



Application Note

Application Note Number	E-PWJ52-4040-VI
Version	1.01
Function	Tracked Vibration Analysis
Airframe	ALL
Engine	PW J52
E-Setup Number	
ACES Systems Analyzer	Viper 4040
Firmware Version	1.04 or greater
Procedure	N/A

Introduction

This Application Note is recommended to perform a tracked vibration analysis in a test cell environment on the Pratt & Whitney J52 engine. This Application Note describes the steps necessary for setup and execution of the Transient Vibration Survey function of the Viper 4040 analyzer.

A. Equipment Set Up

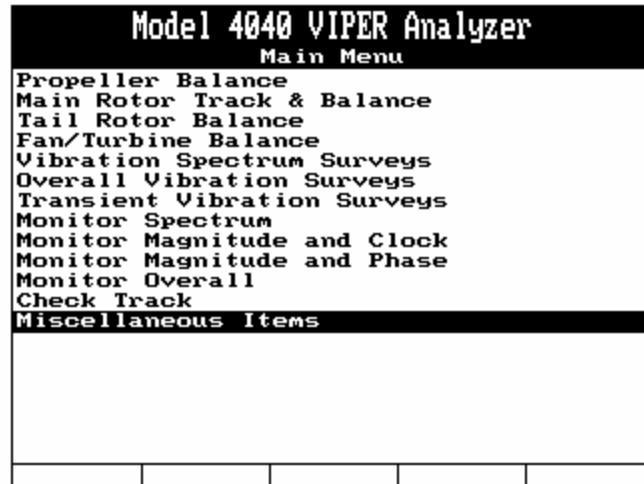
Analyzer Setup

Entering the Vibration Sensor Setup

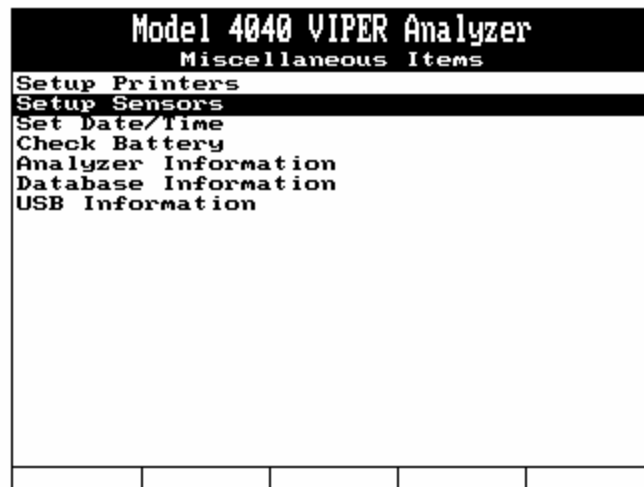
Note

If the Vibration Sensor Setup has previously been entered in this analyzer, you may proceed to step 7 below.

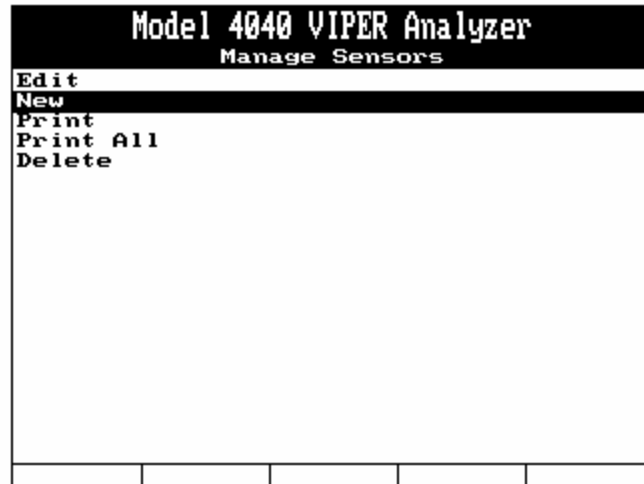
1. Turn the Viper 4040 Analyzer ON by pressing the ON/OFF key.
2. When the boot up process is complete and the Main Menu is displayed, use the [DOWN ARROW] key to select “Miscellaneous Items” and press [ENTER].



- From the Miscellaneous Items menu, use the [DOWN ARROW] key to select "Setup Sensors" and press [ENTER]



- From the Manage Sensors screen, use the [DOWN ARROW] key to select "New" and press [ENTER].



5. In the Sensor Setup screen, use the keypad to enter or select information in each of the fields as follows:

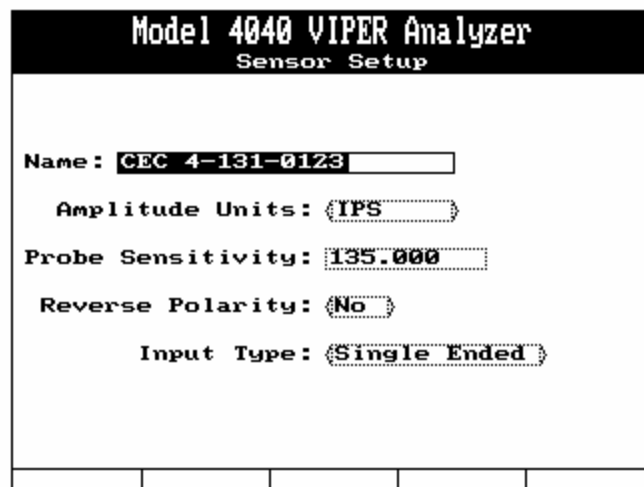
Name : Use the keypad to enter “CEC 4-131-0123”. Press the [DOWN ARROW] key to move to the next field.

Amplitude Units : Use the [RIGHT ARROW] key to select “IPS” to indicate Inches Per Seconds for this Velocity sensor. ”. Press the [DOWN ARROW] key to move to the next field.

Probe Sensitivity : Use the keypad to enter “135”. This indicates the sensitivity is 135 mV/IPS for this sensor. You need not enter the trailing zeros. They will be entered automatically by the analyzer when you exit this field. ”. Press the [DOWN ARROW] key to move to the next field.

Reverse Polarity : Use the [RIGHT ARROW] key (if necessary) to toggle this answer field to “No”. ”. Press the [DOWN ARROW] key to move to the next field.

Input Type : Use the [RIGHT ARROW] key to select “Single Ended” to indicate a single ended input to the analyzer.



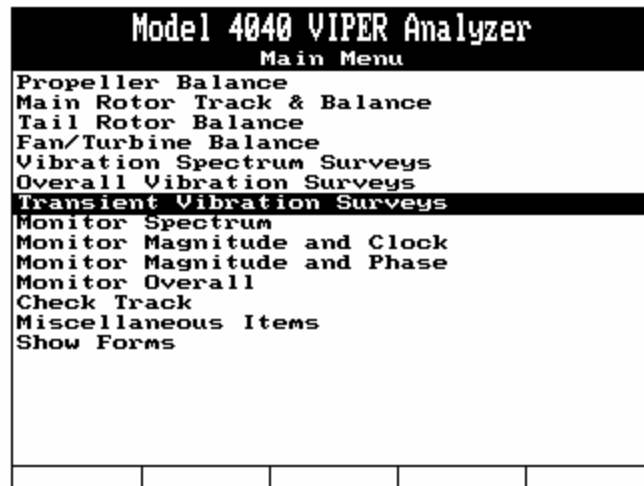
- 6 When all fields are complete per the example, press [ENTER] to accept the setting and continue. The screen will return to the Manage Sensors screen shown above in step 4. From that screen, press the [BACKUP] key two times to return to the Main Menu.

Entering the Transient Vibration Survey Setup

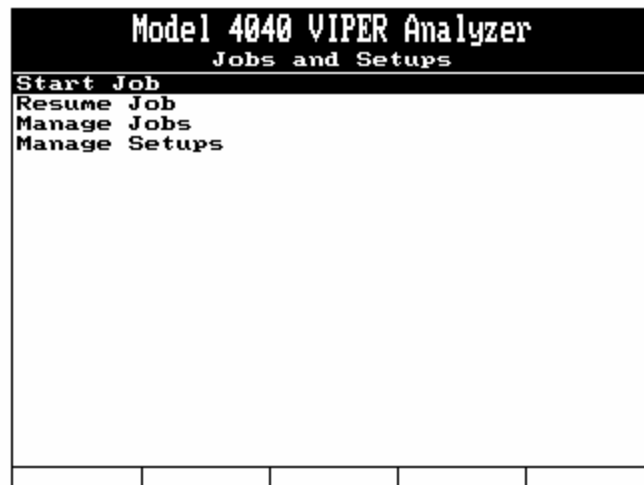
Note

If the Transient Vibration Survey Setup has previously been entered for the J52 in this analyzer, you may proceed to step 16 below.

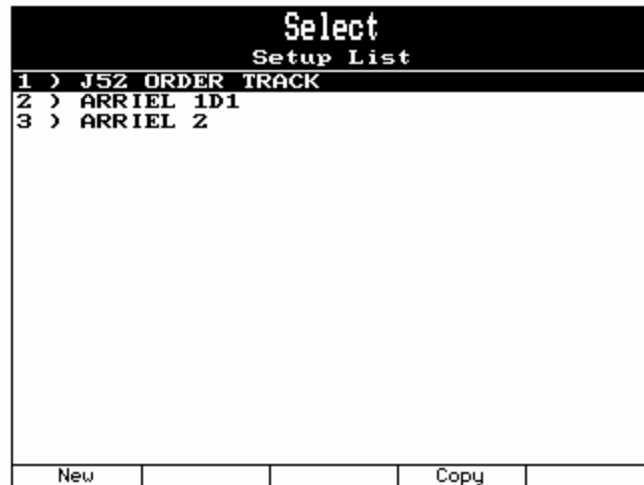
7. From the Main Menu screen, use the [DOWN ARROW] key to select “Transient Vibration Surveys” and press [ENTER].



8. From the Jobs and Setups screen, use the [DOWN ARROW] key to select “Start Job” and press [ENTER].



9. If there are no Setups currently stored in the analyzer, the screen will display the Transient Survey Setup screen. If this is the case, go to step 10. If the Setup List screen is displayed, check to see if the “J52 ORDER TRACK” is among the available selections. If it is, use the [DOWN ARROW] key to select it, press [ENTER] and go to step 20. If the Setup List screen is displayed but the “J52 ORDER TRACK” is not one of the selections, press the [F1] “New” key and go to step 10.



10. When the Transient Survey Setup screen is displayed, use the keypad to enter or select information in each field as follows:

Name : Use the analyzer keypad to enter “J52 ORDER TRACK” in the field. “. Press the [DOWN ARROW] key to move to the next field.

Minimum Frequency : Use the analyzer keypad to enter “40” in this field. “. Press the [DOWN ARROW] key to move to the next field.

Maximum Frequency : Use the analyzer keypad to enter “500” in this field. “. Press the [DOWN ARROW] key to move to the next field.

Resolution : Use the [RIGHT ARROW] key to select “400” lines. “. Press the [DOWN ARROW] key to move to the next field.

Display Type : Use the [RIGHT ARROW] key to select “Overall”. “. Press the [DOWN ARROW] key to move to the next field.

Sample Every : Use the analyzer keypad to enter “50” milliseconds. “. Press the [DOWN ARROW] key to move to the next field.

Channel A Sensor : Use the [RIGHT ARROW] key to select “CEC 4-131-0123”. “. Press the [DOWN ARROW] key to move to the next field.

Channel A Desc : Use the analyzer keypad to enter “INLET” to indicate the inlet sensor will be connected to and monitored by channel A. “. Press the [DOWN ARROW] key to move to the next field.

Channel B Sensor : Use the [RIGHT ARROW] key to select “CEC 4-131-0123”. “. Press the [DOWN ARROW] key to move to the next field.

Channel B Desc : Use the analyzer keypad to enter “DIFF” to indicate the diffuser sensor will be connected to and monitored by channel B. ”. Press the [DOWN ARROW] key to move to the next field.

Channel C Sensor : Use the [RIGHT ARROW] key to select “CEC 4-131-0123”. ”. Press the [DOWN ARROW] key to move to the next field.

Channel C Desc : Use the analyzer keypad to enter “TURB” to indicate the turbine sensor will be connected to and monitored by channel C. ”. Press the [DOWN ARROW] key to move to the next field.

Channel D Sensor : Use the [RIGHT ARROW] key to select “CEC 4-131-0123”. ”. Press the [DOWN ARROW] key to move to the next field.

Channel D Desc : Use the analyzer keypad to enter “GEARBX” to indicate the gearbox sensor will be connected to and monitored by channel D. ”. Press the [DOWN ARROW] key to move to the next field.

Vibration : Use the [RIGHT ARROW] to select “mils”. ”. Press the [DOWN ARROW] key to move to the next field.

Modifier : Use the [RIGHT ARROW] key to select “Pk -Pk” for Peak-to-Peak (Double Amplitude). ”. Press the [DOWN ARROW] key to move to the next field.

Full Scale Vibration : Use the [RIGHT ARROW] key to select “5.00”. This indicates the highest amplitude you expect to encounter is 5 mils.

Model 4040 VIPER Analyzer		
Transient Survey Setup		
Name:	J52 ORDER TRACK	
Minimum Frequency:	40.00	
Maximum Frequency:	500.00	(Hz)
Resolution:	400 lines	
Display Type:	Overall	
Sample Every	50	milliseconds
Channel	Sensor	Desc
A:	CEC 4-131-0123	INLET
B:	CEC 4-131-0123	DIFF
C:	CEC 4-131-0123	TURB
D:	CEC 4-131-0123	GEARBX
Vibration:	mils	
Modifier:	Pk-Pk	
Full Scale Vibration:	5.00	
Config		Plots Limits

11. When all fields are complete, press the [F1] “Config” key. The field labels above the F keys will change to new values. Press the [F1] “Conds” key.
12. When the Conditions screen is displayed, use the keypad to enter information into the fields as follows:

Condition : Use the analyzer keypad to enter “RUNUP”. Press the [DOWN ARROW] key to move to the next field.

Spectrum : Use the [RIGHT ARROW] key to select “Peak Hold”.

Max. Time: Leave the Max Time field at “0”. This will allow the analyzer to acquire data until you stop it by pressing the ENTER key.

When the three fields are completed, press [ENTER] to accept the values and continue.

Model 4040 VIPER Analyzer			
Conditions			
	Condition	Spectrum	Max. Time
1)	RUNUP	Peak Hold	0
2)		None	0
3)		None	0
4)		None	0
5)		None	0
6)		None	0
7)		None	0
8)		None	0
9)		None	0
10)		None	0
11)		None	0
12)		None	0
13)		None	0
14)		None	0
15)		None	0

13. The Transient Vibration Setup screen will again be displayed. Press the [F1] “Config” key again. As before, the field labels above the F keys will change to new values. Press the [F2] “Speeds” key. Use the analyzer keypad to enter and select information in each of the fields as follows:

Chan. 1) Measure: Use the [RIGHT ARROW] key to select “Pulse D-H” (Differential High). Press the [DOWN ARROW] key to move to the next field.

Chan. 1) DESC: Use the analyzer keypad to enter “N1”. Press the [DOWN ARROW] key to move to the next field.

Chan. 1) OFF/100%: MAKE NO ENTRY IN THIS FIELD. Press the [DOWN ARROW] key to move to the next field.

Chan. 1) Factor: Use the analyzer keypad to enter “1”. Press the [DOWN ARROW] key to move to the next field.

Chan. 2) Measure: Use the [RIGHT ARROW] key to select “Pulse D-H” (Differential High) Press the [DOWN ARROW] key to move to the next field.

Chan. 2) DESC: Use the analyzer keypad to enter “N2”. Press the [DOWN ARROW] key to move to the next field.

Chan. 2) OFF/100%: MAKE NO ENTRY IN THIS FIELD. This field is only used to enter a DC offset for certain types of tach signals. Press the [DOWN ARROW] key to move to the next field.

Chan. 2) Factor: Use the analyzer keypad to enter “2.94120”. This indicates the number of pulses per rotation. Press the [DOWN ARROW] key nine times, skipping down to the Plot Info: area. Complete the Plot Info as follows:

Chan. 1) Min : Use the analyzer keypad to enter “3000”. Press the [DOWN ARROW] key to move to the next field.

Chan. 1) Max: Use the analyzer keypad to enter 11500. Press the [DOWN ARROW] key to move to the next field.

Chan. 1) Div: Use the analyzer keypad to enter “6”. Press the [DOWN ARROW] key to move to the next field.

Chan. 2) Min : Use the analyzer keypad to enter “6000”. Press the [DOWN ARROW] key to move to the next field.

Chan. 2) Max : Use the analyzer keypad to enter “12500”

Chan. 2) Div : Use the analyzer keypad to enter “6”. Press the [DOWN ARROW] key to move to the next field.

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

Model 4040 VIPER Analyzer				
Speed Inputs Setup				
	Measure	DESC	OFF/100%	Factor
1)	Pulse D-H	N1	0.00000	1.00000
2)	Pulse D-H	N2	0.00000	2.94120
3)	None		0.00000	0.00000
4)	None		0.00000	0.00000
Plot Info:				
	Min	Max	Div	
1)	3000.0	11500	6	
2)	6000.0	12500	6	
3)	0.00	0.00	0	
4)	0.00	0.00	0	

14. The Transient Vibration Setup screen will again be displayed. Press the [F1] “Config” key again. As before, the field labels above the F keys will change to new values. Press the [F3] “Parms” key. Use the analyzer keypad to enter and select information in each of the fields as follows:

Description : In the description column of the first row, use the analyzer keypad to enter “XN1”. Use the [DOWN ARROW] key to move to the next field.

Type : In the type column of the first row, use the [RIGHT ARROW] key to select “Pwr”. Use the [DOWN ARROW] key to move to the next field.

F (lower) : In the F (lower) column of the first row, use the analyzer keypad to enter “0.95”. Use the [DOWN ARROW] key to move to the next field.

F (upper) : In the F (upper) column of the first row, use the analyzer keypad to enter “1.05”. Use the [DOWN ARROW] key to move to the next field.

Speed : In the Speed column of the first row, use the [RIGHT ARROW] key to select “xCS1”. Use the [DOWN ARROW] key to move to the next field.

Description : In the description column of the second row, use the analyzer keypad to enter “XN2”. Use the [DOWN ARROW] key to move to the next field.

Type : In the type column of the second row, use the [RIGHT ARROW] key to select “Pwr”. Use the [DOWN ARROW] key to move to the next field.

F (lower) : In the F (lower) column of the second row, use the analyzer keypad to enter “0.95”. Use the [DOWN ARROW] key to move to the next field.

F (upper) : In the F (upper) column of the second row, use the analyzer keypad to enter “1.05”. Use the [DOWN ARROW] key to move to the next field.

Speed : In the Speed column of the second row, use the [RIGHT ARROW] key to select “xCS2”.

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

Model 4040 VIPER Analyzer				
Transient Parameters Setup				
Description	Type	F(lower)	F(upper)	Speed
XN1	Pwr	0.95	1.05	xCS1
XN2	Pwr	0.95	1.05	xCS2
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1
	Pwr	0.00	0.00	xCS1

15. The Transient Vibration Setup screen will again be displayed. Press the [F4] “Plots” key. When the Transient Plots Setup screen is displayed, use the [DOWN ARROW] key to move from field to field then use the [RIGHT ARROW] key to toggle the Yes / No field for each parameter and plot as follows:

Parameter	Time	xCS1	xCS2
Overall	<Yes>	<Yes>	<Yes>
XN1	<Yes>	<Yes>	<No>
XN2	<Yes>	<No>	<Yes>

When all fields are set, press [ENTER] to accept the settings and continue. When the Transient Survey Setup screen is again displayed, you may press [ENTER] to store the Setup and continue

with data acquisition or press [BACKUP] until the Main Menu is again displayed. You may then select another function or turn the analyzer OFF.

Model 4040 VIPER Analyzer			
Transient Plots Setup			
Parameter	Time	xCS1	xCS2
Overall	Yes	Yes	Yes
XN1	Yes	Yes	No
XN2	Yes	No	Yes

B. Data Acquisition

16. Turn the analyzer ON by pressing the ON/OFF key.
17. When the Main Menu is displayed, use the [DOWN ARROW] key to select “Transient Vibration Surveys” and press [ENTER].

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

than entering them manually. When all required fields are complete, press [ENTER] to accept the data and continue.

Model 4040 VIPER Analyzer				
Customer Information				
Enter the following optional Customer information.				
Name:	U.S. NAVY			
A/C Registration:				
A/C Total Time:	0			
Press ENTER to continue				
Names				

21. The Engine Information screen will be displayed. Use the [DOWN ARROW] key to move from field to field. Use the [RIGHT ARROW] key to select the “Position” if this setup is for multiple engine installations. Use the analyzer keypad to enter the Engine Serial Number (S/N), Type, Time Since Overhaul (TSO) and Time Since New (TSN). If multiple Serial Numbers (S/N) are stored in the analyzer memory, you may press the [F1] “Serial Nos” key to produce a list of those Serial Numbers from which you may select for entry into the S/N field rather than entering it manually. When all fields are complete as necessary, press [ENTER] to accept and continue.

Model 4040 VIPER Analyzer				
Engine Information				
Position:	1			
Propeller:				
S/N				
Type				
TSO	0			
TSN	0			
Engine:				
S/N	12345			
Type	J52			
TSO	0			
TSN	0			
Serial Nos				

22. An information screen directing you to “Start the Engine and Establish Normal Operating Conditions” will be displayed. At this time you should start the engine in accordance with established procedure and allow the engine to warm up to normal operating temperatures. When the engine is warmed up and you are ready to proceed, press the [F5] “Continue” key.

Model 4040 VIPER Analyzer				
Start Engine				
<p>Start the Engine and Establish Normal Operating Conditions.</p>				
				Continue

23. The Overall Vibration screen will be displayed showing the number of samples taken and the engineering units of vibration (mils) and modifier (Pk-Pk). The screen will also display the Current amplitudes for each of the parameters defined in the setup. Additionally, it will show the Maximum amplitude for the selected sensor relative to each parameter. To change the selected sensor in the Maximum column, press the corresponding key (F1 through F4). When ready, advance the engine from idle to military power using a slow steady acceleration of approximately 60, but not less than 40 seconds. When the acceleration is complete, press [ENTER] to stop data acquisition and continue.

Model 4040 VIPER Analyzer				
Overall Vibration				
Samples: 146				
Units:mils Pk-Pk				
	Current		INLET Maximum	
INLET	0.00		0.00	
DIFF	0.00		0.00	
TURB	0.00		0.00	
GEARBX	0.00		0.00	
N1	4254.48		0.00	
N2	38742.63		0.00	
INLET	DIFF	TURB	GEARBX	

24. An information screen will be displayed asking “Store the data?” Press the [F1] “Yes” key to store the data and continue.

Model 4040 VIPER Analyzer				
Store the data?				
Yes				No

25. Another information screen with the message “Survey is complete! Perform Normal Shutdown Sequence” will be displayed. Shutdown the engine in accordance with established procedures. When Shutdown is complete, press the [F5] “Continue” key. The test is now complete. You may turn the analyzer power OFF.

Model 4040 VIPER Analyzer Shutdown Engine				
Survey is complete! Perform Normal Shutdown Sequence.				
				Continue

Data Transfer Procedure

1. Start AvTrend on the PC
2. Connect the DB25/DB9 end of the comm/printer cable to the comm port of the PC. Connect the MS 6 pin end of the cable to the analyzer at the AUX/COMM port.
3. Turn power to the analyzer ON by pressing the ON/OFF key.
4. From the Analyzers Main Menu, Select Transfer Data With PC, press enter.
4. From the AvTrend main menu, select FILE | TRANSFER | RETRIEVE DATA.
5. Data transfer will take several minutes.
6. After transfer is complete, in AvTrend click on the Jobs branch of the data tree (left hand side of screen).
7. Select Jobs, Transient Jobs, J52 Order Track, and the desired serial number of the engine you wish to view.
8. Right click the desired test (see date and time).
9. Select Export, Data File.
10. Enter export filename and location in dialog box. Directory should be \Program Files\AvTrend\Export. Filename format is J52-<engine serial number>-YYMMDD.
11. When transfer is complete disconnect analyzer from PC.

Notes:

1. If the analyzer hangs up during the above process, reboot by depressing 5 and hold Main Menu key for 5 seconds. When asked "Do you want to erase existing jobs and setups?" Select [F5] "NO". Wait for system to boot. This boot sequence is longer than a normal boot.



Application Note

Engine Type : PW J52

Procedure : Tracked Vibration Analysis

Part Number: 11-200-0119

AppNote Number: E-PWJ52-4040-VI-1.0

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