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MODEL 6500-HA Rev. F2

USER'S MANUAL

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REVISION HISTORY

Document No.	Release Date	Description
9100 Rev F2	03/09/2010	6500-HA Rev F2 User's Manual

WARNING

THE 6500-HA USES LINE VOLTAGES FOR ITS OPERATION WHICH ARE POTENTIALLY DANGEROUS. IMPROPER OPERATION OF THIS EQUIPMENT MAY RESULT IN PERSONAL INJURY OR LOSS OF LIFE. HENCE THE EQUIPMENT DESCRIBED IN THIS MANUAL SHOULD BE OPERATED ONLY BY PERSONNEL TRAINED IN PROCEDURES THAT WILL ASSURE SAFETY TO THEMSELVES, TO OTHERS AND TO THE EQUIPMENT.

BEFORE PERFORMING ANY MAINTENANCE, TURN THE POWER OFF AND DISCONNECT THE POWER CORD FROM THE POWER SOURCE.

ALWAYS USE A 3-PIN GROUNDED OUTLET AS YOUR AC POWER SOURCE

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SECTION 1

INTRODUCTION

Note: Pt = Pitot and Ps = Static

The model 6500-HA is a high accuracy automated pressure controller, specifically designed for controlling air data parameters such as altitude, airspeed, Mach and climb. This instrument can also be used to control pressures in units of inHg and mbar. The 6500-HA requires external vacuum and pressure supplies in order for it to perform the control function.

The 6500-HA has two high accuracy transducers that measure pressure in the range of 0 to 38 inHg absolute on the Ps (static) output, and 0 to 100 inHg absolute on the Pt (pitot) output. These transducers are designed to accurately measure the pressure of dry air over an ambient temperature range of 0°C to 50°C. The 6500-HA is fully RVSM compliant.

The 6500-HA allows the user to control altitude in feet or meters, climb in feet per minute or meters per minute, airspeed in knots, mach, mph and kmph. It also allows the user to control EPR on the pitot output.

The model 6500-HA features programmable limits on altitude, airspeed, mach number, and climb rate. These limits are checked during data entry and thereby prohibit entry of erroneous target values. These limits are also checked continuously during operation, and if any of these is exceeded, the unit automatically takes abortive action.

The user has the ability to program into the 6500-HA a profile of set-points to be controlled in a sequence. Once such a profile has been setup, the user can command the unit to move from one set-point to the next simply by pushing the 'GO' button. Up to 50 points can be stored in one profile. The 6500-HA can store up to 20 such profiles in non-volatile memory at any one time.

Calibration of the unit is required only once a year. For higher accuracy, calibration is recommended once every 6 months. This process is the only scheduled maintenance function required on the 6500-HA.

The model 6500-HA comes with an RS232 interface. This interface is mainly used to download profiles from a computer. The high accuracy of the 6500-HA and its ease of use make it the ideal Air Data Controller for an instrument shop.

SECTION 2

CONTROLS AND CONNECTIONS

Note: Pt = Pitot and Ps = Static

2.1 FRONT PANEL

The front panel of the 6500-HA is shown in Figure 2.1. The various components of the front panel are described below.

[1] Power ON/OFF switch

This is a Push On / Push Off switch. In the depressed position the switch is ON. This switch is used to connect AC power to the unit. When power is applied to the unit, the front panel display will be illuminated.

[2] Contrast Control knob

This single-turn knob is used to adjust the viewing angle of the display.

[3] Remote Connection

An optional Remote Unit may be connected to the 6500-HA at this connector.

[4] Ps Test Port

This 1/8 - NPT port is the Ps (Static) port of the unit. This port can be used to connect to the Static port of the Unit Under Test (UUT). This port will have a factory-installed stainless steel AN-4 fitting.

Caution: If this port is not connected to a UUT then it must be plugged/ capped while the 6500-HA is operational.

Caution: A Unit Under Test must not be connected to this port or disconnected from this port unless the 6500-HA is in Measure Mode.

Caution: Do not connect the UUT to this port while performing the Self Test.

6500 FRONT PANEL

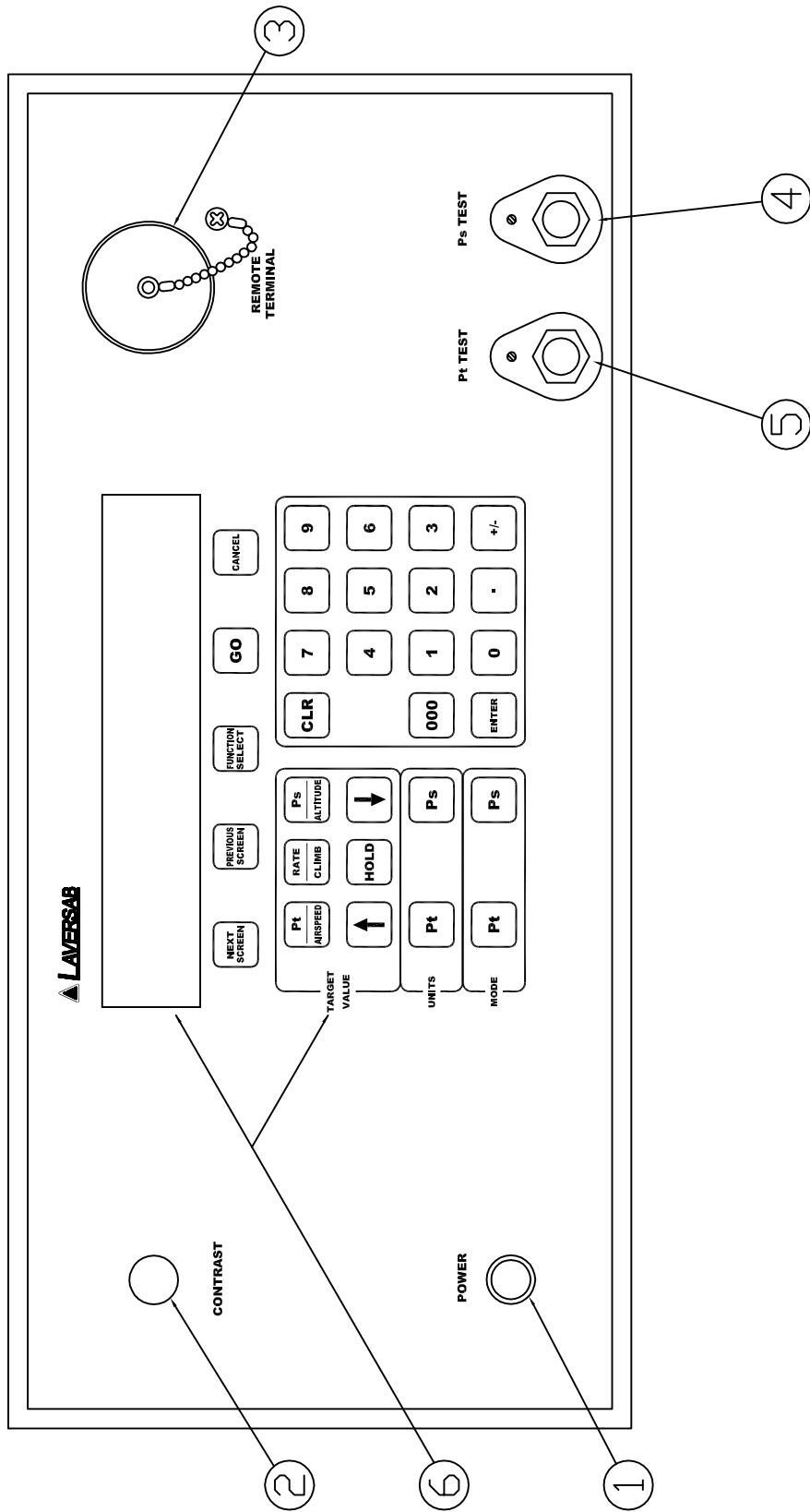


Figure 2.1

6500 REAR PANEL

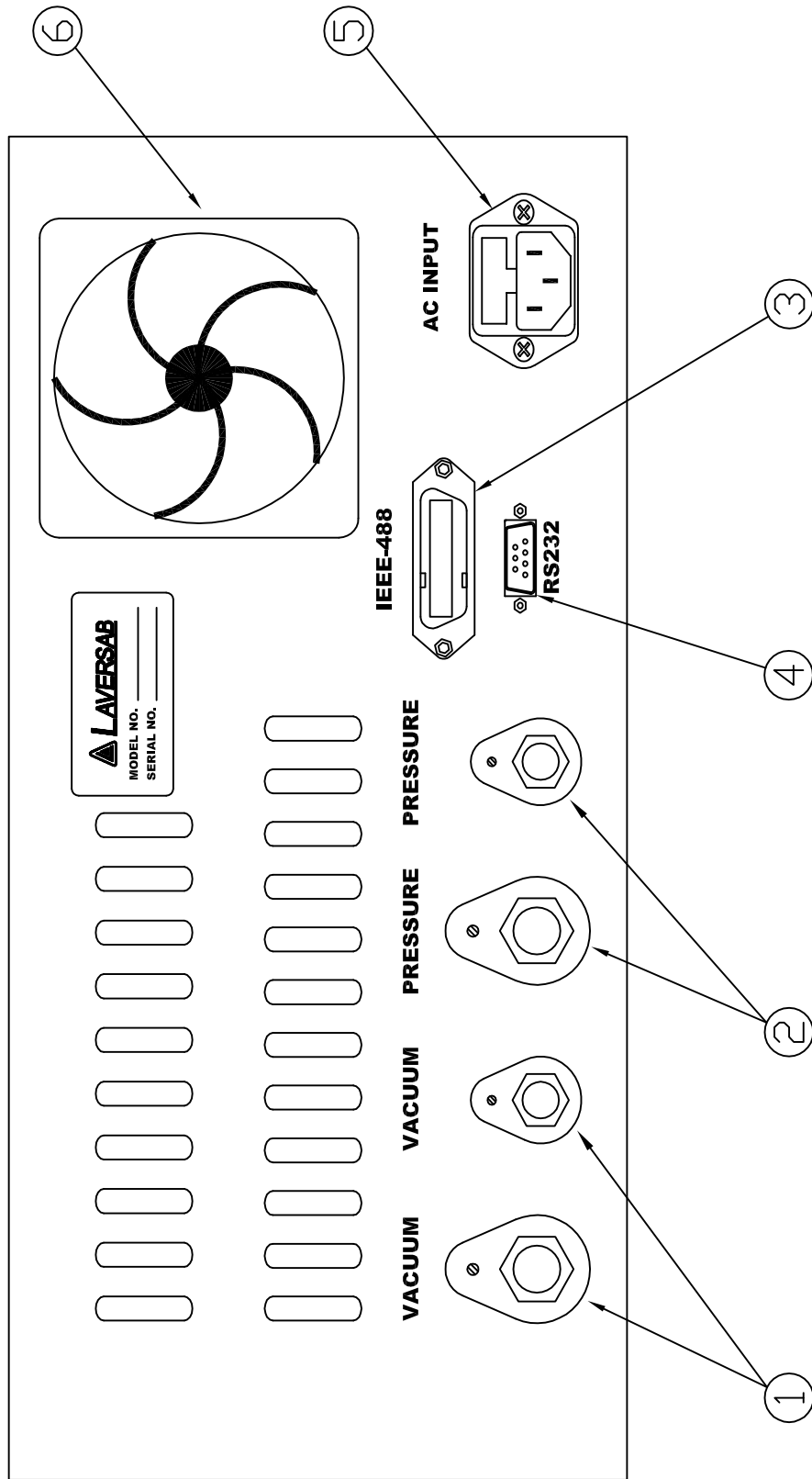


Figure 2.2

[5] Pt Test Port

This 1/8 - NPT port is the Pt (Pitot) port of the unit. This port can be used to connect to the Pitot port of the Unit Under Test (UUT). This port will have a factory-installed stainless steel AN-4 fitting.

Caution: If this port is not connected to a UUT then it must be plugged/ capped while the 6500-HA is operational.

Caution: A Unit Under Test must not be connected to this port or disconnected from this port unless the 6500-HA is in Measure Mode.

Caution: Do not connect the UUT to this port while performing the Self Test.

[6] KEYPAD & LCD DISPLAY

The back-lit LCD display has 4 lines of 40 characters each. The viewing angle of the display can be adjusted using the Contrast knob.

There are five function keys just below the display. **NEXT SCREEN** and **PREVIOUS SCREEN** are used to move between the different operating screens of the 6500-HA. At present there are only three upper level operating screens : Main, Calibrate and Self test.

The **FUNCTION SELECT** key is used to go into a screen which allows the user to choose any one of ten functions. The functions are:

0. Set IEEE address
1. View Limits
2. Set Limits
3. Set Knots rate
4. Execute profile
5. Setup profile
6. Height Correction
7. Set "Ground"
8. Go to "Ground"
9. Encoder

These functions are described in detail in Section 3.

The **GO** key is used to execute all changes made through the Remote unit. After the changes have been 'ENTER' ed, they will flash on the screen until executed by the GO key. This allows for simultaneous execution of several changes in target values, modes, units etc.

The **CANCEL** key has multiple purposes. It is used to abort all changes that are flashing on the screen. It is also used to exit out of target value entry, unit selection and mode selection. It is used to exit out of other screens like Leak test and Function select. The **CANCEL** key is also used to acknowledge error messages or exit an executing profile.

NUMERIC KEYS :

These keys are used for numeric entry of target values and other numeric data. The '+/-' key operates just like on a calculator and is used to enter negative values. This key must be used after entering the positive value, to make it negative. The '000' key allows the entry of three consecutive zeroes.

The **CLR** key is used to clear the data entry field.

The **ENTER** key is used to accept numeric entries and also select units and modes.

TARGET VALUE KEYS :

There are typically 3 parameters that the 6500-HA controls - Altitude, Climb and Airspeed. Each parameter has its own target value key. The **Pt/AIRSPEED** key is used to select Pt or Airspeed target value entry, the **Ps RATE/CLIMB** key is used to select Climb value entry, and the **Ps/ALTITUDE** key is used to select Ps or Altitude value entry. After selecting the target value key, the new value can be entered using the numeric keypad.

The **UP ARROW** and **DOWN ARROW** keys are used to “Jog” a target value. The arrow keys are also used to move between various choices during Unit selection and Mode selection. For more information, please refer to Section 3.2.2.

The **HOLD** key is used to hold the outputs at their current Actual value. This is explained in detail in Section 3.2.2.

UNITS SELECT KEYS :

Units can be selected independently for the Pt and Ps outputs. Pressing the **Pt UNITS** key will bring up the choices in Pt units onto the 4th line of the display. To exit from this selection mode, press **CANCEL**. To move between the choices use the arrow keys. There are nine Pt units in all. The cursor location is indicated by the blinking unit mnemonic. Once the cursor is on the desired units, press 'ENTER' to select that unit.

The **Ps UNITS** key brings up the choices for Ps units onto the 4th line of the display. Use **CANCEL** to exit this unit selection mode. Use the arrow keys to move between the choices. Use the **ENTER** key to select a choice. There are four Ps units to choose from.

For more information on Units Selection please refer to Section 3.2.3.

MODE SELECT KEYS :

These keys are used to select between one of three operating modes. Pressing these keys brings up the selection of modes onto the 4th line of the display. The desired selection can be chosen by moving the cursor using the arrow keys and then pressing ENTER. The GO key will execute the entered selection. Modes can be selected independently for the Ps and Pt outputs.

For more information on Mode Selection please refer to Section 3.2.4.

2.2 REAR PANEL

The rear panel of the 6500-HA is shown in Figure 2.2 The various components of the front panel are described below.

[1] Vacuum Port (2 each)

These ports are used for connecting a vacuum supply to the 6500-HA. A vacuum supply of 0.3 inHg absolute or lower is ideal, and must be connected to **both** vacuum ports for proper operation. The vacuum supply must be capable of achieving a pressure that is at least 0.5 inHg lower than the lowest desired controllable pressure on the 6500-HA; i.e. if the lowest controllable pressure is 2.0 inHg absolute then the vacuum supply must be capable of generating 1.5 inHg absolute or lower.

Caution: If an oil-based vacuum pump is used then do not turn off the pump while it is still connected to the vacuum port of the 6500-HA, as this may cause severe damage to the 6500-HA.

[2] Pressure port (2 each)

These ports are used for connecting the pressure supply to the 6500-HA. A clean, **DRY AIR** (not Nitrogen) pressure supply of 110 inHg absolute (80 inHg gauge or 40 psig) is ideal, and must be connected to **both** pressure ports for proper operation. The pressure supply must be at least 5 inHg higher than the highest desired controllable pressure on the 6500-HA.

Caution: Do not turn off the 6500-HA while the pressure supply is connected to it, as this may cause severe damage to the 6500-HA and/or the UUT.

Caution: The pressure supply must be clean, Dry Air only. Using any other medium will cause significant accuracy errors.

[3] IEEE-488 port

If the "IEEE" option is provided on the 6500-HA, a standard 24-pin female IEEE-488 interface connector is available on the rear panel. Remote communication with the 6500-HA is possible through this interface. For more details on using this interface, please refer to Section 8.

[4] RS232 interface connector:

The connector is a standard DB-9 female connector used for a serial RS232 interface. It can be connected directly to the "COM" port of a standard PC to allow communication. This port is normally used for downloading "profiles" from a computer. Other remote communication with the 6500-HA is also possible through this interface. For more details on downloading profiles, please refer to Section 4. For more details on communication with the 6500-HA, please refer to Section 8.

[5] AC input connector and Fuse

A 5x20 mm fuse is located inside the fuse holder. The fuse is a time-delay fuse with a rating of 1.0 amp, 250 Volts.

The 6500-HA will accept AC voltages between 90-260 VAC, 47-440 Hz. Typical power consumption is less than 80 VA.

Caution: A power cord with a suitable Earth connection must be used to power the 6500-HA to prevent the possibility of a shock hazard.

[6] Circulating Fan intake

The intake for the circulating fan must not be blocked. Periodically, the filter on this intake must be cleaned.

SECTION 3

UNDERSTANDING THE 6500-HA

Note: Pt = Pitot and Ps= Static

The 6500-HA is typically used to calibrate and check air data instruments like altimeters, climb indicators, and airspeed/ Mach indicators in an instrument shop. This section will explain how to use the 6500-HA to perform these functions.

3.1 START UP

- Step 1: Open one of the Ps test ports and one of the Pt test ports to ambient
- Step 2: Connect power to the 6500-HA and turn it ON.
- Step 3: Connect the pressure supply to the Pressure port of the 6500-HA. Connect the vacuum supply to the Vacuum port of the 6500-HA.

Note: DO NOT connect the pressure or vacuum supplies until the 6500-HA has been turned ON.

DO NOT connect any UUT to the test ports.

The 6500-HA will turn ON with two beeps. The display will briefly show the sign-on screen and then go into the Main screen. The Main screen should appear as follows:

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

The Actual values shown on line 2 will be different from the ones shown above. The 4th line should be blank.

Before actually using the 6500-HA to perform certain tasks, it is important to understand how to use the 6500-HA to make it do what you want. This section explains everything about the information that you see on the display, what it means, and

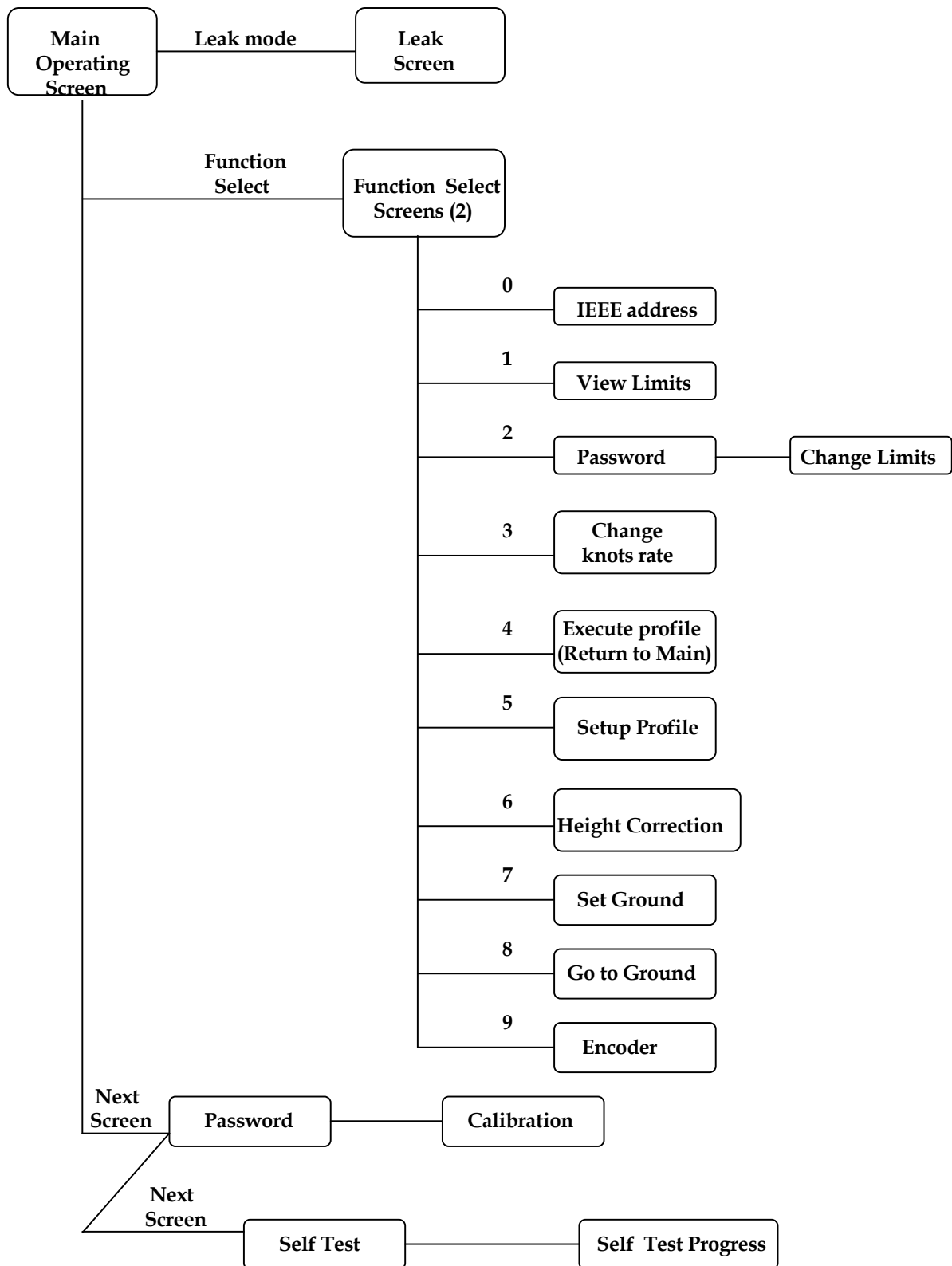


Figure 3.1

how to change all the parameters that are shown on the display. As we proceed through the explanations, it will become clearer as to how the 6500-HA actually operates.

Interaction with the 6500-HA is done through several different screens that are displayed.. All the screens are shown in Figure 3.1. Of the screens shown in Figure 3.1, the Self Test screen is used only at startup, all the Function Select screens are used only a few times during normal operation and also when first setting up the 6500-HA. The Calibrate screen is used only once a year by the calibration facility. During normal operation, the two screens that are used the most are the Main Operating screen (Main Screen) and the Leak Screen. All the different screens, except the calibration screen, are explained in this section. The Calibration screen is explained in section 6.

3.2 MAIN OPERATING SCREEN

Most of the operation of the 6500-HA is done in the Main Screen. All the pertinent parameters are displayed on this screen. The screen is also used to change Target values, Units, and Modes. The following sub-sections explain the various uses of the Main Screen.

3.2.1 DISPLAYED PARAMETERS

There are 11 basic parameters of importance while using the 6500-HA. Each of these parameters is displayed on the Main Screen. Each parameter is explained below and highlighted in a sample screen.

Parameter 1. Pitot Units: Unit of measurement for displaying the Pitot output. Normally, the Pitot unit used is 'Knots' for displaying airspeed. Other possible units for displaying the Pitot output are shown in section 3.2.3, which also explains how to select a particular unit. The currently selected Pitot unit is shown on the first line of the display (as shown below). The two values (101.2 and 20.0) that appear below it are in these units.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 2. Static Units: Unit of measurement for displaying the Static output. Normally, the Static unit used is 'Feet' for displaying altitude. Other possible units for displaying the Static output are shown in section 3.2.3, which also explains how to select a particular unit. The currently selected Static unit is shown on the first line of the display (as shown below).

The two values (1005 and 0) that appear below it are in these units.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 3. Climb Units: Unit of measurement for displaying the rate of change of the Static output, or Climb. Normally, the climb unit used is 'Feet/min' for displaying rate of change of altitude. These units cannot be independently chosen. Whatever the unit selected for the Static output, the climb unit is the per-minute rate of that selected Static unit. If the Static unit selected is 'inHg' then the climb unit will be 'inHg/min'. The currently selected climb unit is shown on the first line of the display (as shown below). The two values (3500 and 3000) that appear below it are in these units.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 4. Pitot "Actual" value: This is the current pressure measured at the Pitot output (Pt test port), displayed in the current units. In the sample screen shown below, the current pressure at the Pitot output is 101.2 knots. This value is updated every 0.25 seconds.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 5. Static "Actual" value: This is the current pressure measured at the Static output (Ps test port), displayed in the current units. In the sample screen shown below, the current pressure at the Static output is 1005 Feet. This value is updated every 0.25 seconds.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 6. Climb “Actual” value: This is the current rate of change of pressure measured at the Static output (Ps test port), displayed in the current units. In the sample screen shown below, the current rate of change of pressure at the Static output is 3500 feet/min.. This value is updated every 0.25 seconds.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 7. Pitot “Target” value: This is the value that you command the 6500-HA to achieve on the Pitot output (Pt test port). In the sample screen below, the 6500-HA has been commanded to achieve a pressure of 20.0 knots on the Pitot output. The Pitot “Target” value is meaningful only when the Pitot output is in the “Control” mode. This is explained later in this section. How to change the Pitot “Target” value is explained in section 3.2.2.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 8. Static “Target” value: This is the value that you command the 6500-HA to achieve on the Static output (Ps test port). In the sample screen below, the 6500-HA has been commanded to achieve a pressure of 0 Feet on the Static output. The Static “Target” value is meaningful only when the Static output is in the “Control” mode. This is explained later in this section. How to change the Static “Target” value is explained in section 3.2.2.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 9. Climb “Target” value: This is the value that you command the 6500-HA to achieve as the rate of change of pressure (climb/dive) on the Static output (Ps test port). In

the sample screen below, the 6500-HA has been commanded to achieve a climb of 3000 Feet/min. on the Static output. A dive would be indicated by a negative value. The Climb “Target” value is meaningful only when the Static output is in the “Control” mode. This is explained later in this section. How to change the Climb “Target” value is explained in section 3.2.2.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 10. Pitot Mode: The Pitot output (Pt test port) can be in one of three modes –

Measure (“M”), Leak (“L”), or Control (“C”).

In the Measure mode, the pressure at the Pitot output is simply being measured and displayed as the “Actual” value in the current Pitot units. The pressure is not being changed by the 6500-HA. In this mode, the Pitot valve inside the 6500-HA that is used to change the pressure at the Pitot output is pneumatically isolated from the Pitot output. In the Measure mode, the Pitot “Target” value is meaningless, since the 6500-HA is not trying to achieve any specific target value.

The Leak mode is pneumatically identical to the Measure mode. When either (Pitot or Static) output is in Leak mode, the screen changes from the Main Operating screen to the Leak screen. The Leak screen is detailed in section 3.3.

When the Pitot output is in the Control mode the 6500-HA is actually attempting to achieve the Pitot “Target” value. The Pitot control valve inside the 6500-HA is now connected to the Pitot output and is actually increasing or decreasing the pressure to achieve and maintain the “Target” value.

For an explanation of how to change the Pitot mode between Measure, Leak and Control, please refer to section 3.2.4.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Parameter 11. Static Mode: The Static output (Ps test port) can be in one of three modes –

Measure (“M”), Leak (“L”), or Control (“C”).

In the Measure mode, the pressure at the Static output is simply being measured and displayed as the “Actual” value in the current Static units. The pressure is not being changed by the 6500-HA. In this mode, the Static valve inside the 6500-HA that is used to change the pressure at the Static output is pneumatically isolated from the Static output. In the Measure mode, the Static “Target” value is meaningless, since the 6500-HA is not trying to achieve any specific target value.

The Leak mode is pneumatically identical to the Measure mode. When either (Pitot or Static) output is in Leak mode, the screen changes from the Main Operating screen to the Leak screen. The Leak screen is detailed in section 3.3.

When the Static output is in the Control mode the 6500-HA is actually attempting to achieve the Static “Target” value. The Static control valve inside the 6500-HA is now connected to the Static output and is actually increasing or decreasing the pressure to achieve and maintain the “Target” value.

For an explanation of how to change the Static mode between Measure, Leak and Control, please refer to section 3.2.4.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	

Split Screen: The Main operating screen displays all 11 parameters conveniently. The screen can actually be divided into 2 halves, the left half shows all the 4 Pitot parameters, whereas the right half shows all the 7 Static parameters. The sample screens below shows this separation.

		Pitot half					
Units:		knots	Feet/min	Feet			
Actual:	M	101.2	3500	1005	M		
Target:		20.0	3000	0			

		Static half		
Units:	knots	Feet/min	Feet	
Actual:	M 101.2	3500	1005	M
Target:	20.0	3000	0	

The Main operating screen will be used almost all the time during normal operation for commanding target values, viewing actual values, setting units and modes.

Error Messages: The Main screen is also used to display error conditions as they occur. The errors are displayed on the last (4th) line of the display, as shown below.

Units:	knots	Feet/min	Feet	
Actual:	M 101.2	3500	1005	M
Target:	20.0	3000	0	
Error 5: Pitot target exceeds limits				

Profile Execution: When a “profile” is being executed, the 4th line of the display will indicate the profile number and the point in the profile. A sample screen is shown below, where point number 12 of profile number 3 is being executed. Notice that this sample screen shows some of the values to be different from our previous sample screens. The essence of using profiles is that all the 7 parameters can be changed simply by moving to the next point in the profile, eliminating the need to perform a lot of data entry.

Units:	knots	Feet/min	Feet	
Actual:	C 101.2	3500	1005	C
Target:	200.0	6000	5000	
Executing Profile 3.12 Lear-55 ADC				

For more information on profiles, please refer to Section 4.

3.2.2 TARGET VALUE ENTRY

Note: Target values are maintained through a power OFF/ON cycle.

Pitot target value : A Pt or airspeed target value can be entered using the Pt/AIRSPEED key. On pressing this key the target value field for Pt gets put into reverse video. The 6500-HA is now awaiting numeric entry from the operator. While this new value is being entered, the old target value is still effective and does not in any way affect the Pitot output. After the Pt/AIRSPEED key is pressed, the display will appear as shown below.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:			3000	0	

Use the numeric keys to enter the value. Use the +/- key to change the sign of the value. The 6500-HA will beep on every key entry, and it will beep for a longer time period if extra invalid digits are entered. It is not necessary to enter the decimal point and the digit after the decimal point if that digit is "0". That is, if you want to enter the number "200.0" you may enter just "200" and leave out the "." And the "0". After entering "200" the display will appear as shown below.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		200	3000	0	

If a mistake is made during entry, it can only be corrected by using the CLR key to clear the entry and re-entering the value. When the desired value is input into the value entry field, press ENTER and the value will blink. The trailing decimal and '0' will automatically get added. In the sample screen below the "200.0" is shown shadowed to indicate "blinking".

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		200.0	3000	0	

The value will continue to blink until the GO key is pressed. Only after the GO key is pressed,

will the value become effective.

If you change your mind and want to abort the new value entry, press CANCEL to exit the value entry mode. You can press CANCEL even when the value is blinking. In the above example, if you were to press CANCEL the old Pt target value of 20.0 will remain effective.

If there is an error in the value being entered then that error will be displayed on line 4 of the display. To clear the error, enter CANCEL or CLR. This will also erase the erroneous value and the previous value will stay in effect. Most errors are caused because a value entered is outside the limits.

If the new value does not blink after pressing ENTER and no error message appears, then there is a communication problem between the Remote unit and the main unit. Please abort and contact the factory.

If GO is pressed after ENTERING the value, the 6500-HA will try to achieve this new target value **ONLY IF** the Pitot output is in the CONTROL mode. Therefore, it is desired that both Pitot and Static values be entered so that both are blinking before the GO key is pressed.

Static target value: For entering Ps or altitude target values, press the Ps / ALTITUDE key and then follow the same process as described above.

Rate/ Climb target value: For entering Rate or CLIMB target values, press the RATE / CLIMB key and then follow the same process as described above.

Note that while entering Climb values, it is NOT necessary to include the sign of the rate of climb. The 6500-HA will automatically determine the direction of the rate of change. The displayed actual value will, however, indicate with a minus sign that the rate of change is a descent instead of a climb.

Target Rate in inHg/min or mbar/min

When operating the tester in units of inHg or mbar, there are two important points to keep in mind.

- a. The target rate (inHg/min or mbar/min) is valid for both Static and Pitot outputs
- b. The target rate (inHg/min or mbar/min) is limited by the target altitude rate. This means that the target altitude rate (in feet/min) is never exceeded, regardless of the target rate in inHg/min or mbar/min.

Target Value Jog

Each of the three target values can be jogged up or down in small increments by using the arrow keys. This is done to help the operator achieve a perfect reading on the instrument in the aircraft, by bumping the set-point in small increments.

To jog a value, select the value by pressing the appropriate target value key and then use the arrow keys. The selected target value can be “jogged” with the arrow keys until any key other than the arrow keys is pressed. Each time the arrow key is pressed, the selected target value will be incremented (UP arrow) or decremented (DOWN arrow) by a specific amount, depending on the units of the target value.

The increments for the different units are as follows:

<u>Pt units</u>	<u>Ps units</u>	<u>Climb units</u>
Knots: 1	Feet: 1	feet/min: 10
mach: 0.001	Psin: 0.001	inhg/min: 0.01
PtinHg: 0.001	mtrs: 1	mtrs/min: 10
QcinHg: 0.001	mbar: 0.01	mbar/min: 0.1
Ptmb: 0.01		
Qcmb: 0.01		
mph: 1		
kmph: 1		
EPR: 0.001		

Use of the HOLD key

While the Pitot and Static outputs are moving towards their targets, the HOLD key may be pressed to hold the outputs at their current Actual value. This allows the user to indefinitely hold the outputs at their current value (regardless of leaks) while attending to other issues. When the “Hold” is in effect, this is indicated by all the Target values continuously being blinked (flashing on/off). To release the hold and continue ramping towards the target, the HOLD key needs to be pressed again.

3.2.3 UNITS SELECTION

Note: Selected Units are maintained through a power OFF/ON cycle

Pitot Units: There are nine units to select from on the Pt output. The units are: knots, Mach, Pt inHg, Qc inHg, Pt mbar, Qc mbar, miles per hour (mph), kilometers per hour (kmph), and

Engine pressure ratio (EPR). EPR is defined as the ratio of Pt to Ps and is unit-less. Any of these units can be selected by pressing the Pt units key. The choices will appear on line 4 of the display, four at a time. The cursor is placed under the first choice. The arrow keys can be used to move the cursor. The UP ARROW key moves the cursor left, the DOWN ARROW key moves the cursor right. AS the cursor moves past the last selection, the next selection will be displayed. The sample screen below shows the different Pt units, with the cursor under "knots".

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	
Pt units :	knots, Mach, PtinHg, QcinHg,				

When the cursor is moved past QcinHg , line 4 of the display will look like this:

Pt units : Mach, PtinHg, QcinHg, <u>Pt</u>mbar,				
-------------------	---	--	--	--	--

Each time the cursor is moved right, the displayed units will scroll left. When the cursor is moved to the last selection, line 4 will look like this:

Pt units : Qcmbar, Mph, Kmph, <u>EPR</u>.				
-------------------	--	--	--	--	--

Select the desired units by moving the cursor to the unit of choice and then press ENTER. The new units will be displayed on the screen and will blink. Also, the actual and target values will get converted into the new units and the target value will blink. This is shown in the sample screen below where the units of Mach have been selected.

Units:		Mach	Feet/min	Feet	
Actual:	M	0.136	3500	1005	M
Target:		0.064	3000	0	

The unit selection will not become effective until the GO key is pressed. The 6500-HA will return to the old units if the CANCEL key is pressed. .

Static Units: There are four Ps units to choose from: Feet, Ps inHg (Psin), meters, and mbar (Psemb). When a particular unit is selected, the units for climb automatically changes to selected units/minute. Any of these units can be selected by pressing the Ps Units key. Line 4 of the display will show all four units, with the cursor under "Feet". The arrow keys can be

used to move the cursor. The UP ARROW key moves the cursor left, the DOWN ARROW key moves the cursor right. The sample screen below shows the different Ps units, with the cursor under "Feet".

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	
Ps units :	Feet, Psin, mtrs, Psmb				

Select the desired units by moving the cursor to the unit of choice and then press ENTER. The new units will be displayed on the screen and will blink. Also, the actual and target values, both for Static and Climb will get converted into the new units and the target values will blink. This is shown in the sample screen below where the units of "PsinHg" have been selected.

Units:		knots	PsinHg/min	PsinHg	
Actual:	M	101.2	8.345	28.986	M
Target:		20.0	10.000	29.054	

The unit selection will not become effective until the GO key is pressed. The 6500-HA will return to the old units if the CANCEL key is pressed. .

It must be noted that the units change does not perform a conversion between the units of feet/minute or meters/minute to Ps inHg/min or Ps mbar/min. The target values for inHg/min and mbar/min are distinct from feet/min and meters/min. The values do get converted between feet/min and meters/min. They also do get converted between inHg/min and mbar/min.

3.2.4 MODE SELECTION

Note: Mode selections are NOT maintained through a power OFF/ON cycle. The unit always powers ON with both Pitot and Static outputs in the Measure mode.

Pitot Mode : The Pitot output has three modes of operation. The three mode are Measure (M), Leak (L) and Control (C). The power-up mode defaults to Measure (M). To change the mode press the Pt Mode key. The three modes will be displayed on line 4 of the display, with the cursor under the Measure mode. The UP ARROW key can be used for moving the cursor left and the DOWN ARROW key can be used to move the cursor right. The cursor wraps around the selections, that is, moving the cursor left past "MEAS" wraps it around to "CTRL". The sample screen below shows the three mode choices displayed on line

4 of the display, with the cursor under "MEAS".

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	
Pt mode :	<u>MEAS</u>, LEAK, CTRL				

Move the cursor to the desired mode and then press ENTER. The selected mode is displayed on the screen and blinks until the GO key is pressed. The new mode will not become effective until the GO key is pressed. The sample screen below shows the selected Pitot mode as "LEAK". Notice that the "L" on the left in line 2 is blinking.

Units:		knots	Feet/min	Feet	
Actual:	L	101.2	3500	1005	M
Target:		20.0	3000	0	

Important note: When either the Pitot or Static Mode is changed to Control (C), BOTH Pitot and Static outputs are automatically changed to Control. During normal operation you want both Static and Pitot outputs connected to the UUT (or PLUGGED if not connected to a UUT) and both of them achieving a specific target value. Leaving one output in Measure or Leak and the other output in Control should be done only during a Leak check.

Static Mode: The Static output has three modes of operation. The three mode are Measure (M), Leak (L) and Control (C). The power-up mode defaults to Measure (M). To change the mode press the Ps Mode key. The three modes will be displayed on line 4 of the display, with the cursor under the Measure mode. The UP ARROW key can be used for moving the cursor left and the DOWN ARROW key can be used to move the cursor right. The cursor wraps around the selections, that is, moving the cursor left past "MEAS" wraps it around to "CTRL". The sample screen below shows the three mode choices displayed on line 4 of the display, with the cursor under "MEAS".

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	M
Target:		20.0	3000	0	
Ps mode :	<u>MEAS</u>, LEAK, CTRL				

Move the cursor to the desired mode and then press ENTER. The selected mode is displayed on the screen and blinks until the GO key is pressed. The new mode will not become effective until the GO key is pressed. The sample screen below shows the selected Static mode as "LEAK". Notice that the "L" on the right in line 2 is blinking.

Units:		knots	Feet/min	Feet	
Actual:	M	101.2	3500	1005	L
Target:		20.0	3000	0	

Important note: When either the Pitot or Static Mode is changed to Control (C), BOTH Pitot and Static outputs are automatically changed to Control. During normal operation you want both Static and Pitot outputs connected to the UUT (or PLUGGED if not connected to a UUT) and both of them achieving a specific target value. Leaving one output in Measure or Leak and the other output in Control should be done only during a Leak check.

The 'MEASURE' to 'CONTROL' transition

When either a Pitot or Static output is changed from Measure or Leak to Control mode, a sequence of events takes place that needs explaining. Since the controlling portion of the 6500-HA is isolated from the output during Measure or Leak modes, it will usually be at a pressure quite different from that at the output. Simply introducing the controlling section into the pneumatic system connected to the output will cause a surge in pressure (or vacuum) at the output. To prevent such a surge, the 6500-HA measures the pressure at the output, shuts-off the output from the internal 6500-HA pneumatics, and then controls the pressure within the internal control mechanism to match the pressure at the output. Once this is done, the 6500-HA controlling section is connected to the output. This process is termed as Equalization.

While the 6500-HA is undergoing this process, the term 'EQZN' is displayed on the main screen in place of the "Actual" value. The whole process usually takes about 15 seconds or less to complete. During the 'EQZN' process, the Main Operating screen will appear as shown below.

Units:		knots	Feet/min	Feet	
Actual:	C	EQZN	EQZN	EQZN	C
Target:		20.0	3000	0	

Once the Equalization process is complete, the Actual values appear on the Main Screen. Following the Equalization process, *only* when the actual value on the Static output is less than 2000 feet from Ground and the Pitot output is less than 150 knots, the 6500-HA will automatically inject a small vacuum on the Static output and a small pressure on the Pitot output. This is done to determine the volume of the Pitot and Static system of the UUT, so that the 6500-HA can automatically adjust the gain of it's control mechanism. Due to this, the actual value will always increase in both altitude and in knots for about 5 seconds, regardless of the target value. Once this process is complete, the actual values will move towards the target values.

This process is part of the "Measure" (or "Leak") to "Control" transition, and will take place only when the transition to "Control" takes place within 2000 feet of Ground and 150 knots.

3.3 LEAK SCREEN

Although most of the operation of the 6500-HA will be performed while in the Main Operating Screen described above, at times, the Leak Screen is also accessed.

If **BOTH** Pitot and Static outputs are simultaneously put into the "Leak" mode, the display changes to a special Leak screen that is explained below in Section 3.3.1: Timed-Leak Screen.

When **ONLY ONE** of the Pitot or Static outputs is put into the "Leak" mode, the display changes to the Leak Screen (after pressing GO). A sample Static Leak Screen is shown below.

Start: 5000 feet	Instant Leak rate
Curr: 4990 feet	30 Feet/m
Timer: 00:20	Per min. Leak rate
Pt = 200 kts	WAIT Feet/m

A sample Pitot Leak Screen is shown below.

Start: 200.0 kts	Instant Leak rate
Curr: 199.5 kts	1.5 knots/m
Timer: 00:20	Per min. Leak rate
Ps = 0 feet	WAIT knots/m

The parameters shown in the Leak Screen are:

- a. Start: This is the reading at which the leak test was started.

- b. Curr: This is the current reading of the output being leak checked
- c. Timer: Shows the elapsed time of the leak test in minutes and seconds
- d. Pt: (Ps:) Shows the actual value of the output that is **not** in leak test.
- e. Instant Leak rate: Shows the instantaneous rate at which the output is leaking. For the Static leak check this number is updated every 0.25 seconds and shows "0" for leaks less than 20 ft/min. For the Pitot leak check this number is updated every 3 seconds.
- f. Per min. leak rate: This is the amount the output has leaked in the past full minute. It is updated at the end of every minute on the timer. Until the first minute has elapsed it shows "WAIT".

While in the Static Leak Screen, if the leak ever exceeds 2000 ft/min, the 6500-HA will automatically trip out of the Leak mode and revert back to Control mode. It will then display a message as follows:

**Static leak exceeds 2000 ft/min.
Returning STATIC to Control Mode.
Please press "GO"**

While in the Pitot Leak Screen, if the leak ever exceeds 50 knots/min, the 6500-HA will automatically trip out of the Leak mode and revert back to Control mode. It will then display a message as follows:

**Pitot leak exceeds 50 knots/min.
Returning PITOT to Control Mode.
Please press "GO"**

When either of these warning messages is displayed, press GO, which will bring up the Main Operating Screen. At this point it is recommended to go back to GROUND and to Measure mode on both outputs and fix the leak before proceeding further.

It is important that each output be put into the Leak mode independently. That is, when the Pitot system needs to be checked for leaks, only the Pitot output should be in Leak mode, keeping the Static output in Control mode. When the Static system needs to be checked for leaks, only the Static output should be in Leak mode, keeping the Pitot output in Control mode.

Pressing the CANCEL key allows you to exit from the Leak Screen, back to the Main Operating Screen. If the mode prior to entering the Leak mode was Control then the 6500-HA will revert back to Control mode on exiting the Leak Screen.

3.3.1 TIMED-LEAK SCREEN

When both Pitot and Static outputs are simultaneously put into Leak mode, then the leak screen displays the leak values in a timed-leak format as shown below. The sample screen shown below assumes the following:

- a. Units are set to knots and feet
- b. Leak timers are set for 1, 2 and 3 minutes
- c. The leak-check was started at 100 knots and 15000 feet
- d. The elapsed leak time is 3 minutes and 5 seconds

98.8 knots	-27 ft/min.	14903 feet
1m: 99.5 / -0.5		14965 / -35
2m: 99.1 / -0.9		14932 / -68
3m: 98.8 / -1.2	3:05	14905 / -95

The first line shows the current Actual values. The second line shows the Actual values and total leak at the end of 1 minute. The third line shows the Actual values and total leak at the end of 2 minutes. The fourth line shows the Actual values and total leak at the of 3 minutes. The fourth line also shows the elapsed leak time in the “mm:ss” format, in the center of the line.

When both Static and Pitot are in leak mode and the you first enter the Leak screen, it looks like the sample screen below. Since the elapsed time is at 0:00, only the current Actual values are displayed, and an arrow points to the first leak-timer setting, which is shown to be 1 minute. The arrow indicates that the first leak-timer value may be changed at this point, if necessary.

Changing leak-timer values:

The leak-timer value can be changed by using the Up-Arrow and Down-Arrow keys. If neither of these keys is pressed before the elapsed time reaches 10 seconds, then **all three** leak-timer values are maintained at their current setting and the arrow is cleared from the display. The 1st leak-timer value can be adjusted between 1 and 18 minutes.

100.0 knots	0 ft/min.	15000 feet
1m: ←		
2m:		
3m:	0:00	

To accept the setting of the 1st leak-timer and move the arrow to the 2nd leak-timer, press ENTER. The screen will appear as below. Change the 2nd leak-timer value if desired, using the Arrow keys. The leak-timer value must be changed before the elapsed time reaches 58 seconds. The 2nd leak-timer value can be adjusted between 2 and 19 minutes.

100.0 knots	0 ft/min.	15000 feet
1m:		
2m: ←		
3m:	0:08	

To accept the setting of the 2nd leak-timer and move the arrow to the 3rd leak-timer, press ENTER. The screen will appear as below. Change the 3rd leak-timer value if desired, using the Arrow keys. The leak-timer value must be changed before the elapsed time reaches 58 seconds. The 3rd leak-timer value can be adjusted between 3 and 20 minutes.

100.0 knots	0 ft/min.	15000 feet
1m:		
2m:		
3m: ←	0:15	

To accept the setting of the 3rd leak-timer and complete the leak-timer settings, press ENTER. The arrow will be cleared from the display.

It is highly recommended that the leak-timer values be checked and adjusted, if necessary, when the unit is first turned ON, by putting both Pitot and Static outputs into Leak mode simultaneously. This will prevent having to set them when the aircraft is actually being leak-checked.

The leak-timer values are maintained through a power OFF cycle.

How the Timed-Leak screen is updated:

The first line of the screen, which shows the current Actual values, is updated every 0.25 seconds. The elapsed time is updated every second.

Assuming that the leak-timers are set to 1, 2 and 3 minutes, when the elapsed time reaches 1:02 (2 seconds after the elapsed time reaches the first leak-time) , the leak screen will be updated and appear as shown below. The second line shows that at the end of 1 minute the knots value leaked to 99.5 knots and the accumulated leak in 1 minute was -0.5 knots, since the knots value at the start of the leak check was 100 knots. The second line also shows that at the end of 1 minute, the altitude was at 14965 feet and the accumulated leak in 1 minute was -35 feet, since the altitude was at 15000 feet at the start of the leak check.

99.5 knots	-33 ft/min.	14964 feet
1m: 99.5 / -0.5		14965 / -35
2m:		
3m:	1:02	

When the elapsed time reaches 2:02, the leak screen is updated again. The third line shows that at the end of 2 minutes the knots value leaked to 99.1 knots and the accumulated leak in 2 minutes was -0.9 knots, from the start value of 100 knots. The third line also shows that at the end of 2 minutes, the altitude was at 14932 feet and the accumulated leak in 2 minutes was -68 feet, from the start value of 15000 feet.

99.1 knots	-30 ft/min.	14931 feet
1m: 99.5 / -0.5		14965 / -35
2m: 99.1 / -0.9		14932 / -68
3m:	2:02	

When the elapsed time reaches 3:02, the leak screen is updated again. The fourth line shows that at the end of 3 minutes the knots value leaked to 98.8 knots and the accumulated leak in 3 minutes was -1.2 knots, from the start value of 100 knots. The fourth line also shows that at the end of 3 minutes, the altitude was at 14905 feet and the accumulated leak in 3 minutes was -95 feet, from the start value of 15000 feet.

98.8 knots	-27 ft/min.	14904 feet
1m: 99.5 / -0.5		14965 / -35
2m: 99.1 / -0.9		14932 / -68
3m: 98.8 / -1.2	3:02	14905 / -95

After the 4th line is updated, the leak screen will continue to update the current Actual values on line 1 and the elapsed time on line 4. The remaining information will remain unchanged so that the user can note down the values at a later time, before exiting the leak screen.

3.4 SELF TEST SCREEN

As part of the start up procedure, it is recommended that a Self Test be performed on the 6500-HA. Before performing the Self Test you must follow the start up procedure explained in section 3.1. The Main Operating Screen must be displayed on the Remote unit. There should be no errors displayed on line 4 of the display. If there are errors on line 4 of the display, press CANCEL to clear each error as it appears, until line 4 is clear.

Now press NEXT SCREEN twice. The display will show the screen shown below.

SELF TESTS
Vent Ps and Pt ports to ambient
Turn On pressure and vacuum supplies
Then press "GO"

There are seven tests performed on the system. These tests check every subsystem for acceptable operation. If a malfunction is detected in any part of a subsystem, that subsystem is flagged as defective. Once a defective subsystem is detected, the self test function is aborted. Therefore, if more than one subsystem is defective, the first defective subsystem will cause the tests to abort, thereby preventing the user from detecting the flaws in the other malfunctioning subsystems.

The tests are performed on the following subsystems:

1. System ROM.
2. System RAM.
3. Ps pressure measurement system
4. Pt pressure measurement system
5. Pressure and Vacuum pump assembly
6. Ps pressure control system
7. Pt pressure control system.

To start the Self Test, please make sure that the Pitot and Static outputs are open to ambient, and then press GO. The status of each test will be displayed on the screen as shown below.

ROM OK	RAM OK
Ps measurement system OK	
Pt measurement system OK	

After the pump section test has passed successfully, the screen is cleared and the status of the remaining tests is displayed as shown below.

Pump section OK
Ps control system OK
Pt control system OK. Tests successful.

After the tests have been completed successfully, press the CANCEL key to return to the Main Operating Screen.

If any of the tests fail, then note the failure, turn OFF the unit and contact the factory.

3.5 FUNCTION SELECT SCREEN

There are 10 different functions that can be performed. These are:

0. Set IEEE address
1. View Limits
2. Set or Change Limits
3. Set or Change the knots rate
4. View or Execute profiles
5. Setup profiles
6. Height Correction
7. Set Ground
8. Go To Ground
9. Encoder

Pressing the "Function Select" key on the keypad allows you to go into the function select screen which is shown below.

Select function	(DN ARROW for functions 4 to 9)
0. IEEE address = 5	
1. View limits	2. Set limits
3. Set knots rate ... now at 500.0 kts/min	

If you want to select functions 4 through 8, press the Down Arrow key on the keypad to move to the screen shown below.

Select function	(UP ARROW for functions 1 to 3)
4. Execute profile	5. Set profiles
6. Height Correction	7. Set "Ground"
8. Go to "Ground"	

Once in the correct screen, select a number to go to the desired function. An explanation of each of the functions is given below.

3.5.0 FUNCTION 0: IEEE ADDRESS

This function allows the user to enter a valid IEEE-488 address for the 6500-HA. This address is meaningful only if the "IEEE" option is provided on the 6500-HA. A valid address between 1 and 30 may be entered on the screen shown below.

Current IEEE addr = 5
New IEEE addr = ██████.

3.5.1 FUNCTION 1: VIEW LIMITS

The 6500-HA checks both the Target values and the Actual values to determine if they are within specific limits. These limits can be set by the user. To view these limits, you can press the Function Select key and then choose Function 1 (View Limits) by pressing "1". The VIEW LIMITS screen appears as shown below.

VIEW LIMITS	
1. max. knots = 500.0	4. max. feet = 50000
2. min. knots = -200.0	5. min. feet = -2000
3. max. mach = 1.000	6. max. ft/min.= 6000

To exit from this screen, press CANCEL.

For an explanation of the limits please refer to the "Set Limits" function.

3.5.2 FUNCTION 2: SET LIMITS

To set the limits, press 2 on the Function Select screen. Access to the "Set Limits" screen is protected by means of a password. Enter the password followed by the ENTER key on the screen shown below.

SET LIMITS	
Please enter password :	<input type="password"/>

The correct password will take you into the "Set Limits" screen shown below.

SET LIMITS	
1. max. knots = 500.0	4. max. feet = 50000
2. min. knots = -200.0	5. min. feet = -2000
3. max. mach = 1.000	6. max. ft/min.= 6000

There are six limit values that can be set. These limits are checked when a Target value is entered. If the target value exceeds any of the limits, an error is generated. The Actual values are also checked when the 6500-HA is in the "Control" mode. If any of these limits is exceeded by a pre-defined amount, an error will be generated and the 6500-HA will revert to "Measure" mode.

An explanation of each limit follows:

1. Max. knots : This defines the maximum airspeed that can entered as a Target value or generated as an Actual value. Typically this is set to the maximum airspeed that the UUT can tolerate. The maximum value for this limit is 1100 and the minimum is 0. A typical setting for

this limit is 500.0

2. Min. knots : This limit is usually negative and it defines the maximum “Negative Qc” that the airspeed instruments (UUT) can tolerate. In most cases it should be set to about “-200.0” since almost all airspeed indicators can tolerate at least that much negative Qc. Setting it any closer to “0.0” may cause the limit to be tripped very frequently. The maximum value for this limit is 0 and the minimum is -900.

3. Max. Mach : This limit is usually set to the maximum allowable Mach number that the UUT can tolerate. The maximum value for this limit is 5.0 and the minimum is 0.1 A typical setting for this limit is 1.0.

4. Max. Feet : This limit is usually set to the maximum altitude that the UUT can tolerate. The maximum value is 100,000 and the minimum is 0. A typical setting for this limit is 50,000.

5. Min. Feet : This limit is usually set to the minimum altitude that the UUT can tolerate. It is usually a negative number. The maximum value for this limit is 0 and the minimum is -16,000. A typical setting for this limit is -2000.

6. Max. Ft./min : This limit is usually set to the maximum rate of climb that the UUT can tolerate. The maximum value for this limit is 50,000 and the minimum is 100. A typical setting for this limit is 6000.

To modify a limit, select the limit by entering its serial number (1 to 6). The entry field will be blanked and a new value can be entered into it, followed by the “ENTER” key. The value becomes effective as soon as it is entered. In the screen shown below, “1” was selected to modify the max. knots limit.

Note: To set a negative value, enter the positive value and then press the “+/-” key.

SET LIMITS	
1. max. knots = <input type="text"/>	4. max. feet = 50000
2. min. knots = -200.0	5. min. feet = -2000
3. max. mach = 1.000	6. max. ft/min.= 6000

The CLR key is used to clear the value entered. The CANCEL key is used to exit the SET LIMITS screen.

3.5.3 FUNCTION 3: SET KNOTS RATE

Pressing "3" on the Function Select screen brings you into the "Set Knots Rate" screen. This screen is shown below.

CURRENT RATE = 250.0 knots /min. NEW RATE = <input type="text"/> knots /min. min : 50 , max : 500
--

The knots rate is the rate at which the Actual airspeed value is ramped towards the Target airspeed value. A typical knots rate value of 500.0 is ideal for most operations. Enter the desired value followed by the ENTER key. This will take you into the following screen which shows that a new value of 300.0 was entered. Press GO to return to the Main screen.

Thank you. Press "GO" to continue. NEW RATE = 300.0 knots /min.
--

3.5.4 FUNCTION 4: VIEW & EXECUTE PROFILES

To execute a profile, press Function Select and then press "4". This will bring you back into the Main Screen as shown below. You will need to enter the profile number that you want to execute. A full explanation of profiles is given in Section 4.x

Units:	knots	Feet/min	Feet	
Actual: M	101.2	3500	1005	M
Target:	20.0	3000	0	
ENTER PROFILE NUMBER :	<input type="text"/>			

Assuming you enter a profile number of "2.1", followed by the ENTER key, the first point of profile # 2 will be displayed on the screen. Also, the name of the profile is shown here. This is shown in the screen below. The name of profile 2 is CJ1-RVSM. In this profile note that both Modes changed to "C", and all three target values changed. These parameters were programmed as the first point of profile # 2. You will also notice that the number "2.1" is flashing. This indicates that the current profile point is ready for execution and awaiting the "GO" key to be pressed. When the "GO" key is pressed, the 6500-HA will execute the profile point, i.e. it will change to Control mode and move towards the desired targets.

Units:	knots	Feet/min	Feet	
Actual:	C 101.2	3500	1005	C
Target:	100.0	5000	1000	
ENTER PROFILE NUMBER : 2.1 CJ1-RVSM				

Once the targets have been achieved, you can move to the next profile point by pressing ENTER. Then, the parameter values in point 2 of profile # 2 will be displayed, the profile number will change to "2.2" and will again flash, awaiting the "GO" key.

If you want only to view the profile without executing it, then DO NOT press the "GO" key. Simply press the "ENTER" key to go to the next point in the profile. Each time you press the "ENTER" key, the next profile point will be displayed. When you press the "ENTER" key after the last point in the profile, the Main screen will revert back to its original setting prior to invoking Function 4.

At any time, to exit out of the profile viewing or execution function, press CANCEL and the screen will revert back to the last executed point.

3.5.5 FUNCTION 5: SETUP PROFILES

This function is used to load profiles into the 6500-HA from a PC. A full explanation of how to load profiles into the 6500-HA is provided in Section 4.. The following screen will come up when Function 5 is selected.

<p>PROFILE SETUP Please stay in this screen and download One or more profiles through the RS232 interface. On completion press "GO".</p>

Once the profiles have been loaded, press GO to exit this function.

3.5.6 FUNCTION 6: HEIGHT CORRECTION

This function allows the user to enter the difference in height between the 6500-HA and the Unit Under Test (UUT). This value should normally be 0 unless the 6500-HA is elevated to a height of more than 1 foot above the UUT. A value of between 0 and 50 feet can be entered. The screen appears as shown below.

Current Height Correction = 0 feet
New Height Correction = ██████ feet
Enter new height (0-50) or press CANCEL

3.5.7 FUNCTION 7: SET GROUND

The "Set Ground" function is used to indicate to the 6500-HA the ambient "Ground" pressure. Before connecting the 6500-HA to the UUT, just after the Self Test has been performed, it is recommended that this function be invoked. The Pitot and Static ports must still be open to ambient when using this function. When the "GO" key is pressed in the screen shown below, the 6500-HA will "memorize" the ambient pressure it measures, as the "Ground" pressure. This will be used later when the "Go To Ground" function is invoked.

Press "GO" to Set Ground ;
or press "CANCEL" to exit.

3.5.8 FUNCTION 8: GO TO GROUND

The "Go To Ground" function is used to bring the UUT down to "Ground". The target altitude is set to the value "memorized" in the "Set Ground" function and the target airspeed is set to 20 knots and the 6500-HA ramps towards these targets. Once these targets have been achieved, you must put the 6500-HA into Measure mode on both outputs and only then disconnect the UUT from the 6500-HA. The "Go to Ground" screen is shown below.

Press "GO" to Go To Ground ;
or press "CANCEL" to exit.

When "GO" is pressed, the 6500-HA shows the Main screen. This screen is shown below, with the new targets of 100 knots and 275 feet. This assumes that the "Ground" pressure was 275 feet when the "Set Ground" function was invoked.

Units:		knots	Feet/min	Feet	
Actual:	C	101.2	3500	1005	C
Target:		20.0	5000	275	

3.5.9 FUNCTION 9: ENCODER

This function is valid only when the 6500-HA is provided with the "Encoder" interface option.

When this function is selected, Static units must be "Feet". If not, the following screen will be displayed.

**Static units must be Feet
Press GO to continue**

Pressing "GO" will return you to the Main Screen.

If Static units is "Feet", then the following screen will be shown.

	A1	A2	A4	B1	B2	B4	C1	C2	C4	D4
CODE:	0	0	0	0	1	0	1	1	0	0
FL. LEVEL :	123									
ALT. (ft.) :	12300					1. Target = 12300				

If an altitude encoder is electrically connected to the Encoder interface connector on the rear panel of the 6500-HA (not shown in Fig. 2.2) and is pneumatically connected to the Ps output of the 6500-HA, then the 10-bit code on line 2 and flight level on line 3 will correspond to the altimeter reading.

The value of the target altitude can be changed by pressing "1" followed by the desired value, followed by the ENTER key. The target altitude can be jogged (after pressing "1") using the UP-ARROW and DOWN-ARROW keys on the keypad. Changing the target altitude is meaningful only if the Static output is in "Control" Mode.

The Actual altitude is shown on the left side of line 4. The Actual altitude will change at the commanded VSI that is setup in the Main Screen. As the actual altitude changes to match the target altitude, the flight levels will change and the 10-bit code will change.

If an encoder is not connected to the 6500-HA, the flight level will be blank. If the code received from the encoder is an invalid code, then the flight level will display "XXX".

Exit this function using the CANCEL key.

SECTION 4

PROFILES

Profiles are created in Microsoft Excel and downloaded into the 6500-HA through the COM1 port on your PC using the Hyperterminal program that is normally available on all PC's.

4.1 WHAT IS A PROFILE.

A profile is a set of up to 50 points that tell the 6500-HA what you would want it to do at each point. Each point consists of 7 parameters: 1) Pitot units, 2) Pitot mode, 3) Pitot target value, 4) Static units, 5) Static mode, 6) Static target value and 7) Static rate (Climb) target value. These 7 parameters are defined by you in the Excel program.

A total of 20 such profiles can reside in the 6500-HA at any time. Each profile is identified by a number between 1 to 20 and also a name which can have up to 12 characters. The profile number and the name are also part of the profile that is created in Excel.

A typical profile named "Sample" is shown below as it would appear in Excel.

	A	B	C	D	E	F	G
1	Profile						
2	Sample		3		0		
3	knots	Control	100.0	Feet	Control	0	6000
4	knots	Control	200.0	Feet	Control	0	6000
5	knots	Leak	200.0	Feet	Control	0	6000
6	knots	Control	100.0	Feet	Control	1000	6000
7	knots	Control	200.0	Feet	Control	5000	6000
8	knots	Control	300.0	Feet	Control	10000	6000
9	knots	Control	100.0	Feet	Control	18000	6000
10	knots	Control	100.0	Feet	Leak	18000	6000
11	knots	Control	100.0	Feet	Control	30000	6000
12	knots	Control	100.0	Feet	Control	50000	6000
13	knots	Control	20.0	Feet	Control	Ground	6000
14	knots	Measure	20.0	Feet	Measure	Ground	6000
15	END						

Row 1 always says "Profile". This indicates to the 6500-HA that a profile is to follow.

Row 2 left cell shows the name of the profile. This profile is named "Sample". The name can have up to 12 alphanumeric characters. This name will show up on the 4th line of the

6500-HA display when this profile is executed.

Row 2 middle cell shows the number of the profile. This profile has a number 3. This tells the 6500-HA that this profile is to be loaded in as profile number 3. When profile 3 is executed on the 6500-HA, this "Sample" profile will be executed. This number can be any number between 1 and 20. When this profile is downloaded into the 6500-HA it will overwrite the previous profile that was resident in the 6500-HA as number 3.

Row 2 right cell shows the height correction. This should normally be zero.

Rows 3 through 14 are the points of the profile. This profile has only 12 points. For each of these points the columns contain the following information:

<u>Column</u>	<u>Information</u>
A	Pitot units
B	Pitot mode
C	Pitot target value
D	Static units
E	Static mode
F	Static target value
G	Rate target value

In the sample profile, Row 3, which is the first point in the profile, tells the 6500-HA to go in Control mode to 100 knots on the Pitot side, and in Control mode to 0 feet at 6000 ft/min on the Static side.

Row 4 (point 2) makes the 6500-HA go to 200 knots and 0 feet at 6000 ft/min.

Row 5 (point 3) puts the Pitot side into Leak mode while still keeping Static in Control at 0 feet.

Row 6 (point 4) puts the Pitot side back into Control and takes it down to 100 knots. The Static side is simultaneously moved up to 1000 feet at 6000 ft/min.

Row 7 (point 5) takes Pitot up to 200 knots and Static up to 5000 feet at 6000 ft/min.

Row 8 (point 6) takes Pitot up to 300 knots and Static up to 10,000 feet at 6000 ft/min.

Row 9 (point 7) takes Pitot down to 100 knots and Static up to 18,000 feet at 6000 ft/min.

Row 10 (point 8) keeps Pitot at 100 knots and puts Static into Leak mode while at 18,000 feet.

Row 11 (point 9) keeps Pitot at 100 knots and ramps Static in Control mode to 30,000 feet at 6000 ft/min.

Row 12 (point 10) keeps Pitot at 100 knots and ramps Static to 50,000 feet at 6000 ft/min.

Row 13 (point 11) takes Pitot down to 20 knots and ramps Static back to “Ground” at 6000 ft/min.

Row 14 (point 12) puts both Pitot and Static into Measure mode.

4.2 CREATING A PROFILE

1. Start with opening the “Profile Template.xls” file.
2. Do not change anything on Row 1.
3. On Row 2, left-most cell, replace “Template” with the name of your profile. Limit is 12 characters.
4. On Row 2, middle cell, replace “11” with a profile number between 1 and 20 that you would like this profile to be saved as, in the 6500-HA.
5. Do not change row 2 right-most cell.
6. In rows 3 through 50, change the cells as per the points you want to generate in your test. For entering Units and Modes use the drop down menu selections for those cells. If you do not use all the rows for your profile, select the cells in the unused rows up to row 50 and delete them, shifting the cells up. DO NOT delete rows 51, 52 and 53.
7. Format the cells with values so that they show the correct number of digits after the decimal point. For instance, knots values have 1 digit after the decimal, Mach values have 3 digits after the decimal. Format the cell just like a regular Excel cell with a number. The following table lists the digits after the decimal for the various units. The Static rate (Feet/min etc.) value has the same number of digits after decimal as the Static value.

Pitot units	Digits after decimal	Static units	Digits after decimal
Knots	1	Feet	0
Mach	3	Ps inHg	3
EPR	3	Meters	1
Pt inHg	3	Ps mb	2
Qc inHg	3		
Pt mb	2		
Qc mb	2		
Mph	1		
Kmph	1		

8. Check the values, units and modes in your profile to ensure they are all valid and correct. If you going into the Leak mode at any point, then make sure that you achieve that point in Control mode before you actually change to Leak mode. For example, if you want to perform a Leak at 18,000 feet, then you must have one point

in Control mode which takes the Static port to 18,000 feet, followed by another point where the Static port is put into Leak mode at 18,000 feet.

9. Caution: If you are using Mach on the Pitot side, make sure that while the Static side is moving from a low altitude to a higher altitude, the target Mach number must be kept low (about 0.200). After the higher altitude is achieved, the Mach number can be increased to the desired value. This must be done to prevent a high Mach number at a low altitude causing an excessive airspeed (knots) to be generated. For example, if you want to achieve 0.800 Mach at 30,000 feet, 35,000 feet and 40,000 feet then your profile points must be set up as follows:

Mach	Control	0.200	Feet	Control	30000	6000
Mach	Control	0.800	Feet	Control	30000	6000
Mach	Control	0.800	Feet	Control	35000	6000
Mach	Control	0.800	Feet	Control	40000	6000

Notice how the Mach is kept low until 30,000 feet is achieved. Then it is ramped to 0.800 which would be an acceptable airspeed. Once this first point is achieved you do not have to lower Mach again because for altitudes of 35,000 and 40,000 feet, the same Mach number would actually result in a lower airspeed and the unit will automatically control this without any damage to the UUT.

10. Now that the profile is complete, save the profile as an Excel file (.xls file) using the name of the profile as the filename. Then save it again using the "Save As" command but this time change the file type (using the "Save as type:" drop-down selection) to "Text - Tab delimited". Use the profile name as the filename again. You will get many warnings from Excel about the incompatibility of this text file, but simply say "Yes" to all the warnings. Once you have saved the file as a text file, you will need to close the file. When you do this, many more warnings will pop up. Please say "yes" to all these too.
11. At the end, you should have two files for your new profile. One .xls file and one .txt file, both with the same filename. Your profile has been created.

4.3 SETTING UP HYPERTERMINAL

You download a profile into the 6500-HA using the Hyperterminal program. At first you need to setup Hyperterminal. You only need to do this once.

1. Hyperterminal comes loaded in your PC as part of the accessories. Go into "All Programs", then select "Accessories", then select "Communication", then select Hyperterminal. It will ask you to setup a new connection. Create a new connection with the name "6500-HA". A dialog box named "Connect To" will appear. The bottom selection in this box is "Connect using". From the drop down menu in

“Connect using”, select “COM1”. Select “OK”. A new dialog box will open named “Com1 Properties”. Setup the Port Settings as follows:

Bits per second:	9600
Data Bits:	8
Parity:	None
Stop Bits:	1
Flow control:	None

Select “Apply”. Then select “OK”. This will take you into the “6500-HA Hyperterminal” window.

2. Select “File”. Select “Properties”. A new dialog box “6500-HA Properties” appears. Select the “Settings” tab. In the “Emulation” menu select “ANSI”. Select “OK”. Now you are back in the “6500-HA Hyperterminal” window. Select “File”, select “Save”. Close this window. A warning appears, select “Yes”. Hyperterminal is now setup.
3. To verify that the 6500-HA file is setup in Hyperterminal, select “All Programs” from the desktop, select “Accessories”, select “Communications”, select “Hyperterminal”. The “6500-HA” icon should appear. If it does not appear then you will need to repeat steps 1 and 2 above.

4.4 DOWNLOADING PROFILES

1. Connect the one-to-one RS232 cable to the RS232 port on the 6500-HA. You will need to remove the access panel for this. Connect the other end of this cable to the COM1 port on your PC.
2. Turn on the 6500-HA and select Function 5, Set Profiles. The following screen appears.

PROFILE SETUP
Please stay in this screen and download
One or more profiles through the RS232
interface. On completion press “GO”.

Stay in this screen until all profiles you would like to download have been downloaded.

3. Start the 6500-HA file in Hyperterminal. On the task bar select “Transfer”. Then select “Send Text file”. The dialog box will open that allows you to select the .txt file

you want to transfer. Open this file. You will see the profile being downloaded as it is echoed back from the 6500-HA.

4. After the profile has completed downloading, the last section should say "PASS". If it does not then the profile did not download correctly. If no characters are echoed when you open the .txt file to download then you probably have a communication problem.
5. If you see "garbage" on the first line of the profile as it downloads then you should redo the download. This could happen on some systems on the very first profile you download during a session in Hyperterminal.
6. To download more profiles in the same session simply repeat step 3 from the point you select "Transfer". After all profiles you wish to download have been transferred, press GO on the 6500-HA. Check that the profile loaded properly by selecting Function 4 on the 6500-HA and entering the profile number starting at step 1 (i.e. "18.1" to check profile 18). Step through the profile using only ENTER and check if the points match what you have setup on the PC as your profile.

4.5 EXECUTING A PROFILE

On the 6500-HA, select Function 4: Execute profile. On line 4 on the Main screen, a profile number is required to identify the profile. This number is x.y where x is the profile number and y is the point number within that profile. Since a particular point can be specified, the user can start a profile at any point, not necessarily at point 1. 'x' can have a value between 1 and 20 and 'y' can have a value between 1 and 50.

When a profile number is entered using the ENTER key, the name of the profile will appear to the right of the profile number and the parameters of the particular point in that profile will be displayed on the screen in their respective locations. It will appear as if the user had entered all those parameters from the front panel. The value x.y will flash on line 4 of the display, indicating that the point is ready to be executed. To execute the point press 'GO'. To view the next point in the profile press 'ENTER'. As long as the profile point number is flashing, it will not be executed.

Some of the rules to follow and points to observe while executing profiles are:

1. Press CANCEL to abort a profile. If CANCEL is pressed while the system is moving towards a target value, it will continue to do so. Aborting a profile simply allows the user the freedom to perform all functions possible from the front panel with no restrictions. Operating within a profile restricts the user to follow the profile.

2. Press GO to execute the flashing profile point. Once the 6500-HA achieves the state it has been commanded to go to, it will stay there until the next profile point is invoked (using ENTER) and executed (using GO).
3. Press ENTER to invoke the next profile point. All parameters of the point will be shown on the screen and the point number will flash on line 4. ENTER allows the user to view an entire profile without executing any point. It also allows the user to skip certain points if so desired.
4. Only the ARROW keys are effective during profile execution to allow the user to jog the profile's target values. A new target value cannot be entered while a profile is executing. The existing target value may be jogged up or down in fixed increments as described in section 3.2.2.
5. No other keys are effective. Changing units or modes or target values will require aborting the profile.
6. When a profile goes into leak mode, the Leak Screen will be displayed. The profile will stay in this screen until the user enters CANCEL to exit the leak screen. The 6500-HA returns to the main screen where the user must press ENTER to invoke the next profile point.
7. When the last point in the profile is executed, pressing ENTER will cause line 4 of the display to be cleared. This will be the only indication that the profile has been completed.
8. Each profile can have up to 50 points. There can be 20 profiles resident in the 6500-HA at any one time.
9. New profiles can be loaded any number of times. They have to be numbered 1 to 20 and will overwrite existing resident profiles with the same profile number.
10. Errors during profile execution will cause the profile to abort. It can be restarted by the user at the point where the error occurred, after the error is rectified.
11. If a particular test procedure requires more than 50 points, then these points can be split between 2 or more profiles. For instance, if a transponder test requires 80 points, then the first 50 points can be loaded as profile 1 and the remaining 30 points can be loaded as profile 2. When profile 1 has been completed at point 1.50, the 6500-HA will stay at that point until the next command. The user can start profile 2.1 and execute the 51st point and continue through the remaining 30 points using profile 2.

SECTION 5

TYPICAL USE

This section assumes that the user has read Section 3 and understood the functioning of the 6500-HA. Please do not follow the sequence shown below without first reading Section 3.

The following steps show a typical use of the 6500-HA for checking aircraft instruments.

The following steps must be performed at the start of each day.

1. Open one Ps port and one Pt port to ambient.
2. Turn the 6500-HA ON.
3. Connect the pressure and vacuum supplies AFTER the 6500-HA is ON.
4. Run the SELF TEST.
5. SET GROUND (Function 7).

The following steps must be performed while checking each UUT (Unit Under Test).

6. Ensure that both Pt and Ps ports are in MEASURE mode.
7. Connect the UUT to the Pt and Ps ports. If only one port is to be used (like when testing an altimeter) make sure the unused port is plugged. Plug the spare Ps and Pt ports.

Caution: When testing an airspeed indicator, make sure the Ps port is connected to the Static (Reference) port on the airspeed indicator.

8. GO TO GROUND (Function 8). This puts both Ps and Pt ports into CONTROL mode.
9. Step through the points at which you need to check the UUT. If you have a profile set up then execute the profile at this point.
10. You may go into LEAK mode to perform a leak check on the UUT, but DO NOT go into MEASURE mode since it will not protect you against large leaks in the UUT.
11. When all the test points have been checked, GO TO GROUND.
12. Put both Ps and Pt ports into MEASURE mode.
13. Disconnect the UUT.

If you lose power while performing a test, make sure you disconnect the pressure and vacuum supplies.

During the test, if the Control is erratic, go back to Ground, put both ports in MEASURE mode, check for excessive leaks in the connections to the UUT then proceed from Step 8.

SECTION 6

CALIBRATION

6.1 EQUIPMENT:

This calibration procedure requires the following equipment:

1. Vacuum pump.
2. Pressure supply of clean, dry air at 50 psia
3. Pressure standard having accuracy of at least 0.001 inHg up to 32 inHg and an accuracy of at least 0.002 inHg from 32 inHg to 100 inHg.

6.2 GENERAL NOTES:

The transducers inside the 6500-HA are sensitive to the change in density of the medium being used. The unit must be calibrated with Dry Air only. Calibrating with Nitrogen or any medium other than Dry Air will give erroneous results.

Because the transducers are medium-sensitive, care must be taken to ensure that the hoses used in the calibration system do not out-gas. Normally, PVC hoses, or refrigeration type hoses have a tendency to out-gas. The ideal hoses to use are Teflon or Teflon-coated hoses because they have a very low absorption and out-gas coefficient. Stainless steel hoses may also be used.

If the wrong type of hoses are used, then the typical results obtained will show that the error increases as the pressure increases. Also, it is very unlikely that the repeatability of the indicated pressure will be less than 0.002 inHg at 100 inHg. If the system cannot achieve repeatability of 0.002 inHg or less, then the most likely cause is the out-gassing of hoses.

In the following sections, the instructions call for generating a pressure of 1.000 inHg abs. using the Pressure Standard. If your Standard cannot generate such a low pressure, then please generate as low a pressure as possible provided it is less than 4.0 inHg abs.

The 6500-HA has a drift of typically 0.005 %FS per year. Therefore it needs to be calibrated once a year to perform adequately as a calibration standard for air data equipment. To maintain higher accuracy, the unit must be calibrated once every 6 months.

6.3 Ps (Static) CALIBRATION:

Step 1. Connect the output of the Pressure Standard to the Ps port on the 6500-HA. The pressure and vacuum sources are to be connected to the Pressure Standard and it is assumed that the Pressure Standard has a suitable control mechanism which can allow the user to control the pressure at its output.

Step 2. Turn on the 6500-HA and allow it to warm up for about 30 minutes. Change the units to "PsinHg" on the Static side and "PtinHg" on the Pitot side. Refer to section 3.2.3 on how to change units. During the warm-up period, purge the system with Dry Air by cycling the pressure at the Static port between 38 inHg absolute and 1 inHg absolute (or lower), at least three times. Also, ensure that there are no leaks in the system

Step 3. After the warm-up period is over, using the Pressure Standard, generate a pressure of 1.000 inHg absolute. Allow the pressure to be stable at 1.000 inHg for 2 minutes and take the reading on the Ps port (PsinHg) of the 6500-HA. This is the first of your "Before" calibration adjustment reading. It will indicate the zero drift since the previous calibration.

Note: If your Standard cannot generate 1.000 inHg abs., the lowest possible pressure below 4.000 inHg abs. will be acceptable.

Step 4. Generate a pressure of 38.000 inHg absolute, allow the pressure to stabilize for 2 minutes and take the reading on the Ps port (PsinHg) of the 6500-HA. This is the second of your "Before" calibration adjustment reading. It will indicate the zero plus slope drift since the previous calibration. Leave the pressure at 38.000 inHg while you perform the next step.

Note: If your Standard cannot generate 38.000 inHg abs., any pressure between 32.000 and 38.000 inHg abs. will be acceptable.

If you do not wish to make a calibration adjustment, but just want to verify the accuracy of the 6500-HA, please skip to Step 10.

Step 5. To make a calibration adjustment for the Ps port, on the 6500-HA, move to the the CALIBRATION screen using the NEXT SCREEN key and enter the password. The calibration screen appears as follows:

CALIBRATION		
	Pt inHg	Ps inHg
Vacuum:	1. _____	3. _____
F.S. :	2. _____	4. _____

Step 6. Ensure that the pressure generated by the Standard on the Ps port is still 38.000 inHg. Select item '4' using the keypad on the remote unit and then enter the value 38.000 in item 4. This indicates the full scale point for the calibration. If you make an error while entering data, press "CLR". Do not press "CANCEL". You may re-enter the value any number of times.

Note: If your Standard cannot generate 38.000 inHg abs., any pressure between 32.000 and 38.000 inHg abs. will be acceptable. Enter the value of the generated pressure.

Step 7. Now generate a pressure of 1.000 inHg with the Standard. Allow the pressure to stabilize for 2 minutes, select item '3' using the keypad on the remote unit and then enter the value 1.000 in item 3. This indicates the vacuum point for the calibration. If you make an error while entering data, press "CLR". Do not press "CANCEL". You may re-enter the value any number of times.

Note: If your Standard cannot generate 1.000 inHg abs., the lowest possible pressure below 4.000 inHg abs. will be acceptable. Enter the value of the generated pressure.

Step 8. On the keypad of the remote unit, press "PREV SCREEN". The display will return to the Main Screen. **If you press "CANCEL" the calibration adjustment will become void.**

Step 9. Turn the 6500-HA OFF, wait 30 seconds and then turn it back ON. The calibration adjustment is now complete for the Ps port.

Step 10. Verify the calibration by generating pressures in approximately 10% increments and noting the 6500-HA Ps port (PsinHg) readings. Your calibration sheet will appear as shown in Figure 6.1.

6.4 Pt (Pitot) CALIBRATION:

Step 1. Connect the output of the Pressure Standard to the Pt port on the 6500-HA. The pressure and vacuum sources are to be connected to the Pressure Standard and it is assumed that the Pressure Standard has a suitable control mechanism which can allow the user to control the pressure at its output.

Step 2. Turn on the 6500-HA and allow it to warm up for about 30 minutes. Change the units to "PsinHg" on the Static side and "PtinHg" on the Pitot side. Refer to section 3.2.3 on how to change units. During the warm-up period, purge the system with Dry Air by cycling the pressure at the Pt port between 100 inHg absolute and 1 inHg absolute (or lower), at least three times. Also, ensure that there are no leaks in the system

Step 3. After the warm-up period is over, using the Pressure Standard, generate a pressure of

1.000 inHg absolute. Allow the pressure to be stable at 1.000 inHg for 2 minutes and take the reading on the Pt port (PtinHg) of the 6500-HA. This is the first of your “Before” calibration adjustment reading. It will indicate the zero drift since the previous calibration.

Note: If your Standard cannot generate 1.000 inHg abs., the lowest possible pressure below 4.000 inHg abs. will be acceptable.

Step 4. Generate a pressure of 100.000 inHg absolute, allow the pressure to stabilize for 2 minutes and take the reading on the Pt port (PtinHg) of the 6500-HA. This is the second of your “Before” calibration adjustment reading. It will indicate the zero plus slope drift since the previous calibration. Leave the pressure at 100.000 inHg while you perform the next step.

Note: If your Standard cannot generate 100.000 inHg abs., any pressure between 80.000 and 100.000 inHg abs. will be acceptable.

If you do not wish to make a calibration adjustment, but just want to verify the accuracy of the 6500-HA, please skip to Step 10.

Step 5. To make a calibration adjustment for the Pt port, on the 6500-HA, move to the the CALIBRATION screen using the NEXT SCREEN key and enter the password. The calibration screen appears as follows:

CALIBRATION			
	Pt inHg		Ps inHg
Vacuum:	1. _____		3. _____
F.S. :	2. _____		4. _____

Step 6. Ensure that the pressure generated by the Standard on the Pt port is still 100.000 inHg. Select item ‘2’ using the keypad on the remote unit and then enter the value 100.000 in item 2. This indicates the full scale point for the calibration. If you make an error while entering data, press “CLR”. Do not press “CANCEL”. You may re-enter the value any number of times.

Note: If your Standard cannot generate 100.000 inHg abs., any pressure between 80.000 and 100.000 inHg abs. will be acceptable. Enter the value of the generated pressure.

Step 7. Now generate a pressure of 1.000 inHg with the Standard. Allow the pressure to stabilize for 2 minutes, select item ‘1’ using the keypad on the remote unit and then enter the value 1.000 in item 1. This indicates the vacuum point for the calibration. If you make an error while entering data, press “CLR”. Do not press “CANCEL”. You may re-enter the value any number of times.

Note: If your Standard cannot generate 1.000 inHg abs., the lowest possible pressure below

4.000 inHg abs. will be acceptable. Enter the value of the generated pressure.

Step 8. On the keypad of the remote unit, press "PREV SCREEN". The display will return to the Main Screen. **If you press "CANCEL" the calibration adjustment will become void.**

Step 9. Turn the 6500-HA OFF, wait 30 seconds and then turn it back ON. The calibration adjustment is now complete for the Pt port.

Step 10. Verify the calibration by generating pressures in approximately 10% increments and noting the 6500-HA Pt port (PtinHg) readings. Your calibration sheet will appear as shown in Figure 6.1.

Note: The 6500-HA displays 4 digits after the decimal for Ps inHg and Pt inHg. Although the procedure above is shown for only 3 digits after the decimal point, 4 digits after the decimal may be entered for the calibration values, if required.

Model: 6500-HA-HA

Serial#: 74678

Full scale: Ps: 38 inHg
Pt: 100 inHg

Last Calibrated date: 10/10/01

CALIBRATION RESULTS

STATIC PRESSURE (Ps):

<u>TEST POINT</u>	<u>AS FOUND</u>	<u>AS LEFT</u>	<u>DEVIATION</u>
	inHg	inHg	inHg
1. Vacuum	1.0001	1.0000	0.0001
2. Fullscale	38.0002	38.0000	0.0002

PITOT PRESSURE (Pt):

<u>TEST POINT</u>	<u>AS FOUND</u>	<u>AS LEFT</u>	<u>DEVIATION</u>
	inHg	inHg	inHg
1. Vacuum	1.0002	1.0000	0.0002
2. Fullscale	100.0005	100.0000	0.0005

VERIFICATION RESULTS

STATIC PRESSURE (Ps)

PITOT PRESSURE (Pt)

<u>APPLIED</u>	<u>DISPLAYED</u>	<u>APPLIED</u>	<u>DISPLAYED</u>
inHg	inHg	inHg	inHg
1.0000	1.0000	1.0000	1.0000
4.0000	4.0000	10.0000	9.9998
8.0000	8.0000	20.0000	19.9997
12.0000	12.0000	30.0000	30.0002
15.0000	15.0000	40.0000	40.0002
19.0000	19.0001	50.0000	50.0003
23.0000	23.0001	60.0000	60.0002
27.0000	27.0000	70.0000	70.0001
30.0000	30.0000	80.0000	80.0001
34.0000	34.0000	90.0000	90.0002
38.0000	38.0000	100.0000	100.0001

Calibrated by:

Date:

Figure 6.1 Sample calibration sheet

SECTION 7

MAINTENANCE

Scheduled maintenance of the 6500-HA includes calibration once a year. The calibration procedure is described in Section 6. In addition to calibration, there is only one other item that requires regular maintenance : replacing the fan intake filter as required.

SECTION 8

COMMUNICATION INTERFACE

The model 6500-HA is capable of communicating with a remotely located computer via the RS232 serial interface. Using this interface it is possible to perform all functions that are available on the front panel.

8.1 RS232 SERIAL INTERFACE

The serial interface is a three wire interface using the signals RX, TX and GND. Each byte of data is sent in ASCII format using 8 bits per byte, with 1 stop bit, no parity at 9600 baud.

The pin-out of the interface is as follows:

- Pin 2 - Transmit (TX)
- Pin 3 - Receive (RX)
- Pin 5 - Signal ground (GND)

The baud rate, parity, bits per byte, and number of stop bits cannot be altered and is set to 9600, No parity, 8 bits and 1 stop bit respectively.

8.2 IEEE-488 INTERFACE

This interface is accessible through the 24-pin parallel connector under the "Interface Connectors" cover on the top panel. This interface supports the following IEEE-488 functions.

SH1	Source Handshake
AH1	Acceptor Handshake
T2	Basic Talker
L2	Basic Listener
SR1	Service Request
DC1	Device Clear

The IEEE-488 address of the 6500-HA can be changed using Function '0' as described in Section 3.5.0.

For the 6500-HA to input a command, it must first be addressed to Listen. The command that follows must be terminated with a Line Feed <LF>.

To get data from the 6500-HA the unit must be addressed to Talk. Prior to asking the 6500-HA to Talk, the data to be sent by the 6500-HA must be specified through a command. For the 6500-HA to understand the command it must be in the Listen mode. For example, to read the Actual Static value, the following sequence must be executed:

- a. Address 6500-HA to Listen
- b. Send command string "SA\n" ("\n" is <LF>)
- c. Address 6500-HA to Talk
- d. Read the Actual Static value from the 6500-HA

8.3 COMMUNICATION SYNTAX

All commands to the 6500-HA are two letter commands. Some commands are used both to read and write data. Others are used only to read data back from the 6500-HA. If a command is used to write data then it is followed by the equal sign followed by the data to be written. Each command must be terminated by a carriage return <CR>. Each value returned by the 6500-HA is terminated by a <CR> .

<u>Command</u>	<u>Type</u>	<u>Description</u>
PA	R	Actual pitot value in current units
RA	R	Actual climb/ Ps rate value in current units
SA	R	Actual static value in current units
PT=n	R/W	Read/ Set Pt target value
RT=n	R/W	Read/ Set climb/Ps rate target value
ST=n	R/W	Read/ Set Ps target value
PJ=n	W	Jog up (n=0) or down (n=1) Pt target
RJ=n	W	Jog up (n=0) or down (n=1) rate target
SJ=n	W	Jog up (n=0) or down (n=1) Ps target

<u>Command</u>	<u>Type</u>	<u>Description</u>																				
PU=n	R/W	Read/ Set Pt units as per following: <table border="1"> <thead> <tr> <th><u>n</u></th> <th><u>units</u></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>knots</td> </tr> <tr> <td>2</td> <td>mach</td> </tr> <tr> <td>3</td> <td>Pt inHg</td> </tr> <tr> <td>4</td> <td>Qc inHg</td> </tr> <tr> <td>5</td> <td>Pt mb</td> </tr> <tr> <td>6</td> <td>Qc mb</td> </tr> <tr> <td>7</td> <td>mph</td> </tr> <tr> <td>8</td> <td>kmph</td> </tr> <tr> <td>9</td> <td>EPR</td> </tr> </tbody> </table>	<u>n</u>	<u>units</u>	1	knots	2	mach	3	Pt inHg	4	Qc inHg	5	Pt mb	6	Qc mb	7	mph	8	kmph	9	EPR
<u>n</u>	<u>units</u>																					
1	knots																					
2	mach																					
3	Pt inHg																					
4	Qc inHg																					
5	Pt mb																					
6	Qc mb																					
7	mph																					
8	kmph																					
9	EPR																					
SU=n	R/W	Read/ set Ps units as follows: <table border="1"> <thead> <tr> <th><u>n</u></th> <th><u>units</u></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Feet</td> </tr> <tr> <td>2</td> <td>Ps inHg</td> </tr> <tr> <td>3</td> <td>meters</td> </tr> <tr> <td>4</td> <td>Ps mb</td> </tr> </tbody> </table>	<u>n</u>	<u>units</u>	1	Feet	2	Ps inHg	3	meters	4	Ps mb										
<u>n</u>	<u>units</u>																					
1	Feet																					
2	Ps inHg																					
3	meters																					
4	Ps mb																					
PM=n	R/W	Read/Set Pt mode to Measure (1), Leak (2), control (3)																				
SM=n	R/W	Read/set Ps mode to Measure (1), Leak (2), Control (3)																				
ER	R	Read current error ; 0 if no error																				
L1=n	R/W	Read/set max. knots limit																				
L2=n	R/W	Read/set min. knots limit																				
L3=n	R/W	Read/set max mach																				
L4=n	R/W	Read/set max. altitude																				
L5=n	R/W	Read/set min. altitude																				
L6=n	R/W	Read/set max. altitude rate																				
KR=n	R/W	Read/set knots rate																				
PF=n	R/W	Read/set current profile point																				
GO	W	Command to execute current settings.																				

<u>Command</u>	<u>Type</u>	<u>Description</u>
CN	W	Command to cancel current settings
IE=n	R/W	Read/set IEEE address
C1=n	R/W	Read/set Pt vacuum calibration point
C2=n	R/W	Read/set Pt fullscale calibration point
C3=n	R/W	Read/set Ps vacuum cal. point
C4=n	R/W	Read/set Ps fullscale calibration point
CC	W	Activate new calibration points after new values have been entered for either C1 and C2, or C3 and C4. The calibration will become effective only after this command is executed.
SF=0	R	Read the status of the Self Test last performed.
SF=1	W	Start the Self Test.
SG	W	Set 'Ground'
GG	W	Go To 'Ground'

APPENDIX A
ERROR CODES

All errors are displayed on line 4 of the display when the 6500-HA is in the Main screen. An error must be acknowledged before any other key entries are accepted. The error may be acknowledged either by pressing the CANCEL or the CLR key.

<u>ERROR CODES</u>	<u>DESCRIPTION</u>
1	Pressure exceeded 110 %FS on Pt output
2	Pressure exceeded 110 %FS on Ps output
3	Pt target value exceeds Qc limits
4	Pt target value exceeds Mach limit
5	Ps rate target exceeds Rate limit
6	Ps target exceeds altitude limits
7	Pt actual value exceeds Qc limit
8	Pt actual value exceeds Mach limit
9	Rate exceeds limits.
10	Unused
11	Invalid Profile point
12	Ps control-transducer error
13	Pt control-transducer error
14	Ps actual value exceeds limit
15	Internal Use only
16	Internal Use only
17	If Pt is left in Measure mode, Qc limit will soon be exceeded
18	If Pt is left in Measure mode, Mach limit will soon be exceeded
19	Ps actual value exceeds limit

APPENDIX B
SPECIFICATIONS

Static Output

Pressure function

range: 0.1 to 38 inHg
resolution: 0.0001 inHg
accuracy: 0.001 inHg

Altitude function

range: -4000 ft. to 100,000 ft.
resolution: 1 foot
accuracy: 1 ft. @ 0 ft.
3 ft. @ 35,000 ft.
6 ft. @ 50,000 ft.
25 ft. @ 80,000 ft.

Climb function

range: 0 ft/min to 50,000 ft/min
resolution: 1 ft/min
accuracy: 1% of rate of climb

Pitot Output

Pressure function

range: 0.1 to 100 inHg
resolution: 0.0001 inHg
accuracy: 0.002 inHg

Airspeed function

range: 0 to 1100 knots
resolution: 0.1 knots
accuracy: 1.0 knots @ 20 knots
0.3 knots @ 50 knots
<0.2 knots above 100 knots
<0.1 knots above 300 knots

Mach function

range: 0.0 to 5.0 Mach
resolution: 0.001 Mach
accuracy: 0.001 above 0.2 Mach

EPR function

range: 0 to 199
resolution: 0.001
accuracy: 0.002 typ.

Power requirement

90-260 VAC, 47-440 Hz., 100 watts

Interfaces

RS232 and IEEE-488

Dimensions & weights

Main unit: 17.0" x 15.5" x 6.5" / 20 lbs

Environmental specs:

Operating temp. 0° to 50°C (20° to 26°C for High Accuracy)
Storage temp. -25° to 75°C
Humidity: 5 to 95% non-condensing

APPENDIX C

REPAIR AND RETURN POLICIES

If it is determined that the product is defective, please call Laversab customer service department: (281) 325-8300 or fax (281) 325-8399 or e-mail aservice@laversab.com for further assistance.

Before shipping any equipment to Laversab for repair, please call the customer service department at (281) 325-8300 or fax (281) 325-8399 or e-mail to aservice@laversab.com. Please include a description of the problem that has been identified when returning defective equipment.

Ship equipment to :