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Propeller Balance Monitoring System (PBMS)

MAINTENANCE TERMINAL USER MANUAL

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Maintenance Terminal Manual (PBMS)

RECORD OF REVISIONS

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RECORD OF TEMPORARY REVISIONS

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INTRODUCTION

1.   General

This manual provides information on the Propeller Balance Monitoring System (PBMS) supplied by Ultra Electronics, Precision Control Systems. The manual is divided into the following sections:

- Introduction
- PBMS Description and Operation
- Balance Procedures
- PBMS Terminal

The PBMS system provided by Ultra Electronics, Precision Control Systems is designed to provide balance information taken from data gathered during flight to enable maintenance engineers to best balance their aircraft propellers for the in-flight condition.

NOTE: It may also be used to provide balance information taken from data gathered during ground runs as long as the set-up conditions are within the guidelines described in Section 3.C.4. However, it must be understood that although the resulting balance data will be valid it will not be optimised for the 'In-Flight' condition.

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ABBREVIATIONS AND ACRONYMS

Abbreviations	Definition
AC	Alternating Current
ANCU	Active Noise Control Unit
ANVC	Active Noise and Vibration Control
PBMS	Propeller Balance Monitoring System
VGA	Video Graphics Adaptor

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1. DESCRIPTION AND OPERATION

    A. System Description

        (1) The functions of the Propeller Balance Monitoring System (PBMS) are:

            (a) To automatically determine and store the data required to calculate the level of propeller unbalance during normal revenue flight operation.

            (b) To use this data, during ground maintenance, to define the redistribution of weights in the propeller balance plane necessary to achieve propeller balance within specified limits.

        (2) PBMS consists of:

            (a) A Vibration Sensor mounted on each propeller gearbox or engine.

            (b) A data processing function contained within the Active Noise Control Unit (ANCU).

            (c) The PBMS Terminal.

        (3) During flight the ANCU processes the outputs of the Vibration Sensors together with data such as propeller rpm. The data required to calculate the level of unbalance is recorded and stored automatically.

        (4) The unbalance data stored in the ANCU can be retrieved via a serial interface to the PBMS Terminal. The PBMS Terminal interprets the data to display vibration levels and calculate balance solutions. The balance solutions define a distribution of masses necessary to achieve balance within specified limits.

    B. ANCU Description

        (1) The ANCU is an ARINC 600 4MCU sized unit, hard mounted to the aircraft on four feet.

        (2) Electrical connections to the ANCU are as follows:

            (a) Up to five EPX connectors, J1 through J4 and J6, mounted on the rear endplate.

            (b) A 9 way D-type connector, J5, mounted on the front endplate.

            (c) A MIL-C-38999 connector, J7, mounted on the front endplate.

        (3) The majority of the connections to the ANCU relate to its Active Noise and Vibration Control function. The Connectors used for the PBMS function are:

            (a) J1 which is the input connector for aircraft +28V dc power and the frequency reference signals which define the propeller engine speeds.

            (b) J7 which is the input connector for the Vibration Transducer signals.

            (c) J5 provides the EIA-232 interface to the PBMS Terminal.

        (4) A Tri-State LED indicator on the front endplate displays the system status.
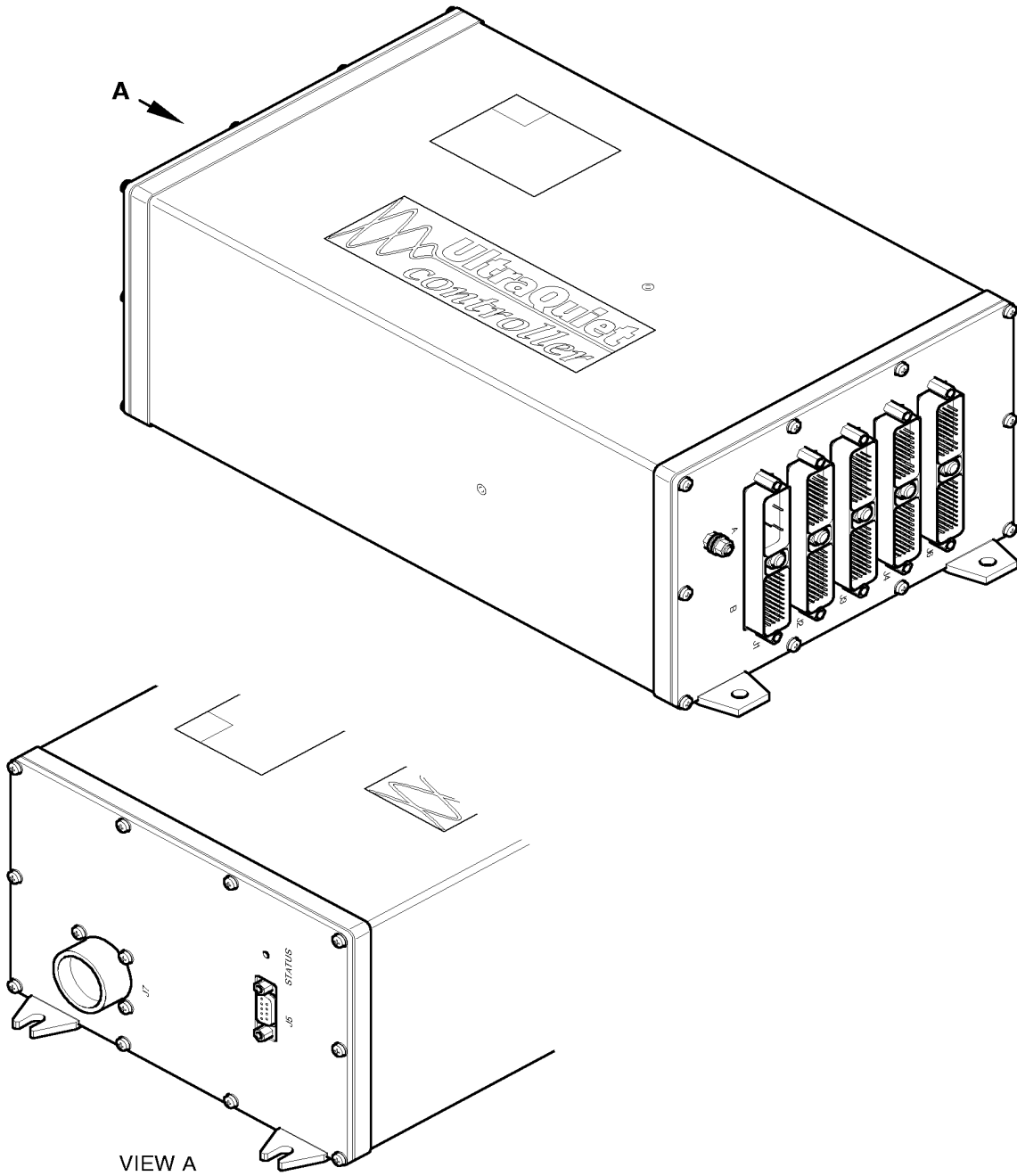
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Figure 1-1 Active Noise Control Unit

C.   Vibration Sensor Description

(1)   The PBMS Vibration Sensor consists of a miniature sensor element and interface circuit encased within a sealed enclosure. It is attached to the engine gearbox using a single bolt. Power for the Vibration Sensor is provided by the ANCU.

D.   PBMS Terminal Description

(1)   The PBMS Terminal consists of Ultra Electronics proprietary software running on a laptop PC. The basic functions provided are:

    (a)   Read data from the ANCU and store it on the PBMS Terminal's hard drive.

    (b)   Show the vibration levels on the PBMS Terminal display.

    (c)   Calculate the balance weight installation required to minimise propeller engine vibration.

E.   PBMS Terminal Printer

(1)   The PBMS Terminal can print to the file types that follow:

    (a)   .TXT (text)   These files can be viewed and printed from most word processing packages.

    (b)   .BMP (graphics)   These files can be viewed, and printed from most graphics packages.

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2.   PBMS TERMINAL

A.   General

   (1)   This section details the procedures for using the PBMS Terminal.

   (Note: the term PBMS Terminal is used to describe the PBMS Terminal Software operating on a laptop PC.) The procedures that follow are described as:

   (a)   Start the PBMS Terminal (Reference Paragraph E);

   (b)   Read PBMS Data from a ANCU (Reference Paragraph F);

   (c)   Read PBMS Data from a File (Reference Paragraph G);

   (d)   Display Vibration Levels (Reference Paragraph H);

   (e)   Calculate a New Balance (Reference Paragraphs I and J);

   (f)   PBMS Terminal Set-up (Reference Paragraph K);

   (g)   Exit the PBMS Terminal Session (Reference Paragraph M);

   (2)   The examples of PBMS terminal screens shown in the section that follows may differ slightly depending on aircraft type.

B.   PBMS Terminal Requirements

   (1)   Hardware

   (a)   A 386 SX Processor or above.

   (b)   A PCMIA drive (optional)

   (c)   A VGA compatible display.

   (d)   Windows XP or 7 Operating System.

   (e)   A minimum of 1 Mbyte of RAM.

   (f)   A hard disk with at least 10 Mbytes of free disk space.

   (g)   Battery power with a minimum battery life of at least 1.5 hours.

   (h)   CD ROM Drive.

   (2)   Software

   (a)   PBMS Terminal Software supplied on a CD-ROM as part of the Ground Support Software for Active Noise and Vibration Control Systems. The PBMS Terminal software contains the following files:

   - Pbms.exe (PBMS Terminal executable file).

   - Dash 8 Databases.

   - PBMS830.lng.

   - PBMShelp.Dat.

   - Ptmenu.lng.

   - Coure.fon.

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- Smalle.fon.
- User830.env.

C. PBMS Terminal Software Installation Procedure

(1) The PBMS Terminal programme is normally located in the same directory as the Maintenance Terminal Software i.e. C:\MT830 and is called PBMS.EXE.

(2) If it is not installed in this directory it can be installed using the procedure that follows:

(a) Insert the CD-ROM Part No. 8-800-07-040 (Windows 7) or 8-800-07-030 (Windows XP) in the CD-ROM Drive (D: Drive). The Software should run automatically.

NOTE: YOU MAY NEED TO IDENTIFY THE DRIVE LETTER FOR YOUR CD-ROM DRIVE. ON MOST PC'S, THIS WILL BE THE D: DRIVE. THE FOLLOWING PROCEDURE USES THIS DRIVE IDENTIFICATION. IF YOUR PC IS DIFFERENT YOU WILL NEED TO REPLACE D: WITH THE APPROPRIATE LETTER.

(b) If the Software does not start:

(i) Select 'Start' from the Windows taskbar

(ii) Select 'Run'

(iii) Type: **D:\setup.exe**

(iv) Select 'OK'

(c) Follow the on-screen prompts to the License Agreement.

(d) Read the License Agreement.

(e) You must agree to the license before you can continue with the installation.

(f) Select the directory where the software is to be installed. The default is 'C:\MT830'

(g) Select PBMS Terminal Software by clicking on the drop-down box at the side of the feature and select 'Will be installed on local hard drive' to install the feature.

(h) Select the 'Next' button and follow the on-screen prompts to begin installation.

(i) When installation has finished put the CD-ROM back into its protective sleeve and store it in a safe place.

D. Registering the PBMS Terminal

(1) This process is required to be followed the first time after the PBMS Terminal Software has been installed onto a laptop PC.

NOTE: YOU DO NOT HAVE TO CONNECT THE PBMS TERMINAL TO THE ANCU FOR THE REGISTRATION PROCESS

(2) Switch the Laptop PC on.

(3) Open from the PBMS icon created on the Windows Desktop or in Windows Explorer double click **PBMS.exe** located in **C:/MT830.**

(4) After a few seconds the Welcome screen will be shown (Refer to Figure 2-1) followed by the Registration Check Screen (Refer to Figure 2-2).
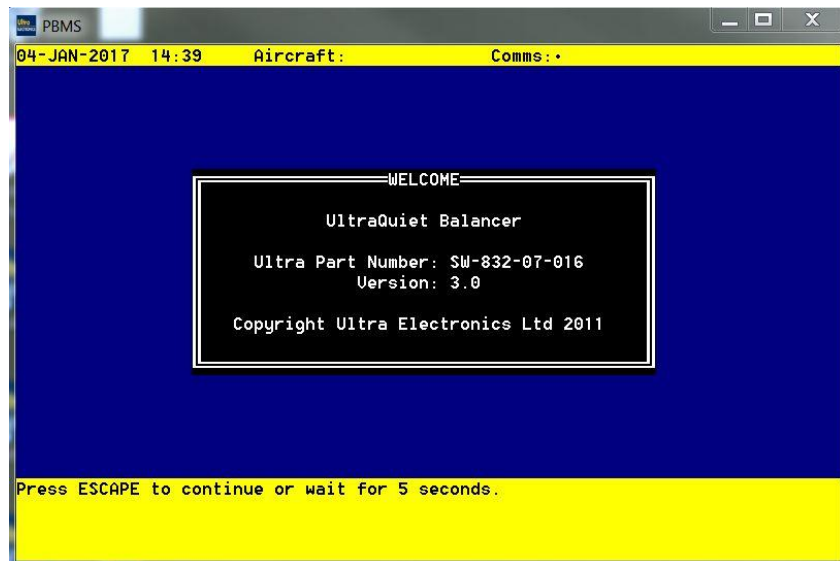
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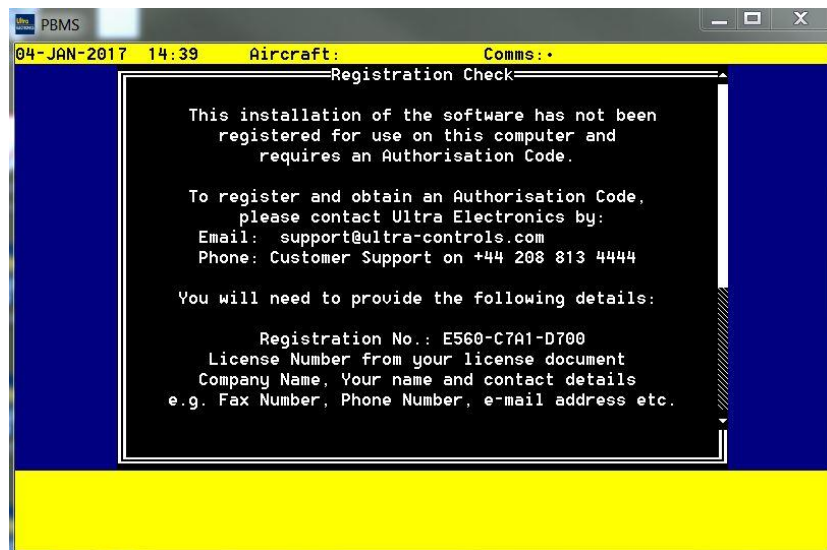

Figure 2-1 Welcome Screen

Figure 2-2 Registration Check Screen

(5)   Call or E-mail Ultra Electronics for your Authorisation Code. You will need to give the information that follows:

(a)   Your name and Company name.

(b)   The software licence number from the label inside the CD case.

(c)   The Registration Number generated by the PBMS Terminal (Refer to Figure 2-2).

(d)   A contact telephone number.

Once you have an Authorisation Code press <ENTER>. The Software Registration Screen will be shown (Refer to Figure 2-3).
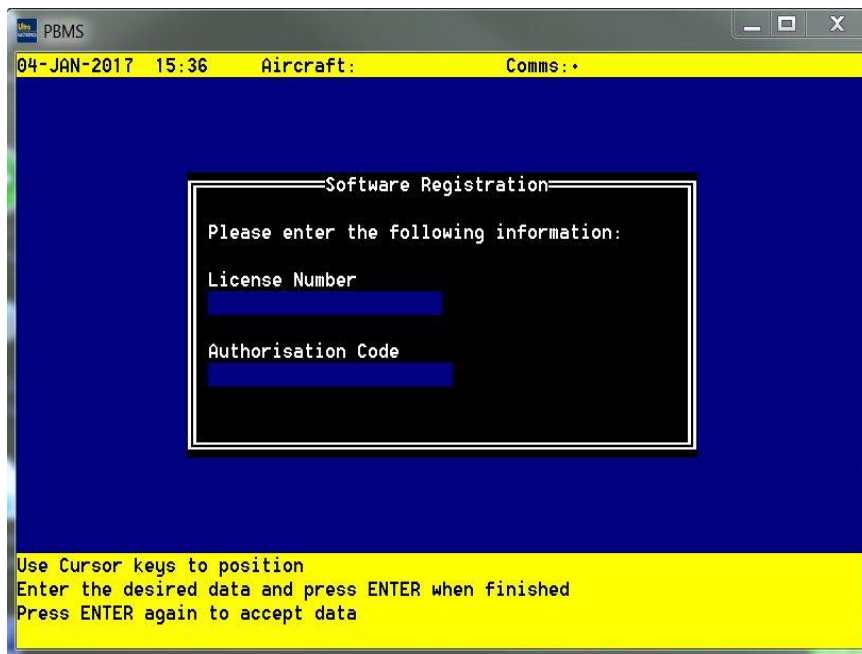
Figure 2-3 Software Registration Screen

(6)   Enter your licence number on to the registration screen.

(7)   Enter the Authorisation Code as supplied by Ultra Electronics, Precision Control Systems and press <ENTER>.

(8)   The registration process is required for the first installation of the PBMS Terminal and when your authorisation code expires.

E.   Start the PBMS Terminal

(1)   This process is to be followed each time the PBMS Terminal is started.

(a)   Switch on the PBMS Terminal (laptop PC).

(2)   Double click the PBMS icon created on the Windows Desktop or in Windows Explorer double click **PBMS.exe** located in **C:/MT830.**

(a)   After 5 seconds the 'Log File Details' screen will be shown on the PBMS Terminal display (Refer to Figure 2-4).

Figure 2-4 Log File Details Screen

(3)   Enter the Aircraft Serial Number and the User ID (your name) and press <ENTER>.

(4)   The PBMS Terminal will show the log file name in which the maintenance session record will be stored. Press <ENTER> to confirm the data. The 'Main Menu' will be shown on the PBMS Terminal display (Refer to Figure 2-5).

Figure 2-5 Main Menu Screen

F.   Read PBMS Data from Controller

(1)   Connect serial cable from the PBMS Terminal to the J5 remote maintenance connector on the aircraft. Switch 'On' the ANVS.

> **NOTE: IF YOU ARE UNABLE TO COMMUNICATE WITH THE ANCU VIA THIS CONNECTOR THEN YOU SHOULD USE J5 CONNECTOR ON THE FRONT OF THE ANCU.**

(2)   Select 'Read PBMS Data from ANCU' from the 'Main Menu' and press <ENTER>. The PBMS Terminal will try to establish communications with the ANCU.

> **NOTE: DURING THIS SEQUENCE A NUMBER OF DIFFERENT SCREENS WILL BE SHOWN ON THE PBMS TERMINAL DISPLAY. ON COMPLETION, IF SUCCESSFUL, THE SCREEN SHOWN BELOW WILL BE DISPLAYED ON THE PBMS TERMINAL DISPLAY (REFER TO FIGURE 2-6).**
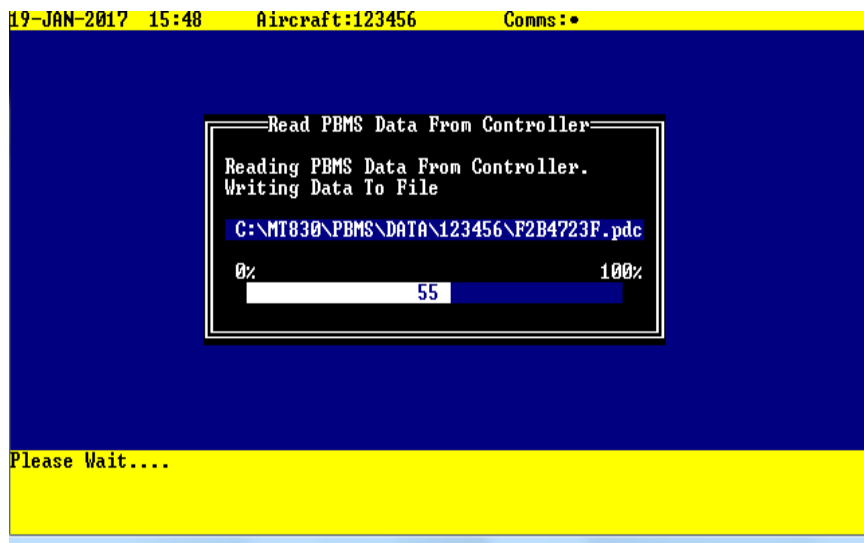
Figure 2-6 Read PBMS Data from ANCU Screen

(3)   The PBMS Terminal will then read data from the ANCU and write the data into a file (the file name is shown on the screen). The PBMS Terminal provides an indication of progress (Ref Figure 2-6).

(4)   After reading data from the ANCU to the PC, the data will then be read into the PBMS Terminal ready for use.

> **NOTE: ONCE THE DATA HAS BEEN READ BY THE PBMS TERMINAL IT WILL NO LONGER EXIST ON THE ANCU.**

(5)   The PBMS Terminal will return to the 'Main Menu' at the completion of this operation.

G.   Read PBMS Data from File

(1)   Select 'Read PBMS Data from File' from the 'Main Menu' and press <ENTER>. The PBMS Terminal will show the data files available for the aircraft serial number entered in the 'Log Files Details Screen'.

(2)   Select the required data file using the curser keys and press <ENTER>.

    NOTE: WHERE MORE THAN ONE DATA FILE IS LISTED; THE FILE WITH THE MOST RECENT DATE SHOULD BE USED. THE MOST RECENT FILE WILL BE SHOWN AT THE TOP OF THE LIST.

(3)   The PBMS Terminal will show the message:

    'Reading Data. Please Wait…'

    and then return to the 'Main Menu'. The selected data file has now been loaded into the PBMS Terminal and data from this file will be used in the 'Display Vibration Levels' and 'Calculate New Balance' functions.

H.   Display Vibration Levels

(1)   Select 'Display Vibration Levels' from the 'Main Menu' and press <ENTER>. The PBMS Terminal shows the average vibration level for each sensor, on each engine, for each flight condition (Ref Figure 2-7). Use the cursor keys if required to scroll up and down the table. The maximum measured vibration level is also displayed.

    NOTE: THE VIBRATION UNITS USED IN THIS SCREEN CAN BE EITHER METRES PER SECOND, CENTIMETRES PER SECOND OR INCHES PER SECOND. INSTRUCTIONS ON HOW TO CHANGE THE UNITS DISPLAYED ARE PROVIDED IN PARAGRAPH K.2 PAGE 2-13.

(2)   To obtain a copy of the Vibration Levels press <Alt><P> on the PBMS Terminal. The vibration levels will be printed to a file.
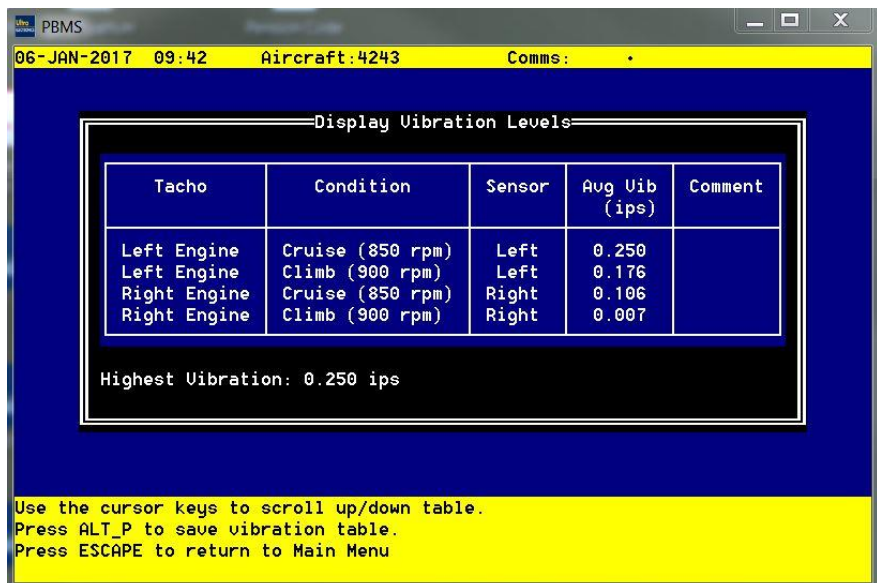

Figure 2-7 Display Vibration Levels Screen

(3)   Press Esc to return to Menu

NOTE: F1 CAN BE PRESSED AT ANY TIME FOR FURTHER INFORMATION WITH OTHER INSTRUCTIONS AT THE BOTTOM OF THE SCREEN.

I.   Calculate New Balance

(1)   Select 'Calculate New Balance' from the 'Main Menu' and press <ENTER>. The PBMS Terminal will ask you to select which engine requires the new balance (Refer to Figure 2-8). Select the required engine with the cursor key and press <ENTER>.

Figure 2-8 Tachometer Selection Screen

(2)   The PBMS Terminal will prompt you to enter an optional comment for the log file. After entering your comment, press <ENTER>.

NOTE: THE PBMS TERMINAL ACCEPTS BLANK ENTRIES IN THE COMMENTS LOG.

(3)   The 'Calculate New Balance' screen will be shown on the PBMS Terminal (Refer to Figure 2-9). At this point, the only data displayed on the screen are the vibration levels in the data being used to calculate the new balance.
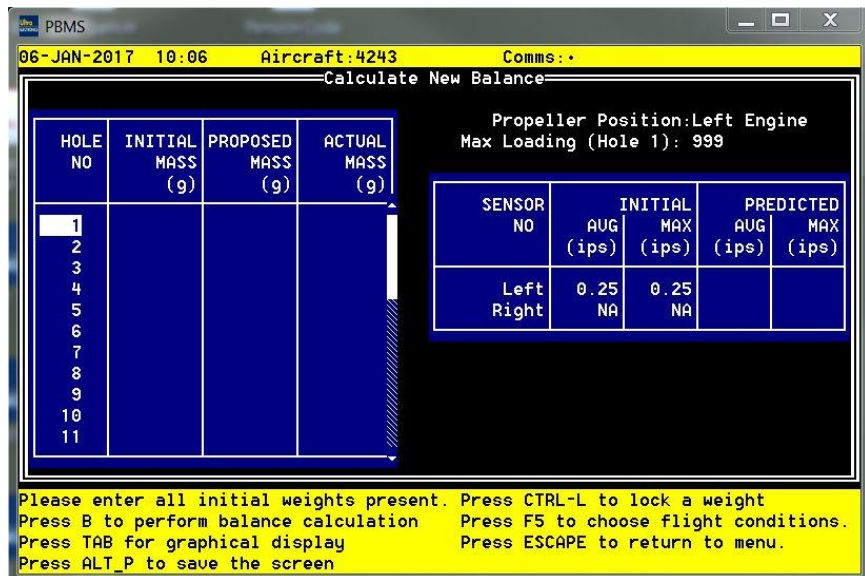
Figure 2-9 Calculate New Balance Screen

(4) The PBMS Terminal needs the following information before it can calculate a new balance:

(a) The balance weights currently installed on the propeller balance ring.

(b) What flight condition categories are to be used to calculate the new balance.

> **NOTE: THE VIBRATION UNITS USED IN THIS SCREEN CAN BE EITHER METRES PER SECOND, CENTIMETRES PER SECOND OR INCHES PER SECOND. THE MASS UNITS CAN BE KILOGRAMMES, GRAMMES OR OUNCES. INSTRUCTIONS ON HOW TO CHANGE THE UNITS DISPLAYED ARE PROVIDED IN PARAGRAPH 2.K(2) PAGE 2-13.**

(5) On initial entry to the 'Calculate New Balance' screen, the cursor is positioned ready for the mass of any weight installed at Hole No. 1 to be entered. Type in the weight of the mass installed and press <ENTER>. The cursor will move to the next hole no. If no weight is installed, type '0' and press <ENTER>. Repeat until data has been entered for all of the hole positions.

> **NOTE: THERE IS A MAXIMUM BALANCE WEIGHT ALLOWED FOR EACH HOLE, AND A TOTAL COMBINED MASS OF ALL INSTALLED BALANCE WEIGHTS. THESE LIMITS ARE DEFINED BY THE AIRCRAFT MANUFACTURER AND CONTAINED IN THE AIRCRAFT DATABASE CONFIGURATION PARAMETERS. THE PBMS TERMINAL SOFTWARE WILL NOT LET YOU EXCEED THESE LIMITS.**

(6) If for any reason an already installed weight cannot be removed, select the hole position with the cursor keys and press <CTRL> and <L> keys. The PBMS Terminal will mark the hole number with an asterisk. The PBMS Terminal will not change this weight when calculating the new balance weight positions.

(7)   Once data has been entered for all of the hole positions, a graphical display of the balance plane can be obtained by pressing the <TAB> key. This display can be used to confirm that the data on the balance weights currently installed has been correctly entered. Press <ESC> to return to the 'Calculate New Balance' Screen. (See Paragraph J for more information on the graphical display).

(8)   Press the 'F5' key to bring up the 'Flight Condition Selection' window (Refer to Figure 2-10). Use the cursor key to highlight a flight condition category and use the <SPACE BAR> key to switch it on or off. Press <ESC> to return to the 'Calculate New Balance' Screen.
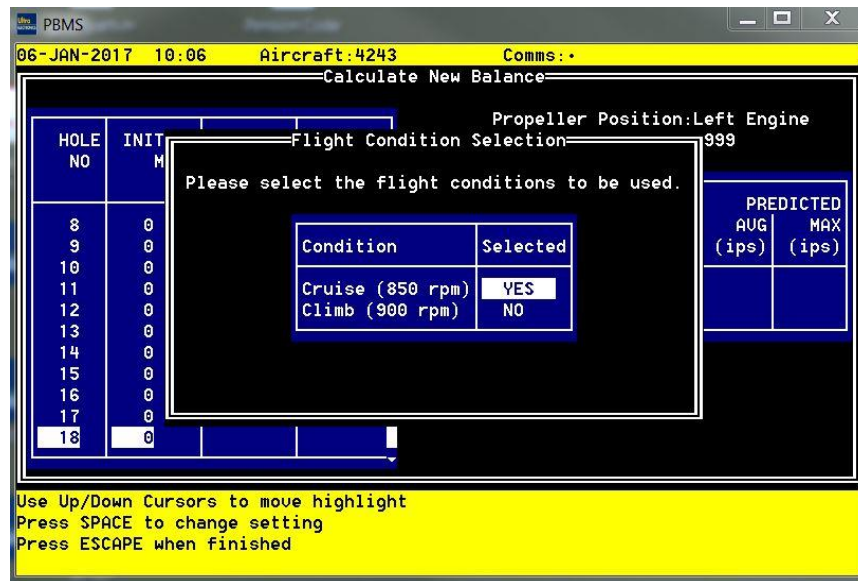
Figure 2-10 Flight Condition Selection Window

(9)   With the current balance weight data entered and the required flight conditions selected, press 'B' to perform the balance calculation. The PBMS Terminal will display the masses required at each Hole No. to reduce the vibration levels. The PBMS terminal will also display a prediction of the vibration levels that would be achieved with the proposed masses installed.

J.   The Balance Graphical Display

(1)   The Balance Graphical Display can be accessed from the 'Calculate New Balance' screen by pressing the <TAB> key as soon as the data on initial masses has been entered.

(2)   The Balance Graphical Display provides the following data:

- Initial Imbalance
- Hole Locations and Numbers
- Installed Masses
- Blade Positions
- Predicted Imbalance (after balance calculation has been run)
- Proposed Mass Installation (after balance calculation has been run)

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(3)   Figure 2-11 provides an example of a typical Balance Graphical Display

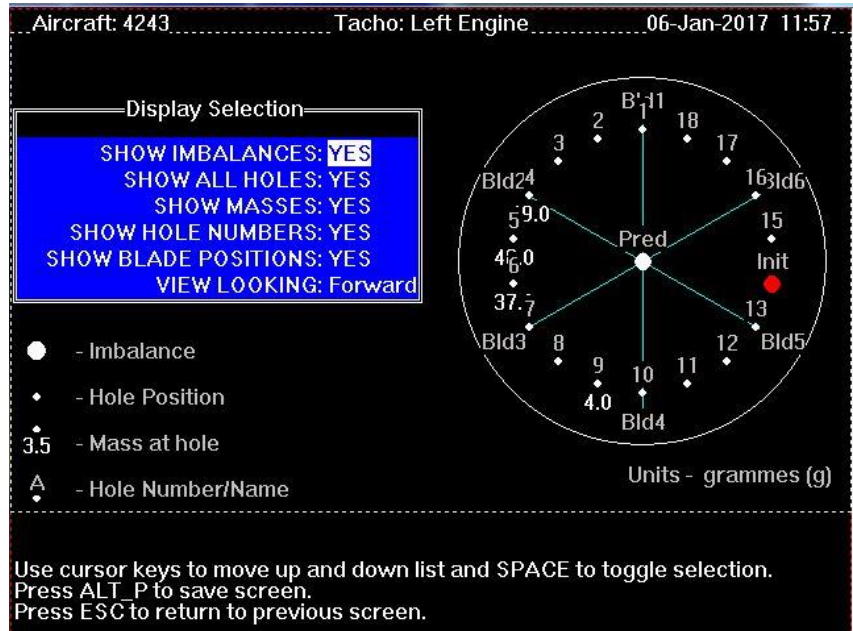**NOTE: Q400 AIRCRAFT HAVE18 HOLES. Q1/2/300 AIRCRAFT EACH HAVE 28 HOLES**

Figure 2-11 Balance Data Graphic Display

(4)   Items in the display can be switched on or off by using the cursor keys to select the item and then pressing the <SPACE BAR> to switch it on or off. The same process changes the view between 'Forward' and 'To Rear'.

(5)   To obtain a copy of the Balance Data Graphic Display, press <Alt><P> on the PBMS Terminal. The Balance data graphic display will be printed to a file. You can return to the 'Calculate New Balance' screen by pressing the <ESC> key.

K.   PBMS Terminal Set-up

   (1)   Set-up Menu

      (a)   Select 'Set-up Menu' from the 'Main Menu' and press <ENTER>. The 'Set-up Menu' will be shown on the PBMS Terminal display (Refer to Figure 2-12).

Figure 2-12 Set-up Menu Screen

   (2)   Measurement Units

      (a)   Select 'Measurement Units' from the 'Set-up Menu' and press <ENTER>. The Measurement Units will be shown on the PBMS Terminal display (Refer to Figure 2-13).

      (b)   Vibration units can be set to metres per second, centimetres per second or inches per second.

      (c)   Mass units can be set to kilogram's, grams or ounces.

      (d)   Use the cursor keys to select the measurement unit to be changed and then press <ENTER> to display the options.

      (e)   Use the cursor keys to select the required measurement unit and press <ENTER> to select it.

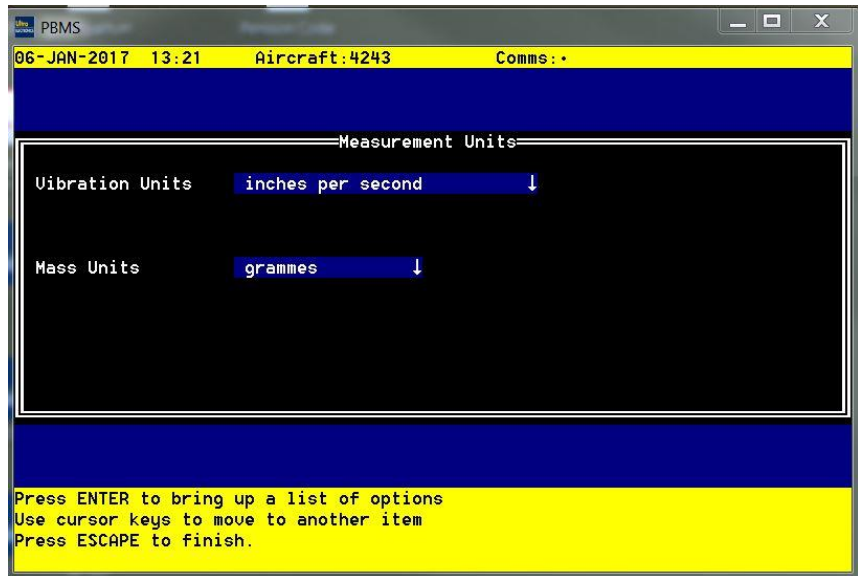   (f)   Press <ESC> to return to the 'Set-up Menu'.

Figure 2-13 Measurement Units Screen

(3) User Default Directories

(a) Select 'User Default Directories' from the 'Set-up Menu' and press <ENTER>. The PBMS Terminal display will show the list of 'User Default Directories' (Refer to Figure 2-14).
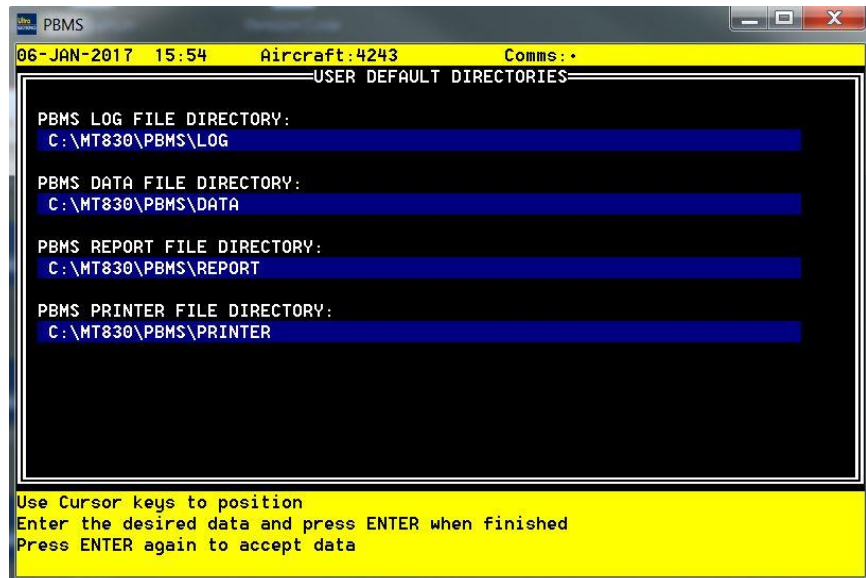

Figure 2-14 User Default Directories Screen

(b) The PBMS terminal stores data in 4 directories, below the main directories are:

- The Log File Directory. This stores session log files.

- The Data File Directory. This stores downloaded data.

- The Report File Directory. This is for future use.

- The Printer File Directory. This stores print files (.TXT or .BMP).

(c) Use the cursor keys to select the directory to be changed. Type in the new directory name and press <ENTER> when finished. Press <ENTER> again to accept the data. This action will take you back to the Set-up Menu.

(4) Flight Condition Set-up

(a) Select 'Flight Condition Set-up' from the 'Set-up Menu' and press <ENTER>. This will bring up the 'Flight Condition Selection' screen (Refer to Figure 2-15).
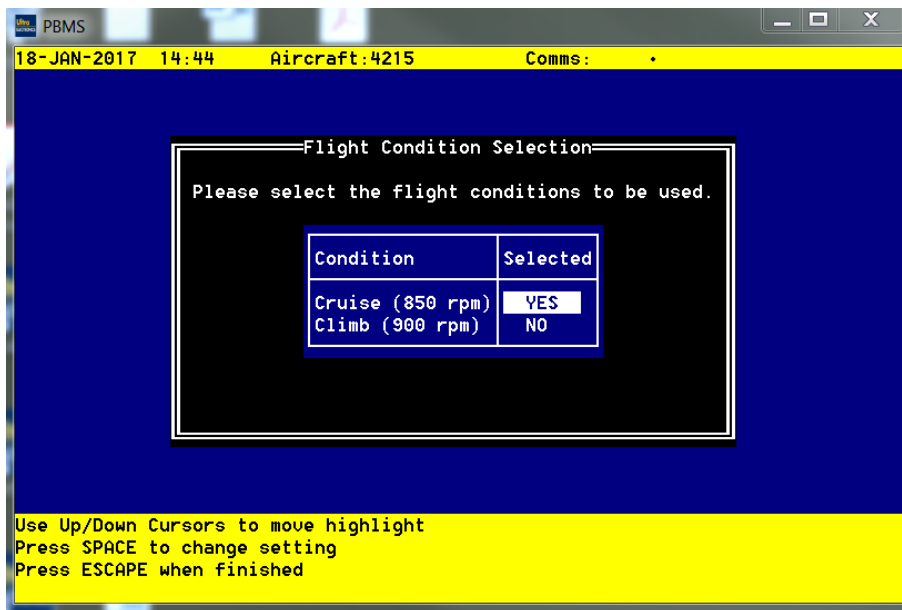

Figure 2-15 Flight Condition Set-Up Screen

(b) Use the cursor keys to select a flight condition category and use the <SPACE BAR> to switch it on or off. Press <ESC> to return to the 'Set-up Menu'.

(5) System Information

(a) Connect serial cable from the PBMS Terminal to the J5 remote maintenance connector on the aircraft. Switch 'On' the ANVS.

NOTE: IF YOU ARE UNABLE TO COMMUNICATE WITH THE ANCU VIA THIS CONNECTOR THEN YOU SHOULD USE J5 CONNECTOR ON THE FRONT OF THE ANCU.

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(b) Select 'System Information' from the 'Set-up Menu' and press <ENTER>. The PBMS Terminal will initialise communications with the ANCU and identify the ANCU.

NOTE: DURING THIS SEQUENCE A NUMBER OF DIFFERENT SCREENS WILL BE SHOWN ON THE PBMS DISPLAY. ON COMPLETION, THE PBMS TERMINAL WILL THEN DISPLAY THE SYSTEM INFORMATION SCREEN (REFER TO FIGURE 2-16).

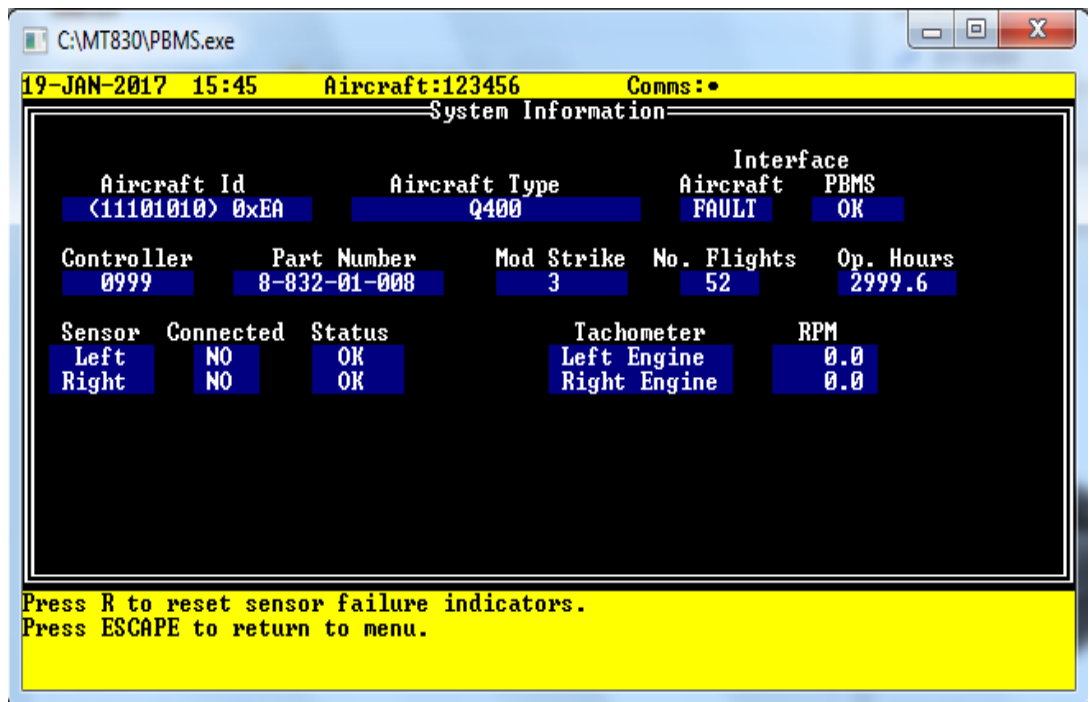(c) The information shown on the PBMS Terminal display is as follows:

Figure 2-16 System Information Screen

(d) The Data Labels on the System Information Screen at Figure 2-16 are detailed as follows:

•	Aircraft Id Setting	Hard wired code on the aircraft J1 connector used to identify the aircraft type
•	Aircraft Type	As identified by the aircraft ID (from database)
•	Interface Aircraft	RS 422 interface to ANCU
•	Interface PBMS	PBMS (internal) interface with ANCU
•	ANCU	Serial Number of ANCU held in ANCU memory
•	Part Number	Part Number of ANCU held in ANCU memory
•	Mod Strike	Mod Strike Number of ANCU held in ANCU memory
•	Sensor	Left & Right engine transducers, mounted to each gearbox housing
•	Connected	Sensor detected by ANCU
•	Status	Sensor reported as OK/Failed by ANCU
•	Tachometer Readings	From the Tachometer signal wiring on the aircraft wiring harness J1 connector

(e) Press <ESC> to return to the 'Set-up Menu'.

L. Production Menu

(1) This section is restricted by password and is not for general use therefore, it can only be used by personnel with the required data.

M. Exiting the PBMS Terminal

(1) To exit the PBMS Terminal, select 'Exit' from the 'Main Menu'. The message '**Exiting PBMS terminal Program. Log File Name C:\MT830\XXXX\YYYY\ZZZZZZZZ.log'** will be shown on the PBMS Terminal display. The saved Log File is a text file record of the communications between the PBMS Terminal and the <u>ANCU</u> during the maintenance session.

(a) XXXX is a sub directory set in the User Default Directory (Refer to Para K(3)).

(b) YYYY is a sub directory created with the same name as the aircraft serial number entered at the 'Log File Details' screen.

(c) ZZZZZZZZ.log is the name given to the log file created for the Maintenance Session you have just completed.

3.   BALANCE PROCEDURES

A.   Introduction

(1)   There are 4 steps to balance a propeller. They are:

(a)   Obtain in-flight vibration data from the ANCU.

(b)   Determine if the vibration levels exceed desired limits.

(c)   Calculate the mass and location of balance weights which will reduce the vibration to an acceptable level.

(d)   Install the balance weights.

(2)   The paragraphs that follow provide a description of each of the steps required to balance a propeller.

(3)   The examples of PBMS Terminal screens shown in the section that follows may differ slightly depending on aircraft type.

B.   Obtaining In-Flight Vibration Data

(1)   The Active Noise Control Unit (ANCU) stores 1P vibration data together with data such as propeller rpm and altitude in non-volatile memory. This process occurs automatically whenever propeller speed is above 300 rpm, requiring no operator action. The ANCU will store the last 75 hours of vibration data on the Q400 series aircraft and the last 125 hours on Q1/2/300 series aircraft.

(2)   The vibration data stored in the ANCU is accessed using the PBMS Terminal as follows:

(a)   Connect serial port 1 on the PBMS Terminal to connector J5 on the ANCU. Switch the ANCU to 'ON'.

NOTE: **IF THE AIRCRAFT HAS BEEN FITTED WITH A REMOTE J5 MAINTENANCE CONNECTOR THEN YOU SHOULD USE THIS CONNECTOR.**

(b)   Start the PBMS Terminal.

(c)   From the 'Main Menu' Select 'Read PBMS Data from ANCU' and press <ENTER>. The PBMS Terminal will try to establish communications with the ANCU.

NOTE: **DURING THIS SEQUENCE A NUMBER OF DIFFERENT SCREENS WILL BE SHOWN ON THE PBMS TERMINAL DISPLAY. ON COMPLETION, IF SUCCESSFUL, THE SCREEN THAT IS BELOW WILL BE DISPLAYED ON THE PBMS DISPLAY (REFER TO FIGURE 3-1).**
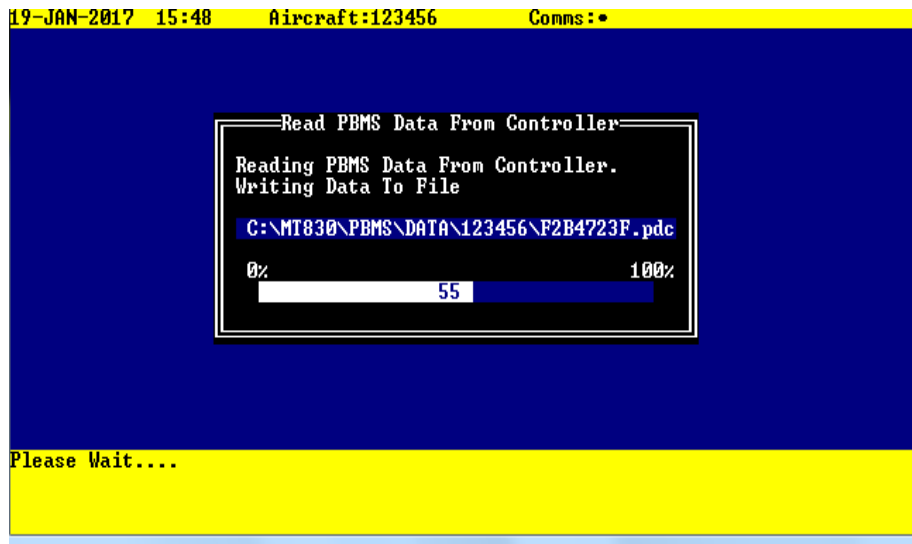
Figure 3-1 Read PBMS Data from ANCU Screen

(d) The PBMS Terminal will then read data from the ANCU and write the data into a file (the file name is shown on the screen). The PBMS Terminal display provides an indication of progress.

(e) The PBMS Terminal display will return to the 'Main Menu' when all the data has been read from the ANCU.

C. Determining Vibration Levels

(1) After the data has been read from the ANCU, it must be reviewed to determine if the vibration levels exceed the desired limits.

(2) If data has just been read from an ANCU, the PBMS Terminal will automatically use this data. Otherwise, the data to be used must be selected from one of the files stored on the PBMS Terminal. Data files are selected as follows:

(a) From the 'Main Menu' select 'Read PBMS Data From File' and press <ENTER>. The PBMS Terminal will show the data files available for the aircraft serial number you entered in the 'Log Files Details Screen'.

(b) Use the cursor keys to select the required data file and then press <ENTER>.

NOTE: WHERE MORE THAN ONE DATA FILE IS LISTED; THE FILE WITH THE MOST RECENT DATE SHOULD BE USED. THE MOST RECENT FILE WILL BE SHOWN AT THE TOP OF THE LIST.

(c) The PBMS Terminal display will show the message:

'Reading Data. Please Wait…'

and then return to the 'Main Menu'. The selected data file has now been loaded into the PBMS Terminal. Data from this file will be used in the 'Display Vibration Levels' and 'Calculate New Balance' functions.

(3)   To show vibration levels, from the 'Main Menu' select 'Display Vibration Levels' and press <ENTER>.

(4)   The PBMS Terminal processes the vibration data from each PBMS Sensor into one of two pre-defined flight conditions. These flight conditions are as follows:

BOMBARDIER DASH 8 Q400		
Parameter	**Category 1**	**Category 2**
Propeller 1	840 – 860 rpm	890 to 910 rpm
Propeller 2	840 – 860 rpm	890 to 910 rpm
BOMBARDIER DASH 8 Q200/Q300/S300 Retro-fit		
Parameter	**Category 1**	**Category 2**
Propeller 1	1044-1064	900-920
Propeller 2	1044-1064	900-920

(5)   The 'Display Vibration Levels' screen (Refer to Figure 3-2) shows the average vibration level for each PBMS Sensor on each engine for each flight condition. Use the cursor keys to scroll up and down the table if required. The maximum vibration level is also shown
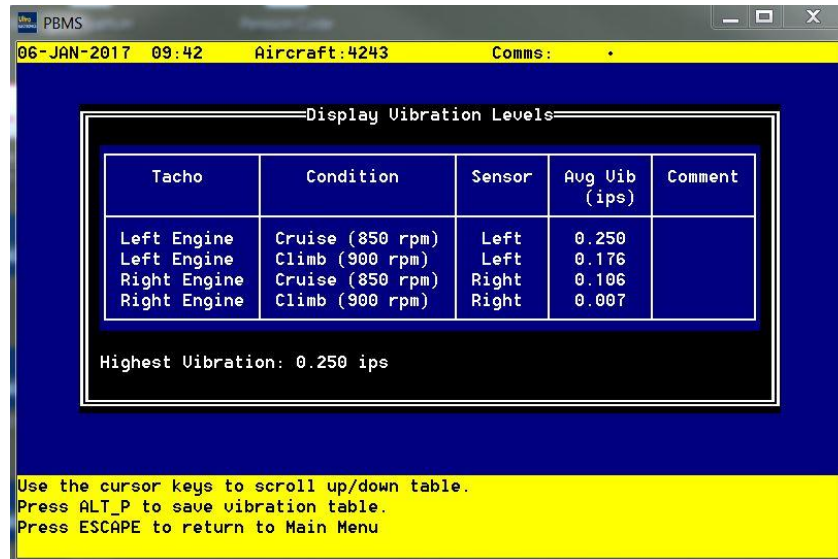

Figure 3-2 'Display Vibration Levels' Screen

NOTE: THE VIBRATION UNITS USED IN THIS SCREEN CAN BE EITHER METRES PER SECOND, CENTIMETRES PER SECOND OR INCHES PER SECOND. INSTRUCTIONS ON HOW TO CHANGE THE UNITS DISPLAYED ARE PROVIDED IN SECTION 2.K.3.

(6)   To obtain a copy of the Vibration Levels follow the on-screen instructions shown at the bottom of the display. The vibration levels will either be printed to the dedicated printer connected to the parallel port or to a file. This is dependant on the printer set up which is defined in Section 2.K.3.

(7)   Press <ESC> to return to the 'Main Menu'.

D.   Calculate a Balance Solution

(1)   From the 'Main Menu' select 'Calculate New Balance' and press <ENTER>. The PBMS Terminal will ask you to select which engine requires the new balance. Use the cursor keys to highlight the required engine and press <ENTER>.

(2)   The PBMS Terminal will prompt you to enter a comment for the log file. Enter a comment and press <ENTER>.

NOTE: THE PBMS TERMINAL WILL ACCEPT A BLANK ENTRY IN THE COMMENTS.

(3)   The 'Calculate New Balance' screen will be shown on the PBMS Terminal (Refer to Figure 3-3). At this point, the only data shown on the screen are the vibration levels in the data being used to calculate the new balance.
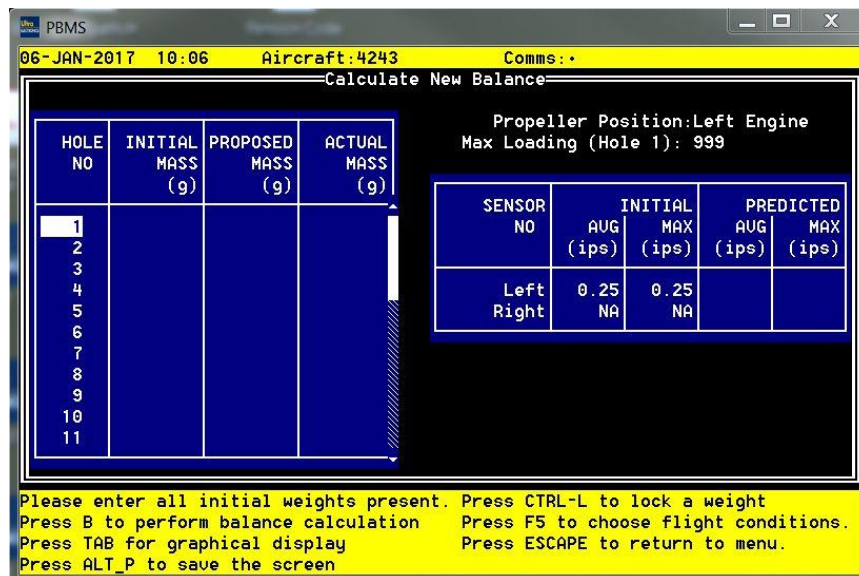

Figure 3-3 Calculate New Balance Screen

(4)   Before a new balance can be calculated, the PBMS Terminal needs the information that follows:

(a)   The balance weights currently installed on the propeller balance ring.

(b)   What flight condition data is to be used to calculate the new balance.

NOTE: THE VIBRATION UNITS USED IN THIS SCREEN CAN BE METRES PER SECOND, CENTIMETRES PER SECOND OR INCHES PER SECOND AND THE MASS UNITS CAN BE KILOGRAMMES, GRAMMES OR OUNCES. INSTRUCTIONS ON HOW TO CHANGE THE UNITS SHOWN ARE PROVIDED IN SECTION 2.K.2.

(5)   When the 'Calculate New Balance' screen is first shown on the display the cursor is positioned ready for the mass of the balance weight installed at Hole No. 1 to be entered. Type in the mass of the balance weight installed at Hole No. 1 and press <ENTER>. The cursor will move to the next hole number. If no balance weight is installed you must type '0' and press <ENTER>. Repeat this until data has been entered for all of the hole positions.

> NOTE: THERE IS A MAXIMUM BALANCE WEIGHT ALLOWED FOR EACH HOLE, AND A TOTAL COMBINED MASS OF ALL INSTALLED BALANCE WEIGHTS. THESE LIMITS ARE DEFINED BY THE AIRCRAFT MANUFACTURER AND CONTAINED IN THE AIRCRAFT DATABASE CONFIGURATION PARAMETERS. THE PBMS TERMINAL SOFTWARE WILL NOT LET YOU EXCEED THESE LIMITS.

(6)   If for any reason a previously installed balance weight cannot be removed, use the cursor keys to select the hole position and press <CTRL> and <L> keys. The PBMS Terminal will mark the hole number with an asterisk. The PBMS Terminal will not change this balance weight when the new balance weight positions are calculated.

(7)   Once the data has been entered for all of the hole positions, a graphical display of the balance plane can be obtained by pressing the <TAB> key. This display can be used to confirm that the data on the balance weights currently installed has been correctly entered. Press <ESC> to return to the 'Calculate New Balance' screen. Refer to Figure 2-8.

(8)   Press the <F5> key to bring up the 'Flight Condition Selection' window (Refer to Figure 3-4). Use the cursor key to select a flight condition and use the <SPACE BAR> to switch it on or off. Press <ESC> to return to the 'Calculate New Balance' Screen.
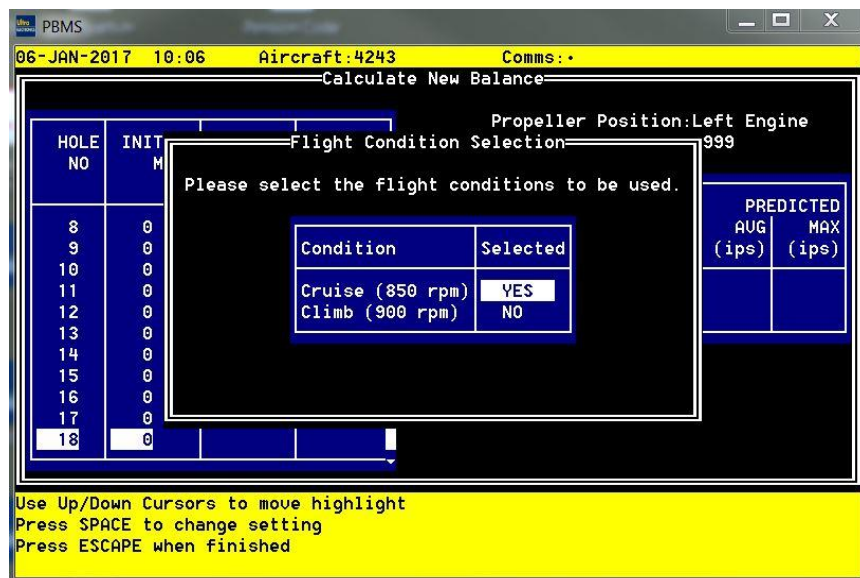

Figure 3-4 Flight Condition Selection Window

(9)   With the current balance weight data entered and the required flight conditions selected, press <B> to perform the balance calculation. The PBMS Terminal will display the masses required at each Hole No. to reduce the vibration levels. The PBMS Terminal will also show a prediction of the vibration levels that would be achieved with the proposed mass installations. (Refer to Figure 3-5)

(10)   If the proposed mass cannot be achieved on a certain hole then complete the 'actual mass' column with the new actual masses installed at each hole.

(11)   Press<B> to repeat the balance calculations.

(12)   The PBMS Terminal will now show a prediction of the vibration levels that would be achieved with the new actual mass installations (Refer to Figure 3-6).
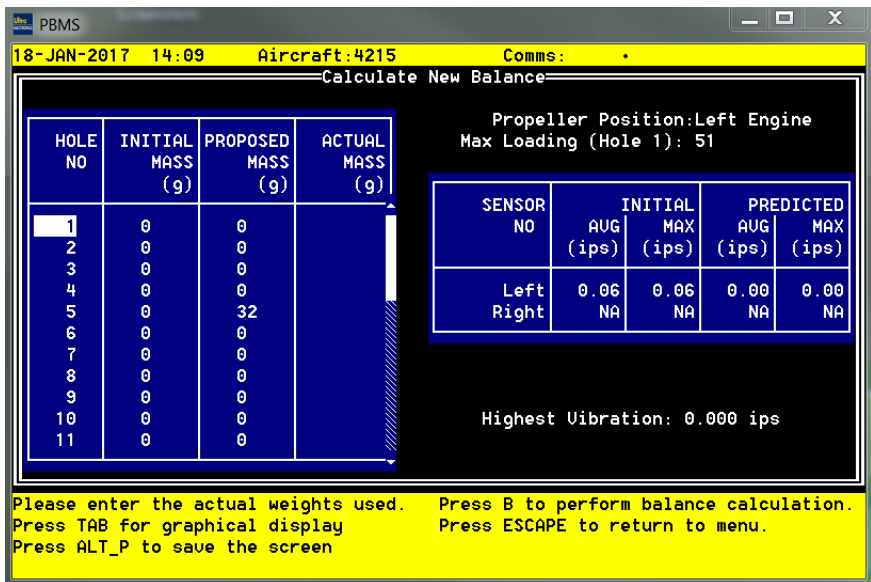
Maintenance Terminal Manual (PBMS)
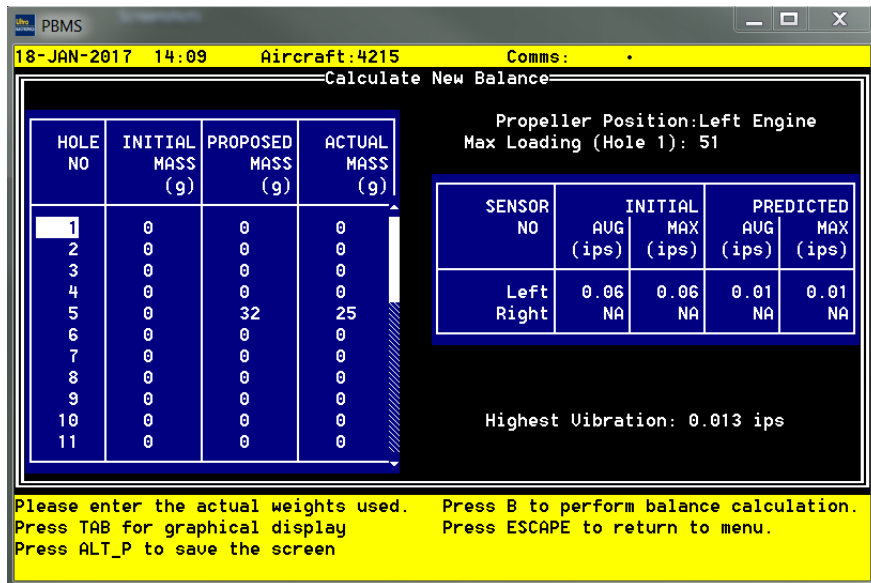

Figure 3-5 Calculate New Balance (2) Screen

Figure 3-6 Calculate New Balance (3) Screen

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4.   ERROR MESSAGES

The following Error Messages may be observed during operation PBMS Maintenance Terminal.

ERROR MESSAGE	DESCRIPTION
"Invalid Aircraft Serial Number"	An Aircraft Serial Number of at least 4 digits must be entered into the field in the 'Log Files Details Screen'.
"You Must Enter Your Name"	Your name must be entered into the field in the 'Log Files Details Screen'.
"No ANCU Connected"	If no ANCU is connected, the Warning Screen (Refer to Figure 4-1) will be shown on the PBMS Terminal. Select Abort and press <ENTER> to return to the Main Menu. Check the connection between serial port 1 on the PBMS terminal and connector J5 on the ANCU and correct any problems before reselecting 'Read PBMS Data From ANCU' in the 'Main Menu'.
"There is no PBMS data on ANCU to be downloaded"	Press <ESC> to return to the 'Main Menu'.
"Some Parameters Are Missing"	Contact Customer Support at the address shown on the 'Title Page'.
"No Data Files Can be Found"	There are no data files stored on the PBMS Terminal that match the aircraft serial number entered in the 'Log Files Details Screen'.
"No PBMS Data Loaded"	You have not loaded data from a data file on the PBMS Terminal or from the ANCU before trying to perform a function that uses this data. These functions are: ▪ Display Vibration Levels ▪ Calculate New Balance ▪ Flight Condition Set-up

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18-JAN-2017  14:03     Aircraft:              Comms:·

                        ═══════WARNING═══════
                    There does not appear to be a controller
                    attached to the Maintenance Terminal.
                    Please check that all cables are properly
                    connected and that the controller is
                                switched on.

                    You may try to detect the controller again,
                    or exit from the Maintenance Terminal

                            DETECT/EXIT

Use cursor keys to select desired response
Press ENTER to continue.
```

Figure 4-1 Warning Screen