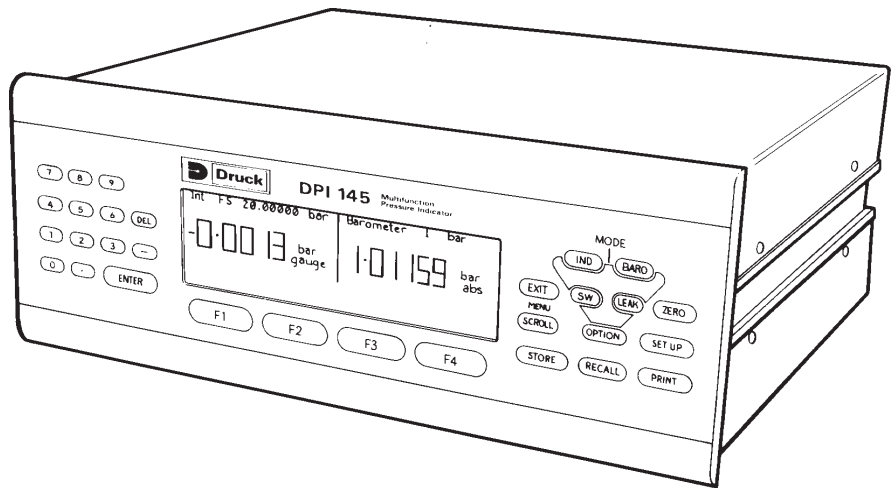


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Druck DPI 145

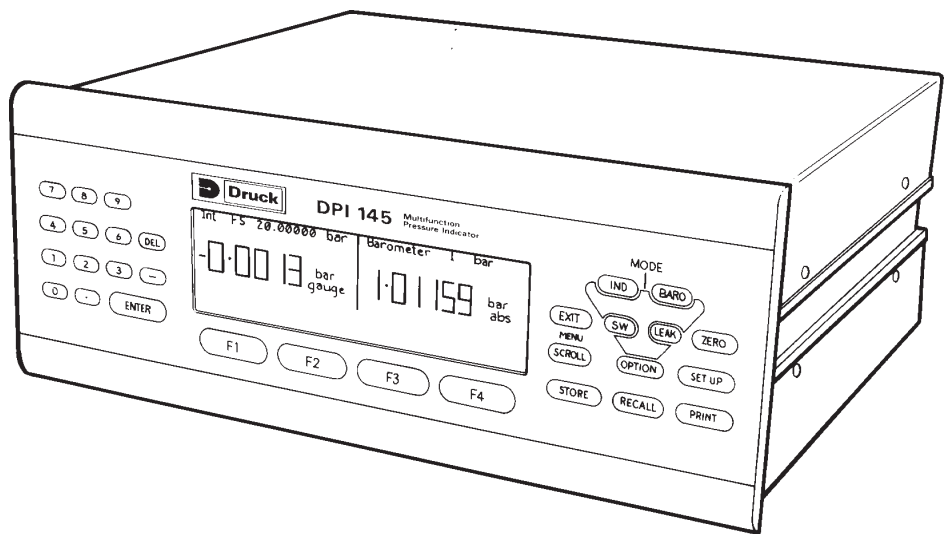
Multi-Function Pressure Indicator

User Manual K147



DPI 145

MULTI-FUNCTION PRESSURE INDICATOR



DPI 145 Multi-Function Pressure Indicator

Covers software versions 3.XX

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SAFETY

- The manufacturer has designed this equipment to be safe when operated using the procedures detailed in this manual. Do not use this equipment for any other purpose than that stated.
- This publication contains operating and safety instructions that must be followed to ensure safe operation and to maintain the equipment in a safe condition. The safety instructions are either warnings or cautions issued to protect the user and the equipment from injury or damage.
- Use qualified* technicians and good engineering practice for all procedures in this publication.

Toxic Materials

- There are no known toxic materials used in this equipment.

Maintenance

- The equipment must be maintained using the manufacturer's procedures and should be carried out by authorized service agents or the manufacturer's service departments.

Technical Advice

- For technical advice contact the manufacturer or subsidiary.

* *A qualified technician must have the necessary technical knowledge, documentation, special test equipment and tools to carry out the required work on this equipment.*

Pressure Safety

- Do not allow pressures greater than the Safe Working Pressure to be applied to the instrument refer to the Specification section of this manual.

Toxic Materials

- During normal operation, it is not possible for the user to come into contact with any hazardous substance which might be employed in the construction of the instrument. The use of hazardous materials in the construction of this instrument has been minimised. Care should however, be exercised during maintenance and the disposal of certain parts:

<p>Memory Back-up Supply - Uses a battery containing Lithium, completely sealed within the instrument. The battery can only be replaced by the Druck Service Department or an accredited Druck service Agent.</p>
--



On the instrument, this symbol indicates that the user should refer to the User Manual. Potentially hazardous operations are indicated in the text by means of a hazard warning triangle. Specific warnings relating to each section of the manual are given at the beginning of that section.



This product meets the essential protection requirements of the relevant EEC directives. Further details of applied standards may be found in the product specification.

1	INTRODUCTION	1-1
1.1	Instrument Specification	1-2
1.2	Options	1-6
1.3	Associated Publications	1-7
2	FUNCTIONAL DESCRIPTION	2-1
2.1	General	2-1
2.2	Familiarisation	2-3
2.2.1	Indicator Mode	2-6
2.2.2	Barometer Mode	2-7
2.2.3	Option	2-7
3	INSTALLATION	3-1
3.1	Mounting	3-1
3.1.1	Free Standing	3-1
3.1.2	Rack Mounting	3-4
3.1.3	Panel Mounting	3-6
3.2	Connector Connections	3-6
3.3	Pressure Connections	3-7
3.4	Electrical Connections	3-7
3.4.1	Power Supply Connections	3-8
3.5	Communication Interface Connections	3-10
3.5.1	RS 232 Interface	3-10
3.5.2	IEEE 488 Interface	3-11
3.6	Connection of External Transducers	3-11
3.6.1	Piezo Resistive Types	3-12
3.6.2	Resonant Transducer Types	3-12
3.7	Switch Test and Analogue (I/V) Output	3-13
3.8	Installation of Software Options	3-14
4	OPERATION	4-1
4.1	General	4-1
4.1.1	Menu Icons	4-1
4.2	Preparation for Operation	4-2
4.3	Instrument Set-up	4-2
	First Time Operation (Setup or Cal Pin)	4-3
	Instrument Clock Time and Date	4-4
	Display Parameters	4-5
4.3.1	Set-up Units	4-6
4.3.2	Set-up Data Communications	4-8
	RS232 Set-up	4-8
	IEEE 488 Set-up	4-9
4.3.3	Select Printer and Print Screen	4-10

Continued...

Contents Continued...

4.3.4	Channel Display Functions	4-11
	Resolution	4-11
	Name	4-12
	Filter	4-13
	Protection	4-14
	Alarms	4-14
4.3.5	Set-up Barometer Parameters	4-18
	Channel	4-19
	Height	4-19
	Temperature	4-20
4.4	Use Instrument as Barometer	4-20
	Display	4-21
	Units	4-21
	Process	4-21
	Barograph	4-22
4.5	Indicator Mode	4-23
4.5.1	Select Channel for Display	4-23
4.5.2	Change Channel Units	4-24
4.5.3	Set-up a Channel Process	4-25
4.5.4	Use of the Maths Function	4-28
4.6	Measuring a Pressure	4-29
4.6.1	Connection of External Pressure Transducers	4-30
4.7	Leak Test	4-33
4.8	I/V Output	4-35
4.8.1	Generating of Output Voltages or Currents (Prog. Output)	4-35
4.8.2	Set an Analogue Output Proportional to an Indicated Measurand	4-37
4.9	Pressure Switch Testing	4-38
4.10	Data (Screen) Store Operations	4-40
4.10.1	Screen Store Operations	4-40
4.10.2	Configuration Store Operations	4-41
4.11	Data Log	4-43
4.11.1	Use of Data Log Directory and Delete Functions	4-44
4.11.2	Data Log Record Operations	4-45
4.11.3	Data Log Replay Operations	4-52
4.12	Data (store) Recall Operations	4-56
4.12.1	Screen Recall Operations	4-56
4.12.2	Configuration Recall Operations	4-57
4.13	Software Options - Aeronautical	4-58
4.13.1	Form of Test	4-58
4.13.2	Operation	4-59
4.13.3	Change Aeronautical Settings	4-61
4.13.4	Rate of Climb Tests	4-62
4.14	Software Options - Airfield Barometer	4-64
4.14.1	Airfield Option Set-up	4-66
4.14.2	Change Airfield Setting	4-68

Continued...

Contents Continued

5	CALIBRATION	5-1
5.1	Calibration Check	5-1
5.2	Calibration Adjustment	5-2
5.2.1	General Procedures	5-3
5.2.2	Cal Status Menu	5-4
5.3	Transducer Types	5-5
5.3.1	Internal Piezo Resistive Types	5-5
5.3.2	External Piezo Resistive Types	5-6
5.3.3	Internal Resonant Types	5-6
5.3.4	External Resonant Types	5-6
5.4	Using the Calibration Menu	5-7
5.4.1	Selection of new P.I.N. Number	5-8
5.4.2	Instrument Pressure Calibration Menu Option	5-9
5.4.3	Electrical Calibration Menu Options	5-12
5.4.4	Ratio Calibration Option	5-13
5.5	Correction of Zero and Full Scale Errors	5-14
5.5.1	Internal Transducers	5-14
	Fixed Range PRT and Digitally Compensated PRT's	5-14
	Auto Ranging Pair	5-15
	Resonant Transducers	5-17
5.5.2	External Transducers	5-18
	Fixed Range PRT and Digitally Compensated PRT's	5-18
	Resonant Sensors	5-20
5.5.3	External Transducer Identification Entry (PRT Types only)	5-20
5.6	Linearity Compensation	5-21
5.6.1	Internal Transducers	5-22
	Fixed Range PRT and Digitally Compensated PRT's	5-22
	Auto Ranging Pair	5-23
	Resonant Transducers (Internal)	5-26
5.6.2	External Transducers	5-29
	Fixed Range PRT and Digitally Compensated PRT's	5-29
	Resonant Transducers (External)	5-30
5.7	Temperature Effects Compensation	5-31
5.8	Analogue and Programmable Output Adjustment	5-32
6	MAINTENANCE	6-1
6.1	Safety Instructions	6-1
6.2	Fuse Replacement	6-2
6.3	Cleaning	6-4
6.4	Memory and Clock Support Battery	6-4
6.5	Approved Service Agents	6-5

ABBREVIATIONS

NOTE: Abbreviations are the same in the singular and plural.

ac	alternating current
atm	atmosphere
°C	degrees Celsius
°F	degrees Fahrenheit
COM	common
cm²	centimetre squared
contd	continued
dc	direct current
DMM	digital multimeter
DUT	device under test
ENT	enter
FS	full-scale
ft	feet
N/C	not connected
kg	kilogram
Pa	Pascal
LSD	Least Significant Digit
PIN	personal identification number
M	metres
mA	milli Amperes
mm	milli metres
No.	number
PR	Piezo Resistive
PRESS	pressure
PTX	pressure transmitter
RDG	reading
RS 232	serial data transmission standard
SCIP	Standard Communication Protocol for Programmable Instrumentation
T	tare
VAC	vacuum

1 INTRODUCTION

The DPI 145 is a high precision pressure instrument, designed to operate as a general purpose indicator and barometer. The instrument is designed for general laboratory use and is available in either free standing or rack mounting form.

In its role as an indicator, up to six measuring channels are provided. The customer can choose from a range of pressure transducers mounted within the instrument or connected externally.

The instrument can accommodate Druck piezo-resistive transducers offering measurement over a wide pressure range and compatibility with a wide range of fluids. In addition, Druck micro-machined resonant sensors can be employed for high stability low pressure measurements. The Solartron 7881 resonant cylinder transducer is also available for this purpose. Where the greatest precision over a wide range of pressures is required an auto-ranging pair of piezo resistive transducers can be fitted.

Using many advanced measurement features including extensive linearization and thermal compensation of both the sensor and electronics, the highest stability and precision of measurement is achieved.

The user can control the instrument via the high contrast display and keyboard or from a computer via the RS232 and IEEE 488 interfaces. The instrumentation standard communication language SCPI is used, reducing programming time and assisting interchangeability of instruments.

Many powerful features are built into the instrument allowing the measured pressure to be displayed in various ways. Filters and offsets can be applied in addition to a wide range of measuring units. Mathematical functions can be performed between channels, and simple conversion formulae can easily be entered

Additionally, the instrument has specific modes of operation such as Barometer, Airfield Barometer and Aeronautical Instrument Calibration. In these modes the display format and facilities change in order to meet the specific requirements of these applications. The instrument is also capable of generating electrical output voltages and currents. These electrical outputs can be programmed to any level within the range of the instrument or be linearly related to any measurement or process channel output.

The unit can be powered either from an a.c. mains source or from a low voltage d.c. source.

1.1 Instrument Specification

Internal Measuring Channels

The instrument performance is determined by the sensor(s) fitted internally and externally. See Option B for External Transducer performance.

Pressure Ranges

Fixed Range Piezo Resistive Sensors (PRT)

Sensors can be fitted giving full-scale values within the following limits.

Gauge:	70 mbar to 70 bar
Sealed Gauge:	71 to 350 bar
Absolute:	350 mbar to 350 bar
Differential:	175 mbar to 70 bar

Auto-Ranging Piezo Resistive Sensors

Discrete ranges, gauge only.

Gauge:	-1 to 20 bar
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Resonant Sensors

All resonant sensors are absolute types and cover the following discrete ranges.

Druck Resonant Pressure Transducer (RPT)

Absolute:	35 to 1300 mbar
	35 to 2620 mbar
	35 to 3500 mbar
	800 to 1150 mbar (barometric)

Solartron 7881

Absolute:	35 to 1300 mbar
	35 to 2600 mbar
	35 to 3500 mbar
	800 to 1150 mbar (barometric)

Maximum Safe Working Pressure

1.5 x F.S. up to a maximum working pressure of 385 bar (at 350 bar 1.1 x F.S.). No shift in calibration is caused by pressures to these values.

Measuring Accuracy

Assuming regular zeroing, positive direction performance unless otherwise stated.
All values ± 1 digit.

Piezo Resistive Sensors

Fixed Range PRT	Linearity, Hysteresis & Repeatability	Linearity, Hysteresis & Repeatability + 90 Day Stability
0 to 100 mbar	>20% F.S. $\pm 0.05\%$ rdg. <20% F.S. $\pm 0.01\%$ F.S.	0.065% rdg. 0.013% F.S.
101 mbar to 70 Bar	>20% F.S. $\pm 0.025\%$ rdg. <20% F.S. $\pm 0.005\%$ F.S.	0.04% rdg. 0.008% F.S.
Above 70 Bar	>20% F.S. $\pm 0.04\%$ rdg. <20% F.S. $\pm 0.008\%$ F.S.	0.07% rdg. 0.015% F.S.

Auto-Ranging PRT	Linearity, Hysteresis & Repeatability	Linearity, Hysteresis & Repeatability + 90 Day Stability
To 20 Bar F.S.	>1% F.S. $\pm 0.025\%$ rdg. <1% F.S. $\pm 0.00025\%$ F.S.	0.04% rdg. $\pm 0.0004\%$ F.S.

Resonant Sensors

Sensor Type	Linearity, Hysteresis & Repeatability + 10-30 deg C Temp. Effects	Linearity, Hysteresis & Repeatability + Temp. + 12 Month Stability
Druck RPT All ranges	$\pm 0.013\%$ F.S.	$\pm 0.01\%$ F.S.
Solartron 7881 All ranges	$\pm 0.02\%$ rdg. plus $\pm 0.01\%$ F.S.	plus $\pm 0.005\%$ F.S.

Media Compatibility

Fixed Range Piezo Resistive: Most fluids

Auto-Range Piezo Resistive:

Most non-corrosive gases

Solartron 7881:

Clean dry air, refer to manufacturer

Measurement Noise

Typical Values:-

Fixed Piezo Resistive:	± 5 ppm F.S.
Auto-Ranging PRT:	± 0.5 ppm F.S.
Resonant:	± 5 ppm F.S.

Update Rate

Dependent on number of channels displayed, maximum two updates per second.

Temperature Effects

Piezo Resistive:	10 to 30°C averaged coefficient = $\pm 0.002\%$ rdg./°C
Resonant:	Included in accuracy

Interfaces**Analogue Output**

Proportional to selected reading. May be selected as voltage or current. User selectable zero and full-scale.

Current Range:	0 to 30 mA
Voltage Range:	0 to +10 V
Accuracy:	$\pm 0.05\%$ rdg. $\pm 0.005\%$ F.S. ± 1 digit

Programmable Output

Range:	As analogue output
Accuracy	
Current:	$\pm 0.035\%$ rdg. plus $\pm 0.01\%$ F.S. ± 1 digit
Voltage:	$\pm 0.025\%$ rdg. plus $\pm 0.01\%$ F.S. ± 1 digit

Accuracies include a 90 day stability and calibration uncertainties.

Digital Communications

RS232 serial data link using SCPI protocol.

Power Supply

A.C. :	80 to 260 V at 45 to 410 Hz
D.C. :	9 to 32 V d.c.
Power Consumption:	10 watts max.

Electrical Safety

Meets BSEN61010-1 as applicable.

The instrument must be connected to the power supply protective earth when operated from a mains supply. Safe for use up to 2,000 metres above sea level.

Environmental Specification

EMC

This equipment meets the following EMC requirements:-
EN50081-1 (Emissions) and EN50082-1 (Immunity).

Temperature

Operating: 0° to 50°C
Storage: -20° to 70°C

Sealing

Front Panel: IP54
Enclosure: IP41

The user must provide a suitable protection in more severe environments.

Humidity

To IEC 1010, 80% up to 30°C decreasing to 50% at 40°C.

Shock & Vibration

Designed to meet IEC 1010.

Weight

Dependent on transducer fit, typically: 4.6kg

Dimensions

110 mm high, 290 mm wide, 250 mm deep
3 U high when rack mounted

Accessories

The instrument is despatched with:
User Manual (K147)
Calibration Certificates
Mains Lead

1.2 Options

Option A - IEEE 488 (GPIB) Digital Communications Bus

Software to operate the IEEE 488 interface can be supplied at the time of purchase or as a retrofitted option. The software is installed and enabled by the use of a one-time electronic key.

The bus employs the SCPI protocol.

CAUTION: For EMC compliance, all IEEE leads must be less than 3M in length.

NOTE: The IEEE 488 connector is always fitted but the IEEE software option must have been installed before the connector can be used.

Option B - External Transducers

Up to a maximum of ten external piezo resistor transducers and one external resonant transducer can be used with the DPI 145. The external transducers are specially made for this application and come complete with 2 metres of cable terminated with a 12-way plug for direct connection to the instrument. Piezo resistive transducers are available to cover gauge, absolute and differential applications and resonant transducers for absolute applications.

The following options are available:

- Option B1*** Provides normal Piezo-resistive transducer temperature error bands.
- Option B2*** Provides enhanced temperature coefficients as detailed for internal sensors.
- Option B3*** Any transducer with calibration accuracy as found.

For any further details, please refer to the manufacturer.

Option C - Negative Calibration

A channel fitted with a gauge or differential fixed range PR transducer can have an additional calibration in the negative pressure direction.

Option D - Aeronautical

This software option can be fitted at time of manufacturer or retrofitted by the user. The software is installed and enabled by the use of a one-time electronic key (refer to Section 3.6). The manufacturer can advise on the optimum transducer types for use with this option.

The option is designed to enable the accurate calibration of Altimeters, Rate of Climb and Air Speed indicators.

Option E - Airfield Barometer

This software option can be fitted at time of manufacture or retrofitted by the user. The software is installed and enabled by the use of a one-time electronic key.

The option is designed to extend the standard Meteorological Barometer features to those required for use as an Airfield Barometer. Features such as QNH and multiple runways offsets are added to the existing QFE, QFF and Trend displays.

Option F - Rack Mount Kit

A plate allowing the instrument to be mounted directly into a 19 inch rack occupying 3 U of rack height.

Option G - Connectors

The following mating connectors can be supplied.

Manufacturer's Order Code	Function	Description	Supplier	Part Number
DPI 145-G4	D.C. Power Input	3-way Plug	Lemo	163-047
DPI 145-G1	External Trans.	12-way Plug	Lemo	163-032* 163-033*
DPI 145-G2	RS232	9-way D type Plug	Various	154-003* 145-008*
DPI 145-G3	I/V Output & Switch Input	BNC	Various	163-048
* Both items required				

1.3 Associated Publications

The following Druck publication is associated with this manual.

K179 - SCPI Commands for Druck Instruments

2 FUNCTIONAL DESCRIPTION (Fig. 2.1)

2.1 General

The DPI 145 is a six channel instrument (M1 to M6), designed to process the output of up to three piezo-resistive pressure transducers and up to three resonant pressure transducers.

The piezo-resistive channels, [M1] to [M3], may be configured in a number of ways. Transducers connected to [M1] and [M2] are mounted within the instrument case and be either gauge or differential type. Alternatively [M1], [M2] can be utilised for processing the outputs of an auto-ranging pair. The -1 to 20 bar gauge auto-ranging sensor utilises two digitally characterised transducers, one covering the -1 to 2 bar range and the other, -2 to 20 bar range respectively.

[M3] is used for processing the output of an external PRT transducer. This transducer, which maybe either a conventional piezo-resistive type or a digitally characterised type, can cover any range up to 700 bar (10,500 psi). The resonant sensor channels, are [M4], [M5] and [M6].

Channels [M4] and [M5] are allocated to internally mounted resonant transducers and can be vibrating cylinder or resonant silicon sensors. Channel [M6] is allocated for an externally mounted resonant transducer.

A BNC socket is provided for analogue output. This socket can be programmed to source current or voltage. These electrical outputs can also be set to be proportional to any measurand (e.g.) either pressure or the resultant of any processed channel. It may also be programmed to a particular voltage or current.

The instrument also provides a BNC socket to enable the instrument to accept trigger inputs for its internal Data Logger and Pressure Switch functions.

An RS232 or optional IEEE 488 interface provides a communication channel between the instrument and a printer or computer system.

An internal power supply unit provides all the regulated supplies that are needed to power the instrument and to source the electrical output signals. The instrument has the facility to be either a.c. mains powered or powered from an external d.c. source.

The instrument's display can be configured to show the output of a single measuring channel or any number of channels simultaneously, together with the clock time (up to a maximum number of eight channels). If a group of channels are being displayed simultaneously, the character size is automatically adjusted and the display partitioned to accommodate the read-out associated with each channel.

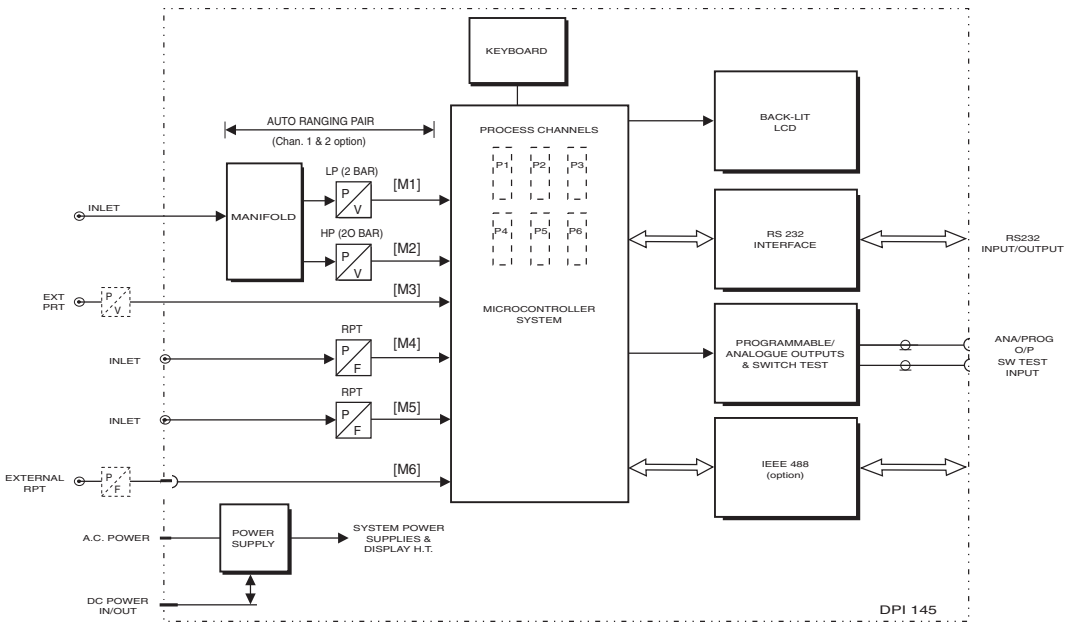


Figure 2.1 - DPI 145 Function Diagram - Typical Configuration

2.2 Familiarisation

The instrument power switch is located adjacent to the power inlet on the rear panel. All other controls are located on the front panel as shown in Figure 2.2. The instrument stores its configuration at switch-off and returns to this condition when power is restored. All data stored in the instrument memory is also retained when power is removed.

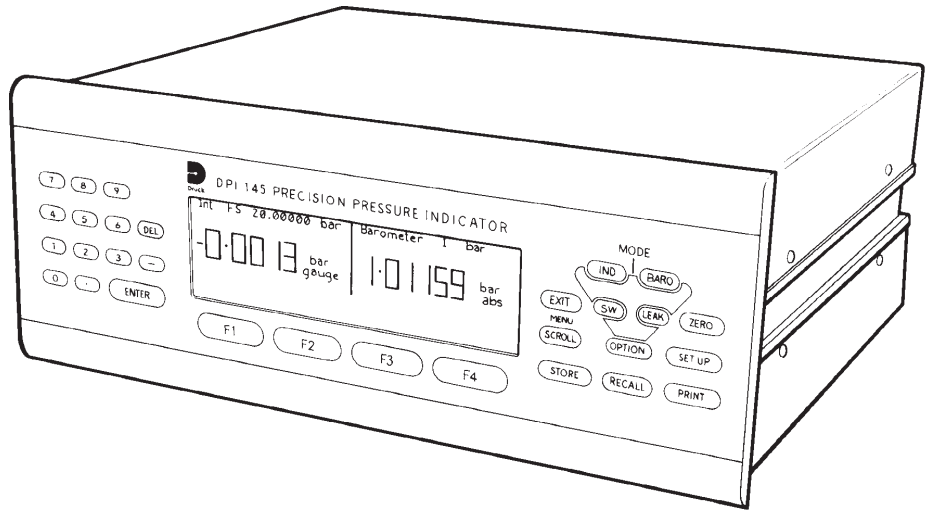


Figure 2.2 - DPI 145 Front Panel

Measured values and key functions/user dialogue are shown on a back-lit graphics Liquid Crystal Display. The user alters the function of the instrument using the control keys, four of which are function keys (labelled F1 to F4) whose purpose at any time is indicated on the display above these keys.

A range of transducers is available for the instrument covering piezo resistive silicon diaphragm, resonant silicon diaphragm and resonant cylinder types. Some of these are available as a digitally characterised auto-ranging module, others are available in internal and external mounting. Whatever the fit of transducers, the instrument has six **Measuring Channels (M1 to M6)** to which three transducers (**RPT**) and three are for piezo resistive transducers (**PRT**). One of each of these types is reserved for external transducers i.e. the instrument has one external **PRT** channel and one external **RPT** channel.

In addition to the Measuring Channels, the instrument can display up to six **Process Channels (P1 to P6)**. A Process Channel is a pseudo channel that does not carry raw measured data, instead it carries either processed or mathematically derived data. Figure 2.3 shows the concept.

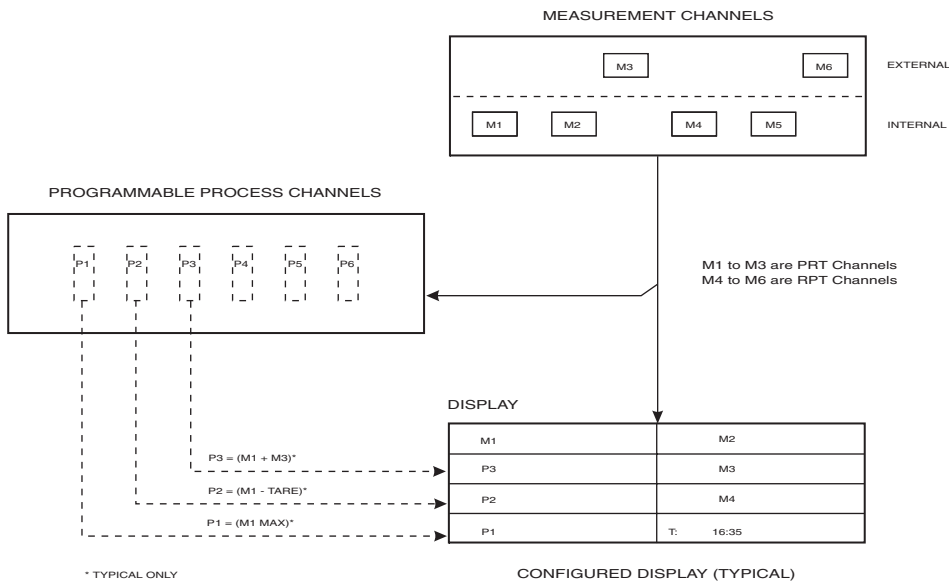


Figure 2.3 - Measurement and Process Channel Display

For example Measuring Channel [1] (**M1**) may be configured in an instrument as a **2 bar g** channel but Process Channel [2] (**P2**) may carry a version of **M1** which has had atmospheric pressure added to it thus giving an absolute pressure reading. Alternatively **P2** could be programmed to carry a Tared reading or the Peak of **M1**. The processes available are **Min, Max, Tare, %FS** (Percentage Full Scale) and **Flow**.

The Process Channel concept is used again in the mathematical functions of the instrument. If, for example, the instrument was programmed to subtract **M1** from **M2**, say for a differential measurement, then the result will be placed in a Process Channel.

Once a Process Channel has been loaded with data in this way it can be controlled, for display and process purposes, in the same manner as a Measuring Channel. Any combination of Process or Measurement channels, up to a maximum of eight at any one time, may be displayed.

Four modes of operation are supplied as standard, further modes can be purchased as options. **Indicator mode** is a flexible general purpose pressure measurement mode, whilst **Barometer mode** is aimed specifically at the requirements of atmospheric pressure measurement for meteorological applications. **Switch Test**, enabled by pressing the **SW** key, allows easy and comprehensive testing of pressure switches. **Leak Test**, entered by pressing the **Leak** key, allows pressure drop and leak rate to be measured over a programmable time interval.

2.2.1 Indicator Mode

This mode provides access to all the pressure transducers and all the processing and mathematical functions. With **Indicator mode** enabled, a total of eight values can be displayed. All six Measuring Channels and all six Process Channels can be individually accessible. The features of Indicator are:

- **Display**

Allows one or several of the measuring and process channels to be called onto the display. The instrument automatically adjusts the display window and character sizes as more data is called onto the screen.

- **Units**

Allows the selection of one of four regular units to be applied to any channel. The regular units can be chosen from an extensive list displayed under the **Setup** menu.

- **Process**

Allows the measured value to be modified by offsets such as **Tare**, to be expressed as a **Maximum** or **Minimum** value, or as **a percentage of a nominated full scale**. A programmable **filter** gives steady readings when required, without losing fast response to transients.

- **Maths**

This feature enables the user to enter simple mathematical relationships between any of the channels and display the result. Constants can also be entered.

2.2.2 Barometer Mode

This operational mode focuses the instrument onto the chosen barometric transducer. The barometric transducer can be nominated under the **Setup** menu from any of the six Measuring Channels. Data from the barometric transducer is shown as **Local Pressure (QFE)** and equivalent **Sea Level Pressure (QFF)**. Three hour **Pressure Trend** can also be displayed.

2.2.3 Option

Additional **Option modes** will also focus on specific applications such as the Airfield Barometer mode, and the Aeronautical Instrument Calibration mode.

3 INSTALLATION

Safety Instruction



THE INSTALLATION OF ELECTRICAL AND PNEUMATIC SUPPLIES MUST BE CARRIED OUT BY AN INSTALLATION TECHNICIAN*.

**An installation technician must have the necessary technical knowledge, documentation, special test equipment and tools to carry out the work on this equipment.*

3.1 Mounting

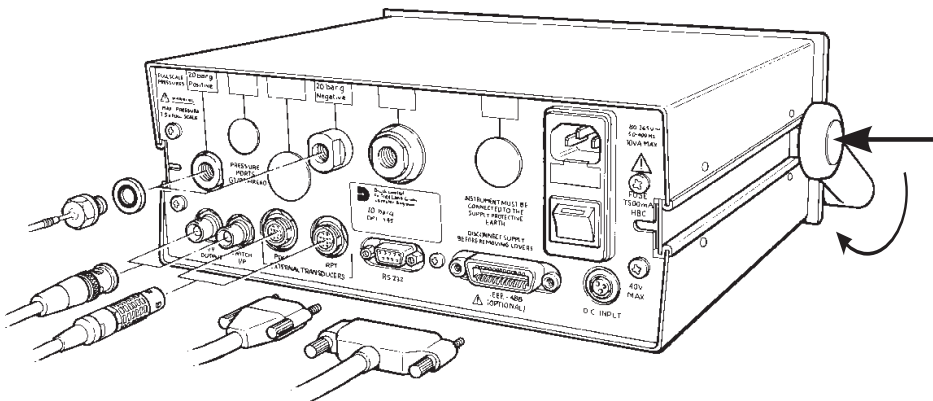
There are three ways in which the instrument may be used:

- Free standing, with or without carrying the handle.
- In a 3U high, standard 19" rack.
- Panel mounted.

The instrument, which is supplied with its carrying handle fitted, has no significant orientation sensitivity.

3.1.1 Free Standing

For the standing applications with the handle fitted, the handle position can be moved by pressing the buttons located at each end of the handle and rotating the handle to the required position.



● Removal of Carrying Handle

For free standing applications not requiring the carrying handle to be fitted, or in preparation for either rack or panel mounting, the carrying handle can be removed as follows, refer to Fig. 3.1.

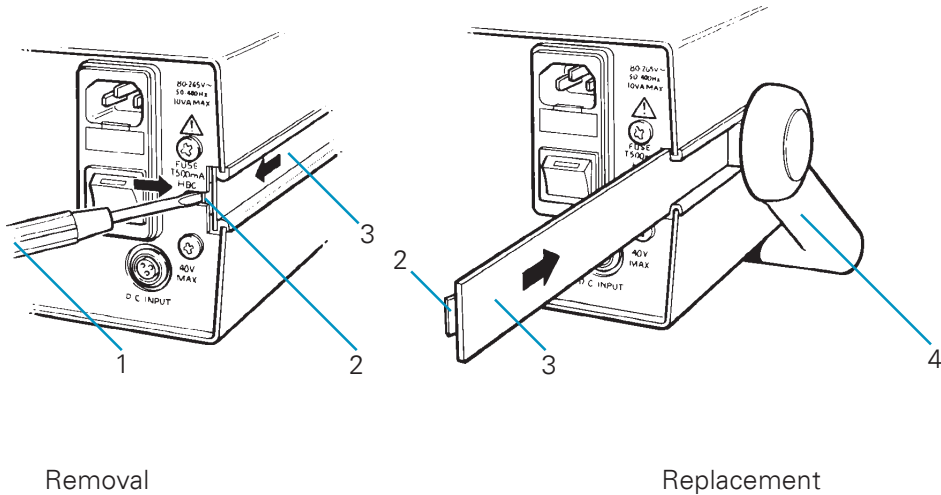


Figure 3.1 - Carrying Handle Removal

Removal

- Turn the instrument around to gain access to the rear panel.
- Switch off the power supply to the instrument and remove the IEC moulded connector from the power socket.
- Insert a screwdriver (1) into one of the recesses in the rear panel as shown in Fig. 3.1, release the spring clip (2) retaining the side plate and slide the side plate (3) out approximately 10 mm.

- Release the corresponding side plate on the other side of the instrument in a similar manner and then slide both side plates out together, complete with carrying handle (4).
- Ensure that the side plates (3) and handle/adaptor block assembly are stored in a safe place. It is recommended that for safe storage, the side plates be re-inserted in the side channels of the instrument.
- Refit the moulded mains power connector to the power socket and switch the power supply on. The instrument is now ready for connection and operation. Connection details are given in Section 3.2 to 3.7.

Replacement

- Switch off the power supply to the instrument and remove the IEC moulded connector from the power socket.
- If the side plates (3) are stored in the side channels, release retaining spring with a screwdriver and slide out of the instrument.
- Slot the side plates (3) into the adaptor blocks (5) (see also Fig. 3.2), fit the handle across the instrument and slide in side plates until they lock.
- Replace the moulded IEC connector and switch on the power supply. The instrument is now ready for connection and operation. Connection details are given in Section 3.2 to 3.7.

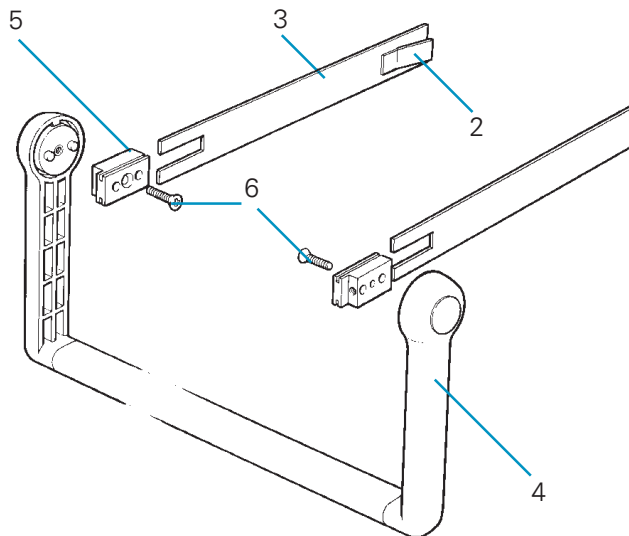


Figure 3.2 - Handle Assembly

3.1.2 Rack Mounting (Figure 3.3)

To convert the DPI 145 instrument for rack mounting, a rack mounting kit is required. This comprises a 3U high, 19" standard rack mounting facia panel with a suitable cut-out for the instrument and two M6 Cap Screws.

To install the instrument into standard rack form, proceed as follows.



- If the instrument has been previously installed, first isolate and disconnect all power supplies.
- Isolate all pressure supply lines and disconnect all pressure inlets/outlets to the instrument.
- Remove any electrical connectors which may be fitted to the instrument (e.g.) external transducers, RS232 or IEEE 488 connectors or Switch Test and I/V Output leads.
- If fitted, remove the carrying handle as described in Section 3.1.1.
- Remove the carrying handle from the adaptor blocks (5) by unscrewing the two countersunk socket head screws (6) as shown in Fig. 3.2.
- Remove the four screws (10) securing the lower cover of the instrument (9) and remove the cover. Refer to Fig. 3.3.
- Slide the instrument (rear first) through the rack front panel (7) as shown in Fig. 3.3..
- Fit a M6 cap screw (6) into each adaptor block (5) and partially screw into the block.

NOTE: No screw thread should initially protrude through the block and the stepped end of the block should be to the front.

- Place an adaptor block into the recessed end of a side plate, with the stepped end of the block facing towards the rack panel. Slide the side plate/adaptor block (3/5) along one of the side channels of the instrument until it locks into position.
- Fit the other side plate/adaptor block (3/5) into the other side channel and lock into position.
- Tighten the M6 cap screw (8) on each side, evenly against the back of the rack panel but do not over-tighten.
- Refit the bottom panel (9) to the instrument.
- Fit the assembly into the cubicle rack and make the pressure and electrical connections as described in Sections 3.2. to 3.7.

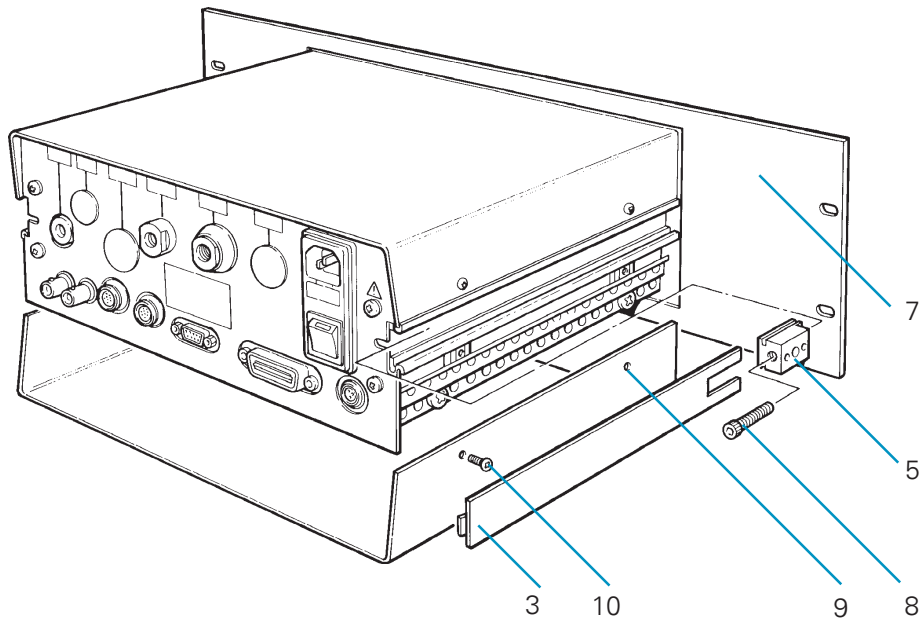


Figure 3.3 - Rack Mounting Arrangement

3.1.3 Panel Mounting (Figure 3.4)

The method of mounting the instrument into a panel is similar to the method for mounting the instrument into a rack, the instrument being mounted through the panel cut-out rather than to the rack fascia panel.

The panel cut-out size is 284 mm x 106 mm.

3.2 Connector Connections

All connections to the instrument are made to the rear panel. Fig 3.4 shows a diagram of a typical rear panel layout, together with the electrical pressure connections.

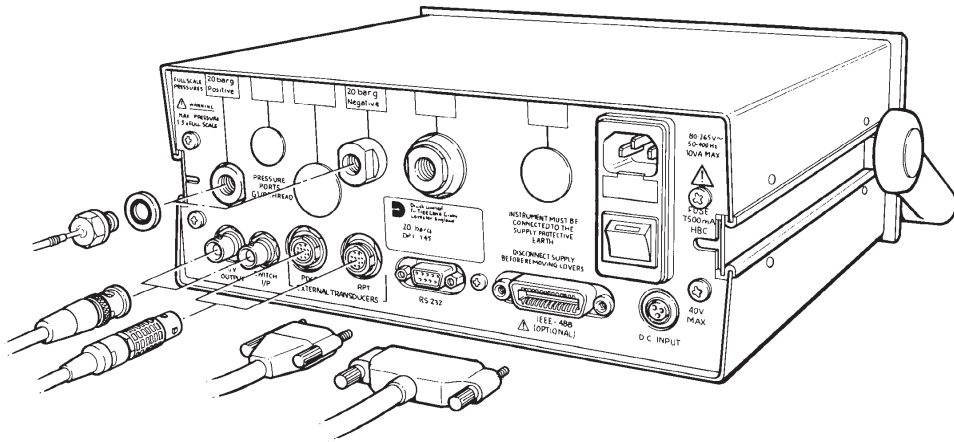


Figure 3.4 - DPI 145 Rear Panel

3.3 Pressure Connections

- **Pressure Safety Instructions**



TURN OFF THE SOURCE PRESSURE AND VENT THE PRESSURE BEFORE DISCONNECTING OR CONNECTING THE PRESSURE LINES. PROCEED WITH CARE.

ONLY USE EQUIPMENT WITH THE CORRECT PRESSURE RATING.

- **Connection**

To connect up to a measuring port, proceed as follows.

- Ensure that the pressure supply is isolated from the supply line. It is recommended that an isolation valve be fitted between the pressure source and the instrument.
- Fit the pressure supply line to the correct measuring port, fitting a bonded seal between the pressure union and the measuring port. All measuring ports use a G $\frac{1}{8}$ thread. Ensure that the coupling is tight and check for leaks. Use the Leak Test facility if required (refer to Section 4.7).

NOTE: The Barometric pressure sensors have a limited operating and calibration range (refer to Section 1, Specification).

3.4 Electrical Connections

- **Electrical Safety Instructions**



USE THE CORRECT SUPPLY SETTINGS. OPERATING VOLTAGE RANGES ARE MARKED ON THE REAR PANEL OF THE INSTRUMENT AND ARE GIVEN IN SECTION 1, SPECIFICATION.

WHEN THE INSTRUMENT IS POWERED FROM LOW VOLTAGE D.C., ENSURE THAT THE CORRECT VOLTAGE AND POLARITY ARE APPLIED TO THE INSTRUMENT.

THE EARTH LEAD (COLOURED GREEN/YELLOW) MUST BE CONNECTED TO THE MAINS SAFETY EARTH.



BEFORE MAKING ANY ELECTRICAL CONNECTIONS TO THE REAR PANEL, SWITCH THE INSTRUMENT OFF.

BEFORE REMOVING ANY COVERS, ISOLATE THE INSTRUMENT FROM ALL ITS SUPPLIES.

3.4.1 Power Supply Connections

The instrument can be powered either from a.c. mains or from a d.c. supply. Section 1, specification, gives full details of the a.c. and d.c. power supply requirements.

● A.C. Power Supply

The a.c. power supply inlet assembly is located on the rear panel as shown on Fig. 3.5. A fuse and Power On/Off switch are also contained within the assembly, details of the fuse fitting being shown in Fig. 3.5.

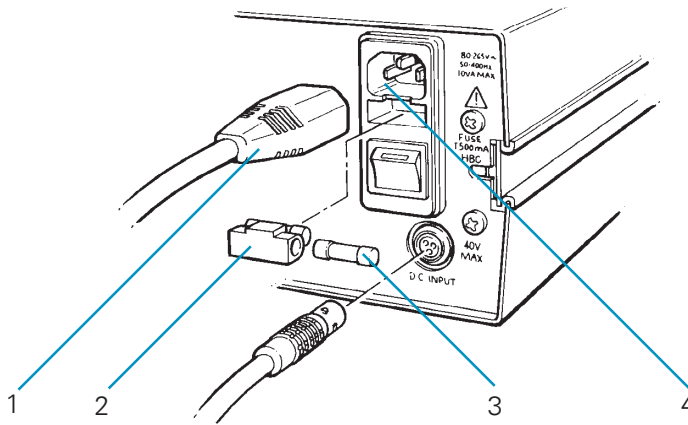


Figure 3.5 - A.C. Power Supply Socket

To connect the a.c. power supply, proceed as follows.

- Insert the moulded IEC connector (1) into the power supply socket (4) and connect to a suitable a.c. power source.
- Switch on the a.c. power supply and switch the instrument ON.
- Check that the display is lit up.



- If the instrument display does not light up, isolate the external power supply and remove the IEC connector (1) from the power socket (4).
- Remove the fuse holder (2) as shown in Fig 3.5. and insert a new fuse.

NOTE: A spare fuse (3) is contained within the fuse holder (2). Refer to Section 6 for details of fuse.

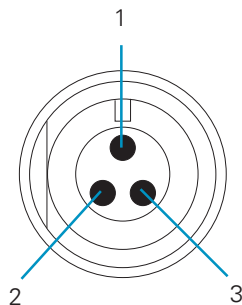
- Replace the IEC connector (1) and switch on the power supply and the instrument.

Should the moulded on mains connector need to be removed from the cable assembly (1) for any reason the cable connections are.

Blue	-	Neutral
Brown	-	Live
Green/Yellow	-	Protective Earth

• D.C. Power Supply

The d.c. input connector is located on the rear panel in the position shown on Fig. 3.5. To connect the input, proceed as follows.



1. Supply (+ve)
2. Supply (-ve)
3. Make no Connection

Figure 3.6 - D.C. Power Supply Connector Pin Out

- Insert the d.c. power supply connector and switch on the supply.

NOTE: The d.c. supply can be connected whilst the a.c. mains supply is connected without risk of damage. However, if the instrument is to be run from the a.c. supply only, then the dc supply should be isolated.

To run the instrument from the d.c. supply only, connect the d.c. supply and disconnect, or switch off, the a.c. mains supply. The rear panel on/off switch only controls the a.c. mains input.

3.5 Communication Interface Connections

Both the RS232 and IEEE 488 interfaces are connected using polarised plugs. To connect up the interfaces, push the appropriate connectors into the relevant sockets and tighten up the securing screws.

The RS232 is fitted as standard while IEEE 488 is a software option. The communication protocol used on the IEEE 488 and RS232 interfaces is given in Druck Publication No. K179.

3.5.1 RS232 Interface

The pin connections for the 9-pin RS232 connector and the relationship between the instrument and the RS232 control signals, together with device interconnection interface is shown in Table 1. The instrument is configured as Data Circuit Terminating Equipment (DCE).

Instrument		Control Line		Computer/Printer	
Instrument Function	Connector Type	Signal Direction	RS 232 Terminology	Connector Type	
	9 Way D Pin No.			9 Way D Pin No.	25 Way D Pin No.
RxD(I/P)	3	←	TxD	3	2
TxD(O/P)	2	→	RxD	2	3
GND	5	↔	GND	5	7
CTS(I/P)	7	←	RTS	7	4
RTS(O/P)	8	→	CTS	8	5
Pulled High Internally	1	→	RLSD (DCD)	1	8
Not Used	4	←	DTR	4	20
Pulled High Internally	6	→	DCR DCE Ready	6	6
Equipment Chassis	Connector Shell	↔	Cable Screen	-	1

Table 1 - RS232 Connections

3.5.2 IEEE 488 Interface

It should be noted that while the IEEE 488 connector is always fitted, the operating software is a software option. Ensure that the IEEE 488 software option has been installed before attempting to use the connector (refer to Section 3.8).

The Pin-out of the connector is shown in Table 2

Pin No.	Signal	Pin No.	Signal
1	DI01	13	DI05
2	DI02	14	DI06
3	DI02	15	DI07
4	DI04	16	DI08
5	DI05	17	REN
6	DAV	18	GND
7	NRFD	19	GND
8	NDAC	20	GND
9	IFC	21	GND
10	SRQ	22	GND
11	ATN	23	GND
12	Shield	24	SIG GND

Table 2 - IEEE 488 Connections

Details of the communication protocol used on the IEEE 488 interface are given in Druck Publication No. K179.

3.6 Connection of External Transducers

External transducers ordered as instrument options are delivered terminated with a suitable connector for direct interfacing with the instrument.

Two types of external transducer may be used with the DPI 145, Piezo resistive types (digitally and non-digitally characterised) and Resonant types. **Both types use the same type of connector but have differing pin allocations.**

3.6.1 Piezo Resistive Types

Connections for Piezo resistive transducer types are shown in Fig. 3.7. The bridge supply from the instrument is 5 V and the maximum current that can be drawn from the instrument is 25 mA. When energised from 5 V, the bridge should have a full scale output in the range 15 to 100 mV.

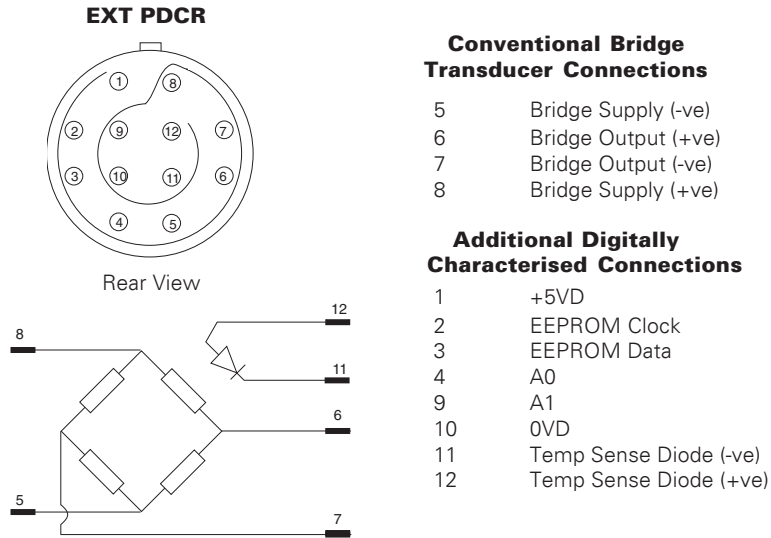


Figure 3.7 - External Transducer Connections (Piezo Resistive Types)

3.6.2 Resonant Transducer Types

Connections for resonant transducer types are shown in Fig. 3.8. It should be noted that these connections are designed to interface with Druck RPT 200 style transducers made for this instrument.

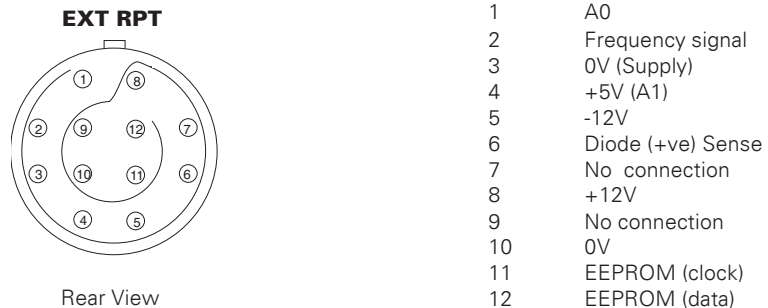


Figure 3.8 - External Transducer Connections (Resonant Types)

To connect an external transducer, plug the connector into the appropriate socket. Resonant sensors should be plugged into the socket labelled **EXT RPT** and Piezo Resistive sensors into the socket labelled **EXT PDCR**.

NOTE: The external transducer input sockets, although of the same pattern, are electrically different i.e. a **Piezo Resistive** device will not operate if plugged into the **Resonant Sensor** socket and similarly, vice versa.

Secure the connector into the socket by tightening the connector securing screws.

For information on the use of external transducers with the equipment, refer to Section 4.6.1. Section 5, Calibration, gives details of the calibration procedures for external transducers. When a conventional PRT (not Digitally Characterised) is connected to the instrument for the first time, the pressure reading will be shown on the display in units of voltage not pressure. This is because the zero and full scale offsets of the transducer must be corrected by compensation before voltage can be interpolated as pressure. Refer to Section 5 for compensation details.

3.7 Switch Test and Analogue (I/V) Output

Connections to the **Switch Test** and the **I/V Output** sockets are made via coaxial BNC connectors. To connect to either of these sockets, plug a lead fitted with a BNC connector into the socket.

The Pin-out of both sockets is shown in Fig. 3.9.

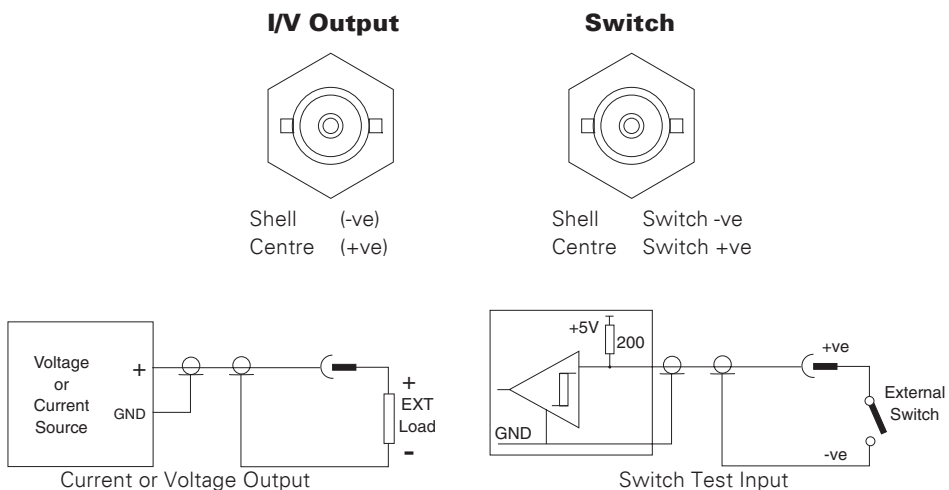


Figure 3.9 - Switch Test and I/V Output Socket Connections

3.8 Installation of Software Options

If the software options of the instrument (IEEE 488, Aeronautical and Airfield) are ordered with the instrument, they are enabled during manufacture. The following procedure details the method of enabling the options after delivery of the instrument.

The method of enabling the software options is by means of a Software Key. This Software Key is supplied at the time of instrument options purchase and can be used **only once**. To enable software options, proceed as follows.

- Ensure that the instrument is switched off.
- Insert a valid Software Key for the option(s) to be installed into the **EXT PRT** socket, located on the rear panel of the instrument.
- Switch on the instrument.
- Depending upon the options purchased, the display will read as follows. The example shows a key giving access to three options (e.g.),

Option Key:	DPI 145	One Time - Valid	
Options:	IEEE	AERO	AIRFIELD
Times Used:	0		
Install Option ?			
Yes	No		

In this example the display shows that the key in use is for a DPI 145, can be used once only, has not been used to date (valid) and will enable the installation of three software options.

- To enable the options listed for use, press the **Yes** (F1) key. The display will now change to indicate that the key has been used and is no longer valid (e.g.),

Option Key: DPI 145 One Time - Expired
Options: IEEE AERO AIRFIELD
Times Used: 1 Installed on S/N 16061
Option Key is no longer valid
Quit

Note that the serial number of the instrument and the time of installation is written to the key which, following installation, cannot be reused.

- Press **Quit** (F1) and remove the software key from the **EXT PRT** socket. The options are now enabled and available for use.

4 OPERATION

4.1 General

This section, describes the use of the DPI 145 instrument, has been structured on a functional basis.

The instrument can be fitted with up to six measurement channels and operates in one of two basic modes, indicator or barometer. When configured as an indicator, it can be set as a pressure switch tester and as a leak tester.

When configured as a barometer, the instrument will indicate **QFE** (local barometric pressure), **QFF** (barometric pressure at Sea Level), 3 hour **Trend** and as a **Barograph**.

The **Store** and **Datalog** features of the instrument are applicable to both the indicator and barometric modes of operation.

In addition to the pressure indicator and barometric pressure monitoring facilities, the instrument can generate electrical output voltages and currents. These electrical outputs can be programmed to any level within the range of the instrument or be linearly related to any measurand or process channel. The electrical output facilities are available in both the indicator and barometric modes

4.1.1 Menu Icons

In the following sections, the menu driven operations of the instrument are supported by icons to show the structures associated with each command. A typical icon is shown below, together with a description.

	SET-UP	←		First menu level (system function)
F1	● Units	←		Sub-menu level - if option selected, shown in blue
F2	○ Channel			
F3	○ Option			
F4	○ Barometer	>> ←	menu	Indicates presence of more functions on this level. Press Menu Scroll to obtain next page of menu sub-options
F1	○ Output			
F2	○ Comms	←		Second page of Sub-menu options
F3	○ Printer			
F4	○ External	>> ←	menu	Indicates presence of more functions on this level. Press Menu Scroll to obtain next page of menu sub-options
F1	○ Cal. Status			
F2	● Cal Test			Final Sub-menu page (shown selected).
F3	○ Display			
F4	○ Calendar	>> ←		Press Menu Scroll to return to first page of options
F1	○ Cal			
F2	○ Test			
F3	■ Cal Pin	←		Options shown indicate all the options available under the option selected in block shown in blue above. This Sub-Sub option will also be shown in blue
	□ Set-up Pin			

The icon is divided into a number of blocks of four functions, each corresponding to a function key as indicated. By working down the icon from top to bottom, the key sequence for the system function at the lowest level is obtained. In this example, the key sequence required in order to change the instrument's PIN number i.e. **SET-UP/Menu Scroll/Cal/Test (F2)/Cal Pin (F3)**.

4.2 Preparation for Operation

Normally, the DPI 145 instrument is a.c. mains powered. Additionally, it can be powered from an external d.c. source (supply input ranges are detailed in Section 1). When the instrument is being powered from an a.c. source, the instrument provides an auxiliary d.c. output.

● Switching ON and OFF

The instrument is switched ON using an **ON/OFF** switch located on the rear panel of the instrument. The **ON/OFF** switch is an integral part of the a.c. power connector and the mains supply fuse is also housed within the connector.

After switch-on, a short initiation period follows during which, the electronic control system is reset and the electrical outputs are switched off. When the instrument display is ON, the instrument is ready for operation. If no Measurement or Process channels are selected for display, clock time will be displayed, together with a status message.

There are no channels selected.

4.3 Instrument Set-up

The instrument is supplied calibrated. A number of other parameters are also factory set as follows:

- Time -Set to U.K. local time
- Date -Set to current date
- DisplayTimeout -Disabled (off)
- Display Resolution -Set to maximum (all channels)
- Initial PIN Number -Set as 123

● First Time Operation (Set Set-up or Cal PIN)

Access to the Set-up and calibration utilities are password protected and a factory set password (123) is entered into every instrument delivered. Since misuse of the Set-up and/or the Cal/Test facility of an instrument can result in the loss of its calibration, it is recommended that a separate PIN number is set-up for each in order to restrict unauthorised access. To set a new PIN number, proceed as follows:

SET-UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
○ Comms	
○ Printer	
○ External	
○ Cal. Status	
● Cal. Test	
○ Display	
○ Calendar	
□ Cal	
□ Test	
■ Cal Pin	
□ Set-up Pin	

- Switch the instrument ON.
- Press the **SET-UP** key. Enter the set-up PIN number (123) on the numeric key-pad and press ENTER.
- Press **MENU SCROLL** (twice).
- Select **Cal/Test** (F2) from the third page of Set-up menu. The instrument will now prompt for entry of the current password as follows:

Cal/Test - Enter Pin Number: □

- Enter PIN number (123) on the numeric key-pad and press **ENTER**. The instrument now displays the Cal/Test menu

Cal/Test Menu

Cal Test Cal Pin Set-up Pin

- Select **Set-up Pin** (F4) or **Cal Pin** (F3) as required and a prompt is given for a new PIN number.

Enter Pin Number: □

Enter key alone sets no Pin number

- Enter a new PIN number via the numeric key-pad and press **ENTER**.
- At the **Verify new Pin** number prompt, enter the new PIN number via the numeric key-pad and press **ENTER**. If the new PIN number is entered correctly, the instrument responds with **Verification OK** and exits the Set-up mode. If the new PIN number is entered incorrectly at the **Verify New Pin number** prompt, the instrument responds with **Pin numbers do not agree** and exits the Set-up mode, the old PIN number being retained.

CAUTION The instrument calibration can be lost by incorrect use of the calibrate facility.

● Instrument Clock Time and Date

To set-up the instrument Clock Time and Date, proceed as follows.

SET-UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
○ Comms	
○ Printer	
○ External	
○ Cal. Status	
○ Cal. Test	
○ Display	
● Calendar	
■ Time	
□ Date	
□ On	
□ Off	

- Switch the instrument ON
- Press the **SET-UP** key. If set, enter the Set-up PIN and press ENTER.
- Press **MENU SCROLL** twice to display the third page of the Set-up menu.
- Select **Calendar** (F4) from the third page of the Set-up menu.
- Select **Time** option (F1) and a prompt is given for a new time.

Enter new Time (Hours. Mins): □

- Enter the new time in hours and minutes format via the numeric keypad, using the decimal point as a delimiter.
- Press **ENTER** to accept the entered value.
- To select Time to be displayed, press the **On** (F3) key. Conversely, to remove time from the display, press the **Off** (F4) key.

NOTE: If no channels are selected for display, Time will be displayed by default, whether or not it has been switched ON under this utility.

- Select the **Date** (F2) option.

Enter New Date (Day.Mth.Year):

Enter the new date in Day, Month and Year format via the numeric keypad, using the decimal point as a delimiter.

- Press **ENTER** to accept the entered date.

● Display Parameters

When the instrument is first supplied, the display contrast and brightness are both preset. To change the setting for either parameters, proceed as follows.

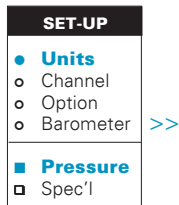
SET-UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	>>
○ Output	
○ Comms	
○ Printer	>>
○ External	
○ Cal. Status	
○ Cal. Test	>>
● Display	
○ Calendar	
■ Contrast	>>
□ Brightness	
□ Timeout	

- Switch the instrument ON
- Press the **SET-UP** key followed by the **MENU SCROLL** key twice (to obtain the third page of the Set-up menu). Pin number will need to be entered first (if set).
- Select **Display** (F3) from the Set-up menu.
- Select **Contrast** from the Display Set-up menu.
- Use the **Up** (F1) and **Down** (F2) keys to change the (e.g.) **Contrast** level to the required level.
- Press **Exit Menu** once to return to the Display Set-up menu.
- Select **Timeout** (F3) if required and enter required timeout period (1 to 500 min) on the numeric key-pad followed by **ENTER**.
- Press **On** (F1) to enable or **Off** (F2) to disable the Timeout feature. At the end of the Timeout period, the display backlight is turned off. Pressing any key will immediately restore the display and reset the Timeout period.
- Press **Exit Menu** three times to exit Set-up or allow sufficient time for it to timeout.

4.3.1 Set-up Units

- **Pressure**

Instruments are supplied with their pressure scales programmed to specific function keys as follows, **bar** (F1), **psi** (F2), **mH2O (F3)** and **kPa** (F4). U.S. version of the instrument default to **psi** (F1), **Hg20** (2), **inHg** (F3) and **kPa** (F4). Japanese version default to **kg/cm²** (F1), **mmHg** (F2), **mH₂O** (F3) and **mbar** (F4). To change any default setting, proceed as follows.



- Switch the instrument ON
- Press the **SET-UP** key. If set, enter the Set-up PIN and press **ENTER**.
- Select **Units** (F1) from the Set-up menu.

- Select **Pressure** (F1) from the Defaults Units Selection menu.

Operation of this key displays the full range of units available together with an indication of the units to which each function key is currently assigned.

Use function keys to select units:

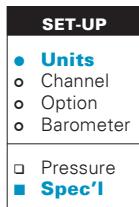
bar	kg/m ²	torr	ftH ₂ O
Pa - F4	mmHg - F3	atm	ftH ₂ O4
hPa	cmHg	psi - F2	"H2O60
kPa	mHg	lb/ft ²	Spec'l
MPa	mmH ₂ O	inHg	Blank
mbar - F1	cmH ₂ O	inH ₂ O	Blank
kg/cm ²	mH ₂ O	inH ₂ O4	Blank

The default setting for any key is changed by pressing the required function key. This causes it to scroll through the menu, missing out units assigned to the other function keys. The display shows the function key next to the assigned pressure unit. Assigning three function keys to **Blank** provides the facility of setting-up the instrument for single pressure unit operation.

- **Spec'I**

The instrument has the facility to enable the operator to set-up a user defined conversion factor for the pressure reading, the value being the number of Pascals in one user defined unit. The default setting of the Pascals to Spec'I conversion is 100 (scaling the pressure display in hPa).

By entering a conversion factor (Pascals to Spec'I unit factor) under Set-up, the instrument can be made to read any required unit. To change the default setting of the Special factor, proceed as follows.



- Switch the instrument ON
- Press the **SET-UP** key.
- Select **Units** (F1) from the Set-up menu.
- Select **Spec'I** (F2) from the Default Units Selection menu. The instrument now displays a prompt showing the current conversion factor and requesting entry of a new factor.

Pascals to Spec'I Factor: □ 100.00

- Enter the required conversion factor on the numeric key-pad and press **ENTER**.
- Press **EXIT MENU** three times to exit set-up.
- Assign a function key to Spec'I (refer to Pressure Section 4.3.1).

NOTE: If the **Spec'I** conversion factor is changed while the **Spec'I** Units factor is selected, the **Spec'I** Units factor will have to be re-selected in order to make use of the new conversion factor.

4.3.2 Set-up Data Communications

● **Comms**

To set-up the instrument’s data communications parameters, proceed as follows.

SET-UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
● Comms	
○ Printer	
○ External	
<input type="checkbox"/> RS232	>>
<input type="checkbox"/> IEEE	

- Switch the instrument ON
- Press the **SET-UP** key.
- Press **Menu Scroll** to select second page of Set-up options.
- Select **Comms** (F1) from the Set-up menu. If the IEEE 488 option is installed, the instrument now prompts for either the **RS232** or **IEEE** to be selected for Set-up. If no IEEE 488 is installed, the RS232 Set-up menu is presented immediately.

■ **RS232 Set-up**

Selecting **RS232** from the Set-up menu or **COMMS** only if no IEEE 488 option is present, provides a status report of the currently set Comms parameters and the facility to set-up the **Baud rate** (F1), **Parity** (F2) and **Handshake** (F3) parameters of the RS232 communication protocol.

Baud rate: 9600 Parity: none HS: Hardware
Baud rate Parity Handshake

SET-UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
● Comms	
○ Printer	
○ External	
■ RS232	>>
<input type="checkbox"/> ***	
△ Baud rate	
△ Parity	
△ Handshake	

□ **Baud rate**

This option allows the baud rate to be set-up via the **Previous** (F1) and **Next** (F2) keys. The current setting is indicated by an arrow. A typical baud rate display is shown below.

Select baud rate		
110	600	4800
150	1200	9600 ←
300	2400	19.2K
Previous		Next

After setting up the required baud rate, press **Exit Menu** to return to the Comms sub-menu. Repeat **Exit Menu** operations until the Set-up option clears.

SET-UP	
o Units	>>
o Channel	
o Option	
o Barometer	
o Output	>>
● Comms	
o Printer	
o External	
■ RS232	
□ IEEE	
□ Baud rate	
■ Parity	
□ Handshake	

• Parity

This option allows the RS232 parity checking mode to be set-up. Three options are available **Odd** (F1), **Even** (F2) and **None** (F3).

Select the required option by pressing the appropriate function key.

SET-UP	
o Units	>>
o Channel	
o Option	
o Barometer	
o Output	>>
● Comms	
o Printer	
o External	
■ RS232	
□ IEEE	
□ Baudrate	
□ Parity	
■ Handshake	

• Handshake

Selection of this option allows the RS232 handshaking mode to be set-up. Four options are available, **None** (F1), **Software** (F2), **Hardware** (F3) and **Both** (F4).

Select the required option by pressing the appropriate function key.

■ IEEE 488 Set-up

o Units	>>
o Channel	
o Option	
o Barometer	
o Output	>>
● Comms	
o Printer	
o External	
□ RS232	
■ IEEE	

Selecting **IEEE** from the **COMMS** menu (only if IEEE 488 option is enabled), displays the currently set instrument address and, using a flashing cursor, requests entry of a new address for the instrument.

IEEE address 4

Enter the required instrument address on the numeric keypad (a number within the range **0 to 30**), and press **ENTER**. If an out of range number is entered, the instrument displays an error message **number out of range** and retains the original address.

Press **Exit Menu** once only to return to the Set-up Menu or twice to quit Set-up.

4.3.3 Select Printer and Print Screen

● Printer

To select a printer, proceed as follows,

SET-UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
○ Comms	
● Printer	
○ External	
▣ Previous	
▣ Next	

- Switch the instrument to ON.
- Press the **SET-UP** key.
- Press **MENU SCROLL** to select the second page of the set-up menu.
- Select **Printer** (F2) from the Set-up menu.

Selecting the Printer option (F2) from the Set-up menu, provides a list of printers supported by the instrument,

Printer Selection

Druck 40 column printer ←
80 column printer

PreviousNext

The currently selected printer is indicated by the position of the cursor arrow. Use the **Next** (F2) and **Previous** (F1) keys to move the cursor arrows to the required printer. Press the **Exit Menu** key to return to the Default Setting Menu.

● Print Screen

To print the screen, proceed as follows.

- Ensure that the external printer or computer is connected to the RS232 port and that the port is correctly configured (See Section 4.3.2).
- Press and hold the **PRINT** key for 1 second. If the key is not held for long enough, an error message is written to the display.

Keep key depressed to print screen.

4.3.4 Channel Display Functions

● Resolution

The display resolution can, depending upon the range selected, be set-up to give a maximum of 6½ digits. To select the required resolution, proceed as follows.

SET-UP	
○	Units
●	Channel
○	Option
○	Barometer
■	Resolution
□	Name
□	Filter
□	Protection
★	Alarms

- Switch the instrument ON.
- Press the **SET-UP** key.
- Select **Channel** (F2) from the Set-up menu.
- Select **Resolution** (F1) option.
- In response to the Select Pressure Channel prompt, select the required channel by pressing the appropriate function key. Note that both measurement and process channels can be selected.

Select Pressure Channel
2 Bar G 20 Bar G Process

If Process is chosen, a list of process channels will be written to the screen from which one channel must be selected.

2 BarG Max	P1:	Displayed
2 BarG + Process 1	P2:	Displayed
2 BarG * Process 2	P3:	
Not Defined	P4:	
Not Defined	P5:	
Not Defined	P6:	

Select process to set resolution:

Up Down Select

Use the **Up** (F1) and **Down** (F2) keys to position the reverse video cursor over the required channel and press **Select** (F4). The following prompt will then be given,

Pressure display resolution dp's = 3
Up Down

Use the **Up** (F1) and **Down** (F2) keys to set the required resolution. Press **Exit Menu** to return to Select Pressure Channel menu and once more to quit **Set-up**.

- **Name**

Alpha-numeric names can be added to each measurement and process channel. To add/change a channel name, proceed as follows.

SET-UP	
<input type="radio"/>	Units
<input checked="" type="radio"/>	Channel
<input type="radio"/>	Option
<input type="radio"/>	Barometer
<hr/>	
<input type="checkbox"/>	Resolution
<input checked="" type="checkbox"/>	Name
<input type="checkbox"/>	Filter
<input type="checkbox"/>	Protection

- Select **Name** (F2) from the channel Set-up menu. The following sub-menu will then be presented.

Select Channel to add Name

2 bar g 1 bar A Process

- Select the appropriate channel (e.g.) **1 bar A** (F2). The text entry sub-menu will now be presented (e.g.)

Enter text:

Alpha ↑ Alpha ↓ ← →

Alpha characters are entered using the **Alpha ↑** (F1), **Alpha ↓** (F2), **←** (F3) and **→** (F4) keys. **Alpha ↑** (F1) scrolls forwards through the alphabet and **Alpha ↓** (F2) backwards. Shifting right to the next character position or left to a previous character position is achieved by the **→** (F4) and **←** (F3) keys respectively.

Numeric entries are added directly from the numeric key-pad. Pressing the **ENTER** key, located on the numeric key-pad, accepts the name.

● **Protection**

The protection function is used to prevent a process channel from being overwritten. To set-up the protection function, proceed as follows.

SET-UP	
○	Units
●	Channel
○	Option
○	Barometer
□	Resolution
□	Name
□	Filter
■	Protection

- Select **Protection** (F4) from the channel Set-up menu. The following sub-menu will then be presented.

2 BarG Max	P1:	Displayed
2 BarG + Process 1	P2:	Displayed
2 BarG * Process 2	P3:	
Not Defined	P4:	
Not Defined	P5:	
Not Defined	P6:	

Process Channel Protection

Select	On/Off
--------	--------

Use the **Select** (F1) key to position the cursor over the required channel and press the **On/Off** key (F4).

The **Displayed** legend against the selected channel will change to read **Displayed Prot**, to indicate that the channel is now protected.

- Press **Exit Menu** three times to exit the Set-up mode.

● **Alarms**

One of two types of alarm function are provided for each measurement channel, **Threshold** and **Band**. For each type of alarm, alarm annunciation can be either an internal bell or an external voltage current, or both.

○ **Set-up Threshold Alarm**

To set-up a **Threshold** alarm, proceed as follows.

SET-UP	
○	Units
●	Channel
○	Option
○	Barometer
□	Resolution
□	Name
□	Filter
□	Protection
■	Alarms
□	Identity

>>

>>

- Select **Alarms** (F1) from the channel Set-up menu by pressing Menu Scroll, followed by **Alarms** (F1).
- Select required alarm channel by pressing the appropriate key **2 bar g** (F1).

Select Alarm Channel

2 bar g	1 bar A	Process
----------------	----------------	----------------

SET-UP	
<input type="radio"/>	Units
<input checked="" type="radio"/>	Channel
<input type="radio"/>	Option
<input type="radio"/>	Barometer
<input type="checkbox"/>	Resolution
<input type="checkbox"/>	Name
<input type="checkbox"/>	Filter
<input type="checkbox"/>	Protection
>>	
<input checked="" type="checkbox"/>	Alarms
<input type="checkbox"/>	Identity

The alarm selection menu is then presented as follows.

Select type of alarm:

Threshold Band Enable Clear

- Select **Threshold** (F1). A prompt for the threshold level is now given and the existing level is displayed.

Enter Threshold: 1.8

- Enter required threshold level **1.8** (the required centre of the alarm dead band) on the numeric key-pad and press **ENTER**. A prompt for the hysteresis level that indicates the current status is then given,

Hysteresis 0.18

- Enter the required hysteresis level **0.18** on the numeric key-pad and press **ENTER**. A prompt for required bell indication is then given,

Bell indication

On Off

- Select **On** (F1) or **Off** (F2) as required. A prompt for the required Electrical Output indication is given.

Electrical Indication

Current Voltage None

- Select the required electrical output indication **Current** (F1), **Voltage** (F2) or **None**.

Note that the Electrical Output level will be the same as the output set-up under the Prog Output facility (refer to Section 4.8.1).

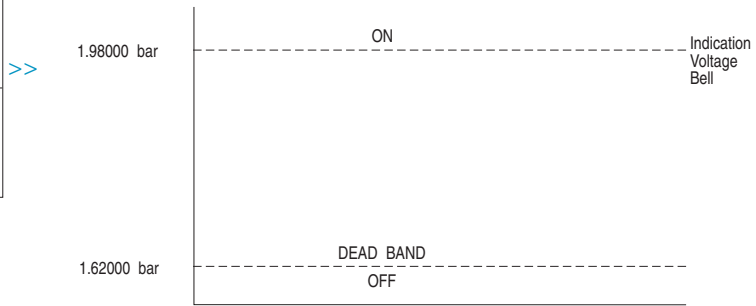
SET-UP

- Units
- **Channel**
- Option
- Barometer

- Resolution
- Name
- Filter
- Protection

- **Alarms**
- Identity

■ A summary screen of the threshold parameters is now written to the display (e.g.)



■ The **Invert** (F1) option is used to reverse the alarm condition i.e. ON = OFF and vice versa. **Change** (F2) allows the parameters to be altered and **OK** causes the alarm to be set. **Quit** (F4) exits the alarm setting mode without changing/setting any alarm parameters.

○ **Set-up Band Alarm**

The Band alarm for a channel is similar in set-up to a Threshold alarm, the difference between the two alarm modes being that an operating band is specified and that an alarm is generated if the recorded pressure falls outside this limit (either positive or negative). To set-up the alarm mode, proceed as follows.

SET-UP

- Units
- **Channel**
- Option
- Barometer

- Resolution
- Name
- Filter
- Protection

- **Alarms**
- Identity

- Select **Alarms** (F1) from the channel Set-up menu by pressing **Menu Scroll**, followed by **Alarms** (F1).
- Select required alarm channel by pressing the appropriate key (e.g.) **2 bar g** (F1).

Select Alarm Channel

2 bar g 1 bar A Process

SET-UP	
<input type="radio"/>	Units
<input checked="" type="radio"/>	Channel
<input type="radio"/>	Option
<input type="radio"/>	Barometer
<hr/>	
<input type="checkbox"/>	Resolution
<input type="checkbox"/>	Name
<input type="checkbox"/>	Filter
<input type="checkbox"/>	Protection
>>	
<hr/>	
<input checked="" type="checkbox"/>	Alarms
<input type="checkbox"/>	Identity

The alarm selection menu is then presented as follows.

Select type of alarm:

Threshold Band Enable Clear

- Select **Band** (F2). A prompt for the Upper Band Limit is now given and the existing level is displayed (e.g.),

Enter Upper Band Limit: 1.8

- Enter required Upper Band Limit (e.g.) **1.8** on the numeric key-pad and press **ENTER**. A prompt for the Lower Band Limit is then given (e.g.)

Enter Lower Band Limit: 1.5

- Enter the required Lower Band Limit (e.g.) **1.5** on the numeric key-pad and press **ENTER**. A prompt for required Bell indication is then given (e.g.)

Bell indication

On Off

- Select **On** (F1) or **Off** (F2) as required. A prompt for the required Electrical Output indication is given (e.g.)

Electrical Indication

Current Voltage None

- Select the required electrical output indication **Current** (F1), **Voltage** (F2) or **None**.

Note that the Electrical Output level will be the same as the output set-up under the Prog Output facility (refer to Section 4.8.1).

- **Channel**

This option allows the channel number of the Barometric sensor to be selected. To change the current channel, proceed as follows.

SET-UP	
○ Units	
○ Channel	
○ Option	
● Barometer	>>
■ Channel	
□ Height	
□ Temperature	

- Select **Channel** (F1) from the Barometer menu.
- In response to the prompt (e.g.)

Enter new barometer channel □

Enter number of required channel on numeric key-pad and press **ENTER**.

- **Height**

To change (set) the height of the selected barometer, proceed as follows.

SET-UP	
○ Units	
○ Channel	
○ Option	
● Barometer	>>
□ Channel	
■ Height	
□ Temperature	

- Select **Height** (F2) from the Barometer menu.
- In response to the prompt (e.g.)

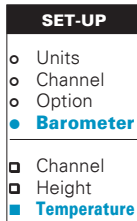
Enter new barometer height □

Enter height (in metres) on numeric key-pad and press **ENTER**.

- Press **Exit Menu** twice to quit set-up.

- **Temperature**

To change (set) the ambient temperature of the selected barometer, proceed as follows.



- Select **Temperature** (F3) from the Barometer menu.
- In response to the prompt

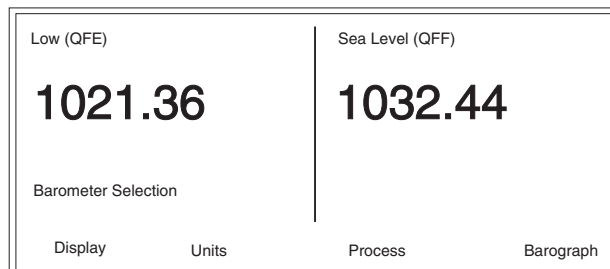
Enter new barometer temperature □

Enter new temperature (in degrees Celsius) on the numeric key-pad and press **ENTER**.

- Press **Exit Menu** twice to quit set-up.

4.4 Use Instrument as Barometer

To select the Barometer mode, press the '**BARO**' key. Following operation of this key, the instrument will prompt as follows.



Use the function keys as follows to set-up the required display.

● Display

This function is used to select the barometer parameters to be displayed. Select parameters as follows.

BARO	
<input checked="" type="radio"/>	Display
<input type="radio"/>	Units
<input type="radio"/>	Process
<input type="radio"/>	Barograph
<hr/>	
<input checked="" type="checkbox"/>	QFE
<input type="checkbox"/>	QFF
<input type="checkbox"/>	Trend

- Select the **Display** key (F1).
- Select required parameters (e.g.) **QFE** for display by pressing the appropriate function key (F1). The instrument prompts for the channel to be selected for display as follows (e.g.)

**Barometer channel
On**

NOTE: If the Barometer was already switched ON for display, only the opposite state (e.g.) OFF will be displayed as a menu option.

- **Trend** is the change in **QFE** or **QFF** over the last 3 hour period and is updated every 10 minutes.
- Select **On** (F1) to display the selected channel.
- Press **Exit Menu** to return to the Barometric Selection menu and select other parameters in a similar manner.

● Units

Select Barometric units as follows.

BARO	
<input type="radio"/>	Display
<input checked="" type="radio"/>	Units
<input type="radio"/>	Process
<input type="radio"/>	Barograph
<hr/>	
<input type="checkbox"/>	bar
<input type="checkbox"/>	psi
<input type="checkbox"/>	mH ₂ O
<input checked="" type="checkbox"/>	mbar

- Select the **Units** key (F2).
- Select required units. If the required units are not indicated, use the Set-up facility to select units required (e.g.) mbar (refer to Section 4.3.1).

● Process

Two barometric process channels are provided (**Max.** and **Min.**) for the QFE and QFF parameters.

QFE is the local atmospheric pressure as measured at the transducer port.

QFF is the estimated equivalent Sea Level pressure calculated knowing measuring site altitude and local air temperature according to the UK meteorological office conversion formula.

Select process channels as follows.

BARO	
○	Display
○	Units
●	Process
○	Barograph
■	QFE
□	QFF
▢	Max
△	Min
◆	On
◇	Off

- Select the **Process** from the Barometer Selection menu.
- Select **QFE** (F1) or **QFF** (F2) (e.g.) **QFE** (F1) from Select Barometer Process menu.
- Select **Max** (F1) or **Min** (F2) (e.g.) **Max** (F1).
- Select **On** (F1) to enable Process to be displayed or **OFF** (F2) to disable Process from being displayed.

● Barograph

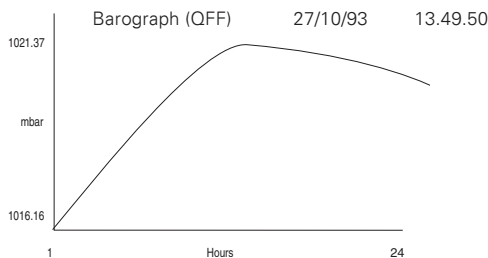
The instrument is programmed to sample and record barometric pressure at hourly intervals. Stored barometric pressures can then be plotted against time to obtain a barograph reading.

Up to 24 hours of data is stored. After 24 hours of operation, the early data is discarded at each new sample. The barograph therefore shows a 'rolling' 24 hour display.

To obtain a Barograph of either QFE or QFF, proceed as follows.

BARO	
○	Display
○	Units
○	Process
●	Barograph
■	QFE
□	QFF

- Press the **BARO** key to reveal Barometer selection menu.
- Select **Barograph** (F4).
- Select **QFE** (F1) or **QFF** (F2) as required. After a short processing period, the barograph is plotted on the display.

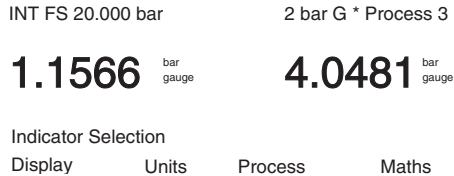


- To return to the barometric display, press **Exit Menu** three times.

If it is required to show/store more than a 24 hour period or to sample at other than 1 hour intervals, use the wider facilities of Datalog under the **Store** key.

4.5 Indicator Mode

To select Indicator Mode or, if operating as an indicator to display the indicator selection menu, press the **IND** key. The currently selected indicator channels, together with the indicator selection menu will then be displayed.



4.5.1 Select Channel for Display

The following procedure indicates the method of selecting a particular channel for display.

IND	
●	Display
○	Units
○	Process
○	Maths
■	2 bar g
□	20 bar g
□	70 bar g
□	Process

- Switch the instrument to ON.
- Select **Display** (F1).
- Select Pressure channel required from function keys. Only the ranges fitted to the instrument and 'Process' (if a process is defined) will be written to the function keys.
- Select required channel **2 bar g** by pressing the appropriate function key. The instrument will then prompt for the selected channel to be enabled (disabled) for display as follows.

Transducer display On

Use the appropriate key to enable or disable the channel display.

NOTE: If the channel was switched off, only the opposite state (e.g.) **ON** will appear on the Transducer display for selection. If the channel is selected, a further menu, showing the processes configured, is written to the display from which a single process channel must be selected.

Max	P1	Displayed
2 Bar G Min	P2	
20 Bar G + 2 Bar G	P3	
	P4	
	P5	
	P6	
Display processing channel		
Select	Reset Peak	On/Off

The currently selected channel is highlighted by a reverse video cursor.

Select the required processing channel using the select key and enable (disable) the selected channel using the **On/Off** key (F4). Depending on the process, other interactive functions may be written to the function keys (e.g.)

Reset Peak for **Max**.

4.5.2 Change Channel Units

To change the units of any configured measurement channel, proceed as follows.

IND
○ Display
● Units
○ Process
○ Maths
<input type="checkbox"/> 2 bar g
<input type="checkbox"/> 20 bar g
<input type="checkbox"/> 70 bar g
<input type="checkbox"/> Process

- Switch the instrument to ON.
- Select **Units** (F2).
- Select Pressure channel required **70 bar g** by pressing the appropriate function key. The units selection menu is then presented.

Select Units
bar psi mH₂O mbar

- Select the required units from the Select Units menu.
- If Process is selected, a further menu, showing the processes configured, is written to the display from which a single process channel must be selected.

2 Bar G Max	P1	Displayed
2 Bar G Min	P2	
20 Bar G + 20 Bar G	P3	
Not defined	P4	
Not defined	P5	
Not defined	P6	
Select process to change units		
Select	Reset Peak	OK

Select the required processing channel by positioning the reverse video cursor using the **Select** (F1) key and pressing **OK** (F4). Select the required units for the Process channel by pressing the appropriate function key. The Select Units menu is then presented.

Select Units

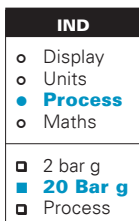
bar psi mH₂O mbar

Depending on the Process, other interactive functions may be written to the other function keys **Reset Peak** for **Max**.

4.5.3 Set-up a Channel Process

Five Process functions are provided on the instrument, **Tare**, **Peak**, **%F.S.**, **Filter** and **Flow**. These functions can be applied to any measurement channel or any configured Process channel.

To define a process, proceed as follows.



- Switch the instrument to ON.
- Select **Process** from the Select Pressure Channel menu. Only the ranges fitted to the instrument and Process (if a Process has been defined), will be written to the screen.

- Select the required channel **20 bar g** by pressing the appropriate function key. The instrument responds by displaying the processes available.

Select processing function >>

Max Min Tare %F.S.

The presence of the >> symbol indicates that further pages of process options are available. These can be displayed by pressing the **Menu Scroll** key.

NOTE: If any of the following functions are enabled, they will remain enabled after the instrument is switched off and on again.

● Max

The **Max** function causes the maximum value measured in the selected channel or process to be displayed. Following selection of a measurement channel or process, proceed as follows.

IND	
○	Display
○	Units
●	Process
○	Maths
■ 2 Bar G	
□	20 Bar G
□	Process
□	Max
△	Min
△	Tare
△	% F.S.

- Select **Max** (F1) from Select Processing function menu. The Process is automatically added to the next free channel and enabled for display. If all process channels are occupied, an error message is displayed.

No free channels available

To free a process channel, use the **Display** option to turn off a channel no longer required. This channel will then be overwritten by the Process function.

● Min

The **Min** function causes the minimum value measured in a selected channel or process to be displayed. The function is selected in a similar manner to that described for Max.

● Tare

The **Tare** function permits a programmable offset to be either subtracted from or added to the indicated pressure reading. Following selection of a measurement channel or process channel (e.g.) **2 bar g**, to enter the **Tare** function, proceed as follows.

IND	
○	Display
○	Units
○	Process
○	Maths
■ 2 Bar G	
□	20 Bar G
□	Process
△	Max
△	Min
□	Tare
△	%FS
◇	Reading

- Press **Tare** (F3) key. A menu showing the status of the Tare process is now displayed.

Pressure Tare Value: 1.45000 bar

Reading

- Either press the **Reading** (F1) key to set the currently indicated value as the Tare value or enter the required Tare value on the numeric key-pad and press **ENTER**. Note that any Tare value entered will be subtracted from the indicated pressure reading. If a Tare value requires adding to the indicated pressure reading, a negative number should be entered.

● **%F.S.**

The **%F.S.** key is used to re-configure the pressure display to read percentage of Full Scale rather than pressure units. Following selection of a measurement channel or process channel from the Indicator Selection Menu, select the **%F.S.** function and proceed as follows.

IND
<ul style="list-style-type: none"> ○ Display ○ Units ● Process ○ Maths
<ul style="list-style-type: none"> ■ 2 Bar G □ 20 Bar G □ Process
<ul style="list-style-type: none"> ★ Max ★ Min ★ Tare ★ %F.S.
<ul style="list-style-type: none"> ◇ Reading

- Select **%F.S.** (F4) key. The %F.S. display menu is now displayed and will indicate current function status.

0%: 0.00000 □ FS: 20.0000 bar
Reading

- Set the required value for 0% either by pressing **ENTER** to accept the current value in the status line or **Reading** (F1) to enter the currently displayed pressure value as 0%. Alternatively, enter a numeric value on the key-pad, followed by **ENTER**.
- Set the required value for 100% either by pressing **ENTER** to accept the current value in the status line or **Reading** (F1) to enter the currently displayed pressure value as 100%. Alternatively, enter a numeric value on the key-pad, followed by **ENTER**.

● **Flow**

The **Flow** function is used to convert a pressure reading to a flow rate. Following selection of a measurement channel or process channel from the Indicator Selection menu, the Flow function is selected as follows.

IND
<ul style="list-style-type: none"> ○ Display ○ Units ● Process ○ Maths
<ul style="list-style-type: none"> ■ 2 Bar G □ 20 Bar G □ Process
<ul style="list-style-type: none"> ★ Max ★ Min ★ Tare ★ %FS
<ul style="list-style-type: none"> ★ Flow

- Press the **Menu Scroll** key to reveal the second page of the Select Processing function menu.
- Press the **Flow** (F1) key.

Note: The flow calculation used is a square root function.

4.5.4 Use of the Maths Function

The **Maths** function permits the measurand of any channel or **Process** selected for display to be mathematically related to any other selected channel or process. Mathematical operators available for use are **Add (+)**, **Subtract (-)**, **Multiply (*)** and **Divide (/)**.

The process of setting up a Maths function is menu driven, the sequence being as follows.

IND
<ul style="list-style-type: none"> ○ Display ○ Units ○ Process ● Maths
<ul style="list-style-type: none"> □ 2 Bar G □ 20 Bar G ■ Process
<ul style="list-style-type: none"> △ + △ - △ * △ /
<ul style="list-style-type: none"> ★ 2 Bar G ★ 20 Bar G ★ Process

- Select the **Maths** function.
- Select first term of mathematic expression (select Channel or Process).
- Select the required mathematical operator.
- Select second term of mathematical expression (select Channel or Process).
- Place the result in one of the Process Channels.

A typical mathematical set-up sequence is as follows.

IND
<ul style="list-style-type: none"> ○ Display ○ Units ○ Process ● Maths
<ul style="list-style-type: none"> □ 2 Bar G □ 20 Bar G ■ Process
<ul style="list-style-type: none"> △ + △ - △ * △ /
<ul style="list-style-type: none"> ★ 2 Bar G ★ 20 Bar G ★ Process

- When the Maths function is first selected, the instrument displays all the currently configured channels and requests selection of a channel (the first term in the mathematical expression),

Select Pressure Channel
2 bar G 20 Bar G Process

- Following selection of the channel, the mathematical operator is requested as follows.

Select Maths Function
+ - * /

- After selection of the mathematical operator, the second term of the expression is requested as follows.

Select Pressure Channel
2 Bar G 20 Bar G Process

- If Process is selected as a channel, the instrument will prompt for selection of a process for the second mathematical term.

2 Bar G Max	P1	Displayed
2 Bar G + Process1	P2	Displayed
Not defined	P3	
Not defined	P4	
Not defined	P5	
Not defined	P6	
Select Maths Function		
Select	OK	

Use the **Select** (F1) key to position the cursor over the required channel and press **O.K.** (F4). The mathematical expression will immediately be placed in the next available process channel and enabled for display.

NOTE: If all the Process channels are currently in use and being displayed, one channel will have to be removed from the display (using the **Display** option) and the Maths function re-specified.

4.6 Measuring a Pressure

To use the instrument to indicate a pressure, proceed as follows.

- Ensure that the pressure to be monitored is not likely to exceed the operating range of the instrument (refer to specification, Section 1.3).



If any doubt, CHECK before connecting the instrument.

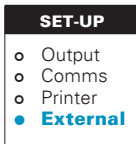
- Switch the instrument ON using the **ON/OFF** switch located on the rear panel.
- Select the required channel for display (refer to Section 4.5.1).
- Select the required units for the channel (refer to Section 4.5.2).
- Before applying the external pressure/vacuum, zero the pressure display using the **ZERO** key.

- Apply the external pressure.
- Use the Process function to define any pressure processing which may be required (refer to Section 4.6.3).
- Use the **PRINT** and **STORE** (Datalog) options as required (see Sections 4.3.3 and 4.10).

4.6.1 Connection of External Pressure Transducers

• External PRT's

To connect an external PRT pressure transducer to the instrument, proceed as follows.



- Plug the transducer into the appropriate External transducer socket. Plug Piezo Resistive types into the socket labelled **EXT PRT**.
- For Piezo Resistive type of External transducer, select **SET-UP**.
- Select **External** from the Select Pressure Channel menu. If a non-digitally characterised transducer is connected, a table listing all external transducers entered into the instrument's memory is displayed.

External Transducer		
SN: AY136720 ←	SN: Undefined	
SN: KP10031	SN: Undefined	
SN: 17667	SN: Undefined	
SN: Undefined	SN: Undefined	
SN: Undefined	SN: Undefined	
Previous	Next	Select

Channel M3 is allocated to external PRT transducers.

- Check the serial number of the transducer fitted against the serial number of the selected transducer in the table. If necessary, position the cursor against the required transducer using the **Previous** (F1) and **Next** (F2) keys and press the **Select** (F4) key.

It should be noted that the calibration routines for external transducers, which includes the specification and entry of new external transducer parameters, is given in Section 5. If digitally compensated external transducers are used, selection of the plugged in transducer is automatic.

IND	
• Display	
○ Units	
○ Process	
○ Maths	
<hr/>	
□ M1	
□ M2	
■ External	
□ Resonant	

- Press the **IND** mode switch.
- Select **Display** from the Change Indicator setting menu.
- Press **External**. The instrument prompts for the transducer output to be selected for display.

Ext PRT

On

- Select **On** (F1) to enable the display or **Off** to disable the display.

For users requiring details of the external transducer connections, the pin-out of the External PRT transducer connector is shown in Section 3.6.1.

● **External RPT's**

The DPI 145 instrument accepts a single resonant transducer. Each transducer is fitted with a plug to match the **EXT RPT** socket located on the rear panel. Channel **M6** is allocated to external resonant transducers.

If more than one external RPT is used with the equipment, it is important to check that the correct transducer is being used. This is best carried out using the Cal Status facility as follows.

SET-UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
○ Comms	
○ Printer	
○ External	
● Cal Status	
○ Cal Test	
○ Display	
○ Calendar	
□ Previous	
■ Next	

- Press **SET-UP** followed by **MENU SCROLL** twice to select third page of Set-up Menu.
- Select **Cal Status** (F1).
- Scroll through Cal Status pages by pressing the **Next** (F2) key until **M6** (External Resonant) is displayed.
- Check the serial number of the external **RPT** to be used against the **M6** Cal Status page to ensure that they match.

To use the external **RPT**, proceed as follows.

IND	
● Display	
○ Units	
○ Process	
○ Maths	
□ M1	
□ M2	
□ External	
■ Resonant	
△ M4	
△ M5	
▲ External	
△	

- Plug the external **RPT** into the **EXT RPT** socket located on the rear panel of the instrument.
- Press the **IND** mode switch.
- Select **Display** (F1) from the change indicator setting menu.
- Press **Resonant** (F4) and select **External** (F3).

The instrument prompts for the transducer output to be selected for display.

Ext RPT
On

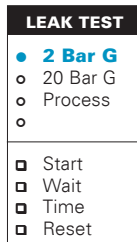
- Select **On** (F1) to enable the display or off to disable the display.

For users requiring details of the external RPT connectors, the pin-out of the External RPT transducer connector is shown in Section 3.6.2.

4.7 Leak Test

To carry out a **Leak Test** with the instrument, proceed as follows.

NOTE: Leak Test is only available when the instrument is configured as an indicator.



- Press the **IND** mode select key.
- Select channel to be tested from Select Channel Menu (e.g.) **2 bar g.**
- Select the Leak Test mode select key. Four options will now be displayed over the function keys: **Start** (F1), **Wait** (F2), **Time** (F3) and **Reset** (F4). The dialogue line of the display will also show the function and the currently set **Wait** and **Time** parameters.

Leak Test: Wait 90 sec. Time 20 sec.

Start Wait Time Reset

The display window is also re-configured to show.

Pressure Drop _____

Leak Rate _____

- If required, press the **Wait** function key (F2) and enter the required wait period (in seconds) on the numeric keys, followed by the **ENTER** key. This parameter defines the delay period between the pressing of the **Start** key and commencement of the measurement period. A period of 60 seconds (minimum) is recommended.
- Set-up the required test duration period by pressing the **Time** key and entering the required test duration period on the numeric keys, followed by **ENTER**.
- Apply the external pressure.
- Press the **Start** (F1) key. The instrument display will now indicate **Leak Test Running** and start the countdown of the Wait period (indicated by the Wait period display counting down to zero). After termination of the Wait period, the Time display commences a countdown from the set period to zero. The measuring time of the Test period is indicated by the display counting down to zero.

At the end of the Test period, the display will indicate **Pressure Drop** and **Leak Rate** in the currently selected units.

- If required, press the **STORE** key to gain access to the **STORE** options in order to store the current display information. If a printer is connected to the instrument, the current display can be printed by operation of the **PRINT** key.
- Press the **Reset** key (F4) to clear the display in readiness for another leak test.

NOTE: If while setting-up the instrument, the display times out (indicated by the disappearance of the legends over the function keys), press the **Leak Test** key again to reactivate the function keys.

4.8 I/V Output

The electrical outputs of the DPI 145 are taken from the BNC I/V socket located on the rear panel. There are two basic options available for the electrical outputs.

- **Programmable Output**

Direct output of a user defined output voltage or current.

- **Analogue Output**

Output of a voltage or current proportional to a selected measurement channel or process. Full Scale (F.S.) and zero output levels can be defined.

The output facilities are mutually exclusive so only a Programmable Output or an Analogue Output can be generated at any one time i.e. not both simultaneously.

4.8.1 Generating of Output Voltages or Currents (Prog. Output)

- To generate an output voltage or current, proceed as follows.

SET-UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
● Output	
○ Comms	
○ Printer	
○ External	
□ Ana. Output	
■ Prog. Output	
△ Voltage	
△ Current	
□ Set	
◇	
□ On	
◇ Off	

- Switch the instrument to On using the **ON/OFF** switch. The electrical outputs from the instrument will default to Off.
- Press the **SET-UP** key and press **Menu Scroll**.
- Select **Output** (F1).
- Select **Prog. Output** (F2).
- Select **Voltage** or **Current** as required (e.g.) **Voltage** (F1).

- Press the **Set** key (F1) and enter the required output level, either using the **Up/Down** function keys (F3) and (F4) or by direct numerical value entry from the keyboard, followed by **ENTER**.
 - Connect the external load to the **I/V** BNC Output socket located on the rear panel, shown in Fig. 4.3.
 - Set the output to On using the **On** (F3) key. When the output is switched On, the (e.g.) output voltage level, is displayed.
 - To disable the programmable output, press the **Off** (F4) key.

It should be noted that if the instrument is subsequently switched off while the Programmable Output is enabled, when the instrument is next switched on, the last analogue value set-up will be retained but the output will be switched off. To enable the output again, repeat the above procedure.

4.8.2 Set Analogue Output Proportional to an Indicated Measurand

To set-up the instrument to provide an analogue output proportional to an indicated measurand, proceed as follows.

SET-UP	
○ Units	
○ Channel	
○ Option	
○ Barometer	
● Output	
○ Comms	
○ Printer	
○ External	
□ Ana. Output	
■ Prog.Output	
▲ 2 bar g	
△ 1 bar a	
□ Voltage	
◇ Current	
+ Set	
+	
+ On	
+ Off	

>>

- Switch the instrument ON using the **On/Off** switch. Any analogue output previously defined will default to OFF.
- Press the **SET-UP** key and press **Menu Scroll**.
- Select **Output** (F3).
- Select **Ana Output** (F1).
- Select Pressure Channel (e.g.) **2 bar g** (F1)
- Select required type of output (e.g.) **Voltage** (F1).
- A set-up prompt will now be displayed.

Analogue output-Volts

Set On Off

- To define the linear relationship between the selected measurand (e.g.) Pressure and Analogue Output (e.g.) **Volts**, press the **Set** (F1) key. A prompt for the lower point of the relationship will be displayed, together with the last parameter levels which were set-up.

Lower Point □ 0.0000 bar = 0.000V

- Enter the required level for each parameter (e.g.) Lower Point and Level on the numeric keyboard and press **ENTER**. Press the **Accept** (F1) key and a prompt for the upper point will appear (e.g.)

Upper Point 2.0000 bar = 5.0000 V

- Enter the required level for each parameter (e.g.) Upper Point and Level on the numerical keyboard and press **ENTER**. To return to the lower limit (if necessary), press **Accept** (F1).

- Press **Exit Menu** and enable the analogue output by pressing the **On** (F3) key. The display will now indicate the analogue output mode (e.g.)

Pressure > Volts.

- To disable the analogue output, press the **Off** (F4) or select another type of Analogue output. Alternatively, switch the instrument OFF and ON again.

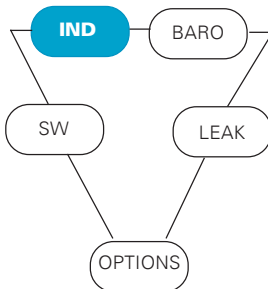
The instrument is now programmed to provide an analogue (voltage) output proportional to the indicated pressure of the selected channel.

4.9 Pressure Switch Testing

The **Switch Test** function of the instrument allows the operating point of pressure switches to be accurately determined.

Switch Test is excluded from Barometer Mode.

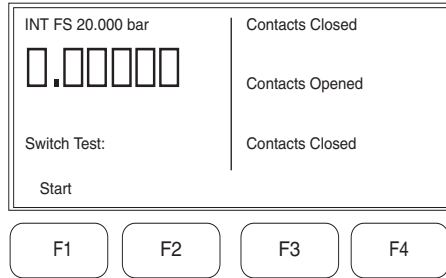
To carry out a **Switch Test** operation, proceed as follows.



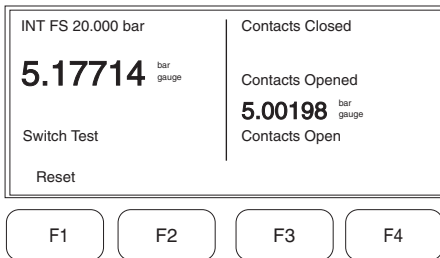
SW	
<input type="radio"/>	2 Bar G
<input checked="" type="radio"/>	20 Bar G
<input type="radio"/>	Process
<input type="radio"/>	External
<input type="checkbox"/>	Reset

- Ensure that the instrument is switched ON.
- Press the **IND** mode select key to ensure that the instrument is configured as an indicator.
- Connect the pressure switch to be tested to one of the measurement channels, and an external pressure source.
- Connect the test lead into the **BNC SWITCH TEST** socket located on the rear of the instrument and connect to the pressure switch contacts.
- Press the **SW** key.

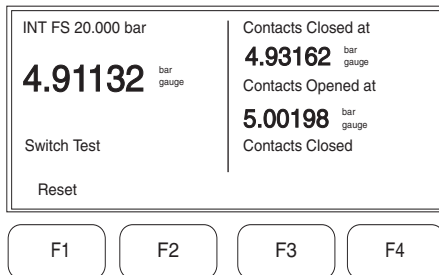
- Select required pressure channel (e.g.) **20 bar g**. The instrument responds with a flashing Switch Test indication and by displaying the current pressure and the status of the pressure switch contacts.



- Press the **Start** (F1) key and slowly increase the external system pressure. Continue until the switch contacts change state.



- Slowly decrease the applied pressure. As the system pressure drops, the indicator records the pressure at which the pressure switch contacts change state.



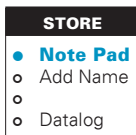
- If required, on completion of test, press the **STORE** button to give access to the **STORE** options in order to store data associated with the test. The display will now show the hysteresis between the operating points of the pressure switch contacts.
- Press the **Reset** (F1) to cancel the last test and set-up another.
- Where a pressure switch has change over contacts, repeat the test for the other switch pole i.e. test both the normally open and normally closed contact sets. For pressure switches with multiple contact sets, repeat the test for each contact set.
- Press **Exit Menu** key to quit **Switch Test**.

4.10 Data Store Operations

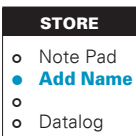
The Data Store facility, which is operative in all instrument modes i.e. **IND**, **BARO** and **OPTION**, provides the facility to store a single screen and a mode configuration. The **Store** Option also provides access to the Data Log facility. **Store Recall** operations are described in Section 4.12.

4.10.1 Screen Store Operations

In any mode of operation i.e. **IND**, **BARO** or **OPTION**, to store a display screen, proceed as follows.



- Press the **STORE** key.
- Select **Note Pad** (F1) to store screen in the next location, without adding any supporting note, **or...**
- Select **Add Name** (F2) to first add supporting notes to screen to be stored. On pressing (F2) a prompt to enter text is displayed as follows.



Enter Text:

Alpha ↑ **Alpha** ↓ ← →

This test number can be either alphabetical, numerical or a combination of both. Alpha characters are entered using the **Alpha** ↑ (F1), **Alpha** ↓ (F2), ← (F3), → (F4) keys. **Alpha** ↑ (F1) scrolls forwards through the alphabet and **Alpha** ↓ (F2) backwards. Shifting right to the next character position or left to a previous character position is achieved by the ← (F3), and → (F4) keys respectively.

Numeric entries are added directly from the numeric key-pad. The full alphanumeric text is accepted by pressing the **ENTER** key, located on the numeric key-pad. The current screen, together with the added note is then stored in the next available location. Twenty **Store** locations are provided.

4.10.2 Configuration Store Operations

In addition to the twenty store locations provided for screen displays, six further locations are provided for the storage of mode configurations.

A mode configuration comprises the number of parameters set-up for display on the screen. If, for instance, two channels were set-up for display under the Aeronautical Option, storing this as a configuration would set-up the instrument to display the same two channels when this configuration was recalled.

In any mode of operation, to store a configuration, proceed as follows.

- Set-up the required channels for display under the appropriate **Display** option (refer to sections 4.4, 4.5.1, 4.5.2 and 4.13.2).

STORE	
○	Note Pad
○	Add Name
●	Config
○	Datalog

- Press the **STORE** key.
- Select **CONFIG** (F3). A listing of the currently stored configurations is now presented.

1	IND 1
2	IND 2
3	BARO
4	OPTION 4
5	OPTION 2
6	EMPTY

Select Screen Configuration Store:

Select

OK

- Use the **Select** (F1) key to position the reverse video cursor over an empty channel, or over a channel to be overwritten and press the **OK** (F4) key. The instrument now prompts for a name to be appended to the configuration.

Altitude	Cal Airspeed
1277 feet	200 knots

Name Store:

Alpha ↑ **Alpha** ↓ ← →

This configuration file test can be either alphabetical, numerical or a combination of both. Alpha characters are entered using the **Alpha** ↑ (F1), **Alpha** ↓ (F2), ← (F3), → (F4) keys. **Alpha** ↑ (F1) scrolls forwards through the alphabet and **Alpha** ↓ (F2) backwards. Shifting right to the next character position or left to a previous character position is achieved by the ← (F3), and → (F4) keys respectively.

4.11 Data Log

The Data Log Function of the instrument enables it to store a large number of complete screens. The function has two basic modes of operation, **Record** and **Replay**. The Data Log Function is available under the STORE facility in all modes of instrument operation i.e. **IND**, **BARO** and **OPTION**.

To perform a Data Log operation, proceed as follows.

STORE
○ Note Pad
○ Add Name
○
● Datalog
■ Record
□
□ Directory
□ Delete
□ Continue
△
△
△ Quit
□ Alpha ↑
□ Alpha ↓
□ ←
□ →
* Periodic
* Event

- Switch the instrument ON.
- Set-up the instrument to display the required measurands.
- Press the **STORE** key. Selection of this function displays the Select Note Pad or Data Log Menu as follows.

Select Note Pad or Data Log

Record Directory Delete

- To obtain a listing of the Data Log File names already used, press the **Directory** key (F3). (Refer to Section 4.11.1 for use of this utility).
- Select **Record** (F1) from the Data Log Menu. A prompt to continue with the Data Log function or to **Quit** is now given.

Will log the current display: 14:50:46

Continue Quit

- Press the **Continue** (F1) function key. A file identity number is first requested, followed by a dialogue prompting for the required Start and Stop parameters. Refer to Section 4.11.2 for details for the operation of the Data Log Record Mode.
- For details of the methods of replaying recorded Data Log data, refer to Section 4.11.3.

4.11.1 Use of Data Log Directory and Delete Functions

- **Directory**

Selection of the **Directory** (F3) option from the Data Log menu provides a list of all the completed Data Log operations that have been stored in the instruments' memory. These will be listed in the order in which the Data Log Operations were carried out (not in file number order). A typical directory listing is shown below.

STORE	
<input type="radio"/>	Note Pad
<input type="radio"/>	Add Name
<input type="radio"/>	
<input checked="" type="radio"/>	Datalog
<input type="checkbox"/>	Record
<input type="checkbox"/>	Directory
<input type="checkbox"/>	Delete

File ID (Data Log)		Free Blocks: 10846
A17966	28/01/93	15.37.10
A17222	28/01/93	15.40.03
C070842	28/01/93	15.51.32
B2	28/01/93	15.58.17
Page Up Page Down		

The (e.g.) **Free Blocks: 10846** legend gives an indication of the remaining memory space and the first page of the directory (five entries) is displayed. The **Page Up** and **Page Down** functions, allocated to the F1 and F2 keys respectively, provide a means of scrolling forward (to the next page) or back (to a previous page) of a directory listing. The **Exit Menu** key is used to return to the main Data Log menu. When first entering the Data Log functions, it is good practice to interrogate the directory. This will enable the operator to determine what file ID numbers have already been used, since an attempt to use an existing file ID number to record a Data Log operation will result in the display of an error message - **File already exists**.

- **Delete**

STORE	
<input type="radio"/>	Note Pad
<input type="radio"/>	Add Name
<input type="radio"/>	
<input checked="" type="radio"/>	Datalog
<input type="checkbox"/>	Record
<input type="checkbox"/>	Directory
<input checked="" type="checkbox"/>	Delete
<input type="checkbox"/>	Yes
<input type="checkbox"/>	No

This Data Log function enables files to be detected from the Data Log memory. Selection of the function provides a directory listing and four cursor keys **Page Up** (F1), **Page Down** (F2), ↑ (F3) and ↓ (F4).

File ID (Data Log)		Free Blocks: 10846	
A	28/01/93	15.37.10	
B	28/01/93	15.40.30	
C	28/01/93	15.43.16	
D	28/01/93	15.49.32	
E	28/01/93	15.58.29	
Page Up	Page Down	↑	↓

The **Page Up** and **Page Down** keys are used to select the appropriate directory page and the **↑ ↓** keys to select the file on the page. To delete this selected file, position the cursor against the file name and press the **ENTER** key on the numeric key-pad. A warning is displayed as follows.

Delete- Are you sure?

Yes **No**

This file is deleted on subsequent operation of the **Yes** (F3) key or, the Delete operation can be aborted by operation of the **No** (F4) key.

4.11.2 Data Log Record Operations

To carry out a Data Log Record operation, proceed as follows.

STORE
○ Note Pad
○ Add Name
● Datalog
■ Record
□ Directory
□ Delete
▢ Continue
Δ
Δ
Δ Quit
★ Alpha ↑
★ Alpha ↓
★ ←
★ →
◇ Periodic
◇ Event

- Press the **STORE** key and select **Datalog** (F4) from the menu.
- Select **Record** (F1) from the Datalog menu. A prompt to **Continue** (F1) with the Datalog function or to **Quit** (F4) is now given (e.g.),

Will log the current display 14:22:46

Continue **Quit**

- Press the **Continue** (F1) key. A file number is requested for the new Data Log file as follows.

Enter File ID:

Alpha ↑ Alpha ↓ ← →

This File number can either alphabetical, numerical or a combination of both. Alpha characters are entered using the **Alpha** ↑ (F1), **Alpha** ↓ (F2), ← (F3), → (F4) keys. **Alpha** ↑ (F1) scrolls forwards through the alphabet and **Alpha** ↓ (F2) backwards. Shifting right to the next character position or left to a previous character position is achieved by the ← (F3), and → (F4) keys respectively.

Numeric entries are added directly from the numeric key-pad. The full alphanumeric text is added to the file by pressing the **ENT** key, located on the numeric key-pad.

- Following entry of the file number, the instrument prompts for the selection of a trigger mode as follows.

Select trigger for Data Logging

Periodic

Event

■ Periodic Mode

STORE	
<input type="radio"/>	Note Pad
<input type="radio"/>	Add Name
<input type="radio"/>	
<input checked="" type="radio"/>	Datalog
<input checked="" type="checkbox"/>	Record
<input type="checkbox"/>	Directory
<input type="checkbox"/>	Delete
<input type="checkbox"/>	Continue
Δ	
Δ	
Δ	Quit
<input type="checkbox"/>	Periodic
◇	Event
◇	
◇	
* Switch	
* Threshold	

The **Periodic** trigger mode (F1) is basically an internally generated trigger mode which permits the Data Logger to be controlled either by programmable times or by the number of samples taken. The frequency of sampling (in seconds) is first of all defined followed by a required Stop condition. The Stop condition can be either a programmable future time or after a programmable number of samples. If **Samples** (F2) are selected as the Stop condition, then the Data Logger can also be programmed to start either immediately (**now**), at a future period in time (**later**) or following any one of a number of external events (**condition**).

The function associated with the periodic Trigger Mode are described in Section 3. Figure 4.1 shows the sequence of parameter selection for the Periodic Mode and Figure 4.2 typical summary screen displays.

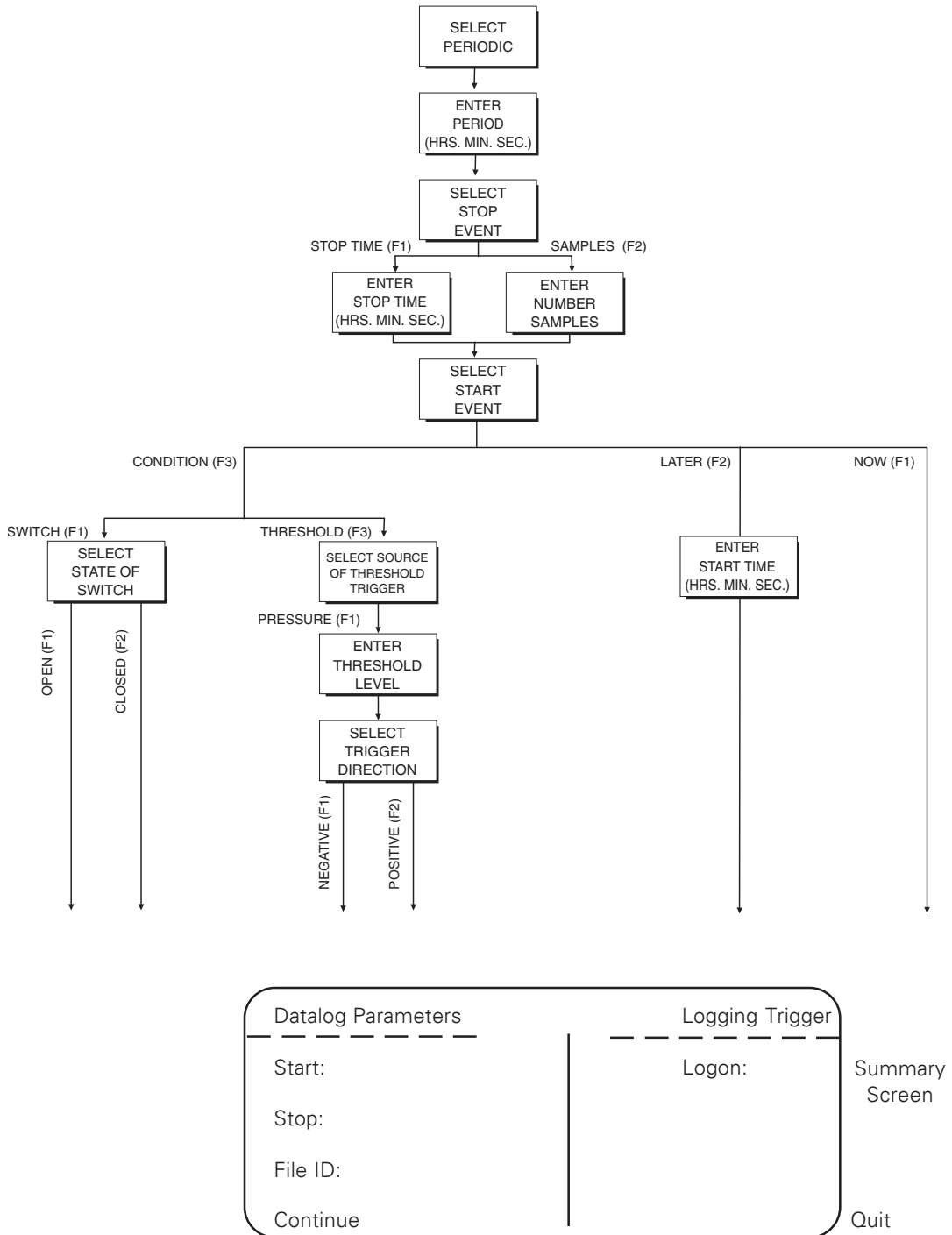


Figure 4.1 - Periodic Mode

Data Log Parameters		Logging Trigger	
Start:	Now	Logon:	Periodic time 00.00.20
Stop:	14.00		
File ID:	CER01		
Continue			Quit

Example 1:

After **Continue** (F1) has been pressed, will log at 20 sec. intervals from present time, terminating at 14:00.

Data Log Parameters		Logging Trigger	
Start:	+Threshold 10.0000 bar	Logon:	Periodic time 00.00.30
Stop:	20 samples		
File ID:	CER02		
Continue			Quit

Example 2:

After **Continue** (F1) has been pressed, will log at 30 sec. intervals starting when pressure rises through 10 bar. Stop after 20 samples have been taken.

Data Log Parameters		Logging Trigger	
Start:	Switch Test Open	Logon:	Periodic time 00.00.30
Stop:	at 14:50		
File ID:	CER03		
Continue			Quit

Example 3

After **Continue** (F1) has been pressed, will log at 30 sec. intervals, starting when switch contacts (connected to the Switch Input) first open. Stop at 14:50 or following **Stop** command (F4).

Data Log Parameters		Logging Trigger	
Start:	at 14:30	Logon:	Periodic time 01.00.00
Stop:	12 Samples		
File ID:	CER04		
Continue			Quit

Example 4

After **Continue** (F1) has been pressed, will log at 1 hourly intervals, commencing at 14:30. Stop after 12 Samples or following the **Stop** command (F4).

STORE	
○	Note Pad
○	Add Name
○	
●	Datalog
■ Record	
□	Directory
□	Delete
▣ Continue	
△	
△	
△	Quit
◇ Periodic	
▣	Event
◇	
◇	
* Switch	
* Threshold	

■ Event Mode

The **Event** trigger mode is used where Data Log operations are to be triggered by external events. Three basic event modes are provided **Now** (F1), **Later** (F2) and **Condition** (F3). A manual trigger facility is extended to the F1 function key by the **Now** option and a Data Log operation is recorded every time the **Log** key (F1) is pressed. The function is exited by pressing the **Stop** (F4) key.

A Single Shot timed operation is provided by the **Later** Option (F2) and a Data Log operation is recorded at the programmed time.

The **Condition** option (F3) allows the external event trigger to be selected from either a **Switch** (F1) or **Threshold** (F3). **Switch** (F1) provides repetitive trigger action to the Data Logger and **Threshold** (F3) an 'One Shot' trigger i.e. the first time that a pre-programmed threshold is exceeded in either a positive or a negative direction.

Figure 4.1 shows the sequence of parameter selection for the Event mode and Figure 4.2 typical summary screen displays.

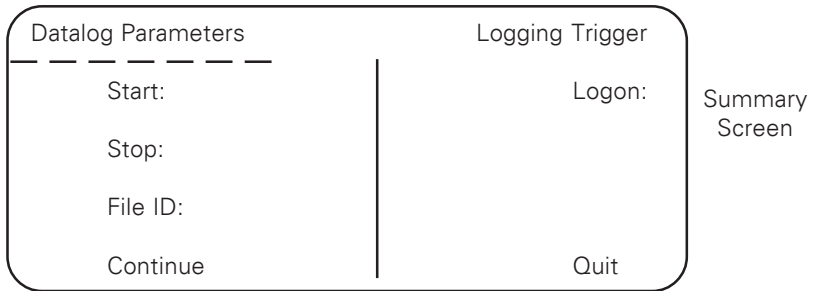
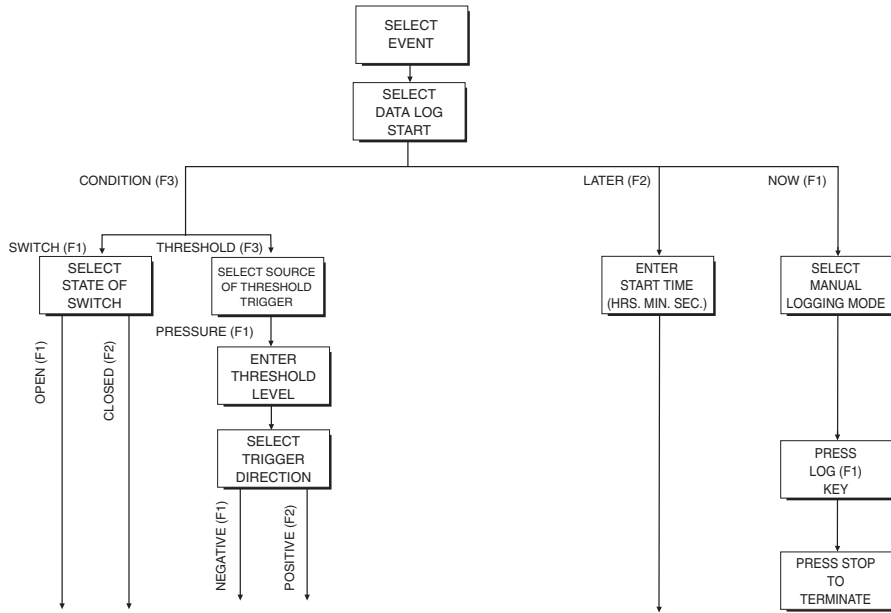


Figure 4.2 - Event Mode

Data Log Parameters		Logging Trigger	
Start:	Now	Logon:	Switch Test Open
Stop:	14.00		
File ID:	CER11		
Continue			Quit

Example 1:

After **Continue** (F1) has been pressed, will log every time the external switch contacts (connected to the External Switch socket) open. Logging sequence is terminated by pressing the **Stop** (F4) key.

Data Log Parameters		Logging Trigger	
Start:	at 16:00	Logon:	Start
Stop:	Single Shot		
File ID:	CER12		
Continue			Quit

Example 2:

After **Continue** (F1) has been pressed, will perform a single shot logging operation at the programmed time (1600). A **File Closed** message is then displayed to indicate that the logging operation has terminated.

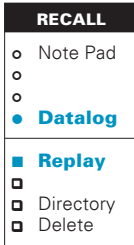
Data Log Parameters		Logging Trigger	
Start:	N/A	Logon:	- Threshold 10.2500 bar
Stop:	Single Shot		
File ID:	CER13		
Continue			Quit

Example 3:

After **Continue** (F1) has been pressed, will perform a single shot logging operation when the recorded pressure drops below 10.25 bar. A **File Closed** message is then displayed to indicate that the logging operation has terminated.

4.11.3 Data Log Replay Operations

Data Log **Replay** operations are carried out under the **RECALL** function. To replay Data Log results data, proceed as follows.



- Press the **RECALL** key and select **Datalog** (F4).
- Select **Replay** (F1) from the Datalog menu.

A directory showing the first page of Data Logged files is displayed.

File ID (Data Log)	Free Blocks: 10846	
→ AF 26123	22/02/93	9.23.40
AX 27000	22/02/93	9.56.10
AY 28000	22/02/93	11.16.20
Page Up	Page Down	↑ ↓

To replay a Data Log file, select the required file using the **Page Up** (F1), **Page Down** (F2), **↑** (F3) or **↓** (F4) cursor keys and press the **ENT** key on the numeric key-pad.

Four display modes are now provided as follows.

Select replay format:

Display Graph Print Upload

● Display

Selection of the **Display** option (F1) writes the data associated with the first location of the selected Data Log file to the display.

Location 1 of 20 AY28000

Previous Next 16.07.59 05/08/93

RECALL	
<input type="radio"/>	Note Pad
<input type="radio"/>	
<input type="radio"/>	
<input checked="" type="radio"/>	Datalog
<input checked="" type="checkbox"/>	Replay
<input type="checkbox"/>	Directory
<input type="checkbox"/>	Delete
<input checked="" type="checkbox"/>	Display
<input type="checkbox"/>	Graph
<input type="checkbox"/>	Print
<input type="checkbox"/>	Upload

To display the data relating to all subsequent locations, press the **NEXT** key. If an out of range location is requested, the instrument remains at the current location and flashes an error message **Number out of range**. **Previous** displays, data in the previous location. Repeated pressing of the **Previous** key causes the instrument to step back one location each time. At the end of file, the following is displayed.

20 of 20 End AY 28000

Previous Next 16.07.59 05/08/93

● Graph

Selection of the **Graph** option (F2) permits the operator to choose a graphical output of a selected data log file for display. To select a graphical output, proceed as follows.

RECALL	
<input type="radio"/>	Note Pad
<input type="radio"/>	
<input type="radio"/>	
<input checked="" type="radio"/>	Datalog
<input checked="" type="checkbox"/>	Replay
<input type="checkbox"/>	Directory
<input type="checkbox"/>	Delete
<input type="checkbox"/>	Display
<input checked="" type="checkbox"/>	Graph
<input type="checkbox"/>	Print
<input type="checkbox"/>	Upload

- Press the **RECALL** key and select **Datalog** (F4) from the Select Replay Mode menu.
- Select **Replay** (F1) from the Data Log menu.

When Replay is selected, a directory showing the first page of the Datalogged files is displayed. To replay a Data Log file, select the required file using the **Page Up** (F1) and **Page Down** (F2) ↑ (F3) or ↓ (F4) cursor keys and press the **ENTER** key on the numeric key-pad.

Four display modes are then provided, these being termed **Display** (F1), **Graph** (F2), **Print** (F3) and **Upload** (F4).

- Select **Graph** (F2) from Select Replay format menu and specify the X and Y axes for the required graph. A typical dialogue follows.

Select graph y axis:

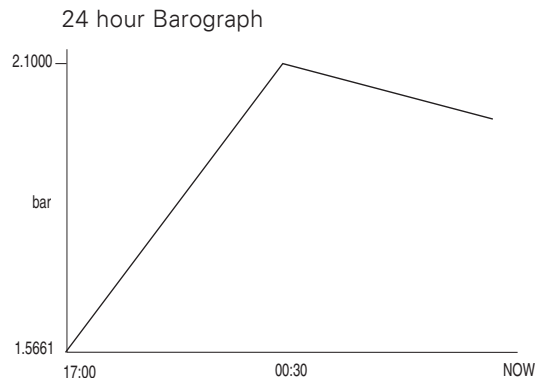
2 BarG 20BarG Process2 Time

Following selection of the Y axis parameter (e.g.) **2 bar g**, the instrument prompts for a corresponding X axis parameter.

Select graph x axis:

2 BarG 20BarG Process Time

After selection of the second X axis, the defined graphical function is drawn on the screen.



To define another type of graph, press **Exit Menu** once and re-specify the axes as required. To exit the Recall mode press **Exit Menu** repeatedly until the main display is restored (four times from displayed graph).

● Print

Selection of the **Print** option causes all data associated with the selected replay file to be down-loaded to a printer. To make use of this option, a printer must be connected to the RS232 interface. The instrument software supports two types of printer, a 40 column portable printer and an 80 column printer. The printer types are set-up under the **Set-up** facility. The instrument automatically formats the output file for the type of printer in use.

To print a datalog file, proceed as follows.

RECALL	
○	Note Pad
○	
○	
●	Datalog
■	Replay
□	Directory
□	Delete
△	Display
△	Graph
□	Print
△	Upload

- Press **RECALL** and select **Datalog** (F4) from the Select Replay Mode menu.
- Select **Replay** (F1) from the Data Log menu.

When Replay is selected, a directory showing the first page of Datalogged files is displayed. To replay a Data Log file, select the required file using the **Page Up** (F1) and **Page Down** (F2). ↑ (F3) or ↓ (F4) cursor keys and press the **ENTER** key on the numeric key-pad.

Four display modes are then provided, these being termed **Display** (F1), **Graph** (F2), **Print** (F3) and **Upload** (F4).

- Select **Print** (F3) from the Select Replay Format menu. The selected file is downloaded and printed as soon as the **Print** key (F3) is pressed.

NOTE: If any difficulties are experienced with the printout, check that the instrument is configured for the correct type of printer (refer to Section 4.4.3).

● Upload

Selection of the **Upload** option causes all data associated with the selected **Data Log** file to be uploaded to an external system via the RS232 port. This file is sent as ASCII text and as such is readily readable and importable into common spread-sheets such as Microsoft Excel. The RS232 port is configured from the Set-up facility (refer to Section 4.4.2). To upload a file to an external system, proceed as follows.

RECALL	
○	Note Pad
○	
○	
●	Datalog
■	Replay
□	
□	Directory
□	Delete
△	Display
△	Graph
△	Print
□	Upload

- Press **RECALL** and select **Datalog** (F4) from the Select Replay Mode menu.
- Select **REPLAY** (F1) from the Data Log menu.

When **Replay** is selected, a directory showing the first page of data log files is displayed. To replay a Data Log file, select the required file using the **Page Up** (F1), **Page Down** (F2), **↑** (F3) or **↓** (F4) cursor keys and press the **ENTER** key on the numeric key-pad.

Four display modes are then provided, these being termed **Display** (F1), **Graph** (F2), **Print** (F3) and **Upload** (F4).

- Select **Upload** (F4) from select Replay format menu. The selected file is uploaded and printed as soon as the **Upload** key (F4) is pressed.

NOTE: If any difficulties are experienced with the Upload facility, check that both the instrument and external data comms. system are configured in the same manner. Refer to Section 4.4.2 for details of the Data Comms Set-up.

4.12 Data (store) Recall Operations

The **Recall** function is used to recall screens stored during use of the instrument, Data Log results and stored instrument configurations.

The following sections detail the method of recalling stored screen and configuration data. Data Log recall operations are described in Section 4.11.3.

4.12.1 Screen Recall Operations

To recall a stored screen to the display, proceed as follows.

RECALL	
○	Note Pad
○	
○	
●	Datalog
SCROLLS	

- Press the **RECALL** key.
- Select **Notepad** (F1) from the Select Replay Mode menu. The last stored screen will be presented in reverse video.
- Press **Menu Scroll** to provide details of the screen currently being displayed.

SCROLL

- Press **Menu Scroll** to return to the current location display.

RECALL

- Press **RECALL** again to step back to a previous location if required.

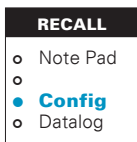
NOTE: If a memory location is empty, the current time and a status message is displayed.

There are no channels selected

14.26

4.12.2 Configuration Recall Operations

To recall a previously stored instrument configuration to the display, proceed as follows.



- Press **RECALL** key.
- Press the **Config** (F3) key. A list of up to six previously stored configurations is now presented.
- Press **RECALL** key.

1	IND 1
2	IND 2
3	BARO
4	OPTION 4
5	OPTION 2
6	EMPTY

Select Screen Configuration Store:

Select

OK

- Position the reverse video cursor over the required configuration store location using the **Select** (F1) key and select location using the **OK** (F4) key. The selected configuration is now recalled to the screen.

4.13 Software Options - Aeronautical

There are two software options available for the DPI 145, the Aeronautical Option and the Airfield Option. The following sections detail the operation of the Aeronautical Option. This option enables the instrument to be configured to provide the following displays.

- Altitude in feet and metres.
- Calibrated Airspeed (C.A.S.) in knots or km/hr.
- Rate of Climb (R.O.C.) in ft/min or m/min.
- Pitot Pressure in any units of the instrument.
- Static Pressure in any units of the instrument.
- $Q_c \Delta P$ in any units of the instrument.
- Mach.

The display of the instrument can be configured to show any one parameter or combination of parameters up to a maximum of all seven if necessary.

Two pressure channels are required by the Aeronautical Option, one for the Q_c pressure and one for the Static pressure. The Q_c pressure is measured by an internal differential pressure transducer (PRT-type) and the Static pressure by an internal absolute transducer (RPT - type).

4.13.1 Form of Test

The DPI 145 instrument is a pressure indicator and so an external controller is required to generate the appropriate Q_c and Static pressure for the type of test required. Fig. 4.3 shows a typical set-up.

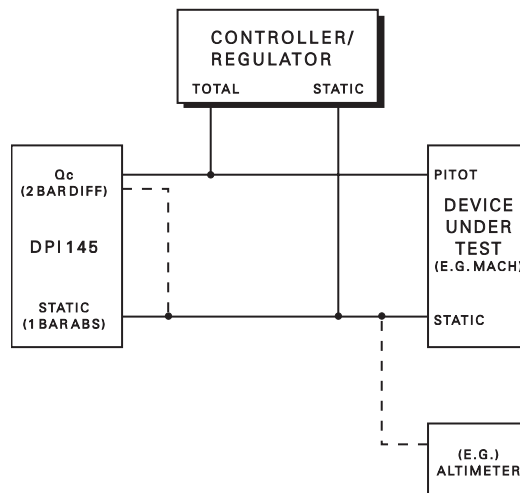


Figure 4.3 - Typical Test Set-up

The instrument is effectively connected in parallel with the device under test.

NOTE: The differential Pitot channel of the DPI 145 has the positive input pressure connected to the controller/regulator’s Total output and the negative input connected to its Static output. This channel effectively measures Q_c .

4.13.2 Operation

To use the instrument for Aeronautical measurements, proceed as follows.

- Ensure that the equipment is switched off and make the appropriate pressure connections to the rear panel.

NOTE: That the Q_c channel has its positive input connected to the Total pressure supply and its negative input to the Static pressure supply.

SET-UP	
○	Units
○	Channel
●	Option
○	Barometer
■	Aero
□	Airfield
▢	Altitude
△	Airspeed
△	ROC Filter
△	Timed ROC
▢	2 bar d
◇	1 bar a
◇	
◇	

- Switch the instrument ON and press the **SET-UP** key.
- From the Option Set-up menu, select **Aero**. The display will now indicate the status of the **Altitude** (Static) channel and the **Airspeed** (Q_c) channel.

Altitude Channel 4 Airspeed Channel 1
Altitude Airspeed ROC filter Timed ROC

- Select either **Altitude** (F1) or **Airspeed** (F2) and select the appropriate transducer for that channel **2 bar d for Airspeed and 1 bara for Altitude**.
- Select **ROC Filter** (F3) to set-up the Rate of Climb filter parameters. Refer to Section 4.13.4.
- Select **Timed ROC** (F4) to enter the required method for Rate of Climb calculations. Two methods are provided, **Mean** and **Timed**. **Mean** provides a method of constantly averaging over the operator selected time period. **Timed** takes a snapshot of the altitude at the beginning and end of the time period and averages between these two points.
- Press **EXIT** three times to quit Set-up.

The instrument is now ready for operation. A typical operational procedure is as follows.

- Connect device under test and the DPI 145 instrument to the pressure source controller (see Figure 4.3.)
- Check pressure connections.
- Switch on the instrument and press the **OPTION** key. The instrument now responds with the following prompt.

Select Option

Aero Airfield Timed ROC

- Select **Aero** (F1). The instrument now responds with the following prompt.

Change Aeronautical Settings?

Display Units Timed ROC

- Select **Display** (F1) to configure the instrument to read the required parameters (refer to Section 4.13.3), **or...**
- Select **Units** (F2) to configure the instrument to display the required units (refer to Section 4.13.3).
- Select **Timed ROC** (F3) to enter the required rate integration period, (applicable to both rate calculation methods).
- Switch on the controller.
- Carry out the required test. For Rate of Climb (R.O.C.) tests, refer to Section 4.13.4.

OPTION	
● Aero	
○ Airfield	
■ Display	
■ Units	
■ Timed ROC	
△ Altitude	
△ Airspeed	
△ Mach	
△ ROC	>>
△ Ptotal	
△ Pstatic	
△ Qc	
△ Tared Alt	>>

4.13.3 Change Aeronautical Settings

● Display

The options in this menu are used to select the required **Display** parameters and **Units**. To change the parameters proceed as follows.

<ul style="list-style-type: none"> ■ Display □ Units
<ul style="list-style-type: none"> ▣ Altitude △ Airspeed △ Mach △ ROC
<ul style="list-style-type: none"> △ Ptotal △ Pstatic △ Qc △ Tared Alt

- Select **Display** (F1).
- Select Altitude and press the **On** (F1) key. Note if the display is already on, only the off function will be presented.
- >> ○ Repeat the selection process for each parameter by pressing the appropriate function keys. Note that to obtain the second page of menu options, the **Menu Scroll** key must be pressed.
- After selection of the required display parameters, press **Exit Menu** twice to quit the Display set-up mode.

● Units

The options in this sub-menu are used to set-up the required Altitude, Airspeed and Pressure units. To set-up these parameters proceed as follows.

<ul style="list-style-type: none"> □ Display ■ Units
<ul style="list-style-type: none"> ▣ Altitude △ Airspeed △ Pressure △
<ul style="list-style-type: none"> * Feet * Metres

- Select **Units** (F2).
- Select **Altitude** and use the **Feet** (F1) or **Metres** (F2) to select the required units.
- Repeat the selection process for **Airspeed** (F2) and **Pressure** (F3).

It should be noted that selecting **Pressure** (F3), provides a choice of the default units i.e. **bar** (F1), **psi** (F2), **mH₂O** (F3) and **mbar** (F4). If the units required are not displayed, refer to Section 4.3.1.

4.13.4 Rate of Climb Tests

To carry out **Rate of Climb** (ROC) tests, proceed as follows.

OPTION
<ul style="list-style-type: none"> ● AERO ○ Airfield
<ul style="list-style-type: none"> ■ Display □ Units □ Timed ROC
<ul style="list-style-type: none"> △ Altitude △ Airspeed △ Mach □ ROC
<ul style="list-style-type: none"> * On

- Connect the device under test and the DPI 145 instrument to the pressure source controller (see Figure 4.3.).
- Check all pressure connections. Using the Change Aeronautical Settings Menu, Select **Display** (F1) followed by **ROC** (F4) and **On** (F1). The display will now indicate Rate of Climb.

<p>Ptotal</p> <p style="font-size: 2em; font-weight: bold;">1006.32</p> <p style="text-align: right; font-size: 0.8em;">mbar</p>	<p>Pstatic</p> <p style="font-size: 2em; font-weight: bold;">800.66</p> <p style="text-align: right; font-size: 0.8em;">mbar</p>
<p>Rate of Climb</p> <p style="font-size: 2em; font-weight: bold;">0</p> <p style="text-align: right; font-size: 0.8em;">ft/min</p>	<p>Qc Pressure</p> <p style="font-size: 2em; font-weight: bold;">205.66</p> <p style="text-align: right; font-size: 0.8em;">mbar</p>

- Switch on the (external) controller and generate a Rate of Climb. The Rate of Climb display will provide a dynamic indication of ROC.

To obtain a Rate of Climb indication over a timed period, proceed as follows.

OPTION
<ul style="list-style-type: none"> ● AERO ○ Airfield
<ul style="list-style-type: none"> □ Display □ Units ■ Timed ROC
<ul style="list-style-type: none"> □ Start △ △ △ Clear

- Press the **OPTION** key. A third sub-menu **Timed ROC** will appear on the change aeronautical; settings menu.
- Select **Timed ROC** (F1) and the following prompt is presented.

Rate Integration Time: 30 seconds
Start Clear

- Enter the required Integration period (default 30 seconds) on the numeric key-pad and press **ENTER**.

NOTE: **The method of rate of climb calculation is selected under set-up (refer to Section 4.13.2).**

OPTION	
<input checked="" type="radio"/>	AERO
<input type="radio"/>	Airfield
<input type="checkbox"/>	Display
<input type="checkbox"/>	Units
<input checked="" type="checkbox"/>	Timed ROC
<input checked="" type="checkbox"/>	Start
<input type="checkbox"/>	Δ
<input type="checkbox"/>	Δ
<input type="checkbox"/>	Δ Clear

- Switch on the controller (external) and when required, press the **Start** (F1) key. The timed ROC period now commences, indicated by the Rate Integration time counting down. When the integration period has expired, the rate of climb display window is updated.

Ptotal		Pstatic
900.39	mbar	725.37 mbar
Rate of Climb		Qc Pressure
1000	ft/min timed	125.02 mbar
Rate Integration Start	Test Complete	30 seconds Clear

- To reset the display to dynamic operation, press Exit Menu or, to carry out another test, press **Start** (F1).

● Rate of Climb (Low Pass Filter)

A low pass filter is provided for the ROC channel. The filter has a variable time constant and a variable step response. The variable step response effectively overrides the filter operation when incremental ROC transients exceed a preset threshold (step value). To set-up the filter parameters, proceed as follows.

SET-UP	
<input type="radio"/>	Units
<input type="radio"/>	Channel
<input checked="" type="radio"/>	Option
<input type="radio"/>	Barometer
<input checked="" type="checkbox"/>	Aero
<input type="checkbox"/>	Airfield
<input type="checkbox"/>	
<input type="checkbox"/>	
<input type="checkbox"/>	Δ Altitude
<input type="checkbox"/>	Δ Airspeed
<input checked="" type="checkbox"/>	ROC Filter
<input type="checkbox"/>	Δ

- Select **SET-UP** and select **Option** (F3).
- Select **Aero** (F1) from Option Set-up menu.
- Select **ROC Filter** (F3) from the channel Set-up menu.
- Select a channel for the filter (e.g.) 2 bar g. The following sub-menu reports the currently set filter parameters. The filter is permanently enabled.

Filter Average 7 Step 250ft

SET-UP	
<input type="radio"/>	Units
<input type="radio"/>	Channel
<input checked="" type="radio"/>	Option
<input type="radio"/>	Barometer
<hr/>	
<input checked="" type="checkbox"/>	Aero
<input type="checkbox"/>	Airfield
<input type="checkbox"/>	
<input type="checkbox"/>	
<hr/>	
<input type="checkbox"/>	Altitude
<input type="checkbox"/>	Airspeed
<input checked="" type="checkbox"/>	ROC Filter
<input type="checkbox"/>	Timed ROC

- The average figure includes the number of sequential readings averaged by the filter. A number between 1 and 99 can be entered. High values effectively give the filter a long time constant. Enter the required number on the numeric key-pad and press ENTER.

NOTE: The default value is 7.

- The step figure indicates the value (expressed in feet), which, if the filter sees a step increase in excess of this value, the low pass characteristic is effectively bypassed. Setting this to a high value has the effect of decreasing the step response of the filter. Enter the required number on the numeric key-pad , press ENTER.

NOTE: The default value is 250ft.

- The filter is permanently enabled.

4.14 Software Options - Airfield Barometer

The standard instrument includes meteorological barometer facilities such as Barograph, QFF Calculations (estimated Sea Level pressure accounting for local air temperature) and three hour trend.

A barometer for use on an airfield requires further features including an alternative method of estimating Sea Level pressure.

- **Runway QFE**

The instrument allows parameters to be entered and displayed for a maximum of six runways. Each runway adopts the standard aeronautical designation indicating the bearing of the runway ('03 is a runway at 030°, when the same strip is used in the opposite direction, it is named by the reciprocal bearing 210° so becomes '21'). Additionally, runways can be 'handed' the display showing 03L and 03R.

The instrument calculates the 'Runway QFE' by allowing for height difference between the runway threshold heights and the barometer height.

To do this, the user enters the barometer height Above Sea Level, the threshold height Above Sea Level and the local air temperature.

The QFE value is displayed in accordance with aeronautical practice, that is, rounded to whole millibars by rounding down. This resolution is pre-set and is not adjustable.

- **Airfield QNH**

Airfield QNH is the estimated Sea Level pressure based on the local airfield measurement and using a formula which does not take account of air temperature.

The QNH is displayed in accordance with aeronautical practice, that is rounded to whole millibars by rounding down. This resolution is pre-set and is not adjustable.

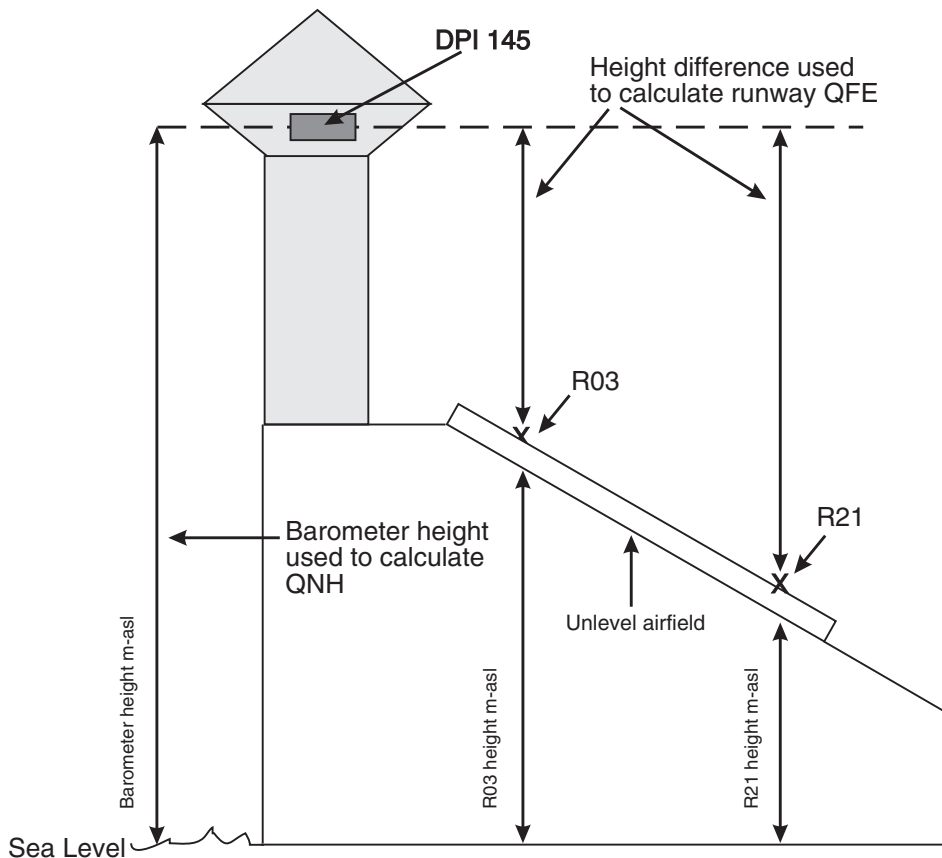


Figure 4.4 - Calculation of Runway QFE & QNH

4.14.1 Airfield Option Set-up

To set-up the Airfield Option for operation, proceed as follows.

SET-UP	
○	Units
○	Channel
●	Option
○	Barometer
<hr/>	
□	Aero
■	Airfield
□	
□	
<hr/>	
△	Runways
△	Temperature
△	Site
△	Channel

- Switch the instrument **ON** and press the **SET-UP** key.
- Press the **Option** (F3) key and select **Airfield** (F2) from the Select Option menu. This gives access to the Airfield set-up options.

Four options are provided, **Runways** (F1), **Temperature** (F2), **Site** (F3) and **Channel** (F4).

- **Set-up Measurement Channel.**

On selection of F4, the instrument reports the channel currently being used as the Airfield Option sensor.

**Airfield Channel - 1.1. bar A
Alter**

To change the measurement channel, select **Alter** (F1) and a menu showing the configured channels will be displayed.

20 bar g 2 bar g Ext PRT 1.1 bar A

Select the required measurement channel by pressing the relevant function key.

- **Set-up Site**

This option is used to enter the height of the Barometer Above Sea Level. On selection of **Site** (F3) the instrument reports the currently set barometer height and prompts for a new value to be entered.

**Barometer Height 100 m-ASL
Alter**

Press the **Alter** (F1) key and enter the required height above Sea Level on the numeric key-pad and press **ENTER**. If the barometer is Below Sea Level, enter a negative number.

- **Set-up Airfield Temperature**

This option is used to enter the local temperature of the Airfield. On selection of **Temperature** (F2), the instrument reports the currently set temperature. A flashing cursor over the first digit of the current value prompts for a new value to be entered.

Airfield Temperature 20 °C

Enter the required value on the numeric key-pad and press **ENTER**. The instrument then returns to the Airfield set-up display.

- **Set-up Runways**

Initially, when the instrument is delivered, no runways will be set-up. To set-up the required runways, proceed as follows.

- Select **Runways** (F1) from the Airfield Set-up menu. A list of runways will now be reported.

Runway	— — —	Height	0.0 m-ASL	Not Used
Runway	— — —	Height	0.0 m-ASL	Not Used
Runway	— — —	Height	0.0 m-ASL	Not Used
Runway	— — —	Height	0.0 m-ASL	Not Used
Runway	— — —	Height	0.0 m-ASL	Not Used
Runway	— — —	Height	0.0 m-ASL	Not Used
Select Name		Height		In Use

- Position the reverse video against an empty location (initially all will be empty) using the **Select** (F1) key.
- Select **Name** (F2) and enter the required runway number (e.g.) 27. If the runway is split to have left and right-hand sections, use the **Right/Left** key to select the correct identification, if not press the **Accept** key. Press **Accept** (F3) to store the required runway data.
- Ensure that the cursor is over the required runway and select **Height** (F3). The instrument prompts for a new **Runway Height**.

New Runway Height

Enter the required Runway Height in metres Above Sea Level (e.g.) 89 and press **ENTER**. If the runway is Below Sea Level, enter a negative number.

The current settings are now displayed.

Runway	09L	Height	89.0 m-ASL	Not Used
Runway	————	Height	0.0 m-ASL	Not Used
Runway	————	Height	0.0 m-ASL	Not Used
Runway	————	Height	0.0 m-ASL	Not Used
Runway	————	Height	0.0 m-ASL	Not Used
Runway	————	Height	0.0 m-ASL	Not Used
Select	Name	Height	In Use	

When runway is 'Not Used', display of data for this runway is inhibited. To select the runway as available for display, press the **In Use** Key (F4).

NOTE: The function of the **In Use** key is reallocated to **Not Used**. Refer to paragraph 4.14.2 for details of how to display runway data.

4.14.2 Change Airfield Settings

● Display

The Options in this menu are used to select the required Display parameters and Units. To change the parameters, proceed as follows.

OPTION
○ Aero
● Airfield
○
○
■ Display
□ Units
□
□
△ QNH
△ RWY 27L
△ RWY 09L
△ RWY 27R

- Press the **OPTION** key and select **Airfield** (F2).
- Select **Display** (F1). The channels available for display will be reported as follows.

Select required display

QNH RWY 27L RWY 09L RWY 27R

- Select channels required for display by pressing the appropriate keys.

NOTE: If the >> cursor is displayed, another page of selection is available and can be displayed by pressing the Menu Scroll key.

For a configured runway to be available for display, it must be marked as In Use (refer to Set-up Runways section in paragraph 4.14.1).

A typical configured display is shown below.

Airfield QNH 1047 mbar	QFE RWY 27L 1034 mbar
QFE RWY 09L 1044 mbar	

Airfield pressures are always shown to the nearest mbar by rounding down the exact pressure, in line with airfield practice..

● Units

The Options under this sub-menu are used to set-up the required pressure units.

OPTION
○ Aeronautical
● Airfield
○
○
□ Display
■ Units
●
●
△ mbar
△ inHg
△ hPa

- Press the **OPTION** key and select **Airfield** (F2).
- Select **Units** (F2).
- Select either **mbar** (F1), **inHg** (F2), **hPa** (F3) as required.

5 CALIBRATION

The instrument is supplied by the manufacturer, complete with calibration certificate(s). A calibration period of 12 months is recommended. The actual calibration interval depends on instrument usage and the total measurement uncertainty acceptable for the specified application. In order that the instrument remains within the quoted accuracy, it is suggested that Piezo Resistive transducers are checked every 90 days and Resonant transducers, every 12 months.

The DPI 145 is a very precise measuring instrument and the test equipment and conditions of test must be suitable for the type of work and the test equipment and conditions of test must be suitable for the type of work. A Class A compensated deadweight tester must be used. The calibration check and calibration adjustment should be carried out in a controlled environment by a calibration technician*.

The manufacturer offers a comprehensive and, if required, UKAS or NIST accredited calibration service.

** A calibration technician must have the necessary technical knowledge, documentation, special test equipment and tools to carry out the calibration work on this equipment.*

5.1 Calibration Check

At the chosen calibration interval, the instrument readings should be compared with a known pressure standard.

The recommended method starts at 0, increasing in 20% steps to 100% full-scale and then decreasing in 20% steps to 0.

Note any deviations between the instrument and the pressure standard and consider traceability (accuracy to a National Standard).

If, after a calibration check, the results exceed the tolerance in the specification (or other suitable performance standard), carry out a calibration adjustment.

5.2 Calibration Adjustment

The instrument can be fitted with many types of transducers. It is important to identify the transducer type before the calibration check to make sure the correct specification and adjustment procedure is used. Refer to Section 5.2.2 for details of Cal Status checks.

The results of the calibration check should be studied to find the deviations to be adjusted. If the instrument is operating correctly, only zero and full-scale calibration will vary. Any excessive non-linearity or temperature effects indicate a fault.

If there is non-linearity with or without offset and gain errors then non-linearity compensation adjustment is necessary.

If a temperature coefficient outside specification is found then temperature compensation might be attempted by the user. However, temperature performance drift is most unlikely. In the unlikely event that this type of error is found it is most probably an indication of a damaged or failing transducer under these circumstances, the instrument should be returned to a qualified service agent. (refer to Section 6.5).

Frequency output transducers (also termed 'resonant' types, such as Druck RPT and Solartron), use a temperature and linearity compensation technique that requires the entry of 'constants' for each individual transducer at the time when the transducer is installed. These constants should **NOT** be adjusted during the life of the transducer. They will only require a change if the transducer is replaced. These transducers can be adjusted for zero and full-scale.

The use of a dead-weight tester having measured masses and correcting for temperature and gravity is mandatory for this level of calibration. The work should be carried out in a controlled environment, with adequate stabilisation time prior to and during adjustment.

5.2.1 General Procedures

The following general hints are provided as a guide to calibration procedures.

Do

Use high quality **Repeatable and Linear** pressure sources and allow adequate stabilisation time before calibration (minimum 1 hour).

Conduct the calibration in a temperature and preferably humidity controlled environment.

Use deadweight testers carefully and away from draughts.

Use only one deadweight piston to cover the whole of the operating range of any auto ranging pair.

Do Not

Conduct linearity compensation unless a calibration check shows excessive non-linearity.

Conduct temperature compensation unless sure of the reason why the compensation has changed.

Attempt to alter the **Constants** of an existing, working resonant transducer.

Note:

The following routines require entry to the **Set-up** and **Cal Test** menus. Both menus can be PIN protected. Initially, PIN number **123** is set for both **Set-up** and **Cal Test**.

WARNING

Misuse of the **CAL TEST** facility can result in the complete loss of the instrument's calibration.

5.2.2 Cal Status Menu

The **Cal Status** menu provides a log of the calibrations and calibration dates for the internal and external transducers fitted to the instrument and for the Ratio and Electrical Calibrations.

It also provides a cross reference to the serial numbers of the internal and external measurement transducers. The **Cal Status** menu is accessible from the **SETUP** menu as follows.

SET UP	
○ Units	
○ Channel	
○ Option	
○ Barometer	>>
○ Output	
○ Comms	
○ Printer	
○ External	>>
● Cal Status	
○ Cal Test	
○ Display	
○ Calendar	
□ Previous	
□ Next	
•	
•	

- Press the **SETUP** key and enter the Setup Pin (if set).
- Press **Menu Scroll** twice to obtain the third page of Set-up Options.
- Select **Cal/Status** (F1). This gives access to the first page of the Cal Status menu (e.g.)

Ratio Calibration Dates

Transducer Supply	4/01/95
Span Cal Sig	4/01/95

Previous	Next
-----------------	-------------

- Use the **Next** (F2) key to step through all the Cal Status pages which are presented in the following order.

Ratio Calibration Dates

Electrical Calibration Dates

M1	=	Internal Druck PRT
M2	=	Internal Druck PRT
M3	=	External (PRT) Nos 1 to 10 (sequentially)
M4	=	Internal Resonant RPT
M5	=	Internal Resonant RPT
M6	=	External Resonant RPT

Once away from the first screen, the **Previous** (F1) key can be used to step back one screen for each press.

5.3 Transducer Types

The instrument can be equipped with a wide range of transducer types, which can be fitted internally and externally. The following list details the types of transducer that can be fitted.

5.3.1 Internal Piezo Resistive Types

The internal types of transducer fall into two distinct categories, Piezo -resistive and resonant. Channels M1 and M2 are allocated to internal Piezo resistive types.

- **Fixed Range Internal Piezo Resistive Transducers**

Description - These devices comprise a silicon diaphragm Piezo resistive strain gauge with internal, passive analogue temperature compensation. They may be either gauge, absolute or differential types. They have a 50 mV full-scale output when energised from a 5 Volt supply.

- **Digitally Characterised Piezo Resistive Transducers**

Description -These devices are Piezo resistive devices without passive temperature compensation. Their temperature and linearity compensation characteristics are stored digitally within the transducer in an EEPROM.

- **Digitally Characterised, Auto Ranging Piezo Resistive Transducers.**

An auto ranging pair comprises two digitally characterised transducers mounted on a manifold block together with a solenoid operated protection valve. One transducer typically covers the lower 10% of the combined operating range and the other the complete operating range. The instrument automatically selects the required transducer depending upon the magnitude of the pressure currently being measured.

The calibration routines for all types of internal and external transducer, whether fixed range or digitally compensated types, are similar and are described in the following sections. If the transducers are digitally compensated devices, the compensation data contained within the transducers EEPROM will be overwritten with the new calibration data. Standard fixed range devices have their calibration table data, contained within the instrument, overwritten.

It is important when calibrating a transducer to determine its operating pressure and temperature range. For internally mounted transducers, this information will be contained on the instrument's calibration certificate. The operating pressure is also indicated on the rear panel of the instrument above the pressure inlet.

5.3.2 External Piezo Resistive Types

External types of Piezo resistive transducer can be either fixed range types or digitally compensated types or a combination of both. Each type of transducer is fitted with a special plug to fit the **EXT PDCR** socket located on the rear panel. Channel M3 (External) is allocated to external Piezo resistive transducers

The data appropriate to each type is stored in the instrument's memory and can be selected from a directory containing up to six separate devices (refer to Sections 3.5.3 and 3.6.2). The calibration method is similar to the internal Piezo resistive transducers.

For external transducers, pressure and temperature information will be contained on their calibration certificate and its operating pressure will be engraved on its casing.

5.3.3 Internal Resonant Types

The internal types of resonant transducer fall into two distinct types, vibrating cylinder (Solartron) and resonant silicon (Druck). Each type has a different operating frequency range.

5.3.4 External Resonant Types

The DPI 145 instrument accepts a single resonant transducer. Each transducer is fitted with a plug to fit the **EXT RPT** socket located on the rear panel. Channel M6 is allocated to external resonant transducers

The calibration method is similar to the calibration method for the internal Resonant transducers. If more than one external resonant transducer is used with the equipment it is important to check that the correct set of data has been loaded for the device to be tested **BEFORE ANY WORK IS COMMENCED**. Check against the calibration certificate for the appropriate external device.

5.4 Using the Calibration Menu

The calibration routines are entered via an option of the SET-UP facility **Cal/Test** (F4). To select the calibration mode, proceed as follows.

SET UP	
o Units	>>
o Channel	
o Option	
o Barometer	
o Output	>>
o Comms	
o Printer	
o External	
o Cal. Status	
● Cal Test	
o Display	
o External	
□ Cal	
□ Test	
□ Cal Pin	
□ Setup Pin	

- o Switch the instrument ON.
- o Press the **SET-UP** key and enter the Setup Pin (if set).
- o Press **Menu Scroll** twice to obtain the third page of Set-up Options.
- o Select **Cal/Test** (F2) from the SET-UP menu.

The instrument will now prompt for the entry of a PIN number. A typical prompt is shown below.

NOTE: If there is a long delay between the request prompt and entry of the PIN number, the display will "time out" and Set-up will then need to be re-selected.

Cal/Test-Enter pin Number:

Enter the correct PIN number and press **ENTER**. Initially, the instrument is supplied with PIN number 123 installed. At the Enter Pin Number prompt, enter the PIN number to gain access to the user Cal/Test menu as follows.

User Cal/Test Menu

Cal	Test	Cal Pin	Setup Pin
F1	F2	F3	F4

These three options **Cal** (F1), **Test** (F2) and **Cal Pin** (F3) provide access to the instrument's calibration **Cal, Test** and selection of a new PIN number (Cal Pin) and (Setup Pin) routines.

If a **"Cal disabled - Please remove Cal link"** message is displayed, Link 2 on the main circuit board must be removed before proceeding. *To prevent accidental overwrite of calibration data, Link 2 must be replaced on completion of calibration.*

CAUTION: It should be noted that the facilities under the **Test (F2)** key are powerful fault finding aids. Misuse of the facilities will cause serious damage to the instrument. They should, therefore, only be used by trained service personnel.

5.4.1 Selection of New PIN number

Access to all the calibration and test routines are protected by a PIN number. Initially, on delivery, PIN number 123 is installed.

The PIN number can be changed, by the **New Pin** option of the user Cal/Test menu. To change a PIN number, proceed as follows.

SET UP	
○ Units	>>
○ Channel	
○ Output	
○ Calendar	
○ Comms	>>
○ Printer	
○ Display	
○ Barometer	
○ Cal. Status	
● Cal. Test	
○	
○	
□ Cal	
□ Test	
■ Cal Pin	
□ Setup Pin	

- Switch the instrument ON.
- Press the **SET-UP** key and enter the Setup Pin (if set).
- Press the **Menu Scroll** key twice to obtain the third page of Set-up Option.
- Select **Cal/Test** from the Set-up menu by pressing the F2 function key.
- Enter the existing PIN number and press **ENTER**.
- Select **Cal Pin** from the user Cal/Test menu by pressing the F3 function key. The instrument now prompts for a new PIN number, a typical dialogue being shown below. The numbers shown in brackets. <27> represent keyboard entries made by the operator, followed by operation of the **ENTER** key located on the numerical key-pad.

**Enter new PIN number<27> (Max 8 numbers)
Enter on its own is no PIN.**

On entry of the required PIN number, the instrument requests verification of the new pin number prior to setting it. Enter the required new Pin number in response to the following prompt.

Verify new PIN number <27>

The Setup Pin can be changed in a similar manner by selecting **Setup Pin** (F4) instead of F3.

The **Pressure** (F1) option provides access to the pressure calibration adjustment routines of the instrument. Initially, all the configured channels will be displayed as follows (e.g.).

Calibration adjustment menu

M1 M2 External Resonant

- **Piezo Resistive Internal and External Transducers**

Channels **M1**, **M2** and **External** apply to the internal (**M1** and **M2**) and external (**M3**) Piezo-resistive transducers. Selection of either of these options permits one of three types of calibration adjustment to be carried out.

- **2 Point Correction (Zero and Full-Scale Correction)**

This is a simple span and zero calibration adjustment. Zero pressure and nominal full-scale pressure are applied to the transducer to be adjusted, the exact value of full-scale pressure applied being typed in via the key-pad. This procedure leaves the linearity and temperature compensation data unchanged. *Refer to Section 5.5 for method.*

- **Linearity Compensation**

Used to provide linearity correction of the pressure reading. A minimum of 5 points must be entered over the appropriate pressure range (e.g.) -1 to 2 bar. The procedure takes the form of applying precisely known pressures and entering the pressures via the key-pad. Positive pressures are applied to the channel's pressure port and negative pressures are simulated by application of a positive pressure to the associated channel's Reference port. *Refer to Section 5.6 for method.*

- **Temperature Compensation**

Used to provide temperature compensation of the pressure reading. The temperature compensation procedure takes the form of applying zero and nominal full-scale pressure to the transducer to be compensated and entering the precise value of the nominal full-scale pressure applied via the key-pad. This procedure is repeated at a minimum of four different temperatures over the temperature range of interest. *Refer to Section 5.7 for method.*

● Resonant Internal and External Transducer

SET UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
○ Comms	
○ Printer	
○ External	
○ Cal. Status	
● Cal Test	
○ Display	
○ Calendar	
■ Cal	
□ Test	
□ Cal Pin	
□ Setup Pin	
Ⓢ Pressure	
△ Electrical	
△ Ratio	
* M1	
* M2	
* External	
* Resonant	
● M4	
○ M5	
○ External	

Selection of **Resonant** (F4) from the Pressure Cal adjustment menu displays all the configured resonant channels.

Select Resonant

M4

M5

External

Selection of any of these options provides access to the calibration menu for the particular channel selected. The four options are;

■ Constants

This function provides access to the calibration constants of the barometric transducer. The constants are derived at the time of manufacture of the transducer and should **NEVER** be altered in any way without reference to the manufacturer.

■ Frequency

This function is used to set-up the internal reference frequency of the instrument. The procedure takes the form of measuring the reference frequency (nominally 10 MHz) to be found on the main printed circuit board connector PL14 pin 2 (signal) pin 3 (ground) and entering its value via the key-pad.

■ Diode

The function is used to set-up the measurement of the barometric transducer diode voltage output. The procedure takes the form of measuring the actual diode voltage output from the barometric transducer and entering its value via the key-pad. (The voltage, with respect to 0V may be found on test points **V DIODE 1 [M4], V DIODE 2 [M5] and V DIODE 3 [EXTERNAL]**).

■ **BSL (Best Straight Line)**

This function is used in the final stage of calibration of a resonant transducer, to correct for any residual errors after the frequency and diode measurements have been completed. A minimum of two and a maximum of six known pressures need to be applied and entered into the instrument.

The calibration method for resonant transducers is described in Sections 5.6.1 and 5.6.2.

5.4.3 Electrical Calibration Menu Options

Calibration procedures must be carried out in a controlled environment (e.g.) Standards Laboratory

To gain access to the electrical calibration routines, proceed as follows.

- Access the calibration adjustment menu as described in Section 5.4.2.
- Select **Electrical** (F2) from the menu, and the **Calibrating Programmable Output** menu is displayed as follows.

Calibrating programmable output:

Volts Current

■ **Voltage**

Calibration adjustment of the voltage output takes the form of measuring two output voltages across the **V/I OUT** socket located in the rear panel of the instrument. These two voltages are provided automatically by the instrument, when the voltage function is selected. The measured values are then entered via the key-pad.

The calibration method is detailed in Section 5.8

■ Current

Calibration adjustment of the current output takes the form of measuring two output currents provided across the **I/V OUT** socket located in the rear panel of the instrument. These two currents are provided automatically by the instrument when the current output calibration function is selected. The measured values are then entered via the key-pad.

The calibration method is detailed in Section 5.8.

5.4.4 Ratio Calibration Option

The **Ratio** (F3) option from the calibration adjustment menu provides the facility to set-up the Ratio Reference within the instrument.

The Ratio Reference is used by the instrument for measuring the output from the internal and external PRT type transducers. It is therefore important that the Ratio Reference is correctly set up **prior** to any calibration adjustment of the instrument's pressure ranges. Normally, the **Ratio** calibration should not require changing.

CAUTION: If the Ratio Calibration is changed, all the existing instrument pressure range calibrations will be invalidated and will need to be repeated (Linearity and TC).

The procedure takes the form of measuring the transducer supply, nominally 5 Volts, and measuring "Span and Cal", nominally 100 mV and entering these values via the numeric key-pad.

5.5 Correction of Zero and Full-Scale Errors

The procedure for the correction of zero and full-scale errors depends upon the type(s) of transducer fitted to the instrument and upon whether the transducer to be corrected is internal or external to the instrument.

5.5.1 Internal Transducers

- **Fixed Range PRT and Digitally Compensated PRT's**

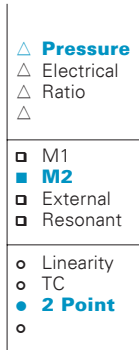
The following procedure details the method of carrying out a two point (Zero and Full-Scale) calibration for these types of transducer. These transducers will be fitted to measurement channels **M1** and **M2**. Note that if only one measurement channel is configured, only one channel number will appear on the display.

△ Pressure
△ Electrical
△ Ratio
△
□ M1
■ M2
□ External
□ Resonant
○ Linearity
○ TC
● 2 Point
○

- Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).
- Select required channel, **M1** or **M2**.
- Select **2 Point** (F3).
- Connect the channel input to an external pressure source and pressure measurement standard (deadweight tester).
- Apply lowest pressure - zero and in response to the prompt,

Enter applied Pressure 1:

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.



- Press the **Accept** (F1) key to accept the entered pressure.
- Apply the highest pressure (full-scale) and in response to the prompt,

Enter applied Pressure 2: □

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

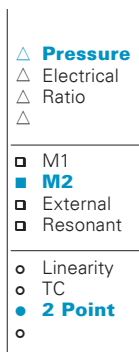
- Press the **Accept** (F1) key to accept the entered pressure. The display briefly displays the following message,

Calculating Coefficients - Please Wait before returning to the **Pressure Cal Adjustment** menu.

- Check calibration at 25% and 75% full-scale. If calibration is out of specification, a linearity compensation should be carried out (refer to Section 5.6).

● Auto Ranging Pair

An auto ranging pair comprises two digitally compensated transducers covering the range (-1 to 2 bar) and (0 to 20 bar). For calibration purposes, the 0 to 20 barg transducer is allocated to Channel (**M1**) and the 0 to 2 barg to channel **M2**. The following procedure details the method of carrying out a 2 point calibration of an auto ranging pair.



- Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).
- Select channel **M2** (this selects the 2 bar transducer).
- Select **2 Point** (F3).
- Connect the channel input to pressure measurement standard (deadweight tester). Note that an auto ranging pair has only one pressure input.

Use the same deadweight piston for both the **-1 to 2 bar** (M2) and **0 to 20 bar** (M1), 2 point calibrations.

- Apply lowest pressure (-1 bar) and in response to the prompt,

Enter applied Pressure 1:

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

NOTE: -1 bar is applied by applying a positive pressure of 1 bar to the reference port.

- Press the **Accept** (F1) key to accept the entered pressure.
- Apply the full-scale pressure (for the 2 bar transducer) i.e. 2 barg, and in response to the prompt,

Enter applied Pressure 2:

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

- Press the **Accept** (F1) key to accept the entered pressure. The display briefly displays the following message (e.g.),

Calculating Coefficients - Please Wait

before returning to the **Pressure Cal Adjustment** menu.

- Check calibration at 25% (0.5 barg) and 75% (1.5 barg) of full-scale. If calibration is out of specification, a linearity compensation should be carried out (refer to Section 5.6).

- Select channel **M1** (this selects the 20 bar transducer).
- Select **2 Point** (F3).
- Apply lowest pressure (zero) and in response to the prompt,

Enter applied Pressure 1:

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

<input checked="" type="checkbox"/>	M1
<input type="checkbox"/>	M2
<input type="checkbox"/>	External
<input type="checkbox"/>	Resonant
<input type="checkbox"/>	Linearity
<input type="checkbox"/>	TC
<input checked="" type="checkbox"/>	2 Point
<input type="checkbox"/>	

- Press the **Accept** (F1) key to accept the entered pressure.
- Apply the full-scale pressure (for the 20 bar transducer) 20 barg, and in response to the prompt,

Enter applied Pressure 2: □

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

- Press the **Accept** (F1) key to accept the entered pressure. The display briefly displays the following message,

**Calculating Coefficients - Please Wait
before returning to the *Pressure Cal Adjustment* menu.**

- Check calibration at 25% (5 barg) and 75% (15 barg) of full-scale. If calibration is out of specification, a linearity compensation should be carried out (refer to Section 5.6).
- **Resonant Transducers**

A number of different types of resonant transducer may be fitted to the instrument. Refer to Specification, Section 1.

A two point, Zero and Full-Scale calibration can be carried out on a resonant transducer. Refer to Stage 3 in Section 5.6.1.

5.5.2 External Transducers

- **Fixed Range PRT & Digitally Compensated PRT's**

The following procedure details the method of carrying out a two point (Zero and Full-Scale) calibration for these types of transducer. An external PRT transducer is fitted to the **External** measurement channel (**M3**). To carry out a 2 point correction on an external transducer, proceed as follows.

△ Pressure
△ Electrical
△ Ratio
△
□ M1
■ M2
□ External
□ Resonant
○ Linearity
○ TC
● 2 Point
○

- Plug the external transducer into the socket labelled **EXT PDCR** on the rear panel of the instrument.
- Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).
- Select **External** (F3). The status of the External input is now reported,

M3 Enabled
Enable Disable

Press the **Enable** (F1) key to display the table of configured External Transducers.

External Transducer	
SN: AY136720	← SN: Undefined
SN: KP10031	SN: Undefined
SN: 17667	SN: Undefined
SN: Undefined	SN: Undefined
SN: Undefined	SN: Undefined

Previous Next Delete Select

- Position the cursor against the serial number of the required transducer using the **Previous** (F1) and **Next** (F2) keys and press the **Select** (F4) key.

If the external transducer's serial number is not contained in the directory, proceed as outlined in Section 5.5.3.

<ul style="list-style-type: none"> <input type="checkbox"/> M1 <input type="checkbox"/> M2 <input checked="" type="checkbox"/> External <input type="checkbox"/> Resonant
<ul style="list-style-type: none"> <input checked="" type="radio"/> Enable <input type="radio"/> Disable <input type="radio"/> <input type="radio"/>
<ul style="list-style-type: none"> <input type="checkbox"/> Linearity <input type="checkbox"/> TC <input checked="" type="checkbox"/> 2 Point <input type="checkbox"/>

- Select **2 Point** (F3).
- Connect the external transducer to pressure measurement standard.
- Apply lowest pressure (zero) and in response to the prompt,

Enter applied Pressure 1:

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

NOTE: If a negative pressure is required, effect this by applying a positive pressure to the transducers reference port.

- Press the **Accept** (F1) key to accept the entered pressure.
- Apply the highest pressure (full-scale) and in response to the prompt,

Enter applied Pressure 2:

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

- Press the **Accept** (F1) key to accept the entered pressure. The display briefly displays the following message,

Calculating Coefficients - Please Wait
before returning to the **Pressure Cal Adjustment** menu.

- Check calibration at 25% and 75% full-scale. If calibration is out of specification, a linearity compensation should be carried out (refer to Section 5.6).

• Resonant Sensors

A two point calibration is not usually carried out on external resonant sensors. Linearity compensation is carried out as detailed in Section 5.6.

5.5.3 External Transducer Identification Entry (PRT Types only)

If the parameters of an external transducer are not entered in the **External Transducer** directory, proceed as follows.

△ Pressure
△ Electrical
△ Ratio
△
□ M1
■ M2
□ External
□ Resonant
○ Linearity
○ TC
● 2 Point
○

- Plug the external transducer into the socket labelled **EXT PDCR** on the rear panel of the instrument.
- Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).
- Select **External**. The status of the External input is now reported,

M3 Enabled
Enable Disable

Press the **Enable** (F1) key to display the table of configured External Transducers.

External Transducer			
SN: AY136720		SN: Undefined	
SN: KP10031		SN: Undefined	
SN: 17667		SN: Undefined	
SN: Undefined	←	SN: Undefined	
SN: Undefined		SN: Undefined	
Previous	Next	Delete	Select

- Position the cursor at an "Undefined" location and press **Select** (F4). If all locations are occupied, one location will need to be deleted using the **Delete** (F3) key.

- Select **FS/Type/SN** (F3) from the *External Pressure Transducer Cal* menu.
- Select **FS** (F1) and enter the full-scale reading of the transducer on the numerical key-pad and press **ENTER**.
- Select Alter **Type** (F2) and select the transducer type by pressing **Absolute** (F1), **Gauge** (F2), or **Differential** (F3).
- Select **Serial No.** (F3) from the External Pressure Transducer Cal menu.
- Enter the serial number of the transducer on the numeric key-pad and press **ENTER**.
- Press **Exit Menu**.

The external transducer parameters are now entered in the external transducer directory and this transducer is designated as the current device.

5.6 Linearity Compensation

The following procedures outline the method of carrying out a linearity compensation of the instrument's internal and external transducers.

Before any linearity compensation procedures are carried out, perform a 2 point calibration on the relevant channel to determine whether or not a full linearity compensation needs to be carried out. Two point calibration procedures are outlined in Section 5.5.

5.6.1 Internal Transducers

● **Fixed Range PRT & Digitally Compensated PRT's**

The following procedure details the method of carrying out a full linearity compensation for these types of internally fitted transducer. These transducers will be fitted to measurement channels M1 and M2. Note that if only one measurement channel is fitted, only M1 will appear on the display.

SET UP	
○ Units ○ Channel ○ Option ○ Barometer	>>
○ Output ○ Comms ○ Printer ○ External	>>
○ Cal. Status ● Cal Test ○ Display ○ Calendar	
■ Cal □ Test □ Cal Pin □ Setup Pin	
△ Pressure △ Electrical △ Ratio	
* M1 * M2 * External * Resonant	
● Linearity ○ TC ○ 2 Point ○	

- Determine the pressure operating range of the transducer (channel) to be calibrated.
- Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).
- Select required channel, **M1** or **M2**.
- Select **Linearity** (F1).
- Connect the channel input to pressure measurement standard (deadweight tester).
- Apply lowest pressure (zero) and in response to the prompt,

Applied Pressure 1: □

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.
- Press the **Accept** (F1) key to accept the entered pressure.
- In response to the following prompt.

Another Point ?
Yes **No**

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

- Select **Yes** (F1).

NOTE: A minimum of five points are required for a linearity calibration. Typically, 14 are used, spread throughout the operating range of the transducer.

- Repeat the above procedure for as many pressures as required. When the final pressure has been entered, answer **No** (F2) in response to the **Another Point** prompt.

Two messages will then be briefly displayed:

Transferring to EPROM (digitally compensated types only).

Calculating Coefficients - Please Wait

On completion of the above, the selected transducer is calibrated.

- **Auto Ranging Pair**

An auto ranging pair comprises two digitally compensated transducers covering the range (-1 to 2 bar) and (0 to 20 bar). For calibration purposes, the 0 to 20 barg transducer is allocated to Channel M1 and the -1 to 2 barg to channel M2. The following procedure details the method of carrying out a 2 point calibration of an auto ranging pair.

● 2 Bar Transducer

SET UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
○ Comms	
○ Printer	
○ External	
○ Cal. Status	
● Cal Test	
○ Display	
○ Calendar	
■ Cal	
□ Test	
□ Cal Pin	
□ Setup Pin	
△ Pressure	
△ Electrical	
△ Ratio	
* M1	
* M2	
* External	
* Resonant	
● Linearity	
○ TC	
○ 2 Point	
○	

■ Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).

■ Select channel **M2** (F2). This selects the 2 bar transducer.

■ Select **Linearity** (F1).

■ Connect the channel input to a pressure measurement standard (deadweight tester). Note that an auto ranging pair has only one pressure input and one reference input.

■ Apply lowest pressure (e.g.) -1 bar and in response to the prompt,

Enter applied Pressure 1: □

Enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

NOTE: To apply negative pressures, apply a positive pressure to the reference input.

■ Press the *Accept* (F1) key to accept the entered prompt, pressure.

■ In response to the following prompt.

Another Point ?
Yes No

- Select **Yes** (F1) and enter the applied pressure (measured on the pressure standard), on the numeric key-pad, followed by **ENTER**.

NOTE: A minimum of five points are required for a linearity calibration. Typically, 14 are used, spread throughout the operating range (-1 to 2 bar) of the 2 bar transducer.

At zero pressure, change the pressure input to the positive port.

- Repeat the above procedure for as many pressures as required. When the final pressure has been entered, answer **No** (F2) in response to the **Another Point ?** prompt.

Two messages will then be briefly displayed:

Transferring to EPROM (Digitally compensated types only).

Calculating Coefficients - Please Wait

On completion of the above, the 2 bar transducer in the auto ranging pair is calibrated.

○ 20 Bar Transducer

- Select **M1** (F1) from the Pressure Cal adjustment menu and repeat the procedure previously described for the 2 bar transducer, applying the same number of calibration pressures throughout the 0 to 20 bar pressure range.

● **Resonant Transducers (Internal)**

A number of different types of resonant transducer may be fitted to the instrument. Refer to specification (Section 1) for details.

It is therefore essential to determine the type of resonant transducer(s) used in the instrument and its pressure operating range, **before** carrying out any linearisation procedures. This information is contained on the instrument's calibration certificate. The pressure operating range is also indicated on the rear panel of the instrument above the channel input port.

To carry out a full calibration on an internally fitted resonant sensor, proceed as follows.

SET UP	
○ Units	>>
○ Channel	
○ Option	>>
○ Barometer	
○ Output	>>
○ Comms	
○ Printer	>>
○ External	
○ Cal. Status	■
● Cal Test	
○ Display	
○ Calendar	
■ Cal	■
□ Test	
□ Cal Pin	
□ Setup Pin	■
△ Pressure	
△ Electrical	
△ Ratio	■
* M1	
* M2	
* External	
* Resonant	■
● M4	
○ M5	
○ External	
○	

- Determine the pressure operating range of the transducer(s) fitted.
- Connect the channel input to an appropriate pressure measurement standard.
- Enter the Cal adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).
- Select **Resonant** (F3) and select required channel for calibration i.e. **M4** (F1) or **M5** (F2). Note, only channels configured for display will appear on the menu.

A menu will now be displayed as follows.

Resonant 1 Cal. menu
Constants Frequency Diode BSL

The **Constants** (F1) option is used to enter the transducer constants at first calibration and should not normally be required for a recalibration

○ Stage 1

- Remove the top cover of the instrument to gain access to the main board.

WARNING: Be careful while operating the instrument with the covers removed.

- Select **Frequency** (F2) from the Resonant Cal Menu. The currently entered frequency is displayed and a flashing cursor prompts for the entry of a new frequency.

10 MHz frequency 9.999989

- Measure the transducer frequency between **PL14, Pin 2 (+ve)** and **Pin 3 (OV_D)**. Enter the measured frequency on the numeric key-pad and press **ENTER**.

○ Stage 2

- Select **Diode** (F3) from the Resonant Cal Menu. The currently entered diode voltage is displayed and a flashing cursor prompts for the entry of a new frequency.

Diode voltage 0.58011V

- Measure the diode voltage between **0V (-ve)** and test point **V diode 1 (+ve)** (for channel **M4**) or **V diode 2 (+ve)** (for channel M5) or **V diode 3 (+ve)** (for External resonant transducers, channel M6). Enter the measured voltage on the numeric key-pad and press **ENTER**.

5.6.2 External Transducers

● Fixed Range PRT and Digitally Compensated PRT's

The following procedure details the method of carrying out a full linearity calibration for these types of transducer. An external PRT transducer is fitted to the **External** measurement channel (**M3**). To carry out a full linearity calibration on an external transducer, proceed as follows.

SET UP	
○ Units	>>
○ Channel	
○ Option	>>
○ Barometer	
○ Output	>>
○ Comms	
○ Printer	>>
○ External	
○ Cal. Status	>>
● Cal Test	
○ Display	>>
○ Calendar	
■ Cal	>>
□ Test	
□ Cal Pin	>>
□ Setup Pin	
△ Pressure	>>
△ Electrical	
△ Ratio	>>
* M1	
* M2	>>
* External	
* Resonant	>>
● Enable	
○ Disable	>>
○	
○	>>

- Plug the external transducer into the socket labelled **PDCR** on the rear panel of the instrument.
- Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).
- Select **External**. The status of the External input is now reported,

M3 Enabled
Enable Disable

Press the **Enable** (F1) key to display the table of configured External Transducers.

External Transducer			
SN: AY136720	←	SN: Undefined	
SN: KP10031		SN: Undefined	
SN: 17667		SN: Undefined	
SN: Undefined		SN: Undefined	
SN: Undefined		SN: Undefined	
Previous	Next	Delete	Select

- Position the cursor against the serial number of the required transducer using the *Previous* (F1) and *Next* (F2) keys and press the *Select* (F4) key.

If the external transducer's serial number is not contained in the directory, proceed as outlined in Section 5.5.3.

- Connect the external transducer to an external pressure source and pressure measurement standard.
- Select **Linearity** (F1) from the External pressure transducer Cal menu.
- Continue as described in Section 5.6.1 for Fixed Range PRT and digitally Compensated PRT's

● **Resonant Sensors (External)**

The DPI 145 instrument is configured for a single external resonant transducer. The method of linearity calibration is similar to that described for the Internal Resonant transducers, differing only in the method of selecting the transducer. To select the external RPT, proceed as follows.

SET UP	
○ Units ○ Channel ○ Option ○ Barometer	>>
○ Output ○ Comms ○ Printer ○ External	>>
○ Cal. Status ● Cal Test ○ Display ○ Calendar	
■ Cal □ Test □ Cal Pin □ Setup Pin	
△ Pressure △ Electrical △ Ratio	
* M1 * M2 * External * Resonant	
● M4 ○ M5 ○ External ○	

- Plug the external RPT into the **EXT RPT** socket on the rear panel of the instrument.
- Determine the pressure operating range of the external transducer fitted.
- Connect the External RPT input to an appropriate pressure source and pressure measurement standard.
- Enter the Cal adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).
- Select **Resonant** (F3) and select **External** channel (M6) for calibration.

A menu will now be displayed as follows.

Resonant 1 Cal. menu
Constants Frequency Diode BSL

The **Constants** (F1) option is used to enter the transducer constants at first calibration and should not normally be required for a recalibration.

- Proceed with **Stages 1 to 3** as outlined for **Resonant Transducers (Internal)**, Section 5.6.1.

5.7 Temperature Effects Compensation

Temperature effects compensation is carried out on Internal and External PRT's only. To carry out a temperature compensation run, proceed as follows.

SET UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
○ Comms	
○ Printer	
○ External	
○ Cal. Status	
● Cal Test	
○ Display	
○ Calendar	
■ Cal	
□ Test	
□ New Pin	
△ Pressure	
△ Electrical	
△ Ratio	
* M1	
* M2	
* External	
* Resonant	
○ Linearity	
● TC	
○ 2 Point	

- Place the instrument (if internal channels are being compensated) or the External transducer in a temperature controlled environment and allow time for the instrument/transducer's temperature to stabilise at first calibration temperature.
- Connect the selected channel input to an external pressure source and pressure measurement standard (deadweight tester).
- Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Pressure** (F1).
- Select channel, **M1**, **M2** or **External**.
- Select **TC** (F1). The following menu is now displayed.

Temperature 1 : **0.00**
OK Cal Done Clear TC

- Enter the first temperature in °C and press **ENTER**. Select **OK** (F1) and the following prompt is displayed.

Enter Zero Pressure 1 **bar**

- Apply the zero pressure and type its value on the numeric key-pad and press **ENTER**. The following prompt is now displayed.

Enter Zero Pressure 1: **0.455 bar**
OK

- Press **OK** (F1) to accept the entered pressure.
- The instrument now prompts for a second (full-scale) pressure as follows.

Enter FS Pressure 1: **bar**

- Apply the full-scale pressure and type its value on the numeric key-pad and press **ENTER**. The following display is now presented.

Enter FS Pressure 1: **9.988 bar**
OK

Press **OK** (F1) to accept the entered value.

The temperature calibration program now continues by requesting a second temperature to be entered, together with the corresponding zero and full-scale pressures. Repeat the application of zero and full-scale pressures for each of the operating temperatures throughout the required temperature range.

Sufficient time (2 hours) must be allowed for the instrument/transducer's temperature to stabilise between each set of pressure readings. A minimum of four operating temperatures must be used.

On completion of temperature compensation, press **Cal Done** (F2). If less than four temperature points are entered, an error message will be displayed.

At least 4 points needed.

5.8 Analogue and Programmable Output Adjustment

The following details the method of calibrating these outputs.

● Voltage output

SET UP	
○ Units	>>
○ Channel	
○ Option	
○ Barometer	
○ Output	>>
○ Comms	
○ Printer	
○ External	
○ Cal. Status	
● Cal Test	
○ Display	
○ Calendar	
■ Cal	
□ Test	
□ Cal Pin	
□ Setup Pin	
△ Pressure	
△ Electrical	
△ Ratio	
* Volts	
* Current	
*	
*	

- Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Electrical** (F2).

- Connect a BNC connector to the **I/V output** socket located on the rear panel and connect a Digital Voltmeter to the connector

- Select **Volts** (F1). The following prompt is displayed.

Output voltage 1 is: □

- Type the voltage recorded on the digital voltmeter on the numeric key-pad and press **ENTER**. The following prompt is now displayed.

Output voltage 2 is: □

- Type the voltage recorded on the digital voltmeter on the numeric key-pad and press **ENTER**. Voltage (**Ana Output**) calibration is now complete.

● Current output

SET UP	
○ Units	
○ Channel	
○ Option	
○ Barometer	>>
○ Output	
○ Comms	
○ Printer	
○ External	>>
○ Cal. Status	
● Cal Test	
○ Display	
○ Calendar	
■ Cal	
□ Test	
□ Cal Pin	
□ Setup Pin	
△ Pressure	
△ Electrical	
△ Ratio	
* Volts	
* Current	
*	
*	

- Enter the Cal Adjustment menu as detailed in Section 5.4.2 and select **Electrical** (F2).
- Connect a BNC connector to the **I/V output** socket located on the rear panel and connect a Digital Ammeter to the connector
- Select **Current** (F2). The following prompt is displayed.
Output current 2 is: □
- Type the current recorded on the digital ammeter on the numeric key-pad and press **ENTER**. The following prompt is now displayed.
Output current 2 is: □
- Type the voltage recorded on the digital voltmeter on the numeric key-pad and press **ENTER**. Current (**Prog Output**) calibration is now complete.

6 MAINTENANCE

There are no user serviceable parts on the DPI 145 instrument other than the power supply fuse.

6.1 Safety Instructions

- Observe the general safety procedures detailed at the beginning of this User Manual.
- This instrument must only be serviced by a Druck approved service organisation. Section 6.5 details a list of Druck subsidiaries worldwide.
- "Continuing Electrical Safety Assessment (Electricity at Work Regulations)". A periodical inspection of the instrument to determine the continuing electrical safety may be undertaken at the user's discretion. If the user decides that practical testing is required to determine the continuing electrical safety then, due to the sensitive nature of the instrument, dielectric strength (flash) testing should not be undertaken as permanent damage may be caused.

However, routine testing to prove the Earth Continuity (limited to 25 Amp test current for 5 seconds) and Insulation Resistance (500V d.c.) may be undertaken periodically at the user's discretion.

- Do not use user replacement parts other than those supplied by the manufacturer or manufacturer's agent.

6.2 Fuse Replacement

If when an a.c. mains supply is connected to the instrument and the instrument fails to operate when it is switched on, replace the power supply fuse as follows (refer to Fig. 6.1).

- Set the On/Off switch (4) to OFF.
- Isolate the external power supply and remove the IEC power connector (1).
- Remove the fuse carrier (2) from the power supply assembly (5) and replace the fuse.

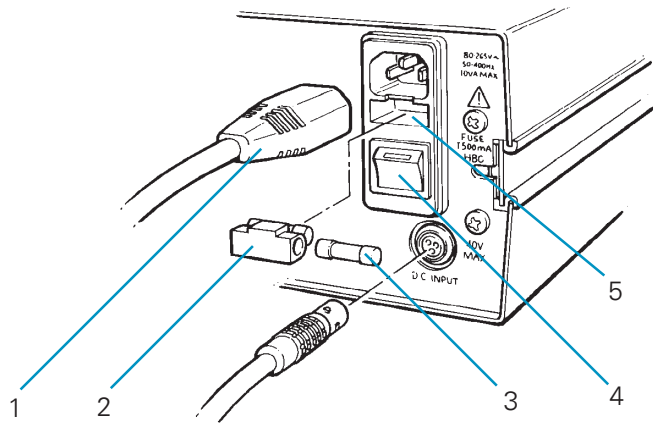
NOTE: A spare fuse (3) is carried in the fuse carrier.

It is essential that the correct type of fuse is fitted to the instrument. Before fitting a replacement, ensure that it is of the correct type (**HBC T500**).

- Replace the fuse carrier (2) in the power supply inlet (5).
- Replace the IEC power connector (1), switch on the power supply and switch on the instrument.
- If the fuse immediately blows on switch-on, contact the manufacturer or Service Agent.



DO NOT ATTEMPT ANY FURTHER SERVICING PROCEDURES.



- 1 IEC Power Connector
- 2 Fuse Carrier
- 3 Spare Fuse
- 4 On/Off Switch
- 5 Power Supply Assembly

Figure 6.1 - Power Supply Fuse Replacement

6.3 Cleaning

Clean case with damp cloth and mild detergent.

6.4 Memory and Clock Support Battery

The instrument employs a long life battery to ensure that data is retained and the clock continues to operate when power is removed.

This battery has a life of 5 to 10 years and may never need to be replaced during the life of the instrument.

If the memory or clock fails to function correctly after several years of use the battery may need to be replaced. The battery is not a user replaceable item. The instrument should be returned to the manufacturer or service agent.

6.5 **Approved Service Agents**

Find the authorized service agents and the manufacturer's service departments at:

www.gesensing.com

