



Application Note

Application Note Number	E-HOT53-4040-VI
Version	N/A
Function	Engine Vibration Analysis
Airframe	N/A
Engine	T53 Series
E-Setup Number	N/A
ACES Systems Analyzer	Model 4040 Viper
Firmware Version	1.00 or greater
Procedure	N/A

Introduction

This outline covers the required equipment, installation, analyzer setup, and data acquisition process for using the ACES Systems' Model 4040 Viper Analyzer for engine vibration analysis on the Honeywell / Allied Signal T-53 series engines. General instructions for the use of the 4040 can be found in user manual #4040-OM. Ensure all maintenance actions are performed in accordance with applicable maintenance manual.

A. Required Equipment

The following ACES Systems' equipment is required.

Item	Quantity	Description	TEC Part Number
1.	1	Model 4040 Analyzer	10-100-4040
2.	1	Mount, Sensor	LTCT535
3.	1	Mount, Sensor	LTCT458
3.	1	Mount, Sensor	LTCT433
4.	3	Charge Amplifier, Model 510	10-100-1500
5.	3	Cable, High Temperature	10-320-0008
6.	3	Cable, Sensor	10-320-0158
7.	3	Sensor, 62225	69-100-0016

Optional Equipment

Certain airframe applications require the use of LTCT6756 sensor mount as an alternate to the oil scavenge adapter.

Miscellaneous Equipment

4-40 screws provided with high temperature sensors.

B. Equipment Installation

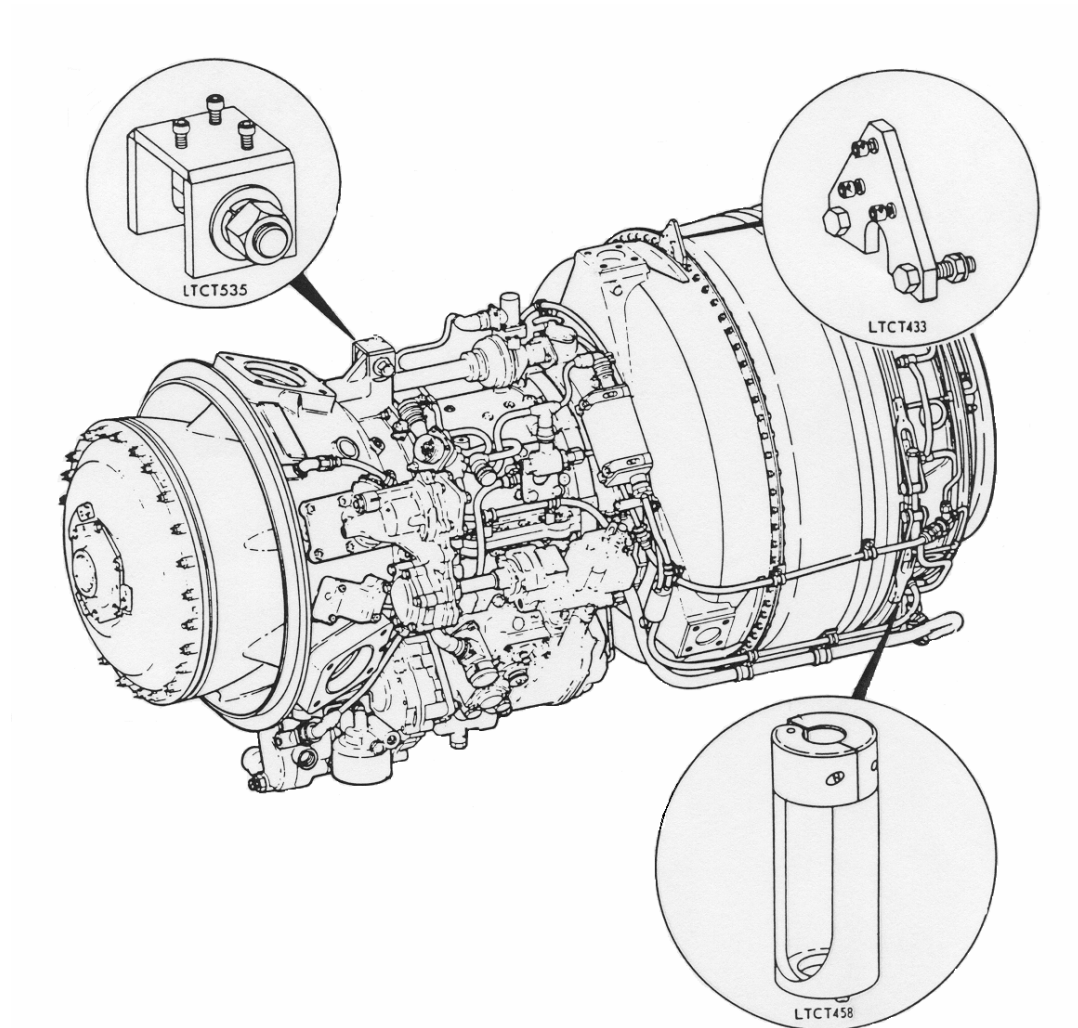
This section details the steps necessary to install the required vibration analysis equipment on the T-53 turboshaft engine.

1. Install sensor mount (P/N LTCT535) on the front lifting eye located on the accessory section of the engine. Install vibration sensor (P/N 69-100-0016) to the mount and secure with 4-40 screws.
2. Install sensor mount (P/N LTCT433) to the combustion section case split line at the 12:00 position. Install sensor (P/N 69-100-0016) to mount and secure with 4-40 screws.
3. Install sensor mount (P/N LTCT458) to the aft lower side of the engine. Install sensor (P/N 69-100-0016) to mount and secure with 4-40 screws.
4. Connect high temperature cable (P/N 10-320-0008) to forward sensor. Connect 510 charge converter (P/N 10-100-1500) to high temperature cable. Connect sensor cable (P/N 10-320-0165) to output side of the 510 charge converter. Route cable into cabin area. Connect sensor cable to channel A of the analyzer.
5. Connect high temperature cable (P/N 10-320-0008) to aft sensor. Connect 510 charge converter (P/N 10-100-1500) to high temperature cable. Connect sensor cable (P/N 10-320-0158) to output side of the 510 charge converter. Route cable into cabin area. Connect sensor cable to channel B of the analyzer.
6. Connect high temperature cable (P/N 10-320-0008) to third sensor. Connect 510 charge converter (P/N 10-100-1500) to high temperature cable. Connect sensor cable (P/N 10-320-0158) to output side of the 510 charge converter. Route cable into cabin area. Connect sensor cable to channel C of the analyzer.

Caution

Use caution when routing cables to avoid rotating components, engine or airframe controls, and areas of high temperature.

Equipment Installation Diagram



C. Analyzer Set Up

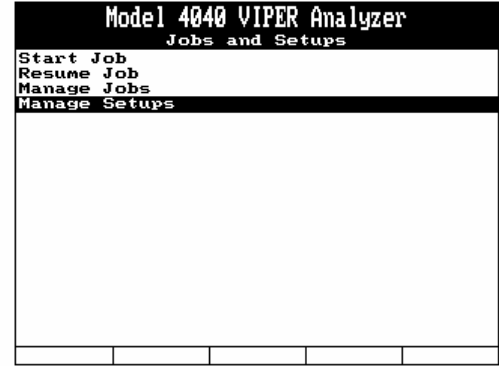
This section provides instruction on how to define and store a vibration survey setup for the T53 turboshaft engine. These steps will only have to be performed the first time you use the analyzer for this purpose; the information will be stored in the database for future use.

1. Turn the analyzer **[ON]**.
2. From the “Main Menu”, select “Miscellaneous Items” and press **[Enter]**.
3. From the “Miscellaneous Items” menu, select “Setup Sensors” and press **[Enter]**.
4. From the “Manage Sensors” menu, select “Edit” and press **[Enter]**.
5. A sensor list appears showing all of the factory defined sensor types. If “Endevco 62225” is not in the list, press **[F-1]** to define a “New” sensor. If this sensor type is present, press the **[MAIN MENU]** key to return to the main menu, and proceed to paragraph 7.
6. If defining a new sensor type, the “Sensor Setup” screen as shown to the right will appear. Enter the information exactly as it appears in this example. Failure to do so will result in incorrect readings. When completed, press **[Enter]** once to exit and save, and **[MAIN MENU]** once to return to the main menu.
7. From the “Main Menu”, select “Vibration Spectrum Surveys” and press **[Enter]**.

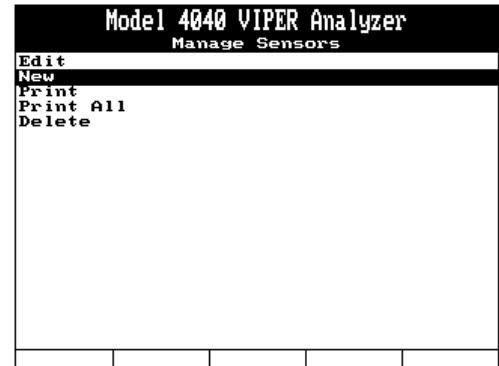
Model 4040 VIPER Analyzer				
Sensor Setup				
Name:	62225 w/510			
Amplitude Units:	IPS			
Probe Sensitivity:	20.000			
Reverse Polarity:	No			
Input Type:	Single Ended			

Model 4040 VIPER Analyzer				
Main Menu				
Propeller Balance				
Main Rotor Track & Balance				
Tail Rotor Balance				
Fan Balance				
Vibration Spectrum Surveys				
Overall Vibration Surveys				
Transient Vibration Surveys				
Monitor Spectrum				
Monitor Magnitude and Clock				
Monitor Magnitude and Phase				
Monitor Overall				
Check Track				
Transfer Data with PC				
Miscellaneous Items				
Show Forms				

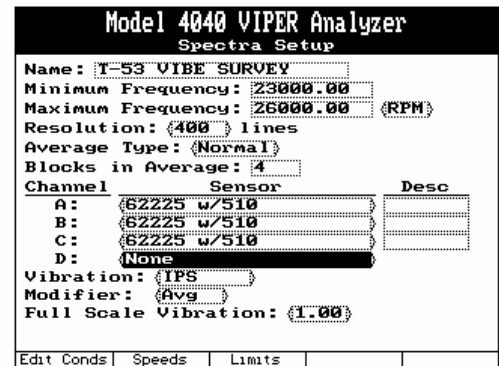
- From the “Vibration Spectrum Surveys” menu, select “Manage Setups” and press **[Enter]**.



- From the “Manage Setups” menu, select “New” and press **[Enter]**.



- The “Spectra Setup” screen will now appear. Using the example to the right as a guide, enter the survey information as shown in the appropriate fields. When finished, press **[F-1]** “Edit Conds” to move to the next screen.



- The “Conditions” screen appears. Under the “Condition” column, enter a name for vibration points to be acquired. Enter the corresponding target N1 and N2 values. These figures will serve as a guide in setting the proper engine/rotor/propeller condition prior to acquiring each point. Refer to the appropriate engine model maintenance manual for the number of test points and the N1 / N2 values to use.

Model 4040 VIPER Analyzer	
Conditions	
Condition	
1)	N190 N292
2)	N190 N297
3)	N195 N297
4)	N1MAX N297
5)	N190 N2100
6)	
7)	
8)	
9)	
10)	
11)	
12)	
13)	
14)	
15)	

- When completed, press **[Enter]** once to return to the “Spectra Setup” screen. Press **[F-3]** “Limits” to enter the vibration limits into the setup.

Model 4040 VIPER Analyzer		
Spectra Setup		
Name:	T-53 VIBE SURVEY	
Minimum Frequency:	23000.00	
Maximum Frequency:	26000.00 (RPM)	
Resolution:	400 lines	
Average Type:	Normal	
Blocks in Average:	4	
Channel	Sensor	Desc
A:	62225 w/510	
B:	62225 w/510	
C:	62225 w/510	
D:	None	
Vibration:	IPS	
Modifier:	Avg	
Full Scale Vibration:	1.00	

- Enter the Channel A vibration limits as shown. When completed press **[F-3]** to copy the information to channel B.

Model 4040 VIPER Analyzer				
Edit Limits for Channel A:				
	F-low	F-high	Unit	Limit
1)	23000.00	26000.00	xRPM	1.30
2)	23000.00	26000.00	xRPM	1.30
3)	23000.00	26000.00	xRPM	1.30
4)	23000.00	26000.00	xRPM	1.30
5)	23000.00	26000.00	xRPM	1.30
6)	0.00	0.00	xCS1	0.00
7)	0.00	0.00	xCS1	0.00
8)	0.00	0.00	xCS1	0.00
9)	0.00	0.00	xCS1	0.00
10)	0.00	0.00	xCS1	0.00
11)	0.00	0.00	xCS1	0.00
12)	0.00	0.00	xCS1	0.00
13)	0.00	0.00	xCS1	0.00
14)	0.00	0.00	xCS1	0.00

- Change the vibration limits for channel B as shown. When complete, press **[F4]** to copy the information to channel C.

Model 4040 VIPER Analyzer			
Edit Limits for Channel B:			
	F-low	F-high	Unit Limit
1)	23000.00	26000.00	xRPM 1.70
2)	23000.00	26000.00	xRPM 1.70
3)	23000.00	26000.00	xRPM 1.70
4)	23000.00	26000.00	xRPM 1.70
5)	23000.00	26000.00	xRPM 1.70
6)	0.00	0.00	xCS1 0.00
7)	0.00	0.00	xCS1 0.00
8)	0.00	0.00	xCS1 0.00
9)	0.00	0.00	xCS1 0.00
10)	0.00	0.00	xCS1 0.00
11)	0.00	0.00	xCS1 0.00
12)	0.00	0.00	xCS1 0.00
13)	0.00	0.00	xCS1 0.00
14)	0.00	0.00	xCS1 0.00
CopyToAll	CopyToA	CopyToC	CopyToD

- Change the vibration limits for channel C as shown. When completed, press **[Enter]** once to return to the “Spectra Setup” screen.

Model 4040 VIPER Analyzer			
Edit Limits for Channel C:			
	F-low	F-high	Unit Limit
1)	23000.00	26000.00	xRPM 2.30
2)	23000.00	26000.00	xRPM 2.30
3)	23000.00	26000.00	xRPM 2.30
4)	23000.00	26000.00	xRPM 2.30
5)	23000.00	26000.00	xRPM 2.30
6)	0.00	0.00	xCS1 0.00
7)	0.00	0.00	xCS1 0.00
8)	0.00	0.00	xCS1 0.00
9)	0.00	0.00	xCS1 0.00
10)	0.00	0.00	xCS1 0.00
11)	0.00	0.00	xCS1 0.00
12)	0.00	0.00	xCS1 0.00
13)	0.00	0.00	xCS1 0.00
14)	0.00	0.00	xCS1 0.00
CopyToAll	CopyToA	CopyToB	CopyToD

- Press **[Enter]** again to save the setup and return to the “Manage Setups” menu.

Model 4040 VIPER Analyzer			
Spectra Setup			
Name:	T-53 VIBE SURVEY		
Minimum Frequency:	23000.00		
Maximum Frequency:	26000.00 (RPM)		
Resolution:	400 lines		
Average Type:	Normal		
Blocks in Average:	4		
Channel	Sensor	Desc	
A:	62225 w/510		
B:	62225 w/510		
C:	62225 w/510		
D:	None		
Vibration:	IPS		
Modifier:	Avg		
Full Scale Vibration:	1.00		
Edit Conds	Speeds	Limits	

D. Data Acquisition

This section presents the steps necessary to acquire a survey.

1. Turn the analyzer [ON].
2. From the “Main Menu”, select “Vibration Spectrum Surveys” and press [Enter].
3. From the “Vibration Spectrum Surveys” menu, select “Start a Job” and press [Enter].
4. Next, if the T53 setup is already stored in the analyzers setup list, select it and press [Enter]. If not, press [F-1] for a “New” setup. Define a new setup as described in the analyzer setup section of this application note.

Select Setup List			
1	>	T-53 VIBE SURVEY	
2	>	RR ALLISON 250	
New			Copy

5. The “Customer Information” screen appears. You may enter this optional customer information and press [Enter] or skip this step by leaving the fields blank and pressing [Enter]. If you have used the analyzer prior to this job, you will be able to recall a list of names to select from by pressing the [F-1] “Names” key.

Model 4040 VIPER Analyzer Customer Information			
Enter the following optional Customer information.			
Name:	CUSTOMER NAME		
A/C Registration:	N12345		
A/C Total Time:	1200		
Press ENTER to continue			
Names			

Note:

It is recommended that you enter at least a customer name, as it will aid in recalling the data at a later date for printing or resuming.

6. The “Engine Information” screen will appear next. You may enter this optional engine information and press **[Enter]** or skip this step by simply pressing **[Enter]**. If you have used the analyzer prior to this job, you will be able to recall a list of serial numbers to select from by pressing the **[F-1]** “Serial Nos.” key.

Model 4040 VIPER Analyzer			
Engine Information			
Position:	1		
Propeller:			
S/N			
Type			
TSO	0		
TSN	0		
Engine:			
S/N	54321		
Type			
TSO	0		
TSN	0		
Serial Nos			

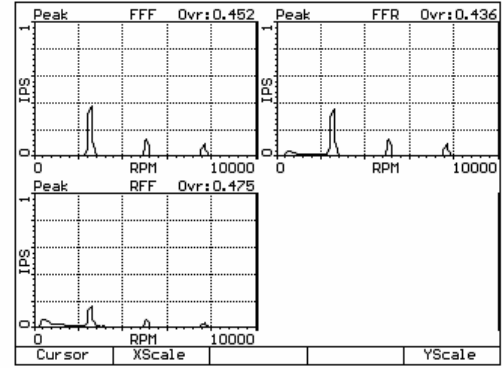
7. Start the engine and establish normal operating conditions. Once this has been achieved, press **[Enter]** to continue

Model 4040 VIPER Analyzer			
Start Engine			
Start the Engine and Establish Normal Operating Conditions.			
			Continue

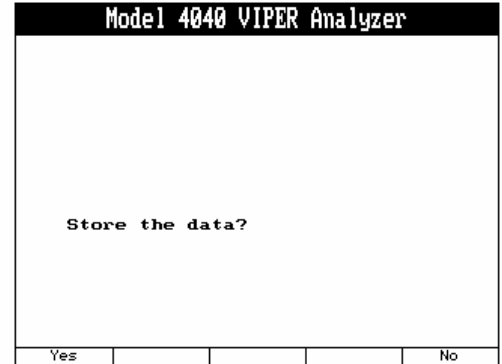
8. The “Select Aircraft Condition” screen appears as shown to the right. To acquire a measurement, select that condition and press **[Enter]**.

Model 4040 VIPER Analyzer			
Select Condition			
[]	N190	N292	
[]	N190	N297	
[]	N195	N297	
[]	N1MAX	N297	
[]	N190	N2100	
End Run			Quit Job

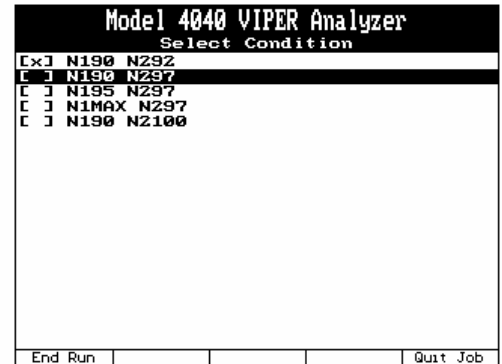
- After selecting a condition to measure, the data acquisition screen appears as shown to the right. The vibration for each sensor channel is shown in the upper right hand corner of each display. Use the cursor functions as described in Chapter 20, “Reading Spectrum and Scales” of the Model 4040 user’s manual to identify any peaks within the spectra. When finished measuring the current point, press **[Enter]** to stop data acquisition.



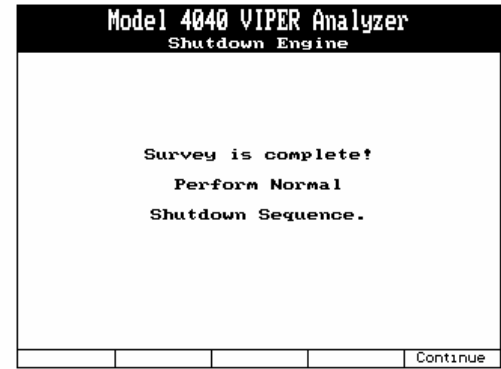
- After pressing **[Enter]**, data acquisition will stop and a “Storage Confirmation” screen will be presented to allow the actual N1 and N2 values to be recorded and prompt you to store the data. If you wish to record N1 / N2, simply enter the value in the appropriate field. When completed, press **[F-1]** or **[Enter]** to store the data, or press **[F-3]** to exit without saving.



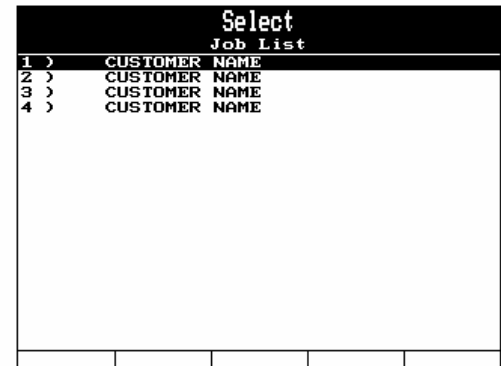
- At this point, you will be returned to the “Select Aircraft Condition” screen as detailed in paragraph “8” of this section. From there, select another point to measure or exit the survey. Once a condition has been measured, an “x” will be placed in the box preceding the point name. You may select to re-measure a condition if you so desire, the information previously stored will then be written over.



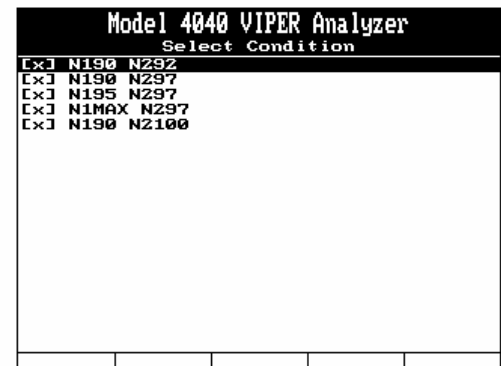
12. Once all of the conditions have been acquired, the following screen will appear. Press **[Enter]** to continue. The analyzer will go back to the “Vibration Spectrum Survey” menu. Select and Press “Manage Jobs” and then select and press “Review Jobs”.



13. Select the job to review and press **[Enter]**.



14. Select the condition to view and press **[Enter]**. The spectral plot for the selected condition will now be displayed. To view another condition, press **[Enter]**, select the new condition and press **[Enter]** again.





Application Note

Honeywell T-53

Vibration Survey

Part Number: 11-200-0158

AppNote Number: E-HOT53-4040-VI

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