



Temperature Measurement Methods and Calibration Unit H981



- *Allows Investigation of Temperature Measurement Methods and Temperature Scales*
- *Safe and Suitable For Unsupervised Student Operation*
- *Allows Investigation of Practical Problems in Measurement of Temperature Using a Variety of Instrument Types*
- *Optional Computerised Data Acquisition Upgrade*
- *Two year Warranty*



Introduction

The measurement of temperature is a fundamental requirement in every branch of engineering, science and technology. The notion of an arbitrary and an absolute temperature scale can be difficult for many students to grasp. This is further complicated by the many and varied methods of measurement and measurement errors that can occur.

The fact that temperature cannot be measured directly, but has to be inferred from its effect upon a sensor (pressure, voltage, resistance or volume change for example) is also a difficult for many students to appreciate.

The Hilton **Temperature Measurement Methods and Calibration Unit H981** allows students to thoroughly examine a large variety of temperature measurement devices, how errors can be introduced and avoided, methods of calibration and the structure of the International Temperature Scale (ITS-90)

The unit will be of interest to students in every branch of Engineering, Science, Physics and Technology.

Experimental Capabilities

- The use of (expansion) liquid in glass thermometers for measurement of fixed scale points.
- The use of vapour pressure for temperature measurement.
- The use of bi-metallic expansion devices for temperature measurement.
- The Peltier and Seebeck thermo-electric effects.
- Investigation of junction voltage from different thermocouple types.
- The use of ice point reference with a thermocouple.
- The law of intermediate metals and intermediate temperatures associated with thermocouples.
- Voltage calibration of different thermocouple types using a water-ice reference.
- The effect of lead resistance and voltmeter meter impedance on thermocouple measurements.
- Use of a direct reading, internally compensated thermocouple indicator.
- Connection of thermocouples in series for signal amplification and parallel for averaging of measured temperatures.
- Investigation of the response rate of various thermocouples and sensors.
- Investigation of the platinum resistance sensor (PRT), its resistance change with temperature and the reference PRT equation of ITS-90.
- Investigation of the use of 2, 3 and 4 wire PRT sensor connection and the error effects of lead resistance.
- The use of a direct reading PRT indicator device.
- Investigation of the resistance change of a negative temperature coefficient thermistor sensor with temperature.

- The use of a direct reading thermistor indicator device.
- Calibration of all of the supplied sensors with reference to an accurate platinum resistance thermometer (PT100)

With the Optional H981A Dry Well Calibrator

- Calibration of all of the supplied sensors with a dry well calibrator

Description

A bench mounted console provides power and connection points for a variety of instruments and sensors. The console is self contained and is supplied with a wide range of ancillary items and sensors that are stored in a latching aluminium case for security.

The console also provides power for an external temperature controlled heater that allows sensor calibration and performance at elevated temperatures including the steam reference point (100°C). Alternatively this may be supplemented by the optional **H981A Dry Well Calibrator**.

An external stainless steel vacuum flask allows ice point reference to be established.

Electrical safety is provided by a double pole overload and earth leakage circuit breakers.

Digital panel mounted instruments include:

- Platinum resistance temperature indicator
- Thermistor temperature indicator.
- Thermocouple (type K, nickel-chrome, nickel-aluminium) temperature indicator with multi-way selector switches.
- Millivoltmeter.

All of the electronic indicators provide re-transmission signals for use either by user supplied chart recorders/data acquisition systems or the optional **HC982A Computerised Data Acquisition System**.

Dedicated panel mounted accessories include:

- A precision voltage amplifier to allow investigation of the junction output of a variety (type K, type T and type J) of thermocouples at different temperatures both in isolation and with an ice point reference
- Connection points for thermocouple probes allowing series or parallel connection and investigation of meter and lead resistance effects.
- Connection points for platinum resistance and thermistor probes to allow investigation of resistance-temperature characteristics.
- A constant current source and probe connection points for a 4 wire platinum resistance probe. Provision is also made for investigation of 2, 3 and 4 wire connection and errors introduced by lead resistance.
- Connection points for the optional **HC982A Computerised Data Acquisition System**.



Optional Extra HC982A **Data Acquisition Upgrade**

Hardware details

The Optional Computerised Data Acquisition Upgrade HC982A consists of a 21 channel Hilton Data logger (D103), together with pre-configured, ready to use, Windows™ compatible educational software.

Factory fitted coupling points on the H981 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 H981.

Software Details

The pre-configured menu driven Software supplied with the Computer Upgrade HC982A allows all recommended experiments involving the electronic transducers and instruments on the H981 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 HC982A package allows the D103 to be disconnected from the H981 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 HC982A 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 HC982A 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 HC982A

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