GE Druck

Pressure measurement
for research & industry

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DPI 515

Precision Pressure Controller/Calibrator

User Manual

K245

Amendment Record

Iss No	Date	C/N No	Originator	Typed	Amendments
1	10/0101/99	-	CER	CER	New specification
2	08/06/00	10639	CER	CER	No details recorded on amendment sheet
3	10/06/05	12648 13826 17261	BL	BL	Software up-issue to release 5.0 Addition of volume fill menu options Manual completely revised to GE format.

Approvals

Engineering **Phil Bradley** P. Bradley **Date:** 1-7-05	**Marketing** **Julian Williams** Julian Williams **Date:** 8/6/05	**Publications** **Paul Stephens** **Date:** 1/7/2005
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GE Infrastructure
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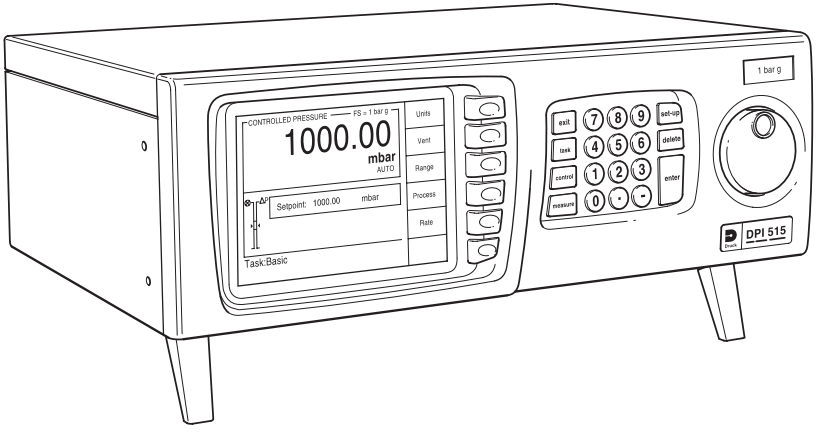
Precision Pressure Controller/Calibrator

User manual K245



Introduction

This technical manual provides operating instructions for the Druck DPI 515 Precision Pressure Controller/Calibrator.

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 suitably qualified * technicians and good engineering practice for all procedures in this publication.

Pressure

Do not apply pressures greater than the safe working pressure to the equipment.

Toxic Materials

There are no known toxic materials used in construction of this equipment.

Maintenance

The equipment must be maintained using the procedures in this publication. Further manufacturer's procedures should be carried out by authorized service agents or the manufacturer's service departments.

Technical Advice

For technical advice contact the manufacturer.

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

CE This equipment meets the requirements of all relevant European safety directives. The equipment carries the CE mark.

When disposing of this equipment, consider the re-use of the following major materials:

- Sheet metal case parts: steel
- Front panel, rotary control, rack handles: ABS
- Manifolds to 70 bar (1000 psi): Aluminium 6082

Abbreviations

The following abbreviations are used in this manual; the abbreviations are the same in the singular and plural.

abs	Absolute
ABS	Acrylonitrile butadiene styrene
a.c.	Alternating current
ALT	Altitude
BSP	British pipe thread
CAS	Calibrated airspeed
CSK	Countersunk
d.c.	Direct current
DPI	Digital Pressure Instrument
e.g.	For example
etc.	And so on
Fig.	Figure
ft	Foot
g	Gauge
Hg	Mercury
HTS	High tensile steel
Hz	Hertz
IAS	Indicated airspeed
i.e.	That is
IEC	International Electrotechnical Commission
IEEE 488	Institute of Electrical and Electronic Engineers standard 488 data
in	Inch
kg	Kilogram
kts	knot
LCD	Liquid crystal display
m	Metre
mA	Milliampere
max	Maximum
mbar	Millibar
min	Minute or minimum
mm	Millimetre
mV	Millivolts
No.	Number
NPT	National Pipe Thread
Para.	Paragraph
PDCR	Pressure transducer
Ps	Static pressure
psi	Pounds per square inch
Pt	Total pressure (Pitot)
PTX	Pressure transmitter

Abbreviations (continued)

Qc	Differential pressure Ps/Pt
QFE	Local atmospheric pressure
QNH	Barometric pressure at sea level
ROC	Rate of climb
RS232	Serial communications data standard
SCM	Sensor Conditioning Module
SCPI	Standard Commands for Programmable Instruments
UUT	Unit under test
V	Volts
+ve	Positive
-ve	Negative
°C	Degrees Celsius

Associated publications

Druck publication	K257 SCPI User Manual
	K283 DPI 515 Calibration Manual

Symbols

The equipment contains the following symbols to identify hazards.

This symbol, on the equipment, indicates that the user must refer to the user manual. This symbol, in this manual, indicates a hazard to the user.

This symbol, in the equipment, identifies static sensitive components, handle with extreme care.

Pressure units and conversion factors

Pressure unit	Factor (Pascal)	Pressure unit	Factor (Pascal)
bar	100000	lbf/ft^2	47.8803
lbf/in^2 (psi)	6894.76	inHg	3386.39
mH_2O	9806.65	inH_2O [1]	249.089
mbar	100	ftH_2O [1]	2989.07
kgf/cm^2	98066.5	atm	1013525.0
kgf/m^2	9.80665	kgf/cm^2	98066.5
mmHg	133.322	kgf/m^2	9.80665
cmHg	1333.22	hbar	10000000
mHg	133322.0	$tonf/ft^2$ (UK)	107252.0
mmH_2O [1]	9.80665	$tonf/in^2$ (UK)	15444300
mH_2O [1]	98.0665	inH_2O (USA) [2]	248.64135
N/m^2	1	ftH_2O (USA) [2]	2983.6983
hPa	100	kP/mm^2	9806650
kPa	1000	kP/cm^2	98066.5
MPa	1000000	kP/m^2	9.80665
torr	133.322		

Unit Conversion

To convert FROM pressure VALUE 1 in pressure UNITS 1
TO pressure VALUE 2 in pressure UNITS 2, calculate as follows:

$$\text{VALUE 2} = \text{VALUE 1} \times \frac{\text{FACTOR 1}}{\text{FACTOR 2}}$$

Note

The conversion factor for pressure units referenced [1] are calculated for a water temperature of 4°C. Pressure units referenced [2] are calculated for a water temperature of 68°F these units are normally used in the USA.

CONTENTS

1 Description

1.1 Introduction

The Druck DPI 515 Precision Pressure Controller/Calibrator measures and controls pneumatic pressure and displays, on an LCD screen, the pressure measurement and controller status. A key-pad next to the display enables manual selections and settings in both measure and control modes. The instrument can be operated remotely through serial or parallel communication interfaces. The instrument can contain one or two pneumatic measure/control channels of different pressure ranges.

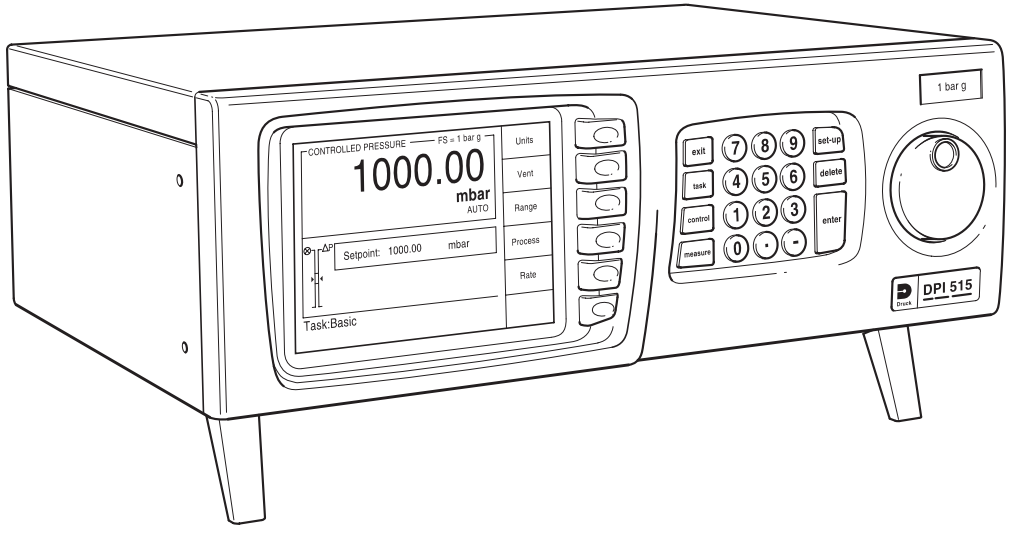


Figure 1-1 DPI 515 General view

The rear panel houses the electrical and pneumatic output and input connections. Each pneumatic channel (up to 70 bar (1000 psi) maximum) contains a positive and negative pressure supply port, an outlet port, vent port and reference port. The electrical connections provide an a.c. power supply, serial and parallel communication interfaces, d.c. output and logic input and output.

Note: *Two connectors identified as instrument bus are for factory use only.*

The Druck DPI 515 can be used as a benchtop instrument or for mounting in a standard 19 inch rack system by using the rack mounting kit (option D) to adapt the instrument case.

1 Description

The Druck DPI 515 uses the SCPI (Standard Commands for Programmable Instruments) communication protocol enabling a standardised communication codes with other instruments. Additionally, emulation-supported command codes enable operation with other GE products: Druck DPI 500, DPI 510 and DPI 520 controllers and the Ruska 7000 controller.

Options add to the abilities of the Druck DPI 515 these include a barometric reference, negative calibration to minus 1 bar (15 psi), enhanced absolute pressure performance and aeronautical units.

Further information and notes on applications are available on the Druck web site at www.gesensing.com and www.DPI515.com.

2 Installation

2.1 Packaging

On receipt of the instrument check the contents of the packaging against the following list:

Packaging List

i) DPI 515 Pressure Controller/Calibrator.

ii) Power supply cable.

iii) User manual (this publication).

iv) Silencer (for each VENT port).

v) Calibration certificate.

2.2 Packaging for Storage or Transportation

To store the instrument or to return the instrument for calibration or repair as follows:

1. Pack the instrument as detailed in section 6.9, Reference and Specification.

2. To return the instrument complete the return goods/materials procedure detailed in section 6.8, Reference and Specification.

2.3 Preparation for use

Note: *Before operation, remove protective film from the display.*

The instrument can be used as a:

- Free standing instrument positioned on a horizontal surface.
- Rack-mounted in a standard 19 inch rack using the rack-mount accessory kit.

For free standing instruments, use the two feet on the base to elevate the instrument to provide a better viewing angle.

To rack-mount the DPI 515 instrument requires the rack-mount accessory kit, refer to section 2.5.

2.4 Pneumatic connections

WARNINGS:

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

ONLY USE EQUIPMENT WITH THE CORRECT PRESSURE RATING.

BEFORE APPLYING PRESSURE, EXAMINE ALL FITTINGS AND EQUIPMENT FOR DAMAGE. REPLACE ALL DAMAGED FITTINGS AND EQUIPMENT. DO NOT USE ANY DAMAGED FITTINGS OR EQUIPMENT.

THE SUPPLY- CONNECTION DISCHARGES FULL SYSTEM PRESSURE, ON HIGH PRESSURE UNITS THIS DISCHARGE CAN CAUSE PHSYICAL INJURY. FIT THE SILENCER SUPPLIED OR AN EQUIVALENT COMPONENT TO DIFFUSE THE DISCHARGE.

Connection			USA only
Input	supply +	1/8 BSP	1/8 NPT
	supply -	1/8 BSP	1/8 NPT
Output		1/8 BSP	1/8 NPT
Vent		1/8 BSP	1/8 NPT
Reference		M5	M5

Pressure supply (Figure 2-1)

1. The pressure supply must be clean, dry gas, nitrogen or air and at the correct pressure refer to the specification (Section 6).
2. Make sure that the user systems can be isolated and vented.
3. Connect pressure and vacuum supplies to the SUPPLY + and SUPPLY - connection ports.
4. Connect the Unit Under Test (UUT) to the required outlet connection port.

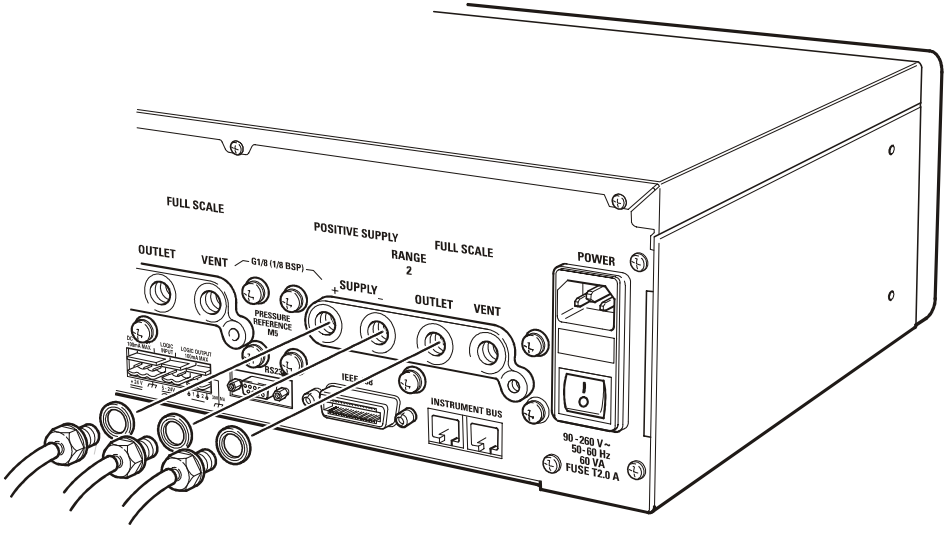


Figure 2-1, Pneumatic Connections

Each pressure range of the instrument requires a positive pressure supply. Instruments operating in an absolute range or negative pressure range require a vacuum supply. A vacuum supply should also be used for a fast response for instruments operating near atmospheric pressure.

Supply equipment

Pneumatic supplies should have isolation valves and, where necessary, conditioning equipment. Each positive pressure supply should be regulated at 110% of the pressure range stated on the pressure supply label. An instrument using a negative supply must be enabled in the set-up menu.

On instruments without a negative supply, the positive pressure discharges from the system to atmosphere through the negative supply port. A silencer can be fitted to the negative port to reduce airflow noise.

Pneumatic Connection Examples (Figures 2-2, 2-3 and 2-4)

These examples show a dual range instrument; for a single range instrument use range 1 connections. Option G contains the in-line filters F1 and F2.

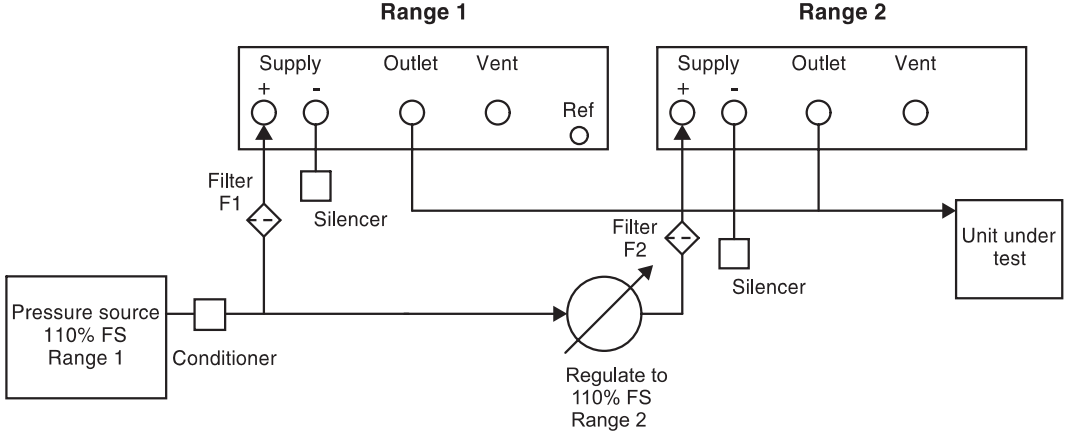


Figure 2-2, Pneumatic Connections up to 70 bar (1000 psi) (without vacuum supply)

Note: ***CONNECTED RANGES*** *must be enabled when connecting the outlet ports together. This applies to instrument ranges of 70 bar (1000 psi) and below. Enabled in* ***SETUP/SUPERVISOR/SYSTEM/CONNECTED RANGES.***

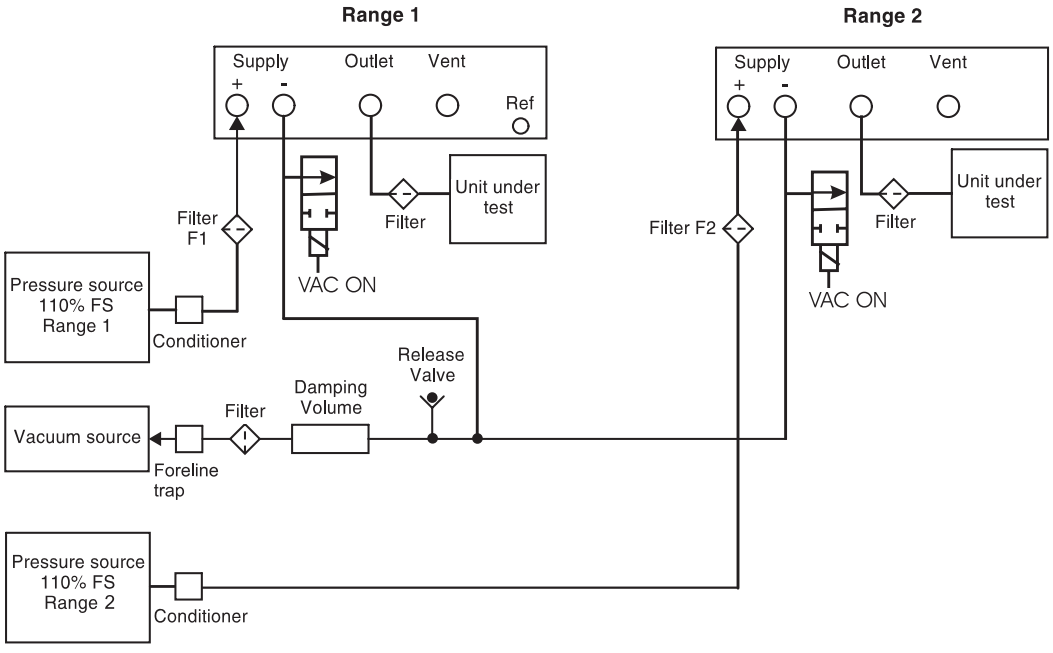


Figure 2-3, Pneumatic Connections up to 70 bar (1000 psi) (with vacuum supply)

Notes:

1. *Option G includes in-line filters F1 and F2.*

2. *Refer to section 6, Reference and Specification for details of other system components.*

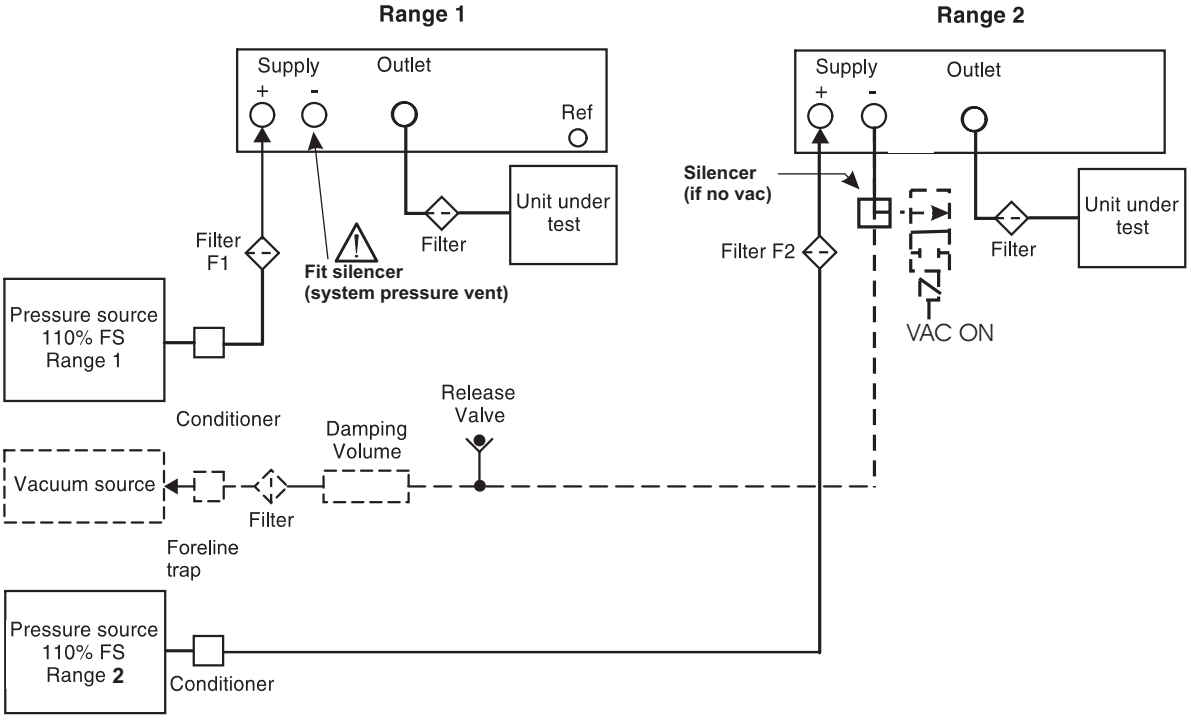


Figure 2-4, Pneumatic Connections above 70 bar (1000 psi)

The positive pressure supply needs to be regulated for each range. The supply pressure should be 110% of the pressure range. The pressure range supply rating label on the rear panel gives the required pressure supply value. Refer to Section 6, Reference and Specification for the recommended regulators.

When connecting a number of instruments of differing ranges to a common pressure supply, appropriate external pressure regulators must be fitted in each instrument supply line.

Note: *Instruments with a range above 100 bar (1450 psi) must not have outlet ports connect together.*

2.5 Rack-mounting (Figure 2-5)

General

There must be enough space at the rear of the instrument for all the cables and pipes. The length of the cables and pipes must allow for the removal and fitment of the instrument. The cooling air outlet at the top left-hand corner of the rear panel of the instrument must not be covered or obstructed. Allow a free flow of air around the instrument, especially at high ambient temperatures.

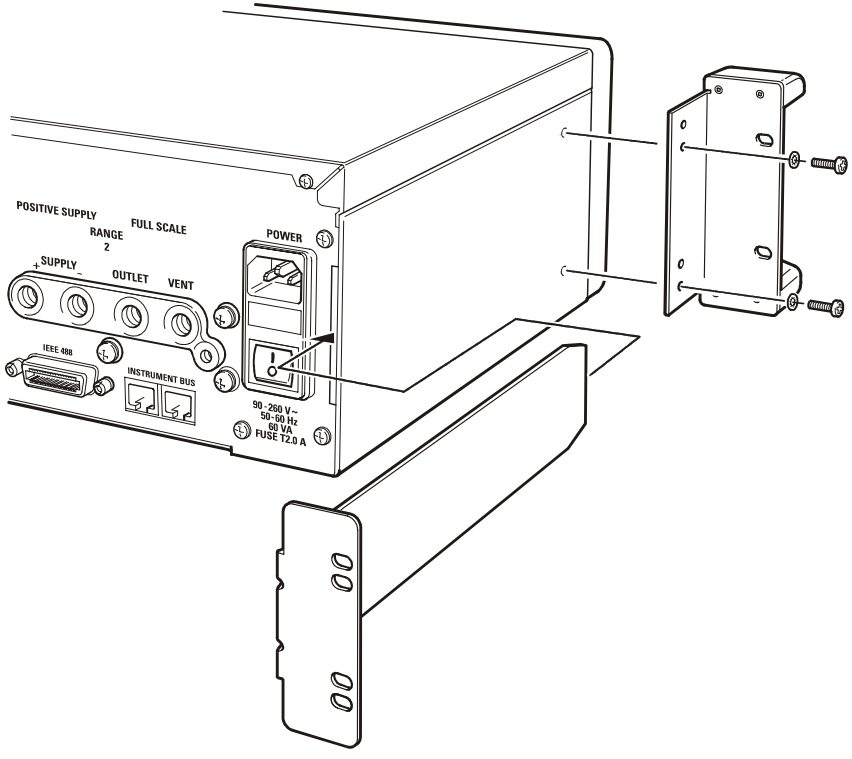


Figure 2-5 Rack-mounting

Procedure

- Slide the two support arms into the slots either side of the rear panel.
- Locate the two handle brackets on the side of the instrument and secure with the two screws and washers.
- Support the instrument and connect the cables and pipes. Locate and slide the instrument into the rack.
- Secure the instrument in the rack.
- Secure the two rear support arms to the rear tappings of the rack.

2.6 Electrical connections

WARNINGS

1. **THE GROUND LEAD (GREEN/YELLOW) OF THE INSTRUMENT MUST BE CONNECTED TO THE AC SUPPLY PROTECTIVE SAFETY GROUND.**

2. **ISOLATE THE POWER SUPPLY BEFORE MAKING ANY ELECTRICAL CONNECTIONS TO THE REAR PANEL.**

3. **ISOLATE THE POWER SUPPLY BEFORE REMOVING THE INSTRUMENT'S COVERS.**

General

The instrument must be connected to the correct electrical power supply as stated on a label next to the power connector. See section 6 Reference and Specification.

Make sure that the power supply is off before connecting the power cable.

Requirements for rack-mounted instruments

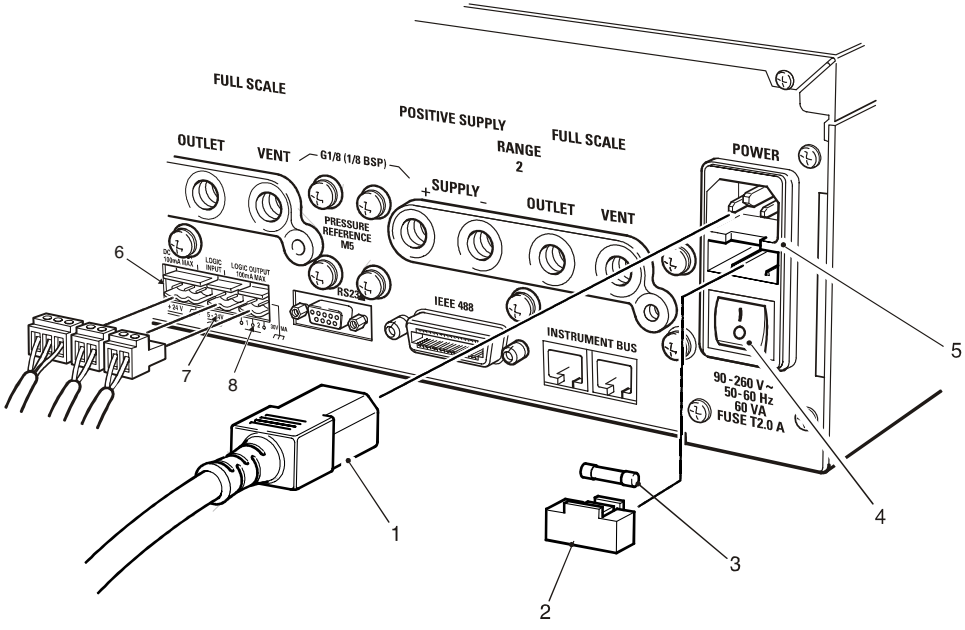
- Install an isolator in the power supply circuit. The power supply connector and switch on the rear panel of the instrument will not be accessible.

- Set the power supply isolator to OFF. Connect the power supply and set the power supply switch to ON before sliding the instrument into the rack.

Connecting (Figure 2-6)

To connect the power supply to the instrument proceed as follows:

- Insert the moulded IEC connector (1) into the power supply assembly (5).
- Set the ON/OFF switch (4) to ON (for rack-mounted instruments set the power supply isolator to ON).
- Check that the front panel display shows the power-up sequence.



1	IEC power connector	5	Power supply assembly
2	Fuse carrier	6	24 V dc output
3	Fuse	7	Logic input
4	ON/OFF switch	8	Logic output

Figure 2-6 Electrical connections

24V DC Output

Using a 2-way connector:

pin 1 - +24 Vdc
pin 2 - frame

This facility can energise external equipment. An integral self-resetting fuse protects this output.

Logic (switch) Input

Using a 2-way connector:

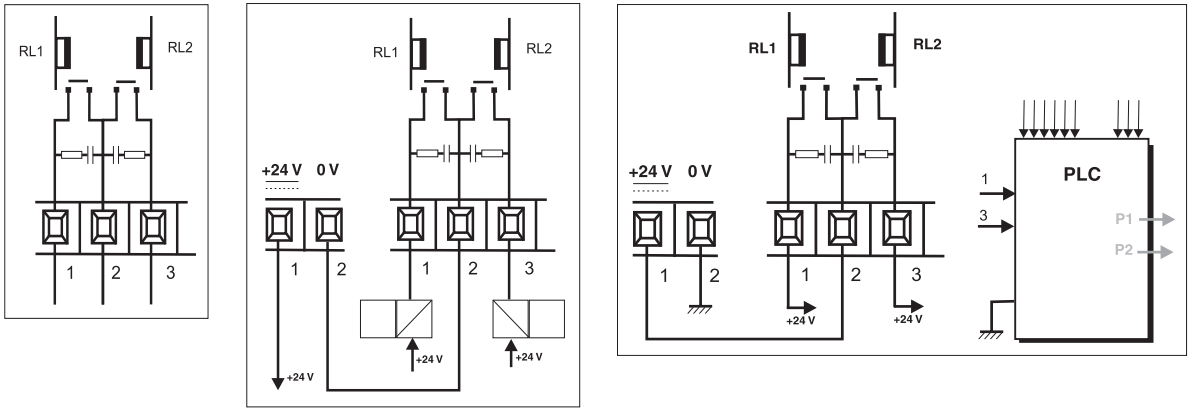
pin 1 - +5 Vdc
pin 2 - +24 Vdc

This facility can be used to trigger the instrument from a pressure switch contact during the Pressure Switch Task (see Section 3.4). Integral opto-isolators protect this input circuit.

Logic Outputs

Using a 3-way connector 1_2_3: pin 1 output, pin 2 common, pin 3 output.
Pin 1 and 3 volt-free contacts of relays RL1 and RL2.

Example connections



Note: *Between each set of contacts, a resistor/capacitor filter circuit restricts the upper operating frequency, see Section 6 Reference and Specification.*

Computer Connections

Fit the appropriate connectors into the rear panel communications port and secure with the captive screws.

Note: *Only one interface can operate at a time. Set the required communications type in **SETUP/SUPERVISOR/COMMS/PORT** menu, see Section 6.6.*

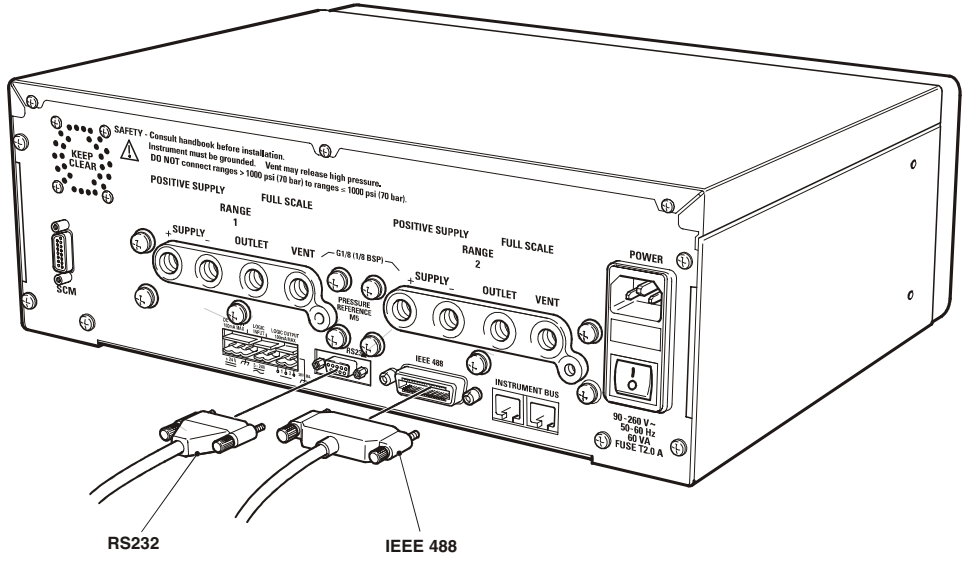


Figure 2-7, RS232 and IEEE 488 Connections

2.7 RS232 Interface

When using the RS232 interface, a cable must be connected directly from the instrument to a suitable port on the computer in a 'point to point' link. Table 2-1 shows the pin connections for the 9-pin D-type, RS232 connector, the RS232 control signals, and the computer/printer interconnection. The instrument is configured as Data Circuit Terminating Equipment (DCE).

Instrument			Control Line		Computer/Printer	
Instrument Function	Connector Type		Signal Direction	RS232 Terminology	Connector Type	
	Lemo	9-way D-type Pin No.			9-way D-type Pin No.	25-way D-type Pin No.
RxD (I/P)	1	3	←	TxD	3	2
TxD (O/P)	6	2	→	RxD	2	3
GND	3	5	↔	GND	5	7
CTS (I/P)	2	7	←	RTS	7	4
RTS (O/P)	5	8	→	CTS	8	5
Pulled high internally	4	1	→	RLSD (DCD)	1	8
Not used	N/C	4	←	DTR	4	20
Pulled high internally	4	6	→	DCR DCE Ready	6	6
Equipment Chassis	Connector Shell	Connector Shell	↔	Cable Screen	-	1

Table 2-1, RS232 Connections

Software Handshaking

Note: *Use software handshaking as the only recommended communications method.*

For software handshaking between the instrument and a computer (or printer) that uses a 9-pin, D-type port connection, proceed as follows:

- Use a straight 9-way to 9-way male to female connector cable.
- Connect the cable between the computer communications port and the instrument's 9-way, D-type, RS232 port connector as shown in Figure 2-8.
- Use the Set-up/Supervisor/Comms menu (see Section 6.6) to set-up the required RS232 parameters.

Note: *Use a 9-way to 25-way adaptor for a computer with 25-way communications port.*

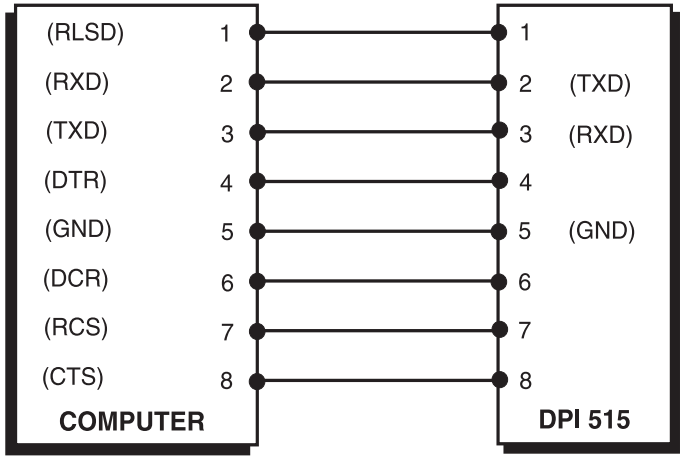


Figure 2-8, RS232 9-way connections (Software Handshaking)

Hardware Handshaking

Note: *Only use hardware handshaking when necessary. Use software handshaking as the only recommended communications method.*

For hardware handshaking between the instrument and a computer that uses a 9-pin, D-type port connection, proceed as follows:

- Use a straight 9-way to 9-way male to female connector cable.
- Connect the cable between the computer communications port and the instrument's 9-way, D-type, RS232 port connector as shown in Figure 2-9.
- Use the Set-up/Supervisor/Comms menu (see Section 6.6) to set-up the required RS232 parameters.

Note: *Use a 9-way to 25-way adaptor for a computer with 25-way communications port*

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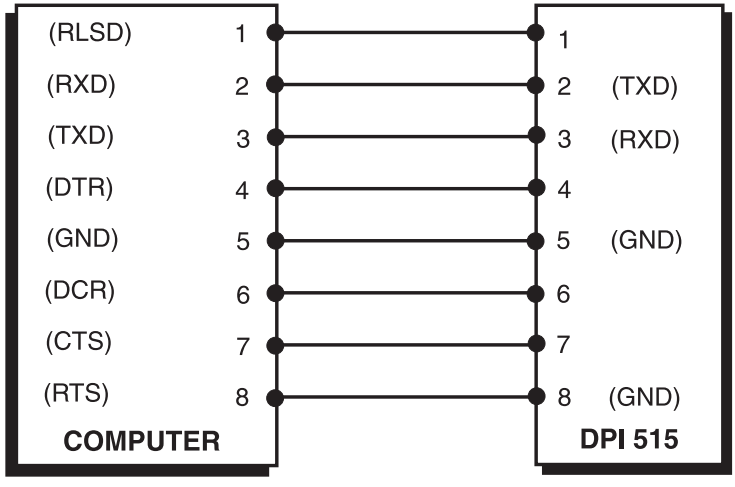


Figure 2-9, RS232 9-way Connections (Hardware Handshaking)

2.8 IEEE 488 Interface (Figure 2-10)

This interface complies with IEEE 488.2 HS standard. The IEEE 488 parallel interface connects a computer/controller to one or more DPI 515 instruments and possibly other instruments. Up to 30 instruments can be connected through a high-speed data bus to the computer/controller.

To connect up the IEEE 488 interface, proceed as follows.

Note: *The length of each IEEE 488 cable must be less than 3 metres to comply with the EMC requirements, see Section 6 Reference and Specification.*

Single Unit Installation (Fig 2-10)

Connect an IEEE 488 connector/cable assembly to the rear panel IEEE 488 connector of the instrument.

- Connect the other end of the connector/cable assembly to the IEEE 488 connector on the controller/computer.
- Change the IEEE 488 communication parameters as described in the Set-up (Comms) Menu (refer to Section 6.6).

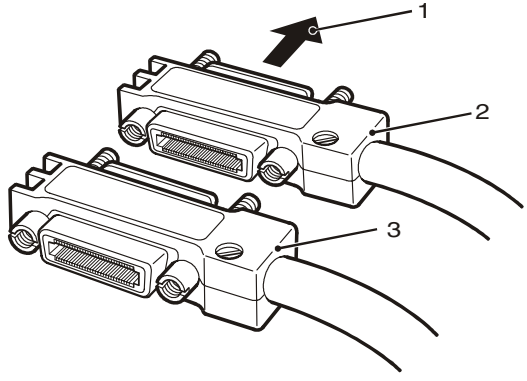
Multiple Unit Installation (Figure 2-10)

To install multiple units use stacking plugs to link from first instrument to the second instrument.

Proceed as follows.

- Connect a pair of IEEE 488 stacking connectors to the rear panel IEEE 488 connector of the instrument.

1 Connector to rear panel of first instrument.
2 Connector from controller/computer.
3 Connector to rear panel of second instrument.



- Connect the other end of one of the connectors to the IEEE 488 connector on the controller/computer and the other connector into the next instrument.
- Repeat this procedure for all the instruments in the system.
- Use the Set-up (Comms) menu on each instrument to set up the required communication parameters (Refer to Section 6.6).

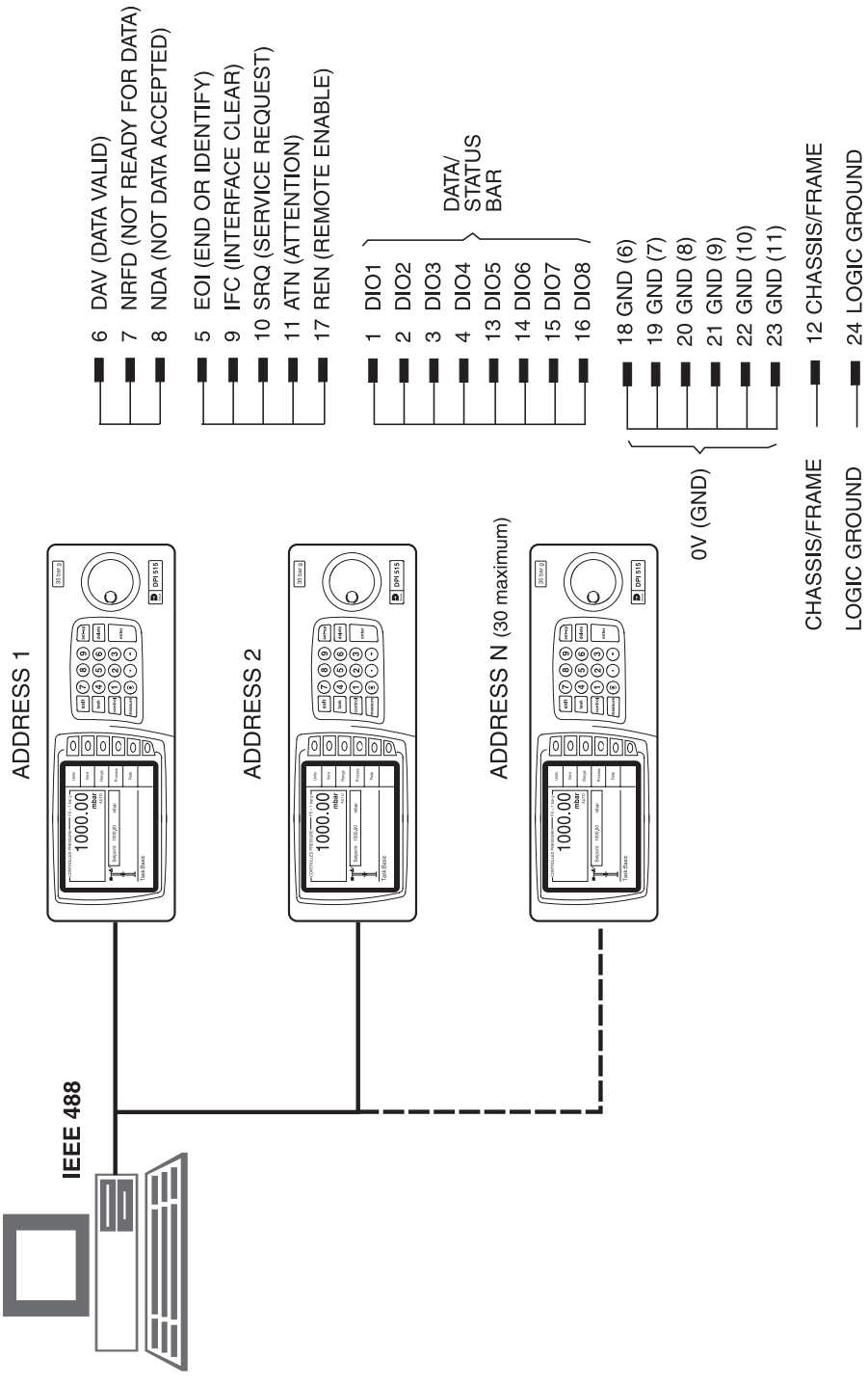


Figure 2-10 - IEEE 488 Connection

2.9 Aeronautical Option.

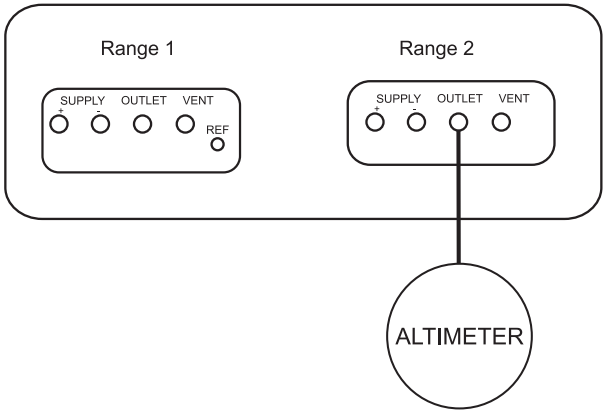


Figure 2-11, Altimeter Checks (Typical Pressure Range 35-1310 mbar abs 1.0-38.68 inHg)

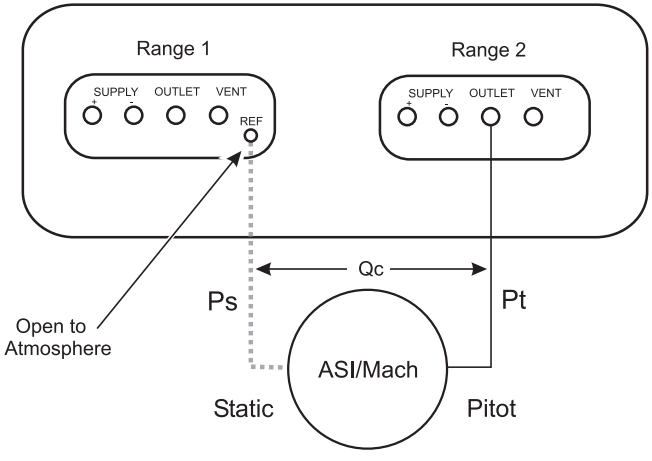


Figure 2-12, Check Airspeed Indicator or MACH meter

Notes:

1. *Select Go To Ground to ensure zero pressure before connecting the ASI or Mach meter.*
2. *Reference port on Range 1 and 2 manifolds*

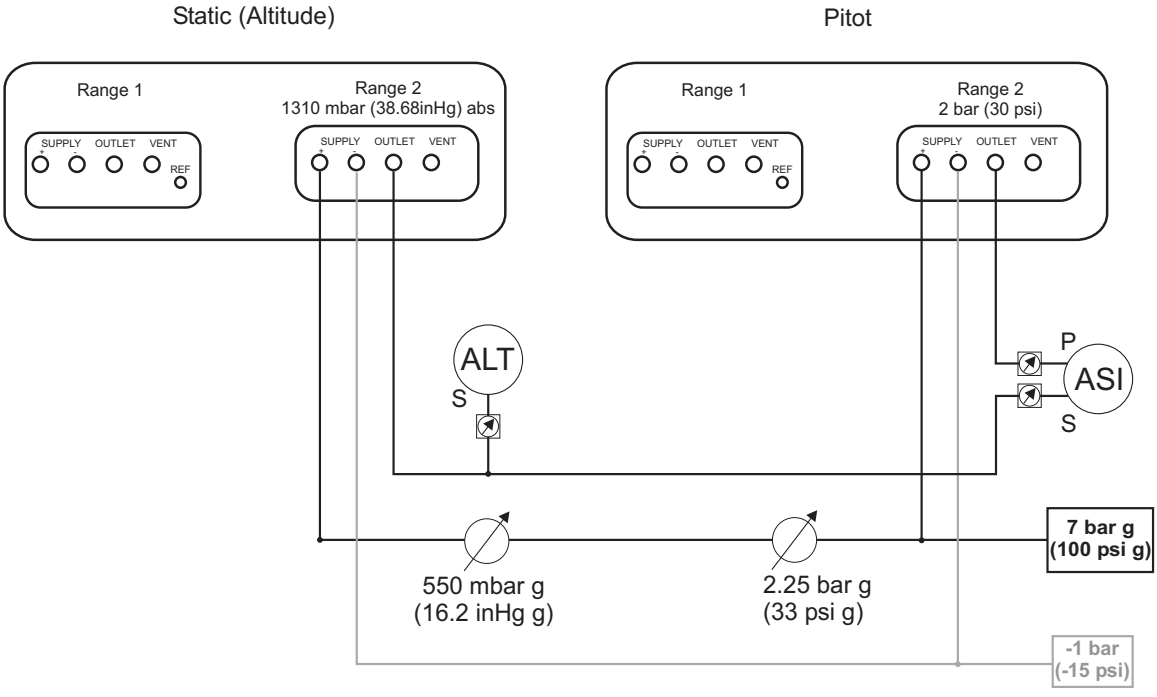


Figure 2-13, Example Connection of Two Instruments for Airspeed and Altimeter Testing

Notes:

1. *Good control can only be establish with the correct source supply pressure. High source pressure can cause violent jumps in the output pressure that can damage rate-sensitive equipment connected to the system. Low source pressure can cause poor stability of the output pressure and may not meet control specifications for accuracy.*

2. *When not testing an altimeter, the reference port can be opened to atmospheric pressure, ASI calibration checks can be done relative to atmospheric pressure.*

3. *When ASI calibration checks require an altitude above atmospheric pressure, use a shut-off valve to isolate the port or blank off the altimeter test port (or connect a serviceable altimeter) to enable control of static pressure.*
   - ***i*** *The reference port is active for all ranges via the connection on range 1 of the instrument only.*
   - ***ii*** *The reference port of range 2 is blanked off and unused.*

4. *When only testing altimeters, use a shut-off valve to isolate the port or blank off the ASI test port (or connect a serviceable ASI).*

2.10 Sensor Calibration Module

The following details the test configurations for amplified output transducers, millivolt output transducers and multiple transducer/transmitter testing. A rear panel, 15-way D-Type connector provides the outputs/inputs comprising two regulated power supply outputs, 24V for current loop applications, a protected extension of the internal 24V supply and a regulated 10V dc supply for the excitation of external transducers. Internally, the instrument has a return line resistance of 0.15 W. The SCM can supply a maximum current of 200 mA, this limits the maximum number of sensors that can be supplied in parallel. The SCM option contains a set of test leads, see the connection details below.

D-type pin no.	Cable colour	Cable function	Connector colour
1	Blue	+24V OUT	Blue
2	Yellow	+10V OUT	Yellow
3	Green	0V OUT	Green
4	Brown	11V+ IN	Red
5	Brown	11V- IN	Black
6	Violet	135 mV+	Red
7	Violet	135 mV-	Black
8	White	25 mA+ IN	Red
9	White	25 mA- IN	Black
10 to 15	Not used	-	-

Notes:

1. *The ends of the test lead terminate in standard 4mm plugs and a pair of test probes (one red, one black), enables connection to the units under test.*
2. *Allow at least 2 minutes after applying power to the unit under test before taking readings. Readings taken before the 2 minutes warm-up will be inaccurate. Alternatively, arrange for continuous power to the unit under test.*

Single Pressure Transmitter (Figure 2-14)

Connect the cable of the transmitter to the SCM interface. Connect the pressure port of the transmitter directly to the outlet port of the instrument.

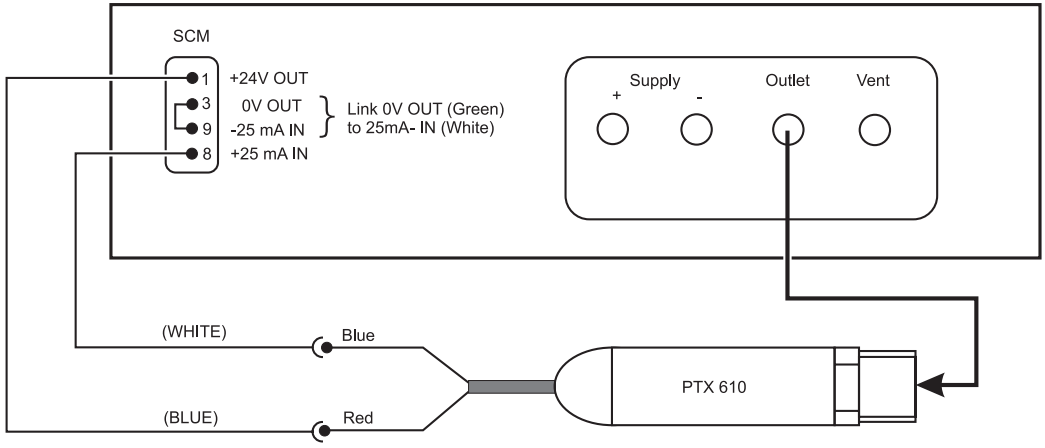


Figure 2-14, Single Pressure Transmitter Test Set-up

Multiple Pressure Transmitter Testing (Figure 2-15)

Connect each transmitter to the pressure manifold. Connect the inlet port of the pressure manifold directly to the outlet port of the instrument.

At each applied pressure, switch, in turn, each transmitter into the current loop (either manual or automatic multiplexing).

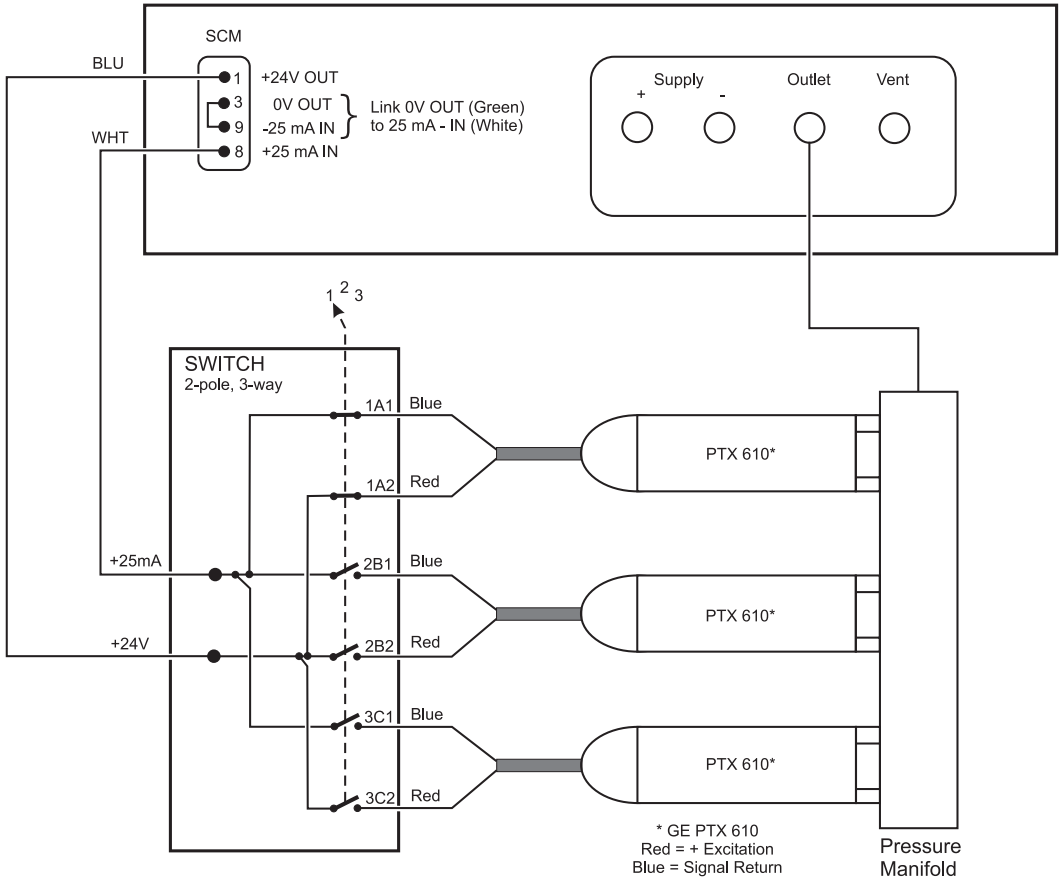


Figure 2-15, Multiple Pressure Transmitter Test Set-up

Note:

The 4mm test plugs can be connected together by inserting the pin of one into the end of another. To link pins 3 and 9, insert the black connector (connected to the white lead labelled 25mA - IN), into the Green 0V connector.

3-wire and 4-wire, Amplified Output Pressure Transducers (Figures 2-16 and 2-17)

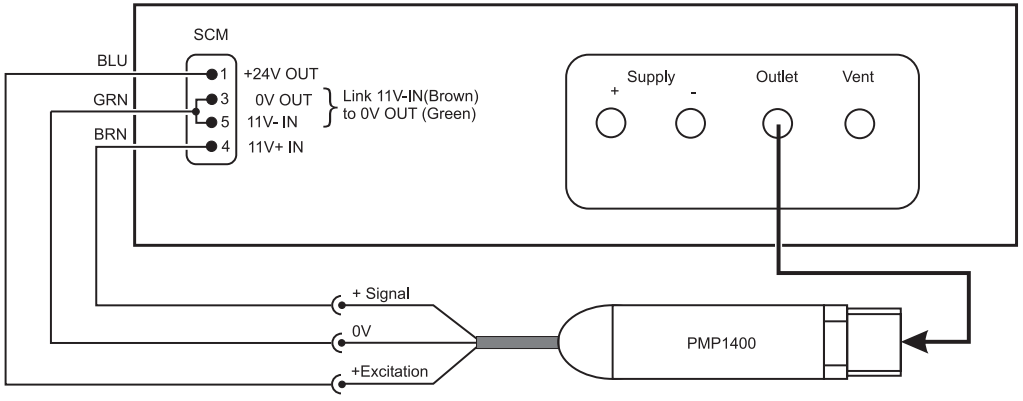


Figure 2-16, 3-wire, Amplified Voltage, Pressure Transducer Test Set-up

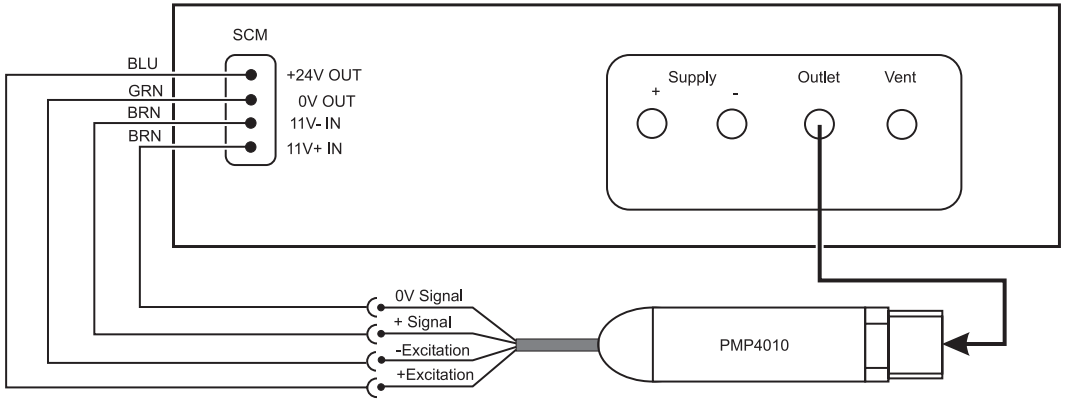


Figure 2-17, 4-wire, Amplified Voltage, Pressure Transducer Test Set-up

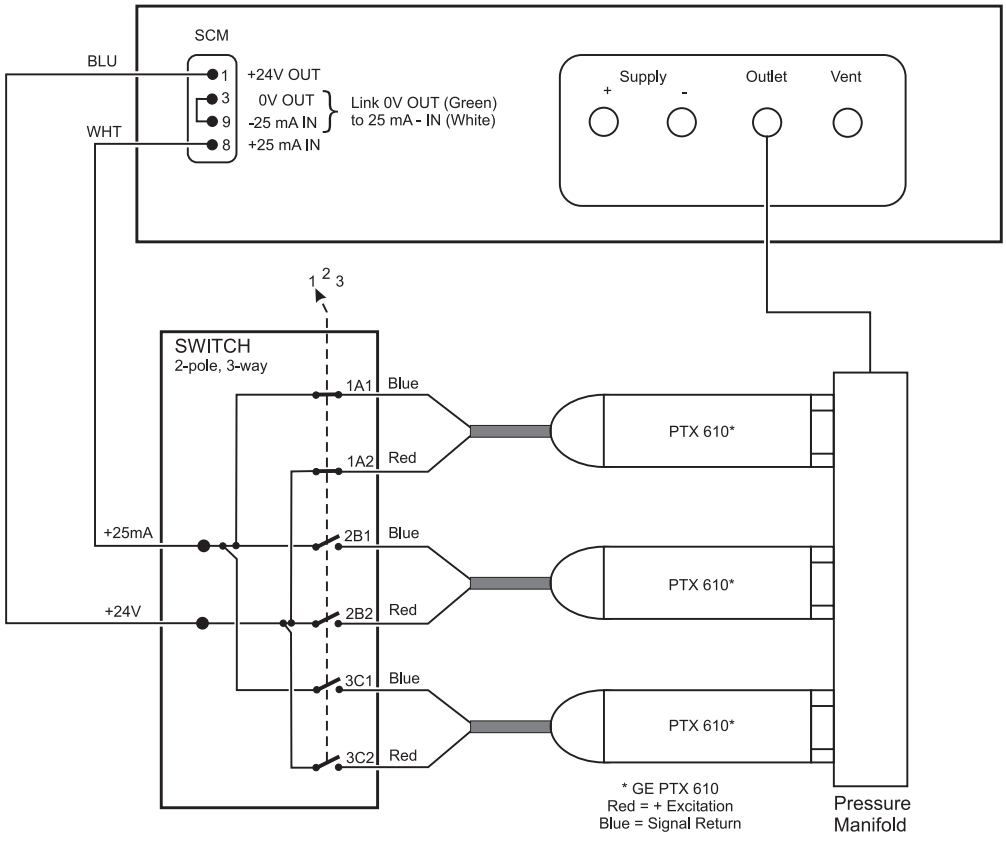


Figure 2-18, Multiple Pressure Transducer Test Set-up

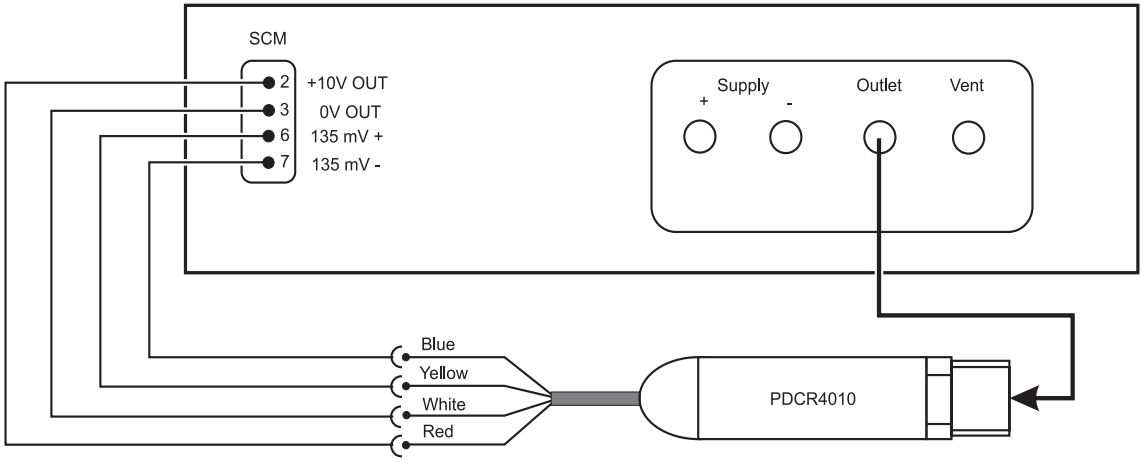


Figure 2-19, Millivolt Output Pressure Transducer Test Set-up (Compensated)

Note:

Using the regulated 10V supply compensates the transducer output for variations in the supply.

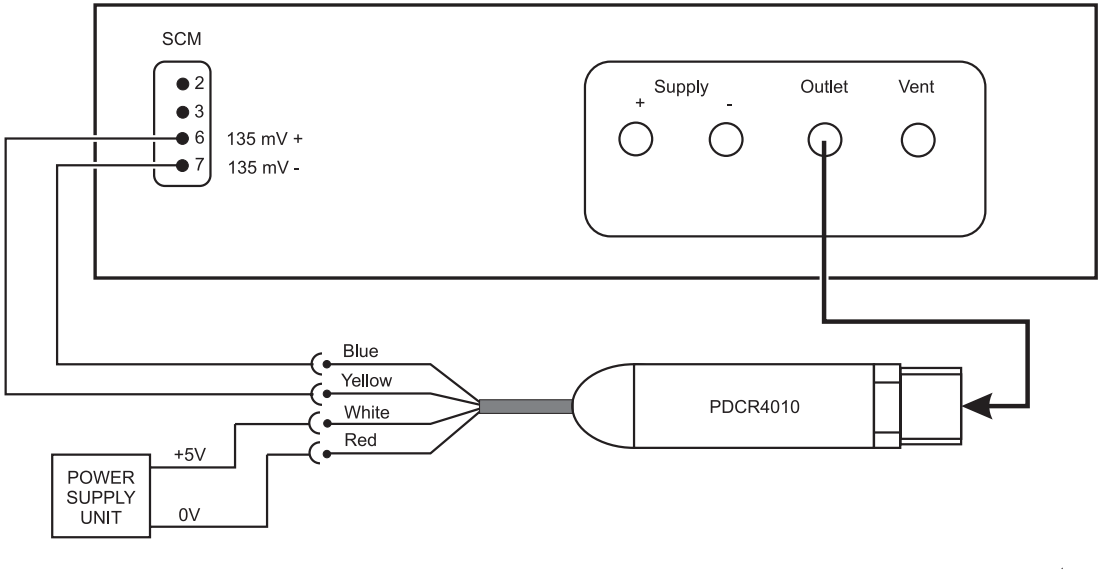


Figure 2-20, Millivolt Output Pressure Transducer Test Set-up

Note:

When using an external supply, the instrument cannot compensate for changes in transducer output due to power supply variations.

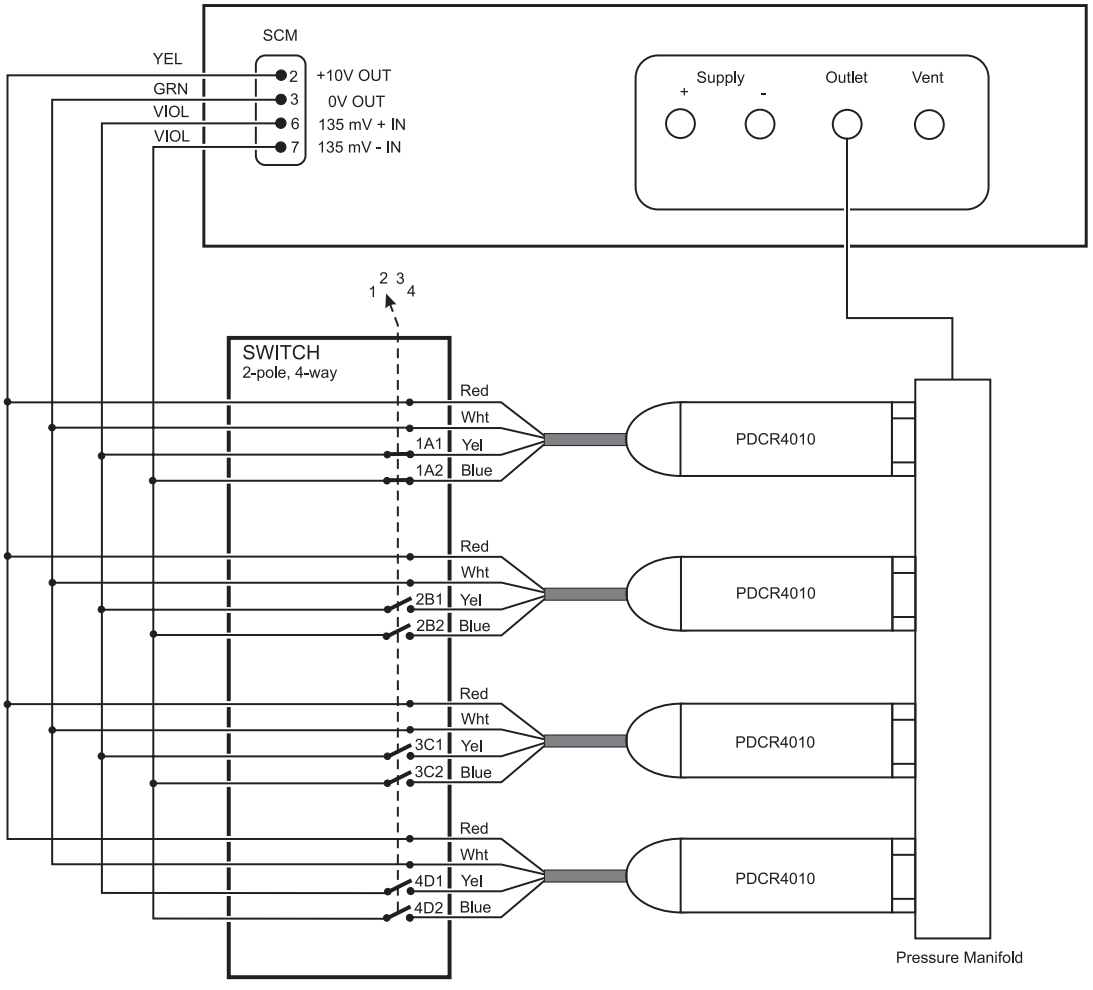


Figure 2-21, Multiple Millivolt Output Pressure Transducer Test Set-up

Note:

This configuration uses the SCM 135mV Supply Corrected range. The SCM 10V regulated supply, connected in parallel, provides permanent excitation to all the pressure transducers, preventing errors from cold measuring elements.

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3 Operation

3.1 Preparation

Make sure the electrical cables and pneumatic pipes comply with the installation requirements in Section 2.

Carry out the following before use:

- If necessary, carry out the maintenance task detailed in Section 4.

- For bench-top, single instrument operation carry out the following:

    1. Make sure the instrument power supply switch on the rear panel is set to OFF.

    2. Connect the instrument to the electrical supply, make sure the supply includes a connection to a protective earth.

    3. Inspect the pneumatic hoses for damage, ingress of dirt and moisture.

Before use, the instrument should be tested, for first time users see section 3.3, for users requiring more operating detail see section 3.4.

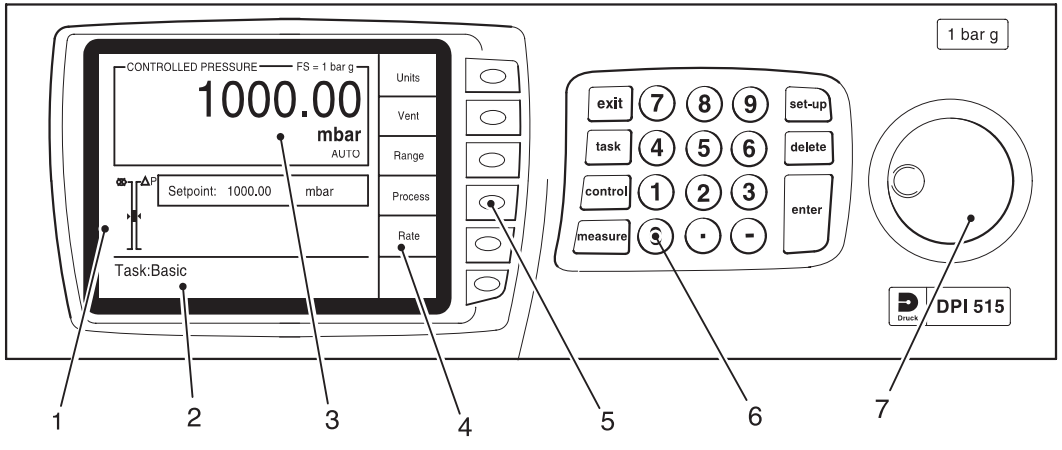
This section contains a quick reference chart detailing all the key-pad functions. Further quick reference charts, at the end of this section, detail the set-up menu.

Review and become familiar with the whole procedure before starting a process on a component or system.

3.2 Quick Reference (Figure 3-1)

A brief description of key-pad functions and general display indications follows:

Key/selection/display	Function and comments
Pressure Window (Task menu)	Displays state of the pressure outlet selected, e.g. Value, Measured Pressure, Controlled Pressure, Changing Pressure and full-scale range.
Help Window (Set-up menu)	Displays a Help facility explaining functions of soft keys and gives instructions for setting parameters.
Message Window	Displays menu level and task in use. Provides message line giving instructions for setting parameters or operation.
Soft keys	Select menu functions
Soft Boxes	Displays the functions of the associated soft key
Numeric Keys	Sets the value for a parameter.
Exit	Returns instrument to previous menu.
Task	Displays **Task** menu, enabling a new task to be selected.
Control and Measure	Switches instrument between Control and Measure modes.
Set-up	Displays **Set-up** menus.
Delete	Deletes the last entered character from value entry box.
Enter	Enters values set on screen display
Jog Control	Incremental control of display settings, e.g. set-point in control mode, **Preset** and **Divider** set-points and **Display** parameters (**Resolution, Brightness and Contrast**).
Display	Shows task specific information such as, current, set-point, rate and test parameters. When enabled, shows instrument activity indicator.



1 Display panel 2 Message window 3 Pressure/Help window 4 Soft boxes
5 Soft keys 6 Key-pad 7 Jog control

Figure 3-1, Instrument Controls and Indications

3.3 First Time Operators

The following sequences of operation should be used by first time operators and by operators that use the instrument occasionally. For regular operators, familiar with the instrument, go to section 3.4.

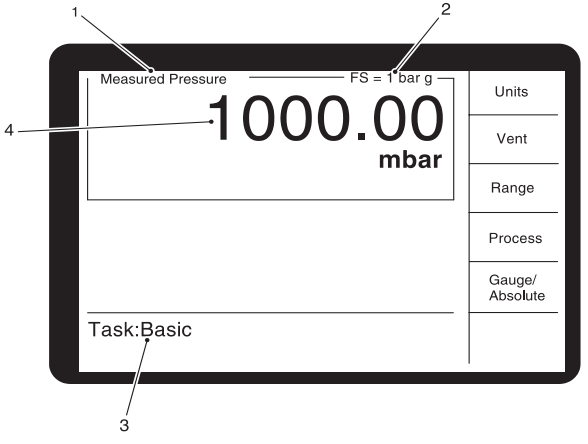
Note: *The following sequence is an example, the values and selections displayed depend on the range (s) and options enabled in the instrument. To control pressure, the outlet port must be connected to a UUT or a blanking plug fitted. The UUT must be of the correct pressure rating or the instrument set to limit the set-point value to a safe pressure.*

Set the power supply to ON and the power-up routine starts:

(1) The display first shows:

(2) After a short time the display shows the start of the power-up sequence, the instrument carries out a self-test. If the test finds a fault, the display shows an error, refer to section 5, Fault Finding and Testing

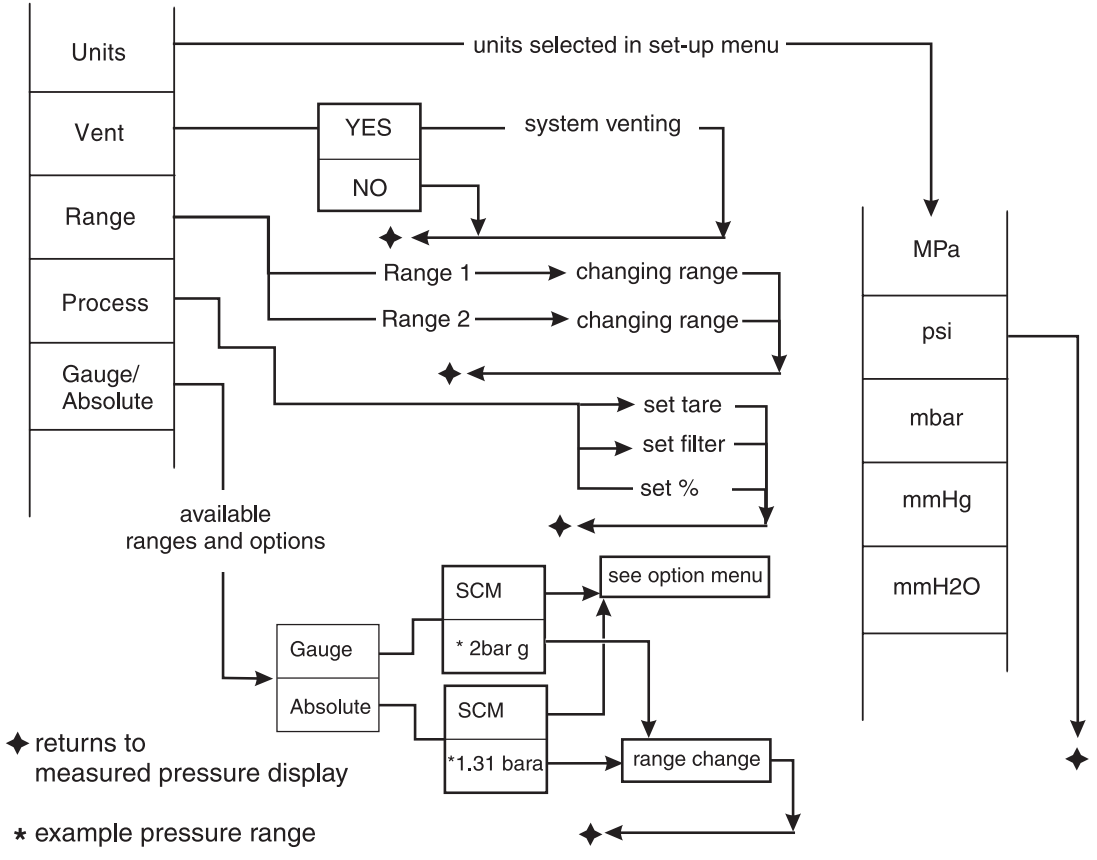
(3) After a successful self-test sequence the system changes to measure mode. The display changes to measured pressure, showing the parameters selected in Set-up.



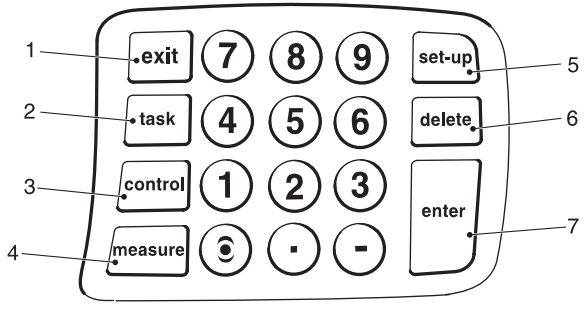
1 Mode 2 Range
3 Message window 4 Pressure reading

(4) The instrument is now ready for use.

Soft keys in measure mode



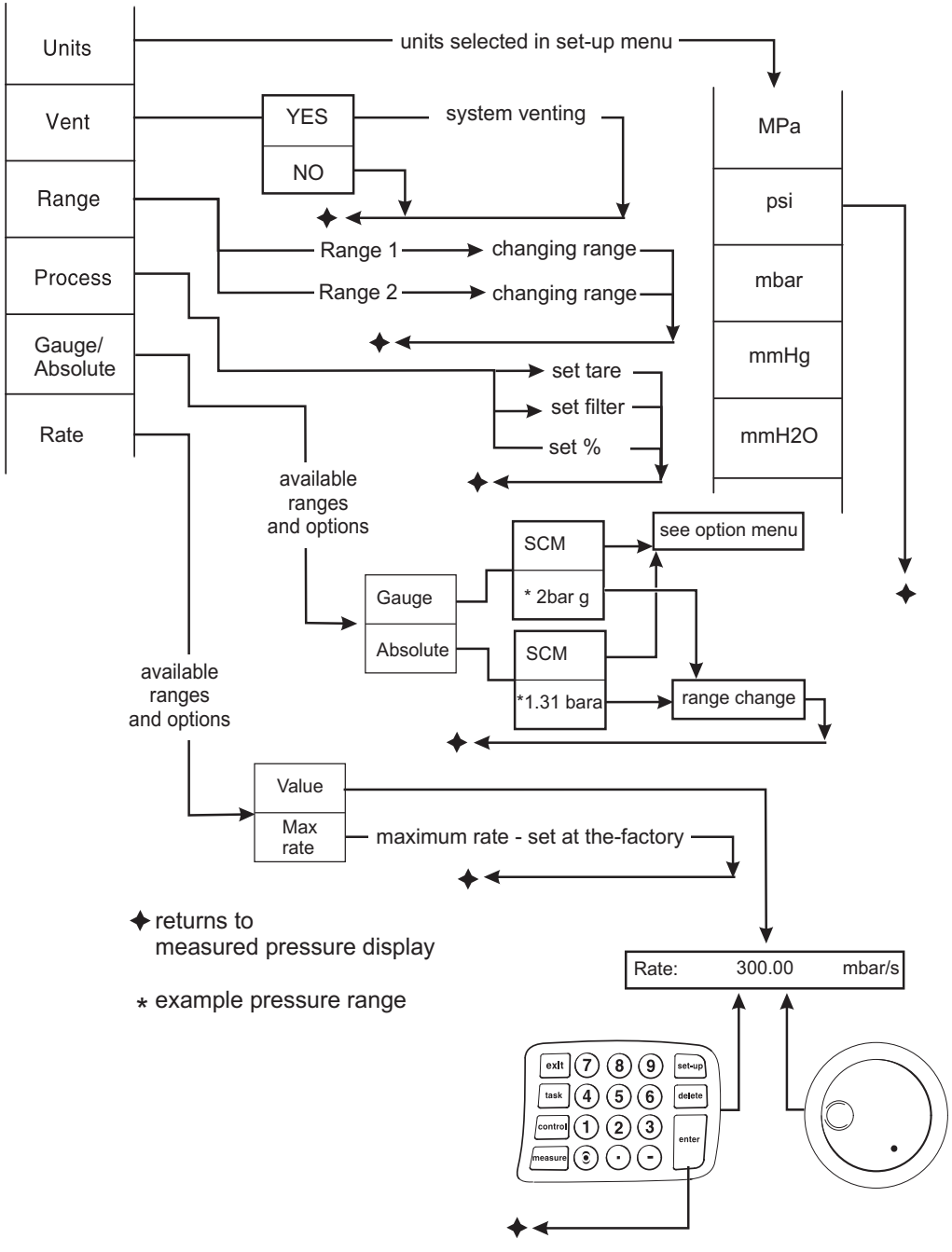
Key-pad



1	returns to measure mode
2	see 3.4, task selection
3	see below, control mode
4	see above, measure mode
5	see 3.5, set-up menu
6	removes last entered digit
7	sets numeric value

Soft keys in controlled pressure mode

Press the **control** key and the instrument changes the soft keys to:

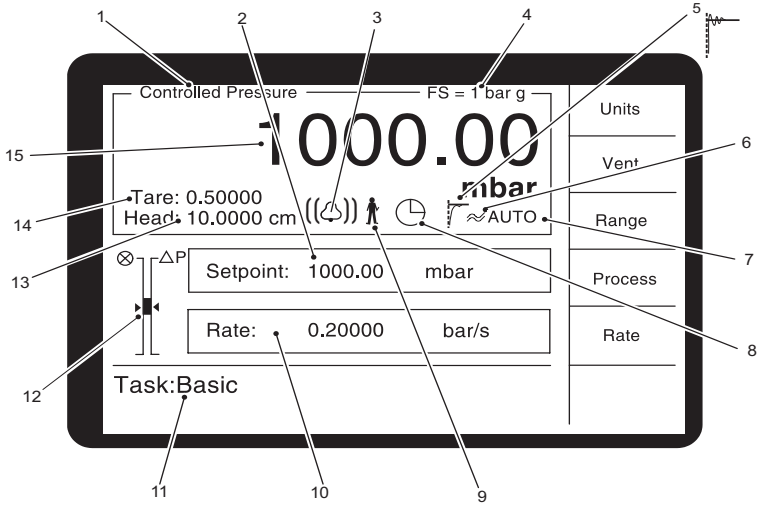


Indications in controlled pressure mode (example 1)

Status displays and messages	Function and comments
Mode status: **Measured pressure** **Changing pressure** **Controlled pressure**	 Measure mode Control mode with pressure changing to set-point. Control mode pressure at set-point.
AUTO	Displayed when autorange enabled.
Tare: 0.50000	Tare value set to 0.50000 and enabled selected by **Process** soft key.
Filter	Filter enabled, selected by **Process** soft key.
%	Per cent reading of full-scale or set span, selected by **Process** soft key.
Head: 10.0000 cm	Head value set to 10 cm, height difference between instrument and UUT
Runner	Pressure change in progress - enabled and disabled in **Setup/User/Display**
Wait indicator	Instrument stopped - performing internal function.
Message window	Displays **Task** function, with instructions for setting a parameter or an operation.
set-point: 120.59 bar	Set-point at value of 120.59 in current selected units; can be changed using the numeric key-pad or jog control.
Rate: 30 bar/s	Rate at value of 30 bar/s in current selected units per second; can be changed using the numeric key-pad or jog control.

Key to display

1 Status
2 Set-point value
3 Alarm indicator
4 Range
5 In controlled mode, no over shoot or fast
6 Filter ON
7 Autorange
8 Wait indicator
9 Runner
10 Rate value
11 Message window
12 Activity indicator
13 Head (pressure) value
14 Tare value
15 Pressure reading

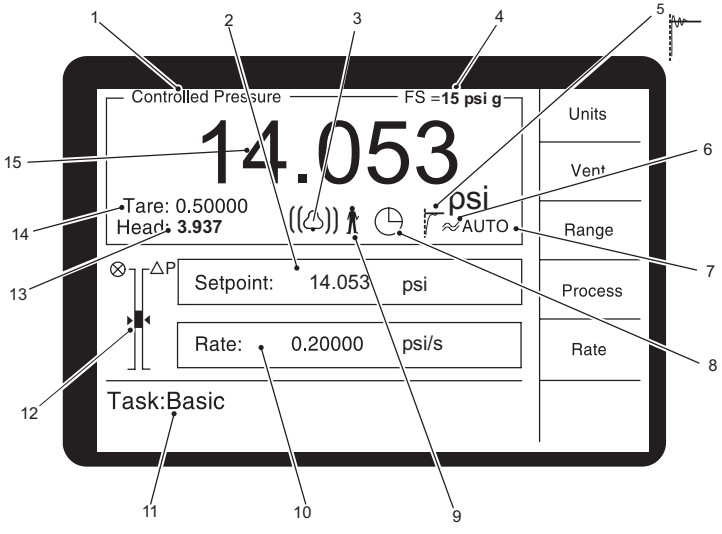


Indications in controlled pressure mode (example 2)

Status displays and messages	Function and comments
Mode status: **Measured pressure** **Changing pressure** **Controlled pressure**	 Measure mode Control mode with pressure changing to set-point. Control mode pressure at set-point.
AUTO	Displayed when autorange enabled.
Tare: 0.50000	Tare value set to 0.50000 and enabled selected by **Process** soft key.
Filter	Filter enabled, selected by **Process** soft key.
%	Per cent reading of full-scale or set span, selected by **Process** soft key.
Head: 3.9370 in	Head value set to 3.937 in, height difference between instrument and UUT
Runner	Pressure change in progress - enabled and disabled in **Setup/User/Display**
Wait indicator	Instrument stopped - performing internal function.
Message window	Displays **Task** function, with instructions for setting a parameter or an operation.
set-point: 14.053 psi	Set-point at value of 14.053 in current selected units; can be changed using the numeric key-pad or jog control.
Rate: 0.20 psi/s	Rate at value of 0.20 psi/s in current selected units per second; can be changed using the numeric key-pad or jog control.

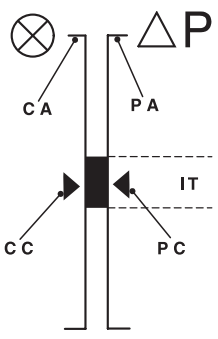
Key to display

1 Status
2 Set-point value
3 Alarm indicator
4 Range
5 In controlled mode, no over shoot or fast
6 Filter ON
7 Autorange
8 Wait indicator
9 Runner
10 Rate value
11 Message window
12 Activity indicator
13 Head (pressure) value
14 Tare value
15 Pressure reading



Controlling to a new set-point

- To change the set-point value, press the **control** key and, using the numeric keys or jog control, set the new set-point value.
- If necessary, use the **delete** key to remove the last digit in the set-point value display field.
- When the display shows the new set-point value press the **control** key.
- The display shows the pressure value changing as the instrument controls to the new set-point, at the set rate of change.
- The activity indicator shows the progress of the instrument controlling within the rate of change limits.



Status Indicator

CA	Controller activity	CC	Controller condition
PA	Pressure activity	PC	Pressure condition
IT	In-limits tolerance		

Note: *In normal controlled pressure conditions the status indicator stays within the in-limits tolerance band. If the status indicator moves outside the in-limits tolerance band this can be caused by either a leak in the system or a change in supply pressure.*

△P *shows the difference between the current pressure reading and the set-point value.*

⊗ *this valve symbol shows the working effort of the apply and release valves. The higher the pointer ▶ the more the work rate of the apply valve. The lower the pointer ▶ the more the work rate of the release valve.*

Controlling to ambient/zero pressure

- Use the numeric keys or jog control and set the new set-point value of ambient or zero pressure.
- When the display shows the new set-point value, press the **control** or **enter** key.
- The display shows the pressure value changing as the instrument controls to the new set-point, at the set rate of change.
- When the display shows ambient or zero pressure, press the **measure** key to switch off the controller and return to measure mode.

Note: *The instrument stays in measure mode showing the pressure measured at the outlet port.*

3.4 Operation and Example Procedures

Introduction

Before operation, the instrument must be connected to the correct electrical and pneumatic supplies as detailed in Section 2, Installation.

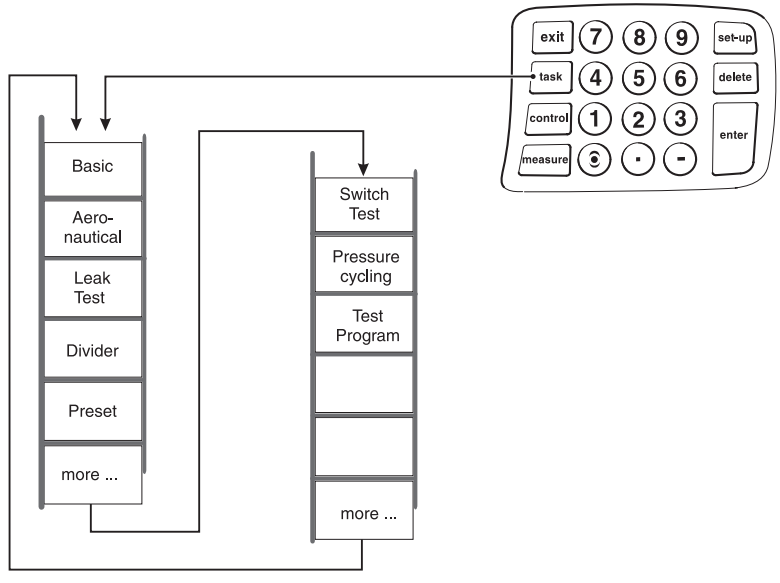
Switch the instrument ON and, after a short time, the display shows measured pressure mode (except when regulator mode is selected) in the Basic Task screen.

A dual range instrument always starts in the higher pressure range.

Measure and Control Modes

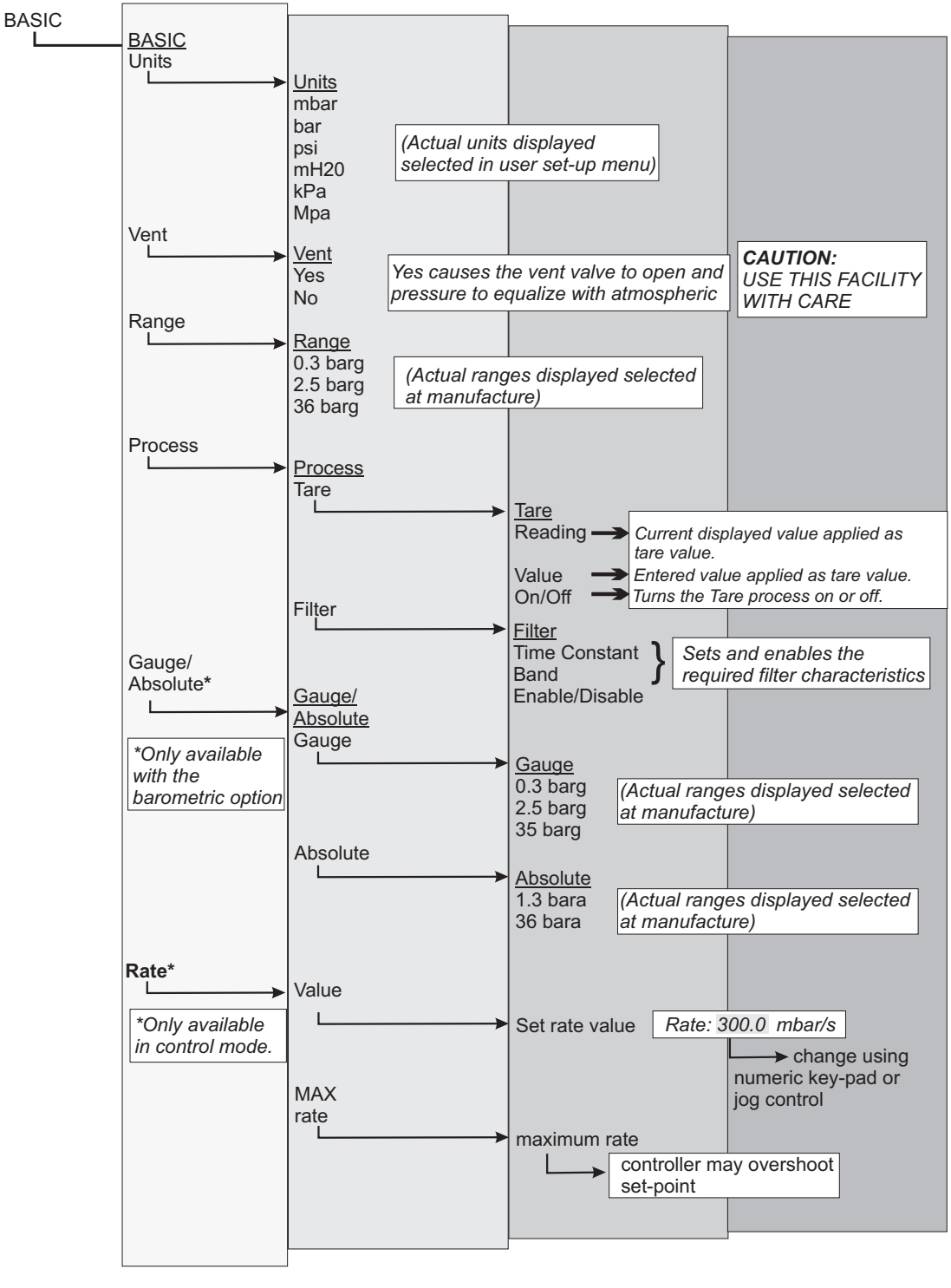
The instrument operates in two modes, **Measure** or **Control.** Pressing the **Measure** key selects **Measure** mode, the instrument works as a precision pressure indicator and shows the pressure measured at the outlet port. Pressing the **Control** key selects **Control** mode, the instrument works as a precision pressure controller and shows the controlled pressure measured at the outlet port. Pressing the **Task** key enables various pre-determined functions

Task key



The message window at the bottom of the screen shows **Task:Select,** prompting for a selection of an option from one of the soft keys. When selected, e.g. **Basic,** the display shows the soft key options for the task **(Units, Vent, Range** and **Process)** and the upper line of the message window changes to display **Task:Basic.** The status window at the top of the screen displays **Measured Pressure**.

Basic Task Selections



Basic task

To control pressure in the **Basic Task** proceed as follows.

(a) Select the required pressure range and units of pressure measurement from the soft boxes displayed.
(b) Press the **Control** key. The display changes to show set-point and rate.
(c) The message window shows **Confirm/Change set-point,** and **press Control to start**.
(d) Press the **Rate** soft key. The display shows two options, **Value** and **Max Rate**.
(e) Press **Value** and enter the required rate of pressure change on the key-pad, e.g. 0.1 bar/s (1.5 psi/s), and press **Enter.** The display returns to the control mode screen.
(f) Use the key-pad to select the required set-point e.g. 1.5 bar (22 psi) and press **Control.**

The screen display changes as follows:

- The status window changes to show **Changing Pressure.**
- The runner icon (if enabled) activates.
- The activity indicator (if enabled) displays the current pressure and controller condition.

When the controller achieves the selected pressure set-point, the screen display changes as follows:

- The status window changes to **Controlled Pressure.**
- The runner icon in a standing position.
- The activity indicator shows the controlled pressure within the in-limits tolerance.

Caution: ***Using the vent function can damage rate-sensitive equipment connected to this controller. Enter a set-point of ambient/zero pressure and use the controller to reduce pressure before selecting VENT.***

(g) On completion of testing, press the **Vent** soft key to reduce the system pressure to near atmospheric pressure. This feature should be used to reduce system pressure to a safe value before disconnecting the Unit Under Test.

Notes:

1. *The vent opens for approximately 5 to 10 seconds.*
2. *Always use the vent function before disconnecting pressure equipment from the outlet port.*

(h) Press the **measure** key to switch off the controller.

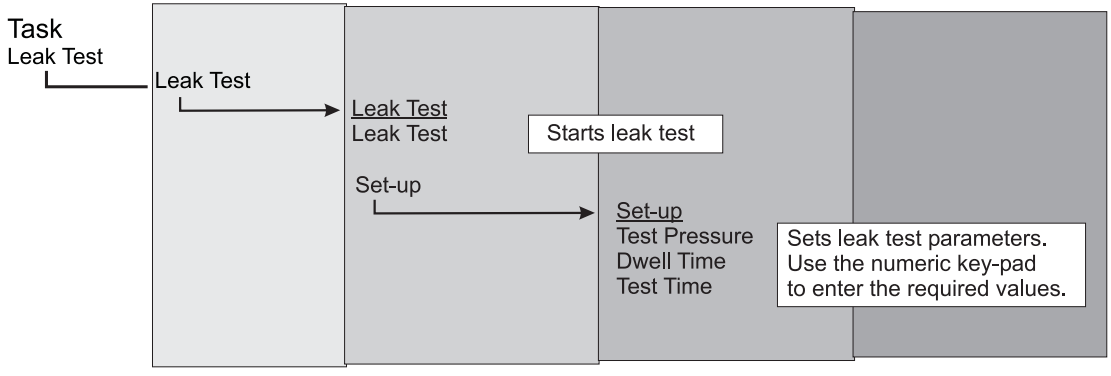
Aeronautical option

The aeronautical option is a specialised application of the DPI 515 instrument refer to 3.9.

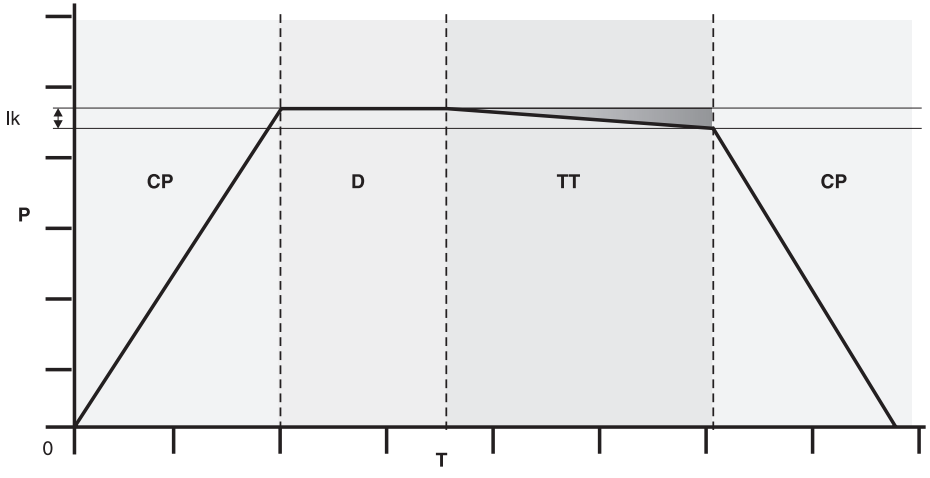
Leak testing

This task applies a test pressure to an external system to find any leaks in a system connected to the instrument. This task sets the test pressure, dwell time at the test pressure and the leak test time.

Leak test menu structure



At the start of the test, the instrument applies a test pressure to the user system. A dwell time allows the user system to stabilise.



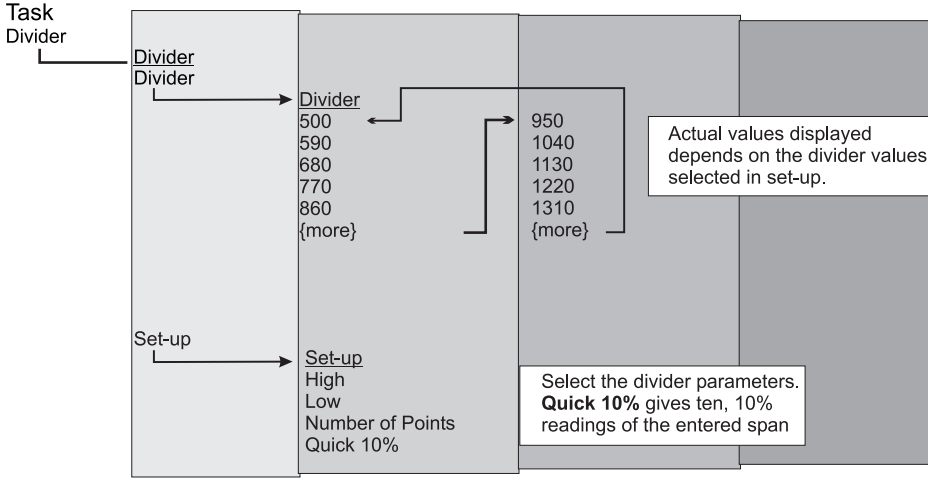
CP	=	changing pressure	D	=	dwell time
lk	=	leak	P	=	pressure
T	=	time (seconds)	TT	=	test time (up to 9999 seconds)

The instrument changes to measured mode and then records the pressure change during test time. On completion, the display shows the Start Pressure, End Pressure, Pressure Change and Leak Rate.

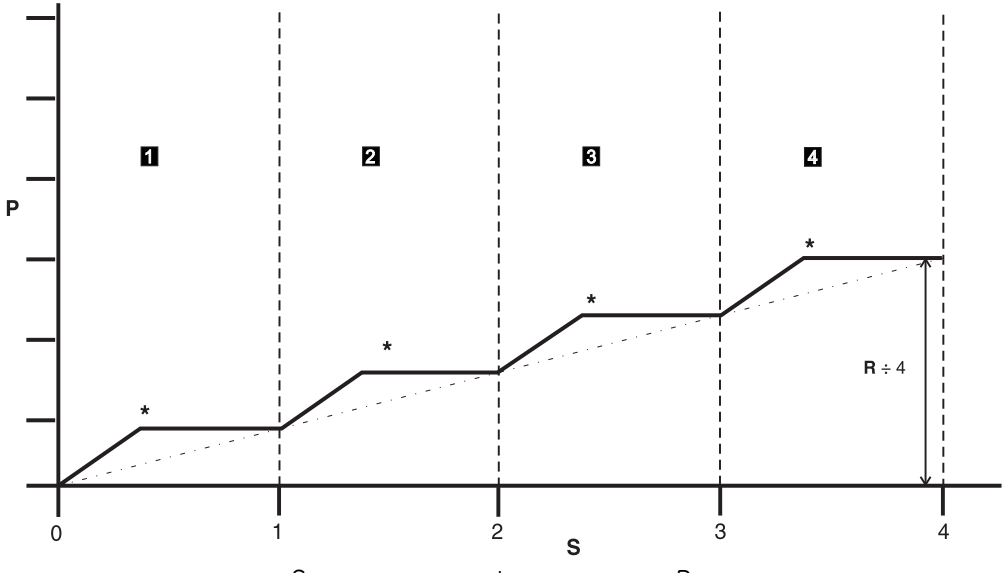
Divider

Select and set-up the divider task by pressing **Task/Divider/Set-up**. The set-up menu defines pressure span and then divides the span into a number of equal test points (min 2, max 25). Alternatively, using the Quick 10% selection the menu sets 10 equally-spaced test points.

Divider menu structure



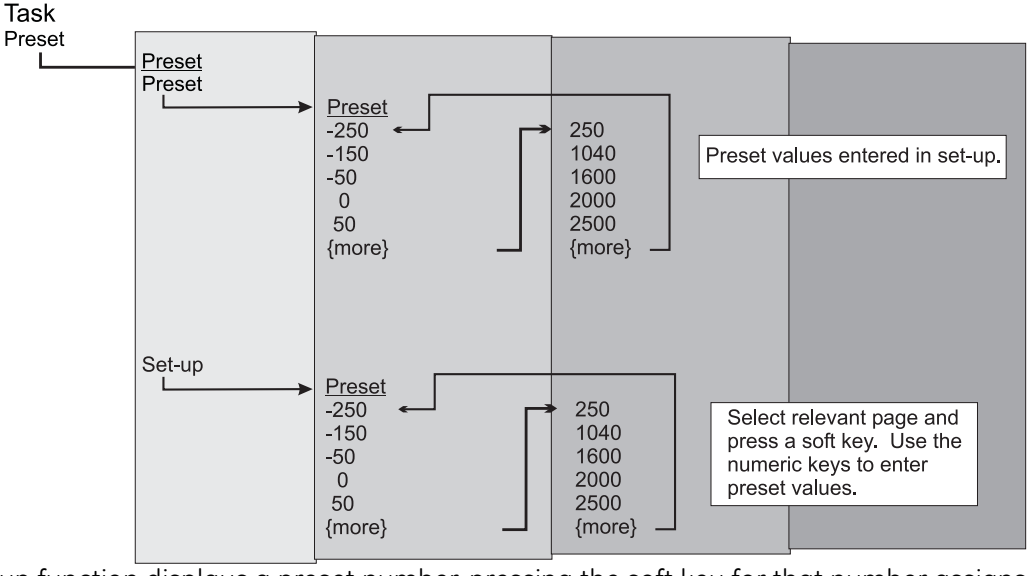
Select required **Range, Units, Rate**, etc. in Basic task. When **Divider** is then entered from the **Task** menu, these test point pressures are displayed in the soft key boxes. By entering control mode, the soft keys can be pressed to change to these test pressures (and ***controlled at the selected pressure). The jog control can be used to "nudge" the set-point, jog resolution in **SETUP/USER/JOG RESOLUTION**.



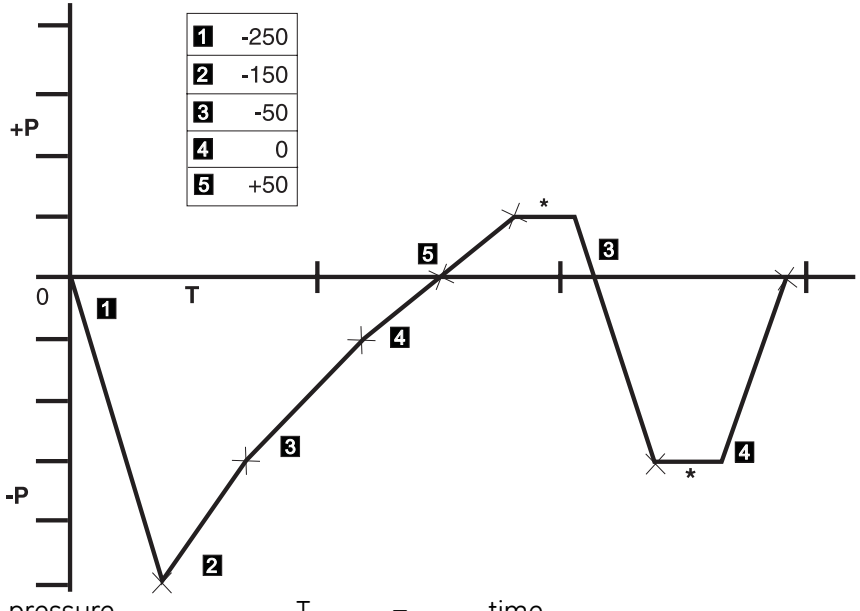
P = pressure S = steps R = range

Preset

The **Preset** function is similar to the **Divider** function except that, using **Task/Preset/Setup**, individual set-point values can be defined for each soft box (maximum 25 set-points). The jog control can be used to "nudge" the individual set-point values, jog resolution in **SETUP/ USER/JOG RESOLUTION**.



The set-up function displays a preset number, pressing the soft key for that number assigns a pressure value to the key. After setting all the required preset pressures, enter control mode and then press a soft key to change to the pressure assigned to that key (and ***controlled at the selected pressure).



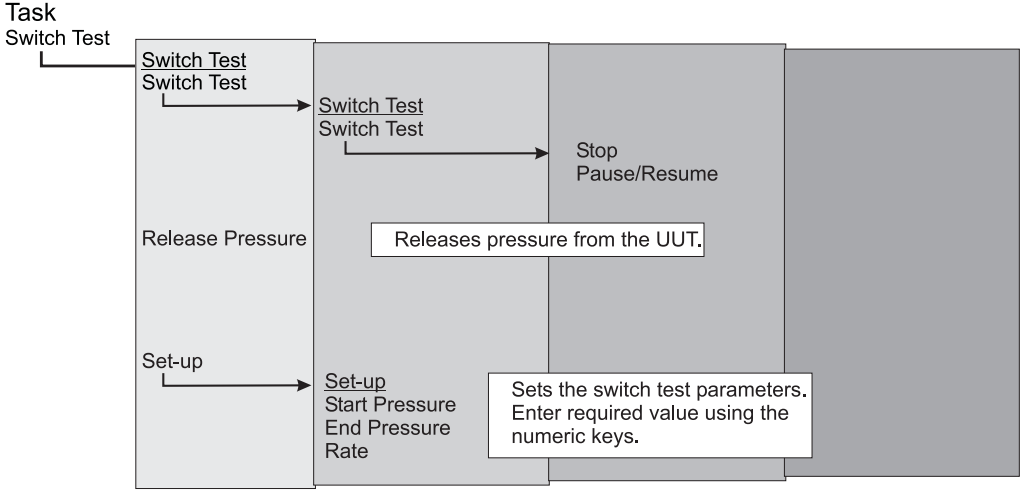
P = pressure T = time

Switch test

This function automates the testing of pressure switch devices. Connect the pressure port of the switch to be tested to the appropriate outlet port. Connect the switch contacts in series with the 24V dc output and the **Logic** Input.

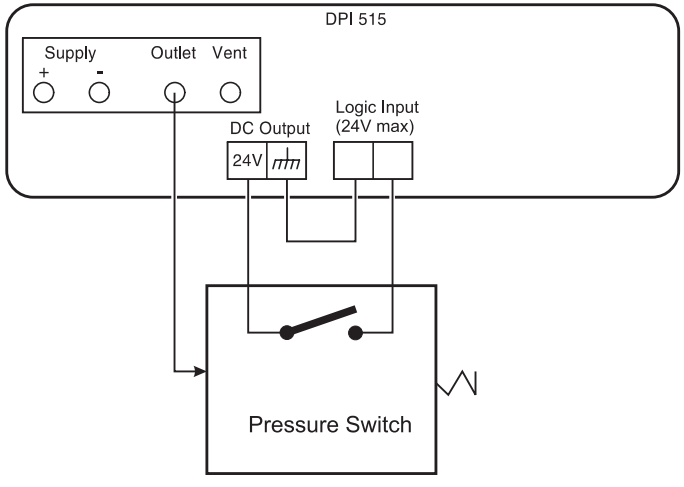
Note: *The potential-free logic input connections require a switching potential (24V max) to be applied. If necessary, this can be an external d.c. source.*

Set the switch test parameters in the **Task/Switch Test /Set-up** menu, including the test range and test rate of change. Slower rates give more accurate results.



Note: *This facility uses the rate of change of pressure set in the Basic task.*

After the test, the display shows the pressures at which the contacts open and close and the switch hysteresis (the difference between the two switching pressures). Before disconnecting the switch under test, press the **Release** soft key to release any residual pressure.



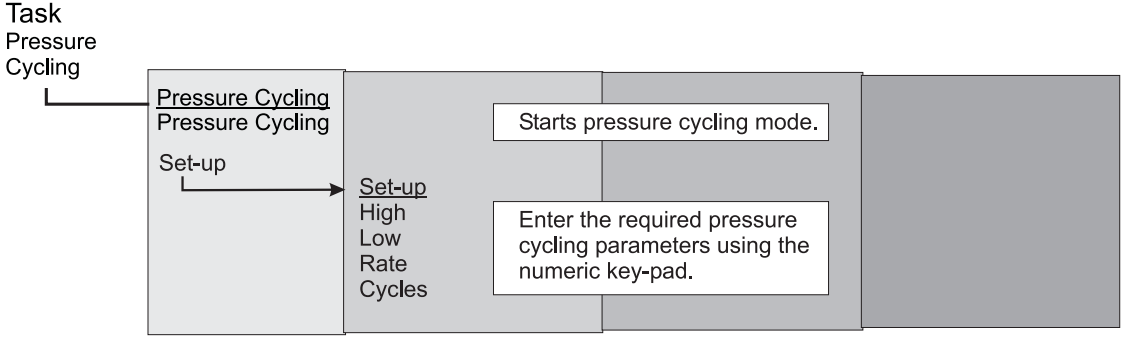
Example Switch Test Connections

Pressure Cycling

Programs the controller to apply low and high pressure values at a defined rate of pressure change for a defined number of cycles. This facility exercises pressure gauges or similar equipment before calibration or testing.

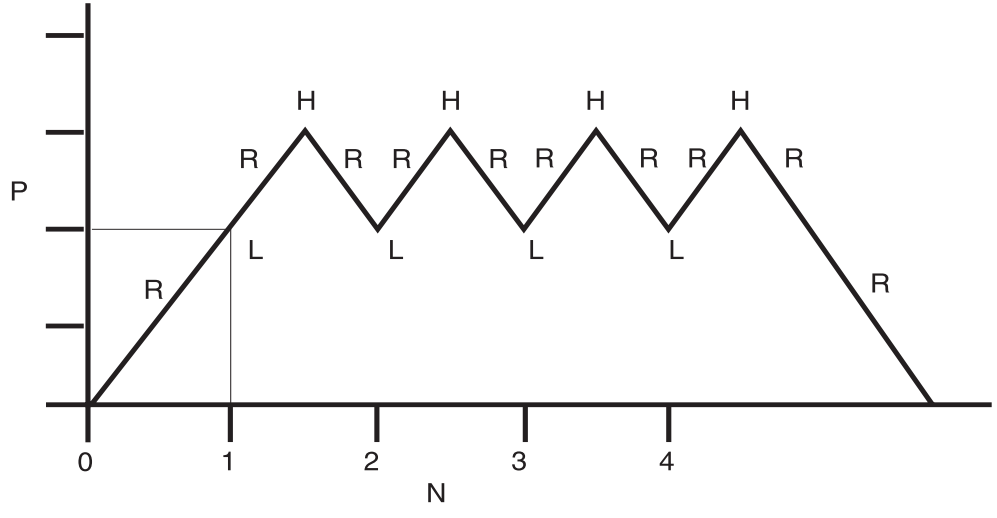
Set the pressure cycling parameters in **Task/Pressure Cycling/Set-up**.

- Use the soft keys and numeric keys to set **High, Low, Rate** of pressure change and the number of **Cycles.**



Run

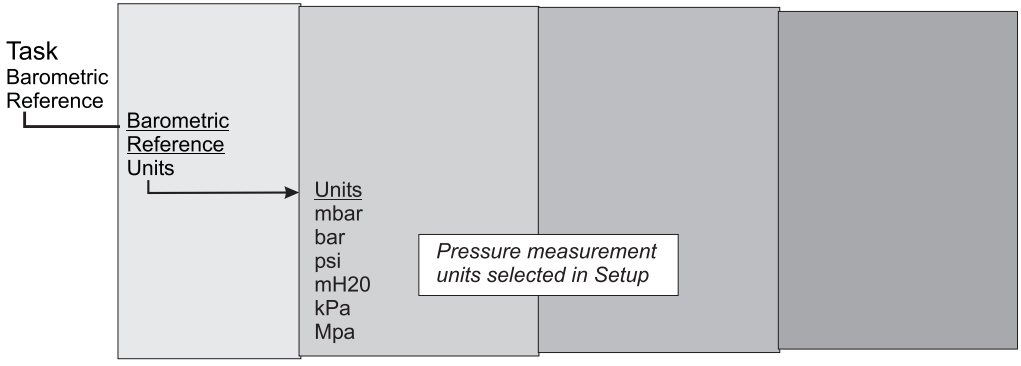
- When selected, the controller performs a pressure cycle routine using the range outlet port and settings selected in the Basic task.



R	=	rate of pressure change	L	=	low value set-point
H	=	high value set-point	N	=	number of cycles
P	=	pressure			

Barometric Reference

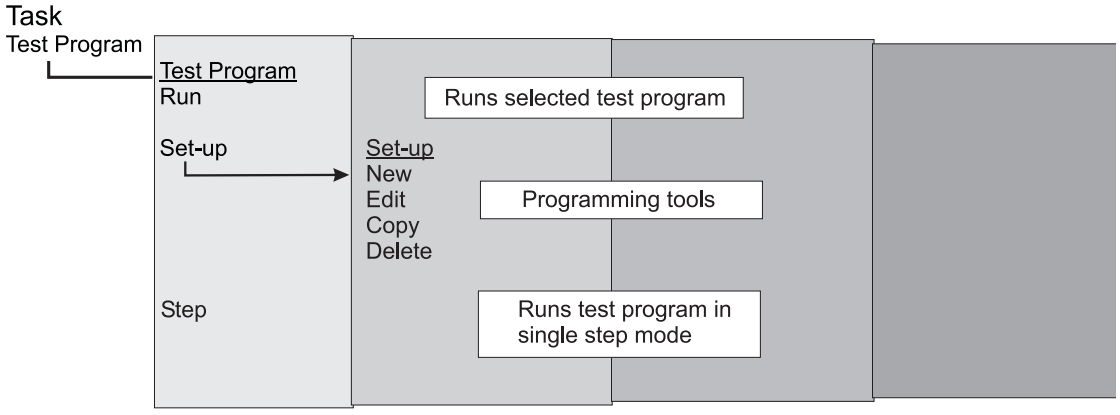
The barometric reference option measures the barometric pressure at the reference port of Range 1. It permits the controller to operate in either gauge or absolute mode. Select gauge or absolute in Basic mode. The controller stops during a change between gauge and absolute.



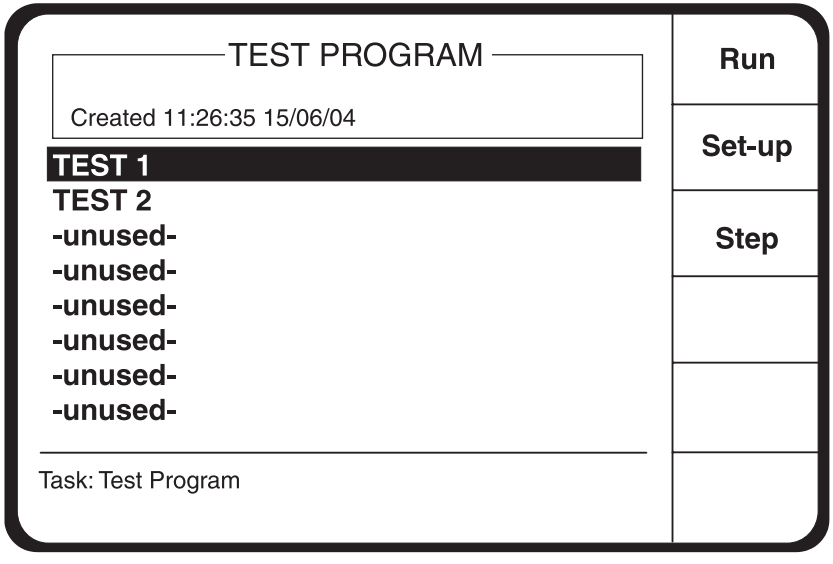
The barometric task only changes the barometric pressure units. Select the units available on the soft keys for this option in the User set-up.

Test Program

The test program task provides a facility for writing and executing test procedures.



Selecting a test program from the Task menu displays all the task programs currently stored, together with the **Run**, **Set-up** and **Step** function keys.



Test Program screen

Program

To start a test program, select the test program listed on the screen using the jog (rotary) control and press the **RUN** key. When the program starts, a Stop legend replaces the Run legend. Press the Stop key at any time to stop the test program. The Step function key allows the selected program to be executed one step at a time.

- To write a test program, press the Set-up soft key and select **New**.
- To edit an existing program, press **Edit**.
- Enter a name for the program using the text editor keys to select letter range and the jog control to select the letter within the range. Use the right arrow key to move to the next character position.
- Press **enter** on completion.
- The display shows the line instruction with insert and delete selections. Pressing insert changes the display to a list of the available programming commands.

Table 3.1 - Test Program Commands

Command	Description	Command	Description
set-point	Allows set-point to be entered.	**Text**	Sets screen message.
Dwell	Specifies dwell time (seconds).	**Beep**	Beep on/off.
In Limits	Wait for In Limits condition.	**Rate Value**	Specifies controller rate.
Range	Specifies instrument range	**Rate Max**	Sets controller rate to maximum.
Zero	Output zeroed	**Vent**	Instructs instrument to vent.
Control	Selects Control mode.	**Count**	Used in a loop to count the number of loop cycles.
Measure	Selects Measure mode.	**I/P Logic**	Specifies change of state for external contacts as a halt condition.
Goto	Used to set-up a loop. Enter program line number to go to.	**Settling**	Used to specify overshoot requirements.
Pause	Causes test program to pause for user input (**Resume**)	**Resolution**	Sets display resolution.
Units	Selects required display units.	**End**	Program end command.

To select a command, use the jog control to highlight the command on the display and press **enter** to write it into the program. Place the Range, Units, Rate, Settling and Resolution commands at the start of the program this protects pressure-sensitive UUT.
When selected, certain commands require a value or selection to be set (e.g.) **Range, Rate, Text** the display shows a screen prompt for the appropriate setting.

Example Program

Note: *Changes to instrument settings made in a test program remain valid only for the test program. The instrument reverts to the pre-test settings on completion.*

Step	Command	Argument	Action
1	RANGE	2.5 BAR G	*Select 2.5 mbar g range*
2	UNITS	MBAR	*Select units, mbar*
3	RATE	100	*Select rate, 100 mbar/min*
4	RESOLUTION	5	*Display resolution, 5 digits*
6	SETTLING	ZERO	*No overshoot*
7	TEXT	Operator instruction, e.g.	"Connect UUT"
8	ZERO		
9	SET-POINT	400	*Set-point, 400 mbar*
10	CONTROL		*Controller ON*
11	IN LIMITS		*Wait for In Limits Condition*
12	BEEP	ON	*Beep on, approx. 1 sec*
13	BEEP	OFF	
14	MEASURE		*Switch to Measure (controller off)*
15	DWELL	30	*Wait for 30 sec*
16	set-point	800	*Set-point, 800 mbar*
17	CONTROL		*Controller on*
18	IN LIMITS		*Wait for In Limits Condition*
19	BEEP ON		*Beep on (approx. 1sec)*
20	BEEP OFF		
21	MEASURE		*Switch to Measure (controller off)*
22	TEXT	Operator instruction, e.g.	*(Wait for beep, record pressure)*
23	DWELL	30	*Wait for 30 sec*
24	BEEP ON		*Beep on, approx. 1 sec*
25	BEEP OFF		
26	TEXT	Operator instruction, e.g.	*"Min pressure allowed 785 mbar"*
26	PAUSE		*WAIT,* *(press **Resume** to continue)*
27	VENT		*Vent*
28	END		*Program end*

Programming Loops

To program a loop, use the **Goto** command. Include the **Count** command in the loop for counting the number of loop cycles.

Note:

*The test program commands do not include tests for conditional jumps; to stop a test program from looping, the **Stop** soft key must be pressed by the operator.*

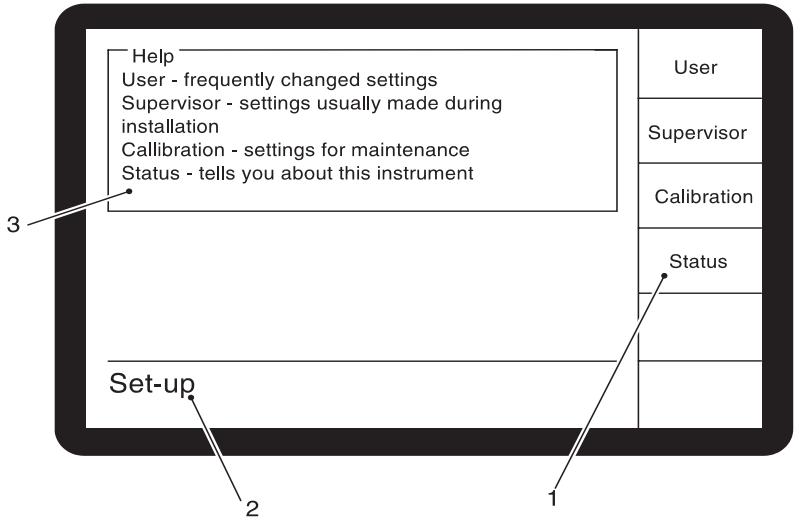
Example of programming a loop

1	RANGE	2.5 MBAR G	*Select 2.5 mbar g range*
2	UNITS	MBAR	*Select units, mbar*
3	RATE	100	*Select rate 100mbar/min*
4	RESOLUTION	5	*Display resolution 5 digits*
6	SETTLING	ZERO	*No overshoot*
7	TEXT	Operator instruction, e.g.	"Connect UUT"
8	ZERO		
9	SET-POINT	400	*Set-point, 400 mbar*
10	CONTROL		*Controller ON*
11	IN LIMITS		*Wait for In-limits condition*
12	BEEP ON		*Beep on, approx. 1 sec*
13	BEEP OFF		
14	MEASURE		*Switch to measure (controller off)*
15	DWELL	30	*Wait, 30 sec*
16	SET-POINT	800	*Set-point, 800 mbar*
17	CONTROL		*Controller on*
18	IN LIMITS		*Wait for In-limits condition*
19	BEEP ON		*Beep on, approx. 1sec*
20	BEEP OFF		
21	MEASURE		*Switch to measure, controller off*
22	COUNT		*Increment loop counter*
23	VENT		*Vent*
24	GOTO	9	*Loop back to program line 9*
28	END		*Program end*

3.5 Set-up Selections

Two set-up selections provide access to the instrument set-up menus, **User** and **Supervisor.** The **User** set-up provides direct access by the operator with the **Supervisor** set-up accessed only by a four digit PIN.

Press **Set-up** on the key-pad and the display shows four selections, **User, Supervisor, Calibration** and **Status** next to the corresponding soft keys on the right of the display screen.



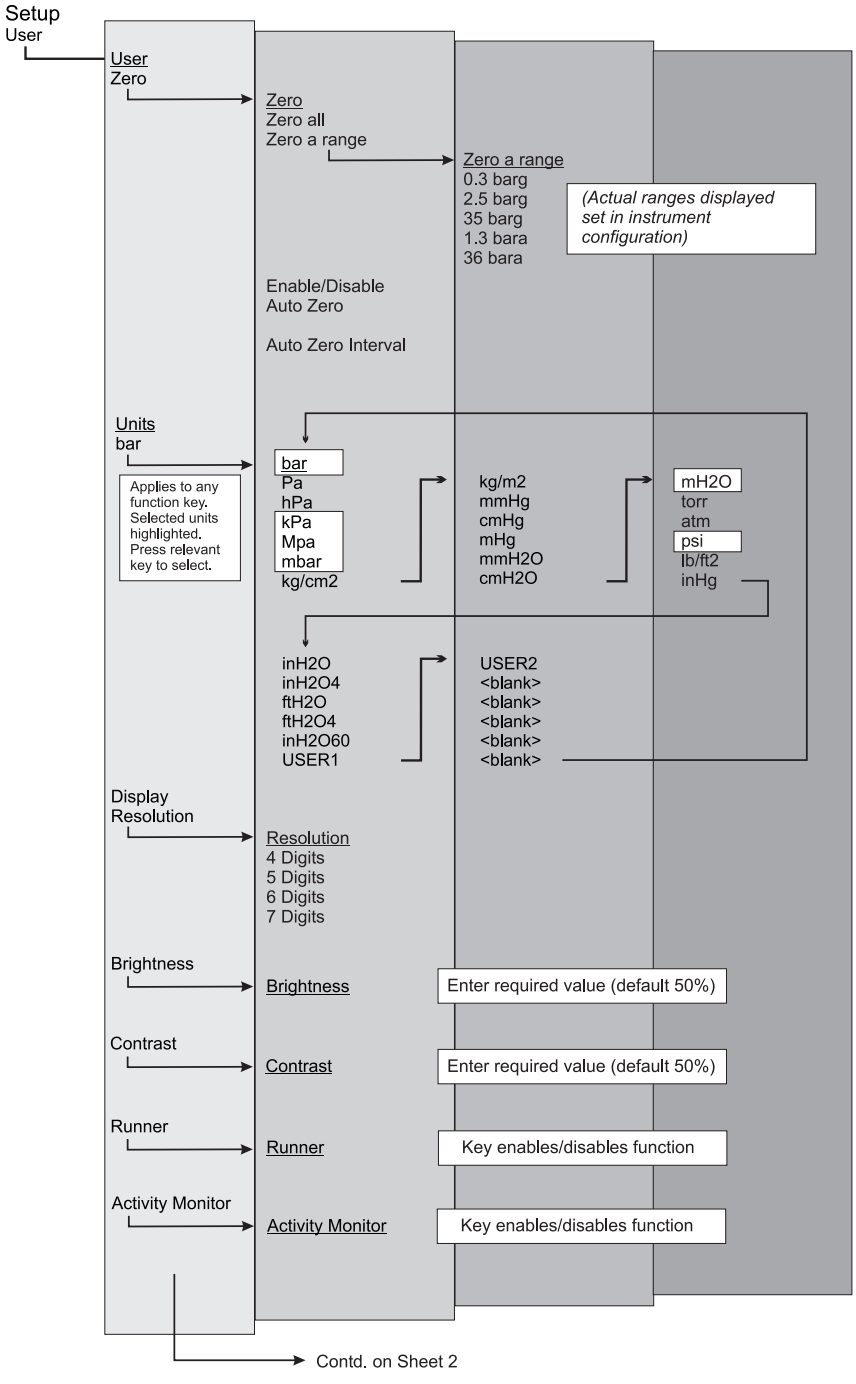
1 Selections 2 Message window 3 Help window

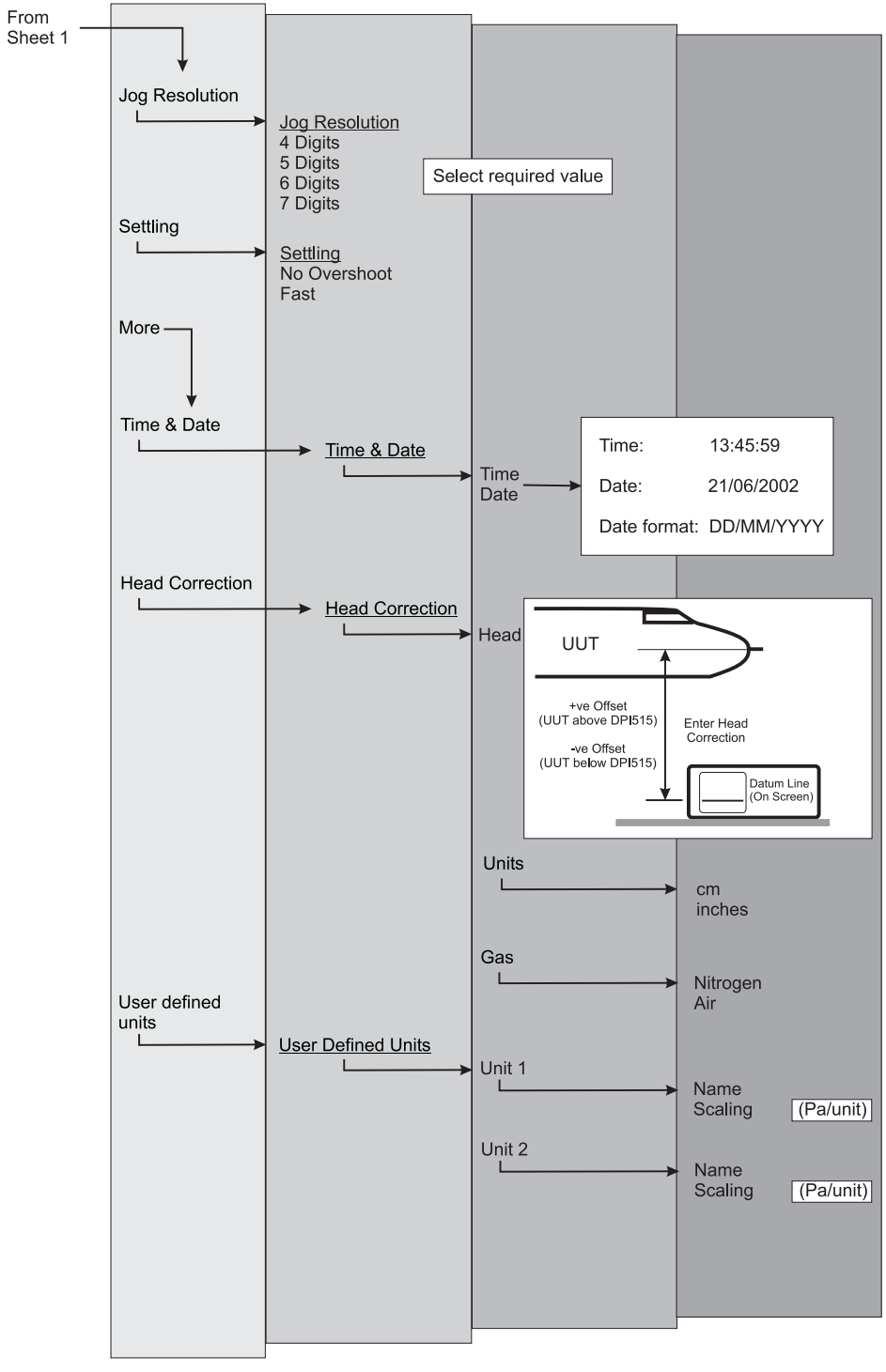
The upper part of the screen shows the HELP window describing the sub-menus available in these four selections. The upper line of the message window shows the menu option in use. Pressing the appropriate soft key selects the appropriate menu, when selected, e.g. **User**, the display shows more selections in the soft boxes on the right of the screen and the message window changes to show **Set-up: User.**

When selected, e.g. **Units**, the display shows selections in the soft boxes on the right of the screen, the upper line of the message window changes to show **Set-up: Units**. A 'message line' appears at the bottom of the message window prompting the user's next action.

To return to the **User** selections, press **Exit** on the key-pad. To return to the **Set-up** menu, press **Exit** twice or **Set-up** once.

The User Set-up menu provides facilities for programming frequently changed settings as follows.


Setup
User
User
Zero
Zero
Zero all
Zero a range
Zero a range
0.3 barg
2.5 barg
35 barg
1.3 bara
36 bara
(Actual ranges displayed set in instrument configuration)
Enable/Disable
Auto Zero
Auto Zero Interval
Units
bar
Applies to any function key. Selected units highlighted. Press relevant key to select.
bar
Pa
hPa
kPa
Mpa
mbar
kg/cm2
kg/m2
mmHg
cmHg
mHg
mmH2O
cmH2O
mH2O
torr
atm
psi
lb/ft2
inHg
inH2O
inH2O4
ftH2O
ftH2O4
inH2O60
USER1
USER2
<blank>
<blank>
<blank>
<blank>
<blank>
Display
Resolution
Resolution
4 Digits
5 Digits
6 Digits
7 Digits
Brightness
Brightness
Enter required value (default 50%)
Contrast
Contrast
Enter required value (default 50%)
Runner
Runner
Key enables/disables function
Activity Monitor
Activity Monitor
Key enables/disables function
Contd. on Sheet 2


From
Sheet 1
Jog Resolution
Jog Resolution
4 Digits
5 Digits
6 Digits
7 Digits
Select required value
Settling
Settling
No Overshoot
Fast
More
Time & Date
Time & Date
Time
Date
Time: 13:45:59
Date: 21/06/2002
Date format: DD/MM/YYYY
Head Correction
Head Correction
Head
UUT
+ve Offset
(UUT above DPI515)
-ve Offset
(UUT below DPI515)
Enter Head
Correction
Datum Line
(On Screen)
Units
cm
inches
Gas
Nitrogen
Air
User defined
units
User Defined Units
Unit 1
Name
Scaling
(Pa/unit)
Unit 2
Name
Scaling
(Pa/unit)

3.6 Aeronautical Option

The Aeronautical task enables control and measurement of altitude and airspeed in aeronautical units such as feet and metres (altitude) and knots, mph, km/h (airspeed). This task utilises dual pressure displays to show the parameter and the rate of change of Altitude, Airspeed, Mach and Airspeed with Mach number.

The Aeronautical Task enables the testing and calibration checking of aeronautical indicators and system components by controlling and displaying values and rates in aeronautical units.
The instrument automatically selects the appropriate pressure ranges for altitude and airspeed (normally 1.3 bar (19.5 psi) absolute and 2.0 bar (30 psi) differential respectively).

Cautions:

1. **Do not exceed the maximum pressures stated in the appropriate Component Maintenance Manual for the unit under test.**
2. **Carefully de-pressurize all pipes to atmospheric pressure before disconnecting and connecting to the unit under test.**

Example of Two Instruments for Altitude and Airspeed Testing (Figure 2-13)
This example shows how two instruments can be used to simultaneously generate altitude and airspeed.

Cautions:

1. **Before testing, set the rate of change for both DPI 515 Instruments to a safe value. A high rate of change can damage sensitive aeronautical components. Refer to the appropriate Component Maintenance Manual for the unit under test.**
2. **In this example configuration, negative airspeed can be generated this can damage an airspeed indicator. To prevent negative airspeed, apply the static pressure before the pitot pressure for increasing and decreasing airspeed values.**

Aeronautical Task

Select the Aeronautical task from the **Task** menu. The display shows four menu items:

Mode

- Press the mode soft-key to select an operating mode such as Altitude or Speed.

Units

- The **Units** soft-key provides access to either the **Aeronautical** or **Pressure** units. At any time, the units can be changed between pressure and pressure converted to aeronautical units. The display shows the outlet pressure converted to Altitude, CAS or Mach using BS 2G 199:1984***** conversions and assuming standard atmospheric conditions.

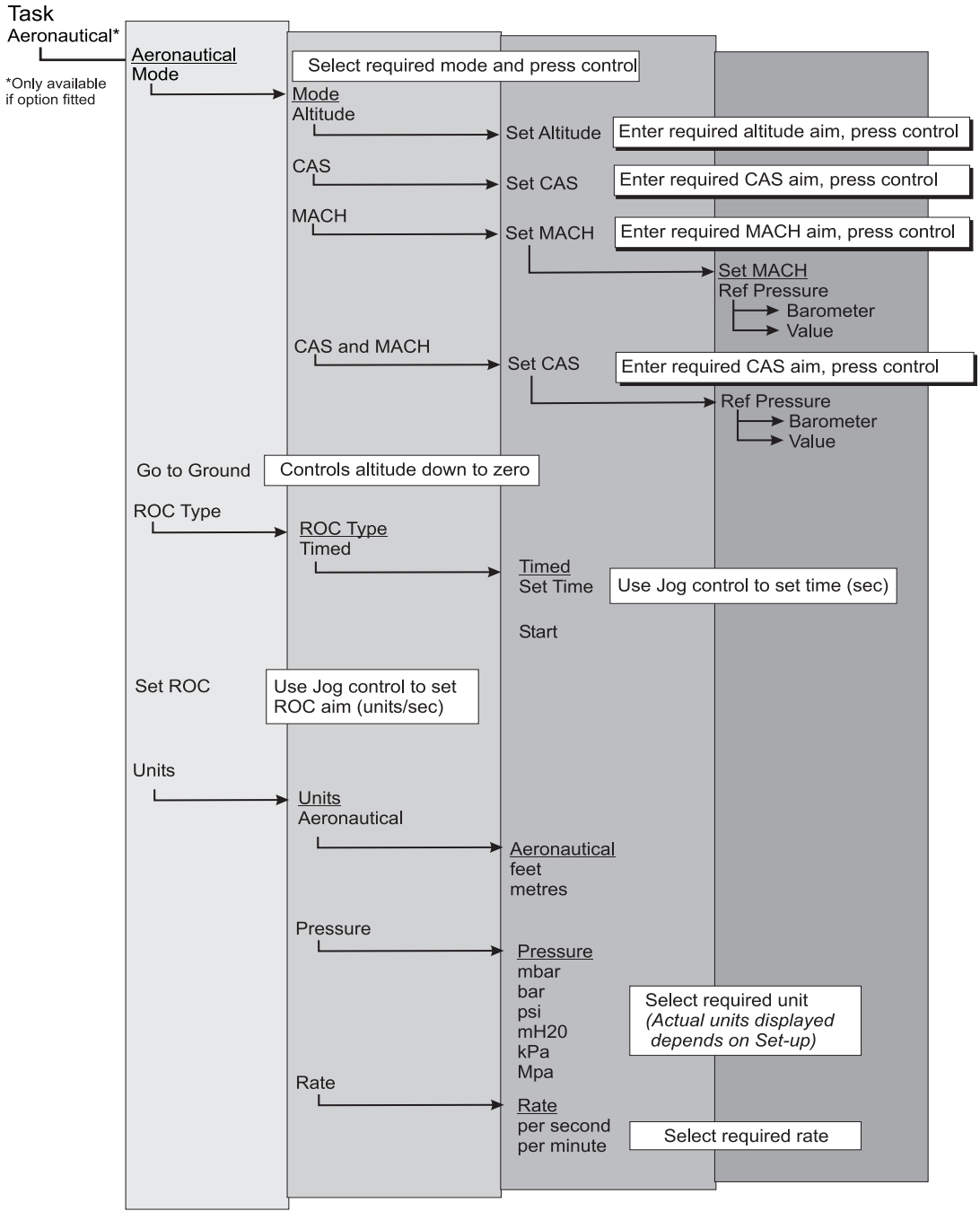
  ***** *Based on tables from ICAO Standard Atmosphere 1964.*

Reference Pressure

- Press this key to select the required reference pressure. This can be either the barometric pressure (from the instrument's internal barometric sensor), or any numeric value (e.g.) 1013.25 mbar (29.92 inHg).

Go to ground

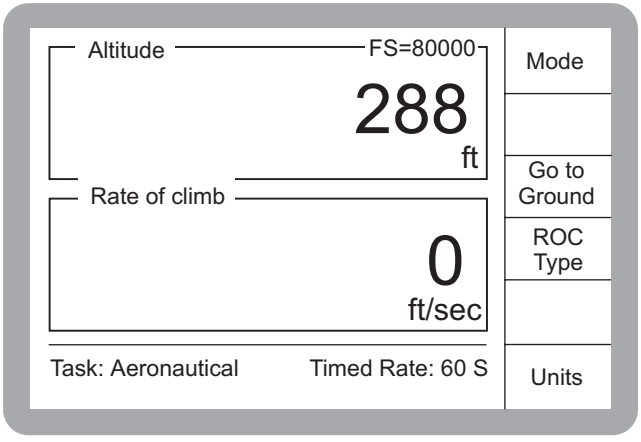
- Press this key to return the instrument and any unit under test (UUT) connected to it safely to ground pressure at a controlled (timed) rate.


Task
Aeronautical*
*Only available if option fitted
Aeronautical Mode
Select required mode and press control
Mode
Altitude
Set Altitude
Enter required altitude aim, press control
CAS
Set CAS
Enter required CAS aim, press control
MACH
Set MACH
Enter required MACH aim, press control
Set MACH
Ref Pressure
Barometer
Value
CAS and MACH
Set CAS
Enter required CAS aim, press control
Ref Pressure
Barometer
Value
Go to Ground
Controls altitude down to zero
ROC Type
ROC Type
Timed
Timed
Set Time
Use Jog control to set time (sec)
Start
Set ROC
Use Jog control to set ROC aim (units/sec)
Units
Units
Aeronautical
Aeronautical
feet
metres
Pressure
Pressure
mbar
bar
psi
mH20
kPa
Mpa
Select required unit
(Actual units displayed depends on Set-up)
Rate
Rate
per second
per minute
Select required rate

Altitude Measure Mode

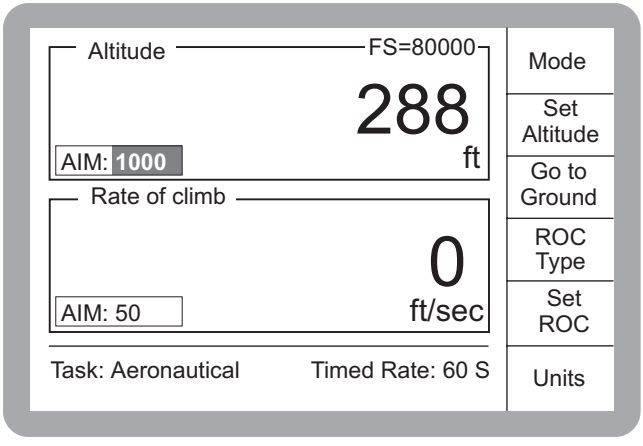
Press **Mode** and select **Altitude** from the menu. The display shows Altitude in the upper window and Rate of climb in the lower window. Both windows show the current value in large characters.

The ROC type soft-key permits the rate of climb display to be rapidly updated (**Instant**) or to measure ROC averaged over a pre-set time period **(Timed)**. The latter method results in a lower noise reading



Altitude Control Mode

Press **Mode** and select **Altitude** from the menu. Press **Control**, the display shows the aim value entry boxes together with the **Set Altitude** and **Set ROC** soft boxes.



Set Altitude

- Press this soft-key to highlight the Aim value entry box on the Altitude display. The numeric key-pad may be used to input the required Altitude. Press ENTER to confirm.

Set Rate of Climb (ROC)

- Press this soft-key to highlight the Aim value entry box on the ROC display. The numeric key-pad may be used to input the required ROC set-point. Press ENTER to confirm.

ROC Type

- Timed ROC can be used to produce an accurate measurement of ROC over specified period (in seconds).
- Instantaneous ROC shows the current ROC value on the display.

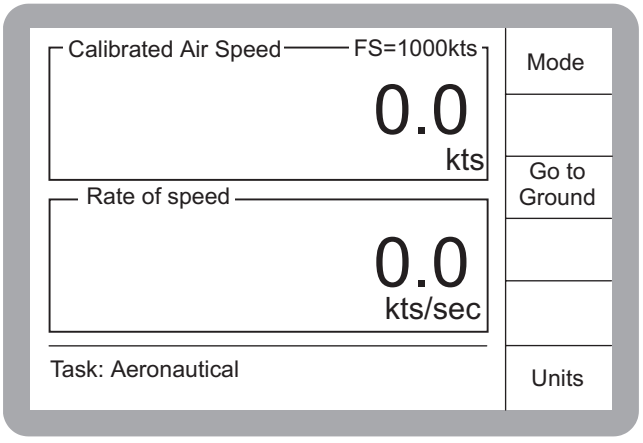
With the Aim Altitude and the ROC set, press Control again to start the change to the new aim value.

Go to Ground

- Pressing this soft-key option makes the instrument control the altitude to ZERO feet/ metres (@1013.25 mbar), at the currently set ROC for safe disconnection.

CAS Measure Mode

Press **Mode** and select **CAS** from the menu. The display shows CAS in the upper window and rate of Speed (acceleration) in the lower window. Both windows show the current value in large characters.



CAS Control Mode

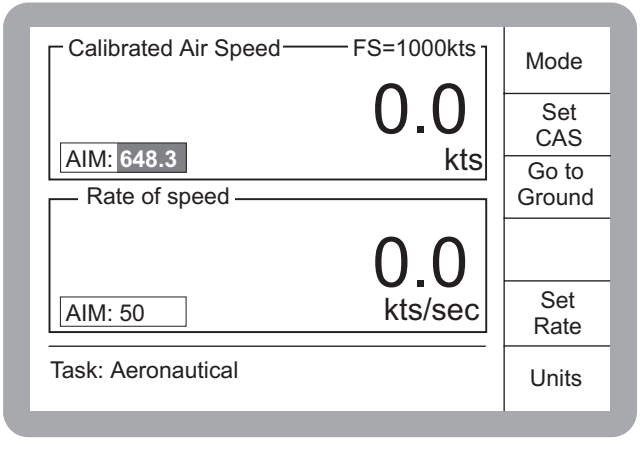
Press **Mode** and select **CAS** from the menu. Press **Control**, the display shows the aim value entry boxes together with the **Set CAS** and **Set Rate** soft boxes.

Set CAS

- Press this soft-key to highlight the Aim value entry box on the Airspeed display. The numeric key-pad may be used to enter the required airspeed set-point. Press ENTER to confirm.

Set Rate

- Press this soft-key to highlight the Aim value entry box in the Rate of Speed window. The numeric key-pad may be used to enter the required Rate of Speed set-point. Press ENTER to confirm.



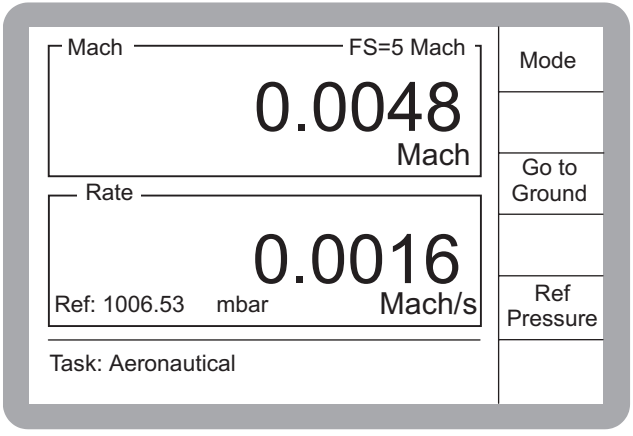
With the Aim CAS and the Rate set, press **Control** again to start the change to the CAS Aim.

Go to Ground

- Pressing this soft-key option makes the instrument control the airspeed to ZERO for safe disconnection of the Unit Under Test (UUT).

Mach Measure Mode

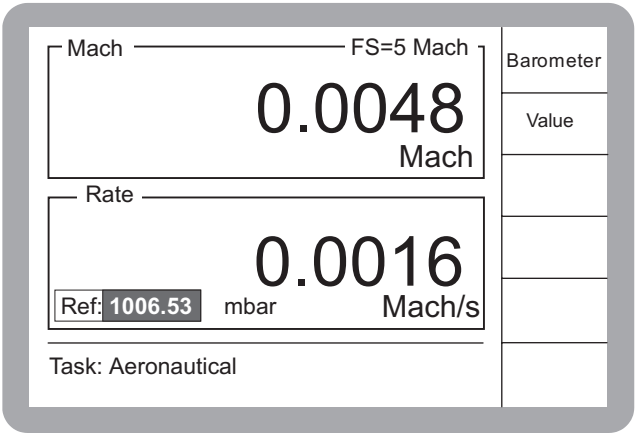
Press **Mode** and select **MACH** from the menu. The display shows Mach in the upper window and Rate (Rate of Mach, acceleration) in the lower window. Both windows have a current value display in large characters. Only the Rate window has a reference (Ref:) value in smaller characters.



Mach Reference Pressure

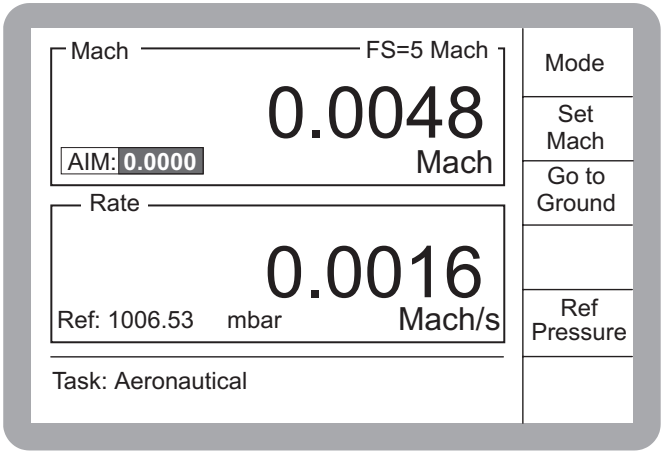
The reference pressure can be set to a fixed value for the static (Ps) pressure**.**

- The instrument then calculates Mach number values based on this reference pressure.
- The static (Ps) connection can remain open to atmosphere pressure.



Mach Control Mode

- Press **Mode** and select **MACH** from the menu. Press **Control** the display shows Mach in the upper window and rate in the lower window. Both windows show the current value in large characters.
- Mach aim value entry box with the Set Mach soft box.
- Press this soft-key to highlight the Aim value entry box in the Mach window. The numeric key-pad may then be used to enter the required Mach aim. Press ENTER to confirm.



Set Mach

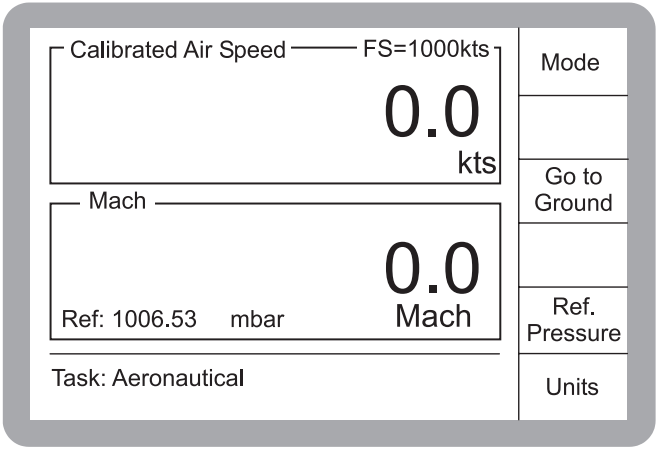
- Press this soft-key to highlight the Aim value entry box. With the Mach Aim set, press **Control** again to start the change to the Aim Mach.

Go to Ground

- Pressing this soft-key option makes the instrument control the airspeed to ZERO (Mach = 0), for safe disconnection.

CAS and Mach Measure Mode

This mode enables the testing of combined speed indicators (CAS Mach). Press **Mode** and select **CAS MACH** from the menu. The display shows.CAS in the upper window and Mach in the lower window.



Go to Ground

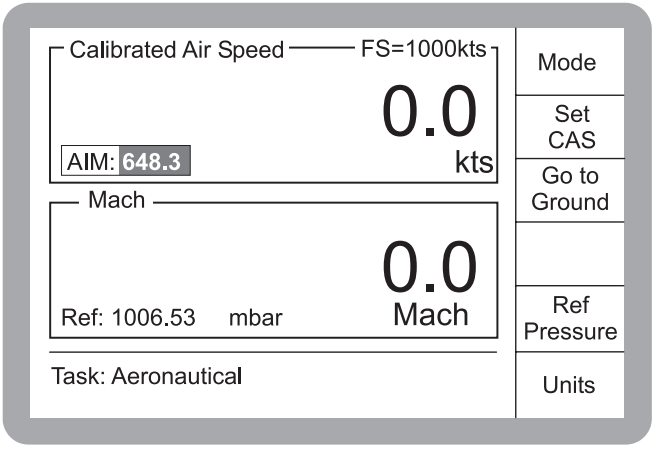
- Pressing this soft-key option makes the instrument control the airspeed to ZERO (Mach = 0), for safe disconnection.

Mach Reference Pressure

- The reference pressure can be set to a fixed value for the static (Ps) pressure. The instrument then calculates CAS and Mach number values based on this reference pressure.

CAS and Mach Control Mode

Press **Mode** and select **CAS MACH** from the menu. Press **Control** and the display shows the CAS aim value entry box.



Set CAS

- Press this soft-key to highlight the Aim value entry box on the Airspeed display. The numeric key-pad may then be used to enter the required CAS value. Press ENTER to confirm.

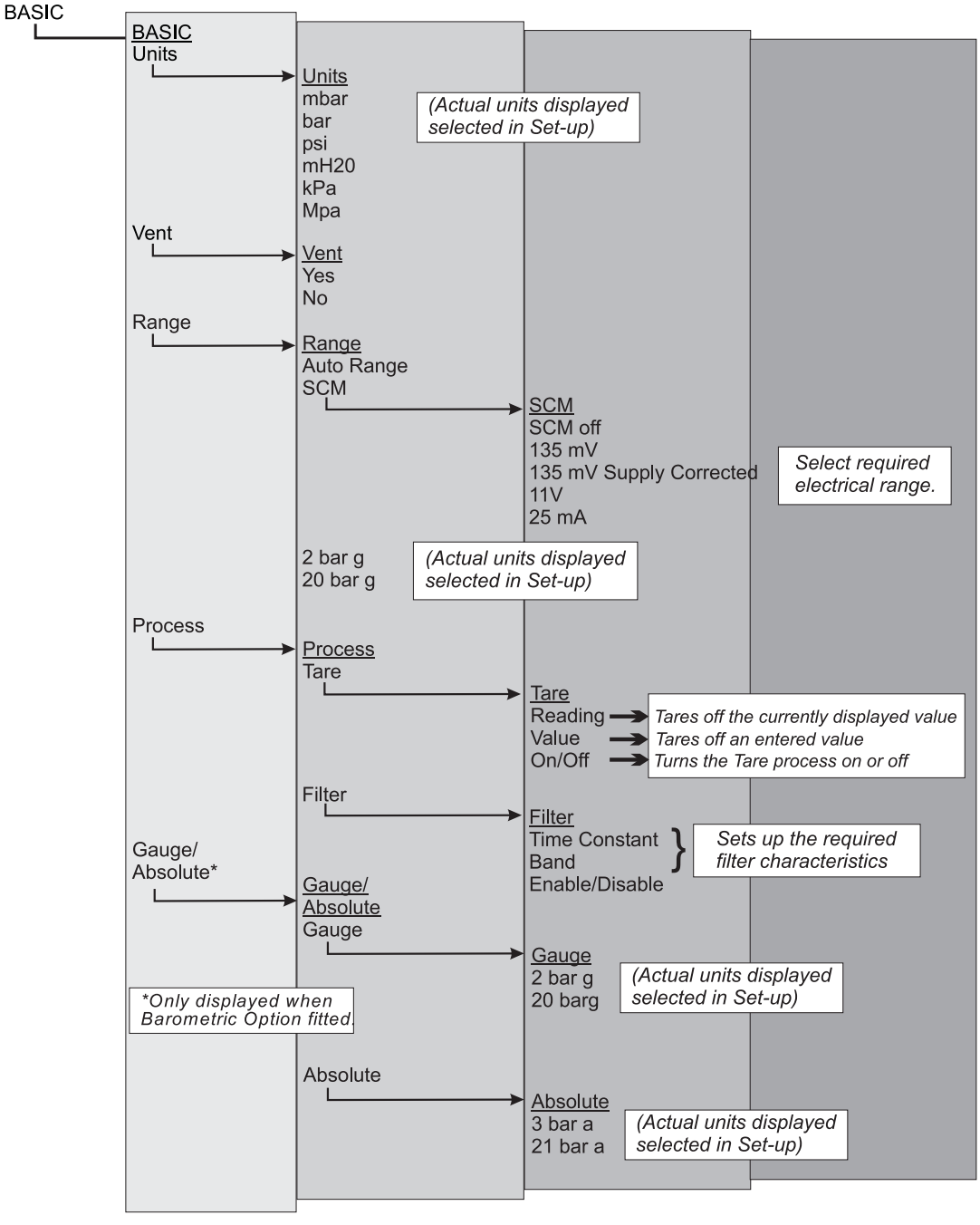
With the Aim CAS and the Rate set, press **Control** again to start the change to the CAS Aim at a rate of change set in CAS control mode.

Go to Ground

- Pressing this soft-key option makes the instrument control the airspeed to ZERO (Mach = 0).

3.7 Sensor Calibration Module Option

The SCM option module provides an interface for the direct connection of a wide variety of pressure transducers/transmitters. When connected, the DPI 515 instrument with the supporting SCM software can be used to calibrate these devices.

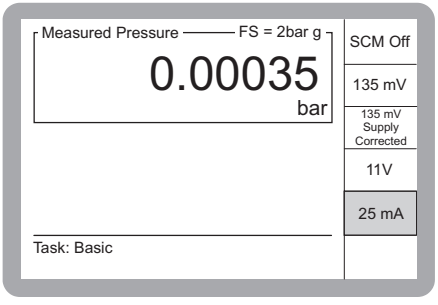


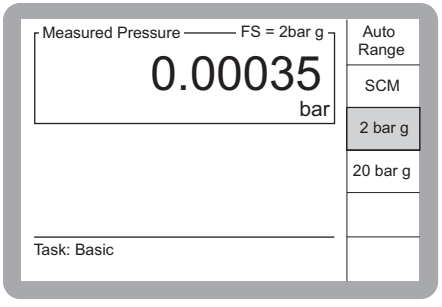
A rear panel, 15-way D-Type connector provides the outputs/inputs comprising two regulated power supply outputs, 24V for current loop applications, a protected extension of the internal 24V supply and a regulated 10V dc supply for the excitation of external transducers, refer to Section 2 Installation.

SCM Option Task

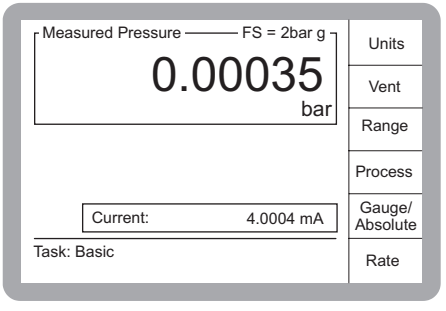
Enter the SCM option from the Basic Task by selecting **Range** and one of the SCM test options **(135 mV, 135 mV Supply Corrected, 11V or 25mA)** and proceed as follows:

1. Press **Range** and select the required range for the UUT (e.g.) **2 bar g**. Press **Range** again, followed by **SCM** and then select the appropriate SCM function (e.g.) **25 mA.**

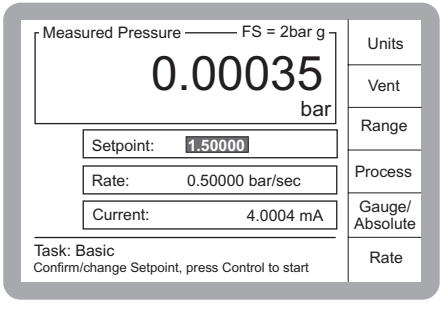




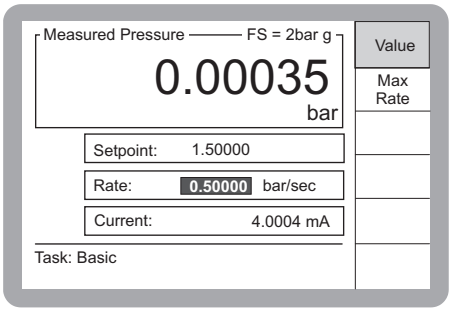
2. After selection of SCM function, the display shows. the transmitter output. Press **Control** to display **set-point** and **Rate** setting windows.



3. Set the required set-point, either by direct entry from the key-pad, followed by **Enter** or by rotating the Jog control, followed by **Enter**.

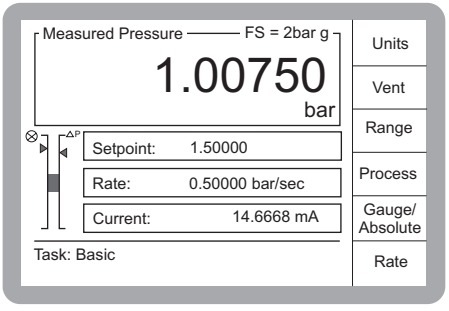


4. Press the **Rate** key. Select the required rate of change of pressure, either by direct entry from the key-pad, followed by **Enter** or by rotating the jog control followed by **Enter**. Alternatively, select **MAX** for maximum rate of change.



5. Press **Control** to start the test. The display shows the activity monitor and the instrument controls the applied pressure to the set-point at the preset rate.

6. At the end of testing enter a set-point of zero (or ambient pressure) to safely return to ground pressure at a controlled (timed) rate.



4 Maintenance

4.1 Introduction

This section contains the routine maintenance and procedures to replace components detailed in Section 5, Testing and Fault Finding and listed in Table 4.2.

Table 4.1 - Maintenance Tasks

Task	Period
Visual Inspection	Daily, before use
Cleaning	Weekly*
Test	Before use
Calibration	12 months

** may change depends on usage (e.g., rack mounted, bench top) and environment (e.g., humidity, dust).*

4.2 Visual Inspection

Inspect the external of the instrument, and associated equipment, for obvious signs of damage, dirt, and ingress of moisture. If necessary, clean the instrument as detailed below.

4.3 Cleaning

Clean the instrument every week. Clean the front panel with a damp lint-free cloth and mild detergent.

Caution: Do not use solvents for cleaning.

4.4 Calibration

The instrument should be withdrawn from service and returned to the manufacturer or calibration facility.

To find the date of the last calibration, press SETUP/Status/Calibration history. Do not use an instrument with out-of-date calibration.

4.5 Replacement Parts

Use only the replacement parts listed in Table 4.2.

WARNING:

ISOLATE THE INSTRUMENT POWER SUPPLIES BEFORE REMOVING THE COVERS, WITH POWER APPLIED THE INSTRUMENT CONTAINS LETHAL VOLTAGES.

Caution:

This instrument contains static sensitive components, handle with extreme care.

Table 4.2 - Replacement Parts List

Part number	Description
-	Fuse T2.0A
176-066	Control Valve (0 to 10 bar) [0 to 150 psi]
176-067	Switching Valve (0 to 10 bar) [0 to 150 psi]
079-061	Bolts, M3 socket head, high tensile steel countersunk
176-065	Control Valve (>10 to 70 bar) [>150 to 1000 psi]
176-067	Switching Valve (>10 to 70 bar)[>150 to 1000 psi]
079-061	Bolts, M3 socket head, high tensile steel countersunk
176-072	Control Valve (70 to 210 bar) [1000 to 3000 psi]
-	Switching Valve (not fitted)
079-030	Bolts, M4 socket head, high tensile steel countersunk

4.6 Fuse Replacement (Fig 4-1)

Replace the fuse when detailed in Section 5, Testing and Fault Finding:

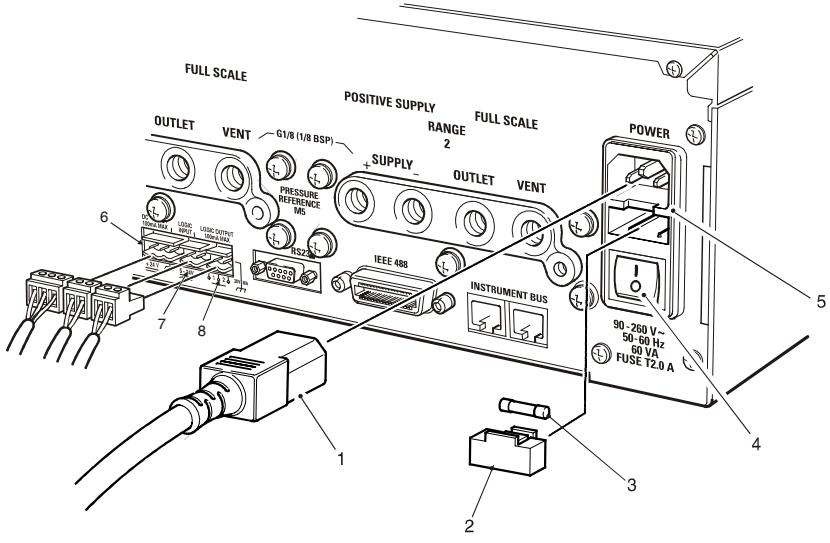
- Set the power switch (4) to OFF.
- Isolate the power supply to the instrument and disconnect the IEC power supply connector (1).

Note: *To gain access to rack-mounted instruments, it may be necessary to partially or completely withdraw the instrument. Isolate pneumatic supplies and de-pressurise all pressure supply inlet and outlet lines.*

- Remove the fuse carrier (2) from the power supply input socket assembly (5) and replace the fuse cartridge.

Note: *Fit the correct type of fuse detailed in Table 4-2.*

- Refit the fuse carrier (2) in the power supply inlet socket assembly (5).
- Reconnect the IEC power supply connector (1). Refit and reconnect rack-mounted units as detailed in Section 2 Installation.
- Switch on the power supply and set the power supply switch to ON. The instrument should now be operational.
- If the fuse blows immediately on switch-on, contact the manufacturer or Service Agent.



1	IEC power supply connector	2	Fuse carrier	3	Fuse
4	Power supply switch	5	Power supply inlet socket assembly		

Figure 4-1, Power Supply Fuse Replacement

4.7 Valve Replacement

Replace a valve when detailed in Section 5, Testing and Fault Finding:

Procedure

Full-scale pressures below 70 bar [1000 psi] (Figure 4-2 and 4-4)

A similar valve replacement procedure applies to all the valves located on this manifold:

Note: *The Apply and Release control valves are a matched pair, do NOT replace single valves.*

(a) Disconnect the supply pressure and vent all pressure from the instrument.

(b) Switch off the controller and isolate the power supply.

(c) Remove the instrument top cover by removing the three securing screws from the top edge of the rear panel, sliding the cover back and then up.

(d) Identify the valve to be replaced from Figure 4-2.

(e) Unscrew the valve solenoid locking ring (1) and remove the locking ring and the lock washer (2). Lift the solenoid (3) clear of the valve body (5).

Note: *There is no need to disconnect the electrical connections to the solenoid.*

(f) Remove the four, M3 socket head, high tensile steel countersunk bolts (9), securing the valve body (5) to the manifold block (8) and lift the valve body clear of the manifold. Discard the four, M3 socket head HTS CSK bolts (9).

Note: *Do not re-use the original* M3 socket head HTS CSK bolts (9) *and only use the replacement parts listed in Table 4-2*.

(g) Wipe the surface of the manifold clean.

(h) Ensure that the valve seating area on the manifold block is clean and place the new valve body (5) into position over the fixing holes.

(i) Insert the M3 socket head HTS CSK bolts (9) and initially, screw in finger tight.

(j) Carefully torque tighten in sequence to 1.2 Nm (10.62 lbf in) the M3 socket head HTS CSK bolts (9).

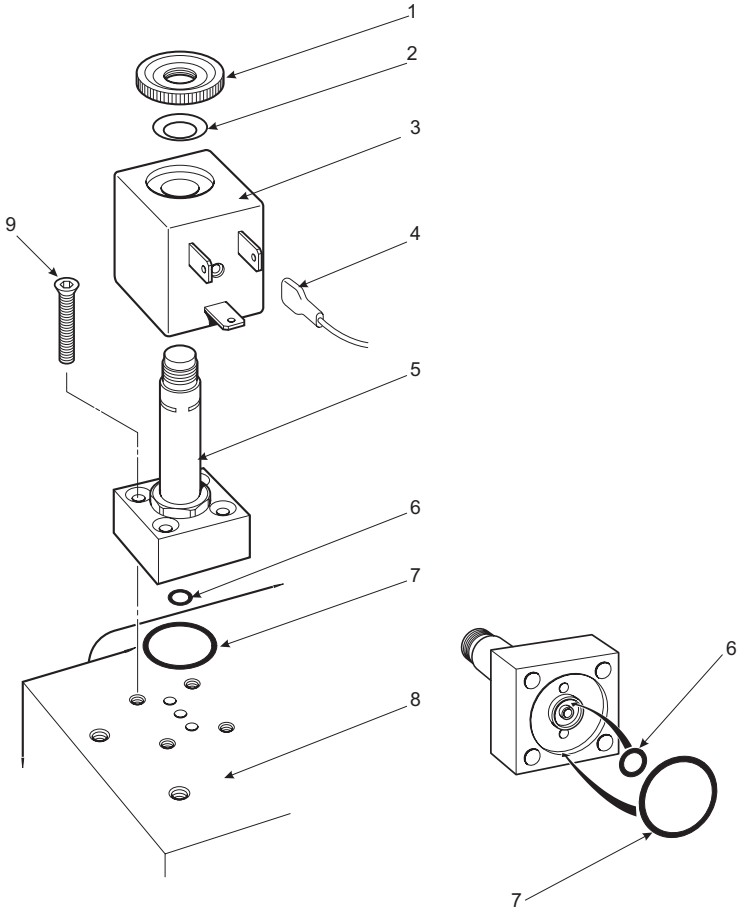
(k) Unless the valve solenoid is faulty, refit the solenoid (3) over the valve body (5), replace the lock washer (2) and tighten the locking ring (1).

Note: *If the spade terminal connectors (4) have become disconnected from the solenoid, push the connectors back onto the solenoid terminals. The connections to each valve are colour coded (see Figure 4.2).*

(l) Refit the top cover of the instrument and reconnect the power supply and the input and output pneumatic supplies.

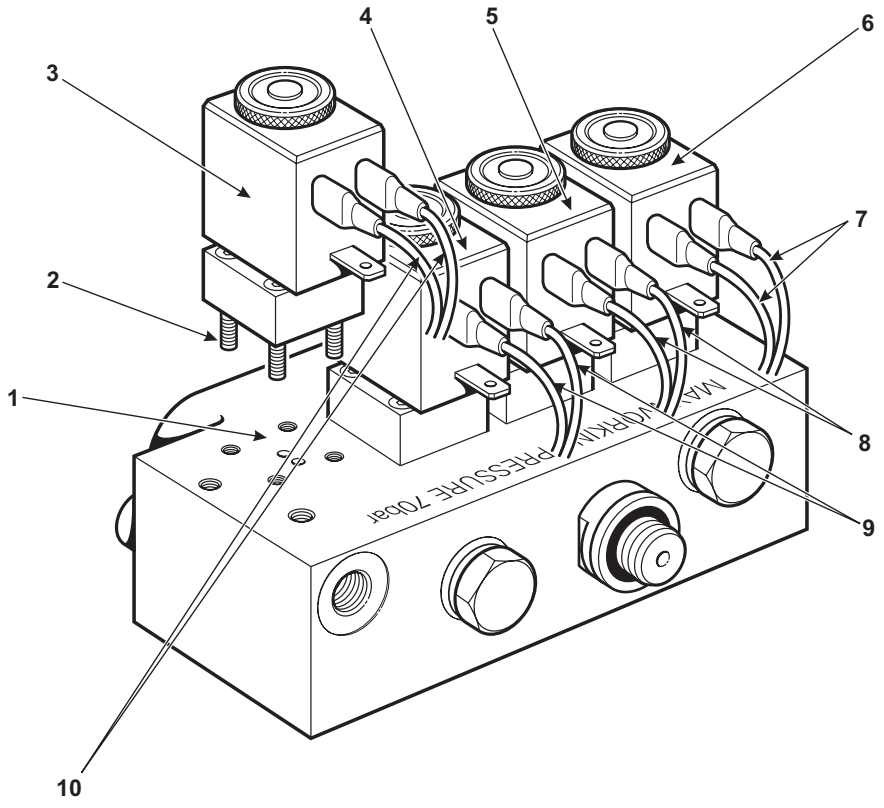
(m) Switch on the instrument and carry out a leak test (see Section 3).

(n) Carry out the valve correction procedure as detailed in Section 4.4.



1	Solenoid locking ring	2	Washer	3	Solenoid
4	Terminal, spade	5	Valve body	6	O-ring
7	O-ring	8	Manifold	9	M3 socket head HTS CSK bolt

Figure 4-2, Low Pressure Manifold Valve Replacement



1	Manifold	2	M3 socket head HTS CSK bolt	3	Zero valve assembly
4	Isolation valve assembly	5	Release control valve	6	Apply control valve
7	Brown cables	8	Red cables	9	Orange cables
10	Yellow cables				

Figure 4-3, 0-70 bar (0-1000 psi) Manifold Assembly

Procedure

Full-scale pressures from 70 to 210 bar [1000 to 3000 psi] (Figure 4-4 and 4-5)

The valve replacement procedure, which is the same for both valves, is as follows.

Note: *The Apply and Release control valves are a matched pair, do NOT replace single valves.*

(a) Disconnect the supply pressure and vent all pressure from the instrument.

(b) Switch off the controller and isolate the incoming power supply.

(c) Remove the instrument top cover by removing the three securing screws from the top edge of the rear panel, sliding the cover back and then up.

(d) Identify the valves to be replaced from Figure 4.5.

(e) Unscrew the valve solenoid clamp nut (1) and remove it. Lift the solenoid (2) clear of the valve body (4).

Note: *Only disconnect the solenoid when replacing the solenoid. Leave the solenoid electrically (3) connected for all other operations.*

(f) Remove and discard the four, M4 socket head, high tensile steel countersunk bolts (9), securing the valve body (4) to the manifold block (8) and lift the valve body clear of the manifold.

(g) Wipe the surface of the manifold clean.

(h) Make sure the valve seating area on the manifold block is clean. Place the new valve body (4) in position, using the spigot (5) to locate the valve.

(i) Insert four new M4 socket head HTS CSK bolts (9) and initially, tighten finger-tight.

Note: *Do not re-use the original M4 socket head HTS CSK bolts (9) and use only the replacement parts specified in Table 2.*

(j) Carefully torque tighten in sequence to 2.0 Nm (17.7 lbf in) the M4 socket head HTS CSK bolts (9).

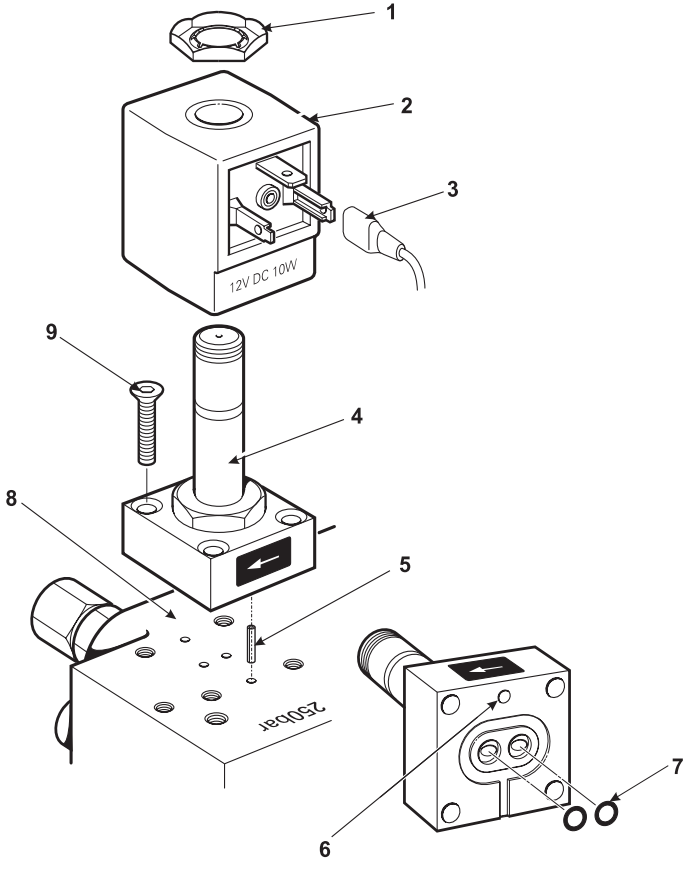
(k) Unless the valve solenoid is faulty, refit the solenoid (2) over the valve body (4), and tighten the locking nut (1).

Note: *If the spade terminal connectors (4) have become disconnected from the solenoid, push the connectors back onto the solenoid terminals. The connections to each valve are colour coded (see Figure 4.5).*

(l) Refit the top cover of the instrument and reconnect the power supply and the input and output pneumatic supplies.

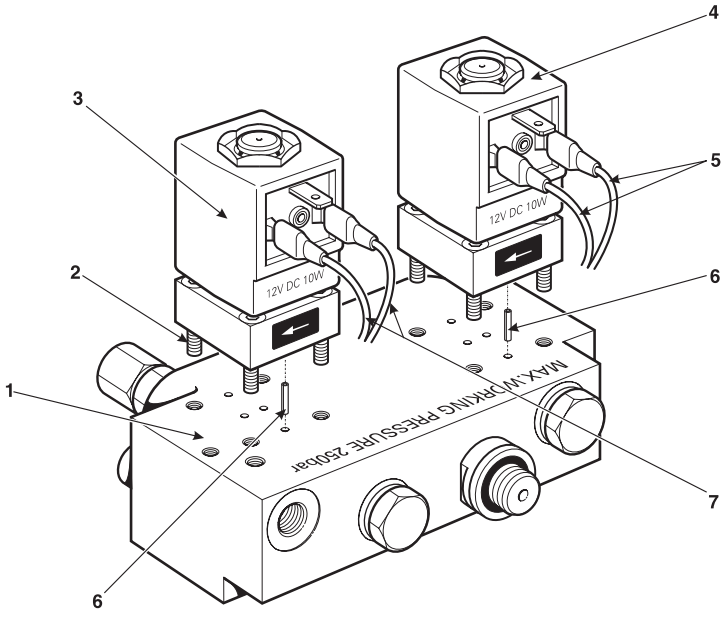
(m) Switch on the instrument and carry out a standard serviceability test (see Section 5, Testing and Fault Finding).

(n Carry out the valve correction procedure as detailed in Section 4.8.



1	Solenoid locking ring	2	Solenoid	3	Terminal, spade
4	Valve body	5	Spigot	6	Spigot location
7	O-ring	8	Manifold	9	M3 socket head HTS CSK bolt

Figure 4-4, High Pressure Manifold Valve Replacement



1	Manifold	2	M3 socket head HTS CSK bolt	3	Release control valve
4	Apply control valve	5	Brown cables	6	Locating spigot
7	Red cables				

Figure 4-5, >70 bar to 210 bar [1000 to 3000 psi] Manifold Assembly

4.8 Valve correction

This facility, in the calibration menu, adjusts the pressure controller valves of the highest possible performance. When pneumatic supply pressure sources are changed, a valve correction must be carried out. If the controller performance has deteriorated use this facility to restore performance.

Notes

1. *The pneumatic supplies must meet the standard stated in the specification. This valve correction feature makes adjustments to compensate for the pneumatic supplies.*

2. *When using valve correction, a vacuum pump must be connected to the negative supply port and a blanking plug fitted to the Outlet port.*

Procedure

***Note**: Before using this facility, carry out a leak test and check for correct pneumatic supply pressures.*

(1) Select **Range**, select the range to be corrected.

(2) Select **Set-up/Calibration**.

(3) Enter **PIN** and press **Enter**.

(4) Select **Valve Correction** and, if the supply pressures are correct, select **YES**.

(5) The instrument starts the process of collecting data by measuring the performance of the 'apply' valves and then the 'release' valves.

***Note:** This process takes between 10 minutes and 1 hour (approximately) to complete and depends on the pressure range. The higher the range the longer the process.*

(6) When the instrument completes the data collecting process, the display shows a message with a prompt to **Accept/Repeat** or **Quit Valve Correction**.

(7) Selecting **Accept**, the instrument stores the new data and, when next selected, applies these corrections to the controller.

(8) Selecting **Repeat** starts the process again.

(9) Selecting **Quit Valve Correction** returns the instrument to the calibration menu without storing the new data.

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5 Testing and Fault Finding

5.1 Introduction

- The DPI 515 contains a built-in, self-test and diagnosis system that continuously monitors the performance of the unit. At power-up, the system performs a self-test.
- This section details the standard serviceability test. A fault finding table lists possible faults, the probable cause and the procedures to rectify the fault.

5.2 Standard Serviceability Test

The following procedure shows if the unit is serviceable and checks functions and facilities of the DPI 515. In this procedure:
All key presses are highlighted in BOLD and shown as identified on the front panel.
Key presses inside brackets e.g., (units), are soft key presses indicated on the screen.

Procedure

1. Connect the instrument as detailed in Section 2, Installation. Connect a UUT or fit blanks to the output port or ports.

2. Select **Basic Task** and proceed as follows.

   (a) Select the required pressure range and units of pressure measurement from the soft boxes displayed.
   (b) Press the **Control** key. The display changes to show set-point and rate.
   (c) The message window shows **Confirm/Change set-point,** and **press Control to start**.
   (d) Press the **Rate** soft key, then press **Value**.
   (e) Enter the required rate of pressure change on the key-pad, e.g. 0.1 bar/s (1.5 psi), and press **Enter.** The display returns to the Control mode screen.
   (f) Use the key-pad to select the required set-point e.g. 1.5 bar (22 psi) and press **Control.**

3. The screen display changes as follows:
   - The status window changes to show **Changing Pressure.**
   - The runner icon (if enabled) activates.
   - The activity indicator (if enabled) displays the current pressure and controller condition.

4. When the controller achieves the selected pressure set-point, the screen display changes as follows:
   - The status window changes to **Controlled Pressure.**
   - The runner icon in a standing position.
   - The activity indicator shows the controlled pressure within the in-limits tolerance.

Caution: ***Using the vent function may damage rate sensitive equipment connected to this controller. Use the controller to reduce pressure to ambient/zero before selecting VENT.***

(g) Press the **Vent** soft key to reduce the system pressure to near atmospheric pressure. This feature should be used to reduce system pressure to a safe value before disconnecting the Unit Under Test.

Notes:

1. The vent opens for approximately 5 to 10 seconds.

2. Always use the vent function before disconnecting pressure equipment from the outlet port.

(h) Press the **measure** key to switch off the controller.

5.3 Fault Finding

Check the fault conditions and solutions listed in the following table before contacting gesensing.com or a recommended Service Agent.

Fault	Solution
Power supply connected, display not lit.	Check rear panel switch set to on. Check fuse and, if necessary, replace Check power supply fuse (UK models only) and, if necessary, replace.
24 V DC output intermittent.	Internal self-resetting fuse operating. Reduce load current to specified value.
Instruments functions, but does not reach all set-points.	Check pneumatic supplies for correct pressures. Check system for leaks.
In measure mode with output port sealed, the pressure continues to increase or decrease.	Increasing pressure, leaking Apply control valve. Decreasing pressure, leaking Release control valve. Confirm by isolating supplies. *Contact approved service agent.*
Instrument stops in Control mode when controlling to a new pressure.	Fill time-out enabled but time-out period setting too short.
Instrument stops in Control mode when controlling at a new pressure.	Dwell time-out enabled but timeout period setting too short.
Instrument will not zero, does not achieve set-point, control stability message.	Blocked or leaking zero valve. Check for blockage. Check, clean or replace zero valve.
Instrument controlling to set-point, no pneumatic output	Blocked isolation valve. Check for blockage of isolation valve. Check, clean or replace isolation valve.
Erratic or inaccurate zero	Leaking isolation valve. Check, clean or replace isolation valve.
Increased gas consumption. Unstable control at set-point or does not achieve set-point.	System internal leak. Carry out leak test at full-scale pressure. Worn control valve. Replace control valves.

Table 5.1 - Fault Location

Note: *In normal controlled pressure conditions the status indicator stays within the tolerance band. If the status indicator moves outside the tolerance band this can be cause by either a leak in the system or a change in supply pressure.When the controlled pressure stays status indicator is within tolerance band the pressure at the outlet is within the limits set in Set-up/Supervisor/ In Limits. If the controller status indicator is outside the tolerance band, then this could indicate either a leak in the system or that the supply pressure differs from the pressure for which the control valves have been characterised.*

5.4 Approved Service Agents

For the list of service centres
visit out web site:

www.gesensing.com

6 Reference and Specification

6.1 Installation notes

The DPI 515 pressure controller/calibrator can be fitted with one or two pressure ranges. Each range requires an independent pressure supply and set of connections with the exception of the reference connection this provides a reference to atmosphere for gauge sensors.

Each range must have the correct supply pressure and a suitable supply medium (see 6-7, Specification). The supply gas density and type does not affect the accuracy of pressure measurement.

Gas supply

Each range requires a positive supply of 110% of range. For absolute or negative gauge operation or if the installation requires a fast response around atmospheric pressure a vacuum source must be connected to the negative supply (vent port for units above 70 bar [1000 psi]).
The positive pressure supply requires a gas regulator for each range. The range supply rating label gives the required supply value. see recommended regulators in 6.8.

Supply conditioning equipment

Supplies should be provided with an isolation valve and any other necessary conditioning equipment. Some supplies may need the removal of water, oil or particulate contamination. Any water in the compressed gas supply will be in vapour form, i.e. non-condensing and must be removed using a mist filter. Oil must be completely removed as this causes a rapid deterioration of the control valve performance. The compressed gas supply must not contain particulates and must be removed using a particulate filter. Do not use a compressed gas supply containing corrosive material.

Systems without a negative supply

Without a negative supply (vacuum pump), release the positive pressure from the system to atmosphere through the negative supply port.
The release from the negative port may be piped away to a place where this discharge causes no disturbance or hazard. Alternatively, a silencer may be fitted to the negative supply port to reduce acoustic noise and air flow. On units above 70 bar [1000 psi], the vent port provides the same function as the negative supply port.

The need for a negative supply

General

Supply pressures there must be a difference of 10% of full-scale between the supply pressure and the maximum outlet pressure. When operating at positive or negative full-scale, there must be a pressure difference between supply and outlet to cause a gas flow.

Operating near atmospheric pressure or below

Any controller operating near atmospheric pressure or below requires a vacuum pump or other negative supply connected to the negative supply port for optimum performance. Without a vacuum supply, as the outlet pressure approaches atmospheric pressure, the differential pressure approaches zero resulting in a reduced flow to the outlet.
Reduced flow causes an increase in the time to control to atmosphere, especially with large user volumes, and an increased overshoot at low pressures. With a small zero offset stored in the instrument, the controller may aim for a pressure slightly below atmospheric pressure and fail to reach this value.

With high pressure instruments (above 70 bar [1000 psi]) the resolution around atmospheric pressure decreases and the overshoot and added time to reach zero are not significant.

Conclusion

Use a vacuum supply for:

- Absolute ranges
- Negative gauge ranges

A vacuum supply improves:

- Time to reduce system pressure at pressures below 2 bar (30 psi), full-scale.
- Control stability near atmospheric pressure.
- Overshoot at low pressures.

6.2 Operational requirements

Special Note
A contaminated UUT must have additional in-line filters connected between the outlet port and the UUT to prevent contamination of the instrument.

Negative or Vacuum Supply

The instrument must be configured to work with or without a negative supply, see **Setup/ Supervisor/Negative supply**.

The negative supply for absolute control does not need to be regulated. The output (recommended) of the vacuum pump should be less than 35 mbar (1.04 inHg) absolute. Any variation between this and absolute zero will have little effect on instrument operation.

Oil Contamination

Precautions must be taken against oil transfer to the instrument.

Recommended

1. A venting solenoid connected to atmosphere and the pump. When the pump supply is switched off, the valve opens allowing atmospheric pressure to enter the pump directly rather than through the pipe to the instrument.

   Note: *Without this arrangement, oil may progressively move up the supply pipe and into the instrument.*

Pump Performance

Recommended for ranges above 2 bar (30 psi) gauge, positive full-scale

1. When installing a vacuum supply protect the vacuum pump against the discharge of positive pressure by the controller into the vacuum pump. This may result in reducing vacuum pump performance.

2. Use a release valve in the negative supply to vent pressure to atmosphere if the vacuum pressure rises above atmospheric pressure. The release valve should be installed on the instrument side of a volume which is approximately equal to the system volume. The volume slows any rapid pressure rise giving the release valve time to open and the pump time to reduce the pressure.

   Note: *A wide bore vacuum pipe can have enough volume and, used with a release valve, could provide the necessary overpressure protection.*

Venting

Either a zero or vent operation uses the vent port.

Vent

The system gas at the outlet pressure can be released from the vent port. Unrestricted gas flow occurs in this operation.

Recommended

Use a controlled method to reduce the system pressure, at a controlled rate, to near atmospheric pressure then select vent.

Zero

During a zero operation only the internal volume of the instrument vents to atmosphere.

Recommended

Do not obstruct the vent port. To reduce acoustic noise and safely dampen gas exhaust, a silencer may be fitted to the vent port.

Outlet port

Caution:

Ranges above 70 bar (1000 psi) must not be connected to the outlet of any other range. Outlet ports of ranges above 70 bar (1000 psi) must be connected separately to UUT.

The outlet port provides the controlled pressure output to the unit under test (UUT). Each range has one outlet port. The outlet ports on a dual range instrument, up to 70 bar (1000 psi), can be connected together and then connected to the UUT. Configure the instrument in **SETUP/Supervisor/System/Stand alone**.

Reference Port

The reference port provides the negative pressure to the gauge sensor and to the barometric reference (Option A). Gauge sensors (range 1 or range 2) use this port identified as "Reference Connection". For gauge sensors (without a barometric reference) small pressures can be applied (see 6-7, Specification). All other pressure measurement requires the port to be opened to atmosphere.

When in gauge mode, the instrument shows the pressure difference between the reference and outlet ports.

Note: *This is not true differential operation as there is no differential calibration of the sensor.*

The transducer of the barometric reference option senses atmospheric pressure via the reference port, when enabled the port MUST be open to atmosphere.

The reference connection should be actively used for precision low pressure measurement. The instrument controls pressure relative to the pressure at the reference port. An atmospheric pressure change causes the controller to adjust the pressure and appears at

the pressure outlet as apparent instability. To keep a stable controlled pressure, the reference port should be connected to a large volume with a small leak to atmosphere. This dampens any atmospheric pressure changes.

The controller and UUT references should be connected together to provide a common reference to atmosphere.

6.3 Basic task

When used for the first time, the instrument powers-up in basic task measure mode, giving access to screen configuration as follows.

Note: *After the first time, the instrument powers-up in the last selected task before switching off.*

Units

- Press the **Units** soft key to display a short list of six pressure units, taken from a larger list, which can be accessed under **Set-up/User/Units.**
- Special units can also be defined by accessing **Set-up/User/User Defined Units**.

Vent

- Press the **Vent** soft key to reduce the system pressure to near atmospheric pressure. Use this feature to reduce system pressure to a safe value before disconnecting the Unit Under Test.

Range

- Press the **Range** soft key to select the Control/Measurement full-scale range (only used on dual range instruments).
- In **Autorange** operation, the controller selects the most appropriate range to provide the pressure for the set-point selected. This only works with dual range units below 70 bar (1000 psi).
- **Autorange** only appears as an option if configured for connected ranges under **Setup/Supervisor/System/Standalone**.

Process

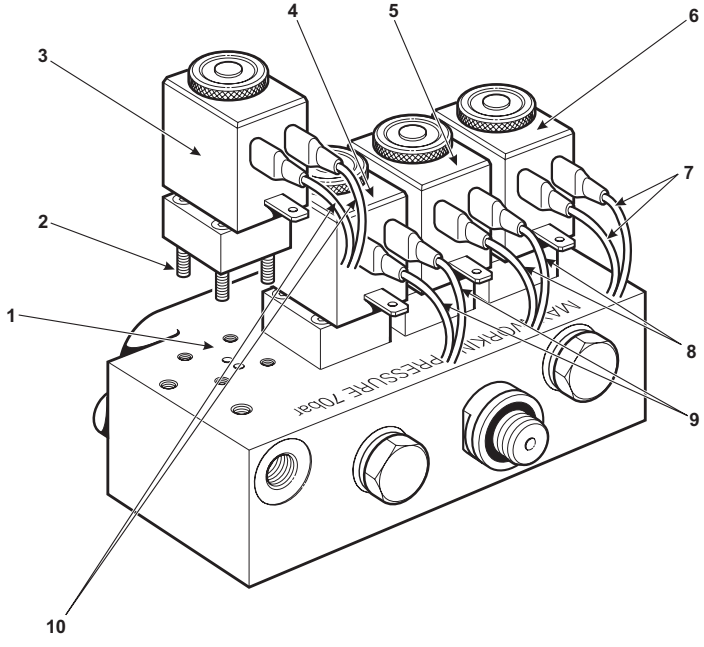
Selects display processing features that change the reading, as follows:

- **Filter:** The reading can be filtered by a custom low pass filter or the filter can be disabled **(default disabled)**. Although the controller always works at a speed independent of the resolution and filter, applying the filter appears to slow the controller action.
- **Tare:** A specific tare value can be selected or the current displayed pressure reading can be "captured" as the tare value. The display shows the selected tare value in the pressure window.
- **%:** Pressure can be expressed as a percentage of full-scale or as a percentage of a specified span.

6.4 Valve Assembly Description

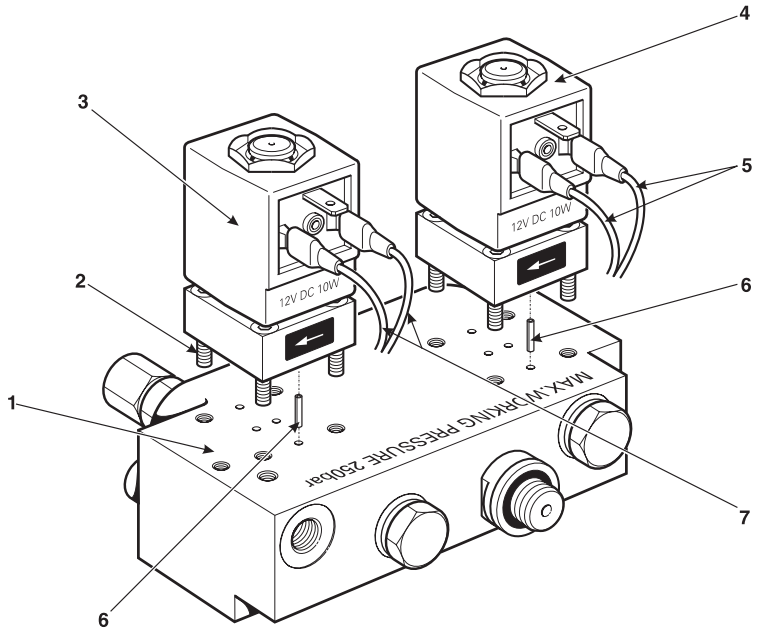
Located on the inside of the rear panel, a manifold assembly provides pressure measurement and control for a pressure range. Each assembly comprises a metallic manifold, pressure transducers and solenoid actuated pneumatic valves. Every manifold assembly has two control valves (termed 'apply and release'). Low pressure (70 bar [1000 psi] and below) manifold assemblies have two 'switching' valves (termed 'zero' and 'isolation').

There are two different types of manifold assembly a low pressure manifold (pressures up to 70 bar [1000 psi]) and a high pressure manifold (pressures >70 bar to 210 bar [>1000 to 3000 psi]).



1	Manifold	2	High tensile fixing screws (4 per valve)		
3	Zero switching valve	4	Isolation switching valve	5	Release control valve
6	Apply control valve	7	Brown cables	8	Red cables
9	Orange cables	10	Yellow cables		

Figure 6-1, 0-70 bar (0-1000 psi) Manifold Assembly



1	Manifold	2	High tensile fixing screws (4 per valve)		
3	Release control valve	4	Apply control valve	5	Brown cables
6	Locating spigot	7	Red cables		

Figure 6-2, >70 bar to 210 bar (>1000 to 3000 psi) Manifold Assembly

6.5 User Set-up

Zero

During use, the instrument pressure sensor can show small zero shifts caused by time and temperature changes. A regular zeroing increases measuring precision.

A gauge pressure sensor can be zeroed immediately using the **Set-up/User/Zero/Zero a range** or **Zero All** function or by using the **Auto Zero** function to fully automate the process. The auto-zero interval needs to be set in hours. On dual range units, **Zero All** zeros both ranges.

Note: *With zero of small user volumes a small positive pressure offset may be seen after a zero operation (maximum 0.2 mbar). This real pressure change, caused by the closure of the zeroing valve in the instrument does not affect precision.*

Units

Use soft keys to select the new units to be displayed in the **Task/Basic/Units** soft boxes.

Display

- Allows the display parameters, ***resolution***, ***brightness*** and ***contrast*** to be adjusted. Resolution should be set to give an appropriate value for the measurement units and precision of the instrument (normal setting - six digits). Too high a resolution may give an unstable reading. If seven digits are selected, then the filter should be used to stabilise the reading.
- Enables and disables the ***runner*** and ***activity indicator*** icons on the task screen as required.

Note: *These display icons have no effect on controller operation.*

Jog Increment

- Sets the resolution of the rotary control for trimming the set-point.

Settling

- Sets how the controller achieves a set-point.
- ***No Overshoot:*** controller changes pressure slowly and does not go beyond set-point.

Note: *This function can be used for UUT that have hysteresis errors.*

- ***Fast:*** controller changes pressure as fast as possible and may go beyond set-point (overshoot).

Note: *Use this function for optimum speed.*

Time & Date

- Sets instrument clock and calendar.

Head Correction

- Corrects display pressure for the height difference between instrument and UUT.

Special Units

- Permits the user to define a set of units by following the screen prompts.
- Up to two special units may be programmed by selecting a Pascal multiplier.
- A five character name can be assigned.

6.6 Supervisor Set-up

The Supervisor menu provides facilities for programming settings. These are usually made during installation as follows:

Note: *A PIN protects the Supervisor menu against unauthorised use. Each instrument on delivery contains the factory set PIN (0268). To continue protecting the supervisor set-up menu the PIN should be changed as soon as possible.*

In Limits

- A tolerance value at the set-point. When the controller achieves the set-point, the instrument controls within this tolerance value. It does not affect controller stability or precision.
- The instrument uses the 'in limits' flag when performing a control task such as Leak Test, Switch Test and Pressure Cycling.

Note: *In remote control (RS232 or IEEE488), the control computer can be used to interrogate the 'in limits' register to confirm the controller has achieved set-point.*

Set-point Limits

- Defines the limits of pressure the user can enter as a set-point (useful for protecting sensitive UUT).
- Limit applies regardless of the pressure range in use.

Lock

- **Lock Jog:**
  - Disables the rotary control. Used when the control might be accidentally operated.
- **Lock Task:**
  - Allows any combination of tasks to be disabled.

Note: *Restricts operation of the instrument to specific tasks or functions, ideal for production procedures.*

Language

- Provides a choice of display messages in English, French, German, Spanish, Italian, Portuguese or Japanese.

PIN

- Changes the Supervisor PIN: enter the existing PIN, then the new PIN and confirmation of the new PIN.

Note: *Confirmation of the new PIN <u>permanently</u> replaces the old PIN. Record this new PIN and keep this record on a safe place.*

Alarms

- One or two pressure alarms can be set. An alarm triggers when the pressure exceeds the High Alarm or falls below the Low Alarm. A buzzer sounds when the alarm triggers and the alarm symbol (bell) appears on the display.

Comms

- Selects a communication port and parameters for operation and, either the RS232 or the IEEE 488 port (only one may be used). The user can select appropriate settings for communicating with the control computer (PC) and the required command protocol.

Note: *Recommended command protocol - SCPI. Publication K257 SCPI Manual can be downloaded from www.DPI515.com*

Power Up

- With Normal selected, the instrument powers up in **Measure** mode.
- With Regulator selected, the instrument powers-up in **Control** mode at a pre-selected set-point value.

Note: *When using Regulator mode, be sure to disable the* ***Idle Timeout*** *feature.*

Timeout

- Presets the times for automatically changing from control to measure mode.

Note: *Controller timeouts can save supply gas, extending control valve life and minimising acoustic noise.*

- **Idle Timeout** starts when the controller achieves the set-point after the set time, the instrument changes to measure mode.
- **Fill Timeout** starts when a new set-point is entered. The controller must achieve the "in-limits" set-point within the fill timeout interval. Not achieving the "in-limits" set-point causes the instrument to change to measure mode.

Note: *This may be a system fault, e.g., a large leak in the system connected to the instrument. The controller can keep the set-point within the in-limits tolerance with small system leaks.*

- **Vent Timeout** starts when **Vent** is selected and allows time for the complete system to de-pressurize to atmospheric pressure.

Note: *Not achieving full de-pressurization may be a system fault.*

Logic Outputs

- Selects the type of response and condition of the two logic outputs. These operate when:
  - Vent command selected.
  - Range change selected.
  - A high or low alarm, high/low activates
  - A command from the control computer (PC) received.

Factory Settings

- Restores instrument settings to factory default.

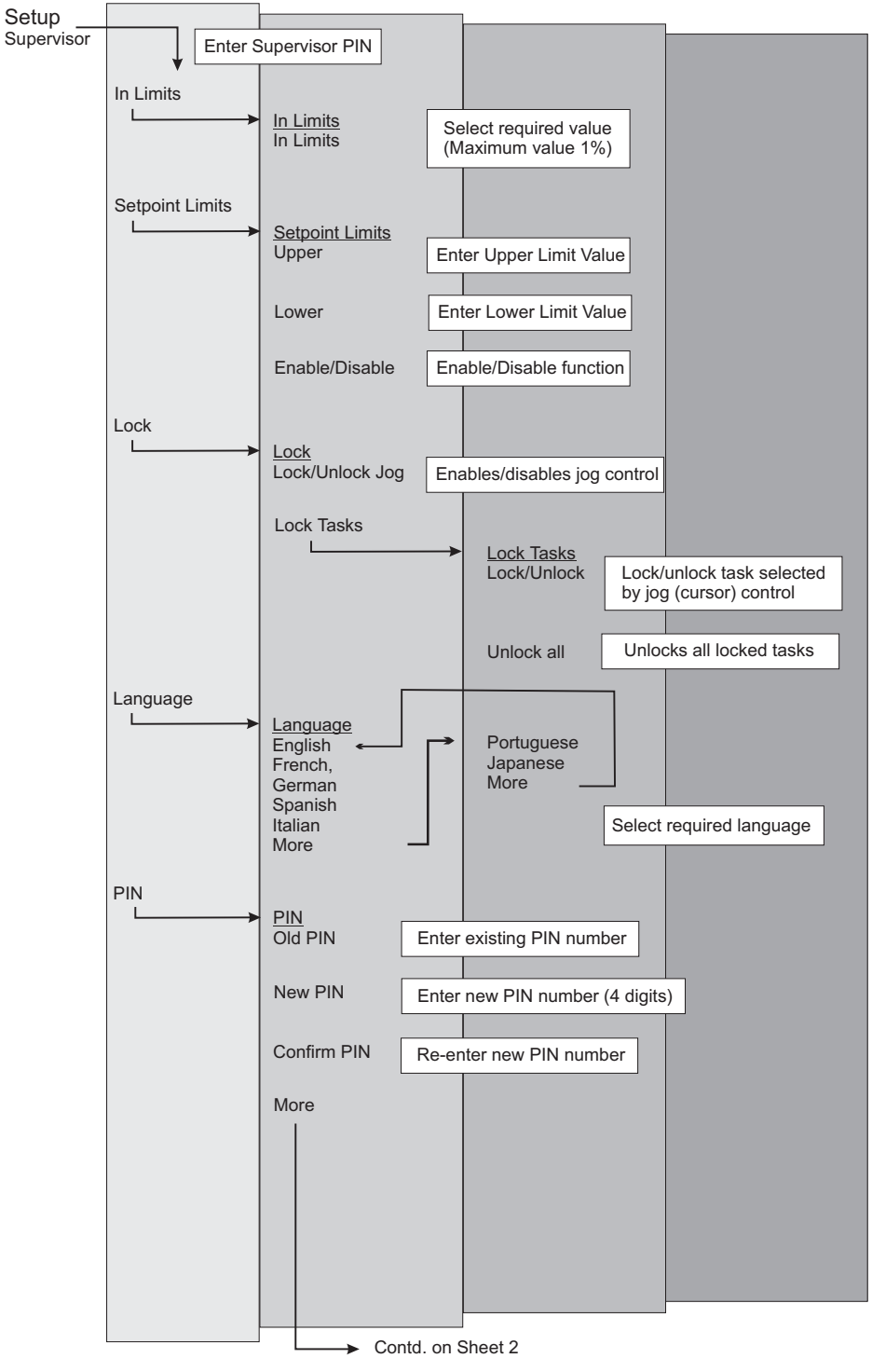
Note: *Does not affect PIN settings.*

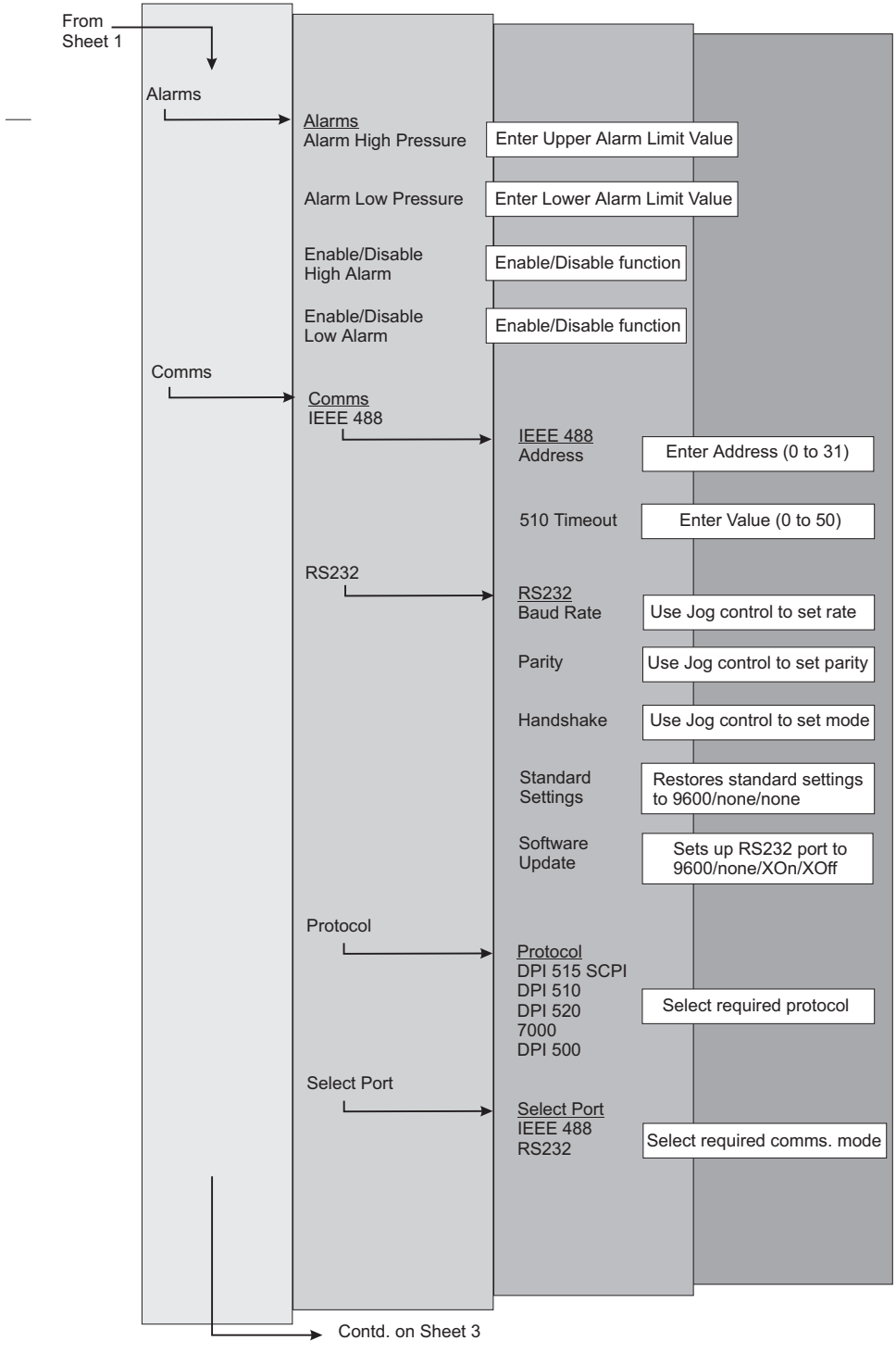
Calibration

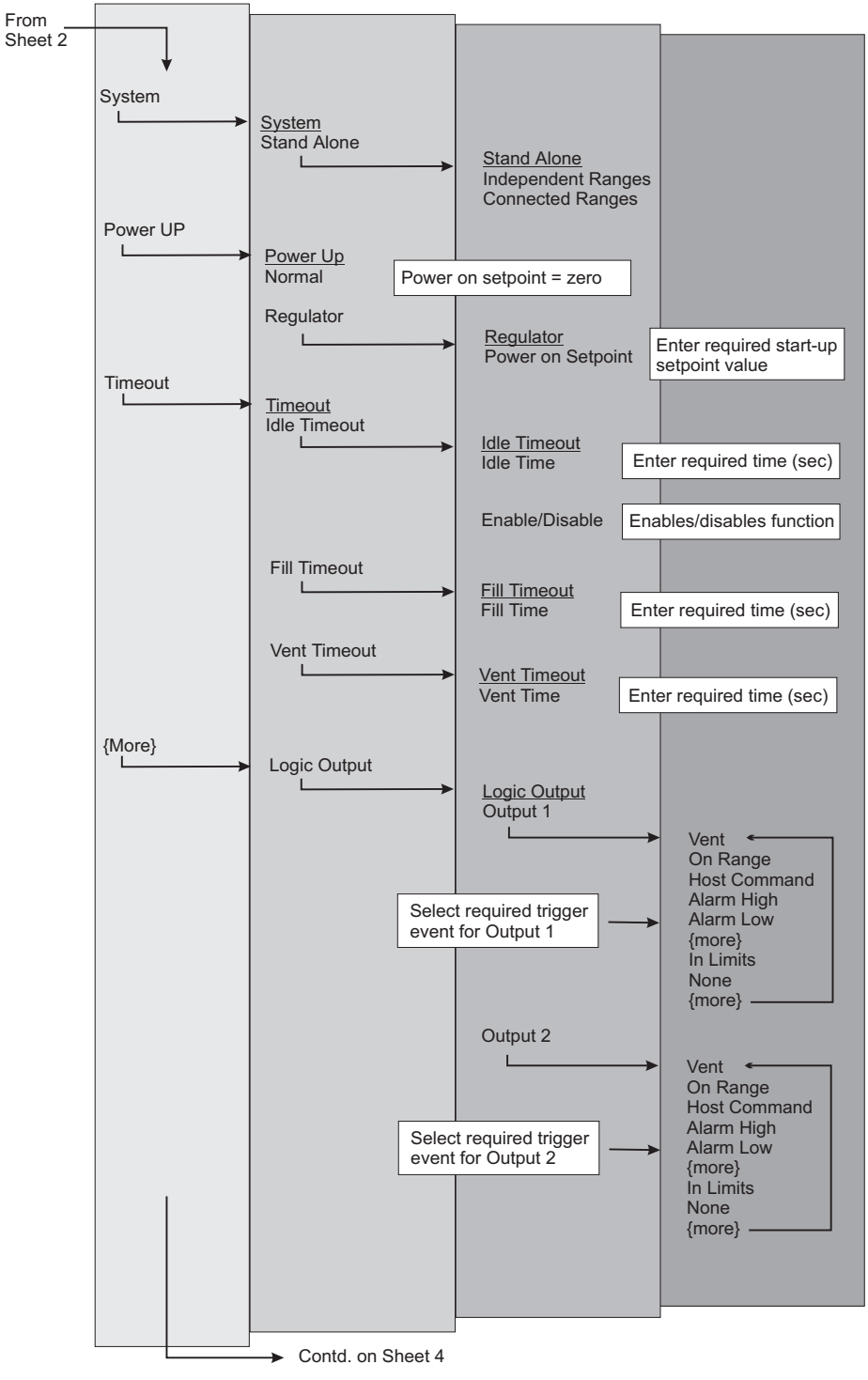
The calibration menu provides facilities for programming settings for maintenance as follows:

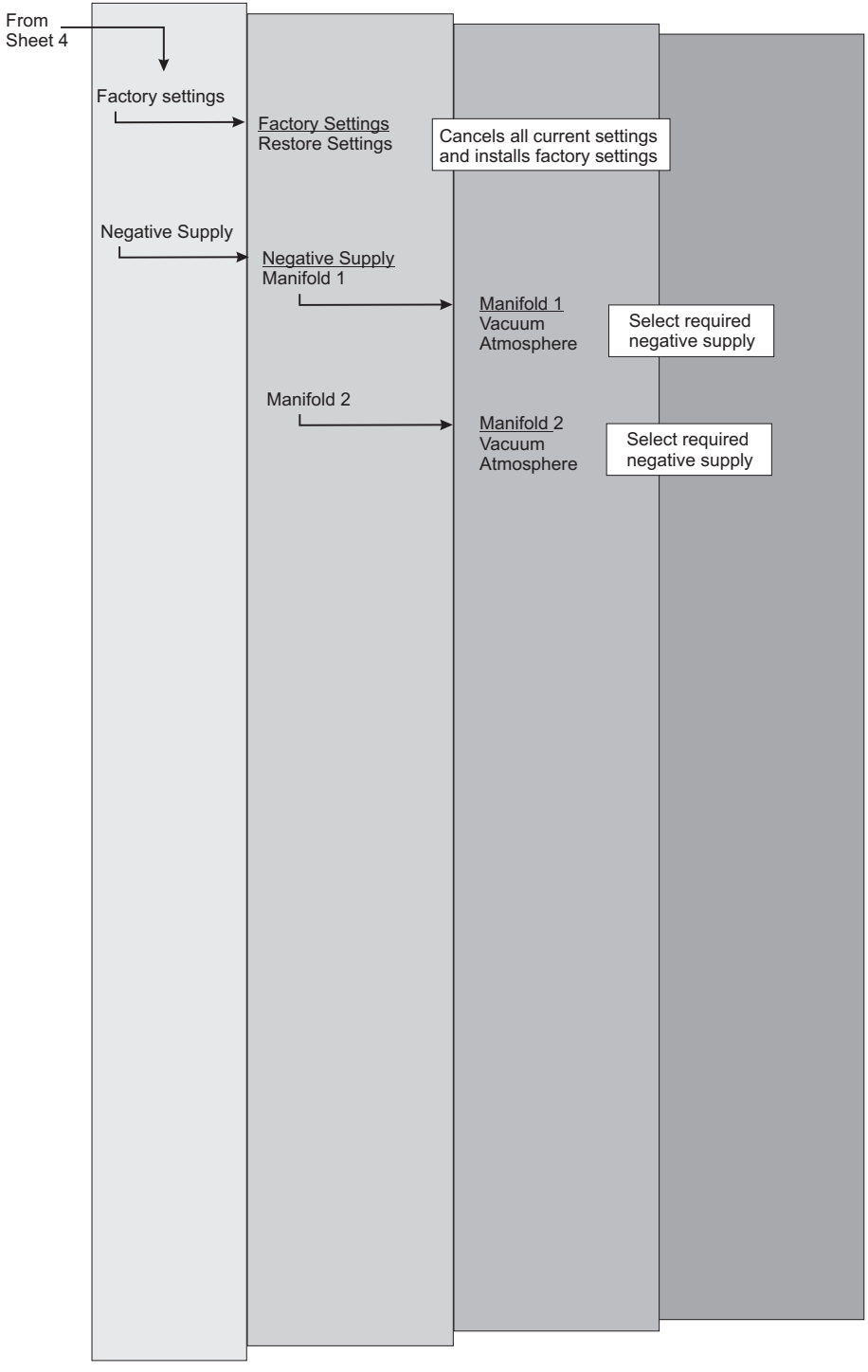
Note: *A PIN protects the Calibration menu against unauthorised use. Each instrument, on delivery, contains the factory set PIN (4321). To continue protecting the supervisor set-up menu, the PIN should be changed as soon as possible.*

- **Change Cal PIN**
  - Changes the Calibration Personal Identification Number (PIN). Enter the existing PIN, the new PIN and confirmation of the new PIN.
- **Sensor Correction**
  - Selects the range for a calibration routine.
- **Valve Correction**
  - Performs valve correction routine.
- The ***Status*** menu provides the user with information about the instrument as follows:
  - Hardware Build.
  - Displays ranges of sensors calibrated with the instrument and the options fitted.
  - Software Build.
  - Displays versions of software for the instrument.
  - Calibration History.
  - Displays a list of instrument calibration dates.


Setup
Supervisor
Enter Supervisor PIN
In Limits
In Limits
In Limits
Select required value
(Maximum value 1%)
Setpoint Limits
Setpoint Limits
Upper
Enter Upper Limit Value
Lower
Enter Lower Limit Value
Enable/Disable
Enable/Disable function
Lock
Lock
Lock/Unlock Jog
Enables/disables jog control
Lock Tasks
Lock Tasks
Lock/Unlock
Lock/unlock task selected
by jog (cursor) control
Unlock all
Unlocks all locked tasks
Language
Language
English
French,
German
Spanish
Italian
More
Portuguese
Japanese
More
Select required language
PIN
PIN
Old PIN
Enter existing PIN number
New PIN
Enter new PIN number (4 digits)
Confirm PIN
Re-enter new PIN number
More
Contd. on Sheet 2


From Sheet 1
Alarms
Alarms
Alarm High Pressure
Enter Upper Alarm Limit Value
Alarm Low Pressure
Enter Lower Alarm Limit Value
Enable/Disable High Alarm
Enable/Disable function
Enable/Disable Low Alarm
Enable/Disable function
Comms
Comms
IEEE 488
IEEE 488
Address
Enter Address (0 to 31)
510 Timeout
Enter Value (0 to 50)
RS232
RS232
Baud Rate
Use Jog control to set rate
Parity
Use Jog control to set parity
Handshake
Use Jog control to set mode
Standard Settings
Restores standard settings to 9600/none/none
Software Update
Sets up RS232 port to 9600/none/XOn/XOff
Protocol
Protocol
DPI 515 SCPI
DPI 510
DPI 520
7000
DPI 500
Select required protocol
Select Port
Select Port
IEEE 488
RS232
Select required comms. mode
Contd. on Sheet 3


From Sheet 2
System
System
Stand Alone
Stand Alone
Independent Ranges
Connected Ranges
Power UP
Power Up
Normal
Power on setpoint = zero
Regulator
Regulator
Power on Setpoint
Enter required start-up setpoint value
Timeout
Timeout
Idle Timeout
Idle Timeout
Idle Time
Enter required time (sec)
Enable/Disable
Enables/disables function
Fill Timeout
Fill Timeout
Fill Time
Enter required time (sec)
Vent Timeout
Vent Timeout
Vent Time
Enter required time (sec)
{More}
Logic Output
Logic Output
Output 1
Vent
On Range
Host Command
Alarm High
Alarm Low
{more}
In Limits
None
{more}
Select required trigger event for Output 1
Output 2
Vent
On Range
Host Command
Alarm High
Alarm Low
{more}
In Limits
None
{more}
Select required trigger event for Output 2
Contd. on Sheet 4


From
Sheet 4
Factory settings
Factory Settings
Restore Settings
Cancels all current settings
and installs factory settings
Negative Supply
Negative Supply
Manifold 1
Manifold 1
Vacuum
Atmosphere
Select required
negative supply
Manifold 2
Manifold 2
Vacuum
Atmosphere
Select required
negative supply

6.7 Communications - instrument emulation

The DPI 515 Precision Pressure Controller/Calibrator can be remotely controlled using the SCPI (Standard Commands for Programmable Instruments) command language. SCPI can be implemented over RS232 or IEEE 488 interfaces. Refer to publication K179 for a complete listing and explanations of these commands.

Partial emulations are provided to give a measure of compatibility with existing Druck instruments the DPI 510 and DPI 520 and the Ruska 7000. For further details, refer to the relevant controller manual available on ge.sensing.com.

B <value>	Set Tare amount
C0	Go to MEASURE mode.
C1	Go to CONTROL mode.
D0, D2	Transmit Pressure Reading
D1	Transmit Set-point
Fxx	*(Ignored)*
I0	Disable SRQ
I1	SRQ on In Limit
I2	SRQ on Error
I3	SRQ on In Limit and Error
I4	SRQ on End of Conversion
I5	SRQ on Error and End of Conversion
I6	SRQ on In Limit and End of Conversion
I7	SRQ on In Limit, Error and End of Conversion
J0, J1, J2	Set Pre-programmed rate.
M	Unlock keyboard
N0, N1, N2, N3, N4	Set talk mode notation
O1	Zero
P <value>	Set Pressure Set-point
R0	Unlock keyboard
R1, R2	Lock keyboard
S0,S1,S2,S3	Set pre-programmed units
T0	Turn off Tare mode
T1	Turn on tare mode to value set to B (B must be set first)
U1 to U23	Set S4 units (setting S4 changes current units immediately).
V <value>	Set slew rate (sets low overshoot mode)
W <value>	Set In Limit wait time
/0 to /11	Set set-point as fraction of P value
*0 to *11	Set pre-programmed set-point
@0	Disable error reporting
@1	Enable error reporting

Response Formats

N0 <Pressure or Setpoint><REM|LOC>RnSnDn[@nn]
N1 <Pressure or Setpoint>[@nn]
N2 <REM|LOC>RnSnDnCnInFn
N3 <In Limit Status>[@nn]
N4 @nEnJnVnnnnUaaaa

Note: *Secondary addressing is not supported.*

Reset Conditions

N0 D0 F0 I0 @1 R0 S0 W002

Format

Upper and lower case are equivalent. Spaces and equal signs are ignored before numeric values. Spaces, commas, semi-colons, and colons are ignored before and after commands. This section describes the differences between the DPI 510 communications protocol and the DPI 515 emulation protocol.

1 S0 is always bar.
2 S1 is always psi.
3 S2 is always kPa.
4 Message terminator is CR/LF on RS232 and CR/LF/EOI on IEEE.
5 Presets set to 0,10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110 kPa.
6 Ratios set to 0,10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110%.
7 J0 is always **Variable** rate.
8 J1 is always **Auto** rate which is max rate with no overshoot.
9 J2 is always **Max** rate.
10 TBA
11 On the DPI 510, some commands are only accepted in **Remote** mode. In emulation mode they are always accepted.
12 The **Zero** command 01 takes much longer to execute on a DPI 515 (opens zero valve, etc.
13 No daisy chaining (no addressed mode) over RS232.
14 No interrupt packets over RS232.
15 No dialogue mode on RS232.

All commands for the Ruska 7000 Series controllers are emulated by the DPI 515. Refer to the relevant Ruska controller manual for details.

To select this protocol use Setup/Supervisor/Comms/Protocol/SCPI 7000.

6.8 Specification

Standard Pressure Ranges

- 70, 200, 350, 700 mbar, 1, 2, 3.5, 7, 10, 20, 35, 70, 100, 135 and 210 bar gauge.
- 1, 3, 5, 10, 15, 30, 50, 100, 300, 1000, 2000 and 3000 psi gauge.
- Gauge instruments available with negative calibration as an option.

Overrange

- 10% above full-scale pressure range (measure mode only).

Power supply

90 to 260V ac, 50 to 60 Hz.
Power rating 60 VA.
Installation Class 2.

Temperature

Operating:	5°C to 50°C (41°F to 122°F)
Calibrated:	23°C (73.4°F)
Storage:	-20°C to 60°C (4°F to 140°F)

Environment

Humidity	0 to 95%, non-condensing.
Vibration	Compliant with Def. Stan. 66-31 8.4 cat 3.
Shock	Mechanical shock conforms to EN61010.

Conformity

BSEN61010, BSEN61326-1, 97/23/EC.
CE marked.

Positive pressure

- Supply pressure depends on the full-scale pressure rating of a specific range. See rating label on rear of instrument for pressure range.

Negative pressure

- Atmospheric pressure or vacuum. See Section 2, Installation.

Pressure Media

- Clean, dry, non corrosive gas, typically air or nitrogen.
- Particulate size should be filtered to less than 20 microns.
- All oil mist must be removed.
- Any moisture must be non-condensing.
- Option G contains in-line filters with 20 micron elements.

Materials in contact with pressure media

<u>to 70 bar (1000 psi)</u>:

- Aluminium 6082 (HE30)
- Bonded seals Nitrile Rubber
- Plugs Stainless Steel 316
- Valve Parts: AISI 302, AISI 303, AISI 430FR
- Non-Butyl Rubber, polyethylene, polyurethane.

above 70 bar (1000 psi):

Aluminium Bronze CA 104 in lieu of Aluminium 6082.

- Reference Port: – in addition to above, brass and silicon rubber.
- Filters: - Stainless steel 316 and copper.

Measurement Stability

- 0.02% of reading per annum for ranges between 25 and 350 mbar (0.74 and 10.34 inHg)
- 0.01% of reading per annum for ranges between 0.7 and 210 bar (10 and 3000 psi)

Controller Stability

- For ranges between 0.7 and 70 bar (10 and 1000 psi): better than 0.001% of span
- For pressures above 70 bar (1000 psi): better than 0.0015% of span
- For pressures below 0.7 bar(10 psi): better than 0.003% of span

Controller Response

- Less than 5 seconds into a 50 cm^3 (3 cu in) volume up to 10% full-scale steps within 20 ppm of set-point. (settling = fast, rate = max).

Gas Consumption

- The system consumes supply gas only in control mode. The system uses no gas in measure mode or when the instrument powers-down.

Warm-up Time

- 15 minutes to specification

Panel

- Large area, high-contrast, emissive graphics LCD.
- Readout. ±9999999 maximum, updated every 0.6 seconds.
- Pressure Units. 24 scale units plus one user defined.
- Languages. English, French, German, Italian, Portuguese and Spanish.

Option A

Barometric Reference

Pressure reference

Normally atmospheric pressure, but with gauge transducers fitted without barometric reference then a maximum of 1.5 bar (19.5 psi) g can be applied. Pressure media to be non-condensing high purity gas only.

Flow

- All of the supply gas delivered to the load.
- Maximum supply flow when making fast pressure steps can be estimated from the control valve orifice size and considering the differential pressure at that moment. Orifice sizes:

0 - 10bar	(0 - 150 psi)	-	1.6 mm	(0.0629 in) dia.
>10 - 70bar	(>150 - 1000psi)	-	0.8 mm	(0.0315 in) dia.
>70 - 210bar	(>1000 - 3000 psi)	-	0.5 mm	(0.0197 in) dia.

Pressure Outlet

Pressure within the specified positive and negative full-scales.

24 Vdc

- Output for energizing external equipment:
  Voltage 24 V dc ±1 V at maximum current of 100 mA.

Logic Output

- Volt free relay contacts maximum current 100mA dc to 60 Hz. Maximum of 30 volts between the contacts and ground.

Weight

- 9 kg (19.8 lbs) approximately

Dimensions

- 390 mm (15.35 in) [wide] x 132 mm (5.19 in) [high] x 300 mm (11.81 in) [deep].
- 3U high case.

Installation

- Retractable feet supplied for benchtop use.
- Optional rack mounting kit for installation within a 19 inch rack system.

Pneumatic Connections

- 1/8 female (BSP) on Vent, Supply and Outlet connections.
- Reference connection M5 female.

Precision

Note: *Precision assumes regular zeroing and includes non-linearity, hysteresis, repeatability and temperature effect between 18°C and 28°C (65°F and 82°F) (add 0.004% full-scale for 10°C to 45°C [50°F to 113°F]).*

- 0.01% full-scale from 700 mbar to 210 bar (10 psi to 3000 psi).
- 0.03% full-scale below 700 mbar (10 psi).

Option C1

Altitude Range

- Control and measurement of altitude (ft and m) and vertical speed [rate of climb] (ft/min, m/min, m/sec, hm/sec).
- Range, -3000 to +80,000 feet.

Option C2
Airspeed Range

- Control and measurement of airspeed and rate of airspeed (kts, kts/hr, mph, km/hr, km/min) and Mach (Mach Number).
- Range, 910 knots.

Option C2
Altitude and Airspeed Range

- Both ranges as above on a dual range instruments.

Option D
Rack Mounting Kit

- Includes side and rear supporting brackets for 19 inch rack systems.

Option E1
Low Absolute Pressure – Enhanced Performance, single range

- An enhanced measurement stability for the following pressure ranges:

750 – 1150 mbar a	(22 - 34 inHg a)
35 – 1310 mbar a	(1 - 39 inHg a)
35 – 2620 mbar a	(1 - 77 inHg a)
35 – 3500 mbar a	(1 - 100 inHg a)

- Precision 0.01% full-scale including non-linearity, hysteresis, repeatability and temperature effects over 10°C to 40°C (50°F to 104°F). Measuring stability 0.01% full-scale per annum.

Option E2
Low Absolute Performance – Enhanced Performance, dual range

- An enhanced measurement stability for the following pressure ranges:

750 – 1150 mbar a	(22 - 34 inHg a)
35 – 1310 mbar a	(1 - 39 inHg a)
35 – 2620 mbar a	(1 - 77 inHg a)
35 – 3500 mbar a	(1 - 100 inHg a)

- Precision 0.01% full-scale including non-linearity, hysteresis, repeatability and temperature effects over 10°C to 40°C (50°F to 104°F). Measuring stability 0.01% full-scale per annum.

Note: *This option cannot be ordered with either Option A or C*

Option F1
LabVIEW®,Driver

- Software driver for LabVIEW.

Option G1
Filter Set – Single Range Instrument

- Set of in-line filters for the pressure supply and outlet.

Option G2
Filter Set – Dual Range Instrument

- Set of in-line filters, one for each pressure supply and outlet.

Option H
Pressure Controller Sensor Calibration Module
Excitation Voltage Output
10V dc regulated and 24V dc unregulated
Measurement Input
Range ±135mV absolute*

Accuracy over 10 to 28°C (50 to 82°F):	0.02% rdg +0.002% full-scale
Accuracy over 10 to 45°C (50 to 113°F):	0.035% rdg +0.002% full-scale

Range ±135mV compensated**

Accuracy over 10 to 28°C (50 to 82°F):	0.01% rdg +0.002% full-scale
Accuracy over 10 to 45°C (50 to 113°F):	0.015% rdg +0.002% full-scale

Range 0 to 11V

Accuracy over 10 to 28°C (50 to 82°F):	0.02% rdg +0.002% full-scale
Accuracy over 10 to 45°C (50 to 113°F):	0.035% rdg +0.002% full-scale

Range 0 to 25 mA

Accuracy over 10 to 28°C (50 to 82°F):	0.03% rdg +0.005% full-scale
Accuracy over 10 to 45°C (50 to 113°F):	0.05% rdg +0.005% full-scale

* *absolute range refers to the accuracy when using an external supply voltage for the sensor under test.*

** *range includes error compensation for internal regulated +10 volts excitation voltage, essential for proportional strain gauge sensors.*

6.9 Return Goods/Material Procedure

Should the unit require calibration or become unserviceable it can be returned to the nearest GE Service Centre listed at **gesensing.com**.

Please contact our Service Department, either by 'phone, fax or E-mail, to obtain a Return Goods Authorisation (RGA) or in the USA, Return Material Authorization [RMA], providing the following information:

Product (i.e. DPI 515)
Serial number
Details of defect/work to be undertaken
Calibration traceability requirements
Operating conditions

Safety Precautions

You must also tell us if the product has been in contact with anything hazardous or toxic and, the relevant COSHH or in the USA, MSDS, references and precautions to be taken when handling.

Important notice

Service or calibration by unauthorized sources will affect the warranty and may not guarantee further performance.

Packaging Procedure

1 The instrument should be at zero/ambient pressure. Set the power switch to off. Shut off the pneumatic pressure and vacuum supplies to the instrument.

- Switch off and isolate the electrical power supply to the instrument. Remove the instrument from the equipment rack to access the rear panel.
- Disconnect the power supply cable and the pneumatic supply hose assemblies.
- Stow the power supply cable in the packaging below.
- Remove any pressure adaptors and silencers (VENT ports).

2 If available, use the original packing material. When using packing materials other than the original, proceed as follows.

- Fit protection to all the ports to prevent ingress of moisture and dirt.

Note: *Use the original red plastic plugs or low tack masking tape.*

- Wrap unit in polyethylene sheeting.
- Select a double-wall cardboard container. Inside dimensions must be at least 15 cm (6") greater than the equipment. The carton must meet test strength requirements of $\geq$125 kg (275 lbs).

- Protect all sides with shock-absorbing material to prevent equipment movement within the container.
- Seal carton with approved sealing tape.
- Mark carton “FRAGILE” on all sides, top, and bottom of shipping container.

Environment

- The following conditions apply for both shipping and storage:
- Temperature range -20° to +60°C (-4° to +140°F)

6.10 Ancillary equipment

The installation of the DPI 515 instrument requires specific ancillary equipment such as regulators, pressure fittings vacuum pumps, oil mist filters, foreline traps etc.

The following table lists parts and suppliers for many of the items required for correct installation. This list is not a complete or mandatory listing it should be used an aid for sourcing the relevant components.

GE accepts no responsibility for the suppliers listed or the availability of parts or price.

Range	Manufacturer	Model	Outlet Range (bar)	Maximum pressure (bar)
70 mbar	Norgen	11-818-999	20 - 500 mbar	8
200 mbar - 2 bar	Marsh/Economatics	960-013-000	138 - 272 mbar	10
3.5 - 20 bar	Drager	44-1111-24	0 - 35	415
35 bar	Drager	44-1112-24	0 - 55	415
70 bar	Drager	44-1113-24	0.7 - 105	415
100 to 210 bar	Drager	44-1115-24	1.72 - 280	415

Table 6-1, Pressure Regulators for Positive Source Supply

For pre-regulation of low pressure regulators, the Drager 44-1800 may be used, it is also suitable for direct regulation of positive source pressures between 20 to 135 bar.

Suppliers of Ancillary Equipment

Supplier	Address	Telephone/Fax
Economatics www.economatics.co.uk	Economatics Epic House Damall Road Attercliffe Sheffield England S9 5AA	Tel: (0114) 281 3344 Fax: (0114) 243 9306
Marsh Bellofram www.marshbellofram.com	Bellofram Corporation State Route 2 Box 305 Newell WV 26050 USA	Tel:0800-727-5646 Fax: (304) 387 4417
	Bellofram (Europe) 9 Castle Park, Queens Drive, Nottingham NG2 1AM	Tel: +44(0) 115 9933300 Fax: +44(0) 115 9933301
Norgren www.norgren.com	IMI Norgren Ltd PO Box 22 Eastern Avenue Lichfield Staffordshire England WS13 6SB	Tel: (01543) 265000 Fax: (01543) 265811
	Norgren Inc. 5400 South Delaware St. Littleton Colorado 80120-1663	Tel: ++1(303) 794 2611 Fax:++1(303) 795 9487
Drager Tescom www.tescom-europe.com www.tescom.com	Drager Tescom Unit 5 Coatbank Way Coarbridge Strathclyde Scotland ML5 3AG	Tel: (01236) 440884 Fax: (01236) 434740

Swagelock www.swagelock.com	Swagelock UK Manchester Valve & Fitting Company Science Park North Birchwood Warrington Cheshire WA3 7WF	Tel: (01925) 822662 Fax: (01925) 820129
Hydrotechnik www.hydroteknik.co.uk	Hydrotechnik UK Ltd Unit 10, Easter Park Lenton Lane Nottingham NG7 2PX	Tel: +44(0) 115 9933300 Fax: +44(0) 208741 9935

Table 6-2, Suppliers of Ancillary Equipment

Vacuum System Parts

The parts list below lists a typical system to supply vacuum, enabling the control of sub-atmospheric pressures by the DPI 515 instrument. Part numbers quoted in the table are taken from the BOC Edwards Vacuum Products 2000 Catalogue.

Description	*Part Number*	*Quantity*
RV5 240V Vacuum Pump, 91 litre/min	A653-01-903	1
EMF10 Mist Filter	A462-26-000	1
NW25/NW10 Reducer fitting	C105 -14-436	2
NW10 "T2 Fitting	C105 -11-411	1
IPVA10EK Air Admit Valve Norm Open	C417 -21-000	1
Flexi SS NW10 hose 1M	C105 -11-287	4
NW10 Clamp	C105 -12-401	5
NW10 Seal	C105 -11-398	5
NW25 Clamp	C105 -14-401	3
NW25 Seal	C105 -14-398	3
NW16/10	C105 -12-349	1
NW16 to ¼ NPT M Fitting, SS	C105 -01-103	1
Foreline Trap	FL20K	1

Supplier	Address	Telephone/Fax
BOC Edwards www.bocedwards.com	BOC Edwards Vacuum Technology Manor Royal Crawley West Sussex England RH9 2LW	Tel: (01293) 528844 Fax: (01293) 533453
BOC Edwards	BOC Edwards Vacuum Technology (USA) 301 Ballard Vale Street Wilmington MA 01887 USA	Tel: (1) 978 658 5410 Fax: (1) 978 658 7969

Table 6-3, Suppliers of Vacuum System Parts