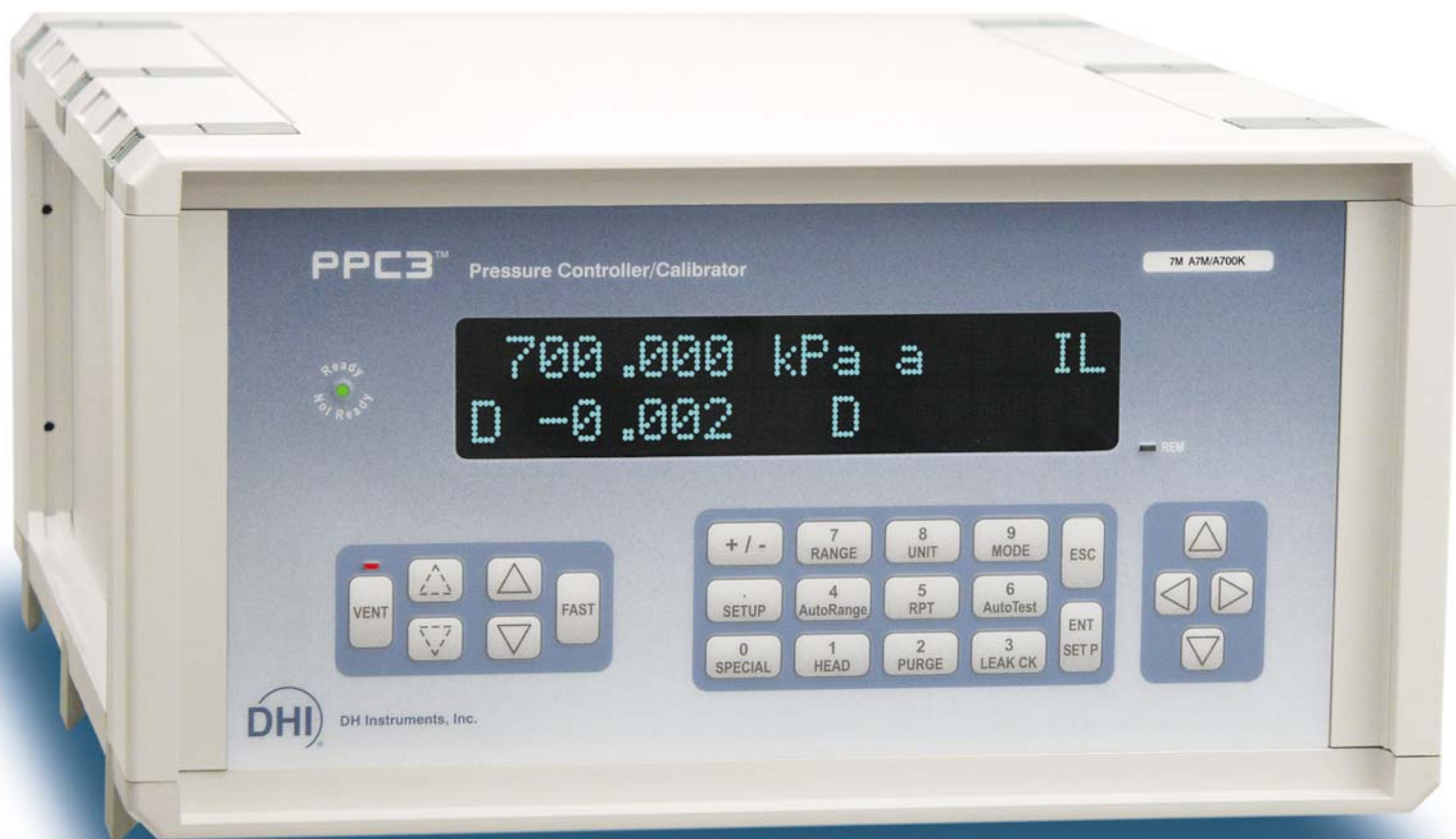


# PPC3™

## Pressure Controller/Calibrator



Premium Performance... Maximum Versatility...  
Outstanding Reliability...



Calibration Solutions  
for Pressure  
and Flow™

### INTRODUCTION

PPC3, DHI's third generation pressure controller/calibrator, breaks new ground with an unprecedented combination of high end performance, operational versatility and long term reliability.

New, individually characterized, quartz reference pressure transducer (Q-RPT) modules increase precision and reduce measurement uncertainty... with the choice of two performance and cost levels.

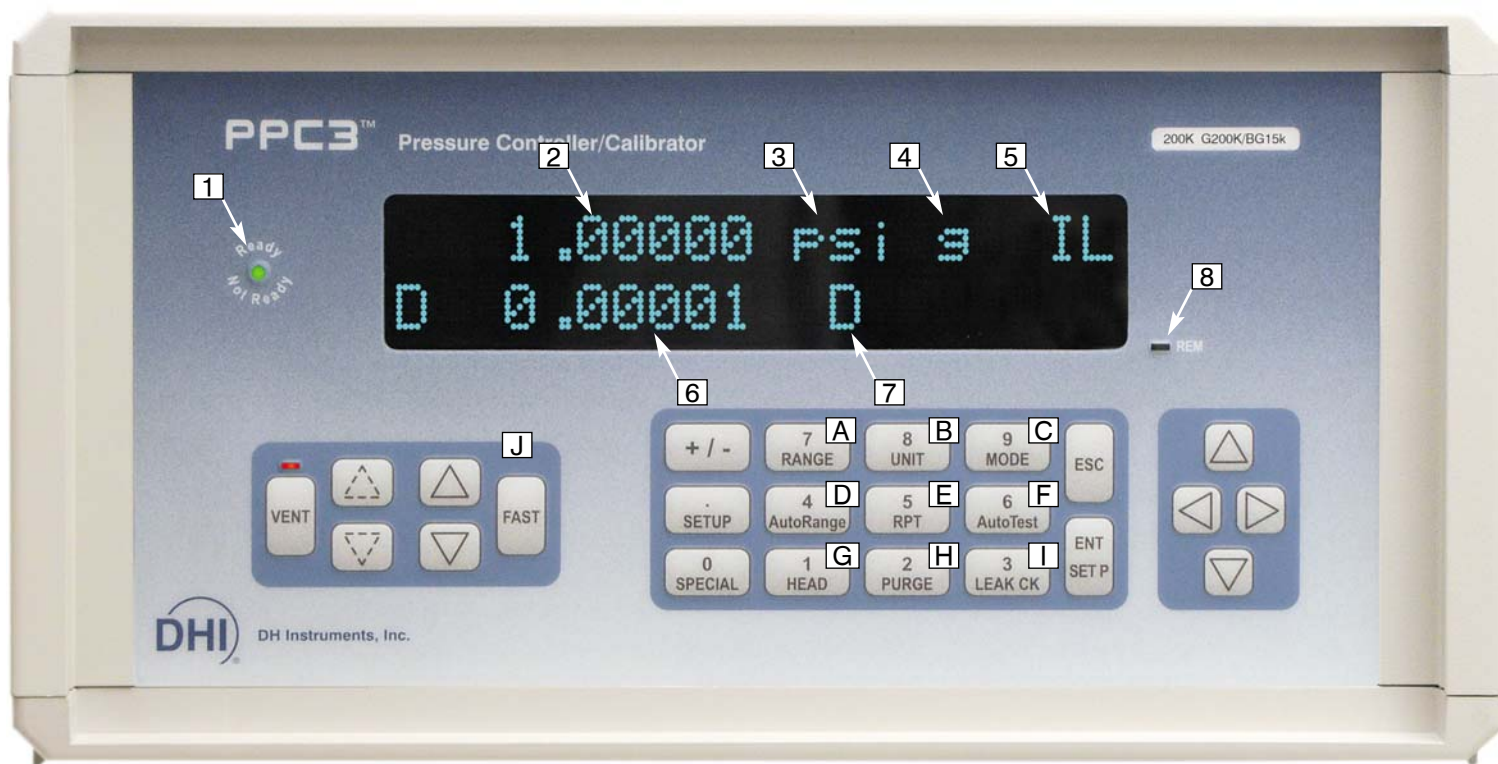
The new AutoRange™ feature supports infinite ranging, automatically optimizing all aspects of operation for the exact range to be explored and bringing a new dimension in rangeability to pressure controllers.

Patented positive shut-off pressure control gives 50:1 control turndown.

Open architecture allows nearly limitless system configurations to adapt to your specific application's requirements.

PPC3 carries on the PPC line's tradition of combining very high end performance with ruggedness and reliability.

With all of this, PPC3 delivers the performance and features needed to face a new generation of pressure calibration and test challenges in calibration labs, instrument shops and automated test stands.



1. Indication of pressure "Ready" (green) "Not Ready" (red) condition
2. Controlled pressure
3. Unit of measure
4. Measurement mode (absolute, gauge, compound gauge)
5. Active Q-RPT module (up to six possible)
6. Current deviation from target control value
7. Control mode and status
8. Remote activity indicator

- A. Select between saved, user defined range configurations.
- B. Select pressure unit of measure.
- C. Select measurement mode (absolute, gauge, compound gauge).
- D. Automatically optimize measurement, control and safety features for the exact pressure range and mode of operation.
- E. View and select active Q-RPT (from up to six in PPC/RPM system).

- F. Set up and run calibration sequences automatically, with tolerance testing, based on DUT tolerance, range and measurement mode.
- G. Make automatic fluid head corrections for differences in height between PPC3 and DUT.
- H. Run automated test purge function.
- I. Run leak test functions.
- J. Direct pressure control keys for slewing or jogging and venting pressure.

# QUARTZ REFERENCE PRESSURE TRANSDUCER (Q-RPT) MODULES

PPC3's outstanding pressure measurement specifications are made possible to **DHI's** exclusive quartz reference pressure transducer (Q-RPT) modules.

Q-RPTs measure pressure by measuring the change in the natural oscillating frequency of a quartz crystal with pressure induced stress. To be qualified for use in a Q-RPT module, each transducer is individually evaluated and characterized using primary pressure standards. Only transducers exhibiting required levels of linearity, repeatability and stability are selected. A proprietary compensation model, derived from more than 15 years experience with thousands of quartz pressure transducers, is applied to optimize the metrological characteristics needed in a transfer standard. **Standard** and **premium** class Q-RPT modules are available to best fit your performance and budgetary requirements.

Q-RPT modules integrate the quartz transducer into a rigid, standardized assembly that protects the transducer from undesired connecting stresses. It includes micro-valves to support AutoZeroing, measurement mode changes and switching of the active RPT.

Dynamic atmospheric pressure compensation using an independent on-board barometer allows instantaneous switching between absolute, gauge and compound gauge modes at any time without significant effect on measurement uncertainty. No additional hardware or options are needed.

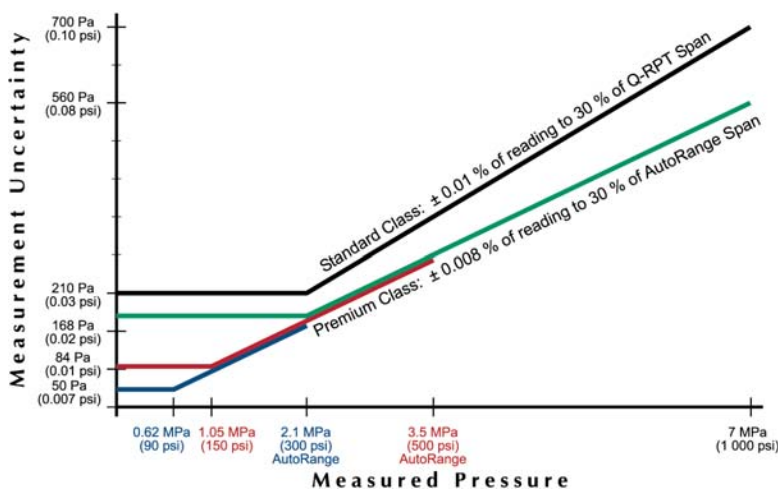


Q-RPT Module

The barometer is used only to measure the small variations in atmospheric pressure that occur during gauge mode operation so its absolute error and drift over time do not contribute to measurement uncertainty and it does not require formal calibration.

In addition to outstanding metrological characteristics, Q-RPT modules offer the advantages of:

- Negligible warm up time
- No gas species dependence
- Quartz element isolated from test medium
- Minimal sensitivity to orientation



Q-RPT Measurement Uncertainty (A7M Example)

## INFINITE RANGING™ AND AutoRange™

There's a lot more to covering a wide range of test devices with a single pressure controller than "% of reading" measurement uncertainty.

In addition to the necessary measurement uncertainty, PPC3 offers the full pressure control and feature adaptability that are needed for true rangeability in test and calibration applications.

**Infinite Ranging** gives PPC3 unprecedented versatility in adapting to a wide variety of devices to be tested. With the easy to use **AutoRange** function, a few simple key strokes or a single remote command string at the start of a test adapt every feature of the controller to optimize it for the range to be studied. Just enter the maximum pressure and the measurement mode and:

- Q-RPT is selected... If there are several Q-RPTs in the PPC3 system, the optimum Q-RPT to cover the defined range is automatically identified and selected.
- Unit of measure is set.
- Absolute, gauge or compound gauge measurement mode is activated.
- Display resolution is adjusted to the appropriate level.
- Pressure control limits are set to fit the range of operation.
- Measurement uncertainty is reduced proportionally to the selected range (**premium** class Q-RPTs only).
- Overpressure limits are adjusted to automatically protect the device under test for the actual range of operation.

Note: The use of PPC3's Infinite Ranging and AutoRange feature is recommended to optimize coverage of varying DUT ranges but is not required to obtain "% of reading" measurement specifications.



## OPEN ARCHITECTURE

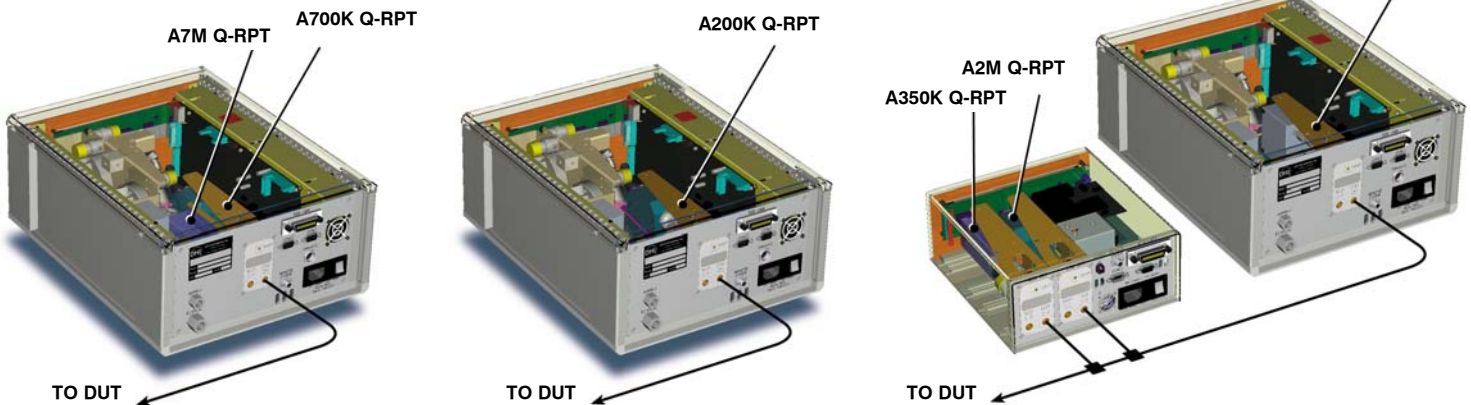
PPC3 offers a new level of latitude in putting together an automated pressure calibration system. A PPC3 controller can be configured with one, two or no **internal** Q-RPT modules. Up to four **external** Q-RPTs contained in one or two **DHI** RPM4 Reference Pressure Monitors can also be integrated into the system.

External RPM4s included in a PPC3 system are “daisy chained” to PPC3 by 9 pin RS-232 cable(s). The RPM4's Q-RPTs then become part of the PPC3 system and are managed by PPC3 transparently to the user. There is only one test connection for the system's full range of operation.

Examples of possible PPC3 system configurations include:

- A PPC3 with one or two built-in Q-RPTs to act as a stand alone, “one box” controller/calibrator package.
- A PPC3 with no built-in Q-RPTs and one or two external RPM4s (each with one or two Q-RPTs) to configure a system whose reference pressure measurement is remote from the controller. This configuration is ideal when possible differences in pressure between the controller and the test measurement location are a concern or when it is advantageous for the controller to be permanently installed, separate from the reference measurement devices.
- A PPC3 with no built-in Q-RPTs to act as low cost automated pressure setting and controlling device for use in a variety pressure calibration and test configurations.

### OPEN ARCHITECTURE PPC3 SYSTEM CONFIGURATION EXAMPLES



#### PPC3-7M A7Ms/A700Ks

“One box” controller/calibrator with overall range of 0 to 7 MPa (1 000 psi).

Absolute, gauge and compound gauge.

Delivered pressure uncertainty of  $\pm 0.01\%$  of reading from 7 MPa (1 000 psi) to 200 kPa (30 psi),  $\pm 22$  Pa (0.003 psi) under 200 kPa (30 psi).

#### PPC3-200K A200Kp

“One box” controller/calibrator with overall range of 0 to 200 kPa abs (30 psia),  $\pm 100$  kPa gauge (15 psig).

Absolute, gauge and compound gauge.

Delivered pressure uncertainty of  $\pm 0.009\%$  of reading down to 30 % of any AutoRanged span from 18 kPa (2.7 psi) to 200 kPa (30 psi).

#### PPC3-2M with RPM4 A2Mp/A350Kp

Controller with remote reference pressure measurement with overall range of 0 to 2 MPa (300 psi).

Absolute, gauge and compound gauge.

Delivered pressure uncertainty of  $\pm 0.009\%$  of reading down to 30 % of any AutoRanged span from 100 kPa (15 psi) to 2 MPa (300 psi).

## PRESSURE CONTROL

PPC3 controls pressure using **DHI's** patented, positive shut-off pressure control. Positive shut-off pressure control is recognized for its high reliability, very wide dynamic range and minimal gas consumption.

Thanks to positive shut-off pressure control, a PPC3 pressure controller has both the speed and precision to control pressure ranges in a 50:1 turn down ratio with a single high pressure supply. PPC3 offers 0.002 % of reading control down to 2 % of the controller's maximum pressure. This allows PPC3 to cover a very wide range without the deterioration in

delivered pressure uncertainty at the low end that is found in other controllers.

The PPC3 pressure control module owes its reliability to the use of low power solenoid valves with less than 1 mm displacement used at very low operating frequency.

Third generation positive shut-off pressure control also features improved low absolute pressure precision and supply shut-off capability to allow lower ultimate absolute pressures when setting zero.

## AUTOMATION MADE EASY

PPC3 provides a host of stand-alone, automated features including multi-increment test setup and execution. PPC3's high range turndown and open architecture make configuration of a single automated system to cover a very wide range simple. For communication from a remote computer, RS232 and IEEE-488 interfaces are included. For those not desiring or not in a position to develop their own software, **DHI's** exclusive **COMPASS® for Pressure**

software provides an off-the-shelf solution. **COMPASS for Pressure** has the power and flexibility to automate nearly any level of testing imaginable... including all aspects of test execution, data acquisition and report generation, whether for a bench top calibration system or a complete, multi-function sensor test stand.

**DHI** also offers, integrated, turn-key calibration systems including pressure generation, control and data acquisition hardware.



## FEATURES, FEATURES, FEATURES

PPC3 includes all the features you expect in today's state of the art instruments:

- Instantaneous switching between absolute, gauge and compound gauge modes
- Instantaneous switching between control and measure modes with no pressure discontinuity
- Automated AutoZeroing while vented at atmospheric pressure
- 16 SI and US pressure units as well as user definable units
- Simple, objective pressure "ready/not ready" indicator with user adjustable criteria
- Automatic fluid pressure head correction

- On board, programmable calibration sequences with DUT tolerance testing
- Remote [ENTER] footswitch for hands free test execution
- Valve driver option for system design
- Automated self purging liquid trap (SPLT) accessory for protection against liquid contamination
- Automated leak testing routines
- Rugged enough for mobile applications and standard shipment without special packaging
- Flash memory for simple and free embedded software upgrades from [www.dhainstruments.com](http://www.dhainstruments.com)

... and much more.

## ORDERING INFORMATION

### CONFIGURING A PPC3 CONTROLLER/CALIBRATOR...

1. Determine maximum controlled pressure required. Select a controller in the PPC3 Controllers table (see page 6) whose maximum pressure equals or exceeds this value.
2. Decide whether Q-RPTs will be internal (built-in to PPC3) and/or external (in remote RPM4s).
3. If Q-RPTs are to be built-in to the PPC3 controller, select one or two Q-RPTs from the Q-RPTs table on page 6.
4. If Q-RPTs are to be external to the PPC3, configure the appropriate RPM4(s) using the RPM4 brochure. The same Q-RPTs are available in RPM4 as in PPC3. Note that the maximum pressure of the PPC3 will define the maximum pressure of the system.

Notes: If there is a Gxxx Hi Q-RPT, an external Axxx Q-RPT cannot be used.  
If there is a BGxxx Q-RPT, there can be no internal Lo Q-RPT.

### For a PPC3 with no internal Q-RPT

**PPC3-nnna**

Where: **nnna** indicates the PPC3 controller's designation (see PPC3 Controllers table, page 6).

### For a PPC3 with 1 or 2 internal Q-RPTs

**PPC3-nnna mnnnac1/mnnnac2**

Where: **nnna** indicates the PPC3 controller's designation (see PPC3 Controllers table, page 6).

**mnnnac1** Indicates the Hi RPT designation. **c** indicates RPT class (**s** for Standard, **p** for Premium, **u** for utility sensor if there is no Hi RPT).

**mnnnac2** Indicates the Lo RPT designation and class. Leave blank if there is no Lo Q-RPT.

### PPC3 MODEL EXAMPLES

DESIGNATOR	CONTROLLER	Q-RPTs		SYSTEM MAXIMUM PRESSURE FROM
		Hi	Lo	
PPC3-10M A10Mp/A2Mp	PPC3-10M	A10M, premium class	A2M, premium class	Hi Q-RPT maximum, 10 MPa (1 500 psi)
PPC3-700K A350Ks	PPC3-700k	A350K, standard class	None	Hi Q-RPT maximum, 350 kPa (50 psi)
PPC3-2M u/A200Kp	PPC3-2M	None (utility sensor)	A200K, premium class	Controller maximum, 2 MPa (300 psi)
PPC3-7M	PPC3-7M	None (utility sensor)	None	Controller maximum, 7 MPa (1 000 psi)

### ADD OPTIONS AND ACCESSORIES TO YOUR PPC3 SYSTEM AS NEEDED...

#### OPTIONS

DESIGNATOR	DESCRIPTION
PPC3 04-2	SI units version
PPC3 05	CE mark
PPC3 06	Lateral recessed handles (06-1)  Full size, padded front, cross bar handle/stand (06-2)
PPC3 07	Special calibration

#### ACCESSORIES

DESIGNATOR	PART NO.	DESCRIPTION
SPLT	401370	Self purging liquid trap for PPC3 TEST port
RPM4		Reference pressure monitor for external Q-RPTs and/or absolute mode AutoZ. See RPM4 brochure.
Case	401899	Reusable molded shipping case
Drivers Connector	401382	Connector for external electrical drivers
Rack Mount Kit	400440	Rack mount kit for standard 19 in. rack
PK-PPC-BG-DVU	401699	Dual volume unit for use with BG15K Q-RPT
Footswitch	401886	Remote [ENTER] footswitch
VA-PPC/MPC-REF, 220V	401160	Vacuum pump package for PPC EXHAUST port
VA-PPC/MPC-REF, 110V	400922	
RS232 Cable	100847	9 pin, 2 m for PPC3 COM1 or PPC3 to RPM4 connection

## PPC3 PRESSURE CONTROLLER

A base PPC3 controller includes a utility sensor covering the maximum range of the controller. The base controller can be used in precision pressure control applications in which accurate pressure measurement is not needed. To obtain high accuracy measurement, PPC3 uses internal and/or external Q-RPTs. One or two Q-RPTs can be built into the PPC3. Up to four external Q-RPTs can be implemented using **DHI** RPM4 reference pressure monitors. RPM4's Self Defense System (SDS) protects the lower pressure Q-RPTs when they are not in use (see **OPEN ARCHITECTURE** on page 3).

The table at right lists the PPC3 Pressure Controller models available with their maximum pressures. Q-RPTs can be selected from the Q-RPT table to obtain the range coverage and measurement modes desired.

See the **DHI** RPM4 Reference Pressure Monitor brochure to configure RPM4s with Q-RPTs for use external from the PPC3 (see **ORDERING INFORMATION** on page 5 for additional information on configuring a PPC3).

### PPC3 CONTROLLERS

PPC3 DESIGNATION	MAXIMUM PRESSURE kPa (psi)
PPC3-10M	10 000 (1 500) gauge and absolute
PPC3-7M	7 000 (1 000) gauge and absolute
PPC3-2M	2 000 (300) gauge and absolute
PPC3-700K	700 (100) gauge and absolute
PPC3-200K	200 (30) gauge 300 (45) absolute

All PPC3 models operate in absolute, gauge and negative gauge modes.

Nominal range turndown for  $\pm 0.002\%$  FS control is 50:1.

## PPC3 QUARTZ REFERENCE PRESSURE TRANSDUCERS (Q-RPTs) AND RANGES

The table at right provides a list of the Q-RPTs available to be included in a PPC3. In an SI version, the ranges are defined in and the default unit is kPa. Ranges in other units are the equivalent of the kPa ranges. In a US version, the ranges are defined in and the default unit is psi. Ranges in other units are the equivalent of the psi ranges.

There are two classes of Q-RPT measurement specifications and all PPC3 Q-RPTs are available in both classes:

- **Standard class Q-RPTs** have precision of  $\pm 0.008\%$  of reading and one year measurement uncertainty of  $\pm 0.01\%$  of reading from 30 to 100 % of Q-RPT span. Standard class Q-RPTs are indicated by "s" following the Q-RPT designator (for example, A10Ms).
- **Premium class Q-RPTs** have precision of  $\pm 0.005\%$  of reading and one year measurement uncertainty of  $\pm 0.008\%$  of reading from 30 to 100 % of AutoRanged span. Span can be turned down by AutoRange to 30 % of maximum Q-RPT span. Premium Q-RPTs are indicated by "p" following the Q-RPT designator (for example, A700Kp).

### QUARTZ REFERENCE PRESSURE TRANSDUCERS (Q-RPTs)

RPT DESIGNATION	SI VERSION		US VERSION	
	MAXIMUM PRESSURE Absolute [kPa]	MAXIMUM PRESSURE Gauge [kPa]	MAXIMUM PRESSURE Absolute [kPa]	MAXIMUM PRESSURE Gauge [kPa]
A10M <sup>1</sup>	10 000	10 000	1 500	1 500
A7M <sup>1</sup>	7 000	7 000	1 000	1 000
A3.5M <sup>1</sup>	3 500	3 500	500	500
A2M <sup>1</sup>	2 000	2 000	300	300
A1.4M <sup>1</sup>	1 400	1 400	200	200
A700K <sup>1</sup>	700	700	100	100
A350K <sup>1</sup>	350	250	50	35
A200K <sup>1</sup>	200	100	30	15
A160K <sup>1</sup>	160	60	23	8
A100K <sup>1</sup>	110	10	16	1.5
G200K <sup>2</sup>	--	200	--	30
G100K <sup>2</sup>	--	100	--	15
BG15K <sup>3</sup>	--	15	--	2.2
BA100K <sup>4</sup>	110	--	16	--

1. All AXXXX RPTs support absolute, gauge and compound gauge modes.

2. All GXXXX RPTs are gauge mode only.

3. BG15K is bidirectional gauge from -15 to +15 kPa (-2.2 to +2.2 psi).

4. BA100K is a barometric range whose low point is 70 kPa absolute (10 psi).



## SPECIFICATIONS

### GENERAL

<b>Power Requirements</b>	85 to 264 VAC, 50/60 Hz, 30 VA max consumption	<b>Pressure Ranges</b>	Vacuum to 10 MPa (1 500 psi)
<b>Normal Operating Temperature Range</b>	15 to 35 °C	<b>Operating Medium</b>	Any clean, dry, non-corrosive gas
<b>Vibration</b>	Meets MIL-T-28800D	<b>Pressure Connections</b>	
<b>Weight (Typical)</b>	12.7 kg (28.2 lb)	SUPPLY	1/8 in. NPT F
<b>Dimensions</b>	18 cm H x 32 cm W x 40 cm D (7.1 in. x 12.6 in. x 15.8 in.)	EXHAUST	1/4 in. NPT F
<b>Microprocessor</b>	Motorola 68302, 16 MHz	VENT	10-32 UNF
<b>Communications Ports</b>	RS-232 (COM1, COM2), IEEE-488.2	TEST (+), VENT (-)	1/8 in. NPT F
<b>Operating Modes</b>	Absolute, gauge, compound gauge	<b>Utility Sensor</b>	
		<b>Precision/Resolution</b>	± 0.10 % span / 0.001 % span
		<b>CE Conformance</b>	Available, must be specified

### PRESSURE CONTROL

#### Control Precision

#### Lowest Controllable Pressure (gauge)

#### Lowest Controllable Pressure (absolute, negative gauge)

#### Ultimate Pressure (absolute, negative gauge)

#### Typical Pressure Setting Ready Time

#### Optimum Test Volume

PPC3-200k	PPC3-700k	PPC3-2M	PPC3-7M	PPC3-10M
± 0.002 % of reading or of 2 % of controller span, whichever is greater.* Q-RPT used must provide resolution higher than expected control precision.				
Zero set by automated venting. Lowest point above or below zero limited only by Q-RPT resolution and control precision.				
1.5 kPa (0.2 psia)	3 kPa (0.4 psia)	5 kPa (0.75 psia)	5 kPa (0.75 psia)	10 kPa (1.5 psia)
TEST port is isolated and connected to vacuum supply. Typically < 50 Pa (0.008 psia) depending on vacuum source and test volume configuration.				5 kPa (0.75 psia)
15 to 30 seconds.				
500 cc	500 cc	500 cc	250 cc	250 cc

\* Control precision is reduced in absolute mode under 7 kPa (1 psia).

### MEASURED AND DELIVERED PRESSURE (Q-RPT)

**Warm Up Time** None required, 30 minute temperature stabilization recommended from cold power up

**Resolution** To 1 ppm, user adjustable

**Acceleration Affect** ± 0.008 % /g maximum  
Allows operation at ± 20° from reference plane without significant effect

**Calibration** A2LA accredited calibration report included

#### Q-RPTs Classes Available

**STANDARD** % of reading uncertainty, 30 to 100 % of Q-RPT span

**PREMIUM** Enhanced % of reading uncertainty and up to 3:1 AutoRange turndown

	<b>STANDARD CLASS</b>	<b>PREMIUM CLASS</b>
<b>Precision<sup>1</sup></b>	± 0.008 % of reading <sup>5</sup>	± 0.005 % of reading, and AutoRange turndown <sup>6</sup>

<b>Predicted One Year Stability<sup>2</sup></b>	± 0.005 % of reading <sup>5</sup>	± 0.005 % of reading <sup>5</sup>
---	-----------------------------------	-----------------------------------

<b>Measurement Uncertainty<sup>3</sup></b>	± 0.010 % of reading <sup>5</sup>	± 0.008 % of reading, and AutoRange turndown <sup>6</sup>
--	-----------------------------------	---

<b>Delivered Pressure Uncertainty<sup>4</sup></b>	± 0.011 % of reading <sup>5</sup>	± 0.009 % of reading, and AutoRange turndown <sup>6</sup>
---	-----------------------------------	---

1. Combined linearity, hysteresis and repeatability. Add ± 1 Pa (0.00015 psi) in gauge mode with an absolute (Axxx) Q-RPT for the resolution and short term stability of the on-board barometer.
2. Predicted one year stability limit (k=2) assuming regular use of AutoZero function. AutoZero occurs automatically whenever vented in gauge mode, by comparison with a barometric reference in absolute mode. Absolute mode predicted one year stability without use of AutoZ is ± (0.005 % Q-RPT span + 0.005 % of reading).
3. Maximum deviation of the Q-RPT indication from the true value of applied pressure including precision, predicted one year stability, temperature effect and calibration uncertainty, combined and expanded (k=2) following the ISO "Guide to the Expression of Uncertainty in Measurement."
4. Maximum deviation of PPC3 controlled pressure from the true value including measurement uncertainty and dynamic control hold limit.
5. % of reading applies to 30 to 100 % of Q-RPT span. Under 30 % of Q-RPT span, uncertainty is a constant value obtained by multiplying the % of reading value by 30 % of Q-RPT span.
6. % of reading applies from 30 to 100 % of any AutoRanged span equal to or greater than 30 % of the Q-RPT span. Under 30 % of AutoRanged span, uncertainty is a constant value obtained by multiplying the % of reading value by 30 % of AutoRanged span. If the AutoRanged span is less than 30 % of the Q-RPT span, uncertainty is % of reading or % of reading by 9 % of Q-RPT span, whichever is larger.

Due to a policy of continuous improvement, all specifications contained in this document are subject to change without notice.

PPC3, AutoRange, COMPASS, Infinite Ranging, RPM4 and SDS are trademarks, registered and otherwise, of DH Instruments, Inc.

Products described in this brochure are protected by US and international patents and patents pending.