



DPI 610



Portable Pressure Calibrator



User Guide M-2914

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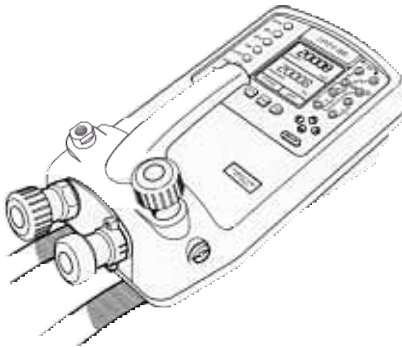
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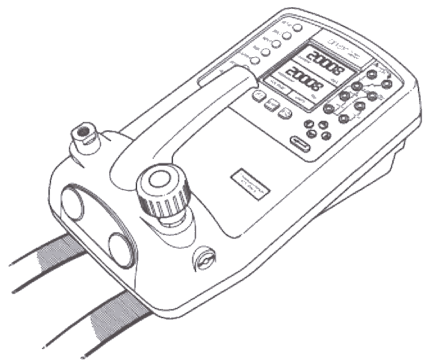
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WARNING: These products are not designed for use in, and should not be used for, patient connected applications.

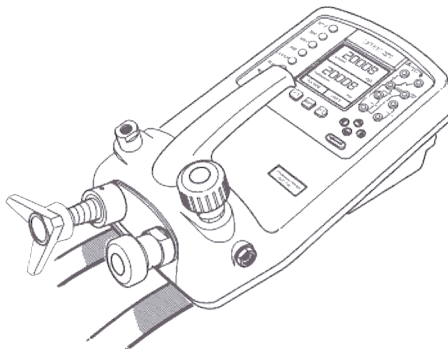
**DPI 610
PORTABLE PRESSURE CALIBRATOR/INDICATOR
USER GUIDE
M-2914**



Calibrator Version



Indicator Version



Hydraulic Actuator Version

DPI 610 Portable Pressure Calibrator

Software version 2.XX



Omega Engineering, Inc. 1997

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SAFETY

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

Pressure

Do not apply pressure greater than the maximum safe working pressure to the instrument.

Toxic Materials

There are no known toxic materials used in this instrument.

Maintenance

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

Electrical Safety

The instrument is designed to be completely safe when used with options and accessories supplied by the manufacturer for use with the instrument.

Test leads

Only use the test leads supplied with this instrument; the test leads must not be used with any other test equipment.

Software Version

This user guide contains operating instructions for instruments with software version 2.XX. Further changes to the instrument's software may require a change to the operating instructions and an issue number change of the user guide.

Technical Advice

For technical advice contact the manufacturer, agent or subsidiary refer to the list at the rear of this manual.

- * A qualified person must have attended a product training course given by the manufacturer or appointed agent and successfully completed the training course on this instrument.



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

Battery Safety

This instrument is fitted with a battery pack of rechargeable cells (nickel cadmium).

Before storing this instrument remove the batteries.

When fitting batteries make sure the electrical contacts are clean and observe the correct polarity.

The battery compartment should be inspected for corrosion caused by leaking batteries. Corrosion must be removed using approved methods*.

When storing and transporting batteries make sure that they cannot be short circuited. A short circuited battery can become very hot and can, in certain circumstances, explode. It is recommended that a suitable container is used for storing and transporting batteries.

Dispose of old batteries using a safe, approved method.*

*Refer to the Battery Manufacturer for this information

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INTRODUCTION

Summary of Functions

General

The DPI 610 is a rugged, portable precision instrument available either as an indicator or calibrator. Additionally, a hydraulic actuator version (HAV) is available.

The instrument is used for calibrating transducers and systems over the range -14.7 psi to 300 psi, (HAV - up to 6000 psi). When used in conjunction with external transducers, the range of the standard calibrator/indicator can be extended up to 10,000 psi.

The instrument is also capable of sourcing and sinking an external current loop up to a maximum output current of 25 mA and measuring dc voltages of $\pm 50V$ and dc currents of ± 55 mA. Ambient temperature measurement is also provided.

The instrument can be powered either by the standard rechargeable NiCad battery pack or by six alkaline C-cells. An external power supply/charger unit is provided as standard and the instrument has an RS232 interface.

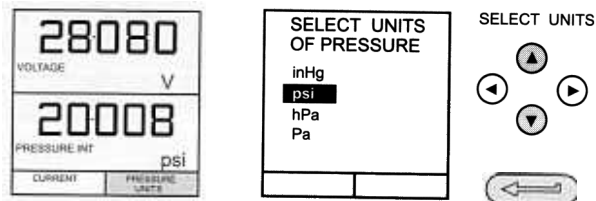
Important notice

Zinc-carbon and zinc-chloride cells are not recommended for this instrument, this type of battery will probably cause unsatisfactory performance.

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). A typical diagram is shown below:



In the above diagram the following key sequence is indicated.

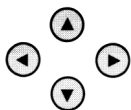
- Press the **F2** key (the key immediately below the **UNITS** soft box).
- Use the **Up** and **Down** cursor keys (only) to select the required option (If all keys shaded, use all these keys to select or enter data).
- Press the **ENTER** key.

INTRODUCTION

Summary of Functions

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 ○

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

Maximum Instrument Ratings

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

PRESSURE	120% FULL SCALE
VOLTAGE	50 V D.C.
CURRENT	55 mA D.C.

Note: The display flashes if the voltage or current are outside the range by 110% of the above values.

OPERATOR CONTROLS (Figure 1 and 2)

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:

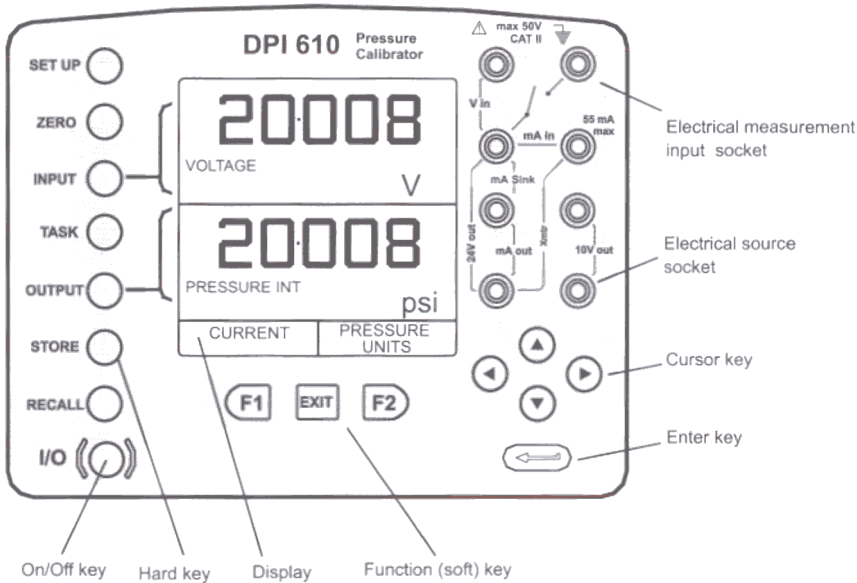
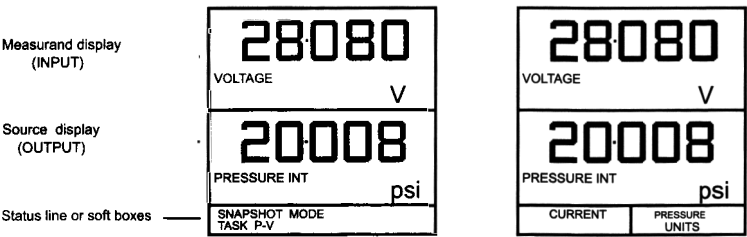


Figure 1 - DPI 610 Keypad

DISPLAY

The display section of the instrument basically divides into three distinct sections. The two main sections of the display are used to display a *Measurand (input parameter)* and a *Source (output parameter)*. The remaining section is used either as a status display area or to define soft key functions. Typical displays are shown below, one showing a status line and the other a soft box allocation:



INTRODUCTION

Summary of Functions

HARD KEY FUNCTIONS (Fig. 1)

Key	Function	Ref Page
ON	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.	30
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. Operational only in ADVANCED mode.	17
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.	10-16
OUTPUT	The OUTPUT key is used to select which of the instrument's source outputs is displayed.	22-25
STORE	Depending on 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.	27, 31
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.	27, 31
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

INTRODUCTION

Summary of Functions

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** (\blacktriangle), **Down** (\blacktriangledown), **Left** (\blacktriangleleft) and **Right** (\blacktriangleright). 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** (\blacktriangleleft) and **Right** (\blacktriangleright) cursor keys will switch between pages.

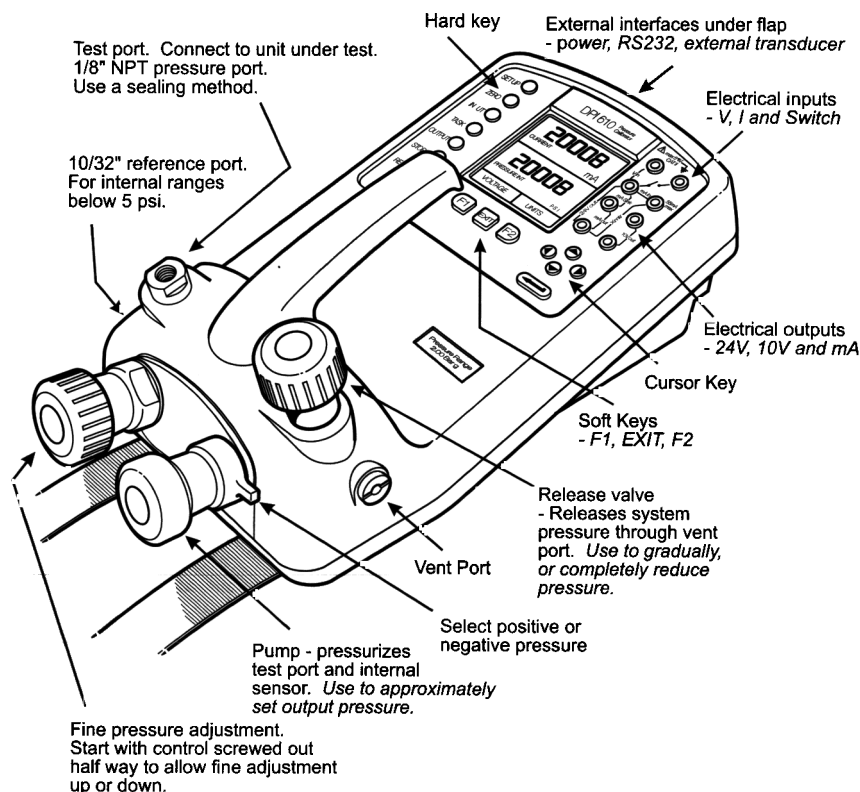


Figure 2 - DPI 610 Calibrator Controls

ELECTRICAL CONNECTIONS

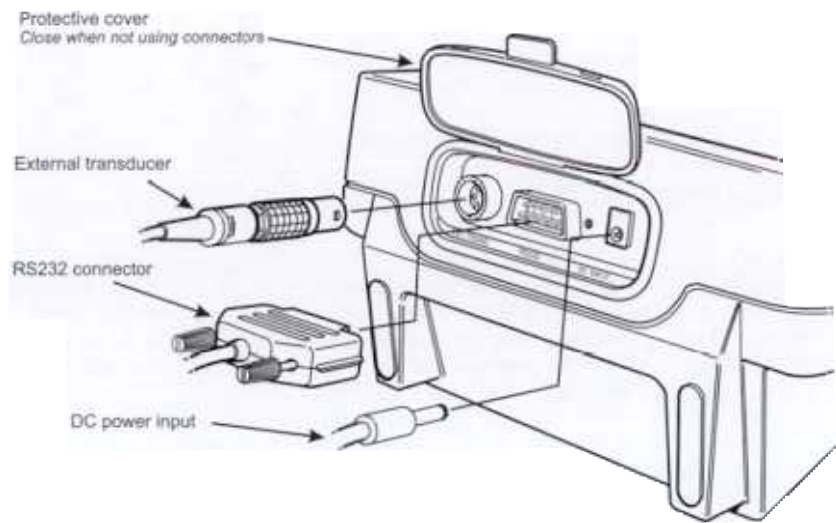


Figure 3 - Electrical System Connections

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

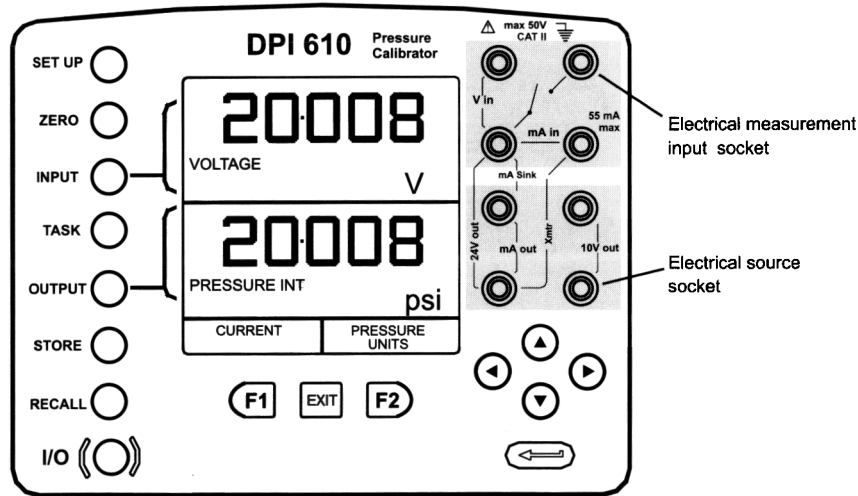
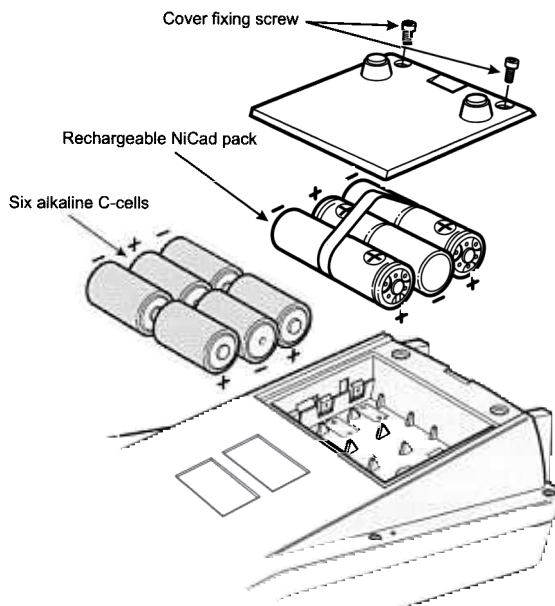


Figure 4 - Electrical Measurement Inputs/Source Outputs

Getting Started

Fitting Batteries



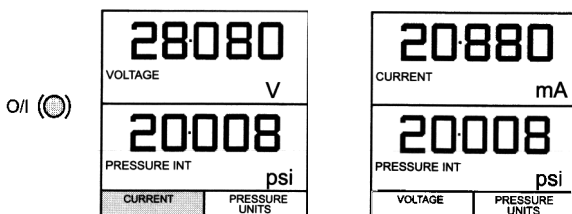
Caution:

*Old batteries can leak and cause corrosion.
Never leave discharged batteries in the instrument.*

Note: A rechargeable NiCad battery pack is fitted as standard; initially, it may not be fully charged and could cause **Battery low** indication. Fit the power adaptor/charger unit and **switch instrument ON** to charge the battery pack.

Switching On

Press the **O/I** 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**.

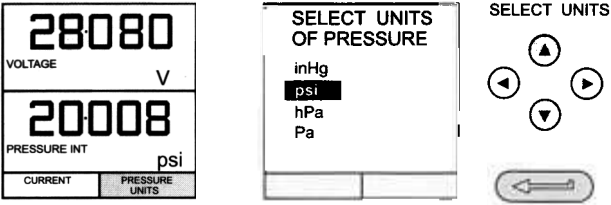
Note: No other keys are active in this mode and the instrument can only be reconfigured by pressing the **TASK** key and selecting another mode.

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 33. To return to **BASIC** mode, press **TASK** and select **BASIC**.

Note: Press ENTER  to confirm selection on display.

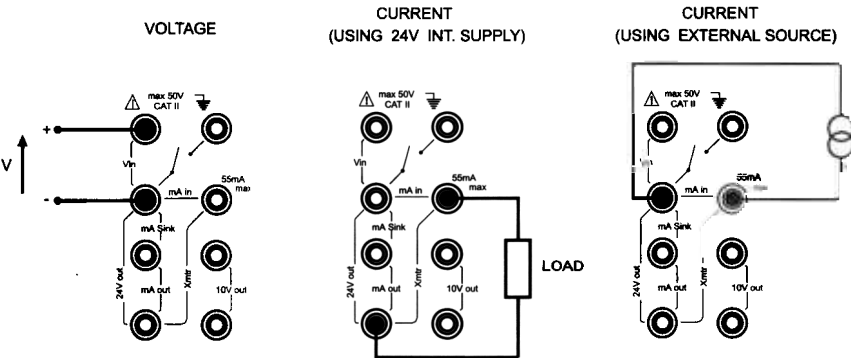


In **BASIC** mode, the unit is configured to carry out basic Pressure to Voltage (**P to V**) or Pressure to Current (**P to I**) tests a typical test procedures follow:

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

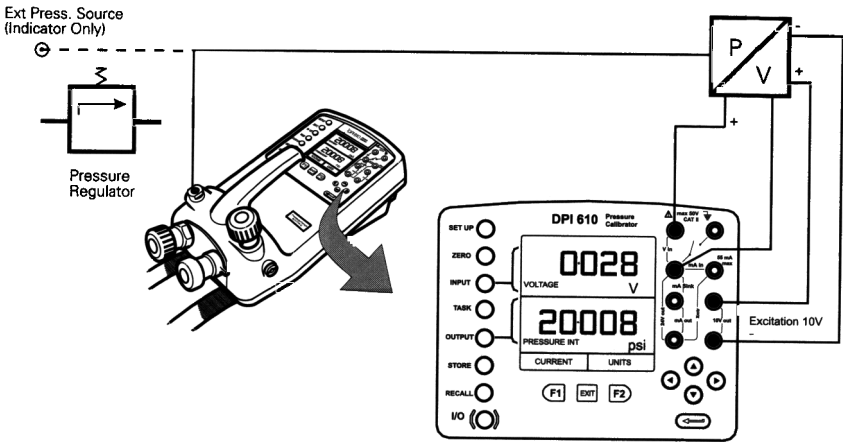
Note: Max applied voltage = 50V DC, Max current = 55 mA DC



Getting Started

Typical Calibration Setup (Pressure to Voltage)

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

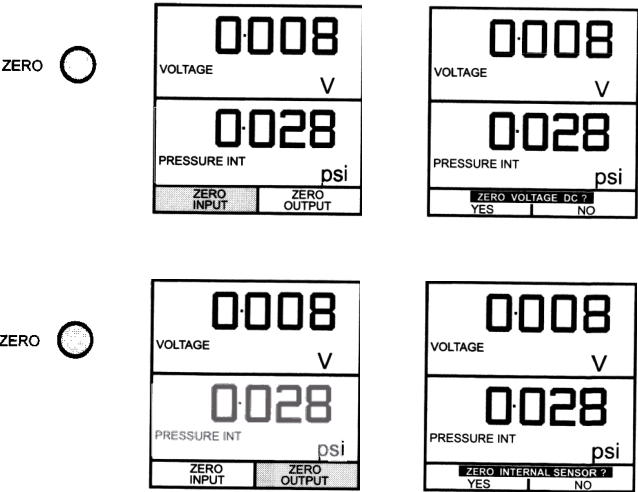


● General Procedure

- Use the hand-pump to pressurize 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), proceed as follows:



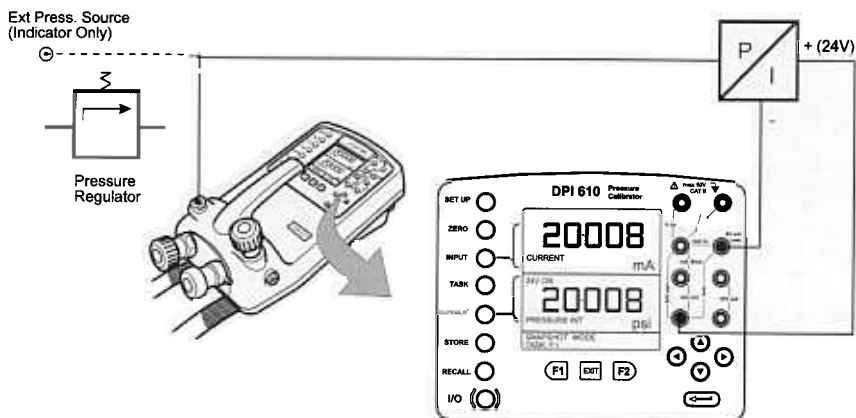
Making Measurements

Basic Mode (Task BASIC)

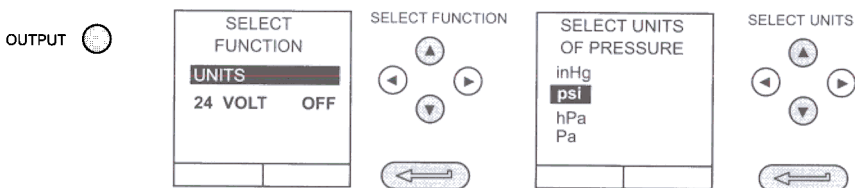
This instrument will power up in this mode the first time that it is used. To select **BASIC** from any other task, press the **TASK** key and select **BASIC** and press the **ENTER** key. **BASIC** mode is fully described in the **Getting Started**, section (see page 9).

Pressure Transmitter (P-I) Task

To energize the transmitter from the calibrator.

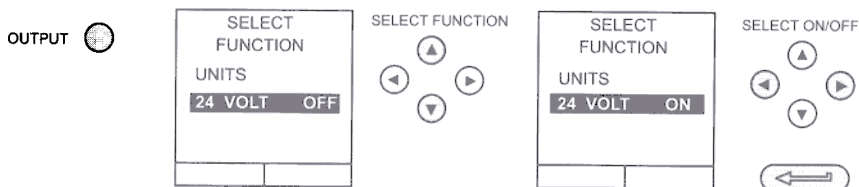


Set Units



Note: If the four units displayed are not the units required, press **SETUP**, select **SETTINGS** and refer to Page 32.

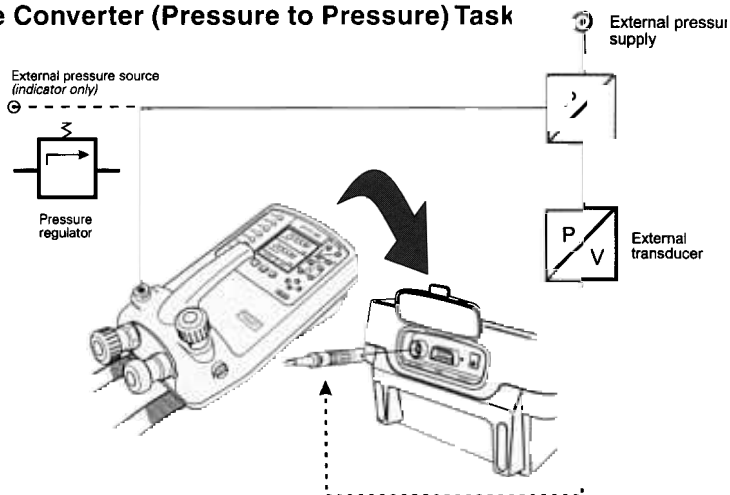
Set 24 Volts



Note: To conserve battery power, keep 24V switched off if not required

Making Measurements

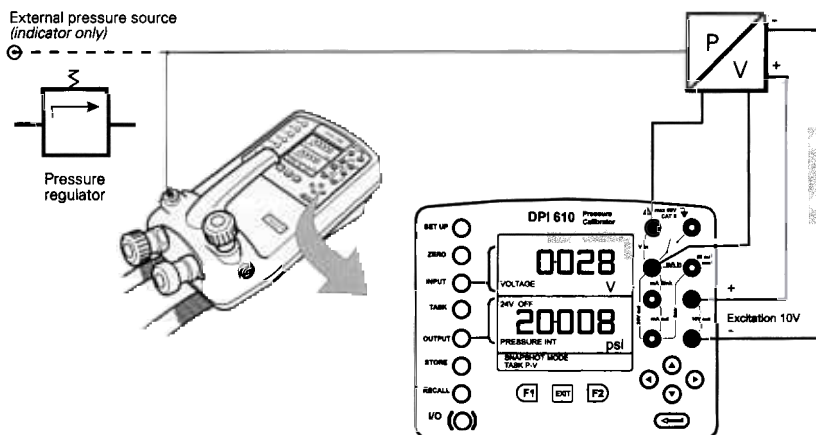
Pressure Converter (Pressure to Pressure) Task



- Testing a converter requires one pressure to be applied to the UUT and another (converter output) to be measured. The additional measurement is provided by the external transducer option. **P-P** task configures the instrument to output pressure and to measure pressure.

Note: Match pressure ranges to give required accuracy and avoid overpressure.

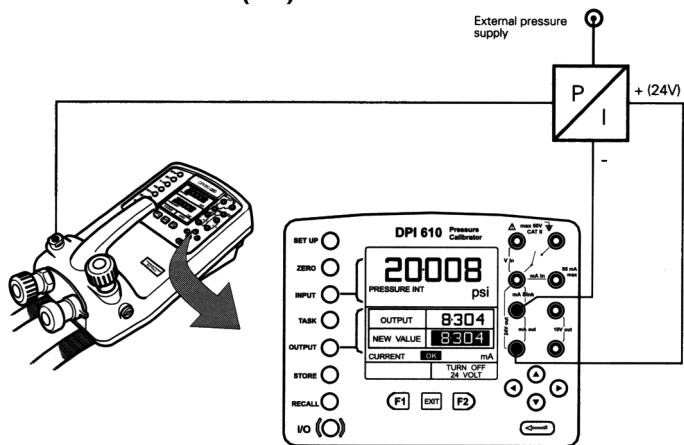
Voltage Output Pressure Transmitter (P-V) Task



- Voltage output transducers with a 10 volt supply and outputs of $\pm 10\text{V}$ can be calibrated. Use the '10V out' to supply the transducer and connect its output to the voltmeter.

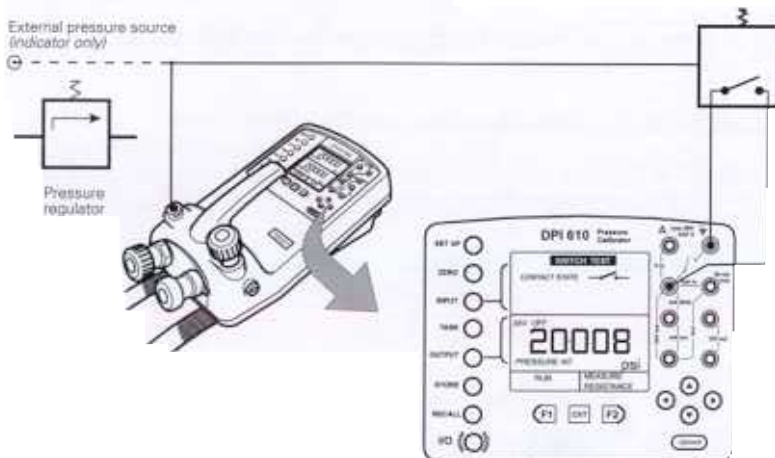
Making Measurements

Current to Pressure Converter (I-P) Task



- Use the **Up** (Δ) 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" output up/down.

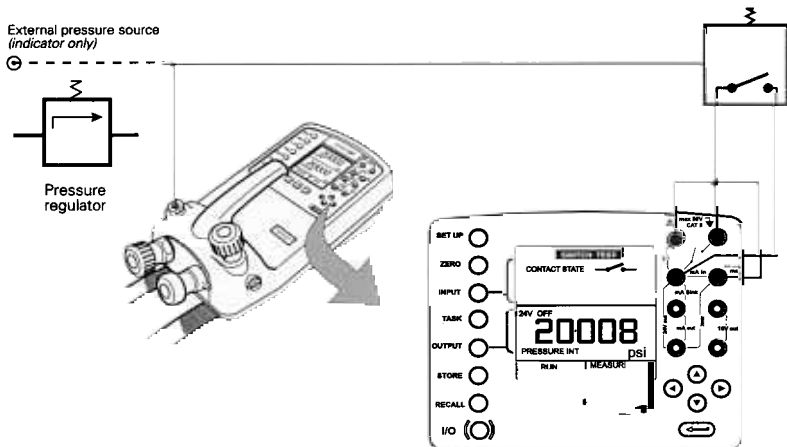
Pressure Switch Tests (P-SWITCH) Task



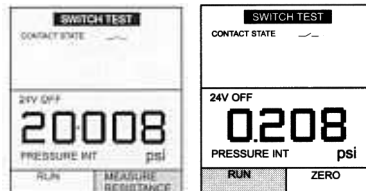
- Contact state will be shown on display. When contacts close, buzzer sounds.
- To run switch test, close vent valve and press the **RUN** (F1) key.
- Using the hand-pump, increase the applied pressure to just below the switch operating point. Screw the volume adjuster in until the switch operates (the 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 hysteresis displayed.

Making Measurements

Pressure Switch Tests with Contact Resistance Measurement



To perform switch test with contact resistance measurement, select P-SWITCH and proceed as follows:

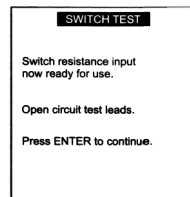
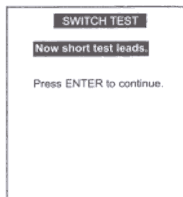
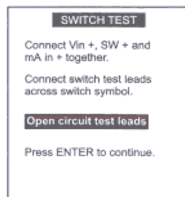


The switch test is performed in the same way as the previous section, except that the contact resistance is measured and displayed together with the results.



To ensure accurate measurements it is recommended that the zero procedure is carried out before performing the test.

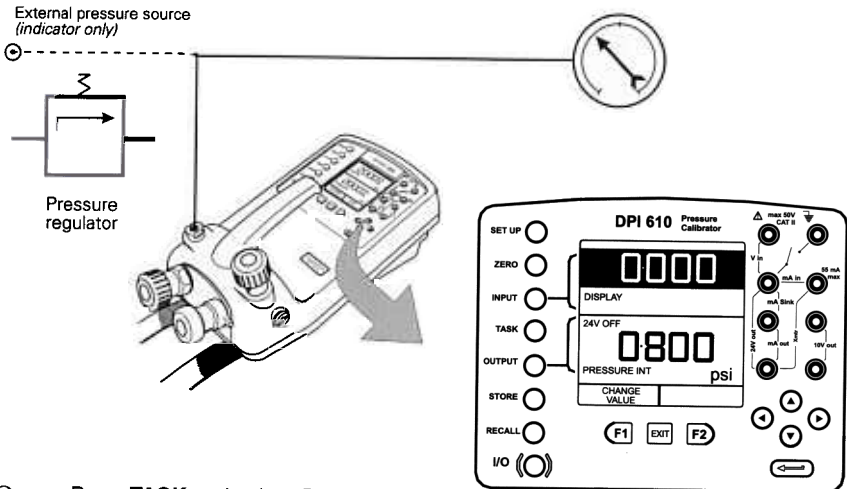
Note: Allow sufficient time between contact closure for resistance measurement to stabilize.



Making Measurements

Pressure to Display (P-DISPLAY) Task

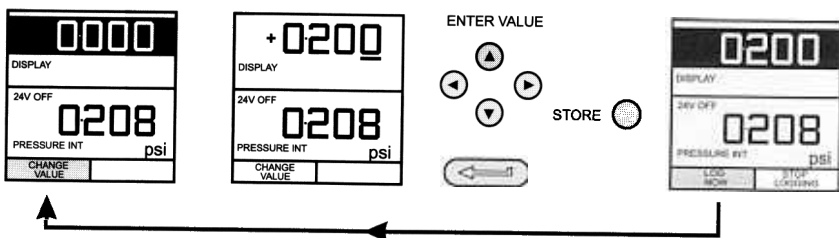
P-Display is a special application of Datalog. To use this mode, select Datalog as detailed on Page 32. Connect the device under test to the instrument as shown below:



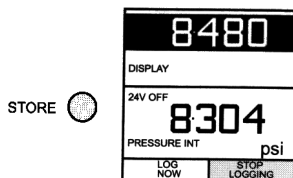
- Press **TASK** and select **P-DISPLAY**.
- Setup a datalog file as detailed on Page 29.

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:

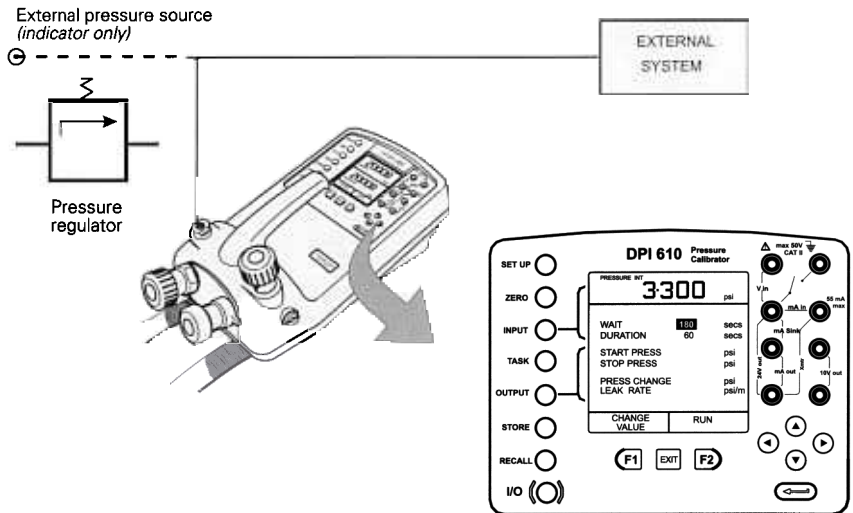


- After logging final test point, terminate as follows:
FINAL POINT



Making Measurements

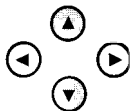
Leak Test (LEAK TEST) Task



- Setup the leak test WAIT and DURATION times to the required values as shown below. A minimum wait period of 3 minutes is recommended.

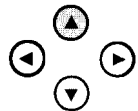
PRESSURE INT	
0304 psi	
WAIT	180 secs
DURATION	60 secs
START PRESS	psi
STOP PRESS	psi
PRESS CHANGE	psi
LEAK RATE	psi/m
CHANGE VALUE	RUN

SET WAIT TIME



PRESSURE INT	
0304 psi	
WAIT	180 secs
DURATION	60 secs
START PRESS	psi
STOP PRESS	psi
PRESS CHANGE	psi
LEAK RATE	psi/m
CHANGE VALUE	RUN

SET DURATION



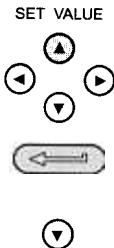
- Close the vent valve and pressurize the external system to the required **LEAK TEST** pressure.
- Press the RUN (F2) key to start the leak test. When completed, the beeper sounds and the leak test results are written to the display.

Making Measurements

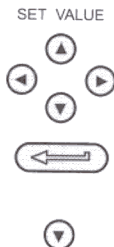
Transmitter Simulator (Tx SIM) Task

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 setup screen if parameters are correct.

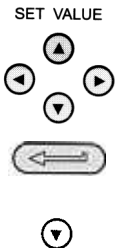
Tx SIMULATION	
LOWER POINT	
0.000	psi
4.000	mA
UPPER POINT	
20.000	psi
20.000	mA
CHANGE VALUE	



Tx SIMULATION	
LOWER POINT	
0.000	psi
4.000	mA
UPPER POINT	
20.000	psi
20.000	mA
CHANGE VALUE	



Tx SIMULATION	
LOWER POINT	
0.000	psi
4.000	mA
UPPER POINT	
20.000	psi
20.000	mA
CHANGE VALUE	



Tx SIMULATION	
LOWER POINT	
0.000	psi
4.000	mA
UPPER POINT	
20.000	psi
20.000	mA
CHANGE VALUE	



On completion of **Tx SIM** setup, the display is configured as follows:

20.008	
PRESSURE INT	
psi	
24V OFF	
20.006	
CURRENT	OK
mA	
TURN ON 24V	

Set-up the output loop as detailed on Page 23 and turn on the internal electrical supply if required.

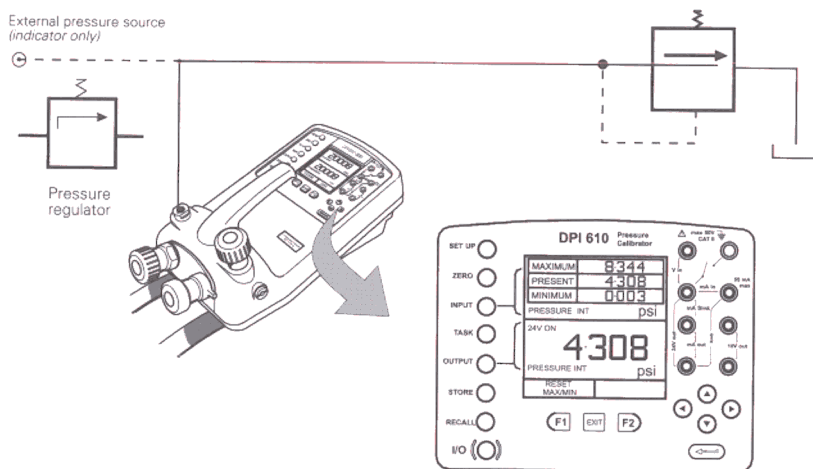
To subsequently change any of the **Tx SIM** scaling parameters, press **OUTPUT** to obtain the TX Simulation display.

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 32.

Making 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 by means of the cursor keys.
- To turn on the 24 Volt internal supply, if required, press **OUTPUT**, select **24 VOLT** and switch **ON** with the right cursor button and press **ENTER**.
- 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.

- Open vent valve to release test pressure

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

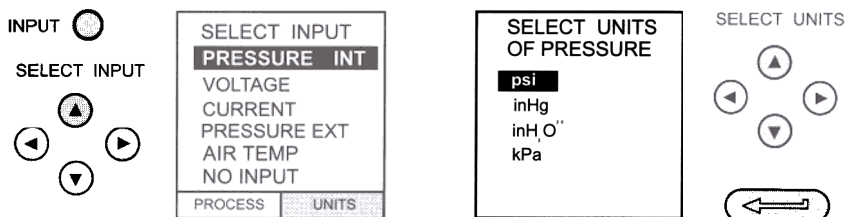
General

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:

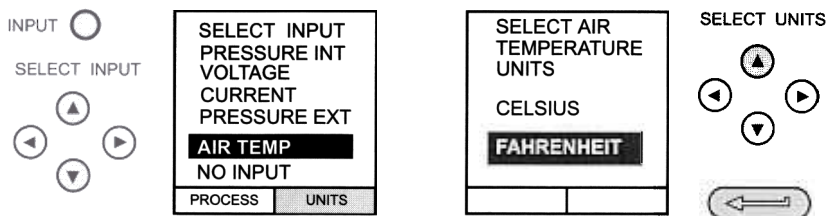


Note: Left/right arrow keys function as page up/down keys.

Refer to pages 19-22 for details of process functions.

Ambient Temperature Measurement

To set up the instrument to read ambient temperature, proceed as follows:



Note: Up to 1 hour may be required for the temperature reading to stabilize.

Process Functions

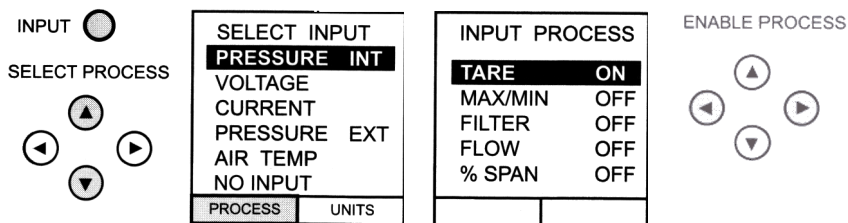
If required, the following process functions are available on the Measurand (*INPUT*) display but **only** in **ADVANCED** task. If the instrument is in any other mode i.e. BASIC or any other task mode, the input and output displays must first be configured in **ADVANCED** task.

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



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

Advanced Task

Process Functions

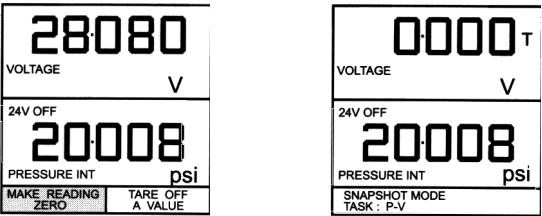
○ Tare Process Function

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

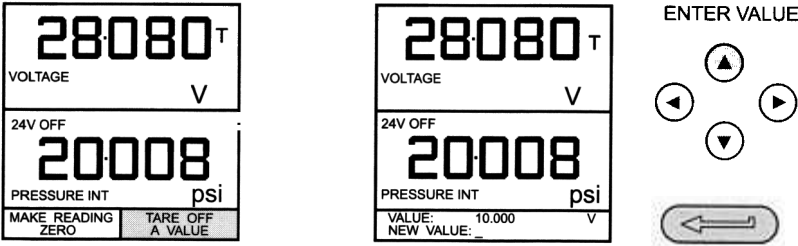
Disable **TARE** by entering process menu and turning the function **OFF**.

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:



Tare Off An Entered Value To tare off an entered value current, proceed as follows:



Advanced Task

Process Functions

○ 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:

MAXIMUM	44308
PRESENT	8304
MINIMUM	0003
VOLTAGE V	
24V ON	
8304	
PRESSURE INT psi	
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.

To setup procedure is as follows

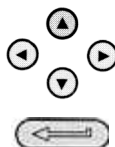
SET FILTER	
TIME TO SETTLE	
TIME = 2 Seconds	
BAND = MAX AMPLITUDE OF NOISE TO BE FILTERED, CHANGES GREATER THAN BAND BYPASS FILTER	
BAND = 1.5 % FS	
CHANGE VALUE	

SELECT VALUE



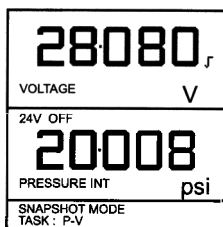
SET FILTER	
TIME TO SETTLE	
TIME = 2 Seconds	
BAND = MAX AMPLITUDE OF NOISE TO BE FILTERED, CHANGES GREATER THAN BAND BYPASS FILTER	
BAND = 1.5 % FS	
CHANGE VALUE	

SELECT VALUE



○ 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:



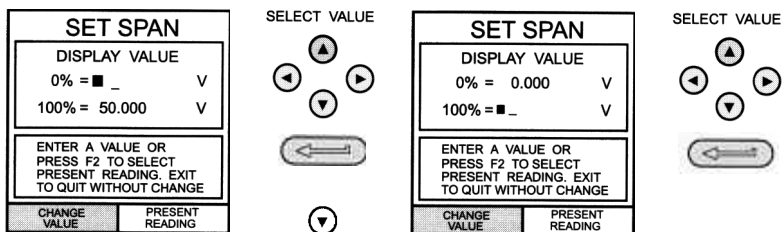
To cancel **FLOW**, press **INPUT** and turn function OFF at the process menu.

○ % 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

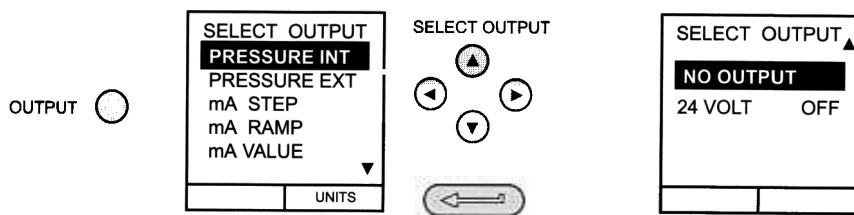
Advanced Task

Select Output

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:



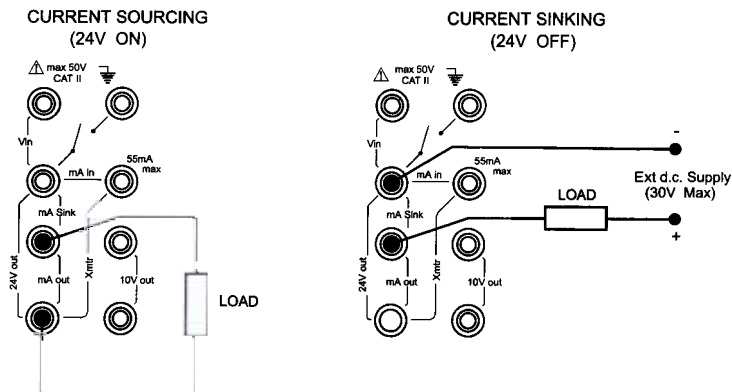
Note: Left/right arrow keys function as page up/down keys.

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)

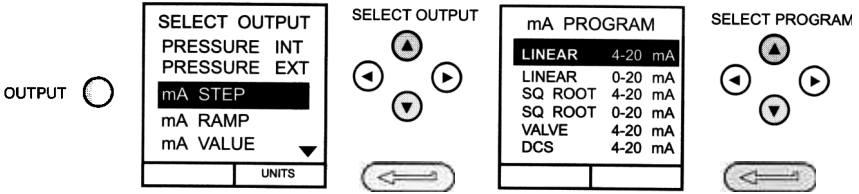
For all the electrical outputs, the output loop can be powered either by the instrument's internal 24V supply (Sourcing) or alternatively, from an external supply (current sinking). To conserve battery power, the 24V internal supply should be switched off (even when not being used to power an external loop).

External connections to the front panel of the instrument are shown below for both sourcing and sinking applications:

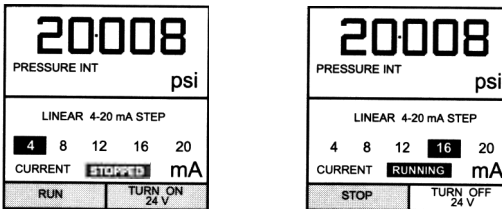


mA Step

To select one of the electrical output programs, press the **OUTPUT** key and proceed as follows:



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



- Press **TURN 24V ON** (F2) to turn on the 24V supply for current sourcing applications. For current sinking applications, connect external supply as shown on Page 23 and leave 24V supply OFF.
- 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.
- Press **STOP** (F1) when running to stop at any point. Press **RUN** (F1) to resume.

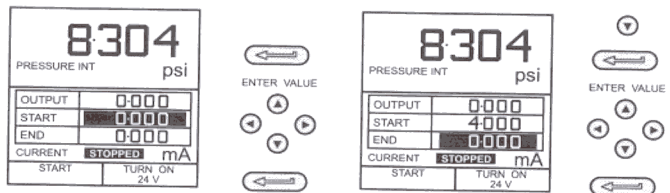
Advanced Task

Select Output

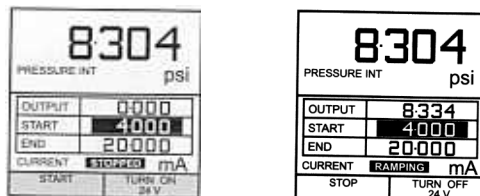
mA Ramp

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

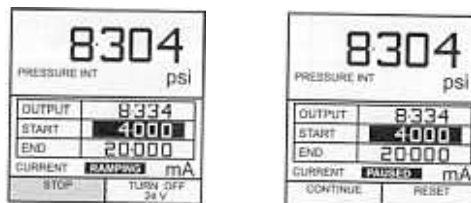
- Define ramp required by entering **START** and **END** current values as shown below:



- Press **TURN 24V ON (F2)** to turn on the 24V supply for current sourcing applications. For current sinking applications, connect external supply as shown on Page 23 and leave 24V supply OFF.
- Press **RUN (F1)** to run program. A status display **CHECK LOOP** indicates a fault in the external loop i.e. supply fault or open circuit.

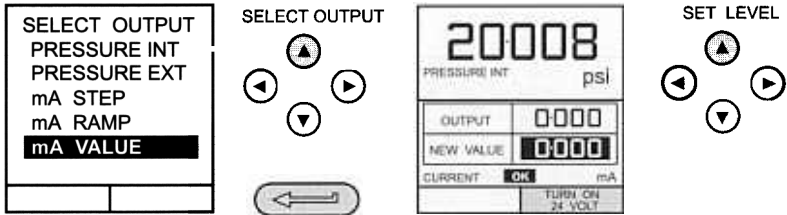


- Press **STOP (F1)** when running to stop at any point. Press **CONTINUE (F1)** to resume from point of pause or **RESET (F2)** to return to start point.



mA Value

Press the **OUTPUT** key and select **mA Value** from the Output menu. The procedure is shown below:

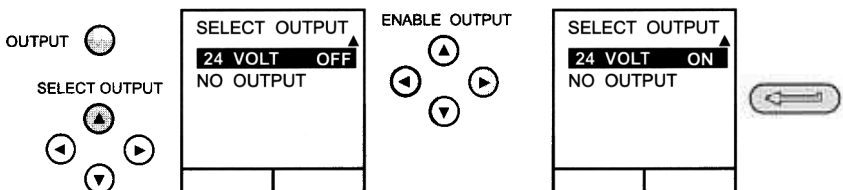


- Press **TURN 24V ON (F2)** to turn on the 24V supply for current sourcing applications. For current sinking applications, connect external supply as shown on Page 23 and leave 24V supply OFF.
- Use **Up (▲)** and **Down (▼)** cursor keys to adjust output current level. Whilst the loop is made, a status display indicates **OK**. A status display **CHECK LOOP** indicates a fault in the external loop i.e. supply fault or open circuit.

24 Volt

Press the **OUTPUT** key and select **24 VOLT** from the Output menu. The procedure is shown below:

Note: The 24V selection is located on the second page of output functions.



Note: To conserve battery power, keep 24V supply switched off when not in use (even if the output is unloaded).

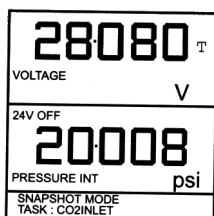
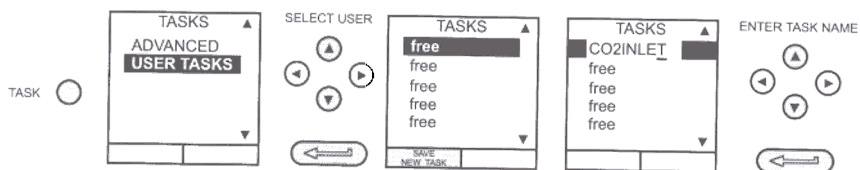
Advanced Task

Task Setup/Removal

Define New Task

To define a new task, proceed as follows

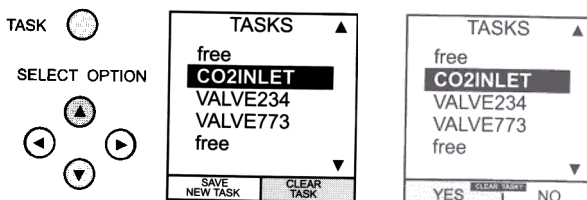
- Select **ADVANCED** from **TASK** menu.
- Using the **INPUT** key, select the required measurand as the input display and setup any process functions required.
- Using the **OUTPUT** key, select the required measurand as the output display.
- Press **TASK** and select **Free**. Enter new task name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



On completion of this procedure, the display reverts to newly setup task as shown.

Clear Task

To clear a user defined task, select **TASK** and proceed as follows:

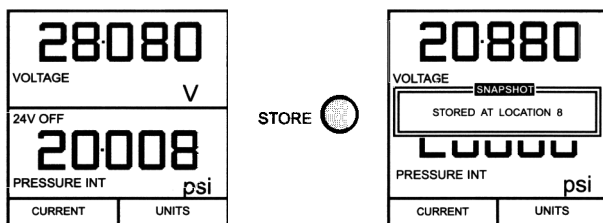


Saving Display or Datalog

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

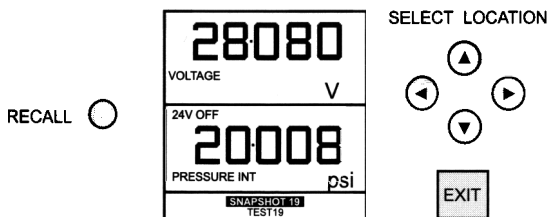
Store Operations

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

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

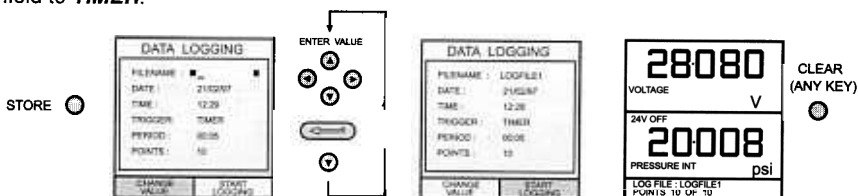
Datalog is a special application of store mode which enables the calibrator to either automatically log displays at preset time intervals or to manually log a display on operation of the **STORE** key. Logged data is written to a user specified file.

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 (See Page 32).

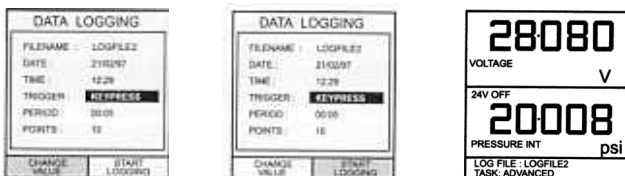
Auto Log (Timer)

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

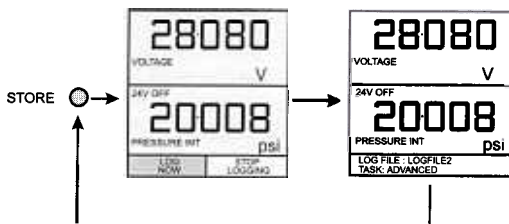


Manual Logging

Enter the file details as shown above and select **KEYPRESS** for **TRIGGER** field. Screen reverts to displayed parameters showing setup file as shown below:



- Use a combination of **STORE** and **LOG NOW** (F2) to log events as follows.



Appendix 1

HYDRAULIC CALIBRATOR VERSION

Recall Datalog Files

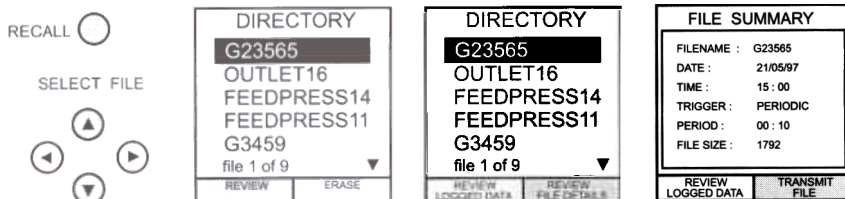
To recall a datalog file to the display, ensure that **DATALOG** is selected from the **SETUP** menu, proceed as follows:



Downloading Datalog Files

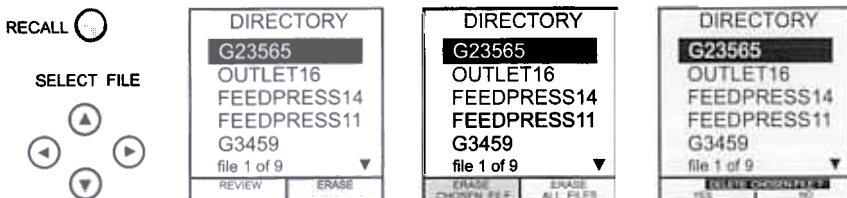
Connect the RS232 socket of the instrument into either the COM1 or COM2 port of the PC. Ensure that the RS232 parameters at the PC end match those of the instrument. The RS232 parameters of the instrument can be checked as detailed on Page 34. Set up a file on the PC to receive the data, (e.g.) in the *Windows Terminal* program.

To download the file, proceed as follows:



Delete Datalog Files

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



Using setup

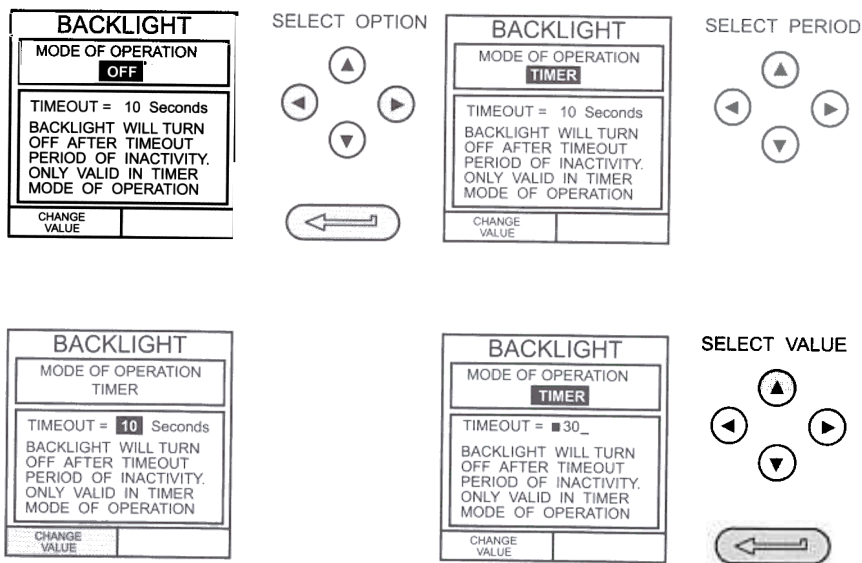
General

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

- Backlight Management - On, Off and Timed.
- Store Mode - None, Snapshot, Datalog
- Contrast.
- Instrument Settings - Units, Language, RS232 parameters, Power-down, and Calibration Routines (*Refer to page 35 for Calibration details*).

Backlight

Select Backlight from the set-up menu and proceed as follows:



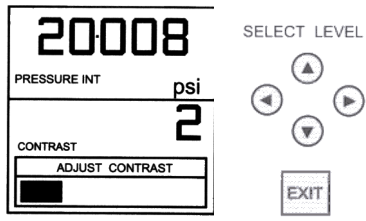
If **TIMER** mode is selected, any key press brings on the backlight for the **TIMER** period.

If **ON** is selected, the backlight remains on permanently and if **OFF** is selected, the backlight remains permanently off.

Using Setup

Contrast

Select **CONTRAST** from the set-up menu and proceed as follows



Store Mode

Select **STORE MODE** from the set-up menu and select required mode as follows

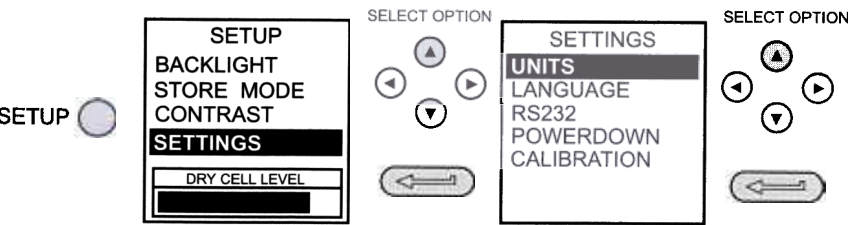


Calibration

Calibration routines are password protected. Refer to Calibration Section, Page 34 for details of use.

Settings - Select Setup Option

To select one of the Settings options from the Setup menu, proceed as follows:



Units

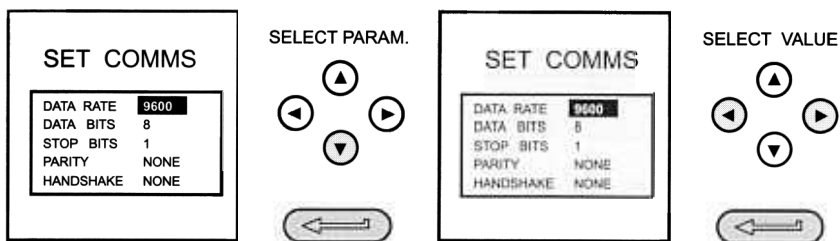
[illegible]

A screenshot of the 'LANGUAGE' menu. The word 'LANGUAGE' is at the top. Below it, 'ENGLISH' is highlighted with a black background. Other options listed are 'FRENCH', 'GERMAN', 'ITALIAN', 'PORTUGUESE', and 'SPANISH'.

Using Setup

RS232

Select **RS232** from the Settings Menu and proceed as follows:



Note: Communications default settings are shown above.

Power-down

Select **Power-down** from the Setup menu. The method of setting up the **Power-down** (Auto Power Off) function is similar to that detailed for the Backlight (Page 31).

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

General

The instrument is supplied by the manufacturer, complete with calibration certificate(s). The re-calibration interval will depend on the total measurement uncertainty which is acceptable for a particular application. In order that the instrument remains within the quoted accuracy, it is suggested that its calibration be checked at 90 day intervals.

The DPI 610 is a very precise measuring instrument 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 competent, trained person.

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, NIST accredited calibration service.

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

Do

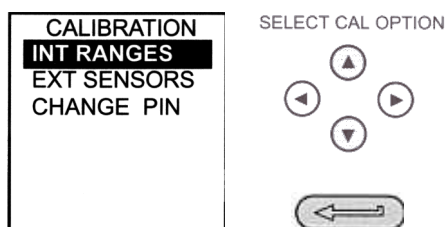
Use high quality **Repeatable and Linear** pressure sources and allow adequate stabilization time before calibration (minimum 1 hour).

Conduct the calibration in a temperature and preferably, humidity controlled environment. Recommended temperature is **70°F, ±4°F**.

Use deadweight testers carefully and away from draughts.

Using the Calibration Menu

The calibration routines selected from the Setup menu as detailed on page 32. Enter the calibration PIN number, press ← and the Calibration Menu will be displayed as follows:



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 50V)

- 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.

Appendix 1

HYDRAULIC CALIBRATOR VERSION

Introduction

This version of the instrument provides manual generation of hydraulic pressure and consists 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.

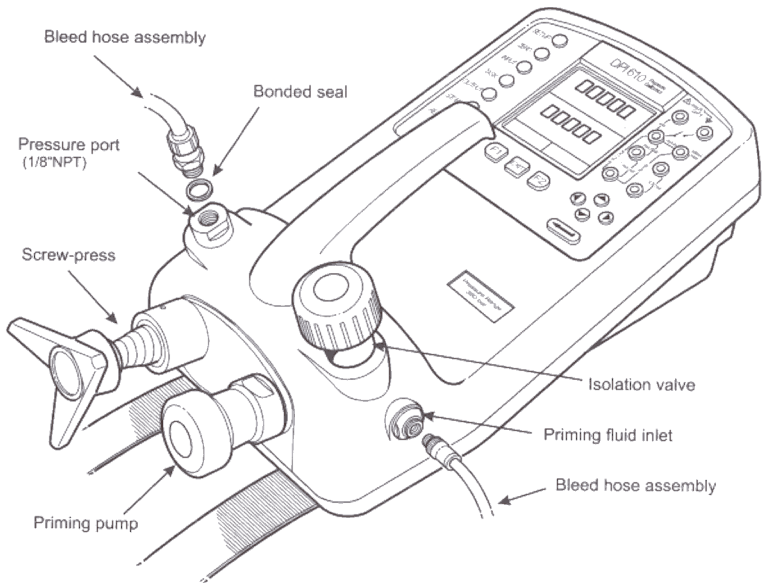


Figure A1 - DPI 610 HC Connections

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

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

ISO 3448 grade	Approx. SAE Viscosity Classification	Shell	Exxon	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 PROTECTION.

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. Connect only clean equipment to the instrument. Severe damage can be caused if contaminated equipment is connected to this instrument. An external filter is recommended to avoid any contamination.

Preparation for Use

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

WARNING

ENSURE 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.

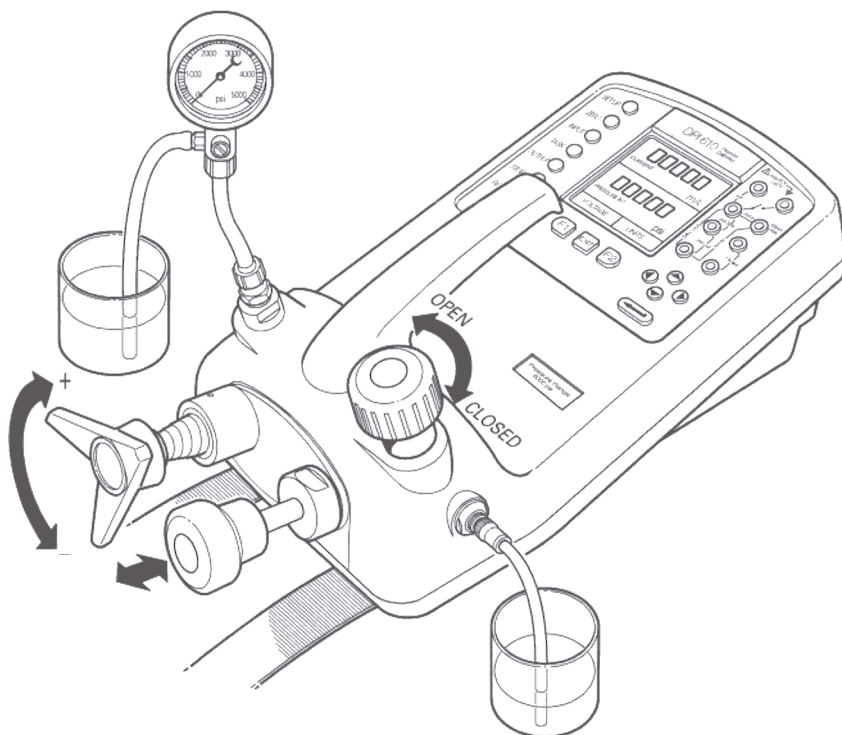


Figure A2 - Priming/Test Set-up

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 43
- (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 (approximately 7cc).
- (7) Switch the instrument **ON** and, still using the priming pump, pressurize the system to approximately 30 psi.
- (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 stabilize 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 counter clockwise. 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 counter clockwise. Turn the instrument onto its 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 express 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:

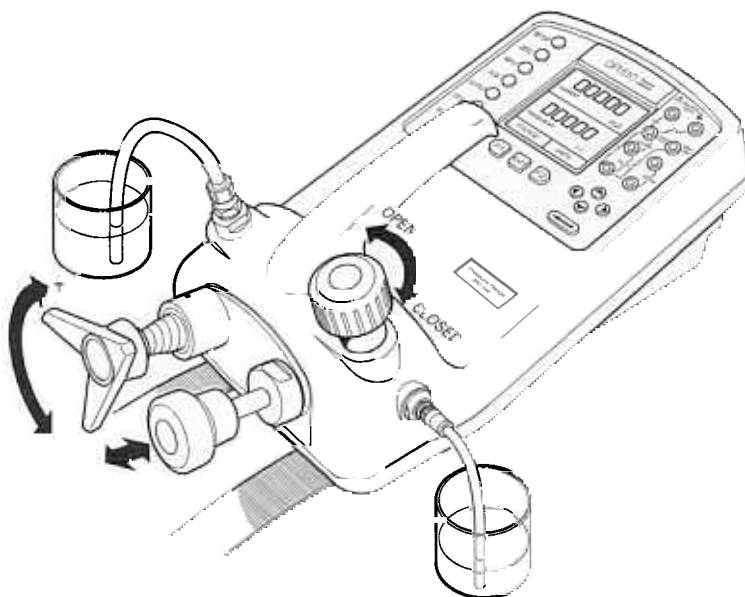


Figure A3 - DPI 610 HC - Flushing/Filling Connections

- (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 in the output port and, to prevent the ingress of any contaminant, fit a blanking plug in the output port.
- (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.**



WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available **BEFORE** contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available **BEFORE** contacting OMEGA:

1. P.O. number to cover the **COST** of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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