



# Application Note

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## **Agusta A109 Series**

### **Tail Rotor Balance**

**Part Number: 11-200-0117**

**AppNote Number: A-AG109-4040-TR (Rev. 3.0, Sept 2007)**

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# Application Note

Application Note Number	A-AG109-4040-TR
Revision	3.0 (From Airframe Rev 1)
Function	Tail Rotor Balance
Airframe	Agusta A109 Series
Engine	N/A
E-Setup Number	a-ag109-4040-tr.asf
ACES Systems Analyzer	Model 4040
Boot/App Version	3.0/3.0 or later
Procedure	N/A

## Introduction

This Application Note covers the required equipment, equipment installation, analyzer setup, data acquisition and solution process for using the ACES Systems Model 4040 with the Tail Rotor Enhanced Performance Option to perform a tail rotor balance on the Agusta A109 Series. General instructions for the use of the Model 4040 can be found in the Model 4040 User Manual #4040-OM-01 (P/N 75-900-4040). All procedures for balance and all adjustments should be made in accordance with the Airframe Maintenance Manual.

## A. Equipment Setup

**Required Equipment:** The following equipment is required to perform a Tail Rotor Balance\*:

Item	Quantity	Description	Part Number
1.	1	Analyzer, Model 4040	10-100-4040
2.	1	Tachometer, Optical, Phototach (New)	10-100-1773
3.	1	Cable, Tach, Generic, 50'	10-320-0126
4.	1	Sensor, Vibe, Accel, 991D-1	69-100-0075
5.	1	Cable, Sensor 991D-1, 50'	10-320-0163
6.	1	Mount, ¼X28 Sensor, Vibe ¼" Hole, S/Stl	22-430-0035
7.	1	Tape, Reflective, Roll, 10'	10-400-0176
8.	1	Option, 4040 Main and Tail Rotor	11-900-0005
9.	1	Mount, Phototach, A-109 Tail Rotor	10-100-0486



\*This listing shows the latest design parts. It is acceptable to perform this task using previous designs with the appropriate accessories. For compatibility issues, contact ACES Systems.

### Miscellaneous Equipment

Tape or tie wraps to secure cables to airframe.

If adjustments are to be made to the tail rotor balance, use only hardware or balance weights that are specified in the applicable airframe maintenance manual.

## B. Equipment Installation

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1. Park the aircraft on a flat level surface with the nose into the wind. Place the Viper 4040 Analyzer (Item 1) in the flight compartment.
2. Install the Phototach (Item 2) into Mount (Item 9) and attach to left side of vertical stabilizer on the second screw from the rear, where the gearbox fairing meets the stabilizer. (Figure 1)

#### NOTE

**See Paragraph D.2 for additional installation instructions of Phototach and Tape.**

3. Install the 991D-1 Sensor (Item 4) into the Sensor Mount (Item 6) and attach the assembly to the 90-degree gearbox cover on the side opposite the Tail Rotor. The connector **MUST** point UP. (Figure 2)

#### NOTE

**Secure and route cables as not to interfere with hot or rotating components.**

4. Connect the 50' Tachometer Cable (Item 3) to the Phototach. Wrap the cable around the tail-boom away from rotating components and into the cabin. Connect the opposite end of the Cable to "TACH 1" on the Analyzer.
5. Connect the 50' Vibration Sensor Cable (Item 5) to the Vibration Sensor. Wrap the cable forward around the tail-boom away from rotating components and into the cabin. Connect the opposite end of the cable to "CHANNEL A" on the analyzer.
6. (Optional) Number the holes on tail rotor balance wheel as shown in Figure 3, this will aid in the application of balance weights. If this step is omitted, be sure to refer to the diagram shown in Figure 3 for the proper hole assignments when placing weight on the tail rotor balance wheel.
7. Reinstall any previously removed cowlings.

### Equipment Installation Diagram



Figure 1



Figure 2

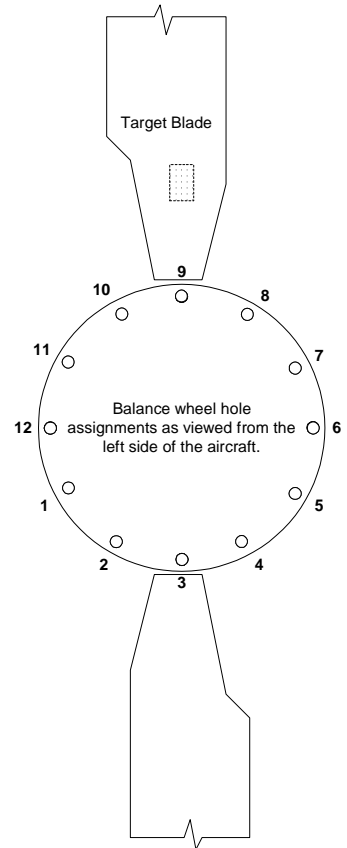


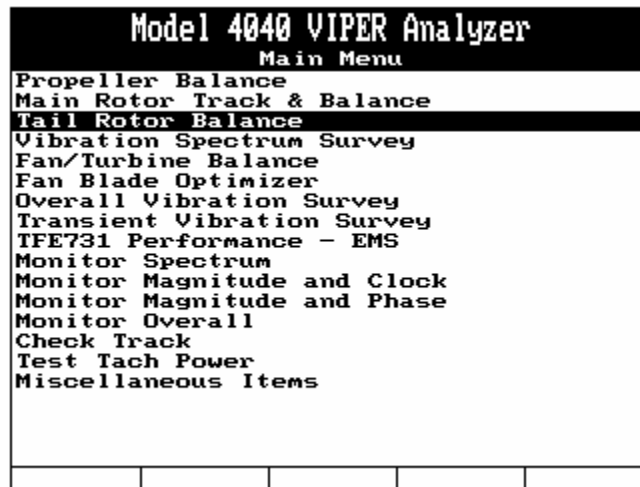
Figure 3



## C. Analyzer Set Up

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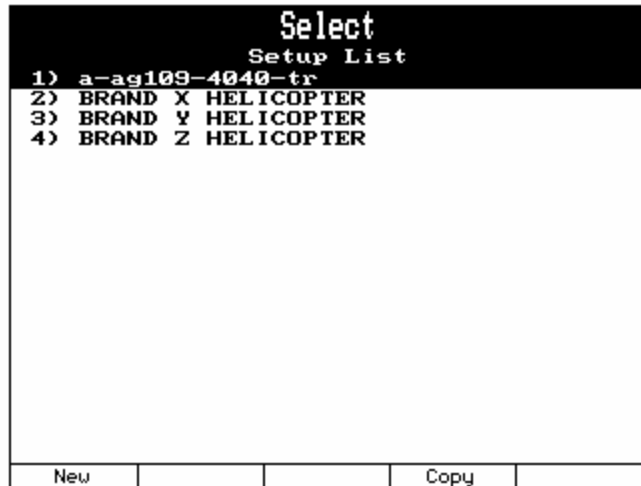
1. Insure the analyzer battery is charged prior to starting the job. See the Model 4040 User Manual #4040-OM-01 (P/N 75-900-4040) Chapter 2 for detailed instructions on battery charging.
2. Turn the analyzer ON by pressing the [ON/OFF] key.
3. From the Main Menu shown below, select “Tail Rotor Balance” and press the [ENTER] key.



4. From the Tail Rotor Balance Menu shown below, select “Start Job” and press the [ENTER] key.



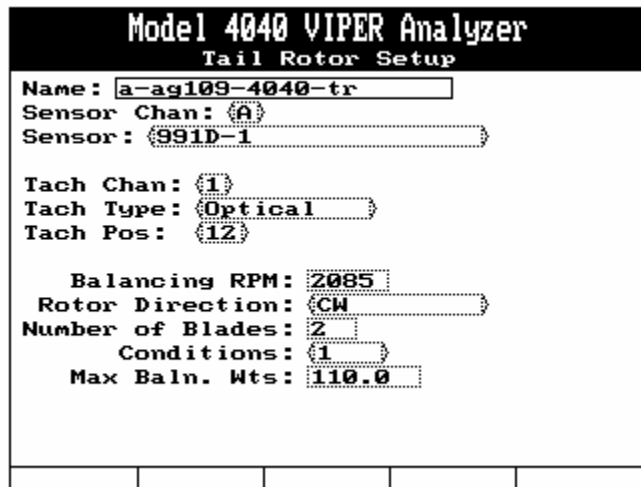
5. If the Agusta A109 Series is listed in the Setup List, select it using the [↓] key, press [ENTER] and go to Section D below. If the Agusta A109 Series is not in the Setup List, press the [F1], “New” key and go to step 6 below.



- The “Tail Rotor Setup” screen now appears. Enter the Tail Rotor Setup as shown below. You can enter any name that is convenient for locating the setup in the future. When completed press [ENTER].

**NOTE**

Fill in the fields of this screen from the PhotoTach’s perspective.



- The “Tail Rotor Chart Setup” screen will appear next as displayed below. Enter the information as indicated in the illustration below. Press [ENTER] to continue.

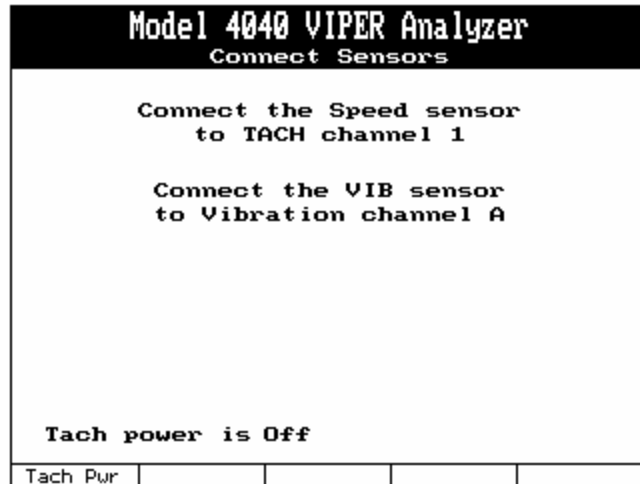
Model 4040 VIPER Analyzer			
Tail Rotor Chart Setup			
Name:	a-ag109-4040-tr		
Chart Type:	Regular	Num WtPos:	12
Grams/IPS:	10.000		
WtPos	Add @	WtPos	WtPos
1	10 : 00	8	
2	9 : 00	9	
3		10	
4		11	
5		12	
6			
7			
WtPos MUST be in CW or CCW order			

## D. Data Acquisition

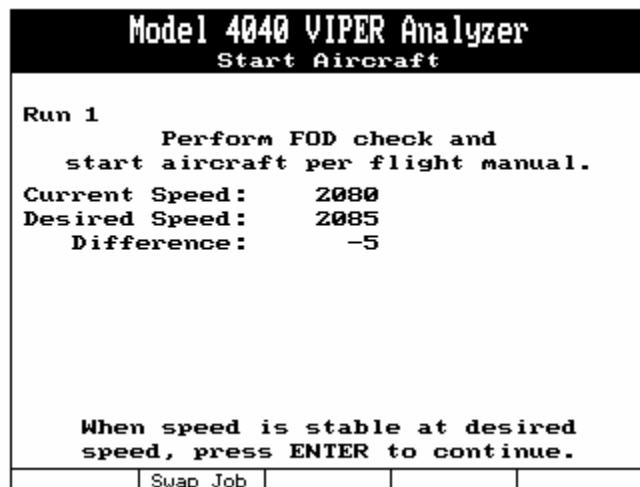
- The “Job Identification” Screen will be displayed, as shown below. Use the analyzer keypad to enter a customer name in the “Name:” field. The analyzer will maintain a list of customer names as new names are entered. If names have been previously entered into this analyzer, you may press the [F1] “Names” key and select a customers name from the provided list. Press the [↓] key to move to the next field and use the analyzer keypad to enter the optional aircraft registration and aircraft total time as required. When all fields are complete, press the [ENTER] key to accept and continue.

Model 4040 VIPER Analyzer			
Job Identification			
Name:	CUSTOMER NAME		
A/C Registration:	N1234		
A/C Total Time:	123.4		
Press ENTER to continue			
Names			

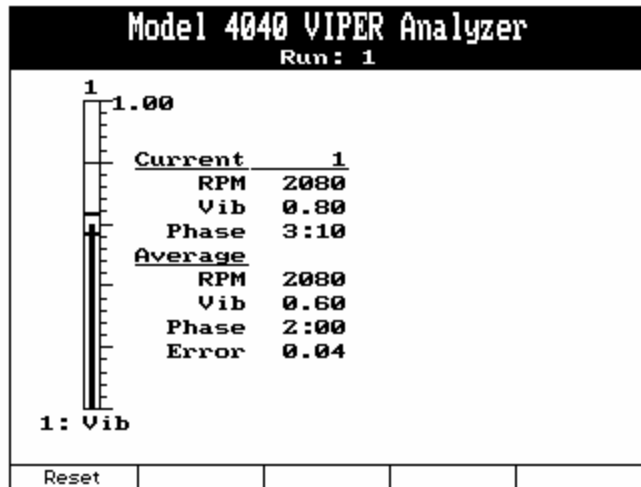
- The next screen to be displayed will be the “Connect Sensors” screen as illustrated below. This screen gives instructions on installing sensors and cables. You may also check the Phototach alignment by pressing the [F1] “Tach Pwr” key which supplies power to the optical tachometer for checking alignment with the reflective tape.



- a. Press [F1] “Tach Pwr”. Select a blade to be identified as the target blade. (See Section B Figure 3)
  - b. Hold a 2-inch piece of reflective tape (Item 7), reflective surface facing the Phototach, against the backside of the blade. Do not remove backing at this point.
  - c. The red “Gate” light on the back of the Phototach should illuminate as the reflective tape is properly aligned in front of the LED. Clean an area of the blade in preparation for mounting the reflective tape.
  - d. Remove the backing and install the reflective tape on the clean blade surface.
  - e. Press [ENTER] when finished with Tape installation.
3. The “Start Aircraft” screen will be displayed with instructions to “Perform FOD check and start aircraft per flight manual”. When the aircraft is started and normal operating conditions have been established, press the [ENTER] key to continue. Use the [F2] “Swap Job” key to return directly to the Main Menu without rebooting the analyzer.

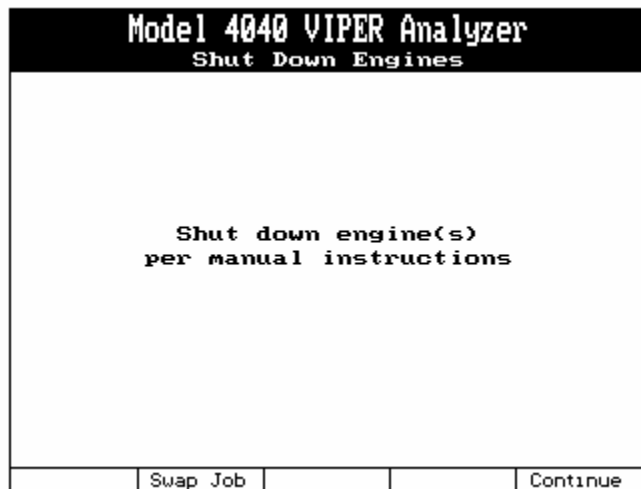


- The analyzer will present the data acquisition screen as shown. This screen allows you to monitor both the current and averaged vibration readings. While monitoring the measurement, you may press the **[F1]** “Reset” key to restart the averaging process. Use this feature as a way to validate the quality of the measurement. If the averaged readings return to a value similar to that prior to being “Reset”, the measurement can be considered good. If the measurement is not similar, you may choose to “Reset” the average again.



See the Model 4040 User Manual #4040-OM-01 (P/N 75-900-4040) Chapter 20 for detailed instructions on how to read the “Converging Vibration Indicator and Scale.”

- You will be prompted to “Shut down engine(s) per manual instructions” as shown below. Use the **[F2]** “Swap Job” key to return directly to the Main Menu without rebooting the analyzer. Press **[F5]** to proceed after engine shut down.



- The “Review Prior Run(s) Data” screen will appear as shown below. This screen allows the user to view the vibration readings that were acquired during the condition. Press **[F1]** to “Retake” the data or **[ENTER]** to continue. Pressing **[F5]** will “Quit Job”.

Model 4040 VIPER Analyzer			
Review Prior Run(s) Data			
Run	RPM	IPS	Clock
1	2080	0.600	2:00
Retake #1			

- The “T/R Sugg. & Inst. Wts” screen will present a suggested solution based on the chart created in the original setup and the vibration IPS and clock reading. You have the opportunity to install the suggested weight corrections or decide on a different corrective action. It is important that the entry under the “Enter Installed Weights” reflect the actual weight amounts and locations used.

Model 4040 VIPER Analyzer			
T/R Suggested/Installed Weights			
Run 1	Suggestion:		
Chart:	a-ag109-4040-tr		
9	6.0	10	0.0
Enter Installed Weights:			
1	0.0	11	0.0
2	0.0	12	0.0
3	0.0		
4	0.0		
5	0.0		
6	0.0		
7	0.0		
8	0.0		
9	7.0		
10	0.0		
Inst=Sugg	Inst=None		Quit Job

**CAUTION**

At no point should a correction be made that contradicts information in the maintenance manual.

Using the keypad, record the actual weight(s) installed between runs and their location. If you choose to remove weight from an opposite or alternate position, enter the negative adjustment. Do this by moving the highlight to the appropriate field, press the [SPACE+/-] key once to produce a (-).

To remove all values in the suggested column use the [F2] “Inst=None” key. If you decide you would like to revert back to the suggested weights use [F1] “Inst=Sugg” key.



The [F5] “Quit Job” exits the balance job with no provisions to resume the job at a later point in time. If you wish to leave the job and be able to resume it later, press the [MAIN MENU] key.

8. When you have finished with the solution process, press [ENTER] and you will be taken to the “Start Aircraft” screen as shown in Paragraph 3 of this section to continue the balance process.

## E. Quit Job

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1. Repeat steps D.3 through D.8 applying the solutions as necessary. When you are satisfied with the balance results, you can quit the job from any screen displaying the [F5] “Quit Job” key. Pressing this key will mark the job as complete.
2. From the screen shown below, decide if you would like to update the ICF used in the original setup. Pressing [F1] “Yes” will add the chart corrections from this job to the ICF from the original setup. This can be a powerful tool when using this setup in the future. The chart corrections learned as a result of the previous job will be applied from the beginning of the next job that uses the same setup. This can reduce the number of runs required to balance the helicopter. If you select [F3] “No” any chart corrections applied during the previous job will be discarded. The setup will revert to the chart settings in place before the job was started. This can be useful if the helicopter didn’t respond as others of the same model or if a mistake was made somewhere during the job that caused extra runs to balance the helicopter.

Model 4040 VIPER Analyzer				
Update Setup ICFs?				
Do you want to update the setup's influence coefficients based on the result of this job?				
Yes				No