the tail of the aircraft. From this viewpoint, determine the approximate clock position (1:00 to 12:00) of the tachometer pickup.

CAUTION

Sensors connected to Channel A and Channel B must be of the same type. Using different sensors during the same job will cause erroneous readings and problems achieving good balance results.

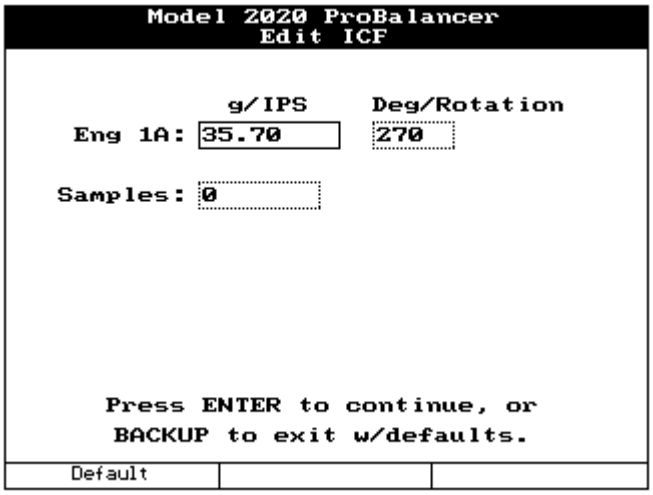
12. Move down to the “Sens Type” field using the [⇓] key. Select the sensor type from the available options using the [⇒] key.

13. Move to the next field, “Sens Chan” using the [⇓] key. Select sensor channel “A” or “B” according to which of the analyzer’s input channels you intend to use. The default for single-sensor input is Channel A. Use the [⇒] key to make the selection.

14. Using the [⇓] key, move to the “Sens Pos (FLA)” field. Using the [⇒] key, select the vibration sensor position. The sensor position is determined by standing Forward of the propeller Looking Aft (FLA) toward the tail of the aircraft. From this viewpoint, determine the approximate clock position (1:00 to 12:00) of the sensing axis of the vibration sensor.

4.1.1.2.1. – Edit ICF

The “Edit ICF” (which corresponds to the [F1] key) selection appears at the bottom left of the “Prop Balance Setup” banner screen. Press the [F1] key if you wish to define the Influence Coefficients for this setup. The following “Edit ICF” banner screen is displayed.

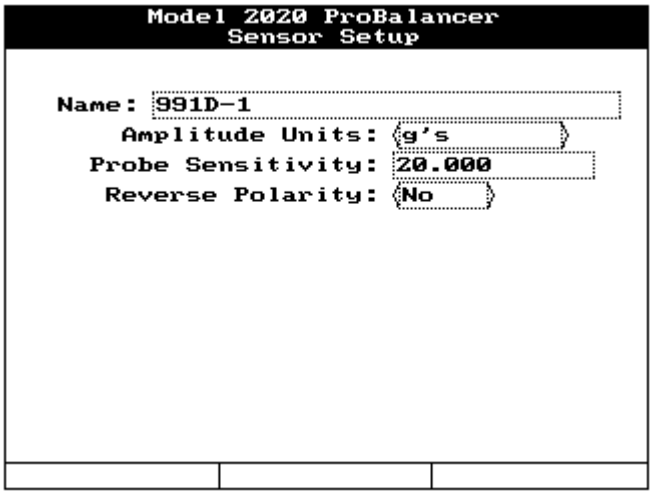


If you do not have ICF information for the balance setup, press the [F1] (Default) key. This sets the ICF at the default for the known conditions. The ICF default value is added automatically when the Setup is created. The user may use this key at any time to reset the ICF to default. If an ICF has been calculated by the analyzer and stored from previous runs, the “Samples” field displays the number of samples included in the calculation.

When satisfied with the displayed ICF, press [BACKUP] to return to the “Prop Balance Setup” banner screen.

4.1.1.2.2. - Sensor Setup

Pressing the [F3] (Sensor) key from the “Prop Balance Setup” banner screen displays the “Sensor Setup” banner screen shown below. The information on this screen should correspond to the sensor you selected for this setup in Step 11 of Section 4.1.1.1 above.

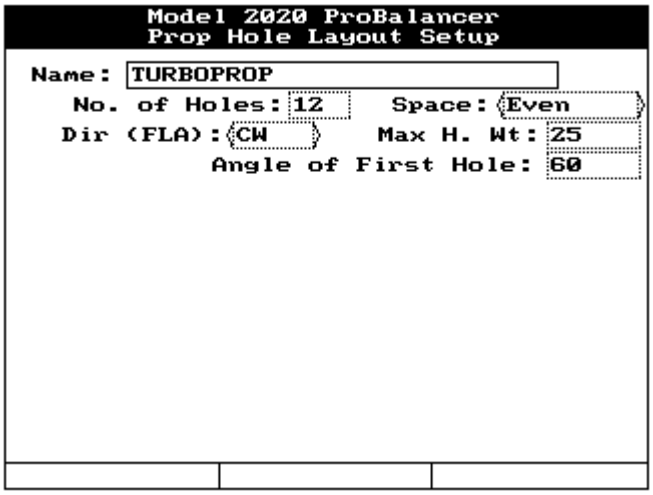


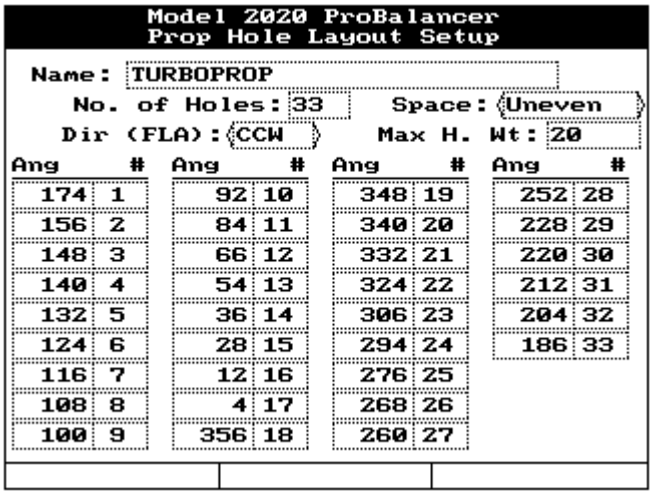
This is an information-only screen for use in verifying the parameters of the vibration sensor you have chosen. You may not edit or otherwise enter information on this screen. If this sensor does not possess the specifications you require for this setup, you may enter a new sensor in the "Sensor Setup" screen, or choose another sensor from the existing list. Press [BACKUP] or [ENTER] to exit this screen and return to the "Prop Balance Setup" banner screen.

When all fields are completed to your satisfaction, press the [ENTER] key to accept and store the setup.

4.1.1.2.3. – Prop Hole Layout Setup

The "Prop Hole Layout Setup" banner screen is the next screen displayed. The "Name" field is automatically filled in from the name you entered in the previous "Prop Balance Setup" screen. Complete the fields on the screen by doing the following:





1. Use the [⇓] key to move to the "No. of Holes" field. Enter the number of holes that correspond to the total number of trim weight mounting locations. The valid range of values for this field is 1 to 36.

2. Move to the "Space" field using the [⇓] key and then use the [⇒] key to select "Even" or "Uneven" from the available selections.

   Even indicates that all trim weight mounting locations are evenly spaced. The analyzer will automatically calculate the number of degrees between holes in this case.

   If you select "Uneven," and then use the [⇓] key to move away from the field, several fields ("Ang" and "#") appear at the bottom of the screen. You will complete these fields later in the process at Step 5.

3. Use the [⇓] key to move to the next field, "Dir (FLA)." Complete this field by using the [⇒] key, select CW for clockwise or CCW for counter-clockwise to indicate the direction of increasing hole numbers as viewed from forward looking aft.

4. Move to the "Max H. Wt" field using the [⇓] key. Using the keypad, enter the maximum allowable weight (in grams) for any single hole. Use the [⇓] key to move to the next field.

5. Complete the next fields differently depending on data you input in Step 2 above.

   If you selected "Even" in Step 2 - The "Angle of First Hole" field is displayed. Use the keypad to enter the angle of hole number 1 as viewed from the front of the engine looking aft. To determine this angle, do the following. With mag switches OFF, rotate the propeller to align with the desired "Tape" or "Sensor" location as described in Chapter 2. The "weights relative to" reference was chosen in Section 4.1.1.2 Step 7 above. With the propeller in this position when measuring "relative to" Tape, use the 12:00 position as the "0" or "360 degrees" (index point) and measure *clockwise* to the angle of hole number 1. With the propeller in this position when measuring "relative to" Sensor, use the position of the Vibration Sensor as the "0" or "360 degrees" (index point)

and measure *clockwise* to the angle of hole number 1. For example, if the #1 hole is at the 3:00 position, the angle would be 90 degrees; if at the 9:00 position it would be 270 degrees. *The measurement to hole number 1 must always be in a clockwise direction regardless of the direction of rotation of the propeller or the direction of hole numbering.* The analyzer's logic corrects for these factors.

If you selected "Uneven" in Step 2 – Multiple angle/hole number fields are displayed. Each hole angle must be defined individually. Using the keypad, complete each field by entering a hole number ("#") and its corresponding angular ("Ang") location as viewed from the front of the engine looking aft. Use the [⇓] and [⇑] keys to move between these fields.

To determine these values, do the following. With mag switches OFF, rotate the propeller to align with the desired "Tape" or "Sensor" location as described in Chapter 2. The "weights relative to" reference was chosen in Section 4.1.1.2 Step 7 above. With the propeller in this position when measuring "relative to" Tape, use the 12:00 position as the "0" or "360 degrees" (index point) and measure *clockwise* to the angle of each hole number and record that angle adjacent to the hole number. With the propeller in this position when measuring "relative to" Sensor, use the position of the Vibration Sensor as the "0" or "360 degrees" (index point) and measure *clockwise* to the angle of each hole number and record that angle adjacent to the hole number. (See the example "Prop Hole Layout Setup" screen shown at the beginning of the section.) For example, if the number 1 hole is near the 6:00 position, the angle may be measured as 174 degrees. On the screen, use the keypad to enter the angle of hole number 1 as "174." Then, using the [⇓] key to move to the adjacent field ("#"), input the number "1." Next, measure to hole number 2. If hole number two is measured as 156 degrees, enter that value and "2" in the adjacent field. Continue this process until all angles for all holes are defined. *The measurement must always be in a clockwise direction regardless of the direction of rotation of the propeller or the direction of hole numbering.* The analyzer's logic corrects for these factors.

6. When all fields are complete, press [ENTER] to accept the settings and continue.

   The analyzer will display the message, "Store this new setup?" If you choose to store this new setup in the analyzer's memory, press the [F1] key for "Yes," otherwise press [F2] for "No."

4.1.2. – Customer Information

At this point in the "Propeller Balance" process, you should have completed the following steps: selected "Propeller Balance" from the Main Menu; selected "Start Job;" and completed the "Prop Balance Setup" screen which included editing ICF and sensor setup, or you selected a setup from a list of predefined setups. Depending on whether or not you have Enhanced Performance Software installed, you may have also defined values for a number of trim weight mounting holes.

If these steps have been completed, then the "Customer Information" banner screen will be displayed. Customer information is optional but will appear on the job printout if entered and will assist you in identifying this job when stored in memory. Complete the information fields using the keypad. Press [ENTER] to continue.

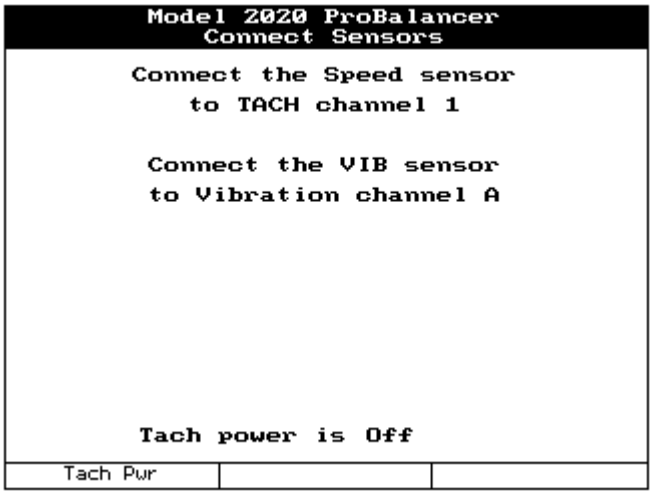
NOTE
If no customer information is entered, the job will be commonly labeled "Unnamed" in the resume and manage job lists. This will complicate finding a specific job, as multiple jobs are stored. We recommended you enter a customer name.

4.1.3. – Engine Information

The "Engine Information" banner screen is displayed. This information is optional but will appear on the job printout if entered and will assist you in identifying this job when stored in memory. Complete the information fields using the keypad. When finished, press [ENTER] to continue.

4.1.4. – Connect Sensors

The "Connect Sensors" banner screen will be displayed. Messages that appear on this screen prompt you to perform the physical installation and connection of the tach and vibration sensors to the input ports you specified in the setup.



4.1.4.1. – Tachometer Setup

To install the tachometer, do the following:

1. Near the bottom of the screen, ensure that the message, "Tach Power is off" is displayed.

2. Install the Phototach at the position specified in the setup. The Phototach should be not less than 4 inches but no greater than 18 inches from the back surface of the target blade. Use speed tape or duct tape to secure the 3x3 base mount to the cowling surface. An angle of approximately 5 degrees from perpendicular to the target blade will produce the best results.

3. Connect the tachometer cable to the Phototach connector. Route the cable away from hot areas and electrical equipment back to the cockpit and attach to the tach channel specified in the setup you are using. Secure the cable along its route with duct tape or tie wraps. Press the [F1] "Tach Pwr" key so that the message, "Tach Power is On" is displayed near the bottom of the screen.

WARNING
Insure mag switches are off prior to any movement of the propeller.

4. Rotate the propeller to visually align the Phototach with a point on the backside of the target blade where you intend to place the reflective tape. Clean this area thoroughly to insure adhesion of the tape.

5. Cut a strip of reflective tape (3M Tape, Model 7610 is recommended) approximately 1.5 to 2 inches long. With the tape backing still in place, hold the tape in position on the propeller blade and move the propeller blade back and forth in front of the Phototach beam.

NOTE
To insure quality reflective action back to the Phototach, use 3M 7610 reflective tape. Use of other reflective tape or devices may result in poor signals back to the Phototach.

NOTE
If balancing large-diameter or high-speed propellers, refer to Chapter 15, Equipment and Accessory Setup and Troubleshooting for information on reflective tape width requirements for these applications.

6. With an inspection mirror, watch the red LED gate indicator light on the aft end of the Phototach illuminate and extinguish as the tape crosses the beam. This indicates the position of the tape is correct.

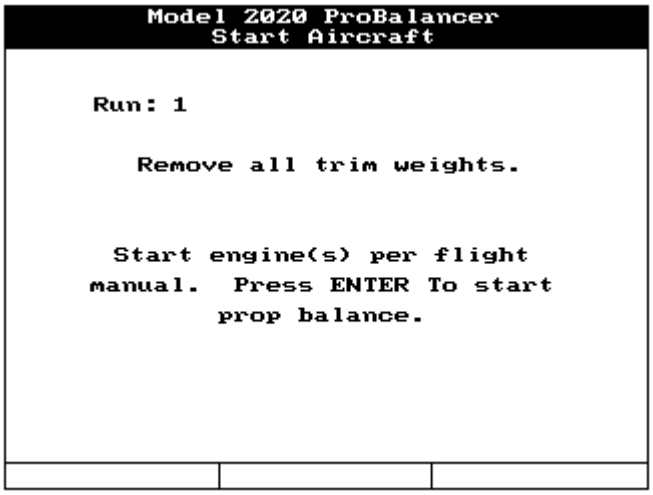
7. Remove the tape backing and attach the reflective tape to the propeller at that location. Be sure to smooth out any wrinkles or bubbles in the tape. Ensure the edges are smoothed and firmly attached.

8. Connect the vibration sensor cable to the sensor connector. Route the cable away from hot areas and electrical equipment back to the cockpit and attach to the sensor channel specified in the setup you are using. Secure the cable along its route with duct tape or tie wraps.

NOTE
All trim balance weights installed during previous dynamic balance procedures should be removed before proceeding beyond this point. Refer to the ACES Systems' *Guide to Propeller Balancing* (included with your Model 2020) for a full list of FAA-approved inspection requirements.

4.1.5. – Start Aircraft

When you have completed the physical equipment setup tasks, press [ENTER] on the analyzer to continue with the propeller balance job.



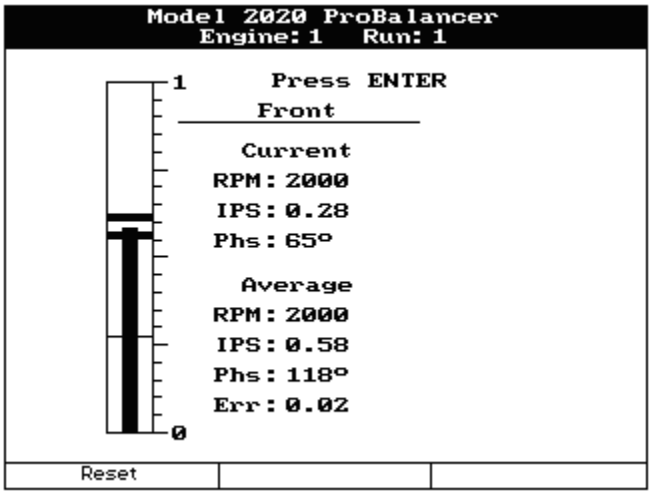
The analyzer will then display the “Start Aircraft” banner screen (shown above). Two information lines are shown on the screen. The first: “Remove all trim weights” and the second: “Start engine(s) per flight manual. Press [ENTER] to start prop balance.”

Removing previously installed trim balance weights is necessary to prevent stack ups, or attempts to counterbalance installed weights. Follow the instructions in the *ACES Systems' Guide to Propeller Balancing* included with your analyzer for inspections prior to balancing. The document is FAA approved and provides guidelines for the selection and installation of balance weights. When balance weights are removed and inspections are complete, press [ENTER] to continue.

4.1.6. – Acquiring Data

After starting the aircraft, the “Set Engine Speed” banner screen is displayed. At the top left of the screen, the run number is displayed. Directly below the run number, is the message, “Set eng # x RPM to: xxxx (where xxxx is the balance speed entered in the setup being used.) This is your target RPM for balancing. The next line, “Current RPM: xxxx.” indicates the RPM the propeller is turning currently. Attempt to match the two as closely as possible with throttle/prop lever adjustments. The next line, “Difference: xx” gives the current difference between the Target and the Current RPM. When the target speed and current speed are matched as closely as possible, press [ENTER] to continue.

The screen changes to display the “Engine: x Run: x” banner screen. (See the figure below.)



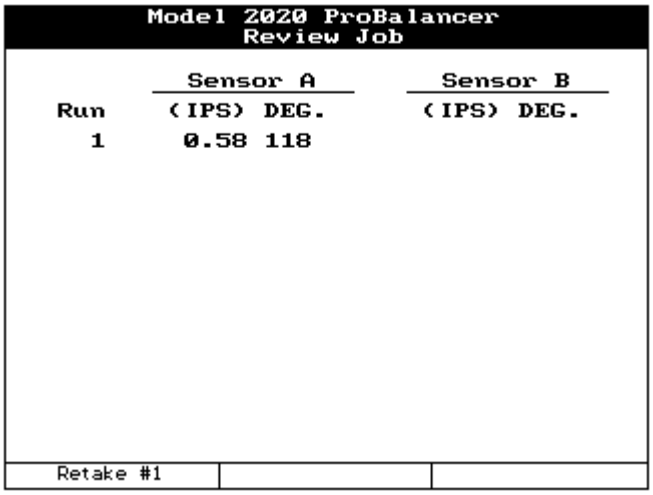
The converging vibration indicator shows the average amplitude. (See Chapter 16, Reading Spectrum and Scales, for information on how to read the data contained on this screen.) The sensor location (Front) is indicated at the top of the text, right side of the screen. The current and average frequency, amplitude, and phase are also displayed along with a numeric error value in the averaging. After the "Press ENTER" message appears and when the error is at its lowest point and no longer decreasing, press [ENTER] to stop the data collection process. If you wish to reset the averaging and take new data, press the [F1] "Reset" key.

4.1.7. – Review Job

When you are finished acquiring data, the "Review Job" banner screen (shown below) is displayed next. The amplitude and phase (IPS and DEG.) are displayed for each input channel. Data is displayed for only the input channels that were used for the job; others are left blank.

If you are satisfied with the results of the run and are ready for a solution, press [ENTER] to accept the data and continue.

If you want to retake data for this run, press the [F1] "Retake #1" key. This option returns you to the "Set Engine Speed" banner screen (see section 4.1.6 above).



Once you have accepted data by pressing the [ENTER] key as described in the previous section, an information screen advising you to shutdown the aircraft in accordance with the flight manual is displayed. Shutdown the aircraft and press [F3] “Continue” to continue.

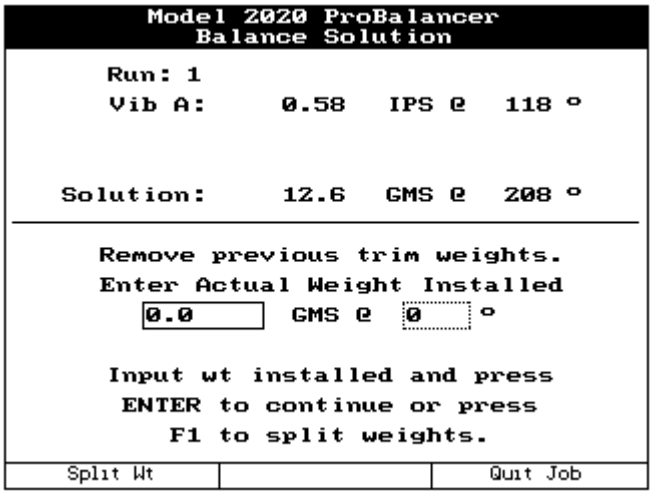
4.1.8. – Balance Solution

The analyzer is capable of suggesting a corrective action based on the measured vibration and defined ICF. From this point on, the screen dialogs require user feedback to continually update the ICF. In the screens below, the information required for correct ICF update is described.

4.1.8.1. – Balance Solution Without EPS Upgrade

The “Balance Solution” banner screen shown below is displayed. The screen is identified at the top left as being “Run: 1.” Vibration amplitude and phase angle are displayed for each channel being used (Channel A only in the example screens shown) and a solution for the first run.

In this example screen shown below, the “Solution” is “12.6 GMS @ 208°” which means to place 12.6 grams (GMS) of weight at 208 degrees from the index point. (See Chapter 2, Analyzer Description on how to use the Propeller Protractor to locate the installation angle.)



In the lower portion of the screen you see an information line stating "Remove previous trim weights." Since all previously installed trim weights were removed prior to the start of the first run; this is only a reminder for Run 1. This same information line in following runs means to remove the trim weights installed on the previous run. In other words, the balance solution and resulting weight installed here after Run 1 may change in Run 2. The weights installed after Run 1 would be removed and new weights added at another location to refine the balance solution.

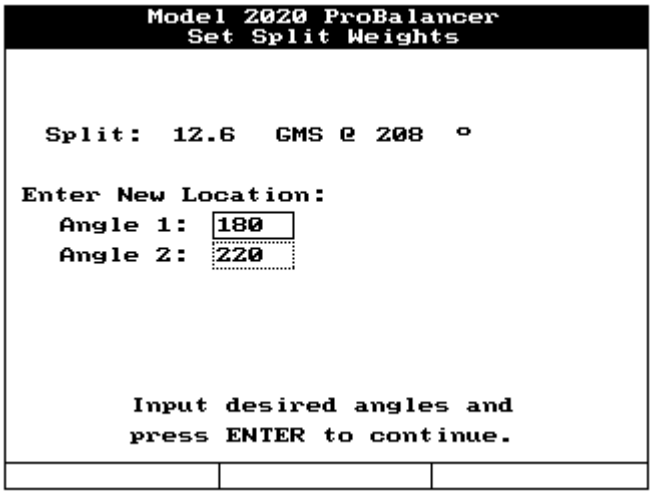
NOTE

In subsequent runs, all installed weights from each previous run must be removed. The "remove weight" message will be repeated for every run and solution. Each new solution dictates that the previously applied solution (installed weight) be totally replaced. In some cases this may mean removing and reapplying weight at the same or near the same location. Failure to remove previously installed weight prior to applying the new solution weight will result in failure of the propeller balance function.

The next line of text states "Enter Actual Weight Installed." In the weight and angle fields directly below this line, enter the exact amount of weight and the angle, as near as possible, where it was installed. If you are unable to install the exact amount of weight in the recommended solution, install a weight as near the suggested solution weight as possible. Enter the actual weight value as added to the propeller. Use the [⇓] key to move from the weight field to the angle field. Enter the actual location where the weight was added to the propeller. Pressing the [⇓] key again will return you to the weight field. The important point is *whatever the actual weight and location is, enter it here*. If the solution exceeds the single location limits of the propeller or spinner assembly (refer to *ACES Systems' Guide to Propeller Balancing* included with your analyzer) you may split the weight across two locations. If you wish to split weights, press the [F1] "Split Wt" key to access the Set Split Weights screens as shown in Step 4.1.8.1.1 below. If you do not wish to split the weights at this time, press [ENTER] to continue and then move to the end of this section, to continue with the instructions at the "Start Aircraft" screen. You will be allowed to split the weight at any time during the job.

4.1.8.1.1. – Set Split Weights

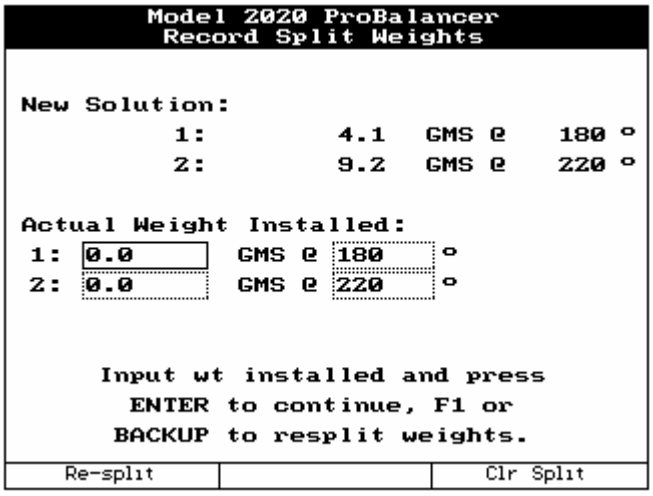
To use the split weight option, press the [F1] "Split Wt" key from the "Balance Solution" banner screen. The "Set Split Weights" banner screen below is displayed.



The single location solution (in this case 12.6 Grams @ 208 degrees) is displayed at the top of the screen. The next line states "Enter New Location." Use the keypad to complete the next two fields, "Angle 1" and "Angle 2." Locate the two available weight installation locations (one on each side of the 208-degree location) and enter them in the two fields. Use the [⇓] key to move between the fields. Press [ENTER] to continue.

4.1.8.1.2. - Record Split Weights

The screen displays the "Record Split Weights" banner screen like the one shown below.

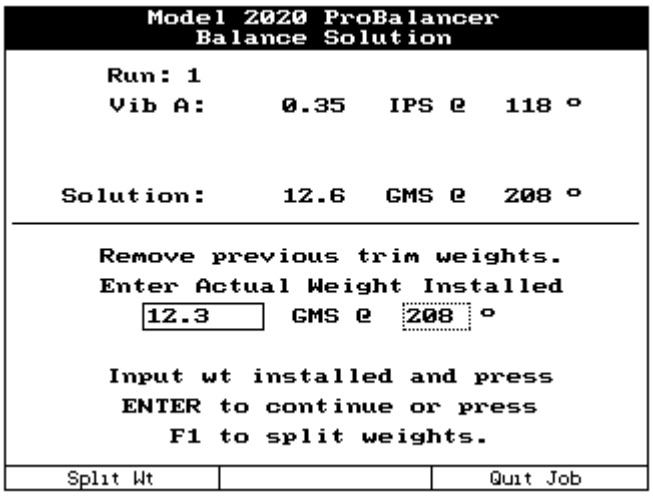


The "New Solution" is given for the two new angles you specified as available for weight application. Match the new weight solution as near as possible to the recommended solution

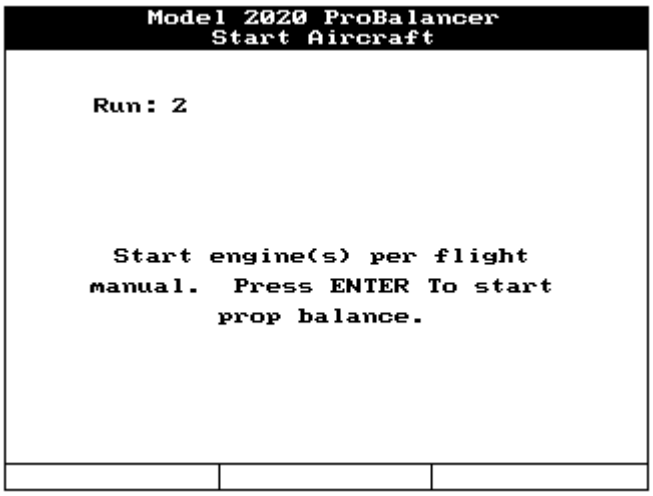
and install it at the new angles. Weigh the test weights carefully and enter the exact amount of weight in the "Actual Weight Installed" fields.

If you discover a problem with the split weight locations you specified, press the [F1] "Re-split" key and enter the two new angles. If you decide splitting the weight is unnecessary, press the [F3] "Clr Split" key to return to the "Balance Solution" screen and enter a single weight location.

When the "Actual Weight Installed" fields are completed, press [ENTER] to continue. The screen will return to the "Balance Solution" banner screen, as shown below, with the combined split-weight solution being displayed for the user. Press [ENTER] to continue.



The screen will display the "Start Aircraft" banner screen shown below.



The "Start Aircraft" banner screen indicates the upcoming run number and directs you to "Start engine(s) per flight manual". Press [ENTER] to start prop balance." Then repeat the procedures described above starting with item, 4.1.6 until the level of vibration is at or better

than an acceptable level. See the *ACES Systems Guide to Propeller Balancing* for details of vibration levels and weight installation procedures.

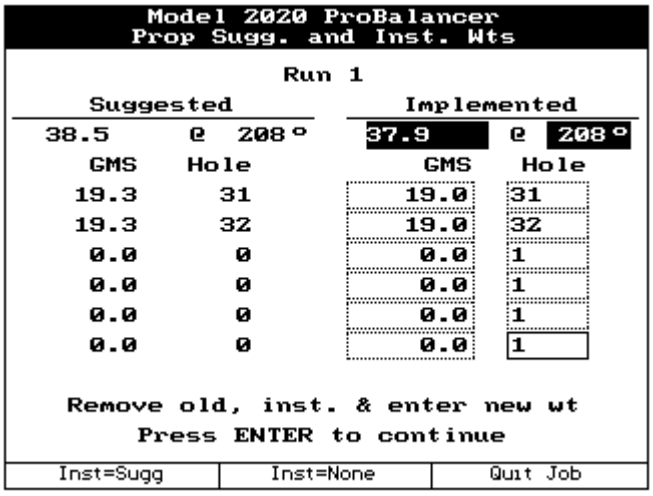
NOTE

If the engine/propeller assembly is mechanically sound, a normal balance job should take no more than three runs to complete. The analyzer will only allow you to complete 6 runs in attempts to balance. If the balance job is not completed by the sixth run you should suspect possible problems with your technique or mechanical faults with the engine and/or propeller assembly. Mechanical faults may also be indicated by drastic changes in suggested weight or angle from one solution to the next.

4.1.8.2. – Balance Solution With EPS Upgrade

The "Prop Sugg. and Inst. Wts" banner screen shown below is displayed. The screen is identified at the top as being "Run: 1". The left side of the screen shows, from top to bottom, the suggested combined effective weight of the individual hole weights. Listed below the combined effective weight are the individual hole weights and numbers required for weight installation. The right side of the screen shows, from top to bottom, the implemented combined effective weight of the individual hole weights. Listed below the combined effective weight, are the individual hole weights and numbers actually used.

In the example screen shown below, the "Suggested" installation is "38.5 GMS @ 208°" which means to place 38.5 grams (GMS) of weight at 208 degrees from the index point. (See Paragraph 4.1.1.2.3 – Prop Hole Layout Setup on how to use the Propeller Protractor to locate the hole angles.) This is done by entering the individual hole weights and numbers under GMS and Hole. Navigate through the fields using the [⇑] [⇓] arrow keys. These entries will be recalculated to display the combined effective weight shown directly under the Implemented text. This will allow you to see how closely the implemented installation is to the suggested solution. In the example below, the closest available weight to 19.3 grams was 19.0 grams. This weight was entered in the GMS box adjacent to the hole where it was actually installed. The effective weight was recalculated and found to be slightly below the suggested weight at the same angle. The analyzer will use this information along with the vibration readings from the next run to update the ICF and provide subsequent solutions.

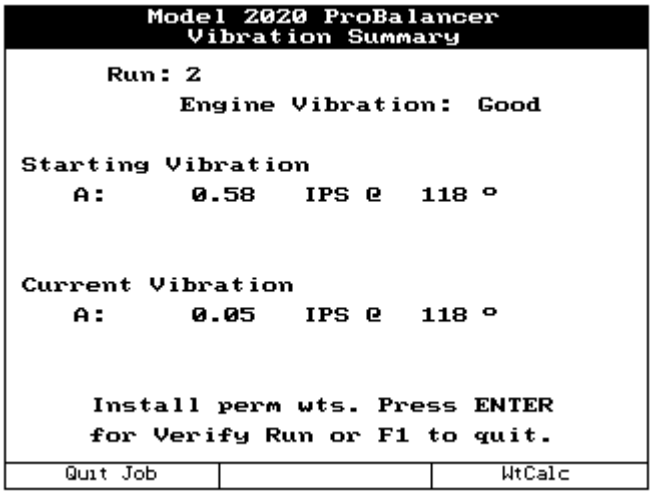


In the lower portion of the screen you see an information line stating “Remove old, inst. and enter new wt”. Since all previously installed trim weights were removed prior to the start of the first run; this is only a reminder for Run 1. This same information line in following runs means to remove the trim weights installed on the previous run. In other words, the balance solution and resulting weight installed here after Run 1 may change in Run 2. The weights installed after Run 1 would be removed and new weights added at another location to refine the balance solution.

NOTE

In subsequent runs, all installed weights from each previous run must be removed. The “remove weight” message will be repeated for every run and solution. Each new solution dictates that the previously applied solution (installed weight) be totally replaced. In some cases this may mean removing and reapplying weight at the same or near the same location. Failure to remove previously installed weight prior to applying the new solution weight will result in failure of the propeller balance function.

4.1.9. Vibration Summary

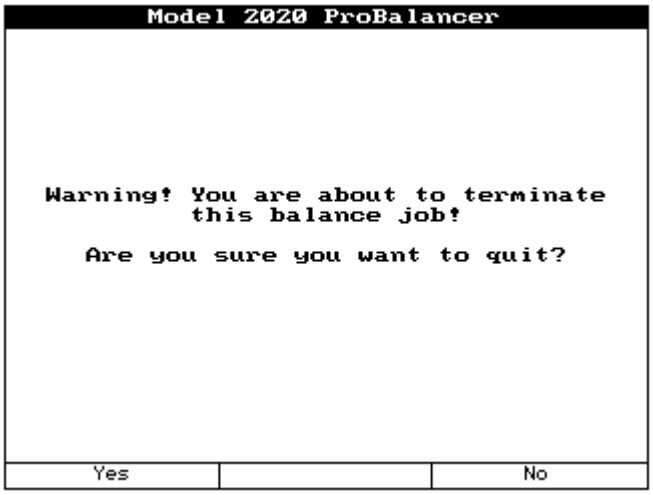


The vibration summary screen, as shown above, will appear when the current vibration measurement is below 0.07 IPS. The screen will display run number at which the current vibration level was recorded. It will give a brief description of the current engine vibration level. The screen will show the starting vibration magnitude and phase angle on any channels defined in the setup. In the case above, measurements were recorded on channel A only. The screen will also display the current vibration magnitude and phase on any channel defined in the setup.

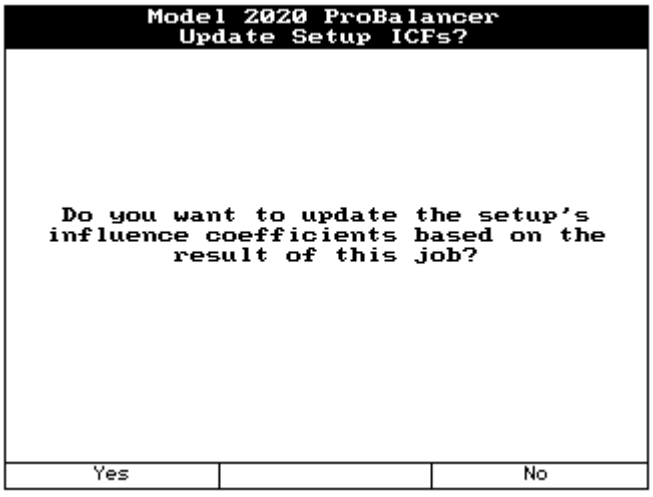
The bottom of the screen prompts you to install the permanent weights. Use the [F3] “Wt Calc” button to automatically access the “Weight Calculator” as explained in Paragraph 4.5 below. Pressing [ENTER] will start an additional run used to verify that the installation of the permanent weights retained satisfactory vibration level readings.

You can terminate the job at the current vibration reading and weight installation by pressing the [F1] “Quit Job” key. This will mark the job as complete. Two warning screens will

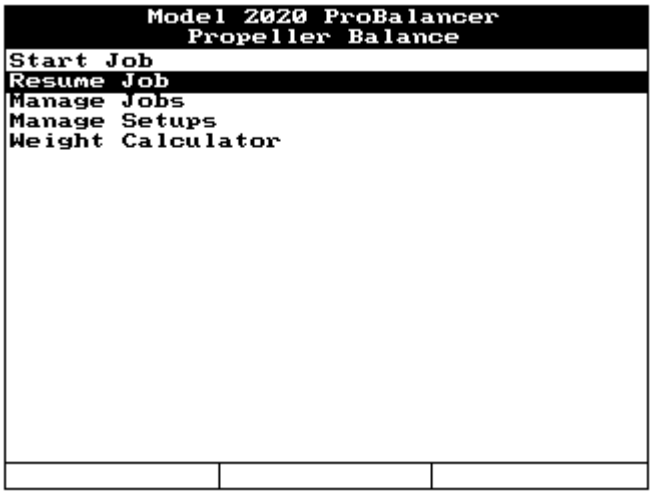
appear. The first, shown below, asks you to confirm that you want to Quit the Job in progress. Press [F1] “Yes” if you are sure you want to complete this job. Press [F3] “No” to return to the “Vibration Summary” screen.



If you selected “Yes” to terminate the current job, a second screen will appear as shown below. This screen asks if you would like to use the information learned in this job to update the influence coefficient (ICF) stored in the setup. If the job went well, pressing [F1] “Yes”, will update the setup’s ICF. It is possible that future jobs performed using the same setup will require fewer runs. If the job went poorly for some reason and the data is suspect, pressing [F3] “No” will allow you to keep the previous ICF.



4.2. – Resume Job

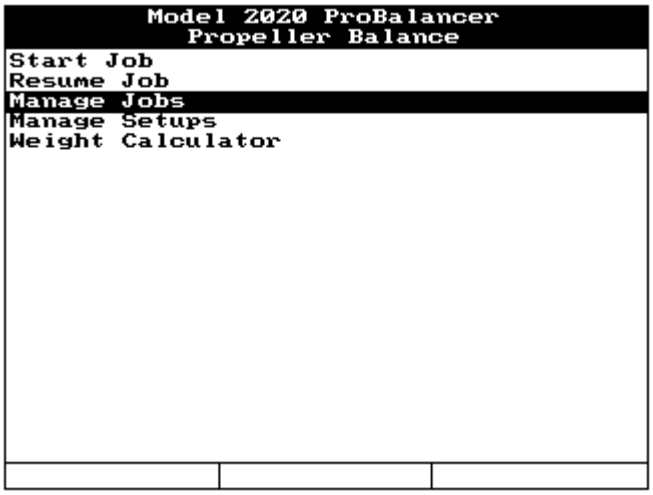


Selecting “Resume Job” from the “Propeller Balance” banner screen menu allows you to select a job to resume. Using the [⇓] key, highlight the job you wish to complete from the list of incomplete jobs, and press [ENTER]. You will be taken to the last step completed in the job process.

NOTE

If you did not enter information in the optional “Customer Information” fields when starting a job, that job will be stored by the name, “Unnamed.” If several “Unnamed” jobs are listed, you may wish to review the data for each in order to ensure you are resuming the job you intended. See Section 4.3 for specific guidelines on the Review function.

4.3. – Manage Jobs



Selecting “Manage Jobs” from the “Propeller Balance” banner screen menu presents several sub-menu choices to choose from. These choices allow you to “manage” previously completed job data you have stored in the analyzer.

4.3.1. – Review

Selecting the “Review” option presents a list of stored jobs on the “Job List” banner screen. You can select one job for on-screen viewing. When viewing is complete, press the [BACKUP] or [ENTER] key to exit the screen. The analyzer will then return you to the "Manage Jobs" menu screen to select another function.

4.3.2. – Print

The “Print” option presents a list of stored jobs on the “Job List” banner screen. From the list, you may select one job for printing. See Chapter 14, “Printing” for a detailed explanation of how to set up the analyzer to print.

4.3.3. – Print All

The “Print All” option sends all currently stored jobs to the printer. When you select “Print All,” a message will appear on the analyzer’s “Print All Jobs” banner screen asking you to verify that you want to print all jobs. Answer the prompt, “Are you sure?” by pressing the [F1] key for “Yes” or the [F3] key for “No.” If you choose the “Yes” answer, ensure your printer is prepared (paper, print cartridge, etc.) to complete the number of jobs stored. The “Yes” answer will send *all* currently stored jobs to the printer. The “No” answer will return you to the previous menu.

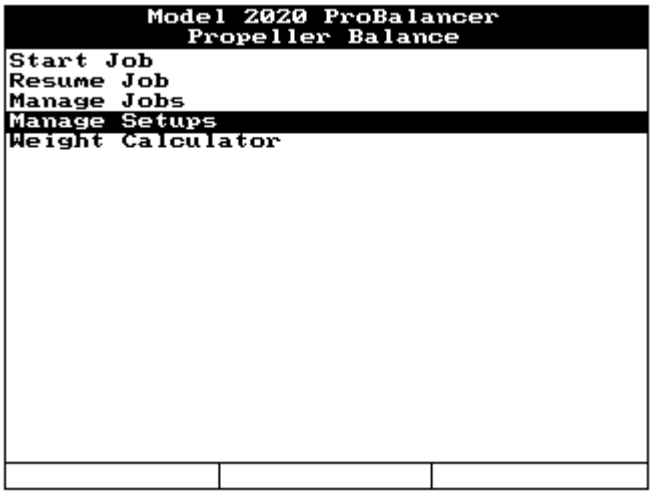
4.3.4. – Delete

The “Delete” option presents a list of stored jobs on the “Job List” banner screen. From the list, you may select one job for deletion. After making your selection, the “Delete Job” banner screen will appear, asking you to verify your intent to delete the selected job by pressing the [F1] key for “Yes” or the [F3] key for “No.” You may wish to print the job for reference or permanent record prior to deleting. Once deleted, the job cannot be retrieved from the analyzer.

4.3.5. – Delete All

The “Delete All” option will delete all currently stored jobs. After selecting this option, the “Delete All Job” banner screen will appear, asking you to verify your intent to delete all the jobs by pressing the [F1] key for “Yes” or the [F3] key for “No.” You may wish to print the jobs for reference or permanent record prior to deleting. Once deleted, the jobs cannot be retrieved from the analyzer.

4.4. – Manage Setups



Selecting “Manage Setups” from the “Propeller Balance” banner screen menu presents several sub-menu choices to choose from. These choices allow you to “manage” setups you have stored previously in the analyzer.

4.4.1. – Edit

Selecting the “Edit” function displays the “Setup List” screen. Select the setup you wish to edit. The screen will display the “Propeller Balance Setup” screen. Edit the setup as necessary and press [ENTER] to store and exit the edited setup screen. Refer to section 4.1.1 for

detailed instructions on how to complete/edit the fields in the “Propeller Balance Setup” screen.

4.4.2. – New

Selecting “New” will allow you to build a new propeller setup. After selecting “New”, the screen will display the fields necessary for building the new setup. Refer to section 4.1.1.

4.4.3. – Print

Selecting the "Print” function displays the “Setup List” screen. Ensure your printer is turned on and connected to the analyzer with the COMM/Print cable supplied with your analyzer. Select the setup you wish to print. (See Chapter 14, “Printing” for a detailed explanation of how to set up the analyzer to print.)

4.4.4. – Print All

Selecting “Print All” sends all currently stored setups to the printer. When making this selection, you will be asked to verify “Are you sure?” by pressing the [F1] key for “Yes,” or the [F3] key for “No.” If choosing the “Yes” answer, ensure your printer is prepared (paper, print cartridge, etc.) to complete the number of jobs stored. The “Yes” answer will send *all* currently stored setups to the printer. The “No” answer will return you to the previous menu.

4.4.5. – Delete

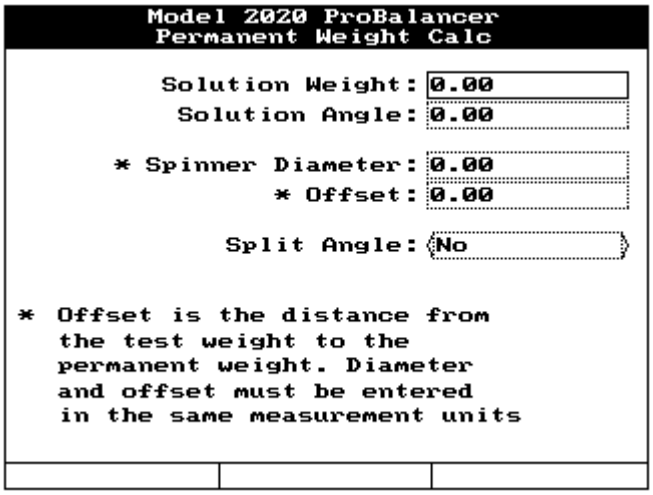
The “Delete” option presents you with a list of stored setups. From the list, you may select one setup for deletion. If you wish to delete all stored setups, you must delete them individually. After making your selection, you will be asked to verify your intent to delete the selected job by pressing the [F1] key for “Yes,” or the [F3] key for “No.” We highly recommend you print the setup for reference or permanent record prior to deleting them. Once deleted, the setups cannot be retrieved from the analyzer.

4.5. Weight Calculator

CAUTION

Before installing any permanent weights, the test weights must be removed. The test weights will be replaced by the weight suggested in the analyzer to compensate for the change in arm of the permanent installation location.

The weight calculator, as shown below, can be used for placement of the final balance weights. This function can be accessed from inside a job when the vibration level drops below 0.07 IPS by using the [F3] "Wt Calc" function key (see paragraph 4.1.9 above). It can also be used at any time to suggest the correct final balance weights to install based on any installed test weights.



Use the following description of each line to enter data in the weight calculator. Use the [⇓] or [⇑] key to move between fields.

1. In the "Solution Weight" line enter the amount of test weight in grams installed at the test location. This field will be automatically filled in if the weight calculator was activated as a result of pressing the "Wt Calc" key from paragraph 4.1.9 above. This line will show the effective weight of any test weights installed. This includes the effective weight of any weight split.

2. In the "Solution Angle" line enter the angle of the installed test weight. Use the same method that you used for placing the initial test weight. This field will be automatically filled in if the weight calculator was activated as a result of pressing the "Wt Calc" key from paragraph 4.1.9 above. This line will show the effective solution angle of any test weights installed. This includes the effective weight of any weight split.

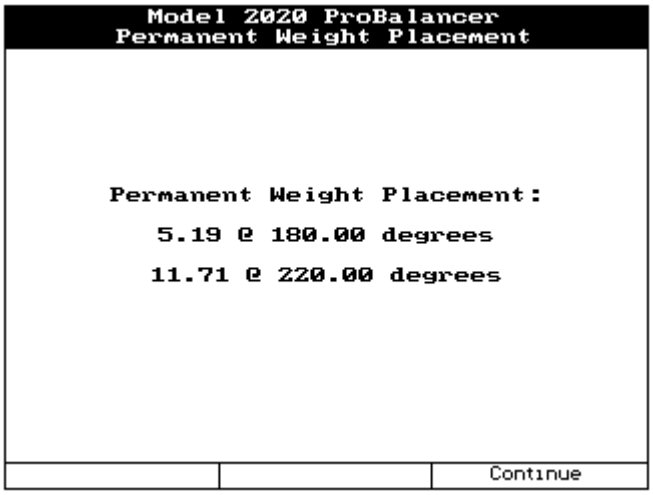
3. The "Spinner Diameter" value will be determined by measuring the outside diameter of the spinner. If the test weights were installed on a location other than the outer

circumference of the spinner, use the measurement from the location where the test weights were installed. This value will typically be in inches.

4. The “Offset” is the distance the radius will change between the test weight location and the final weight location. This value must be entered in the same measurement units as used to enter the Spinner Diameter.

5. By selecting “No”, the final weight can be reinstalled at a single weight location. Or, using the “Split Angle” toggle field, you can select “Yes” to bring up the Split Weight screen as shown in paragraph 4.1.8.1.1 above.

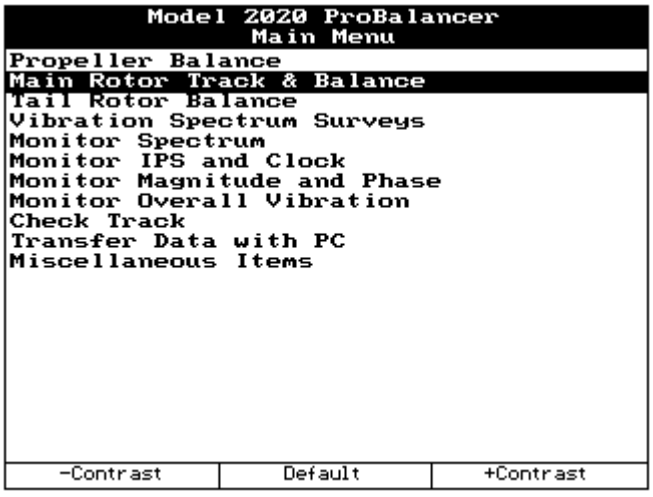
The “Permanent Weight Placement” screen seen below will show the suggested weight to place at each location to compensate for the reduced radius from the previously installed test weights. How closely the vibration level recorded on the Verification Run matches the previous run will be dependent upon how closely the suggested weight values and angles were matched.



Chapter 5
Main Rotor Track & Balance

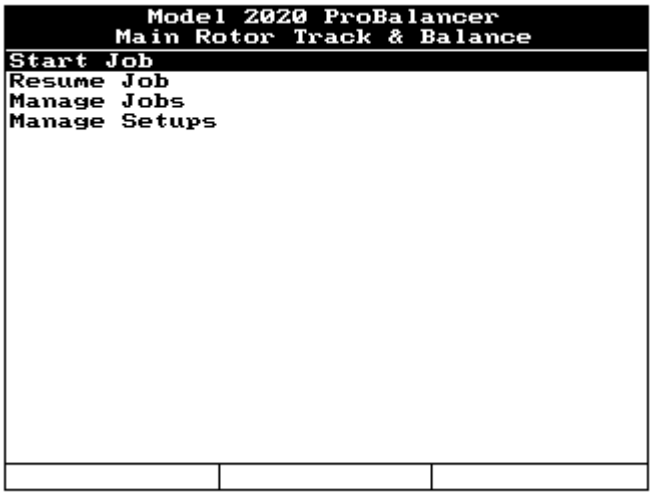
(Revision 4, Aug 2012)

"Main Rotor Track & Balance" is an analyzer function that is accessed from the analyzer's Main Menu banner screen (shown in the illustration below). Selecting "Main Rotor Track & Balance" from the main menu brings up the "Main Rotor Track & Balance" banner screen (shown in Paragraph 5.1 below). Each of the listings on the "Main Rotor Track & Balance" banner screen menu is an option within the "Main Rotor Track & Balance" function. Descriptions of each of these options follow, along with the information required to complete the menu screens within the options, and the steps necessary to perform the main rotor balance function.



5.1 – Start Job

Selecting “Start Job” from the “Main Rotor Track & Balance” banner screen allows you to begin a main rotor balance job. When you select this option, one of three screens will appear next depending on whether you are using the main rotor function for the first time, have previously defined main rotor setups, or have a previously started job stored in the analyzer.



If you are using the analyzer for the first time, the “Main Rotor Setup” banner screen will appear allowing you to define a new main rotor setup to use. Proceed to paragraph 5.1.1 “Main Rotor Setup” for detailed instructions on defining a setup.

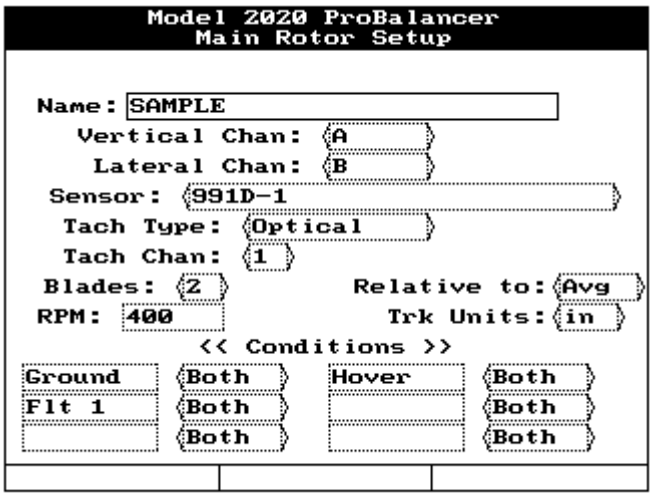
If you have previously saved setups stored in the analyzer’s memory, a screen will display the current list of setups. You can then select a setup from this list to use for the job. Proceed to paragraph 5.1.2 to begin a main rotor track & balance job.

If another job was already in progress but not completed, the “Incomplete Job” banner screen will be displayed and the analyzer will present a message prompting you to verify that you wish to finish the incomplete job or begin a new job. The screen will display the message, “The last job performed is incomplete. Finish it?” If you wish to return to the unfinished job, press the [F1] “Yes” key and you will be returned to the point where the in-progress job was stopped allowing it to be completed. If you wish to continue with a new job, press the [F3] “No” key, and the screen will then display the list of previously saved setups stored in the analyzer’s memory. Select a setup to use and press [ENTER] to continue. If no setup exists that you want to use, press [F1] “New” and create a setup as shown in paragraph 5.1.1.

5.1.1 - Main Rotor Setup

The “Main Rotor Setup” banner screen allows you to define and store a main rotor balance setup. As shown in the figure below, some fields in this screen have default values that appear automatically. You can use this information, if appropriate, or input your own specific

setup information using the keypad. (Refer to Chapter 3, "Using the Model 2020 ProBalancer Analyzer" if you are unfamiliar with using the keypad.)



To complete the "Main Rotor Setup" banner screen, do the following:

1. In the "Name" field, use the keypad to enter a name to identify the setup such as the aircraft model. A name must be entered in this field or the setup will not be stored.

CAUTION

Sensors connected to Channel A and Channel B must be of the same type. Using different sensors during the same job will cause erroneous readings and problems achieving good balance results.

2. Use the [⇓] key to move to the "Vertical Chan" (Channel) field. Use the [⇒] key to "toggle" between the selections in this field, either "A," "B," "A+B," or "None." The value you select for this field determines which analyzer channel you are using to measure and display the vertical vibration.

3. Use the [⇓] key to move to the "Lateral Chan" field. Use the [⇒] key to "toggle" between the selections in this field, either "A," "B," "A-B," or "None." The value you select for this field determines which analyzer channel you are using to measure and display the lateral vibration.

4. Move to the "Sensor" field using the [⇓] key. Use the [⇒] key to toggle between the options and select a sensor. If the sensor you are using does not appear as an optional selection, you must input a new sensor setup into the analyzer's memory. See Chapter 13, Section 13.2.2, "Setup Sensors," for instructions on how to perform this function.

5. Move to the "Tach Type" field using the [⇓] key. The selection in the "Tach Type" field identifies which tachometer sensor you are using as the once-per-revolution source. For main rotors, this will most often be "Mag (Hi)." Use the [⇒] key to make the selection. If you are unable to obtain a tachometer signal when the job is started, edit the setup and select "Mag (Lo)".

NOTE

If the tachometer type is changed in a setup, you must start a new job for the changes to take effect.

6. Use the [⇓] key to move to the "Tach Chan" field. Use the [⇒] key to select and identify which Tach input port on the analyzer you are using to acquire tachometer data.

7. Move to the "Blades" field using the [⇓] key. Using the [⇒] key, select the number of blades on the main rotor system you are balancing.

8. Use the [⇓] key to move to the "Relative to" field. This selection will determine the reference blade for tracking displays. Selecting "AVG" will present rotor blade positions relative to the average of all blades. Selecting a specific blade number will present all other blade positions relative to the blade number selected.

9. Move to the "RPM" field using [⇓] key. This selection is only used as an RPM target for starting the job and will be over-ridden while performing the job. The analyzer will store the RPM where the first vibration reading was taken then use this value on all subsequent runs. This field will accept any numeric value; however, the value in this field must be within +/- 50% of the actual main rotor speed or a "HIGH"/"LOW" error message will be displayed during data acquisition and data collection will be prevented. It is important to keep this in mind when configuring setups that need to define an "IDLE" condition. For example, if the Idle RPM is 45% of the 100% Rotor RPM, the target RPM must be set slightly below 100% Rotor RPM. The analyzer will still recognize the target RPM for the second condition since it will not exceed 150% of the defined target RPM. See Chapter 15 for additional information on troubleshooting Tach readings.

10. Move to the "Trk Units" field using [⇓] key. Select the units of measure the analyzer will present on the tracking display screen. Use the [⇒] key to select either "in" or "mm".

11. Using the [⇓] key, move to the first field in the grouping of "Conditions" fields. In these fields you may define up to six flight conditions under which to measure and store data. These conditions may be a maximum of six characters long and should represent a flight regime at which you wish to record data.

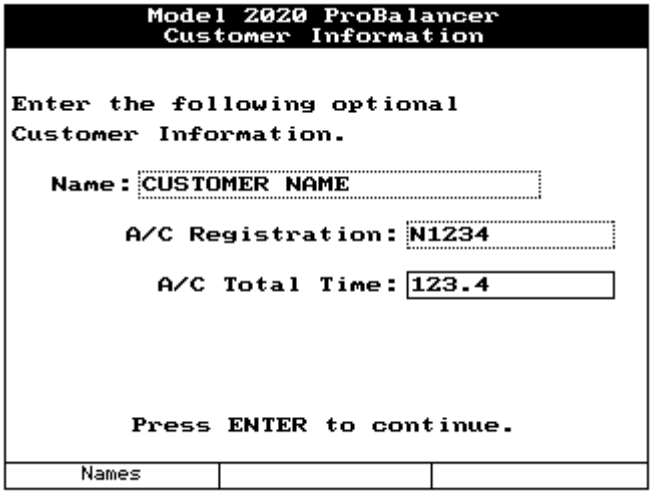
12. Directly to the right of each flight condition name box is a toggle selection for the type of measurement desired for that condition. Use the [⇓] key to move to the next box. In each of these fields, use the [⇒] key to select from "Both" (which will allow measurement and storage of both vibration and track), "Vib" (which will measure and store only vibration), or "Trk" (to measure only track).

When all fields are completed to your satisfaction, press [ENTER].

NOTE

It is recommended that setups be stored for future use. It is not necessary to create a new setup for aircraft of the same model. Once a setup is stored, it may be used again in the future on another aircraft of the same model. This can eliminate time spent on data entry.

5.1.2 – Customer Information



After you complete the "Main Rotor Setup" banner screen, the next screen that appears is the "Customer Information" banner screen. You do not have to complete this screen, but it recommended you enter at least a customer name. If entered, this information will appear on the job printout and will assist you in identifying this job when it is stored in the analyzer's memory. Complete the information fields using the keypad. You can also find a listing of previously used customer names by pressing the [F1] "Names" key to view the "Customer Name List". If a customer name is displayed, you can use the [⇓] key to highlight it and pressing [Enter] will enter this name on the "Name" line of the "Customer Information" screen. When finished entering customer data, press [ENTER] to continue.

NOTE
If no customer name is entered, the job will be commonly labeled "Unnamed" in the resume and manage job lists. This will complicate finding a specific job, as multiple jobs are stored. We recommended you enter a customer name.

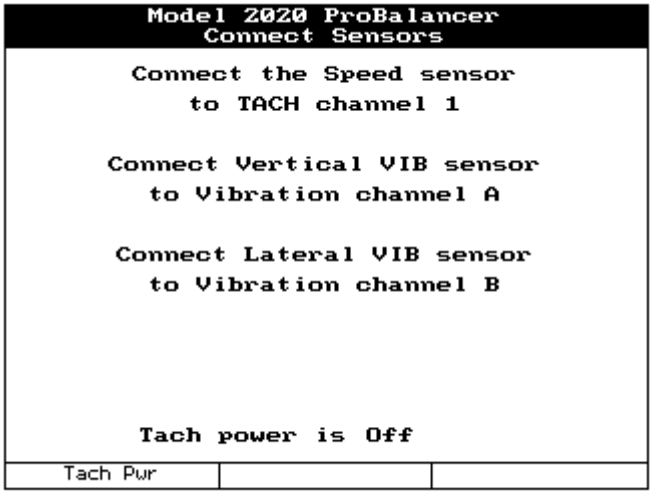
5.1.3 – Tracking Selections

The "Tracking Selections" screen is displayed allowing you to choose a tracking device for use with the job. The tracking device field is a toggle selection of "TraX", "Tracker" or "Strobe." Use the [⇒] key to select the correct device. Then, use the [⇓] key to then move to the lower portion of the screen and input the remaining information based on the tracking device selected. For additional information, please see the appropriate Supplement as found in the back of this manual. Use the [⇓] key to move between these fields. This information is necessary for the tracker to operate correctly.

NOTE
It is highly suggested that you use no more than 30 for the number of rotations to measure track. This will result with greater accuracy from the tracker.

5.1.4 – Connect Sensors

After you complete the “Customer Information” banner screen, the “Connect Sensors” banner screen will be displayed as in the example below. Messages that appear on this screen prompt you to perform the physical installation and connection of the tachometer and vibration sensors to the input ports you specified in the setup.



You must use the vibration sensor installation locations as specified by the manufacturer’s charts. The orientation of the sensor is key to the accuracy of the polar charts, if the sensor is installed in a direction other than specified for the chart, the clock angles will be incorrect.

If you are using a magnetic pickup for the speed sensor, install and set the gap as directed in the applicable maintenance manual or polar chart. The Model 2020 only accepts a “single” type interrupter; it will be necessary to remove any double interrupter installed and replace it with a single interrupter.

It is permitted to use the phototach for the main rotor one-per-revolution source. If using a phototach as the tachometer, read section 5.1.4.1, “Optical Tachometer Setup” below. Also at this time, install any ship’s power and strobe cables as needed.

CAUTION

The Model 2020 recognizes only a single-interrupter type once-per-revolution. If the factory installation calls for double-interrupter logic, you must remove the double interrupter from the main rotor and use a single interrupter only. Not accomplishing this will produce inaccurate tachometer measurements or failure to obtain a tachometer signal altogether.

5.1.4.1 - Optical Tachometer Setup

To install the optical tachometer, do the following:

1. If not specifically defined by application note or manufacturer, locate a position that allows the phototach to be installed no more than 18 inches away or closer than 4 inches from a rotating main rotor component. This component will be used to install the reflective tape and serve as the once-per-revolution tachometer source for the analyzer. Connect and route the tachometer cable from the phototach to the analyzer.

NOTE

If possible, the location of the phototach should allow for the reflective tape to trigger it when the main rotor is in the reference position as specified by the balance chart. This will provide a direct correlation of the clock angles produced by the analyzer and the charts. If this is not possible, the clock positions on the chart will have to be rotated based on the vibration results from the first applied correction.

2. While still in the "Main Rotor Equipment Setup" banner screen, a message is presented near the bottom that reads "Tach Power is Off." The Block directly below this statement and corresponding to the [F1] key, is labeled "Tach Pwr" Pressing the [F1] key will power the Tach. Turning the tachometer power on is *not* required to start the balance job. This option is only necessary to verify the proper alignment of the phototach and the tape.

3. Rotate the main rotor until the target object is aligned with the Phototach. Clean this area thoroughly to insure adhesion of the tape.

4. Cut a strip reflective tape (3M Tape, Model 7610) approximately 1.5 to 2 inches long. With the tape backing still in place, hold the tape in position on the target object, then verify the red LED gate indicator light on the back end of the phototach is illuminated. This indicates the position of the tape is correct.

5. Remove the tape backing and attach reflective tape at that location. Be sure to smooth out any wrinkles or bubbles in the tape. Insure the edges are smoothed and attached.

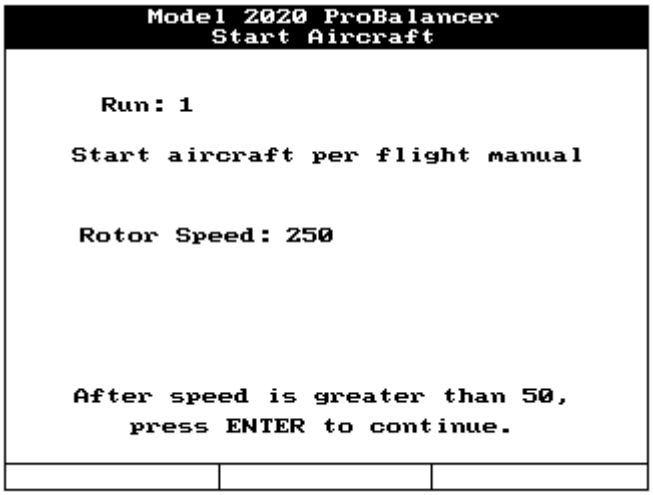
NOTE

When aligning the PhotoTach and reflective tape, the most reliable results will be obtained if the two are not aligned exactly perpendicularly. Please see Section 15.8 for an illustration of the best mounting orientation.

6. When you have completed the physical equipment setup tasks, press [ENTER] on the analyzer to continue with the main rotor balance job.

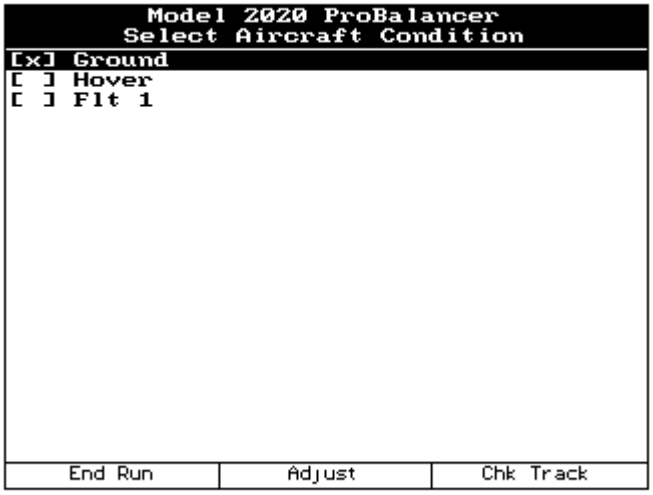
5.1.5 – Start Aircraft

The analyzer will display the "Start Aircraft" banner screen (shown below). (Refer to the aircraft's flight manual for start and operation instructions.) This screen allows you to view the current main rotor RPM. When the aircraft has been started and the RPM is stabilized, press [ENTER] to continue.



5.1.5.1 – Select Aircraft Condition

Next, the analyzer displays the “Select Aircraft Condition” screen as shown in the illustration below. This function tracks measurements acquired at various flight conditions in the current run (The flight conditions displayed are those that were defined in the setup process.).



To start the measurement process, use the [⇑] or [⇓] keys to select a flight condition and press [ENTER]. As measurements are taken and stored by the analyzer, the status of the flight condition is marked with an “X” preceding the condition name. These conditions may be re-measured if desired, however the data previously acquired will be written over and lost.

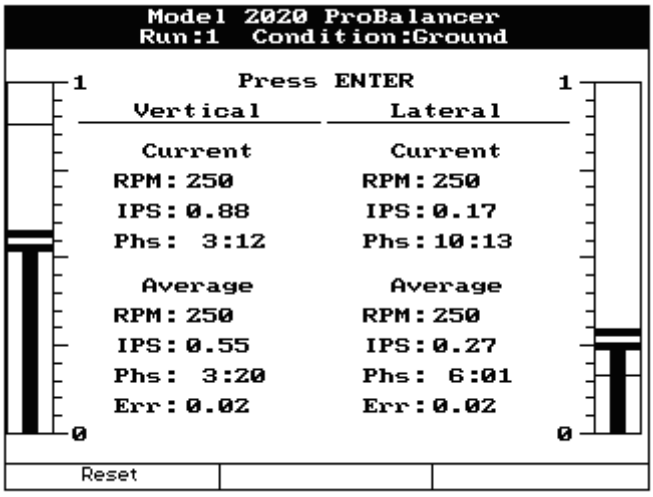
Pressing the [F1] “End Run” key will initiate an aircraft shutdown prompt and data save sequence.

Pressing the [F3] “Chk Track” key at the lower portion of the screen will initiate a track measurement. The “Chk Track” option from this screen is only used to make a quick check of

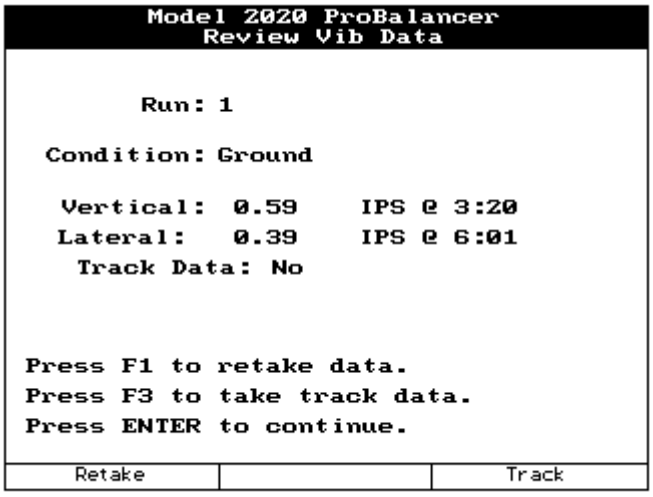
the blade track with no storage. If you wish to acquire and store track measurements, you must do so from the “Review Data” screen as shown in paragraph 5.1.5.3.

5.1.5.2 – Acquiring Vibration Data

After selecting to measure a condition, the analyzer displays the vibration data being acquired as shown in the example below. (See Chapter 16, Reading Spectrum and Scales, for a detailed explanation of this screen.) The screen banner indicates the run number and flight condition for which you are acquiring measurements. During the acquisition process, you may choose to reset the vibration average by pressing the [F1] “Reset” key. When you are satisfied with the vibration readings, press [ENTER].



5.1.5.3 – Review Vib Data



The analyzer displays the “Review Vib Data” banner screen shown below for the condition just acquired. Through this screen, you may choose to retake the data just collected by

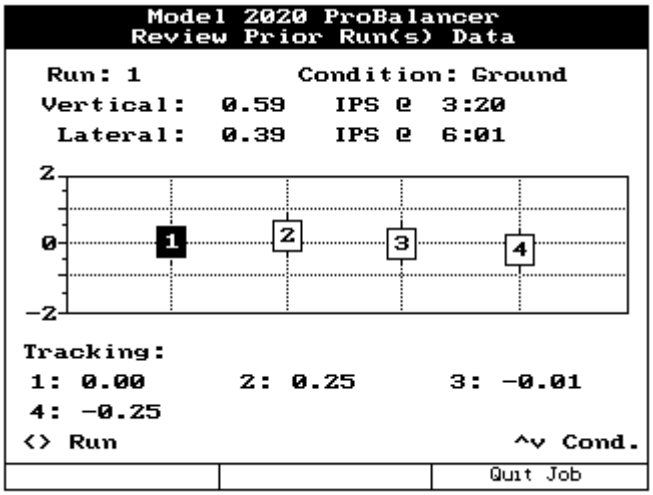
pressing the [F1] key, input or measure track (depending upon the tracking option used) by pressing the [F3] key, or simply press [ENTER] to continue without measuring the track.

See Chapter 12 “Check Track” for instructions on how to enter track data using the strobe. See the “Model 550 TraX™” Supplement for instructions on how to use the Model 550 TraX™. See “Model 540/540-2 Optical Tracker Supplement” for instructions on how to use the Model 540 or 540-2 Optical Tracker.

When finished acquiring measurements for the current run, select “End Run” by pressing the [F1] key from the “Select Aircraft Condition” banner screen as described in paragraph 5.1.5.1.

5.1.5.4 – Review Prior Runs

The analyzer displays the “Review Prior Run(s) Data” banner screen shown below. Through this screen you can review all of the measurements taken for both the current and past runs as well as conditions measured within each run. The run number is shown in the upper left-hand corner of the screen followed by the condition displayed on the right.



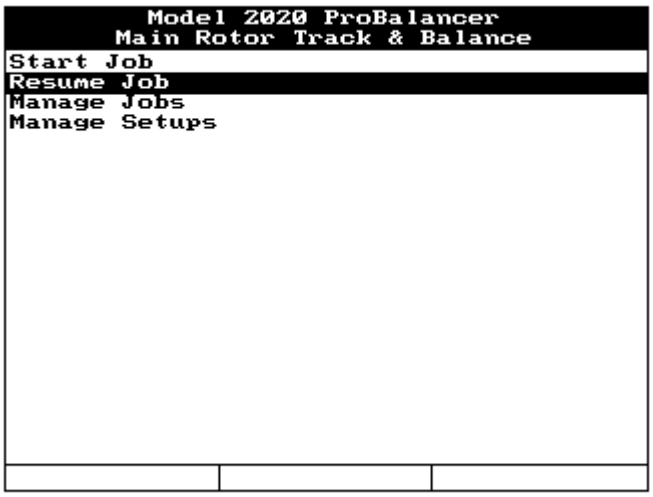
To move between runs, if there is more than one, use the [⇐] or [⇒] keys. To view the various conditions measured within a run, if there is more than one, use the [⇑] or [⇓] keys.

Take this information and plot it on your charts for corrections. When finished making corrections, simply press the [ENTER] key to continue with the next run, or press [F3] to “Quit Job”. Quitting the job will store the job in the analyzer as a completed job, and you may use the “Review Jobs” utility to view it in the future.

5.2 - Resume Job

Selecting “Resume Job” from the “Main Rotor Track & Balance” banner screen menu allows you to select an unfinished job to resume. Using the [⇓] key, highlight the job you wish to

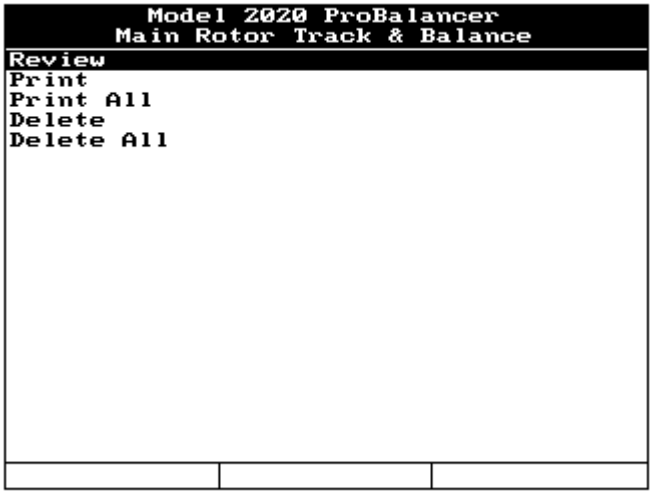
complete from the list of incomplete jobs, and press [ENTER]. You will be taken to the last step completed in the job process and allowed to complete it.



NOTE
If no customer information was entered to identify the job, it will be labeled as an "Unnamed" in the incomplete job list. If there are more than on "Unnamed" jobs, you may wish to use the review job utility to identify it prior to selecting the job to complete.

5.3 - Manage Jobs

Selecting "Manage Jobs" from the "Main Rotor Track & Balance" banner screen menu presents several sub-menu choices to choose from. These choices, shown below, allow you to "manage" job data you have stored in the analyzer.



5.3.1 - Review

Selecting the “Review” option presents a list of stored jobs on the “Job List” banner screen. You can select one job for on-screen viewing. When viewing is complete, press the [BACKUP] or [ENTER] key to exit the screen. The analyzer will then return you to the "Manage Jobs" menu screen to select another function.

5.3.2 - Print

The “Print” option presents a list of stored jobs on the “Job List” banner screen. From the list, you may select one job for printing. See Chapter 14, “Printing” for a detailed explanation of how to set up the analyzer to print.

5.3.3 - Print All

The “Print All” option sends all currently stored jobs to the printer. When you select “Print All,” a message will appear on the analyzer’s “Print All Jobs” banner screen asking you to verify that you want to print all jobs. Answer the prompt, “Are you sure?” by pressing the [F1] key for “Yes” or the [F3] key for “No.” If you choose the “Yes” answer, ensure your printer is prepared (paper, print cartridge, etc.) to complete the number of jobs stored. The “Yes” answer will send *all* currently stored jobs to the printer. The “No” answer will return you to the previous menu.

5.3.4 - Delete

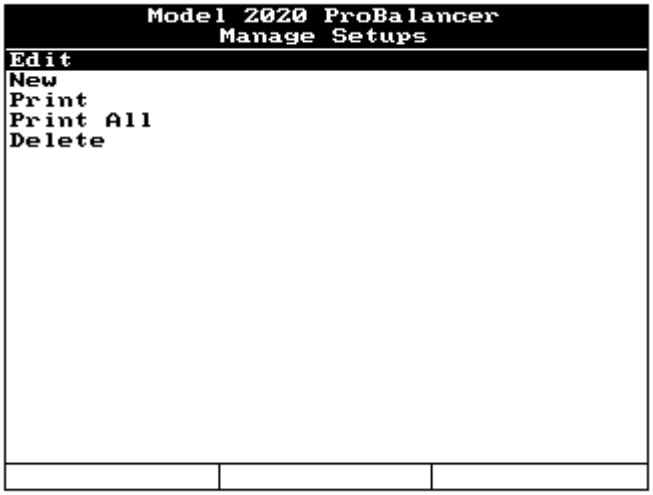
The “Delete” option presents a list of stored jobs on the “Job List” banner screen. From the list, you may select one job for deletion. After making your selection, the “Delete Job” banner screen will appear, asking you to verify your intent to delete the selected job by pressing the [F1] key for “Yes” or the [F3] key for “No.” You may wish to print the job for reference or permanent record prior to deleting. Once deleted, the job cannot be retrieved from the analyzer.

5.3.5 - Delete All

The “Delete All” option will delete all currently stored jobs. After selecting this option, the “Delete All Jobs” banner screen will appear, asking you to verify your intent to delete all the jobs by pressing the [F1] key for “Yes” or the [F3] key for “No.” You may wish to print the jobs for reference or permanent record prior to deleting. Once deleted, the jobs cannot be retrieved from the analyzer.

5.4 - Manage Setups

Selecting “Manage Setups” from the “Main Rotor Track & Balance” banner screen menu presents several sub-menu choices to choose from. These choices, shown below, allow you to “manage” setups you have stored previously in the analyzer.



5.4.1 - Edit

Selecting the “Edit” function displays the “Setup List” screen. Select the setup you wish to edit. The screen will display the “Main Rotor Setup” screen. Edit the setup as necessary and press [ENTER] to store and exit the edited setup screen. See paragraph 5.1.1 for help in defining a setup.

5.4.2 – New

Selecting “New” allows you to define and store a new main rotor setup as described in paragraph 5.1.1. “Main Rotor Setup”.

5.4.3 - Print

Selecting the “Print” function displays the “Setup List” screen. Ensure your printer is turned on and connected to the analyzer with the COMM/Print cable supplied with your analyzer. Select the setup you wish to print and press [ENTER]. (See Chapter 14, “Printing” for a detailed explanation of how to set up the analyzer to print.)

5.4.4 - Print All

Selecting “Print All” sends all currently stored setups to the printer. When making this selection, you will be asked to verify “Are you sure?” by pressing the [F1] key for “Yes,” or the [F3] key for “No.” If choosing the “Yes” answer, ensure your printer is prepared (paper, print cartridge, etc.) to complete the number of jobs stored. The “Yes” answer will send *all* currently stored setups to the printer. The “No” answer will return you to the previous menu.

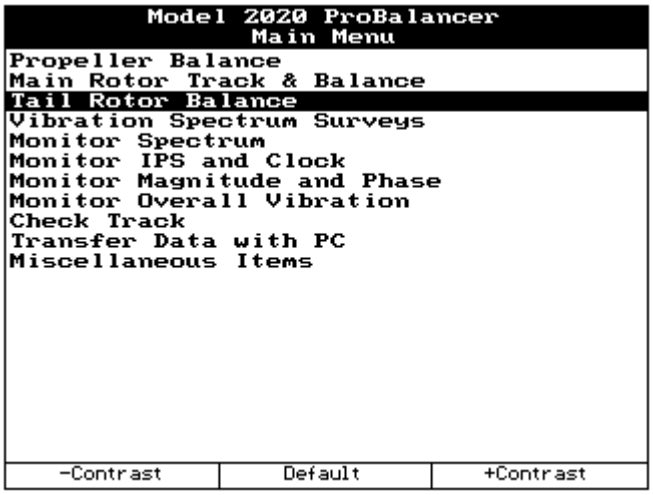
5.4.5 - Delete

The “Delete” option presents you with a list of stored setups. From the list, you may select one setup for deletion. If you wish to delete all stored setups, you must delete them individually. After making your selection, you will be asked to verify your intent to delete the selected setup by pressing the [F1] key for “Yes,” or the [F3] key for “No.” We highly recommend you print the setups for reference or permanent record prior to deleting them. Once deleted, the setups cannot be retrieved from the analyzer.

Chapter 6
Tail Rotor Balance

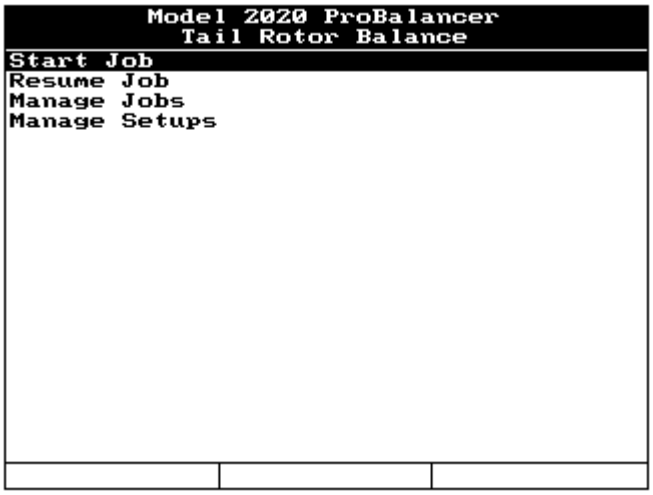
(Revision 3, Aug 2012)

"Tail Rotor Balance" is an analyzer function that is accessed from the analyzer's Main Menu banner screen (shown in the illustration below). Selecting "Tail Rotor Balance" from the main menu brings up the "Tail Rotor Balance" banner screen (shown in paragraph 6.1 below). Each of the listings on the "Tail Rotor Balance" banner screen menu are options within the "Tail Rotor Balance" function. Descriptions of each of these options follow, along with the information required to complete the menu screens within the options, and the steps necessary to perform the tail rotor balance function.



6.1 - Start Job

Selecting "Start Job" from the "Tail Rotor Balance" banner screen allows you to begin a tail rotor balance job. When you select this option, one of three screens will appear next depending on whether you are using the tail rotor function for the first time, have previously defined tail rotor setups, or have a previously started job stored in the analyzer.



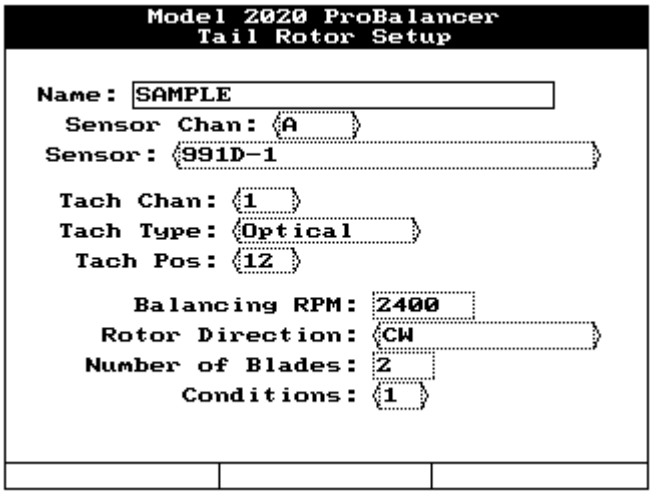
If you are using the analyzer for the first time, the "Tail Rotor Setup" banner screen will appear allowing you to define a new tail rotor setup to use. Proceed to paragraph 6.1.1 "Tail Rotor Setup" for detailed instructions on defining a setup.

If you have previously saved setups stored in the analyzer's memory, a screen will display the current list of setups. You can then select a setup from this list to use for the job. Proceed to paragraph 6.1.2 to complete a tail rotor balance job.

If another job was already in progress but not completed, the "Incomplete Job" banner screen will be displayed and the analyzer will present a message prompting you to verify that you wish to finish the incomplete job or begin a new job. The screen will display the message; "The last job performed is incomplete. Finish it?" If you wish to return to the unfinished job, press the [F1] "Yes" key and you will be returned to the point where the in-progress job was stopped allowing it to be completed. If you wish to start a new job, press the [F3] "No" key and the screen will then display the list of previously saved setups stored in the analyzer's memory. Select a setup to use and press [ENTER] to continue. If no setup exists that you want to use, press [F1] "New" and create a setup as shown in paragraph 6.1.1.

6.1.1 - Tail Rotor Setup

The "Tail Rotor Setup" banner screen allows you to define and store a tail rotor balance setup. As shown in the following figure, some fields in this screen have default values that appear automatically. You can use this information, if appropriate, or input your own specific setup information using the keypad. (Refer to Chapter 3, "Using the Model 2020 ProBalancer Analyzer" if you are unfamiliar with using the keypad.)



To complete the "Tail Rotor Setup" banner screen, do the following:

1. In the "Name" field, use the keypad to enter a name to identify the setup such as the aircraft model. A name must be entered in this field for the setup to be stored.

2. Use the [⇓] key to move to the "Sensor Chan" (Sensor Channel) field. Use the [⇒] key to toggle between the available selections for the field which are "A" or "B." The selection identifies which analyzer vibration channel you are using to measure the tail rotor vibration.

3. Move to the "Sensor" field using the [⇓] key. Use the [⇒] key to toggle between the options and select a sensor. If the sensor you are using does not appear as an available selection, you must input a new sensor setup into the analyzer's memory. See Chapter 13, Section 13.2.2, "Setup Sensors," for instructions on how to perform this function.

4. Use the [⇓] key to move to the "Tach Chan" field. Use the [⇒] key to select and identify which Tach input port on the analyzer you are using to acquire the tachometer signal.

5. Move to the "Tach Type" field using the [⇓] key. The selection in the "Tach Type" field identifies which tachometer sensor you are using as the once-per-revolution source. For tail rotors, this will most often be "Optical." Use the [⇒] key to make this selection.

6. Use the [⇓] key to move to the "Tach Pos" field. Use the [⇒] key to select the clock position in hours (1-12) of the point at which the Phototach beam and the reflective tape intersect. The Tach position is entered from the opposite perspective from the phototach, or as if seen from the position you would stand if using a strobe light to acquire a clock angle.

7. Use the [⇓] key to move to the "Balancing RPM" field. Using the keypad, enter the expected tail rotor RPM at which the balance will be performed. This selection is only used as an RPM target for starting the job and will be over-ridden while performing the job. The analyzer will store the RPM where the first vibration reading was taken then use this value on all subsequent runs. This field will accept any numeric value; however, the

value in this field must be within +/- 50% of the actual tail rotor speed or a "HIGH"/"LOW" error message will be displayed during data acquisition and data collection will be prevented. It is important to keep this in mind when configuring multiple-condition setups that need to define different speed conditions. For example, if the First Condition RPM is 45% of the maximum rotor RPM, the target RPM must be set slightly below 100% Rotor RPM. The analyzer will still recognize the target RPM for the second condition since it will not exceed 150% of the defined target RPM. See Chapter 15 for additional information on troubleshooting Tach readings.

8. Move to the "Rotor Direction" field using the [⇓] key. Using the [⇒] key, select the tail rotor direction of rotation as viewed from the opposite perspective from the phototach, or as if seen from the position you would stand if using a strobe light to acquire a clock angle.

9. Move to the "Number of Blades" field using the [⇓] key. Using the keypad, enter the number of blades on the tail rotor assembly you are balancing. Acceptable entries are from 2 to 20 blades.

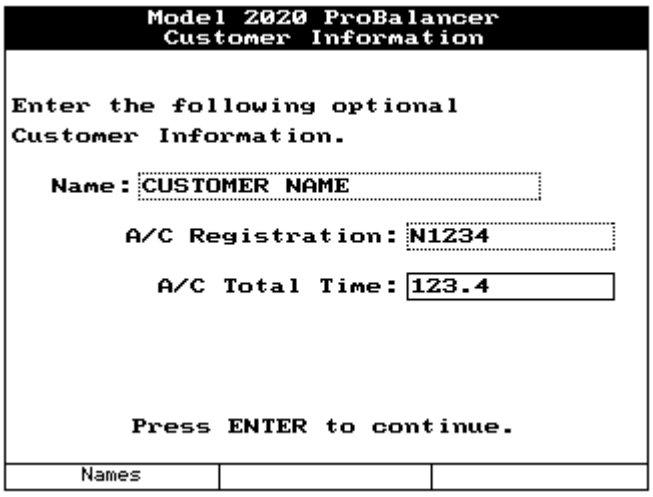
10. Move to the "Conditions" field using the [⇓] key. Use the [⇒] key to enter the different conditions you will operate the helicopter in to balance the tail rotor assembly. In most cases this will be "1" for full power neutral pitch. There will be cases, such as: multiple power settings or multiple pitch settings that require additional conditions.

When all fields are completed to your satisfaction, press [ENTER] to accept the setup.

NOTE

It is recommended that setups be stored for future use. It is not necessary to create a new setup for similar model aircraft. Once a setup is stored, it may be used again in the future on another aircraft of the same model. This can eliminate time spent on data entry.

6.1.2 - Customer Information

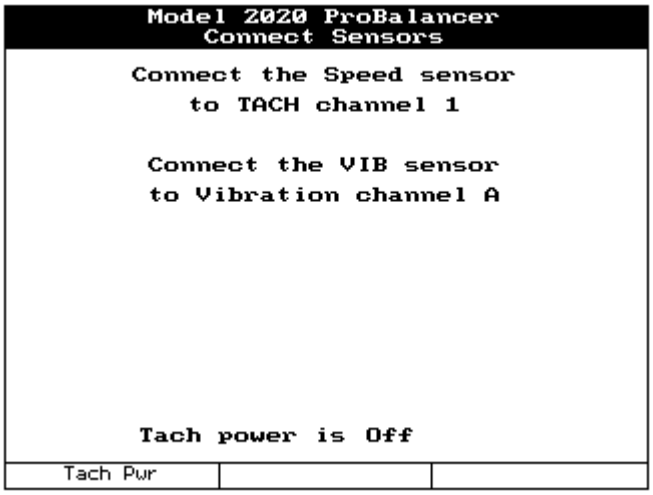


After you complete the “Tail Rotor Setup” banner screen, the next screen that appears is the “Customer Information” banner screen. You do not have to complete this screen, but it is recommended you enter at least a customer name. If entered, this information will appear on the job printout and will assist you in identifying this job when it is stored in the analyzer’s memory. Complete the information fields using the keypad. You can also find a listing of previously used customer names by pressing the [F1] “Names” key to view the “Customer Name List”. If a customer name is displayed, you can use the [⇓] key to highlight it and pressing [Enter] will enter this name on the “Name” line of the “Customer Information” screen. When finished entering customer data, press [ENTER] to continue.

NOTE
If no customer information is entered, the job will be commonly labeled “Unnamed” in the resume and manage job lists. This will complicate finding a specific job, as multiple jobs are stored. We recommended you enter a customer name.

6.1.3 - Tail Rotor Equipment Setup

After you complete the “Customer Information” banner screen, the “Tail Rotor Equipment Setup” banner screen will be displayed. Messages that appear on this screen prompt you to perform the physical installation and connection of the tachometer and vibration sensors to the input ports you specified in the setup. Go to paragraphs 6.1.3.1 and 6.1.3.2 for generic vibration sensor and phototach installation instructions.



6.1.3.1 - Vibration Sensor Installation

Install the vibration sensor in the location specified by the applicable balance chart you are using. Be sure to orient the connector in the direction specified by the chart as this will drastically affect the accuracy of the balance chart.

6.1.3.2 - Phototach Installation and Test

To install and test the Phototach, do the following:

1. Install the phototach in a location on the gearbox or tail boom at a location not more than 18 inches away or closer than 4 inches from the tail rotor component you plan to install tape on.

2. Pick a blade or hub component that will be used as the “Target” blade (This should be defined by the chart you are using.).

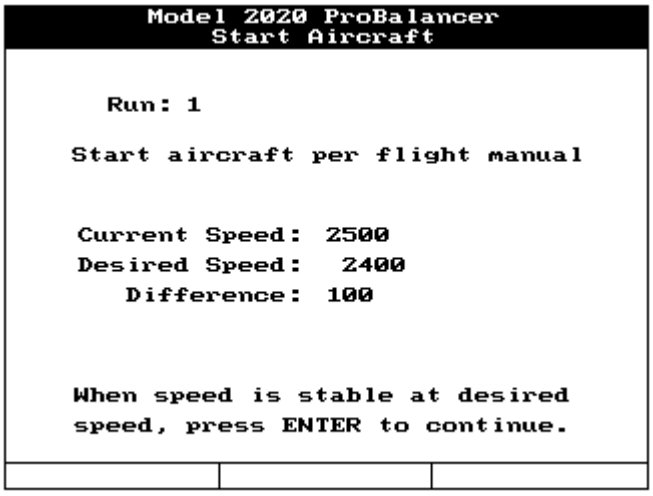
3. Next, rotate the “Target” blade in front of the Phototach. Clean this area thoroughly to insure adhesion of the tape. Check the bottom of the analyzer screen for the message, “Tach Power is OFF.” The Block directly below this statement and corresponding to the [F1] key, is labeled “Tach Pwr.” Pressing the [F1] key will power the Tach. Turning the tachometer power on is not required to start the balance job. This option is only necessary to verify the proper alignment of the phototach and the tape.

4. Cut a piece of reflective tape approximately 1.5 to 2 inches long and hold it in front of the Phototach on the “Target” blade or component. Observe the back of the Phototach for the red LED gate light to illuminate. Adjust the position of the tape on the target blade until this occurs.

5. When satisfied with the position, mark it, then remove the backing and attach the tape to the target. Verify that the red LED gate light still illuminates with the tape in front of the Phototach.

When you have completed the physical equipment setup tasks, press [ENTER] on the analyzer to continue with the tail rotor balance job.

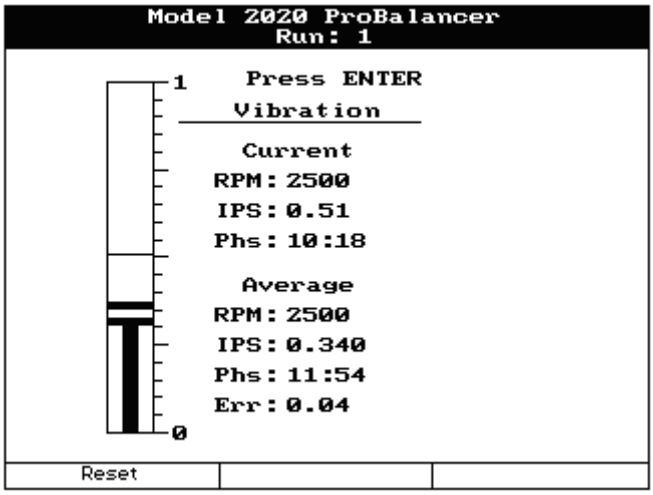
6.1.4 - Start Aircraft



The analyzer will display the “Start Aircraft” banner screen shown in the illustration above. This screen shows the current speed in RPM, desired speed, and the difference between the two. When the current speed matches the desired speed, press [ENTER] to begin acquiring a measurement. If you choose to use a different RPM setting than that which is defined in the

setup, simply press [ENTER] when the RPM signal is satisfactory to continue. Refer to your aircraft's flight manual for aircraft start and operation instructions.

6.1.4.1 - Run 1, Acquiring Vibration Data

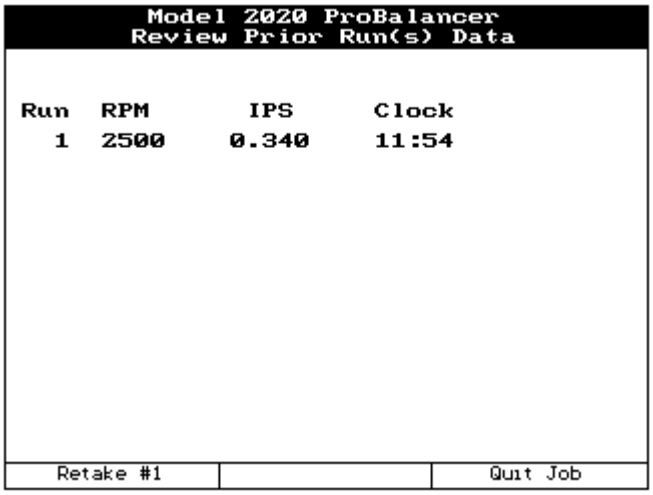


After a short delay, the analyzer now displays the vibration data being acquired (See Chapter 16, "Reading Spectrum and Scales" for a detailed explanation of this screen.). The screen banner will indicate the current run number. Allow the analyzer to average the data for a short period prior to stopping acquisition. During the acquisition process, you may choose to reset the vibration average by pressing the [F1] key. After the "Press ENTER" message appears and when you are satisfied with the quality of the measurement, press [ENTER]. You will be prompted to shut the aircraft down by pressing the [F3] "Continue" key.

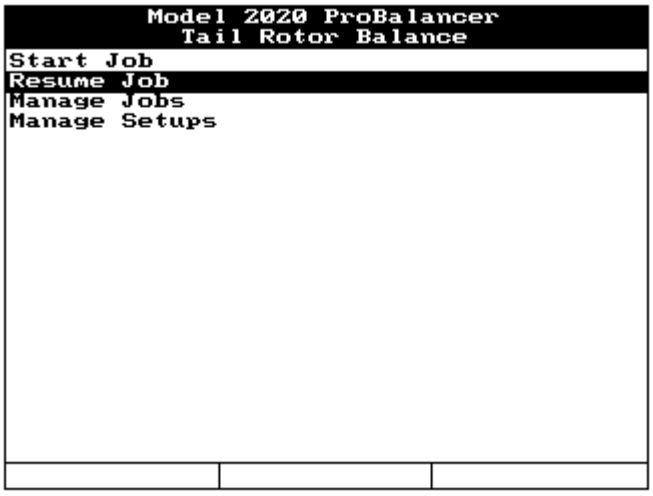
6.1.4.2 - Review Prior Run(s) Data

The "Review Prior Run(s) Data" screen will appear. This screen allows you to track the vibration data for all runs you have measured. If you are unhappy with the readings for the last run, press the [F1] "Retake" key to go back to paragraph 6.1.4.

Take the current run's vibration data and plot it on the applicable balance chart to make corrections. When you are finished making corrections, press the [ENTER] key to go to the next run, or [F3] to "Quit Job."

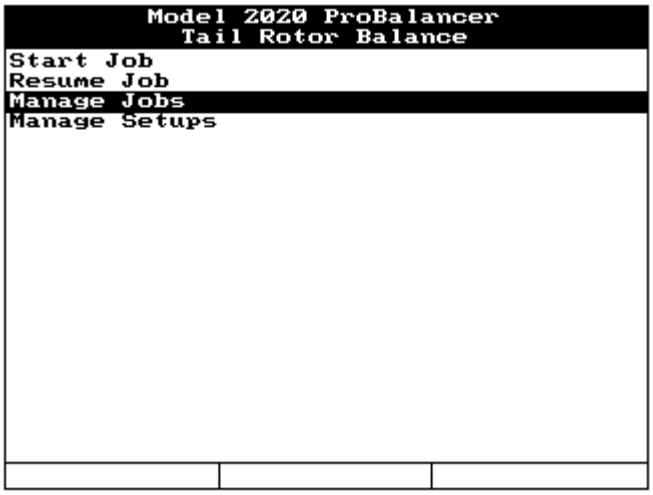


6.2 - Resume Job



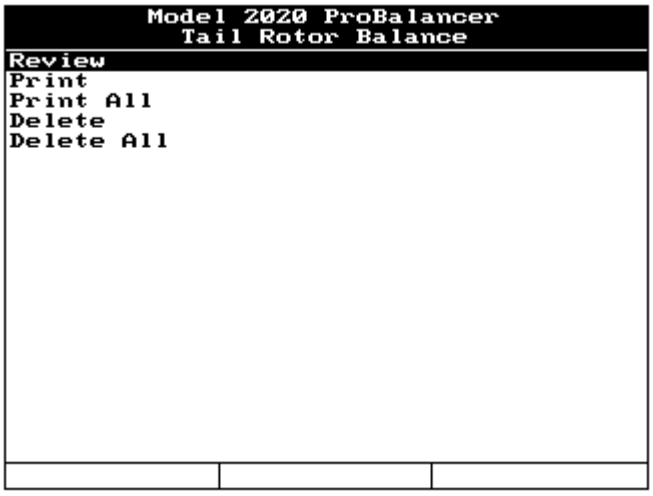
Selecting “Resume Job” from the “Tail Rotor Balance” banner screen menu allows you to select an unfinished job to resume. Using the [⇓] key, highlight the job you wish to complete from the list of incomplete jobs, and press [ENTER]. You will be taken to the last step completed in the job process and allowed to complete it.

6.3 - Manage Jobs



Selecting “Manage Jobs” from the “Tail Rotor Balance” banner screen menu (shown above) presents several sub-menu choices (shown below) to choose from. These choices allow you to “manage” previously stored job data in the analyzer.

6.3.1 - Review



Selecting the “Review” option presents a list of stored jobs on the “Job List” banner screen. Customer names preceded by “*” are incomplete jobs. Jobs identified only by customer name are completed jobs. You can select one job for on-screen viewing. When viewing is complete, press the [BACKUP] or [ENTER] key to exit the screen. The analyzer will then return you to the "Manage Jobs" menu screen to select another function.

6.3.2 - Print

The “Print” option presents a list of stored jobs on the “Job List” banner screen. From the list, you may select one job for printing. See Chapter 14, “Printing,” for a detailed explanation of how to set up the analyzer to print.

6.3.3 - Print All

The “Print All” option sends all currently stored jobs to the printer. When you select “Print All,” a message will appear on the analyzer’s “Print All Jobs” banner screen asking you to verify that you want to print all jobs. Answer the prompt, “Are you sure?” by pressing the [F1] key for “Yes” or the [F3] key for “No.” If you choose the “Yes” answer, ensure your printer is prepared (paper, print cartridge, etc.) to complete the number of jobs stored. The “Yes” answer will send *all* currently stored jobs to the printer. The “No” answer will return you to the previous menu.

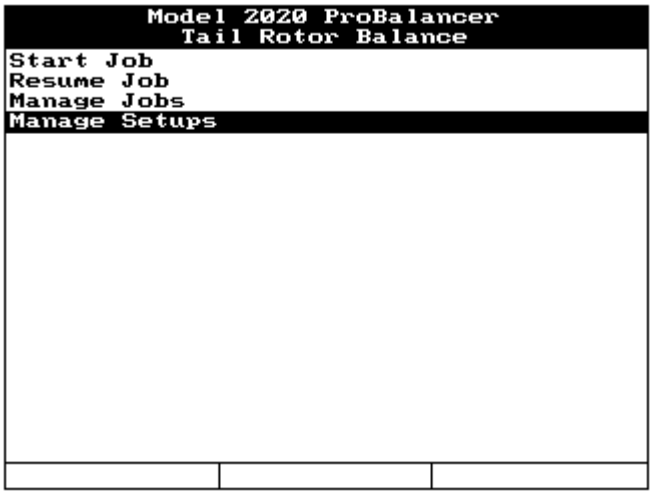
6.3.4 - Delete

The “Delete” option presents a list of stored jobs on the “Job List” banner screen. From the list, you may select one job for deletion. After making your selection, the “Delete Job” banner screen will appear, asking you to verify your intent to delete the selected job by pressing the [F1] key for “Yes” or the [F3] key for “No.” You may wish to print the job for reference or permanent record prior to deleting. Once deleted, the job cannot be retrieved from the analyzer.

6.3.5 - Delete All

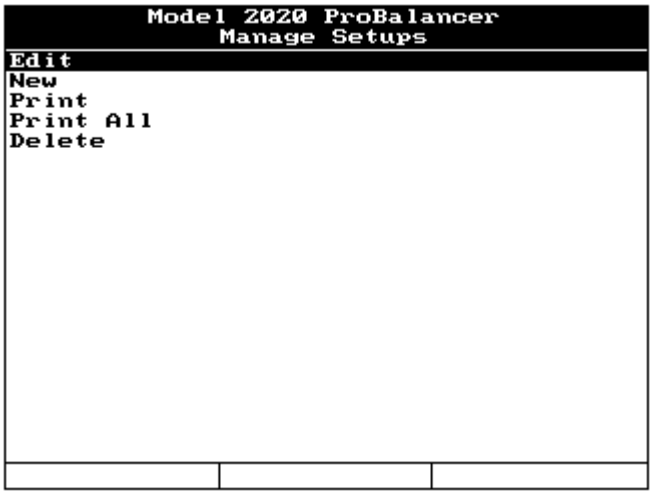
The “Delete All” option will delete all currently stored jobs. After selecting this option, the “Delete All Jobs” banner screen will appear, asking you to verify your intent to delete all the jobs by pressing the [F1] key for “Yes” or the [F3] key for “No.” You may wish to print the jobs for reference or permanent record prior to deleting. Once deleted, the jobs cannot be retrieved from the analyzer.

6.4 - Manage Setups



Selecting “Manage Setups” from the “Tail Rotor Balance” banner screen menu (shown above) presents several sub-menu choices (shown below) to choose from. These choices allow you to “manage” setups you have stored previously in the analyzer.

6.4.1 - Edit



Selecting the “Edit” function displays the “Setup List” screen. Select the setup you wish to edit. The screen will display the “Tail Rotor Setup” screen. Edit the setup as necessary and press [ENTER] to store and exit the edited setup screen. If no setups are stored in the analyzer, the “Tail Rotor Setup” banner screen will appear allowing you to define and store a new setup. Detailed instructions can be found in paragraph 6.1.1, “Tail Rotor Setup.”

6.4.2 - New

When the “New” function is selected, the “Tail Rotor Setup” banner screen appears allowing you to define and store a new setup. Do this as described in paragraph 6.1.1, “Tail Rotor Setup.”

6.4.3 - Print

The “Print” option presents a list of stored setups on the “Job List” banner screen. Ensure your printer is turned on and connected to the analyzer with the COMM/Print cable supplied with your analyzer. Select the setup you wish to print and press [ENTER]. (See Chapter 14, “Printing,” for a detailed explanation of how to set up the analyzer to print.)

6.4.4 - Print All

Selecting “Print All” sends all currently stored setups to the printer. When making this selection, you will be asked to verify “Are you sure?” by pressing the [F1] key for “Yes,” or the [F3] key for “No.” If choosing the “Yes” answer, ensure your printer is prepared (paper, print cartridge, etc.) to complete the number of jobs stored. The “Yes” answer will send *all* currently stored setups to the printer. The “No” answer will return you to the previous menu.

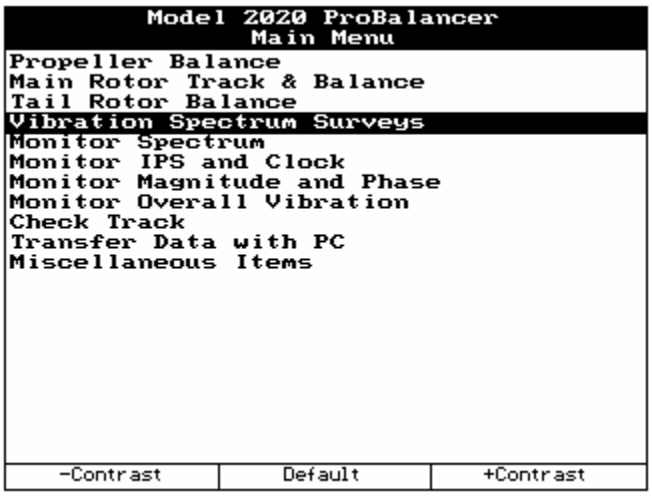
6.4.5 - Delete

The “Delete” option presents you with a list of stored setups. From the list, you may select one setup for deletion. If you wish to delete all stored setups, you must delete them individually. After making your selection, you will be asked to verify your intent to delete the selected job by pressing the [F1] key for “Yes,” or the [F3] key for “No.” We highly recommend you print the setup for reference or permanent record prior to deleting them. Once deleted, the setups cannot be retrieved from the analyzer.

Chapter 7
Vibration Spectrum Surveys

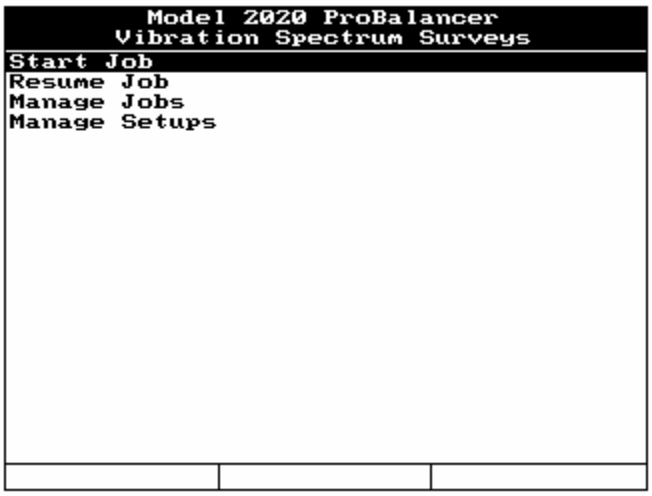
(Revision 3, July 2007)

"Vibration Spectrum Surveys" is an analyzer function that is accessed from the analyzer's Main Menu banner screen as shown in the illustration below. Selecting this function from the main menu brings up the "Vibration Spectrum Surveys" banner screen menu. Each of the listings on this banner screen menu is an option within the "Vibration Spectrum Surveys" function. Descriptions of each of these options follow, along with the information required to complete the menu screens within the options, and the steps necessary to perform the vibration spectrum surveys function.



The Vibration Spectrum Surveys option allows the user to rapidly complete and store vibration surveys using the "Setup" feature (described in section 7.1.1 below). With the setup feature you may complete surveys on several different components without manually entering the setup data between surveys. Each job is unique and very quick.

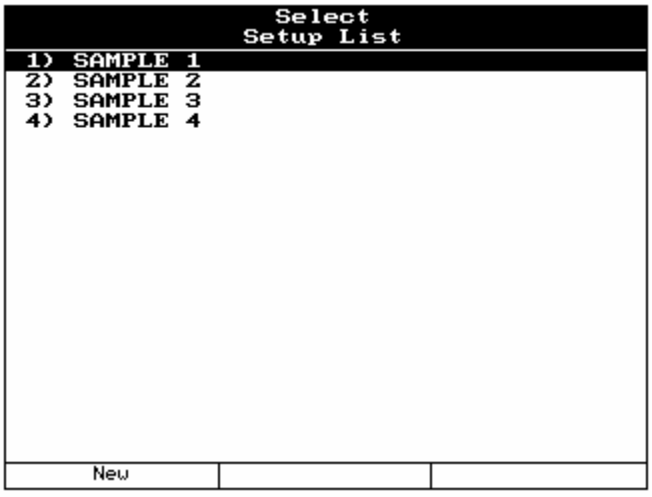
7.1 - Start Job



Selecting "Start Job" from the "Vibration Spectrum Surveys" banner screen allows you to begin a vibration spectrum survey. When you select this option, one of two screens will appear next depending on whether you are starting a job from scratch or whether an incomplete job still exists in the analyzer's memory.

If you are starting a new job with no setups previously defined in the analyzer's memory, the screen will automatically display the "Spectra Setup" banner screen. See section 7.1.1. for step-by-step instructions on completing the Spectra Setup.

If you are starting a new job with previously defined setups available in the analyzer's memory, the screen will automatically display the Setup List banner screen similar to the one shown below. The actual setup names will be those which you have entered into your analyzer. You can then select a setup from this list. If you select from the list, you proceed to the "Customer Information" banner screen described in section 7.1.2.



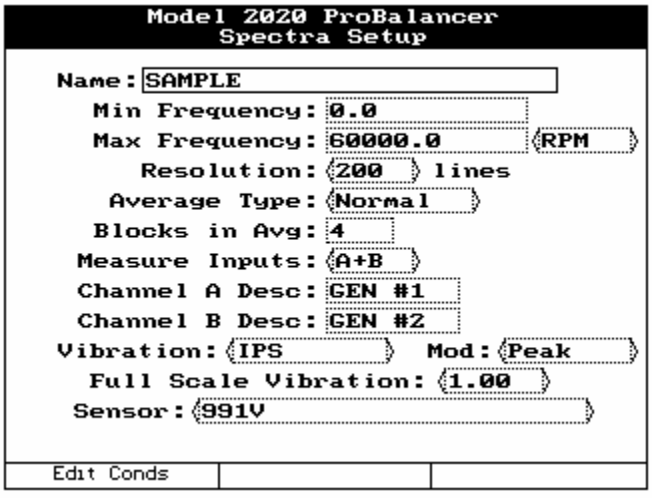
If another job was in progress but was not completed, the "Incomplete Job" banner screen will be displayed to inform you of this. The analyzer will then display a message prompting you to verify that you want to complete the in-progress job or that you want to ignore it and begin a completely new job. This verification prevents you from accidentally erasing data from an in-progress job. The screen will display the message "The last job performed is incomplete. Finish it?" You must then choose a "Yes" or "No" answer by pressing the corresponding [F1] key, for "Yes," or the [F3] key, for "No." The "Yes" answer will return you to the point where the in-progress job was stopped and allow you to complete it. If you choose the "No" answer, the screen will then display the "Spectra Setup" banner screen so you can program a new setup *or* if you have previously-saved setups stored in the analyzer's memory, a screen displaying the list of setups will be displayed. You can then select a setup from this list. If you select from the list, you proceed to the "Customer Information" banner screen described in section 7.1.2. Instructions for completing the "Spectra Setup" banner screen appear in the following Section, 7.1.1.

NOTE

The analyzer will store Setups as long as available memory remains. If you are attempting to store a survey that will exceed the analyzer's memory capacity, the analyzer will display a message saying "You must delete an item before adding a new one." Press the [BACKUP] key and select "Manage Setups" to delete the Setup of your choosing.

7.1.1 - Spectra Setup

The "Spectra Setup" banner screen allows you to define and store a vibration spectrum survey job. As shown in the figure below, some fields in this screen have default values that appear automatically. You can use this information if appropriate or input your own specific setup information using the keypad. (Refer to Chapter 3, "Using the Model 2020 ProBalancer Analyzer" if you are unfamiliar with using the keypad.) The analyzer will display the "Spectra Setup" banner with default values or values entered from the previous job such as those shown in the figure below.



To complete the "Spectra Setup" banner screen, do the following:

1. Using the keypad, enter a name for the vibration spectra survey job. (Refer to Chapter 3, "Using the Model 2020 ProBalancer Analyzer" if you are unfamiliar with using the keypad.)

   "Name," "Channel A Desc," and "Channel B Desc" are optional fields that do not need to be filled in to use the Vibration Spectrum Survey function; however, this information will aid you in differentiating this spectra from other stored spectra should you choose to review or print it at a later time. The "Name" field should be one of your choosing which you will easily recognize and associate with this job. The Channel A and Channel B descriptions likewise should be a description of your choosing which you and your co-workers easily understand, such as "LAT," "VERT," or "GEN #1" and "GEN # 2." All other fields must be selected or filled in.

2. Using the [⇓] key, move to the "Min Frequency" and "Max Frequency" fields. Using the keypad, enter the minimum and maximum frequency requirements for the job.

   For instance, if the frequency of interest is 18,000 RPM (300 Hz), choose a minimum and maximum frequency that will place the 18,000 RPM (300 Hz) in the center of the range. The minimum could be 15,000 RPM (250 Hz) and the maximum 21,000 RPM (350 Hz) for example.

   You should also consider other factors such as Harmonics. If you want multiples of the fundamental frequency included in the frequency range, determine to what extent that need is (1X, 2X, 3X, and so on) then extend the frequency range to include it. For example, 18,000 RPM (300Hz) is the frequency of interest, the fundamental frequency. If you want 3X harmonics included in the frequency range you must multiply the fundamental frequency 18,000 RPM (300 Hz) times the harmonic range (3X) and arrive at an upper range of 54,000 RPM (900 Hz).

3. Use the [⇓] key to move to the "RPM" field. Determine if the required frequency units are revolutions per minute (RPM) or cycles per second (Hz), use the [⇒] key to "toggle" between the two selections in this field.

4. Move to the "Resolution" field using the [⇓] key. Complete the field by setting the resolution as required at 100, 200, 400, or 800 lines by pressing the [⇒] key until the desired resolution is displayed.

   Unless you are attempting to separate two frequencies that are within close proximity to one another, 100 or 200 lines should suffice for general analysis. Higher resolutions will provide a much sharper image of the specified frequency band, but also require more time and more memory for acquisition and should only be used when needed.

5. Move to the "Average Type" field using the [⇓] key. Select the "Average Type" by toggling between the fields using the [⇒] key.

   The two available options are "Normal" and "Peak." Normal averaging displays an exponential running average of the last specified number of blocks of data. This means the amplitudes most likely will change (either increase or decrease) as the average is calculated. Peak averaging plots the highest or worst case amplitude for all frequencies and holds that value on the display until a higher value is acquired. The displayed

amplitude will not decrease thus the term "peak hold." Consult your aircraft's equipment maintenance manual for specific requirements of a vibration survey or for analysis guidelines.

6. Use the [⇓] key to move to the "Blocks in Avg" field. Using the keypad, enter the number of data blocks you wish to be used in the calculations. The default is 4. The valid range is 0 to 999. Remember that higher numbers of averaging, while providing more reliable data, also require more time. The default of 4 is sufficient for most applications.

CAUTION
Sensors connected to Channel A and Channel B must be of the same type. Using different sensors during the same job will cause erroneous readings and problems achieving good balance results.

7. Use the [⇓] key to move to the "Measure Inputs" field. Select from the choices by using [⇒] key. The selection identifies which Channel input port on the analyzer you have selected to acquire vibration data. The available choices are Channel(s) "A," "B," or "A+B."

   Choosing a single channel for measurement will allow you to select 1,200,000 RPM (20 kHz) as the "Max Frequency." Selecting to sample two channels will allow for a "Max Frequency" of 720,000 RPM (12 kHz) on each individual channel.

8. Use the [⇓] key to move to the "Channel A Desc" and "Channel B Desc" fields. As described in step 1 above, these fields are optional. The available field length is 6 characters. Use the keypad to complete these fields.

9. Use the [⇓] key to move to the "Vibration" field. The "Vibration" field determines the engineering units in which the amplitude or "Y" axis of the spectra will be displayed. Consult your ship's equipment maintenance manual for specific requirements of a vibration survey or for analysis guidelines. Use the [⇒] key to select IPS (Inches Per Second), mm/sec (millimeters per second), cm/sec (centimeters per second), Mils (1/1000th of an inch), Microns (1/1000000th of a meter), or G's (equivalent gravities).

10. Move to the "Mod" field using the [⇓] key. "Mod" is an abbreviation for unit Modifiers relevant to the engineering units specified in step 9 above. Use the [⇒] key to select either "Peak", "Pk – Pk" (Peak to Peak), "Avg" (Average) or "RMS" (Root Mean Square). Consult the appropriate equipment maintenance manual for specific requirements of a vibration survey or for analysis guidelines.

11. Use the [⇓] key to move to the "Full Scale Vibration" field. Toggle between the possible selections by using [⇒] key. The full scale indicates the maximum amplitude you expect to acquire or the maximum amplitude of interest. You should choose an amplitude that will adequately display the full amplitude of any specified limit. If you do not expect amplitudes in excess of what would normally be experienced for the equipment application, set this field as low as possible while still allowing sufficient space to display the maximum limitations as stated above.

NOTE
Encountered amplitudes above this setting may cause the analyzer to overload. It is best to set the "Full Scale Vibration" higher than needed as opposed to lower than needed for this reason. The overload does not

cause a fatal error. You can recover from the overload by pressing the [MAIN MENU] key and starting the process again from the beginning. However, avoiding an overload will save you time in the process.

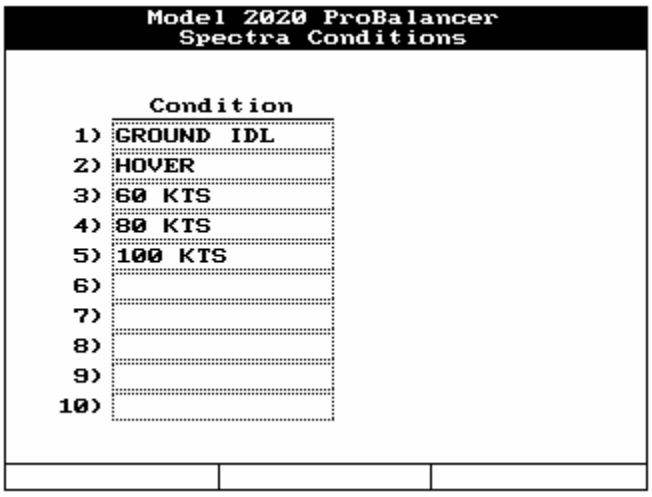
The available selections are 0.01, 0.02, 0.05, 0.10, 0.20, 0.50, 1.00, 2.00, 5.00, 10.0, 20.0, 50.0, 100, 200, 500, 1000, 2000, and 5000. This scale refers to the number of engineering units of vibration amplitude specified in step 9 above.

12. Move to the "Sensor" field using the [⇓] key. Use the [⇒] key to toggle between the options and select a sensor. If the sensor you are using does not appear as an optional selection, you must input a new sensor setup into the analyzer's memory. See Chapter 13, Section 13.2.2, "Setup Sensors" for instructions on how to perform this function.

NOTE
See the Chapter 15, Equipment and Accessory Setup and Troubleshooting, for additional information on installing accessory equipment such as vibration sensors and tachometers.

7.1.1.1 – Edit Conditions

The "Edit Conds" (which corresponds to the [F1] key) selection appears at the bottom left of the "Spectra Setup" banner screen. Press the [F1] key if you wish to define conditions for the survey. If you choose this option, the following "Spectra Conditions" banner screen is displayed.



To input conditions, do the following:

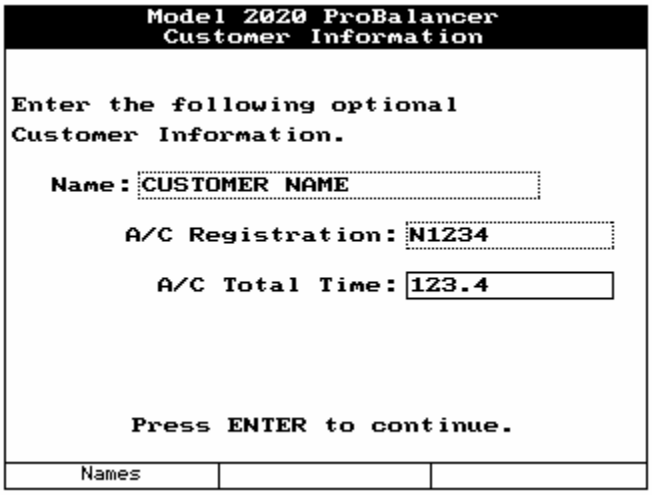
1. Use the [⇑], [⇓], keys to navigate the screen and input conditions' data using the keypad.

2. In the "Condition" column, use the analyzer keypad to enter a descriptive name for up to ten conditions. You may define up to ten individual points at which you collect and optionally store data. When defined, these conditions are stored with the setup and are accessed when the setup is selected.

3. When the conditions are completed per your requirements, press [ENTER] to accept and exit back to the “Spectra Setup” screen.

4. Press [ENTER] again and an information screen will ask, “Store this new setup?” Press [F1] to answer “Yes” and continue, or [F3] to answer “No” and continue.

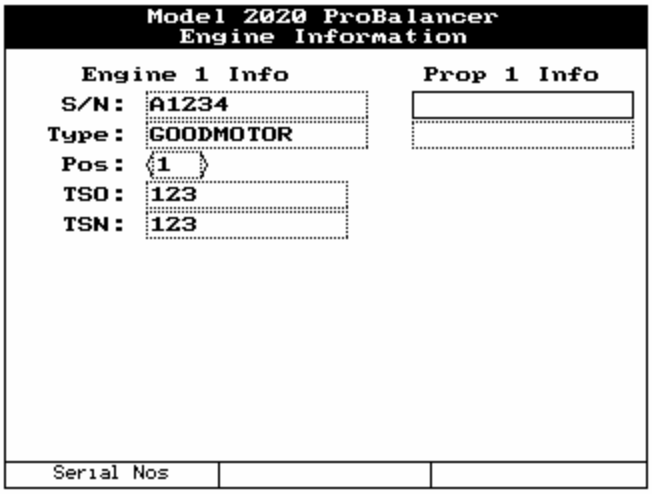
7.1.2 - Customer Information



The next screen displayed is the “Customer Information” banner screen shown in the following illustration. All information on this screen is optional; however we highly recommend you fill in as much information as possible to ease the task of storage and retrieval of surveys. If you have other customer information stored, you may press the [F1] key to select from a list of stored customer names, which will then be entered into the “Name” field. When all fields are completed as desired, press [ENTER] to continue.

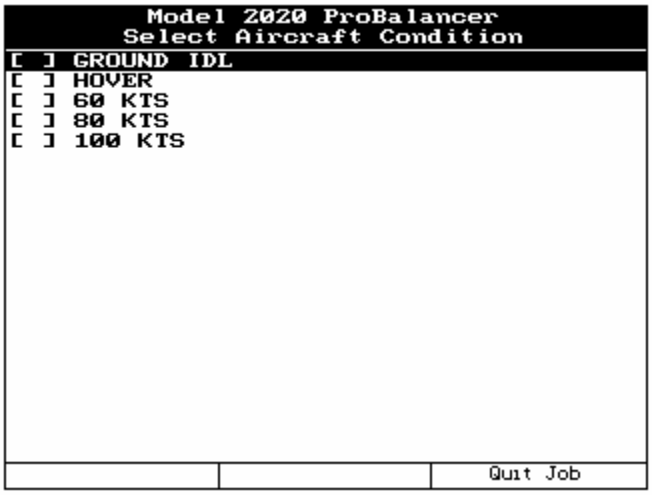
7.1.3 – Engine Information

The “Engine Information” banner screen is displayed as shown below. A serial number (“S/N”) and “Type” field are available for both an engine and a propeller so that stored surveys can be traced by either component of the powertrain system. All fields are optional but we highly recommend you fill in as much information as possible for ease of use in trending, recall, and storage.



Navigate between the fields using the [⇓] and [⇑] keys. All fields are entered from the keypad with the exception of the "Pos" (Position) field, which is a selection field. The position indicates the position on the airplane of the engine, propeller or subcomponent. Using the [⇒] key, select positions from 1 through 4. The "TSO" and "TSN" fields for "Time Since New" and "Time Since Overhaul" are optional fields. When all fields are filled as required, press [ENTER] to continue.

7.1.4 – Select Aircraft Condition



The "Select Aircraft Condition" banner screen is displayed as above. The conditions are those defined in the "Edit Conditions" screen (see section 7.1.1.1).

Use the [⇑] or [⇓] keys to highlight the condition you wish to collect.

7.1.5 – Start Component

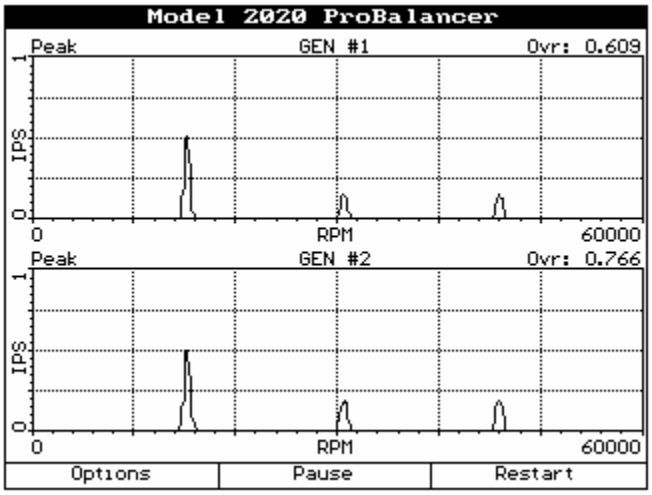
Start the component you are checking (engine, generator, gearbox, etc.). When the component reaches the desired operating condition (speed, temp, etc.), press the [ENTER] key to begin acquiring data.

NOTE

When the spectra is displayed on screen, you may press the [⇒] or [⇐] keys to produce a NORMAL CURSOR immediately at the highest displayed amplitude frequency. The [⇑] and [⇓] keys may also be used immediately to EXPAND or SHRINK the Y scale.

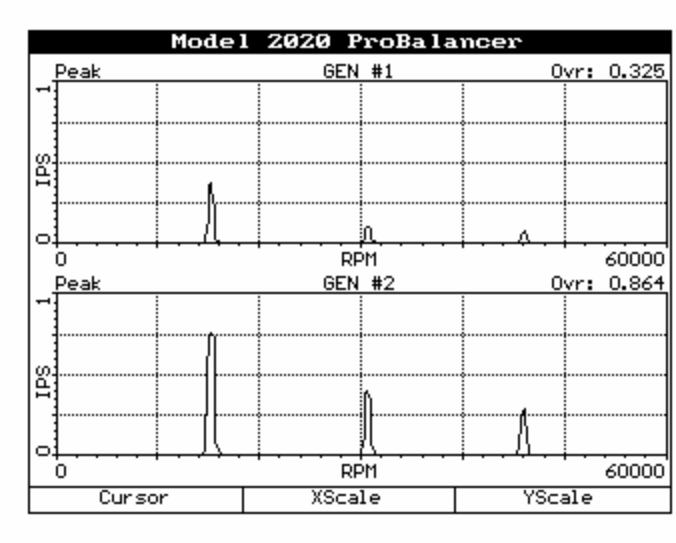
7.1.6 - Collecting Data

When the spectra is displayed, you will also see three function boxes at the bottom of the screen (see following figure) corresponding to the position of the [F1], [F2], and [F3] keys directly below them. The boxes read “Options,” “Pause,” and “Restart.”



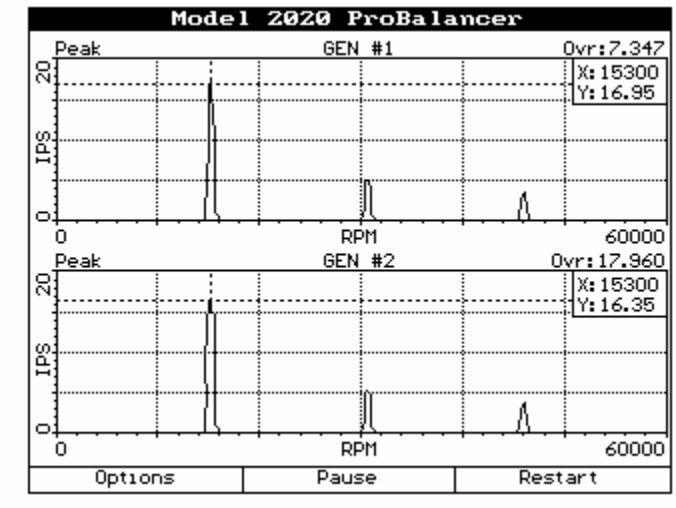
Once any of these “F” key options are selected, both the screen and the corresponding “F” key functions change. With each selection, the “F” keys offer different options (e.g., Expand, Shrink, X scale) for viewing the spectra. The “F” key function for viewing spectra is described in the following steps.

1. Pressing the [F1] “Options” key will change the [F1], [F2], and [F3] boxes to read “Cursor,” “X scale,” and “Y scale” respectively as shown in the figure below.



2. Pressing the [F1] "Cursor" key will change the [F1], [F2], and [F3] boxes to read "Normal," "Harmonic," and "None" respectively. The functions of the "F" keys will continue to change as the screens change.

3. Pressing the [F1] "Normal" key will produce a normal cursor on the screen accompanied by an X and Y scale value readout box in the upper right corner of each displayed spectra (see the following figure). These X and Y values are relative to the current position of the cursor only. The cursor can be moved along the X (horizontal) axis of the spectra by pressing the [⇐] or [⇒] keys. Hold down the key for large and rapid incremental changes. The value of the X-axis (frequency) and Y-axis (amplitude) will be displayed for the current position of the cursor. Incremental values are determined by the number of lines of resolution specified in the setup screen. An example of a normal cursor and readout box is shown below.

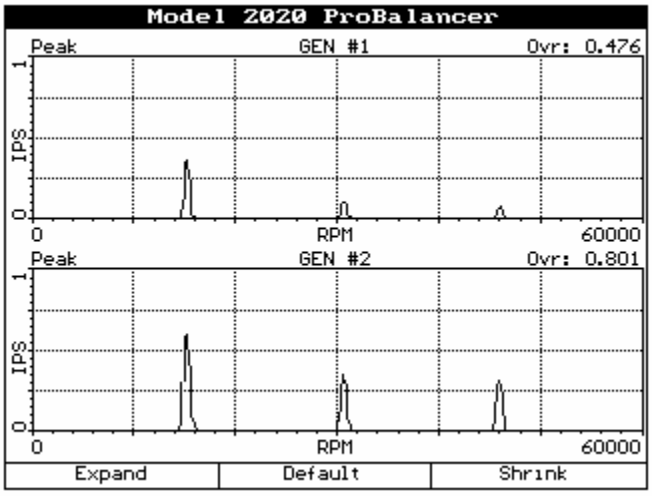


4. Pressing the [F2] "Harmonic" key will produce multiple harmonic cursors according to the specified frequency range. When this key is pressed, cursors will appear to the right of the fundamental frequency identified by the leftmost cursor. For example, if the

fundamental frequency is 18,000 RPM (300 Hz) cursors will be placed at 2X (36,000 RPM (600 Hz)) 3X (54,000 RPM (900 Hz)) 4x (72,000 RPM (1200 Hz)) and so on until the upper frequency limit of the screen is met. When the primary cursor (for the fundamental frequency) is moved, the multiple harmonic cursors will automatically follow the movement and position themselves at the new multiple of the fundamental frequency. To remove the harmonic cursors, repeat steps 1 to 3 above. At step 4, press either the [F1] "Normal" or [F3] "None" key and the multiple cursor will be replaced by your selection.

5. Pressing the [F3] "None" key will remove either a normal or harmonic cursor if currently displayed on screen. The three boxes above the [F1], [F2] and [F3] keys will return to "Options," "Pause," and "Restart" respectively. If no cursor is displayed when pressing this key, only the box nomenclature will change.

6. Pressing the [F1] "Options" then [F2] "X scale" key will change the [F1], [F2], and [F3] boxes to read "Expand," "Default," and "Shrink" respectively as shown in the following figure.



7. Pressing the [F1] "Expand" key will expand the X scale of the spectra, in effect enlarging the viewing area. You might think of this function as a "Zoom Out" feature. The center of the Expanded view will be the position of the cursor prior to pressing the [F1] key. If the view is already at the maximum range of the specified X scale range, no scaling change will occur. However, the cursor will be displayed and the X, Y, and "Ovr" (Overall) values will be shown in the upper right corner of the screen. The [F1], [F2] and [F3] boxes will return to the format described in step 5 above. If you wish to expand the X scale even further, retrace the steps from that point as described in the text.

8. Pressing the [F2] "Default" key will return the X scale to the values specified in the setup. This is a quick and easy way to return the expanded or shrunken X scale to that default value without the necessity of numerous keystrokes. If the X scale is already at the setup values when the [F2] "Default" key is pressed, the three function boxes will return to "Options," "Pause," and "Restart". No other changes will occur.

9. Pressing the [F3] “Shrink” key will lower the X scale of the spectra, in effect shrinking the viewing area. You might think of this function as a “Zoom In” feature. If the view is already at the minimum of the specified X scale range, no scaling change will occur. However, the cursor will be displayed and the X, Y, and “Ovr” (Overall) values will be shown in the upper right corner of the screen. The [F1], [F2] and [F3] boxes will return to the format described in step 5 above. If you wish to Shrink the X scale even further, retrace the steps from that point as described in the text.

10. Pressing the [F1] “Options” then [F3] “Y scale” key changes the [F1], [F2], and [F3] boxes to read “Expand,” “Default,” and “Shrink” respectively (see paragraph 6 above).

11. Pressing the [F1] “Expand” key will expand the Y scale of the spectra, in effect enlarging the viewing area. You might think of this function as a “Zoom Out” feature. If the view is already at the maximum range of the specified Y scale range, no scaling change will occur. However, the cursor will be displayed and the X, Y, and Ovr: (Overall) values will be shown in the upper right corner of the screen. The [F1], [F2] and [F3] boxes will return to the format described in step 5 above. If you wish to Expand the Y scale even further, retrace the steps from that point as described in the text.

12. Pressing the [F2] “Default” key will return the Y scale to the values specified in the setup. This is a quick and easy way to return expanded or shrunken Y scale to that default value without the necessity of numerous keystrokes. If the Y scale is already at the setup values when the [F2] “Default” key is pressed, the three function boxes will return to “Options,” “Pause,” and “Restart.” No other changes will occur.

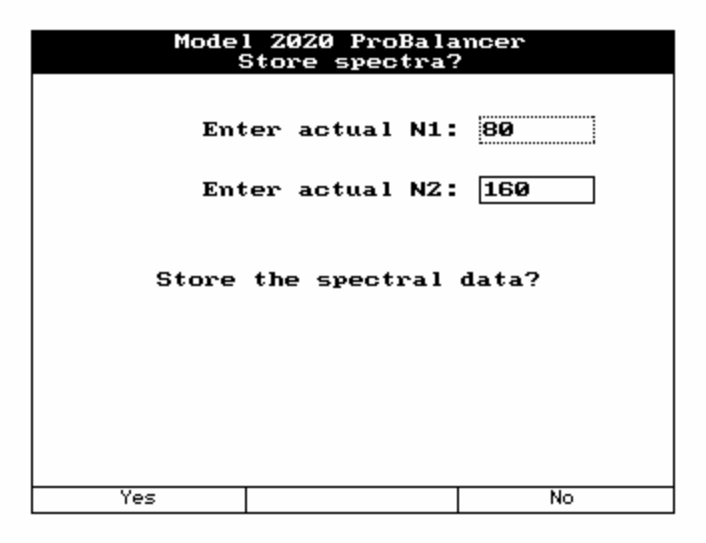
13. Pressing the [F3] “Shrink” key will lower the Y scale of the spectra, in effect shrinking the viewing area. You might think of this function as a “Zoom In” feature. If the view is already at the minimum of the specified Y scale range, no scaling change will occur. However, the cursor will be displayed and the X, Y, and “Ovr” (Overall) values will be shown in the upper right corner of the screen. The [F1], [F2] and [F3] boxes will return to the format described in step 5 above. If you wish to shrink the Y scale even further, retrace the steps from that point as described in the text.

14. Pressing the [F2] “Pause key will stop data acquisition and freeze the screen with the latest displayed data. The [F1], [F2], and [F3] boxes will change to read [F1] “Blank”, [F2] “Blank”, and [F3] “Resume”. Pressing the [F2] “Resume” key will restart the data acquisition and continue the data collection process with the latest data.

15. Pressing the [F3] “Restart” key will restart data sampling. If the “Average Type” selected is Peak, the display will reset to display the maximum values obtained after the “Restart” key was pressed. This can be used as way of validating the data.

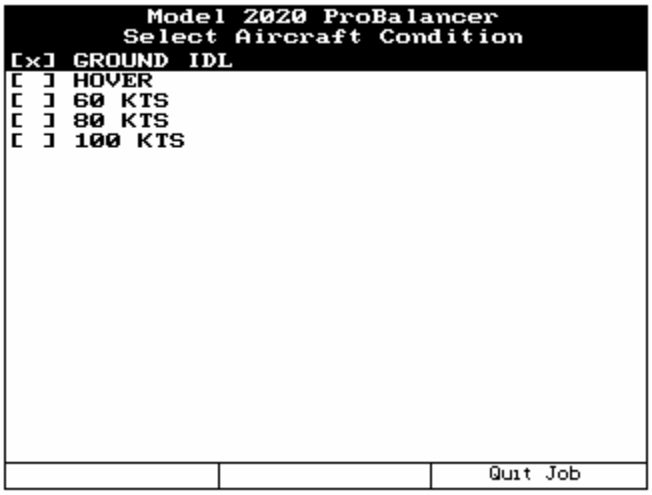
7.1.7 - Storing Data

Anytime the spectrum is displayed on screen you may press [ENTER] to terminate data acquisition. The analyzer then displays the screen shown below.



The two fields “Enter actual N1” and “Enter actual N2” are for user reference and are optional. We recommend you fill in as much information as possible as an identifying aid for recalling data. The last line on the screen reads “Store the spectral data?” The [F1] and [F3] keys are now designated “Yes” and “No” respectively. Press the key that corresponds to your choice.

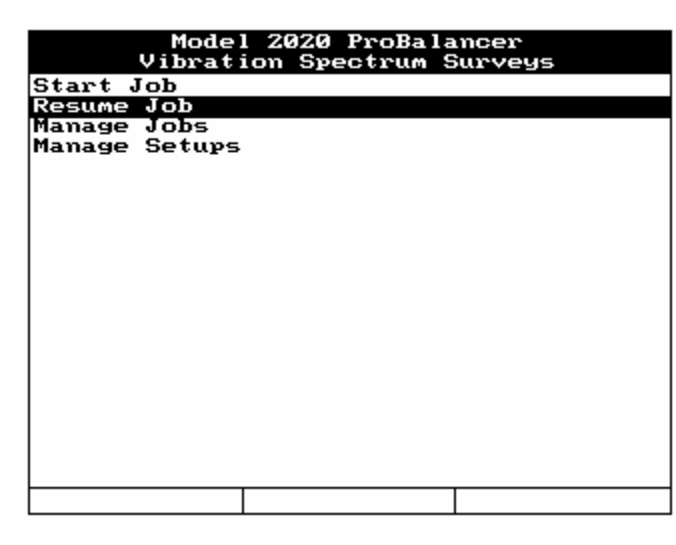
The “Select Aircraft Condition” banner screen is again displayed as shown in the following figure. Notice that the condition for which you just collected and stored data now has an “X” immediately to the left of the defined condition. This alerts the user that data has been collected and stored for this condition. This does not preclude you from selecting and acquiring new data for this condition. However, if you choose to store the data, the previously stored data will be written over and cannot be recovered.



At this point you may select a new condition and repeat procedures starting from section 7.1.4 until all required data are collected.

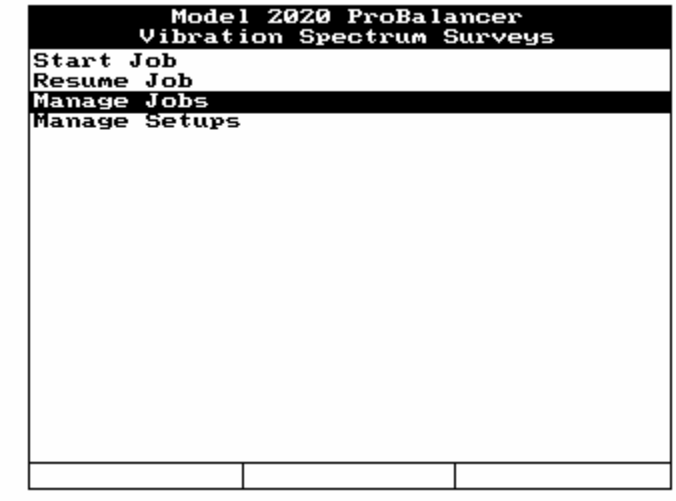
To quit the job and return to the “Vibration Spectrum Surveys” banner screen, press [F3] for “Quit Job.”

7.2 - Resume Job

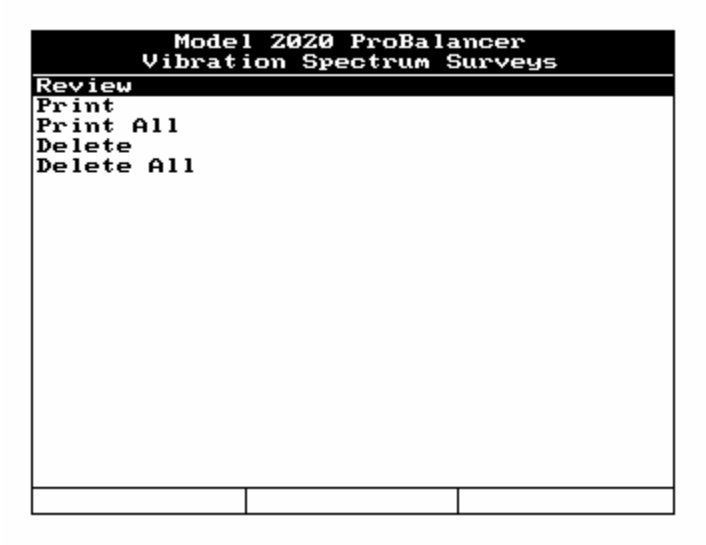


When you select “Resume Job” from the “Vibration Spectrum Surveys” banner screen menu, the “Incomplete Jobs” banner screen will be displayed. Incomplete jobs are listed by name, preceded by an asterisk. Select the job you wish to complete and the analyzer will return you to the point where the in-progress job was stopped, allowing you to complete it.

7.3 - Manage Jobs



Selecting “Manage Jobs” from the “Vibration Spectrum Surveys” banner screen menu presents several sub-menu choices to choose from. The selections are displayed in the example below. These choices allow you to “manage” previously completed job data you have stored in the analyzer.



7.3.1 - Review

Selecting the “Review” option presents a list of stored jobs on the “Job List” banner screen. You can select one job for on-screen viewing. When viewing is complete, press the [BACKUP] or [ENTER] key to exit the screen.

7.3.2 - Print

The “Print” option presents a list of stored jobs on the “Job List” banner screen. From the list, you may select one job for printing. See Chapter 14, “Printing” for a detailed explanation of how to set up the analyzer to print.

7.3.3 - Print All

The “Print All” option sends all currently stored jobs to the printer. When you select “Print All,” a message will appear on the analyzer’s “Print All Jobs” banner screen asking you to verify that you want to print all jobs. Answer the prompt, “Are you sure?” by pressing the [F1] key for “Yes” or the [F3] key for “No.” If you choose the “Yes” answer, ensure your printer is prepared (paper, print cartridge, etc.) to complete the number of jobs stored. The “Yes” answer will send *all* currently stored vibration survey jobs to the printer. The “No” answer will return you to the previous menu.

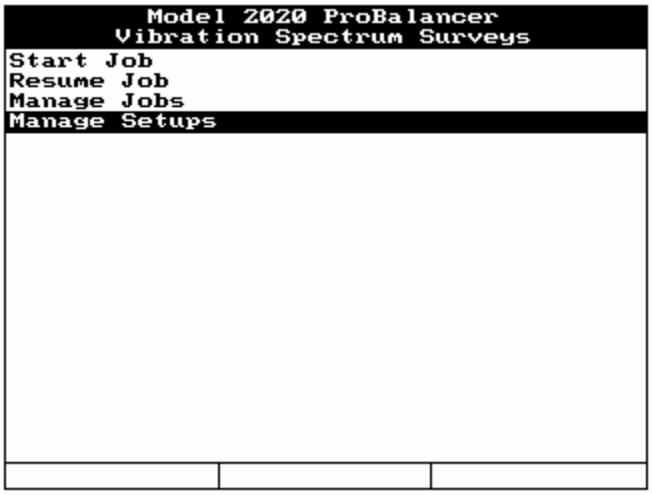
7.3.4 - Delete

The “Delete” option presents a list of stored jobs on the “Job List” banner screen. From the list, you may select one job for deletion. After making your selection, the “Delete Job” banner screen will appear, asking you to verify your intent to delete the selected job by pressing the [F1] key for “Yes” or the [F3] key for “No.” You may wish to print the job for reference or permanent record prior to deleting. Once deleted, the job cannot be retrieved from the analyzer.

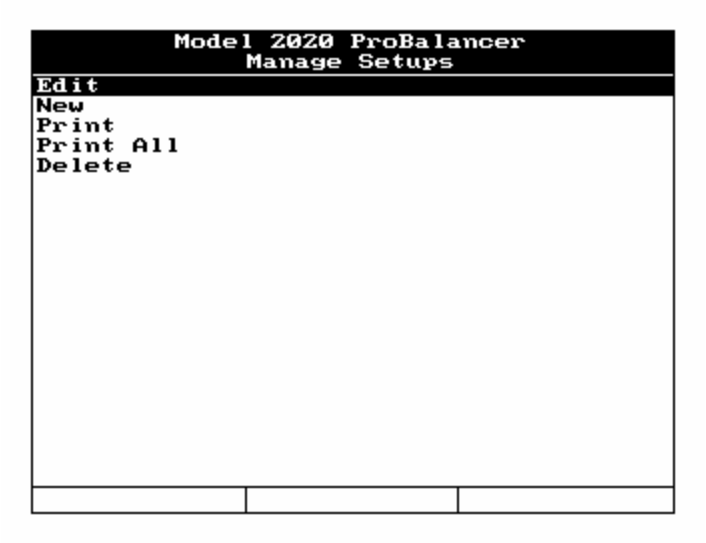
7.3.5 - Delete All

The “Delete All” option will delete all currently stored jobs. After selecting this option, the “Delete All Job” banner screen will appear, asking you to verify your intent to delete all the jobs by pressing the [F1] key for “Yes” or the [F3] key for “No.” You may wish to print the jobs for reference or permanent record prior to deleting. Once deleted, the jobs cannot be retrieved from the analyzer.

7.4 - Manage Setups



Selecting “Manage Setups” from the “Vibration Spectrum Surveys” banner screen menu presents several sub-menu choices to choose from. The selections are displayed in the example below. The choices are shown in the example screen below. These choices allow you to “manage” setups you have stored previously in the analyzer.



7.4.1 - Edit

Selecting the "Edit" function displays the "Setup List" screen. Select the setup you wish to edit. The screen will display the "Spectra Setup" screen. Edit the setup as necessary and press [ENTER] to store and exit the edited setup screen.

7.4.2 – New

If you select "New," the "Spectra Setup" screen is displayed. See section 7.1.1 for instructions on how to proceed from this point.

7.4.3 - Print

Selecting the "Print" function displays the "Setup List" screen. Ensure your printer is turned on and connected to the analyzer with the COMM/Print cable supplied with your analyzer. Select the setup you wish to print. (See Chapter 14, "Printing" for a detailed explanation of how to set up the analyzer to print.)

7.4.4 - Print All

Selecting "Print All" sends all currently stored setups to the printer. When making this selection, you will be asked to verify "Are you sure?" by pressing the [F1] key for "Yes," or the [F3] key for "No." If choosing the "Yes" answer, ensure your printer is prepared (paper, print cartridge, etc.) to complete the number of jobs stored. The "Yes" answer will send *all* currently stored vibration survey setups to the printer. The "No" answer will return you to the previous menu.

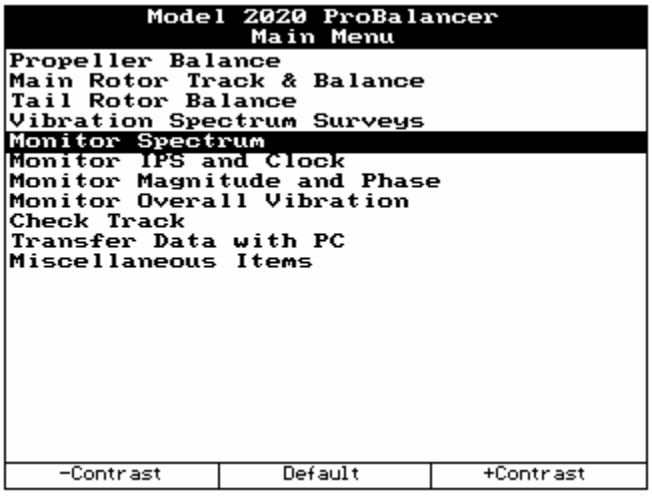
7.4.5 - Delete

The “Delete” option presents you with a list of stored setups. From the list, you may select one setup for deletion. If you wish to delete all stored setups, you must delete them individually. After making your selection, you will be asked to verify your intent to delete the selected job by pressing the [F1] key for “Yes,” or the [F3] key for “No.” We highly recommend you print the setup for reference or permanent record prior to deleting them. Once deleted, the setups cannot be retrieved from the analyzer.

Chapter 8
Monitor Spectrum

(Revision 3, July 2007)

"Monitor Spectrum" is an analyzer function that is accessed from the analyzer's Main Menu banner screen. A description of this function follows, along with the information required to complete the menu screens within the function, and the steps necessary to perform the function.

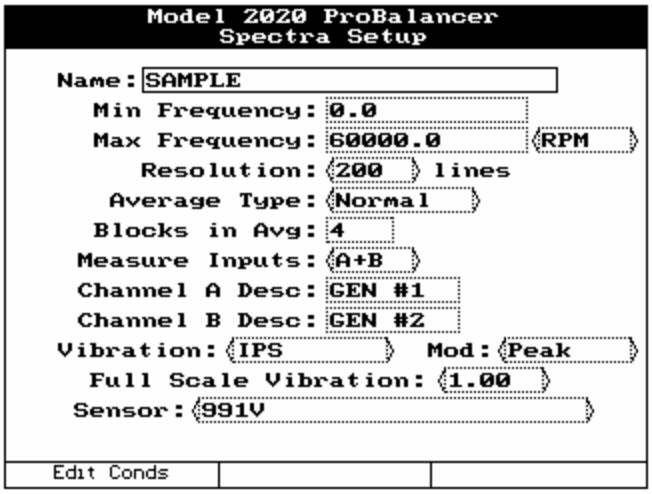


The "Monitor Spectrum" function allows the user to rapidly set up the analyzer to acquire vibration data for troubleshooting, verification of repair, comparison of similar components or "snap shot" recording of pre- or post-maintenance conditions.

To use the "Monitor Spectrum" function, do the following:

1. Select "Monitor Spectrum" from the Main Menu banner screen.

   The analyzer will display the "Spectra Setup" banner screen with default values or values entered from the previous job such as those shown in the illustration below.



2. Enter a name for the spectrum in the "Name" field if desired (see paragraph below) using the keypad. (Refer to Chapter 3, "Using the Model 2020 ProBalancer Analyzer" if you are unfamiliar with using the keypad.)

   "Name," "Channel A Desc," and "Channel B Desc" are optional fields that need not be filled in to use the "Monitor Spectrum" function. However, this information will aid you in differentiating these spectra from other stored spectra should you choose to store it for later review or printing. The "Name" field should be one of your choosing which you will easily recognize and associate with this job. The "Channel A" and "Channel B" descriptions likewise should be a description of your choosing which you and your co-workers easily understand, such as "LAT", "VERT", or "GEN #1" and "GEN #2" for instance. All other fields on this screen must be filled in.

3. Use the [⇓] key to move down to the next field. Using the keypad, enter the determined minimum and maximum frequency range in the "Min Frequency" and "Max Frequency" fields. Use the [⇓] and [⇑] keys to move between fields.

   Determine the minimum and maximum frequency requirements. For instance, if the frequency of interest is 18,000 RPM (300 Hz), you might choose a minimum and maximum frequency that will place 18,000 RPM (300 Hz) in the center of the range. The minimum might then be 15,000 RPM (250 Hz) and the maximum 21,000 RPM (350 Hz) for instance. You might also consider other factors such as Harmonics. If you want multiples of the fundamental frequency included in the frequency range, determine to what extent that need is (1X, 2X, 3X and so on). Then, extend the frequency range to include it. For example, 18,000 RPM (300 Hz) is the frequency of interest, the fundamental frequency. If you want 3X harmonics included in the frequency range you must multiply the fundamental frequency (18,000 RPM (300 Hz)) times the harmonic range (3X) and arrive at an upper range of 54,000 RPM (900 Hz).

4. Use the [⇓] key to move to the "RPM" field. Determine if the required frequency units are revolutions per minute (RPM) or cycles per second (Hz). Press the [⇒] key to toggle between the frequency unit selections in the field.

5. Use the [⇓] key to move to the "Resolution" field. Set the Resolution as required at 100, 200, 400, or 800 lines by pressing the [⇒] key to toggle through the selections until the desired resolution is displayed.

   Unless you are attempting to separate two frequencies that are within close proximity to one another, 100 or 200 lines should suffice for general analysis. Higher resolutions will provide a much sharper image of the specified frequency band but also require more time and memory for acquisition.

6. Use the [⇓] key to move to the "Average Type" field. Select the average type by toggling between the selections in the field using the [⇒] key.

   There are two available options, "Normal" and "Peak". If you select "Normal" the screen will constantly update both the amplitude and frequency. The screen will have a dynamic appearance and change as the input condition changes. If you select "Peak" the analyzer will plot and hold the highest amplitude received on screen. This value will not decrease once plotted, but will increase if an amplitude of higher value is acquired. Consult the appropriate equipment maintenance manual for specific requirements of a vibration survey or for analysis guidelines.

7. Use the [⇓] key to move to the "Blocks in Avg." field. Enter the number of data blocks you wish to be used in the calculations. The default is four. The valid range is 0 to 999. Remember that higher numbers of averaging, while providing more reliable data, also require more time. The default of 4 is sufficient for most applications.

CAUTION
Sensors connected to Channel A and Channel B must be of the same type. Using different sensors during the same job will cause erroneous readings and problems achieving good balance results.

8. Use the [⇓] key to move to the "Measure Inputs" field. Toggle between the choices in this field using the [⇐] or [⇒] keys. The available choices are Channel(s) A, B, or A+B. The value in this field identifies which vibration channel input data will be acquired from.

   Choosing a single channel for measurement will allow you to select 1,200,000 RPM (20,000 Hz) as the "Max Frequency." Selecting to sample two channels will allow for a "Max Frequency" of 720,000 RPM (12,000 Hz) on each individual channel.

9. Use the [⇓] key to move to the "Channel A Desc" and "Channel B Desc" fields. These fields are defined by you and do not necessarily need to be filled in. The fields will accept any alphanumeric characters entered from the keypad. These fields are used as descriptors for the individual channels such as "LAT" and "VERT" or "GBOX" and "CORE". The maximum field length is 6 characters.

10. Use the [⇓] key to move to the "Vibration" field. The "Vibration" field determines the engineering units in which the amplitude, or "Y" axis, of the spectra will be displayed. Consult the appropriate equipment maintenance manual for specific requirements of a vibration survey or for analysis guidelines. Use the [⇐] or [⇒] keys to toggle between the selections in the field. The available selections are: IPS (Inches Per Second), mm/sec (millimeters per second), cm/sec (centimeters per

second), Mils (1/1000th of an inch), Microns (1/1000000th of a meter) and G's (equivalent gravities).

11. Use the [⇓] key to move to the "Mod" field. "Mod" is short for unit MODifiers relevant to the engineering units specified in step 10, above. Use the [⇐] or [⇒] keys to toggle through the available selections in the field which are: Peak, Pk-Pk (Peak to Peak), Avg. (Average), and RMS (Root Mean Square). Consult the appropriate equipment maintenance manual for specific requirements of a vibration survey or for analysis guidelines.

12. Use the [⇓] key to move to the "Full Scale Vibration" field. The "Full Scale Vibration" field is a toggle selection field. Use the [⇐] or [⇒] keys to toggle through the available selections for the field. The available selections are 0.01, 0.02, 0.05, 0.10, 0.20, 0.50, 1.00, 2.00, 5.00, 10.0, 20.0, 50.0, 100, 200, 500, 1000, 2000, and 5000. This scale refers to the number of engineering units of vibration amplitude specified in the previous field.

    The full scale indicates the maximum *vibration* amplitude you expect to acquire or the maximum amplitude of interest. Choose the amplitude that will adequately display the full amplitude of any specified limits as a minimum. If you do not expect amplitudes in excess of what would normally be experienced for the equipment application, set this field as low as possible while still allowing sufficient space to display the maximum limitations as stated above.

NOTE
Amplitudes encountered above the setting in this field may cause the analyzer to overload. It is best to set the Full Scale Vibration higher than needed as opposed to lower than needed so the overload does not cause a fatal error. You can recover from the overload by pressing the [Main Menu] key and starting the process again from the beginning. However, avoiding an overload will save you time in the process.

13. Use the [⇓] key to move to the "Sensor" field. Use the [⇐] or [⇒] keys to toggle through the available sensor selections for the field.

    If the desired sensor does appear in the selections, see Chapter 13, Section 13.2.2, "Setup Sensors" for instructions on setting up new sensors that can then be selected in this field.

14. When all required fields in on the "Spectra Setup" banner screen are filled, turn the analyzer off by pressing the [ON/OFF] key.

15. Physically install the sensors and cables required for the task.

16. Return to the analyzer, turn it on, select "Monitor Spectrum" from the Main Menu banner screen to continue with the spectrum monitoring function. All information just entered in the "Spectra Setup" banner screen fields should still appear. This information will remain in each field until you change it.

NOTE
See Chapter 15, "Equipment and Accessory Setup and Troubleshooting"

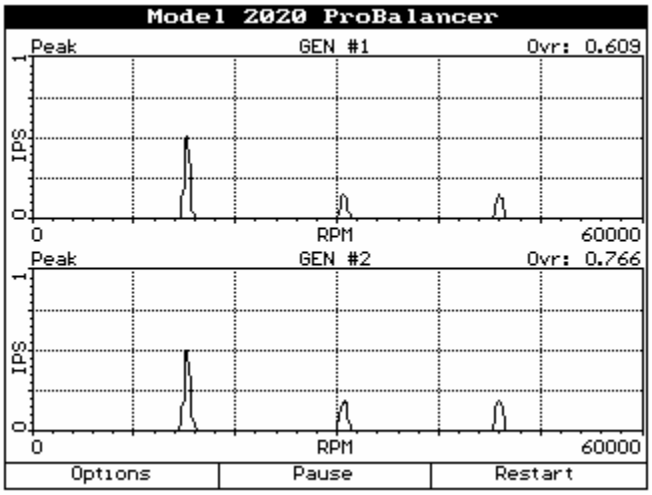
for additional information on installing accessory equipment such as vibration sensors and tachometers.

17. Start the component you are checking (engine, generator, etc.). When the component is at normal operating condition (speed, temp, etc.) press the [ENTER] key to begin acquiring data.

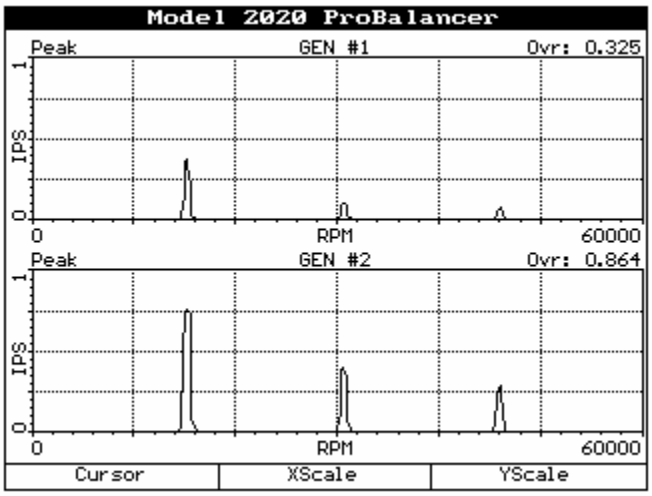
NOTE

When the spectrum is displayed on screen, press the [⇐] or [⇒] key to produce a NORMAL CURSOR immediately at the frequency where the highest amplitude is displayed. The arrow keys may also be used to immediately EXPAND [⇑] or SHRINK [⇓] the Y scale.

18. When the spectra is displayed, you will also see three function boxes at the bottom of the screen (see following figure) corresponding to the position of the [F1], [F2], and [F3] keys directly below them. The boxes read “Options,” “Pause,” and “Restart.”

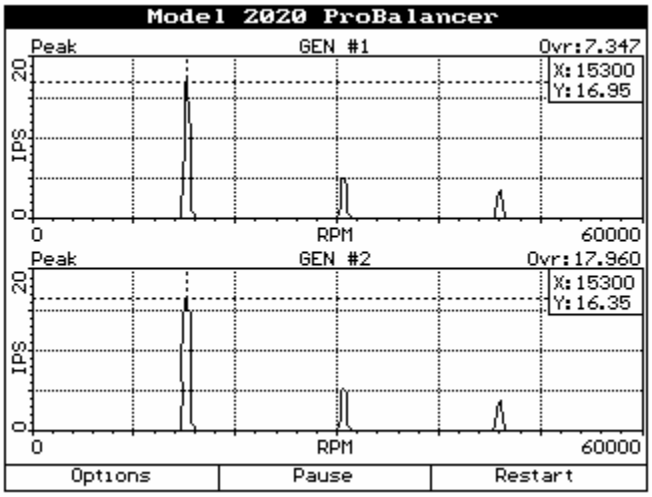


19. Press the [F1] “Options” key to change the [F1], [F2], and [F3] boxes to read “Cursor,” “X scale,” and “Y scale” respectively as shown in the figure below. The functions of the “F” keys will continue to change as the screens change. Steps 20-34 walk you through the various “F” key options that will appear. Use the “F” keys as needed in the monitoring process.



20. Press the [F1] “Cursor” key to change the [F1], [F2], and [F3] boxes to read “Normal,” “Harmonic,” and “None” respectively.

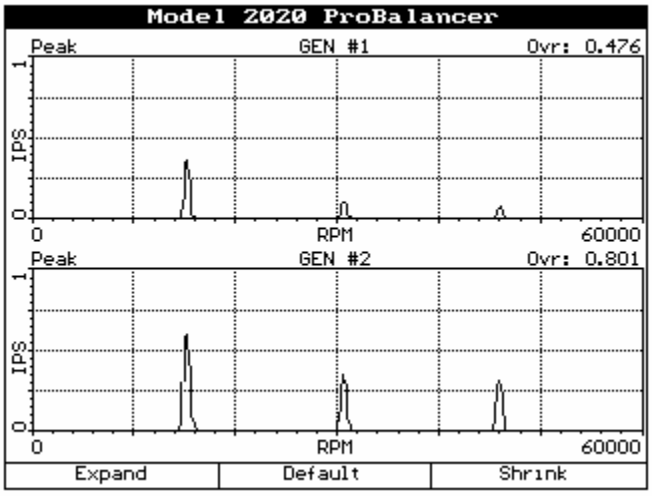
21. Press the [F1] “Normal” key to produce a normal cursor on the screen accompanied by an X and Y scale value readout box in the upper right corner of each displayed spectra (see following figure). These X and Y values are relative to the current position of the cursor only. The cursor can be moved along the X (horizontal) axis of the spectra by pressing the [⇒] or [⇐] keys. Hold down the key for large and rapid incremental changes. The value of the “X” axis (frequency) and “Y” axis (amplitude) will be displayed for the current position of the cursor. Incremental values are determined by the number of lines of resolution specified in the setup screen.



22. Press the [F2] “Harmonic” key to produce multiple harmonic cursors according to the specified frequency range. When this key is pressed, the cursors will appear to the right of the fundamental frequency identified by the left most cursor. For example, if the fundamental frequency is 18,000 RPM (300 Hz), cursors will be placed at 2X (36,000 RPM (600 Hz)) 3X (54000 RPM (900 Hz)) 4x (72000 RPM (1200 Hz)) and so on until the upper frequency limit of the screen is met. When the primary cursor (for the fundamental frequency) is moved, the multiple harmonic cursors will automatically follow the movement and position themselves at the new multiple of the fundamental frequency. To remove the harmonic cursor, repeat step 20 and press the “None” key. This will remove all cursors from the screen.

23. Press the [F3] “None” key to remove either a normal or harmonic cursor if currently displayed on screen. The three boxes above the [F1], [F2] and [F3] keys will return to “Options,” “Pause,” and “Restart” respectively. If no cursor is displayed when pressing this key, only the box nomenclature will change.

24. Press the [F2] “X scale” key to change the [F1], [F2], and [F3] boxes to read “Expand,” “Default,” and “Shrink” respectively as shown in the following figure.



25. Press the [F1] "Expand" key to expand the X scale of the spectra, in effect enlarging the viewing area. You might think of this function as a "Zoom Out" feature. The center of the expanded view will be the position of the cursor prior to pressing the [F1] key. If the view is already at the maximum range of the specified X scale range, no scaling change will occur, however the cursor will be displayed and the X, Y, and overall (Ovr:) values will be shown in the upper right corner of the screen. The [F1], [F2] and [F3] boxes will return to the format described at the beginning of paragraph 18. If you wish to expand the X scale further, repeat the steps described in this paragraph.

26. Press the [F2] "Default" key will return the X scale to the values specified in the setup. This is a quick and easy way to return the expanded or shrunken scale to the default value without the necessity of numerous keystrokes. If the X scale is already at the setup value when the [F2] "Default" key is pressed, the three function boxes will return to the settings in paragraph 18. No other changes will occur.

27. Press the [F3] "Shrink" key to lower the X scale of the spectra, in effect shrinking the viewing area. You might think of this function as a "Zoom In" feature. If the view is already at the minimum of the specified X scale range, no scaling change will occur, however the cursor will be displayed and the X, Y, and overall (Ovr:) values will be shown in the upper right corner of the screen. The [F1], [F2] and [F3] boxes will return to the format described in step 18 above. If you wish to shrink the X scale even further, repeat the steps in this paragraph.

28. Press the [F3] "Y scale" key to change the [F1], [F2], and [F3] boxes to read "Expand," "Default," and "Shrink" respectively.

29. Press the [F1] "Expand" key to expand the Y scale of the spectra, in effect enlarging the viewing area. You might think of this function as a "Zoom Out" feature. If the view is already at the maximum range of the specified Y scale range, no scaling change will occur. The [F1], [F2] and [F3] boxes will return to the format described in paragraph 18 above. If you wish to Expand the Y scale even further, retrace the steps from that point as described in the text.

30. Press the [F2] “Default” key to return the Y scale to the values specified in the setup. This is a quick and easy way to return the expanded or shrunken scale to the default value without the necessity of numerous keystrokes. If the Y scale is already at the setup value when the [F2] “Default” key is pressed, the three function boxes will return to the format described in paragraph 18. No other changes will occur.

31. Press the [F3] “Shrink” key to lower the Y scale of the spectra, in effect shrinking the viewing area. You might think of this function as a “Zoom In” feature. If the view is already at the minimum of the specified Y scale range, no scaling change will occur on the screen. The [F1], [F2] and [F3] boxes will return to the format described in paragraph 18. If you wish to Shrink the Y scale even further, retrace the steps from that point as described in the text.

32. Press the [F2] “Pause” key to stop data acquisition and freeze the screen with the latest displayed data. The [F1] and [F3] boxes will change to read “Store” and “Resume,” respectively. The box that corresponds to the [F2] key has no value and is blank.

33. Press the [F1] “Store” key to display the “Customer Information” banner screen. You may enter optional Customer Information for later identification of the stored spectra (recommended). When the desired information is entered, press [ENTER] to accept and store the information with the spectra and return to the Main Menu.

NOTE

The analyzer will store spectra jobs as long as memory is available. If you are attempting to store a job and the analyzer displays a message saying “You must delete an item before adding a new one,” press the [BACKUP] key and select “Manage Jobs” to delete the spectra of your choosing. This action should free enough memory to store the new data. This is also an indication that you should review and remove or transfer all data that is not necessary.

NOTE

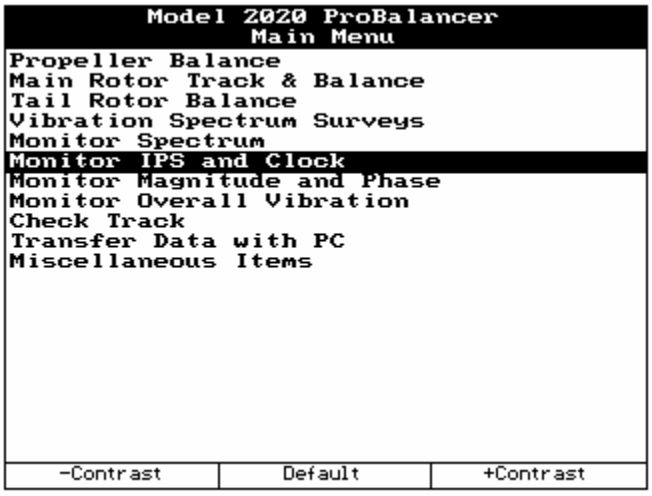
The “Monitor Spectrum” banner screen menu does not contain a store or review option. In order to *review* spectra, you must exit the “Monitor Spectrum” banner screen and select the “Vibration Spectrum Surveys” banner screen menu. See Chapter 7, Vibration Spectrum Surveys for instructions on how to perform this function.

34. Press the [F3] “Resume” key to restart the data acquisition and continue the averaging process with the latest averaged data.

Chapter 9
Monitor IPS and Clock

(Revision 3, July 2007)

"Monitor IPS and Clock" is an analyzer function that is accessed from the analyzer's Main Menu banner screen. A description of this function follows, along with the information required to complete the menu screens within the function, and the steps necessary to perform the function.

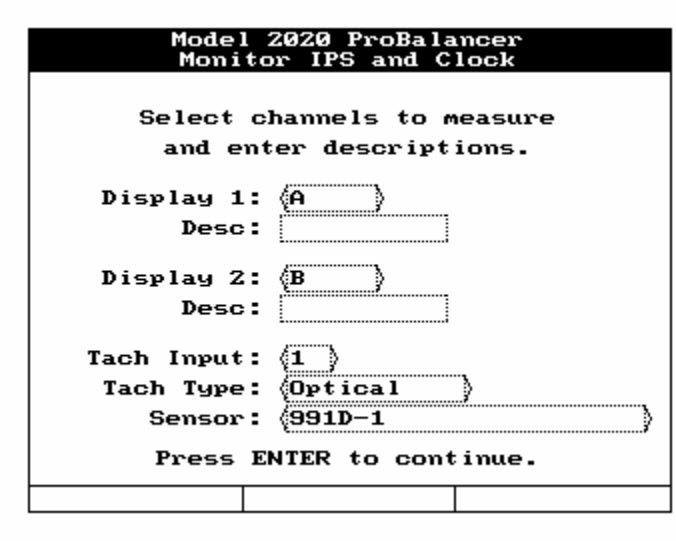


The "Monitor IPS and Clock" function provides for rapid acquisition of a clock angle and amplitude reading without defining and saving a setup. This function allows for no storage of readings for future review.

It is not recommended that you use this function for the acquisition of measurements from tail rotors or other items that have a balance chart that utilizes a strobe light for phase (clock) angles. Measurements acquired with this function will not be accurate for use in these applications. To balance these applications, use the "Tail Rotor Balance" selection from the Main Menu.

To use the "Monitor IPS and Clock" function, do the following:

1. From the Main Menu banner screen, select “Monitor IPS and Clock.” The “Monitor IPS and Clock” banner screen appears as shown in the figure below.



CAUTION
Sensors connected to Channel A and Channel B must be of the same type. Using different sensors during the same job will cause erroneous readings and problems achieving good balance results.

2. Use the [⇒] key to toggle between the selections in the “Display 1” field to select the output of “Display 1.” The available selections are: “A,’ “B,” “A+B,” and “A-B.”

3. Use the [⇓] key to move down to the “Description” field. Enter a name from the keypad in the description field. (Refer to Chapter 3, “Using the Model 2020 ProBalancer Analyzer” if you are unfamiliar with using the keypad.) The description field is optional.

4. Use the [⇓] key to move down to the “Display 2” field. Using the [⇒] key, toggle between the available selections to select the output of “Display 2.” The available options are: “A,” “B,” “A+B,” “A-B,” and None. If you only wish to measure Display 1, select “None.”

5. Use the [⇓] key to move down to the “Description” field. Enter a name from the keypad in the description field. The description field is optional. If you are only measuring one channel, leave this field blank.

6. Use the [⇓] key to move down to the “Tach Input” field. Toggle between selections using the [⇒] keys to select the tachometer-input channel to be monitored.

7. Move down to the “Tach Type” field by using the [⇓] key. Use the [⇒] key to select the tachometer type you are using for the once-per-revolution input into the analyzer.

8. Use the [⇓] key to move down to the “Sensor” field. Select a sensor type by using the [⇒] key to toggle between selections.

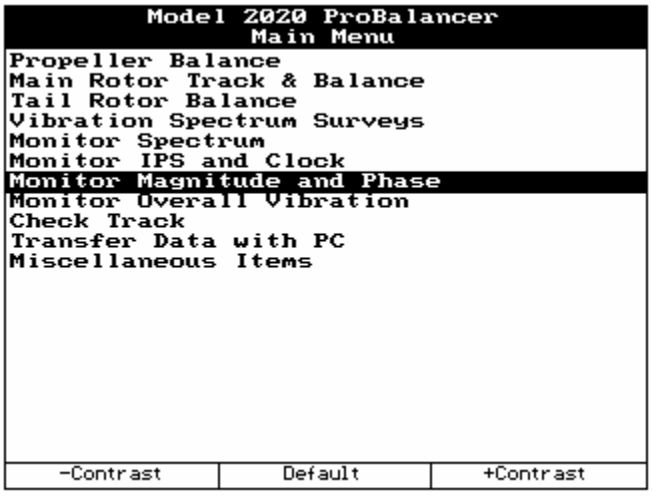
9. Once all fields are filled press the [ENTER] key to begin acquiring vibration data. See Chapter 16, “Reading Spectrum and Scales” for a detailed explanation of the information contained on the acquisition screen.

10. When finished acquiring vibration data, press the [ENTER] key to stop.

Chapter 10
Monitor Magnitude and Phase

(Revision 3, July 2007)

"Monitor Magnitude and Phase" is an analyzer function that is accessed from the analyzer's Main Menu banner screen. A description of this function follows, along with the information required to complete the menu screens within the function, and the steps necessary to perform the function.

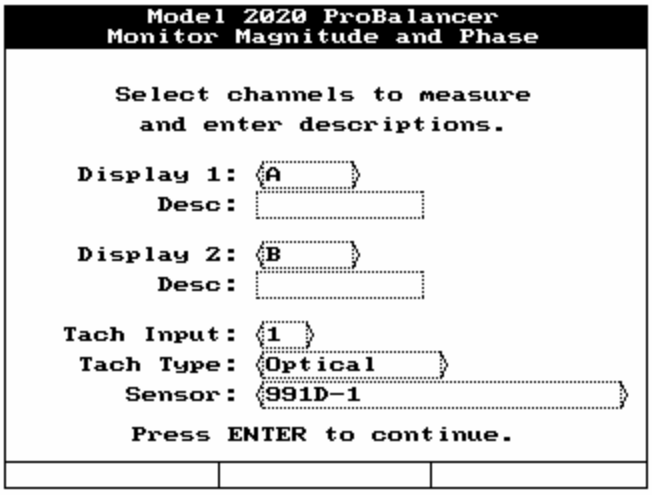


The "Monitor Magnitude and Phase" function provides for rapid acquisition of a phase angle and amplitude reading without defining and saving a setup. This function allows for no storage of readings for future review.

CAUTION
Sensors connected to Channel A and Channel B must be of the same type. Using different sensors during the same job will cause erroneous readings and problems achieving good balance results.

To use the "Monitor Magnitude and Phase" function, do the following:

1. Select the "Monitor Magnitude and Phase" from the Main Menu banner screen. The "Monitor Magnitude and Phase" banner screen appears as shown in the following figure.



2. Use the [⇒] key to toggle between the selections in the "Display 1" field to select the output of "Display 1." The available selections are: "A,' "B," "A+B," and "A-B."

3. Use the [⇓] key to move down to the "Description" field. Enter a name from the keypad in the description field. (Refer to Chapter 3, "Using the Model 2020 ProBalancer Analyzer" if you are unfamiliar with using the keypad.) The description field is optional.

4. Use the [⇓] key to move down to the "Display 2" field. Using the [⇒] key, toggle between the available selections to select the output of "Display 2." The available options are: "A," "B," "A+B," "A-B," and "None". If you only wish to measure Display 1, select "None."

5. Use the [⇓] key to move down to the "Description" field. Enter a name from the keypad in the description field. The description field is optional. If you are only measuring one channel, leave this field blank.

6. Use the [⇓] key to move down to the "Tach Input" field. Toggle between selections using the [⇒] keys to select the tachometer-input channel to be monitored.

7. Move down to the "Tach Type" field by using the [⇓] key. Use the [⇒] key to select the tachometer type you are using for the once-per-revolution input into the analyzer.

8. Use the [⇓] key to move down to the "Sensor" field. Select a sensor type by using the [⇒] key to toggle between selections.

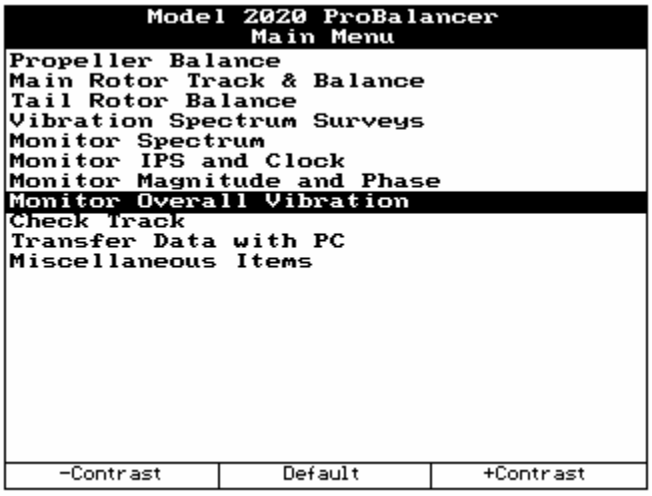
9. Once all fields are filled, press the [ENTER] key to begin acquiring vibration data. See Chapter 16, "Reading Spectrum and Scales" for a detailed explanation of the information contained on the acquisition screen.

10. When finished acquiring vibration data, press the [ENTER] key to stop.

Chapter 11
Monitor Overall Vibration

(Revision 3, July 2007)

"Monitor Overall Vibration" is an analyzer function that is accessed from the analyzer's Main Menu banner screen. A description of this function follows, along with the information required to complete the menu screens within the function, and the steps necessary to perform the function.

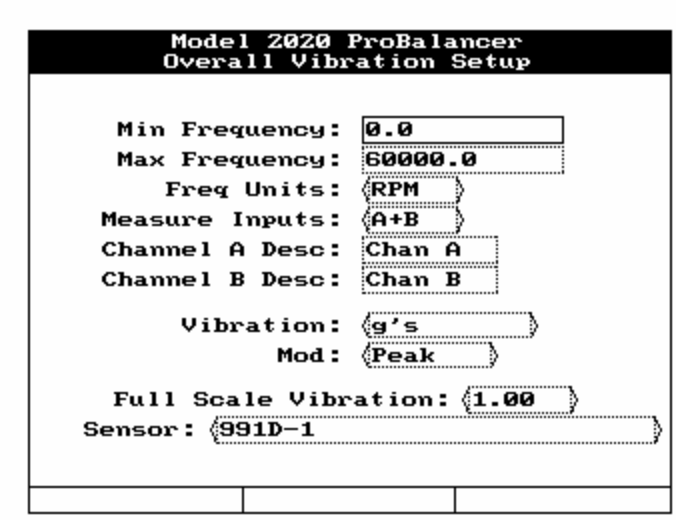


"Monitor Overall Vibration" allows the user to monitor the overall vibration condition of a system or component in a digital numeric display only. This function also provides the means to monitor under one set of criteria, then quickly change those criteria and return to the monitor mode. As with all "monitor" functions of the analyzer, there are no provisions for storing, reviewing, or printing the monitored data.

To use the "Monitor Overall Vibration" function, do the following:

1. Select "Monitor Overall Vibration" from the Main Menu banner screen.

   The "Overall Vibration Setup" banner screen appears as shown below. To complete the "Overall Vibration Setup" screen, define the fields according to your requirements.



2. Enter the minimum frequency of interest in the "Min Frequency" field using the keypad. (Refer to Chapter 3, "Using the Model 2020 ProBalancer Analyzer" if you are unfamiliar with using the keypad.)

3. Use the [⇓] key to move down to the next field. Using the keypad**, e**nter the maximum frequency of interest in the "Max Frequency" field.

4. Use the [⇓] key to move down to the "Freq Units" field. Use the [⇒] key to toggle between the selections in this field. The selections are RPM or Hz.

CAUTION

Sensors connected to Channel A and Channel B must be of the same type. Using different sensors during the same job will cause erroneous readings and problems achieving good balance results.

5. Use the [⇓] key to move down to the "Measure Inputs" field. Use the [⇒] key to toggle between the selections in this field. Select A, B, or A+B according to your needs.

   Choosing a single channel for measurement will allow you to select 1,200,000 RPM (20,000 Hz) as the "Max Frequency." Selecting to sample two channels will allow for a "Max Frequency" of 720,000 RPM (12,000 Hz) on each individual channel.

6. Use the [⇓] key to move down to the "Channel A Desc" and "Channel B Desc" fields. Using the keypad, enter a descriptive name (up to six alphanumeric characters) for each Channel input. Use the [⇓] and [⇑] keys to move between these fields.

7. Use the [⇓] key to move down to the "Vibration" field. Select the engineering units you wish the vibration to be displayed in by using the [⇒] key to toggle between the available selections which are g's, IPS, mm/sec, cm/sec, mils, and microns.

8. Use the [⇓] key to move down to the "Mod" field. Select the unit modifiers for your display by using the [⇒] key to toggle between the available selections which are Peak, Pk-Pk, Avg, and RMS.

9. Move to the “Full Scale Vibration” field by using the [⇓] key. Use the [⇒] key to toggle between the available selections in this field. Select a level of vibration that will be higher than, but not less than, the highest level of vibration you expect to encounter.

10. Use the [⇓] key to move down to the “Sensor” field. Select the vibration sensor you are using for this job by using the [⇒] key to toggle between the available selections. If the sensor you are using is not displayed refer to Paragraph 13.2.2. “Sensor Setup.”

11. When all fields are defined, press [ENTER] to begin monitoring.

12. The “Overall Vibration” monitoring banner screen will display the current and maximum vibration levels for Channel A and Channel B according to your specifications. The total number of samples taken and the Units of engineering will also be displayed. Press the [F1] key if you want to reset the screen and retake data.

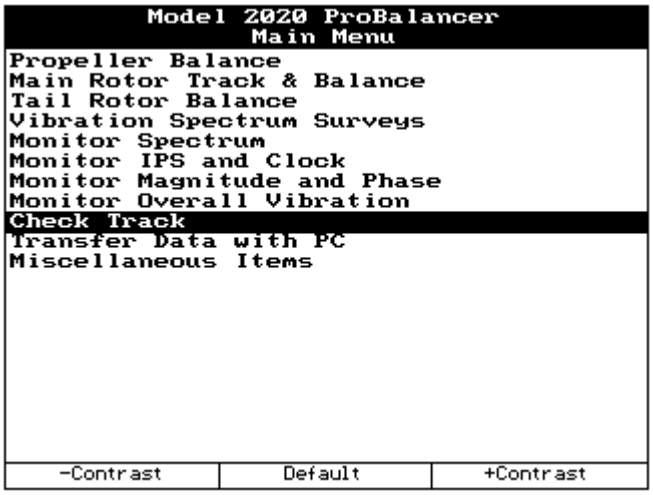
13. If you want to exit back to the “Overall Vibration Setup” banner screen to change the parameters for the monitoring, press either [BACKUP] or [ENTER]. You will be returned to the “Overall Vibration Setup” banner screen where you can then change any of the defined fields. Press [ENTER] to begin monitoring under the new criteria.

14. To exit the “Monitor Overall Vibration” function, press [BACKUP] twice from the monitoring screen or once from the “Overall Vibration Setup” screen.

Chapter 12
Check Track

(Revision 4, August 2012)

"Check Track" is an analyzer function that is accessed from the analyzer's Main Menu banner screen. A description of this function follows, along with the information required to complete the menu screens within the function, and the steps necessary to perform the function.



The "Check Track" option is provided for quick track observations. This function does not allow data storage for later recall and review of data as do the other rotor-related functions of the analyzer.

The "Check Track" function can be performed using either an industry-standard strobe for visual blade tracking or the ACES Systems' TraX™ or Optical Tracker for blade tracking.

Before using the "Check Track" function on the analyzer, you must first install physical equipment such as cables and sensors. To setup equipment, do the following:

1. Place the analyzer in the location it will be used. Install and connect the one-per-rev source to the TACH channel of choice. (You must use a single-interrupter magnetic pickup or optical tach for the once-per-rev signal.)

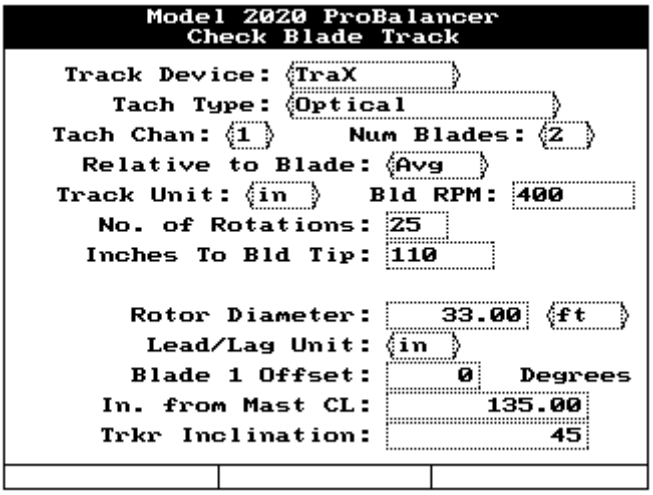
2. Connect the integrated cable of the Model 550 TraX™ directly to the "AUX/COM" input port located on the top end of the analyzer. If using the Model 540 Optical Tracker, connect the tracker to the interface, and the interface to the analyzer's "AUX/COM" input port located on the top end of the analyzer. If using the Model 540-2 Optical Tracker, connect the tracker connector directly to the "AUX/COM" input port located on the top end of the analyzer.

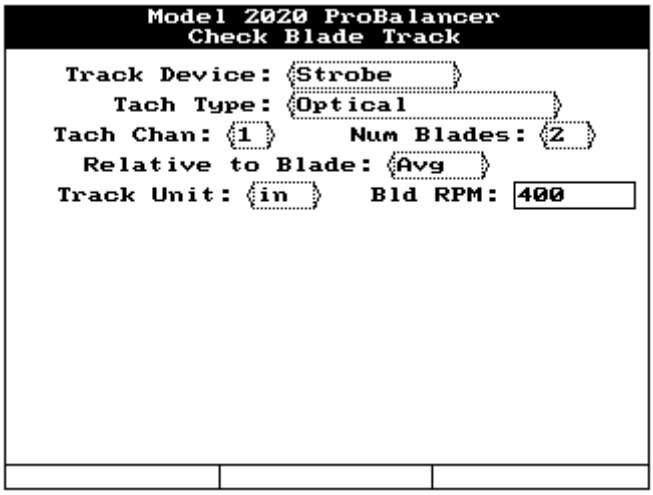
   If using a strobe light, connect the strobe interface cable to the analyzer's "STROBE" input port. Connect the strobe to the interface. Set the strobe to the slave mode or turn the internal oscillator off. Connect the interface to the ship's 28-volt power source. If ship's power is 12V you must transform it to 28V to use the strobe with the analyzer. Install tip targets or place reflective tape to the blade tips per manufacturer's directions.

NOTE

Using the strobe may cause the "ON/OFF" function of the analyzer to be disabled. If you cannot turn the analyzer off using the [ON/OFF] key, disconnect the strobe, and then turn the analyzer off.

After all equipment is installed, return to the analyzer. Then select "Check Track" from the Main Menu banner screen. The "Check Blade Track" banner screen appears as shown in the two figures below.





Complete the fields on the Check Blade Track screen using the instructions below as necessary.

NOTE

The Track Device selection will determine the fields necessary for that device. Not all fields are required for every device and therefore some fields may be omitted from the display.

1. Use the [⇒] key to toggle between the selections in the "Track Device" field, "ACES TraX", "Strobe" or "Tracker". As shown in the figures above, the lower portion of the "Check Blade Track" banner screen changes depending on the type of track device you selected.

2. Use the [⇓] key to move down to the "Tach Type" field. Using the [⇒] key, toggle between the available selections to select the tach type you are using to generate the once-per-rev signal.

3. Use the [⇓] key to move to the "Tach Channel" field. Using the [⇒] key, toggle between the available selections to select the tach channel you connected your tachometer to.

4. Use the [⇓] key to move down to the "No. of Blades" field. Using the [⇒] key, select the number of blades on the rotor you are checking.

5. Use the [⇓] key to move down to the "Relative to Blade" field. This field sets the blade number the track screen will be referenced to. The blade identified here will not move on the track-recording screen. This blade will be shown on the zero reference line; the other blades will be shown above or below this. Selecting Relative to "Avg" will cause the track picture to be split evenly above and below the line based on the overall spread of the total number of blades selected. Use the [⇒] key to select the reference blade.

6. Move to the "Track Unit" field using the [⇓] key. Select the track units from either inches or mm by using the [⇒] key to toggle between the available selections. This will set the scale for the track-recording screen.

7. From the “Track Units” field, use the [⇓] key to move down to the “Blade RPM” field. Enter the blade rpm using the keypad. (Refer to Chapter 3, “Using the Model 2020 ProBalancer Analyzer” if you are unfamiliar with using the keypad.)

8. From the “Bld RPM” field, use the [⇓] key to move down to the “No. of Rotations” field. Using the keypad, enter the number of rotations you wish to use when acquiring blade data. Valid entries in this field are from 20 to 99. Typically, the default setting of 25 will provide enough samples for accurate readings. Depending upon light conditions, there may be cases where this value needs to be increased or decreased to maintain accuracy. (Refer to Chapter 3, “Using the Model 2020 ProBalancer Analyzer” if you are unfamiliar with using the keypad.)

9. Use the [⇓] key to move down to the “Inches to Blade Tips” field. Using the keypad, enter the distance, in inches, between the point where the tracker will be used, to the blade tip in the location where the interrupter is over the magnetic pickup. (Or the reflective tape in front of the PhotoTach when used as the one-per-revolution source.)

NOTE

The “Inches to Tip” field will ALWAYS be defined in inches. This field is independent of any units defined elsewhere in the configuration.

10. Use the [⇓] key to move down to the “Rotor Diameter” field. Enter the diameter of the Main Rotor into this field using the analyzer’s keypad. (Refer to the Model 550 TraX™ operational supplement, P/N 75-900-4043 for additional details as necessary.)

11. Use the [⇓] key to move down to the unlabeled units field. Use the [⇒] key to select the measurement units you would like to use for the Main Rotor Diameter ONLY. Track elevation, lead/lag units, and adjustment units are all set in separate locations. (Refer to the Model 550 TraX™ operational supplement, P/N 75-900-4043 for additional details as necessary.)

12. Use the [⇓] key to move down to the “Lead/Lag Unit” field. Use the [⇒] key to select the measurement units you would like to use for the Lead/Lag ONLY. Track elevation, rotor diameter, and adjustment units are all set in separate locations. (Refer to the Model 550 TraX™ operational supplement, P/N 75-900-4043 for additional details as necessary.)

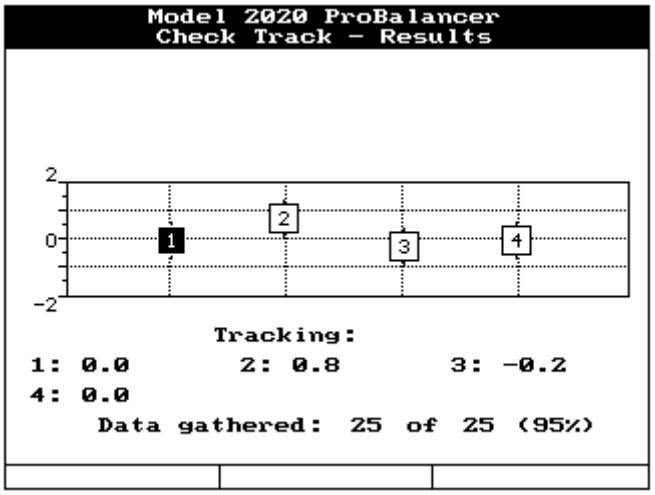
13. Use the [⇓] key to move down to the “Blade 1 Offset” field. Use the analyzer’s keypad to enter a number between (-)180 and 180 indicating the angular distance from the location of the TraX™ to the location of the Target Blade at the time of the Tach event. (Refer to the Model 550 TraX™ operational supplement, P/N 75-900-4043 for additional details as necessary.)

14. Use the [⇓] key to move down to the “In. from Mast CL” field. Use this field to enter the distance between the centerline of the mast and the mounted location of the TraX. This is the linear distance measured in the same plane as the TraX is mounted. Valid entries are from 1 inch to 999 inches. (Refer to the Model 550 TraX™ operational supplement, P/N 75-900-4043 for additional details as necessary.)

15. Use the [⇓] key to move down to the "Trkr Inclination" field. Use the Inclinometer to measure the installed angle and enter it in this field. Valid entries are from 30 thru 90 degrees. (Refer to the Model 550 TraX™ operational supplement, P/N 75-900-4043 for additional details as necessary.)

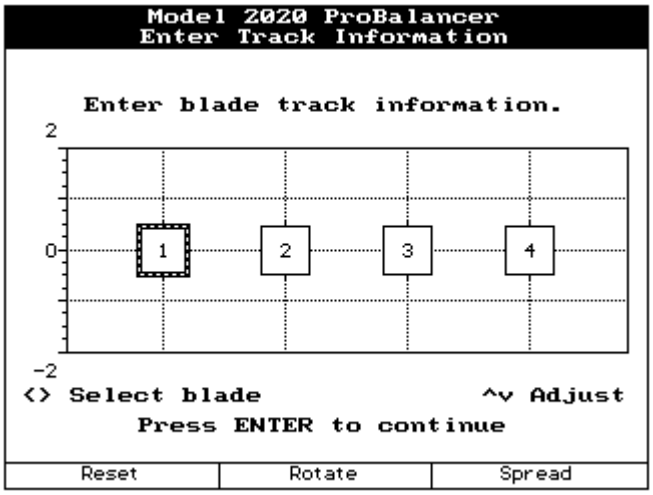
16. When all fields are completed to your satisfaction, press [ENTER].

17. After setting up the tracking parameters, the process changes depending on the type of tracking device you are using.

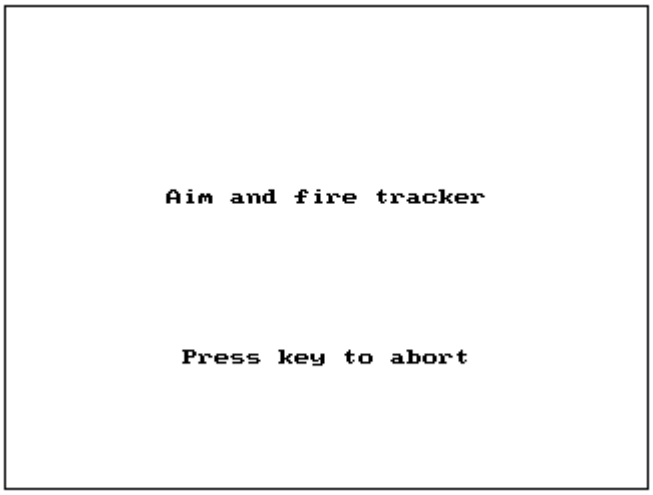


If using the TraX™ - When you press [ENTER] to accept the configuration above, the TraX™ will automatically begin taking data. As long as the Tach and Ready lights continue to flash, the unit is actively collecting data. When the Tach and Ready lights extinguish, the "Check Track – Results" screen will appear as shown in the sample above.

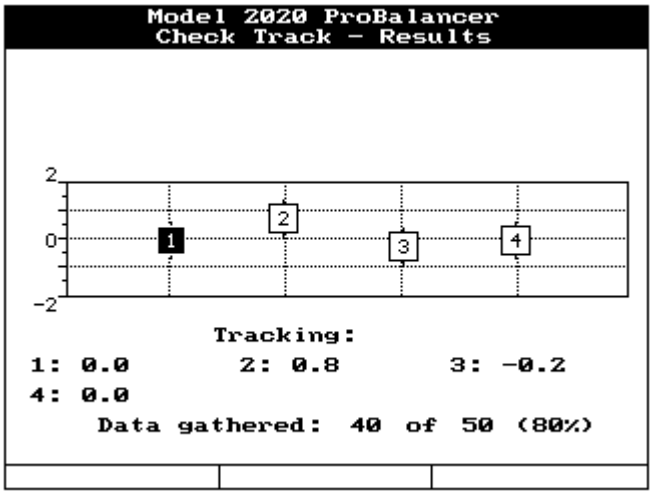
The "Check Track -Results" screen presents the blade-tip-path information in both a graphical and a numeric format. The final percentage display on the "Data Gathered" line at the bottom of the screen is an indicator of the quality of data. The higher the percentage, the better the data quality. When finished, press the [BACKUP] key to exit back to the Main Menu banner screen. You may retake the track data by simply selecting the "Check Track" function again from the Main Menu banner screen and performing Steps 1 - 16 again.



If using a strobe - When the screen shown above appears, aim the strobe and press the trigger to fire. The targets will appear as a stacked image. By using the [F3] key you can spread the targets out from each other. Each time you press the [F3] key the targets separate further. To return the targets to the stacked position, press the [F1] "Reset" key. To rotate the group of targets to another position for ease of viewing, press the [F2] "Rotate" key. To input the target positions, use the [⇐] or [⇒] key to select the blade, and the [⇑] or [⇓] key to move the blade identifier to a relative position on the screen as seen with the strobe. A single press of the [⇑] or [⇓] key will move the blade icon 0.10 inches or 2 mm depending upon the units selected. When finished, press the [BACKUP] key to exit back to the Main Menu banner screen.



If using the Optical Tracker - After arming the tracker by pressing [ENTER], a message to "Aim and Fire Tracker" appears on the screen (shown above). Aim the tracker and press the trigger to begin acquiring data. When acquisition is finished, the "Check Track Results" banner screen (shown in the following figure) appears.

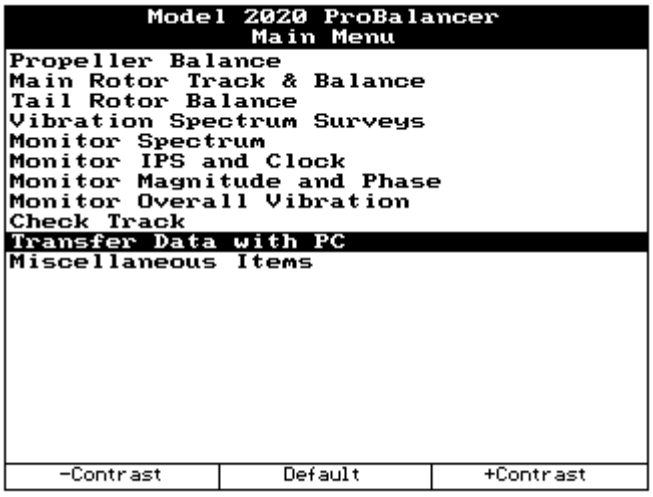


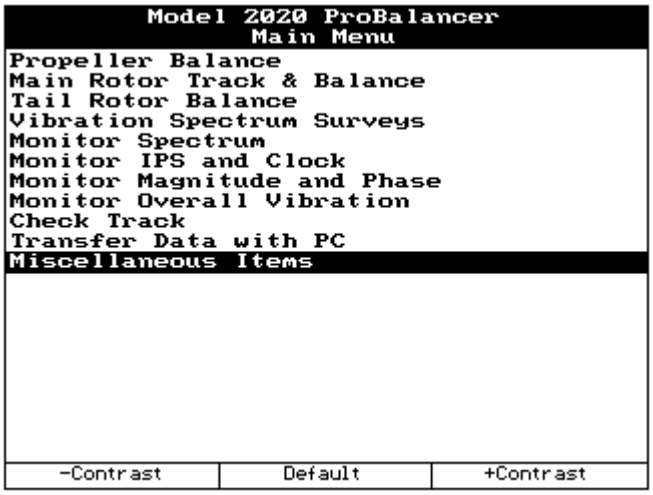
The “Check Track -Results” screen presents the blade-tip-path information in both a graphical and a numeric format. The “Data Gathered” line at the bottom of the screen is an indicator of the quality of data. The higher number of gathered data packets, the better the data quality. When finished, press the [BACKUP] key to exit back to the Main Menu banner screen. You may retake the track data by simply selecting the “Check Track” function again from the Main Menu banner screen and performing steps 1-16 again.

Chapter 13
Transfer Data with PC and Miscellaneous Items

(Revision 3, Aug 2012)

"Transfer Data with PC" and "Miscellaneous Items" are two analyzer functions that are accessed from the analyzer's Main Menu banner screen as shown below. A description of each of these two functions follows, along with the information required to complete the menu screens within these functions, and the steps necessary to perform the functions.





13.1 - Transfer Data with PC

The "Transfer Data With PC" menu selection is used in conjunction with ACES Systems' *AvTrend* Bronze™, WinFlash™, and ACES Comm™ software programs. The Model 2020 ProBalancer Analyzer supports all these software programs.

AvTrend Bronze is included with all new Model 2020 ProBalancer Analyzers. It allows the user to link between the PC and the analyzer enabling the user to update software, store data, and print reports. Data files can be found on the ACES Systems' web page or emailed from the factory to upgrade the analyzer. Data from the field can be emailed to the factory for troubleshooting and evaluation. Reports can easily be printed on most printers attached to the PC.

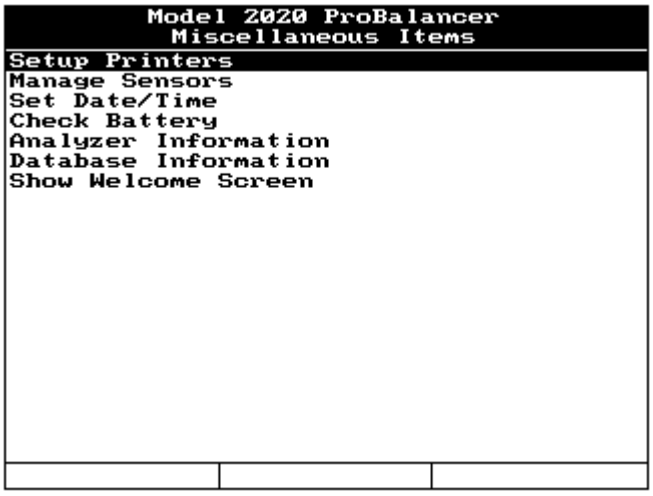
WinFlash provides a link between your PC and the analyzer so you can upgrade the analyzer software version without the having to send the analyzer back to the factory. Upgrade files will be sent to you on a floppy disk but can be emailed to you upon request.

ACES Comm is a software program that accomplishes several tasks. It enables you to download jobs to your PC for storage only. It also facilitates the download of your current setups into a PC for storage. When the download takes place, the influence for a particular setup is upgraded to include its most recent uses. This refines the influence and further expands the ability to conduct a single run adjustment.

A user manual as well as help files accompanies each of these software programs. Refer to those sources for detailed operating instructions.

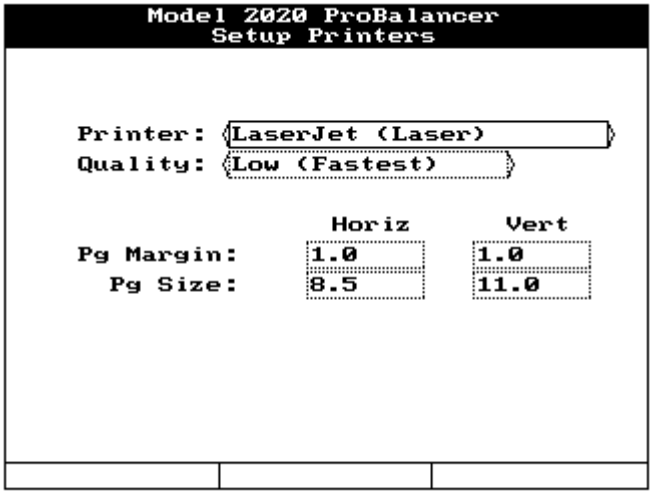
Open the appropriate PC based software. Connect the Model 2020 ProBalancer Analyzer with the supplied COMM/Print cable to the PC serial port. Select "Transfer Data with PC" from the "Main Menu" and press [ENTER]. Data transfer will begin. When finished, the "Main Menu" will reappear.

13.2 - Miscellaneous Items



The “Miscellaneous Items” banner menu screen shown above contains several menu items, three of which are used for identification of the analyzer. The other items are user-accessible and editable items. All are described in the following sections.

13.2.1 - Setup Printer



The “Setup Printer” option allows you to select from three possible printer types, three print qualities, horizontal and vertical page margins, and paper size. The analyzer supports Epson FX compatible dot matrix printers, Hewlett-Packard Laser Jet II or higher version Laser Jet printers, and Seiko DPU-414 thermal printers. (See your specific printer manual for Epson FX compatibly information.) The analyzer supports only the three listed printer types with its direct serial output. However, the analyzer will also support parallel printers but a serial-to-parallel print converter is required to accomplish this. The converter can be purchased from

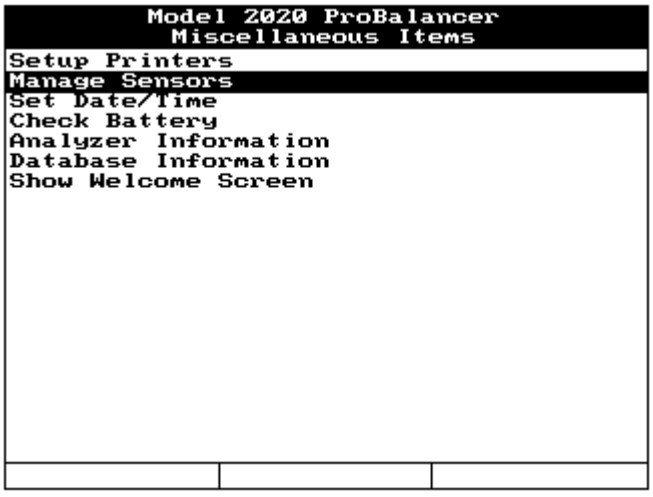
ACES Systems. ACES Systems does not provide support for difficulties in printing associated with printer converters not purchased through ACES Systems due to the large number of converters available for which we have no technical information.

Print quality is largely determined by the visual quality of spectral graphics and print desired by the user. The higher quality print takes longer for the dot matrix printer to perform. Experiment with the three quality options to determine which best fits your needs.

To complete the “Setup Printer” process, do the following:

1. Select “Miscellaneous Items” from the Main Menu banner screen.
2. Select “Setup Printers” from the “Miscellaneous Items” banner screen menu.
3. Use the [⇒] key to toggle between the three printer choices in the “Printer” field to select a printer.
4. Use the [⇓] key to move down to the next field, “Quality.” Select print quality by using the [⇒] key to toggle between the choices.
5. Use the [⇓] key to move down to the next field, “Pg Margin, Horiz” Enter the desired margin size using the keypad. Use the [⇓] key to move to the next field in this area of the screen. Enter all dimensions in the four fields in this part of the screen using the keypad. The “Pg Margin” fields are fixed for the DPU-414 printer selection and not editable.
6. Press [ENTER] to accept your settings and exit the screen.

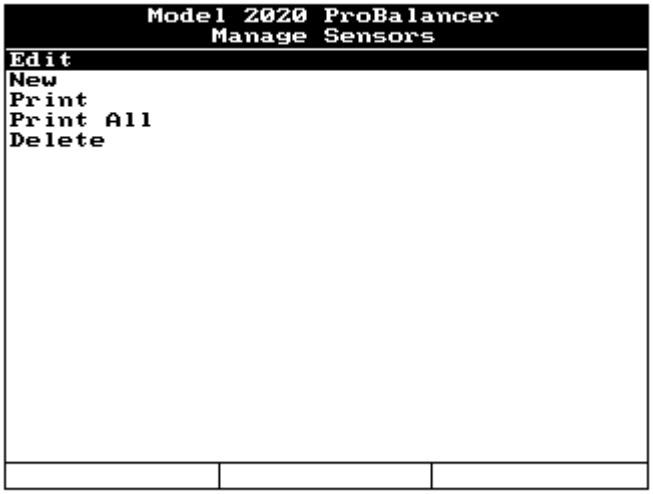
13.2.2 - Manage Sensors



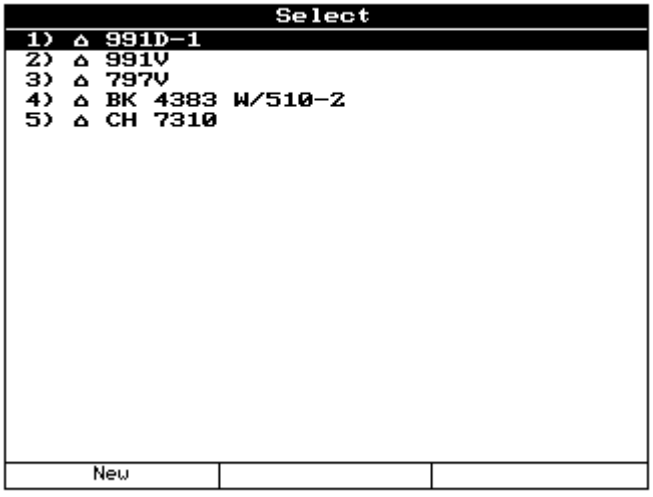
The “Manage Sensors” option allows you to preprogram information about all the vibration sensors you own or use. Once all sensors are preprogrammed, they can be recalled and

selected from an option list during a balance/analysis procedure, saving time during the procedure by eliminating the need to reinput sensor data.

The “Manage Sensors” option also allows you to edit, create, print, and delete sensors from the analyzer’s memory. The “Manage Sensors” banner screen is shown below.



When the “Edit” function is selected, the screen changes to the “Select” banner screen. On this screen you may choose to “Edit” the information for any of the listed sensors simply by selecting that sensor from the list. The screen will then change to the “Sensor Setup” screen and show the complete information currently in memory for the selected sensor. If you want to add a “New” sensor to your list, you may choose “New” from the Manage Sensors banner screen or press the [F1] “New” key from the “Select” banner screen. Either will change the screen to the “Sensor Setup” banner screen where all fields will be blank. Enter the sensor information as necessary for the new sensor.



13.2.2.1 – Add or Edit Sensor

Names for some industry-standard sensors have already been preloaded into the analyzer at the factory. The default sensors preloaded in the Model 2020 ProBalancer Analyzer will have a "⏢" preceding the sensor name. These sensors are locked and cannot be edited or deleted. If your sensor name appears in the preprogrammed list, you may not need to proceed further. If your sensor name does not appear, then you must select [F1] "New" to add a new sensor name and specifications.

To preprogram a sensor in the analyzer's memory, you will need the follow sensor specifications which should be available from the data sheet supplied with your sensor.

1. The sensor's model or name that will be familiar to you and other users.

2. The sensor's amplitude units, sometimes called EU or engineering units. This will be expressed in one of the following formats: g's (for equivalent gravities), IPS (Inches Per Second), mm/sec (millimeters per second), cm/sec (centimeters per second), mils (1000^{th} of an inch) or microns ($1{,}000{,}000^{th}$ of a meter).

3. The sensor's sensitivity. This is normally expressed in mV per engineering unit, as described above. For instance, the standard accelerometer supplied with the 2020 ProBalancer Analyzer is the model 991D -1. Its engineering unit is in g's and it produces 20 mV for every g of force exerted on it, therefore its sensitivity is 20 mV/g.

To add a sensor or to edit the specifications for an already programmed sensor, do the following:

1. Select "Miscellaneous Items" from the Main Menu banner screen.

2. Select "Manage Sensors" from the "Miscellaneous Items" banner screen menu.

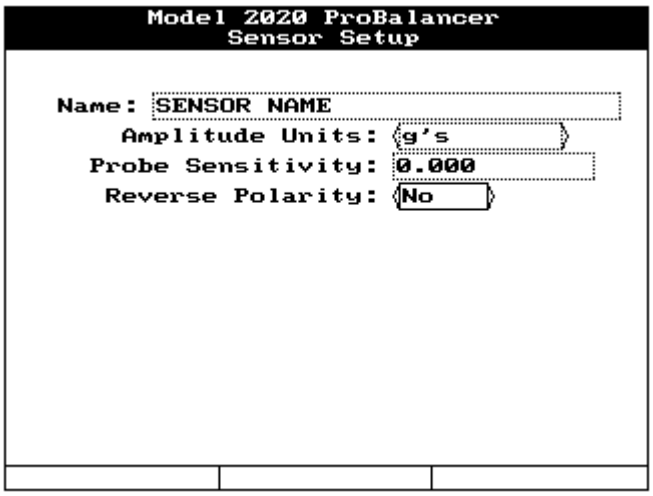
3. Select "Edit" from the "Manage Sensors" banner screen menu.

NOTE

To edit an existing sensor in the list, select it at this point, and proceed with step 5. For adding a new sensor, go to step 4. Preset sensors cannot be edited, only those entered by the user.

4. Press the [F1] key, which corresponds, to the function key window labeled "New" at the bottom of the screen.

The "Sensor Setup" screen shown below will be displayed. Toggle between the fields using the [⇑] or [⇓] key.



5. Enter a name for the sensor in the "Name:" field, using the keypad. The field will accept up to twenty, alphanumeric characters.

6. The "Amplitude Units:" field is a toggle selection field. Use the [⇐] or [⇒] key to toggle between the selections until the appropriate units are displayed. The choices are gs; (for equivalent gravities), IPS (Inches Per Second), mm/sec (millimeters per second), cm/sec (centimeters per second), mils (1000th of an inch) or microns (1,000,000th of a meter).

7. The "Probe Sensitivity" field is used to enter the amount of sensor output equal to one amplitude unit as defined in paragraph 6 above. In the example shown above, the 991D-1 will output 20 mV per one g of vibration. This value will be expressed in mV per unit. If the sensor's output is not in mV, a charge amplifier will need to be included in the circuit.

8. The "Reverse Polarity" is a toggle selection field. The two selections are "Yes" and "No". This is a special function that will only apply to a very few sensors available. The selection should be toggled to "No" for the majority of cases. The 991V sensor is a factory installed sensor type that uses the reverse polarity and is set to "Yes". If you do not know the polarity requirements of the sensor, call ACES Systems and ask for Customer Support.

9. When all fields are completed as required, press [ENTER] to accept your answer and exit the screen.

13.2.2.2 - Print, Print All, or Delete Sensor

Print, Print All, and Delete are all selections available on the "Manage Sensors" banner screen menu.

To access any of these functions, do the following:

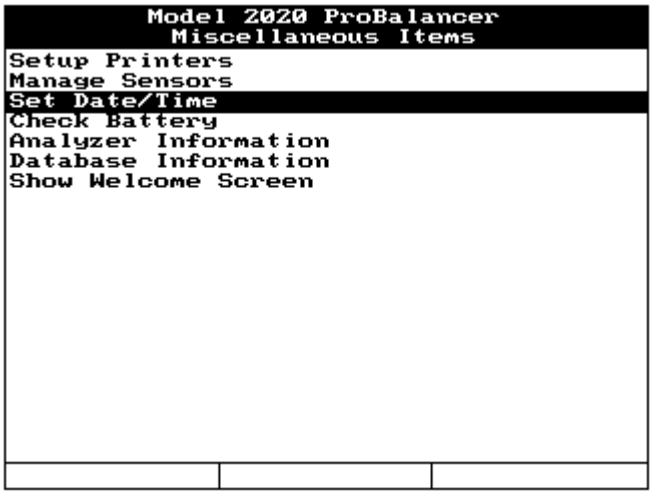
1. Select Print, Print All, or Delete from the "Manage Sensors" banner screen menu.

a. If you select “Print,” next select a sensor from the list that appears. The analyzer will display the message “Output to printer complete.” Press [F3] to continue.

b. If you select “Print All,” the analyzer will display a message that asks “Are you sure?” Press [F1] to confirm “Yes,” press [F3] for “No” and to return to the “Manage Setups” screen.

c. If you select “Delete,” next select a sensor to delete from the list that appears. The analyzer will display a message that asks “Are you sure?” Press [F1] to confirm “Yes,” press [F3] for “No” and to return to the “Manage Setups” screen.

13.2.3 - Set Date and Time

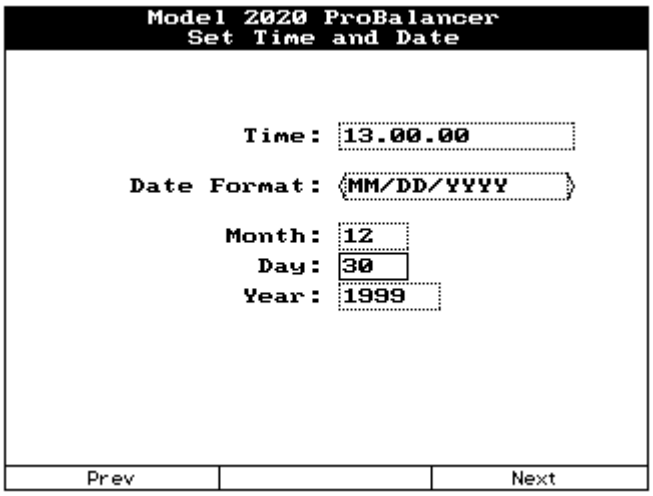


The “Set Date and Time” selection allows you to set the desired date and time in the analyzer. These settings are entered directly using the analyzer keypad.

To set the date and time, do the following:

1. Select “Miscellaneous Items” from the Main Menu banner screen.

2. Select “Set Date and Time” from the “Miscellaneous Items” banner screen menu. The screen shown below will appear.



3. Enter the time in a 24-hour format as follows in the "Time" field.
   Hour - Valid range is 1 through 24, followed by a "." (Decimal)
   Minute - Valid range is 0 through 59, followed by a "." (Decimal)
   Seconds - Valid range is 0 through 60

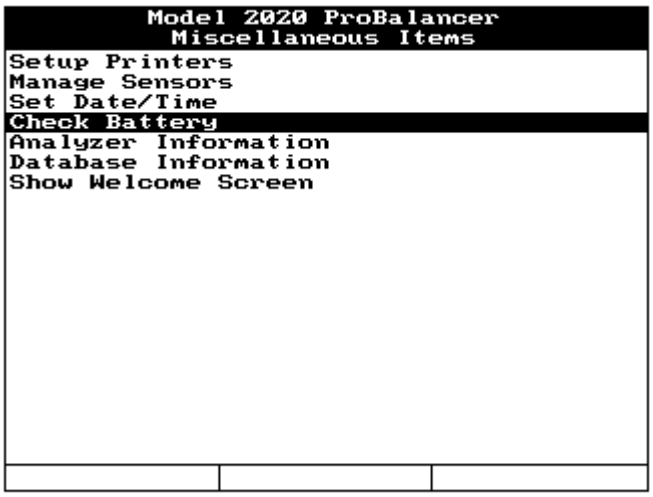
4. Use the [⇓] to move to the "Date Format" field. You may specify the date format you wish to use by using the [⇒] key to toggle the selection to the format you wish to use. Available formats are: MM/DD/YYYY, DD/MM/YYYY and YYYY/MM/DD, where YYYY = Year, MM = Month and DD = Day.

5. Use the [⇓] key to move to the "Month" field and enter the month. Valid range is 01 through 12.

6. Use the [⇓] key to move to the "Day" field and enter the date. Valid range is 01 through 31.

7. Use the [⇓] key to move to the "Year" field and enter the Year. The valid range is 1998 through 9999. Press [ENTER] to accept the entries and exit the screen.

13.2.4 - Check Battery



The Check Battery function allows the user to check the remaining battery life prior to beginning a job. The current state of the battery is presented in a percentage of full charge remaining. This check is for planning purposes only but should give you sufficient information to determine f you have enough battery capacity remaining to conduct a normal job. A fully charged, new battery should normally supply constant power to the analyzer using two vibration sensors and one optical tachometer for approximately 10 hours. This time will vary dependent on the number of sensors and tachometers and their power requirements. Therefore, for planning purposes, an indication of 50% should be sufficient charge remaining for 5 hours of operation.

To check the battery state, do the following:

1. Select “Miscellaneous Items” from the Main Menu banner screen.

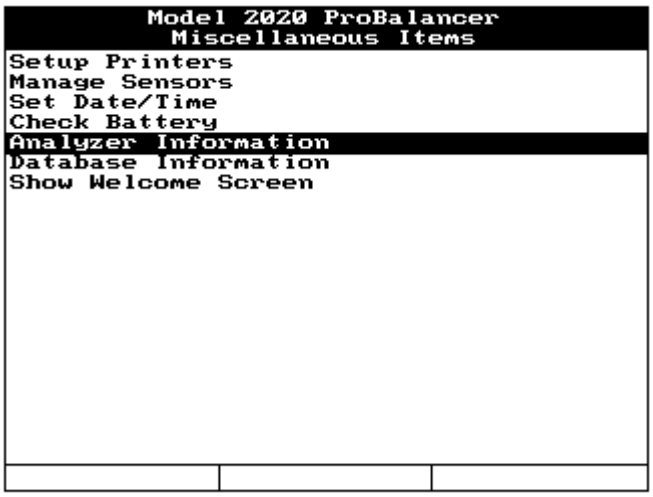
2. Select “Check Battery” from the “Miscellaneous Items” banner screen menu as shown above.

3. The analyzer will display the percentage of full battery charge remaining.

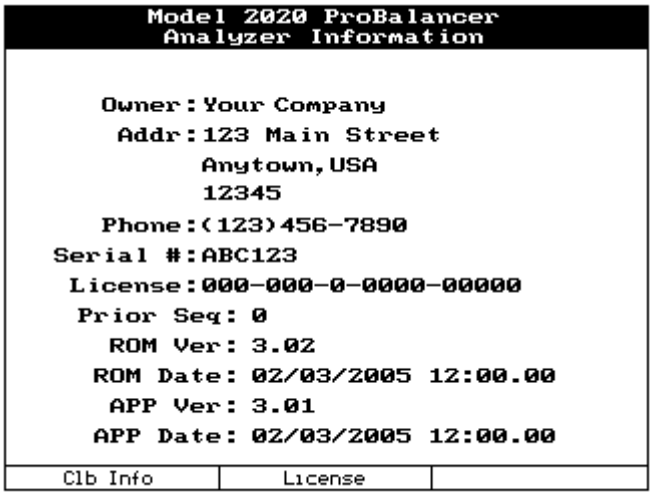
NOTE

We recommend the battery be charged on a regular schedule and that a job not be started with less than 50% of full charge remaining. See “Chapter 2, Analyzer Description” for instructions on charging the battery.

13.2.5 - Analyzer Information



The “Analyzer Information” banner screen contains information about the analyzer and its owner. The information is entered into each individual analyzer at the factory at the time of purchase. A sample screen is shown below.



This information is significant for two reasons. If your analyzer is ever stolen or lost, it can easily be identified by the information contained on this screen. The information cannot be deleted or altered and remains intact regardless of the availability of power to the analyzer. Also, if the analyzer is used in a business, this information is used as advertisement and future reference to your customers as each printout from the analyzer contains a header based on the information from this screen. The analyzer information can only be entered or changed by technicians at the ACES Systems facility. Check to insure all information on this screen is correct. If changes are required, contact ACES Systems at the phone number listed at the front of this manual.

To access the “Analyzer Information” banner screen, do the following:

1. Select “Miscellaneous Items” from the Main Menu banner screen.

2. Select “Analyzer Information” from the “Miscellaneous Items” banner screen menu.

   In addition to owner information, this screen displays the following information. The screen will also show:

   License – Indicates whether you currently have Enhanced Performance software capabilities.

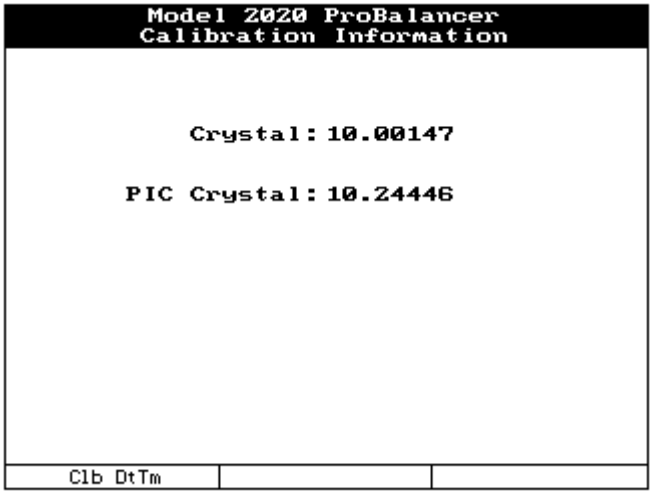
   Prior Seq - Indicates whether you have purchased a limited-use license.

   ROM Ver – Indicates the version of Read Only Memory currently installed in your analyzer. This may also be referred to as the “BOOT ROM.”

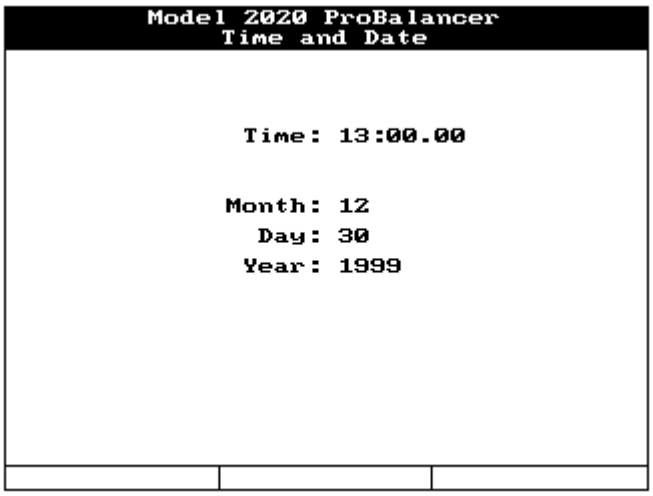
   APP Ver – Indicates the version of the currently installed application software running in your analyzer (The application version is upgraded by you, the user via ACES Systems’ *AvTrend* or WinFlash Software.).

   APP Date – Indicates the date of the currently installed application software.

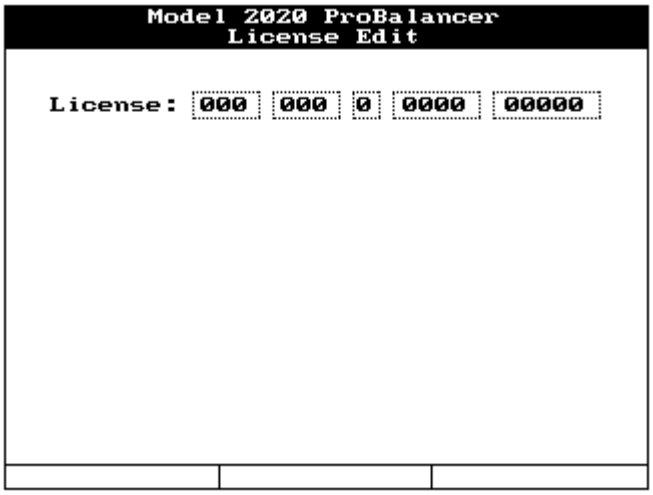
At the bottom of the screen, the [F1] and [F2] keys correspond to “Clb Info” and “License” on the screen. By pressing the [F1] “Clb Info” key, the screen will display the “Crystal” and “Pic Crystal” calibration factors as shown below. Technicians at the factory use these factors in calibration procedures as a reference. They cannot be altered in any way by the end user. License information that correlates to the [F2] key is described in paragraph 13.2.5.1 below.



Press [F1] “Clb DtTm” (Calibration date and time) again to display the date and time that the analyzer was last calibrated as shown below. Press [ENTER] to exit this screen and return to the “Crystal” and “Pic Crystal” display. Pressing [ENTER] at this screen will take the user back to the “Analyzer Information” screen.



13.2.5.1 - Entering a License Number for Enhanced Performance Software (EPS)



If you purchase the optional Enhanced Performance Software (EPS), you will be issued a license number for the functions of your choice. When you receive the license number it must be entered into the analyzer as follows:

1. Select “Miscellaneous Items” from the Main Menu banner screen.

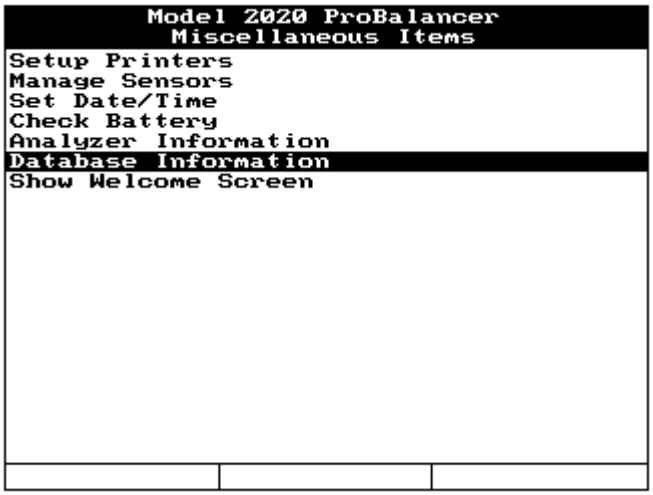
2. Select “Analyzer Information” from the “Miscellaneous Items” banner screen menu.

3. When the “Analyzer Information” banner screen appears, press the [F2] key corresponding to “License” in the rectangular block directly above it.

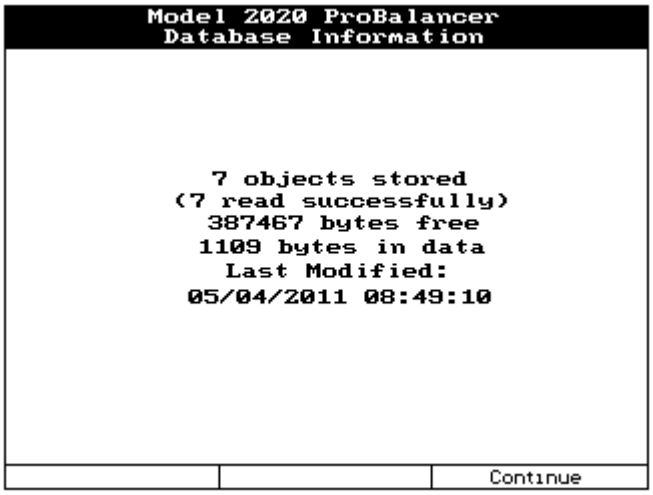
4. When the “License Edit” banner screen appears, as shown above, enter the license number in the fields using the number keys. As each field is filled with its maximum number of numeric characters, move to the next field using the [⇓] key. When all fields

are filled, press [ENTER] to accept. If the number was entered incorrectly or is invalid, a screen will warn you of this. In this case, press the [F3] key to “Continue” and attempt to reenter the number. If no error message is displayed, you entered the license number correctly.

13.2.6 – Database Information



The “Database Information” selection will produce the “Database Information” banner screen as illustrated by the sample below. In the center of the screen the total number of objects stored and read successfully will be displayed. The total free memory (in bytes) and the total amount of stored data (in bytes) will be displayed. The date the database was modified last will also be displayed. This is an information (read only) screen and its contents cannot be altered by the user from within this screen. Press the [F3] “Continue” key or the [BACKUP] key to exit this screen.

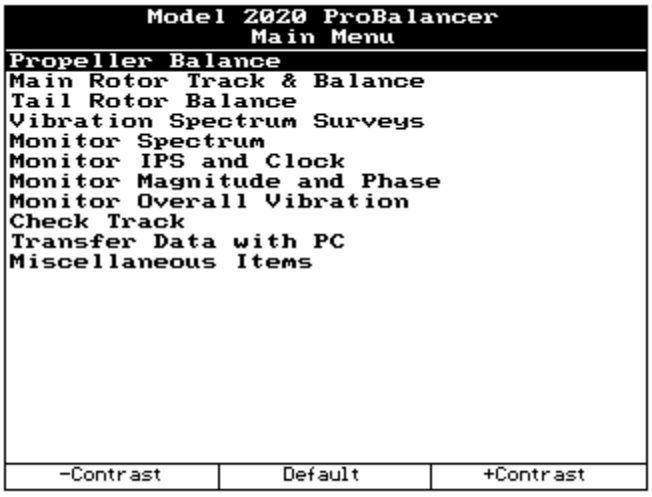


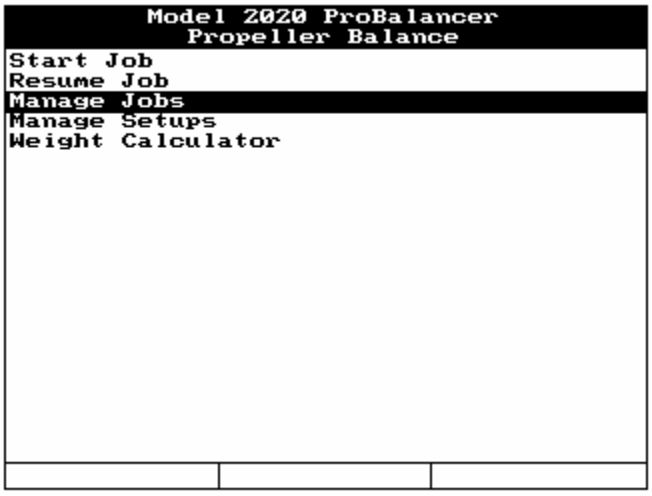
Chapter 14
Printing

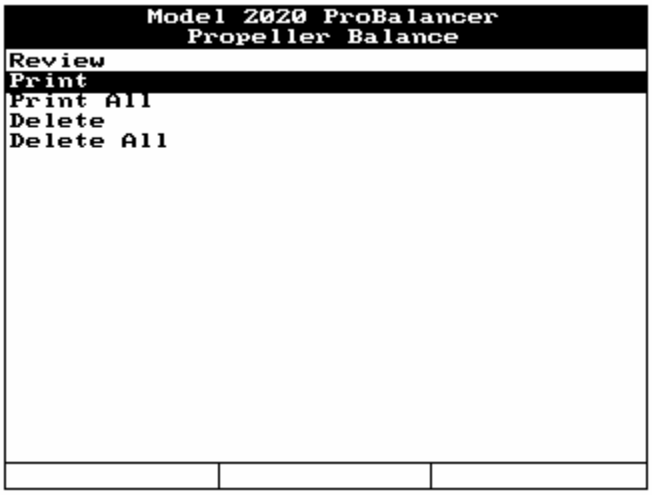
(Revision 2, February 2005)

The ACES Model 2020 ProBalancer Analyzer allows you to print propeller balance jobs, rotor track and balance jobs, job setups, and graphic spectra.

The “Print” option is available through the various analyzer functions mentioned above as a selection from the “Manage Job” submenus of these functions (shown below in the example banner screen menu for “Propeller Balance”). See the chapters for the individual functions for specifics on how to access the print function within each.







Before printing for the first time to a printer, you must first input the printer's specifics into the analyzer's memory using the "Printer Data Setup" function as described in the following section, 14.2. Once a specific printer is "setup" you do not have to repeat this step each time you print to that printer. Before printing you must also physically attach the analyzer and printer with cables, connectors, etc. as needed for that specific printer. This process is described in section 14.3. The process of selecting and accessing the "Print" function from the analyzer is described in section 14.4.

14.1 – Supported Printers

The ACES Model 2020 ProBalancer Analyzer supports direct printing to Epson-compatible dot matrix printers, Hewlett-Packard Laser Jet II or higher versions of Laser Jet printers, and Seiko DPU-414 thermal printers. (See your specific printer manual for Epson compatibly information.)

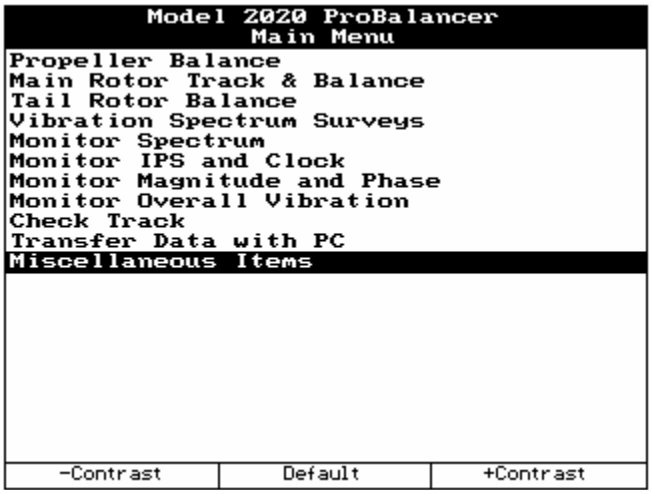
The analyzer supports only the three listed printer types with its *direct serial* output. However, the analyzer also supports printing to parallel printers but a serial-to-parallel print

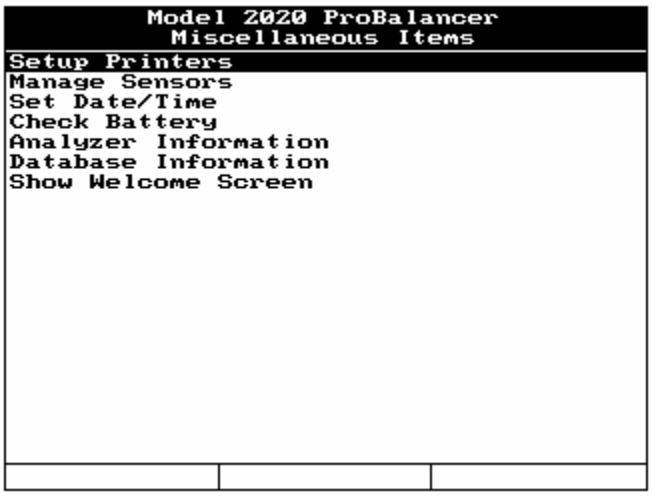
converter is required to accomplish this. The converter can be purchased from ACES Systems or from your local electronics dealer. ACES Systems does not provide technical support for difficulties in printing associated with printer converters not purchased through ACES Systems since there are so many converters available for which we have no technical information.

The communications/printer cable provided with the analyzer is a serial communications cable for transfer of data to a personal computer, serial printer, or serial-to-parallel converter. If using a parallel printer, you will also need a standard printer cable (purchase locally) configured for connection of the converter to your parallel printer.

14.2 - Printer Data Setup

Before printing from the analyzer to a specific printer for the first time, you must first enter data specific to the printer type into the analyzer's memory through the "Setup Printers" function. This function is accessed through the Miscellaneous Items option on the Main Menu (see illustrations below). Once a specific printer is "setup," you do not have to perform the "Printer Setup" process each time you print to that printer.





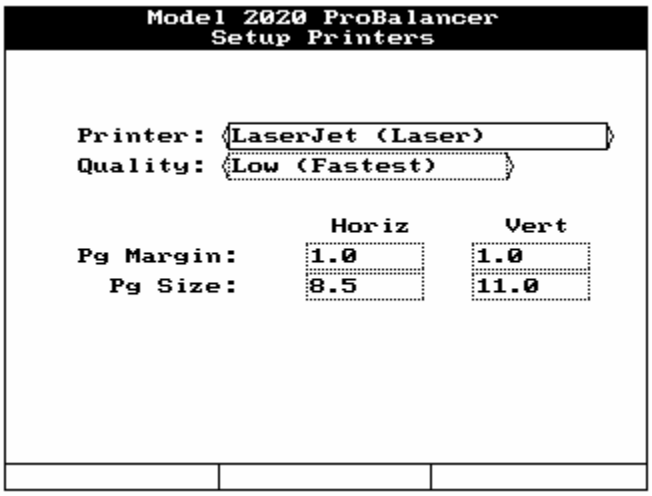
The “Setup Printer” option allows you to select from three possible printer types (discussed in the previous section, 14.1), three print qualities, horizontal and vertical page margins, and paper size.

Print quality is largely determined by the visual quality of spectral graphics and print desired by the user. The higher quality print takes longer for the dot matrix printer to perform. Experiment with the three quality options to determine which best fits your needs.

To complete the “Setup Printer” process, do the following:

1. Select “Miscellaneous Items” from the Main Menu banner screen.

2. Select “Setup Printers” from the “Miscellaneous Items” banner screen menu. The “Setup Printer” banner screen shown below appears.



3. Use the [⇒] key to toggle between the three printer choices in the “Printer” field to select a printer. The three selections have default values entered for “Pg Margin” and “Pg Size”. These values can be edited as necessary by following the steps below. (Refer to Chapter 3, “Using the ACES Model 2020 ProBalancer Analyzer” if you are unfamiliar with using the keypad or the toggle function.)

4. Use the [⇓] key to move down to the next field, “Quality.” Select print quality by using the [⇒] key to toggle between the choices.

5. Use the [⇓] key to move down to the next field, “Pg Margin, Horiz”. Enter the desired margin size using the keypad. Use the [⇓] key to move to the next field in this area of the screen. Enter all dimensions in the four fields in this part of the screen using the keypad. The “Pg Margin” and “Pg Size” fields are fixed for the DPU-414 printer selection, editing is unnecessary.

6. Press [ENTER] to accept your settings and exit the screen.

Proceed to the next section to configure printer equipment (cables, connectors, etc.) for printing.

14.3 – Printer Equipment Setup

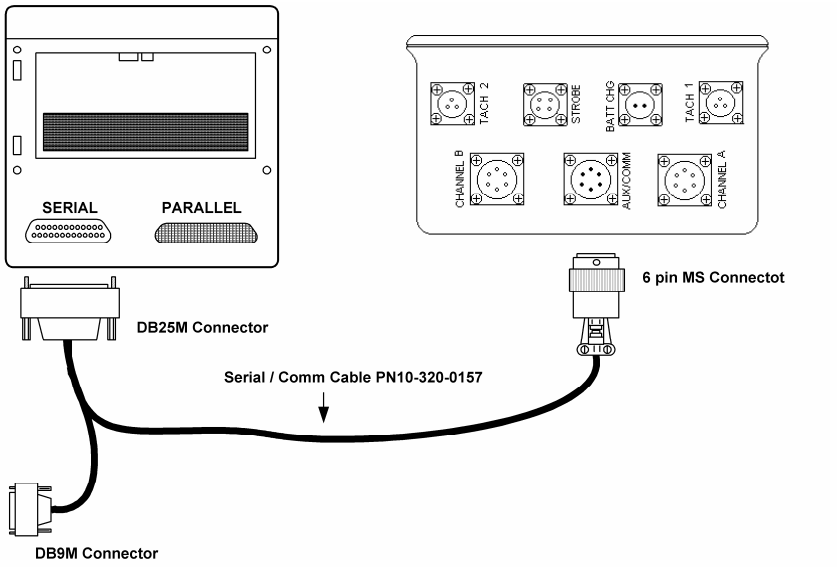
There are four possible printer equipment configurations for printing with the ACES Model 2020 ProBalancer Analyzer. Each configuration is described in the following sections.

14.3.1 - Print to a Serial Printer with DB25M Connector

14.3.1.1 – Equipment Required

1. Serial Printer, Epson FX Compatible/Hewlett Packard LaserJet II or newer/ Seiko DPU 414
2. ACES Model 2020 ProBalancer Analyzer
3. Serial/Communication Cable (PN10-320-0157)
4. Adapter (Gender Changer) (PN75-900-0201)

14.3.1.2 - Equipment Setup



Configuration 1; Print to Serial W / DB25M Connector

To setup the equipment for this printing configuration, refer to the illustration above and do the following:

1. Connect the 6 Pin connector on the Serial/Communication Cable (PN10-320-0157) to the ACES Model 2020 ProBalancer Analyzer's AUX/COM Port
2. Connect the other end of the Serial/Communication cable (DB25 Connector) to the Adapter (Gender Changer) (PN 75-900-0201)
3. Plug the Adapter into the serial port on the printer

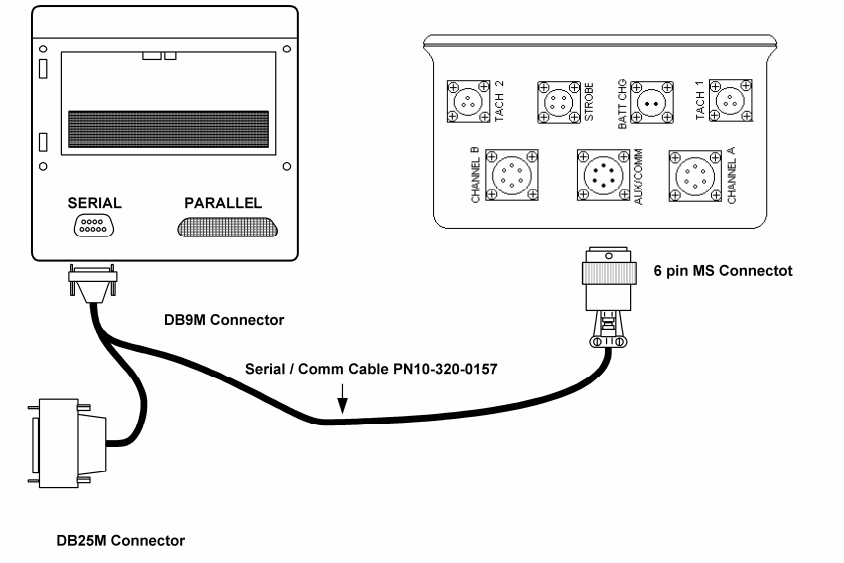
You are ready to print. See section 14.4 to continue with the printing process.

14.3.2 - Print to a Serial Printer with DB9M Connector

14.3.2.1 - Equipment Required

1. Serial Printer, HP LaserJet II or newer (higher) version of LaserJet printer/Epson FX/Seiko DPU 414
2. ACES Model 2020 ProBalancer Analyzer
3. Serial/Communication Printer Cable (PN10-320-0157)
4. 9-Pin Null Modem Adapter (PN75-900-0226)

14.3.2.2 - Equipment Setup



Configuration 2; Print to Serial W / DB9M Connector

To setup the equipment for this printing configuration, refer to the illustration above and do the following:

1. Connect the Serial/Communication Printer Cable 6 Pin MS Connection to the ACES Model 2020 ProBalancer Analyzer
2. Connect the other end of the Serial/Communication Printer Cable DB9 Connector to the 9-Pin Null Modem Adapter
3. Connect the Null Modem Adapter to the DB9 Pin port on the Printer.

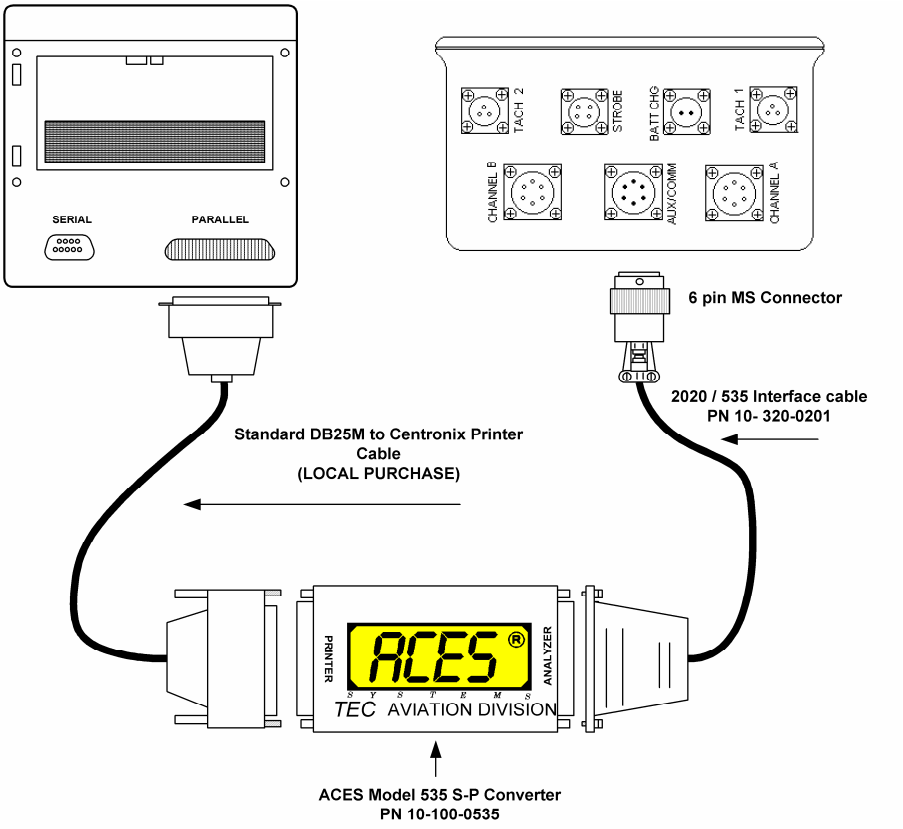
You are ready to print. See section 14.4 to continue with the printing process.

14.3.3 - Print to a Parallel Printer with Converter

14.3.3.1 - Equipment Required

1. Parallel Printer; HP LaserJet II or newer (higher) version of LaserJet printer/Epson FX/Seiko DPU 414
2. ACES Model 2020 ProBalancer Analyzer
3. Interface Cable (535) (PN 10-320-0201)
4. ACES Systems' Model 535 S-P Converter (PN10-100-0535)
5. Standard DB25M-Centronix Printer Cable (purchase locally)

14.3.3.2 - Equipment Setup



Configuration 3; Print to Parallel W / Converter

To setup the equipment for this printing configuration, refer to the illustration above and do the following:

1. Connect the 6 Pin MS connector of the Interface Cable (535) (PN10-320-0201) to the 6-Pin, AUX/COM port of the ACES Model 2020 ProBalancer Analyzer.

2. Connect the DB25 connector end of the Interface cable to the “Analyzer” port of the ACES Systems’ Model 535 S-P Converter (PN10-100-0535)

3. At the “Printer” end of the ACES Systems’ 535 Converter, attach the Standard DB25M to Centronix cable (purchase locally)

4. Connect the Centronix connection to the Centronix connection on the Printer.

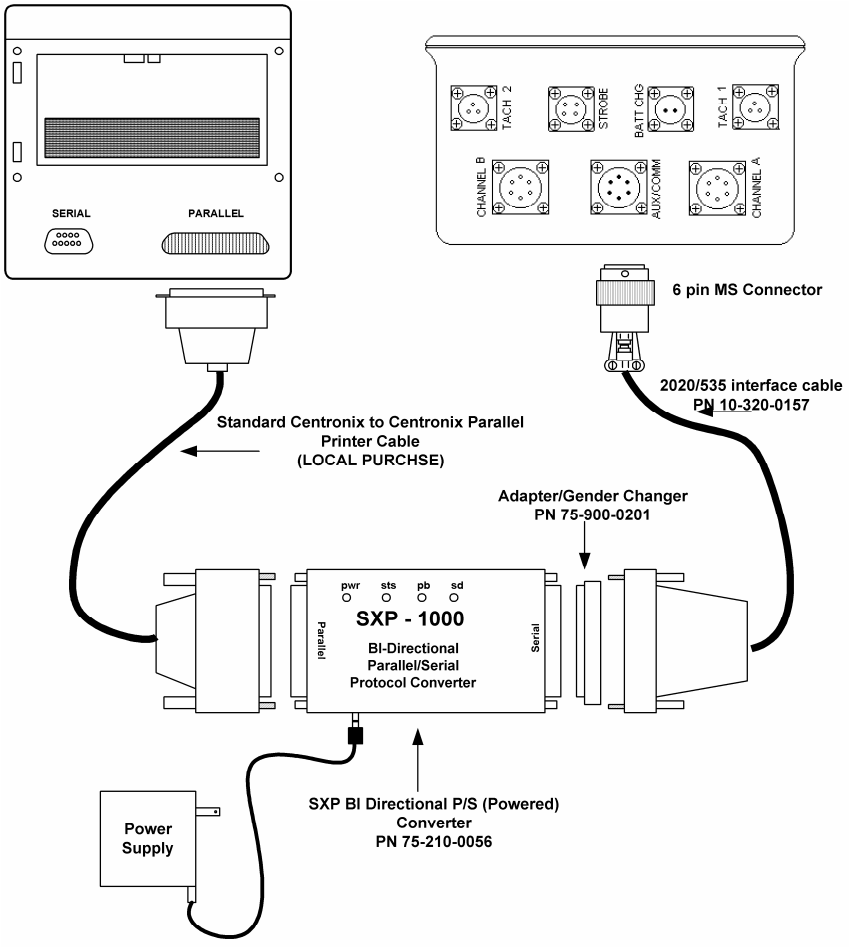
You are ready to print. See section 14.4 to continue with the printing process.

14.3.4 - Print to a Parallel Printer with Powered Converter

14.3.4.1 - Equipment Required

1. Parallel Printer, HP LaserJet II or newer (higher) version of LaserJet printer
2. ACES Model 2020 ProBalancer Analyzer
3. Serial/Communication Printer Cable (PN10-320-0157)
4. Adapter (gender changer) (PN75-900-0201)
5. SXP 1000 bi-directional (Powered) Converter (PN75-210-0056)
6. Standard Centronix to Centronix Cable (purchase locally)

14.3.4.2 - Equipment Setup



Configuration 4; Print to Parallel W / External Powered Converter

To setup the equipment for this printing configuration, refer to the illustration above and do the following:

1. Connect the 6-Pin MS connector of the Serial/Communication Printer Cable (PN10-320-0157) to the AUX/COM port on the ACES Model 2020 ProBalancer Analyzer

2. Connect the other end of the Serial/Communication Printer Cable DB25 Connector to the Adapter (Gender Changer) (PN75-900-0201)

3. Connect the Adapter to the DB25 connector on the SXP 1000 Converter (PN75-210-0056)

4. Connect the Standard Centronix Printer Cable to the SXP 1000 Converter and the other end to the Centronix connection on the printer.

NOTE
For this configuration, the DIP switches on the SXP1000 must be set as follows: 1, 3, 7, 8, 9 & 10 OFF. 2, 4, 5 & 6 ON. "DTE" must also be selected. The DIP switches and DTE switches are located on the side of the converter adjacent to the external power cord port.

You are ready to print. See section 14.4 to continue with the printing process.

14.4 – Print

To print a propeller balance job, rotor track and balance job, setup, or graphic spectra, do the following:

1. Turn the printer on and ensure you have sufficient paper loaded for the print job.

2. From the analyzer's Main Menu banner screen, select the procedure you intend to print from, such as "Propeller Balance," "Tail Rotor Balance" or "Vibration Spectrum Surveys."

3. Select "Manage Jobs" or "Manage Setups"

4. From the "Manage Jobs" or "Manage Setups" menu, select "Print"

5. Select the job or setup you want to print.

6. Press "Enter" to print.

The analyzer screen will display the message "Printing in Progress," and when all data has been transferred from the analyzer to the printer's print buffer, the analyzer will display the message "Output to Printer Complete." Press the [F3] "Continue" key to return to the procedure's sub menu.

If the print job was not successful, recheck the printer for possible problems. Examples of problems include inadequate paper quantity, paper jam, pauses, printer not turned on, improper connection of the cable, improper converter, the wrong printer is selected on analyzer printer setup, or loss of power. Check these potential problem areas, then try to print again. If the print function still does not work, call ACES Systems' Customer Support at the phone number listed at the front of the manual.

Chapter 15
Equipment and Accessory Setup and Troubleshooting

(Revision 3, Aug 2012)

The information in this chapter is provided to assist you in avoiding some of the common pitfalls associated with setting up and using the various accessories required for performing routine balance or vibration survey jobs with the Model 2020 ProBalancer Analyzer.

15.1 - Battery Charger

CAUTION
The charger is built for indoor use only. Don't expose the charger to the elements.

Always replace the cap on the "BATT CHG" port of the analyzer. The unprotected pins may short out on surrounding material and cause damage to the analyzer or battery.

Charging a fully dead battery requires at least two hours. Do not leave the 220V charger connected for more than 24 hours.

15.2 - Cables

Cables can be damaged if pinched in doors and windows. Always check for pinches, cuts, and abrasions prior to using the cable. Bent or damaged pins may cause problems with normal operation. Route cables away from all hot areas and electrical equipment. Duct tape or wire ties are excellent for securing the cables. Check all connectors for evidence of damage. An optional automatic cable check device is available from ACES Systems.

15.3 - LASETACH®

WARNING
Never look directly into the laser aperture. Damage to the eye can occur.

Don't use the LASETACH® when the weather conditions include precipitation. A single drop of water on the aperture lens can dissipate or block the laser beam.

Never use any reflective target tape other than that recommended in the manual (3M Tape, Model 7610 or ACES Systems' P/N 10-400-0176). The incorrect type of reflective tape can render the LASETACH ineffective in high-speed applications. An angle of 5 to 10 degrees from the perpendicular of the LASETACH/reflective tape is best.

15.4 - Phototach

The Phototach is very rugged. It is water resistant, but water on the lens may render it ineffective. Always check the lens for cleanliness and to be sure it is free of damage such as cracks and scratches.

The optimum range of the Phototach is 12 to 18 inches. It may work at closer or more distant ranges, although it may not be as reliable.

15.5 – Propeller Protractor

The protractor is made of hard plastic. If folded or crimped it will bend and remain bent. To straighten it, lay it on a flat surface and heat it with a hair dryer on a high setting. Discontinue the heat and leave the protractor in its flat position on the level surface to cool.

15.6 - Reflective Tape (3M Tape, Model 7610)

Always thoroughly clean the area where the tape is to be applied. Using scissors or some other cutting tool, round off corners of the tape and be sure all edges are pressed down. Rounded corners help to prevent tape from peeling up during use. Remove any bubbles in the tape by pressing them toward the edge of the tape. If used on a very high speed application, you may use super glue or clear nail polish on the edges of the tape to prevent "lifting" due to the airfoil effect during high speed runs.

15.6.1 - Reflective Tape Width Requirements

If problems are experienced using the Phototach while balancing high-speed props with the reflective tape further out on the blade, refer to the following chart for tape placement adjustments.

1. First, measure the distance from the center of the propeller shaft to the location you intend to place the reflective tape.

2. In the chart below, select from the RPM column the first speed greater than the speed at which you intend to balance.

3. From this RPM number, proceed across the chart to the right until you come to the first number larger than the distance measured in Step 1. above.

4. From this point, follow the column up to the top to the minimum tape width required for your application.

   As an example, use the following parameters: the distance from the propeller shaft to the intended tape location measures 25 inches and the balance speed is 2300 RPM. Select 2400 from the RPM column since this is the first speed greater than your intended balance speed of 2300. From this number, follow the row across to 26.5, which is the first number higher than your intended tape location of 25 inches. From 26.5 follow the column straight up to the top--2 inches. This is the width of tape required for accurate readings at the intended distance and RPM level. (If your reflective tape is only 1-inch wide, place two 1-inch strips of tape side by side to create 2 inches.)

	Minimum Tape Required			
RPMs	**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
2800	11.4	22.7	34.1	42.4

15.7 - Vibration Sensor

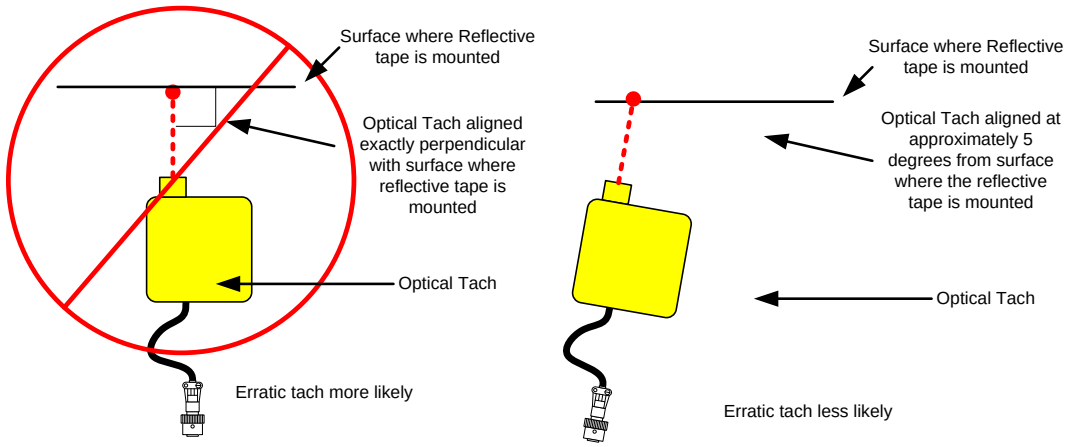
Do not drop the sensor. Although built for rugged use, most accelerometers and velocity sensors are susceptible to internal damage when dropped, especially on hard surfaces.

When connecting cables to the sensor, make sure the cable is not forced against the cowling at the point where it is connected to the sensor.

Be sure to include your sensor with the unit when sending it in for calibration. The sensor will also be checked as part of the calibration procedure.

15.8 – Optical Tachometer

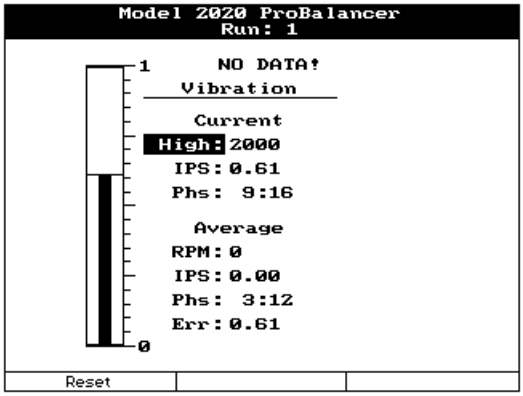
Adjust the optical Tach so that an angle of approximately 5 degrees from perpendicular to the reflective tape exists as shown in the figure below. This will produce the best results when reading RPM.



15.9 – Reinitializing the Analyzer

With the analyzer turned [OFF], push and hold the [5MNO] key. While holding the [5MNO] key down, turn the analyzer on by momentarily pushing the [ON/OFF] key. After the analyzer screen appears, release the [5MNO] key. Your analyzer is now reinitialized. You will be prompted to "Delete all stored data, Yes/No?" If possible, you should try selecting [F3] "No" first to retain any unsaved data. If this does not resolve your problem, repeat the process and select [F1] "Yes". You will delete any data saved in the analyzer, but the problem should be resolved.

15.10 – RPM Error Indications



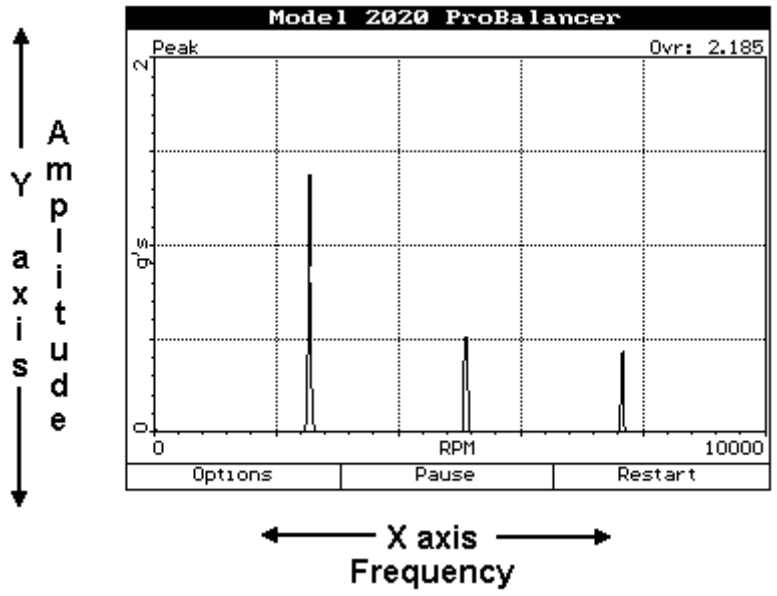
The text below the "Current" heading indicates the RPM, IPS, and Phase Angle from the latest collect vibration sample. These values will change as the individual readings are collected. The RPM will be the currently recorded speed value. For Run 1 the "RPM" heading itself will blink "HIGH" (as shown in the Figure above) or "LOW" if the current RPM is more than +/- 200 RPM from the RPM defined in a Propeller Balance setup. For Run 1 in Main Rotor Track and Balance or Tail Rotor Balance, the HIGH/LOW warning will appear if the value is +/- 50% of the RPM value defined in the setup. For Run 2, the HIGH/LOW warning will appear if the value is +/- 50 RPM from the value recorded during Run 1. If you continually receive this warning there are several items to check. First, the RPM in the setup should be checked and confirmed to be set at the desired balance RPM. Second, this indication can be triggered by multiple Tach pulses as a result of multiple pieces of reflective tape when using an optical Tach or multiple interrupters when using a Magnetic Pick-up. Third, dirty or missing tape can cause the Tach signal to drop out and read lower than expected. See the sections above for additional troubleshooting information related to specific Tachs and their triggers.

Chapter 16
Reading Spectrum and Scales

(Revision 3, Aug 2012)

The information in this chapter is provided to assist you in reading the graphical displays of the various types of data that can be acquired using the Model 2020 ProBalancer Analyzer.

16.1 - Reading the X and Y Plotted Vibration Spectrum



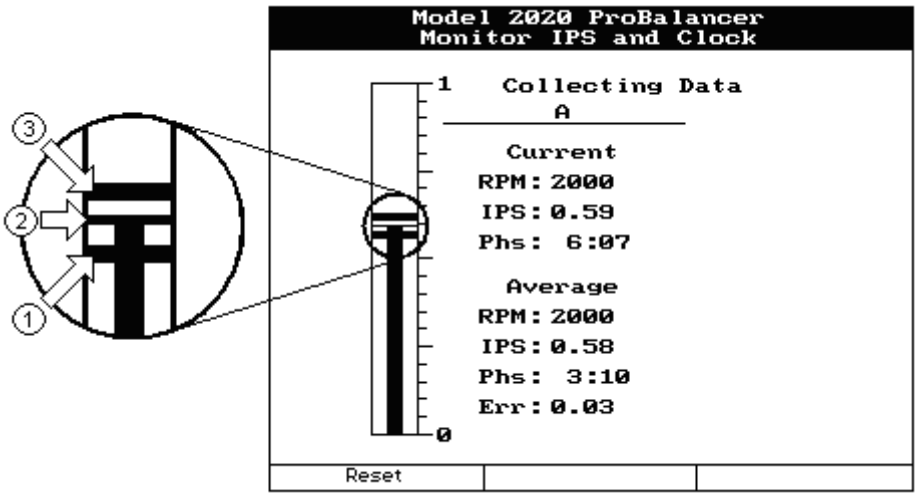
A graphic spectrum display allows the user to investigate all aspects of a rotating component related to vibration. In the figure above, the primary indicators are the plotted peaks that represent component vibrations.

The scale of the "X" axis, along the lower horizontal edge, displays the frequency of interest in Hertz (Hz), which is cycles per second, or in Revolutions per minute (RPM), as shown in

the figure. The frequency scale is a means of locating a component operating at a known number of cycles per second (Hz) or minute (RPM).

The scale of the "Y" axis, along the left vertical edge, displays the amplitude or strength of the component's expended energy in the specified engineering units. In the figure above, the engineering units are presented as IPS, or Inches Per Second, of movement.

16.2 - Reading the Converging Vibration Indicator and Scale



The converging vibration indicator and scale, as shown in the illustration above, appears in several instances when using the analyzer. The Propeller Balance, Main Rotor Track and Balance, Tail Rotor Balance, Monitor Magnitude and Phase, and Monitor IPS and Clock functions all use the converging vibration scale.

The scale is graduated along the right vertical side of the indicator from 0 at the bottom to the upper end of the scale. The vertical indicator bar which begins at the bottom and continues upward in the center of the window indicates the current average. A thin horizontal line (see arrow 2 in the figure above) indicates the latest collected amplitude. The lower error bar (see arrow 1 in the figure above) and the upper error bar (see arrow 3 in the figure above) will converge on the average indicator as errors are averaged out of the indication. Also notice that to the right of the indicator, the error is reported as a numeric value.

The IPS value will correspond to the thin horizontal line as shown by arrow 2 in the figure above. As this value changes, the line will redraw at the current value. IPS reading will change due to mechanical looseness, minor fluctuations in RPM, wind gusts, and other outside factors.

The Phase Angle will change with every data sample. It will redraw when the IPS value and thin horizontal line redraw. However, there is no indication of the Phase Angle on the converging vibration indicator.

The top line of this screen can display three different status messages. The messages are:

"NO DATA!" This message is displayed until in-range RPM, IPS, and Phase Angle readings are recorded by the analyzer. The only way to exit the screen while this message is displayed is to use the [BACKUP] key.

"Collecting Data" This message is displayed during data acquisition. As long as the data remains in-range, the analyzer will add each new sample to the running average. The only way to exit the screen while this message is displayed is to use the [BACKUP] key.

"Press ENTER" This message will appear when a minimum number of consistent samples have been collected. Allow the unit to collect data as long as the error continues to decrease. This will insure you have the most accurate data possible. Use the [ENTER] key to exit this screen and store the reading.

If you believe wind gust, aircraft movement or other external influences have caused the indications to be corrupted, press the [F1] key for "Reset." This will clear the averaged data and begin a new average. This will reset the message line at the top of the screen to "Collecting Data". When satisfied that the data is acceptable, press [ENTER] to stop the data collection and accept the reading.

The text below the "Current" heading indicates the RPM, IPS, and Phase Angle from the latest collect vibration sample. These values will change as the individual readings are collected. The RPM will be the currently recorded speed value. For Run 1 the "RPM" heading itself will blink "HIGH" or "LOW" if the current RPM is more than +/- 200 RPM from the RPM defined in a Propeller Balance setup. For Run 1 in Main Rotor Track and Balance or Tail Rotor Balance, the HIGH/LOW warning will appear if the value is +/- 50% of the RPM value defined in the setup. For Run 2, the HIGH/LOW warning will appear if the value is +/- 50 RPM from the value recorded during Run 1.

Chapter 17
Specifications

(Revision 4, Aug 2012)

ACCURACY	**Vibration Amplitude** +/-5%, 0-10 IPS	
	Frequency Range (Model 2020) 0 -10K Hz per channel, simultaneous or 0 - 10K Hz single channel	
	Frequency Range (Model 2020 TURBO and Model 2020 HR) 0-12K Hz per channel, simultaneous or 0 – 20K Hz single channel	
	Tachometer Inputs +/-. 3%, 100-10,000 RPM	
POWER SUPPLY	**Type (Lead Acid)** Camcorder-Type Battery, Model RB 85 or equivalent (12 V, 2.3 Amp hour internal lead acid battery.)	
	Type Nickel Metal Hydride (NiMH) 12 V, 4.5 Amp hour internal Nickel Metal Hydride (NiMH) battery	
	Operation Time 8 -10 hours approximately	
	Voltage 12 V DC Battery or 14-28 V DC ships power	
	Charging Time (Lead Acid Battery) approximately 2 hours	
	Charging Time (NiMH Battery) 2 to 4 hours on internal smart charging circuit	
PHYSICAL	**Height**	9.3"
	Width	7.5"
	Depth	4.4"
	Weight	4.8 lbs.
	Operating Temperature	0 to +50C
AC INPUT	The data acquisition system is capable of measuring AC values from 0.1 volts to 2.048 volts peak.	
UNCONDITIONED TACHOMETER INPUT	Tachometer signal processing electronics are capable of adjusting the full-scale input range to handle any available sensor for measuring speed. Adjustment of the tachometer conditioning electronics is performed automatically by the microprocessor and requires no user intervention. The voltage level used as a reference for detection of the start of the revolution can be adjusted from 120mV to 5 volts. The tachometer circuitry can detect speeds up to 10,000 RPM.	
SENSOR TYPES	The analyzer will accept any vibration signal input (acceleration, velocity, or displacement.) The input is then displayed as collected or integrated to any other vibration unit. The vibration input will accept any voltage - generating sensor (must have external charge converter when in charge mode) and will supply power to the sensor when required.	
ANALYSIS RANGE	A high roll-off, 8-pole elliptical, anti-aliasing filter is used with a Fast Fourier Transform (FFT) to accurately transform data from the time to the frequency domain. The analyzer will perform FFT resolutions of 100,200,400, and 800 lines.	