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**Pressure measurement
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DPI 610/615 IS
Portable Pressure Calibrator/Indicator

User Manual

K249

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Amendment Record

Iss No	Date	C/N No	Originator	Typed	Amendments
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2	13/09/01	12016	CER	-	No details recorded on amendment sheet
3	01/11/01	12946	CER	-	No details recorded on amendment sheet
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Approvals

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Engineering Harbi Mankia Date:		

Print Instructions

Print black on white, double sided as supplied on disk.

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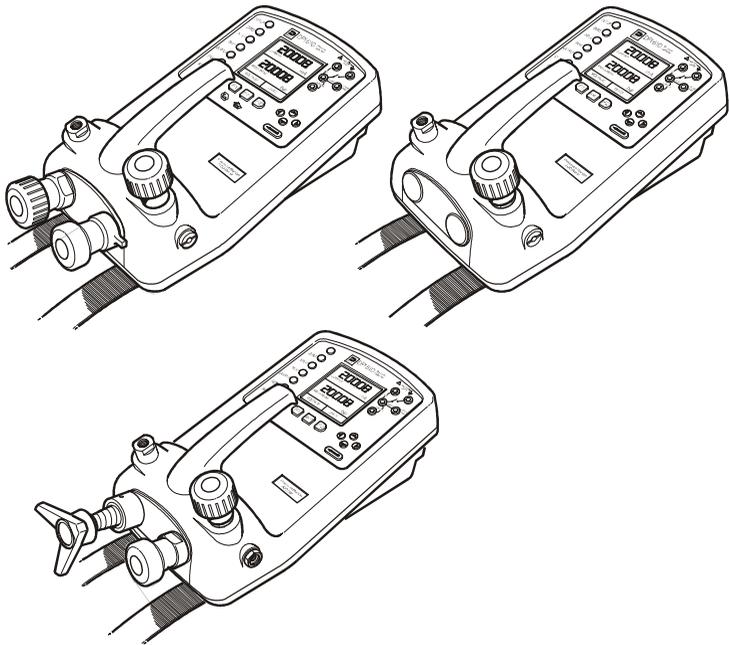
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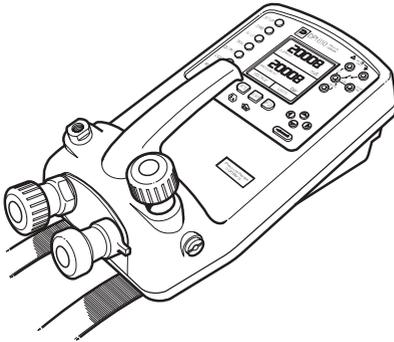
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Portable Pressure Calibrator

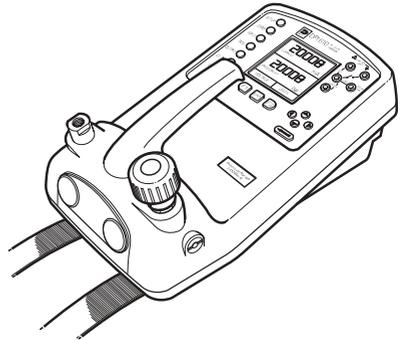
User manual - K249



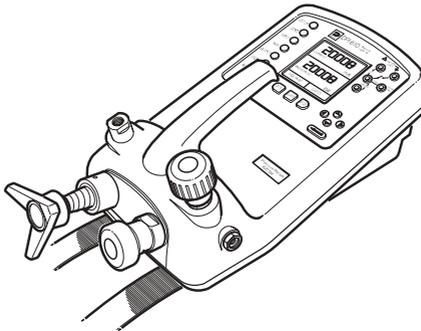
DPI 610/615 IS
PORTABLE PRESSURE CALIBRATOR/INDICATOR
USER GUIDE
K249



Calibrator Version



Indicator Version



Hydraulic Actuator Version

DPI 610/615 IS Portable Pressure Calibrator

WARNING

Before operating this instrument, read the safety instructions!

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GE Druck

EC Declaration of Conformity

English

Product: **DPI 610/615 (IS) PORTABLE PRESSURE CALIBRATOR SERIES**

The above products meet the protection requirements of the relevant EC Directives.

Supplier: **Druck Ltd, Fir Tree Lane, Groby, Leicester, LE6 0FH, England**
Tel: +44 (0) 116 231 7100, Fax: +44 (0) 116 231 7101

Signed: 
For and on behalf of GE Druck Limited

Date: **9th Feb 2004**

Name: **R G Brown** C Eng FIEE FIMC Position: **Instrument Engineering Manager**

Relevant European Directives	
Directive Name	Directives
Equipment and Protective Systems for Use in Potentially Explosive Atmospheres (ATEX)	94/9/EC *
Low Voltage Directive	72/23/EEC
Electromagnetic Compatibility	89/336/EEC as amended by 92/31/EEC and 93/68/EEC
Pressure Equipment Directive	97/23/EC (Category SEP)

*The ATEX directive only applies to instruments marked with the type examination certificate BAS02ATEX1174X from Electrical Equipment Certification Service.

Standards	
Standard Name	Standard
Special requirements for construction, test and marking of electrical apparatus of equipment group II, category 1 G	EN50284: 1999
Electrical apparatus for potentially explosive atmospheres - General requirements	EN50014: 1997 + Amds 1&2
Electrical apparatus for potentially explosive atmospheres - Intrinsic safety "i"	EN50020: 1994
Safety requirements for electrical equipment for measurement, control and laboratory use.	BS EN 61010-1:2001
Electrical equipment for measurements, control and laboratory use - EMC requirements	EN 61326-1:1997

Special conditions:
DPIP61XIS is not capable of withstanding the 500V RMS strength test between external connectors and the frame as required by clause 6.4.12 in EN50020.

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.

Approved Service Agents

www.gesensing.com

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.*



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



This symbol, on the instrument, indicates that the user should refer to the user manual. This symbol, in this manual, indicates a hazardous operation.

Specification

Pressure Ranges (Internal Transducers)

Safe working pressure

20 bar range	1.75 x full-scale
350 bar range	1.2 x full-scale
400 bar range	1.5 x full-scale
All other ranges	2 x full-scale

Accuracy

Combined non-linearity, hysteresis and repeatability

±70 mbar range	0.05% F.S.
up to ±150 mbar	0.05% span
200 mbar to 20 bar (Calibrator):	0.025% F.S.
35 bar to 700 bar (Indicator):	0.025% F.S.
70 bar to 400 bar (Hydraulic)	0.025% F.S.

Temperature Effects

±0.004% of reading/°C (averaged over -10° to -40°C w.r.t. 20°C)

Electrical Parameters

Voltage Inputs

Range:	±30V
Accuracy	±0.05% rdg, ±0.004% F.S.
Resolution	100µV max

Current Inputs

Range:	±55mA
Accuracy	±0.05% rdg, ±0.004% F.S.
Resolution	1µA max

Current sink

Range:	24mA
Accuracy	±0.05% rdg, ±0.01% F.S.

Display

Size:	60 x 60 mm LCD Graphics
Reading	±99999, update rate 2 readings/sec

Environmental

Operating Temp.:	-10°C to 50°C (Calibrated -10°C to 40°C)
Storage Temp:	-20°C to 60°C
Calibration Temp:	21°C ±2°C

Sealing

Sealed to IP54

Physical

Size:	300 x 170 x 140 mm
Weight:	3 kg

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General

The DPI 610 IS and DPI 615 IS intrinsically safe instruments measure and display pneumatic and hydraulic pressure applied to the test port. Pressure measurement can be absolute, gauge and sealed gauge and in ranges from 2.5 mbar to 700 bar.

Calibrator versions of this instrument contain pneumatic or hydraulic pressure generation components to produce pneumatic pressure ranges between -1 to 20 bar and hydraulic pressure ranges up to 400 bar.

Using external electrical connections, the DPI 610 IS and DPI 615 IS intrinsically safe instruments measure ± 30 volts d.c. and ± 55 mA. An integral sensor provides measurement of ambient temperature. Additional sensors (option B1) connect to an external connector and extend the pressure measurement range and include differential pressure measurement. The DPI 615 instrument has an RS 232 connector to enable downloading of test data to a compatible documenting system. Six alkaline C size batteries, IEC Type LR14, power the instrument.

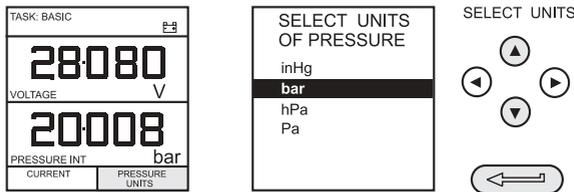
Important Notice

Zinc-carbon and zinc-chloride cells must **NOT** be used in this instrument.
Use only the battery types as shown in the Table on page 7.

Description of Procedures

In the procedures outlined in this User Guide, hard (fixed function) and soft (variable function) key operations are shown in bold type (e.g.) **TASK** and **F1**. These statements mean press the **TASK** key and press the **F1** key. Soft key operations can be allocated to both the F1 and F2 keys. Where a specific soft function is referred to it is written in bold italics (e.g.) **PROCESS**.

This instrument has a number of operating modes which are described in simplified form in the following sections. Diagrams accompanying the procedures give typical selection sequences and shaded controls indicate that this control key should be pressed in the appropriate sequence. Diagrams should be read from left to right, top to bottom where appropriate. A shaded display soft box indicates that the function key immediately below that soft box should be pressed (either **F1** for the left hand soft box or **F2** for the right).



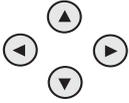
In the above diagram the following key sequence is indicated.

- (a) Press the **F2** key (the key immediately below the **UNITS** soft box).
- (b) Use the **Up** and **Down** cursor keys (only) to select the required option. (If all keys shaded, use all these keys to select or enter data).
- (c) Press the **ENTER** key.

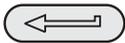
Using This Guide

The following key symbols are used in the procedure diagrams which follow

SELECT VALUE



Shaded cursor keys indicate that a combination of these four keys, Up, Down, Left and Right should be used to (e.g.) enter an alpha numeric value or to select a function.



Indicates the **ENTER** key. Used to confirm an operation or a selection. Shading indicates key operation.



Exit key, used to clear current menu selection and return to next menu level above current level. Used as an escape key from current operation. Shading indicates key operation.

RECALL 

Hardkey (total 7). Legend beside key symbol indicates function. Shading indicates key operation.

Maximum Instrument Ratings

The following table shows the maximum measurement input ratings of the instrument which should not be exceeded.

PRESSURE	120% FULL SCALE
VOLTAGE	30 V d.c.
CURRENT	55 mA d.c.

Note 1: The display flashes if the input pressure, voltage or current overrange.

Note 2: Max applied voltage for external loop supply = 30V dc (see Page 8).

OPERATOR CONTROLS (Figure 1)

These divide into two groups, the operator/display controls (shown in Figure 1) and the pressure/vacuum generation components (shown in Figure 2). The operator controls and a typical display, common to all instrument versions, is shown below.

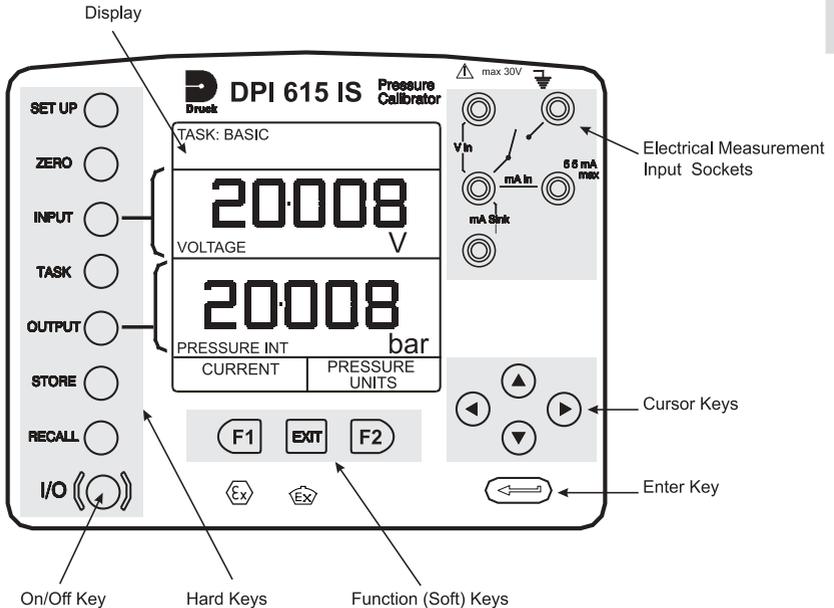
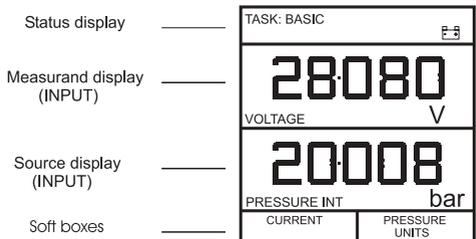


Figure 1 - DPI 610/615 Key-pad

DISPLAY

The display section of the instrument basically divides into four distinct sections. The two main sections of the display are used to display a *Measurand (input parameter)* and a *Source (output parameter)*. The remaining sections are used as a status display area and to define soft key functions. A typical display is shown below (e.g.),



HARD KEY FUNCTIONS (Fig. 1)

Key	Function	Ref Page
I/O	This key is used to turn the instrument ON and OFF.	7
SETUP*	The SETUP key provides access to the instrument's general configuration parameters which are set up to certain default parameters on delivery.	36
ZERO	The ZERO key can be used to zero either the selected measurand or source display, if the display reading is within 5% of zero. Attempts to zero a larger offset result in an error message, <i>Zero too large</i> .	9
INPUT*	The INPUT key is used to select which measurand is displayed.	18, 19
TASK	The TASK key is used as a means of rapidly configuring the instrument for a number of different types of external device calibration. There are twenty task configurations available, eleven of which are pre-programmed and nine are user definable.	10
OUTPUT*	The OUTPUT key is used to select which of the instrument's source outputs is displayed.	24-27
STORE*	Depending upon how the instrument's STORE mode is setup, this key is used either to store up to 20 display screens (in SNAPSHOT mode), or to manually log a screen in DATALOG mode.	29, 36
RECALL*	This key is used to recall a previously stored screen to the display. Depending on the STORE mode set-up, operation of this key recalls either the snapshot of a previously stored screen or datalog file. In STORE mode, selection displays the last screen stored. By using the cursor keys, the operator can scroll either forward or back through memory locations.	28, 31, 35
ENTER ←	The ENTER key is used either to enter data (accept entered data), or, in conjunction with the soft keys, to accept a given selection.	2
EXIT	The EXIT key operates in conjunction with all the other hard and soft keys to exit from the current screen or menu level, to the level immediately preceding it. To quit completely from any menu level, press EXIT until the MEASURE/SOURCE screen is displayed.	2

* These key functions are not available in BASIC mode

SOFT KEYS (Fig. 1)

Three soft keys, designated **F1, EXIT** and **F2**, are situated immediately below the display as shown below. These keys have their function allocated by the instrument software which is indicated in the bottom of the display (Voltage for **F1** and Units for **F2** in this example). They are used to select menu (program) options and are fully described under the appropriate section headings.

CURSOR KEYS (Fig. 1)

The cursor keys consist of a block of four keys, arranged as shown in Figure 1. They are designated **Up ▲**, **Down ▼**, **Left ◀** and **Right ▶**. In programs where options need to be selected from a list, (e.g.) the **TASK** selection program, the **Up** and **Down** cursor keys are used to highlight one of the options, from which it can be selected by the **ENTER** key. In **TASK** mode, where more than one page of options are provided, the **Left ◀** and **Right ▶** cursor keys will switch between pages.

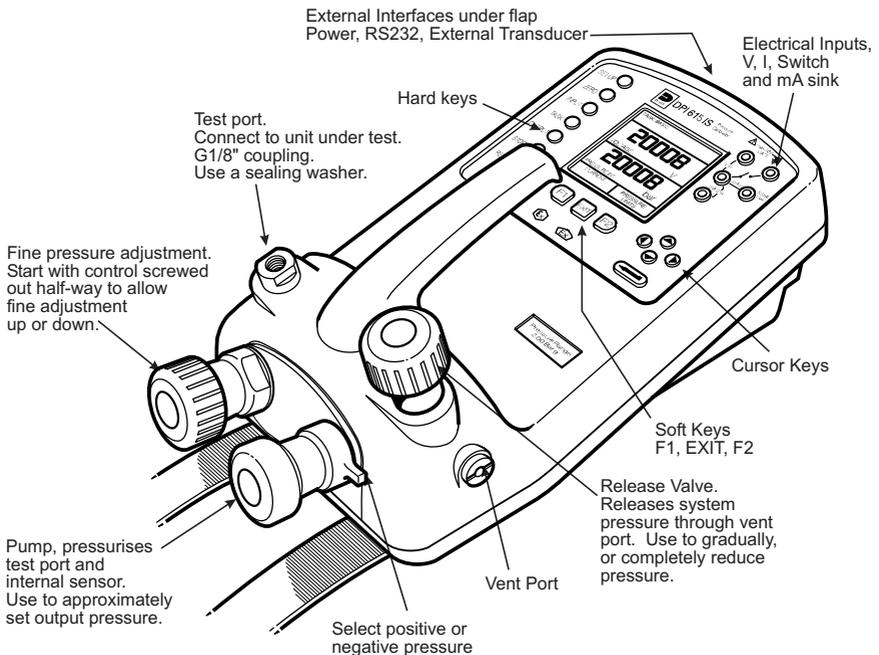


Figure 2 - DPI 610/615 IS Calibrator Controls

ELECTRICAL CONNECTIONS

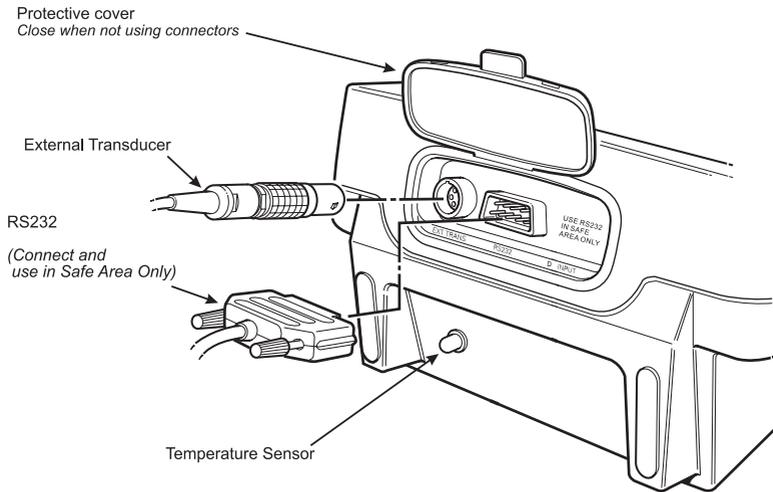


Figure 3 - Electrical System Connections

Measurement inputs and Source Outputs are made via the control panel sockets as shown below.

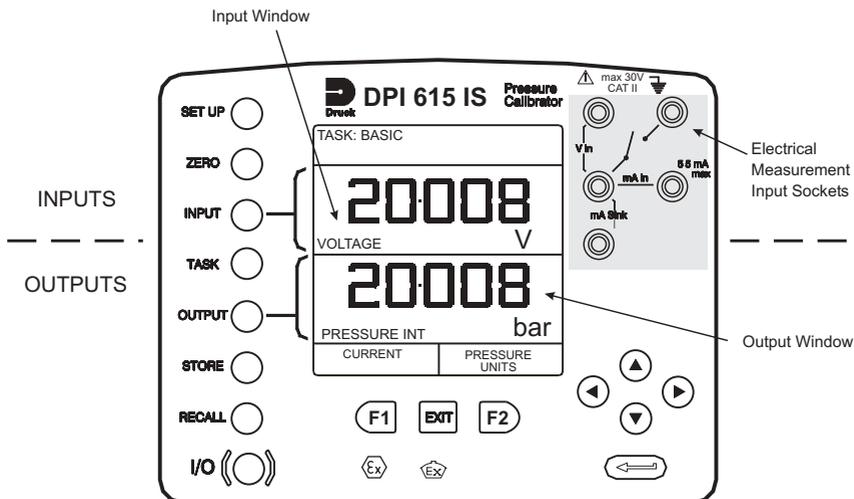
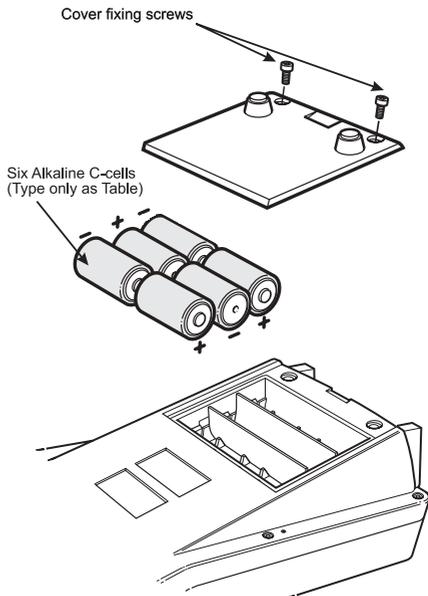


Figure 4 - Electrical Measurement Inputs/Source Outputs

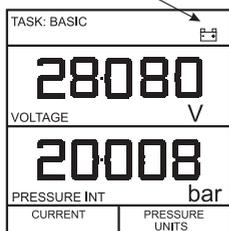
Getting Started

Fitting Batteries

Manufacturer	Type No.
Energizer	Industrial Type EN93
Energizer	E93.LR14.C.AM2
Duracell	MN1400-LR14
Varta	No. 4014 Type LR14.C.AM2
Procell	MN1400 - LR14



Low battery indicator

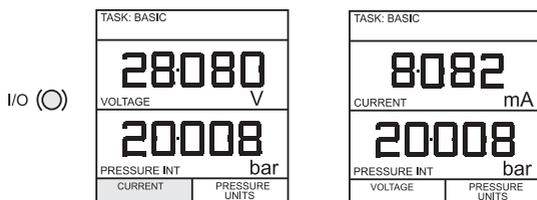


WARNING: BATTERIES MUST ONLY BE FITTED IN A SAFE AREA. USE ONLY THE BATTERIES SPECIFIED IN THE TABLE.

Caution: *Old batteries can leak and cause corrosion. Never leave discharged batteries in the instrument. Old batteries should be treated as hazardous waste and disposed of accordingly.*

Switching On

Press the **I/O** switch on the front panel and proceed as follows.



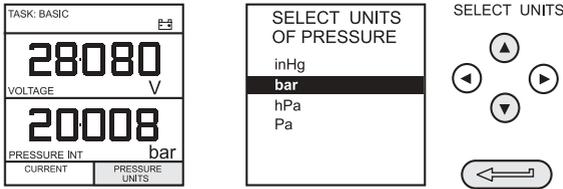
The first time that the instrument is powered up, it will power-up in **BASIC** mode with the main screen displaying voltage in the measurand display area and pressure in the source display area. To switch to **Current** as measurand, press **F1** as shown. Similarly, **F1** to return to **Voltage**.

Note: *No other keys are active in this mode and the instrument can only be reconfigured by pressing the **TASK** key and selecting another mode.*

Getting Started

Change Pressure Units

To change the pressure units proceed as follows. If the four units displayed are not the units required, press **TASK** and select any task, other than **BASIC**, press **SETUP** and proceed as detailed on page 36. To return to **BASIC** mode, press **TASK** and select **BASIC**.

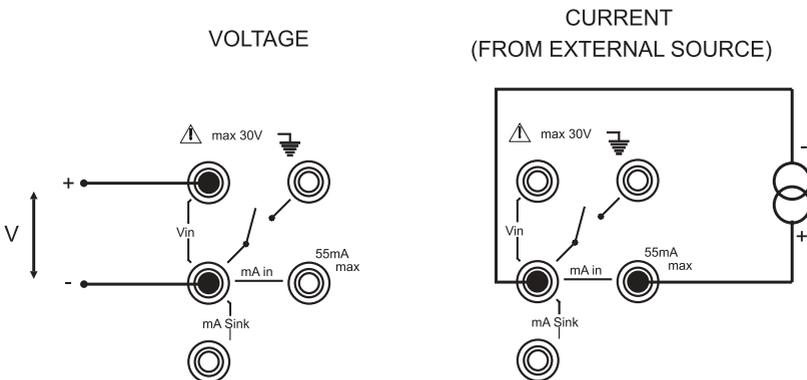


In **BASIC** mode, the unit is configured to carry out basic Pressure to Voltage (**P** to **V**) or Pressure to Current (**P** to **I**) tests, a typical test procedure follows.

Voltage and Current Measurements

Connect the electrical input sockets as follows for voltage and current measurements. Use the test leads provided and **DO NOT** push bare wires into the sockets.

Note: Maximum applied voltage = 30V dc., Maximum input current = 55mA dc

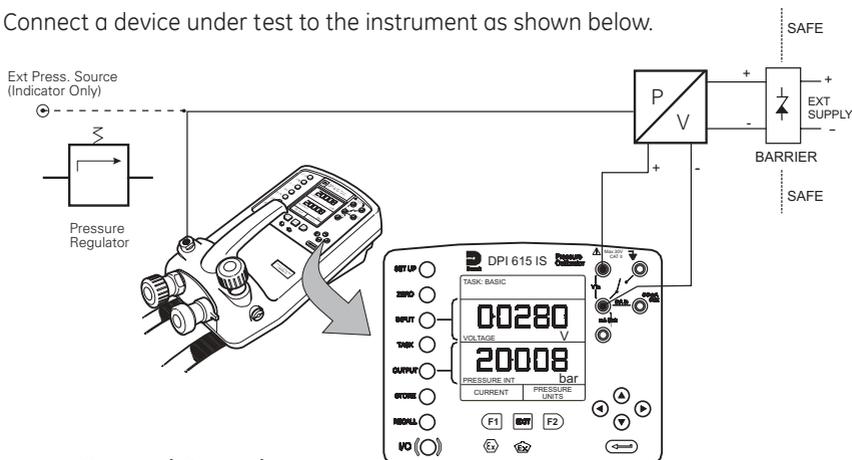


Note: Maximum applied voltage for external loop supply = 30V dc

Getting Started

Typical Calibration Setup (Pressure to Voltage)

Connect a device under test to the instrument as shown below.



- **General Procedure**

Use the hand-pump to pressurise the system to the required level as indicated on the display. Allow the display to settle and screw the volume adjuster in or out as a fine adjustment to the required pressure. Record the measurand (e.g.) **Voltage**, reading at each applied pressure.

Zero Display Reading

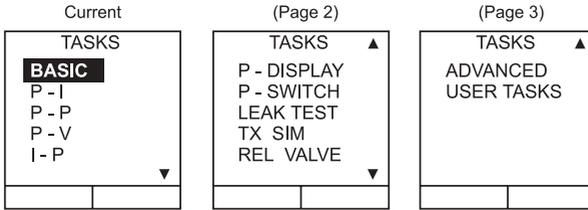
Both the input and output windows can be set to zero by operation of the **ZERO** key, providing that the displayed reading is already within 5% of zero. To zero either the **INPUT** (Measurand) or **OUTPUT** (Source) windows, proceed as follows (e.g.),



Task Selection

Task Key

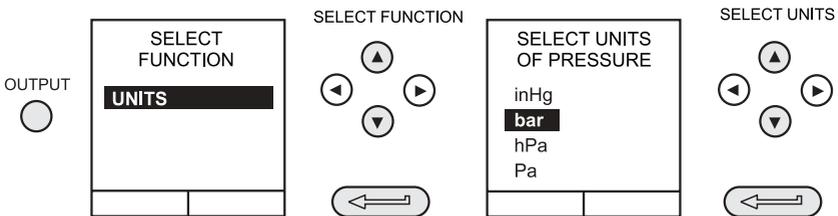
The TASK key is used to set up the instrument for a number of specific types of test. There are two modes BASIC and ADVANCED and nine other specific types of test which automatically configure the instrument on selection from the TASK menu. The tasks available under the TASK menu are held on three pages shown below. To select a task from the menu, press the TASK key, position the cursor over the desired task and press the ENTER key as shown below. Use the right/left cursor keys to switch between pages.



Using TASK Functions

Specific tasks are selected as shown above. The following diagrams show how to connect the unit under test (UUT) for each task selectable under the TASK menu. Input and Output units, where applicable can be selected by pressing either the INPUT or OUTPUT keys as shown below.

Set Units

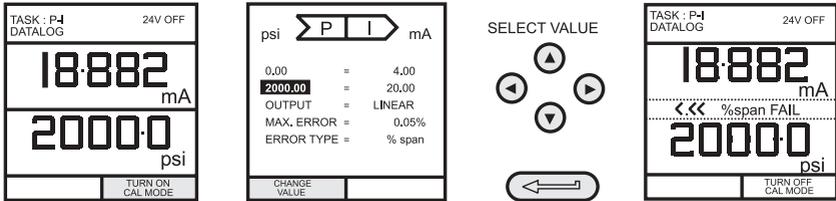


Note: If the four units displayed are not the units required, press **SETUP**, select **SETTINGS** and refer to Page 36.

Task Selection

Cal Mode (DPI 615 versions only)

Cal mode, which is available in tasks P-I, P-P, P-V, P-P, P-DISPLAY and P-SWITCH, provides a method of setting up test parameters manually. Downloaded test procedures can also automatically set up and turn on the Cal Mode function. The method of turning on and setting up Cal Mode is shown below for a P-I task. The method is similar for all the other tasks to which Cal Mode applies.



Pressing the F1 key (TURN ON CAL MODE), provides the set-up screen for the CAL mode. Initially, the cursor is placed in the UUT SPAN field to allow the required span range to be entered. The corresponding values for the UUT output parameter (current) are then set, followed by the maximum error value and error type (%rdg or %Span). When all test parameters have been set-up, the screen changes to display the input and output and the test results. The test result can only be displayed to within a range of $\pm 9.99\%$. If the test result is outside this range, either the left pointing (-ve error) or right pointing (+ve error) chevrons are displayed. Within this error band, the actual tolerance value is displayed. Test results can either be stored as snapshots or logged as datalog files, depending upon how the instrument has been set-up.

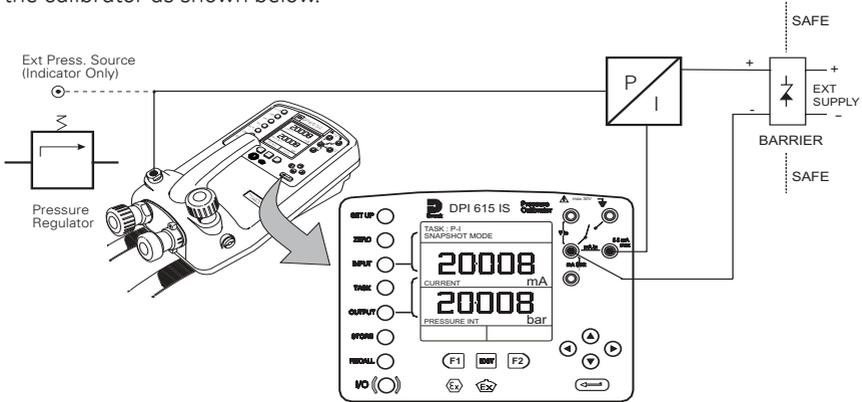
Basic Mode (Task BASIC)

This instrument will power-up in this mode the first time that it is used. To select **BASIC** from any other task, press the **TASK** key and select **BASIC** and press the **ENTER** key. **BASIC** mode is fully described in the **Getting Started**, section (see page 7).

Taking Measurements

Pressure Transmitter (P-I) Task

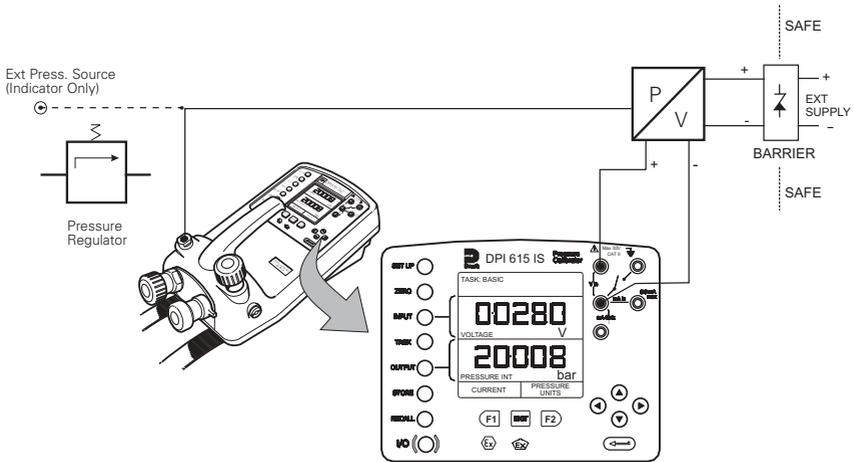
Select the P-I task from the task menu and connect the Unit Under Test (UUT) to the calibrator as shown below.



- If required, select the output units as described on page 10.
- If applicable, turn on Cal Mode and set-up test parameters as detailed on page 11.

Voltage Output Pressure Transmitter (P-V) Task

Select the P-V task from the task menu and connect the Unit Under Test (UUT) to the calibrator as shown below.



- If required, select the output units as described on page 10.
- If applicable, turn on Cal Mode and set-up test parameters as detailed on page 11.

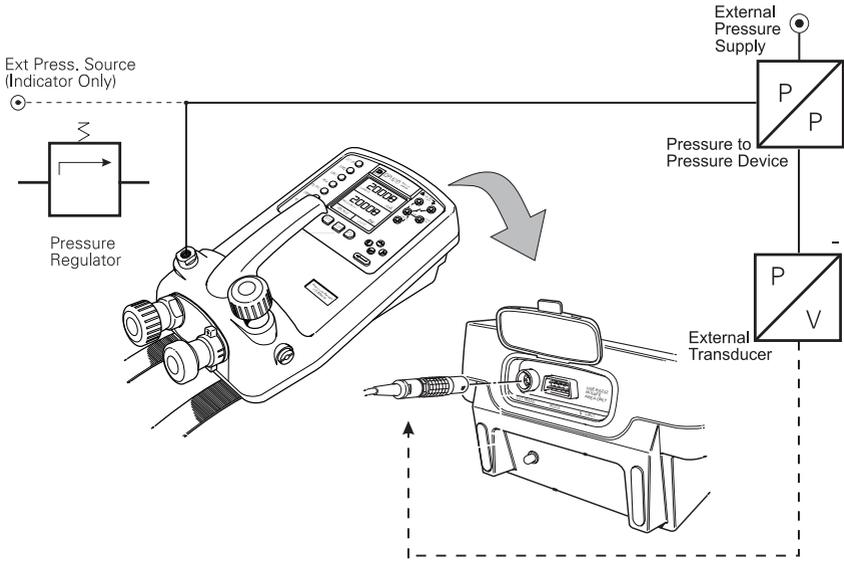
Taking Measurements

Pressure Converter (Pressure to Pressure) Task

Select the P-P task from the task menu and connect the Unit Under Test (UUT) to the calibrator as shown below. Testing a converter requires one pressure to be applied to the unit under test (UUT) and another (converter output) to be measured. The additional measurement is provided by the external transducer option.

Method

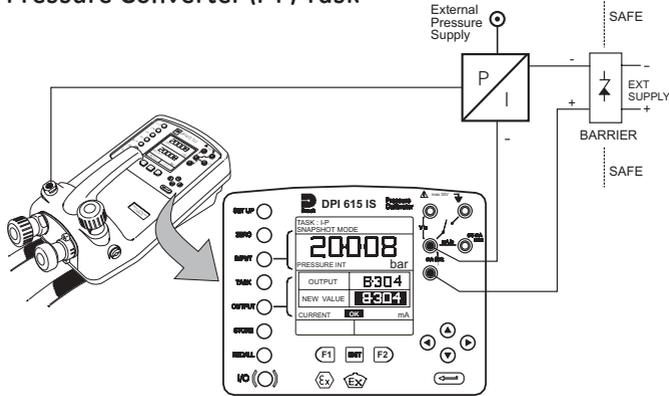
- Connect the UUT to the calibrator as shown below and plug the external transducer into the calibrator as shown below.



- Press the TASK key and select the P-P task. Providing the external transducer has been calibrated and its parameters stored in the instrument, the display will show **External** pressure in the input window and calibrator **Output** pressure in the output window. If an error message "NO SENSOR OR CAL INVALID" is displayed, this indicates that the external transducer has not been entered and/or calibrated with the instrument. Refer to Page 42 for details of adding an external transducer. **If an external transducer change is made, switch the calibrator off and then on to load new transducer data.**
- If required, select the input and output units as described on page 10.
- If applicable, turn on Cal Mode and set-up test parameters as detailed on page 11.

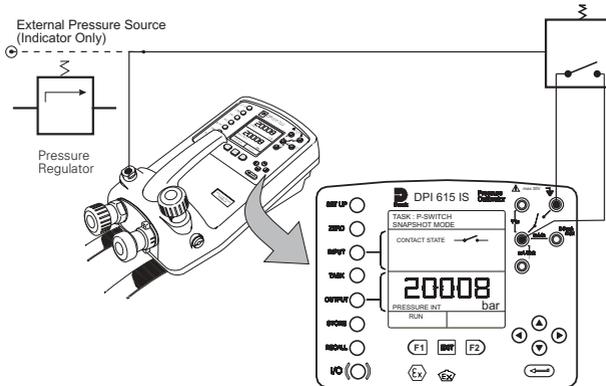
Taking Measurements

Current to Pressure Converter (I-P) Task



- Use the **Up** ▲ and **Down** ▼ cursor keys to adjust the loop current to the required value. Alternatively, press **ENTER** and use cursor keys to enter a finite value. Cursor keys can then be used to nudge the output either up or down.
If required, change pressure units with **INPUT** key. A flashing **CHECK LOOP** message indicates either an open circuit supply loop (or no external supply).

Pressure Switch Test (P-SWITCH) Task

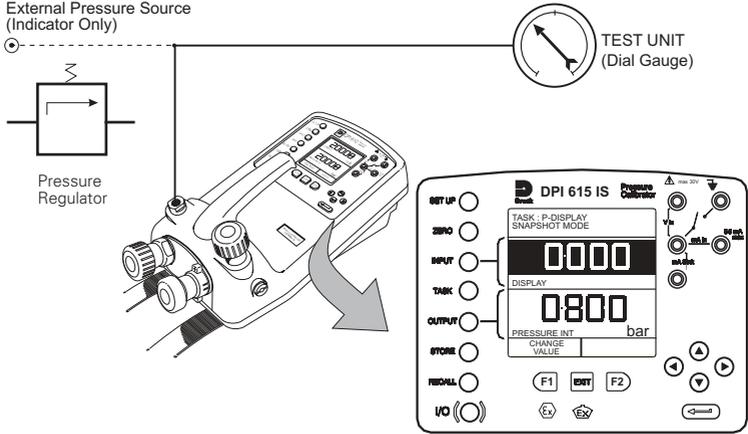


- Contact state will be shown on display. When contacts close, buzzer sounds.
- To run switch test, close vent valve and press the **RUN** (F1) key.
- Using the handpump, increase the applied pressure to just below the switch operating point. Screw the volume adjuster in until the switch operates (the operating pressure of the switch is then written to the display).
- Reduce pressure until the switch releases (indicated by the switch symbol). The release pressure is then written to the display and the hysteresis displayed.

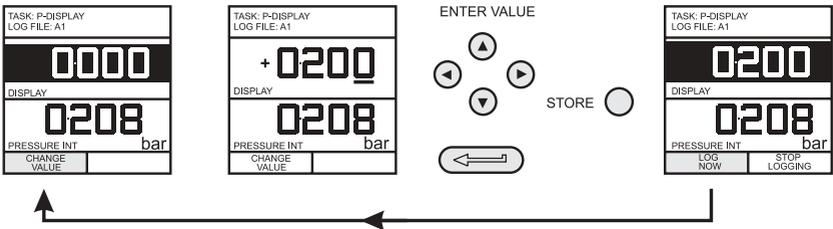
Taking Measurements

Pressure to Display (P-DISPLAY) Task

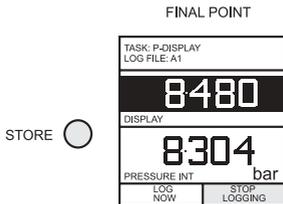
P-Display is a special application of Datalog. To use this mode, select Datalog from the Store Mode menu as detailed on Page 36. Connect the device under test to the instrument as shown below and, if required, turn on and set-up Cal Mode (see page 11).



- Press **TASK** and select **P-DISPLAY**. If required, use **OUTPUT** key to change pressure units.
- Set-up a datalog file as detailed on Page 30.
- **Note:** **TRIGGER** field, automatically set to **KEYPRESS**, cannot be changed.
- Apply a series of test pressures to the device under test. Enter displayed reading at each pressure and log each point (e.g.),

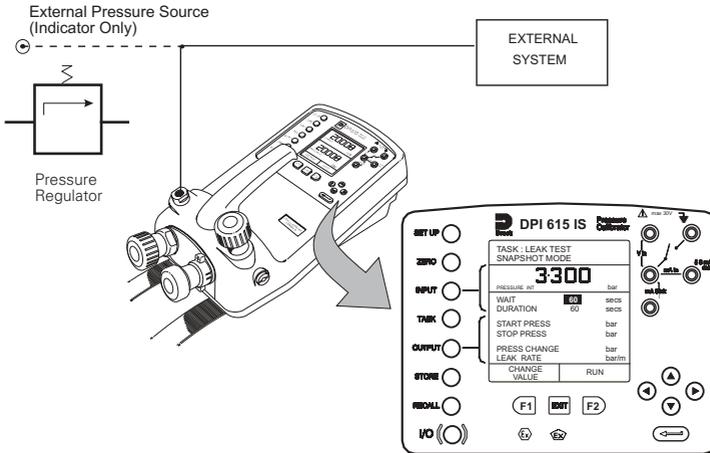


- After logging final test point, terminate as follows (e.g.),



Taking Measurements

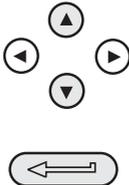
Leak Test (LEAK TEST) Task



- If required, use the **INPUT** key to change pressure units.
- Set-up the leak test **WAIT** and **DURATION** times to the required values as shown below. A minimum wait period of 3 minutes is recommended.

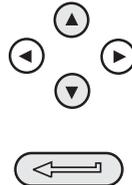
TASK : LEAK TEST SNAPSHOT MODE	
0:304	
PRESSURE INT	bar
WAIT	180 secs
DURATION	60 secs
START PRESS	bar
STOP PRESS	bar
PRESS CHANGE	bar
LEAK RATE	bar/m
CHANGE VALUE	RUN

SET WAIT TIME



TASK : LEAK TEST SNAPSHOT MODE	
0:304	
PRESSURE INT	bar
WAIT	180 secs
DURATION	60 secs
START PRESS	bar
STOP PRESS	bar
PRESS CHANGE	bar
LEAK RATE	bar/m
CHANGE VALUE	RUN

SET DURATION

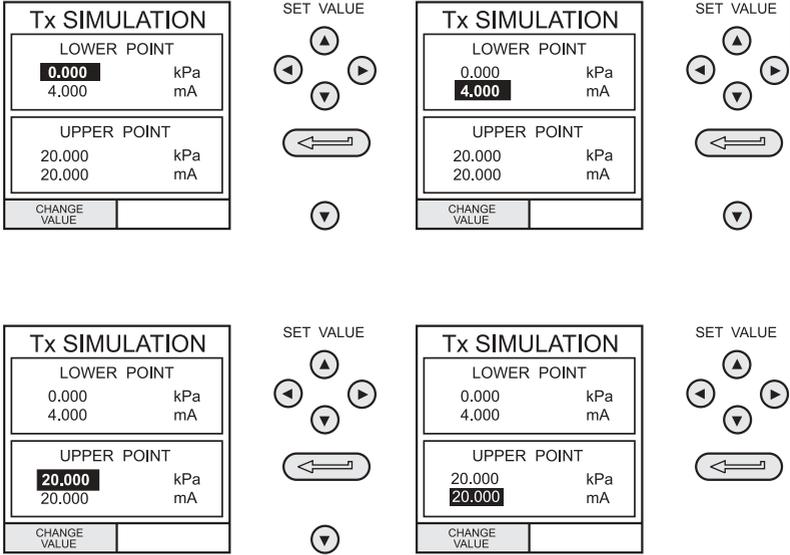


- Close the vent valve and pressurise the external system to the required **LEAK TEST** pressure.
- Press the **RUN (F2)** key to start the leak test. When completed, the bleeper sounds and the leak test results are written to the display.

Taking Measurements

Transmitter Simulator (TX SIM) Task

When used with an external voltage source (see Page 24), provides a current output proportional to the calibrator's measured output pressure (indicated pressure on indicator only version). Select task **TX SIM**. Press **EXIT** to skip set-up screen if parameters are correct.



On completion of **Tx SIM** set-up, the display is configured as follows (e.g.).



Connect an external power source to the output loop as detailed on Page 24.

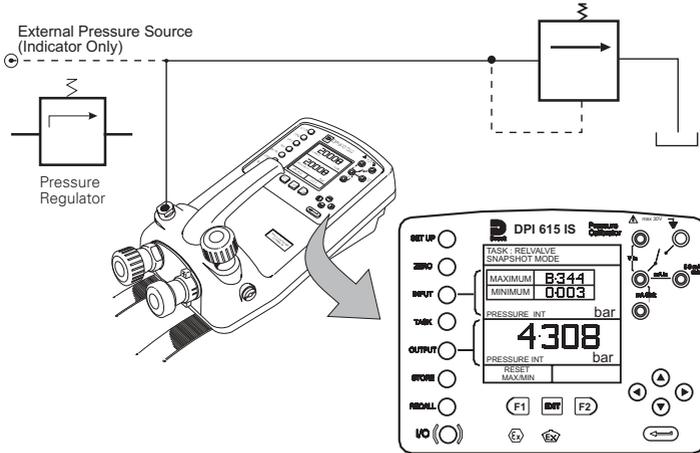
To subsequently change any of the **Tx SIM** scaling parameters, press **CHANGE VALUE** key (F1) to obtain the TX Simulation set-up display.

To change the pressure units, press **INPUT** and select the required scale units. If the required scale units are not listed, press **SETUP**, select **SETTINGS** and proceed as detailed on Page 37.

Taking Measurements

Relief Valve Test (REL VALVE) Task

To carry out a relief valve test, press **TASK** and select **REL VALVE**. Connect the output pressure port of the instrument to an external system as shown below.



- To change the pressure units, if required, press **INPUT** and select the required units using the cursor keys.
- Close the vent valve and, using the hand-pump or external pressure supply, apply pressure to the relief valve under test.
- When the relief valve operates, the maximum recorded pressure indicates the operating point of the valve.
- Record the test results.

Note: The **STORE** key can be used for this purpose. Use right cursor key initially, followed by up/down keys to enter Snapshot text.

- Open vent valve to release test pressure.

Note: If using external pressure supply, isolate supply before opening the vent valve.

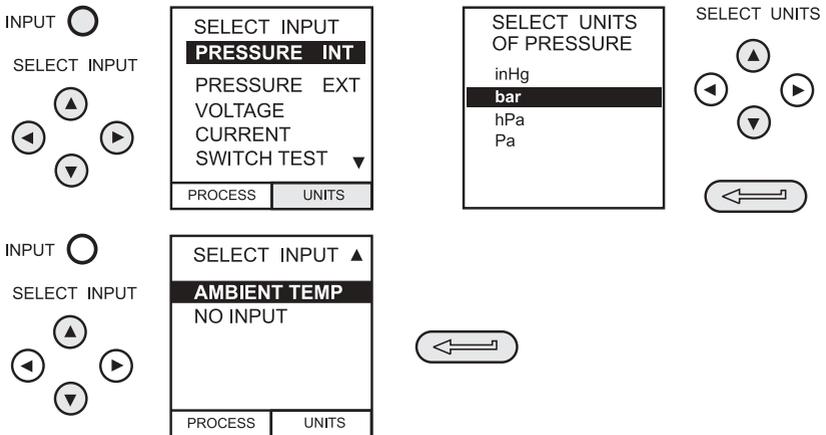
General

Advanced task allows the user to configure the instrument to monitor one of a number of different input measurands (Inputs) and outputs (Sources). Additionally, five process functions, **Tare**, **Max/Min**, **Filter**, **Flow** and **% Span** can be applied to the input functions.

Select Input

To select an input channel for display, select **ADVANCED** Task from the task menu and proceed as follows. If, in addition to process functions, a range of units is available for the selected channel, a **UNITS** soft box (actioned by the F2 function key), will be written to the display.

The following procedure shows the method of input channel selection and the method of changing units (e.g.),

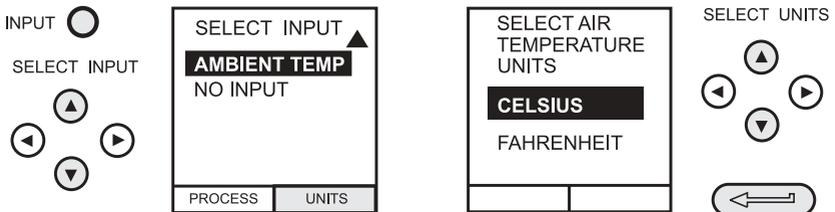


Note: Left/right arrow keys function as page up/down keys.

Refer to pages 20 to 23 for details of process functions.

Ambient Temperature Measurement

To set-up the instrument to read ambient temperature, proceed as follows (e.g.),



Note: Ensure that the temperature reading has stabilised.

Process Functions

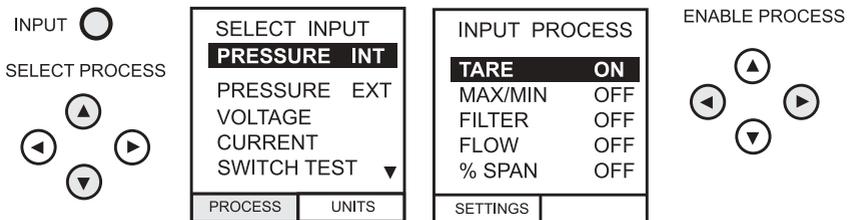
If required, the following process functions are available on the Measurand (*INPUT*) display but **only** in **ADVANCED** task. If the instrument is in any other mode i.e. BASIC or any other task mode, the input and output displays must first be configured in **ADVANCED** task.

Note: *PROCESS functions are not available to the output (SOURCE) channel.*

A summary of the process functions follows.

- Tare** Allows either the current display value or a manually entered value to be tared off display parameter reading.
- Max/Min** Displays running Max/Min and Present display values simultaneously. Resettable via F1 key.
- Filter** Applies low pass filter function to displayed parameter. Filter characteristics (*Settling time and Band*) are user programmable.
- Flow** Applies square root function to displayed parameter.
- % Span** Converts displayed parameter reading to a percentage of span. Span definable via the F1 key.

Following selection of **ADVANCED** from the task menu, press the **INPUT** key. Use the **Up ▲** or **Down ▼** cursor keys to select the required input. Press the **PROCESS** (F1) key and use the **Left ◀** or **Right ▶** cursor keys to enable the process on/off (e.g.),



Press **ENTER** to switch the process ON with existing settings or F1 to change process settings (where applicable).

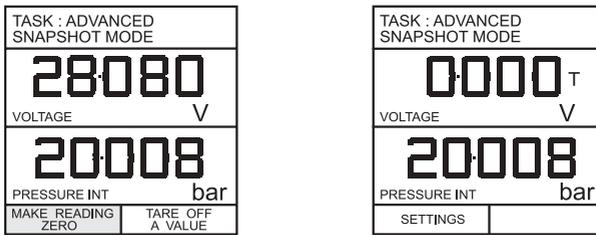
- Tare Process Function**

To set-up a Tare function, enable **TARE** from the process menu and press F1 to enter the Tare **SETTINGS** functions.

Disable **TARE** by entering process menu and turning the function **OFF**.

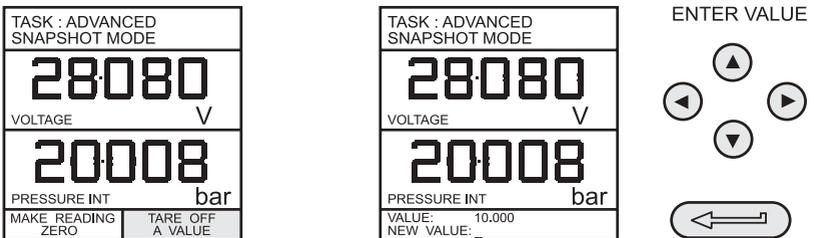
Note: Last TARE setting is retained and will be applied when function is next enabled.

Tare Current Measurand Reading To tare-off the current display reading, proceed as follows (e.g.),



Tare Off An Entered Value To tare-off an entered value current, proceed as follows (e.g.),

Note: Display shows the last entered Tare Value.



- Min/Max Process Function**

To set-up an input display to show min/max and present measurand reading, enable MIN/MAX from the process menu and press F1 (SETTINGS) to provide **RESET** function. The display is now reconfigured to show the max/min values as follows (e.g.),

TASK : ADVANCED SNAPSHOT MODE	
MAXIMUM	8304
PRESENT	4308
MINIMUM	0003
VOLTAGE V	
8304	
PRESSURE INT bar	
RESET	
MAX/MIN	

Reset Max/Min display at any time by pressing the F1 key.

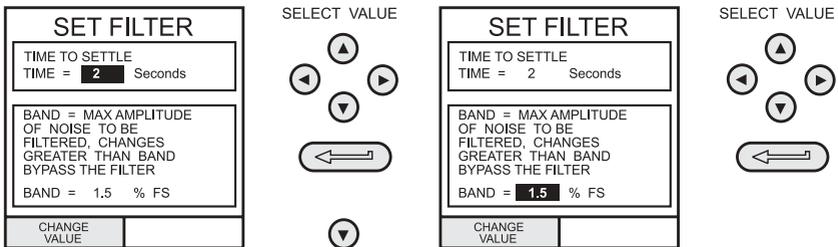
To quit max/min, press **INPUT**, select **MAX/MIN** from process menu and switch the function off.

- Filter Process Function**

To apply the low pass filter to a selected measurand, enable **FILTER** from the process menu and press F1 (SETTINGS) to provide access to the filter parameters. Two settings are required, *Time to Settle* and *Band*.

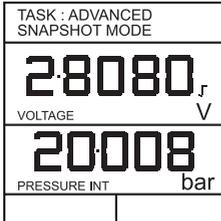
To examine the current filter settings and exit without change, press the **EXIT** key.

The set-up procedure is as follows.



- **Flow Function**

To apply the flow function to a selected measurand, enable **FLOW** from the process menu and press **ENTER**. The square root symbol is displayed beside the measurand to indicate that the **FLOW** function is active (e.g.)



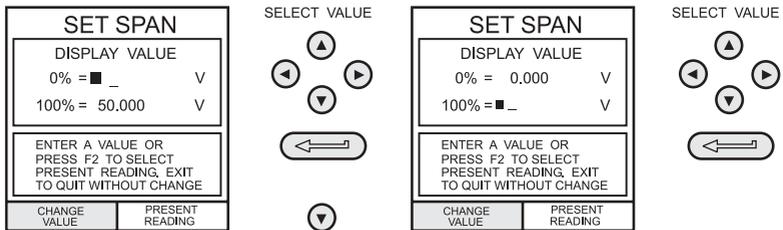
To cancel **FLOW**, press **INPUT** and turn function OFF at the process menu.

- **% Span**

To convert a selected measurand display from a numerical value to a percentage of full-scale reading, enable **SPAN** from the process menu and press F1 (SETTINGS) to provide access to the span definition parameters. Two span definitions are required, **Zero** and **Full Scale**.

To leave span at current setting, press **EXIT**.

To define zero and full-scale settings, proceed as follows.

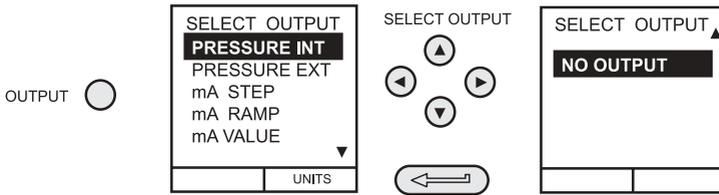


To cancel **% SPAN**, press **INPUT** and turn function OFF at the process menu.

Select Output

To select an output channel for display, select **ADVANCED** mode from the Task menu and proceed as follows. If a channel has a range of units available, a **UNITS** soft box (actioned by the F2 function key), will be also be written to the display.

The following procedure shows the method of output channel selection. Note that there are two pages of options. The second page can be obtained directly from the first by pressing the **RIGHT** cursor key.



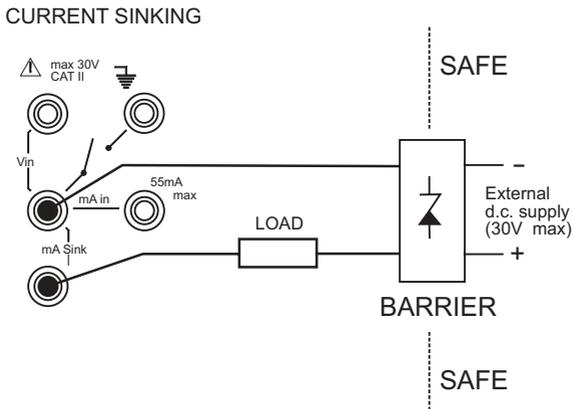
Note: Left/right arrow keys function as page up/down keys.

To change the output units (*Pressure* channels only), select the channel with the cursor keys and press F2 before pressing **ENTER**.

Electrical Outputs (Loop Power)

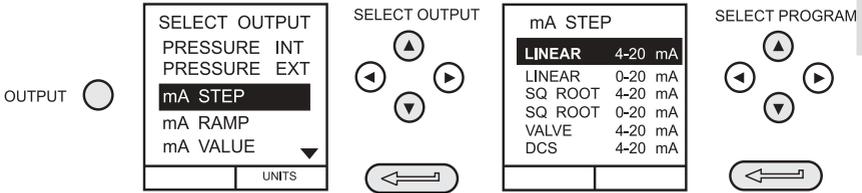
All the electrical outputs, the output loop must be powered from an external supply (current sinking).

External connections to the front panel of the instrument are shown below.

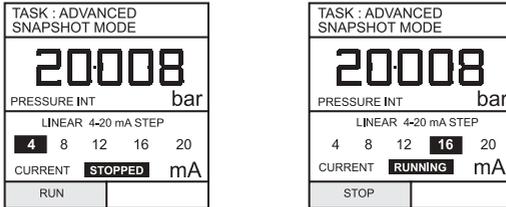


mA Step

To select one of the electrical output programs, press the **OUTPUT** key and proceed as follows (e.g.),



On selection of (e.g.) Linear, the output display window changes to show the selected program of output currents (e.g.),



- Connect an external power source as shown on Page 24.
- Press **RUN** (F1) to run program. A flashing status display **CHECK LOOP** indicates a fault in the external loop i.e. supply fault or open circuit.

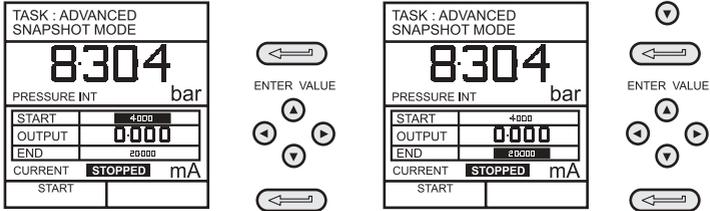
Note: The dwell time at each step is approximately 10 seconds.

- Press **STOP** (F1) when running to stop at any point. Press **RUN** (F1) to resume.

mA Ramp

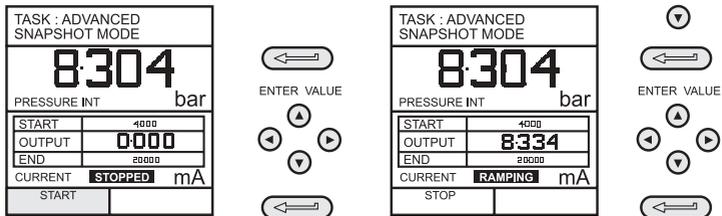
Press the **OUTPUT** key and select **mA Ramp** in a similar manner to that shown above.

- Define ramp required by entering **START** and **END** current values as shown below (e.g.),

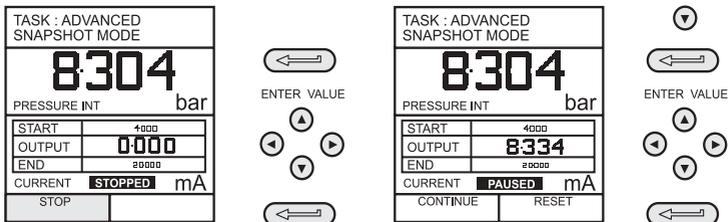


- Connect an external power source as shown on Page 24.
- Press **START** (F1) to run the program. A status display **CHECK LOOP** indicates a fault in the external loop i.e. supply fault or open circuit.

Note: The ramp cycle (min to max or max to min), is approximately 60 seconds.

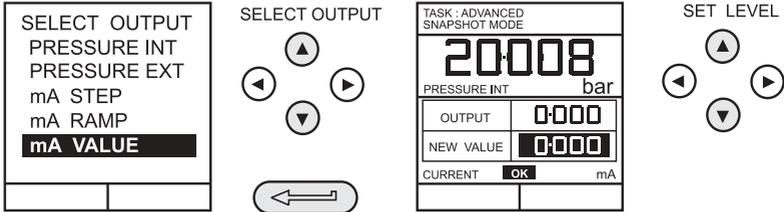


- Press **STOP** (F1) when running to stop at any point. Press **CONTINUE** (F1) to resume from point of pause or **RESET** (F2) to return to start point.



mA Value

Press the **OUTPUT** key and select **mA Value** from the Output menu. The procedure is shown below (e.g.),



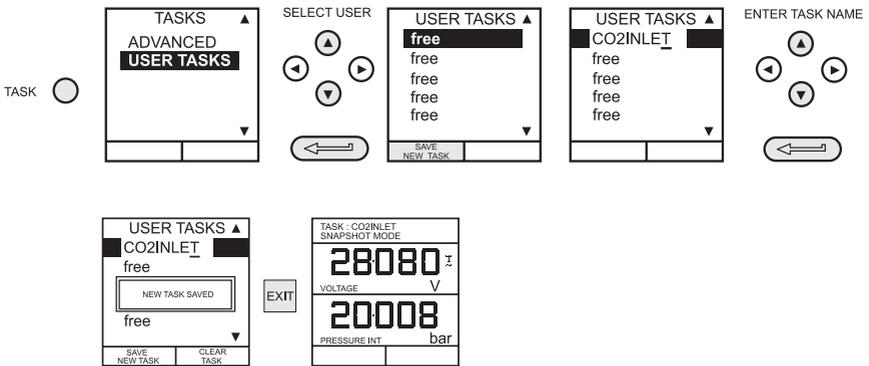
- Connect an external power source as shown on Page 24.
- Use **Up ▲** and **Down ▼** cursor keys to adjust output current level. While the loop is made, a status display indicates **OK**. A status display **CHECK LOOP** indicates a fault in the external loop i.e. supply fault or open circuit.

English

Define New Task

To define a new task, proceed as follows.

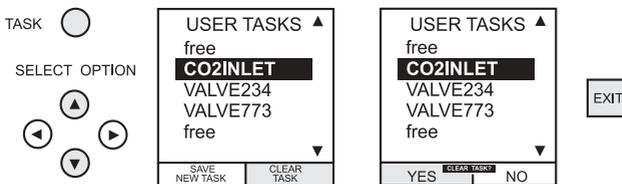
- Select **ADVANCED** from **TASK** menu.
- Using the **INPUT** key, select the required measurand as the input display and set-up any process functions required.
- Using the **OUTPUT** key, select the required measurand as the output display.
- Press **TASK** and select **Free**. Enter new task name as follows (e.g.),



On completion of the above procedure, the display reverts to newly set-up task as shown.

Clear Task

To clear a user defined task, select **TASK** and proceed as follows (e.g.),

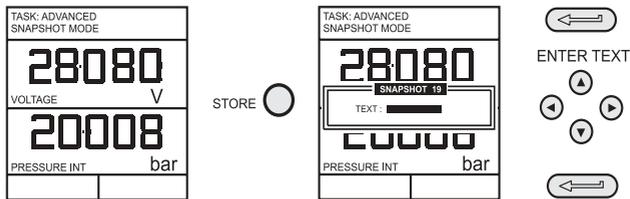


Saving Display (Snapshot) or Datalog

Memory operations depend upon how Store mode has been set-up. Three options are available **None**, **Snapshot** and **Datalog**. Refer to **SETUP** for details.

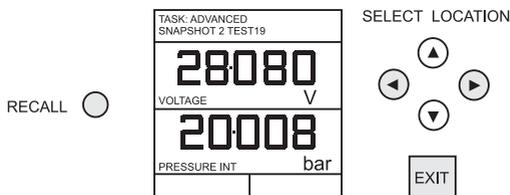
Store Operations (Screen Snapshots)

To store any display (menu displays excepted), press the **STORE** key. This saves the current display to the next available location. Supporting text (10 characters) may be appended. Twenty memory locations are available on a cyclic buffer. When all 20 have been used, store operations overwrite existing locations, starting at *Location 1*.



Recalling Stored Data (Screen Snapshots)

To recall a previously stored display, press the **RECALL** key. This recalls the last display saved. Press the **Left** ◀ or **Right** ▶ cursor keys to recall the previous or next locations respectively. To exit **RECALL**, press the **EXIT** key.



Datalog Operations

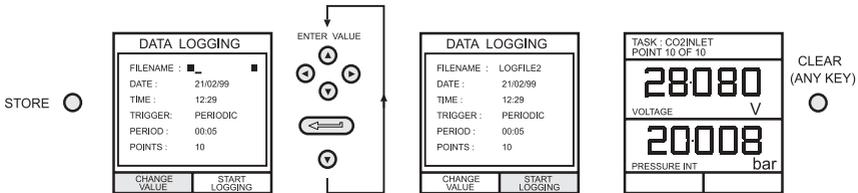
Datalog is a special application of store mode which enables the calibrator to either automatically log displays at preset time intervals or to manually log a display on operation of the **STORE** key. Logged data is written to a user specified file.

To set up a datalog file, proceed as follows.

- Select a task, other than **BASIC**. If using **ADVANCED**, set-up required Source and Output parameters.
- Use **SETUP** to select Datalog from the Store Mode Menu (See Page 36).

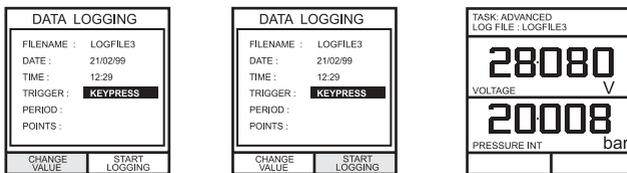
Auto Log (Timer)

Press **STORE** and set-up the datalog file parameters as shown below. Use **CHANGE VALUE** (F1) followed by cursor keys to set field values. For Auto Log, set-up **TRIGGER** field to **PERIODIC**.

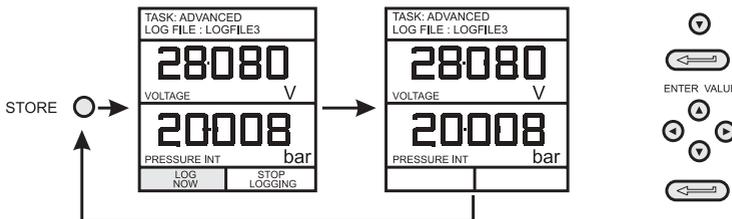


Manual Logging

Enter the file details as shown above and select **KEYPRESS** for **TRIGGER** field. Screen reverts to displayed parameters showing set-up file as shown below (e.g.),

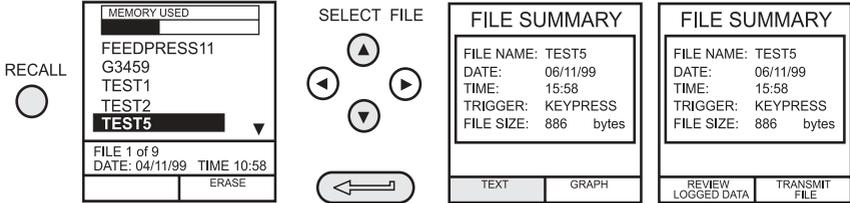


- Use a combination of **STORE** and **LOG NOW** (F1) to log events as follows.

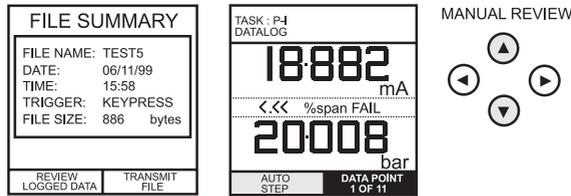


Recall Datalog Files

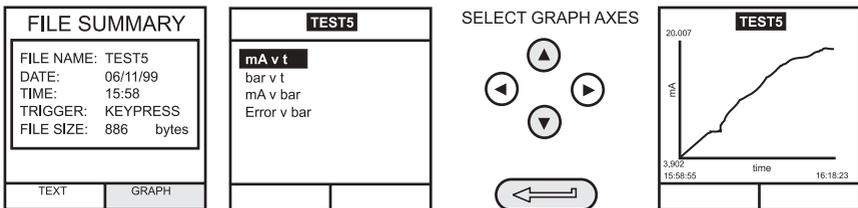
To recall a datalog file to the display, make sure that **DATALOG** is selected from the **SETUP** menu and proceed as follows (e.g.),



Datalog files can be displayed either as text (stored screens) or in graphical form. To display as text, proceed as follows from the File Summary menu. Select Auto Step to automatically review each screen at 1 second intervals or use the left and right cursor keys to manually review.



To display logged data in graphical form, on screen, proceed as follows from the File Summary menu (e.g),



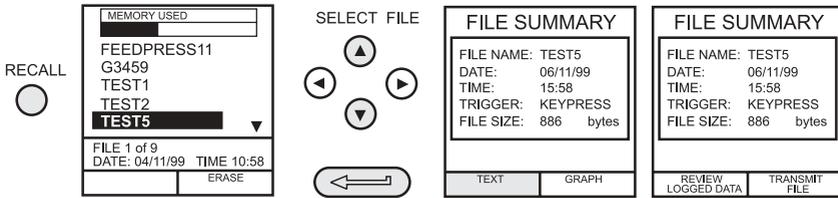
Uploading Datalog Files

WARNING

THE RS232 INTERFACE MUST ONLY BE USED IN A SAFE AREA

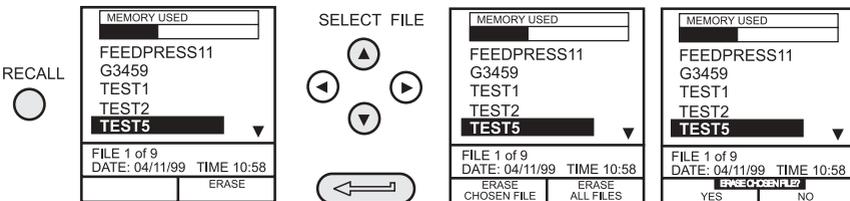
Connect the RS232 socket of the instrument into either the COM1 or COM2 port of the PC. Ensure that the RS232 parameters at the PC end match those of the instrument. The RS232 parameters of the instrument can be checked as detailed on page 38. Set up a file on the PC to receive the data, (e.g.) in the *Windows Terminal* program.

To upload a file, proceed as follows. Appendix 1 give details of a typical uploaded datalog file.



Delete Datalog and Procedure Files

To delete a datalog file, or a procedure file, proceed as follows. Alternatively, to delete all logged files simultaneously, select **ERASE ALL FILES** (F2) at the erase screen.



Downloading Procedure Files (DPI 615 versions only)

WARNING

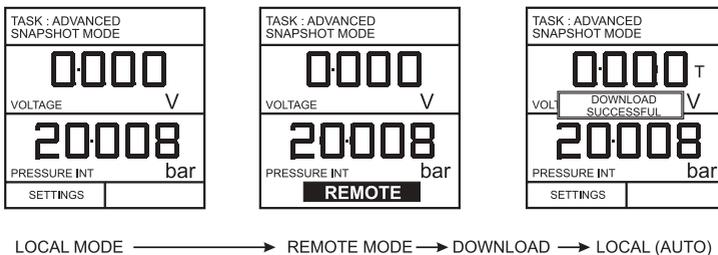
THE RS232 INTERFACE MUST ONLY BE USED IN A SAFE AREA

Complete test procedures may be downloaded from a PC to the DPI 615 instrument via the RS232 port. A procedure consists of a number of Druck Universal Command Interface (DUCI) commands which are usually assembled by a linking management software application (such as the Druck Intecal_W).

Before downloading a procedure, the DPI 615 must be in the REMOTE mode. To place the instrument into REMOTE mode, proceed as follows.

- Connect the instrument's RS232 port to a free COM port on a PC.
- Make sure that the COMMS parameters of the PC match those of the instrument (refer to Page 38).
- Make sure that the instrument is not already running a procedure. If it is, quit the procedure.
- Download the procedure. Procedures are stored in the Datalog directory.

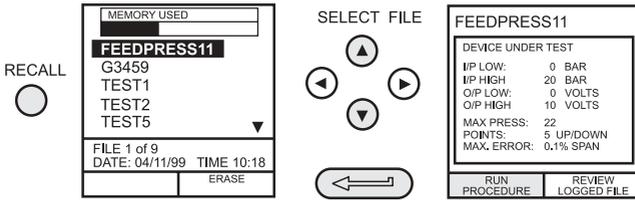
The following sequence shows a typical download sequence which commences with the instrument in LOCAL mode.



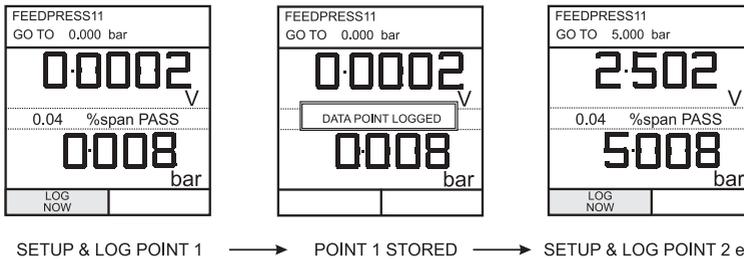
After the procedure file has been downloaded, the instrument is usually returned to the LOCAL mode by the last command in the procedure file. If the instrument remains in REMOTE mode, switch it OFF and ON to reset it.

Running Procedure Files (DPI 615 versions only)

To run a procedure, make sure that the DPI 615 is set to the Datalog mode (see page 36), and proceed as follows.



After selecting F1, proceed by entering the User ID and Serial Number and then select F1 (Continue) and follow the on-screen procedural instructions (e.g.),

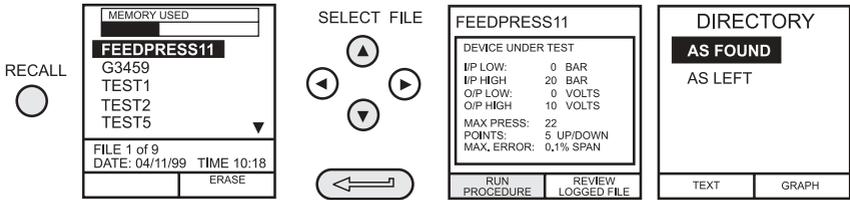


When the test procedure for a given UUT has been completed, the result of running the first test is stored as an AS FOUND file. This file cannot be overwritten. Any other tests on the device are stored as an AS LEFT file which is overwritten each time the procedure on this device is run.

When recalling the results of a procedure, the choice of AS FOUND or AS LEFT is provided (refer to page 35).

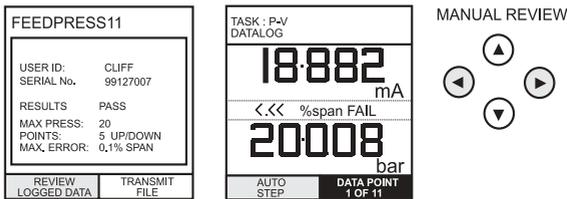
Recalling Data Files

Data or results files generated by running procedures are stored in the instrument's datalog directory. To recall a data file to the display, make sure that **DATALOG** is selected from the **SETUP** menu and proceed as follows (e.g.),



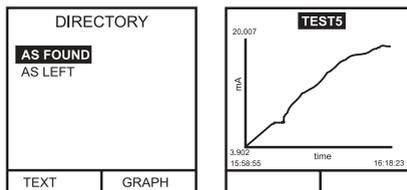
Use the cursor keys to select either the AS FOUND option or the AS LEFT option for display. AS FOUND is the result of the first run of a procedure and AS LEFT is the result of the last time the procedure was run.

Procedure data files can be displayed either as text (stored screens) or in graphical form. To display as text, select the TEXT option (F1) from the directory and proceed as follows from the File Summary menu. Select Auto Step (F1) to automatically review each screen at 1 second intervals or use the left and right cursor keys to manually review.



To transmit the selected logged data via the RS232 interface, connect the instrument to a free port on an external PC, make sure that the instrument's RS232 parameters match those of the PC.

To display logged data in graphical form, on screen, select GRAPH (F2) from the directory and proceed as follows (e.g.),



Using Setup

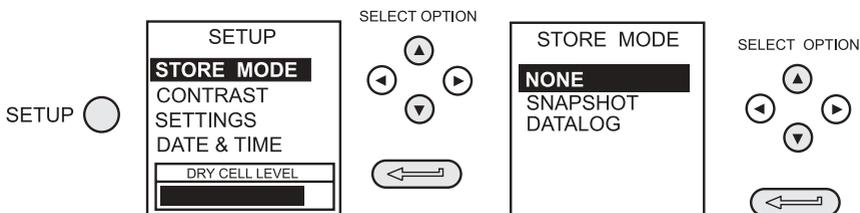
General

SETUP mode is available in all modes except **BASIC**. It permits the set-up of the following instrument parameters.

- Store Mode - None, Snapshot, Datalog.
- Contrast.
- Instrument Settings - Units, Language, RS232 parameters, Powerdown, and Calibration Routines (*Refer to page 40 for Calibration details*).
- Date and Time (Real Time clock).

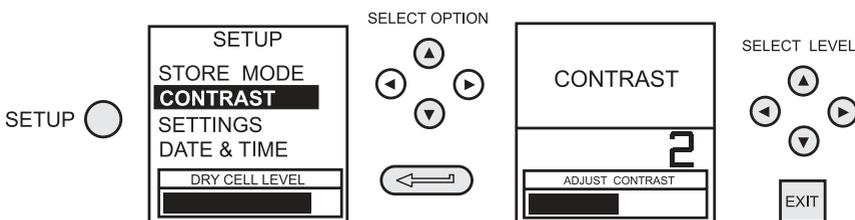
Store Mode

Select **STORE MODE** from the **SETUP** menu and select required mode as follows.



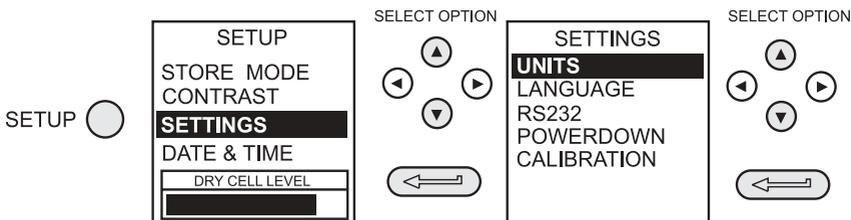
Contrast

Select **CONTRAST** from the **SETUP** menu and proceed as follows.



Settings - Select Setup Option

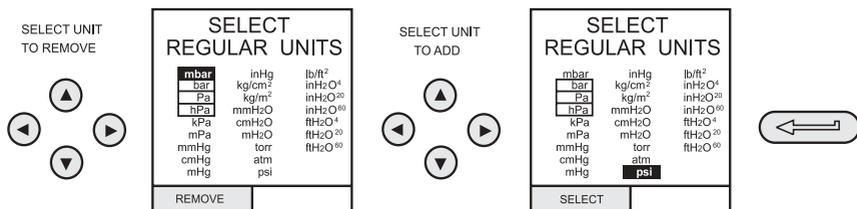
To select one of the **SETTINGS** options from the **SETUP** menu, proceed as follows.



Using Setup

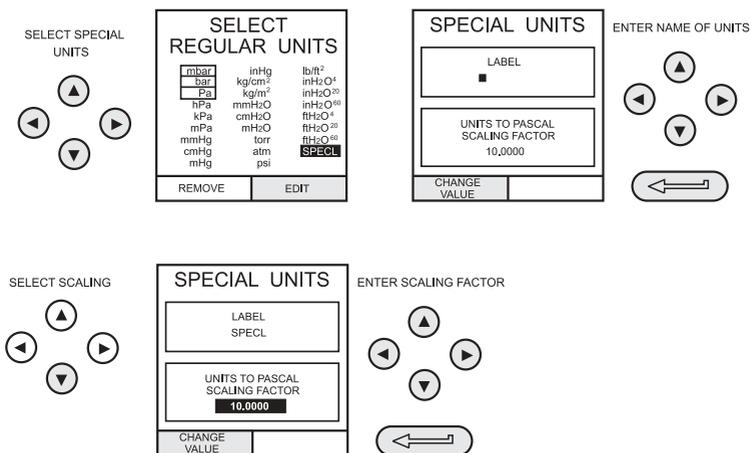
Units

Select (pressure) Units from the **SETTINGS** menu and proceed as follows.



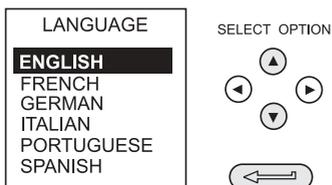
Define Special Units

Select (pressure) Units from the **SETTINGS** menu, and select Special Units and proceed as follows.



Language

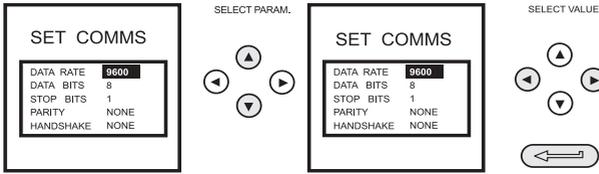
Select the **LANGUAGE** version required from the Settings menu and proceed as follows.



Using Setup

RS232

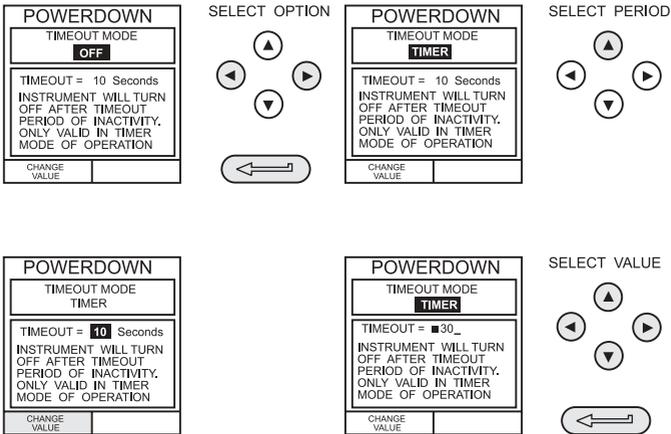
Select **RS232** from the **SETTINGS** Menu and proceed as follows.



Note: Use of the RS232 communications interface is only permitted in a SAFE area. The settings shown above are the default settings.

Powerdown

Select **Powerdown** from the **SETUP** menu and proceed as follows.



If **TIMER** mode is selected, following a period of inactivity, the instrument will automatically power off after the preset **TIMER** period.

If **OFF** is selected, auto power off is inhibited and once switched on, the instrument will remain **ON** until it is manually switched **OFF**.

Calibration

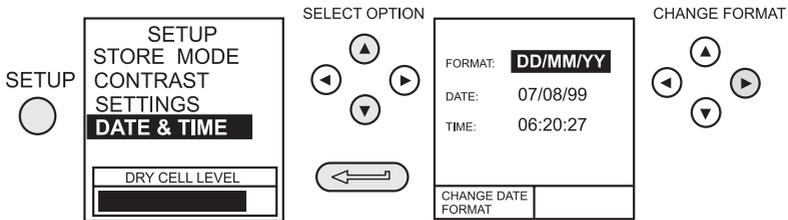
Calibration routines are password protected. Refer to Calibration Section, Page 40 for details of use.

Using Setup

Date and Time (Real Time clock)

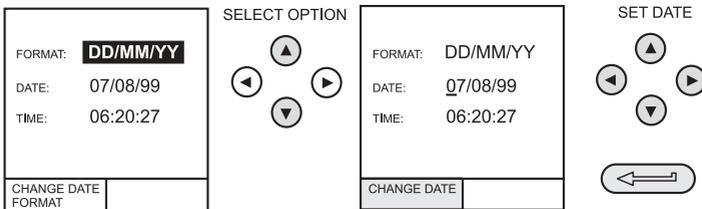
Date Format

To set-up the real time clock, select **DATE & TIME** from the **SETUP** menu and, using the right arrow key, set-up the required date format as shown below (e.g.),



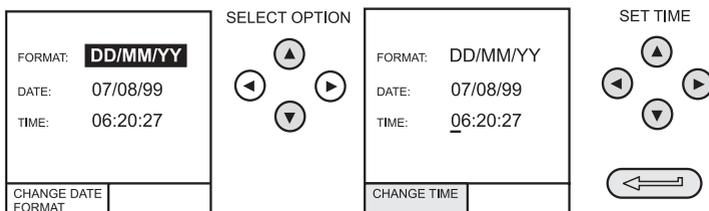
Set Date

Select **DATE** from the **DATE & TIME** menu and change the date by means of the cursor keys as shown below. The up/down keys change the numerical value of the selected digit (indicated by the underline cursor) and the left/right keys select the required digit position.



Set Time

Select **TIME** from the **DATE & TIME** menu and change the date by means of the cursor keys as shown below. The up/down keys change the numerical value of the selected digit (indicated by the underline cursor), and the left/right keys select the required digit position.



Calibration

General

The instrument is supplied by the manufacturer, complete with calibration certificate(s). A re-calibration interval of 12 months is recommended. The actual re-calibration interval will depend upon the total measurement uncertainty which is acceptable for a particular application.

The DPI 615 are very precise measuring instruments and the test equipment and conditions of test must be suitable for the type of work. The use of a Class A compensated deadweight tester is essential. The tests should be carried out in a controlled environment by a calibration technician*.

If, when the accuracy of the instrument is checked, it is found to fall outside the specification, calibration adjustment can be undertaken to compensate errors.

The manufacturer offers a comprehensive and, if required, NAMAS accredited calibration service.

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

Calibration Check

At the chosen interval, the instrument readings should be compared with a known standard. Any deviations between the instrument and the standard should be noted, taking due account of the traceability (accuracy to a National Standard). If these deviations exceed the published tolerance, or any other suitable chosen performance standard, then the user may wish to carry out a calibration adjustment.

It is recommended that measurements be checked at 0, 20, 40, 60, 80 and 100% of full-scale on an ascending and descending run.

Calibration Adjustment

If the instrument is operating correctly, only zero and full-scale calibration will vary. Any excessive non-linearity or temperature effects indicate a fault. The instrument should be returned to a qualified service agent.

Calibration

General Procedures

The following general hints are provided as a guide to calibration procedures. Full calibration procedures are described in publication number K235.

Do

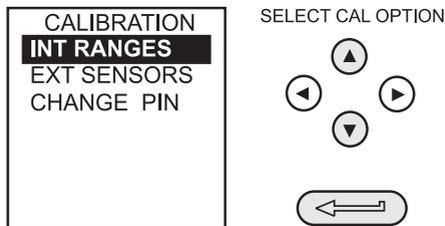
Use high quality **Repeatable and Linear** pressure sources and allow adequate stabilization time before calibration (minimum 1 hour).

Conduct the calibration in a temperature and preferably, humidity controlled environment. Recommended temperature is **21°C, ±2°C**.

Use deadweight testers carefully and away from draughts.

Using the Calibration Menu

The calibration routines are selected from the **SETUP** menu as detailed on page 36. Enter the calibration PIN number, initially set to **4321**, press  and the Calibration Menu will be displayed as follows. It is recommended that the PIN number be changed as soon as possible.



Select the item to calibrate from the menu as shown above and follow the calibration procedure outlined on the display. The following test equipment will be required.

Pressure Measurement Channels (Internal and External)

- Deadweight Tester.

Voltage Ranges (5V and 30V)

- Voltage source.

Current Inputs and Outputs

- Digital Milliammeter.

Calibration

Temperature

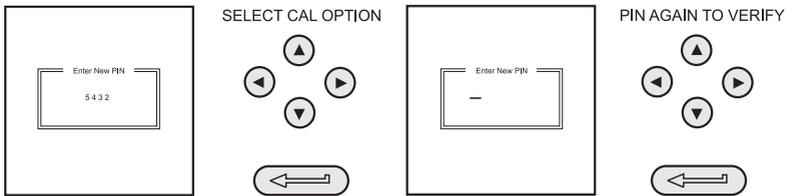
- Precision Temperature Meter.

On completion of calibration routines, exit the calibration mode by pressing the **EXIT** function key.

Change PIN Number

To change the PIN number, select **CHANGE PIN** from the calibration menu and proceed as follows. Note that to set and verify a new PIN number, the new PIN number must be entered twice.

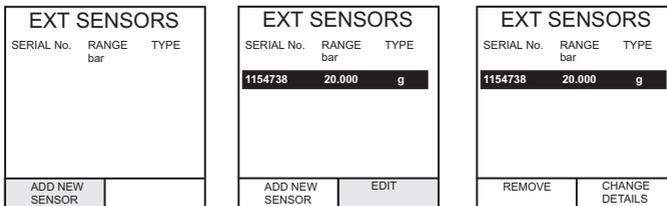
If the second number entered differs from the first, no new PIN number is set.



Add External Sensor

To add an external sensor to the directory of external sensors, proceed as follows.

- Plug the external transducer into the connector located on top of the instrument and proceed as shown below.



Digitally-compensated transducers will be downloaded into the directory as soon as the F1 key is operated. Data for other types can be edited by selecting EDIT (F2). If the data cannot be edited a warning message (ACTION INVALID) is displayed.

Cleaning Instructions

Clean the case of the instrument by using a damp cloth and mild detergent.

Note: *DO NOT* use any solvents to clean the instrument.

HYDRAULIC CALIBRATOR VERSION

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Introduction

These versions of the DPI 610 IS and DPI 615 IS provide manual generation of hydraulic pressure and consist of a screw-press with a priming pump and priming isolation valve as shown below. The bleed pipe connections are also shown in Figure A1.

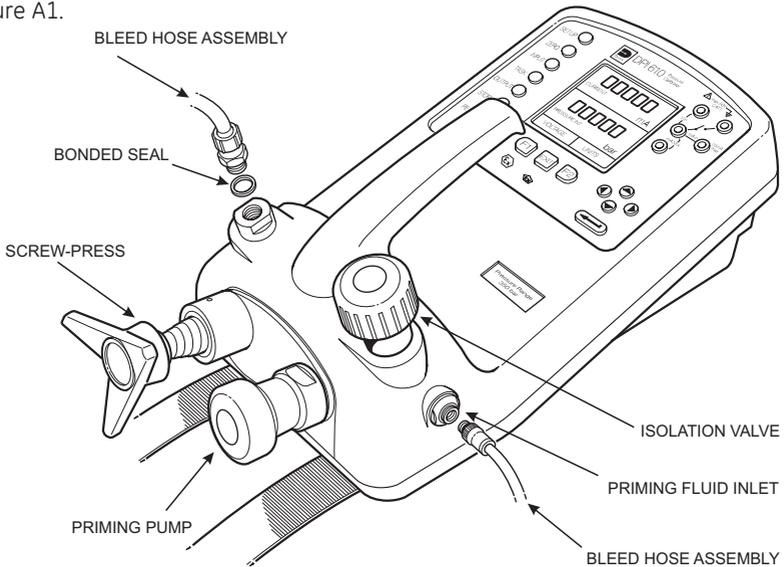


Figure A1 - DPI 610/615 HC Connections

The internal hydraulic parts are brass, stainless steel, copper, nylon and fluorocarbon rubber (Viton). The hydraulic fluid can be either demineralised water or one of the hydraulic fluids listed in Table A1.

Caution: Only use the recommended hydraulic fluids.
DO NOT mix hydraulic fluids.

ISO 3448 Viscosity grade	Approx. SAE Viscosity Classification	Shell	Esso	Mobil
VG10	5W	Tellus R10	Nuto H10	Velocite No.6
VG15		Tellus T15 Tellus V15	Nuto H15	
VG22		Tellus 22 Tellus R22	Nuto H22	DTE 22
VG 32	10W	Tellus V32	Nuto H32	DTE Oil Light DTE 24
VG 37		Tellus 37 Tellus R37 Tellus T37 Tellus V37		

Table A1 - Recommended Hydraulic Fluids

Safety Instructions

WARNING

HYDRAULIC FLUID IS INJURIOUS. OBSERVE RELEVANT HEALTH AND SAFETY PRECAUTIONS. USE APPROPRIATE PROTECTIVE BARRIERS AND EYE PROTECTOR.

BEFORE APPLYING PRESSURE, EXAMINE ALL FITTINGS AND EQUIPMENT FOR DAMAGE AND ENSURE THAT ALL EQUIPMENT IS TO THE CORRECT PRESSURE RATING.

DO NOT EXCEED THE MAXIMUM WORKING PRESSURE OF THE INSTRUMENT (INDICATED ON START-UP SCREEN AT SWITCH-ON).

Caution: Observe absolute cleanliness when using the instrument. Severe damage can be caused if equipment connected to this instrument is contaminated. Connect only clean equipment to the instrument. To avoid any contamination, an external filter is recommended.

Preparation for Use

- Fit the bleed pipe connection to the priming port using the bonded seal as shown in Figure A1.
- Make sure that the screw-press is wound fully in (clockwise).
- Make sure that the isolation valve is open (fully anticlockwise).
- Connect the device or system under test to the pressure port using a bonded seal as shown in Figure A2.

WARNING

MAKE SURE THAT THE CONNECTING LINE TO THE EXTERNAL DEVICE OR SYSTEM IS CAPABLE OF WITHSTANDING THE LINE PRESSURE TO BE APPLIED.

Note: A bleed point must be provided on the external device.

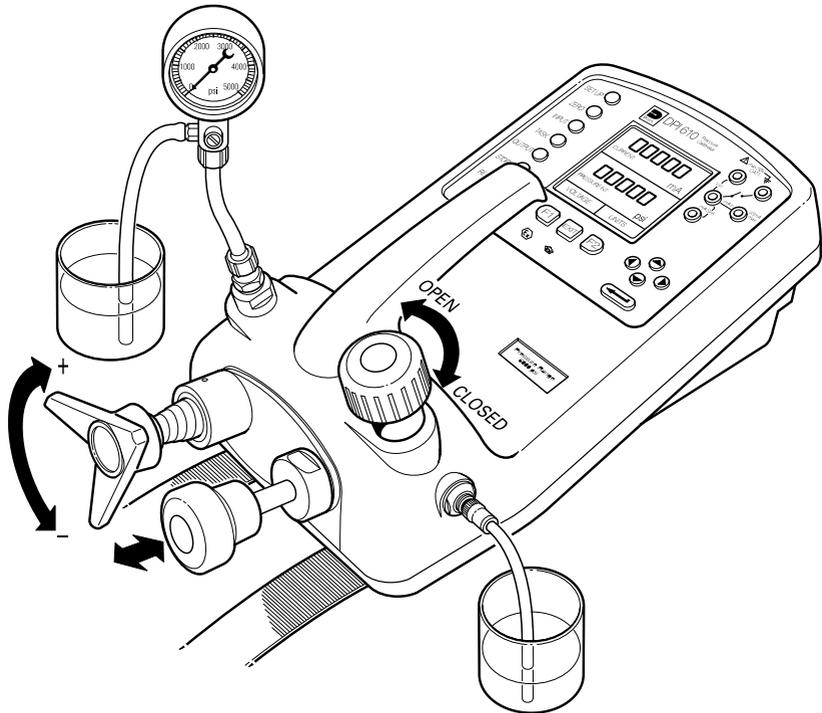


Figure A2 - Priming/Test Set-up

Bleeding the System

Before any measurements can be made, the hydraulic system needs to be primed and bled free of air. During the following operations, prepare for fluid spillage and provide a suitable receptacle for collecting the spillage.

- (1) Prepare for use as detailed on page 46.
- (2) Fill a suitable container with the required hydraulic fluid and place the priming inlet assembly hose into the fluid.
- (3) Open the bleed valve on the Unit Under Test (UUT). If possible, fit a hose to the bleed point and place this in a container of the same fluid.
- (4) Use the priming pump, to pump hydraulic fluid into the instrument and the connected system. Monitor the hydraulic fluid level, ensuring that the priming hose stays below the fluid level and is not allowed to suck in air. Top-up hydraulic fluid level as necessary.

- (5) Continue use of the priming pump until only hydraulic fluid and no air is expelled from the bleed point.
- (6) Close the bleed point when the priming pump is at the bottom of its stroke (fully pushed in) and slowly wind out the screw-press to its fullest extent to draw in further hydraulic fluid (approx. 7cc).
- (7) Switch the instrument **ON** and, still using the priming pump, pressurise the system to approximately 2 bar.
- (8) Close the isolation valve and remove the connection to the priming/fluid inlet port.

Operation

To obtain a pressure reading, proceed as follows.

- (1) Switch the instrument **ON** and select the required **TASK**.
- (2) Rotate the screw-press clockwise to increase the applied pressure.

Note: *When hydraulic fluid is compressed and flows through a restriction, there is an increase in temperature which, in turn, has an effect on pressure. Allow sufficient time for this pressure reading to stabilise before recording or logging a reading.*

- (3) When the test is complete, reduce the pressure in the system to zero by turning the screw-press anticlockwise. Before disconnection of the UUT, open the isolation valve to bleed off any residual pressure.
- (4) Remove the connection to the UUT and fit a blanking plug into the instrument's pressure port. Clean any spilt fluid off the instrument case.

Draining the Hydraulic Fluid

To drain the hydraulic fluid from the instrument, proceed as follows:

- (1) Turn the isolation valve fully anticlockwise. Turn the instrument onto the left hand side (pressure port nearest to workbench). Place receptacle below the pressure port to collect hydraulic fluid.
- (2) Drain the system by slowly winding in the screw-press and then depressing the priming pump plunger to expel any fluid remaining in the instrument.
- (3) If necessary, apply an air line to the priming fluid inlet to clear any remaining fluid out of the instrument.

Flushing - Replenishing or Changing the Hydraulic Fluid

If necessary, to remove any contaminants, flush out the hydraulic system as follows.

- (a) Connect a priming hose assembly to the fluid inlet port and the pressure port as shown below.

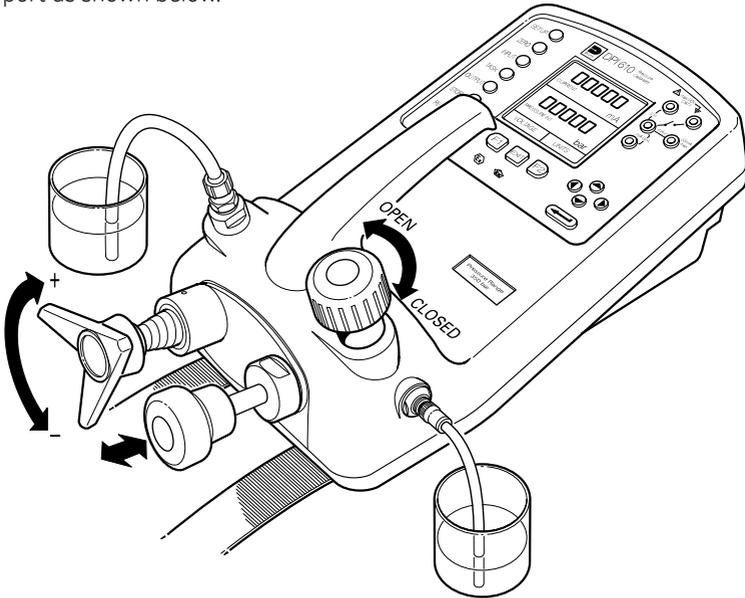


Figure A3 - DPI 610/615 IS HC - Flushing/Filling Connections

- (b) Fill the priming fluid container with fresh hydraulic fluid of the required type. Use the priming pump, to pump fresh hydraulic fluid through the system until clean hydraulic fluid, free of air bubbles, emerges into the container at the output port. Discard the contaminated fluid expressed during this process.
- (c) Remove the hose located to the output port and, to prevent the ingress of any contaminant, fit a blanking plug in its place.
- (d) Close the isolation valve and remove the priming fluid inlet hose from the priming inlet.
- (e) Clean off any surplus oil which may have spilled onto the instrument casing.

The instrument is now ready for operation or storage. If storing, apply a label detailing the type of hydraulic fluid contained in the instrument. **For long term storage, it is recommended that the instrument be drained and stored empty.**

Notes

Appendix 1

DATALOG FILE EXAMPLE

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Typical Uploaded Datalog File (DPI 610 IS)

The following gives details of a typical data file upload.

```

FILENAME:  TEST 5
DATE:      05/11/1999
TIME:      15:58
TRIGGER:   KEYPRESS
AMBIENT TEMP : 24.1 C

NO. OF POINTS  11
RECORD TYPE    0
CURRENT        mA  PRESSURE INT bar

```

```

3.902  0.008  -0.65 %span  05/11/1999  15:58:55
6.076  2.311  1.42 %span  05/11/1999  16:00:03
7.598  4.404  0.47 %span  05/11/1999  16:00:57
8.085  5.023  0.41 %span  05/11/1999  16:01:45
9.949  7.249  0.94 %span  05/11/1999  16:02:42
13.002 11.300 -0.23 %span  05/11/1999  16:03:30
17.005 16.102  0.77 %span  05/11/1999  16:05:00
17.766 17.106  0.51 %span  05/11/1999  16:06:07
17.812 17.105  0.80 %span  05/11/1999  16:07:49
18.532 17.965  1.00 %span  05/11/1999  16:16:35
20.007 20.212 -1.02 %span  05/11/1999  16:18:23

```

The **Record Type** number contained in the header is a 16-bit field, with the individual bits representing result formats as detailed below.

Record Type 1	P-Display
Record Type 2	Switch Test
Record Type 4	Leak Test
Record Type 8	Input channel: Min/Max ON
Record Type 120	Combination of all input process functions
Record Type 896	Combination of all output process functions
Record Type 1024	mA step mode
Record Type 2048	mA value mode
Record Type 4096	mA ramp mode
Record Type 8192	no input selected
Record Type 16384	no output selected

Typical Uploaded Procedure Data File (DPI 615 IS)

The following gives details of a typical data file upload.

FILENAME: TEST 6
DATE: 05/11/1999
TIME: 15:58
TRIGGER: KEYPRESS
AMBIENT TEMP : 24.1 C

NO. OF POINTS 11
RECORD TYPE 0
CURRENT mA PRESSURE INT bar

3.902	0.008	-0.65	%span	PASS	05/11/1999	15:58:55
6.076	2.311	1.42	%span	FAIL	05/11/1999	16:00:03
7.598	4.404	0.47	%span	PASS	05/11/1999	16:00:57
8.085	5.023	0.41	%span	PASS	05/11/1999	16:01:45
9.949	7.249	0.94	%span	PASS	05/11/1999	16:02:42
13.002	11.300	-0.23	%span	PASS	05/11/1999	16:03:30
17.005	16.102	0.77	%span	PASS	05/11/1999	16:05:00
17.766	17.106	0.51	%span	PASS	05/11/1999	16:06:07
17.812	17.105	0.80	%span	PASS	05/11/1999	16:07:49
18.532	17.965	1.00	%span	PASS	05/11/1999	16:16:35
20.007	20.212	-1.02	%span	FAIL	05/11/1999	16:18:23

The **Record Type** number contained in the header is a 16-bit field, with the individual bits representing result formats as detailed below.

Record Type 1	P-Display
Record Type 2	Switch Test
Record Type 4	Leak Test
Record Type 8	Input channel: Min/Max ON
Record Type 120	Combination of all input process functions
Record Type 896	Combination of all output process functions
Record Type 1024	mA step mode
Record Type 2048	mA value mode
Record Type 4096	mA ramp mode
Record Type 8192	no input selected
Record Type 16384	no output selected