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Next Generation Pressure Controller/Calibrator

Introduction

- PPC4, DHI's fifth generation pressure controller/calibrator

- PPC4 replaces the PPC3 (PPC2+, PPC2, PPC1)

Introduction

- Pressure range of 1 kPa (0.15 psi) to 10 MPa (1500 psi) absolute and gauge including very low gauge

  Utilizes Q-RPT pressure modules
  - Premium Class
  - Standard Class
  - The addition of a new ‘F’ class.

Introduction

- Supports internal and external reference pressure transducers
- AutoRange feature (like PPC3)
- Two enclosure styles to choose from
  - Advanced local user interface (UI) for front panel users
  - Basic interface for computer controlled applications
  - USB connected “Cockpit” software in both cases
- Real time calculation and display of measurement uncertainty
- Command Interpreter

PPC4 Features

- Q-RPT (Quartz Reference Pressure Transducer) Modules: Improved measurement technology not damaged by liquid contamination
- Infinite ranging with AutoRange: Better coverage of a wide range of DUTs with one instrument or system

PPC4 Features

- On-board barometer: Reduces uncertainty in gauge mode on an absolute Q-RPT
- Open architecture: Multiple reference pressure transducers (Q-RPTs) can be internal and/or external to PPC4
- Very high control precision turndown

Quartz Reference Pressure Transducer (Q-RPT) Module

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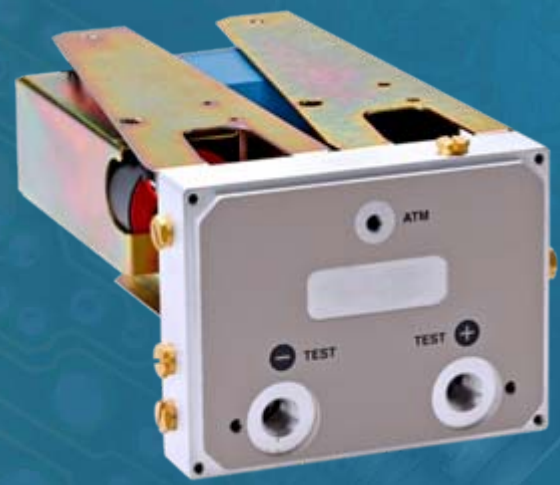
- Module includes valves necessary for AutoZero function and range changing
- Holds transducer in rigid module sub-assembly to reduce mounting stresses and improve stability over time
- Individually characterized with automated primary pressure standards



Quartz Reference Pressure Transducer (Q-RPT)

- Uses oscillating quartz crystal based (Paroscientific) transducers
- DHI proprietary characterization using primary standards and sorting into three performance classes: Premium, Standard & Full Scale Standard
- DHI proprietary transducer modeling and compensation gives unique specifications
- “% of reading” uncertainty, turns down with AutoRange (Premium class)

Q-RPT modules (Absolute)

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Q-RPT Designator	SI Version [kPa]*		US Version [psi]*	
	Absolute Range	Gauge Range	Absolute Range	Gauge Range
A10M	10000	10000	1500	1500
A7M	7000	7000	1000	1000
A3.5M	3500	3500	500	500
A2M	2000	2000	300	300
A1.4M	1400	1400	200	200
A700K	700	700	100	100
A350K	350	250	50	35
A200K	200	100	30	15
A160K	160	60	23	8
A100K	110	10	16	1.5
BA100K	70 to 110	-	10.2 to 16	-

Q-RPT modules (Gauge)

Q-RPT Designator	SI Version [kPa]*		US Version [psi]*	
	Absolute Range	Gauge Range	Absolute Range	Gauge Range
G200K	-	200	-	30
G100K	-	100	-	15
G15K	-	15	-	2.2
BG15K	-	±15		±2.2

*In an SI version, the nominal range is defined in and the default unit is kPa. Ranges in other units are the equivalent of the kPa ranges.

In a US version, the nominal range is defined in and the default unit is psi. Ranges in other units are the equivalent of the psi ranges.

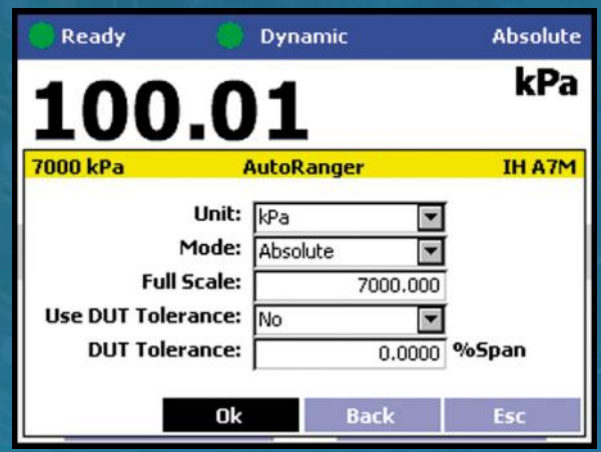
Infinite Ranging with AutoRange

Support a wide range of DUT pressure ranges with a single controller system

Simple, automatic way to adapt **all** measurement and control parameters to specific range of operation. Simplifies operator setup

Improve measurement uncertainty (Premium and FS Standard classes)

Allows setting up and storing operating parameters and limits as a range, for later recall and reuse



Infinite Ranging with AutoRange

AutoRange:

Selects optimum Q-RPT for specified range and mode

Sets measurement mode and pressure unit

Adjusts display resolution appropriately for range

Adjusts pressure control parameters appropriately for range

Sets upper (and lower) pressure limits to protect DUT

Open Architecture, Internal and External Q-RPTs

- Pressure controller can use up to four Q-RPTs for reference pressure measurement
- Q-RPTs can be internal (one or two) to PPC4 or external (up to two). External Q-RPTs are contained in one RPM4 (Reference Pressure Monitor)
- PPC4 can be configured without any Q-RPTs. In this case, a utility sensor acts in place of Hi RPT
- Once identified, all Q-RPTs are integrated into the PPC4 system and their selection and switching is transparent to the user by use of AutoRange function

Open Architecture, Internal and External Q-RPTs

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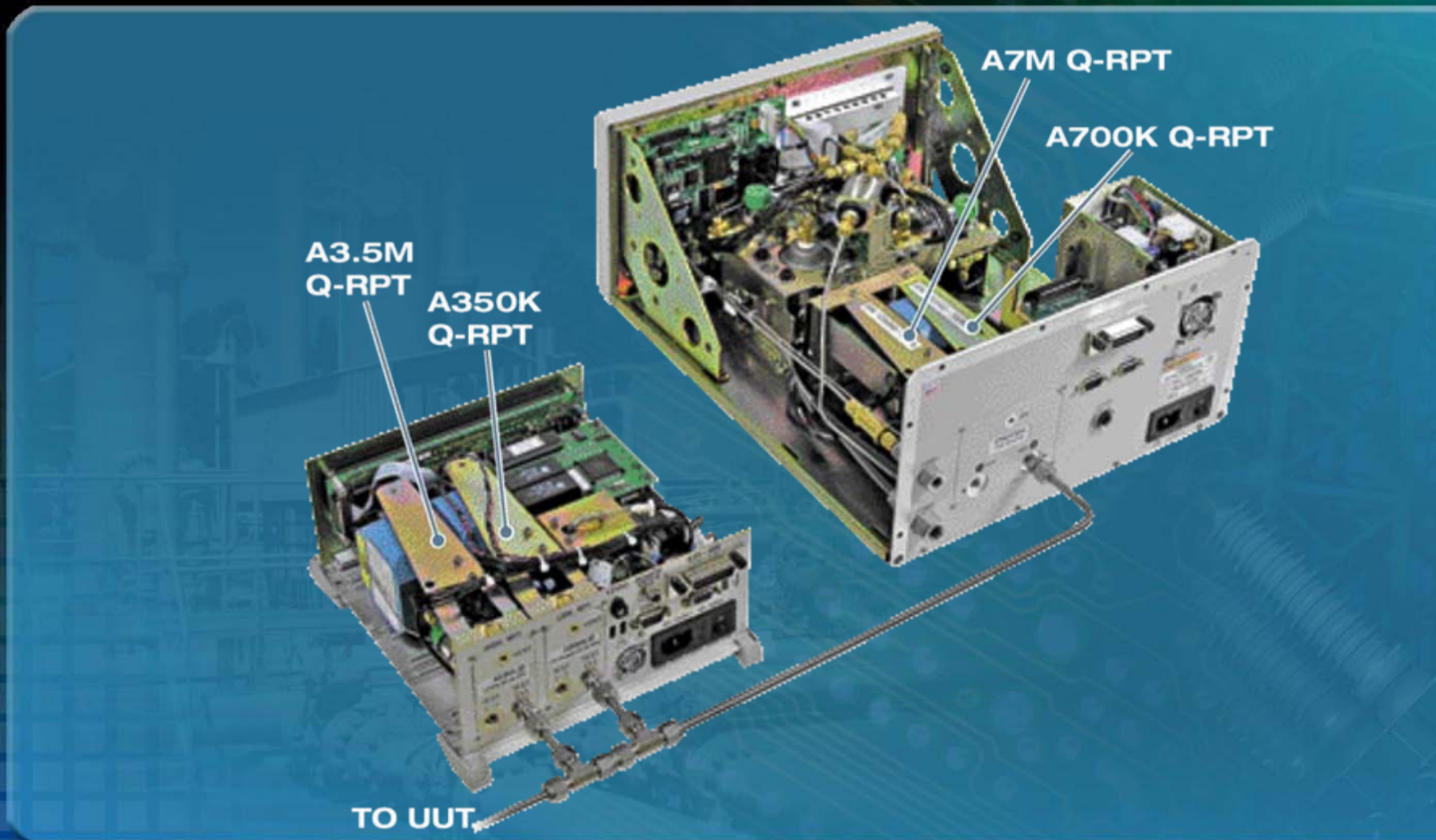

Very High Control Precision Turndown

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A pressure controller is used to apply known values of pressure

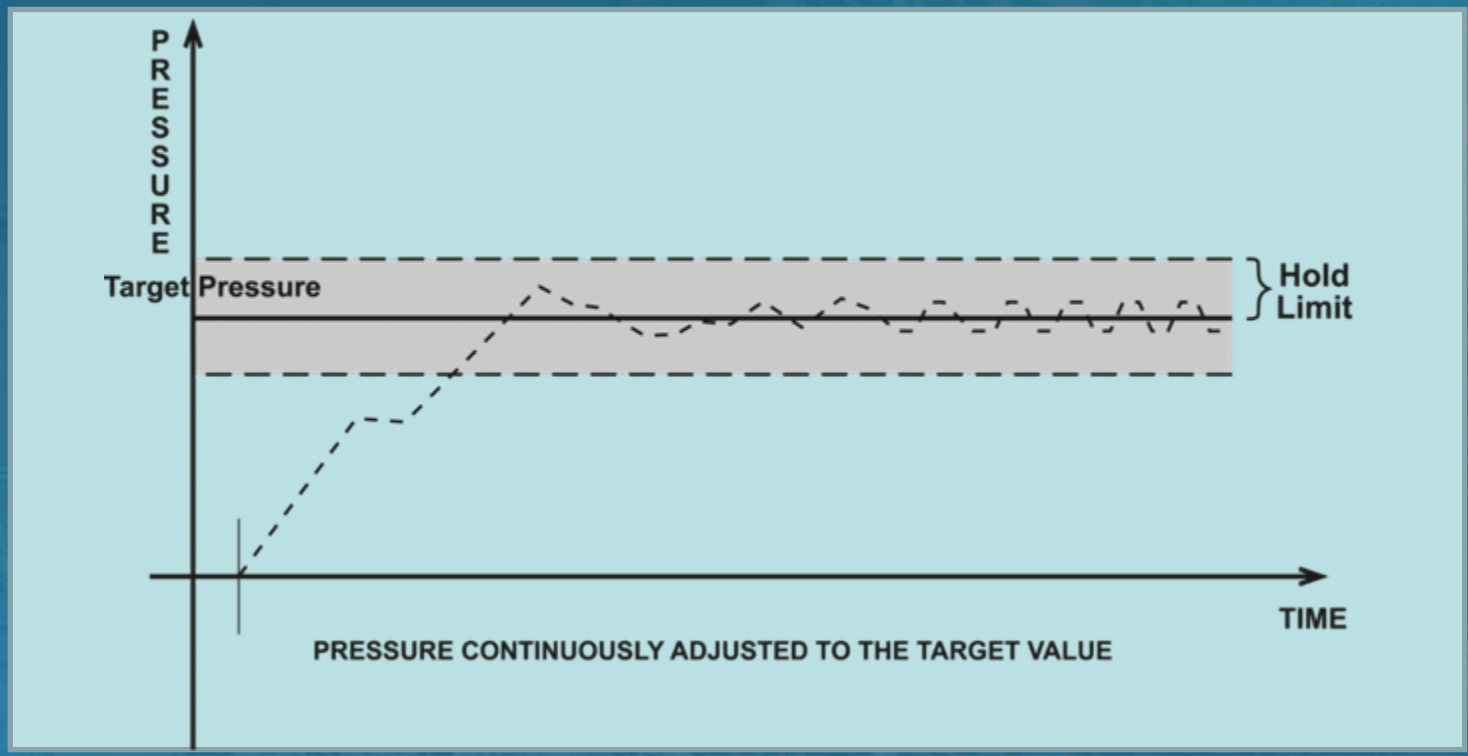
Delivered pressure uncertainty is the most relevant specification for a pressure controller. Delivered pressure uncertainty: measurement uncertainty + control precision (or control error)

For low measurement uncertainty over a wide range to be useful, the controller's control error must also "turn down" at lower pressures

Other controllers offer "% of reading uncertainty" and/or multiple reference sensors, but they have constant control precision which limits delivered pressure uncertainty at low pressure

Very High Control Precision Turndown

Dynamic Pressure Control Error



All dynamic pressure controllers have a control error that is the maximum deviation between the actual pressure and the target pressure while the controller is controlling around the target pressure. In PPC4, the control error is the "hold limit". The hold limit is objectively quantified and can be adjusted by the user.

Very High Control Precision Turndown

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Benefits

Allows **delivered pressure uncertainty** to be near equal to measurement uncertainty over 98% of controller range. Makes low measurement uncertainty over a wide range “worth it”

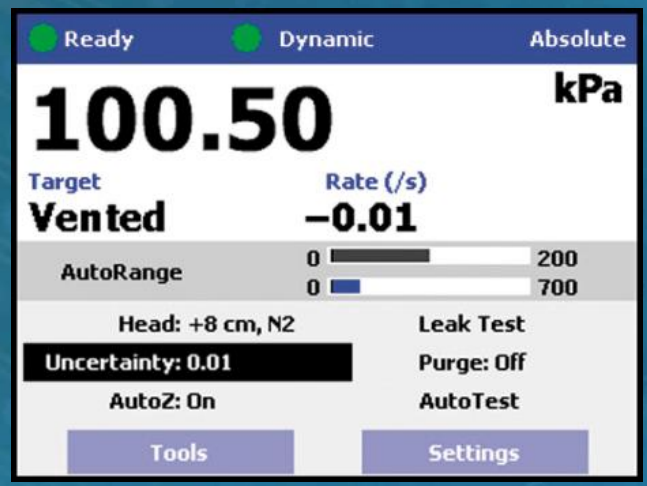
Simplifies system setup by avoiding multiple pressure controllers and/or multiple test ports

Adapts automatically with AutoRange to adjust precision and speed appropriately for defined range

Doesn’t require pressure supply adjustment to change ranges

Real time calculation & display of uncertainty

- Provides an objective value of uncertainty, in current unit of pressure
- Real time, continuous calculations
- Tailored uncertainty components can be entered by the user
- Displays uncertainty in measured or delivered pressure
- Data available over remote interface



Real time calculation & display of uncertainty

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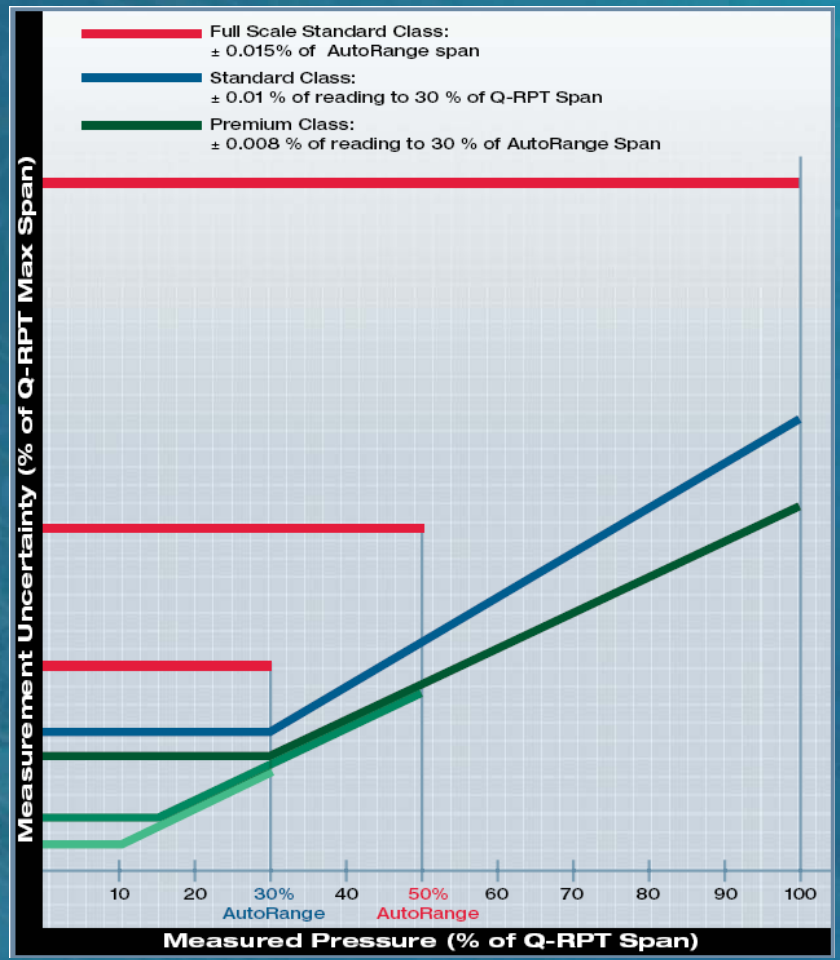
Measurement Uncertainty

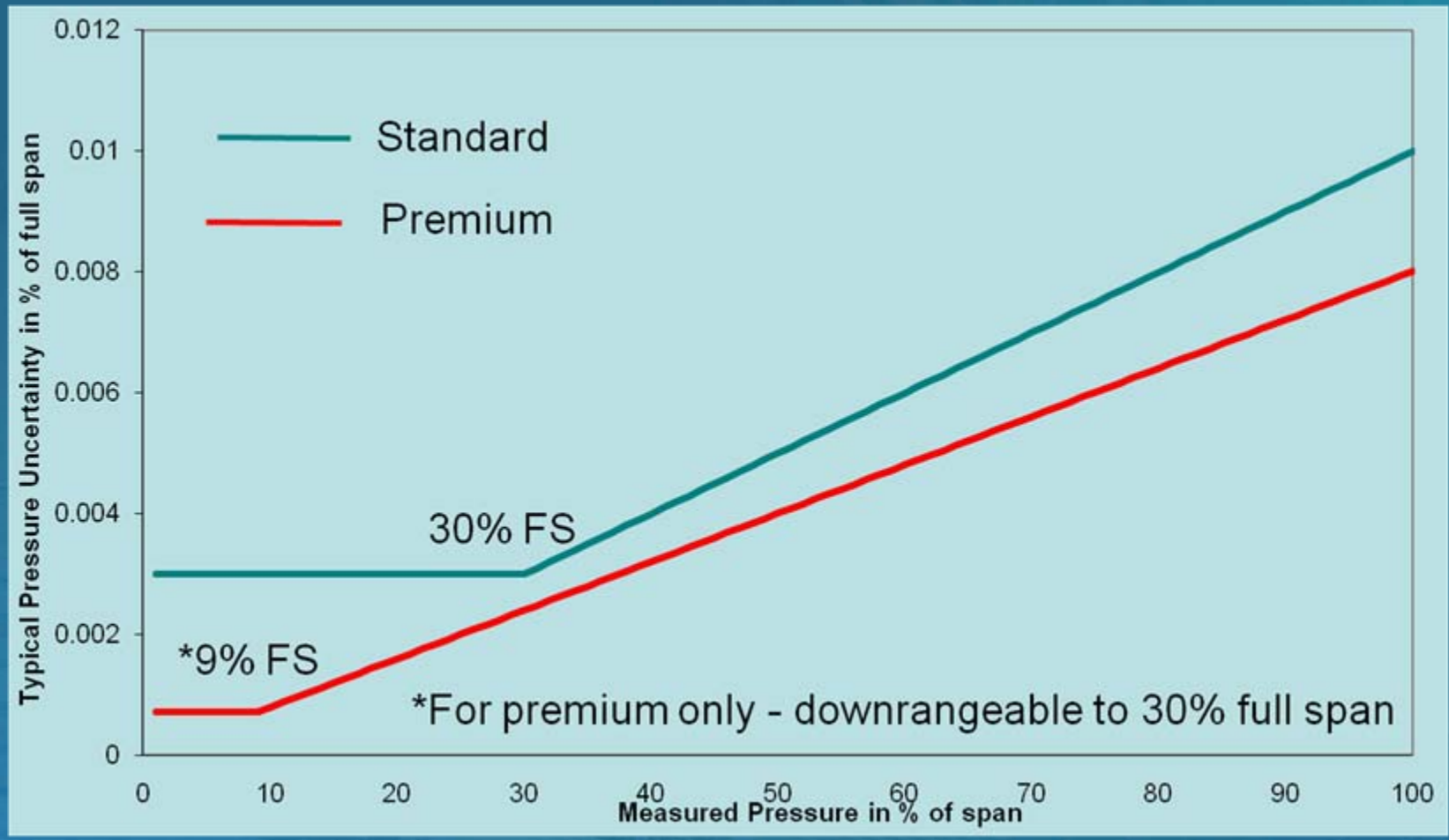
Full Scale Standard Class:
± 0.015% of AutoRange Span

Standard Class:
± 0.01% of reading to 30% of Q-RPT Span

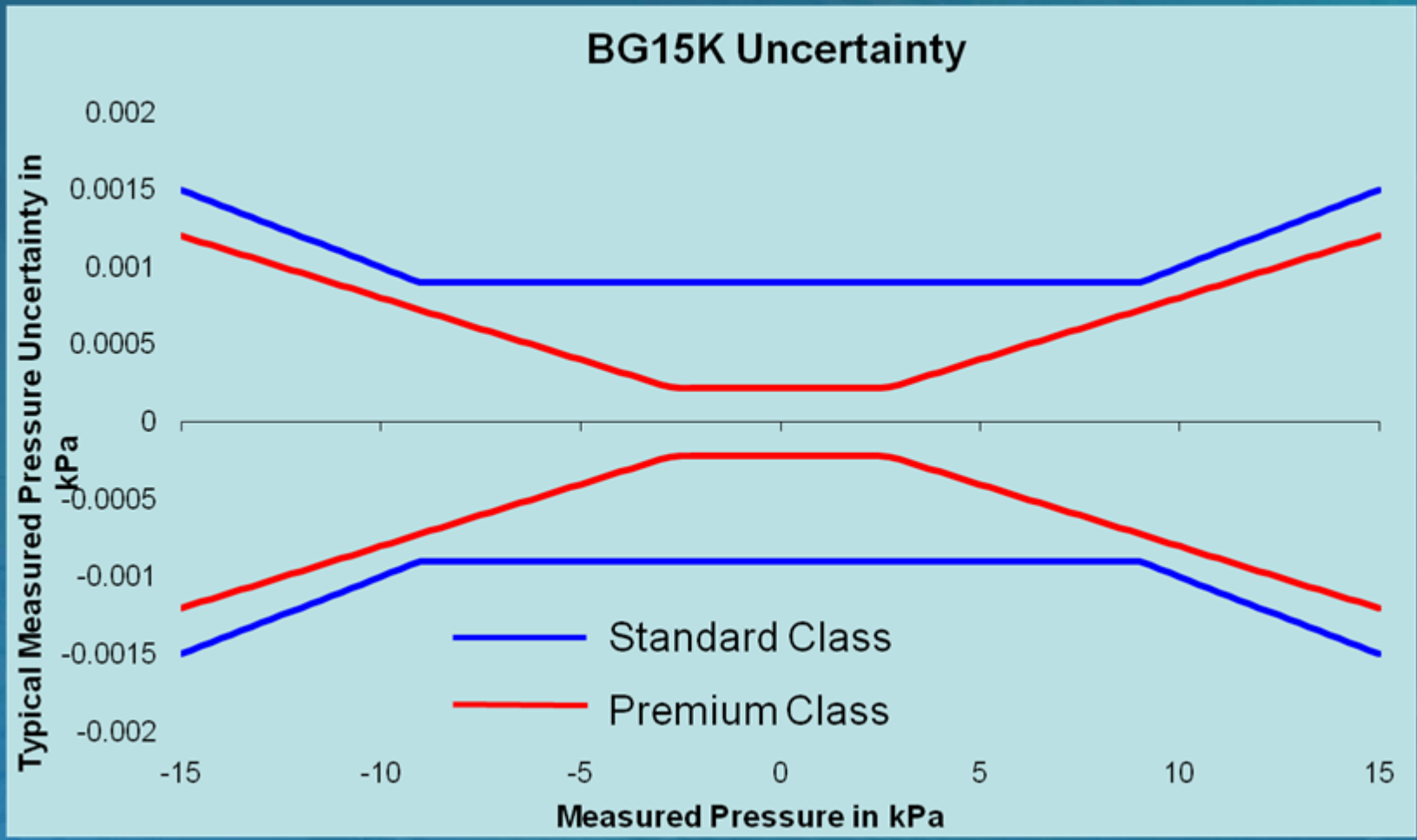
Premium Class:
± 0.008% of reading to 30% of Q-RPT AutoRange Span



Real time calculation & display of uncertainty



Real time calculation & display of uncertainty



Real time calculation & display of uncertainty

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Product Uncertainty

- This is a combination of reference, repeatability, linearity, hysteresis and slope stability uncertainties. There are three quantities that define this component:-
  - The Relative uncertainty (% of reading)
  - The Threshold uncertainty (% of AutoRange span)
  - The Scaling factor for the threshold when the Q-RPT is AutoRanged.
- The product uncertainty is the maximum of the relative or threshold uncertainty for a given measured pressure.

Real time calculation & display of uncertainty

Zero Stability

- Zero stability is an uncertainty based on the zero stability of the Q-RPT. One value for AutoZero ON and one for OFF

Control Uncertainty

- Uncertainty can be defined with or without the control components

Real time calculation & display of uncertainty

UNCERTAINTY		Q-RPT CLASS FULL SCALE STANDARD F CLASS	STANDARD S CLASS	PREMIUM P CLASS
PRODUCT	READING	0.000%	0.010%	0.008%
	SPAN	0.015%	0.003%	0.0024%
	SCALE	30%, 10% for G15K, BG15K	100%	30%
HEAD		0.0 (cm or in)	0.0 (cm or in)	0.0 (cm or in)
ZERO STABILTY	AUTOZ ON*	0.000%	0.000%	0.000%
	AUTOZ OFF*	0.005%	0.005%	0.005%

*Does not apply to gauge type

Default Values for PPC4 Uncertainty Components

Real time calculation & display of uncertainty

- The Uncertainties are RSS'd together to provide the final answer.
- There are multiple components that make up the product uncertainty. We have just taken a snap shot.
- For more detailed information please read Technical Note 8050TN11

Real time calculation & display of uncertainty

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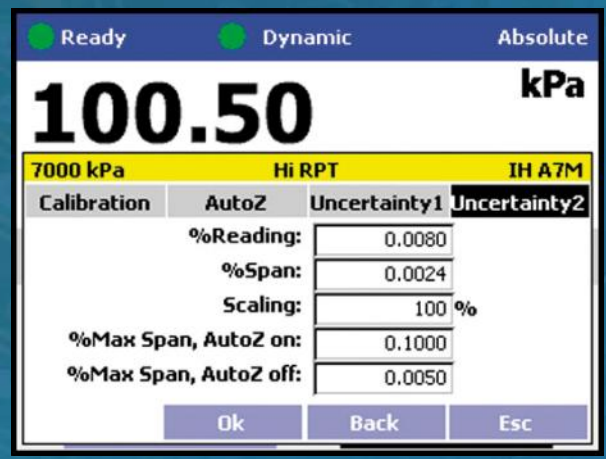
Benefits

- Allows user to cut through sometimes complex uncertainty specifications to a clear uncertainty value
- Reduces dependence on operator skill and judgment
- Speeds measurement reporting
- Eliminates uncertainty calculation errors
- Supports lab audit & assessment



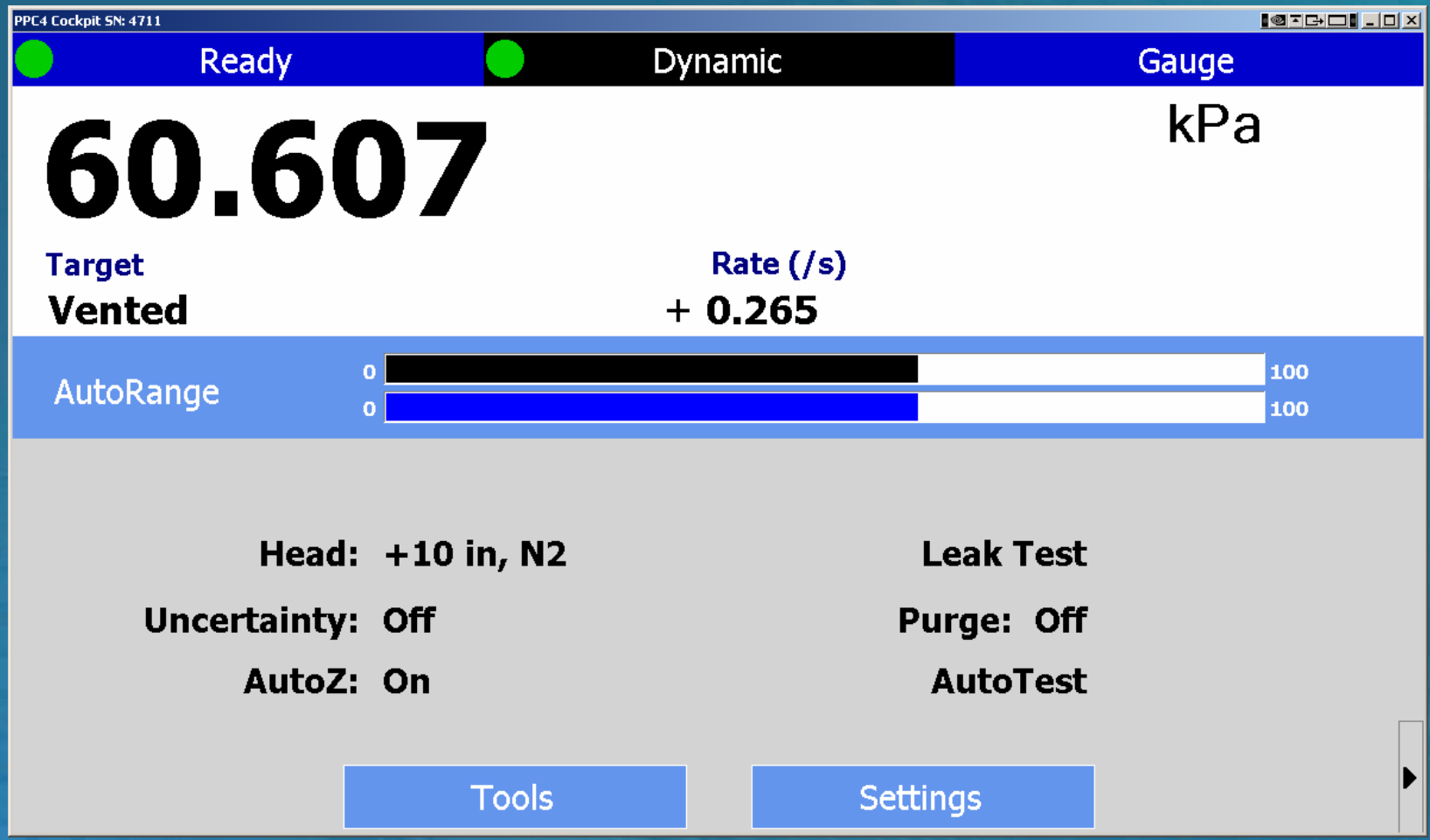
Command Interpreter

- Customize PPC4 commands to interpret and respond to remote commands used on pressure controllers from other manufacturers
- Flexible command emulation capability
- Users can customize PPC4 commands or access a command library
- Customer upgrade to PPC4 Flash memory
- Available Q4/08 as a PPC4 retrofit firmware upgrade

PPC4 Cockpit Software

- Computer based Advanced UI
- Free software included with PPC4
- Easy to install, easy to use
  - USB plug and play connectivity
- Gives all features of Advanced UI on a PC that is remote from PPC4 and without the expense of Advanced UI

PPC4 Cockpit Software



PPC4 Configuration

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PPC4 (Basic)

PPC4-ui (Advanced)

Questions

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