



Boyle's Law Demonstrator H050



- *Investigation of Boyle's Law ($pv = \text{Constant}$).*
- *Allows investigation above and below atmospheric pressure.*
- *If available, allows investigation with other safe gases.*
- *Computerised data acquisition system available*
- *Two Year Warranty.*



Introduction

The Hilton H050 Boyle's Law Demonstrator allows rapid demonstration of the principles of Boyle's Law.

The unit is bench mounted and self-contained having its own compressor/vacuum pump.

The Hilton H050 Boyle's Law Demonstrator will provide interesting and instructive experimental work for all students studying fundamental gas laws and will be of particular interest to those studying:

- **Thermodynamics**
- **Heat Transfer**
- **Chemical Engineering**
- **Mechanical Engineering**
- **Plant and Process Engineering**
- **Refrigeration**
- **Air Conditioning**
- **Physics**

Experimental Capabilities

- Demonstration of Boyle's Law $pV = \text{Constant}$ for air and other safe gases.
- Investigation of the characteristic equation of a gas $pV = mRT$ at ambient temperature

Description

Two sealed glass cylinders with access valves are mounted on a base board and connected via a tube. One cylinder performs the measuring function and the other is used to pressurise the volume of gas contained above oil in the measuring cylinder. The measuring cylinder is fitted with a compound gauge designed to measure the gas pressure both above and below atmospheric pressure.

The height of oil and hence the volume of gas in the measuring cylinder is measured using a graduated scale. A thermometer in the measuring cylinder allows the temperature of the gas in the measuring cylinder to be determined.

A small compressor provides a means of adjusting the pressure of the test gas above and below atmospheric pressure. The compressor is mounted on the base board and controlled by a panel mounted switch.

A pressure switch and relief valves ensure operator safety.

Operation

The volume of gas in the measuring chamber can be adjusted by a control valve at the base of the pressurising chamber and measured using the graduated scale on the measuring chamber. The compressor is used to adjust the pressure above hydraulic oil in the pressurising chamber and this is transmitted to the test gas via the oil.

Changes in oil height and hence test gas volume are measured at the same time as pressures are recorded. Pressure and volume data may be plotted to demonstrate the $pV = \text{Constant}$ Boyle's Law relationship.

For more advanced students the volume of gas in the chamber may be related to the mass m of air in the chamber. By evaluating the data recorded the characteristic gas equation $pV = mRT$ or $PV/mT = \text{Constant}$ may be investigated.

Specification

Unit for demonstrating Boyle's Law

Comprising:

Bench mounted measuring cylinder containing test gas and bourdon tube pressure gauge as well as a pressure relief valve. All necessary valves, pressure gauge, measuring scale and thermometer for air pressure, temperature and volume measurement.

Pressurising glass cylinder with pressure relief valve
Diameter 100 mm, Height 220 mm approximately
Compressor 230V, 50 Hz, 500W. Compressor can also be used as vacuum pump.

Safety

Relief valve in each cylinder plus high pressure cut out switch on compressor power supply.

Residual current circuit breaker and combined main switch/miniature circuit breaker.

Dimensions

Height: 600mm Depth: 610mm

Width: 610mm Weight: 30kg

Accessories and Spares

Unit supplied with:

One experimental operating and maintenance manual in English, Spanish, French.

Accessories and spares, suitable for 2 years normal operation. List available on request.

Services Required

Electrical: A: 500W 220-240 Volts, Single Phase, 50Hz (With earth/ground).
Line current up to 2A at 230v

Or

B: 500W 110-120 Volts, Single Phase, 60Hz (With earth/ground).
Line current up to 4A at 110v



Ordering Information

Order as: Boyle's Law Demonstrator H050

Electrical Specification

Either: **A:** 220-240 Volts, Single Phase 50Hz
(With earth/ground).

Or

B: 110-120 Volts, Single Phase 60Hz
(With earth/ground).

Language

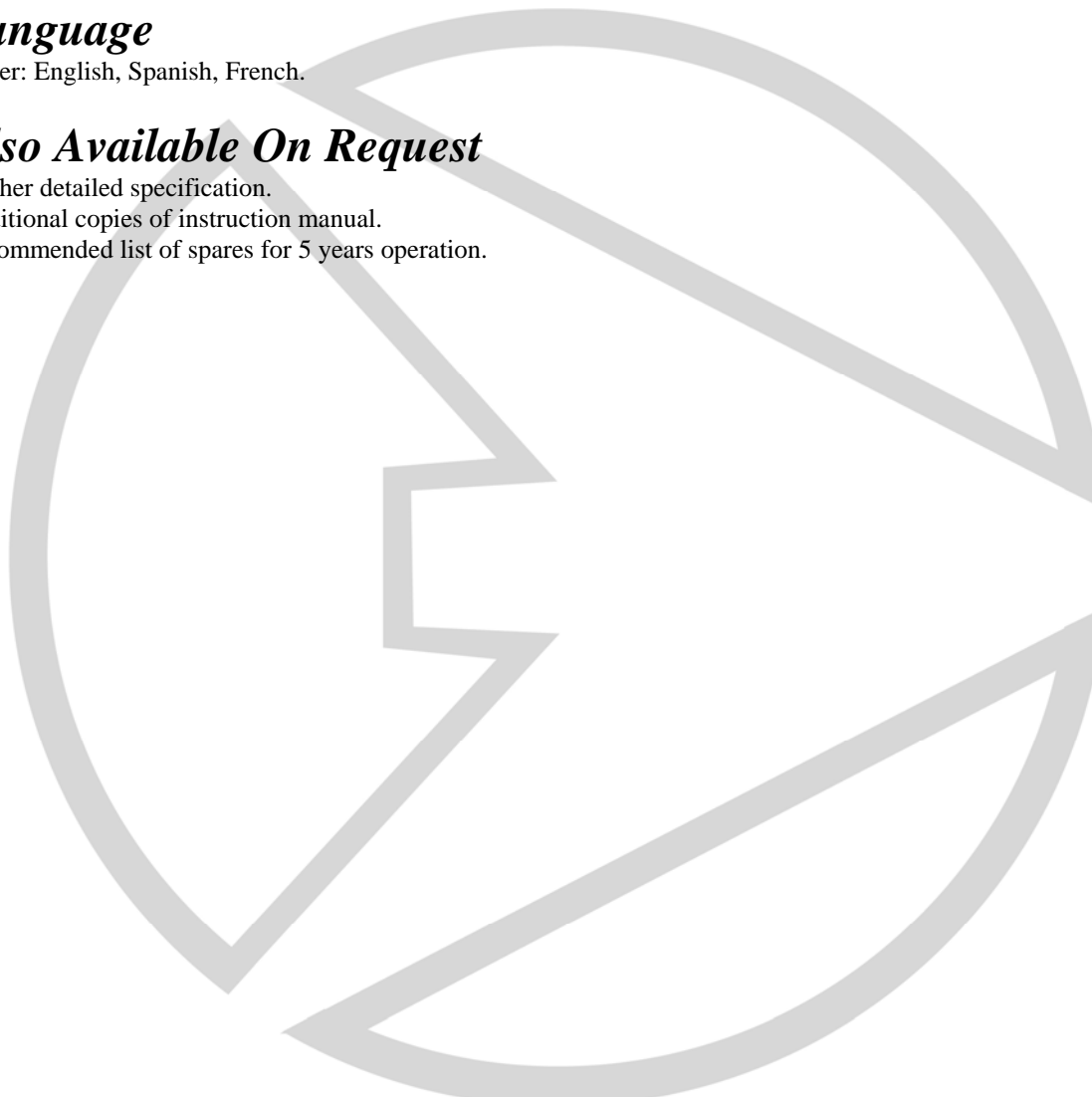
Either: English, Spanish, French.

Also Available On Request

Further detailed specification.

Additional copies of instruction manual.

Recommended list of spares for 5 years operation.





Optional Extra HC051A **Data Acquisition Upgrade**

Hardware details

The Optional Computerised Data Acquisition Upgrade HC051A consists of a 21 channel Hilton Data logger (D103), together with pre-configured, ready to use, Windows TM compatible educational software.

Factory fitted coupling points on the A660 allow installation of the upgrade to the unit at any time in the machine's extensive life.

The Hilton Data logger (D103) connects, using the cable supplied, to a standard USB port on the user-supplied PC. If more than one logger is required connection is via a second USB port or standard USB hub.

The combined educational software and hardware package allows immediate computer monitoring and display of all relevant parameters on the A660.

Software Details

The pre-configured menu driven Software supplied with the Computer Upgrade HC051A allows all recommended experiments involving the electronic transducers and instruments on the A660 to be carried out with the aid of computerised data acquisition, data storage and on-screen data presentation. This enhances student interest and speeds comprehension of the principles being demonstrated.

Students are presented with either raw data for later hand calculation or alternatively data may be transferred to most spreadsheets for computerised calculation and graphical presentation.

Data may be stored on disc and displayed at any time using the software supplied. Alternatively data may be transferred to any compatible spreadsheet together with individual time and date stamp on each reading for complex analysis.

Additional Data Logging Facility Supplied As Standard

The D103 is the third generation of Hilton Data Logger. It comprises an industrially proven 21 channel interface with 8 thermocouples (type T and K as standard) / differential voltage inputs ($\pm 100\text{mv DC}$), 8 single ended DC voltage inputs ($\pm 8\text{v}$), 4 logic or frequency inputs and one mains voltage input. In addition there are on board 12v DC, $\pm 5\text{V DC}$ and $\pm 15\text{v DC}$ power supplies for most commercially available transducers.

The Hilton Data Logging software supplied as standard with the HC051A package allows the D103 to be disconnected from the A660 and used together with most standard transducers as a stand-alone computer data logger for the instrumentation and monitoring of existing laboratory equipment using locally sourced industrial transducers. The software is also backwards compatible with our many second generation D102 data loggers that are already in use worldwide.

Full data logger command protocol and communications details are provided in an extensive user manual that allows other software applications to communicate with the logger via the USB interface. Users can write their own software, typically in LabView, Matlab, C, C++, Visual Basic etc. This further expands the student project capabilities of the HC051A package from teaching and demonstration into the field of research and postgraduate study.

Computer Hardware Requirements

The menu driven Software supplied with the Computer Upgrade HC051A will operate on a PC which has at least 0.5Gb Mb ram, VGA graphics, 1Gb hard drive, CD drive and an available USB port. The software is Windows 2000, XP and 7 compatible.

Ordering Information

Order as: Data Acquisition Upgrade HC051A

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