
Chapter 5

Main Rotor Track & Balance

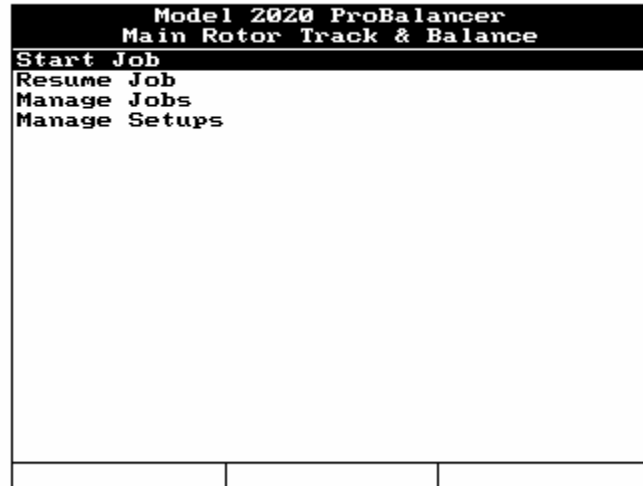
(Revision 3, May 2007)

“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.

| Model 2020 ProBalancer Main Menu | | |
|-------------------------------------|---------|-----------|
| Propeller Balance | | |
| Main Rotor Track & Balance | | |
| Tail Rotor Balance | | |
| Vibration Spectrum Surveys | | |
| Monitor Spectrum | | |
| Monitor IPS and Clock | | |
| Monitor Magnitude and Phase | | |
| Monitor Overall Vibration | | |
| Check Track | | |
| Transfer Data with PC | | |
| Miscellaneous Items | | |
| -Contrast | Default | +Contrast |

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.)

| Model 2020 ProBalancer Main Rotor Setup | | | |
|--|---------|---------------|------|
| Name : | SAMPLE | | |
| Vertical Chan : | A | | |
| Lateral Chan : | B | | |
| Sensor : | 991D-1 | | |
| Tach Type : | Optical | | |
| Tach Chan : | 1 | | |
| Blades : | 2 | Relative to : | Avg |
| RPM : | 400 | Trk Units : | in |
| << Conditions >> | | | |
| Ground | Both | Hover | Both |
| Flt 1 | Both | | Both |
| | Both | | Both |

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. In this field, enter the maximum expected RPM of the rotor system.
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].

If this setup has been defined as a result of selecting to start a job with no previous setups stored, a message will appear on the screen, “Store this new setup?” Press the [F1] “Yes” key to store the setup or the [F3] “No” key to skip this process (This query will only be presented if the user assigns a name to the setup in the “Name” portion of the screen.). If using the “Manage Setups” “Edit” or “New” functions, this message will not appear.

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

| Model 2020 ProBalancer Customer Information | | |
|---|---------------|--|
| Enter the following optional Customer Information. | | |
| Name: | CUSTOMER NAME | |
| A/C Registration: | N1234 | |
| A/C Total Time: | 123.4 | |
| Press ENTER to continue. | | |
| Names | | |

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

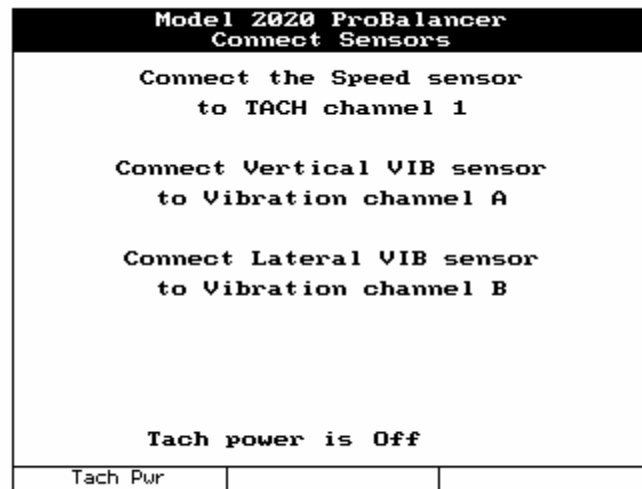
The “Tracking Selections” screen is displayed allowing you to choose a tracking device for use with the job. The tracking device field is a toggle selection of either “Tracker” or “Strobe.” If you select “Tracker,” use the [↓] key to then move to the lower portion of the screen and input the number of revolutions for which you wish to acquire data and the distance, in inches, from the location you will use the tracker (usually cockpit) to the blade tips. 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 less than 50 for the number of rotations to measure track. This will result with greater accuracy from the tracker.

5.1.4 – Main Rotor Equipment Setup

After you complete the “Customer Information” banner screen, the “Main Rotor Equipment Setup” 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.

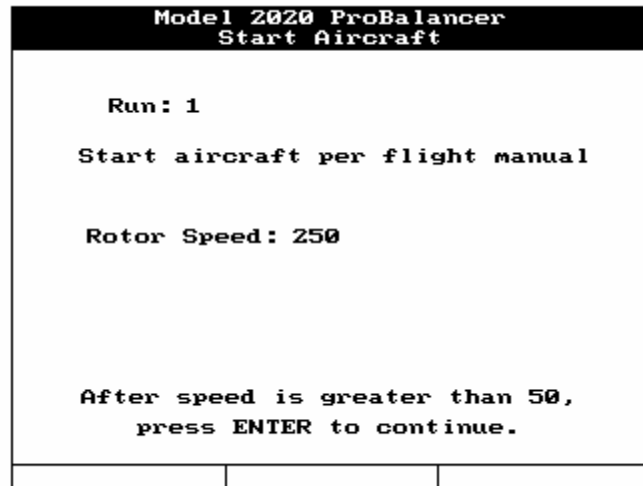
NOTE

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

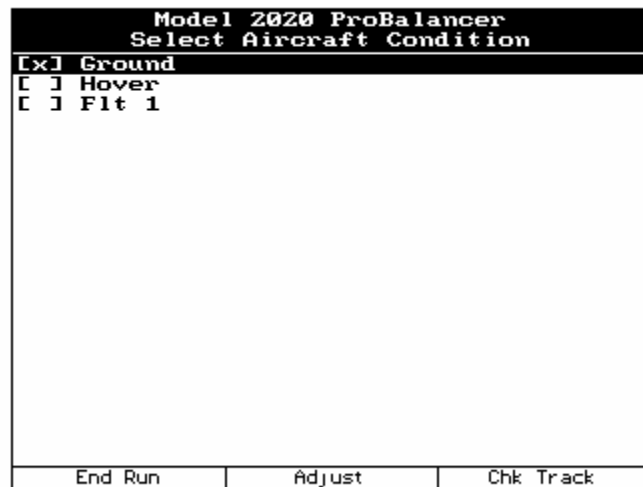
5.1.5 – Start Aircraft

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.

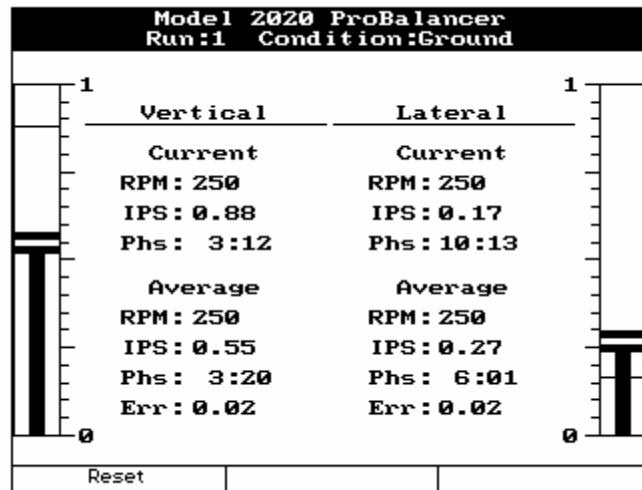
Pressing the [F1] “End Run” key will initiate an aircraft shutdown prompt and data save sequence.

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 Data

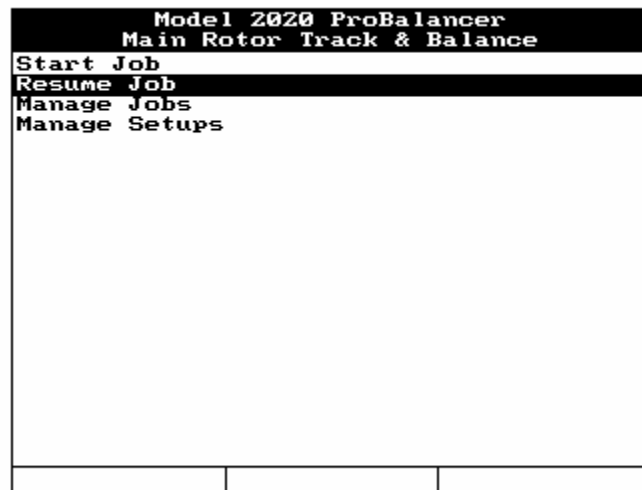
The analyzer displays the “Review Data” banner screen shown below for the condition just acquired. Through this screen, you may choose to retake the data just collected by pressing the [F1] key, input or measure track (depending upon the tracking option used) by pressing the [F3] key, or simply press [ENTER] to continue.

See Chapter 12 step 10 “Check Track” for instructions on how to enter track data using the strobe. See “Optical Tracker Supplement” for instructions on how to use the Optical Tracker.

“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.

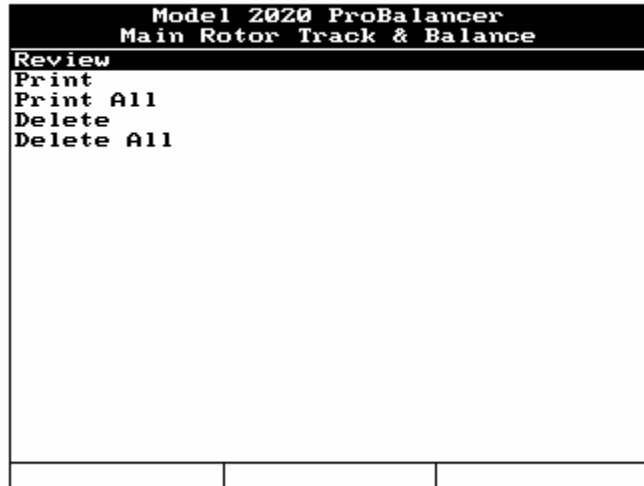


NOTE

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 one “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

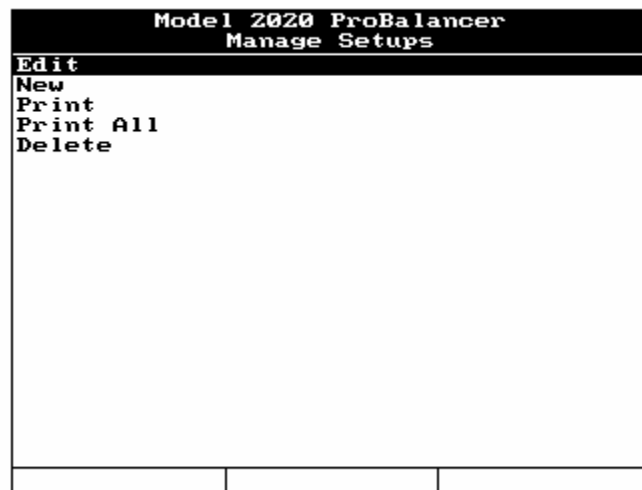
reference or permanent record prior to deleting. Once deleted, the job cannot be retrieved from the analyzer.

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.