

COMPUTER CONTROLLED

AIR DATA TEST SET

D60253

OPERATING INSTRUCTIONS

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1.0 DESCRIPTION

The Computer Controlled Air Data Test Set (CCADTS) has been designed to be sufficiently rugged for 1st line on aircraft applications with accuracy suitable for 2nd and 3rd line workshop use.

The CCADTS is a self contained unit for use with external vacuum and pressure supplies.

The CCADTS comprises of a main unit housing pneumatic controls, sensors and computer, with a separate compact remote control and display unit. The CCADTS may be used in either of two formats.

- (i) With the Remote Control and Display Unit (RCDU) mounted directly onto the front of the main Calibrator /Control Unit (CCU), which is its normal operating and storage position.
- (ii) With the RCDU operating up to 25m from the CCU, connected via an optional electrical cable. In this mode 1st line testing of equipment is simplified by taking just the RCDU into the aircraft, with the main CCU remaining outside.

The fold-out sheet (Fig. 1), at the back of this instruction manual, shows the front panel layout of the test set with the RCDU fixed to the main CCU.

The control and measurement system is based on a 16 bit processor and circuitry developed for airborne primary air data computers. The pressure sensors employed in the CCADTS are designed for air data applications. There are three such sensors used, two being of the vibrating cylinder type, and a third to monitor differential pressures, providing accurate measurement of airspeed down to 20 knots. This transducer is of the type used in the Penny and Giles pitot-static test set currently in use with military and civil helicopter operators world wide.

The RCDU housing is compact and easily handled in the aircraft flight deck, environment. The optional interconnecting lead between RCDU and CCU is a custom designed multicore coaxial cable to ensure resistance to aviation hydraulic liquids. The equipment has been designed to ensure electromagnetic compatibility within the expected aviation environment.

A dedicated printer is available which, when selected, will allow direct copies of screen displays to be made. See Section 3.3 below.

2.0 INSTALLATION

CALIBRATOR/CONTROL UNIT

Pitot and static connections are made via the 7/16" - 20 UNF Pitot port and the 1/2" - 20 UNF Static port (see Chapter 9.0 "Pipe Connections"). Self-sealing connectors, which afford protection for the CCADTS, and the unit under test, in the event of inadvertent disconnection, are available.

External vacuum and pressure connections are made via the 1/2" - 20 UNF Vacuum port and the 7/16" - 20 UNF Pressure port. The services required are:-

- 1) Vacuum: Less than 20 mB abs. and capable of attaining desired flow rates;
- and 2) Pressure: 2.6 to 3.0 bar clean, dry air.

Externally generated pressure and vacuum supplies must be connected to the 'external pressure' and 'external vacuum' ports, to enable operation.

Power is applied to the test set via the multiway power-input connector. A selection of leads is available to provide for any of the following options:-

- 1) 28V d.c.;
- 2) 115V a.c. 400Hz;
- 3) 110V a.c. 60Hz;
- or 4) 240V a.c. 50Hz.

Alternatively, the connections are as follows:-

NOMINAL VOLTAGE	FREQUENCY	WIRE IDENTITY	POWER-INPUT CONNECTOR
28V	d.c.	+28V 0V	pin M * pin K
115/110V	400/60Hz	L N E Link	pin B * pin G pin L pins D & E
240V	50Hz	L N E	pin B * pin G pin L

* Chassis: pin J

Connection of the supply and operation of the power-on switch will illuminate the display and the power-on signal lamp.

A fuse is provided to protect the internal circuitry.

REMOTE CONTROL AND DISPLAY UNIT

CAUTION: THE RCDU MUST NOT BE CONNECTED OR DISCONNECTED WITH THE POWER SWITCHED ON.

The RCDU may be removed from the CCU and connected via the optional interconnecting lead. There is a second fold-out sheet (Fig. 2), at the back of this manual, which shows the layout of the RCDU and may facilitate the reading of these instructions if left unfolded whilst doing so.

PRINTER OPTION

The CCADTS should be connected with the RCDU in the remote mode, see Fig. 3 (at the back of this manual), and with the printer interface lead connected between "SKT1" and the printer.

3.0 OPERATION

3.1 TEST SET OPERATION

Not all of the following CCADTS functions are incorporated into this Test Set. However they may be added later, if desired, by a software upgrade.

Upon switch on the following display is seen on the screen:

```
COMPUTER CONTROLLED AIR DATA TEST SET
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Software Version SW47715 Issue 1

-----
Key      — MENU —
1 Operating Instructions
2 Enter Operating Limits
3 Select Units
4 Measure Only Mode
5 Vent Pressure Lines
6 Leak Check Pressure Lines
7 User Control Mode
8 Preset Sequence Mode
9 IEEE 488 operation

-----
<please wait>
```

After about five seconds, during which time the system performs a check of internal circuitry and memory banks, the display changes to allow input of the required operating limits and ensure protection of the unit under test.

Should the display not change, then the self test routine has detected a fault and the unit should be referred to an authorised service centre. The software number and its issue number should be quoted in any correspondence together with the serial number of the CCADTS unit.

```
— USER ENTRY OF OPERATING LIMITS —  
  
maximum altitude = 20000 feet ■  
(limit: 80000 feet)  
  
maximum airspeed = 180.0 knots  
(limit: 1000 knots)  
  
maximum mach number = 0.400  
(limit: 4.0)  
  
maximum altitude rate = 3000 ft/min  
(limits: 50 to 15000 ft/min)  
  
maximum airspeed rate = 300.0 kn/min  
(limits: 10 to 1000 kn/min)  
  
—  
<to enter set point, press es>  
<to restart alteration routine, press ap>
```


3.1.1 OPERATING LIMITS

When the CCADTS is initially powered up, and after it has successfully completed its internal checks, it will display the 'Enter Operating Limits' page. This presents the opportunity to define the maximum operating envelope for the CCADTS during subsequent tests.

The unit is supplied with a set of default maximum limits. These may be retained by pressing ES when the cursor is along-side each parameter. If the value is desired to be changed, this should be done by typing the new limit followed by ES, until all parameters have been defined.

The cursor will flash alongside the parameter to be entered. The default values are displayed. These may be accepted by pressing ES on the keyboard, or alternative values entered by pressing the appropriate keys, followed by ES.

```
— USER ENTRY OF OPERATING LIMITS —  
  
maximum altitude = 20000 feet  
(limit: 20000 feet)  
  
maximum airspeed = 180.0 knots  
(limit: 1000 knots)  
  
maximum mach number = 0.400  
(limit: 4.0)  
  
maximum altitude rate = 2500 ft/min  
(limits: 50 to 15000 ft/min)  
  
maximum airspeed rate = 300.0 kn/min  
(limits: 10 to 1000 kn/min)  
  
-----  
<to restart alteration routine, press ap:  
<to continue press es>
```

When all values have been entered the user is given the opportunity to re-start the alteration procedure by pressing AP. If all values are as required, continue by pressing ES. The display now changes to the main menu as follows.

```
COMPUTER CONTROLLED AIR DATA TEST SET
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Software Version SW47715 Issue 1

-----
Key          — MENU —
1 Operating Instructions
2 Enter Operating Limits
3 Select Units
4 Measure Only Mode
5 Vent Pressure Lines
6 Leak Check Pressure Lines
7 User Control Mode
8 Preset Sequence Mode
9 IEEE 488 operation

-----
<press key of choice>

*** SYSTEM VENTED ***
```

3.2 KEYBOARD OPERATION

Various control modes may be selected from the main menu presented on the video screen.

The keyboard on the RCDU consists of 4x4 key array with numbers 0-9, +/-, and decimal point. The four keys in the bottom line of the keyboard are all control function keys.

The ES key is the Enter Set parameter key. This key is also pressed to start pressurisation during control procedures.

The CL key is a Clear key. This is used to clear any figures entered in error. This key is also used as an abort key, should the user wish to stop any Test Set process at any time. When CL is pressed twice in quick succession, the system will return to the main menu and hold the pressures currently in the system to allow the operator to decide the next course of action. (The instruction pages may be read at this point).

The AP key is used to alter parameters, and is pressed before inputting new data (eg. new target pressures, etc.).

FN is used to access a number of function options - see "Function Utilities", section 5.0.

3.3 PRINTER OPTION

The printer is factory set, to interface with the CCADTS, and the settings should not be altered. A print of the screen will be effected by pressing the "PRINT" button on the printer.

4.0 MAIN MENU (Operating Modes)

The lines at the bottom of the screen provide information for the user. A 'status line' on the bottom line of the screen is displayed whenever the main menu is on the screen. This indicates whether the system is currently pressurised or vented. It also displays "OPTION NOT FITTED" if the user attempts to enter a function not incorporated into this test set.

```
COMPUTER CONTROLLED AIR DATA TEST SET
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Software Version SW47715 Issue 1

----- MENU -----
Key
1 Operating Instructions
2 Enter Operating Limits
3 Select Units
4 Measure Only Mode
5 Vent Pressure Lines
6 Leak Check Pressure Lines
7 User Control Mode
8 Preset Sequence Mode
9 IEEE 488 operation

-----
<press key of choice>

*** OPTION NOT FITTED ***
```

No pipes should be removed from the CCADTS until 'SYSTEM VENTED' is displayed on the status line.

```
COMPUTER CONTROLLED AIR DATA TEST SET
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Software Version SW47715 Issue 1

-----
Key          MENU
1 Operating Instructions
2 Enter Operating Limits
3 Select Units
4 Measure Only Mode
5 Vent Pressure Lines
6 Leak Check Pressure Lines
7 User Control Mode
8 Preset Sequence Mode
9 IEEE 488 operation

-----
<press key of choice>

*** SYSTEM VENTED ***
```

Above the status line are two 'user prompt' lines. The messages displayed in these two lines provide information to aid the user in operating the CCADTS, and the next course of action (e.g. "press key of choice").

In pressure controlling modes, the bottom line displays not only status information, but is also used to report error conditions, where appropriate.

4.1 MAIN MENU KEY 1 - Operating Instructions

Option number 1 allows access to the basic operating instructions which consist of a number of pages as follows:

```
INSTRUCTIONS PAGE 1
GENERAL OPERATION
For every routine available, the display
is divided into an UPPER SCREEN showing
a title & user set parameters, a LOWER
SCREEN with output parameters and prompt
lines. Particular attention should be
paid to these instruction lines to ease
operation. The keypad is used to input
information to the Test Set. When a key
is pressed, no response will be obtained
until the key has been released. Keys
are used as follows:-
(0-9): Numbers. (.): Decimal Point.
(+/-): Sign Press only if minus required
ES: Enter Set Point. CL: Clear
The pressing of CL twice in quick
succession also returns to main menu
-----
<to continue press es>
```

```
INSTRUCTIONS PAGE 2
whilst holding the pressures in the
system, acting as an abort or help key.
Instructions regarding the use of keys
ES, CL & AP will appear at the bottom of
the display.
PARAMETER ENTRY
Whenever a parameter is required to be
altered press AP, a flashing cursor will
appear next to its current value on the
screen. If no alteration is required,
press ES to enter the value. To clear the
value press CL, enter a new value from
the keyboard, followed by ES. If this is
out of range, an error message will be
displayed. If so, enter a new value within
range and press ES.
-----
<to continue press es>
```

To continue, press ES or, alternatively, the user may return to the Main Menu by pressing CL twice in quick succession.

```
INSTRUCTIONS PAGE 3
2. ENTER OPERATING LIMITS
Allows entry of maximum operating values
for Altitude, Airspeed, Mach number,
Altitude & Airspeed Rates. These limits
are reset at power up to factory set
default values defined by customer. When
these limits are altered during this
routine, the entered values are stored
and are used during every pressure
control routine.

<to continue press es>
```

```
INSTRUCTIONS PAGE 4
3. SELECT MACH NUMBER CORRECTION
Allows selection of aircraft-under-test,
to correct Mach number displayed, so that
Mach P.E. Correction of that aircraft is
simulated. Cursor < shows current choice
(reset to no-correction at power up). To
alter selection press AP until < is next
to unit required, followed by ES.

4. SELECT UNITS
Allows selection of Altitude & Airspeed
units to be used during pressure
control. Cursor < shows current choice
(reset to feet & knots at power up). To
alter selection press AP until < is next
to unit required, followed by ES.
Leak Rate units are derived as follows:-

<to continue press es>
```

```

INSTRUCTIONS                                     PAGE 5

ALT UNITS LEAK RATE  ASI UNITS LEAK RATE
ft          ft/min    kn          kn/min
m           m/min    km/hr       km/h/min
mb          mb/min    mb          mb/min
inHg       inHg/min  inHg       inHg/min
psi        psi/min   psi        psi/min

Altitude Rate units are as follows:-

ALT UNITS      ALT RATE UNITS
ft             ft/min
m             m/min
mb            ft/min
inHg          ft/min
psi           ft/min

<to continue press es>
  
```

```

INSTRUCTIONS                                     PAGE 6

5. MEASURE ONLY MODE
In this routine all pressure control is
disabled. Pressures in the pitot & static
lines are continuously monitored and
altitude, airspeed and Mach number are
continuously displayed.
NOTE: Pump switch should be set to the
INTERNAL position.

6. VENT PRESSURE LINES
When selected, this routine will perform
a controlled descent to safe levels, at
the set maximum rates and will then open
vent and balance valves.

<to continue press es>
  
```


INSTRUCTIONS PAGE 7
7. LEAK CHECK PRESSURE LINES
Upon entry to this routine, the current pressures are displayed. Leak checks can then be carried out at these or user selectable values. The current values as indicated by the flashing cursor are accepted by simply pressing ES. Should new values be required then enter these before pressing ES. The prompt line will then advise that the system is being pressurised. After 30sec. pressurisation will cease and a coarse leak check will be carried out to ensure P & S lines are connected. If all is well pressurisation will continue until the required pressures are achieved, when the display will indicate a volume settlement period.

<to continue press es>

INSTRUCTIONS PAGE 8
The above coarse leak check will not be executed if existing values are accepted. After volume settlement period (approx 3minutes) the leak will be monitored and after a further minute will be displayed as a leak rate. The test will be aborted during volume settlement should the leak rate be greater than 5.0mb/min. Any leak in excess of 1.0mb/min will be highlighted by a flag at the bottom of the screen.

<to continue press es>

INSTRUCTIONS

PAGE 9

8. USER CONTROL

Upon entry to this routine a sub-menu is displayed. Choose one - parameter or all - parameter control as required. The routine then enters the pressure control loop. To alter control parameters, press AP. Alter values as required, followed by ES.

<to continue press es>

INSTRUCTIONS

PAGE 10

9. PRESET SEQUENCES-GENERAL

Upon entry to this routine a sub-menu of defined aircraft / test types is displayed. These follow a calibration schedule stored in memory and divided into tests which are numbered as per the written test schedule. Upon selection of a test, the maximum operating limits for that aircraft / test type become the maximum operating limits of the CCADTS (which will remain the limits on exit of the preset sequence). Upon entry to a test, the test title and first test point are displayed. Press AP to skip to the next test type or ES to proceed. During a test, press ES to skip to next test, AP to skip to next test type, CL twice to exit

<to continue press es>

INSTRUCTIONS PAGE 11
PULL DOWN MENU FACILITIES
The pressing of FN whilst in a pressure control mode accesses a pull-down menu

1. SCREEN PRINT
Selecting option 1 will produce a copy of all data present on the screen at that time. If a printer is not connected a printer not available flag will appear

2. SYSTEM CALIBRATION
Selecting option 2 the user will be requested to enter an access code. If incorrect, an access denied flag will be displayed and the unit will return to the previous mode. If the access code is accepted, the system calibration procedure will commence-see user manual for specific details.

<to continue press es>

INSTRUCTIONS PAGE 12
NUDGE FACILITY
Via the pull - down menu altitude nudge up & down and airspeed nudge up & down facilities are available.

0:ALTITUDE NUDGE UP (10ft increments)
4:ALTITUDE NUDGE DOWN (10ft increments)
3:AIRSPPEED NUDGE UP (1kn increments)
7:AIRSPPEED NUDGE DOWN (1kn increments)

If operating in units other than ft / kn (eg mb) then the movement will be the equivalent of either 10ft or 5kn.

NOTE: The nudge facility is available only in control airspeed, control altitude and control all parameters (both in user control and pressure sequences).

<to continue press es>

```
INSTRUCTIONS PAGE 13
SYSTEM FAULT DETECTED
There are two types of system fault :-
1. USER SYSTEM FAULT DETECTED
This system fault occurs if the system
operating limits have been exceeded. The
CCADTS will default to a vent pressure
lines mode and will display the nature
of the fault at the bottom of the
display. When the CCADTS has reduced the
pressure levels to within limits, press
CL twice to return to main menu.
2. SYSTEM FAULT DETECTED
This system fault occurs if the CCADTS
receives data outside the range of an
internal transducer. The CCADTS will stop
all pressure control and display a fault
diagnosis. Switch off CCADTS and report

```

<to continue press es>

```
INSTRUCTIONS PAGE 14
fault.
POWER FAILURE
In the case of power failure the CCADTS
will automatically vent the pressure
lines. In a balanced condition, the sea
maximum descent rate is factory set to
6000ft/min at 50000ft.
MEMORY CHECK
Upon switch on, the CCADTS will default
to the main menu (with a please wait
prompt) whilst a memory check is carried
out. On passing this check, the CCADTS
will then default to user entry of
operating limits mode. If, however, after
10sec. the main menu is still displayed,
then the unit has failed this check.
Switch off unit and report fault

```

<to continue press es>

These instructions should give basic assistance should the user experience problems during use and they may be displayed without effecting any functional test, by selecting Key 1 on main menu. Note that any pressures in the system will be held indefinitely while the instruction pages are displayed.

4.2 MAIN MENU KEY 2 - User Entry of Operating Limits

Option number 2 allows the operating limits to be altered as previously shown - see section 3.1.1.

4.3 MAIN MENU KEY 3 - Select units

Option number 4 allows the user to select the units to be displayed. The default units are feet for altitude and knots for airspeed.

```
----- USER SELECTION OF UNITS -----  
  
altitude/static pressure units =feet <  
n  
mbar  
inhg  
psi  
  
airspeed/dynamic pressure units=knots  
km/hr  
mbar  
inhg  
psi  
  
< shows current selection  
-----  
<to change current selection,press ap>  
<to continue press es>
```

The units for static pressure are selected first with the cursor shown against the current selection. To change this selection press AP until the cursor is alongside the units you require then press ES.

The units for dynamic pressure are then selected in the same manner and the display changes to main menu.

4.4 MAIN MENU KEY 4 - Measure Only Mode

Option number 4 switches off the pressure control function and the test set adopts a pressure monitoring role to enable calibration of other pressure generating equipment, and to monitor pressures within the system.

```
——— MEASURE ONLY MODE ———  
altitude = -187 feet  
indicated airspeed = 0.0 knots  
mach number = 0.000  
  
—————  
<to return to menu, press cl twice>
```

It is necessary that external pressure and vacuum supplies are connected when using this mode to ensure that the vacuum and pressure reservoirs are at the correct level to revert back to control mode at any time.

To return to Main Menu press CL twice in quick succession.

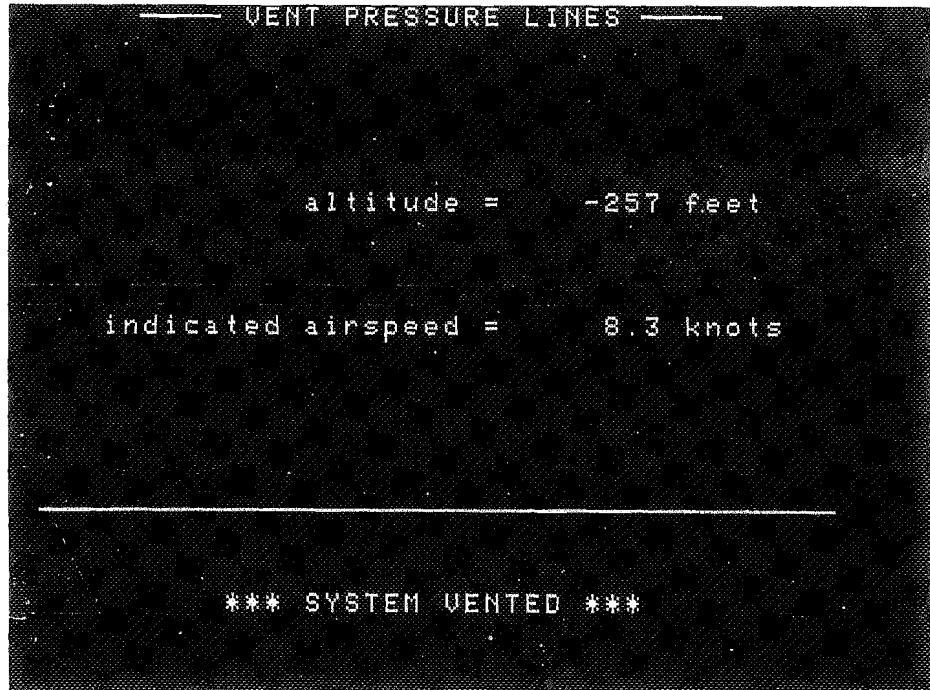
4.5 MAIN MENU KEY 5 - Vent Pressure Lines

Option number 5 vents both pitot and static lines down to ambient pressure at the pre-set maximum rates entered at start up or updated via option 2 from the Main Menu.

```
—— VENT PRESSURE LINES ——  
  
altitude = -278 feet  
  
indicated airspeed = 8.9 knots  
  
—————  
<please wait, venting system>
```

To abort the Vent routine and return to the Main Menu, press CL twice in quick succession.

The value of the last vent level (ie: QFE) is stored within the unit. When a new vent is selected, the system first vents to the last recorded figure. If the new QFE reading is different from the stored value, the system will slowly alter the pressures in the lines until internal and external pressures are matched, and the unit is vented.



As in the main menu, the "status" line indicates when the system is vented.

4.6 MAIN MENU KEY 6 - Leak Check Pressure Lines

Leak checks may be carried out at any time, and at any pressures within the limits previously defined.

The units displayed with the leak routine are controlled via Key 3, "Selection of Units", in the main menu. The displayed leak-rate units are dependant upon the units selected as follows:-

PARAMETER	UNITS SELECTED	LEAK-RATE UNITS
Altitude	feet m mb inHg psi	feet/min m/min mb/min inHg/min psi/min
Airspeed	knots km/hr mb inHg psi	knots/min km/h/min mb/min inHg/min psi/min

A rapid indication as to the existence of any leakage may be obtained by selecting 4 on the main menu and entering the Measure-Only-Mode, which will allow the monitoring of pressure within the system.

NOTE: During Leak Checks, including Measure-Only-Mode use, with altitudes above ground level, ensure that a nominal positive airspeed (say 100kn) is present to avoid the possibility of Airspeed out-of-range conditions arising. Alternatively, engage Fixed-Wing range, as shown in Section 4.7.3 below, to minimise the effect.

However to carry out a full leak check and provide indication of leak rates then selection of option number 6 enters the leak check routine and displays the following:

```
LEAK CHECK PRESSURE LINES

set altitude = -278 feet |
altitude = feet
set ind.airspeed = 9.0 knots
indicated airspeed = knots
leak rate in static = ft/min
leak rate in pitot = kn/min

<to enter set point, press es>
<to restart alteration routine,press ap>
```

Upon entry to this routine the pressures currently in the system are displayed with the cursor flashing alongside the parameter to be entered. The current value may be accepted by pressing ES or changed by pressing the appropriate keys followed by ES to enter the value. The cursor will now move to the set indicated airspeed required which is entered in the same way. If both pressures are as required pressing ES will commence the leak check routine. If pressures other than those currently in the system have been selected the display will update until those pressures are achieved.

To abort the Leak Check routine and return to the main menu, press, CL twice in quick succession.

```
———— LEAK CHECK PRESSURE LINES ————  
  
      set altitude = 10000 feet  
      altitude = 674 feet  
      set ind.airspeed = 250 knots  
      indicated airspeed = 143.5 knots  
      leak rate in static = ft/min  
      leak rate in pitot = kn/min  
  
—————  
<please wait,pressurising system>
```

After some 30 seconds pressurisation will stop and a coarse leak check will be carried out to ensure that there are no large leaks in the system (or in fact that pitot and static lines are connected). Should there be a large leak in the system, then the test will be aborted and an indication given as to which line is leaking, as follows.

```
———— LEAK CHECK PRESSURE LINES ————  
  
      set altitude = 10000 feet  
      altitude = 674 feet  
      set ind.airspeed = 250 knots  
      indicated airspeed = 143.5 knots  
      leak rate in static = ft/min  
      leak rate in pitot = kn/min  
  
—————  
      *** TEST COMPLETE ***  
<to continue press es>  
      *** LEAK DETECTED IN PITOT ***
```

Assuming there are no large leaks in the system, pressurisation will continue until the target pressures are achieved when the display will change to the following.

```
—— LEAK CHECK PRESSURE LINES ——  
  
    set altitude =    10000 feet  
      altitude =     9993 feet  
    set ind.airspeed =    250 knots  
  indicated airspeed =   250.5 knots  
leak rate in static =           ft/min  
leak rate in pitot =           kn/min  
  
<please wait, volume settlement period ;  
  Time Remaining:    112
```

The display will indicate a period of volume settlement and will continue to show the countdown of time remaining.

This period is to ensure stability within the pressure system to accurately monitor leak rates. During this period of volume settlement (approx 3 mins.) the test set is monitoring the leak rate and should this be in excess of 5mb/min (185ft/at 10Kft) the test is aborted and an indication given that there is a system leak, and which line is leaking.

```
—— LEAK CHECK PRESSURE LINES ——  
  
      set altitude =      10000 feet  
      altitude =       7330 feet  
  
      set ind.airspeed =      250 knots  
      indicated airspeed =    136.9 knots  
  
      leak rate in static =          ft/min  
      leak rate in pitot =          kn/min  
  
      *** TEST COMPLETE ***  
<to continue press es>  
      *** LEAK DETECTED IN STATIC ***
```

If not aborted, the period of volume settlement will continue until complete, at which time the display will change to indicate that the unit is now measuring any leaks in the system. This takes a further minute after which time the leak rates are displayed in the appropriate units.

```
----- LEAK CHECK PRESSURE LINES -----  
  
set altitude = 10000 feet  
altitude = 9988 feet  
  
set ind. airspeed = 250 knots  
indicated airspeed = 250.2 knots  
leak rate in static = ft/min  
leak rate in pitot = kn/min  
  
-----  
<please wait, checking for leaks>  
Time Remaining: 47
```

Should the leak rate be in excess of 1mb/min (37ft/min at 10Kft) this is highlighted by flag at the bottom of the screen.

```
----- LEAK CHECK PRESSURE LINES -----  
  
set altitude = 10000 feet  
altitude = 9635 feet  
  
set ind. airspeed = 250 knots  
indicated airspeed = 238.5 knots  
leak rate in static = 359.8 ft/min  
leak rate in pitot = 11.6 kn/min  
  
-----  
*** TEST COMPLETE ***  
<to continue press es>  
*** LEAK DETECTED IN STATIC ***
```

The screen also indicates that the test has been completed. To continue, press ES. Should the user wish to repeat the test this option is available by pressing AP. Alternatively, the user may return to the Main Menu by pressing CL twice in quick succession.

```
LEAK CHECK PRESSURE LINES

set altitude = 10000 feet
altitude = 9999 feet
set ind. airspeed = 250 knots
indicated airspeed = 250.5 knots
leak rate in static = 0.3 ft/min
leak rate in pitot = 0.1 kn/min

*** TEST COMPLETE ***
<to continue press es>
```

```
LEAK CHECK PRESSURE LINES

set altitude = 10000 feet
altitude = 9999 feet
set ind. airspeed = 250 knots
indicated airspeed = 250.5 knots
leak rate in static = 0.3 ft/min
leak rate in pitot = 0.1 kn/min

<to return to menu, press cl twice>
<to restart leak check, press ap>
```

4.7 MAIN MENU KEY 7 - User Control

Option number 7 enters the User Control, via keyboard facility, enabling the user to pressurise the system, either in one of four parameters or in all parameters. Upon selection of this mode, a sub menu is displayed.

```
USER CONTROL - MENU

Key
1 Control Altitude/Static Pressure
2 Control Rate-of-climb
3 Control Airspeed/Dynamic Pressure
4 Control Mach Number
5 Control all parameters

-----
<press key of choice>
```

The user control via keyboard mode uses the same screen format for all operating modes. The screen is divided into two parts. The top half displays the user selected target values of pressure. The bottom half displays the measured pressures currently in the system. As is usual, two prompt lines are displayed at the bottom of the screen and an error/status line below these, on the bottom line.

The status line indicates error conditions as well as conditions such as "PRESSURE ACHIEVED". This Pressure Achieved flag is displayed when the measured pressure is equal to the set (or target) pressure. The measured pressure is allowed to drift 10 feet and/or 1 knot from the set pressure at which point the pressure achieved flag will go out until pressure is re-achieved.

Target values may always be altered at any stage of control by pressing AP, and accepted by pressing ES. After parameter alteration, the control mode is initiated by pressing ES.

4.7.1 USER CONTROL KEY 1 - Control Attitude/Static Pressure
When Key 1 is pressed control of static pressure is possible.

```
----- USER CONTROL VIA KEYBOARD -----  
set altitude = 9997 feet  
  
-----  
altitude = 9997 feet  
  
-----  
<to alter set parameter, press ap>  
<to return to menu, press cl twice>  
*** PRESSURE ACHIEVED ***
```

Upon entry to a control routine the pressures currently in the system are displayed and maintained.

To alter a set parameter press AP. The cursor will flash alongside the set altitude parameter. The new value required should be entered by pressing the appropriate keys followed by ES.

```
----- USER CONTROL VIA KEYBOARD -----  
set altitude = 9997 feet |  
  
-----  
altitude = 9998 feet  
  
-----  
<to enter set point, press es>  
<to restart alteration routine, press ap>
```

The system then allows the user to re-start the alteration routine by pressing AP or to continue and achieve the set parameter by pressing ES.

```
----- USER CONTROL VIA KEYBOARD -----  
set altitude = 15000 feet  
  
-----  
altitude = 9998 feet  
  
-----  
<to restart alteration routine, press ap>  
<to continue press es>
```

At any time during the control mode pressure generation may be halted by:

- (i) Pressing AP which causes the cursor to flash alongside the set parameter. Pressure control can then be re-started by re-entering the set point (press ES) or altering the set parameter and then pressing ES.
- (ii) Pressing the CL key twice in quick succession which returns the CCADTS to the main menu and holds pressure in the system.

```
——— USER CONTROL VIA KEYBOARD ———  
set altitude = 15000 feet  
  
—————  
altitude = 14993 feet  
  
—————  
<to alter set parameter, press ap>  
<to return to menu, press cl twice>  
*** PRESSURE ACHIEVED ***
```

4.7.2 USER CONTROL KEY 2 - Control Rate of Climb

When Key 2 is selected rate of climb checks are possible. Entry into this routine displays the following:

```
----- USER CONTROL VIA KEYBOARD -----  
      set altitude =      14991 feet  
      set altitude rate =      0 ft/min  
  
-----  
      altitude =      14990 feet  
      altitude rate =      0 ft/min  
  
-----  
<to alter set parameter, press ap>  
<to return to menu, press cl twice>
```

The set altitude displays current pressures within the system. To alter the set parameters, press AP. The cursor will flash firstly alongside the set altitude. The user has to select a target altitude and enter this figure by pressing ES. The cursor now moves to alongside the Set altitude rate. The required altitude rate should now be entered. If all values are correct the system may be started by pressing ES to continue. When the requested rate of climb is achieved, the "RATE ACHIEVED" flag is displayed.

NOTE:

An altitude has to be selected great enough to allow sufficient time to achieve the requested rate. The larger the requested rate, the larger the difference between the target altitude and current altitude should be.

```
----- USER CONTROL VIA KEYBOARD -----  
      set altitude =      5000 feet  
      set altitude rate =      0 ft/min |  
  
-----  
      altitude =      14989 feet  
      altitude rate =      0 ft/min  
  
-----  
<to enter set point, press es>  
<to restart alteration routine, press ap>
```

```
----- USER CONTROL VIA KEYBOARD -----  
      set altitude =      5000 feet  
      set altitude rate =      2000 ft/min  
  
-----  
      altitude =      14069 feet  
      altitude rate =     -2000 ft/min  
  
-----  
<to alter set parameter, press ap>  
<to return to menu, press cl twice>  
      *** RATE ACHIEVED ***
```

The process may be stopped at anytime by pressing AP and re-entering new values of altitude rate.

4.7.3 USER CONTROL KEY 3 - Control Airspeed/Dynamic Pressure

Entry into this routine produces the following display:

```
——— USER CONTROL VIA KEYBOARD ———  
  
set ind.airspeed = 247.9 knots  
  
—————  
  
indicated airspeed = 247.9 knots  
  
—————  
<to alter set parameter, press ap>  
<to return to menu, press cl twice>  
*** PRESSURE ACHIEVED ***
```

The procedure to alter parameters and enter set points is exactly as previously described with the prompt lines aiding the user. Airspeeds below 20kn are considered to be zero and the system is balanced. It is possible to enter zero Knots as a command value. The "PRESSURE ACHIEVED" flag will operate at any measured value less than 20kn when the command value is between 0 and 20 Knots.

AIRSPEED RANGES

This Test Set has two airspeed ranges, one from 20 - 240 Kn for helicopter and one from 60 - 1,000. Kn for fixed wing. The selection of the maximum airspeed operating limit determines which range will be effective.

Any maximum airspeed up to 240 Kn will automatically call up the helicopter range. Any maximum airspeed above 240 Kn will call up the fixed wing range.

When the fixed wing range has been selected the low airspeed limit is 60kn. Thus, any entered value below 60kn is considered to be zero and the system is balanced.

```
----- USER CONTROL VIA KEYBOARD -----  
  
set ind.airspeed = 270 knots ■  
  
-----  
  
indicated airspeed = 247.8 knots  
  
-----  
<to enter set point, press es>  
<to clear entered figures, press cl>
```

```
----- USER CONTROL VIA KEYBOARD -----  
  
set ind.airspeed = 270 knots  
  
-----  
  
indicated airspeed = 269.5 knots  
  
-----  
<to alter set parameter, press ap>  
<to return to menu, press cl twice>  
*** PRESSURE ACHIEVED ***
```

4.7.4 USER CONTROL KEY 4 - Control Mach number

Key 4 allows control of Mach number and displays the following:

```
----- USER CONTROL VIA KEYBOARD -----  
      set altitude = 13158 feet  
      set mach number = 0.524  
  
-----  
      altitude = 13158 feet  
      mach number = 0.525  
  
-----  
<to alter set parameter, press ap>  
<to return to menu, press cl twice>  
*** PRESSURE ACHIEVED ***
```


In this mode altitude has to be set first followed by Mach number which are both entered as previously described in other control modes.

```
----- USER CONTROL VIA KEYBOARD -----  
      set altitude = 20000 feet  
      set mach number = .6  
  
-----  
      altitude = 13158 feet  
      mach number = 0.524  
  
-----  
<to enter set point, press es>  
<to clear entered figures, press cl>
```

```
----- USER CONTROL VIA KEYBOARD -----  
      set altitude = 20000 feet  
      set mach number = .6  
  
-----  
      altitude = 19997 feet  
      mach number = 0.601  
  
-----  
<to alter set parameter, press ap>  
<to return to menu, press cl twice>  
      *** PRESSURE ACHIEVED ***
```

4.7.5 USER CONTROL KEY 5 - Control all air data parameters

This is the most comprehensive control mode and allows the user to control all functions simultaneously and independently.

```

  ——— USER CONTROL VIA KEYBOARD ———

      set altitude = 19995 feet
      set ind airspeed = 275.7 knots
      set measured oat = 0.0 °c

      true airspeed = 373.6 knots
      corrected oat = -18.4 °c
      mach number = 0.601

  ———

      altitude = 19987 feet
      indicated airspeed = 275.7 knots
      measured oat = 0.0 °c
      true airspeed = 373.7 knots
      corrected oat = -18.4 °c
      mach number = 0.600

  ———

  <to alter set parameter, press ap>
  <to return to menu, press cl twice>
  *** PRESSURE ACHIEVED ***
  
```

```

  ——— USER CONTROL VIA KEYBOARD ———

      set altitude = 19995 feet
      set ind airspeed = 275.7 knots
      set measured oat = 3.3 °c

      true airspeed =          knots
      corrected oat =          °c
      mach number =

  ———

      altitude = 19991 feet
      indicated airspeed = 275.6 knots
      measured oat = 0.0 °c
      true airspeed = 373.7 knots
      corrected oat = -18.4 °c
      mach number = 0.601

  ———

  <to enter set point, press es>
  <to clear entered figures, press cl>
  
```

Altitude and airspeed are entered in the normal way together with outside air temperature. These three parameters are then used to compute true airspeed, corrected OAT and Mach number. The measured figures are displayed in the lower half of the screen, as normal.

```
----- USER CONTROL VIA KEYBOARD -----  
  
      set altitude = 19995 feet  
      set ind. airspeed = 275.7 knots  
      set measured oat = 3.3 °c  
  
      true airspeed = 375.9 knots  
      corrected oat = -15.3 °c  
      mach number = 0.601  
  
-----  
      altitude = 20000 feet  
      indicated airspeed = 276.0 knots  
      measured oat = 3.3 °c  
      true airspeed = 376.2 knots  
      corrected oat = -15.3 °c  
      mach number = 0.601  
  
-----  
<to alter set parameter, press ap>  
<to return to menu, press cl twice>  
*** PRESSURE ACHIEVED ***
```

4.8 MAIN MENU KEY 8 - Preset Sequence Mode

This option is not installed, but is available as a software upgrade.

4.9 MAIN MENU KEY 9 - IEEE 488 Operation

This option is not installed, but is available as a software upgrade.

5.0 FUNCTION UTILITIES

When FN is depressed in any pressure control or measurement mode, the following screen is displayed; providing several utility options.

```
----- USER CONTROL VIA KEYBOARD -----
      set altitude =      6987 feet
      set ind.airspeed =      0.0 knots
      se
FUNCTION UTILITIES
Press key :
  1 - Screen Print.          nots
  2 - System Calibration.    c
-----
  0 - Altitude Nudge Up.
  4 - Altitude Nudge Down.  eet
indi
  3 - Airspeed Nudge Up.    c
  7 - Airspeed Nudge Down. nots
      corrected oat =      3.3 °c
      mach number =      0.000
-----
<to alter set parameter,press ap>
<to return to menu, press cl twice>
*** PRESSURE ACHIEVED ***
```

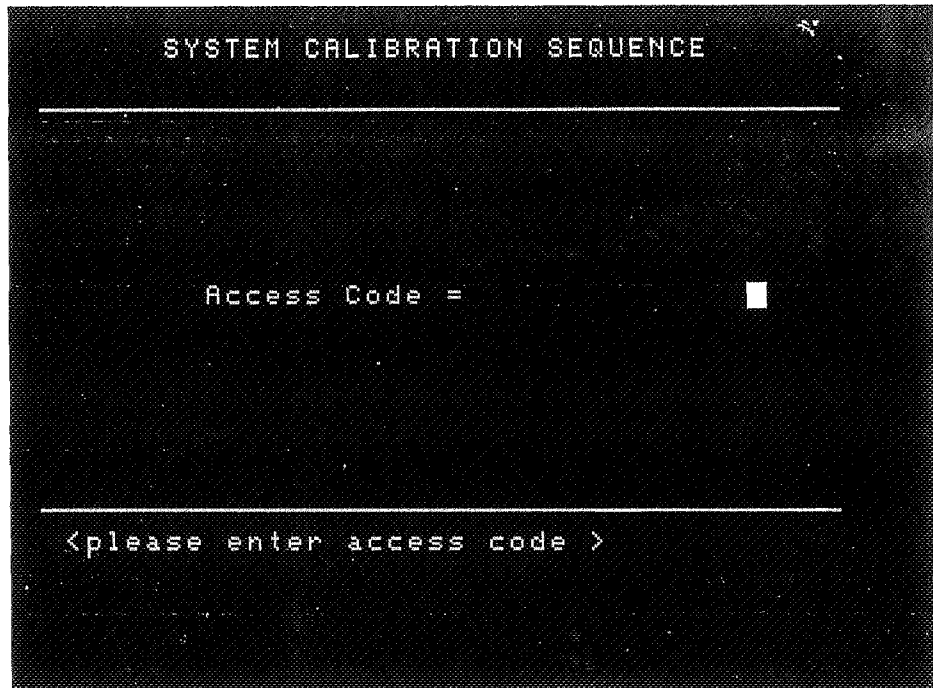
The options displayed are selected by pressing the relevant number on the keypad. The function menu is not available when text only is displayed. Should no button be pressed within 5 seconds, the display will revert to the previous control screen.

5.1 FN KEY 1 - Screen Print (Remote)

This option is not installed, but is available as a software upgrade.

5.2. FN KEY 2 - System Calibration.

Selection of function key (FN) followed by key 2 will commence the system calibration procedure and produce the following display requesting an access code:



The appropriate access code should be entered followed by ES and the calibration procedure as described in the Overhaul Manual should be adopted.

If an incorrect access code is entered the display will indicate the error message "ACCESS DENIED" then return to the previous pressure control or measurement mode.

5.3 NUDGE FACILITY

The function utilities allow the user to nudge Altitude or Airspeed up and down. This function is available in any Altitude or Airspeed control mode. It is not available in Rate of Climb, or Mach tests.

5.3.1 FN KEY 0 - Altitude Nudge Up

The pressing of FN followed by 0 increases the set altitude by 10 ft or an equivalent pressure step if units other than feet are selected.

5.3.2 FN KEY 4 - Altitude Nudge Down

The pressing of FN followed by 4 decreases the set altitude by 10 ft or an equivalent pressure step if units other than feet are selected.

5.3.3 FN KEY 3 - Airspeed Nudge Up

The pressing of FN followed by 3 increases the airspeed by 1kn or an equivalent pressure step if units other than knots are selected.

5.3.4 FN KEY 7 - Airspeed Nudge Down

The pressing of FN followed by 7 decreases the airspeed by 1 kn or an equivalent pressure step if units other than knots are selected.

6.0 SYSTEM FAULT DETECTION

At all times during the operation of the test set, altitude, airspeed and Mach number are constantly monitored to ensure that they are within the operational limits, selected by Key 2 on the main menu. Should for any reason these be exceeded the system will detect this, display an error message, remove control from the keypad, and vent the system safely to ambient conditions.

```
— SYSTEM FAULT DETECTED —  
  
ALTITUDE LIMITS EXCEEDED  
  
altitude = 19997 feet  
  
indicated airspeed = 0.0 knots  
  
_____  
<please wait, venting system>
```

```
— SYSTEM FAULT DETECTED —  
  
AIRSPEED LIMITS EXCEEDED  
  
altitude = 8388 feet  
  
indicated airspeed = 156.5 knots  
  
_____  
<please wait, venting system>
```

```
— SYSTEM FAULT DETECTED —  
  
MACH NUMBER LIMITS EXCEEDED  
  
altitude = 12973 feet  
  
indicated airspeed = 142.3 knots  
  
_____  
<please wait, venting system>
```

Also monitored are the internal sensor input signals and if at any time these are considered to be outside tolerances, then system fault is displayed indicating which sensor is out of limits.

6.1 INPUT ERROR DETECTION

It is not possible to enter a value outside of the operational limits as set via 2 option on the main menu. If this is attempted an error flag is displayed at the bottom of the screen as follows:

```
—— USER CONTROL VIA KEYBOARD ——  
  
set altitude = 25000 feet |  
  
——  
  
altitude = 19994 feet  
  
——  
<to enter set point, press es>  
<to restart alteration routine, press ap>  
*** ALTITUDE OUT OF RANGE ***
```

```
—— USER CONTROL VIA KEYBOARD ——  
  
set altitude = 19992 feet  
set altitude rate = 7000 ft/min |  
  
——  
  
altitude = 19990 feet  
altitude rate = 0 ft/min  
  
——  
<to enter set point, press es>  
<to restart alteration routine, press ap>  
*** ALTITUDE RATE OUT OF RANGE ***
```

```
----- USER CONTROL VIA KEYBOARD -----  
  
set ind airspeed = 600 knots |  
  
-----  
  
indicated airspeed = 275.9 knots  
  
-----  
<to enter set point, press es>  
<to restart alteration routine, press ap>  
*** AIRSPEED OUT OF RANGE ***
```

```
----- USER CONTROL VIA KEYBOARD -----  
  
set altitude = 16424 feet  
set mach number = 2  
  
-----  
  
altitude = 16424 feet  
mach number = 0.000  
  
-----  
<to enter set point, press es>  
<to restart alteration routine, press ap>  
*** MACH NUMBER OUT OF RANGE ***
```

7.0 POWER FAILURE

Should the power supply to the test set fail at any time, the test set will automatically vent the system down to atmosphere at a factory set rate, (approximately 6000 ft/min at 50 Kft.). When power is restored, the default values of operating limits will be reinstated and the user must re-enter his required values. Should the power be restored before the system is totally vented and at pressures in excess of the default values of maximum operating limits, then the test set will not allow operation until pressures are below these default values.

8.0 USEFUL HINTS FOR OPERATION OF CCADTS

8.1 QFE READING

To obtain a reading of QFE switch on and enter operating limits. The display will then show main menu and indicate system vented. Select Key 6 (vent pressure lines) and the display will show static pressure of the day in whatever parameters have been selected.

8.2 ALTITUDE ALERT/ALTITUDE SWITCH POINTS

To test for altitude alert switch points, select user control then Key 2 rate of climb. Select an altitude in excess of that at which the altitude alert should operate. Select 200ft/min being the slowest rate of change possible, ignore the rate achieved flag and press AP when the altitude alert operates. The altitude at which AP was pressed is now displayed in the lower half of the screen.

8.3 STALL WARNING/AIRSPEED SWITCHES

Airspeed switch points can be treated in a similar way by User Control mode, control airspeed. Select an airspeed in excess of the required switch point and press AP when the switch operates to freeze the display at the point AP was pressed. In order to obtain a slow rate of change of airspeed it will be necessary to select the appropriate rate via Key 2 on the main menu (operating limits).

8.4 LEAK CHECKS

It is possible to carry out a leak check at any pressure within the aircraft limits. Should the operator suspect a leak during a test then entering 6 on the main menu and subsequently pressing ES to accept the current pressures will execute a full leak check at those pressures. However the full leak check takes some 4-5 mins to execute. A faster indication can be given by selecting 4 on the main menu, i.e. measure only mode. In this mode static and dynamic pressures are displayed and may be monitored to see if they are changing.

NOTE: During Leak Checks, including Measure-Only-Mode use, with altitudes above ground level, ensure that a nominal positive airspeed (say 100kn) is present to avoid the possibility of Airspeed out-of-range conditions arising. Alternatively, engage Fixed-Wing range, as shown in Section 4.7.3 above, to minimise the effect.

9.0 PIPE CONNECTIONS

9.1 AIRSPEED INDICATOR CALIBRATION CHECKS.

Always connect both "P" and "S" lines, to unit under test, to ensure accurate results.

9.2 ALTIMETER CALIBRATION CHECKS

Connect "S" pipe to unit under test and "P" to a volume of approximately one litre.

NOTE: Alternatively, "P" may be sealed with a suitable blanking plug. However, this might give rise to Airspeed out-of-range conditions during Measure-Only-Mode use.

9.3 VSI CALIBRATION

Connections as for altimeter.