

GE
Sensing

Druck Air Data Test Systems Three-channel Test Set

User Manual K0451



Introduction

- This technical manual provides operating instructions for the Air Data Test System compatible with the requirements of first line operation.

Scope

- This technical manual contains the description, identification data and operating procedures for the user of this equipment.

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* technicians and good engineering practice for all procedures in this publication.

Pressure

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

Toxic Materials

- There are no known toxic materials used in this equipment.

Maintenance

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

Technical Advice

- For technical advice contact the manufacturer or subsidiary.

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



This equipment meets the requirements of all relevant European safety directives. The equipment carries the CE mark.



This symbol, on the instrument, indicates that the user should refer to the user manual. This symbol, in this manual, indicates a hazardous operation.



Do not dispose of this product as household waste. Use an approved organisation that collects and/or recycles waste electrical and electronic equipment. For more information, contact one of these:

- our customer service department (contact us at www.gesensing.com)
- your local government office

Approved Service Agents

For a list of approved service agents, visit our website: www.gesensing.com

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ATEX CERTIFIED ADVANCED HAND TERMINAL**CONDITIONS OF USE**

The ATEX certified Advanced Hand Terminal can be used in zone 2* hazardous areas in accordance with the ATEX certification document and schedule.

Marking detail:

Refer to Advanced Hand Terminal User Manual K0418 and the label on the Advanced Hand Terminal.

SPECIAL CONDITION OF USE

- The power supplies must be isolated when connecting the advanced hand terminal in the hazardous area.
- The advanced hand terminal must not be disconnected when energized in the hazardous area.
- The advanced hand terminal is a non-serviceable component. If the advanced hand terminal becomes unserviceable it can only be replaced by another ATEX compliant hand terminal.

Note:

The advanced hand terminal must only be used with the cable assembly supplied and marked "DO NOT SEPARATE WHILST ENERGISED IN HAZARDOUS AREA"

* Zone 2 hazardous area definition, see page 53.

Abbreviations

The following abbreviations are used in this manual; the abbreviations are the same in the singular and plural.

A	Ampere
abs	Absolute
a.c.	Alternating current
ADTS	Air Data Test System
AHT	Advanced hand terminal
ALT	Altitude
Alt1	Altitude static channel 1
Alt2	Altitude static channel 2
ARINC	Air Radio Incorporated
ASI	Airspeed indicator
ATE	Automatic Test Equipment
CAS	Calibrated airspeed
COSHH	Control of Substances Hazardous to Health Regulations
cm	Centimetre
d.c.	Direct current
Def	Define
e.g.	For example
etc.	And so on
°C	Degrees Celsius
°F	Degrees Fahrenheit
Fig.	Figure
ft	Foot
g	Gauge
h	Hour
HBC	High breaking capacity
Hg	Mercury
hm	Hecto metre
Hz	Hertz
IAS	Indicated airspeed
i.e.	That is
IEC	International Electrotechnical Commission
in	Inch
inHg	Inches of mercury
kg	Kilogram
km	Kilometre
kts	Knots
LCD	Liquid crystal display
m	Metre
mA	Milliampere
max	Maximum
mbar	Millibar
min	Minute or minimum
mm	Millimetre
mph	Miles per hour
mV	Millivolts
No.	Number
PIN	Personal identification number
Ps	Static pressure
Ps1	Static channel 1

Abbreviations (contd)

Ps	Static channel 2
psi	Pounds per square inch
PC	Personnal computer
Pt	Total pressure (Pitot)
Qc	Differential pressure Ps1-Pt
QFE	Local atmospheric pressure
QNH	Barometric pressure at sea level
REF	Reference
RGA	Return Goods Authorization (Druck procedure)
RMS	Root mean square
ROC	Rate of climb
RS232	Serial communications protocol
Rt	Rate
RTC	Real time clock
SCPI	Standard commands for programmable instruments
SST	Standard Serviceability Test
ST	Stainless steel
V	Volts
VA	Volt Ampere
+ve	Positive
-ve	Negative

Glossary

Terminology

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

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

Glossary (contd)

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.

Pressure Units and Conversion Factors

Pressure unit	Factor (Pascals)	Pressure unit	Factor (Pascals)
bar	100000	lbf/ft ²	47.8803
lbf/in ² (psi)	6894.76	inHg	3386.39
mH ₂ O	9806.65	inH ₂ O [1]	249.089
mbar	100	ftH ₂ O [1]	2989.07
kgf/cm ²	98066.5	atm	101325.0
kgf/m ²	9.80665	pdl/ft ²	1.48816
mmHg	133.322	dyn/cm ²	0.1
cmHg	1333.22	hbar	1000000
mHg	133322.0	tonf/ft ² (UK)	107252.0
mm/H ₂ O [1]	9.80665	tonf/in ² (UK)	15444300
cm/H ₂ O [1]	98.0665	inH ₂ O (USA) [2]	248.64135
N/m ²	1	ftH ₂ O (USA) [2]	2983.6983
hPa	100	kp/mm ²	9806650
kPa	1000	kp/cm ²	98066.5
MPa	1000000	kp/m ²	9.80665
torr	133.322		

TABLE OF PRESSURE UNITS AND CONVERSION FACTORS

Unit Conversion

To convert FROM pressure VALUE 1 in pressure UNITS 1

TO pressure VALUE 2 in pressure UNITS 2, calculate as follows:

$$\text{VALUE 2} = \text{VALUE 1} \times \frac{\text{FACTOR 1}}{\text{FACTOR 2}}$$

Note:

The conversion factor for pressure units referenced [1] are calculated for a water temperature of 4°C. Pressure units referenced [2] are calculated for a water temperature of 68°F these units are normally used in the USA.

1 INTRODUCTION AND DESCRIPTION

This three channel air data test system provides accurate air data to test a three port, pitot-static Smart Probe TM and other three-channel systems. To control the system, a touch screen on the front panel enables the user, using a stylus (supplied), to send commands to each control channel and to control test pressures either manually or from a stored test sequence. An advanced hand terminal connected to the front panel can perform the same functions as the touch screen. User-written test sequences, produced on a spreadsheet program can be uploaded from a pc to the ADTS 2XX. Once stored in the system, the test sequence uses tables of pressure data to simultaneously generate pressure aims for all three channels.

Smart Probe TM

The probe uses three pressure measurement channels identified as Ps1, Ps2 and Pt. The aircraft air data computer system receives these three parameters and calculates altitude, airspeed and angle of attack.

where:

- Ps1 = static pressure
- Pt = pitot pressure
- Ps2 = static pressure
- Ps1 = altitude
- Ps1 - Pt = Qc (airspeed)
- Ps1 - Ps2 = differential pressure, calculated with Qc, to produce angle of attack.

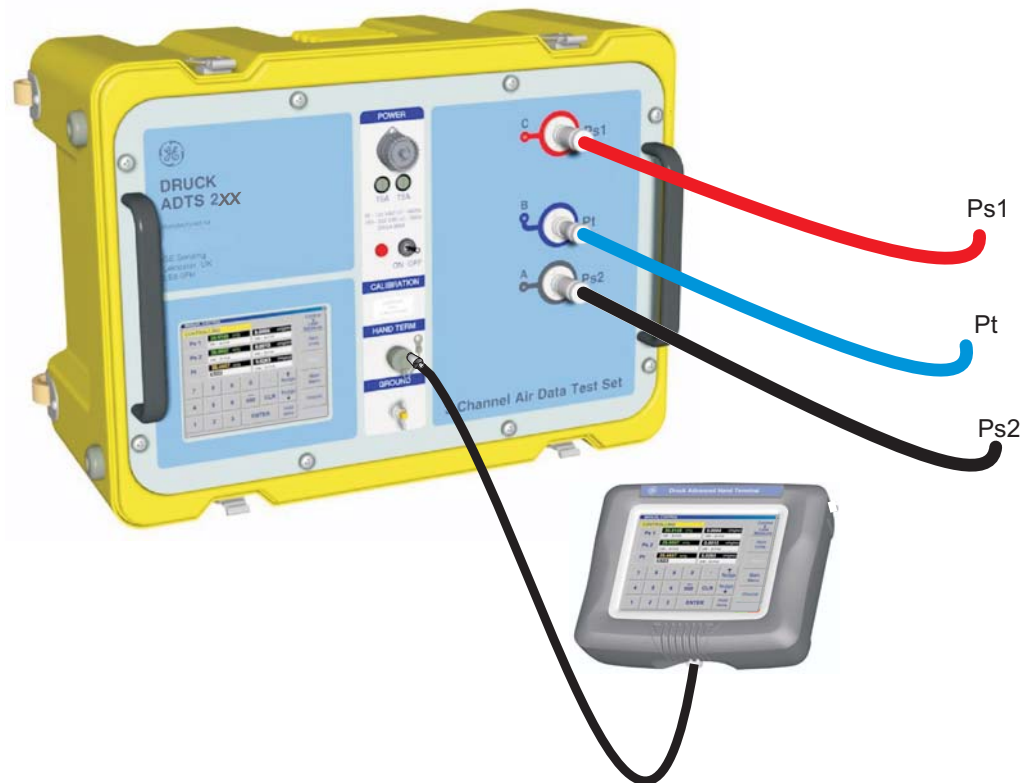


FIGURE 1-1 ADTS 2XX GENERAL ARRANGEMENT

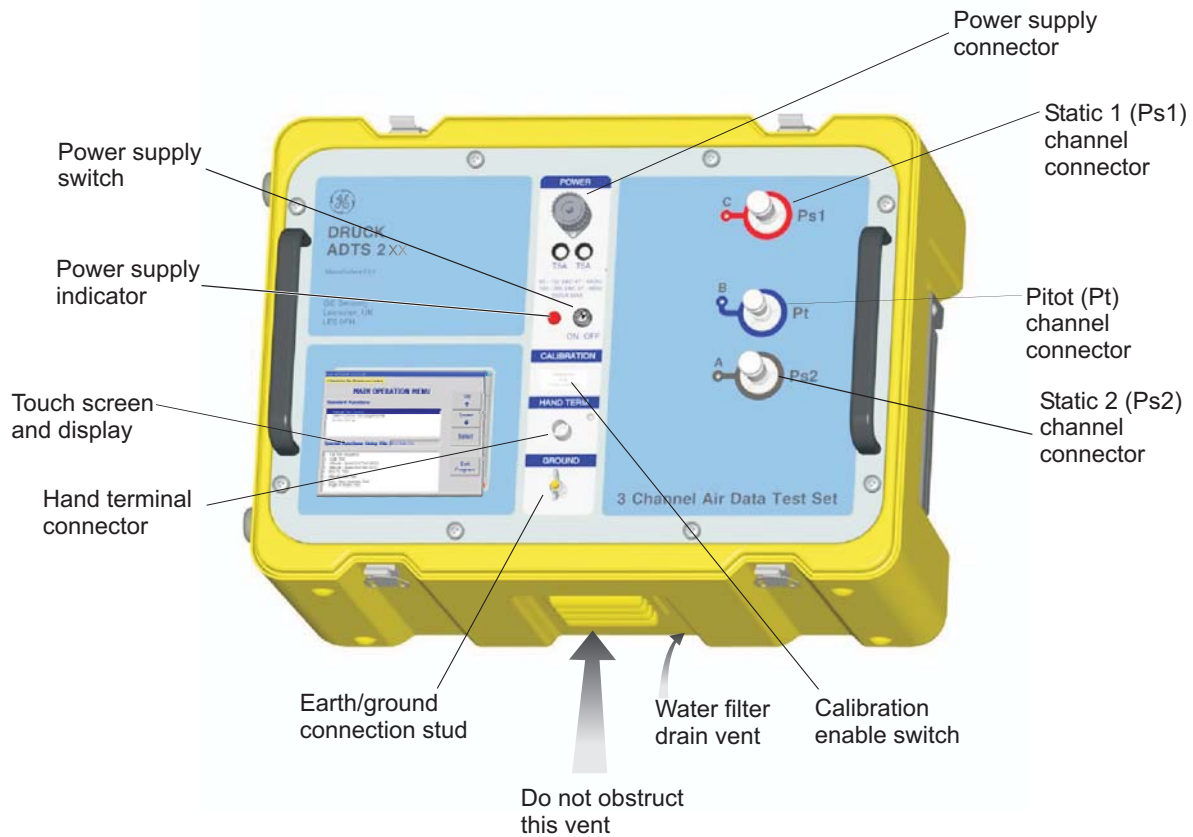


FIGURE 1-2 ADTS 2XX GENERAL VIEW

Operating Environment	
Usage	Indoor and outdoor
Altitude range	-1500ft to 7500ft
Temperature range	0°C to 50°C
Humidity range	0 to 95% non-condensing
Rated pollution degree	II

2 INSTALLATION

2.1 Packaging

- On receipt of the ADTS 2XX check the contents of the packaging against the following lists:

SPECIAL REQUEST

Please keep the special packing box so that the ADTS 2XX can be safely shipped for calibration or repair.

Packaging List - ADTS 2XX

- i) Air Data Test System ADTS 2XX
- ii) Power supply cable 5m
- iii) Accessory bag
 - a) Hose, 1m, blue, AN4 - AN4
 - b) Hose, 1m, red, AN6 - AN6
 - c) Hose, 1m, black, AN6 - AN6
 - d) Cable, communications
 - e) Spare fuses (4 off)
 - f) O-ring 5 i/d x 1 (20 off)
 - g) O-ring 8 i/d x 1 (20 off)
 - h) User Manual (this publication), Calibration Manual K0425 and Quick Reference Guide K0448
- iv) Advanced Hand Terminal
 - a) CD containing file transfer and sample scripts
 - b) Power supply adaptor and cables
 - c) Cable external communications
 - d) AHT User Manual K0418

2.2 Packing for Storage or Transportation

To store the tester or to return the tester for calibration or repair carry out the following procedures:

- Pack the tester as detailed in the following procedure.
- To return the tester for calibration or repair complete the return goods procedure.

Procedure

- The tester should be at zero/ambient pressure. Disconnect the hose assemblies and stow in the accessory bag.
 - Switch OFF and disconnect from the electrical power supply.
 - Close and latch the lid to the tester.
 - The power supply cable, should be placed in the original packing material.
- Place the tester in the original special packing box or appropriate transport container.
 - Mark carton "FRAGILE" on all sides, top, and bottom of the container.
 - To return the tester for calibration or repair complete the return goods procedure as detailed in 2.3.

Environment

- The following conditions apply for both shipping and storage:
 - Store in a cool dry place.
 - Temperature Range -20 to +70 °C (-4 to +158 °F)
 - Altitude up to 15,000 feet (4,570 metres)

Should the tester become exposed to moisture or very high humidity, dry as soon as possible and temporarily store in a dehumidified area. The ADTS 2XX Test Set has one-year re-certification requirement.

Note: *It is important that the customer be sure the tester is in compliance with the OEM re-certification.*

2.3 Returned Goods Procedure

- Should the unit require calibration or become unserviceable it can be returned to the Druck Service Department.
- Please contact our Service Department, either by 'phone, fax or E-mail, to obtain a Returned Goods Authorization (RGA) number or (Return Material Authorization [RMA] in USA), providing the following information:

Product (i.e. ADTS 2XX)
Serial number
Details of defect/work to be undertaken
Calibration traceability requirements
Operating conditions

SAFETY PRECAUTIONS

- You must also tell us if the product has been in contact with anything hazardous or toxic and, the relevant COSHH (MSDS in USA) references and precautions to be taken when handling.

IMPORTANT NOTICE

Service or calibration by unauthorized sources will affect the warranty and may not guarantee further performance.

2.4 Electrical Connection

WARNINGS:

- 1 VOLTAGES IN EXCESS OF 30 VOLTS (RMS) AC OR 50 VOLTS DC, IN CERTAIN CIRCUMSTANCES, CAN BE LETHAL. CARE MUST BE TAKEN WHEN WORKING ON LIVE, EXPOSED CONDUCTORS.
- 2 DO NOT DISCONNECT THE ADVANCED HAND TERMINAL WHEN ENERGIZED IN THE HAZARDOUS AREA.

USE IN A HAZARDOUS AREA

SPECIAL CONDITIONS APPLY TO THE ATEX CERTIFIED ADVANCED HAND TERMINAL REFER TO PAGE V.

Power Supply

Single phase, 90 to 132 VAC, 47 to 400Hz, 200 VA.
180 to 260 VAC, 47 to 66Hz, 300 VA.

Power Supply Connection

The unit must be connected to the correct electrical power supply as stated, adjacent to the power connector.

A qualified technician (see page i) must carry out the following procedure.

CAUTIONS:

- 1 THE SUPPLY MUST PROVIDE CONNECTION TO A PROTECTIVE GROUND TERMINAL. THE UNIT MUST, AT ALL TIMES, BE CONNECTED TO THE SUPPLY EARTH (GROUND).
- 2 THE POWER SUPPLY CABLE AND CONNECTOR MUST BE CORRECTLY RATED FOR THE POWER SUPPLY.

EUROPEAN COLOUR	U.S. COLOR	FUNCTION
Brown	Black	Live
Blue	White	Neutral
Green/Yellow	Green	Protective Earth (Ground)

- Make sure that the power supply is off before connecting the power cable.

Fuses

The two fuses, located in the holders and mounted on the front panel, protect the unit. The fuses are connected in the live and neutral supply circuit and are rated at:

5A anti-surge HBC 250V

External earth/ground connection

- An external earth (ground) cable may be connected to the stud on the front panel of the unit providing integrity of the earth (ground) connection.

Advanced Hand Terminal Power Pack (Figure 2-3)

- Four interchangeable adaptors, supplied with the power pack, can be used to connect to the local power supply. To change the power pin adaptor, push the adaptor from the power pack body, align the replacement adaptor and push into the power pack body.

2.5 Pneumatic Pressure Connections

Ps1 and Ps2 (static)	-	AN6 37° flare
Pt (pitot)	-	AN4 37° flare

When not in use, a blanking cap must be fitted.

Note: When carrying out a leak test, a leak of this blanking cap affects the performance of the ADTS 2XX.

Expansion ports

- Four sets of five expansion ports locate in the lid of the test set to provide hose connections for pitot-static adaptors.
- When not in use, a blanking cap must be fitted to each connector.

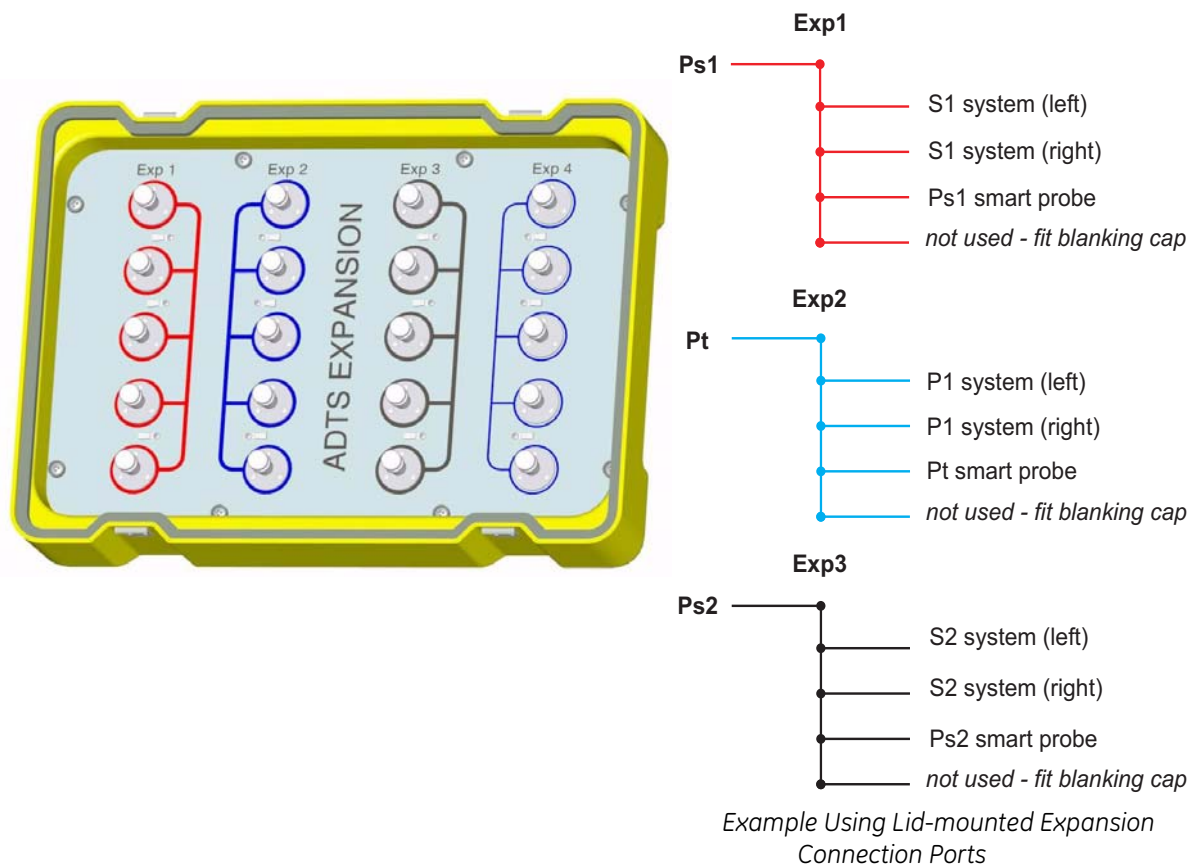


FIGURE 2-1 ADTS 2XX LID-MOUNTED EXPANSION CONNECTIONS

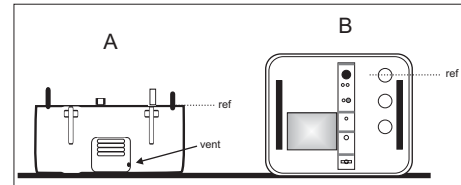
2.6 Positioning of the ADTS 2XX

WARNING: DO NOT DISCONNECT THE ADVANCED HAND TERMINAL WHEN ENERGIZED IN THE HAZARDOUS AREA. THIS CAN CAUSE AN EXPLOSION.

- To operate safely, the ADTS 2XX must be placed outside the user defined zone 2 hazardous area. Only the ATEX certified hand terminal may be used inside the defined zone 2 hazardous area (refer to section 5 for a definition).

CAUTION:

TO OPERATE, PLACE THE UNIT ON A HORIZONTAL SURFACE WITH THE FRONT PANEL UPPERMOST (A) OR WITH THE PNEUMATIC CONNECTOR PS1 UPPERMOST (B) THIS ALLOWS THE WATER IN THE WATER FILTER TO VENT. WATER COULD CONTAMINATE THE CONTROLLER MANIFOLD AND AFFECT CONTROLLER PERFORMANCE.



Note:

In control mode, the water drain, located near the cooling vent, produces a flow of air and some water. The amount of water depends on the humidity and the operating time in control mode.

- It is important that the position of the ADTS 2XX in relation to the aircraft altitude sensors is known. An altitude correction must be made to allow for the difference in height between the ADTS reference level and the reference level of the aircraft's altitude sensors (refer to the Aircraft Maintenance Manual for this information).
- Enter the altitude correction value in the SET-UP menu detailed in section 3.

WARNING: OBSERVE THE APPROPRIATE SAFETY INSTRUCTIONS AND TESTING PROCEDURES DETAILED IN THE AIRCRAFT MAINTENANCE MANUALS AND COMPONENT MAINTENANCE MANUALS.

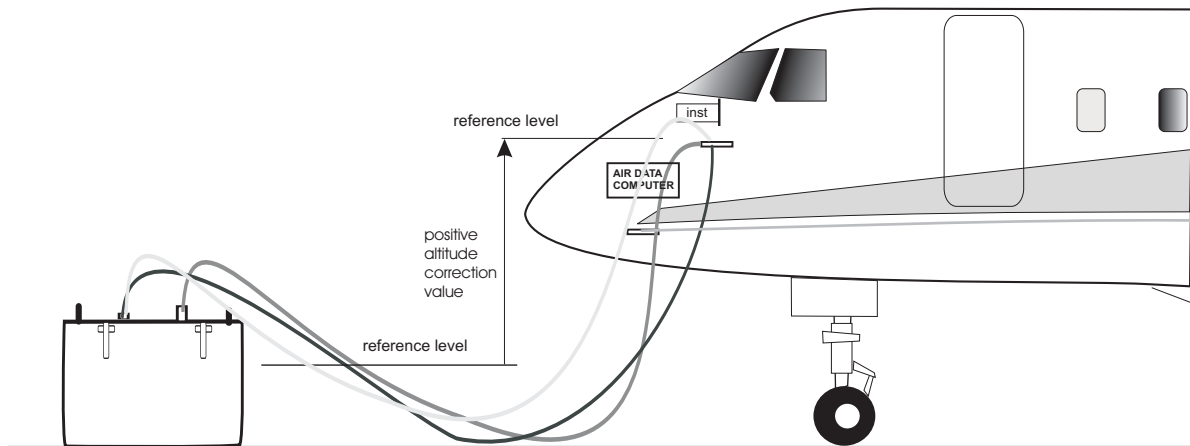


FIGURE 2-2 ADTS 2XX ALTITUDE CORRECTION

2.7 Parts and Accessories

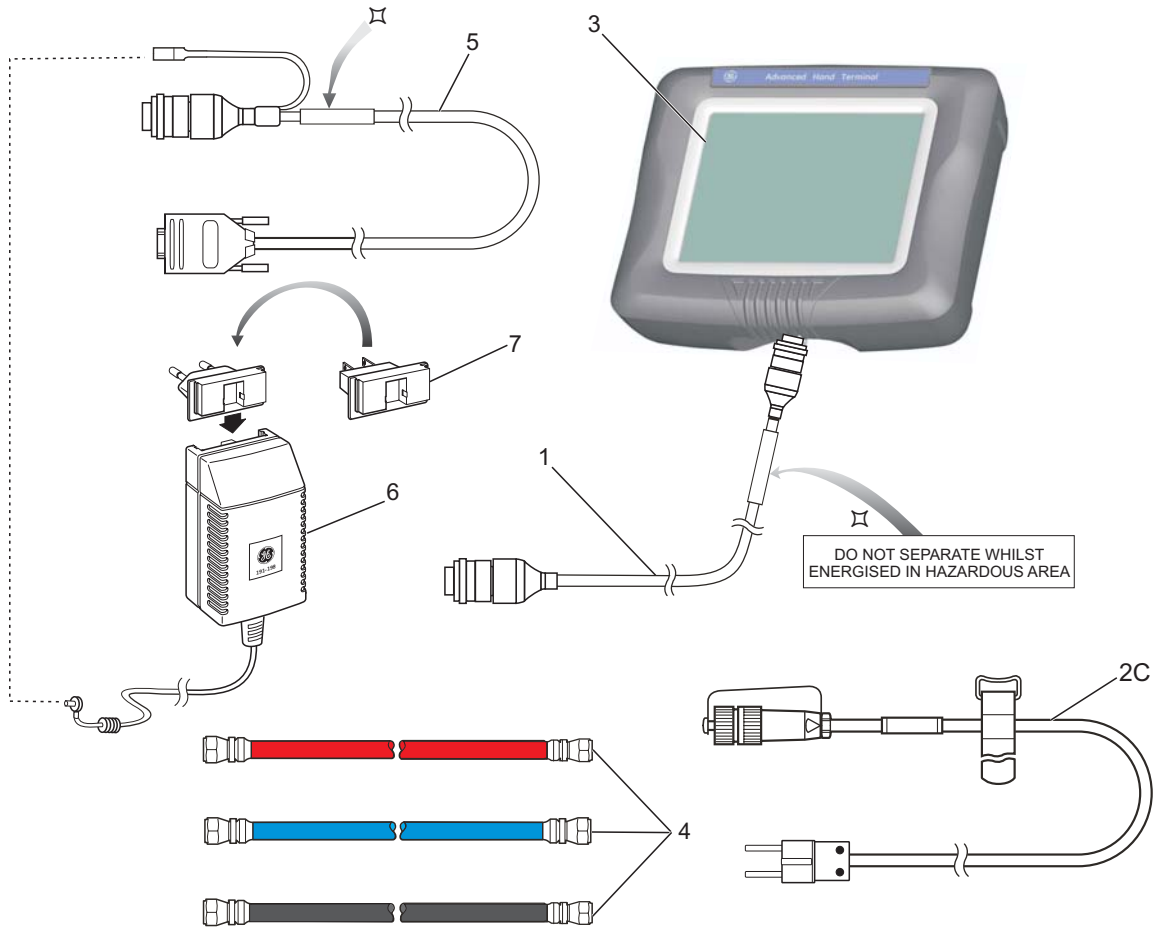


FIGURE 2-3 ADTS 2XX PARTS

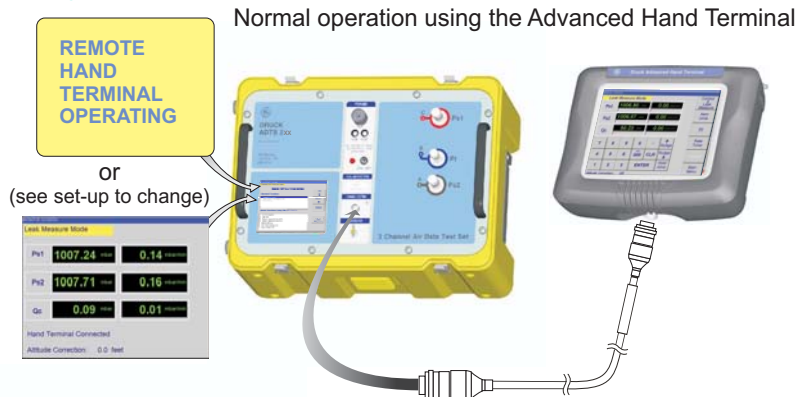
No.	Part Number	Description	Qty per assy
1	ADTS204-3435-01-M2	Cable, Communications, 18m	1
2A*	ADTS505-3124-41-M0	Cable, AC Power, 5m (115V US plug)	1
2B*	ADTS505-3124-40-M0	Alternative Cable, AC Power, 5m (250V UK plug)	1
2C	ADTS405-1891-28-M0	Alternative Cable, AC Power, 5m (250V EU plug)	1
3	ADTS204-3435-05-M2	Hand terminal, advanced	1
4	ADTS204-3435-09-M0	Hose kit, comprising: Hose, red, ST/STN, AN6	1
		Hose, blue, ST/ST, AN4	1
		Hose, black, ST/ST, AN6	1
5	ADTS204-3435-06-M0	Cable, communications, PC	1
6	ADTS204-3435-07-M0	Power pack	1
7	-	part of item 6 Adaptor, power supply, pack (comprising: 4)	1
8*	ADTS204-3435-10-M0	Stylus, pack (comprising: 3)	1

*not illustrated

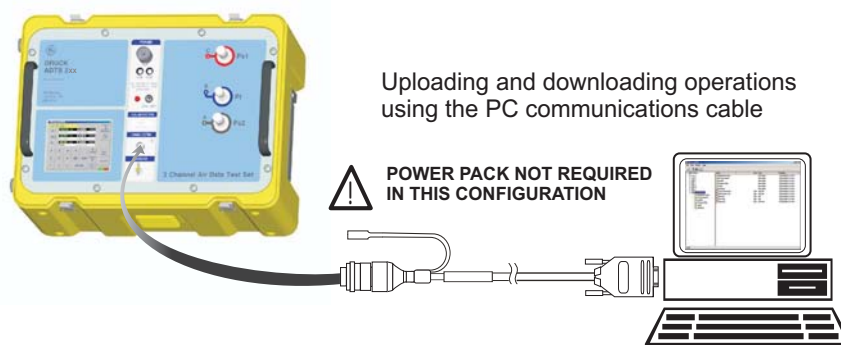
TABLE 2-1 PARTS LIST

2.8 Interconnection and Configuration

Configuration 1



Configuration 2



Configuration 3

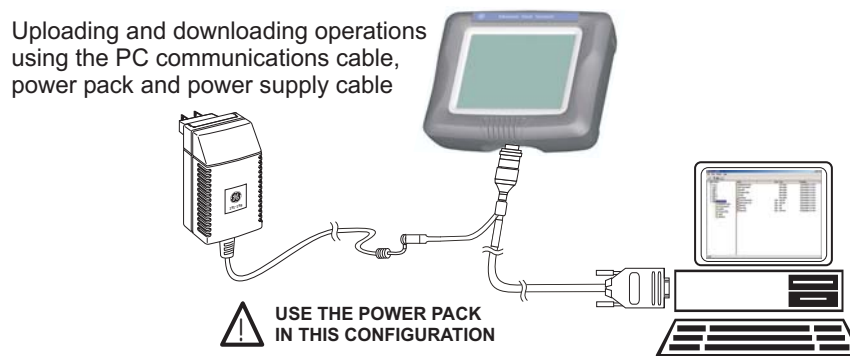


FIGURE 2-4 ADTS 2XX INTERCONNECTION

2.9 Software Programs supplied on CD

File Transfer Utility

Installed on a PC with Windows® 98/2000 or above this utility establishes communications with the Advanced Hand Terminal. It enables the user to use Windows® Explorer to copy files to the Advanced Hand Terminal and perform file handling operations (delete, move, copy etc.) on files stored on the Advanced Hand Terminal hard disk.

ADTS 2XX Remote

Installed on a PC with Windows® 98/2000 or above this utility provides a trial environment (or simulator) for checking test scripts. It performs in the same way as the Advanced Hand Terminal without the need for the connection and operation of the ADTS 2XX.

3 OPERATION

3.1 Preparation

WARNINGS:

- 1 **OBSERVE SAFETY PRECAUTIONS STATED IN LOCAL ORDERS AND THE AIRCRAFT OR EQUIPMENT SERVICING PROCEDURES.**
- 2 **DO NOT DISCONNECT THE ADVANCED HAND TERMINAL WHEN ENERGIZED IN THE HAZARDOUS AREA.**

USE IN A HAZARDOUS AREA

SPECIAL CONDITIONS APPLY TO THE ATEX CERTIFIED ADVANCED HAND TERMINAL REFER TO PAGE V.

CAUTION: IT IS THE RESPONSIBILITY OF THE USER TO MAKE SURE THAT THE PNEUMATIC CONTROL RANGE LIMITS ARE SET BELOW THE MAXIMUM OPERATING LIMITS OF THE EQUIPMENT UNDER TEST REFER TO PAGE 19.

- Make sure the electrical and pneumatic connectors, electrical cables and pipes and positioning of the ADTS 2XX comply with the instructions and requirements in Section 2 Installation.

CAUTION: DO NOT USE SHARP OBJECTS ON THE TOUCH SCREEN; USE THE STYLUS (SUPPLIED AND RECOMMENDED). A SHARP OBJECT WILL PERMANENTLY DAMAGE THE TOUCH SCREEN, IT CANNOT BE REPAIRED.

- Carry out the following before use:
 - If necessary, carry out the maintenance task detailed in Section 4.
 - Make sure the air data test system power supply switch on the front panel is set to OFF. Connect the air data test system to the electrical supply, make sure the supply includes a connection to a protective earth.
 - Inspect the pneumatic hoses for damage, ingress of dirt and moisture. Make sure the aircraft adaptors are serviceable.
 - Make sure the air vents do not become obstructed.
 - Make sure that the power supply switch can be accessed at all times.
- Connect, to the air data test system, the hoses necessary for the test procedures to be carried out: STATIC outputs (Ps1 and Ps2), PITOT output (Pt). Fit the necessary adaptors for aircraft testing to the hoses.

Note: When connected, take care not to kink or stand on the hoses.
- Before use, the ADTS 2XX should be tested by carrying out a leak test.
 1. Fit blanks to all the adaptor test points.
 2. Carry out a leak test, detailed in Section 5.2, or the system leak test procedure.
 3. If necessary carry out an altitude correction, see Figure 2.2.
- Read the whole procedure before starting the test process on an aircraft or component.

3-2 Power-up routine

- Set the power supply switch to ON.
 - Check that the screen shows the correct display for a successful power-up.
- Check:
- the pump operates.
 - the power indicator lights
 - air discharges through the water drain.
- Connect the cable to the AHT communication connector on the ADTS 2XX.
 - Check that the screen shows the correct display.
 - Check that the ADTS 2XX screens show the correct display messages (see below).

Note: This Windows® based facility hides many of the normal features of Windows®.

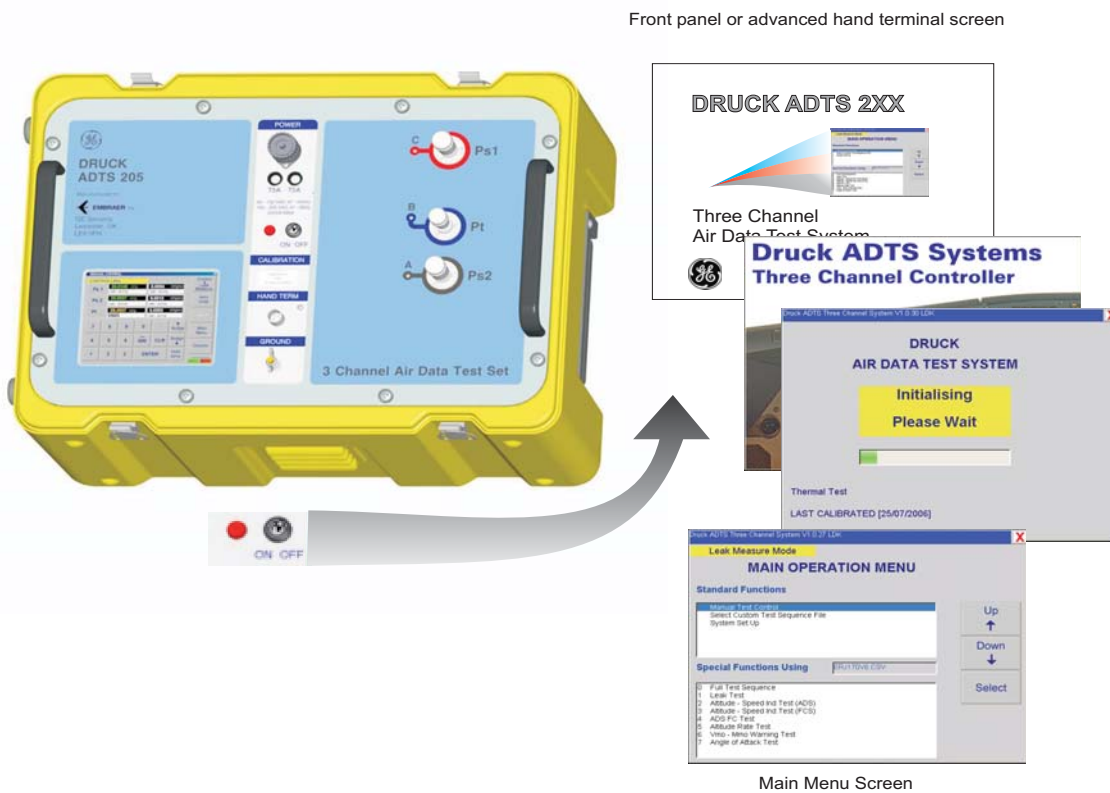
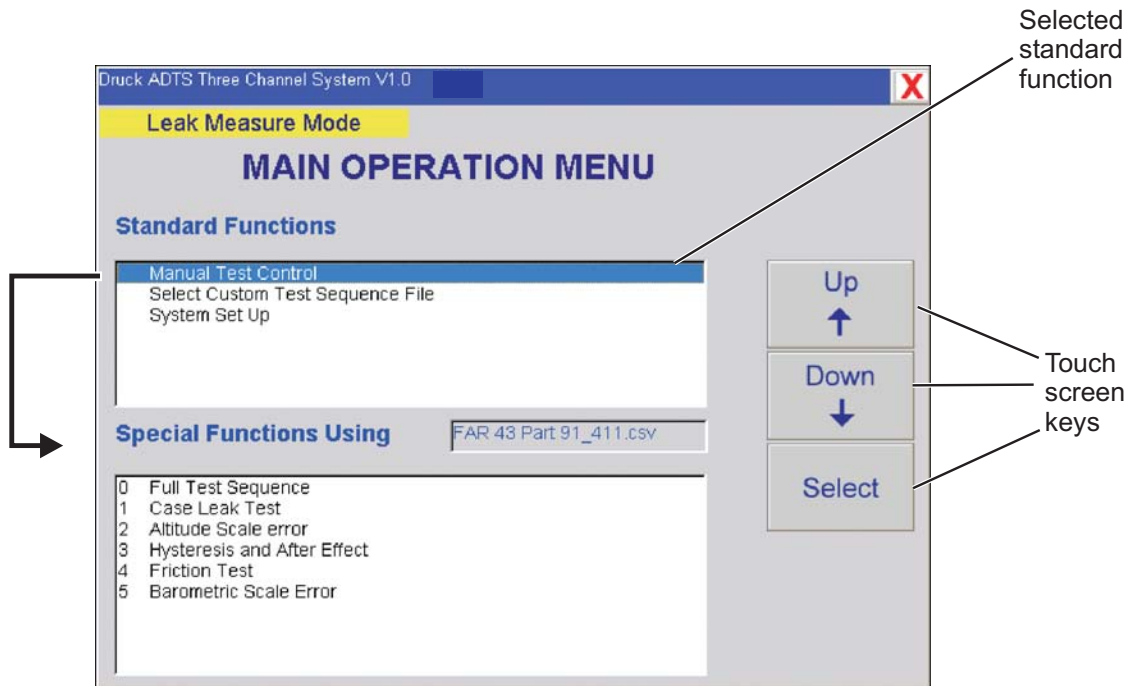


FIGURE 3-1 POWER-UP DISPLAYS

3-3 Main Menu



Full Test Sequence - automatically starts and stops each test in turn (listed in the menu).

FIGURE 3-2 MAIN MENU SCREEN

Screen Displayed Key Selections

Touch screen keys (Figure 3-3)

Function and comments

UP/DOWN	Moves the screen highlight bar up/down.
Select	Selects the test or set of values highlighted by the up/down function.
Back	Returns to the previous screen.
Control	Switches all channels between measure and control modes.
Leak Measure	Starts the Go-to-Ground procedure for all channels.
Ground	
Restore Default Values	Restores the last set of stored data values or unit selection saved as a default.
Save Settings	Data Values or unit selection saved as a default.
Select	Activates the highlighted function.
Exit Program	Exits Program - required for downloading of new test files.
Enter	Confirms data entry to a numeric field.

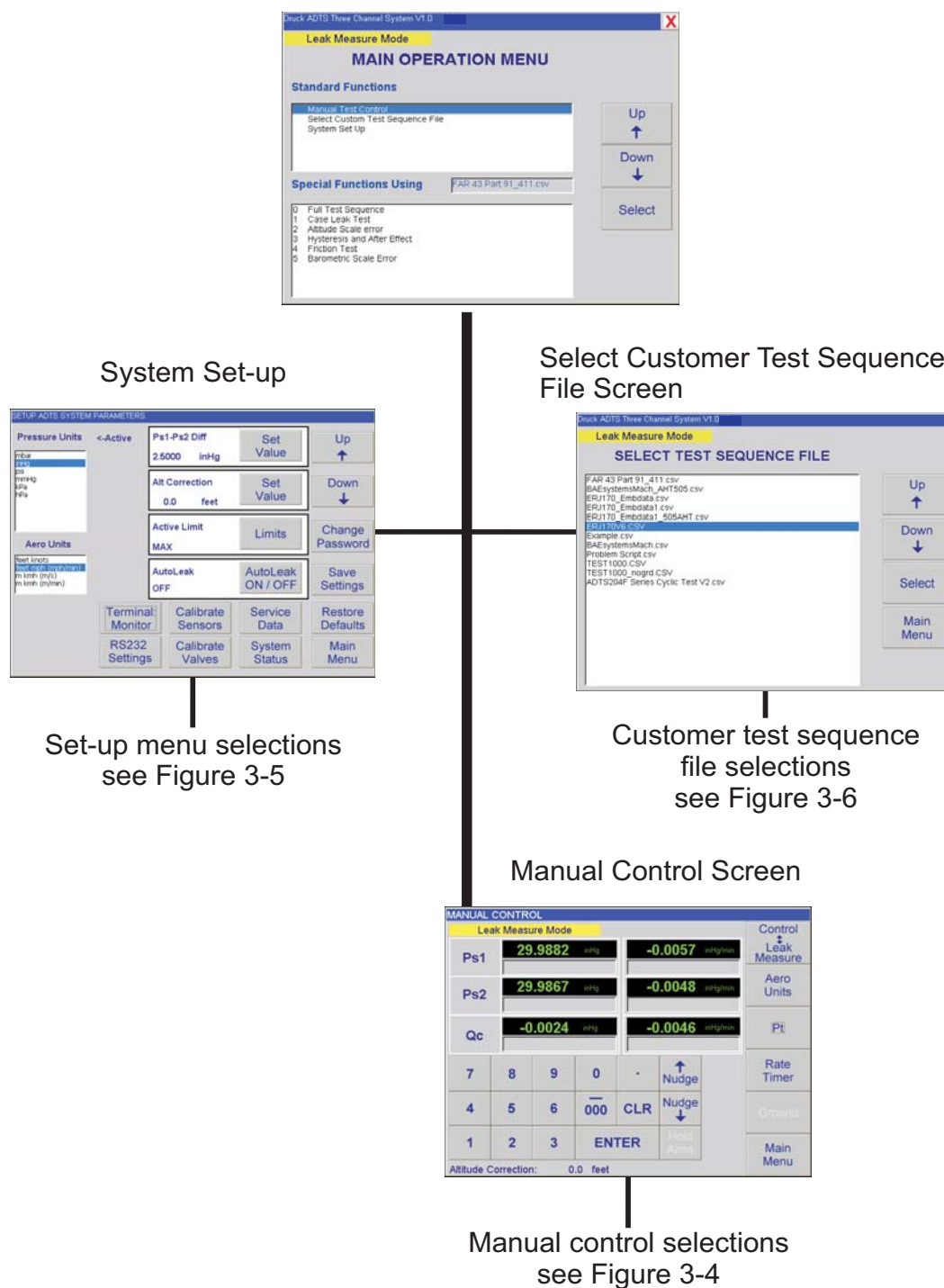


FIGURE 3-3 MAIN MENU SELECTIONS

Manual Mode

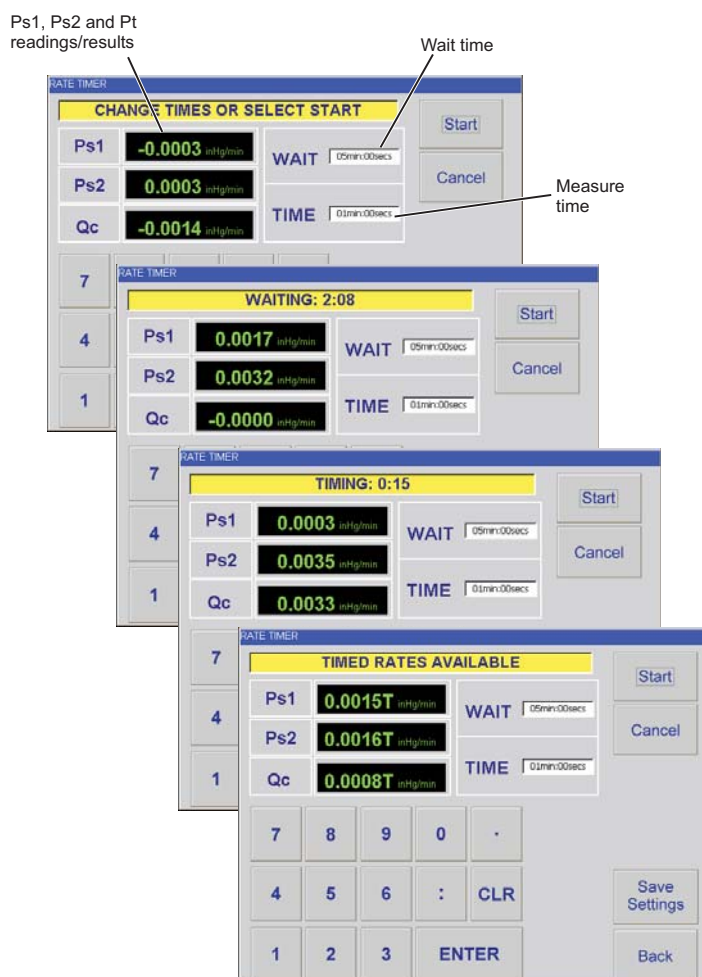


FIGURE 3-4 MANUAL CONTROL SELECTIONS

Selecting Control and Leak/Measure Modes

Manual test control always starts in leak measure mode displaying pressures in the last selected units of measurement. The system can be switched between aero units and pressure units, these units can only be changed in set-up mode.

Selecting control/leak measure switches between leak measure mode and control mode. In control mode the set of limits provide protection for the aircraft system and can only be changed in set-up mode.



EXAMPLE RATE TIMER SCREEN

Rate Timer

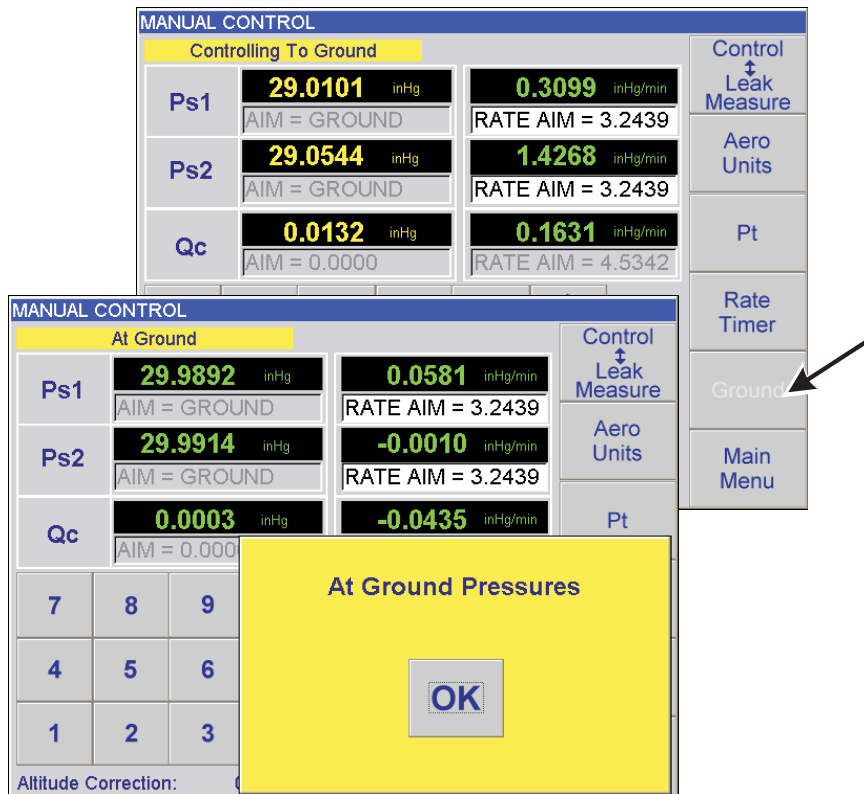
Selected in Leak/Measure Mode

1. Use the touch screen keys to select wait and measure times and use the numeric keys to enter the values.

Note:

Times entered as whole numbers are interpreted as seconds. Numbers higher than 60 are interpreted and displayed as minutes and seconds (i.e. 90 = 1 minute 30 seconds = 1:30).

2. After selecting the timer values and with the required the Ps1, Ps2 and Pt readings, press the START key. The time counter shows the progress of the test: wait time, then test time. The results, at the end of the test, shows the timed rates for each channel indicated by "T" after the digits.
3. Press BACK to return to Leak Measure Mode.



Ground

Selected in Control Mode

1. Use the GROUND touch screen key to select go-to-ground. The displayed channel aims show GROUND, the controller takes all channels to ground pressures and Qc to zero as shown above.

Note:

At any time during this operation, pressing Leak/Measure stops the operation.

2. The display shows At Ground Pressures (see above). Pressing "OK" cancels the yellow message box but leaves the system "At Ground". Pressing Leak/Measure returns the system to Leak/Measure mode.

Select Set-up

- From the main menu, select system set-up.

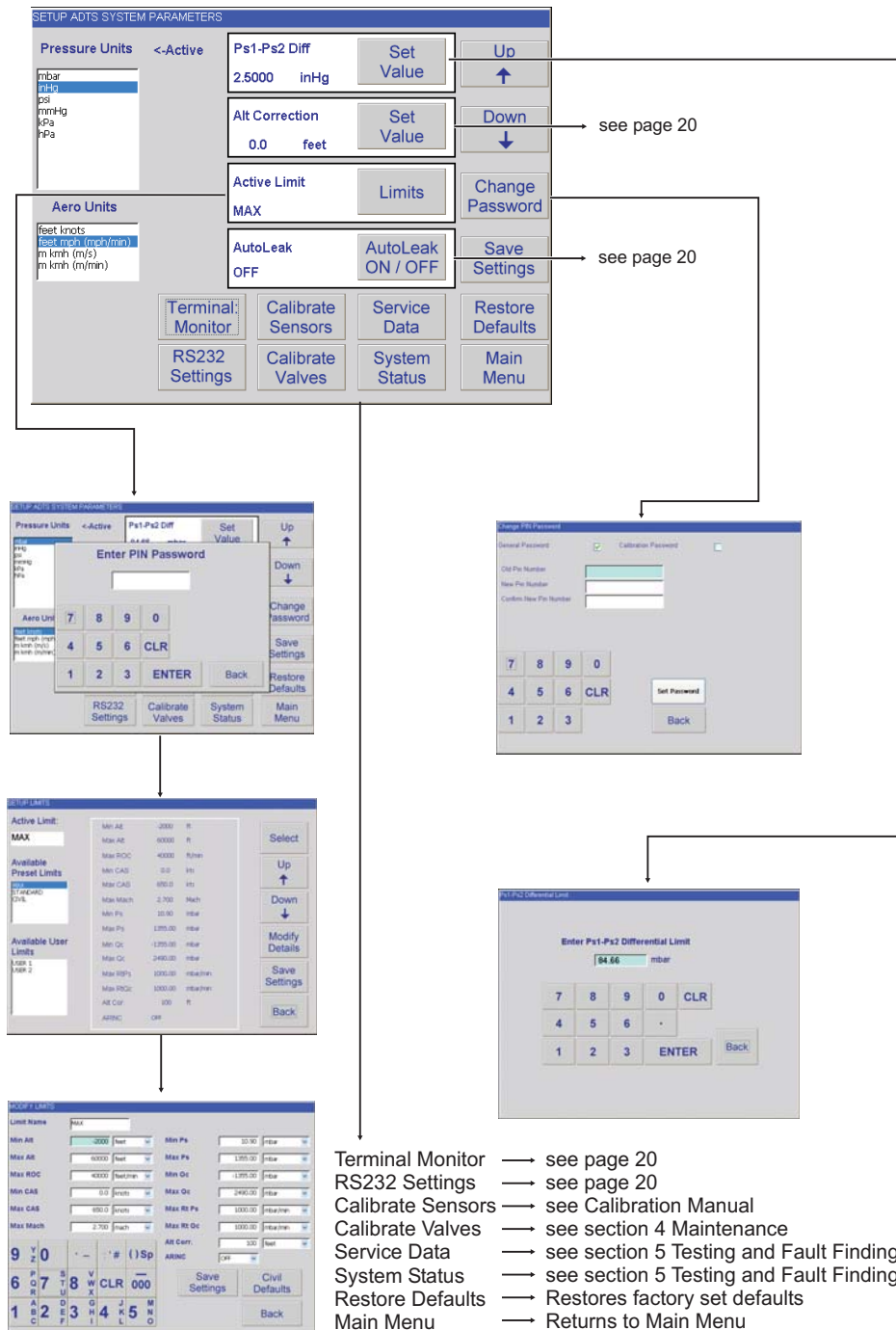


FIGURE 3-5 SET-UP MENU SELECTIONS

2. Select Ps1 to Ps2 differential pressure limit and, using the numeric keys, enter the necessary value for the testing to be carried out.
3. Use the Up and Down keys to highlight the required aeronautical and pressure units.
4. Press SAVE SETTINGS to store in nonvolatile memory or press MAIN MENU to store in volatile memory and return to the Main Menu Screen. Press RESTORE DEFAULTS to restore the last set of stored values and unit selection saved as a default.

Default limits

This first set of user defined limits, identified as: USER 1, are enabled when the ADTS 2XX is switched on. Refer to Section 6 for the details of the preset limits.

Select limits

Enter the PIN to access the SETUP LIMITS display. Select one of the preset limits of MAX, STANDARD and CIVIL or define and enable USER 1 limits. An eight character name/code can replace USER 2 title.

The screenshot shows the 'SETUP LIMITS' screen. A modal window titled 'Enter PIN Password' is centered over the screen, featuring a numeric keypad (0-9), a 'CLR' key, an 'ENTER' key, and a 'Back' key. The background screen shows the 'Active Limit' set to 'MAX' with a 'Min Alt' of -2000 ft. On the right side, there are vertical navigation buttons: 'Select', 'Up', 'Down', 'Modify Details', 'Save Settings', and 'Back'.

This screenshot shows the 'SETUP LIMITS' screen with the 'MAX' limit selected. The parameters are listed in two columns:

- Min Alt: -2000 ft
- Max Alt: 60000 ft
- Max ROC: 40000 ft/min
- Min CAS: 0.0 kts
- Max CAS: 650.0 kts
- Max Mach: 2.700 Mach
- Min Ps: 10.90 mbar
- Max Ps: 1395.00 mbar
- Min Qc: -1395.00 mbar
- Max Qc: 2490.00 mbar
- Max RtPs: 1000.00 mbar/min
- Max RtQc: 1000.00 mbar/min
- Alt Cor.: 100 ft
- ARINC: OFF

 The right side of the screen has the same navigation buttons as the previous screenshot.

The 'MODIFY LIMITS' screen allows for editing the selected limit. The 'Limit Name' is 'MAX'. The parameters are organized into two columns with dropdown menus for units:

- Min Alt: -2000 feet
- Max Alt: 60000 feet
- Max ROC: 40000 feet/min
- Min CAS: 0.0 knots
- Max CAS: 650.0 knots
- Max Mach: 2.700 mach
- Min Ps: 10.90 mbar
- Max Ps: 1395.00 mbar
- Min Qc: -1395.00 mbar
- Max Qc: 2490.00 mbar
- Max RtPs: 1000.00 mbar/min
- Max RtQc: 1000.00 mbar/min
- Alt Corr.: 100 feet
- ARINC: OFF

 At the bottom, there is a alphanumeric keypad (0-9, letters, symbols), a 'CLR' key, and a '000' key. On the right, there are buttons for 'Save Settings', 'Civil Defaults', and 'Back'.

Altitude Correction

An altitude correction must be made to allow for the difference in height between the reference level of the ADTS 2XX and the reference level of the aircraft's altitude sensors. Select the Instrument Altitude Correction and, using the numeric keys, enter the correction value (see Fig 2-2).

Altitude Correction

Enter Altitude Correction

0.0 feet

7 8 9 0 CLR

4 5 6 . -

1 2 3 ENTER Back

RS232 Settings

The RS232 interface enables the unit to communicate with a PC. The parameters for RS232 communications are applied through the set-up menu.

Baud rate	-	600, 1200, 2400, 9600
Data bits	-	8
Stop bits	-	1,2
Parity	-	none, even, odd

ATE Serial Port Settings

Bits Per Second 9600

Data Bits 8

Parity None

Stop Bits 1

Apply

Back

Auto leak

Auto leak automatically regains control if the leak rate becomes too high for any of the control channels. Auto leak operates at preset rates of 3000ft/min and 300knots/min. This facility can be switched off and on in set-up menu.

Pressure Monitor

Set-up selection can be made between the display showing the "REMOTE HAND TERMINAL OPERATING" and the pressure monitor screen. The pressure monitor shows the current pressures of all three channels in the selected units of pressure measurement.

MONITOR SCREEN

Leak Measure Mode

Ps1	1007.24 mbar	0.14 mbar/min
Ps2	1007.71 mbar	0.16 mbar/min
Qc	0.09 mbar	0.01 mbar/min

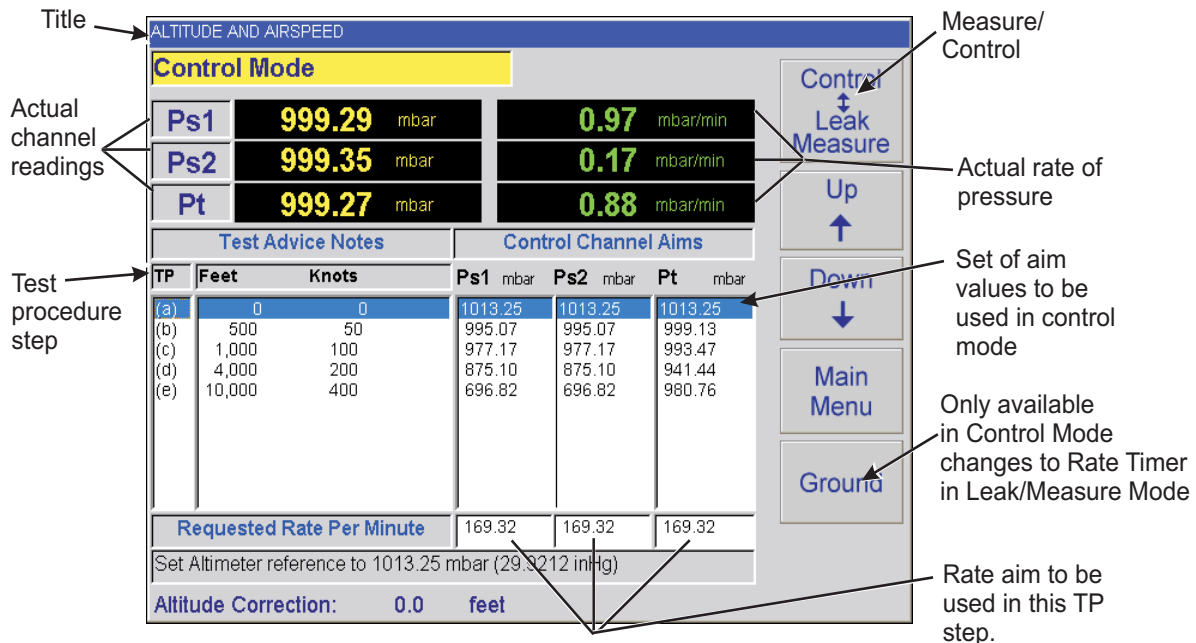
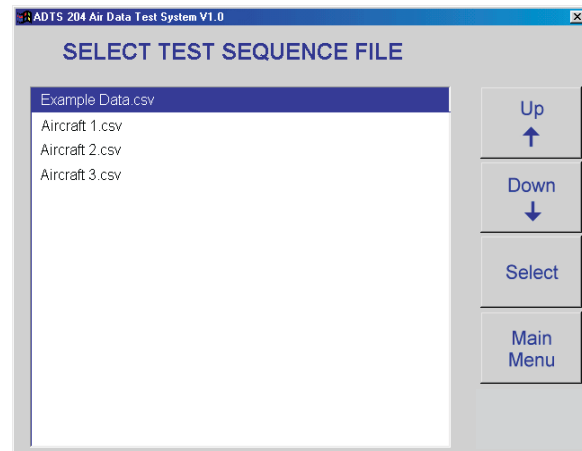
Hand Terminal Connected

Altitude Correction: 0.0 feet

Select Test Sequence File

Files stored in the computer

1. From the main menu, select Custom Test Sequence File.
2. Use the Up and Down keys to highlight the test file.
3. Use the SELECT key to load the file.
4. Press MAIN MENU to return to the Main Menu Screen.



Selecting a Test Sequence

1. From the main menu, select the Custom Test Sequence File. The screen changes to the selected test screen with the data table from the file.
2. Use the touch screen keys to select each test procedure value.
3. After selecting the test procedure value use the Control/Leak Measure key to select CONTROL.
4. The screen changes to CONTROL MODE and shows the actual measurement and rate.

3-4 Creating Custom Test Sequences for the ADTS 2XX

Instructions for generating or editing source data for test table values

The data shown on each screen or table of the test sequence comes from a single data source file. This .CSV format file uses numeric data fields separated by commas. Files of this type may be viewed and edited using a spread sheet program such as Excel. Files would normally be saved with an applicable name for easy identification and selection.

A template file (TEMPLATE.CSV), provided on the software distribution with this product, may be used as the basis for creating new aircraft test sequences. An example, below, shows how the data fields of the file can be used in the test screens.

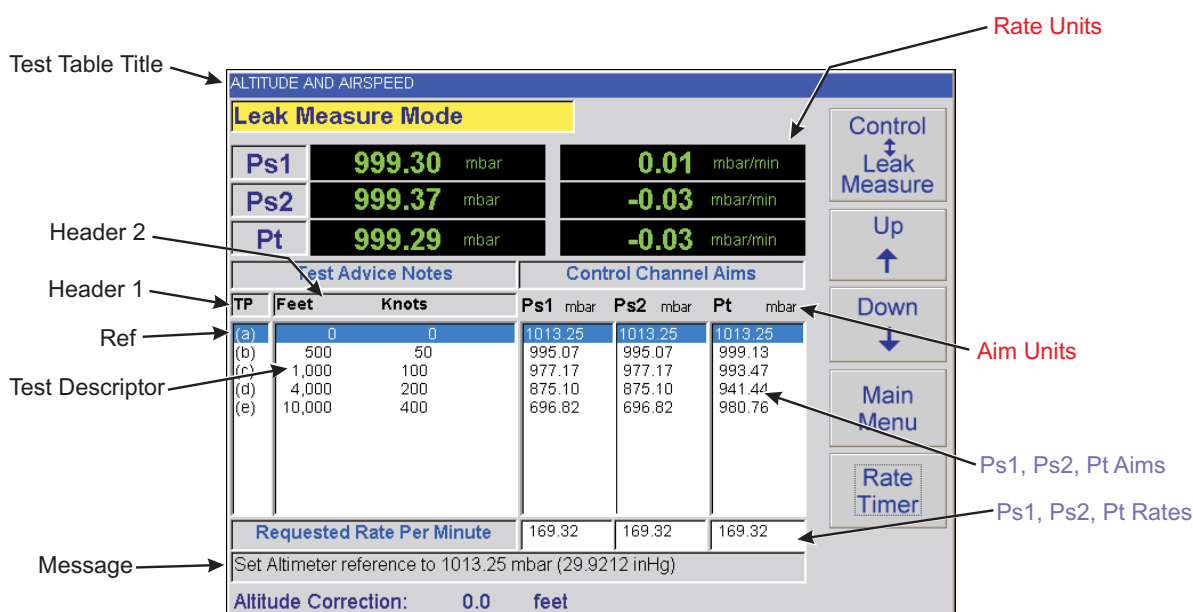


FIGURE 3-6 CUSTOMER TEST SEQUENCE FILE SELECTIONS

TEMPLATE FORMAT DESCRIPTION FOR CREATION OF ADTS 2XX TEST SEQUENCE FILES
(files to be created using EXCEL and saved as <FILENAME.CSV> (comma separated variables))

Test Identifier	Parameter Label	Prompt Message	Ps1 Aim	Ps2 Aim	Pt Aim	Ps1 Rate	Ps2 Rate	Pt Rate
Begin Test Table								
<TEST TABLE TITLE 1>								
<HEADER 1>	<HEADER 2>		<AIM UNIT>	<AIM UNIT>	<AIM UNIT>	<RATE UNIT>	<RATE UNIT>	<RATE UNIT>
<REF (a)>	<TEST DESCRIPTOR (a)>	<MESSAGE (a)>	<Ps1 Aim (a)>	<Ps2 Aim (a)>	<Pt Aim (a)>	<Ps1 Rate (a)>	<Ps2 Rate (a)>	<Pt Rate (a)>
<REF (b)>	<TEST DESCRIPTOR (b)>	<MESSAGE (b)>	<Ps1 Aim (b)>	<Ps2 Aim (b)>	<Pt Aim (b)>	<Ps1 Rate (b)>	<Ps2 Rate (b)>	<Pt Rate (b)>
<REF (c)>	<TEST DESCRIPTOR (c)>	<MESSAGE (c)>	<Ps1 Aim (c)>	<Ps2 Aim (c)>	<Pt Aim (c)>	<Ps1 Rate (c)>	<Ps2 Rate (c)>	<Pt Rate (c)>
<REF (d)>	<TEST DESCRIPTOR (d)>	<MESSAGE (d)>	<Ps1 Aim (d)>	<Ps2 Aim (d)>	<Pt Aim (d)>	<Ps1 Rate (d)>	<Ps2 Rate (d)>	<Pt Rate (d)>
<REF (e)>	<TEST DESCRIPTOR (e)>	<MESSAGE (e)>	<Ps1 Aim (e)>	<Ps2 Aim (e)>	<Pt Aim (e)>	<Ps1 Rate (e)>	<Ps2 Rate (e)>	<Pt Rate (e)>
End Test Table								
Begin Test Table								
<TEST TABLE TITLE 2>	<HEADER 2>		<AIM UNIT>	<AIM UNIT>	<AIM UNIT>	<RATE UNIT>	<RATE UNIT>	<RATE UNIT>
<REF (a)>	<TEST DESCRIPTOR (a)>	<MESSAGE (a)>	<Ps1 Aim (a)>	<Ps2 Aim (a)>	<Pt Aim (a)>	<Ps1 Rate (a)>	<Ps2 Rate (a)>	<Pt Rate (a)>
<REF (b)>	<TEST DESCRIPTOR (b)>	<MESSAGE (b)>	<Ps1 Aim (b)>	<Ps2 Aim (b)>	<Pt Aim (b)>	<Ps1 Rate (b)>	<Ps2 Rate (b)>	<Pt Rate (b)>
<REF (c)>	<TEST DESCRIPTOR (c)>	<MESSAGE (c)>	<Ps1 Aim (c)>	<Ps2 Aim (c)>	<Pt Aim (c)>	<Ps1 Rate (c)>	<Ps2 Rate (c)>	<Pt Rate (c)>
<REF (d)>	<TEST DESCRIPTOR (d)>	<MESSAGE (d)>	<Ps1 Aim (d)>	<Ps2 Aim (d)>	<Pt Aim (d)>	<Ps1 Rate (d)>	<Ps2 Rate (d)>	<Pt Rate (d)>
<REF (e)>	<TEST DESCRIPTOR (e)>	<MESSAGE (e)>	<Ps1 Aim (e)>	<Ps2 Aim (e)>	<Pt Aim (e)>	<Ps1 Rate (e)>	<Ps2 Rate (e)>	<Pt Rate (e)>
End Test Table								

Field Descriptions



- Begin Test Table** - Control keywords - delimits the start of a test table data set.
End Test Table - Control keywords - delimits the end of a test table data set.
 <TEST TABLE TITLE n> - Free text field [34 characters maximum] - title for a page of test aims.
 <HEADER 1> - Free text field column title [3 characters maximum].
 <HEADER 2> - Free text field [29 characters maximum] - describes test.
 <AIM UNIT> - Control field - sets the units for entry of channel pressure aims, pressure or aeronautical, as per the units screen.
 <RATE UNIT> - Control field - sets the units for entry of channel pressure rates, pressure or aeronautical, as per the units screen.
 <REF (a) to (e)> - Free text field per test row [3 characters maximum] - refers to a section of a test document etc.
 <TEST DESCRIPTOR (a)> - Free text field per test row [29 characters maximum] - describes test conditions at that point etc.
 <MESSAGE (a)> - Free text field per test row [70 characters maximum] - gives instructions to the user etc.
 <Ps1|Aim(a) to (e)> - Numeric entry fields [3 per test row] - must contain a pressure aim for each channel in units <AIM UNIT>.
 <Ps1|Rate(a) to (e)> - Numeric entry fields [3 per test row] - must contain a pressure rate for each channel in units <RATE UNIT>.

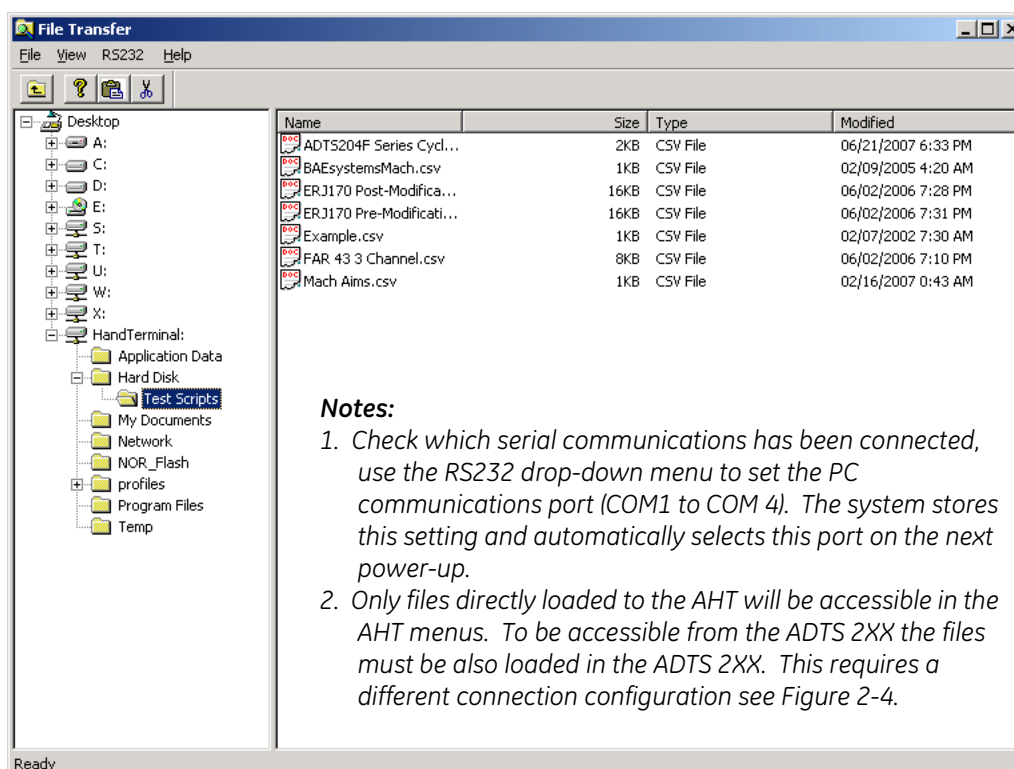
Note: The example template file (.XLS, format, with coloured fields as above) may be used for creation, edit or archive of new test sequence files. A copy of the data sheet MUST be saved in .CSV file format for direct use by the ADTS 2XXuser interface program (.CSV files do not use the colour and column width of the .XLS).

the ADTS 2XX Advanced Hand Terminal or ADTS 2XX

Transferring Files using GE FileTransfer Utility


Connect the PC communications cable (Table 2-1, item 5) into an available 9-way 'D' COM port on the PC and the connector of the Advanced Hand Terminal.

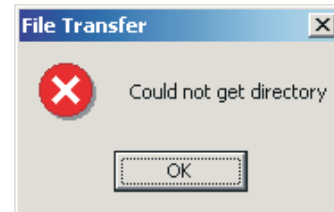
To start the File Transfer Utility on the PC, double click the  icon, set the File Transfer Utility, click the  to expand the Advanced Hand Terminal drive as shown:



To copy a new script file (.csv file) to the Advanced Hand Terminal click-on and highlight the required file and, using the File/Copy/Paste facility in Windows®, click on the Hand terminal/Hard Disk directory as the destination of the file. A progress bar appears and shows the transfer progress. Use the same procedure to transfer files from the Advanced Hand Terminal to the PC. After re-starting the main ADTS 2XX application, the new test file can be selected and used.

File Transfer Utility NO Connection


An egg-timer icon  appears on the screen when the program detects a no connection condition. After approximately 20 seconds this file transfer error message appears.



3.5 Software Settings

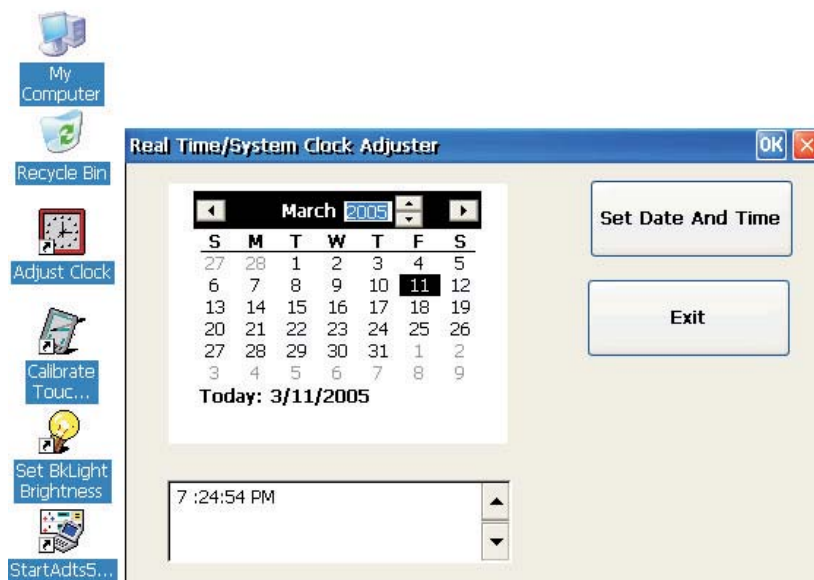
Refer to 2.7 for the list of software supplied with the ADTS 2XX. The following details the adjustments that can be made using this software

DK285 – RTC Adjuster


This program enables the adjustment of the system clock in Windows® and the real-time clock on the control computer board. To execute this application, exit from the ADTS 2XX program and double click on the icon Adjust Clock . The screen capture below shows the application running.

To adjust the date and time, use the window boxes provided on the left of the dialogue box. Click on the year number, the display shows up/down arrows to change the year shown below. When the date and time are correct, click the **Set Date And Time** button.

On completion, click the **Exit** button.




DK286 – Touch Screen Calibrator

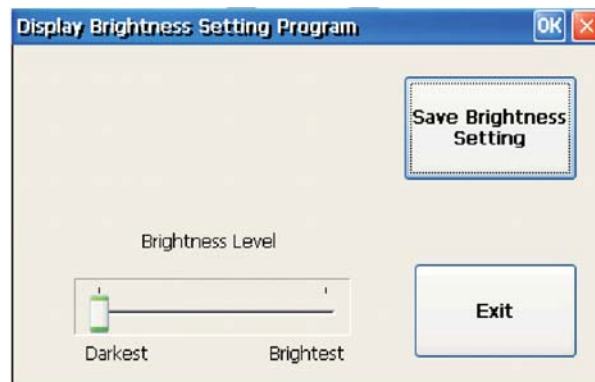
This program enables the calibration of the touch screen. To execute this application, exit from the ADTS 2XX program and double click on the Calibrate Touch icon . The Stylus application, stored as part of the system application, executes first. Select the calibration option and click the **Recalibrate** button. Follow the on-screen instructions, after obtaining all the calibration points, touch the screen once and the Stylus program returns to the previous screen. Close down the Stylus application, the screen shows the following:



This screen gives the opportunity to save the calibration by clicking the **Save Screen Calibration** button, or restoring the default screen calibration stored by clicking the **Restore Default Calibration Data** button. The system stores the calibration data. On completion, click the **Exit** button.

DK287 – Display Backlight Brightness Setting Program

This program enables the user to adjust the brightness of the display backlight. To execute this program, exit the ADTS205 program and double click on the icon Set BkLight Brightness . The screen shows the following:



The slide bar Brightness Level starts in the position of the current backlight brightness. Adjust the brightness level by moving the slide bar left for darker and right for brighter. The backlight changes as the slide bar moves. To save the setting, click the **Save Brightness Setting** button, this stores the current brightness setting. On completion, click the **Exit** button.

3.6 SCPI Commands for the ADTS 2XX

Through the RS232 serial interface the ADTS 2XX can be remotely controlled from a PC. The ADTS 2XX receives commands and queries, it responds by changing operating modes and conditions and by sending information on status and pressure readings. The communications parameters for the RS232 interface can be configured in the set-up menu and are based on typical SCPI syntax. The PC communications cable (item 5, Table 2-1) should be used for connection between the PC and the ADTS 2XX (see Figure 2-4).

External Control using RS232 Communications

SCPI Commands

This section describes each command and query in detail including parameters used and response data returned. The general short form command is shown at the top of each page. The following information given:

Command Syntax	-	The upper case represents the short form command.
Parameter Type	-	REAL, INTEGER, DISCRETE or STRING
Parameter Range	-	Either the range of INTEGER/REAL numbers or the choice of DISCRETE or maximum STRING length.
Units	-	The units used for some specified parameters.
Password	-	Password protects some commands; software version 4.30 onwards.
Function	-	Basic function of the command, see user manual for full description of the function.
Conditions	-	Any condition that limits the use of a command.
Query Syntax	-	Syntax of query command includes parameters passed as part of the query.
Parameter Type	-	As for command (above).
Parameter Range	-	As for command (above).
Returned Data	-	Data returned by the ADTS following a query command.
Returned Data Type	-	As parameter type.
Returned Data Range	-	As parameter range.
Units	-	Units of returned data.
Function	-	Basic function of query command.
Conditions	-	As for command.

Commands to ADTS 205

All SCPI commands must be terminated with 0A Hex

Command Responses from ADTS 2XX

All responses from the ADTS 2XX terminate with 0A Hex.

MEAS

This group of query commands returns the measured values.

MEAS:PRES

Command Syntax

N/A

Parameter Type:

Parameter Range:

Function:

Conditions:

Query Syntax

MEASure:PRESSure? <parameter>

Parameter Type: DISCRETE

Parameter Range: ALT | CAS | MACH | PS | PT | QC

Returned Data Static Channels: <value>,<value>

Returned Data Pitot Channel: <value>,*

Function: To query measured pressure.

Conditions: None

MEAS:RATE

Command Syntax

N/A

Parameter Type:
Parameter Range:
Function:
Conditions:

Query Syntax

MEASure:RATE? <parameter>

Parameter Type: DISCRETE
Parameter Range: ALT | CAS | PS | PT | QC
Returned Data Static Channels: <value>,<value>
Returned Data Pitot Channel: <value>,*

Function: To query measured instant rate of change for specified parameter.

Conditions: Rate timer must not be operating.

STAT

This group of commands monitor and control the status bytes that show the status of the ADTS 2XX.

STAT:OPER:CON

Command Syntax

N/A

Parameter Type:

Parameter Range:

Function:

Conditions:

Query Syntax

STATus:OPERation:CONdition?

Parameter Type: None

Parameter Range:

Returned Data: <status>

Returned Data Type: INTEGER

Returned Data Range: 0-32767

Function: To query the status of the ADTS. The table shows the function of each bit.

Conditions: None

Bit	Data
0	Reserved – returns 0
1	Ps1 controlling and at set-point
2	At ground
3	Ps2 controlling and at set-point
4	Pt controlling and at set-point
5	Reserved – returns 0
6	Reserved – returns 0
7	Reserved – returns 0
8	Reserved – returns 0
9	Reserved – returns 0
10	Reserved – returns 0
11	Reserved – returns 0
12	Reserved – returns 0
13	Reserved – returns 0
14	Reserved – returns 0
15	Reserved – returns 0

SOUR

This group of commands control the controller states, aim and limit values.

SOUR:GTGR

Command Syntax

SOURce:GTGRound

Parameter Type:	None
Parameter Range:	
Function:	To return the ADTS 2XX to ground pressure. Rates to be set first.
Conditions:	Must be in control mode.

Query Syntax

SOURce:GTGRound?

Parameter Type:	None
Parameter Range:	
Returned Data Static Channels:	<state>,<state>
Returned Data Pitot Channel:	<state>
Returned Data Type:	Boolean
Returned Data Range:	0 1
Function:	Returns: 1 - only when the ADTS 2XX is safe at ground 0 - for all other conditions
Conditions:	None

SOUR:PRES

Command Syntax

SOURce:PRESSure <parameter>, <aim>, <aim>

Parameter Type: DISCRETE, REAL

Parameter Range: ALT | CAS | MACH | PS | PT | QC

Static Channels: SOUR:PRES <parameter>,<Ps1 Aim>,<Ps2 Aim>

Pitot Channel: SOUR:PRES <parameter>,<Pt Aim>

Function: To command the selected parameter to a new aim value.

Conditions: Controllers must be ON before using this command.

Query Syntax

SOURce:PRESSure? <parameter>

Parameter Type: DISCRETE

Parameter Range: ALT | CAS | MACH | PS | PT | QC

Units: As set UNIT command

Returned Static Channels: <Ps1 Aim>,<Ps2 Aim>

Returned Pitot Channel: <Pt Aim>, *

Function: To query the last commanded aim values

Conditions: See current limit settings

SOUR:RATE

Command Syntax

SOURce:RATE<parameter> <aim>

Parameter Type	DISCRETE, REAL
Static Channels:	SOUR:RATE <parameter>,<Ps1 Rate Aim>,<Ps2 Rate Aim>
Pitot Channel:	SOUR:RATE <parameter>,<Pt Rate Aim>
Parameter Range:	ALT CAS MACH PS PT QC
Function:	To command the rate of change of the selected parameter to a new aim value.

Conditions: Must be in control mode.

Query Syntax

SOURce:RATE? <parameter>

Parameter Type	DISCRETE
Parameter Range:	ALT CAS MACH PS PT QC
Returned Static Channels:	<Ps1 Aim>,<Ps2 Aim>
Returned Pitot Channel	<Pt Aim>, *

Function: To query last rate command.

Conditions: None.

SOUR:STAT

Command Syntax

SOURce:STATe <state>

Parameter Type DISCRETE
Parameter Range: CONTROL | MEASURE | ON | OFF

Function: To change the mode of the pressure controllers.
CONTROL or ON to go to control mode.
MEASURE or OFF to go to measure mode.

Conditions: Must be in control mode.

Query Syntax

SOURce:STATe?

Parameter Type None
Parameter Range:
Returned Data: <state>
Returned Data Type: DISCRETE
Returned Data Range: ON | OFF

Function: To query state of pressure controllers.

Conditions: None

SYST

This group of commands controls system functions such as data, time and errors.

SYST:ERR

Command Syntax

N/A

Parameter Type:

Parameter Range:

Function:

Conditions: None

Query Syntax

SYSTem:ERRor?

Parameter Type: None

Parameter Range:

Returned Data: <err number>,<err text>

Returned Data Type: INTEGER, STRING

Returned Data Range:

Function: Returns oldest SCPI error and then deletes that error. Use the query repeatedly to get all errors until 0, "No error" is returned.
Note; <err text> is returned in "double quotes".

Conditions: None

UNITS

This group of commands is used for setting the units of measurement.

UNITS:AER

Command Syntax

UNITS:AERonautical <units>

Parameter Type: DISCRETE

Parameter Range: FTKNTS | FTMPH | MKPH(M/S) | MKPH(M/MIN)

Function: Sets the aeronautical units used for SCPI commands and queries.

Conditions: None

Query Syntax

UNITS:AERonautical?

Parameter Type: None

Parameter Range:

Returned Data: <units>

Returned Data Type: DISCRETE

Returned Data Range: FTKNTS | FTMPH | MKPH(M/S) | MKPH(M/MIN)

Function: To query the SCPI aeronautical units.

Conditions: None

UNITS:PRES

Command Syntax

UNITS:PRESsure <units>

Parameter Type:	DISCRETE
Parameter Range:	MBAR, INHG, PSI, MMHG, KPA, HPA
Function:	To set the pressure units used for SCPI commands and queries. The display only shows these units when SOUR:PRES or SOUR:RATE is sent.
Conditions:	None

Query Syntax

UNITS:PRESsure?

Parameter Type:	None
Parameter Range:	
Returned Data	<units>
Returned Data Type	DISCRETE
Returned Data Range:	MBAR, INHG, PSI, MMHG, KPA, HPA
Function:	To query the SCPI pressure units.
Conditions:	None

Standard Commands

The commands starting with * are standard SCPI commands.

*IDN

Command Syntax

N/A

Parameter Type

Parameter Range:

Function:

Conditions:

Query Syntax

***IDN?**

Parameter Type: None

Parameter Range:

Returned Data: DRUCK,ADTS Three Channel System V1.0.28 <Cal Date>
<Cal Date> is NO CALIBRATION DATE or [dd,mm,yyyy]

Returned Data Type: STRING

Function:

Conditions:

*GTL

Command Syntax

***GTL**

Parameter Type

Parameter Range:

Function: Gets the ADTS out of Remote Mode.

Conditions:

Query Syntax

N/A

Parameter Type:

Parameter Range:

Returned Data:

Returned Data Type:

Function:

Conditions:

*REM

Command Syntax

*REM

Parameter Type

Parameter Range:

Function:

Puts the ADTS into Remote Mode ready to receive SCPI Commands.
This is the first command the user must use before sending any other commands.

Conditions:

None

Query Syntax

N/A

Parameter Type:

Parameter Range:

Returned Data:

Returned Data Type:

Function:

Conditions:

3.7 Manual Venting of the Aircraft Pitot and Static Systems

Instrument Status on Power Failure

On removal of power, the main output valve linking external ports Ps1, Ps2 and Pt to the internal pressure controllers will automatically close. The aircraft pitot and static systems remain safe but with the last applied pressures now isolated and maintained in the hoses.

Instrument Status on Restoration of Power

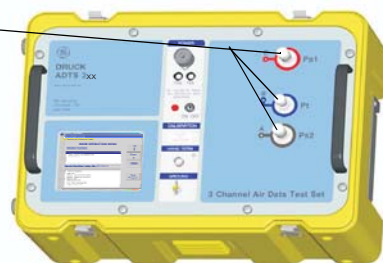
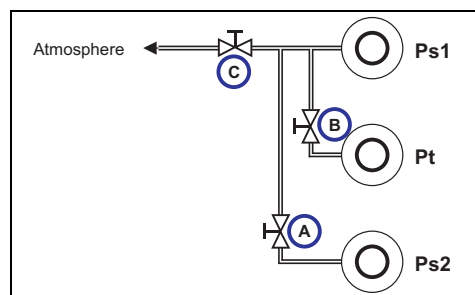
When power is restored to the instrument the normal self test routine for the controllers will be performed and at the end of this the controller will exactly equalize the internal manifold pressures to match those of the external aircraft hoses and then the output valves will be reopened. This process will at all times protect the aircraft pitot and static systems from adverse pressure transients, differentials or excessive rates.

When the output valves are fully opened, the normal parameter measurement screens become available from the main menu and full control is again available. The testing may then either continue from the same point (when the power failure occurred) or the aircraft pitot and static systems may be safely controlled back to ground pressures.

Actions if power cannot be quickly restored

Two courses of action are possible at this point:

- 1 Leave the ADTS 2XX connected to the aircraft pitot and static systems with pipes safely isolated but maintaining trapped pressures until such time as power can be restored.
- 2 Use the manual let-down valves on the instrument front panel to safely bleed the trapped hose pressures back to ambient ground. This must be carried out in a way that ensures the Ps1 to Pt and Ps1 to Ps2 differential pressures remain at zero while the whole connected system is brought to ground pressure. The order of valve opening should be A then B to equalize, then C to vent to ground.



Let-down valves are precision multi-turn, operated by small slotted adjusters

4 MAINTENANCE

4.1 Introduction

This section details the before-use tasks and the weekly inspection to be carried out by the operator. The maintenance chart shows the maintenance tasks, the periodicity of each task and a code referenced to the task detailed in 4.3.

Task	Code	Period
Inspect	A	Daily, before use
Inspect	B	Weekly
Test	C	Before use
Test	D	Daily, before use

* Periodicity may change depending on usage and environment, refer to the Engineering Authority.

TABLE 4-1 MAINTENANCE CHART

4.2 Materials and Tools

This section provides lists of the materials and tools required for the user to maintain the ADTS 2XX.

Item Number	Item name, Description
1	Cloth, Cotton, Lint-Free
2	Detergent, Mild Liquid

Note: *Equivalent substitutes can be used.*

TABLE 4-2 MATERIALS LIST

4.3 Maintenance Tasks

- A Check that all the equipment is present; record any deficiencies. Visually inspect the external of the ADTS 2XX, and its associated equipment, for obvious signs of damage, dirt, and the ingress of moisture. If necessary, use mild liquid detergent (item 2, Table 4-2) and a lint-free cloth (item 1, Table 4-2) to clean the external surfaces. Inspect the pressure outlet ports and expansion ports for ingress of dirt and moisture, clean if necessary with a lint-free cloth.
- B Visually inspect the pneumatic output connectors for damage. Inspect the small o-ring on each pneumatic output connector for cuts and any signs of wear; replace as necessary. Visually inspect pneumatic hoses, electrical cables for cuts, splits and damage; replace as necessary.
Check, by entering the system set-up, service data (figure 4-1 below) the unit and pump operational hours. At 1000 hours (filters) and 3000 hours (pump) return the unit to the servicing depot for maintenance.
- C Before use, power-up the unit as detailed in Section 3. Check the date of the last calibration and, if necessary, refer to the manufacturer. Record any error messages and refer to Section 5.
- D Daily and before use, carry out the SST and leak check detailed in Section 5.

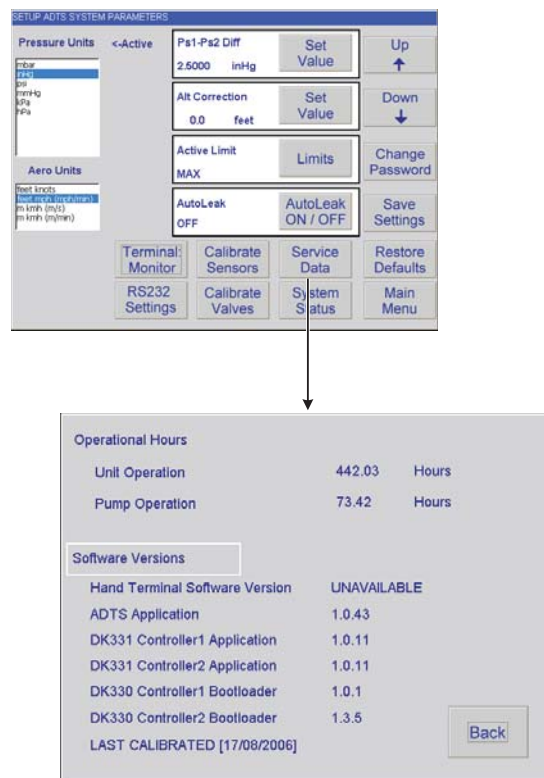


FIGURE 4-1 SERVICE DATA

4.4 Routine Maintenance

Absolute cleanliness of the work area, tools and equipment are essential.

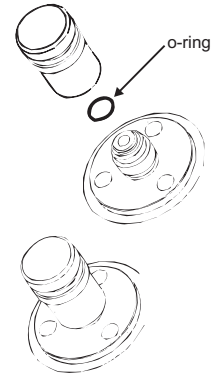
Replacing the output connector o-ring

After inspection as detailed in maintenance task B, carry out the following if the o-ring is worn or damaged:

Carefully remove the o-ring from the small groove at the top of the connector. Fit a new o-ring in the small groove at the top of the connector.

Make sure the o-ring is tight in the groove and not damaged after fitting.

Note: *Damage to this o-ring causes leaks.*



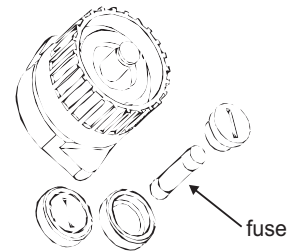
Replacing a fuse

Disconnect the electrical power supply.

Unscrew the fuse holder cap and remove the fuse.

Fit a new fuse of the correct type and rating into the fuse holder cap.

Secure the fuse holder in the front panel.



Repair of the AHT

The AHT is a non-serviceable component. If the AHT becomes unserviceable, it can only be replaced by another ATEX compliant AHT.

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5 TESTING AND FAULT FINDING

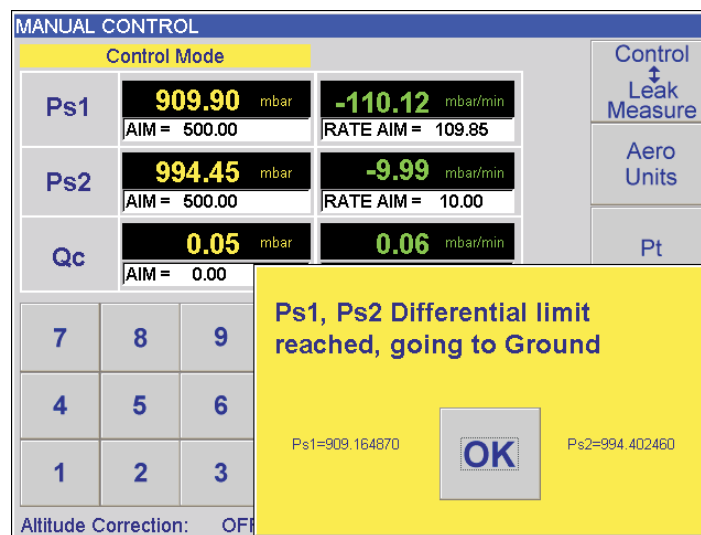
Limited fault finding and rectification can be carried out by the operator. Units can be returned to the nearest GE Sensing Service Department (www.gesensing.com) for fault finding and rectification.

Procedures

Any defect arising must be rectified before proceeding to the next operation.

Limits

The Control PC screen displays operational faults caused by leaks in the aircraft systems or equipment. If the defined differential limit is exceeded the system goes to ground and the screen displays the following message:



5.1 Standard Serviceability Test

- The following procedure shows if the unit is serviceable and checks functions and facilities of the ADTS 2XX. In this procedure:

Procedure

- Connection and power-on checks.
 - Connect power to the unit.
 - Make sure the blanking caps are fitted to the Ps1, Ps2 and Pt front panel outputs.
 - Set the power supply switch to ON.
 - Check power indicator is on.
 - Check the display shows the first power-up message.
- Check the display shows the system starting message.
 - The ADTS 2XX displays any detected errors, refer to fault finding.
- Check that the display then changes to show the leak measure mode menu.

- ❑ If necessary, select aero units and set aeronautical units of ft, kts and ft/min (see 3.3 to change).
- ❑ Press **HOLD AIMS**, to set the required parameters for Alt1, Alt2 and CAS.
- ❑ Press **CONTROL/LEAK MEASURE** to go to control mode.
- ❑ Set the Alt1 and Alt2 rate to 5000 ft/min.
- ❑ Enter an altitude aim of 500 ft and an airspeed aim of 400 knots.
- ❑ Press **SENDS AIMS**.
- ❑ Check that these aim values are achieved, the rate of change are within the selected rates and that the achieved aim values are stable.

Completion

- Press **GROUND**, wait until the display shows 'At Ground Pressures'. On successful completion of this test procedure, switch off and disconnect the power supply.

5.2 ADTS 2XX Leak Check

- Allow at least 15 minutes for the unit to warm-up.

Pressure leak check

- This procedure verifies that the unit is leak tight under positive pressure conditions.
- 1. Select manual control from the main operation menu. Set the units of measurement to inHg. Select RATE TIMER and set the WAIT time to 5min.00secs and the TIME to 1min.00secs.
- 2. Press **LEAK MEASURE/CONTROL** to enter control mode. Press **HOLD AIMS**, to set the required parameters Ps1, Ps2 and Qc. Enter a Ps aim of 31.00 inHg and a Qc aim of 8.00 inHg. Press **SEND AIMS**.
- 3. Check that the system achieves the aim values.
- 4. Press **LEAK MEASURE/CONTROL** to return to Leak Measure mode.
- 5. Select RATE TIMER and press start. The display shows the waiting time counting down then the timing countdown. Finally the display shows timed rates with a 'T' after each value.
- 6. Check that the Ps1, Ps2 and Qc rates are less than or equal to ± 0.015 inHg/min. If the rates are greater than this value, allow further thermal stabilization time and re-test.

Vacuum leak check

- This procedure verifies that the unit is leak tight under vacuum conditions.
- 1. Press **LEAK MEASURE/CONTROL** to enter control mode. Press **HOLD AIMS**, to set the required parameters Ps1, Ps2 and Qc. Enter a Ps aim of 25.00 inHg and a Qc aim of 0.00 inHg. Press **SEND AIMS**.
- 2. Check that the system achieves the aim values.
- 3. Press **LEAK MEASURE/CONTROL** to return to Leak Measure mode.
- 4. Select RATE TIMER and press start. The display shows the waiting time counting down then the timing countdown. Finally the display shows timed rates with a 'T' after each value.

5. Check that the Ps1, Ps2 and Qc rates are less than or equal to ± 0.015 inHg/min. If the rates are greater than this value, allow further thermal stabilization time and re-test.
6. If a rate remains greater than the allowed value an internal leak is present. Return the unit to the repair depot.

System status

- To check the general condition of the controller system go to system set-up, system status (Figure 5-1).

5.3 Fault Diagnosis

- If the display shows a warning or error message, refer to the section below (Tables 5-1, 5-2 and 5-3).
- If a controller is suspect refer to the controller stability check, page 53.

5.4 Error Messages

- At power-up, the ADTS 2XX indicates if there is a fault by displaying an error code and message.
- See paragraph 5.4 (Tables 5-1, 5-2 and 5-3) for the listings of the error codes, check that the error code is complete and listed in the table before returning the unit to the repair depot.

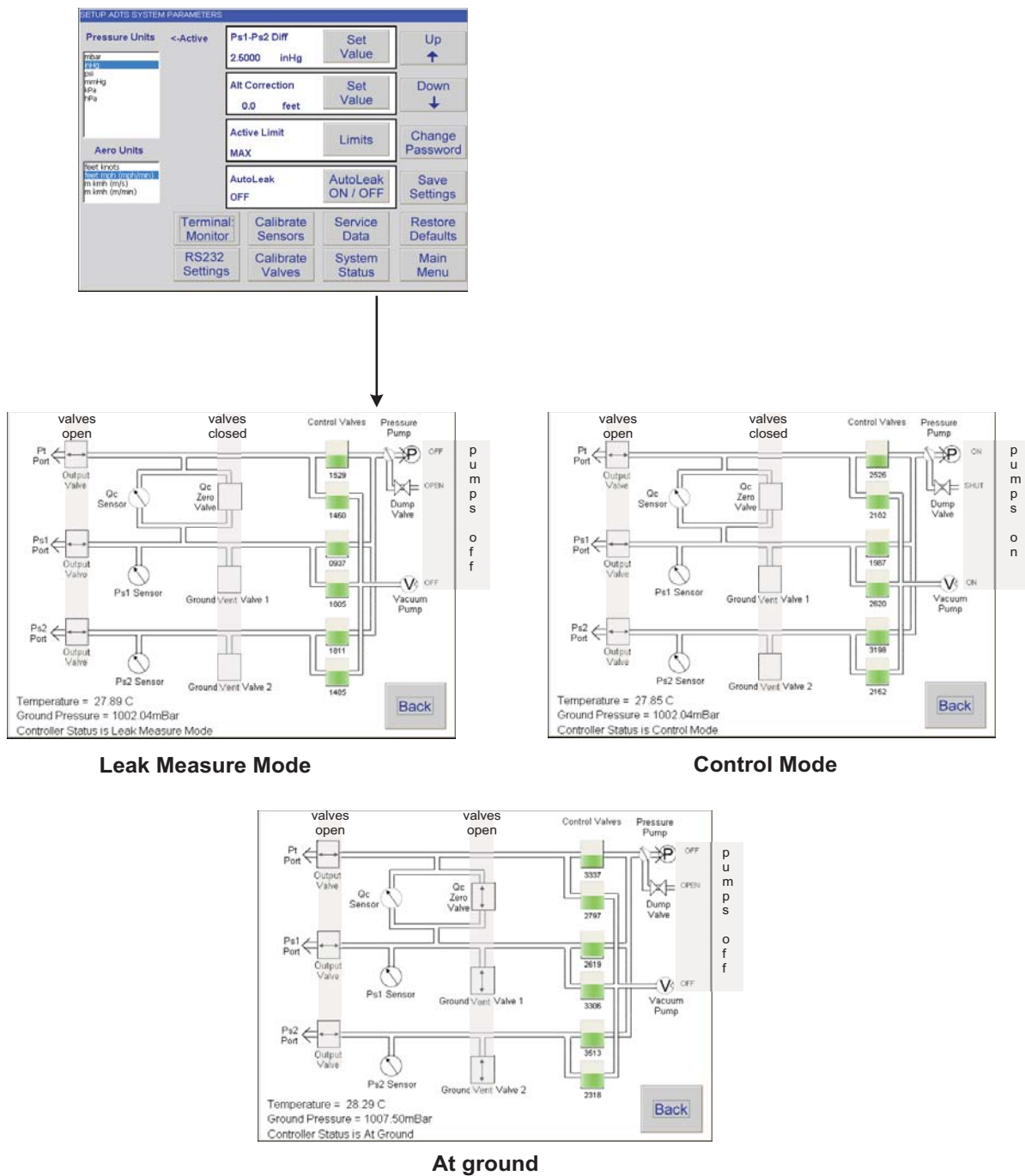


FIGURE 5-1 SYSTEM STATUS

5.5 Fault Finding

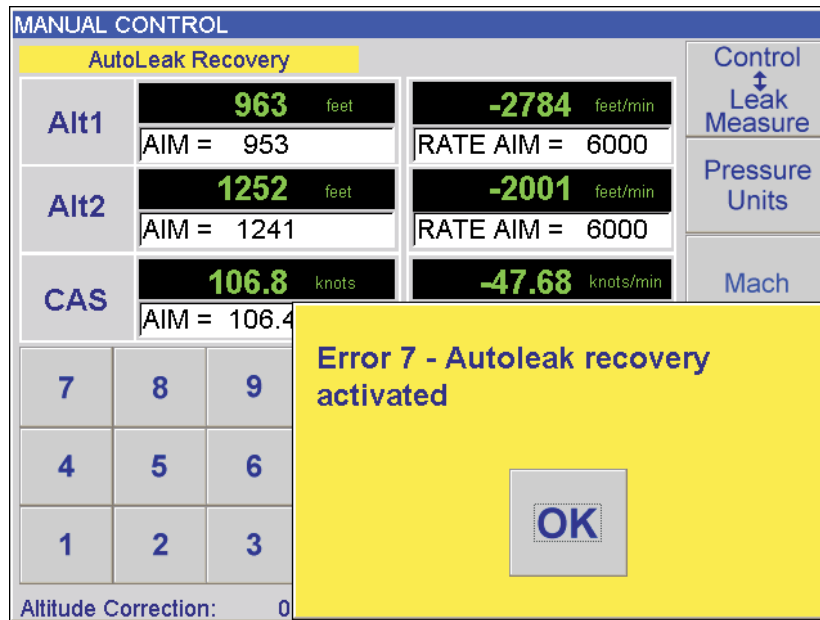


FIGURE 5-2 EXAMPLE ERROR SCREEN

- In the event of a malfunction, the built-in, self-test and diagnostic system displays a message and a code. The message heading **Error** indicates a fault or condition that interrupts normal operation. The following tables list the error messages with the probable cause and action to be taken.
- If the display shows a message not listed in the tables the unit must be switched off. If the display shows the same non-operational message after switching on, the unit should be returned to the repair depot.

No.	Message	Probable Cause	Action
7	Autoleak recovery activated	Excessive leak rate detected in Ps/Qc pressures	Check hoses and aircraft systems for leaks
31	Test set must be at ground	Invalid user request	Select Go to Ground first
32	Pressure leak in Ps1. Leak rate = or Pressure leak in Ps2. Leak rate =	Leaking Ps1 channel pressure control valve or Leaking Ps2 channel pressure control valve	Return unit to repair depot
33	Pressure leak in Pt. Leak rate =	Leaking Pt channel pressure control valve	Return unit to repair depot
36	Ps1 Aim Overshoot or Ps2 Aim Overshoot	Leak rate on Ps1 too high to control or Leak rate on Ps2 too high to control	Check Ps1 or Ps2 hoses and aircraft systems for leaks

37	"Ps1 aim value unobtainable" or "Ps2 aim value unobtainable"	Connected system (Ps1 or Ps2) leak rate changing	Check Ps1 or Ps2 port caps, hoses and connectors for leaks
40	Pt Aim Overshoot	Connected system leak rate changing	Check hoses and aircraft systems for leaks
41	"Pt aim value unobtainable"	Leak rate on Pt too high to control	Check port caps, hoses and connectors for leaks
45	Vacuum leak in Ps1 or Ps2. Leak rate =	Leaking Ps1 or Ps2 channel vacuum control valve	Return unit to repair depot
46	Vacuum leak in Pt. Leak rate =	Leaking Pt channel vacuum control valve	Return unit to repair depot
48	Ps1 or Ps2 pressure control valve cannot be calibrated	Valve fault	Return unit to repair depot
56	Stabilising Qc to Zero	Negative airspeed detected, possible sudden leak	System zero valve opened to stop condition. Check for leak.
57	Current Pressure Limits Exceeded	Limits for Ps or Qc exceeded.	Make sure pressures are within limits, check leak rates

TABLE 5-1 ERROR MESSAGES

- The temperature sensor in the pressure measurement system measures the temperature of the pressure manifold. At a temperature greater than 60°C the sensor triggers an overheat fault. In measure mode, the display flashes between the normal aim/measure screen and "Ps1 (or Ps2) Sensor Outside Calibrated Range". In control mode, the display shows "CONTROL HALTED" the system stops controlling and switches off the pumps. When the sensor detects a temperature of 55°C the display stops flashing.
- Before re-entering control mode check the air vents for obstructions.
- If this overheat fault happens. To re-enter control mode press LEAK MEASURE/CONTROL twice.

No.	Message	Probable Cause	Action
221	"Changed Aim to ARINC Limit"	Value out of ARINC limit range	Re-enter value within allowed range
222	Calibration data failed	Incorrect pressure value entered during calibration	Check and enter correct pressure value for reference pressure point
227	"Changed Aim to Current Limit"	Value out of limit range	Re-enter value within allowed range
228	"Limit Overlap"	Value conflicts with limit ranges	Re-enter value within allowed range
229	"Limit Saved"	Value out of acceptable range	Re-enter value within allowed range
241	"Ground Request in Leak Mode"	System must be in control mode	Select control mode
243	"LDK has an invalid EEPROM archive"	Invalid/corrupted data - recovery in progress	Check custom limit sets not lost

245	"Controller has an invalid EEPROM archive"	Invalid/corrupted data - recovery in progress	Check/correct calibration
247	"Handset has an invalid EEPROM archive"	Invalid/corrupted data - recovery in progress	
250	"Vacuum pump processor has failed"	Internal fault	Return unit to repair depot
251	"Vacuum pump lead is disconnected"	-	Return unit to repair depot
252	"Vacuum pump transistor is faulty or drive inhibited"	Internal fault	Return unit to repair depot

TABLE 5-2 ERROR MESSAGES (CONTINUED)

No.	Message	Probable Cause	Action
253	"Vacuum pump has stalled"	Internal mechanical fault	Restart system, if fault repeats - return unit to repair depot
254	"Pressure pump processor has failed"	Internal fault	Return unit to repair depot
255	"Pressure pump lead is disconnected"	-	Return unit to repair depot
256	Pressure pump transistor is faulty or drive inhibited"	Internal fault	Return unit to repair depot
257	Pressure pump has stalled"	Internal mechanical fault	Restart system, if fault repeats - return unit to repair depot
260	Connected handset has failed to respond. Disconnecting power."	Handset bad connection or comms/power supply fault	Check connections and restart, if fault repeats - return unit to repair depot

261	"Calibration switch has not enabled."	Switch not selected	Set calibration switch
262	"Valve characterisation data is invalid. Restoring from FLASH."	Invalid/corrupted data, recovery in progress	Allow for complete recovery before continuing
263 to 290	"Valve constant out of range"	Essential system data failure	Return unit to repair depot
293	"Limit entry changed to MAX limit set"	User tried to enter limit out of range of the ADTS 2XX	Re-enter within maximum range of the ADTS 2XX
295	"CAS is outside MAX limits"	Differential pressure applied at Ps1/Pt ports over-range	Check/reduce Ps1/Pt pressures applied to ADTS 2XX
296	"Alt1 is outside MAX limits" or "Alt2 is outside MAX limits"	Pressure applied at Ps1 port or Ps2 port over-range	Check/reduce Ps1 or Ps2 pressure applied to ADTS 2XX
297	"ROC is outside MAX limits"	Rate of pressure change at Ps1 port too high	Check/correct hose or aircraft system Ps1 or Ps2 leak
298	"Qc is outside MAX limits"	Differential pressure applied at Ps1/Pt ports over-range	Check/reduce Ps1/Pt pressures applied to ADTS 2XX
299	"Ps1 is outside MAX limits" or "Ps2 is outside MAX limits"	Pressure applied at Ps1 port or Ps2 port over-range	Check/reduce Ps1 or Ps2 pressure applied to ADTS 2XX
300	"RtPs1 is outside MAX limits" or "RtPs2 is outside MAX limits"	Rate of pressure change at Ps1 port or Ps2 port too high	Check/correct hose or aircraft system Ps1 or Ps2 leak
309	"Hand terminal short circuit"	Faulty cable or hand terminal	Check cable, if necessary, replace hand terminal
313	Calibration data not entered. Enter calibration date"	Date entry step missed in calibration procedure	Enter date field requested

TABLE 5-3 ERROR MESSAGES (CONTINUED)

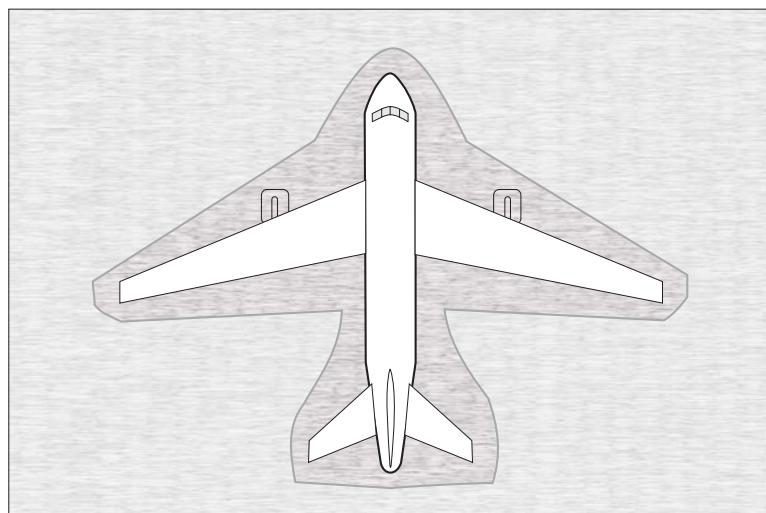
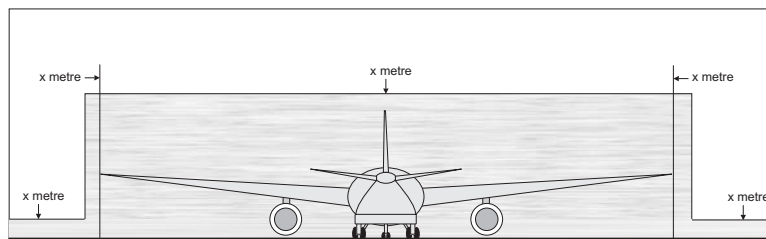
Control Stability

- This section verifies the control stability.
 - (1) Select **CONTROL/LEAK MEASURE** to turn the pressure controllers on. Select Pt data view.
 - (2) Press **HOLD AIMS** touch the aim boxes to enter a **Ps1** and **Ps2** aim of 500 mbar with a rate of change of 200 mbar/min.
 - (3) Enter a Speed/Pt Aim of 0 mbar with a rate of change of 200 mbar/min.
 - (4) Press **SEND AIMS** and wait for the aim values to be achieved.
 - (5) Observe the measured values of Ps1, Ps2 and Pt on the display for 1 min.
 - (6) Check that the displayed values of Ps1 and Ps2 remain within ± 0.05 mbar.
 - (7) Check that the displayed value of Pt remains within ± 0.05 mbar.

Zone 2 definition

Defined as an atmosphere where explosive vapours may be present in an air breathable atmosphere.

In an aircraft hangar, explosive vapour may be present around an aircraft. The amount of explosive vapour varies and depends on local conditions such as hangar ventilation, prevailing metrological conditions and the density of explosive vapours. The local conditions must be assessed and the dimensions (x metre) of the hazardous area defined by the local engineering and safety officials.



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6 REFERENCE AND SPECIFICATION

6.1 General Specification

Weight	22 kg [48.4 lb]
Hand Terminal	2 kg [4.8 lb]

Power Supply

Auto-selection between:

.....	Single phase AC 90 to 260 V
.....	frequency range 47 to 440 Hz
Power	240 VA

EMC emissions/immunity.....	EN61326-1
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Safety performance

Electrical/mechanical.....BS EN61010

Pressure equipment directive (PED), Class SEP, CE marked, ATEX Hand Terminal only, Zone 2 compliant

Shock and vibration

..... BS EN61010 MIL-T-28800 Class 2

Display

640 x 480 pixel, high contrast, backlit, colour LCD, resistive touch screen user interface

Environment

Temperature

The ADTS 505 has the following temperature ranges:

Calibrated	+5° to +35°C (+41° to +95°F)
Operating	0° to +50°C (+32° to +122°F)
Storage	-20° to +70°C (-4° to +158°F)

Humidity

..... 0 to 95% non condensing

Connections

Pressure connections

Ps1 and Ps2	AN-6
Pt	AN-4

Data communications

CANbus (hand terminal), RS232 (ext PC). All terminate on rugged 13-way circular MS38999 series connector.

6.2 Air Data Specifications

Note: All range values at maximum limits.

Ps 1 Port

Pressure Mode

Control Range: 35⁽¹⁾ to 1355 mbar a
 Measure Range: 27.6 to 1355 mbar a
 Resolution: 0.01mbar
 Accuracy: ±0.1 mbar
 Rate Range: 0 to 1000 mbar/min
 Rate Accuracy: ±1% of aim (average)

Aeronautical Mode

Control Range: -2000 to 60,000 ft.
 Measure Range: -3000 to 100,000ft.
 Resolution: 1 ft.
 Accuracy: ±3 ft. (@sea level)
 ±7 ft. (@30,000 ft)
 ±23 ft. (@55,000 ft)
 Rate Range: 0 to 40,000 ft/min
 Rate Accuracy: ±1% of aim (average)

Ps 2 Port

Pressure Mode

Control Range: 35⁽¹⁾ to 1355 mbar a
 Measure Range: 27.6 to 1355 mbar a
 Resolution: 0.01mbar
 Accuracy: ±0.1 mbar
 Rate Range: 0 to 1000 mbar/min
 Rate Accuracy: ±1% of aim (average)

Aeronautical Mode

Control Range: -2000 to 60,000 ft.
 Measure Range: -3000 to 100,000ft.
 Resolution: 1 ft.
 Accuracy: ±3 ft. (@sea level)
 ±7 ft. (@30,000 ft)
 ±23 ft. (@55,000 ft)
 Rate Range: 0 to 40,000 ft/min
 Rate Accuracy: ±1% of aim (average)

⁽¹⁾ limited only by vacuum pump/system leaks

Pt Port**Pressure Mode**

Control Range: 35⁽¹⁾ to 2767 mbar a
 Measure Range: 27.6 to 3500 mbar a
 Resolution: 0.01mbar
 Accuracy: ± 0.35 mbar

Aeronautical Mode

Control Range: 20 to 650 kts (0 to 2.8 Mach)
 Measure Range: 0 to 1000 kts (0 to 10 Mach)
 Resolution: 0.1 kts
 Accuracy: ± 0.5 kts

6.3 Operating Limits**Default limits**

This first set of user defined limits, identified as: USER 1, are enabled when the ADTS 2XX is switched on.

Alternative Limits

Enter the PIN to access the SETUP LIMITS display. Select one of the preset limits of MAX, STANDARD and CIVIL or define and enable USER 2 limits. An eight character name/code can replace the USER 2 title.

Preset limits**Name: "MAX"**

MIN ALT	-2000 ft
MAX ALT	60,000 ft
MAX ROC	40,000 ft/min
MIN CAS	0.0 knots
MAX CAS	650 knots
MAX MACH	2.7 Mach
MIN Ps1/Ps2	10.90 mbar (0.3219 inHg)
MAX Ps1/Ps2	1355.00 mbar (40.0131 inHg)
MIN Qc	-1355.00 mbar (-40.0131 inHg)
MAX Qc	2490.00 mbar (73.5296 inHg)
MAX Rate Ps1/Ps1	1000.00 mbar/min (29.5300 inHg/min)
MAX Rate Qc	1000.00 mbar/min (29.5300 inHg/min)
ALT CORRECTION	100 ft
ARINC LIMITS	OFF
MAX Ps1 to Ps2 Diff.	84.66 mbar (2.5 inHg)

Name: "STANDARD"

MIN ALT	-2000 ft
MAX ALT	60,000 ft
MAX ROC	10,000 ft/min
MIN CAS	0.0 knots
MAX CAS	650 knots
MAX MACH	1.732 Mach
MIN Ps1/Ps2	65.00 mbar (1.9194 inHg)
MAX Ps1/Ps2	1088.60 mbar (32.1463 inHg)
MIN Qc	0.00 mbar (0.0000 inHg)
MAX Qc	866.00 mbar (25.5730 inHg)
MAX Rate Ps1/Ps1	200.00 mbar/min (5.9060 inHg/min)
MAX Rate Qc	200.00 mbar/min (5.9060 inHg/min)
ALT CORRECTION	100 ft
ARINC LIMITS	OFF
MAX Ps1 to Ps2 Diff.	84.66 mbar (2.5 inHg)

Name: "CIVIL"

MIN ALT	-1000 ft
MAX ALT	50,000 ft
MAX ROC	6,000 ft/min
MIN CAS	0.0 knots
MAX CAS	450 knots
MAX MACH	1.0 Mach
MIN Ps1/Ps2	115.97 mbar (3.4246 inHg)
MAX Ps1/Ps2	1050.41 mbar (31.0185 inHg)
MIN Qc	0.00 mbar (0.0000 inHg)
MAX Qc	368.01 mbar (10.8673 inHg)
MAX Rate Ps1/Ps1	109.85 mbar/min (3.2439 inHg/min)
MAX Rate Qc	109.85 mbar/min (3.2439 inHg/min)
ALT CORRECTION	100 ft
ARINC LIMITS	OFF
MAX Ps1 to Ps2 Diff.	84.66 mbar (2.5 inHg)