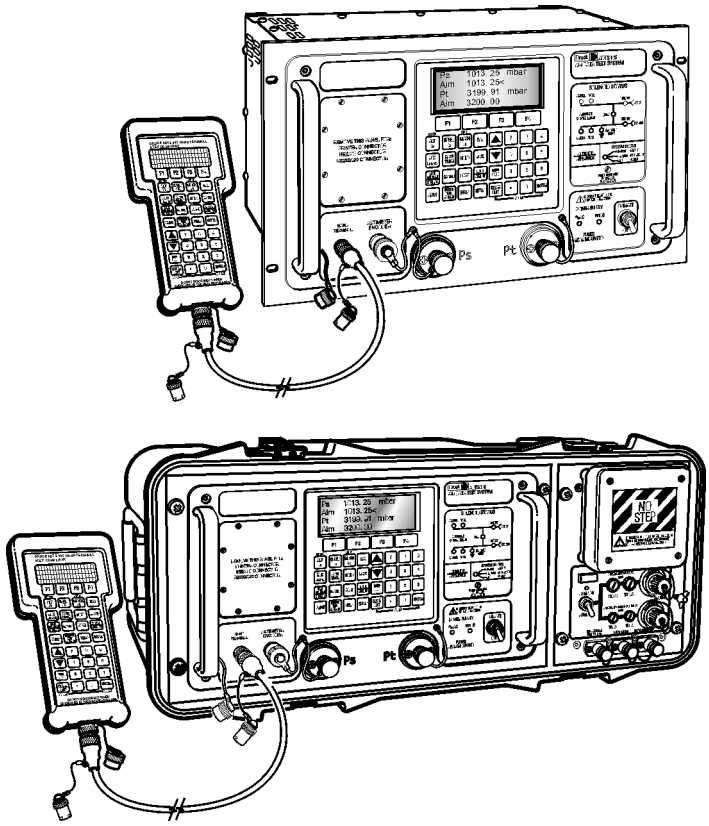
GE
Sensing

Druck Air Data Test Systems

Test Program Manager Version 4

User manual - K250



Introduction

- This technical manual provides details of installation, preparation and operation for the Druck Test Program Manager.

Scope

- This technical manual contains a brief description, installation and procedures for the user of this equipment compatible with the requirements of first line operation.

Language and Communications

- The language and communication procedures are common to all types of Druck ADTS 405 and are contained in the TPM Language Reference Manual, Publication number K230.

Safety

- The manufacturer has designed this equipment to be safe when operated using the procedures detailed in this manual. Do not use this equipment for any other purpose than that stated.
- This publication contains operating and safety instructions that must be followed to ensure safe operation and to maintain the equipment in a safe condition. The safety instructions are either warnings or cautions issued to protect the user and the equipment from injury or damage.
- Use qualified* personnel and good engineering practice for all procedures in this publication.

Pressure

Do not apply pressure greater the maximum safe working pressure to the equipment.

Maintenance

The equipment must be maintained using the manufacturer's procedures and should be carried out by authorised service agents or the manufacturer's service departments.

Technical Advice

For technical advice contact the manufacturer or subsidiary.

* *A qualified person must have the necessary technical knowledge, documentation, special test equipment and tools to carry out the required work on this equipment.*

Associated Documents:

K114 ADTS 405 User Manual
K230 TPM Language Reference Manual

SOFTWARE LICENCE

If there are any queries or problems with this software contact us at www.gesensing.com.

ISSUE NUMBERS

This publication is correct for the following software issue number. If the TPM software has a different issue number, this publication may not contain the correct description or procedures. Refer to the manufacturers for further information.

Manual	Software Numbers
K250	DK124
Issue 2	Version 4.0

Associated Software
DK125 FAR43 Test Program

CONTENTS

ABBREVIATIONS

The following abbreviations are used in this publication

NOTE: Abbreviations are the same in the singular and plural.

ADTS	Air Data Test System
ALT	altitude
ARINC	Air Radio Incorporated
CAS	Calibrated airspeed
CD-ROM	compact disc - read only memory
COL	column
COM	communication (port)
contd.	continued
CR	carriage return
°C	degrees Celsius
CGA	colour/graphics adaptor
DOS	disk operating system
EPR	engine pressure ratio
FAR	Federal Aviation Regulation
FS	full-scale
ft	feet
ft/min	feet/minute
IBM	International Business Machines
inHg	Inches of mercury
M	Mach
max	maximum
min	minute or minimum
mbar	millibar
mbar/min	millibar/minute
MS-DOS	Microsoft disk operating System
No.	number
para.	paragraph
PC	personnel computer
Ps	pressure static
Qc	differential pressure
ROC	rate of climb
RS232	serial data transmission standard
sec	second
TPM	Test Program Manager
UK	United Kingdom
Vc	velocity (airspeed)
VGA	versatile graphics adaptor

Glossary

Terminology

The terminology used in this manual is specific and individual interpretation must not be introduced. The terms are defined as follows:

Adjust	To bring to a more satisfactory state; to manipulate controls, levers, linkages, etc. to return equipment from an out-of-tolerance condition to an in-tolerance condition.
Align	To bring into line; to line up; to bring into precise adjustment, correct relative position or coincidence.
Assemble:	To fit and secure together the several parts of; to make or form by combining parts.
Calibrate:	To determine accuracy, deviation or variation by special measurement or by comparison with a standard.
Check:	Make a comparison of a measure of time, pressure, temperature, resistance, dimension or other quality with a known figure for that measurement.
Disconnect:	To detach the connection between; to separate keyed or matched equipment parts.
Dismantle:	To take apart to the level of the next smaller unit or down to all removable parts.
Examine:	To perform a critical visual observation or check for specific conditions; to test the condition of.
Fit:	Correctly attach one item to another.
Inspect:	Review the work carried out by Specialists to ensure it has been performed satisfactorily.
Install:	To perform operations necessary to properly fit an equipment unit into the next larger assembly or system.
Maintain:	To hold or keep in any particular state or condition especially in a state of efficiency or validity.
Make sure:	To confirm that a proper condition exists; to find out with certainty.
Operate:	Ensure that an item or system functions correctly as far as possible without the use of test equipment or reference to measurement.

Readjust: To adjust again; to move back to a specified condition; to bring back to an in-tolerance condition.

Reconnect: To rejoin or refasten that which has been separated.

Refit: Fit an item which has previously been removed.

Remove: To perform operations necessary to take an equipment unit out of the next larger assembly or system. To take off or eliminate. To take or move away.

Repair: To restore damaged, worn out or malfunctioning equipment to a serviceable, usable or operable condition.

Replace: Remove an item and fit a new or a serviced item.

Reset: To put back into a desired position, adjustment or condition.

Service: To perform such operations as cleaning, lubricating and replenishing to prepare for use.

Test: Ascertain by using the appropriate test equipment that a component or system functions correctly.

INTRODUCTION

The Druck Test Program Manager software package operates on any IBM PC compatible computer with Windows 95/98 or NT. The TPM requires an RS232 serial data link connected between the PC and the Druck ADTS hand-held terminal connector. The TPM operates, under user control, using predetermined test programs or enables the user to enter individual air data test system commands.

This facility processes test procedures such as recording values and readings from instruments under test. Instrument readings and other test results can be entered in the PC by the user. A printed copy of the test results can be produced at a later time from the test results files stored in the PC. The TPM also has a simulator mode to test, debug and gain familiarity with test programs.

The TPM allows the user to:

- Select a test program.
- Use all or part of a test program.
- Temporarily break out of a test to carry out manual checks.
- Enter instrument readings and other data.
- View or print the results.
- Control the air data test system remotely using the PC.
- Down-load a test program to the air data test system.
- Up-load result files from the air data test system.

The accompanying TPM Language Reference Manual should be used when creating or editing test programs. The programs are written in the test program language for the air data test system which is both man and machine readable. It uses English words such as PRINT and AIM, but has closely defined syntax.

Introduction

The test program language can create the following types of tests to efficiently minimize test times:

- Leak tests.
- Airspeed or altitude switch tests.
- Barometric scale error tests.
- Ground proximity warning tests.
- Engine pressure ratio tests.
- Multiple print-outs of pilot, copilot and standby instruments.
- Airspeed tests during altitude tests with separate print-outs, without affecting altitude print-out.
- Scale error tests.
- Hysteresis tests.
- Friction tests.
- Other Pitot - Static tests generally found in aircraft test procedures.

If required, we can provide assistance in writing the test programs.

INSTALLATION

Hardware Requirements

PC

- The TPM operates on any IBM PC, XT, AT or compatible computer with a VGA display.
- The TPM is particularly suitable for note book or lap-top PC with an LCD display.
- It is recommended that the PC has a hard disk drive with 500K byte of free space.
- The PC must be operating Windows 95, 98 or NT.

Cables

- The TPM comes complete with all necessary cables enabling connection to the Druck ADTS 100/101/300/301 series as well as ADTS 405 and 405F.

Printers

- Existing printers in use with a Druck ADTS can be utilized as the output device. Alternatively, any serial or parallel (Centronics) printer compatible with a PC can be used.
- The quality of the print-out depends on the printer used. Printers supporting IBM graphics use solid lines to draw result tables, other printers will draw the tables using dotted lines.

Note: *If printing is to be carried out using a printer connected to the ADTS, then the printer must have a parallel (Centronics) interface.*

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TPM SOFTWARE INSTALLATION

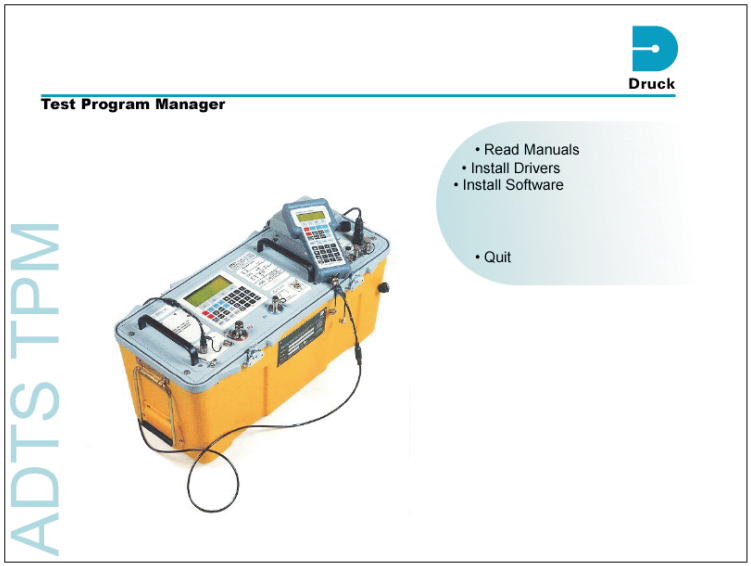
Installing the Software

The software is supplied on a standard CD (with AutoRun).

1. Insert the CD into the CD-ROM drive on the computer.

Note: *If the computer is not set up to open a CD automatically (AutoRun), use a browser to show the contents of the CD and double-click the file MASTER.EXE*

2. A menu screen opens:



3. Select the option “Install Drivers” and follow the on-screen instructions. This installs the necessary serial communications support.

4. Select the option “Install Software” and follow the on-screen instructions. This installs the TPM software program.

   “Install Software” copies the TPM.EXE to the hard disk, creates a short cut icon on the windows desktop, and adds a menu to the task bar.

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CONNECTIONS

The TPM cable connections are as follows:

FUNCTION	62GB 8-4 PLUG	COLOUR	9-WAY D SOCKET	25-WAY ADAPTOR
TXD from ADTS	Pin A	YELLOW	Pin 2	Pin 3
GROUND	Pin B	CLEAR	Pin 5	Pin 7
RXD to ADTS	Pin C	BLUE	Pin 3	Pin 2
12V	Pin D	RED	N/C	N/C
SCREEN	TAG	SCREEN	N/C	N/C
HARDWARE HANDSHAKE	-	-	Pin 4 - Pin 6 - Pin 8	Pin 20 - Pin 6 - Pin 5

CAUTION: COMPLY WITH ALL RELEVANT INSTRUCTIONS IN THE AIRCRAFT MAINTENANCE MANUAL OR COMPONENT MAINTENANCE MANUAL WHEN CONNECTING AND OPERATING THE PITOT-STATIC TEST EQUIPMENT.

Connect the ADTS to the aircraft or instruments under test, refer to the appropriate ADTS User Handbook.

ADTS Power-Up

- Before using the TPM, make sure that the aircraft systems are at ground pressure.
- Switch on the ADTS.
- If connected, disconnect the hand-held terminal and, using the TPM cable supplied, connect the PC to the control port on the ADTS. If required, the hand-held terminal extension cable may be used.

Note: *If the ADTS is already powered up, press the ABORT keys to reset the ADTS.*

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USING THE TPM

Starting

After connecting up, switch on the PC. Start the TPM the same way as starting any Windows-based application:

- Double-click on the icon that was created by the Install program.
- Locate and double-click the TPM.EXE file (the default installation puts this file in \Program Files\Druck\TPM directory).
- Choose *Run* from the Microsoft Windows Task bar Start menu and then *Open.* Type the path of TPM.EXE.

Setting up

When used for the first time, the TPM displays the Setup window, see page 11.

A brief description of the TPM environment

The Test Program Manager comprises five different windows:

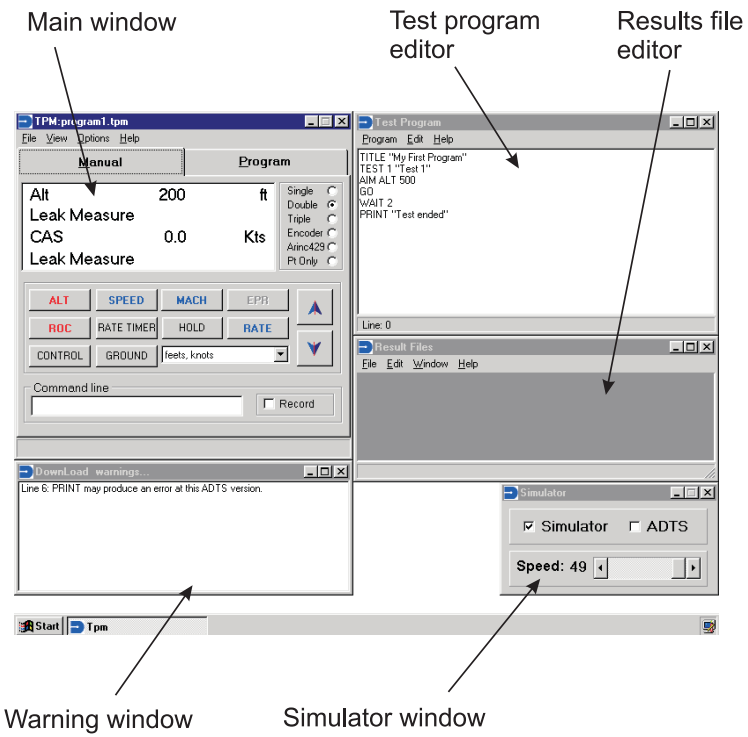
- Main window
  Where the ADTS can be controlled manually and test programs can be run or down-loaded.

- Program Editor
  Where the test programs can be created and edited.

- Result files window
  Where the results files are created, displayed and compiled as the test program runs.

- Simulator window
  Where the simulator of ADTS is turned on or off and its speed set up, see page 15.

- Warning window
  Where this display appears only after a test program is down-loaded into the ADTS and when some of the commands are misused, see page 16.



Main window

When starting the TPM for the first time, the main window shows the software version number.

From the main window, access the main menu or, by pointing and clicking, select one of the two TPM modes: Manual or Program.

Main menu

This menu provides the following facilities:

File

- Down-loads a previously selected test program file to the ADTS. Use the test program editor to select the test program file.
- Up-loads result files from the ADTS.
- Exits the TPM.

View

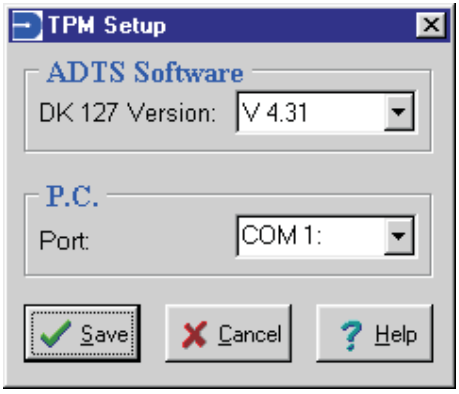
This menu lists all the TPM window displays that can be selected by the user.

Options

The options menu provides TPM set-up and file password protection.

TPM Setup

Click on the Setup menu and the display shows the Setup window.



The ADTS software version (DK127) needs to be correctly set to permit TPM to down-load the test program into the ADTS efficiently.

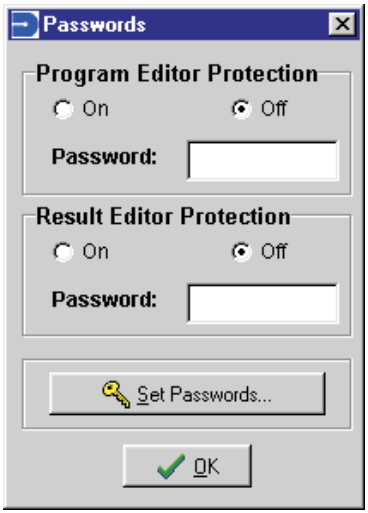
The software version number can be found on the ADTS display a few seconds after Power-up or Reset (by pressing the ABORT keys).

For later ADTS units that use the DK263 software, set the version to V 5.10 or higher.

The Communication Port must be set to the port connecting the data link to the ADTS.

Passwords

Click on the Password menu and the display shows the Passwords window.



TPM files (program editor or result editor) can be protected from change (see page 19).

Enter the correct password and then click On or Off to switch the protection for either the Program Editor or the Result Editor.

New password can be set up by clicking on “Set Passwords”. The password menu is the normal Windows type.

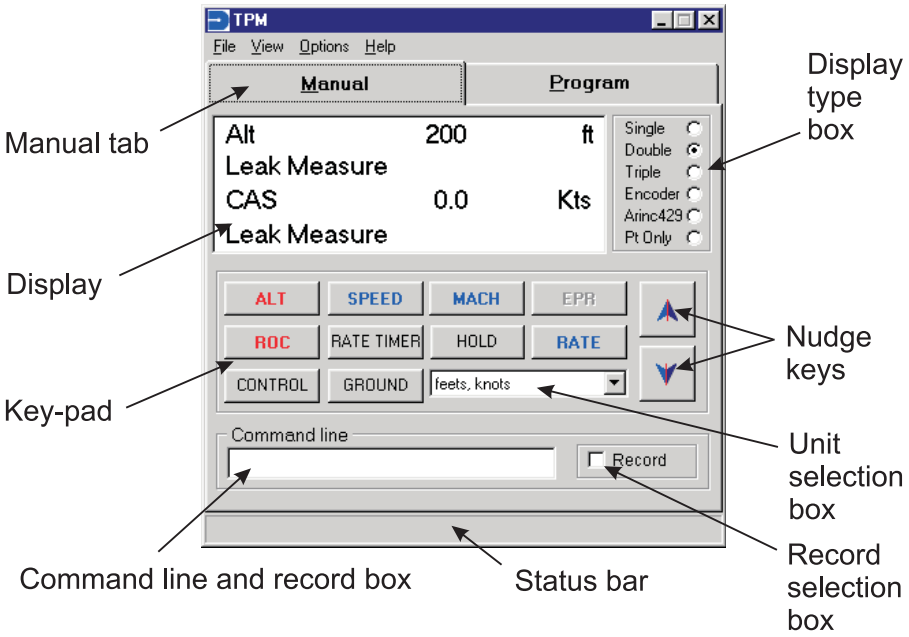
Help

TPM on-line Help provides the similar descriptions and procedures found in this user manual and the language manual. It also provides the version number of the software required when asking for any technical support.

Manual mode

In the TPM manual mode, the ADTS can be directly controlled from the PC. To control from the PC, click on the manual tab on the main window to get the following display:

Note: *Check if the simulator has been switch on or off.*



Using the mouse to point and click, the selections are the same as key presses on the ADTS front panel. Similarly, the display can be configured, in the display type box, to single, dual or triple. When an option of the ADTS is connected (Altimeter encoder or an ARINC 429 interface) select the option in the display type box to change the display to show the option data.

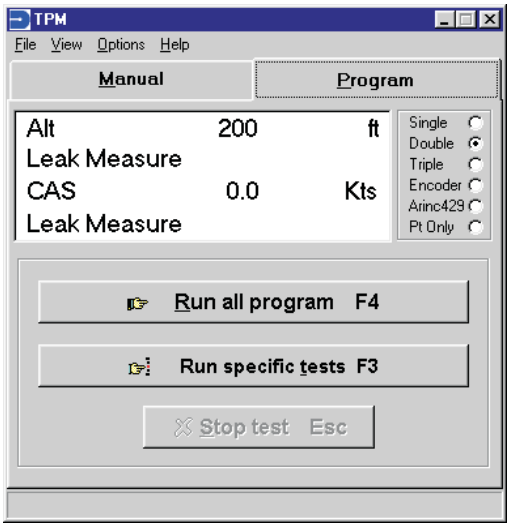
The key-pad selections are the same as the ADTS front panel with the following exceptions:

- Units can be selected from the unit selection box. The list of available units, shown in the selection box, depends on the ADTS software version and selections made in setup (see the ADTS User Manual).
- There may be units available on the ADTS that are not available on TPM even with the correct ADTS software version selected. This is because some units cannot be controlled remotely by TPM.
- Some keys may be disabled if they are not usable in the selected units (i.e., with pressure measurement units such as mbar or inHg the MACH key is disabled, similarly with feet and knots selected the EPR key is disabled).

The command line editor allows control of the ADTS using TPM language. A single command can be typed and executed as if typing a test program. Every time an action, associated to a TPM command, is executed (e.g. to set a parameter to a certain pressure or to select a unit), the command will be displayed and placed in the command line editor. If the record box has been ticked, the command line will be copied across into the program editor window. This allows a test program to be written automatically when carrying out an action in manual mode.

Program mode

The program mode allows the running of a test program or part of it (by selecting the tests to execute).



Click on the program tab and the display shows the test program editor.

Once a test program has been selected in the test program editor, it can be started by selecting “Run all program”.

If this program is made of several tests, each can be selected and run separately by selecting “Run Specific Tests”.

At any time, a test program can be interrupted by selecting “Stop Test“.

Test program editor window

To display the Test Program Editor from the main window click on “Program” or select from the View menu.

The Test Program Editor can be used to create a new test program or, load, edit or print an existing test program.

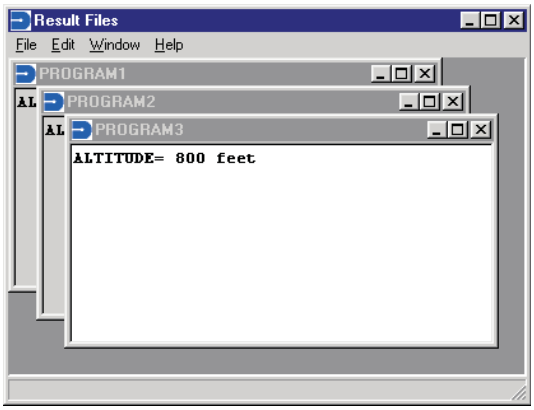
During the test program execution, the command line executed is coloured blue.
If errors occur, the command line changes colour to red.

A protected Test Program Editor (see “TPM files and protection”, page 19), cannot be edited and some of the menu items are disabled.

Clicking the mouse right button accesses the edit functions in a pop-up menu.

Result file editor window

To display the Result File Editor from the main window click on “View” menu or operate a program.



The Result File Editor allows editing or printing of several existing result files.

Each time a result file is created, it is displayed in a new window within the Result File Editor. The highlighted result window has a white background.

On execution of a test program, the TPM automatically makes a result file and gets the file name from the test program name.

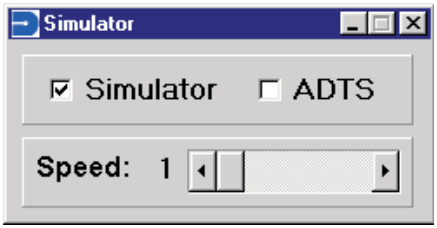
If another result file has the same name, a prompt asks to change the name or the previous result file will be over written.

A protected result file editor, like the test program editor, has some of the menus disabled and no result file can be edited (see “TPM files and protection”).

Simulator window

The simulator acts as the ADTS, the test program can be run without connecting the PC to an ADTS. The displays, user input and printed results will be as normal. This facility can be used to verify a new test program without connecting and operating aircraft systems or instruments. It can also be used to gain familiarity with test programs and the TPM.

The simulator window appears when a TPM mode is selected (Manual or Program) or by clicking the View menu in the main window. The simulator or the ADTS can be selected by pointing and clicking the appropriate box.



The simulator speed can be changed by moving the cursor on the speed bar and can increase the speed up to a factor of 50. This affects the simulated rates of change and can be used to speed up the simulated program execution.
Selecting the ADTS box disables the speed bar.
The simulator cannot be selected (on or off) when a test program is operating.

Warning window

Before down-loading a test program to the ADTS, the program commands are checked against the ADTS software version.
A warning message will be display in the following cases:

- The TPM command might not be a valid command for this ADTS software version. This command has been updated and accepts some new parameters. The TPM cannot detect an invalid parameter in this software version, check in the “TPM Language Manual” if the parameter is compatible with the software.

- The TPM command ignored by the ADTS.
  The command is only usable when the test program is operated from the PC to control the ADTS remotely.

- The TPM command is not recognised by the ADTS with this software version.
  This is a new command and generates an error at program execution.

OPERATION

Controlling the ADTS in manual mode

Set the TPM to manual mode by pointing and clicking on Manual.
Make sure the simulator is selected off by setting the ADTS in remote control and clicking in the ADTS box of the simulator window. This takes a few seconds.
The status bar in the main window indicates when the TPM communicates correctly with the ADTS.
The ADTS should go into remote control mode and display “Test Program Manager Active”.
The TPM display should show the ADTS pressure value.

Note: *Incorrect communications.*

Check for the following:

- *correct connection of the cable between the ADTS and TPM.*
- *correct selection of the COM port in the setup window.*
- *other applications using the same COM port.*
- *ADTS working correctly (disconnect the cable from the hand terminal connector and check if the ADTS goes through all the power-up sequences and displays the pressure parameters).*

Loading a test program

Click on Test Program in the TPM window or the menu “View|Program” editor to display the Test Program editor.
Click on the Program menu “Files|Load” to load the selected program.
The Test Program editor displays the selected program commands and the main window title bar changes to display the selected program file name.

Operating a test program

After loading the selected test program and if the TPM is not in program mode, point and click on the main window Program.

Point and click on the Run all program.

Once a test program starts, manual mode cannot be selected until completion of the test.

If there are several tests in the test program, a selection of `abort’ or `resume’ can be made between each test. Manual mode can be selected between each test by pointing and clicking on Manual.

On completion of all testing, make sure that all aircraft systems are at atmospheric pressure using manual mode or by using the TPM command GROUND at the end of the test program. When all systems are at atmospheric pressure disconnect the ADTS from the aircraft or instruments under test.

FAR 43 test program
We supply the TPM with a complete FAR 43 test program. This FAR 43 test program produces `standard' testing procedures for different aircraft types.

Note: *A back-up copy should be made before editing.*

See the Language Reference Manual for further details. Details of the FAR 43 test are included in Appendix A.

General

To use this test program proceed as follows:
Input header information at the start of a test program.
When the header screen appears, input the required data for each field and press tab to move to the next field.
After completing the header information press the OK button: the first test starts.

Down-loading a test program to the ADTS

When loaded in the TPM, a test program can be down-loaded to the ADTS by clicking in the main window on the menu "Files|Download Test Program".

The warning window may display an error message, see page 16 for details. The display may show instructions to be carried out before continuing the down-load.

If test program file of the same name has already been down-loaded, a prompt asks if it should be replaced.

If communications between the ADTS and TPM are not correct, refer to the note on page 17 "Controlling the ADTS in manual mode".

Up-loading result files

Option available with ADTS 405 with software version DK 127 V4.40 onwards

The ADTS 405 can be set-up to save the result data into a file instead of printing while testing.
Result files can be up-loaded by clicking on the menu "Files|Upload Result File".
A list of result files contained in the ADTS is then displayed in the main window.
A result file can be up-loaded and displayed in the Result editor window.
To save the result file on the PC hard disk `rename' before saving.

TPM files and Protection

The Test Program Manager allows the TPM files to be protected from change.
Both the Test Program editor and the Result File editor have the option to be protected in the Password set-up.
A protected TPM file, in text file format, cannot be edited or saved.

There are two file formats for the TPM files:

- Encrypted, unreadable without TPM.
- Text file format, can be read and edited with any text editor.

The protection prevents the changing of the contents of a TPM file. The editor becomes read only with part of the EDIT menu window disabled and grey. The Record facility from the Manual mode is also disabled.

The following tables show the actions allowed and disallowed with both editors:

	Save as encrypted?	Save as text?	File Edit?
No password set-up or password entered	Yes	Yes	Yes
Password entered	Yes	No	No

	Load encrypted?	Load not encrypted?	Record?
No password set-up or password entered	Yes	Yes	Yes
Password entered	Yes	No	No

where:
Save as encrypted:
Saved, encrypted test program files have the extension ".TPM"; saved, encrypted result files have the extension ".TR".

Save as text:
The test program saves a text file with the extension ".ATP", and saves a result file with the extension ".LST".

File Edit:
A file can be edited by direct access using the mouse or cursor with the normal edit menu functions "Copy", "Cut", and "Paste".

Load Encrypted:
The file to be encrypted is displayed in a decrypted form in the editor.

Load not encrypted:
The text file is displayed in the editor.

Record:
The record button in the manual mode window becomes enabled during the manual mode to save the commands executed in a file.

Note: *Only use names in the DOS 8.3 format (FILENAME.EXT). The ADTS does not support long file names; the TPM does not accept long file names.*

APPENDIX
FAR 43 ALTIMETER TEST PROGRAM

Summary
The FAR 43 test is based on FAR 43 Appendix E 1982 Section a 1. The relevant paragraph numbers are shown after the title of each test description.
A maximum altitude of 45000 ft has been used.
The program allows up to five reading sets to be taken (such as a combination of pilot, copilot and standby altimeters).

Description
Publication K230 TPM Language Reference Manual contains further details of this program including program listings and examples of result printouts.

Test 1 Case Leak
FAR 43 Appendix E 1982 Section a 1 (v)
1. Altitude increases to 18000 ft at 6000 ft/min.
2. Pressure stabilises for 1 minute.
3. Leak test set for 1 minute.
4. Limit of leak rate ±100 ft/min.
5. Altitude decreases to ground (zero).

Test 2 Scale Error, Hysteresis and After Effect (Table 1)
Scale Error
FAR 43 Appendix E 1982 Section a 1 (i)
1. Altitude increases to each set-point value (column 1).
2. The rate of change between set-point values set at 6000 ft/min, reducing rate when nearing set-point.
3. After 1 minute at each set-point, user reading recorded (column 2) and compared with the tolerance (column 3).

Hysteresis
FAR 43 Appendix E 1982 Section a 1 (ii)
1. Altitude decreases to the first hysteresis set-point (column 4).
2. The rate of change between set-point values set at 6000 ft/min, reducing to less than 3000 ft/min when nearing set-point.
3. After 5 minutes at this set-point, user reading recorded and compared with the recorded reading for increasing altitude within the tolerance (column 5).
4. Altitude decreases to the second hysteresis point (column 4) and, after a 1 minute wait at this set-point, user reading recorded and compared with the recorded reading for increasing altitude within the tolerance (column 5).

Altitude (feet)	Recorded values of increasing altitude	Tolerance (1) minus (2) (±feet)	Recorded values of decreasing altitude	Tolerance (2) minus (4) (±feet)
(1)	(2)	(3)	(4)	(5)
-1000	x	20		
0	x	20	x (after effect)	30
500	x	20		
1000	x	20		
1500	x	25		
2000	x	30		
3000	x	30		
4000	x	35		
6000	x	40		
8000	x	60		
10000	x	80		
12000	x	90		
14000	x	100		
16000	x	110		
18000	x	120	x (hysteresis)	75
20000	x	130		
22000	x	140	x (hysteresis)	75
25000	x	155		
30000	x	180		
35000	x	205		
40000	x	230		
45000	x	230		

where:

x = manually recorded and entered value

Table 1 Scale Error Hysteresis and After Effect

After Effect
FAR 43 Appendix E 1982 Section a 1 (iii)

1. Altitude decreases to zero at 6000 ft/min.
2. After a 1 minute wait, user reading recorded and compared with the recorded reading for increasing altitude within the tolerance (column 5).

Test 3 Friction (Table 2)

FAR 43 Appendix E 1982 Section a 1 (iv)

1. Altimeter vibrator circuit set to off.
2. The altitude increases to each set-point in Table 2 at a rate of 6000 ft/min, reducing to less than 750 ft/min when nearing the set-point.
3. At each set-point a user reading recorded, followed by altimeter vibrator circuit set to on and another user reading recorded.
4. The difference between the two readings compared with the tolerance shown in Table 2.
5. At the end of the test, the altitude decreases to zero (ground).

Table 2 Friction Test

Altitude (feet)	Tolerance (–feet)
1000	70
2000	70
3000	70
5000	70
10000	80
15000	90
20000	100
25000	120
30000	140
35000	160
40000	180

Test 4 Barometric Scale Error (Table 3)

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1. The altitude controlled at zero feet and the user instructed to set the altimeter's barometric scale to each of the values in Table 3.
2. A user reading will be taken for each setting and checked against the indicated altitude values in the Table 3 with a tolerance of ±25 feet.
3. The altitude set to ground (go to ground) at the end of the test.

Table 3 Barometric Scale Error

Barometric scale setting		Indicated altitude (feet)
mbar	inHg	
951	28.10	-1727
965	28.50	-1340
982	29.00	-863
999	29.50	-392
1013	29.92	0
1033	30.50	531
1046	30.90	893
1049	30.99	974

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