AIRCRAFT DEVELOPMENT INDUSTRIES cc

# AIR DATA TESTER

# Model PS131b
# and
# Model PS131bII

# TECHNICAL INFORMATION

# CONTENTS:

# SPECIFICATIONS:

## RANGE LIMITS

| DESCRIPTION | MINIMUM | MAXIMUM |
|---|---|---|
| Altitude | -1000 Ft | 49000 Ft |
| Airspeed | 30 Kts | 400 Kts |
| Vertical Speed (*1) | 500 Ft/min | 5000 Ft/min (3000 Ft/min Avg. See Note.) |
| Encoded Altitude | -1300 Ft | 30000 Ft |
| Operating Altitude | -1000 Ft | 10000 Ft |
| Operating Temperature (*2) | 0 ℃ | 35 ℃ |

## RESOLUTION

| DESCRIPTION | RESOLUTION |
|---|---|
| Altitude | 1 Ft |
| Airspeed | 1 Kt |
| Vertical Speed | 10 Ft/min |
| Encoded Altitude | 100 Ft |
| QFE | 0.1 milliBar |
| QNH | 0.1 milliBar |
| Battery Voltage | 0.1 Vdc |
| Element Temperature | 1 ℃ |
| Heating Wait period (*2) | Dependant on Ambient Temp. |

## ACCURACY

| DESCRIPTION | MAX ERROR |
|---|---|
| Altitude | 5 Ft |
| Airspeed | 1 Kt |
| Vertical Speed (*3) | 0 |
| Encoded Altitude | 0 Ft |
| QFE | 0.1 milliBar |
| QNH | 0.1 milliBar |

## ELECTRICAL SPECIFICATIONS

| DESCRIPTION | MINIMUM | MAXIMUM |
|---|---|---|
| Supply Voltage | 22 Vdc | 26 Vdc |
| Supply Current | 3 A | - |
| Power Consumption | 20 W | 60 W |
| Battery Life (*4) | 1/2 Hrs | 2 Hrs |
| Battery Charging Time | 8 Hrs | - |
| RS232 Peripheral Output Voltage | - | 5 Vdc |
| Encoder Output Supply Voltage | - | 15 Vdc |

## PHYSICAL SPECIFICATIONS

| DESCRIPTION | MINIMUM | MAXIMUM |
|---|---|---|
| Dimensions (mm) PS131b | - | 484 X 290 X 88 |
| Dimensions (mm) PS131bII | | 425X284X155 |
| Weight PS131b | - | 6 Kg |
| Weight PS131bII | | 10 Kg |
| Orientation | - | 360 ° |
| Viewing Angle | - | 30 ° |
| | | |
| | | |

## COMPUTER INTERFACE

| DESCRIPTION | VALUE |
|---|---|
| Communication Protocol | RS232 |
| Communication Settings | 9600, n, 8, 1 |
| Communication Format | ASCII string |
| Minimum PC requirements | IBM Compatible, Pentium 75MHz, 16Mb RAM, CD-ROM, 800X600 VGA graphics. Mouse, Free Comm Port. |
| Operating System | Windows 95, 98, ME or Vista only |

(*1) 6000 Ft/min is maximum vertical speed that the unit will try to achieve. It may not always be achievable due to the volume of the aircraft plumbing system and the current altitude. 3000Ft/min is the average vertical speed that can be expected. The unit has been successfully tested to 5000Ft/min climb and 6000Ft/min decent at sea level. See Figure 1

(*2) 35℃ is the temperature to which the element heats the internal transducers. This temperature choice was a compromise between the maximum temperature that would normally be experienced and battery life. Heating wait time will vary depending on the ambient temperature. Usually about 45 to 60 minutes.

(*3) Note that the Vertical Speed has a resolution of 10Ft/min so accuracy within that resolution is unnoticeable. Vertical Speed determined as a mathematical calculation of the altitude change, thus the error is negligible.

(*4) The internal heating element will draw power from the batteries if the unit is disconnected from the mains power. In colder conditions the element will require more power thus the battery life will be reduced. It is recommended that the unit be heated to the operating temperature (35℃) while connected to mains power then taken to the remote location where the batteries will keep the unit warm.

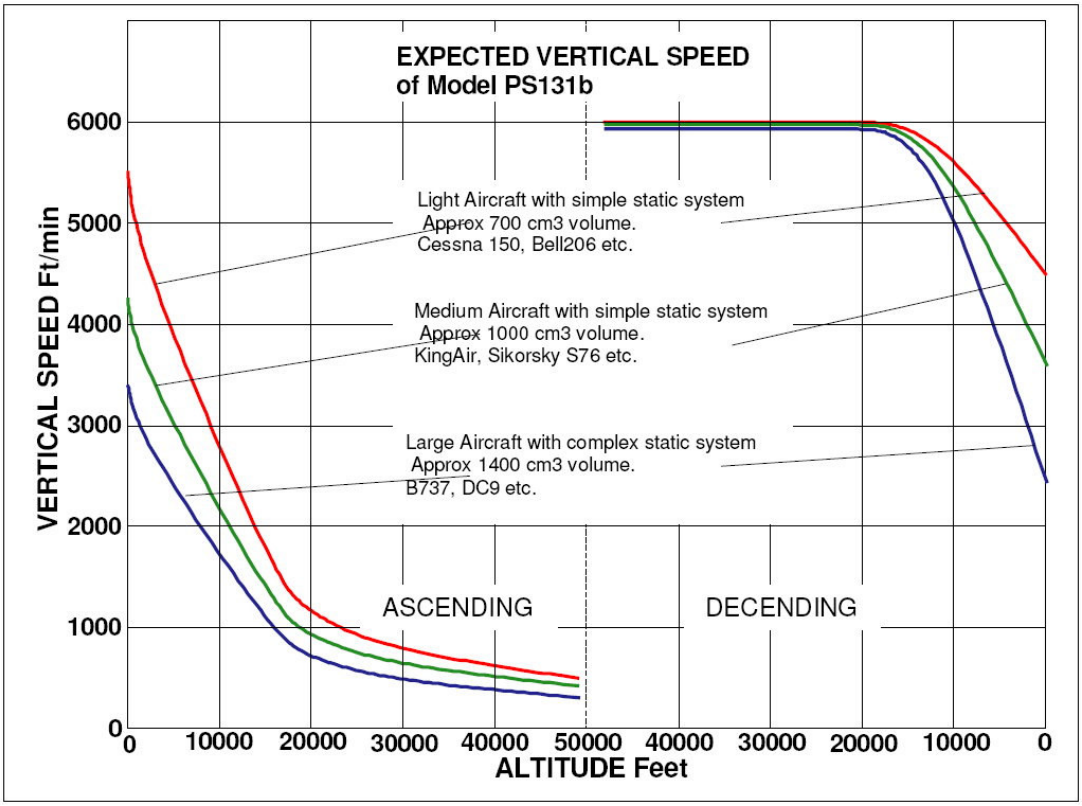


Figure 1

Vertical Speed vs Volume Graph:
The vertical speed capability of the PS131b is inversely proportional to the volume of the static system under test and the current altitude. The graph above
provides an estimation of the expected rate of climb based on volume and altitude.

Using this graph it can be seen that for an aircraft similar in size to a KingAir 200
or a Sikorsky S76, at an Altitude of 10000Ft the rate of climb is expected to be 2200 Ft/min and the rate of descent is 5300 Ft/min.

Note that it is assumed that there are no leaks in the system under test as this will significantly reduce the rate of climb and increase the rate of descent. The condition of the pumps will also affect the vertical speed and pumps require servicing periodically.

# SECTION OVERVIEW:

## MICRO-CONTROLLERS:

The PS131b and PS131bII are primarily controlled by 2 micro-controllers. One micro-controller is the GUI (Graphical User Interface) and the other is the PSS (Pitot Static Slave). The two micro-controllers communicate via an I2C bus to achieve the desired result.

The GUI accepts user input from the Keypad and displays information to the user on the graphic LCD. It also handles RS232 communication to a PC/Laptop by receiving commands and sending data.

The PSS does the measurement and control. The transducers and sensors are measured with analogue-to-digital converters The values are processed, error corrected and an action is taken to achieve the desired target. The PSS board tries to match the target value with the current value by adjusting the pressure and vacuum pumps accordingly.

In order for the PSS to control the higher voltage/current devices such as the pumps and the heating element the signals are switched using opto-isolators and transistors.

## POWER SUPPLY:

The PS131b and PS131b*II* are powered from a Switched Mode Power Supply able to operate from 110Vac 60Hz to 230Vac 50Hz. The output power is 24Vdc 3A. The connector is a 2.1mm power plug with the positive supply being on the center pin.

## BATTERIES:

The internal batteries are charged whenever the supply is connected. The unit does not need to be turned on. The batteries require an 8Hr charge. There are three 6V 4Ah Sealed Lead Acid batteries making up an 18V 4Ah supply. At normal operating current of around 750mA the batteries will run for 1Hour.

The battery voltage is displayed on the LCD and after a sufficient charge will be at 21Vdc. A warning will appear if the battery voltage drops below 17.5Vdc while operating and the beeper will beep continually.

## PUMPS:

The internal pumps are peristaltic pumps operating from 12Vdc geared motors. The current draw of each pump is 170mA at full RPM.

The pumps are controlled using various electrical control mechanisms to achieve direction, speed control and torque.

## PLUMBING:

The PS131b is plumbed with a combination of silicon and nylon hose.

Silicon tubing is used to plumb the pumps and is lubricated with Silicon grease.

The pressure connectors are aluminium and plastic.

## TRANSDUCERS AND SENSORS:

The Altitude is measured using an absolute transducer with a maximum operating pressure of 0 to 1 Bar. The transducer output is measured with a 16bit ADC.

The Airspeed is measured using a differential transducer with a maximum operating pressure of 0 to 5 PSI. The transducer output is amplified and measured by the micro-controller using a 10bit ADC.

The element temperature is measured using an analogue temperature sensor and converted using a 10bit ADC aboard the micro-controller.

The Battery and Supply voltages are measured using a resistor divider network.

## HOUSING:

The PS131b housing is a 19 inch 2U rack mountable enclosure. There are four rubber feet on the underside and four plastic feet on the rear panel for standing upright. Two handles protrude from the front panel. The power plug connector and vent ports are located on the right side panel. The extraction fan is located on the rear. There is nothing mounted on the top panel.

The PS131bII is housed in a weather proof, high durability plastic “Pelican 1500” case.

# COMMUNICATION PROTOCOL:

The PS131b and PS131bII connects to a PC or terminal via RS232. The RS232 settings are 9600bps, No parity, 8 bits per byte, 1 stop bit.

The unit receives and transmits standard ASCII strings, which can be issued and read using a PC running a terminal program such as HyperTerminal.

Each instruction is ended with a Carriage Return <CR>.

The following table lists the commands used to interrogate the PS131b and details its response.

Note that the * symbol indicates that the response will vary according to the relevant data at the time.

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| Command | Description | Varies | Response |
|---|---|---|---|
| Hail | | | PS131b |
| GetVer | Get Firmware Version | * | Firmware v1.0 |
| GetModel | Get Model Number | | PS131b |
| GetSerialNo | Get Units Serial Number | * | 131b0301 |
| GetManDate | Get Manufactured Date | * | Sep 2003 |
| GetCalDate | Get Last Calibration Date | * | Sep 2003 |
| GetCalDue | Get Next Cal Due Date | * | Sep 2004 |
| GetCalAuth | Get Calibration Authority | * | ADI (CTI) |
| GetAlt | Get Altitude | * | Alt 12345 |
| GetAS | Get AirSpeed | * | AS 123 |
| GetVS | Get Vertical Speed | * | VS 1200 |
| SetTargetAlt 1000 | Set Target Alt to 1000Ft | * | TargetAlt 1000 |
| SetTargetAS 100 | Set Target AS to 100Kts | * | TargetAS 100 |
| SetTargetVS 2000 | Set Target VS to 2000F/m | * | TargetVS 2000 |
| GetTargetAlt | Get Target Altitude | * | TargetAlt 1001 |
| GetTargetAS | Get Target Airspeed | * | TargetAS 99 |
| GetTargetVS | Get Target Vert Speed | * | TargetVS 2100 |
| GetCodeAlt | Get Encoded Altitude | * | EncodedAlt 1001 |
| | | or | Invalid Code |
| GetCodeBits | Get Encoder Data Bits | * | A --- B 12- C - 2- |
| GetCodeMatch | Get Encoder = Alt match | * | CodeAltMatch NO |
| | | or | CodeAltMatch YES |

| | | | |
|---|---|---|---|
| GetBattVolt | Get Battery Voltage | * | BattVolt 20.3 |
| GetSupVolt | Get Supply Voltage | * | SupVolt 24 |
| SetBackLight 5 | Set intensity from 0-10 | * | Backlight 5 |
| GetBackLight | Get the lighting intensity | * | BackLight 5 |
| | | | |
| GetTemp | Get Element Temperature | * | ElementTemp(C) 35 |
| GetWait | Get Heat Time Remaining | * | HeatingWait(sec) 0 |
| | | | |
| Pump | Pumps will run if required | | Mode: Pump |
| Stop | Pumps will not run | | Mode: Stop |
| Vent | Pumps will run to ambient | | Mode: Vent |
| GetMode | Get Pump Mode | * | Mode: Pump |
| | | | |
| (Invalid Command) | | | ERROR 1: Command not recognised. |

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***For Example:***

Terminal: Hail<CR>
PS131b response: PS131b<CR>
Terminal: GetAlt<CR>
PS131b response: Alt 12345<CR>
Terminal: SetTargetAlt 20000<CR>
PS131b response: TargetAlt 20000<CR>
Terminal: Pump<CR>
PS131b response: Mode: Pump <CR>
Terminal: OnAlt<CR>
PS131b response: OnAlt NO<CR>
…
Terminal: OnAlt<CR>
PS131b response: OnAlt YES<CR>
Terminal: GetAlt<CR>
PS131b response: Alt 20001<CR>

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