



Application Note

Honeywell AS907

Fan Trim Balance

Part Number: 11-200-0178

AppNote Number: E-HOAS907-4040-FB

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Application Note

Application Note Number	E-HOAS907-4040-FB
Version	1.2
Function	Fan Trim Balance
Airframe	Bombardier Challenger 300
Engine	Honeywell AS907
E-Setup Number	N/A
ACES Systems Analyzer	Viper 4040
Firmware Version	1.04 or Higher
Procedure	N/A

Introduction

This Application Note describes the steps necessary to conduct a Fan Trim Balance procedure on the AS907 engine using the ACES Viper 4040 Analyzer.

A. Equipment Set Up

Required Equipment: The following equipment is required to accomplish a single engine fan trim balance.

Item	Quantity	Description	Part Number
1.	1EA	Analyzer, Viper 4040	10-100-4040
2.	1EA	Cable, Vibe, 6 Pin Generic, 50 Ft.	10-320-0127
3.	1EA	Cable, Interface, Challenger 300 (AS907) to 1725/4040	10-320-0306
4.	1EA	Cable, Tachometer, Generic, 50 Ft.	10-320-0126

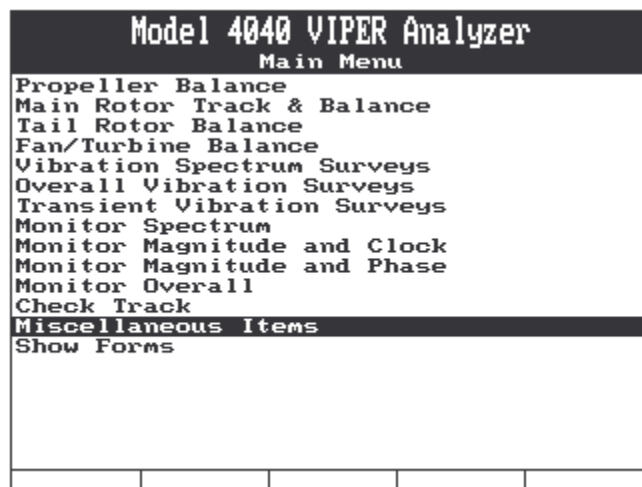
Optional Equipment: The following items are optional and are required only if you are conducting a balance job and not using the wide tooth output from the engine as a once-per-rev/speed signal.

5.	1EA	Tachometer, Lasetach II, 299 (Reflective tape included)	10-100-1300
6.	1EA	Mount, Lasetach Swivel	10-100-0369

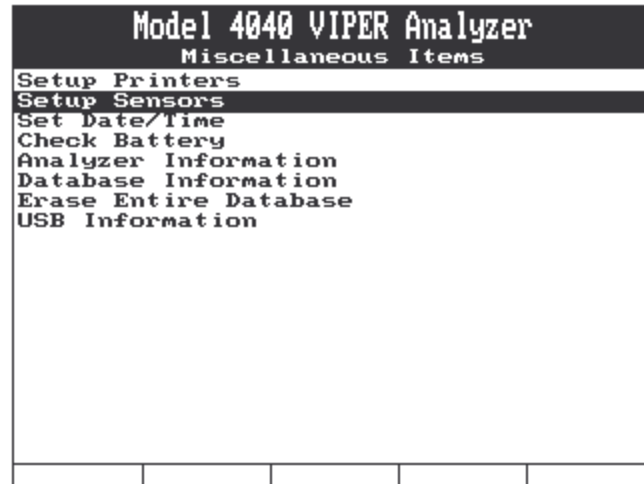
1. Install the Challenger 300 (AS 907) interface cable, item 3, to the maintenance connector adjacent to the aircraft entrance door.
2. Connect the Generic tachometer cable, item 4, (if required) to the Challenger 300 interface, item 3 at the 3 pin tachometer output and route the cable to the cockpit or location where the analyzer will be used. Connect the cable to the TACH1 input of the 4040 analyzer.
3. Connect the six pin generic vibe cable, item 2, to the Challenger 300 Interface cable, item 3, at the six pin vibe output and route the cable to the cockpit or location where the analyzer will be used. Connect the cable to the CHANNEL A input of the 4040 analyzer.

4.0 Fan Balance Setup.

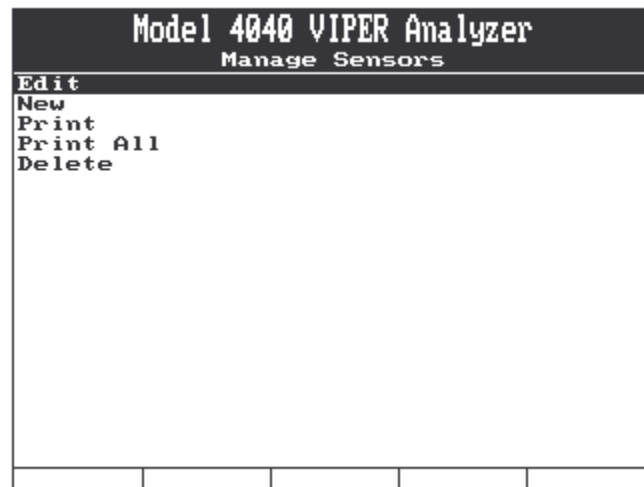
- 4.1 This section will provide you with the steps to enter the Setup into the Viper Analyzer. If the setup has been previously entered, you need not repeat this step. If the setup is available, go to section C. Data Acquisition. Otherwise proceed to item 14 below.
- 4.2 Turn the analyzer on by pressing the ON/OFF key.
- 4.3 The analyzer has several default sensors already in memory. Other sensors may have also been programmed into the analyzer. To view the list of sensors already stored in the analyzers memory, do the following:
- 4.4 From the Main Menu, select Miscellaneous Items.



- 4.5 From the Miscellaneous items menu, select Setup Sensors, then press [ENTER].



- 4.6 From the Manage Sensors menu, select Edit, then press [ENTER].



- 4.7 The Select menu will be displayed which lists all sensors currently programmed into the analyzer memory. If the sensor you are using is listed, you need not re-enter it. Go to item **22**, otherwise press the [BACKUP] key, select New from the Manage Sensors menu and proceed with item 21 below.

Select				
1	>	793		
2	>	AS907 ONBOARD		
3	>	991D-1		
4	>	991V		
5	>	797V		
6	>	BK 4383 W/510-2		
7	>	CH 7310		
New				

4.8 Complete the Sensor Setup screen, shown below, as follows:

In the **Name:** field, enter the sensor name such as AS907 ONBOARD for instance. Press the [↓] key to move to the next field.

Model 4040 VIPER Analyzer Sensor Setup				
Name: AS907 ONBOARD				
Amplitude Units: IPS				
Probe Sensitivity: 105.000				
Reverse Polarity: No				
Input Type: Differential				

NOTE

The examples above show the setup for the AS907 engine-mounted CEC sensor.

In the **Amplitude Units:** field, use the ⇒ key to select units for the sensor. This is the engineering unit of output for the sensor. For the AS907 engine installed sensor, use IPS to indicate Inches Per Second (Velocity). Press the ↓ key to move to the next field.

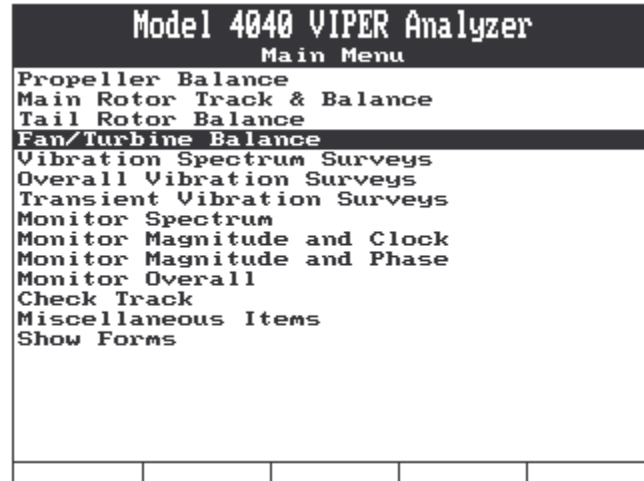
In the **Probe Sensitivity:** field, enter the mV per engineering unit as specified on the data sheet for the sensor you are using. For the engine installed sensor on the AS907, use 105 for 105 mV/IPS. Press the ↓ key to move to the next field.

In the **Reverse Polarity:** field, use the \Rightarrow key, if necessary, to select “Yes or No” as appropriate for the sensor you are using. This is “No” for the engine installed sensor on the AS907, indicating the sensor polarity is not reversed. Press the \Downarrow key to move to the next field.

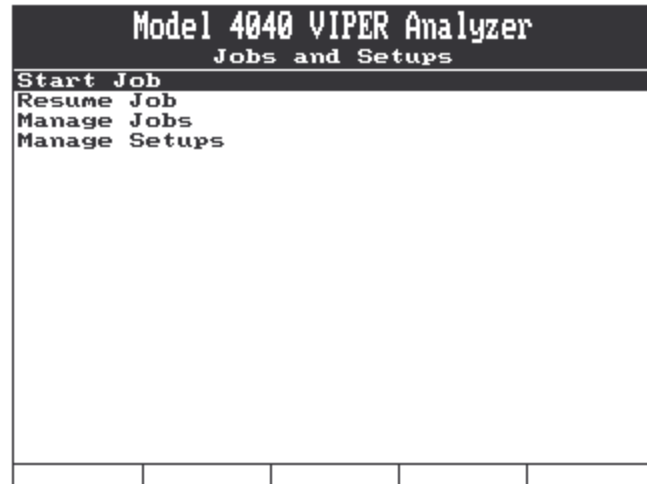
In the **Input Type:** field, use the \Rightarrow key, as necessary, to select “Differential” indicating the type input from the sensor.

When all fields are complete, press [ENTER] to accept and save. The screen will return to the “Manage Sensors” screen. From that screen, press [BACKUP] repeatedly until the Main Menu is again displayed.

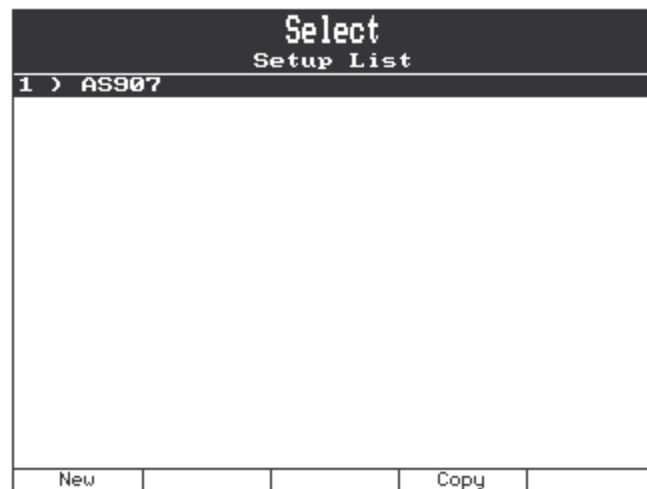
4. After a series of self-checks, the analyzer will display the main menu, shown below. Use the [DOWN ARROW] keys to select “Fan/Turbine Balance” and press [ENTER].



5. The Jobs and Setups page will be displayed. Use the [DOWN ARROW] key to select “Start Job” and press [ENTER].



6. The analyzer will display one of two screens. If any fan trim balance setups have been entered previously, the Setup List will be displayed. Check to see if the AS907 is in the list. If it is, use the [DOWN ARROW] key as necessary to select it, press [ENTER] and go to step **XX** below. If the list is displayed but the AS907 is not on the list, press the [F1] "New" key and go to step **XX** below.



If no setups were previously entered, the Fan/Turbine Balance Setup screen will automatically be displayed. If this screen is displayed, go to step 7 for detailed instructions on how to complete the setup.

Model 4040 VIPER Analyzer	
Fan/Turbine Balance Setup	
Name :	AS907 FAN BALANCE
Num Engs :	1
Eng Rotation :	CW
Num Baln Planes :	1
Num Optional Planes :	0
Balance Wt Type :	Class
Num Class Wt Sets :	1
Label Detail Wts :	No
Baln Weight Unit :	g
Num Sens / Eng :	1
Num Baln Speeds :	2
Slow Roll RPM :	0
Min Baln RPM :	2500
Actual RPM @ 100% :	10156
Vib Unit :	IPS
Modifier :	Peak

7. Complete the Fan/Turbine Balance Setup as follows:

Name : Use the analyzer keypad to enter “AS907 FAN BALANCE”

Num Engs : Use the [RIGHT ARROW] key to select 1 or 2 according to how many engines you will balance during this job.

Eng Rotation : Use the [RIGHT ARROW] key to select “CW” for clockwise.

Num Baln Planes : Use the [RIGHT ARROW] key to select “1”.

Num Optional Planes : Use the [RIGHT ARROW] key to select “0”.

Balance Wt. Type : Use the [RIGHT ARROW] key to select “Class”.

Num Class Wt Sets : Use the [RIGHT ARROW] key to select “1”.

Label Detail Wts : Use the [RIGHT ARROW] key to select “No”.

Baln Weight Units : Use the [RIGHT ARROW] key to select “g” for grams.

Num Sens / Eng : Use the [RIGHT ARROW] keypad to select the number of sensors you are using for this setup (1 or 2).

Num Baln Speeds : Use the [RIGHT ARROW] key to select the total number of balance speeds you will use for this setup or alternately select “Sel. In Job” which will allow you to select the number of balance speeds as you start each job using this setup. If you are unsure about how many speeds to use, choose 2.

Slow Roll RPM : Use the analyzer keypad to enter “0”.

Min Baln RPM : Use the analyzer keypad to enter an RPM below which you do not want to automatically pick speeds for balancing. This is normally the low flight range but never less than idle.

Actual RPM @ 100% : Use the analyzer keypad to enter 10156, the RPM of the fan at 100% power.

Vib Unit : Use the [RIGHT ARROW] key to select “IPS”.

Modifier : Use the [RIGHT ARROW] key to select “Peak”

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

Model 4040 VIPER Analyzer	
Fan/Turbine Balance Setup	
Name:	AS907
Num Engs:	1
Eng Rotation:	CW
Num Baln Planes:	1
Num Optional Planes:	0
Balance Wt Type:	Class
Num Class Wt Sets:	1
Label Detail Wts:	No
Baln Weight Unit:	g
Num Sens / Eng:	1
Num Baln Speeds:	Sel. in Job
Slow Roll RPM:	0
Min Baln RPM:	2500
Actual RPM @ 100%:	10156
Vib Unit:	IPS
Modifier:	Peak

8. The Define Class Wts screen will be displayed. Complete the screen as shown in the example below for the AS907. NOTE: Be sure to enter “0.0” as the weight for the –1 weight and to enter “1” for it’s span. This indicates that the –1 is in place when no weight is required for a hole, but fills the empty bolt hole acting as the spinner attaching hardware only.

Model 4040 VIPER Analyzer					
Define Class Wts					
Name or PN:	DASH				
Num Wts:	15				
Name	Wt	Span	Name	Wt	Span
(The min wt must be a base wt)					
-1	0.000	1	-13	5.880	1
-2	0.400	1	-14	6.440	1
-3	0.860	1	-15	7.120	1
-4	1.310	1			
-5	1.740	1			
-6	2.290	1			
-7	2.760	1			
-8	3.340	1			
-9	3.830	1			
-10	4.310	1			
-11	4.880	1			
-12	5.370	1			

9. When the Balance Plane Information screen is displayed, use the [DOWN ARROW] key to move from field to field and complete the form as follows:

Plane ID : Use the [RIGHT ARROW] key to select “1”.

Num Holes : Use the analyzer keypad to enter “8”.

Home Num Dir : Use the [RIGHT ARROW] key to select “CW” for clockwise.

Spacing : Use the [RIGHT ARROW] key to select “Even”.

MaxWt/Hole : Use the analyzer keypad to enter “7.120”.

MaxWt/Plane : Use the analyzer keypad to enter “21.36”.

Wt Set : This field will default to the only weight set available as defined in step 9 above.

Trial Wt : Use the analyzer keypad to enter “2.76” which is the –7 weight. You may vary this weight as necessary. The trial weight is used only to induce a change to the raw condition (no weights) of the first run in order to calculate an effective influence.

Angle of No. 1 Hole : Use the analyzer keypad to enter “0”.

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

Model 4040 VIPER Analyzer				
Balance Plane Information				
Plane ID:	1	Num Holes:	8	
Hole Num Dir:	CW	Spacing:	Even	
MaxWt/Hole:	7.120	MaxWt/Plane:	21.36	
Wt Set:	DASH	Trial Wt:	2.76	
Angle of No.1 Hole:	0			

10. The sensor information page will be displayed. Use the [DOWN ARROW] key to move from field to field and complete the form as follows:

Engine ID : If not defaulted to “1”, use the analyzer keypad to enter “1”.

Tach Chan : Use the [RIGHT ARROW] key to select the tach channel to which you will connect the tachometer input. The field defaults to “1”.

Tach Type : Use the [RIGHT ARROW] key to select the tachometer type you are using for this balance job. If using the output of the engines tach indication system, select “Lo Tth” for Low Tooth. If using the Lasetach, select “Optical”.

Tach Position (FLA) : Use the [RIGHT ARROW] key to select the position where the tachometer pickup is located relative to a clock hour as viewed from forward of the engine looking aft into the intake. If using the Lasetach, this will be the position where the laser beam strikes the spinner.

Full Scale Vibration : Use the [RIGHT ARROW] key to select a value you may reasonably expect the level of vibration not to exceed during data acquisition. This value should be as

low as possible while still above that expected maximum value. For the AS907, 1.00 should suffice. If you experience an “OVERLOAD” indication during the balance procedure you may edit this field to a higher value.

Sensor Type : Use the [RIGHT ARROW] key to select “AS907 ONBOARD”. This is the sensor entered at the beginning of this application note. If an external sensor is being used, you should enter a setup for that sensor prior to beginning the balance job and edit this setup to select the new sensor at this point.

Cha : Use the [RIGHT ARROW] key to select “A”. This indicates you will connect the vibration output from the engine to CHANNEL A of the analyzer.

Desc : This is an optional field where you may enter a sensor description. This field is useful when using two sensors where you may define one as HORIZ and one as VERT for instance. If you wish you may enter a description or leave this field blank.

Pos : Is the clock position of the vibration sensor on the engine as viewed from the front of the engine looking aft into the intake. Select the clock position using the [RIGHT ARROW] key. If you do not know the sensor position, select UNK for unknown.

Targ : This is the target vibration level you wish to attain as a result of this balance job. Use the analyzer keypad to enter the IPS target value. The analyzer will continue to offer balance solutions until this level is reached or no significant change is made for the application of weights.

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

Model 4040 VIPER Analyzer				
Sensor Information				
Eng ID:	1			
Tach Chan:	1	Tach Type:	Lo Tth	
Tach Pos (FLA):	12	:	00	
Full Scale Vibration:	1.00			
Sensor Type	Cha	Desc	Pos	Targ
AS907 ONBOARD	A		12	0.050

- The next screen displayed will be the “Define Fan/Turbine Balance ICF” screen shown below. If you have selected a multiple speed balance, you must provide an answer (YES or NO) to the question line which reads: “All Speeds Use the Same ICF: Use the [RIGHT ARROW] key to toggle the answer field between YES and NO. The default is YES. If you are unsure, leave the field at YES. If you have an established influence coefficient for this engine you may enter it in the boxes provided. The “g/IPS” field is where you enter the Grams Per IPS influence and the “Deg” field is where you enter the Lead or Lag correction in

degrees. Use the arrow keys to move from field to field and enter the information from the numeric keypad. If you do not have an influence for this engine, leave both fields set to “0”. The analyzer will calculate an influence for the engine during the job and update these fields when the job is complete. When the entries are made according to your requirements, press [ENTER] to accept and continue.

Model 4040 VIPER Analyzer			
Define Fan/Turbine Balance ICFs			
Plane ID: 1			
All Speeds Use the Same ICF: <input checked="" type="checkbox"/> Yes			
Spd Sensor 1			
	g/IPS	Deg	
1	0.00	0	

- A momentary screen with the message “Initiating for data acquisition, please wait...” Will be displayed. When initialization is complete, the Customer Information screen, shown below, will be displayed. At this point you may turn the analyzer OFF and the setup will be stored in the analyzers memory. If you wish to continue with this job, complete the optional Name, Aircraft (A/C) Registration and A/C Total Time using the arrow keys to navigate the fields and the alphanumeric keypad to enter information into the individual fields. For the Name field, you may optionally press the [F1] “Names” key and select a serial number from the database of names maintained there if this name has previously been entered in this analyzer. When the optional data is complete per your requirements, press [ENTER] to accept and continue.

Model 4040 VIPER Analyzer				
Customer Information				
Enter the following optional Customer information.				
Name : <input type="text" value="Unnamed"/>				
A/C Registration: <input type="text"/>				
A/C Total Time: <input type="text" value="0.0"/>				
Press ENTER to continue				
Names				

13. The Engine Information screen, shown below, will be displayed. If you have selected a multiple engine setup, use the [RIGHT ARROW] key to select the engine number for which you will enter the optional Engine Information. Use the [DOWN ARROW] key to move the cursor to the field of your choice. Enter the optional Serial Number (S/N), Type, Time Since New (TSN) and Time Since Overhaul (TSO) in the individual fields using the alphanumeric keypad. For the S/N field, you may optionally press the [F1] "Serial Nos" key and select a serial number from the database of serial numbers maintained there if this serial numbers has previously been entered in this analyzer.

Model 4040 VIPER Analyzer				
Engine Information				
Position:				
<input type="text" value="1"/>				
Engine:				
S/N <input type="text"/>				
Type <input type="text"/>				
TSO <input type="text"/>				
TSN <input type="text"/>				
Serial Nos				

14. The Fan/Turb Balance Equipment Setup screen, shown below, will be displayed with information on the equipment setup. Follow the on screen instructions. The information line which reads "Tach power is Off" is provided to indicate that power to the optional Laser Tach or Phototach is not on at this time. If you are using either of these optical tachometer types, press the [F1] "Tach On" key to turn power on for checking alignment of the optical tachometer. NOTE: When exiting this screen by pressing [ENTER], the position of the Tach

power switch has no effect in follow on screens. When all items are complete, press [ENTER] to confirm completion and continue.

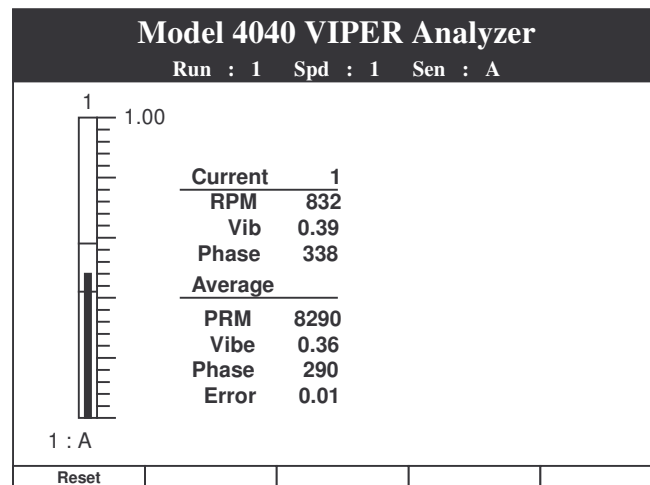
Model 4040 VIPER Analyzer				
Fan/Turb Balance Equipment Setup				
Install the speed sensor and connect to tach channel 1				
Install vibration sensor and connect to vib. channel A				
Remove all trim weights.				
Tach power is Off				
Tach On				

15. The Start Aircraft screen, shown below, will be displayed with the run number “Run 1” at the upper left of the screen. As indicated, Start the engine(s) per flight manual and set the engine(s) to idle. As the engine accelerates to idle, the “Current RPM:” field will indicate the speed of the Fan. If you see the message “NO TACH” in the current RPM field, check all cable connections and review the setup to insure the tach type is set correctly for the tachometer you are using. If the correct RPM is indicated, allow the engine to warm up to normal operating temperatures before proceeding. When the engine is at normal operating temperatures, press [ENTER] to begin data collection for the balance.

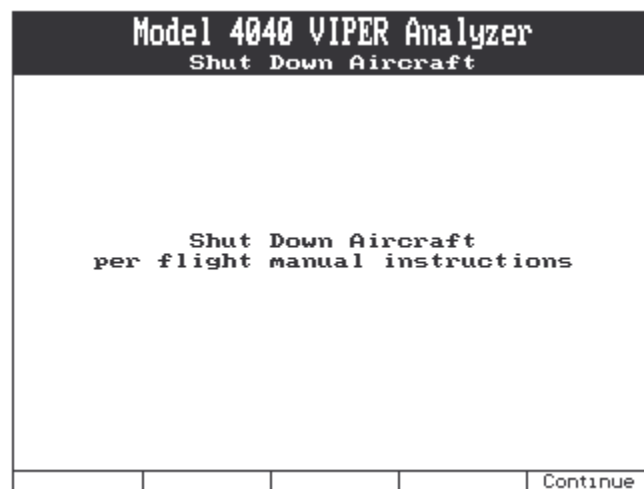
Model 4040 VIPER Analyzer				
Start Aircraft				
Run 1				
Start engine(s) per flight manual				
Set engine(s) to idle				
Current RPM: 400				
Press ENTER to continue.				

B. Data Acquisition

16. The Run 1, Spd 1, Sen 1 banner screen shown below will display the information for the first run. Indications of the Current and Average RPM, Vibration amplitude, and phase angle are displayed to the right of the converging scale. See the Viper 4040 User manual, chapter 20, Reading Spectrum and Scales for a detailed description of how to read the converging scale. After indications are stable, press [ENTER] to accept the collected data and continue. This screen will repeat for each of the speeds specified for balance. When all speeds are collected, the screen will automatically proceed to the shutdown message below in step 17.



17. The next screen to be displayed is the Shut Down Aircraft screen shown below. Proceed with the normal engine shutdown procedure for the aircraft. When complete and the aircraft is secure, press the [F5] "Continue" key.



18. The Review Prior Run(s) Data will be displayed for your review of the data collected up to this point. You may view data from all runs by scrolling through the available run data using the \leftarrow and \rightarrow keys. Optionally you may use the [F1] and [F2] keys to Retake One or Retake All data as required. When you are satisfied with the review, press [ENTER] to continue.

Note

Data shown in these screens are for illustration only and do not reflect actual data corresponding to the AS907 engine.

Model 4040 VIPER Analyzer			
Review Prior Run(s) Data			
Run 1			
Spd	Sensor 1		
	Rpm	Vib	Deg
1	10156	0.27	180
2	9648	0.23	178
<> Run			
RetakeOne	RetakeAll		

19. The Fan / Turb Suggested / Installed Wts screen will be displayed. Notice the first line of text in the screen shows the Run number and the message “Remove Old Wts, Inst. New Wts.” Remove all previously installed trim weights from any previous run and install the weights listed in the “Suggested” column into the hole numbers indicated to their immediate left. The right side of the screen reflects the suggested solution and changes to what you have actually installed only if you edit the solution shown. Be sure the information in the Hole/Bld and Installed column is correct before exiting this screen. If you install the exact suggested weight, you need only press the [ENTER] key to exit this screen with that information. If you installed different weights or installed weights in different holes than those suggested, use the arrow keys to navigate the matrix and indicate your exact installation. This action is very important in that the analyzer will use this information to calculate an influence for subsequent runs. Notice the function keys at the bottom of the screen are labeled for the options of “Inst=Sugg” (install the suggested weights in the suggested holes), “Inst=None” (Install None or no weights), “Sel Pla/W” (select a different Plane or weight set), and “Quit Job” If you enter a solution OTHER than the suggested, then decide to revert back to the suggested, you may press the [F1] “Inst=Sugg” key to automatically return all changed files in the Installed section to the suggested solution shown at the left side of the screen, rather than changing it field by field. When all fields are complete, press [ENTER] to accept and continue.

Model 4040 VIPER Analyzer			
Fan/Turb Suggested/Installed Wts			
Run 1 Remove Old Wts, Inst. New Wts			
Name: Plane 1, DASH			
Hole/Bld	Suggested	Hole/Bld	Installed
8	-4	8	-4
7	-10	7	-10
6	-10	6	-10
1	-1	1	-1
1	-1	1	-1
1	-1	1	-1
1	-1	1	-1
1	-1	1	-1
1	-1	1	-1
Total: Sugg = 9.974 @ 76			
Total: Inst = 10.009 @ 77			
Inst=Sugg	Inst=None		Quit Job

20. The Start Aircraft banner screen will be displayed for the next sequential run as indicated in the upper left portion of the screen. From this point, the sequence of events from item 16 through item 20 will repeat until the fan vibration is reduced to an acceptable level. Normally this goal will be attained in from one to three runs.

Model 4040 VIPER Analyzer			
Start Aircraft			
Run 2			
Start engine(s) per flight manual			
Current RPM: NO TACH			
Desired RPM: 13746			
Difference :			
When speed is stable at desired speed, press ENTER to continue.			