

## DPI 510

### Precision Pressure Controller/Calibrator

- Ranges 0-1 through 0-3000 psi
- Microprocessor based accuracy  $\pm 0.025\%$  of indicated value
- High speed calibration capability  
10 point calibration in 60 seconds
- Automatic Control via IEEE-488 or RS 232
- Adjustable rate control
- Unlimited pressure scales
- Dual range capability
- Barometric Reference to 0.01% accuracy



# DIGITAL PRECISION PRESSURE CONTROLLER

The DPI 510 digital pressure instrument measures, indicates and controls pressures in any scale units with an instrument accuracy of better than  $\pm 0.025\%$  of indicated value through a  $\pm 99999$  display. It is a natural development of the DPI 500 instrument which has established itself as a world leader over the past 10 years. Many new features are now available.

The new DPI 510 uses state of the art microprocessor based techniques and the invaluable experience gained during many years of manufacturing digital pressure indicators and controllers.

Continued use is made of Druck pressure transducers as the sensing element for both gauge and absolute measurements. Considerable improvement in stability, thermal performance and construction techniques are reflected in the DPI 510 specification.

Both single and dual range versions are available providing a wide dynamic ca-

capability. In fact it is possible to provide an accuracy of  $\pm 0.025\%$  of indicated value down to 10% of the full scale range in a single instrument. A conditioning channel is also available for powering a remote sensor and processing its output signal to provide a total calibration capability via IEEE-488 or RS 232 computer control. Refer to ACS510 for Druck software program available for IBM compatible PC's.

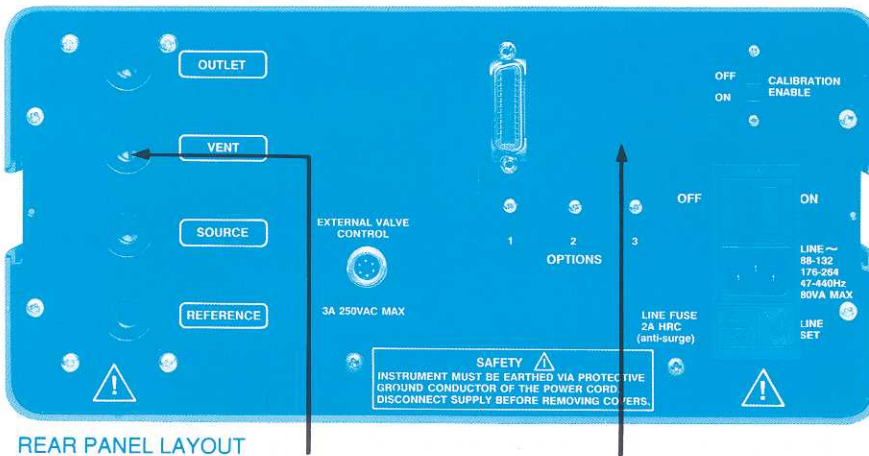
The DPI 510 is a programmable, versatile and stable pressure controller providing a total calibration capability in the single instrument. Alternatively, via computer control, it can be incorporated into a high speed fully automatic pressure calibration system. A simple calibration routine from a Primary Standard Deadweight Tester or Manometer enables the DPI 510 to become a Pressure Transfer Standard traceable to the National Institute of Standards and Technology (formerly NBS).

## Design highlights

The microprocessor techniques significantly enhance the reliability and serviceability aspects of the design, and software generated routines enable a multitude of extra features to be provided which were impossible in earlier analog based instruments. Total flexibility in scaling and range selection is provided by software together with setpoint generation, rates of change, auto tare zero control, range divider functions and many more.

A new mechanical enclosure with an upper and lower cover arrangement allows improved access serviceability and optimizes circuit board layout. Operator controls using a membrane keyboard and schematic pressure diagram are all on the front panel and the electrical and pneumatic interfacing is on the rear with IEEE-488 and RS 232 remote operating options. The DPI 510 can be configured for simple operator use or by password commands more in depth operation can be performed.

To provide both gauge and absolute capability in a single instrument an extremely stable vibrating cylinder transducer can be incorporated (option H) providing barometric reference to 0.01%.



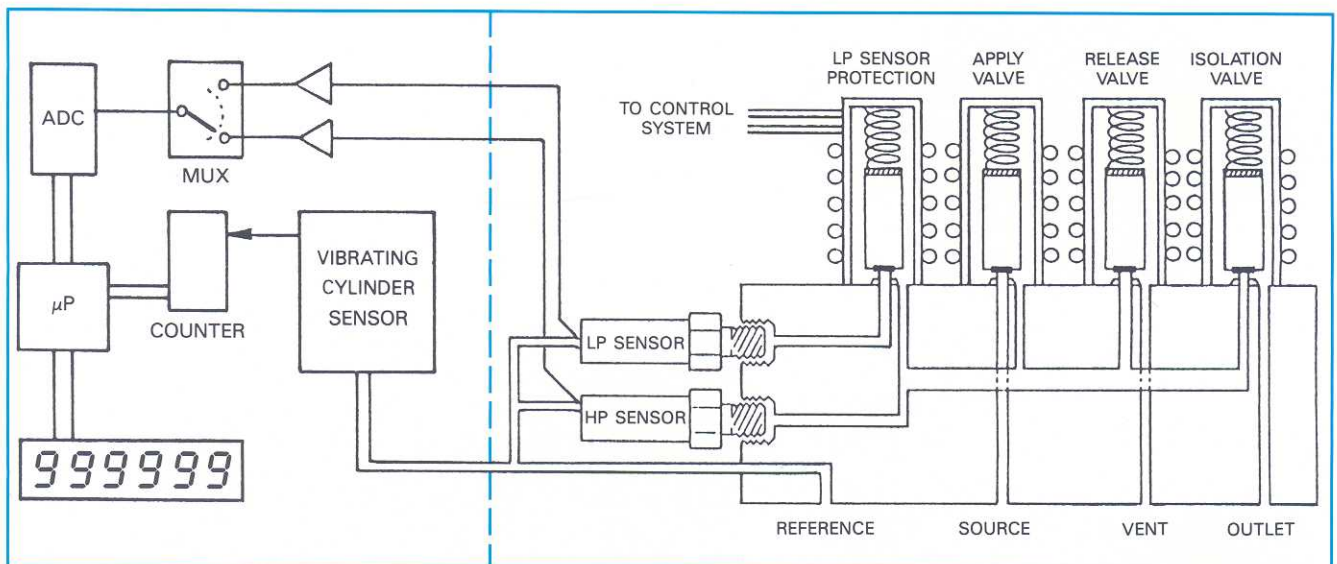
REAR PANEL LAYOUT

## REAR PANEL CONNECTIONS—Pneumatic

- OUTLET** – Controlled pressure outlet port
- VENT** – Allows connection to vacuum source if required
- SOURCE** – Source supply pressure inlet port
- REFERENCE** – Reference for gauge ranges allowing 30psi line pressure differential capability

SOURCE AND VENT  
Reversed for H P unit

OPTION CONNECTIONS



OPTION H

SCHEMATIC OF THE PNEUMATIC CONTROL MANIFOLD—LP VERSION

# PRESSURE CONTROLLER SPECIFICATION

## Operating pressure ranges

Any full scale range can be specified between the ranges listed below:-

0-1 psi to 0-1000 psi gauge  
0-1000 psi to 0-3000 psi sealed gauge  
0-5 psi to 0-3000 psi absolute  
Gauge versions available with -14.5 psi gauge capability as an option.

Barometric reference using vibrating cylinder sensors (option H).

*For differential instrument reference connector on gauge units supplied. Maximum 30 psi line.*

## Pressure scales

23 different scale units are programmed and always available by operator selection Others can be specified when ordering. **When instrument is powered up 3 scales are displayed. These will be psi, ins. Hg and kPa unless ordered differently.** Other units available which may be selected as one of the initial display 3 are as follows: Pa, mPa, mbar, bar, kg/cm<sup>2</sup>, kg/m<sup>2</sup>, mmHg, cmHg, mHg, mmH<sub>2</sub>O, cmH<sub>2</sub>O, mH<sub>2</sub>O, torr, atm, lb/ft<sup>2</sup>, inH<sub>2</sub>O, ftH<sub>2</sub>O. Note: H<sub>2</sub>O scales are available at 4<sup>o</sup> and 20<sup>o</sup>C.

*The controlled pressure is associated with the selected scale on the indicator.*

## Overpressure (positive and negative)

2 x rated pressure will cause negligible calibration change.

Audible alert at 1.2 x rated pressure.

Dual range units have auto protection of LP (low pressure) sensor.

## Pressure media

The source supply pressure must be a dry, non-corrosive, non-conducting gas.

## Source supply pressure

The source supply pressure to be a maximum of 10% above the specified instrument pressure range.

*For higher supply pressure please refer to manufacturer.*

## Transducer principle

Integrated silicon strain gauge bridge.

## Readout

±99999

999999 for barometric option H.

±9999 maximum for ranges between 1 and 2 psi.

## Display

Vacuum fluorescent with dual, pressure and message display.

## Display warning

An overload statement will appear on the message panel at 120% F.S. or the programmed limit – in addition to audible tone warning.

## Resolution

0.005% F.S. maximum

0.01% F.S. maximum for ranges below 2 psi.

## Accuracy

Instrument accuracy is defined as the combined effects of non-linearity, hysteresis and repeatability over the specified pressure range utilizing the auto-zero facility. These are as follows:

**Ranges 0-1 psi to 0-1000 psi**

±0.025% of indicated value from 25% to 100% F. S.

±0.00625% F.S. below 25% F.S.

**Ranges 0-1001 psi to 0-3000 psi**

±0.04% of indicated value from 25% to 100% F.S.

±0.01% F.S. below 25% F.S.

*For absolute ranges the use of option H removes the need to carry out auto zero.*

## Zero control

Pressure offset correction by keypress or automatic (programmable).

## Calibration

Via keypad instructions.

## Operating temperature range

32° to 122°F

## Calibrated temperature range

50° to 86°F

## Thermal effects

0.001% of indicated value/°F averaged over 50° to 86°F

*This temperature coefficient can also apply to remote transducers operating over wider temperature ranges, but for specific applications please refer to manufacturer.*

## Response

1.2 second display update rate.

Analog output 2kHz bandwidth (3db).

## Controller stability

Better than 0.004% F.S. random variation around the control value setpoint.

## Controller response

For dead end system, typical time to set value is 5 seconds.

## Overshoot

Programmable versus response time.

## System volume

No limitation on controlled volume. Increasing volume external to the unit improves stability and reduces response.

## Gas consumption

With a leak tight system, when the control set point is reached there will be zero gas flow.

## Leak detection

The instrument detects any leaks in the system when the controller is off.

## Leak compensation

By remotely positioning the transducer the controller will 'feed' any intermediate leaks and still ensure that the desired pressure is achieved at the remote location.

Typically 61 ins<sup>3</sup>/min. at 15 psi gauge.

## Remote control

Available as options are computer interfaces

(A) IEEE 488

(B) RS 232

Either one of these options can be fitted by the User into a rear panel plug in location.

## Sensor conditioning module

To provide a complete test system an optional conditioning module is available. This provides power to the sensor and permits signal output monitoring on the DPI 510 display – option (C).

## Analog output

An analog output voltage is available in the form of an amplified, buffered 0 to 10V signal. This signal(s) represents the transducer(s) basic characteristics and provides an accuracy of ±0.2% F.S – option (D).

## Barometric reference

A vibrating cylinder sensor provides a high accuracy pressure of the day measurement. By automatically combining this atmospheric reading with gauge pressure sensors it is possible to make absolute ranges without the need to carry out tare zero operations at the absolute zero value –option (H).

## Aeronautical version

Special software is available to enable calibration of altitude and airspeed parameters. Altitude in feet and meters is available and also Rate of Climb. Airspeed in knots, km/hour and Mach is also provided - option (J).

## Automatic calibration software

Druck offers a software package based on IBM PC using the computer interface options and sensor conditioning module. Results tabulation and graph plotting is incorporated. Refer to ACS510.

## Position effect

Negligible.

## Weight

17 lbs. nominal.

## Pressure connections

1/8" NPT female

*Range of adaptors available on request*

## Filters

Internal replaceable line filters fitted in source, vent and outlet.

## Dimensions

14.3 ins. (wide) x 7.0 ins. (high) x 13.6 ins. (deep)  
Mounting facilities available for 19" rack and plain panels – option (E).

## Power supplies

88-132V or 176–264V selectable.  
47-440Hz. 80VA.

## Roughing valve

Where high flow rates are required voltage free contacts are provided to power an external valve of large flow capability

## Remote sensing

For applications which require pressure to be measured distant to the controller, a remote sense port can be provided. Controller will only operate via the remote sense port.  
*Please refer to manufacturer for further details.*

## Dual range versions

To provide a wider dynamic range and improve accuracy at lower scale settings, dual range versions can be provided. However, as Druck utilizes 4 different types of controller systems to cover the total pressure range from 1 to 3000 psi, some limitations do apply. For example, dual range instruments are not possible above 1000 psi.

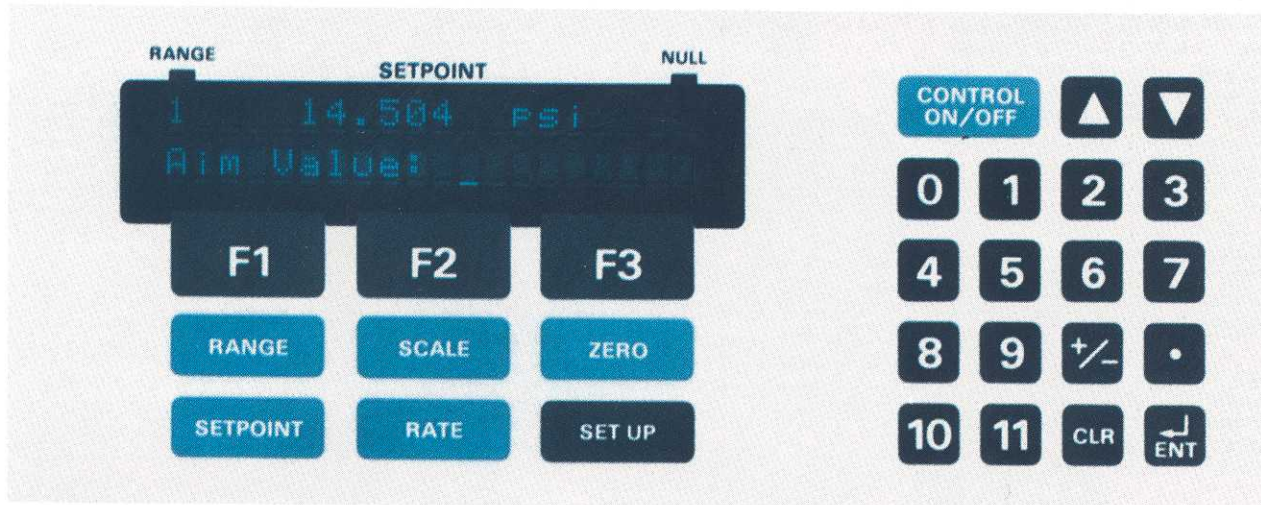
It is, however, possible to provide dual range up to a maximum of 10:1 ratio but due to the selected controller system and operating stability, **it is essential to refer to the manufacturer for specification information and capability.**

## Calibration standards

Instruments supplied by Druck Incorporated are calibrated against precision pressure calibration equipment which is traceable to the National Institute of Standards and Technology (NIST).

## Other digital instruments

Druck manufactures a comprehensive range of pressure indicators, controllers and calibrators. Please refer to manufacturer for further information and data sheets.



### OPERATOR CONTROLS ON THE DPI 510

The membrane keypad used for input of all commands to the DPI 510 pressure controller has been carefully designed to provide the optimum operator control modes.

The function of the individual keys is as follows:

**F1 F2 F3** Three function keys whose actual duties vary dependent upon the title keys range/scale etc. see below.

**RANGE** Enables the range used to be selected on F1 = Range 1, F2 = Range 2 and F3 = Options if installed.

**SCALE** Enables the displayed value engineering units to be selected on F1/F2/F3. On standard instruments these would be set as psi/ins.Hg./kPa, but the operator can under SET UP bring any of the 23 variables onto the F1/F2/F3 keys.



**ZERO** Enables the zero offset value to be removed by key press as a TARE ZERO action or if required an AUTO ZERO can be programmed into the unit under SET UP.

**SETPOINT** Enables the desired pressure VALUE to be entered using F1, to enable a RATIO mode in conjunction with a numeric keypad sequence of F2 and enables a series of PRESET pressures via the numeric keypad on F3.

**RATE** Enables up to three different rates of change to be called for on F1/F2/F3. Two of these can be AUTO=max rate with no overshoot and MAX= fastest possible with overshoot likely.

**SET UP** Enables the operator to define in detail the mode that will be used on the DPI 510 on all the other keys. This can be protected via a coded number to prevent unauthorized use.

**CONTROL ON/OFF** Depressing this key turns the controller on or off. When ON the deviation from the desired setpoint is shown on the message display under the NULL label.

  Increment keys which enable small adjustments to be made to pre set values up or down.

**0-11** Data entry keys for value input and also as step keys for range dividing or pre set pressure steps.

**+/-** Entry of values above or below atmospheric so that gauge instruments can be used below ambient pressure if desired.

- Decimal point.

**CLR** Clear to cancel erroneous entries.

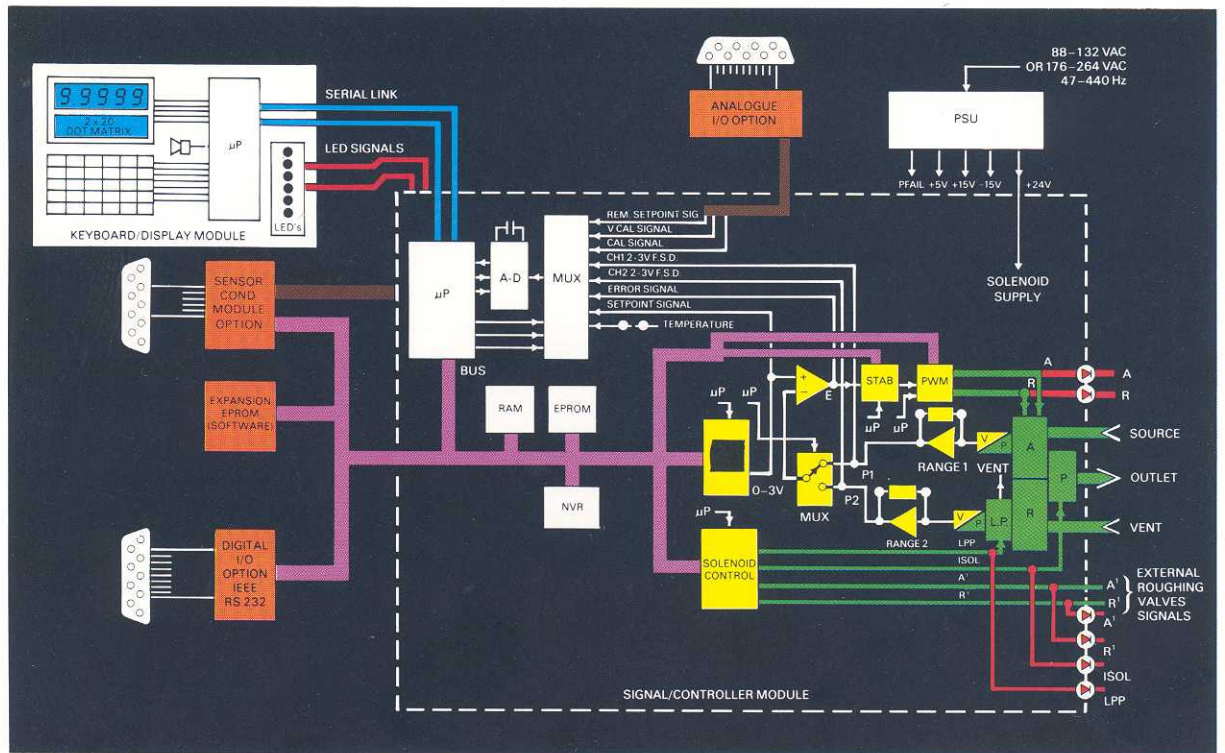
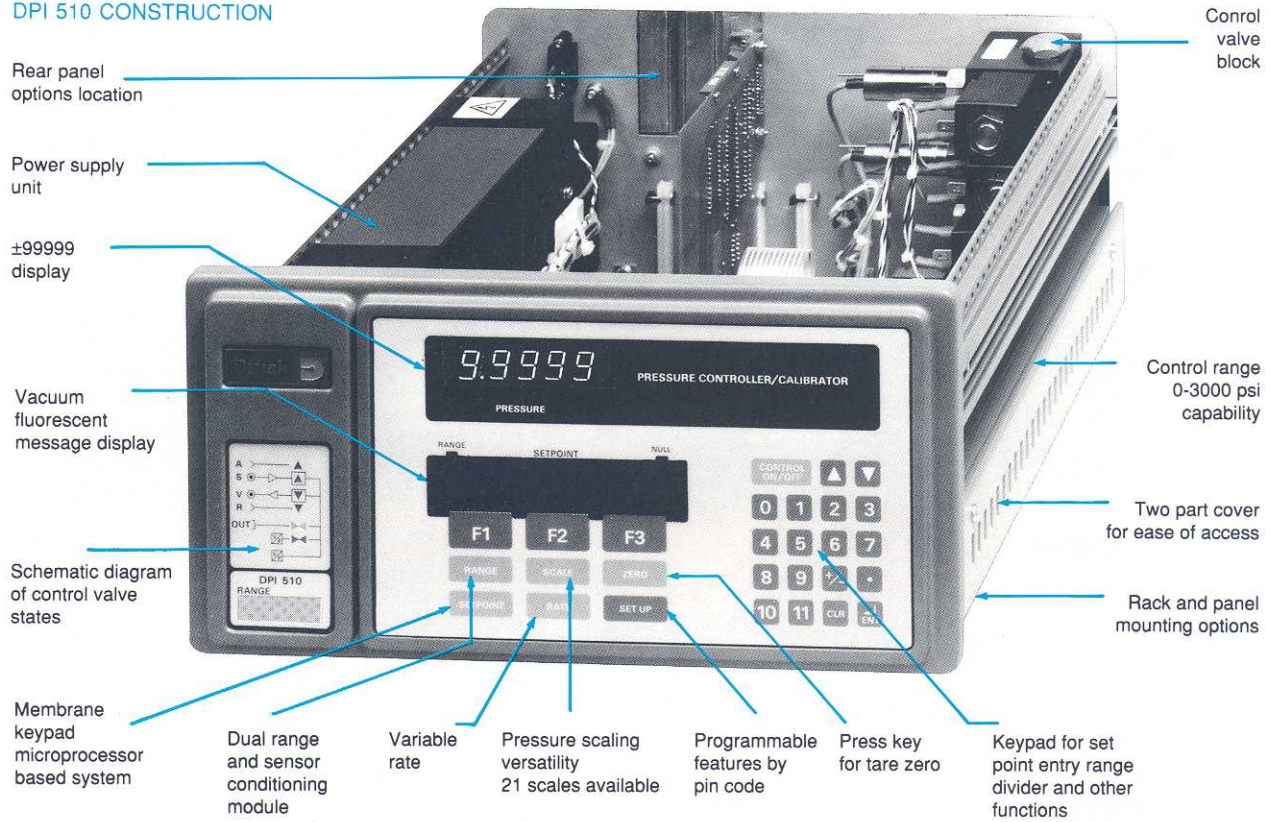
**ENT** The ENTER or execute key which finally inputs the value required.

### DPI 510 APPLICATIONS

The DPI 510 precision pressure controller/calibrator can be used in a wide range of applications in industrial, research, aerospace and similar activities. The following are a few of the typical areas:-

1. Standards and calibration laboratories as Transfer Standards.
2. Pressure gauge manufacturers for production testing.
3. Pressure transducer manufacturers for A.T.E. computer controlled pressure calibration.
4. Industrial pressure transmitter automatic computerized calibration.
5. Automotive pressure sensors mass production testing.
6. Computerized pressure charge and leak test detection.
7. Dynamic test systems for transient pressure response testing.
8. Calibration of aircraft instruments e.g. air speed indicators.
9. Computer controlled pressure ramp generation.
10. Calibration standard pressure generation for scanning valves.
11. Pressure control of environmental chambers - computer controlled.
12. Programmable pressure excursions for fatigue testing.

# DPI 510 CONSTRUCTION



SCHMATIC DIAGRAM – DPI 510

### KEY

- LED SIGNALS
- LED'S
- PNEUMATIC CONTROL SIGNALS
- PNEUMATIC
- CONTROLLER/PNEUMATIC ELECTRONICS
- OPTIONS
- ANALOG I/O
- DIGITAL I/O
- SERIAL LINK

## OPTIONS

### (A) IEEE 488 interface

Full computer control is available via the databus.

The standard IEEE connector is provided on the plug-in rear panel option, the interface mating connector and lead is not provided. Full TALK and LISTEN capabilities are provided with the databus disabling the front panel controls. All the standard front panel facilities can be driven with the exception of the SETUP. Pressure values can be set on the databus to the full 0.005% resolution. Instruments are factory set on address 16 though this can be altered by the user from the front panel to any address 0 to 30. All the DPI 510 control codes are listed in the operating handbook.

### (B) RS 232 interface

As an alternate to option (A) the serial RS 232 interface can be utilized giving control over long distances.

A 25 way D type connector is provided on the plug-in rear panel option and the mating connector is supplied.

Full control as described above for option (A) is provided and the same codes are utilized for the desired modes of operation. The Druck Daisy Chain network system allows multiple instruments to be connected to a single RS 232 computer port and individual instruments to be addressed and commanded.

### (C) Sensor conditioning module (SCM)

To allow the DPI 510 to provide a total service for calibration this option enables a test transducer or transmitter to be energized and have the output displayed on the front panel or made available for computer input.

A 25 way D-type connector is provided on the plug-in rear panel option and the mating connector is supplied.

Connections to the SCM option provide the following:-

### Power supply unit

$\pm 4$  to  $\pm 14.5V$  @ 60mA  
Accuracy 1mV (0.02% min)  
24 volts nominal also for a single input

### Transducer – two transducer inputs

4 to 200mV with 0.005% resolution to 20mV

Accuracy 0.02% of reading after calibration  
CM Range  $\pm 10V$

### Voltage input

100mV to 10V 3 auto-ranges  
Accuracy 0.05% of reading  
CM Range  $\pm 14.5V$

### Current input

20 & 50mA auto ranging  
40 ohm shunt (2V max)  
Accuracy 0.05% of reading  
CM Range  $\pm 10V$

### (D) Analog output

An analog voltage output over the range 0 to 10V is provided relative to the DPI 510 fullscale. On dual channel instruments 2 parallel outputs are provided.

A 9 way D type connector is provided on the plug-in rear panel option and the mating connector is supplied.

The output is an amplified, buffered signal representing the range transducer signal and reflects the basic sensor performances, not the full DPI 510 specification.

Accuracy  $\pm 0.2\%$  F.S. or  $\pm 0.3\%$  F.S. for ranges over 1000psi.

For operation into loads  $> 1000$  ohms.  
Temperature error band  $\pm 0.5\%$  F.S. over  $32^\circ$  to  $122^\circ F$ .

Frequency response 2kHz (3db)

Long term stability of amplifier  $\pm 0.02\%$  F.S. over 3 months.

### (E) Rack and panel mounting

A common mounting kit to enable installation of the DPI into a standard 19" equipment rack or to panel mount into a plain cut-out.

### (F) Remote sense

A remote sense port is provided. Controller will only operate via the remote sense port.

### (G) Minus 1 atmosphere capability

Units will be calibrated and tested for use below atmospheric pressure.

### (H) Barometric reference

This option provides a barometric reference with accuracy to .003 ins.Hg and annual stability of 50 ppm. The display resolution is 999999. It facilitates both single and dual range instrument to provide both gauge and absolute capabilities. A vibrating cylinder sensor is incorporated internally reading pressure of the day. This provides a precision absolute reference and enables gauge sensors to act as absolute also. The atmospheric pressure is added to the gauge value via the microprocessor. This option enables absolute ranges at full specified accuracy to be provided without the need to carry out zero tare at zero absolute - negating also the need for a high quality vacuum pump and measurement.

### (J) Aeronautical Version

Software facilities for the calibration of altitude and airspeed instrumentation by conversion of linear pressure values into non linear feet/meters/Rate of Climb and knots/km/hr/Mach No. Altitudes from -2000 to +100000 ft. and airspeeds from 0 to 1000 knots.

### Accessories

Power cord, five point calibration chart and instruction manual supplied with instrument.

### AUTOMATIC CALIBRATION

Druck offers a software package type ACS510 based on IBM PC's for use specifically with the DPI 510 computer interface (option A or B). When combined with option (C), the Sensor Conditioning Module, it provides a powerful fully automatic calibration facility for pressure transducers or transmitters. It can also be adapted for use with any other type of pressure measuring device.

Results tabulation, storage and graph plotting are provided. Please contact Druck for further information.

### ORDERING INFORMATION

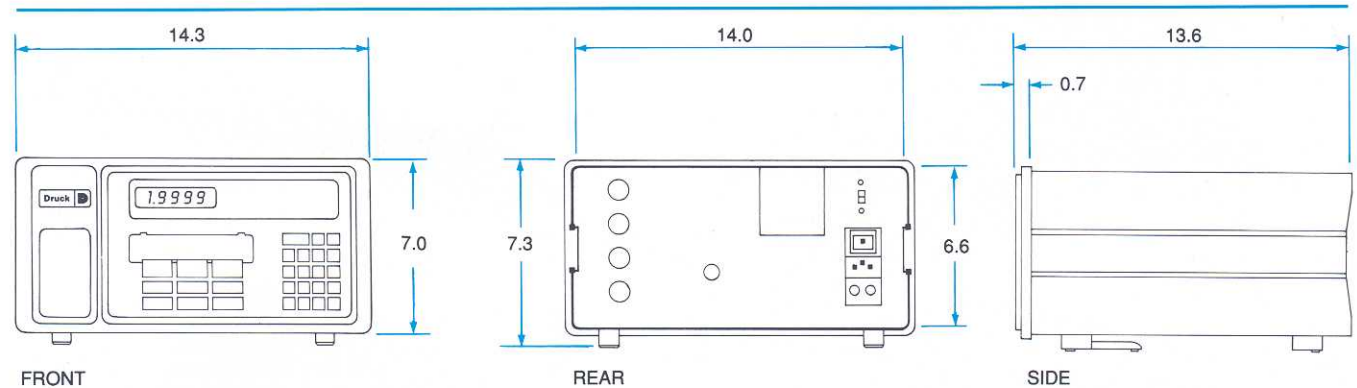
Please state the following:-

- (1) Type number
- (2) Pressure ranges in psi
- (3) Gauge, sealed gauge, absolute or differential
- (4) Preferred scales
- (5) Options Note: A maximum of two from options (A) (B) (C) (H) and (J) may be incorporated into a single instrument.
- (6) Pressure media
- (7) Power supply setting

**Unless otherwise specified the instrument will be delivered with scales of psi/in. Hg/kPa and set for 110V operation.**

*For non-standard requirements please specify in detail.*

*Continuing development sometimes necessitates specification changes without notice.*



Installation Dimensions: inches

CUT-OUT SIZE FOR PANEL MOUNTING 14.1 X 6.7

## Druck Incorporated

4 Dunham Drive  
New Fairfield, CT 06812  
Telephone: (203) 746-0400  
FAX: (203) 746-2494  
Telex: 643118

## Representative: