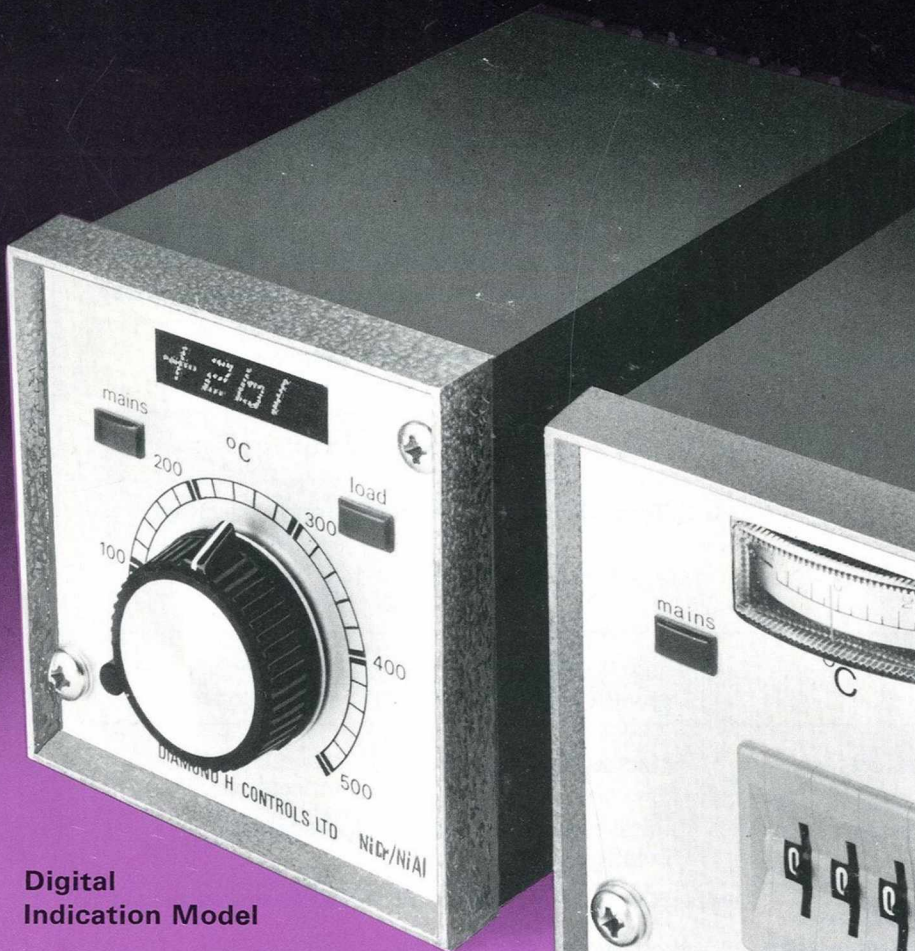
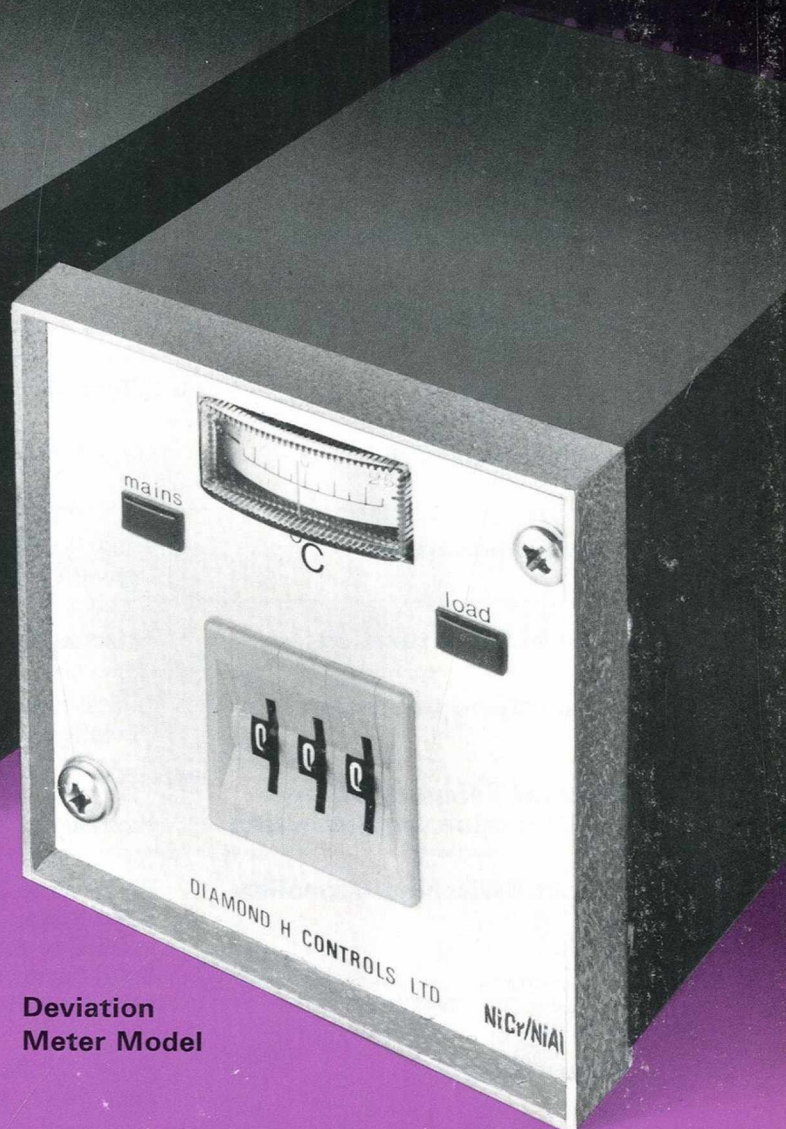


# DH70 Series



**Digital  
Indication Model**



**Deviation  
Meter Model**

## Three-term Temperature Controller

The DH70 is a sophisticated instrument providing accurate temperature control and readout facilities to suit the exacting and varying demands of today's industry.

### Features include

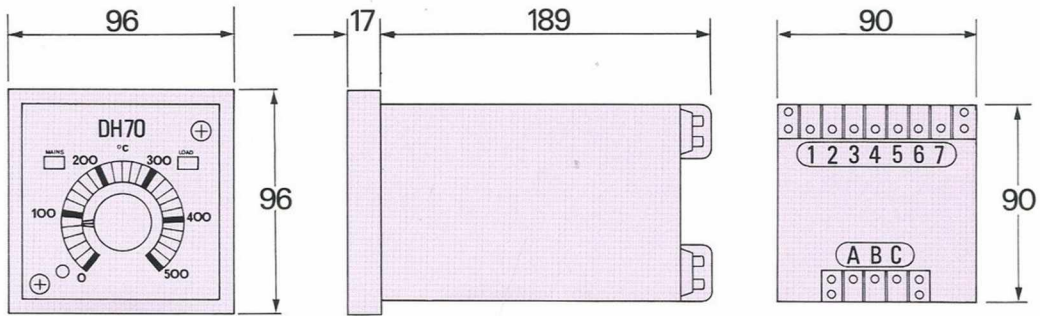
- \* 3 term control – proportional, reset and rate actions – with built-in fast run up and overshoot suppression circuits.
- \* Adjustable time constants.
- \* Choice of readout – digital or deviation meter.
- \* Choice of setting – digital or analogue.
- \* Choice of output switching – solid state or relay.
- \* Choice of ancillary control features.
- \* DIN Standard 96 mm square case.



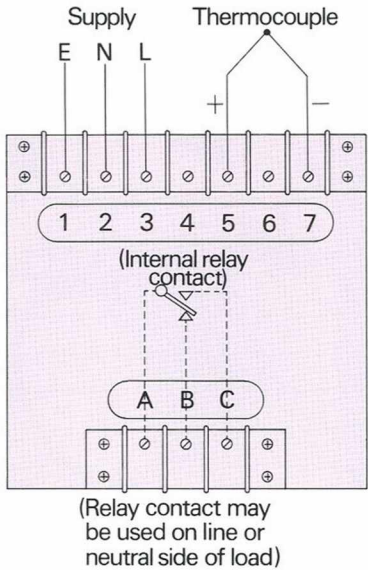
## SPECIFICATION

<b>Sensor</b>	Thermocouple or Resistance Thermometer
<b>Temperature Ranges</b>	Between $-100^{\circ}\text{C}$ and $+1600^{\circ}\text{C}$
<b>Set Point Resolution</b>	$1^{\circ}\text{C}$ (Digital Switch Models)
<b>Calibration Accuracy</b>	$\pm 1 \cdot 5\%$ of span—analogue setting $\pm 0 \cdot 5\%$ of span—digital switch models
<b>Change of set point</b>	$\pm 20\mu\text{V}$ for supply changes of $+10\%$ , $-15\%$ $\pm 2\mu\text{V}/^{\circ}\text{C}$ of ambient temperature $-1\mu\text{V}/\text{ohm}$ of sensor resistance (thermocouples)
<b>Common mode rejection</b>	240V 50Hz on sensor has negligible effect on control
<b>Thermocouple Break Protection</b>	Power automatically switched off
<b>Control Action</b>	3 Term (Proportional, integral and derivative)
<b>Proportional Band</b>	400 $\mu\text{V}$ to 4mV (with $\frac{T_I}{T_D} = 10$ )
<b>Time Constants</b>	Integral variable from 5 to 500 seconds Derivative variable from 1 to 100 seconds
<b>Integral De-saturation</b>	Fitted as standard
<b>Temperature Indication</b>	Digital read-out $\pm 0 \cdot 5\%$ of full scale Deviation Meter $\pm 25^{\circ}\text{C}$
<b>Ambient Temperature and Cold Junction Compensation</b>	Provided as standard
<b>Output Switching Capability</b>	Relay up to 25A 240V A.C. Resistive Solid State, 7A 240V A.C. Resistive at $25^{\circ}\text{C}$ ambient Solid State, 15A and 25A, 240V A.C. Resistive with separate output module
<b>Power Supply</b>	240V, $+10\%$ , $-15\%$ , 50–60Hz (115V models available to special order)
<b>Ambient Temperature Range</b>	0– $70^{\circ}\text{C}$ with Relay output 0– $50^{\circ}\text{C}$ with Solid State output or digital indication
<b>Panel Cut-Out</b>	92 x 92 mm
<b>Overall Dimensions</b>	See drawing
<b>Weight</b>	1.4 kgm.
<b>Power Consumption</b>	10VA approximately

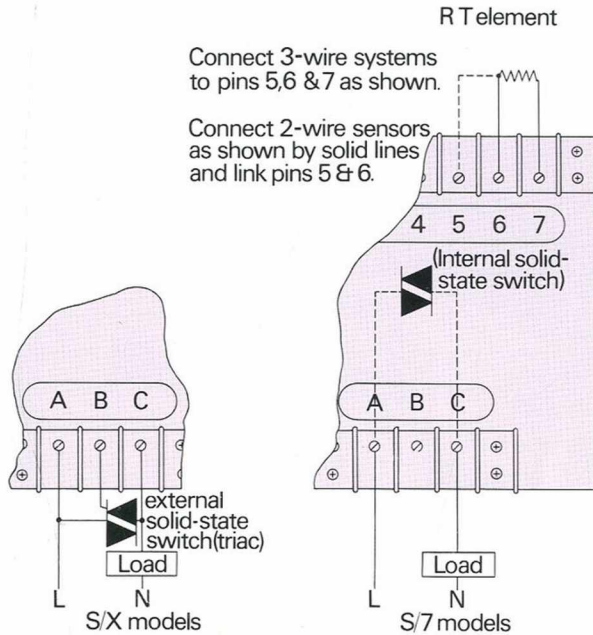
### DIMENSIONS IN MILLIMETRES



### EXTERNAL CONNECTIONS



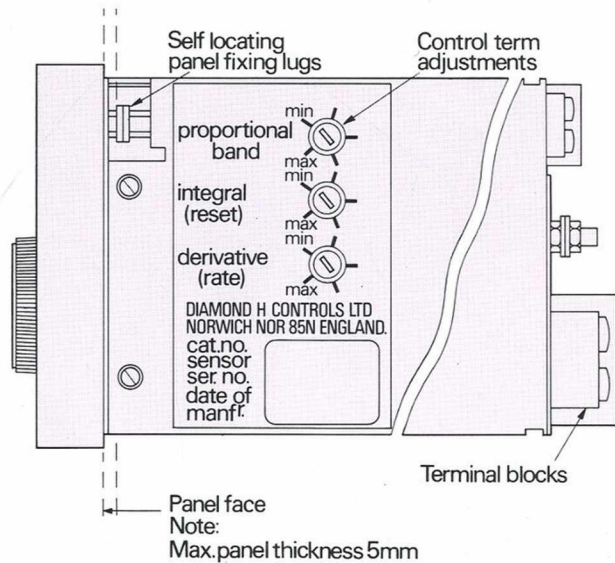
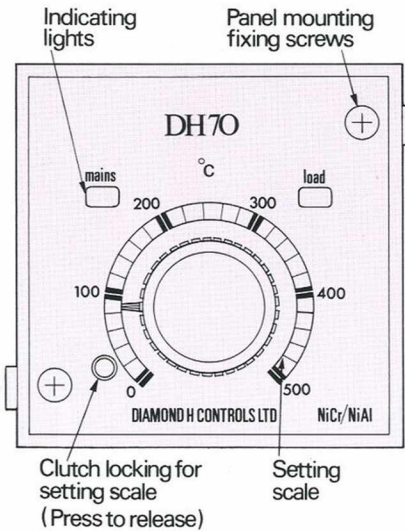
Output connections of R/6 & R/25 models



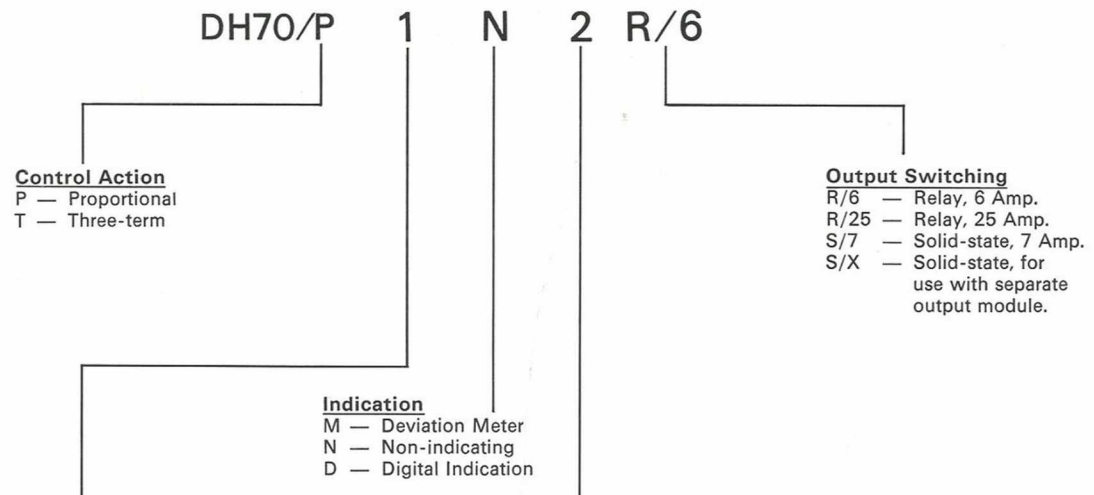
Connect 3-wire systems to pins 5,6 & 7 as shown.

Connect 2-wire sensors as shown by solid lines and link pins 5 & 6.

### OPERATIONAL DATA



# ORDERING INFORMATION



**Standard Temperature Ranges**

Sensor Type	2	6	3	5	1*	4	7	8
	0-100°C	0-250°C	0-350°C	0-500°C	0-999°C	500-1000°C	0-1000°C	0-1600°C
3 - Cu/Con	✓	✓						
2 - Fe/Con	✓	✓	✓	✓				
1 - NiCr/NiAl	✓	✓	✓	✓	✓	✓	✓	
4 - Pt 13% Rh/Pt						✓	✓	✓
8 - PRT130Ω @0°C	✓	✓	✓	✓				
9 - PRT100Ω @0°C	✓	✓	✓	✓				

\*Digital Switch

Alternative Scales to special order.

## Further options

In addition to the standard range of instruments covered by the above ordering code, a number of other features are available, such as limit or alarm circuits, alternative connections, etc.  
For applications requiring special facilities contact our Sales Engineers.

## Associated products

The DH70 Series Precision Temperature Controllers represent just one aspect of an integrated development programme designed to give total system capability for a wide range of process control requirements. Typical examples are the DH71 Series Industrial Temperature Controllers and the DH78 range of Process Timers. New instruments are continually being added to the range; details will be supplied as and when they become available.

Complementary to these instruments is the Company range of Switches, Indicators and Relays for which Data Sheets are also available.

*Dimensions and Specifications subject to change without notice.*

# DIAMOND H CONTROLS LTD

a subsidiary of Oak Industries Inc.

VULCAN ROAD NORTH, NORWICH, NOR 85N Telephone: Norwich 45291/9 Cables: Diamonhart, Norwich TIB 473/4366



The DH81 range of temperature controllers is based upon the well proven DH71 Series. The DH81 range retains the strong mechanical design of die cast front frame but incorporates an entirely new concept of plug-in electronic modules. The DH82, based upon the same design philosophy, has the additional facilities of an illuminated direct reading deviation meter and the optional facility of either single or dual alarm levels. Additionally, the user has a choice of temperature selection either by calibrated scale or thumb wheel digital switch. Output switching can be provided by relay or semi-conductor.

Typical applications include the control of ovens and furnaces; hot metals; plastics; shoe machinery; food production; photographic processing; oil, water or wax baths; dryers; hot presses; print equipment; petro-chemicals; packaging; medical equipment; environmental equipment; and heat exchangers.

# Diamond

## DH81 & DH82 temperature controllers

- \*25A switching capability.
- \*Choice of 8 temperature ranges.
- \*Choice of 6 sensor types.
- \*DIN standard 96 x 96 mm.



### Typical Specification

Control Range	Up to 1600°C.
Set Point Resolution	1°C (Digital Switch Models)
Calibration	
Accuracy	±1.5% of span
Operating Differential	<100µV (T/C); <1 ohm (PRT)
Change of set point	±120µV for supply changes of +10%, -15% (T/C); <250 milliohm (PRT) Typically 4µV/°C of ambient temperature (T/C); 20 milliohm /°C (PRT)
Proportional Band	Maximum 1.2mV (T/C); 10Ω (PRT)
Common Mode Rejection	240V 50Hz on sensor does not affect control
Thermocouple Break Protection	Power automatically switched off

Ambient Temperature and Cold Junction compensation  
Deviation Indicator Range

Output Switching Capability

Power supply

Ambient Temperature Range  
Panel Cut-out  
Overall Dimensions

Provided as standard

± 15% of span w.r.t. proportional band limits (DH82 models)

Relay up to 25A 240V a.c. resistive  
Solid State 7A 240V a.c. at 25°C ambient  
4A 240V a.c. at 50°C ambient

Multi-range variable, 110V, 130V, 220V, or 240V + 10% -15%, 50-60Hz

0-50°C.  
92 x 92 mm.  
See Fig. 5.

### Circuit Operation

The input from the thermocouple or resistance thermometer is applied to an integrated circuit amplifier, which also receives a SET POINT input derived from the temperature control potentiometer or digital switch network, and the cold junction compensation signal. The amplifier is so calibrated that at SET POINT its output reaches the threshold of a low-hysteresis Schmitt trigger circuit, the output of which controls the integral load switching relay via a driver circuit.

Derived from the Schmitt is a proportional action feedback signal, the amplitude of which is determined by the setting of the PROPORTIONAL BAND control. This signal is fed back via a control network to the input amplifier.

When used with a resistance thermometer element a bridge network is used in the input stage. An optional output facility can be provided consisting of a solid state output switch controlled by the internal relay.

control systems that a slight off-set can exist between the set point and the actual load temperature. This is referred to as the proportional off-set (Fig 3), whose magnitude and direction is a function of the load being controlled.

### On/Off Control

When the temperature at the sensor reaches set point, power is turned off by the control unit; conversely when the temperature falls below set point, power is turned on. This produces a temperature control characteristic similar to that shown in Fig. 1.

This type of control is suitable for applications in which temperature fluctuations are not harmful to the process. However, where it is important to hold the temperature at a constant value the use of proportional control is preferable.

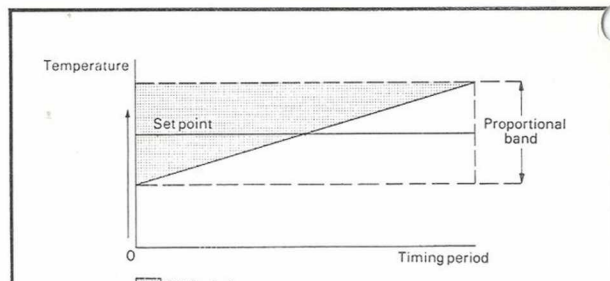


Fig. 2

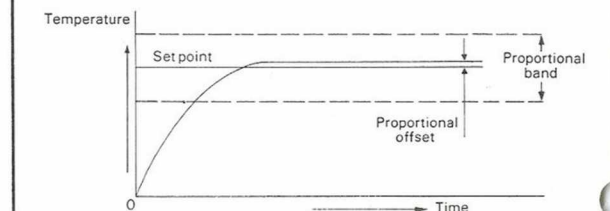


Fig. 3

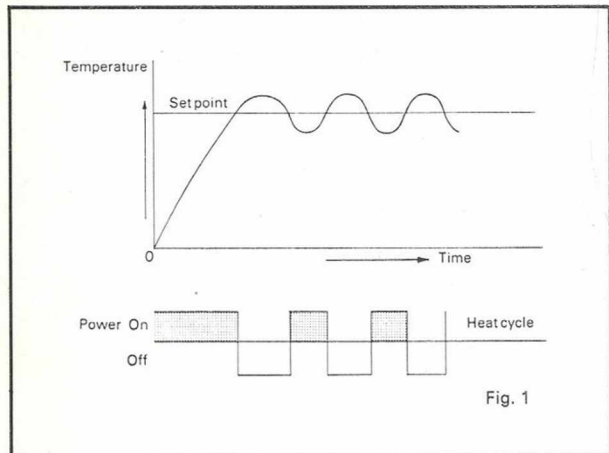


Fig. 1

### Instrument Adjustment

In the case of On/Off temperature control, only the SET POINT control needs adjustment during setting-up.

To obtain the optimum proportional band setting, the complete system should be operated and the load temperature monitored. The PROPORTIONAL BAND control, which is situated behind the hinged nameplate on the front of DH81/P and DH82/P models, should then be set as far counter-clockwise as possible, consistent with stable load temperatures. When turned fully counter-clockwise the controller produces On/Off control action, with its associated temperature fluctuations.

On DH82 controllers fitted with adjustable alarm levels the level control potentiometers are also concealed behind the hinged name plate.

### Sensor Information

A variety of thermocouples and resistance thermometer elements is available. The following list of more common specifications and typical applications is provided for the guidance of the user, and these can be supplied by Diamond H if required.

#### Thermocouple Standards

- BS4937/1973 Iron/Constantan
- BS4937/1973 Copper/Constantan
- BS4937/1973 Nickel Chromium/Nickel Aluminium
- BS4937/1973 Platinum 13% Rhodium/Platinum

#### Resistance Thermometer Element Standard

- BS1904/1970 Platinum

### Proportional Control

Proportional or anticipatory control is effected by varying the available power to the load relative to the deviation from set point. This is illustrated in Fig. 2., which shows that during the heating process, from a temperature below set point power is applied to the load only for a proportion of the time.

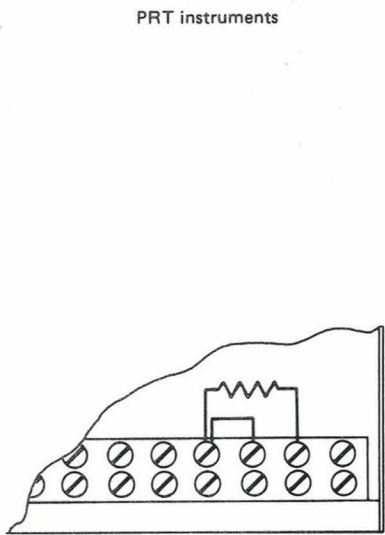
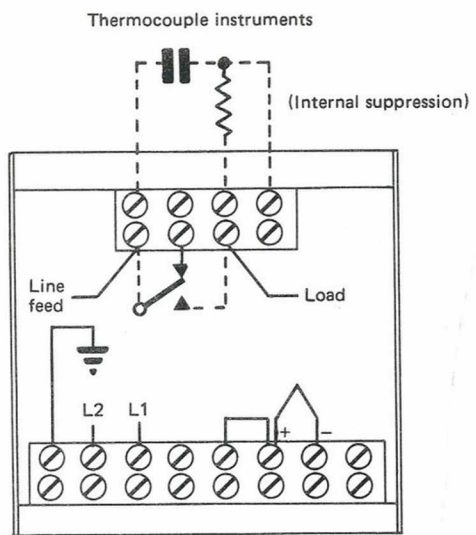
This proportion decreases until set point is reached, by which time the controller is supplying 50% power to the load. Any further temperature rise results in still less load power until, at a temperature above set point, the power level is zero. The difference between the temperatures at which power is 100% and zero is known as the proportional band.

The effect of proportional control is to stabilise the temperature fluctuations associated with On/Off control and so produce a stable temperature (Fig 3). Because of differences between loads it is a characteristic of proportional

### Typical Sensing Element Applications

Maximum Operating Temperature	Sheath Material	Sensing Element	Typical Applications
300° C	Cupro-Nickel	Copper/Constantan	Food Processing, Gear Box Bearing
500° C	Stainless Steel	Platinum Resistance	Packaging, Photographic, Environmental Chambers
750° C	Stainless Steel	Iron/Constantan	Ovens, Annealing Furnaces
1100° C	Inconel	NickelChromium/Nickel Aluminium	Billet Heating, Heat Treatment, Plastic Moulding
1600° C	Alumina	Platinum 13% Rhodium/Platinum	Blast Furnaces

# External Connections



For 2-wire sensors, connector as indicated on rear panel of instrument.  
 For 3-wire sensors, remove link from terminal block and connect as follows:

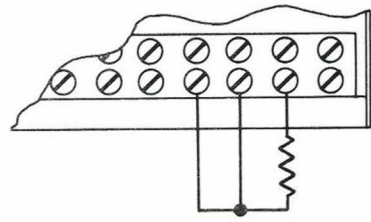
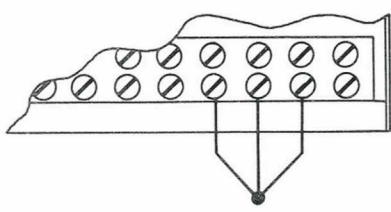


Fig. 4

## Installation and Operational Data

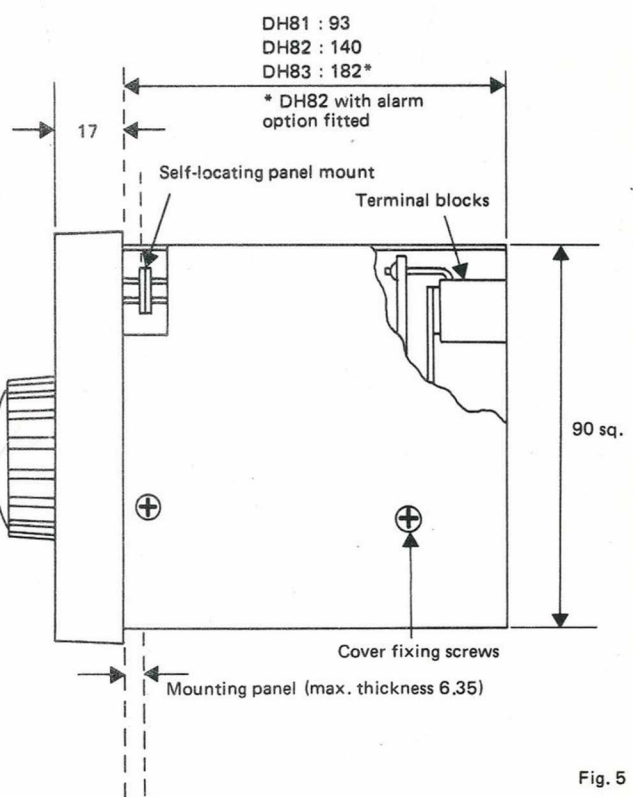
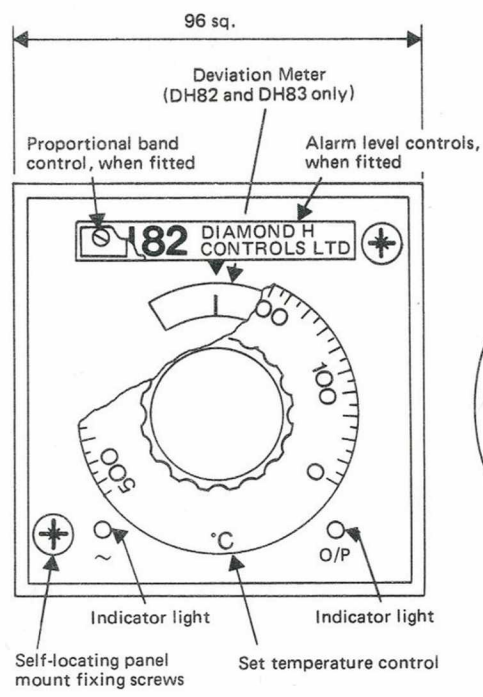
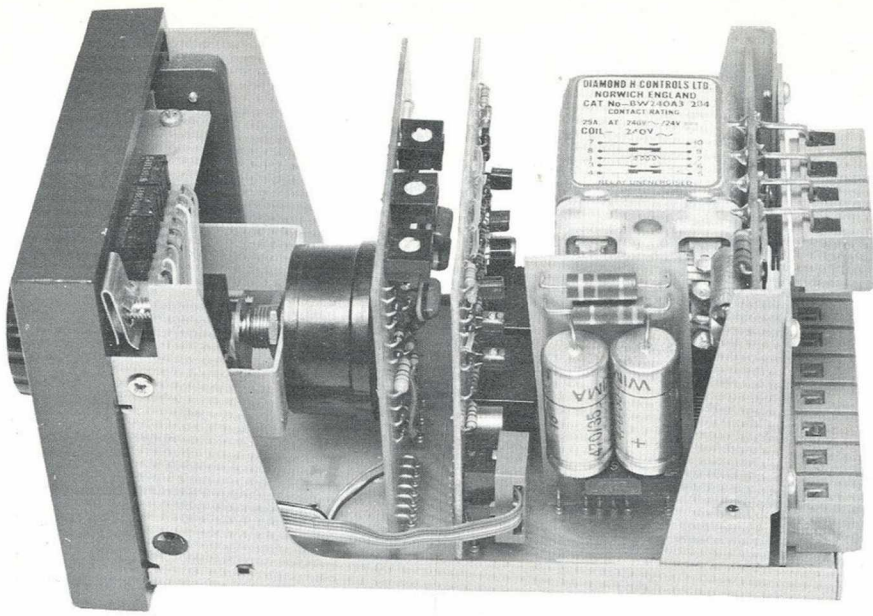


Fig. 5

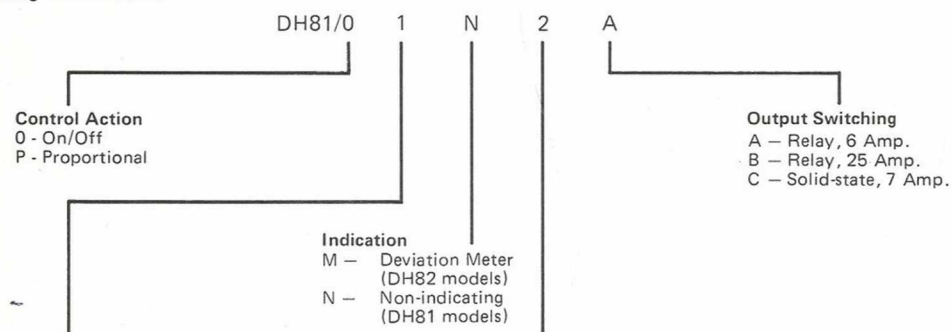
Dimensions in millimetres.





Internal view of indicating control unit with integral 25 Amp Relay and optional alarm outputs.

### Ordering Information



#### Standard Temperature Ranges

Sensor Type	2	6	3	5	1*	4	7	8
	0-100°C	0-250°C	0-350°C	0-500°C	0-999°C	500-1000°C	0-1000°C	0-1600°C
1-NiCr/NiAl	✓	✓	✓	✓	✓	✓	✓	
2-Fe/Con	✓	✓	✓	✓				
3-Cu/Con	✓	✓						
4-Pt 13% Rh/Pt						✓	✓	✓
8-PRT 130Ω @ 0°C	✓	✓	✓	✓				
9-PRT 100Ω @ 0°C	✓	✓	✓	✓				

Alternative Scales are available to special order.

\*Digital switch, DH82 only.

### Further Options

In addition to the standard range of instruments covered by the above ordering code, a number of other features are available. These include limit or alarm circuits and alternative connections, etc. For applications requiring special facilities, please contact our Sales and Application Engineering Department.

### Associated Products

The general purpose DH80 Series Industrial Temperature Controllers represent just one aspect of an integrated product range designed to give total system capability for a wide range of process control requirements. Typical examples are the DH71 Series CSA Temperature Controllers, Process Timers, Power Controllers and Programmers. New instruments are continually being added to the range; details will be supplied as and when they become available. Complementary to these instruments is the Company range of Switches, Indicators and Relays for which Data Sheets are also available.

Dimensions and specifications subject to change without notice.

# Diamond H Controls Limited.

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