Druck
a Baker Hughes business

DPI104
DPI104-IS

Digital Pressure Indicator
Instruction Manual

Druck.com

L1

[1]	DRUCK
	LE6 0FH, UK
[4]	##### #### ##
[5]	DoM: ##/##
[6]	MADE IN #####
[7]	S/N ########

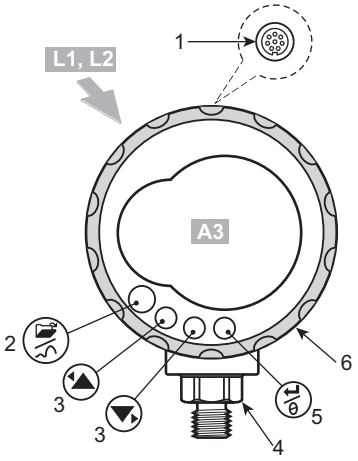
CE #### UKCA ####

[2, 3]

L2

[8]	ITS07ATEX25517X
[9]	ITS21UKEX0076X
[10]	Ex II 1 G
[11]	Ex ia IIC T4 Ga (-10°C ≤ Ta ≤ +50°C)
[12]	IECEx ITS 07.0007X
[13]	WARNING: REPLACE BATTERY IN SAFE AREA ONLY

A1



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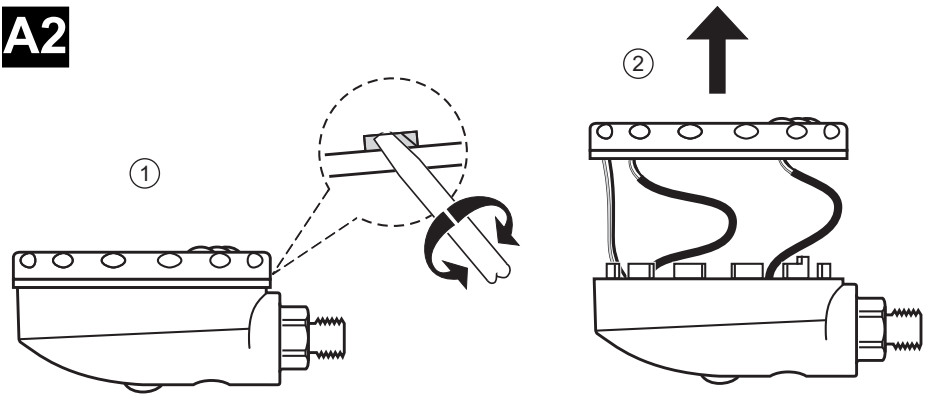
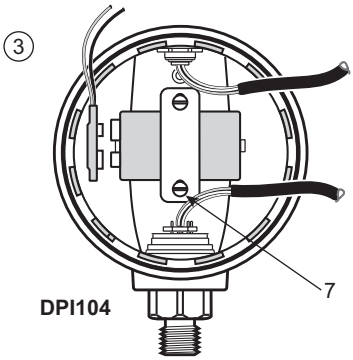
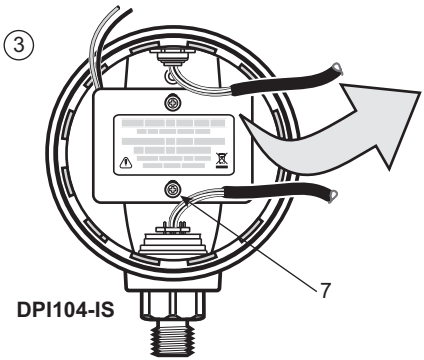




DPI104



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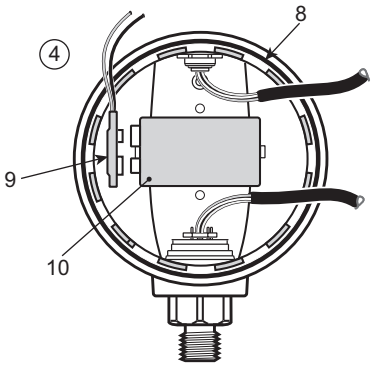

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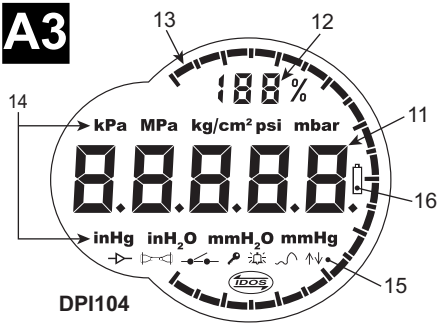
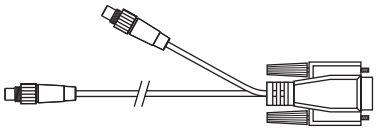


DPI104

DPI104-IS

A4



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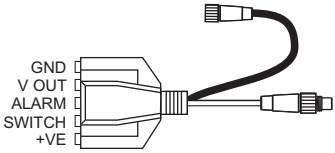
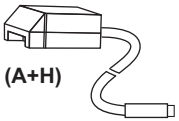


(G)



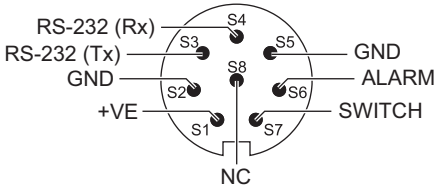
(A+H)

(E)

(F)

B2

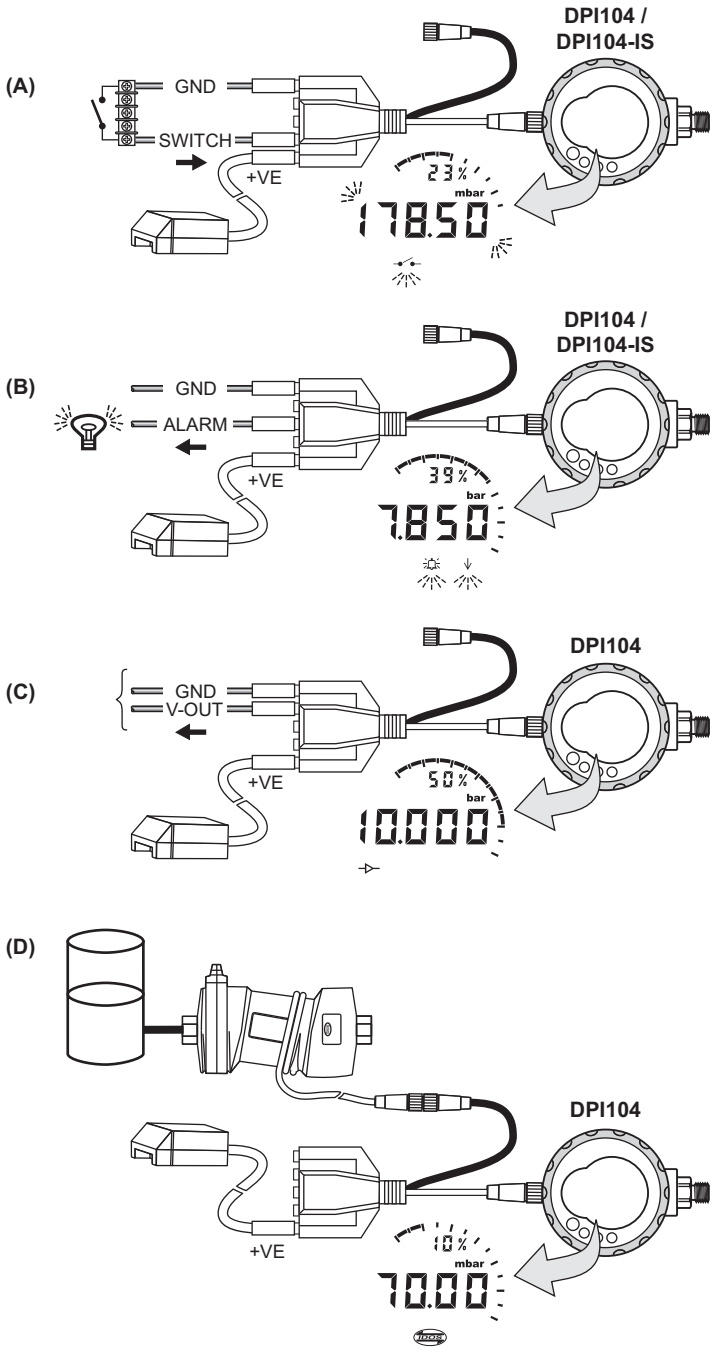
DPI104-IS



		Ui (V)	Ii (mA)	Pi (mW)	Ci	Li
S2-S1	+VE	16.9	22	210	0	1.6 µH
S2-S6	ALARM	16.9	22	210	0.1 nF	0
S2-S7	SWITCH	0	0	0	0	0
S2-S3	RS-232 (Tx)	16.2	4.75	210	440 nF	0
S2-S4	RS-232 (Rx)	16.2	4.75	210	440 nF	0

		Uo (V)	Io (mA)	Po (mW)	Co	Lo
S2-S1	+VE	0	0	0	0	0
S2-S6	ALARM	5	0.5	0.69	99.9 µF	1 H
S2-S7	SWITCH	5	6.75	8.5	100 µF	1 H
S2-S3	RS-232 (Tx)	10	14	260	2 nF	0.41 H
S2-S4	RS-232 (Rx)	10	14	260	2 nF	0.41 H

B3



Introduction

The Druck DPI104 / DPI104-IS is a digital pressure indicator that measures the pressure of liquid, gas or vapor and shows the pressure value on a liquid crystal display (LCD).

DPI104

The DPI104 is designed to operate in the non-hazardous areas. It has the Intelligent Digital Output Sensor (IDOS) technology to use data from a Universal Pressure Module (UPM).

DPI104-IS (Intrinsically Safe)

The DPI104-IS is designed to operate in the “hazardous areas” specified by the certification markings (refer to “Marking Details” on page x).

In this document, “hazardous areas” includes potentially explosive atmospheres, hazardous (classified) locations, explosive gas atmospheres.

Functionality

The DPI104 / DPI104-IS includes the following functions:

- Measure pressure[1] - Accuracy: 0.05% full-scale (FS).
- Large 5-digit main display with 11 pressure units.
- Adjustable full-scale output (FSO).
- 20 segment analog dial in increments of 5% FSO (large division marks = 10% increments).
- 2.5 digit percentage indicator (0-100% FSO).
- 8-pin connector port for RS-232, external power supply.
- Alarm output for high/low pressure conditions.
- Switch input to monitor an external pressure switch.
- Other functions: maximum/minimum, tare, automatic power off.

Additional Functions that are Available in DPI104 Only

- IDOS UPM[2].
- Analogue voltage output (V out/Vo): 0.05 to 5 V dc.
- V out scale factor.

SiCalPro Software

This software package allows the user to control the DPI104 / DPI104-IS remotely through a virtual instrument panel on the computer screen. The calibration data can be logged, viewed and printed in graphical format or as a calibration certificate (safe area only). SiCalPro is free to download from the DPI104 web page at:

https://druck.com/software

Option (B) PC serial lead required.

Option (A) external power supply recommended.

1. Refer to “Menu Operation” on page 3.
2. Optional item.

Safety

This publication contains operating and safety instructions that must be followed to make sure of 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.

The DPI104 / DPI104-IS has been designed to be safe when operated using the procedures detailed in this manual. Do not use this equipment for any other purpose than that stated, the protection provided by the equipment may be impaired.

Before installing and using the DPI104 / DPI104-IS, read and understand all the related data. This includes: all local safety procedures and installation standards (for example: EN 60079-14), and this document.

Before starting an operation or procedure, use only approved engineers who have the necessary skills (if necessary, with qualifications from an approved training establishment). Follow good engineering practice at all times.

WARNING Do not use with media that has an oxygen concentration > 21 % or other strong oxidizing agents.

This product contains materials or fluids that may degrade or combust in the presence of strong oxidizing agents.

Do not use the non-intrinsically safe DPI104 in locations where explosive gas, vapor or dust are present. There is a risk of an explosion.

Some liquid and gas mixtures are dangerous. This includes mixtures that occur because of contamination. Make sure that the DPI104 / DPI104-IS is safe to use with the necessary media.

It is dangerous to ignore the specified limits (refer to data sheet) for the DPI104 / DPI104-IS or to use the DPI104 / DPI104-IS when it is not in its normal condition. Use the applicable protection and obey all safety precautions.

To prevent a dangerous release of pressure, isolate and bleed the system before disconnecting a pressure connection. A dangerous release of pressure can cause injury.

To prevent an explosion or fire, use only the Druck specified battery and external supply.

CAUTION Do not use force to turn the pressure connector or the bezel farther than the end stops. Using force can damage the DPI104 / DPI104-IS.

Do not use the body of the DPI104 / DPI104-IS to tighten the pressure connection, this can cause damage. Use the flat faces on the pressure connector to hold the body and tighten the pressure union.

Symbols

Symbol	Description
CE	This equipment meets the requirements of all relevant European safety directives. The equipment carries the CE mark.
UKCA	This equipment meets the requirements of all relevant UK Statutory Instruments. The equipment carries the UKCA mark.
⚠	This symbol, on the equipment, indicates a warning and that the user should refer to the user manual.
	Druck is an active participant in the UK and EU Waste Electrical and Electronic Equipment (WEEE) take-back initiative (UK SI 2013/3113, EU directive 2012/19/EU). The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment. In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way. The crossed-out wheeled bin symbol invites you to use those systems. If you need more information on the collection, reuse, and recycling systems, please contact your local or regional waste administration. Please visit the link below for take-back instructions and more information about this initiative. **https://druck.com/weee**

DPI104-IS Intrinsically Safe Version

Only approved engineers who have the necessary skills and qualifications must install and use the DPI104-IS in a hazardous area.

⚠ **WARNING Do not open the DPI104-IS when an explosive atmosphere is present - this can cause an explosion.**

Do not use tools on the DPI104-IS that might cause incendive sparks - this can cause an explosion.

Do not connect an energized electrical circuit in a hazardous area while explosive atmospheres are present - this can cause an explosion. Isolate the power supply to the equipment first.

Batteries can cause incendive sparks. Install the battery in DPI104-IS in a safe area only. Use only Panasonic Industrial 6LR61AD.

Note: In this document, a “safe area” includes non-hazardous location, unclassified area.

Marking Details

Refer to Figure L1, Figure L2 and key below:

1. Certificate holder's name and address.
2. CE Mark and Notified Body Number (####).
3. UKCA Mark and Approved Body Number (####).
4. Pressure range. Example: 20 bar g (g: gauge; a: absolute; sg: sealed gauge).
5. Date of manufacture (month/year).
6. Country of assembly: Made in UK/China.
7. Serial number.
8. ATEX certificate number.
9. UKEX certificate number.
10. European ATEX directive markings.
11. Hazardous area markings.
12. IECEx certificate number.
13. Warning text: "WARNING: Replace battery in safe area only".

Special Conditions for Safe Use

When the power supply is through the 8-pin connector, use only a Type A or a Type B cable as specified in IEC 60079-14.

Declaration Requirements – EU Directive 2014/34/EU

The DPI104-IS pressure indicator is designed and manufactured to meet the essential health and safety requirements not covered by the EU Type Examination Certificate ITS07ATEX25517X when installed as detailed above.

Declaration Requirements – UK SI 2016/1107 (as amended by SI 2019/696)

This equipment is designed and manufactured to meet the essential health and safety requirements not covered by UK-Type Examination Certificate ITS21UKEX0076X when installed as detailed above.

Contents

Figures

Tables

1. To Start

Table 1-1: Key to Figure A1

Item	Description
1.	8-pin connector for external power supplies, RS-232/UPM connections and signal input/output.
2. •	Power on button.
•	Menu mode: Press and hold to show the first menu option. To move down the menu structure, press repeatedly, or continue to press and hold.
•	Reject or stop the change to a value.
•	In maximum/minimum mode. Press to show the maximum and minimum values since the last reset. = maximum = minimum
3.	In menu mode: - On/OFF selection. - Move the decimal left/right. - Increase/decrease a value.
4.	Pressure sensor and connector with 320° of turn: gauge (g), absolute (a) or sealed gauge (sg). Refer to “Menu Operation” on page 3.
5. •	In menu mode: - Accepts a menu selection. - Accepts a value. - Shows the next menu level.
•	In Tare mode: Set the pressure value on the display to zero.
•	In maximum/minimum mode. Reset the maximum/minimum values.
6.	Display bezel with 90° of turn.

Table 1-2: Key to Figure A2

Item	Description
7.	On DPI104: Battery clamp with two screws. On DPI104-IS: Battery cover/clamp with two screws and a label:  Warning text: “Replace battery in safe area only. Use only Panasonic Industrial 6LR61AD”.
8.	O-ring
9.	Battery connector.
10.	Battery: 9 V Alkaline (supplied but not installed). Refer to “Menu Operation” on page 3.

Table 1-3: Key to Figure A3

Item	Description
11.	5-digit main display.
12.	2.5-digit percentage indicator (0 - 100% FSO). %FSO = [applied pressure/(FSO High - FSO Low)] * 100
13.	20 segment analog dial in increments of 5% FSO (large division marks = 10% increments). %FSO = [applied pressure/(FSO High - FSO Low)] * 100
14.	The units of measurement: kPa, MPa, kg/cm^2, psi, mbar, bar, mmHg, mmH_2O, mH_2O, inH_2O, inHg.
15.	Mode indication.
	Voltage output (Vout) mode - ON[a].
	RS-232 connection. The data transmit/receive function is active.
	Switch mode - ON. To monitor an external pressure switch.
	= switch closed.  = switch open.
	Menu Lock mode - ON. To restrict access to the menu functions.
	Alarm mode - ON. The symbol flashes when the measured value satisfies one of the alarm conditions.
	 = High alarm.  = Low alarm.
	Maximum/minimum mode - ON.
	IDOS UPM mode - ON[a]. To monitor pressure from a UPM.
16.	Low battery power indication: Battery life < 15%.

a. Available in DPI104 only.

Table 1-4: Key to Figure A4

Option	Description
(A)	Part No 191-350: Universal power supply for accessory B.
(B)	Part No. IA4090-2-V0: DPI104 / DPI104-IS to PC RS-232 cable (8-pin to 9-pin D-type connector). To transmit data to a PC for applicable monitor.
(E)	Part No. 1S-04-0027: 8-pin connector for Figure A1: item 1 (refer to Table 2-2 on page 9).
(F)	Part No. 182-190: High pressure adaptor (9/16 UNF to 3/8 BSP) for a PV212 hydraulic hand pump [range ≥ 1000 bar (15000 psi)].
(G)[a]	Part No. IA4101-1-V0: DPI104 to UPM cable assembly. The assembly has these connections:
	UPM cable + 5-pin connector: To give an IDOS UPM a 3 V power supply and an RS-232 connection to the DPI104 - Figure B3 (D).
	GND: Ground connection.
	V OUT: To supply a voltage output (V out) - Figure B3 (C).
	ALARM: To supply an alarm output - Figure B3 (B).

Table 1-4: Key to Figure A4

Option	Description
	SWITCH: To monitor an external switch - Figure B3 (A).
	12V: Remote power input for accessory H - Figure B3 (D). The assembly can supply 12 V to the DPI104 and 3 V to the IDOS UPM.
(H)[a]	Part No. 191-129: Universal 12 V power supply for accessory G.

a. Accessories (G) and (H) are applicable for DPI104 only.

1.1 Prepare the Instrument

Before using the instrument for the first time:

- Make sure that there is no damage to the instrument and there are no missing items.
- Install the battery (refer to “Installation” on page 7). Then re-attach the display bezel [Figure A1: item 6].

1.2 Power On or Off

Refer to Quick Start, Safety Instructions and User Guide: 122M2073.

When the power is off, the last set of configuration options stays in memory.

Note: The DPI104 / DPI104-IS uses a small quantity of power while it is OFF. To put into storage for a long period, disconnect the battery (Refer to “Installation” on page 7).

1.3 Menu Operation

	Menu Description	Steps 1	Steps 2	Result / Subsequent Steps
OFF	= Power supply: OFF only.		-	Power goes off.
unitS	= Set units: (A2: item 14).			Pressure value changes to the applicable units: psi, mbar, bar...
t On	= Set tare (or set zero): Set to On or Off.			On ➤ tA 00.000: Set a tare value (refer to Table 3-1 on page 11).
OFF	= Monitor maximum/minimum: Set to On or Off.			Monitor function is set on or off.
OFF	= Monitor a pressure switch: Set to On or Off.			Monitor function is set on or off.

	Menu Description	Steps 1	Steps 2	Result / Subsequent Steps
C _ _ _ _	= Calibration: To continue, set the correct calibration access code = last four digits of serial number.			C0 (correct the zero offset value) ➤ C2 (do a two-point pressure calibration) ➤ V2[a] (do a two-point voltage calibration) (refer to “Menu Operation” on page 3).
A OFF	= Set low/high alarm: Set to On or Off.			On ➤ 000.0 ↓ ➤ 100.0 ↑ Set a value for the low and/or high alarm (0 to 105% FSO).
OFF	= Supply voltage output (V out)[a]: Set to Off, P-V, or US.			P-V: V out is proportional to the pressure value on the display. Make sure the V out scale factor is correct. US ➤ 000.0: Set a Vout value (0 to 100%) to control an external pressure regulator. Make sure the Vout scale factor is correct.
S 1.00	= Set V out scale factor[a]: A V out adjustment.			If applicable, set a new Vout scale factor (0.01 to 9.99), factory value = 1.00.
Au On	= Set automatic power OFF: Set to On or Off.			On ➤ Au 15 : Set the period for automatic power OFF (1 to 99 minutes), factory value = 15 minutes.
L OFF	= Set lock code: A menu protection facility. Set to On or OFF.			On ➤ L 000 : Set a new lock code (if necessary), factory code = 000.
Sc 02	= Set scan rate: A rate that the DPI104 / DPI104-IS uses to take pressure samples.			Set an applicable rate (02 to 10 Hz), factory value = 02 Hz.
OFF	= Monitor external IDOS[a]: Set to On or Off.			Monitor function is set on or off.
FS ↑	= Set FSO low register: To set a different range for these functions: analog display, %, alarm.			Set a value for the low end of the range (refer to Table 3-2 on page 17. Factory value = Factory calibration value.

	Menu Description	Steps 1	Steps 2	Result / Subsequent Steps
FS ↓ = **Normal display**	Set FSO high register: To set a different range for these functions: analog display, %, alarm.			Set a value for the high end of the range (refer to Table 3-2 on page 17). Factory value = Factory calibration value.

a. Menu item is available in DPI104 only.

2. Installation

This section describes how to install and connect the DPI104 / DPI104-IS.

WARNING To prevent an explosion or fire, use only the Druck specified battery and external supply.

2.1 DPI104 / DPI104-IS Battery

Do the procedures that follow to install or to replace the battery.

1. If applicable, set the power to off and isolate the external power supply.
2. Remove the display bezel (Figure A2: steps ① and ②).
3. Make sure that the o-ring (Figure A2: item 8) and the related surfaces are serviceable. Use only original parts supplied by the manufacturer.
4. Remove the battery clamp/cover (Figure A2: step ③, item 7).
5. Disconnect the battery connector (Figure A2: step ④, item 9) and discard the used battery (Figure A2: step ④, item 10).

   Note: Use an applicable recycling facility.
6. Attach the battery connector (Figure A2: item 9) to the new battery.
7. Install the new battery (Figure A2: item 10) and re-attach the battery clamp/cover (Figure A2: item 7).
8. Push the display bezel back into position until it is fully engaged.

2.2 DPI104 / DPI104-IS Position

Attach the DPI104 / DPI104-IS in a safe configuration that prevents unwanted stress (for example vibration, physical impact, shock, mechanical and thermal stresses). Do not install the equipment where it can be damaged by a material that causes corrosion. Provide additional protection for equipment that may be damaged in service.

CAUTION Do not use force to turn the pressure connector or the bezel further than the end stops. Using force can damage the instrument.

To get the best installation position, turn the pressure connector (Figure A1: item 4) and the display bezel (Figure A1: item 6) to give the best view of the display. End stops set the limits in each axis.

2.3 Pressure Connections

CAUTION **Do not use the body of the DPI104 / DPI104-IS to tighten the pressure connection, this can cause damage. Use the flat faces on the pressure connector to hold the body and tighten the pressure union.**

Use an applicable method to seal the pressure connections, and then tighten to the applicable torque (refer to Table 2-1).

a) 1/4 NPT:
Pressure < 1000 bar (15000 psi)

b) G1/4:
Pressure < 1000 bar (15000 psi)

c) 9/16 x 18 UNF cone:
Pressure ≥ 1000 bar (15000 psi)

1 (1/4 NPT only) Thread with an applicable sealant.
2 (G1/4 only) Applicable bonded seal.

Figure 2-1: Connection Methods

Table 2-1: Maximum Pressure Connector Torque

Pressure Connector	Maximum Torque
1/4 NPT	68 Nm (50 lbf ft)
G1/4	20 Nm (15 lbf ft)
9/16 x 18 UNF	34 Nm (25 lbf ft)

2.4 Electrical Connections

The DPI104 / DPI104-IS includes an 8-pin electrical connector (Figure A1: item 1). Table 2-2 shows the pin connections.

Table 2-2: Connections for the 8-pin Connector

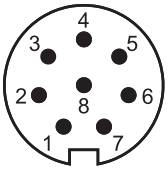
Connector	Pin	Input/ Output	Description
	1	Input	For DPI104: 12 - 24 V dc power supply (+Ve).
		Input	For DPI104-IS: 15 V dc power supply (+Ve).
	2	-	Signal ground (GND).
	3	Output	RS-232 transmit (Tx).
	4	Input	RS-232 receive (Rx).
	5	Output	For DPI104: Voltage output (V out).
		-	For DPI104-IS: Signal ground (GND).
	6	Output	Alarm output (ALARM).
	7	Input	Pressure switch input (SWITCH).
	8	-	No connection.

Table 1-4 on page 2 and Figure A4 gives the optional accessories that use the connector.

Note: Use only original parts supplied by the manufacturer.

The RS-232 interface makes a serial network of units (maximum: 99). Refer to “Menu Operation” on page 3.

2.4.1 External Power

It is recommended that the following functions and operations use an external power supply:

Functions: Maximum/Minimum, Switch, Low/High alarm, V out, IDOS.

Operations that use the DPI104 / DPI104-IS for long periods.

3. Operation

This section describes how to use the DPI104 / DPI104-IS.

Before starting:

- Read and understand the “Safety” section.
- Make sure that the installation is complete (refer to “Installation” section).
- Do not use a damaged DPI104 / DPI104-IS.

3.1 Menu: Set Units

There are 11 different units to measure pressure (refer to “Menu Operation” on page 3).

3.1.1 Units - Setup

Refer to Safety Instructions and User Guide, 122M2073.

3.2 Menu: Set Tare (or Set Zero)

Use the tare function to adjust the pressure value on the display. For example: To make an adjustment for atmospheric pressure. Refer to Table 3-1.

Table 3-1: Permitted Tare Values

Range	Permitted Tare Values
g: 0.7 bar (10 psi)	-0.7 bar (-10 psi) to 105% FS
a, sg, g: ≥ 2 bar (30 psi)	-1 bar (-15 psi) to 105% FS

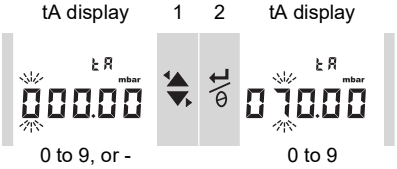
If a value is set that is not in the permitted range, the value goes back to the last accepted value.

3.2.1 Tare - Setup and Use

Menu: Set this function to ON (refer to “Menu Operation” on page 3).

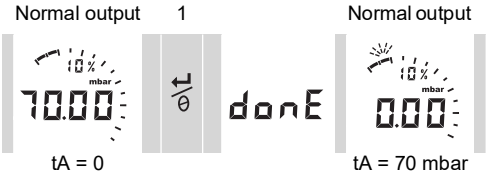
When this function is ON, there are two options to set a tare value (tA):

Menu option: Set the menu “t On”, then set a tA value:



Repeat steps 1 and 2 for each digit and for the decimal point.

Zero option: Step 1 lets you set a value for tA. Press and hold.



When tA is not zero, the last segment on the analog dial flashes.

To make sure that there is an indication of the correct pressure:

While tare is ON, the analog dial and % indication show values calculated from the calibrated range without the tare adjustment.

3.2.2 Tare - With Lock

If the menu lock is On with a lock code set < 500, the zero option is rejected - Error code (E0002).

3.2.3 Tare - With Alarm and/or V out

Note: The V out function is available in DPI104 only.

If the zero option is used to set a tare value (tA) while the alarm and/or Vout functions are ON, the display counts down from: tArE9 to tArE0.

Button	Action
	To cancel the specified tA value, press this button.
	To continue with the specified tA value, press this button OR let the count complete.

When setting a tA value, the alarm and Vout functions use values calculated from the calibrated range and the pressure value on the display.

3.2.4 Tare - With FSO Values

To make sure that there is an indication of the correct pressure while tare is On, the FSO Low and/or FSO High values are not used.

3.3 Menu: Monitor Maximum/Minimum

Use this function to monitor the maximum and minimum pressure. It uses the specified scan rate (refer to “Menu Operation” on page 3).

Recommendation: To save battery power use an external power supply.

3.3.1 Maximum/Minimum - Setup and Use

Menu: Set function to ON (refer to “Menu Operation” on page 3).

When function is ON, use steps 1 and 2 to show the maximum/minimum since the last reset.

1 maximum 2 minimum 3

Step 3 resets the values for maximum/minimum, press and hold.

3.4 Menu: Monitor a Pressure Switch

Use this function to measure the performance of a pressure switch (mechanical operation and hysteresis). It uses the specified scan rate (refer to “Menu Operation” on page 3).

Recommendation: To save battery power use an external power supply.

3.4.1 Pressure Switch Input - Setup and Use

1. Connect the DPI104 / DPI104-IS with the applicable accessories in Table 1-4 on page 2.
   For DPI104: Accessories G/H, refer to Figure B3 (A).
   For DPI104-IS: Accessory E, refer to Figure 3-1 on page 13 and Table 2-2 on page 9.

2. **Menu**: Set function to On (refer to “Menu Operation” on page 3).

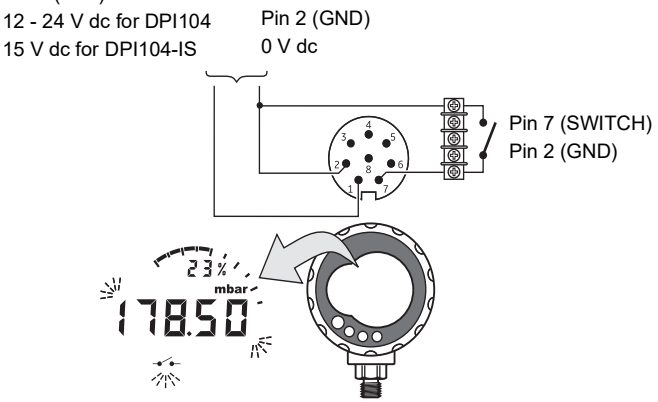


Figure 3-1: Example Configuration - Switch Input

This example (Figure 3-1 on page 13) shows the display when the switch condition changes (open or closed). The analog dial and the % indication continue to monitor the normal pressure.

The switch symbol and the value on the main display flash to give the switch condition and the switch pressure.

Press ↵/θ to reset the monitor function.

3.5 Menu: Calibration

Refer to the “Calibration” section.

3.6 Menu: Set Low/High Alarm

Use the alarm function to show when the pressure is not in the specified limits for the system.

Set applicable values in the range 0 to 105% FSO:

$$\%FSO = \left(\frac{\text{Applied Pressure}}{\text{FSO High} - \text{FSO Low}}\right) \times 100$$

Note: When setting a tare value, the alarm function uses the calibrated range and the pressure value on the display (refer to “Menu Operation” on page 3.

The alarm indication is available on the display and as a signal output (refer to Table 2-2 on page 9.

Figure 3-2 on page 14 gives an example configuration. Figure B3 (B) with Table 1-4 on page 2 gives the accessories (G and H) to be used.

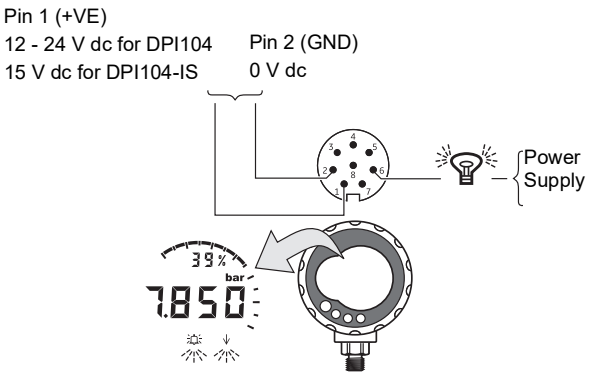


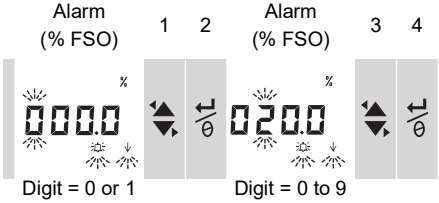
Figure 3-2: Example Configuration - Alarm Output

While there is an alarm condition, the applicable alarm symbol (high or low) flashes on the display (Figure A3: item 15).

Recommendation: To save battery power use an external power supply.

3.6.1 Low/High Alarm - Setup and Use

Menu: Set function to On (refer to “Menu Operation” on page 3). Then use these steps to set the low and/or high alarm.



5. To finish, repeat steps 3 and 4 for each digit.

   If the value entered is not correct, the value resets to the nearest permitted value. That is:

   - A value in the range 0 to 105% FSO.
   - A low alarm value < high alarm value.

   To accept or change the new value, repeat steps 1 to 5.

   Press to cancel the new value.

3.7 Menu: Supply Voltage Output (V out)

Note: This function is applicable for DPI104 only.

Use the Vout function to supply a voltage output (0.05 to 5 V) to an external system. Two options are as follows:

- **P-V**: V out is proportional to the pressure value on the display.
- **US**: User mode. Set a value in the V out register (0 to 100%) to control an external pressure regulator.

Recommendation: To save battery power use an external power supply.

3.7.1 P-V Mode Voltage Calculation

The following equation can be used to calculate V out for an applied pressure:

$$\text{V out} = 5 \times \left(\frac{\text{Applied Pressure}}{\text{FSO}}\right) \times \left(\frac{1}{\text{Scale Factor}}\right)$$

Example - If FSO = 20 bar (300 psi) and V out scale factor = 1.00. Applying 10 bar (150 psi) to this DPI104:

$$\text{V out} = 5 \times \left(\frac{10}{20}\right) \times \left(\frac{1}{1.00}\right) = 2.5 \text{ V}$$

3.7.2 US Mode Voltage Calculation

This calculation uses the values setup for the V out register and the V out scale factor. If the pressure ranges for the DPI104 and the regulator are different, set a new V out scale factor (refer to “Menu Operation” on page 3).

$$\text{V out} = 5 \times \left(\frac{\text{V out Register}}{100}\right) \times \left(\frac{1}{\text{Scale Factor}}\right)$$

Example - If the V out register is set to 25%, and the V out scale factor is set to 0.50:

$$\text{V out} = 5 \times \left(\frac{25}{100}\right) \times \left(\frac{1}{0.50}\right) = 2.5 \text{ V}$$

3.7.3 Voltage Output (V out) - Setup and Use

1. Connect the DPI104 with the applicable Table 1-4 on page 2 accessories:
   - Accessories G/H - refer to cover, Figure B3 (C).
   - Accessory E - refer to Figure 3-3 on page 15 and Table 2-2 on page 9.
2. **Menu**: Set function to OFF, P-V, US (refer to “Menu Operation” on page 3).

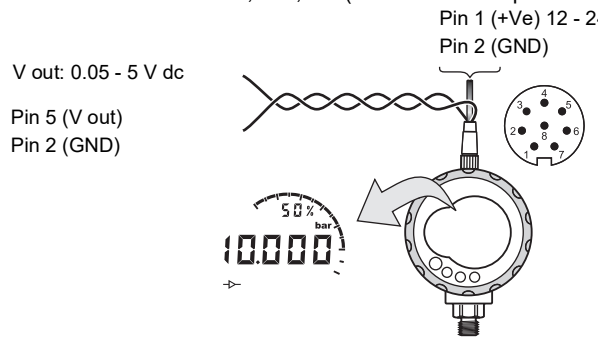


Figure 3-3: Example Configuration - V out

3.8 Menu: Set V out Scale Factor

Note: This function is applicable for DPI104 only.

When the V out function is set to P-V or US mode, the V out scale factor becomes part of the V out calculation (refer to “Menu Operation” on page 3).

If the pressure ranges for the DPI104 and the external pressure regulator are different, an applicable scale factor (0.01 to 9.99) must be set.

$$\text{Scale Factor} = \frac{\text{Maximum Applied Pressure}}{\text{DPI104 FSO}}$$

Example - To get a 25 bar (375 psi) line pressure with:

- An external pressure regulator: FSO = 100 bar (1500 psi)
- A DPI104: FSO = 200 bar (3000 psi)

In this example:

$$\text{Scale Factor} = \frac{100}{200} = 0.5$$

Next calculate the V out register value:

$$\text{V out Register (\%)} = \frac{\text{Applied Pressure}}{\text{DPI104 FSO}} \times 100$$

$$\text{V out Register (\%)} = \frac{25}{200} \times 100 = 12.5\ \%$$

To get a 25 bar (375 psi) line pressure, the DPI104 uses these values to supply the V out value shown below:

$$\text{V out} = 5 \times \left(\frac{\text{V out Register}}{100}\right) \times \left(\frac{1}{\text{Scale Factor}}\right)$$

$$\text{V out} = 5 \times \left(\frac{12.5}{100}\right) \times \left(\frac{1}{0.5}\right) = 1.25\ \text{V}$$

3.9 Menu: Set Automatic Power Off

The power goes off in a specified period after the last button press or external software operation.

Recommendation: Use this function for maximum battery life.

Note: The DPI104 / DPI104-IS uses a small quantity of power when off. For storage, disconnect the battery (refer to “Installation” section).

3.9.1 Automatic Power Off - Setup and Use

Menu: Set this function to ON. Then set an applicable value in the range 1 to 99 minutes (refer to “Menu Operation” on page 3).

Note: If continuous operation is required, set to OFF and use an external power supply.

3.10 Menu: Set Lock Code

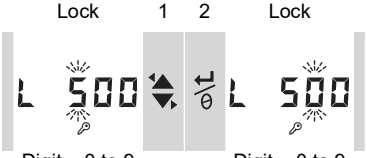
Use the lock function to prevent accidental changes to the configuration. There are two options:

- Lock code < 500: This locks the menu and the tare function. Factory code = 000.
- Lock code > 499: This locks the menu, but the zero option to set a tare value is still available.

Refer to “Menu Operation” on page 3.

3.10.1 Lock Code - Setup and Use

Menu: Set this function to ON (refer to “Menu Operation” on page 3). Use the steps that follow to set a new code.



3. Complete the lock code, repeat steps 1 and 2 for each digit.

The next change to the menu options, the display shows: L _ _ _ _ Enter the applicable code.

To reset the code to the factory code, do a restore operation (refer to “Maintenance” Section).

3.11 Menu: Set Scan Rate

This function sets the rate that the DPI104 / DPI104-IS uses to take pressure samples from the internal sensor.

The nominal update rate for the display is 2 Hz. The up-date rate for the maximum/minimum function and the switch function is greater than or equal to the specified scan rate.

Note: Increasing the scan rate, increases the power consumption.

3.11.1 Scan Rate - Setup and Use

Menu: Set an applicable value in the range 2 to 10 Hz (refer to “Menu Operation” on page 3).

3.12 Menu: IDOS Monitor External IDOS

Note: This function is applicable for DPI104 only

Use this function to read the pressure from an external IDOS UPM. All the other DPI104 pressure functions are available but not the calibration function.

Example: Set tare (or set zero), Monitor maximum/minimum.

This function does not supply power to the IDOS UPM and needs accessories G and H (refer to Table 1-4 on page 2).

3.12.1 Monitor External IDOS - Setup and Use

1. Connect the DPI104, refer to Figure B3 (D).
2. **Menu**: Set to ON (refer to “Menu Operation” on page 3).

3.13 Menu: Set FSO Low/High Registers

Use the FSO low/high registers to set a different range for the functions that follow: analog display, % indication, low/high alarm.

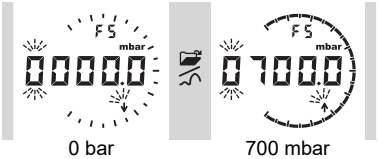
Initially, these register values are set to the factory calibration values.

Example:

Calibrated range: 0.7 bar (10 psi) gauge.

Selected units: mbar

FSO low FSO high



0 bar (0 psi) 700 mbar (10 psi)

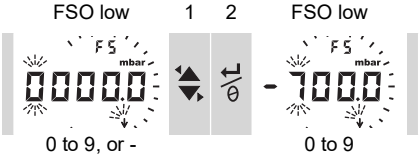
Table 3-2 gives the permitted FSO value.

Table 3-2: Permitted FSO Value

Range	Permitted FSO Value
All ranges: a, sg	0 to 105% FS
g: 0.7 bar (10 psi)	-0.7 bar (-10 psi) to 105% FS
g: ≥ 2 bar (30 psi)	-1 bar (-15 psi) to 105% FS
All ranges	FSO low < FSO high

3.13.1 FSO Low/High Registers - Setup and Use

Menu: Set the menu option to the FSO low register (refer to “Menu Operation” on page 3). Use these steps to set an applicable value in the permitted range (refer to Table 3-2 on page 17):



3. Repeat steps 1 and 2 for each digit and for the decimal point.

   If an incorrect value is entered, the value resets to the nearest permitted value (refer to Table 3-2 on page 17).

   To accept or change the new value, repeat steps 1 to 3.

4. Press to cancel the new value.

5. If necessary, repeat the procedure for the FSO high register.

3.14 Software/Network Connections

External software can be used with the DPI104 / DPI104-IS (Table 1-4 on page 2 accessories B).

3.14.1 Setup a DPI104 Network

Setup a network of up to 99 units in series (‘daisy chain’). Figure 3-4 on page 18shows the electrical connections to do this (refer to Table 2-2 on page 9).

Note: Not applicable for DPI104-IS.

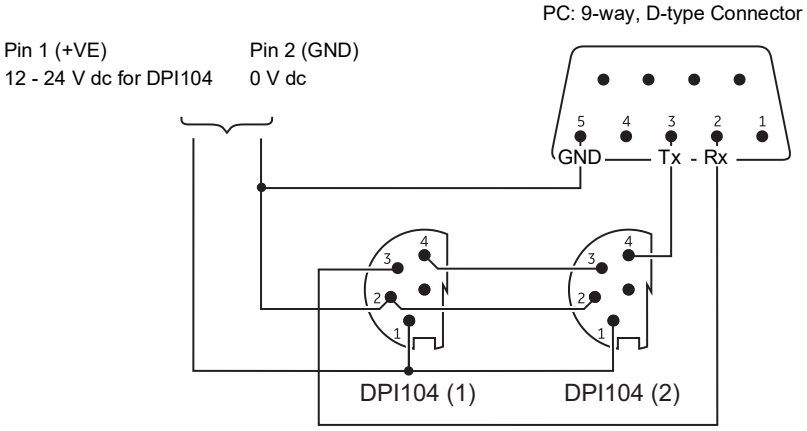


Figure 3-4: Connections for a DPI104 Network

3.14.2 Setup a DPI104-IS

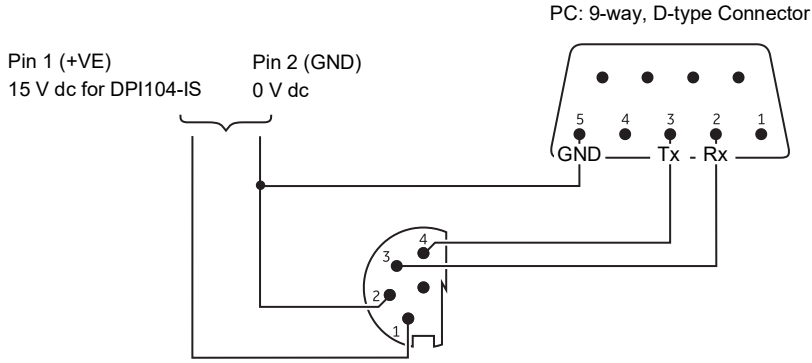


Figure 3-5: RS-232 Connections for DPI104-IS

This symbol appears when the DPI104 / DPI104-IS transmits or receives data.

3.15 Error Indication

Table 3-3: Error Codes/Indications

Code	Description	Action
E0001	Incorrect unlock code.	Use the correct code.
E0002	The tare facility is not available because the menu lock is On and the lock code < 500.	Change the menu configuration.
E0004	Start-up error.	Do a restore operation (refer to “Menu Operation” on page 3).
E0005[a]	External IDOS UPM not found.	Make sure that all the related equipment and connections are serviceable.
E0006	Incorrect calibration access code.	Use the correct code.
E0007	The power supply voltage is too low to do a calibration.	Use an external power supply or replace the battery.
E0009[a]	Unable to supply the specified V out.	Example: Low battery: Use an external power supply or replace the battery. Bad connection: Make sure that all the related equipment and connections are serviceable.
OLoAd	Applied pressure ≥ 110% FS.	Reduce the pressure.
99999/ -9999	There are not enough digits in the main display to give the correct pressure value.	Change the measurement units.

a. Error code is applicable for DPI104 only.

4. Maintenance

4.1 Cleaning

Clean the case with a moist, lint-free cloth and a weak detergent. Do not use solvents or abrasive materials.

4.2 Inspecting

Make sure that there is no damage to the threads and o-rings, free of grit and other obstructions.

4.3 Repair

Do not try to do repairs to this instrument. Return the instrument to the manufacturer or an approved service agent for all repairs.

4.4 Return Goods/Material Procedure

If the unit requires calibration or is unserviceable, return it to the nearest Druck Service Centre listed at: **https://druck.com/service**.

Contact the Service Department to obtain a Return Goods/Material Authorization (RGA or RMA). Provide the following information for a RGA or RMA:

- Product (e.g. DPI104-IS)
- Serial number.
- Details of defect/work to be undertaken.
- Calibration traceability requirements.
- Operating conditions.

4.5 Replace the Batteries

To replace the batteries, refer to “Installation” section.

Note: When replacing batteries all the configuration options stay in memory.

4.6 Restore the Original Configuration

To restore the unit to the original factory configuration:

- Press and hold all four buttons until the display goes off (≈ five seconds).
- The unit will restart.

Refer to “Menu Operation” on page 3 for the factory settings.

The lock code is reset to the factory code (000).

5. Calibration

It is recommended to return the DPI104 / DPI104-IS to the manufacturer or an approved service agent for calibration.

Note: Druck can provide a calibration service that is traceable to international standards. If using an alternative calibration facility, make sure that it uses the following standards.

5.1 Equipment and Conditions

To do an accurate calibration, it requires:

- The calibration equipment specified in Section 5.2.
- A stable temperature environment: 20 ± 1°C (68 ± 2°F).

5.2 Calibration Equipment

5.2.1 Pressure

- An applicable pressure standard (primary or secondary) with a total uncertainty of 0.01% reading or better.
- Make the pressure connection to Figure A1: item 4. Refer to “Menu Operation” on page 3.

5.2.2 Voltage

Note: Voltage calibration is applicable for DPI104 only.

- Voltage calibrator accuracy: 0.025% reading or better.
- Make the V out connection to Figure A1: item 1 (refer to “Menu Operation” on page 3).

5.3 Procedure

1. Connect the applicable calibration equipment (refer to Section 5.2).
2. Menu: Set the menu option to C _ _ _ _.
3. Set the calibration access code = last four digits of the serial number (refer to “Menu Operation” on page 3).

Button	Action
	Press this button to move to the next option without a change to the values.
	Press this button to stop and make changes to a value.

Note: To return to the normal display, wait eight seconds.

There are three calibration options (C0, C2 and V2) for DPI104 and two calibration options (C0 and C2) for DPI104-IS. Refer to Table 5-1:

Table 5-1: Calibration Options

Option	Description
C0	- Set the necessary offset value for the instrument to give the correct pressure related to zero: - All ranges g or sg: Zero (bar/psi) - Ranges a: Ambient pressure
C2	- Do a two-point pressure calibration. - All ranges g or sg: P1 = Zero (bar/psi); P2[a] = FS - Ranges a: P1* = Ambient pressure; P2[a] = FS
V2	- Do a two-point voltage calibration. - All ranges: P1[b] = 0.1000 V; P2[b] = 5.0000 V

a. Adjustable by 5% FS.
b. Adjustable by 50 mV.

Note: V2 calibration is applicable for DPI104 only.

5.3.1 C0 (Zero Offset)

The DPI104 / DPI104-IS shows the following displays:

1. The calibration point to be used for C0. This value is only adjustable for an absolute type DPI104 / DPI104-IS (refer to Table 5-1 on page 24). C0 - Gauge = 0000.0

C0 - Absolute 2. C0 - Absolute 3. 4.

8 seconds 0 to 9

5. Repeat steps 3 and 4 for each digit and for the decimal point. The value is ignored if it is not in the permitted limits (refer to Table 5-1 on page 24).

   The value is then used as the Set Point (SP) on the subsequent displays.

6. This sequence of displays will follow:

Example sequence: Absolute type

   The SP value is followed by the measured pressure - current pressure (CP). This sequence continues until the offset value is accepted or rejected.

7. When the pressure is stable:

Button	Action
	Press this button to accept the new offset value. The display shows “donE”, and then the next calibration option (C2).
	Press this button to reject the new offset value and move to the next calibration option (C2).

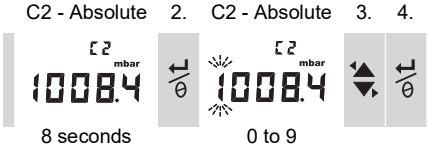
Note: The value is ignored if it is not in the permitted limits (5% FS) or if the CP value is not stable.

5.3.2 C2 (Two-Point Pressure Calibration)

5.3.2.1 Point 1 (P1)

The DPI104 / DPI104-IS shows the following displays:

1. The calibration point to be used for C2 - Point 1. This value is only adjustable for an absolute type DPI104 / DPI104-IS (refer to Table 5-1 on page 24). C2 - Point 1 (Gauge) = 0000.0



5. Repeat steps 3 and 4 for each digit and for the decimal point. The value is ignored if it is not in the permitted limits (refer to Table 5-1 on page 24).

   This value is then used as the set point (SP) for point 1 on the subsequent displays.

6. This sequence of displays will follow:

Example sequence: Absolute type

The SP value is followed by the measured pressure - CP. This sequence continues until the point 1 value is accepted or rejected.

7. When the pressure is stable:

Button	Action
	Press this button to accept the new P1 value. The display shows the calibration point C2 - point 2 (C2).
	Press this button to reject the new P1 value (In DPI104, pressing this button will reject the new P1 value and move to the next calibration option V2).

Note: The value is ignored if it is not in the permitted limits (5% FS) or if the CP value is not stable.

5.3.2.2 Point 2 (P2)

Use the same steps (1 to 5 above) to set C2 - Point 2. This is the FS value and it is adjustable for the absolute and gauge type DPI104 / DPI104-IS (refer to Table 5-1 on page 24.

6. This sequence of displays will follow:

Example sequence: Absolute type

The SP value is followed by the measured pressure - CP. This sequence continues until the point 2 value is accepted or rejected.

7. When the pressure is stable:

Button	Action
	Press this button to accept the new P2 value. The display shows “donE”, and does a two-point calibration. The instrument will restart.
	Press this button to reject the new P2 value (In DPI104, pressing this button will reject the new P1 value and move to the next calibration option V2).

Note: The value is ignored if it is not in the permitted limits (5% FS) or if the CP value is not stable.

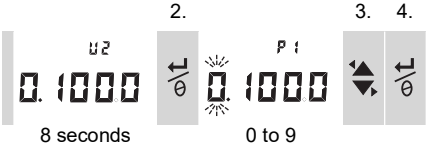
5.3.3 V2 (Two-Point Voltage Calibration)

Note: This calibration is applicable for DPI104 only

5.3.3.1 Point 1 (P1)

The DPI104 shows the following displays:

1. The calibration point to be used for V2 - Point 1.



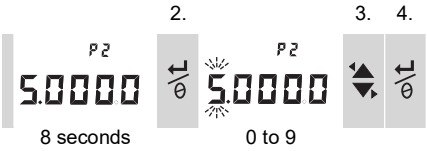
After step 2, the DPI104 sets Vout to 0.1 V. Correct the value (P1) to the value shown on the voltage calibrator.

5. Repeat steps 3. and 4. for each digit. The value is ignored if it is not in the permitted limits (refer to Table 5-1 on page 24).

5.3.3.2 Point 2 (P2)

If P1 has a permitted value, the DPI104 shows these displays:

1. The calibration point to be used for V2 - Point 2.



After step 2, the DPI104 sets Vout to 5.0 V. Correct the value (P2) to the value shown on the voltage calibrator.

5. Repeat steps 3. and 4. for each digit. The value is ignored if it is not in the permitted limits (refer to Table 5-1 on page 24).
6. If P2 has a permitted value, the DPI104 uses the new P1/P2 values to adjust the output (Vt):

Button	Action
	Press this button to accept the V2 calibration. The display shows “donE”. The instrument will restart.
	Press this button to reject the V2 calibration and move to the next menu option.

6. Specification

6.1 General

Table 6-1: General Specification

Function	DPI104	DPI104-IS
Display	LCD	LCD
EMC	EN 61326-1	EN 61326-1
Pressure Safety	Pressure Equipment Directive - Class: Sound Engineering Practice (SEP).	Pressure Equipment Directive - Class: Sound Engineering Practice (SEP).
Power Supply	9V, IEC 6LR61, ANSI/NEDA 1604 battery, or use an external 12 - 24 V dc, 50 mA supply.	9V, Panasonic Industrial 6LR61AD alkaline battery, or use an external 15 V dc, 50 mA supply.
Diameter	95 mm (3.74 in)	95 mm (3.74 in)
Depth	55 mm (2.2 in)	55 mm (2.2 in)
Typical Length (with connector)	≈ 120 mm (4.7 in)	≈ 120 mm (4.7 in)
Weight	350 g (12.5 oz)	350 g (12.5 oz)

6.2 Environmental Conditions

Table 6-2: Environmental Conditions

Function	Calibration Equipment
Operating Temperature	-10 to 50°C (14 to 122°F)
Storage Temperature	-20 to 70°C (-4 to 158°F)
Ingress Protection	IP65[a]
Operating Humidity	0 to 95% relative humidity (RH) non-condensing.
Vibration	Def Stan 66-31, 8.4 cat III
Operating Altitude	2000 metres (6560 ft)
Pollution Degree	2

a. The DPI104 / DPI104-IS has been assessed to the European IEC 60529 standard as having an ingress protection rating of IP65, but this is for reliability purposes and not for safety reasons.

The DPI104 / DPI104-IS is suitable for indoor use with the above environmental requirements. It is permitted to use the DPI104 / DPI104-IS outdoors as a portable instrument if the environmental requirements are met.

The case of the DPI104 / DPI104-IS is not suitable for prolonged exposure to ultra-violet light.

6.3 Electrical

Table 6-3: Electrical Specification

Item	DPI104	DPI104-IS
Switch Input	Maximum impedance: 200 Ω (mechanical contact only).	Maximum impedance: 200 Ω (mechanical contact only). Maximum (mA/V): refer to Figure B2.
Alarm Output	Type: Open Drain Field Effect Transistor (FET). Maximum (mA): 250 mA Maximum (V): 24 V dc	Type: Open Drain Field Effect Transistor (FET). Maximum (mA/V): refer to Figure B2.
Analog Output	0.05 to 5 V dc Minimum load: 500 Ω; Accuracy: 0.1% FS at 20°C (68°F) - user mode only. Temperature coefficient: 0.007% FS / °C (0.0039% FS/°F).	Not applicable.
RS-232 Connection	For: IDOS UPM, external software, or up to 99 units in series (‘daisy chain’).	For: external software.
Battery Life	Up to one year for pressure measurements: Au (power save facility) - On; maximum/minimum, alarm, V out, switch - All set to OFF.	Up to four months for pressure measurements: Au (power save facility) - On; maximum/minimum, alarm, switch - All set to OFF

6.4 Pressure Measurement

Table 6-4: Pressure Measurement Specification

Range[a]			Resolution		Maximum Working Pressure (MWP)		Media Notes
bar	psi	Type	mbar	psi	bar	psi	
(-0.7) 0 to 0.7	(-10.0) 0 to 10	g	0.01	0.001	0.77	11.2	1
(-1.0) 0 to 2.0	(-15.0) 0 to 30	g or a	0.1	0.001	2.2	32	1
(-1.0) 0 to 7.0	(-15.0) 0 to 100	g or a	0.1	0.01	7.7	111.7	2
(-1.0) 0 to 20	(-15.0) 0 to 300	g or a	1	0.01	22	319	2
(-1.0) 0 to 70	(-15.0) 0 to 1000	g or a	1	0.1	77	1117	2
0 to 200	0 to 3000	sg	10	0.1	220	3190	2
0 to 350	0 to 5000	sg	10	0.1	385	5583	2
0 to 700	0 to 10000	sg	10	1	770	11165	2
0 to 1000	0 to 15000	sg	100	1	1100	15950	3
0 to 1400	0 to 20000	sg	100	1	1540	22330	3

a. Available in gauge (g), absolute (a) or sealed gauge (sg). Negative ranges shown in (…) for gauge units only.

Number	Media Note
1	Non-corrosive, non-conductive liquid or non-corrosive, dry gas.
2	Media applicable to stainless steel (316).
3	Media applicable to Inconel 625.

Item	Specification
Accuracy (0 to FS)	0.7 bar (10 psi): 0.15% FS All ranges ≥ 2 bar (30 psi): 0.05% FS
Units	kPa, MPa, kg/cm^2, psi, mbar, bar, mmHg, mmH_2O, mH_2O, inH_2O, inHg
Pressure Connection	Ranges ≤ 700 bar (10000 psi): 1/4 NPT male OR G1/4 male. Ranges > 700 bar (10000 psi): 9/16 x 18 male cone.

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