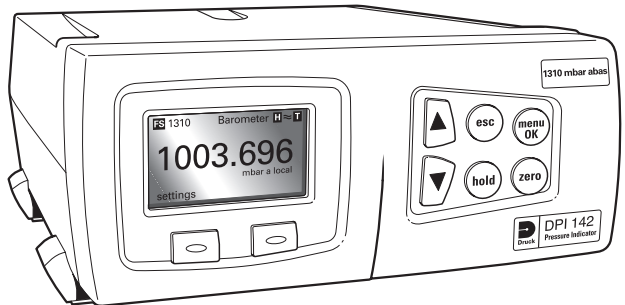
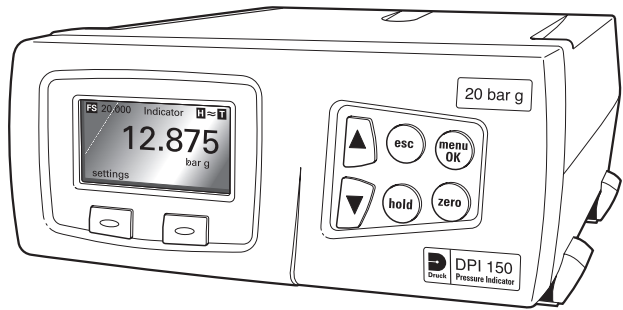


Druck DPI 142/150

Pressure Indicator

Calibration manual - K382



Introduction

This technical manual provides calibration instructions for the Druck DPI 142 and DPI 150 Pressure Indicators.

Scope

This technical manual provides calibration instructions for the calibration technician of this equipment series.

Safety

The manufacturer has designed this equipment to be safe when operated using the procedures detailed in this manual. The user must not use this equipment for any other purpose than that stated.

This manual contains safety and operating instructions that must be followed to make sure of safe operation and to keep the equipment in a safe condition. The safety instructions are either warnings or cautions issued to protect the user and the equipment from injury or damage.

Use suitably qualified* calibration technicians and good engineering practice for all procedures in this manual.

Pressure

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

Technical advice

For technical advice contact the manufacturer or subsidiary.

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

Associated Publications

K343.....	DPI 142 User Manual
K344.....	DPI 150 User Manual
K381.....	DPI 142/150 SCPI User Manual

Druck DPI 142/150 Calibration Manual

ABBREVIATIONS

The following abbreviations are used in this publication.

Note: *Abbreviations are the same in the singular and plural.*

abs	absolute	m	metre
°C	degrees Celsius	mbar	millibar
const	constant	mm	millimetre
DPI	digital pressure indicator (GE Druck product)	mmH ₂ O	millimetres of water
esc	escape	NPT	National Pipe Thread
°F	degrees Fahrenheit	PIN	personal identification number
g	gauge	psi	pounds per square inch
(h)	hour	Ref.	reference
IEEE 488	institute of electrical and electronic engineers standard 488 data	RS232	serial interface communication standard
inHg	inches of mercury	SCPI	standard commands for programmable instruments
kg	kilogram	(s)	seconds
kts	knots	TBA	to be advised
lbs	pounds		

CONTENTS

Title	page
Introduction	1
Preliminary Operations.....	3
Calibration Check DPI 142 and DPI 150 Option A	4
Calibration Adjustment.....	5
Calibration Check DPI 150.....	6
Calibration Adjustment.....	7

Glossary

Terminology

The terminology used in this manual is specific and individual interpretation must not be introduced. The terms are defined as follows:

- Adjust To bring to a more satisfactory state; to manipulate controls, levers, linkages, etc. to return equipment from an out-of-tolerance condition to an in-tolerance condition.
- Align To bring into line; to line up; to bring into precise adjustment, correct relative position or coincidence.
- Calibrate: To determine accuracy, deviation or variation by special measurement or by comparison with a standard.
- Check: Make a comparison of a measure of time, pressure, temperature, resistance, dimension or other quality with a known figure for that measurement.
- Disconnect: To detach the connection between; to separate keyed or matched equipment parts.
- Examine: To perform a critical visual observation or check for specific conditions; to test the condition of.
- Inspect: Review the work carried out by Specialists to ensure it has been performed satisfactorily.
- Maintain: To hold or keep in any particular state or condition especially in a state of efficiency or validity.
- Operate: Make sure that an item or system functions correctly as far as possible without the use of test equipment or reference to measurement.
- Readjust: To adjust again; to move back to a specified condition; to bring back to an in-tolerance condition.
- Reconnect: To rejoin or refasten that which has been separated.
- Reset: To put back into a desired position, adjustment or condition.

Druck DPI 142/150 Calibration Manual

Test: Ascertain by using the appropriate test equipment that a component or system functions correctly.

Uncertainty: The uncertainty of a measurement is defined as a parameter, associated with the result of a measurement, that characterises the dispersion of values that could be reasonably be attributed to the measurand.

Pressure units and conversion factors

Pressure unit	Factor (Pascals)	Pressure unit	Factor (Pascals)
bar	100000	lbf/ft ²	47.8803
lbf/in ² (psi)	6894.76	inHg	3386.39
mH ₂ O	9806.65	inH ₂ O [1]	249.089
mbar	100	ftH ₂ O [1]	2989.07
kgf/cm ²	98066.5	atm	101325.0
kgf/m ²	9.80665	pdl/ft ²	1.48816
mmHg	133.322	dyn/cm ²	0.1
cmHg	1333.22	hbar	1000000
mHg	133322.0	tonf/ft ² (UK)	107252.0
mm/H ₂ O [1]	9.80665	tonf/in ² (UK)	15444300
cm/H ₂ O [1]	98.0665	inH ₂ O (USA) [2]	248.64135
N/m ²	1	ftH ₂ O (USA) [2]	2983.6983
hPa	100	kp/mm ²	9806650
kPa	1000	kp/cm ²	98066.5
MPa	1000000	kp/m ²	9.80665
torr	133.322		

Table of pressure units and conversion factors

Unit Conversion

To convert FROM pressure VALUE 1 in pressure UNITS 1

TO pressure VALUE 2 in pressure UNITS 2, calculate as follows:

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

Note:

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

Introduction

At manufacture this instrument is calibrated against precision calibration equipment which is traceable to the U.K. National Physical Laboratory. The DPI 142 and DPI 150 incorporate a calibration menu; for the indicator to stay accurate, a calibration check should be carried out at chosen intervals (*the recommended maximum interval is 12 months*). If the accuracy of the indicator is not within the permissible deviation, carry out a calibration adjustment. Using the **Set-up/Status/Calibration History** menu, the calibration status of the indicator can be displayed on the front panel screen. The **Calibration History** menu gives a list of dates of the stored calibration corrections.

Table 1
Absolute Pressure Calibration Equipment and Requirements
DPI 142 and DPI 150 Option A

Note: *Equivalent substitutes may be used.*

Range	Uncertainty required	Recommended Equipment	Type
35 mbar to 3500 mbar	$\pm 0.005\%$ Rdg	RUSKA 2465	Piston gauge

Table 2
Gauge Pressure Calibration Equipment and Requirements
DPI 150

Note: *Equivalent substitutes may be used.*

Range	Uncertainty required	Recommended Equipment	Type
25 mbar to 70 mbar	$\pm 0.005\% \text{ FS,}$ $\pm 0.005\% \text{ Rdg}$	Ruska 7050 or 7250	Indicator/ controller
200 mbar to 1 bar	$\pm 0.005\% \text{ Rdg}$	Pressurements 6000 or Ruska 2465	Dead weight/ piston gauge
2 bar to 20 bar	$\pm 0.005\% \text{ Rdg}$	Ruska 2465	Piston gauge
35 bar to 200 bar	$\pm 0.005\% \text{ Rdg}$	Ruska 2465 Ruska 2485	Piston gauge
350 bar 700 bar	$\pm 0.01\% \text{ Rdg}$	Ruska 2485	Piston gauge

Preliminary Operations

Review and become familiar with the whole procedure before beginning a calibration process.

Allow at least one hour for the calibrator to thermally stabilize after switching on and before calibration.

Before starting a calibration procedure:

Carry out a leak test.

If necessary and as a separate procedure from the calibration procedure:

Notes on calibration

The pressure standard outlet port and the indicator inlet port must be at the same level.

On gauge measurements, applying positive pressure to the reference port produces a negative pressure.

Set the calibrator units of pressure to one of the following recommended units of pressure measurement:

Pa, hPa, kPa, MPa, bar, mbar, torr, kgf/cm².

Calibration Security

GE Druck strongly advise protection of the set-up menus in this equipment.

Unauthorised access to the calibration menu can result in degraded performance and inaccuracy. The factory set PIN is: 4321 press MENU OK. The code can be changed to another code of 4 digits; entering 0000 disables this security facility.

Note; *Refer to the user manual to change PIN codes.*

General

1. Carry out a leak check, refer to the User Manual.
2. Connect the instrument and carry out a calibration check.
3. If necessary, carry out a calibration adjustment.
4. After completing the calibration adjustments, adjust the calibration standard to atmospheric pressure.
5. Carry out a calibration check to verify this procedure.
6. Disconnect calibration standard from the instrument.

Druck DPI 142/150 Calibration Manual

Calibration Check DPI 142 and DPI 150 with Option A

After a successful leak test, set the instrument indicator mode:

1. Connect the pressure standard for the pressure range to be checked.

Note: In DPI 150 instruments, Option A connects internally to the negative (reference) pressure port.

2. Adjust the pressure standard to the first pressure value (A) in the Table 3.
3. Compare the pressure value of the pressure standard to the value displayed and record the difference.
4. Repeat steps 2 and 3 for pressure value (B) in the Table 3.
5. If the recorded difference exceeds the tolerance in the table, the instrument needs a calibration adjustment.
6. Adjust the pressure standard to the first pressure value (A) in the Table 3.

Applied Pressure	Tolerance
A	$\pm 0.01\%FS$
B	$\pm 0.01\%FS$

Pressure Ranges

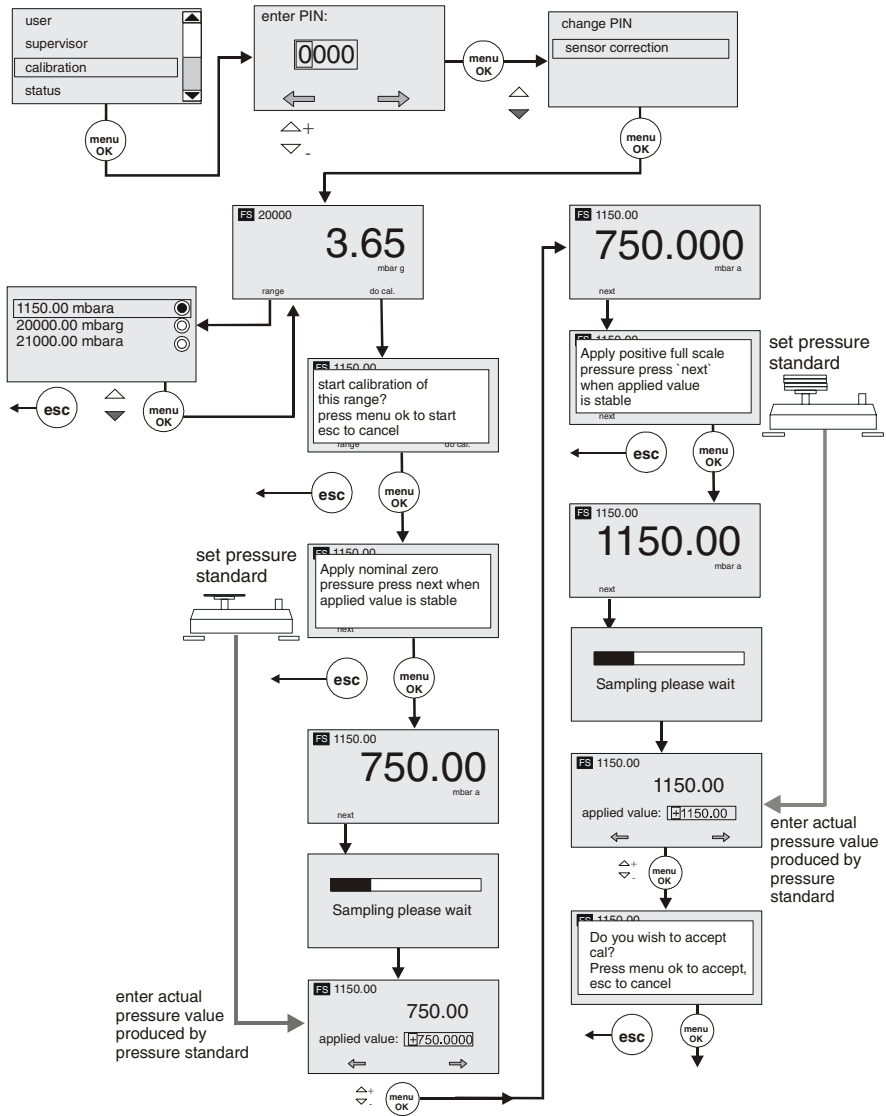
The DPI 142 instrument and the DPI 150 instrument with Option A* have the following pressure ranges.

Table 3
Applied Barometric Pressures

Barometric Range	Pressure Values	
	A	B
*750 to 1150 mbar absolute	750 mbar	1150 mbar
35 to 1310 mbar absolute	35 mbar	1310 mbar
35 to 2620 mbar absolute	35 mbar	2620 mbar
35 to 3500 mbar absolute	35 mbar	3500 mbar

Calibration Adjustment

To adjust a calibration range of the DPI142 and DPI 150 Option A, proceed as follows.1



Druck DPI 142/150 Calibration Manual

Calibration Check DPI 150

After a successful leak test, set the instrument to indicator mode:

1. Connect the pressure standard for the pressure range to be checked.
2. Set the pressure standard to zero pressure, if necessary press the zero key so that the instrument display shows zero.
3. Adjust the pressure standard to the 0% span pressure value.
4. Compare the pressure value of the pressure standard to the value displayed and record the difference.
5. Repeat steps 3 and 4 for the 100% span pressure value.
6. If the recorded difference exceeds the tolerance in the table, the instrument needs a calibration adjustment.
7. Adjust the pressure standard to zero pressure.

Applied Pressure Tolerance
% span

0	± 0.01%FS
100	± 0.01%FS

The DPI 150 instrument has the following pressure ranges.

Table 4

Transducer range	Equivalent Pressure Units					
	mbar	psi	Pa	hPa	kPa	MPa
0.025	25	036	2500	25.0	2.5	0.0025
0.07	70	1	7000	70	7	0.007
0.2	200	3	20000	200	20	0.02
0.35	350	5	35000	350	35	0.035
0.7	700	10	70000	700	70	0.07
1	1000	15	100000	1000	100	0.1
2	2000	30	200000	2000	200	0.2
3.5	3500	50	350000	3500	350	0.35
7	7000	100	700000	7000	700	0.7
10	10000	150	1000000	10000	1000	1
20	20000	300	2000000	20000	2000	2
35	35000	500	3500000	35000	3500	3.5
70	70000	1000	7000000	70000	7000	7
100	N/A	1500	N/A	100000	10000	10
135	N/A	2000	N/A	135000	13500	13.5
200	N/A	3000	N/A	200000	20000	20
350	N/A	5000	N/A	350000	35000	35
700	N/A	10000	N/A	700000	70000	70

Calibration Adjustment

To adjust a calibration range of the DPI 150, proceed as follows.1

