Druck ADTS 405
Air Data Test Systems
User Manual
K114
Introduction
This technical manual provides operating instructions for the Air Data Test System compatible with the requirements of first line servicing.

Scope
This technical manual contains a brief description, operation and testing 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 make sure of 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 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 authorised 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 product meets the essential protection requirements of the relevant EEC directives. Further details of applied standards may be found in the product specification.
Associated Publications

This lists the Druck manuals and publications referenced in this manual.

**Maintenance Manual**
Air Data Test System ADTS 405
K244

**Calibration Manual**
Air Data Test System ADTS 405
K199

**IEEE 488 OPT 2 Manual**
Air Data Test System ADTS 405
K154

**SCPI IEEE 488 Manual**
Air Data Test System ADTS 405
K157

**User Manual**
Altimeter Encoder Option
K170

**User Manual**
ARINC 429 Option
K185

**User Manual**
Line Switching Unit LSU 100/101
K220

**User Manual**
Line Switching Unit LSU 200
K222

**Operating and Communications Manual**
Line Switching Unit LSU Series
K223

**TPM Programming and Communications Manual**
Test Program Manager Version 4 for Windows
K230

**TPM User Manual**
Test Program Manager Version 4 for Windows
K250

**Symbols**

⚠️ This symbol, on the instrument, indicates that the user should refer to the user manual.

🚫 This symbol, on the instrument, indicates do not throw-away in domestic bin, hazardous material, dispose correctly in accordance with local regulations.

___ This symbol, on the instrument, indicates d.c.
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### Abbreviations

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

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<td>Ampere</td>
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<tr>
<td>abs</td>
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<td>a.c.</td>
<td>Alternating current</td>
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<td>ALT</td>
<td>Altitude</td>
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<td>ATEX</td>
<td>Equipment for Use in Potentially Explosive Atmospheres</td>
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<td>CAS</td>
<td>Calibrated airspeed</td>
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<td>d.c.</td>
<td>Direct current</td>
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<td>End of conversion</td>
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<td>EPR</td>
<td>Engine pressure ratio</td>
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<td>EPROM</td>
<td>Electrically programmable read only memory</td>
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<td>ft</td>
<td>Foot</td>
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<td>g</td>
<td>Gauge</td>
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<td>Hg</td>
<td>Mercury</td>
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<tr>
<td>Hz</td>
<td>Hertz</td>
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<td>IAS</td>
<td>Indicated airspeed</td>
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<td>i.e.</td>
<td>That is</td>
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<td>IEEE 488</td>
<td>Institute of Electrical and Electronic Engineers standard 488 data</td>
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<td>in</td>
<td>Inch</td>
</tr>
<tr>
<td>kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>LED</td>
<td>Light emitting diode</td>
</tr>
<tr>
<td>m</td>
<td>Metre</td>
</tr>
<tr>
<td>mA</td>
<td>Milliampere</td>
</tr>
<tr>
<td>max</td>
<td>Maximum</td>
</tr>
<tr>
<td>mbar</td>
<td>Millibar</td>
</tr>
<tr>
<td>min</td>
<td>Minute or minimum</td>
</tr>
<tr>
<td>mm</td>
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<td>Ps</td>
<td>Static pressure</td>
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<td>psi</td>
<td>Pounds per square inch</td>
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<td>Pt</td>
<td>Total pressure</td>
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<td>Local atmospheric pressure</td>
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<td>Barometric pressure at sea level</td>
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<td>Rate of climb</td>
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<td>SCPI</td>
<td>Standard commands for programmable instruments</td>
</tr>
<tr>
<td>TAS</td>
<td>True airspeed</td>
</tr>
<tr>
<td>TE</td>
<td>Test equipment</td>
</tr>
<tr>
<td>V</td>
<td>Volts</td>
</tr>
<tr>
<td>Vc</td>
<td>Calibrated velocity</td>
</tr>
<tr>
<td>Vt</td>
<td>True velocity</td>
</tr>
<tr>
<td>+ve</td>
<td>Positive</td>
</tr>
<tr>
<td>-ve</td>
<td>Negative</td>
</tr>
<tr>
<td>°C</td>
<td>Degrees Celsius</td>
</tr>
<tr>
<td>°F</td>
<td>Degrees Fahrenheit</td>
</tr>
</tbody>
</table>
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 make sure 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** Make sure that an item or system functions correctly as far as possible without the use of test equipment or reference to measurement.

**Power-up** To perform operations necessary to switch on a system ready for use.
Power-down: To perform operations necessary to safely switch off a system after use.

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 required 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.
Returned Goods Procedure for Europe

Should the unit become unserviceable and require repair 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, providing the following information:

- Product (i.e. ADTS 405)
- Pressure medium (i.e. air, nitrogen)
- Serial number
- Details of defect/work to be undertaken
- Operating conditions

Safety Precautions
You must also tell us if the product has been in contact with anything hazardous or toxic and the relevant COSH references and precautions to be taken when handling.

Important notice

Service by unauthorized sources will affect the warranty and may not guarantee further performance.
Returned Material Procedure for USA

Should the equipment 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 Material Authorization (RMA) number, providing the following information:

- Product (i.e. ADTS 405)
- Pressure medium (i.e. air, nitrogen)
- Serial number
- Details of defect/work to be undertaken
- Operating conditions

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

Important notice
Service by unauthorized sources will affect the warranty and may not guarantee further performance.

Approved Service Agents
For the list of service centres visit our web site: www.gesensing.com
AEX Certified ADTS Hand Terminal

CONDITIONS OF USE
The ATEX certified ADTS hand terminal supplied with the ADTS 405 can be used in zone 2 hazardous areas in accordance with the ATEX certification document and schedule.

ATEX Certificate of Conformity
No. Baseefa05ATEX0192

BASEEFA being an Approved Certification Body, in accordance with Article 14 of the Council Directive of the European Communities of 18th December, 1975 (76/117/EEC) certifies that the apparatus has been found to comply with harmonised European Standards:

EN  60079-15: 2003

and has successfully met the examination and test requirements recorded in confidential report number:

05(C)0154 (Baseefa) dated 12th October 2005

NOTE: Refer to pages 2/2 of the Certificate of conformity for electrical connection parameters.

Rated Voltage = 32Vdc.

Marking detail:

ADTS Hand Terminal
Baseefa05ATEX0192

Ex II 3G IP54
Baseefa05ATEX0192 (EC type examination certificate number)
Ex nA nL IIC T4 (-25°C <T_{amb} <=55°C)
Druck, LE6 0FH, UK

SPECIAL CONDITION OF USE
• The power supplies must be isolated when connecting the ADTS hand terminal in the hazardous area.
• The ADTS hand terminal must not be disconnected when energized in the hazardous area.
• The ADTS hand terminal is a non-serviceable component. If the ADTS hand terminal becomes unserviceable it can only be replaced by another ATEX compliant hand terminal.
## Pressure units and conversion factors

<table>
<thead>
<tr>
<th>Pressure unit</th>
<th>Factor (Pascals)</th>
<th>Pressure unit</th>
<th>Factor (Pascals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>bar</td>
<td>100000</td>
<td>lbf/ft²</td>
<td>47.8803</td>
</tr>
<tr>
<td>lbf/in² (psi)</td>
<td>6894.76</td>
<td>inHg</td>
<td>3386.39</td>
</tr>
<tr>
<td>mH₂O</td>
<td>9806.65</td>
<td>inH₂O [1]</td>
<td>249.089</td>
</tr>
<tr>
<td>mbar</td>
<td>100</td>
<td>ftH₂O [1]</td>
<td>2989.07</td>
</tr>
<tr>
<td>kgf/cm²</td>
<td>98066.5</td>
<td>atm</td>
<td>101325.0</td>
</tr>
<tr>
<td>kgf/m²</td>
<td>9.80665</td>
<td>pdl/ft²</td>
<td>1.48816</td>
</tr>
<tr>
<td>mmHg</td>
<td>133.322</td>
<td>dyn/cm²</td>
<td>0.1</td>
</tr>
<tr>
<td>cmHg</td>
<td>1333.22</td>
<td>hbar</td>
<td>10000000</td>
</tr>
<tr>
<td>mHg</td>
<td>133322.0</td>
<td>tonf/ft² (UK)</td>
<td>107252.0</td>
</tr>
<tr>
<td>mm/H₂O [1]</td>
<td>9.80665</td>
<td>tonf/in² (UK)</td>
<td>15444300</td>
</tr>
<tr>
<td>cm/H₂O [1]</td>
<td>98.0665</td>
<td>inH₂O (USA) [2]</td>
<td>248.64135</td>
</tr>
<tr>
<td>N/m²</td>
<td>1</td>
<td>ftH₂O (USA) [2]</td>
<td>2983.6983</td>
</tr>
<tr>
<td>hPa</td>
<td>100</td>
<td>kp/mm²</td>
<td>9806650</td>
</tr>
<tr>
<td>kPa</td>
<td>1000</td>
<td>kp/cm²</td>
<td>98066.5</td>
</tr>
<tr>
<td>MPa</td>
<td>1000000</td>
<td>kp/m²</td>
<td>9.80665</td>
</tr>
<tr>
<td>torr</td>
<td>133.322</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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:

\[
VALUE\ 2 = VALUE\ 1 \times FACTOR\ 1 / FACTOR\ 2
\]

**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 DESCRIPTION

1.1 Introduction

- There are two versions of the ADTS 405, a 19", 6U high (10½") rack-mounted unit and a flight line unit.

- The ADTS 405 is a rack-mounted system and, with external pressure and vacuum supplies connected, provides measurement and control for leak checks, calibration accuracy checks and functional tests of air data instruments, components and systems.

- The ADTS 405F is a self-contained flight-line air data test system providing complete pressure and vacuum measuring and control for on-aircraft sense and leak testing, calibration accuracy checks and functional tests of air data instruments, components and systems. The unit comprises an electronics rack and pump rack enclosed in a high density, polyethylene case.

- The ADTS 405 displays and operates in either units of pressure measurement or aeronautical units. In the control mode, the rate that the pressures change towards new set-points can be controlled in true aeronautical rate units.

- There are two independent pneumatic channels connect to the aircraft or instrument systems, one for static and one for pitot. They can be operated as measure only channels with leak testing facility or each can be control channels producing true pressure conditions for altitude and airspeed.

- To protect sensitive instruments and equipment a `ground' facility automatically and safely controls both channels to atmospheric pressure at the previously entered rates of change and then informs the operator when both channels are safely at `ground'.

- The operator interface is either an ATEX certified hand terminal connected to the front panel or the key pad and display on the front panel. Both provide information and control selections for the user through the keys and display. The unit can also be controlled remotely using the IEEE 488 communications interface. The front panel contains the operate switch and a mimic panel with LED indicators showing the operation of the solenoid-operated pneumatic valves.

- The pump rack, on the ADTS 405F, produces pressure and vacuum supplies for the electronics rack and for external services. Located on the front panel, the external connectors provide for external pressure and vacuum supplies (EXT PRESSURE and EXT VACUUM) and an auxiliary static (vacuum) output (AUX). The rack is cooled by a fan located under a protective cover on the front panel. The power supply connection for the ADTS 405F is located on the front panel.
FIGURE 1-1 ADTS 405 GENERAL VIEW

FIGURE 1-2 ADTS 405F GENERAL VIEW
1.2 Operating Range and Performance

- The ADTS 405 is supplied in one of two full-scale ranges (850 knots or 1000 knots) for measurement and control of the pitot pressure channel.

- Operating limits are set, pre-defined tabular limits known as STANDARD, CIVIL and MAX these can be selected through the SETUP menu (see Reference section 6). Operators may also configure the display to aeronautical or pressure units but should be aware that when units of pressure are selected, wider full-scale pressure limits will be enabled for some parameters.

1.3 Operating Limits

The following sets of operating limits are supplied with the ADTS 405.

850 knot range operating limits

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max Limits</th>
<th>Standard limits</th>
<th>Civil limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min Alt</td>
<td>-3,000 ft</td>
<td>-2,000 ft</td>
<td>-1,000 ft</td>
</tr>
<tr>
<td>Max Alt</td>
<td>105,000 ft</td>
<td>80,000 ft</td>
<td>50,000 ft</td>
</tr>
<tr>
<td>Min CAS</td>
<td>-100 kts</td>
<td>0.0 kts</td>
<td>0 kts</td>
</tr>
<tr>
<td>Max CAS</td>
<td>850 kts</td>
<td>850 kts</td>
<td>450 kts</td>
</tr>
<tr>
<td>Min Ps</td>
<td>3.0 mbar</td>
<td>27.615 mbar</td>
<td>115.972 mbar</td>
</tr>
<tr>
<td>Max Ps</td>
<td>1355.00 mbar</td>
<td>1088.657 mbar</td>
<td>1050.406 mbar</td>
</tr>
<tr>
<td>Min Qc</td>
<td>-1,352.00 mbar</td>
<td>0.0 mbar</td>
<td>0 mbar</td>
</tr>
<tr>
<td>Max Qc</td>
<td>1,700.00 mbar</td>
<td>1688.00 mbar</td>
<td>368.01 mbar</td>
</tr>
<tr>
<td>Max Mach</td>
<td>12.35</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>Max ROC</td>
<td>100,000 ft/min</td>
<td>9,000 ft/min</td>
<td>6,000 ft/min</td>
</tr>
<tr>
<td>Max Rate CAS</td>
<td>2,000 kts/min</td>
<td>600 kts/min</td>
<td>600 kts/min</td>
</tr>
<tr>
<td>Max Rate Ps</td>
<td>10,000.00 mbar/min</td>
<td>200.00 mbar/min</td>
<td>100.00 mbar/min</td>
</tr>
<tr>
<td>Max Rate Qc</td>
<td>10,000.00 mbar/min</td>
<td>200.00 mbar/min</td>
<td>100.00 mbar/min</td>
</tr>
<tr>
<td>ARINC Limits</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Alt Correction</td>
<td>0 ft</td>
<td>0 ft</td>
<td>0 ft</td>
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</table>
1000 knot range operating limits

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max Limits</th>
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<th>Civil limits</th>
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</thead>
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<tr>
<td>Min Alt</td>
<td>-3,000 ft</td>
<td>-3,000 ft</td>
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<tr>
<td>Max Alt</td>
<td>105,000 ft</td>
<td>80,000 ft</td>
<td>50,000 ft</td>
</tr>
<tr>
<td>Min CAS</td>
<td>-100 kts</td>
<td>0 kts</td>
<td>0 kts</td>
</tr>
<tr>
<td>Max CAS</td>
<td>1,000 kts</td>
<td>1,000 kts</td>
<td>450 kts</td>
</tr>
<tr>
<td>Min Ps</td>
<td>3.0 mbar</td>
<td>27.615 mbar</td>
<td>115.972 mbar</td>
</tr>
<tr>
<td>Max Ps</td>
<td>1355.00 mbar</td>
<td>1,128.029 mbar</td>
<td>1050.406 mbar</td>
</tr>
<tr>
<td>Min Qc</td>
<td>-1,352.00 mbar</td>
<td>-16.303 mbar</td>
<td>0 mbar</td>
</tr>
<tr>
<td>Max Qc</td>
<td>2,500.00 mbar</td>
<td>2,490.50 mbar</td>
<td>368.01 mbar</td>
</tr>
<tr>
<td>Max Mach</td>
<td>14.97</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Max ROC</td>
<td>100,000 ft/min</td>
<td>15,000 ft/min</td>
<td>6,000 ft/min</td>
</tr>
<tr>
<td>Max Rate CAS</td>
<td>2,000 kts/min</td>
<td>700 kts/min</td>
<td>600 kts/min</td>
</tr>
<tr>
<td>Max Rate Ps</td>
<td>10,000.00 mbar/min</td>
<td>200.00 mbar/min</td>
<td>100.00 mbar/min</td>
</tr>
<tr>
<td>Max Rate Qc</td>
<td>10,000.00 mbar/min</td>
<td>200.00 mbar/min</td>
<td>100.00 mbar/min</td>
</tr>
<tr>
<td>ARINC Limits</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ALT Correction</td>
<td>0 ft</td>
<td>0 ft</td>
<td>0 ft</td>
</tr>
</tbody>
</table>
2 INSTALLATION

2.1 Packaging

On receipt of the ADTS 405 check the contents of the packaging against the following lists:

**Packaging List - ADTS 405**

- i) Rack ADTS 405
- ii) Power supply cable
- iii) User Manual (this publication)
- iv) Output, hose, 2.5m, red, AN6 - open
- v) Output, hose, 2.5m, blue, AN4 - open
- vi) Input, hose, 2.5m, green, AN6 - open
- vii) Input, hose, 2.5m, yellow, AN4 - open
- viii) Spare fuses (2 off)
- ix) Plug, expansion port

**Packaging List - ADTS 405F**

- i) Flight line ADTS 405F
- ii) Accessory bag
- iii) Power supply cable
- iv) Hand terminal
- v) Hand terminal cable - 2 m
- vi) Hand terminal cable - 18 m
- vii) Output, hose, 2.5m, red, AN6 - open
- viii) Output, hose, 2.5m, blue, AN4 - open
- ix) User Manual (this publication)
- x) Spare fuses (2 off)

2.2 Packaging for Storage or Transportation

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

1. Pack the unit as detailed in the following procedure.

2. To return the unit for calibration or repair complete the return goods procedure as detailed in the preliminary pages.
Procedure

- The unit should be at zero/ambient pressure. Disconnect the hose assemblies and stow in the shoulder bag.

  - Switch OFF and disconnect from the electrical power supply. Disconnect the power supply cable and the hand terminal cable. Disconnect the hand terminal cable from the hand terminal.

  - Stow the power supply cable, hand terminal cable and the hand terminal in the ADTS 405F lid. For ADTS 405 rack units these items should be placed in a sealed polythene bag.

  - Fit the lid to the unit.

- If available, use the original packing material. When using packing materials other than the original, proceed as follows.

  - Wrap unit in polyethylene sheeting.

  - Select a double-wall cardboard container. Inside dimensions must be at least 15 cm greater than the equipment. The carton must meet test strength requirements of >125 kg.

  - Protect all sides with shock-absorbing material to prevent equipment movement within the container.

- Seal carton with approved sealing tape.

- Mark carton “FRAGILE” on all sides, top, and bottom of shipping container.

Environment

- The following conditions apply for both shipping and storage:

  - Temperature Range -40° to +70°C (-40° to +158°F)

  - Altitude ......................... Up to 15,000 feet (4,570 metres)
**Installation**

**Figure 2.1 Equipment and Parts**

- **1** Hand terminal
- **2** Plastic bag with small parts
- **3** Portable display
- **4** 120cm long cable
- **5** 240cm long cable
- **6** 480cm long cable
- **7** 120cm long cable
- **8** 240cm long cable
- **9** 480cm long cable
- **10** 180cm long cable
- **11a** 360cm long cable
- **12** 720cm long cable
- **13** 1080cm long cable

**DO NOT DISCONNECT WHEN ENERGIZED IN THE HAZARDOUS AREA**

**DRUCK ADTS 405 ATEX COMPLIANT HAND TERMINAL**
### Table 2-1 Parts List

<table>
<thead>
<tr>
<th>No</th>
<th>Part Number</th>
<th>Description</th>
<th>Used On</th>
<th>Qty per assy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ADTS405-1728-39-M0</td>
<td>Bag, Shoulder</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>ADTS405-1728-36-M0</td>
<td>Kit, Fuse/ O-Ring</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>ADTS405-1728-37-M1</td>
<td>Hand terminal, ATEX certified</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>ADTS405-1728-47-M0</td>
<td>Cable, AC Power, 5M (260V Open End)</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>ADTS405-1728-28-M0</td>
<td>Cable, Hand terminal 2M</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>6a</td>
<td>ADTS405-1728-27-M0</td>
<td>Cable, Hand terminal 18M</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>6b*</td>
<td>ADTS405-1728-29-M0</td>
<td>Cable, Hand terminal 30M (Option)</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>7*</td>
<td>ADTS405-1729-52-M0</td>
<td>Kit, hose adaptor 2 x 2.5M AN STT/Open</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>ADTS405-1729-61-M0</td>
<td>Hose, Static (Ps), red, ST/OFN, AN6</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>ADTS405-1729-62-M0</td>
<td>Hose, Rtot (Rt), blue, ST/OFN, AN4</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>ADTS405-1728-34-M0</td>
<td>Cable, ARINC (Circular Connector) (Open End) (Option)</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>11a</td>
<td>ADTS405-1728-35-M0</td>
<td>Cable, Altimeter Encoder, 6M (Open End) (Option)</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>11b*</td>
<td>ADTS405-1891-61-M0</td>
<td>Altimeter Encoder Cable, 6M (AAU-32 altimeters) (Option)</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>ADTS405-1728-48-M0</td>
<td>Cable, DC Power, 5M (Option)</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>ADTS405-1891-22-M0</td>
<td>Plug, expansion port</td>
<td>ADTS 405F</td>
<td>1</td>
</tr>
</tbody>
</table>
2.3 Electrical Connection

WARNINGS: 1. VOLTAGES IN EXCESS OF 30 VOLTS (RMS) AC OR 50VOLTS DC, IN CERTAIN CIRCUMSTANCES, CAN BE LETHAL. CARE MUST BE TAKEN WHEN WORKING ON LIVE, EXPOSED CONDUCTORS.

2. DO NOT DISCONNECT THE HAND TERMINAL WHEN ENERGIZED IN THE HAZARDOUS AREA.

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

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.

Note: The ADTS 405 is normally supplied with an approved power supply cable for use in the country of delivery. This can limit the maximum supply voltage that can be safely used.

e.g. a NEMA 5-15P terminated cable, for use in the U.S.A., is approved for a maximum of 125 V ac; it must be replaced for a higher supply voltage.

<table>
<thead>
<tr>
<th>Pin</th>
<th>European Colour</th>
<th>U.S. Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>Black</td>
<td>Live</td>
</tr>
<tr>
<td>4</td>
<td>Blue</td>
<td>White</td>
<td>Neutral</td>
</tr>
<tr>
<td>Centre</td>
<td>Green/Yellow</td>
<td>Green</td>
<td>Protective Earth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Ground)</td>
</tr>
</tbody>
</table>

ADTS 405 rack mounted units
- Make sure that the power supply is off before connecting the power cable.

- If required, connect the hand terminal to the connector using either the 2 metre or 18 metre cable.

Note: Connecting the hand terminal disables the front panel key-pad.

- Fit the expansion port plug (item 13, Table 2-1) to the rear panel expansion port.

Note: For units used with the Druck PV 103 Pump Unit connect the expansion cable, supplied with the PV 103, to the expansion port.
Flight line units

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

*Note:* The flight line version power cable supplies both the electronics and pump racks.

- If required, connect the hand terminal to the connector on the front panel using either the 2 metre or 18 metre cable.

*Note:* Connecting the hand terminal disables the front panel key-pad.

- The two fuses, located in the holders and mounted on the front panel, protect the Electronics Rack and the Pump Rack. The fuses are connected in the live supply circuit and are rated at:

  5A anti-surge HBC 250V

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

**DC Power Option**

The DC power option (nominal 28 V DC), can be an alternative power supply using an additional connector. This is located on the rear of the rack (ADTS 405) or on the pump front panel (ADTS 405F) both have the same connector details.

<table>
<thead>
<tr>
<th>Pin</th>
<th>European Colour</th>
<th>U.S. Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grey</td>
<td>Gray</td>
<td>+28V</td>
</tr>
<tr>
<td>2</td>
<td>White</td>
<td>White</td>
<td>0V Return</td>
</tr>
<tr>
<td></td>
<td>Protective Earth (Ground)</td>
<td>Protective Ground</td>
<td>Protective Earth (Ground)</td>
</tr>
</tbody>
</table>

*Note:* The unit will not be damaged if AC power and DC power are connected at the same time.
2.4 Pneumatic Pressure Connections

**ADTS 405 rack-mounted unit**

- Static (Ps) ................................................................. AN-6 37° flare
- Pitot (Pt) ................................................................. AN-4 37° flare
- Pressure supply ........................................................ AN-4 37° flare
- Vacuum supply ......................................................... AN-6 37° flare

- Connect pressure and vacuum supplies to the rear panel PRESSURE and VACUUM connectors. The pressure supply should be clean, dry gas, nitrogen or air refer to the specification.

- Connect the Unit Under Test (UUT) to either the front panel or optional rear panel Ps (static) and Pt (pitot) output connectors.

**Note:** *Blanking caps must be fitted on unused front or rear outputs.*

**ADTS 405F flight line**

- Static (Ps) ................................................................. AN-6 37° flare
- Pitot (Pt) ................................................................. AN-4 37° flare
- Pressure supply ........................................................ AN-4 37° flare
- Vacuum supply ......................................................... AN-6 37° flare
- Auxiliary vacuum supply ........................................... AN-4 37° flare

- In normal operation make sure that the correct blanking caps are fitted to the external connectors.

- The external pressure and vacuum connections are used when an external pump unit supplies the pressure and vacuum. This may increase the maximum achievable rates of change when connected to large volume systems.

- The auxiliary vacuum, AUX VACUUM, can be used to supply the suction-type static adaptors and provides a nominal 100 mbar (3 inHg) absolute vacuum. When not in use, a blanking cap must be fitted.

**Note:** *A leak of this blanking cap affects the performance of the ADTS 405F.*
Single channel operation

- For single pipe testing of airspeed indicators or similar, requiring only Pt (pitot), connect the UUT to Pt (pitot). The Ps (static) output must be left open to atmosphere (no blanking cap) to provide a reference pressure.

**Note:** The Pt ONLY mode of operation must be used in this configuration.

- For single pipe testing of altimeters or similar, requiring only Ps (static), connect the UUT to Ps (static). The Pt (pitot) output should be left with a blanking cap fitted.

**Note:** The Ps ONLY mode of operation must be used in this configuration.

2.5 Positioning of the ADTS 405

- It is important that the position of the ADTS 405 in relation to the components under test is known. An altitude correction must be made to allow for the difference in height between the reference level, indicated on the mimic panel, and the components under test. The Reference section contains details of altitude correction (SETUP, ALTITUDE).

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

![Diagram of ADTS 405 altimeter reference](image)

Corrected altitude = Altitude measurement + Altitude correction value

**Figure 2-2 ADTS 405 Altitude Reference**
2.6 Positioning of the ADTS 405F

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

- To operate safely, the ADTS 405F 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 6.5 for a definition).

- It is important that the position of the ADTS 405F in relation to the aircraft altitude sensors is known. An altitude correction must be made to allow for the difference in height between the reference level and the aircraft’s altitude sensors. The Reference section contains details of altitude correction.

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

Corrected altitude = Altitude measurement - Altitude correction value

![Figure 2-3 ADTS 405F Altitude Reference](image)

**Figure 2-3 ADTS 405F Altitude Reference**
FIGURE 2-5 ADTS 405 REAR PANEL VIEW

Note:
When not in use, the Expansion Port Plug (Item 13, Table 2-1) MUST be fitted.
3 OPERATION

3.1 Preparation

WARNING:

**OBSERVE SAFETY PRECAUTIONS STATED IN LOCAL ORDERS AND THE AIRCRAFT OR EQUIPMENT SERVICING PROCEDURES.**

- Make sure the electrical and pneumatic connectors, electrical cables and pipes and positioning of the ADTS 405 comply with the instructions and requirements in Section 2 Installation.

- 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.

- Connect, to the air data test system, the hoses necessary for the test procedures to be carried out: red hose to the STATIC output (Ps), blue hose to the PITOT output (Pt). Temporarily seal the free ends of the hoses.

  **Note:** *When connected, take care not to kink or stand on the hoses.*

- Connect the hand terminal to the air data test system through the HAND TERMINAL connector on the front panel. If necessary, connect the hand terminal through the extension cable.

- Before use, the ADTS 405 should be tested, for first time users see section 3.4, for users requiring more operating detail see section 3.5.

- This section contains a quick reference chart showing all the functions of the key-pad. Further quick reference charts show the set-up and configuration settings for each key-pad function.

- Review and become familiar with the whole procedure before starting the test process on an aircraft or component.
3.2 Display Functions and Units of Measure

When operating in either pressure measuring or pressure controlling modes, the ADTS 405 can display the following information:

### Aeronautical Functions

<table>
<thead>
<tr>
<th>Display Abbreviation</th>
<th>Displayed Units (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude (ALT)</td>
<td>ft, m</td>
</tr>
<tr>
<td>Calibrated and True Airspeed (CAS, TAS)</td>
<td>kts, km/h, mph</td>
</tr>
<tr>
<td>Mach (MACH)</td>
<td>-</td>
</tr>
<tr>
<td>Rate of Climb (ROC)</td>
<td>ft/m, m/m, m/s, hm/m</td>
</tr>
<tr>
<td>Rate of Airspeed (Rt CAS)</td>
<td>kts/m, km/h/m, mph</td>
</tr>
<tr>
<td>Rate of Mach (RtMCH)</td>
<td>Mach/m</td>
</tr>
</tbody>
</table>

### Pressure Functions

<table>
<thead>
<tr>
<th>Display Abbreviation</th>
<th>Displayed Units (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static (Absolute) (Ps)</td>
<td>[P]</td>
</tr>
<tr>
<td>Pitot (Absolute) (Pt)</td>
<td>[P]</td>
</tr>
<tr>
<td>Dynamic or Impact (Differential) (Qc)</td>
<td>[P]</td>
</tr>
<tr>
<td>Engine Pressure Ratio (EPR)</td>
<td>-</td>
</tr>
<tr>
<td>Rate of Ps (Rt Ps)</td>
<td>[P] /m</td>
</tr>
<tr>
<td>Rate of Pt (Rt Pt)</td>
<td>[P] /m</td>
</tr>
<tr>
<td>Rate of Qc (Rt Qc)</td>
<td>[P] /m</td>
</tr>
<tr>
<td>Rate of EPR (Rt EPR)</td>
<td>EPR/m</td>
</tr>
</tbody>
</table>

Where [P] is the currently selected pressure units from the following list: mbar, inHg, mmHg, inH₂O (4°C), inH₂O (20°C), psi, hPa, kPa, inH₂O (60°F), kg/cm², %FS.

---

**Figure 3-1 Front Panel**
### 3.3 Quick Reference

The quick reference chart shows normal operation key functions. In the key/selection column the following applies:

- **Key.**
- **Item in menu (soft key).**
- **Sequence of parameters selected by NEXT key.**
- **Sequence of names selected by NEXT key.**
- **Enter number from key-pad.**

#### KEY-PAD FUNCTION

<table>
<thead>
<tr>
<th>Key/selection</th>
<th>Function and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT Ps</td>
<td>Function keys for menus</td>
</tr>
<tr>
<td>SPEED Qc</td>
<td>Altitude (Aeronautical units) or Ps (Pressure units)</td>
</tr>
<tr>
<td>MACH Pt</td>
<td>Airspeed (Aeronautical units) or Qc (Pressure units)</td>
</tr>
<tr>
<td>EPR</td>
<td>Mach (Aeronautical units) or Pt (Pressure units)</td>
</tr>
<tr>
<td>ROC Ps RATE</td>
<td>Engine Pressure Ratio (pressure units only)</td>
</tr>
<tr>
<td>RATE TIMER</td>
<td>Rate of Climb (Aeronautical units) or Rate of Ps (Pressure units)</td>
</tr>
<tr>
<td>HOLD RATE</td>
<td>Start timing rate of change</td>
</tr>
<tr>
<td>LEAK MEASURE/CONTROL</td>
<td>Wait and time choice 1</td>
</tr>
<tr>
<td>GROUND</td>
<td>Wait and time choice 2</td>
</tr>
<tr>
<td>PORT</td>
<td>Wait and time choice 3</td>
</tr>
<tr>
<td>REMOTE PRINT</td>
<td>Hold pressure at present value - Press again to release</td>
</tr>
<tr>
<td>data entry</td>
<td>Rate of change of Pitot parameter - Press Pitot parameter then RATE</td>
</tr>
<tr>
<td>data entry</td>
<td>Switches between measure mode (for leak testing) and control mode</td>
</tr>
<tr>
<td>data entry</td>
<td>Controls Ps to atmospheric pressure and Qc to zero at current rates of change</td>
</tr>
<tr>
<td>data entry</td>
<td>Display local atmospheric (ground) pressure</td>
</tr>
<tr>
<td>data entry</td>
<td>Display sea level equivalent of local atmospheric pressure</td>
</tr>
<tr>
<td>data entry</td>
<td>See Line Switching Unit User Manual</td>
</tr>
<tr>
<td>data entry</td>
<td>Switches (toggles) between remote and local operation</td>
</tr>
<tr>
<td>data entry</td>
<td>Prints current parameter values</td>
</tr>
<tr>
<td>data entry</td>
<td>Inserts alphabet character in user text</td>
</tr>
<tr>
<td>data entry</td>
<td>Deletes last character of user text</td>
</tr>
<tr>
<td>data entry</td>
<td>Numeric entry for user text</td>
</tr>
<tr>
<td>data entry</td>
<td>Execute down-loaded Test Programs</td>
</tr>
<tr>
<td>data entry</td>
<td>Select next listed test program</td>
</tr>
<tr>
<td>data entry</td>
<td>Select previous listed test program</td>
</tr>
<tr>
<td>data entry</td>
<td>Execute selected test program</td>
</tr>
<tr>
<td>data entry</td>
<td>Execute all tests in the test program</td>
</tr>
<tr>
<td>data entry</td>
<td>Selects and executes a specific test program</td>
</tr>
<tr>
<td>data entry</td>
<td>Press HELP then other key for further information</td>
</tr>
<tr>
<td>data entry</td>
<td>Temporary set-up - lost at power down</td>
</tr>
<tr>
<td>data entry</td>
<td>Configuration - changes power-up defaults</td>
</tr>
<tr>
<td>data entry</td>
<td>Hold F1 while pressing SETUP - then enter PIN</td>
</tr>
</tbody>
</table>

- **Nudge (up).** Increases aim value
- **Nudge (down).** Decreases aim value
- **0-9.** Number entry
- **-000.** Minus sign for first number entry 000 (thousand) if not first number of entry
- **CLEAR/QUIT.** Clear number entry - quit from menu or clear warning message
- **ENTER.** Complete number entry
- **CLEAR/QUIT + ENTER.** ABORT - restart with power-up
3.4 First Time Operators

- The following sequences of operation should be used by first time operators and by operators that use the equipment occasionally. For regular users, familiar with the equipment, go to section 3.5. Set the power supply switch to OPERATE and the power-up routine starts.

1. The display, on the front panel or hand-terminal, shows:

   **DK126 Iss 1.xx**
   Display Power Up
   Please Wait

2. After a short time the display shows:

   **DRUCK**
   **ADTS 405**
   **DK263**
   **VER 6.xx**

   **Note:**
   Where x is the current issue number of the software.

3. **Last Calibration**
   dd/mm/yy (dmy)
   RPT Transducer
   PLEASE WAIT

   **Note:**
   Date format can be changed in configuration.
   For units fitted with the Solartron transducer, the display shows Solartron Transducer in place of RPT Transducer.

4. **Self Test**
   PLEASE WAIT
(5) The system opens the zero valves and after approximately 7 seconds the valves close and the routine continues with the display shows:

```
Measuring Ground Pressures
PLEASE WAIT
```

(6) The system opens the output valves and controls pressures at the original measured values.

```
Equalising System Pressures
(Valves May Pulse)
PLEASE WAIT
```

(7) At switch on, check the hand-held terminal display.

**Note:**

The ADTS 405 is a continuous, self-monitoring system. If the system detects an error, the display shows an error message. Lists of errors are detailed in Section 5, Fault Finding and Testing.

```
ALT  0  ft
Leak Measure
WARMUP
```

**Note:**

Wait 15 minutes, before continuing, to allow the system to get to thermal stability. The wait time can be reduced to 5 minutes if the system has been re-powered after a short time.

**Operating modes**

- The air data test system can now be set for a variety of functions and modes. In the following, examples of measure mode, control mode, leak measure mode and go-to-ground show the key presses and selections required for each mode.
Measure Mode

To select the measured parameter press:

- **STATIC**
  - **ALT**
  - **Ps**
- **SPEED**
  - **Qc**
- **PITOT**
  - **MACH**
  - **Pt**

Measured value:
- Alt 10000 ft
- Leak Measure
- CAS 350 kts
- Alt 10000 ft
- Leak Measure

"leak-measure" when measure mode selected

Change display single, dual or triple press:

- [MORE]
- [CONTROL]
- [Ps Pt DUAL]
- [DISPLAYS/OPTIONS]
- [DISPLAY TYPE]
- [OPTIONS]

Change units from aeronautical to pressure:

- [UNITS]
- [NEXT]
- [PREV]
- [SAVE]
Control Mode

For ADTS 405F set the pump switch to PUMP ON.

From leak measure mode press:

- 5 + 000 + ENTER

Aim of 5000 ft press

Return to leak measure at new altitude
Leak Measure Mode

Static channel altitude 5000 ft, measure leak:

Set rate timer: wait 05.00 minutes test 01.00 minutes

F3

WAIT
F1 00:00
F2 00:00
F3 05:00
TIME
00:30
01:00

Alt 5000 ft
Leak Measure

Alt 4996 ft
Leak Measure

Display shows alternating time countdown and TIMING message

Display shows alternating wait time countdown and WAITING message

Display shows T - rate timer result

Note: Compressing a gas generates heat. Gas heated or cooled in an enclosed volume causes a pressure change. It is important, especially for leak testing, to allow enough time for the heated gas to cool and the pressure to stabilize. When setting the rate timer consider three factors:

1. The volume of the system to be tested (large volumes take longer to stabilize).
2. The pressure change (the higher the change the greater heat generated).
3. The ambient air temperature.
Go to Ground

- Alt 5000 < ft
- Leak Measure
- CAS 350 kts
- Leak Measure

**Dual parameter display**

**USER MODE**
- F1 GO TO GROUND
- F2 DISPLAY QFE
- F3 DISPLAY QNH

**F1**
- Alt 5000 ft
- Aim Ground <
- CAS = 350.0 kts
- Aim 0.0

**Note:**
In Leak Measure use F2 and F3 for QFE and QNH information. F1 invalid in this mode.

**Checking Ground**
- PLEASE WAIT

**Equalising System Pressures**
- (Valves May Pulse)
- PLEASE WAIT

**Safe At Ground**
- Press CLEAR/QUIT to continue..

**Note:**
The ground value will not be zero and depends on local atmospheric pressure and airfield altitude.

**Note:**
Safe to disconnect pipes and adaptors from the aircraft or component under test.
3.5 Operation and Example Procedures

3.5.1 Checks Before Use

- Inspection and Cleaning
  Inspect the external of the ADTS 405, and its associated equipment, for damage, dirt, and the ingress of moisture. If necessary, use foam cleaner and a lint-free cloth to clean the external surfaces.
  Inspect the pressure outlet ports for ingress of dirt and moisture, clean if necessary with a lint-free cloth.

3.5.2 Operating Procedures

- The procedures show the steps required to make sure the ADTS 405 is serviceable and the settings required to test an aircraft system or component. For further information refer to the quick reference charts, at the end of this section, and Section 6 - Reference and Specification.

  In the following:

- All key presses are highlighted in **bold** and shown as identified on the key-pad.

- Key presses inside brackets e.g., [MORE], are soft key presses (i.e., function key selections {F1 to F4} indicated on the display screen).

  **Help System**

- The help information includes further details of the function and details associated functions, also see the Reference Section 6.

3.6 Power-up

- Check the power indicator is illuminated and set the front panel power switch to OPERATE.

- The display shows the following sequence:
  a. Display power-up screen.
  b. ADTS 405 power-up screen.
  c. Date of the last calibration and type of main transducer fitted.
  d. Self-test message.
  e. Measuring ground pressure message.
  f. Equalising system pressures message.
  g. Display shows Leak Measure mode and the number of parameters last selected in configuration.

- The ADTS 405 always powers-up in Leak Measure mode with the pressure controllers off. When changing to Control Mode the pump unit must be switched on and producing the correct pressure and vacuum.

**Note:** The display at power-up can be changed, see CONFIGuration.
The ADTS 405 system may now be used but for full specification accuracy and stability, wait the “WARMUP” period of 15 minutes. The display shows “WARMUP” in the lower right hand corner, this message clears automatically after the time period.

3.7 Control or Measure Parameter

To change the displayed parameter:
- Value parameters - Press the parameter key
  e.g., press SPEED/Qc to display airspeed.
- Rate parameter - Press the associated parameter key followed by the rate key for that channel. e.g., display airspeed rate, press SPEED/Qc then RATE. ROC/Ps Rate may be directly pressed without first pressing ALT/Ps.

Note: The displayed parameters depend on the last keys pressed.

To display two parameters:
- Press each value parameter in turn.
  e.g., display altitude and airspeed together, press ALT/Ps then SPEED/Qc.
- In control mode, an arrow, at the right-hand end of the aim value, indicates the last parameter selected. This can be changed by entering a new value.

To display a value parameter together with its rate:
- Press the parameter key followed by the associated rate key.
  e.g., display airspeed and rate of speed together, press SPEED/Qc then RATE.
  See Rate set-up for display details.

Note: If ROC/Ps Rate is pressed, the display automatically shows ALT and ROC.

Aim

A new aim can be entered using the numeric keys. Each digit is displayed as it is pressed. The existing aim is replaced when the first digit of the new aim is pressed. If an error is made during the entry of data, press CLEAR/QUIT to restore the original aim.

Press ENTER to action the new aim.

Note 1: The 000 key can be used as a quick way of entering thousands.

Note 2: The ADTS 405 must be in control mode to enter a new aim (current aim displayed). If the aim field shows “Leak Measure” press LEAK MEASURE/CONTROL to enter control mode.
3.8 Leak Testing the ADTS 405

- It is important to check that the ADTS 405 and the connecting equipment does not leak. Before use a leak check should be carried out as follows:

- Connect the pitot and static hoses (to front panel of ADTS 405F). Temporarily seal the free ends of the hoses.

- Set the display to dual display, see 3.9.

- Set the units to feet and knots, see 3.13.

- Using the SETUP menu, choose the limits set for the aircraft or UUT, see 3.14.
  - Press SETUP, [LIMITS], and [NEXT] repeatedly to select the limit set from those available.
  - Press [SEL] to save and then press CLEAR/QUIT repeatedly until the main pressure screen shown below is displayed.

  Note:
  The numeric value of the parameters displayed change with each power-up sequence. The amount of change depends on local atmospheric pressure conditions at the time of power-up.

  ![](figure3-2.png)

  **Figure 3-2 Main Pressure Display (Leak Measure Mode)**

- Press the LEAK MEASURE/CONTROL key to turn on the pressure controllers.
To apply an altitude of 5000 ft at a rate of climb of 6000 ft/min and an airspeed of 300 kts at a rate of 600 kts/min press the following keys:

- **SPEED/Qc** then **RATE** to select rate of change of speed.
- **6, 0, 0, ENTER** to set the rate.
- **SPEED/Qc** to select airspeed.
- **3, 0, 0, ENTER** to set an airspeed of 300 kts (airspeed [CAS] now starts increasing).
- **ROC/Ps Rate** to select rate of climb.
- **6, 0, 0, 0, ENTER** to set the rate of climb.
- **ALT/Ps** to select the altitude.
- **5, 0, 0, 0, ENTER** to set altitude (altitude [Alt] now starts increasing).
- **SPEED/Qc** to view altitude and airspeed together.

**Note:**

When altitude and airspeed are changing at the same time, and automatic airspeed rate is enabled, the system automatically adjusts the airspeed rate so that the aim points are reached at the same time. The airspeed rate will not exceed the entered aim value.

Wait for the aim values to be achieved.

- Observe over a period of 1 minute that the value of Alt stays within ±10 ft and the value of CAS with ±1 kt.

<table>
<thead>
<tr>
<th>Alt</th>
<th>4050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aim</td>
<td>5000</td>
</tr>
<tr>
<td>CAS</td>
<td>289.0</td>
</tr>
<tr>
<td>Aim</td>
<td>300.0</td>
</tr>
</tbody>
</table>

**Figure 3-3 Main Pressure Display (Control Mode)**
Leak Measure

*Note:* Compressing a gas generates heat. Gas heated or cooled in an enclosed volume causes a pressure change. It is important, especially for leak testing, to allow enough time for the heated gas to cool and the pressure to stabilize.

- Press **LEAK MEASURE/CONTROL** to return to Leak Measure mode.

- Press **RATE TIMER, F3** - [Wait 05:00, Time 01:00].

*Note:* Different wait and time periods can be selected by pressing F1 or F2.

- Wait until rate timer has completed and the results displayed.
- Check rate of climb is less than ±100 ft/min and rate of airspeed (CAS) is less than ±1 kt.

- Press **LEAK MEASURE/CONTROL** to return to Control mode.
- Press **GROUND, F1**, [Go to Ground].
- Wait until for the display shows **Safe At Ground**.

- After a successful leak test, the ADTS 405 is now ready to be connected to an aircraft system or unit under test.

- After an unsuccessful, first-time leak test, leave the system to achieve thermal stability for a further five minutes, press **CLEAR/QUIT** and repeat the leak test. If the leak test is now successful, the ADTS 405 is now ready to be connected to an aircraft system or unit under test.

- After another unsuccessful leak test, disconnect both hoses, check the condition of the o-rings on the Ps and Pt connectors as detailed in the maintenance section and firmly replace the blanking caps. Press **CLEAR/QUIT** and repeat the leak test procedure.

- After a successful leak test without hoses connected, replace or repair the faulty hose(s) and retest. If the ADTS 405 fails the leak test without hoses connected, switch off and return the unit to the repair depot.
3.9 Displays (Fig 3.4, Fig 3.5 and Fig 3.6)

- The display normally shows pressures and rates or aeronautical equivalents. It can be set-up to show, at the same time, one parameter (single), two parameters (dual) or three parameters (triple). The ADTS 405 automatically returns to the pressure display if left inactive in any set-up or menu type display for a period of more than one minute.

- The triple display always shows altitude and airspeed; with pressure units selected, the display always shows Ps and either Qc, Pt or EPR. When ALT or CAS are selected the display shows the aim and measured values of ALT and CAS as a dual display. With any other selected parameter the display shows the measured values of altitude and airspeed and, the aim and measured value of the other selected parameter.

- Additional display modes are available for options.

![Figure 3-4 Single Display](image)
3.10 Rate Timer Displays (Fig 3.7 and Fig 3.8)

- When in Leak Measure mode and, after completing a rate timing, the system generates the rate timer displays. These displays do not depend on the display mode (single, dual, triple or option). Pressing a parameter key (ALT, ROC, etc.,) or CLEAR/QUIT exits the rate timer displays.

**FIGURE 3-7 RATE TIMER DISPLAY AERONAUTICAL UNITS**

**FIGURE 3-8 RATE TIMER DISPLAY PRESSURE UNITS**

*Note:* There is no pointer for the primary parameter, values cannot be entered in the rate timer displays.
3.11 Pt Only Display (Fig 3.8)

- The Pt only display overrides the other display modes (single, dual and triple). The measured altitude and the CAS are produced from Ps in measure mode.

![Diagram of the Pt Only Display]

3.12 Changing the Display

- The display can show either one, two or three parameters as follows:

  **Note:** Display cannot be changed with SETUP switched off or in minimum mode.

- To change the display:
  - Press SETUP.
  - Select [MORE].
  - Select [DISPLAYS/OPTIONS].
  - Select [DISPLAY TYPE].
  - Using [NEXT] or [PREV].
  - Select either SINGLE, DUAL or TRIPLE, ARINC, ENCODER (more display types with options fitted).
  - Press [SAVE] to accept.
  - Press CLEAR/QUIT repeatedly to return to user display.

- To change the display for Pt Only:
  - Press SETUP.
  - Select [MORE].
  - Select [Control], [Ps Pt Dual].
  - Select [Pt Only Mode].
  - Press CLEAR/QUIT repeatedly to return to user display.
3.13 Changing the Units

- The units can be changed to units of pressure measurement or aeronautical units.
- In Full Set-up Mode any set of aeronautical or pressure units can be selected.
- To change the units:
  - Press the SETUP key.
  - Select [UNITS].
  - Use [NEXT] and [PREV] keys to select the required units.
  - Select [SAVE] to accept.
  - Press CLEAR/QUIT repeatedly to return to the main pressure display.
- In Minimum Setup Mode only the default aeronautical and pressure units can be selected.
- To change the unit type:
  - Press the SETUP key.
  - Select [UNITS TYPE].
  - Select either [AERO] or [PRESS] to select the unit type.
  - Select [SAVE] to accept.
  - Press CLEAR/QUIT repeatedly to return to the main pressure display.

**Note:** The default pressure and aeronautical units are defined in the CONFIGuration mode.
- If Set-up Mode is switched off, units cannot be changed.

3.14 Limit Checking

- The system checks all data entered against minimum and maximum limits set for the particular limit set in use. If these limits are exceeded, the data entry is ignored and a warning message displayed showing the minimum and maximum values that can be entered. The system also checks all limits of associated parameters. If these limits are exceeded when a new value is entered, the display shows the name of the associated parameter.
  e.g., If a Mach limit is exceeded when entering an airspeed value the display shows "Mach" and the equivalent maximum and minimum limits as airspeed values. Similarly, if an ARINC 565 limit is exceeded when entering a value and, ARINC limits are enabled, the display shows 'ARINC'.


Using the SETUP function, previously stored sets of limits can be recalled for use. Each set of limits is stored under an aircraft name. Three pre-defined sets of limits “Standard”, “Civil” and “Max” limits are supplied with the ADTS 405.

**Note:** The ADTS 405, when delivered, contains “Standard” and “Civil” limits; to set and store “Max” limits, for the first time, enter configuration. The “Max” limits depend on the range of the pitot channel either 850 or 1000 knots, see section 1.3, operating limits.

To select the limits in use:
- Press **SETUP**.
- Select [LIMITS].
- Use [NEXT] or [PREV] to select the limits required. Each set of limits is identified by its name, including the pre-defined sets of limits (“Standard”, “Civil” and “Max” see section 1.3, operating limits).
- Select [SEL] to select the limits.
- Press **QUIT/CLEAR** to return to the pressure display.

Using the CONFIGuration function, new sets of limits can be created and existing sets of limits can be edited. In addition, the set of limits in use at power-up can be selected. If required, this selection can be locked to prevent unauthorised changing of the limits.

**Auto recovery facilities**
- The pressure controllers in the ADTS 405 can “feed” a leak in an aircraft system. When first testing an aircraft system, a leak test must be carried out at low altitude and airspeed.

- If, during a leak test, a leak in the system produces a rate of climb greater than the rate set in limits or a rate of change of airspeed greater than the rate set in limits, then the pressure controllers automatically regain control to minimise damage to the aircraft system. This AUTO LEAK RECOVERY facility can be disabled.

- If a leak causes the system pressures to exceed any limit during a leak test, the pressure controllers automatically regain control. This AUTO LIMIT RECOVERY system can be disabled.

- If negative airspeed (or Qc) occurs in measure mode, the zero value is automatically opened for one second to balance the airspeed. This only applies when the minimum CAS (or Qc) limit is zero.

- Limits cannot be changed with SETUP switched off or Limit Lock enabled.
Aircraft System Protection

- The ADTS 405 protects the aircraft system against user error and leaks in the aircraft system.

  **Note:** The pumps must be switched on.

  The system protection operates:
  - Limit checking of user entered set-points.
  - Automatic regain of control if leak rate is over limit during leak testing.
  - Automatic regain of control if a leak takes the system pressures outside of limits.

Mach Test and Constant Mach

- To go to 0.8 Mach, enter Control Mode and proceed as follows:
  - Press **SPEED** then **RATE** to select rate of change of airspeed.
  - Enter required rate, e.g. 300 kts/min.
  - Press **MACH**.
  - Enter 0.8.
  - Wait for the Mach to be achieved.

  **Note:** If the altitude changes the system automatically adjusts the airspeed to keep the Mach value constant.

True Airspeed

- The normal airspeed parameter is Calibrated Airspeed (CAS) (equivalent to IAS for testing purposes).

- The airspeed parameter may be changed to True Airspeed (TAS) as follows:
  - Press **SETUP** then **SPEED**.
  - Select [CAS/TAS].
  - Select [TAS].
  - Press **QUIT/CLEAR** repeatedly to exit set-up.
  - Press **SPEED**.

- The display now shows the airspeed parameter as TAS.

  **Note:** Airspeed parameter type can only be changed in Full Set-up mode. Rate of change of airspeed will still be shown as Rate CAS.

- Pitot temperature ($T_t$) is used in the calculation of TAS. To enter $T_t$:
  - Press **SETUP**.
  - Press **SPEED**.
  - Select [Pt TEMPERATURE].
  - Enter the temperature measured by the aircraft’s Pitot temperature sensor.
  - Press **QUIT/CLEAR** three times to return to user display.

  **Note:** Pitot temperature can only be changed in Full Set-up mode.
Airspeed Switch test

The following example shows how an airspeed switch an be functionally checked.

**Note:** For low airspeed switches (i.e. 130 knots) the Pt Only facility could be used.

- Press LEAK MEASURE/CONTROL to enter control mode. Press SPEED/Qc.
- If necessary, press RATE and enter a change of airspeed low enough to observe switch operation.
- Enter an Aim value below the operating limits of the switch (i.e., airspeed switch operating at 130 knots ±2 knots set 127 knots).
- Press ENTER and observe the airspeed changing.
- Using the nudge facility, set to an appropriate step value, increase the Aim value.
- Increase the Aim until the switch operates (contacts close) and record the value.
- Change the Aim to above the airspeed operating range (i.e. 133 knots). Repeat the steps, decreasing the Aim value until the airspeed switch operates (contacts open) and record value.
- This procedure can be repeated. If many operations of a switch are required use the oscillating facility detailed in Full Set-up. The above method can be used for the other parameters:

**Examples:**

- **Altitude switch**
  - low altitude warning
  - landing gear configuration warning
  - height lock
- **Mach switch**
  - Speed brake scheduling
  - Mach cruise lock
Engine Pressure Ratio (EPR)

- The ADTS 405 may be used to check EPR sensors and indicators. Use Ps for INLET pressure and Pt for OUTLET pressure.

- To carry out an EPR check, the display must be showing pressure units e.g., mbar or inHg.

- To change units in FULL SETUP Mode:
  - Press SETUP.
  - Select [UNITS].
  - Select required pressure units for display using [NEXT], [PREV] and [SAVE].
  - Use CLEAR/QUIT to return to pressure display.

- To change units in MINIMUM SETUP Mode:
  - Press SETUP.
  - Select [UNITS TYPE].
  - Select [PRESS].
  - Use CLEAR/QUIT to return to the main pressure display. Pressure units cannot be selected when set-up mode is switched off.

- To enter an EPR of 1.8 with inlet pressure of 500 mbar (15 inHg), proceed as follows:
  - If the display shows “Leak Measure”, press LEAK MEASURE/CONTROL to regain control.
  - Note: The pressure/vacuum pumps must be switched on.

  - Press ROC/Ps RATE to select rate of change of static.
  - Enter required rate of change e.g., 1000 mbar/min, (30 inHg/min).
  - Press EPR then RATE to select EPR rate.
  - Enter required value e.g., 5 EPR/min and press ENTER.
  - Press ALT/Ps.
  - Enter 500 mbar (15 inHg) and press ENTER.
  - Press EPR.
  - Enter 1.8 and press ENTER.
  - An EPR of 1.8 will quickly be achieved.

  - Note: EPR testing can also be performed by specifying the actual INLET and OUTLET values.
3.15 Testing Aircraft Systems or UUT

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

- Connect the hoses and appropriate adaptors to the aircraft system or UUT.
- To make sure that the connections to the aircraft system or UUT are not leaking carry out a leak test detailed in the appropriate aircraft or component manual.

3.15.1 Go To Ground and Shut-down

- On completion of testing and, before disconnecting from the aircraft system or UUT, the pressures in the system must be taken to the local atmospheric pressure (ground) with zero airspeed.
  - If the display shows "Leak Measure", press **LEAK MEASURE/CONTROL**.
  - Press **GROUND, F1, [Go To Ground]**.
  - Wait for the display to show "Safe At Ground". It is now safe to disconnect the aircraft system or UUT.

- The pressure in the system changes towards ground. The ground pressure or "Ground" replaces the static or altitude aim value.
- If required, new rates of change can be entered while going to ground.
- To change the ROC or static rate, press **ROC/Ps Rate** and enter the new value.
- To change the airspeed or Qc rate, press **SPEED/Qc** then **RATE** and enter the new value.
- To change from going to ground, enter a new altitude (static) or airspeed (Qc) set-point.
- When the airspeed reaches zero and the Ps channel pressure nears ground, the system re-measures atmospheric pressure to update the recorded ground pressure (QFE). During this period, the display shows the message "Checking Ground". The ADTS 405 then reconnects to the aircraft system and equalises the system pressures. Commands cannot be entered when these two messages are displayed.
- The Ps channel pressure is then taken to the new recorded atmospheric pressure and, at this new pressure, the display shows the message "Safe At Ground". The ground vent and zero valves remain open to keep the aircraft system vented to atmosphere.
- Press **CLEAR/QUIT** to continue with normal operation. The ground vent and zero valves automatically close.
3.16 Options

WARNINGS:

1. **COMPLY WITH ALL LOCAL SAFETY ORDERS.**
2. **OBSERVE ALL SAFETY PROCEDURES IN THE AIRCRAFT MAINTENANCE MANUALS.**

**SCPI IEEE 488 Option**

The SCPI IEEE 488 interface provides remote control of the ADTS 405 from a suitable PC, using standardised commands. The ADTS 405 implements the full SCPI command set with the exception of expressions and units suffixes. Although all the ADTS 405 commands at the first, or root, level are fully defined in the SCPI standard, many of the functions required have not been allowed for in the standard. The lower levels of commands have been created using the appropriate rules contained within the standard.

Druck publication K157 SCPI User Manual provides details of command codes, command syntax and examples of programming. Section 5 of this manual details a test procedure for the option.

**Altimeter Encoder Option**

The Altimeter Encoder Option allows the output from encoder altimeters to be displayed on either the hand terminal or display and key-pad of the unit. The displayed data includes the bit pattern and the equivalent altitude decoded from the bit pattern. The unit supplies 24 VDC to power the altimeter encoder electronics circuit and the altimeter vibrator circuit.

Druck publication K170 Altimeter Encoder Option User Manual provides details of displayed and encoded data. Section 5 of this manual details a test procedure for the option.

**ARINC 429 Option**

The ARINC 429 Interface provides the ADTS 405 with the ability to continuously transmit all internal aeronautical and pressure measurement parameters. Through an appropriate connector, the ADTS 405 can transmit the measurement parameters to the aircraft systems. The ADTS 405 can also monitor the aircraft ARINC 429 bus and display the measurement data on the hand terminal or the front panel display. The labels used for transmitting and receiving each parameter conform to the standard 429 specification.

Druck publication K185 ARINC 429 Option User Manual provides details of parameters and data output. Section 5 of this manual details a test procedure for the option.
3.17 SETUP and CONFIGuration

- The SETUP key provides access to secondary functions using a menu system, extends the keyboard and allows many of the ADTS 405 functions to be customised. All changes made under SETUP are temporary and will be lost when the system is switched off. The range of options allowed in set-up is determined by the set-up mode.

- Holding down the F1 key while pressing SETUP provides access to the CONFIGuration mode. CONFIGuration is similar to SETUP with many identical functions. The changes made under CONFIGuration are permanent and remain set after the system is switched off. CONFIGuration can be used to change the power-up default settings of the ADTS 405 functions.

*Note: Access to the CONFIGuration mode may be protected by a PIN.*

3.18 Quick Reference

The quick reference charts show full set-up, minimum set-up and configuration functions. In the key/selection column the following applies:

- ALT - Key.
- [NEXT] - Item in menu (soft key).
- (SINGLE DOUBLE) - Sequence of parameters selected by NEXT key.
- (craft1 craft2...) - Sequence of names selected by NEXT key.
- data entry - Enter number from key-pad.

The display shows the main pressure display (Leak Measure or Control mode).

**Set-up example**

Press SETUP and the display shows:

Pressing a function key (F1 to F4) enters the set-up menu.

When in set-up, pressing a key (ALT Ps in this example) enters a menu or setting that applies to the parameter.
FULL SET-UP

Key/selection

**SETUP**

- [UNITS]
  - [NEXT]
  - [PREV]
  - [SAVE]

- [LIMITS]
  - [NEXT]
  - [PREV]
  - [SEL]

- [OSC]
  - [START]
  - [STOP]
  - [FREEZE]
  - [AMPL/FREQ]
    - [AMPL]
    - Data Entry
  - [FREQ]
    - Data Entry

- [Pt]

- [MORE]

- [CONTROL]
  - [Ps Pt DUAL]

- [DISPLAYS/OPTIONS]
  - [DISPLAY TYPE]
    - [NEXT]
    - [PREV]
    - [SAVE]
    - [OPTIONS]
  - [CLOSE O/P VALVES]
  - [OPEN O/P VALVES]
  - [SYSTEM SELF TEST]

**Function and comments**

- Full or minimum set-up selected in configuration.
- Select units
- Step through available units
- Step back through available units
- Select displayed units
- Select set of limits (aircraft 1/aircraft 2 ...)
- As NEXT, in reverse order
- Select displayed limit set
- Oscillate about aim
- For Ps channel

As for Ps channel

- Selects Ps only, Pt only or Dual channel control

Select single, dual or triple display
- (SINGLE\DUAL\TRIPLE\ENCODER\ARINC429)
- As NEXT, reverse order
- Save displayed Display Type
- See option manual
- Close output valves
- Open output valves
- Start self test

**SETUP + KEY PRESS**

- ALT
  - data entry
  - Altitude correction value

- SPEED
  - [AUTO ZERO]
    - [ON]
    - [OFF]
  - [CAS/TAS]
    - [CAS]
    - [TAS]
  - [Pt TEMPERATURE]
    - data entry
  - Calibrated or true airspeed

- MACH
  - [DEFAULT]
  - [OFF]
  - [ON]
  - data entry
  - Temperature for true airspeed
  - Enter Pitot temperature
  - Mach limit
  - Defined by current limits
  - Removes Mach limit
  - Enables Mach limit
  - Enter new Mach limit

**SETUP contd...**
**FULL SET-UP (contd.)**

**Key/selection**

<table>
<thead>
<tr>
<th>Setup contd...</th>
<th>Function and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RATE TIME</strong></td>
<td>Set-up WAIT and TIME time periods</td>
</tr>
<tr>
<td>[WAIT/TIME ON F1]</td>
<td>For F1</td>
</tr>
<tr>
<td>[TIME]</td>
<td>Change to TIME</td>
</tr>
<tr>
<td>[WAIT]</td>
<td>Change to WAIT</td>
</tr>
<tr>
<td>data entry</td>
<td>of TIME time</td>
</tr>
<tr>
<td>data entry</td>
<td>of WAIT time</td>
</tr>
<tr>
<td>See [Wait/Time on F1]</td>
<td></td>
</tr>
<tr>
<td>See [Wait/Time on F1]</td>
<td></td>
</tr>
<tr>
<td><strong>RATE</strong></td>
<td>Automatic airspeed rate</td>
</tr>
<tr>
<td>[ON]</td>
<td>Automatic</td>
</tr>
<tr>
<td><strong>LEAK MEASURE</strong></td>
<td>Auto leak recovery on or off</td>
</tr>
<tr>
<td>[AUTO LEAK]</td>
<td>Auto limit recovery on or off</td>
</tr>
<tr>
<td>[ON]</td>
<td>Airfield altitude for QNH display</td>
</tr>
<tr>
<td>[OFF]</td>
<td></td>
</tr>
<tr>
<td>[AUTO LIMIT]</td>
<td></td>
</tr>
<tr>
<td>[ON]</td>
<td></td>
</tr>
<tr>
<td>[OFF]</td>
<td></td>
</tr>
<tr>
<td><strong>GROUND</strong></td>
<td>Airfield altitude for QNH display</td>
</tr>
<tr>
<td>data entry</td>
<td></td>
</tr>
<tr>
<td><strong>PORT</strong></td>
<td>See Line Switching Unit User Manual</td>
</tr>
<tr>
<td><strong>REMOTE</strong></td>
<td>Remote mode lock, see configuration</td>
</tr>
<tr>
<td><strong>PRINT</strong></td>
<td>Adjust date and time</td>
</tr>
<tr>
<td>[DATE/TIME]</td>
<td>Enter Date</td>
</tr>
<tr>
<td>[DATE]</td>
<td>Enter Time</td>
</tr>
<tr>
<td>data entry</td>
<td>Help on SETUP</td>
</tr>
<tr>
<td>[TIME]</td>
<td></td>
</tr>
<tr>
<td>data entry</td>
<td></td>
</tr>
<tr>
<td><strong>HELP</strong></td>
<td></td>
</tr>
<tr>
<td>▲ (Nudge UP)</td>
<td>Enter nudge values</td>
</tr>
<tr>
<td>[NEXT]</td>
<td>(ALT \ CAS / TAS \ MACH \ ROC \ RATE \ RATE CAS) Aeronautical units or</td>
</tr>
<tr>
<td>data entry</td>
<td>(Ps \ Pt \ Qc \ EPR \ RATE Ps \ RATE Qc \ RATE EPR) Pressure units</td>
</tr>
<tr>
<td>[PREV]</td>
<td>As NEXT, in reverse order</td>
</tr>
<tr>
<td>data entry</td>
<td>Required nudge increment</td>
</tr>
<tr>
<td>▼ (Nudge DOWN)</td>
<td>As Nudge UP</td>
</tr>
</tbody>
</table>
MINIMUM SET-UP

Key/selection

SETUP

[UNITS TYPE]
  [AERO]
  [PRESS]

[LIMITS]
  [NEXT]
  [PREV]
  [SEL]

ALT
  data entry

PORT

HELP

EXECUTE TEST PROGRAM

[PRINT/SAVE]
  [PRINT]
  [SAVE]

[PRINT FILE]
  [NEXT]
  [PREV]
  [PRN]

Function and comments

Full or minimum set-up selected in configuration.

Set units type
Set units to default aeronautical units
Set units to default pressure units

Select set of limits
  (aircraft 1\aircraft 2 ...)
As NEXT, in reverse order
Select displayed limit set

Altitude correction value

See option user manual

Help on set-up

Result file related print option
Print/save mode selection
Print generated result data
Save generated result data to file
Print result file option
Select next result file
Select previous result file
Print selected result file
**CONFIGURATION**

**Key/selection**

**SETUP + F1**

**[UNITS]**
- [AERONAUTICAL]
  - [NEXT]
  - [PREV]
  - [SAVE]
- [PRESSURE]
  - [NEXT]
  - [PREV]
  - [SAVE]
- [TEMPERATURE]
  - [C]
  - [F]

**[LIMITS]**
- [EDIT LIMITS]
- [EDIT EXISTING]
  - [NEXT]
  - [PREV]
  - [SEL]
- [MAX LIMITS]
- [EDIT NEW]
- [CLEAR LIMITS]
  - [NEXT]
  - [PREV]
  - [SEL]
  - [YES]
  - [NO]
- [LOCK AIRCRAFT]
  - [ON]
  - [OFF]
- [DEFAULT AIRCRAFT]
  - [NEXT]
  - [PREV]
  - [SEL]

**Function and comments**

Hold F1 and press SETUP to enter CONFIG

Default units
Select default aeronautical units
Step through available units
Step back through available units
Save selected units
Select default pressure units
Step through available units
Step back through available units
Save selected units
Select default temperature units
°C
°F
Configure sets of limits
Change limit values
Change existing values
(aircraft 1 \ aircraft 2 ...)
As NEXT, in reverse order
Select aircraft to EDIT limits
NAME \ MAX ALT \ MIN ALT \ MAX CAS \ MIN CAS \ MAX MACH \ MAX ROC \ MAX RATE CAS \ MIN Ps \ MAX Ps \ MIN Qc \ MAX Qc \ MAX RATE Ps \ MAX RATE Qc \ ARINC LIMITS \ ALTITUDE CORRECTION
As NEXT in reverse order
Switch (toggle) to ARINC 565 limits
Limit value
Insert alphabet character in name
Nudge up select next letter in alphabet
Nudge down select previous letter in alphabet
Delete last character in name
Create maximum limits called “MAX”
Create new limits
As for [EDIT EXISTING][SEL] above
Clear an existing set of limits
(aircraft 1 \ aircraft 2 ...)
As NEXT, in reverse order
Clear selected limits
Confirm delete
Only DEFAULT limits available in USER mode
SETUP can be used to select aircraft
(aircraft 1 \ aircraft 2 ...)
As NEXT, in reverse order
Select aircraft limits used at power-up. May be locked
Key/selection

CONFIG [SETUP + F1] contd...

- [CONTROL]
  - [Ps Pt DUAL]

- [DISPLAY/OPTIONS]
  - [DISPLAY TYPE]
    - [NEXT]
    - [PREV]
    - [SAVE]
  - [OPTIONS]

- [DATE FORMAT]
  - [DMY]
  - [MDY]

- [SETUP MODE]
  - [OFF]
  - [MIN]
  - [FULL]

CONFIG [SETUP + F1] + KEY PRESS

SPEED

- [AUTO ZERO]
  - [ON]
  - [OFF]
- [CAS/TAS]
  - [CAS]
  - [TAS]
- [PT TEMPERATURE]
  - data entry

RATE TIME

- [WAIT/TIME ON F1]
  - [TIME]
    - [WAIT]
      - data entry

- [WAIT/TIME ON F2]
- [WAIT/TIME ON F3]

RATE

- [ON]
- [OFF]

LEAK MEASURE

- [AUTO LEAK ON/OFF]
  - [ON]
  - [OFF]
- [AUTO LEAK LOCK]
  - [ON]
  - [OFF]
- [AUTO LIMIT ON/OFF]
  - [ON]
  - [OFF]
- [AUTO LIMIT LOCK]
  - [ON]
  - [OFF]

Function and comments

Ps Pt DUAL control
Ps single pipe testing of altimeters. Pt single pipe testing of airspeed and Mach indicators. DUAL normal combined system testing.

Configure display type
(SINGLE \ DUAL \ TRIPLE \ ENCODER \ ARINC429)
As NEXT, in reverse order
Save selection
See option manual
Format of date text
UK format DD/MM/YY
US format MM/DD/YY
Limits access to set-up functions

Auto zero function
Configure Calibrated or True airspeed
Configure Pt temperature
Configure WAIT and TIME times
For F1
Change to TIME
Change to WAIT
TIME time period
WAIT time period
See [Wait/Time on F1]
See [Wait/Time on F1]
Automatic airspeed rate
Automatic
Manual

Auto leak recovery Lock
Lock auto leak recovery Lock
Auto limit recovery state
Lock auto limit recovery state
**Key/selection**  

**Function and comments**

**CONFIG (SETUP + F1) + KEY PRESS contd...**

- **GROUND**
  - data entry
  - **GROUND**

- **PORT**

- **REMOTE**
  - [ON]
  - [OFF]

- **ETP**

- **AUTO RUN**
  - [NEXT]
  - [PREV]
  - [NONE]
  - [SEL]

- **ERASE PROGRAMS**
  - [NEXT]
  - [PREV]
  - [DEL]

- **RESULTS**
  - [PRINT/SAVE]
  - [PRINT]
  - [SAVE]
  - [ERASE FILE]
  - [NEXT]
  - [PREV]
  - [DEL]

- **(nudge up)**
  - [NEXT]
  - [PREV]
  - data entry
  - (nudge down)

- **[000]**
  - data entry

- **(ALT\CAS/TAS\MACH\ROC\RATE CAS\Ps\Pt\Qc\EPR\RATE Ps\RATE Qc\RATE EPR)**

**Airfield altitude for QNH display**

**Refer to option user manual**

**Remote mode lock**

**Run test program on power up**

**Refer to option user manual**

**Delete test program**

**Print/Save mode selection**

**Generated result data printed**

**Generated result data saved in a file**

**Result file delete option**

**Select next result file**

**Select previous result file**

**Delete selected result file**

**As NEXT, in reverse order**

**Required nudge increment**

**As nudge up**

**PIN protection**

**PIN (code number to enter CONFIG) set to 0000 for "no code required"**
4 Maintenance

4.1 Introduction

This section details the maintenance tasks 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.

<table>
<thead>
<tr>
<th>Task</th>
<th>Code</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect</td>
<td>A</td>
<td>Daily, before use.</td>
</tr>
<tr>
<td>Inspect</td>
<td>B</td>
<td>Weekly</td>
</tr>
<tr>
<td>Test</td>
<td>C</td>
<td>Before use.</td>
</tr>
<tr>
<td>Test</td>
<td>D</td>
<td>Daily, before use.</td>
</tr>
<tr>
<td>Calibrate</td>
<td>E</td>
<td>Every 12 months *</td>
</tr>
<tr>
<td>Replace</td>
<td>F</td>
<td>As detailed in fault finding or when detailed after inspection.</td>
</tr>
<tr>
<td>Clean</td>
<td>G</td>
<td>Weekly *</td>
</tr>
<tr>
<td>Service</td>
<td>H</td>
<td>1,000 hours recorded by the pump unit elapsed time indicator or the equipment running log.</td>
</tr>
<tr>
<td>Service</td>
<td>J</td>
<td>3,000 hours recorded by the pump unit elapsed time indicator or the equipment running log.</td>
</tr>
</tbody>
</table>

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

Table 4-1 Maintenance Chart
4.2 Materials

This lists materials required for the user to maintain the ADTS 405. The item number and name in the table identifies the item in the maintenance tasks (for example, "Use a soft bristle brush, item 4, Table 4-2"). The description provides further information required to identify the item.

### Table 4-2 Materials List

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Item Name, Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cloth, Cotton, Lint-Free</td>
</tr>
<tr>
<td>2</td>
<td>Alcohol, Isopropyl (MIL-A-10428, Grade A)</td>
</tr>
<tr>
<td>3</td>
<td>Detergent, Mild, Liquid</td>
</tr>
<tr>
<td>4</td>
<td>Brush, Soft-bristle (MIL-B-43871)</td>
</tr>
</tbody>
</table>

**Note:** Equivalent substitutes can be used.

### Table 4-3 Tool and Test Equipment Requirements

<table>
<thead>
<tr>
<th>Ref Code</th>
<th>Nomenclature</th>
<th>Manufacturer’s part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Voltmeter, Digital</td>
<td>Fluke series II, Type 77 H7291</td>
</tr>
<tr>
<td>2</td>
<td>Insulation Tester, 250V</td>
<td>Robin</td>
</tr>
</tbody>
</table>

**Note:** Equivalent substitutes can be used.
4.3 Maintenance Tasks

A Visually inspect the unit for obvious signs of damage and check that all the equipment is present; record any deficiencies.

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; if necessary, replace as detailed in 4.4. Visually inspect pneumatic hoses, electrical cables for cuts, splits and damage; replace as necessary.

C Before use, power-up the unit as detailed in Section 3. Check the date of the last calibration and, if necessary, refer to task E. Record any error messages and refer to Section 5.

D Daily and before use, carry out the SST detailed in Section 5.

E Normal calibration period 12 months. When calibration is due, the unit should be withdrawn from service and returned to depot or calibration facility. The date of calibration is stored in the unit and displayed in the power-up sequence and on a label on the front panel. Do not use a unit with out-of-date calibration. Engineering authority may change the periodicity of calibration depending on usage and the operating environment.

F As detailed in fault finding or when detailed after inspection replace the listed item in table 2-1.

G Clean the unit every week. Clean the front panel with a damp lint-free cloth (item 1, Table 4-2) and mild liquid detergent (item 3, Table 4-2). Remove any stubborn dirt using isopropyl alcohol (item 2, Table 4-2) and allow to dry. Clean all pneumatic connectors with a soft brush (item 4, Table 4-2). Remove any stubborn dirt using isopropyl alcohol (item 2, Table 4-2) and allow to dry.

H Withdraw the unit from service and return to the repair depot. The intermediate service manual contains the 1,000 hour servicing procedure.

J Withdraw the unit from service and return to the repair depot. The intermediate service manual contains the 3,000 hour servicing procedure.
4.4 Routine Maintenance

**WARNING:**
*SWITCH OFF AND DISCONNECT THE POWER SUPPLY BEFORE STARTING ANY MAINTENANCE TASK.*
Carrying out the maintenance tasks detailed 4.3.

**Servicing Procedures**
The following procedures provide instructions to test and replace items for the operator. Return the unit to the intermediate service depot for further testing and replacement of items.

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:

1. Carefully remove the o-ring from the small groove at the top of the connector.
2. Fit a new o-ring in the small groove at the top of the connector.
3. Make sure the o-ring is tight in the groove and not damaged after fitting.

*Note: Damage to this o-ring causes leaks.*
Cable tests
Carry out the following check when detailed in Testing and Fault Finding, Section 5.

Measure continuity using the DVM (item 1, Table 4-3) set to an appropriate range.

Measure the continuity between corresponding pins at each end of each cable assembly. The measured resistance must not exceed 2.0 ohms.

**Note:** This resistance value is the expected maximum value for the 18 metre (60ft) cable. The resistance value varies depending on the length of the cable.

Measure insulation using the Insulation tester (item 2, Table 4-3), set to an appropriate range.

Measure the insulation resistance between the shell of the connector and all individual pins in turn.

Measure the insulation resistance between the shell of the appropriate connectors and all pins in turn.

Measure also the resistance between individual pairs of pins (i.e., 1-2, 1-3, 1-4, 1-5, 1-6, 2-3, 2-4, 2-5, 2-6, 3-4, 3-5, 3-6, 4-5, 4-6 and 5-6). In all cases the resistance must exceed 10 Mohms.
5 TESTING AND FAULT FINDING

5.1 Introduction

- The ADTS 405 contains a built-in, self-test and diagnostic system. The system continuously monitors the performance of the unit and at power-up carries out a self-test. Warning and error messages are displayed during normal operation if out of range values are entered or if faults occur.

- This section details the standard serviceability test and the possible error messages and codes that can be displayed. A fault diagnosis flow chart and table provide the probable cause and procedures to rectify specific symptoms.

**Error messages**

- When the display shows a message indicating entry of incorrect data or values, pressing QUIT clears the message and allows the correct entry to be made.
5.2 Standard Serviceability Test

- The following procedure can be used to check the functions and facilities of the ADTS 405. For further information refer to Section 6 - Reference and Specification.
- In the following:
  - All key presses are highlighted in **bold** and shown as identified on the key-pad.
  - Key presses inside brackets e.g., [MORE], are soft key presses (i.e., function key selections {F1 to F4} indicated on the display screen).

**Procedure**

- Connection and power-on checks
  - Connect power to the unit and, if necessary, connect the hand terminal. Make sure that the blanking caps are fitted to the Ps and Pt front panel outputs. Check power indicator is on.
  - Set the front panel switch to OPERATE. Set the front panel switch for the pump unit to PUMP ON and check that the pump power indicator lights.
  - Check the display shows the first stage power-up message as below (where: x is the version number of the installed display driver software):
    
    ![Display Power up]

  - Check the second stage power-up message displays as below (where: x is the version number of the installed main operating software):
    
    ![Version Information]

**Note:** "ADTS 405" may be replaced by an alternative identity string. The software version may also be supplemented by extra alpha characters.
The ADTS 405 displays any detected errors. Check that the power-up sequence continues through the following stages without error:
- Calibration date.
- Self-test.
- Measuring ground pressures.
- Equalizing system pressures.

Check that the display then changes to show measured altitude and airspeed (CAS or TAS) values.

**NOTES**

1. *The displayed values change as atmospheric pressure changes at power-up.*

2. *The display shows the “WARMUP” message in the lower right corner indicating that full pressure accuracy and stability may not be achieved. The WARMUP message clears after 15 minutes. This indication does not inhibit operation and these tests may proceed without waiting for the message to clear.*

3. *An automatic zero (if enabled) takes place regularly. The display shows “ZERO” and the state of the valves, on the mimic panel, change for approximately six seconds. Commands may still be entered while auto-zero takes place.*

Press the **MACH** key and check the display changes to show Altitude and Mach measured values.

**Pump unit**

- Set the front panel switch for the pump unit to PUMP ON and check that the pump power indicator lights.

- Press **LEAK MEASURE/CONTROL** to go to control mode. Enter an altitude aim of 5000 ft by pressing **5, 0, 0, 0, ENTER**.

- Enter rate or use default rates.

- Enter an airspeed aim of 500 knots by pressing **SPEED, 5, 0, 0, ENTER**.

- Check that these aim values are achieved.

**Completion**

- On successful completion of this test procedure, select **GROUND**, [Go to Ground] wait until the unit is at ground, switch off and disconnect the power supply.
5.3 **Self-Test Errors**

- At power-up, the ADTS 405 indicates if there is a fault by displaying an error code for example:
  
  701:HHHH PS SELF-TEST ERROR

- The HHHH is a hexadecimal code containing additional information record the whole error code.

- Paragraph 5.8 contains a table listing the error codes, check that the error code is complete and listed in the table before returning the unit to the repair depot.

5.4 **Venting after Overpressure**

- To calibrate or test the ADTS 405, an external pressure source is connected to the Ps and/or Pt output connectors. If, during calibration or test procedures, an overpressure occurs, the output valves close to protect the system. After the valves close pressure may be trapped in the internal system; the display may show on the next power-up error 701:0100 or 702:0100. The following procedure to vent this pressure enters the maintenance mode. Review and become familiar with the whole procedure before beginning the venting process:

1. Remove the source of pressure and vent Ps and Pt to atmosphere (caps off).

   **CAUTION:** **ONLY SELECT ITEMS DETAILED IN THE FOLLOWING MENUS, INCORRECT SELECTIONS CAN CAUSE CHANGES TO SAFETY LIMITS AND THE CALIBRATION DATA OF THE SYSTEM.**

2. Re-power the ADTS 405. During the power-up screen:

   DRUCK
   ADTS 405
   DK XXX
   VER XXX

3. Press F1 and F4 simultaneously. The ADTS 405 enters the maintenance mode with the following screen displays.

   **Note:** *The system may prompt for a PIN. This is not the CONFIG PIN but the Calibration PIN. If this Calibration PIN is enabled and not entered, the system will not execute the following procedure.*
CAUTION: ONLY SELECT ITEMS DETAILED IN THE FOLLOWING MENUS, INCORRECT SELECTIONS CAN CAUSE CHANGES TO SAFETY LIMITS AND THE CALIBRATION DATA OF THE SYSTEM.

4. The system enters the maintenance mode with the following screen display:

   (MAINTENANCE)
   F1 Data Block
   F2 Supervisor EEPROM
   F3 More

5. Select F3. The display shows:

   (MAINTENANCE)
   F1 System
   F2 Hardware
   F3 Error log

6. Select F3. The display shows:

   (MAINTENANCE)
   F1 Vent System
   F2 Set System Ready
   F3 View Temperature

7. Select F1 and when complete, press CLEAR/QUIT three times to reset the system.

5.5 Fault Diagnosis

- If the display shows a warning or error message, refer to the above sections.

- If a fault occurs, refer to the fault location chart, Figure 5-1 and Table 5-1 for possible fault causes and recommended action.
Testing and Fault Finding

Figure 5-1 Fault Finding Chart

Power-up sequence

DK282 version xx.xx
Display Power Up
Please Wait

DKUCK
ADTS 405
DK 263
Ver 6.xx

Last Calibration
mm/dd/yy (mdy)
RPT Transducer
PLEASE WAIT

Self Test
PLEASE WAIT

Measuring Ground
Pressures
PLEASE WAIT

Equalising System
Pressures
(Valves May Pulse)
PLEASE WAIT

ALT 0 ft
Leak Measure
CAS 0.0 kts
Leak Measure
WARMUP

From now on, if any errors occur, the system logs the occurrence and displays an error message. Refer to error codes for fault finding procedure.

Make sure power-up sequence is completed without errors.

To confirm serviceability, carry out the standard serviceability test.

POWER-UP SEQUENCE COMPLETED WITHOUT ERRORS. IF ANY FURTHER ERRORS OCCUR, THE SYSTEM LOGS THE OCCURRENCE AND DISPLAYS AN ERROR MESSAGE.

FUNCTIONAL TESTING COMPLETE.
## Table 5-1 Fault Finding

<table>
<thead>
<tr>
<th>Fault</th>
<th>Symptom</th>
<th>Probable cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Pump power-on indicator does not light.</td>
<td>Faulty power supply. Unserviceable fuse, AC/DC power supply Faulty power supply cable.</td>
<td>Check power supply. Check/replace power supply fuse or reset circuit protection device. Check/replace fuse (front panel). Replace cable and re-test.</td>
</tr>
<tr>
<td>F2</td>
<td>AC or DC power indicator does not light.</td>
<td>AC or DC power supply cable to 405 rack. 405 rack AC input fuse. PSU fault.</td>
<td>Check/replace cables. Check/replace fuse. Record fault and return ADTS 405 to depot for repair.</td>
</tr>
<tr>
<td>F3</td>
<td>Display power-up message appears and status light remains red.</td>
<td>Internal control computer fault.</td>
<td>Record fault and return ADTS 405 to depot for repair.</td>
</tr>
<tr>
<td>F4</td>
<td>No front panel display power-up message, status light green.</td>
<td>Display fault.</td>
<td>Use an available hand-terminal. Record fault and return ADTS 405 to depot for repair.</td>
</tr>
<tr>
<td>F7</td>
<td>No front panel display DK127 message. Status light flashing red/orange.</td>
<td>No front panel display detected. Internal fault.</td>
<td>Record fault and return ADTS 405 to depot for repair.</td>
</tr>
<tr>
<td>F8</td>
<td>No hand-terminal or front panel display DK127 message. Status light flashing red/orange.</td>
<td>No hand-terminal or front panel display detected. Hand-terminal fault. Cable fault. Internal fault.</td>
<td>Remove hand-terminal and re-test.</td>
</tr>
<tr>
<td>F9</td>
<td>Status light off.</td>
<td>Internal PSU fault.</td>
<td>Record fault and return ADTS 405 to depot for repair.</td>
</tr>
<tr>
<td>F10</td>
<td>Status light steady orange.</td>
<td>System fault.</td>
<td>Record fault and return ADTS 405 to depot for repair.</td>
</tr>
</tbody>
</table>
5.6 **Further Testing**

- The following tests should only be carried out if a pneumatic leak or a controller instability is suspected.

**Test Environment and Preliminary Operations**

- These tests should be carried out in a room with a stable temperature environment within the operating temperature range. The room must be free from drafts.

- Review and become familiar with the whole of the test procedure before beginning the test procedure.

- The unit must be thermally stable; switch on and leave the unit for at least one hour to achieve thermal stability.

- Change the units to mbar as follows:

  1. Press **SETUP** then select **[UNITS]**. Repeatedly select **[NEXT]** until the display shows "mbar".

  2. Select **[SAVE]** and then press **CLEAR/QUIT** twice and the display now shows Ps and Pt in units of mbar.

**Pressure Leak Check**

- This section verifies that the unit is leak tight under positive pressure conditions.

  1. Press **LEAK MEASURE/CONTROL** to enter control mode. The display shows "Aim" in place of "Leak Measure".

  2. Enter a Ps aim of 1016 mbar by pressing: **ALT/Ps, 1, 0, 1, 6, ENTER**.

  3. Enter a Qc aim of 272 mbar by pressing: **SPEED/Qc, 2, 7, 2, ENTER**. Wait for the aim values to be achieved then wait for 1 min.

  4. Press **LEAK MEASURE/CONTROL** to return to Leak Measure mode.

  5. Press **RATE TIMER** and select **[WAIT 05:00]**, **[TIME 01:00]**. Observe that the "Waiting" time is shown on the display as it counts down, followed by the "Timing" time.

  6. At the end of the "Timing" period, the display shows the rate of change of Ps, Qc and Pt with a "T" to indicate timed average.
(7) Check that the Ps, Qc and Pt rates are less than or equal to ±0.5 mbar/min. If the leak rate is not achieved, allow further thermal stabilization time and re-test by pressing RATE TIMER and selecting [WAIT 05:00], [TIME 01:00].

(8) Press CLEAR/QUIT to exit rate display.

Vacuum Leak Check
- This section verifies that the unit is leak tight under vacuum conditions.

(1) Press LEAK MEASURE/CONTROL to enter control mode. The display shows “Aim” in place of “Leak Measure”.

(2) Enter a Ps aim of 100 mbar by pressing: ALT/Ps, 1, 0, 0, ENTER

(3) Enter a Qc aim of 0 mbar by pressing: SPEED/Qc, 0, ENTER

(4) Wait the required time for temperature stabilization e.g., one minute. Press LEAK MEASURE/CONTROL return to Leak Measure mode.

(5) Press RATE TIMER and select [WAIT 05:00], [TIME 01:00]. Observe that the “Waiting” time is shown on the display as it counts down, followed by the “Timing” time.

(6) At the end of the “Timing” period, press ROC/Ps RATE to display the measured rate of change of Ps (“T” is shown after the value indicating a timed average).

(7) Check that the Ps, Qc and Pt rates are less than or equal to ±0.5 mbar/min. If the leak rate is not achieved, allow further thermal stabilization time and re-test by pressing RATE TIMER and selecting [WAIT 05:00], [TIME 01:00].

(8) Press CLEAR/QUIT to exit special rate time display.

Range check
- Using key presses based on the above, control the Ps and Qc pressures to the normal limits of operation and make sure that these are achieved. Use minimum Ps and zero Qc and then maximum Ps and maximum Qc.

Note: Do not exceed the maximum Pt as shown on the front panel of the unit. Use maximum available rates of change to minimise test times.
Controller Stability

This section verifies the control stability.

(1) Press **LEAK MEASURE/CONTROL** to turn the pressure controllers on. “Aim” replaces “Leak Measure” on the display.

(2) Enter a Ps aim of 510 mbar with a rate of change of 204 mbar/min. by pressing the following: **ALT/Ps, 5, 1, 0, ENTER, Ps RATE, 2, 0, 4, ENTER.**

(3) Enter a Qc aim of 0 mbar with a rate of change of 204 mbar/min. by pressing the following: **SPEED/Qc, 0, ENTER, RATE, 2, 0, 4, ENTER.**

(4) Press Ps and wait for the aim values to be achieved.

(5) If auto-zero is enabled, wait for an auto-zero to take place. During auto zero, the valve state changes on the mimic panel and the display shows “Zero” in place of the airspeed aim value. The time to auto-zero should be less than 1 minute from achieving the aim value.

(6) Wait for a minimum of 20 seconds after auto-zero before proceeding.

(7) Observe the measured values of Ps and Qc on the display for 1 min.

(8) Check that the displayed value of Ps remains within ±0.068 mbar.

(9) Check that the displayed value of Qc remains within ±0.068 mbar.

**Note:** If a further auto zero takes place, allow the display to stabilize following the auto zero before proceeding.
5.7 Testing an Option Facility

- The following tests should only be carried out if the serviceability of an option facility is suspected or when an error occurs.

Testing the IEEE 488 Facility

- This IEEE 488 facility requires specialist knowledge of both IEEE 488 communications and test programming for specified, authorized test procedures. Only qualified personnel should use this facility, the test procedure must be authorized by the appropriate engineering authority.

- To enable and disable this IEEE 488 facility access the configuration menu. When enabled, this facility will be available from power-up of the ADTS 405 with the settings held in non-volatile memory.

Configuring and Enabling the IEEE 488 Facility

- To enable the IEEE 488, set the ADTS 405 to the SCPI IEEE option and set to Address 1 as follows:

  - Press and hold down F1 then press SETUP to enter the configuration menu. Release both keys.
  - If requested, enter PIN details.
  - Press [MORE], [DISPLAY/OPTIONS], [OPTIONS], [IEEE-488], [SCPI/OPT2].
  - Check the display shows that SCPI is selected, if the settings are correct, press CLEAR/QUIT until the display shows the main pressure display, run the test program below.

- If the display does not show that SCPI is selected, press [SCPI].

  - Press CLEAR/QUIT, [DEVICE ADDRESS].
  - Check the address displayed is 1.
  - If not, press 1 on the numeric key-pad and then ENTER.
  - If any changes have been made, press CLEAR/QUIT until requested to accept the changes, then press ENTER.
  - The ADTS 405 automatically restarts, when the display shows the main pressure display, carry out the following test program.
Programming a Test of the IEEE 488 Facility

- There are many different programs and items of equipment for communicating over the IEEE 488 interface. In the following example, the user must be familiar with the IEEE 488 bus controller to be used.

- The following example commands can be used to check for correct operation of the IEEE 488 interface. Initialize the bus controller as follows:
  - Set Address 1 as the talker listener address.
  - Make sure that bus time-out periods are set sufficiently high (e.g., 5 seconds).
  - Set the bus controller to send EOI with last byte and to expect EOI on last byte of received data.
  - Send interface clear (IEEE 488 command).
  - Send "SOURCE:STATE OFF" (one space between STATE and OFF).
  - Send "SOURCE:STATE?"
  - Instruct device 1 to TALK and input the response string.
  - The response string should be "OFF".

  (1) If the above procedure is unsuccessful, check the continuity of the IEEE 488 cable.

  (2) If faulty, replace the cable.

  (3) If the continuity of the cable is correct, return the ADTS 405 to the repair depot.
Connection of the IEEE 488 Facility

- The front connector is behind the option connector cover plate.

**CAUTION:** The option connector cover must always be fitted when the equipment is used outdoors or in an environment where moisture may enter the unit through the option connector panel.

- The connector details are as follows:

<table>
<thead>
<tr>
<th>Standard Connector Pin Number</th>
<th>Function</th>
<th>Standard Connector Pin Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DI01</td>
<td>13</td>
<td>D105</td>
</tr>
<tr>
<td>2</td>
<td>D102</td>
<td>14</td>
<td>D106</td>
</tr>
<tr>
<td>3</td>
<td>D103</td>
<td>15</td>
<td>D107</td>
</tr>
<tr>
<td>4</td>
<td>D104</td>
<td>16</td>
<td>D108</td>
</tr>
<tr>
<td>5</td>
<td>E0I</td>
<td>17</td>
<td>REN</td>
</tr>
<tr>
<td>6</td>
<td>DAV</td>
<td>18</td>
<td>Gnd [2]</td>
</tr>
<tr>
<td>7</td>
<td>NRFD</td>
<td>19</td>
<td>Gnd [2]</td>
</tr>
<tr>
<td>8</td>
<td>NDAC</td>
<td>20</td>
<td>Gnd [2]</td>
</tr>
<tr>
<td>9</td>
<td>IFC</td>
<td>21</td>
<td>Gnd [2]</td>
</tr>
<tr>
<td>10</td>
<td>SRQ</td>
<td>22</td>
<td>Gnd [2]</td>
</tr>
<tr>
<td>11</td>
<td>ATN</td>
<td>23</td>
<td>Gnd [2]</td>
</tr>
</tbody>
</table>

[1] Chassis connection
[2] 0V return for signals (not chassis)
Testing the Altimeter Encoder Option

- To enable and disable this Altimeter Encoder facility access the configuration menu. When enabled, this facility will be available from power-up of the ADTS 405 with the settings held in non-volatile memory.

Configuring and enabling the Altimeter Encoder Option

- Press and hold down F1 and press SETUP to enter the configuration menu. Release both keys.
- Press [MORE], [DISPLAY/OPTIONS], [DISPLAY TYPE], [NEXT], [ENCODER].
- Check the display shows “Encoder” is selected.
- Press [SAVE], then repeatedly press CLEAR/QUIT until the display shows the following:

```
Alt 5000
ft
Aim 5000
D2 to C4>00001010010
CODE 5000
```

Note: With an incorrect bit combination such as all zeroes, the display shows “ENCODER ERROR” in the place of the decoded value.

- If the above procedure is unsuccessful, check the continuity of the Altimeter Encoder cable.
- If faulty, replace the cable.
- If the continuity of the cable is correct, return the ADTS 405 to the repair depot.
Optional cable (AAU-32 units)

- The 15-core cable is supplied for the AAU-32 encoder unit:

  **Note:** The D2 data line (turquoise cable) is not defined for the AAU-32, it is for above 62,000 ft and not connected.

<table>
<thead>
<tr>
<th>Front panel connector pin No.</th>
<th>Function</th>
<th>Cable colour code</th>
<th>AAU-32 connector pins</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C4 LSB</td>
<td>brown</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>C2</td>
<td>red</td>
<td>C</td>
</tr>
<tr>
<td>5</td>
<td>C1</td>
<td>orange</td>
<td>D</td>
</tr>
<tr>
<td>7</td>
<td>B4</td>
<td>yellow</td>
<td>E</td>
</tr>
<tr>
<td>9</td>
<td>B2</td>
<td>green</td>
<td>F</td>
</tr>
<tr>
<td>11</td>
<td>B1</td>
<td>blue</td>
<td>G</td>
</tr>
<tr>
<td>13</td>
<td>A4</td>
<td>violet</td>
<td>H</td>
</tr>
<tr>
<td>22</td>
<td>A2</td>
<td>white</td>
<td>J</td>
</tr>
<tr>
<td>2</td>
<td>A1</td>
<td>grey</td>
<td>K</td>
</tr>
<tr>
<td>4</td>
<td>D4</td>
<td>black</td>
<td>L</td>
</tr>
<tr>
<td>n/c</td>
<td>D2 MSB</td>
<td>turquoise*</td>
<td>n/c</td>
</tr>
<tr>
<td>8</td>
<td>common (0V) signal</td>
<td>pink</td>
<td>A</td>
</tr>
<tr>
<td>10</td>
<td>common (0V) power</td>
<td>yellow/red</td>
<td>b +M</td>
</tr>
<tr>
<td>14</td>
<td>+24 V vibrator</td>
<td>red/blue</td>
<td>P</td>
</tr>
<tr>
<td>12</td>
<td>+24 V encoder</td>
<td>green/red</td>
<td>c</td>
</tr>
<tr>
<td>shell</td>
<td>case/ground</td>
<td>shell</td>
<td>a + shell</td>
</tr>
</tbody>
</table>
Testing the ARINC 429 Option

- To enable and disable this ARINC facility access the configuration menu. When enabled, this facility will be available from power-up of the ADTS 405 with the settings held in non-volatile memory.

Configuring and enabling the ARINC 429 Option

- To enable the ARINC option as follows:
  - Press and hold down F1 and press SETUP to enter the configuration menu. Release both keys.
  - Press [MORE], [DISPLAY/OPTIONS], [OPTIONS], [ARINC-429].
  - Check the display shows ARINC 429 is selected.

**Note:** If the ARINC 429 option is not fitted the value is replaced by "absent".

- If the above procedure is unsuccessful, check the continuity of the ARINC 429 cable.
- If faulty, replace the cable.
- If the continuity of the cable is correct, return the ADTS 405 to the repair depot.

<table>
<thead>
<tr>
<th>Function</th>
<th>Pin</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>output +ve</td>
<td>15</td>
<td>yellow</td>
</tr>
<tr>
<td>output -ve</td>
<td>16</td>
<td>blue</td>
</tr>
<tr>
<td>input +ve</td>
<td>18</td>
<td>green</td>
</tr>
<tr>
<td>input -ve</td>
<td>19</td>
<td>red</td>
</tr>
<tr>
<td>Ground/earth</td>
<td>shell</td>
<td>-</td>
</tr>
</tbody>
</table>
5.8 Fault Finding

5.8.1 Error Messages

- In the event of a malfunction, the built-in, self-test and diagnostic system displays an error message and error code. A unit displaying this type of error should be returned to the repair depot:

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error Message</th>
<th>Hexadecimal Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>515</td>
<td>PSU NO LONGER READY</td>
<td></td>
</tr>
<tr>
<td>516</td>
<td>UNKNOWN CONTROLLER ERROR</td>
<td></td>
</tr>
<tr>
<td>517</td>
<td>RING TIME OUT</td>
<td></td>
</tr>
<tr>
<td>550</td>
<td>Ps HUMIDITY SENSOR FAILURE</td>
<td></td>
</tr>
<tr>
<td>551</td>
<td>Pt HUMIDITY SENSOR FAILURE</td>
<td></td>
</tr>
<tr>
<td>601</td>
<td>INTERNAL RAM ERROR</td>
<td></td>
</tr>
<tr>
<td>603</td>
<td>ERROR WRITING TO EEPROM</td>
<td></td>
</tr>
<tr>
<td>603</td>
<td>SYSTEM EEPROMS FAULTY OR NOT FITTED</td>
<td></td>
</tr>
<tr>
<td>701</td>
<td>Ps SELF-TEST ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>702</td>
<td>Pt SELF-TEST ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>703</td>
<td>Ps SELF-TEST TIME OUT ERROR</td>
<td></td>
</tr>
<tr>
<td>704</td>
<td>Pt SELF-TEST TIME OUT ERROR</td>
<td></td>
</tr>
<tr>
<td>710</td>
<td>Ps CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>711</td>
<td>Ps CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>712</td>
<td>Ps CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>713</td>
<td>Ps CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>714</td>
<td>Ps CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>717</td>
<td>Ps CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>720</td>
<td>Pt CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>721</td>
<td>Pt CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>722</td>
<td>Pt CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>723</td>
<td>Pt CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>724</td>
<td>Pt CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>727</td>
<td>Pt CONTROLLER ERROR</td>
<td>✓</td>
</tr>
<tr>
<td>801</td>
<td>IEEE488 DRIVER FAILED TO OPEN</td>
<td></td>
</tr>
<tr>
<td>802</td>
<td>IEEE488 DRIVER FAILED TO RESET</td>
<td></td>
</tr>
<tr>
<td>900</td>
<td>INTERNAL SOFTWARE</td>
<td></td>
</tr>
<tr>
<td>999</td>
<td>INTERNAL ERROR</td>
<td></td>
</tr>
</tbody>
</table>

Note:

Some errors display extra information using a four digit hexadecimal code. This should always be recorded with the error number to provide information for the repair depot.

**IMPORTANT NOTE**

If the display shows **ERROR 703 START UP Ps SELF TEST TIME ERROR**.
Check that the expansion port plug (item 13, Table 2-1) is correctly connected in the expansion port on the rear panel (Fig. 2-4).
5.8.2 Warning Messages

The following table lists the warning messages with the probable cause and action to be taken.

**Table 5-3 Warning Messages**

<table>
<thead>
<tr>
<th>No.</th>
<th>Message</th>
<th>Probable Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>INVALID USER INPUT</td>
<td>The numeric value entered was outside the allowed range</td>
<td>Re-enter value within allowed range</td>
</tr>
<tr>
<td>3</td>
<td>OPERATE CAL ENABLE ON STATUS PANEL</td>
<td>Calibration started before removing calibration enable plate on the front panel</td>
<td>Refer to the main fault finding chart in the service manual</td>
</tr>
<tr>
<td>4</td>
<td>ONLY VALID IN CONTROL MODE</td>
<td>Selection not allowed in Leak measure mode</td>
<td>Select controller on</td>
</tr>
<tr>
<td>210</td>
<td>Ps SOFT START TIMEOUT</td>
<td>The Ps controller has failed to go into control mode</td>
<td>Select CONTROL again. If fails again, refer to the main fault finding chart in the service manual</td>
</tr>
<tr>
<td>212</td>
<td>Ps PRESSURE FAIL</td>
<td>The Ps controller has detected loss of supply pressure and automatically switched all channels to measure mode. This can occur at very high rates of pressure change in large volume systems if the pumps cannot produce enough pressure</td>
<td>Restore pressure supply BEFORE going to control mode again. Refer to the main fault finding chart in the service manual</td>
</tr>
<tr>
<td>213</td>
<td>Ps VACUUM FAIL</td>
<td>The Ps controller has detected loss of supply vacuum and automatically switched all channels to measure mode. This can occur at very high rates of pressure change in large volume systems if the pumps cannot produce enough vacuum</td>
<td>Restore vacuum supply BEFORE going to control mode again. Refer to the main fault finding chart in the service manual</td>
</tr>
<tr>
<td>220</td>
<td>Pt SOFT START TIMEOUT</td>
<td>The Pt controller has failed to go into control mode</td>
<td>Select CONTROL AGAIN. If fails again, refer to the main fault finding chart in the service manual</td>
</tr>
<tr>
<td>222</td>
<td>Pt PRESSURE FAIL</td>
<td>The Pt controller has detected loss of supply pressure and automatically switched all channels to measure mode. This can occur at very high rates of pressure change in large volume systems if the pumps cannot produce enough pressure</td>
<td>Restore pressure supply BEFORE going to control mode again. Refer to the main fault finding chart in the service manual</td>
</tr>
</tbody>
</table>

(continued)
### TABLE 5-3 WARNING MESSAGES (CONTINUED)

<table>
<thead>
<tr>
<th>No.</th>
<th>Message</th>
<th>Probable Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>223</td>
<td>Pt VACUUM FAIL</td>
<td>The Pt controller has detected loss of supply vacuum and automatically</td>
<td>Restore vacuum supply BEFORE going to control mode again.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>switched all channels to measure mode. This can occur at very high rates of</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>pressure change in large volume systems if the pumps cannot produce</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>enough vacuum.</td>
<td></td>
</tr>
<tr>
<td>301</td>
<td>LEAK RATE TOO HIGH REGAINING CONTROL</td>
<td>Control mode automatically regained for aircraft safety as leak rates too</td>
<td>Correct leak and retest.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>high</td>
<td></td>
</tr>
<tr>
<td>302</td>
<td>OUTSIDE LIMITS REGAINING CONTROL</td>
<td>Control mode automatically regained for aircraft safety as the measures</td>
<td>Correct leaks and retest. If leak Ps, ensure that nominal Qc pressure is applied (e.g. 200 kts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>values have drifted outside of the operating limits due to leaks</td>
<td>to avoid negative airspeed)</td>
</tr>
<tr>
<td>303</td>
<td>ZERO OFFSET TOO LARGE</td>
<td>The zero offset measured during auto-zero was outside</td>
<td>Return to maintenance depot for calibration</td>
</tr>
<tr>
<td>304</td>
<td>Initializing BLANK SYSTEM EEPROMS</td>
<td>This only occurs if new EEPROMS have been fitted or on main system software</td>
<td>If message occurs during normal operation, return to maintenance depot.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>upgrade</td>
<td></td>
</tr>
<tr>
<td>305</td>
<td>OUTSIDE LIMITS GO TO GROUND</td>
<td>Measured pressure is outside new limits selected or power-up limits</td>
<td>Control pressures to within limits</td>
</tr>
<tr>
<td>306</td>
<td>SWITCH PUMPS ON</td>
<td>Cannot select control mode with the pumps off</td>
<td>Switch pumps on</td>
</tr>
<tr>
<td>307</td>
<td>COMMUNICATION RING FAULT - PACKET IS</td>
<td>Internal error</td>
<td>If the fault can be repeated, return to maintenance depot.</td>
</tr>
<tr>
<td></td>
<td>CORRUPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>308</td>
<td>UPDATING SYSTEM EEPROMS</td>
<td>Software upgrade</td>
<td>Wait 1 minute</td>
</tr>
<tr>
<td>309</td>
<td>CANNOT CONTROL</td>
<td>Failed pump test</td>
<td>Check system limits</td>
</tr>
<tr>
<td>310</td>
<td>PUMP TEST FAILED</td>
<td>Pump not achieving limits</td>
<td>Set lower limits</td>
</tr>
</tbody>
</table>
6 REFERENCE AND SPECIFICATION

6.1 Introduction

- This section includes a full description of each key function including references to associated functions.
- The available keys are:
  - F1 - F4
  - ALT/Ps
  - SPEED/Qc
  - MACH/Pt
  - EPR
  - ROC/Ps RATE
  - RATE TIMER
  - HOLD
  - RATE
  - LEAK MEASURE/CONTROL
  - GROUND
  - PORT
  - REMOTE
  - PRINT
  - EXECUTE TEST PROGRAM
  - HELP
  - SETUP
  - ± (nudge up)
  - ‡ (nudge down)
  - 0 to 9
  - - 000
  - CLEAR/QUIT
  - ENTER
  - . (decimal point)

Double key presses give:
- ABORT (CLEAR + ENTER)
- CONFIGURATION (F1 + SETUP)

6.2 Main Pressure Display

F1 - F4
- These function keys or soft-keys are used to select choices from menus. The menu choices may be shown directly over the keys or displayed as a list.
- When a menu is displayed, press the appropriate function key to select the required choice.
- CLEAR/QUIT can be used to leave a menu without making a selection.
ALT/Ps
- In aeronautical units (ft or m), this key selects an altitude display.
- In pressure units (mbar, inHg etc.), this key selects a static pressure (Ps) display.
- SETUP, [UNITS] can be used to change the units of display, if set-up mode is not switched off.
- Before entering a new altitude or Ps aim, set the rate of change using the ROC/Ps Rate key.
- In Control Mode (Aim display), enter a new altitude or Ps aim using the numeric keys. Use LEAK MEASURE/CONTROL to change between Control and Leak Measure mode.

SPEED/Qc
- In aeronautical units (kts, km/h), this key selects an airspeed (CAS or TAS) display. In pressure units (mbar, inHg etc.), this key selects dynamic pressure and the display shows (Qc).
- The airspeed can be displayed and entered as either Calibrated Airspeed (CAS, Vc) or True Airspeed (TAS, Vt).
  
  Note: For testing purposes, Calibrated Airspeed equates to Indicated Airspeed (IAS).
- The Pt temperature value affects the calculation of TAS. The value of Pt temperature, normally measured by the aircraft temperature sensor, can be changed by SETUP, SPEED/Qc, [Pt TEMPERATURE] only in full set-up mode.
- Use SETUP, SPEED/Qc, [CAS/TAS] to select CAS or TAS.
- CAS/TAS can be changed in full set-up mode.
- If the altitude aim is changed, after the entry of CAS, the Mach and TAS aim values change while the CAS value remains unchanged*.
- If the altitude aim is changed, after the entry of TAS or Mach, the CAS aim value changes while the TAS and Mach values remain unchanged*.
- If the Ps aim is changed, after the entry of Qc, then the Pt aim value changes while the Qc remains unchanged*. 
If the Ps aim is changed, after the entry of Pt, then the Qc aim value changes while the Pt remains unchanged*.

* The display shows $\equiv$ symbol next to the parameter that remains unchanged.

- SETUP, [UNITS] can be used to change the units of display, if set-up mode is not switched off.

- Before entering a new CAS or Qc aim, the rate of change should be set using the RATE key.

- In Control Mode (AIM display), a new CAS or Qc can be entered using the numeric keys. Use LEAK MEASURE/CONTROL to change between Control and Leak Measure mode.

**MACH/Pt**

- In aeronautical units (ft/kts or m/km/h), this key selects a Mach display.

- In pressure units (mbar, inHg etc.), this selects a total pressure (Pt) display.

- If the altitude aim is changed, after the entry of CAS, the Mach and TAS aim values change while the CAS value remains unchanged*.

- If the altitude aim is changed, after the entry of TAS or Mach, the CAS aim value changes while the TAS and Mach values remain unchanged*.

- If the Ps aim is changed, after the entry of Qc, then the Pt aim value changes while the Qc remains unchanged*.

- If the Ps aim is changed, after the entry of Pt, then the Qc aim value changes while the Pt remains unchanged*.

* The display shows $\equiv$ symbol next to the parameter that remains unchanged.

- Before entering a new Mach or Pt aim, set the rate of change of speed using the SPEED/Qc key followed by the RATE key.

- In Control Mode (AIM display), a new Mach or Pt aim can be entered using the numeric keys. Use LEAK MEASURE/CONTROL to change between Control and Leak Measure mode.
Engine Pressure Ratio (EPR) is only available in pressure units (mbar, inHg etc.).

The ADTS 405 can be used to check EPR sensors and indicators.

For EPR testing, use Ps as INLET pressure and EPR to set the ratio of OUTLET pressure (Pt) to INLET pressure.

Before entering a new EPR aim, the rate of change should be set using the RATE key.

In Control Mode (Aim display), a new EPR aim can be entered using the numeric keys. Use LEAK MEASURE/CONTROL to change between Control and Leak Measure mode.

**ROC/Ps RATE**

In aeronautical units (ft or m), this key selects a Rate of Climb (ROC) or vertical speed display.

In pressure units (mbar, inHg etc.), this key selects a rate of change of Ps display.

**SETUP, [UNITS] can be used to change the units, if set-up mode is not switched off.**

In Control Mode (AIM display), a new ROC or Ps rate can be entered using the numeric keys. Use LEAK MEASURE/CONTROL to change between Control and Leak Measure mode.

**RATE TIMER**

The RATE TIMER key starts an internal timer for one of three pre-defined times. On the completion of the time period, the average rate of change over the time period is displayed.

Each selected TIME period can have an associated WAIT period to allow pressures to settle before the timing starts. The WAIT period counts down to zero before the TIME period starts.

To use the rate timer:

- Press RATE TIMER.
Press F1, F2 or F3 to select the required WAIT and TIME periods.

The main pressure displays shows the WAIT or TIME period counting down.

After timing, the timed average value, identified by a T directly to the right of the value, replaces the instantaneous rate value.

In measure mode the display changes to show the timed rate of all associated parameters on the same screen. Pressing one of the set-point keys (e.g., ALT, ROC, SPEED etc.,) or CLEAR/QUIT exits from this screen.

At any time during rate timing or when a timed value is displayed, pressing the RATE TIMER key allows for either the restarting or cancelling of the timing. When timing is cancelled, the rate displays return to instantaneous values.

The timed average value remains until a new aim is entered. During this time, it is possible to view any parameter.

The WAIT and TIME periods can be changed using SETUP, RATE TIMER, providing SETUP lock is not enabled.

**HOLD**

When HOLD is pressed, a changing pressure is instantaneously held. Pressing HOLD again releases the pressure to continue to the aim value. The HOLD facility applies to both channels simultaneously and can be used to test pressure switches as follows:

**Airspeed Switch Test**

Take the airspeed to a value just below the expected trip point.

Enter a low rate of speed.

Enter a new airspeed aim above the trip point.

Immediately the switch trips, press HOLD.

Read the airspeed value - this is the trip value for increasing airspeed.

Enter a new airspeed aim below the expected trip value.

Immediately the switch trips, press HOLD.

Read the airspeed value - this is the trip value for decreasing airspeed.

Press HOLD again to release hold.

For both channels to start moving to new aims at the same time, use the following sequence:

Press HOLD.

Enter Ps channel aim.

Enter Pt channel aim.

Enter required rates.

Press HOLD again to release hold.

HOLD is automatically released when entering Measure Mode.
RATE

- In aeronautical units (kts, km/h), this key selects a rate of change of airspeed (Rate CAS) display.
- In pressure units (mbar, inHg etc.), this key selects a rate of change of pressure (Rate Qc, Rate Pt or Rate EPR) display. The actual display depends on the parameter selected before pressing RATE.
- The following rates are available in aeronautical units:

<table>
<thead>
<tr>
<th>Key-press sequence</th>
<th>Rate of change display</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPEED, RATE</td>
<td>Rate CAS *</td>
</tr>
<tr>
<td></td>
<td>Rate MACH</td>
</tr>
</tbody>
</table>

* Rate CAS is displayed with the airspeed in either CAS or TAS.
- The following rates are available in pressure units:

<table>
<thead>
<tr>
<th>Key-press sequence</th>
<th>Rate of change display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qc, RATE</td>
<td>Rate Qc</td>
</tr>
<tr>
<td>Pt, RATE</td>
<td>Rate Pt</td>
</tr>
<tr>
<td>EPR, RATE</td>
<td>Rate EPR</td>
</tr>
</tbody>
</table>

- If set-up mode is not switched off, SETUP, [UNITS] can be used to change the units of display.
- A new rate aim can be entered using the numeric keys, if the unit is in Control Mode (Aim displayed). Use LEAK MEASURE/CONTROL to change between Control and Leak Measure mode.
- If the automatic airspeed rate is selected (using SETUP, RATE) the airspeed rate is automatically adjusted to simultaneously achieve both altitude and airspeed aim values. This adjustment normally requires a reduction in the rate from the aim value; the rate does not exceed the aim value. When airspeed (not Qc) is automatically reduced, the display shows (A) after RATE CAS.

LEAK MEASURE/CONTROL

- This key switches between Control and Leak Measure mode.

Note: The pneumatic supply pumps must be switched on before going to CONTROL mode.
The controllers can be switched off to measure leaks in the aircraft system.

When in leak measure mode, the display shows “LEAK MEASURE”.

Press LEAK MEASURE/CONTROL to switch the controllers on. The display briefly shows “REGAINING CONTROL” while the pressure controllers adjust to the system pressure. No significant pressure transients are produced when regaining control.

When in control mode, the display shows “Aim” value.

Two safety systems are built-in to protect the aircraft systems during leak testing. These are Auto Leak recovery and Auto Limit recovery.

Auto Leak recovery automatically regains control if the leak rate exceeds the currently set limits on either channel.

Auto Leak recovery can be switched off using SETUP, LEAK MEASURE/CONTROL, [AUTO LEAK].

If negative airspeed or Qc occurs in measure mode, the zero valve automatically opens for a period of one second to balance the airspeed or Qc. This only applies when the minimum CAS (or Qc) limit is zero.

**Note:** This only applies when the minimum CAS or Qc limit is zero.

Auto Limit recovery automatically regains control if the pressure on either channel leaks outside of the selected limits, (except for negative airspeeds).

Auto Limit recovery can be switched off using SETUP, LEAK MEASURE/CONTROL, [AUTO LIMIT].

**Note:** Auto Limit and Auto Leak recovery functions require the pneumatic supply pump to be switched on.

**GROUND**

This key enables a display of ground pressure or automatically controls the pressures in the aircraft system to local atmospheric pressure.

The local atmospheric pressure is recorded by the ADTS 405 during the power-up sequence.
When GROUND is pressed, a menu gives a choice of three ground functions:

**[GO TO GROUND]**

*Note: The Go-to-Ground operates only in Control Mode.*

- Selecting [GO TO GROUND] automatically enters an altitude or static aim equivalent to local atmospheric pressure (QFE) and an airspeed or dynamic pressure aim of zero. The system pressures will then be controlled towards these aims, in the normal way, at the rates set by the ROC/Ps Rate and RATE keys. At any time when going-to-ground, a new rate of change can be entered, the ADTS 405 continues going-to-ground.

- At any time during going-to-ground, a new value aim for ALT, CAS, TAS, Mach, Ps, Qc, Pt or EPR can be entered. This causes the procedure to stop and normal controlling operation to start.

- When the airspeed is zero and the Ps channel pressure is close to ground, the QFE is re-measured to update the stored “ground” pressure value, the display shows the message "CHECKING GROUND". The ADTS 405 then reconnects to the system under test and equalizes the pressures.

- The display shows the message “Safe At Ground”; the ground and zero valves remain open so that the aircraft system permanently vents to atmosphere. No commands can be entered when these two messages are displayed.

- Press CLEAR/QUIT to continue with normal operation. The ground and zero valves then automatically close.

**[DISPLAY QFE]**

- When [DISPLAY QFE] is selected, the local atmospheric pressure recorded during the power-up sequence is displayed as QFE in the default units set in configuration.

- Press CLEAR/QUIT to return to the normal user display.

**[DISPLAY QNH]**

- When [DISPLAY QNH] is selected, the local atmospheric pressure recorded during power-up is converted to the equivalent sea level pressure. The display shows QNH, in the default units set in configuration, together with the station (airfield) altitude.

- The station (airfield) altitude can be changed in full set-up mode by using SETUP, GROUND.
PORT
- This function sets the port option, this changes the ADTS 405 from a single pitot-static output system to a multi-port system by using a Druck Line Switching Unit (LSU 100 and 200 Series). Refer to the option manual.

REMOTE
- Enters Remote Mode; this mode allows an external device to control the unit. In this mode the key-pad (except the Remote key) is disabled. If remote lock is disabled, pressing the remote key when the "REMOTE" message is not displayed forces the unit into remote mode as if the external device has taken control of the unit.
  
  *Note*: This may change operator settings such as the current limit set.

Refer to the option user manual for further details.

PRINT
- The ADTS 405 contains a print facility to print the displayed readings together with up to nine user readings (e.g., Pilot, Copilot, Aux).

- This facility requires a Centronics standard parallel interface printer of 80 or 132 column width.

- This key causes a printout of the date and time followed by the measured value of the parameters. A prompt asks for the entry of a reading which can consist of any characters A to Z, 0 to 9, . (decimal point) or - (minus), in any order. It can be used to enter the value from the unit or system under test or alternatively a test number. When no more entries are required, press CLEAR/QUIT.

- To enter an alphabetic character (A to Z), press the [ALPHA] key and use the s or t (nudge keys) to change to the required character. To enter another alphabetic character, press the [ALPHA] key again. Press [BACK] to delete the last character.

- Up to nine user readings can be entered sequentially. The display prompts for the next user reading each time one is entered. When no further readings are required, press CLEAR/QUIT.

**Example print output:**

```
04Mar00 09:47 Ps 700.00 mbar Qc 30.00 mbar Usr Rdg
```
EXECUTE TEST PROGRAM

The Test Program Manager (option D) enables the ADTS 405 to use prepared test procedures or sequences to meet aircraft and component testing requirements. Using this PC-based application, a test procedure can be programmed and then down-loaded to the ADTS 405. Once down-loaded, the ADTS 405 stores the program for future use. A test program can contain operator prompts to enter numeric values from instruments; test results can be stored in the ADTS 405 and later printed, by a suitable printer, through the serial output port.

A test simulator in the TPM option gives the operator a method of developing a test program. The new test can be verified, on the PC, at up to fifty times normal speed to reduce test time.

EXECUTING TEST PROGRAMS (without auto run)

1. Press the EXECUTE TEST PROGRAM key. This displays the first of the available test programs. The top line shows the file name and the second and third lines show the TITLE.

2. Use [NEXT] or [PREV] to step through the available programs until the required program is displayed. Press [RUN] to select the program.

3. The display shows a menu allowing the following selections:

[F1] Run all tests. This starts the program from the beginning.

[F2] Run specific tests. This allows execution to start with any one of the individual TESTS contained within the test program. Use [NEXT], [PREV] and [SEL] as above.

4. Select [Run all tests] The display returns to the normal user display. “TP”, in the bottom right hand corner of the display, indicates execution of a test program.

5. Various commands prompts the operator by displaying messages on screen such as: “Press the ETP key”.

The ETP key is the general key for moving onto the next step. The CLEAR/QUIT key should only be used to terminate test program execution.

6. At the end of each test, the operator has a choice of continuing, exiting test program execution or going to manual mode.
7. In manual mode, any of the normal key-pad functions may be used. When the manual testing is complete, press **EXECUTE TEST PROGRAM** and the test program continues from where it left off. This feature may be disabled by including the **KEYLOCK** command in the test program. While in manual mode the display prompts “TPM”.

8. When a “go” command is executed, “GO” flashes in the lower right hand corner of the screen. At this point the user should record any instrument readings or displayed leak rates, as required, before continuing by pressing **EXECUTE TEST PROGRAM**. F4 may be used to continue at a “go” command as an alternative to pressing **EXECUTE TEST PROGRAM**.

**Deleting files**

If a test program within an ADTS 405 is no-longer required, then it may be deleted. To delete a test program, proceed as follows:

1. Enter configuration (CONFIG) by pressing and holding **F1** and pressing **SETUP**.
2. At the first menu level of configuration, press the **EXECUTE TEST PROGRAM** key, then F2. The display then shows the file name and title of the first file in the list. Use [NEXT] and [PREV] to step through the files until the display shows the file to be deleted.
3. Select [DEL] to delete the file, then press **CLEAR/QUIT** to quit from configuration.
4. Select [YES] to confirm quit.

**Note:** If the deleted program is marked as “AUTO RUN” then an additional screen asks to confirm if the auto run status should be removed before deletion.

**Auto Running a Program**

To run a program each time the ADTS 405 is switched on, the “Auto run” feature should be enabled. The enabled program starts, from the first line, after successful completion of the ADTS power-up sequence. To set-up the auto run feature, proceed as follows:

1. Enter configuration (CONFIG) by pressing and holding **F1** and pressing **SETUP**.
2. At the first menu level of configuration, press the **EXECUTE TEST PROGRAM** key, then F1. The display shows the name of the current file to “Auto run” or “*NONE*” if auto run is not selected. To change this selection use the [NEXT] and [PREV] keys and when the correct file is displayed press [SEL]. To de-select auto run press [NONE].
HELP

- The HELP key provides help on each key. The help message generally gives associated functions and ways of changing the use of each key. To get help on any of the keys on the key-pad:
  - Press HELP, then press the required key for information.
  - Some help screens show a flashing [MORE] over the F4 key, press F4 for further information.
  - Press CLEAR/QUIT to exit the help system.

▼ or ▲ (nudge keys)

- Change the current aim up or down ▲ by a small increment.

- This facility can be used to align a pointer of an instrument to a precise indicated value and compare this indicated value with the measured value.
  - This facility may be used for pressure switch testing as follows:
    - Aim for a pressure just below the expected operating point.
    - When the pressure is achieved, repeatedly press ▲ until the switch operates.
    - Record the pressure reading shown on the display.
    - Repeat this procedure using the▼ until the switch returns to its original condition, refer to section 3 for an example.
    - Holding the nudge function automatically repeats the function. Record the pressure reading shown on the display.
  - See SETUP,▼ or ▲ to change the value of increment for the nudge facility.

CAUTION: MAKE SURE THE NUDGE INCREMENT IS SET TO A SUITABLE VALUE BEFORE USING THE NUDGE FACILITY TO CHANGE THE AIM VALUE.

- Holding down▼ or ▲ key automatically repeats the function.
- The nudge value can be used for large increments e.g., 100 kts or 5000 ft to "step through" cardinal points on a test.

0 to 9

- Use these keys for numeric entry. Press ENTER to complete numeric entry. Press CLEAR/QUIT if a mistake is made during numeric entry.

- All data entry is based on over-writing the existing value. When the first numeric key is pressed, the existing number is replaced by the key pressed. At any time, the existing number may be recovered by pressing CLEAR/QUIT.
This key performs two functions during numeric entry.

- If it is the first numeric key pressed, it produces a minus sign for the entry of negative numbers.
- If it is not the first key pressed during numeric entry, it produces three zeros for fast entry of thousands e.g. to enter -1000:
  
  Press -000  (Display shows -)
  Press 1      (Display shows -1)
  Press -000  (Display shows -1000)

**Note:** When `-000` is pressed during entry of an aircraft name for limits or in the Print facility, it always produces “-“.

### CLEAR/QUIT

- During numeric entry, CLEAR/QUIT removes the new number and restores the previously entered number.

**Note:** Once the ENTER key has been pressed, the old number cannot be restored.

- When menus are displayed, CLEAR/QUIT exits the menu, generally to the previous display.
- For those displays containing a [SAVE] option, changes made before pressing CLEAR/QUIT are ignored. For all other displays, pressing CLEAR/QUIT saves the changes.
- When warning messages are displayed, pressing CLEAR/QUIT removes the message.
**ENTER**
- The **ENTER** key completes numeric entry.

**CLEAR/QUIT + ENTER (ABORT)**
- Pressing **CLEAR/QUIT** and **ENTER** together, restarts the ADTS 405 from the power-up sequence.
- Output valves close immediately and open during the restart sequence.

*Note:*
*The restart sequence starts with the display showing:*

- The (ABORT) function should only be used as a last resort:
  - When a restart is required after the system has shutdown displaying an error message.
  - As an emergency measure with a serious problem concerning the aircraft or component under test.
- After this restart sequence, the system vents, at a safe rate, both channels (pitot and static) to atmosphere during the power-up sequence.
6.3 SETUP

Pressing the **SETUP** key causes the system to enter a set-up mode preset in the configuration mode. The following section describes the three functions of setup: Full, Minimum and Off. The full set-up allows access to all set-up functions. Minimum set-up allows access to some set-up functions, the off function prevents access to the set-up functions.

**FULL SET-UP**

- Full set-up allows access to secondary functions that do not have an assigned key. Any parameter changed under set-up returns to the default settings on power-down.

- The CONFIGuration mode may be used to change the default settings so that the ADTS 405 powers up in the required state. Most set-up parameters are also available under CONFIG. Additional parameters are only available under CONFIG.

- Certain parameters in set-up can be locked in CONFIGuration mode preventing inadvertent changes such as aircraft limits at power-up with a particular set of limits that must not be changed. Attempting to change a locked parameter causes the display to show a warning message.

- Pressing the **SETUP** key makes the set-up functions available. Pressing the function keys selects the set-up menus, using the appropriate function key selects the required menu choice. To set-up a parameter key, press **SETUP** then press the required parameter key. Each parameter key set-up provides settings to the normal user mode function of the key. Further menus are used under certain direct key set-up functions.

*Note:* The Quick Reference Section of this manual provides details of the set-up menus and keys.

- Once a setting has been changed in set-up, use **CLEAR/QUIT** to return to the preceding menu. After all required parameters have been changed, repeatedly press **CLEAR/QUIT** until the display shows the main pressure display.

- The following section describes each set-up function. Intermediate menus are not described.
SETUP, [UNITS]

- Use [NEXT] or [PREV] to step through the available units until the display shows the required units. Select [SAVE] and then press [QUIT] to make the selection.

The available units are:

- ft and kts (includes Mach)
- ft and mph (includes Mach)
- m and km/h (m/min) (includes Mach)
- m and km/h (m/s) (includes Mach)
- m and km/h (hm/min) (includes Mach)
- mbar
- inHg
- mmHg

SETUP, [LIMITS]

- The ADTS 405 is preprogrammed with the manufacturer’s STANDARD, CIVIL and MAX* limit sets. Different sets of additional aircraft limits can be programmed using the CONFIG mode. SETUP, [LIMITS] allows the selection of the set of limits to be used, each set of limits is identified by its aircraft name.

Note: *The ADTS 405, when delivered, contains “Standard” and “Civil” limits; to set and store “Max” limits, for the first time, enter configuration. The “Max” limits depend on the range of the pitot channel either 850 or 1000 knots, see section 1.3, operating limits.

- Use [NEXT] or [PREV] to step through the aircraft names select [SEL] and press QUIT when the display shows the required name.

- Use CONFIG, [LIMITS] to program the sets of limits. Each set of limits includes:

  - Max ALT
  - Min ALT
  - Max CAS
  - Min CAS
  - Max Mach
  - Max ROC
  - Max Rate CAS
  - Max Ps
  - Min Ps
  - Max Qc
  - Min Qc
  - Max Rate Ps
  - Max Rate Qc
  - ARINC limits on or off
  - Altitude correction value

- The set of limits used at power-up (default) can be selected using CONFIG, [LIMITS], [DEFAULT AIRCRAFT]. The default aircraft settings can be locked using CONFIG, [LIMITS], [LOCK AIRCRAFT] so that the operator cannot change the limits.
If the selected set of limits result in the measured pressures being outside the limits, the display shows the warning message “OUTSIDE LIMITS GO TO GROUND” the Ps and Pt channels should be taken to ground or to pressures within the new selected limits. This warning message is also displayed if the pressures measured directly after power-up are outside the limits used at power-up.

After selecting a set of limits, the altitude correction value can be changed using \texttt{SETUP, ALT}. The maximum Mach limit can be changed or switched off using \texttt{SETUP, MACH}.

**SETUP, [OSC]**

The ADTS 405 has an oscillation facility that causes the pressure to oscillate about the aim value at a user defined frequency and amplitude. 

- Select oscillation channel Ps or Pt.
- Select [AMPL/FREQ] and enter the required amplitude and frequency.
- Select [START] to start oscillation.
- Select [STOP] to stop oscillation at the end of a half cycle.
- Select [FREEZE] to stop oscillation immediately.

**SETUP, [MORE], [CONTROL], [Ps Pt DUAL]**

Dual channel is the normal mode of operation where both Ps (static) and Pt (pitot) channels are connected to the unit or aircraft system under test.

To test instruments such as airspeed indicators with only the Pt (pitot) channel connected, use \texttt{SETUP, [MORE] [CONTROL] [Ps Pt DUAL]} and select [Pt].

When using [Pt ONLY], the blanking cap must be removed from the Ps (static) channel so that Ps is open to atmosphere. All the functions associated with the Ps channel are disabled.

Similarly, to test instruments such as altimeters with only Ps (static) channel connected, use \texttt{SETUP, [MORE] [CONTROL] [Ps Pt DUAL]} and select [Ps]. All the functions associated with the Pt channel are disabled; the blanking cap can remain fitted to this channel.

To return to dual channel operation, select \texttt{SETUP, [MORE], [CONTROL] [Ps Pt DUAL]} and select [DUAL] and connect both channels to the unit or aircraft system under test.

The channel controllers must be in measure mode when changing [CONTROL].

The Ps (static) pressure must be within ±10 mbar of the recorded QFE to select Pt only.

The control channel selection can be locked in CONFIG.
The display can be configured for SINGLE, DUAL or TRIPLE displays. The key press sequence changes the display parameters, the 2nd key press column shows the parameter that changes on entry of a numeric value. The tables show all available parameter combinations with an associated key press sequence.

### Pressure units dual display

<table>
<thead>
<tr>
<th>1st Key Press</th>
<th>2nd Key Press</th>
<th>Upper Display</th>
<th>Lower Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT</td>
<td>SPEED</td>
<td>ALT</td>
<td>CAS or TAS</td>
</tr>
<tr>
<td>ALT</td>
<td>MACH</td>
<td>ALT</td>
<td>MACH</td>
</tr>
<tr>
<td>Any key</td>
<td>ROC</td>
<td>ALT</td>
<td>ROC</td>
</tr>
<tr>
<td>SPEED</td>
<td>RATE</td>
<td>ALT</td>
<td>RATE CAS</td>
</tr>
<tr>
<td>MACH*</td>
<td>RATE</td>
<td>MACH</td>
<td>RATE MACH</td>
</tr>
<tr>
<td>SPEED</td>
<td>MACH</td>
<td>MACH</td>
<td>CAS/TAS</td>
</tr>
<tr>
<td>SPEED</td>
<td>ALT</td>
<td>ALT</td>
<td>SPEED</td>
</tr>
<tr>
<td>MACH</td>
<td>ALT</td>
<td>MACH</td>
<td>MACH</td>
</tr>
<tr>
<td>MACH</td>
<td>SPEED</td>
<td>MACH</td>
<td>SPEED</td>
</tr>
</tbody>
</table>

* The Mach parameter changes on numeric entry

### Aeronautical units dual display

<table>
<thead>
<tr>
<th>1st Key Press</th>
<th>2nd Key Press</th>
<th>Upper Display</th>
<th>Lower Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ps</td>
<td>Qc</td>
<td>Ps</td>
<td>Qc</td>
</tr>
<tr>
<td>Ps</td>
<td>Pt</td>
<td>Ps</td>
<td>Pt</td>
</tr>
<tr>
<td>Ps</td>
<td>EPR</td>
<td>Ps</td>
<td>EPR</td>
</tr>
<tr>
<td>Any key</td>
<td>RATE Ps</td>
<td>Ps</td>
<td>RATE Ps</td>
</tr>
<tr>
<td>Qc</td>
<td>RATE</td>
<td>Qc</td>
<td>RATE Qc</td>
</tr>
<tr>
<td>Pt</td>
<td>RATE</td>
<td>Pt</td>
<td>RATE Pt</td>
</tr>
<tr>
<td>EPR</td>
<td>RATE</td>
<td>EPR</td>
<td>RATE EPR</td>
</tr>
<tr>
<td>Pt</td>
<td>Qc</td>
<td>Pt</td>
<td>Qc</td>
</tr>
<tr>
<td>Qc</td>
<td>Ps</td>
<td>Qc</td>
<td>Qc</td>
</tr>
<tr>
<td>Pt</td>
<td>Ps</td>
<td>Pt</td>
<td>Pt</td>
</tr>
<tr>
<td>EPR</td>
<td>Ps</td>
<td>EPR</td>
<td>EPR</td>
</tr>
<tr>
<td>Qc</td>
<td>Pt</td>
<td>Qc</td>
<td>Qc</td>
</tr>
</tbody>
</table>

Pressure units dual display
At the end of rate timing, the rate of change on both channels are displayed for aeronautical units ROC and RATE CAS and for pressure units RATE Ps, RATE Pt and RATE Qc.

**Note:** This is the same for all display modes.

### Option Displays

- The key presses function, for the option displays, in the same way as a "single display" (i.e., the single displayed parameter comes from the last key press), with the lower half of the display screen showing any available data from the option.
SETUP, [MORE], [DISPLAYS/OPTIONS], [OPTIONS]

- This function allows changes to option hardware that may be fitted. - See option manuals for further details.

- If an option that is not fitted is selected the display shows the error message "Option Hardware not fitted". Refer to the option user manual.

SETUP, [MORE], [CLOSE OUTPUT VALVES]

- This function closes the Ps and Pt valves to enable leak checking of the internal pneumatics of the ADTS 405, with the aircraft system isolated, but still connected. All the normal functions of the ADTS 405 may be used in this mode.

Note: For safety, the output valves can only be closed when the ADTS 405 is at ground.

SETUP, [MORE], [OPEN OUTPUT VALVES]

- This function opens the Ps and Pt output valves after using the [CLOSE OUTPUT VALVES] function.

Note: For safety, the output valves can only be opened when the ADTS 405 is at ground.

SETUP, [MORE], [SYSTEM SELF TEST]

- This function starts a self-test, the system pressures must be at ground pressure and the system in Leak Measure mode. The self-test is the same test routine as in the power-up sequence.

Note: At the end of the self-test the output valves open.
SETUP, ALT (Figures 6-1 and 6-2)

- This function allows the altitude correction value to be changed. If altitude correction is in use the display shows, after warm-up, "A/C" in the lower right hand corner.

- The altitude correction facility corrects for the pressure difference when the ADTS 405 and the aircraft system or components under test are at different heights.

- If the ADTS 405 front panel is vertical, use the altitude reference level shown on the front panel. If the ADTS 405F front panel is horizontal, use the altitude reference level shown on the side of the case.

- Enter the height difference between the aircraft system and the ADTS 405 altitude reference level. The units of entry are the current units or default aeronautical units, see CONFIG, [UNITS], [AERONAUTICAL].

SETUP, SPEED, [AUTO ZERO]

- This function enables or disables the auto zero function. When enabled, this optimizes airspeed accuracy at low airspeeds.

- When enabled the ADTS 405 performs an auto zero when the following conditions are met:
  1. Ps and Pt pressures are stable.
  2. If in control mode, a zero airspeed or Qc aim has been achieved.
  3. If in leak measure mode, the airspeed is less than 20 knots (or Qc equivalent).

- The auto zero will be initiated within one minute of achieving a new aim value and thereafter, every five minutes.

- The auto zero sequence can be interrupted at any time by entering a new command over the key-pad or option interface.

- The controllers must be in measure mode when enabling or disabling auto zero.

SETUP, SPEED, [CAS/TAS]

- This function changes the airspeed display between Calibrated Airspeed (CAS or Vc) and True Airspeed (TAS or Vt). For testing purposes, CAS is equivalent to Indicated Airspeed (IAS).

- The value of TAS displayed depends on the Pt temperature, see SETUP, SPEED, [Pt TEMPERATURE].
Corrected altitude = Altitude measurement + Altitude correction value

**FIGURE 6-1 ALTITUDE CORRECTION RACK MOUNTING**

Corrected altitude = Altitude measurement - Altitude correction value

**FIGURE 6-2 ALTITUDE CORRECTION ON-AIRCRAFT**
SET-UP, SPEED, [Pt TEMPERATURE]
- The function allows the value of Pt temperature to be entered, this is used in the calculation of TAS.
- Enter the Pitot temperature measured by the aircraft’s Pitot temperature sensor in the units shown on the display.
- The default units of temperature measurement may be changed using CONFIG, [UNITS], [TEMPERATURE].

SET-UP, MACH
- This function allows the Mach limit to be changed or disabled. The initial Mach limit comes from the current aircraft limits.
- To change the limit enter a numeric value or select as follows:
  - Select [OFF] to disable the Mach limit.
  - Select [ON] to enable the Mach limit.
  - Select [DEFAULT] to restore the Mach limit from the aircraft limits in use.

SET-UP, RATE TIMER
- This function allows the Wait/Time values to be set for F1, F2, and F3 of the RATE TIMER function.
- To change the times:
  - Select the function to be changed: F1, F2 or F3.
  - Enter the [WAIT] value in minutes and seconds.
  - Enter 00:00 if a wait is not required.
  - Select [TIME].
  - Enter the [TIME] value in minutes and seconds.
  - Press CLEAR/QUIT.
  - Select another WAIT/TIME or press CLEAR/QUIT.
- See the RATE TIMER for further details.

SET-UP, RATE
- This function selects automatic airspeed rate control ON or OFF.
- If the automatic airspeed rate is selected (using SETUP, RATE) the airspeed rate is automatically adjusted to simultaneously achieve both altitude and airspeed aim. This adjustment normally requires a reduction in the rate from the aim value; the rate does not exceed the aim value. When airspeed is automatically reduced, the display shows RATE CAS aim as (A).
- This function only applies when using Aeronautical units (ft and kts, ft and mph, m and km/h [m/min], m and km/h [m/s], m and km/h [km/min]).
SETUP, LEAK MEASURE CONTROL, [AUTO LEAK]

- This function enables or disables the auto leak recovery facility.
  See LEAK MEASURE/CONTROL for further details.

SETUP, LEAK MEASURE CONTROL, [AUTO LIMIT]

- This function enables or disables the auto limit recovery facility.
  See LEAK MEASURE/CONTROL for further details.

SETUP, GROUND

- This function enables the station (airfield) altitude to be entered and is used when
  displaying QNH. See GROUND for further details.

- Enter the station (airfield) altitude in the units shown on the display.
  See CONFIG, [UNITS], [AERONAUTICAL] for default units.

SETUP, PORT

- This function sets up the port option.

- If an option, that is not fitted, is selected the display shows the error message "Option
  Hardware not fitted". Refer to the Line Switching Unit, User Manual.

SETUP, PRINT, [DATE/TIME]

- This function allows the system time and date to be set. The time and date is
  maintained by a battery-backed clock when the ADTS 405 is switched off.

- Use [TIME] or [DATE] to select between time or date.

- To change the time or date, enter all six digits and press ENTER.

- The date format can be either US (mm/dd/yy) or UK (dd/mm/yy) using CONFIG,[MORE],
  [DATE FORMAT]. The time format is hh:mm:ss.

SETUP, EXECUTE TEST PROGRAM

- This function sets up the results file options.

- Result data generated by the test program can either be sent out to the printer port or
  saved to a result file and stored in the ADTS 405. Pressing F1, the [PRINT/SAVE] key,
  sets the option.

- Any of the results files, stored in the ADTS 405, can be sent to the printer port. Press F2,
  the [PRINT FILE] key, to select the required file.
SETUP, HELP

- This function provides help on the set-up key.

SETUP, ▼ or ▲ (nudge keys)

- This function allows the increment value of the nudge key to be adjusted for every parameter.

- When SETUP, ▼ or ▲ are pressed, the display shows the value of nudge for the parameter last displayed.

- Enter a new value to replace the present value.

- Use [NEXT] or [PREV] to display other parameters.

- Press CLEAR/QUIT when the nudge values of all the required parameters have been changed.

- In aeronautical units, the parameters available are:
  ALT  CAS/TAS  MACH ROC  RATE CAS

- In pressure units, the parameters available are:
  Ps  Pt  Qc  EPR
  RATE Ps  -  RATE Qc  RATE EPR

- The nudge value can be used for large increments e.g., 100 kts or 5000 ft to "step through" the cardinal points of a test.

**CAUTION:** MAKE SURE THE NUDGE INCREMENT IS SET TO A SUITABLE VALUE BEFORE USING THE NUDGE FACILITY TO CHANGE THE AIM VALUE.
**MINIMUM SETUP**

- Minimum set-up allows access to a limited number of set-up functions. Any parameter changed under set-up returns to the default settings at power-down.

- The CONFIGuration mode may be used to change the default settings so that the ADTS 405 powers-up in the required state.

**SETUP, [UNITS], [AERO]**

- The current operating limits are changed to the default aeronautical units. These units can be programmed using CONFIG, [UNITS], [AERO].

**SETUP, [UNITS], [PRESS]**

- The current operating limits are changed to the default pressure units. These units can be programmed using CONFIG, [UNITS], [PRESS].

**SETUP, [LIMITS]**

- The ADTS 405 is preprogrammed with the manufacturer's STANDARD, CIVIL and MAX* limit sets. Different sets of additional limits can be programmed using the CONFIG mode. SETUP, [LIMITS] allows the selection of the set of limits to be used, each set of limits is identified by an aircraft name or component/system number.

**Note:**

*The ADTS 405, when delivered, contains "Standard" and "Civil" limits; to set and store "Max" limits, for the first time, enter configuration. The "Max" limits depend on the range of the pitot channel either 850 or 1000 knots, see section 1.3, operating limits.*

- Use [NEXT] or [PREV] to step through the aircraft names and when the display shows the required name, press [SEL], then CLEAR/QUIT.

- Use CONFIG, [LIMITS] to program the sets of limits. Each set of limits includes:

  - Max ALT
  - Min ALT
  - Max CAS
  - Min CAS
  - Max Mach
  - Max ROC
  - Max Rate CAS
  - Max Ps
  - Min Ps
  - Max Qc
  - Min Qc
  - Max Rate Ps
  - Max Rate Qc
  - ARINC limits on or off
  - Altitude correction value

- The set of limits used at power-up (default) can be selected using CONFIG, [LIMITS], [DEFAULT AIRCRAFT]. The default aircraft set of limits can be locked using CONFIG, [LIMITS], [LOCK AIRCRAFT] so that an operator cannot change the limits.
If the selected set of limits result in the measured pressure values being outside the limits, the display shows the warning message “OUTSIDE LIMITS GO TO GROUND” the Ps and Pt channels should be taken to ground or to pressures within the new selected limits. This warning message is also displayed if the pressures measured directly after power-up are outside the limits used at power-up.

After selecting a set of limits, the altitude correction value can be changed using SETUP, ALT. The maximum Mach limit can be changed or turned off using SETUP, MACH.

**SETUP, ALT/Ps (Figures 6-1 and 6-2)**

- This function allows the altitude correction value to be changed. If altitude correction is in use the display shows, after warm-up, “A/C” in the lower right hand corner.
- The altitude correction facility corrects for the pressure difference when the ADTS 405 and the aircraft system or components under test are at different heights.
- If the ADTS 405 front panel is vertical, use the altitude reference level shown on the front panel. If the ADTS 405 front panel is horizontal, use the altitude reference level shown on the side of the case.
- Enter the height difference between the aircraft system and the ADTS 405 altitude reference level. The units of entry are the current units or default aeronautical units, see CONFIG, [UNITS], [AERONAUTICAL].

**SETUP, PORT**

- This function sets the port option for the Druck Line Switching Unit.
- If an option that is not fitted is selected the display shows the error message “Option Hardware not fitted”. Refer to the Line Switching Unit User Manual.

**SETUP, HELP**

- This function provides help on the set-up key.
6.4 CONFIGURATION

- Any parameters, changed in any mode of SETUP, return to the default settings when the system is next switched on. The CONFIGuration mode may be used to change the default settings so that the ADTS 405 powers-up in a specified state. Most SETUP parameters are also available in CONFIG; other parameters are only available in CONFIGuration.

- Some parameters, changed in set-up mode, can be locked in CONFIGuration preventing access. For example, a system used in a servicing procedure for a specific aircraft type can be set to power-up with a specific set of limits that must not be changed. The set-up menus can also be locked out or access restricted preventing changes to operating parameters.

Procedure

- Holding down **F1** then pressing SETUP causes the system to enter CONFIGuration mode. CONFIGuration may be password protected using a four digit PIN. If PIN protected, the display prompts for entry of the PIN. Press each digit of the PIN in turn (ENTER is not required) as each digit is entered, an asterisk appears. If an incorrect PIN is entered, the complete PIN is requested again.

- When the correct PIN is entered, the CONFIG menu appears.

- The PIN may be changed using CONFIG,-000.

- To use the configuration menu, press the appropriate function key to select the required menu item. To configure a parameter key, enter configuration menu then press the required parameter key. Each parameter key configuration provides changes to the normal user mode function and to the settings available in the set-up menu.

- Once a parameter has been changed in configuration, use CLEAR/QUIT to return to the previous menu. After all required key parameters have been changed, repeatedly press CLEAR/QUIT until the display shows the normal operating mode.

Functions

- In the following section, each description of a CONFIGuration function is headed by the menu/key sequence required to select it. Intermediate menus are not described. Many of the functions are equivalent to the set-up functions; refer to SETUP for the details of the function.
CONFIG, [UNITS]

- This function allows the default units to be configured.
- The default [AERONAUTICAL] units are used at power-up for the altitude (and airspeed) display. The default units are also used for the limits entry in CONFIG and entry of any altitude or airspeed related functions in SETUP or CONFIG e.g., airfield altitude or altitude correction.
- The default [PRESSURE] units are used for limits entry in CONFIG and entry of any pressure values in SETUP or CONFIG.
- The default [TEMPERATURE] units are used for entry of temperature values in SETUP or CONFIG.
- The default [AERONAUTICAL] and [PRESSURE] are set in MINIMUM SETUP, [UNITS].

CONFIG, [LIMITS], [EDIT LIMITS], [EDIT EXISTING]

- This function allows existing sets of limits to be configured.
- Use [NEXT] or [PREV] to select the set of limits by aircraft name or component/system name/number when the display shows the required limits, press [SEL] to edit the limit values.
- Use [NEXT] or [PREV] to step through each limit or associated parameter in turn. Enter a new numeric value to change a limit.
- Press CLEAR/QUIT when all required changes have been made and select [YES] to save changes. The parameters are:

<table>
<thead>
<tr>
<th>Name</th>
<th>Max Ps</th>
<th>Min Ps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Alt</td>
<td>Min Ps</td>
<td></td>
</tr>
<tr>
<td>Min Alt</td>
<td>Max Qc</td>
<td></td>
</tr>
<tr>
<td>Max CAS</td>
<td>Min Qc</td>
<td></td>
</tr>
<tr>
<td>Min CAS</td>
<td>Max Rate Ps</td>
<td></td>
</tr>
<tr>
<td>Max Mach</td>
<td>Max Rate Qc</td>
<td></td>
</tr>
<tr>
<td>Max ROC</td>
<td>ARINC Limits</td>
<td></td>
</tr>
<tr>
<td>Max Rate CAS</td>
<td>Altitude Correction</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**

1. The ADTS 405, when delivered, contains “Standard” and “Civil” limits; to set and store “Max” limits, for the first time, enter configuration. The “Max” limits depend on the range of the pitot channel either 850 or 1000 knots, see section 1.3, operating limits.

2. The system’s defined “STANDARD”, “CIVIL” and “MAX” limit sets cannot be redefined. A defined set can be edited but must be saved using a different name. This method could save time.
NAME

- The aircraft name or component/system name/number is used for selecting the set of limits in SETUP or CONFIG. Enter up to 8 characters using 0 to 9, - (minus), . (decimal point) and any alphabetic characters in any order or combination.

- To enter a alphabetic character (A to Z), press [ALPHA] and use the nudge keys to change to the required character. Press [ALPHA] again to enter another alphabetic character. Press [BACK] to delete the last character. When editing text use the CLEAR/QUIT key to cancel editing.

MIN ALT, MAX ALT, MIN CAS, MAX CAS

These are the fundamental aeronautical unit limits.

MAX MACH

This limit only applies in aeronautical mode. It can be used to set a maximum Mach (e.g., Mach 1.05).

If a Mach limit is not required, enter a high value (e.g., 10). The Mach limit can be changed or disabled in full set-up mode using SETUP, [MACH], see SET UP, MACH for further details on Mach limits.

MAX ROC, MAX RATE CAS

These limits are the maximum rate of change for altitude and airspeed and only apply in aeronautical units.

MIN Ps, MAX Ps, MIN Qc, MAX Qc

These are the fundamental pressure unit limits.

MAX RATE Ps, MAX RATE Qc

These limits are the maximum rate of change for Ps and Qc and only apply in pressure units.

ARINC LIMITS (Figure 6-3)

ARINC 565 operating limits are enabled by setting ARINC LIMITS ON and implemented as shown in Fig. 6-3.

Due to the shape of the altitude/airspeed envelope, these limits cannot be implemented using the above altitude, airspeed and Mach limits.

Using the [ON/OFF] function key select the required ARINC limits ON or OFF.

When used in combination with another set of limits, the lower (more restricting) limits apply.

If ARINC limits are selected and any of the other limits are greater than the values of the ARINC limits a display message requests confirmation that the lower, ARINC limit, is to be used before the limit is saved.
ALTITUDE CORRECTION

- The altitude correction value for a specific aircraft may be entered as well as its limits.
- The altitude correction value can be changed during operation in full and minimum set-up modes using SETUP, [ALT]. See SETUP, [ALT] for further details on altitude correction.

SAVING LIMITS

- When all limits and associated functions are set, press CLEAR/QUIT to exit the limit editing screen.
- If changes have been made, the display shows a request for confirmation before saving the changes.
- If the system detects any errors (e.g., duplicate aircraft names, values out of range or editing system-defined limits) the display changes to the edit screen for the error to be corrected.
CONFIG, [LIMITS], [EDIT LIMITS], [MAX LIMITS]

- This function makes a set of maximum limits; a set of MAX limits can be edited using CONFIG, [LIMITS], [EDIT LIMITS], [EDIT_EXISTING] and saved with a new name. This is a quick method for setting-up a set of limits similar to the maximum system limits.
- The system displays an error message if MAX limits already exist.

CONFIG, [LIMITS], [EDIT LIMITS], [EDIT NEW]

- This function is identical to [EDIT EXISTING] and creates a new set of limits. Default values are taken from "Standard" limits. See [EDIT EXISTING] above for further details.

CONFIG, [LIMITS], [CLEAR LIMITS]

- This function clears an existing set of limits. Use [NEXT] or [PREV] to display the name of the limits. Select [SEL] to clear the limits followed by [YES].

CONFIG, [LIMITS], [LOCK AIRCRAFT]

- This function prevents changes to the default limits.
- If lock is [ON], no changes to the power-up default aircraft limits can be made from set-up.

CONFIG, [LIMITS], [DEFAULT AIRCRAFT]

- This function selects the set of limits used at power-up.
- Use [NEXT] or [PREV] to display the name of the required limits. Select [SEL].

CONFIG, [MORE], [CONTROL], [CONTROL MODE]

- CONFIG equivalent of SETUP function.

CONFIG, [MORE], [CONTROL], [CONTROL LOCK]

- This function prevents changes to the default CONTROL SETTING.
- If lock is [ON], no changes to the control channel selection can be made from set-up.

CONFIG, [MORE], [DISPLAY/OPTIONS], [DISPLAY TYPE]

- CONFIG equivalent of SETUP function.

CONFIG, [MORE], [DISPLAY/OPTIONS], [OPTIONS]

- Refer to the option user manuals.

CONFIG, [MORE], [DATE/FORMAT]

- This functions allows the display date format to be selected between [MDY] (mm/dd/yy) and [DMY] (dd/mm/yy).
CONFIG, [MORE], [SETUP MODE]
- This function enables, disables or limits access to the secondary functions. There are three set-up modes:

  FULL
  - This mode provides complete access to all secondary functions when the SETUP key is pressed. All pressure and aeronautical units can be selected.

  MINIMUM
  - This mode provides limited access to the secondary functions when the SETUP key is pressed. This prevents access to error recovery, rate timers etc. Units can only be changed between two pre-selected types, for full details see section 6.3.

  OFF
  - This mode prevents access to all secondary functions.

CONFIG, SPEED, [AUTO ZERO]
- CONFIG equivalent of SETUP function.

CONFIG, SPEED, [CAS/TAS]
- CONFIG equivalent of SETUP function.

CONFIG, SPEED, [Pt TEMPERATURE]
- CONFIG equivalent of SETUP function.

CONFIG, RATE TIMER
- CONFIG equivalent of SETUP function.

CONFIG, RATE
- CONFIG equivalent of SETUP function.

CONFIG, LEAK MEASURE, [AUTO LEAK ON/OFF]
- CONFIG equivalent of SETUP function, see LEAK MEASURE/CONTROL for details.

CONFIG, LEAK MEASURE, [AUTO LEAK LOCK]
- Prevents changes to AUTO LEAK setting in SETUP.

CONFIG, LEAK MEASURE, [AUTO LIMIT ON/OFF]
- CONFIG equivalent of SETUP function, see LEAK MEASURE/CONTROL for details.

CONFIG, LEAK MEASURE, [AUTO LIMIT LOCK]
- Prevents changes to AUTO LIMIT setting in SETUP.

CONFIG, GROUND
- CONFIG equivalent of SETUP function.
CONFIG, PORT
- Refer to the Line Switching Unit User Manual.

CONFIG, REMOTE
CAUTION: Changing between sets of limits can cause damage to sensitive instruments. Entering CONFIG disables lock out. There are two sets of limits: "remote" and "local".

- This function disables the front panel key-pad and allows the ADTS 405 to be controlled by a remote device such as a PC. The front panel display shows the "REMOTE" message. To return to "local" control (key-pad) press REMOTE/LOCAL key, the remote device can disable this key.

Note: Some ATE systems may require the ADTS 405 set in the remote mode before the remote device starts communicating. If remote lock is disabled, set the ADTS 405 while in local control, by pressing the REMOTE/LOCAL key.

CONFIG, ETP, [AUTO RUN]
- Causes a down-loaded test program to operate (Execute Test Program) on power-up. See the Test Program Manager User Manual for further details.

CONFIG, ETP, [ERASE PROGRAMS]
- Removes a down-loaded test program from non-volatile memory. See the Test Program Manager User Manual for further details.

CONFIG, ETP, [RESULT]
- Configures the PRINT/SAVE mode as in set-up mode.
- Selects and deletes a result file stored in the ADTS 405.

CONFIG, ▼ or ▲ (nudge keys)
- CONFIG equivalent of SETUP function.

CONFIG, 000
- This function enables, changes or disables the CONFIG PIN code protecting access to CONFIG menu.
- When enabled, the PIN must be entered before it can be changed. The prompt asks for "Enter Existing PIN", then a new PIN can be entered. This must comprise four numeric digits.
- Once entered, the prompt asks for the new PIN again to protect against data entry errors. To disable the PIN, so that CONFIG can be entered without a PIN, enter 0000.

Note: Access to maintenance functions may also be PIN protected. This PIN number is not the same as the CONFIG PIN.
### 6.5 Specification

#### Physical Specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>ADTS 405</th>
<th>ADTS 405F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Standard 19&quot; rack front panel 6U high (10½&quot;&quot;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depth behind front panel 255 mm (10&quot;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rear panel connections available</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADTS 405F 442 mm x 755 mm x 332 mm (17½&quot; x 30&quot; x 13&quot;)</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>ADTS 405 12 kg [26.5 lb]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADTS 405F 29 kg [64 lb]</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>Single phase AC in the range 90-260 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Over the frequency range 47-440 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No switching required - all automatic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC power option 24 to 30 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADTS 405 400 VA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADTS 405F 500 VA</td>
<td></td>
</tr>
<tr>
<td>Pressure Fittings</td>
<td>Ps MS33656-6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt MS33656-4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pressure supply MS33656-4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vacuum supply MS33656-6</td>
<td></td>
</tr>
</tbody>
</table>

#### Pressure/Vacuum Requirements

The ADTS 405 requires a single vacuum inlet and a single air pressure inlet. At the control set-point operating into a leak tight system, no air is consumed. A single vacuum source is adequate for the rates detailed into the volumes listed with no crosstalk between Ps and Pt channels. A pump capable of 14 litres/min (0.39 cubic ft/min) is required.

The air pressure source should be clean dry air at a pressure of 3 to 6 bar (45 to 90 psi) with the ADTS 405 having an internal regulator to protect the controllers. Filtering should be to better than 15 microns and a flow rate equivalent to 2.8 litres/min (0.1 cubic ft/min) at the above pressure.

**Note:** The Druck PV 103 is a 19" rack unit that meets the requirements of the ADTS 405.

The integral pump rack provides all the requirements of the ADTS 405F.

#### Warm-up

If the ADTS 405 temperature has stabilized within the operating temperature range before switching on, the ADTS 405 requires a warm-up period of 15 minutes to achieve the stated accuracy.
Temperature

The ADTS 405 has the following temperature ranges:
- **Calibrated**: +5° to +35°C (+41° to +95°F)
- **Operating**: -10° to +50°C (+14° to +122°F)
- **Storage**: -40° to +70°C (-40° to +158°F)

Measurement and Control Range Specifications

**Operating Range and Performance**

The ADTS 405 is supplied in one of two full-scale ranges (850 knots or 1000 knots) for measurement and control of the pitot pressure channel. The following operating parameters are based on a 1000 knots capability test systems. Variations for 850 knots test systems are shown, where appropriate, in brackets.

For both full-scale ranges, limits are set pre-defined tabular limits known as STANDARD, CIVIL and *MAX these can be selected through the SETUP menu.

**Note:**

The ADTS 405 is supplied without *MAX limits, a prompt in the SETUP limits menu asks for MAX limits to be created. This function automatically loads the maximum values appropriate for the full-scale range.

Operators may also configure the display to aeronautical or pressure units but should be aware that when units of pressure are selected, wider full-scale pressure limits will be enabled for some parameters.
Performance expressed in example aeronautical units

<table>
<thead>
<tr>
<th>Units</th>
<th>Altitude</th>
<th>Rate of Climb (ROC)</th>
<th>Calibrated Airspeed (CAS)</th>
<th>Mach</th>
<th>Rate of change of Airspeed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Range</td>
<td>-3000 to 105,000</td>
<td>100,000</td>
<td>-100 to 1000</td>
<td>14.97</td>
<td>2000</td>
</tr>
<tr>
<td>Calibrated or Standard Range</td>
<td>0 to 80,000</td>
<td>9,000</td>
<td>-100 to 1000</td>
<td>5</td>
<td>700</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±3 at 0</td>
<td>±7 at 30,000</td>
<td>±29 at 60,000</td>
<td>±1% of value</td>
<td>±0.5 at 50</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±1 at 0</td>
<td>±2 at 30,000</td>
<td>±7 at 60,000</td>
<td>±0.5%</td>
<td>±0.4 at 50</td>
</tr>
<tr>
<td>Resolution</td>
<td>1</td>
<td>1</td>
<td>0.1</td>
<td>0.001</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**Notes**

1. Altitudes above 80,000 ft and the peak rates of climb are available but subject to the use of a suitable vacuum pump.

2. The accuracy figures stated relate to operation over the temperature range 5° to 35°C (+41° to +95°F).

**Diagram:**

Effect of Operating Temperature Range on Static Channel Altitude Errors

**Note:** The accuracy figures stated assume Auto-Zero function enabled.
Performance expressed in example pressure units

<table>
<thead>
<tr>
<th>Units</th>
<th>Static (Ps)</th>
<th>Rate Ps</th>
<th>Pitot (Pt)</th>
<th>Differential (Qc)</th>
<th>Rate Qc</th>
<th>EPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Range</td>
<td>mbar abs</td>
<td>mbar/min</td>
<td>mbar abs</td>
<td>mbar diff</td>
<td>mbar/min</td>
<td>-</td>
</tr>
<tr>
<td>Calibrated or Standard</td>
<td>3 to 1355</td>
<td>10,000</td>
<td>3 to 3500</td>
<td>-1352 to 3377</td>
<td>10,000</td>
<td>0.1 to 10</td>
</tr>
<tr>
<td>Range</td>
<td>35 to 1355</td>
<td>200</td>
<td>35 to 3500</td>
<td>-1320 to 2500</td>
<td>200</td>
<td>0.1 to 10</td>
</tr>
<tr>
<td>Accuracy (2)</td>
<td>±0.1</td>
<td>±1% within 5 seconds</td>
<td>±0.012% RDG +0.007% FS</td>
<td>RSS of Ps and Pt</td>
<td>±1% within 5 seconds</td>
<td>Better than 0.005</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.05</td>
<td>±0.5%</td>
<td>0.05 to 0.17</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**NOTES**

(1) Pressures below 35 mbar absolute and the peak rates of change are available but subject to the use of a suitable vacuum pump.

(2) The accuracy figures stated relate to operation over the temperature range 5°C to 35°C (+41°F to +95°F).
Repeatability
Repeatability is defined as the change or variation in reading when the same pressure is reapplied after an excursion between minimum and maximum of the range (i.e., including hysteresis). The repeatability does not include curve fit errors.

Accuracy
Accuracy figures stated include curve fit errors, repeatability and temperature effects over the range 5°C to 35°C (+41°F to +95°F). The ADTS 405 can achieve the stated accuracy after a 15 minute warm-up period.
Control Performance

Stability
The ADTS 405 provides stable pressure values at the outlet ports and continues to control smoothly without oscillation into volumes of up to 17 litres (1,000 cubic inches) on Ps and a volume of up to 10 litres (600 cubic inches) on Pt at rates up to 6000 ft/min. Lower volumes enable higher rates of change to be achieved.

The following are the figures based on a 40 ppm of Ps full-scale or Qc full-scale over a bandwidth of 0.1 to 1.5 Hz and using RMS values. Below are shown the two Qc ranges used by the ADTS 405.

<table>
<thead>
<tr>
<th>CHANNEL</th>
<th>CONTROLLER STABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ps</td>
<td>1,355 mbar 40 inHg</td>
</tr>
<tr>
<td></td>
<td>±0.038 mbar</td>
</tr>
<tr>
<td></td>
<td>±0.0011 inHg</td>
</tr>
<tr>
<td>Qc</td>
<td>1,700 mbar 50 inHg</td>
</tr>
<tr>
<td></td>
<td>±0.045 mbar</td>
</tr>
<tr>
<td></td>
<td>±0.0014 inHg</td>
</tr>
<tr>
<td>Qc</td>
<td>2,500 mbar 74 inHg</td>
</tr>
<tr>
<td></td>
<td>±0.070 mbar</td>
</tr>
<tr>
<td></td>
<td>±0.0021 inHg</td>
</tr>
</tbody>
</table>

Rate Control
The ADTS 405 operates in both aeronautical rates and pressure rates, e.g. ft/min and mbar/min and controls Ps, Pt and Qc parameters in either aeronautical or pressure units.

The following are possible:

- Ps - ft/min or metres/min - max rate 100,000 ft/min
- absolute pressure units/min
- Pt - absolute pressure units/min
- Qc - kts/min or km/h/min - max rate 2,000 kts/min
- differential pressure units/min

Using single vacuum pump, a rate of 20,000 ft/min can be achieved with a volume of 10 litres (600 cubic inches) connected to the static (Ps) channel and 6.7 litres (400 cubic inches) connected to the pitot (Pt) channel.

Control Response
The required operating pressure value will be achieved without any overshoot, independent of the system volume, on either Ps or Pt channels. The system response to input commands takes place within a 400 millisecond period.
Dynamic Testing
The ADTS 405 can generate sinusoidal variations of either the Ps or Pt or both channels. Frequency and amplitude of the required oscillation can be programmed; external volumes limit the achievable results. Maximum drift from the mean value during dynamic testing should be no more than twice that specified for steady state testing.

Control Offset
The displayed value will be within the control stability values for the appropriate channel.
Zone 2 Hazardous Area Definition
Defined as an atmosphere where explosive vapours may be present in an air
breathable atmosphere.
ONLY USE ATEX CERTIFIED EQUIPMENT IN THIS DEFINED AREA. USING NON-CERTIFIED EQUIPMENT RISKS AN EXPLOSION.

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.
THE POWER SUPPLIES MUST BE ISOLATED WHEN CONNECTING ELECTRICAL EQUIPMENT IN THE HAZARDOUS AREA.
DO NOT DISCONNECT ATEX CERTIFIED ELECTRICAL EQUIPMENT SUCH AS THE ADTS HAND TERMINAL WHEN ENERGIZED IN THE HAZARDOUS AREA.