VAISALA

MEASUREMENT STANDARDS LABORATORY

CERTIFICATE OF CALIBRATION no U00357

Customer	UNIVERSITY OF HAWAII 1680 East West RD. Post 602 Honolulu, HI 96822 USA
Item	Pressure Transmitter Pressure range from 500 to 1100 hPa abs., calibrated from 500 to 1100 abs. Resolution 0,01 hPa, read via serial port
Manufacturer	Vaisala Oyj
Model	PTB220
Serial number	C2750001
Instrument number	- -
Calibration performed	February 4, 2011
Date	February 10, 2011
Signature	Heli Järvinen Team Leader
Page 1 (5)	
Documents attached	-
NOTES	-

Vaisala Oyj, PO Box 26, FI-00421 Helsinki, Finland
Telephone +358 9 894 91 • Fax +358 9 8949 2227
Email MeasStdLab@vaisala.com • www.vaisala.com
Domicile Vantaa, Finland • VAT FI01244612 • Business ID 0124416-2

Date	February 10, 2011
Item	Pressure Transmitter
Manufacturer	Vaisala Oyj
Model	PTB220
Serial number	C2750001
Instrument number	- -

Measurement Standards Laboratory
Heli Järvinen

Configuration

The transmitter's configuration and settings were read from the transmitter's memory. The calibration is valid only with configuration and settings given in table 1.

Table 1. Configuration and settings

Setups read from the memory		Instrument configuration	
Software version	PTB220 / 3.05	CPU serial number	C2750001
Configuration	1		
Linear adjustments	ON	Transducer type	Serial number
Multipoint adjustments	ON	P1: PMT 16A	C2230076
Averaging time	1.0 s	P2: PMT 16A	Not installed
Mtim [ms]	64	P3: PMT 16A	Not installed

PRESSURE CALIBRATION

Description

The above described Pressure Transmitter was calibrated from 500 to 1100 absolute pressure in the Measurement Standards Laboratory (MSL) of Vaisala Oyj on February 04, 2011 by Pekka Puttonen.
Before the calibration the Multi Point Correction (MPC) and Linear Correction (LC) -values of the transmitter were read from the transmitter's memory.
The pressure readings of the transmitter were compared to the values of the reference in the range from 500 to 1100 absolute pressure.
Pressure readings of the transmitter were read with the MPC -corrections ON and the old LC -corrections ON. The pressure readings with new coefficients were then calculated from the measurement results using the new LC -corrections.
The new LC -corrections were calculated using the least squares method, stored into the transmitter's memory and the pressure readings with new coefficients were calculated using these new corrections.
The pressure calibration is valid only with the MPC and LC -corrections switched ON.
The supply voltage during the calibration was 15,0 VDC ± 0,3 VDC and the warm-up and stabilization time was more than 2 hours.
The used pressure transmitting medium was air and/or nitrogen.

Reference

DHI PPC3 Pressure Controller/Calibrator, sno 722, traceable to the National Institute of Standards and Technology (NIST, USA) via MSL and Centre for Metrology and Accreditation (MIKES, Finland).

Uncertainty

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %. The standard uncertainty of measurement has been determined in accordance with EA Publication EA-4/02.
- The uncertainty is calculated from the uncertainties caused from the reference equipment, calibration process and unit under calibration (UUC) including resolution, stability (short term), linearity, repeatability, hysteresis and rounding of the final results.
- The measurement results and uncertainty may be interpolated between measurement points.

The measurement uncertainty represents the situation at the time and conditions of calibration. When using the UUC at different conditions and at different time the effect of the conditions and stability of the UUC shall be evaluated separately.

HJV

Date	February 10, 2011
Item	Pressure Transmitter
Manufacturer	Vaisala Oyj
Model	PTB220
Serial number	C2750001
Instrument number	- -

Measurement Standards Laboratory
Heli Järvinen

Corrections

The MPC and LC -corrections were read from the transmitter's memory.

Table 2. MPC -corrections

MPC -corrections P1	
Calibration date 2009-06-23	
Reading [hPa]	Correction [hPa]
500,170	+ 0,030
600,090	+ 0,060
700,040	+ 0,050
800,010	+ 0,040
900,080	+ 0,020
999,960	+ 0,030
1059,940	+ 0,030
1099,900	+ 0,030

Table 3. Old LC -corrections

LC -corrections P1	
Calibration date 2009-06-23	
Reading [hPa]	Correction [hPa]
*******,***	0,000
0,000	0,000

The new LC -corrections were calculated using the least squares method, stored into the transmitter's memory and the pressure readings with new coefficients were calculated using these new corrections.
The pressure calibration is valid only with the MPC and LC -corrections switched ON.

Table 4. New LC -corrections

LC -corrections P1	
Reading [hPa]	Correction [hPa]
500,000	- 0,063
1100,000	- 0,021

1170

Date	February 10, 2011
Item	Pressure Transmitter
Manufacturer	Vaisala Oyj
Model	PTB220
Serial number	C2750001
Instrument number	- -

Measurement Standards Laboratory
Heli Järvinen

Measurement results

One single measurement point consists of an average of ten readings of the reference and the transmitter.
Measured one increasing and decreasing pressure cycle consisting of 18 measurement points.

Table 5. Measurement results

Reference [hPa]	With old LC -corrections Reading [hPa]	With old LC -corrections Correction [hPa]	With new LC -corrections Reading [hPa]	With new LC -corrections Correction [hPa]
1100,06	1100,09	- 0,03	1100,06	0,00
1049,99	1050,01	- 0,02	1049,99	0,00
1000,26	1000,30	- 0,04	1000,27	- 0,01
949,92	949,96	- 0,04	949,93	- 0,01
850,10	850,14	- 0,04	850,11	- 0,01
750,13	750,16	- 0,03	750,12	+ 0,01
650,15	650,19	- 0,04	650,14	+ 0,01
550,32	550,38	- 0,06	550,32	0,00
500,14	500,21	- 0,07	500,15	- 0,01
500,05	500,13	- 0,08	500,07	- 0,02
549,98	550,04	- 0,06	549,98	0,00
649,95	650,00	- 0,05	649,94	+ 0,01
749,98	750,02	- 0,04	749,98	0,00
849,81	849,84	- 0,03	849,80	+ 0,01
949,92	949,96	- 0,04	949,93	- 0,01
999,96	1000,00	- 0,04	999,97	- 0,01
1050,00	1050,02	- 0,02	1049,99	+ 0,01
1099,91	1099,93	- 0,02	1099,91	0,00

The correction shall be added algebraically to the reading.

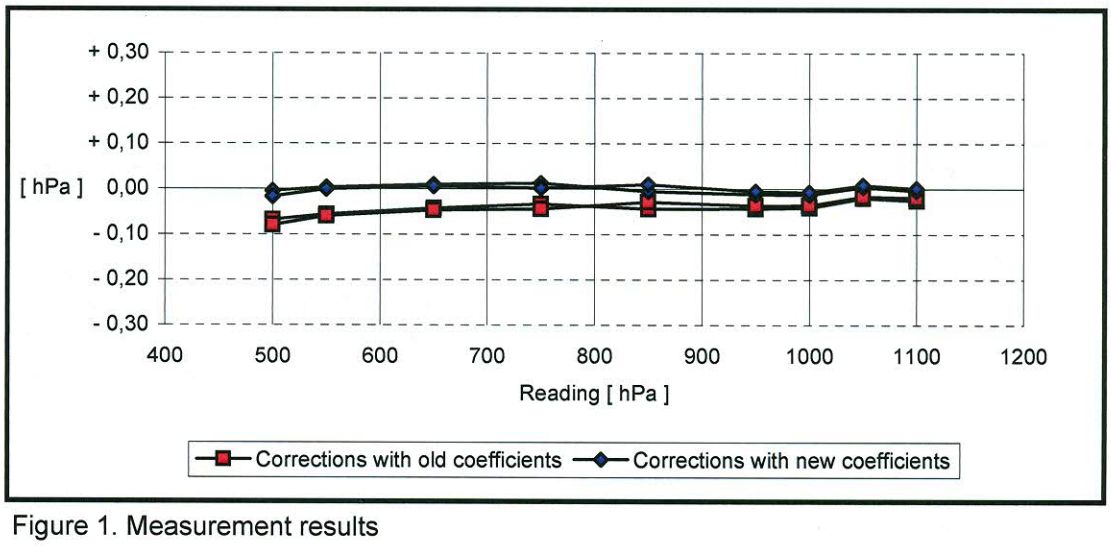

Figure 1. Measurement results

Date	February 10, 2011
Item	Pressure Transmitter
Manufacturer	Vaisala Oyj
Model	PTB220
Serial number	C2750001
Instrument number	- -

Measurement Standards Laboratory
Heli Järvinen

Results

The values in table 6 are averages of the measured values.

Table 6. Final results

Reference	With old LC -corrections		With new LC -corrections		Uncertainty
	Reading	Correction	Reading	Correction	
[hPa]	[hPa]	[hPa]	[hPa]	[hPa]	[hPa]
1099,98	1100,00	- 0,02	1099,98	0,00	± 0,05
1050,00	1050,02	- 0,02	1049,99	+ 0,01	± 0,05
1000,11	1000,15	- 0,04	1000,12	- 0,01	± 0,05
949,92	949,96	- 0,04	949,93	- 0,01	± 0,05
849,96	850,00	- 0,04	849,96	0,00	± 0,05
750,06	750,10	- 0,04	750,05	+ 0,01	± 0,05
650,05	650,10	- 0,05	650,04	+ 0,01	± 0,06
550,15	550,21	- 0,06	550,15	0,00	± 0,05
500,09	500,16	- 0,07	500,10	- 0,01	± 0,07

The correction shall be added algebraically to the reading.

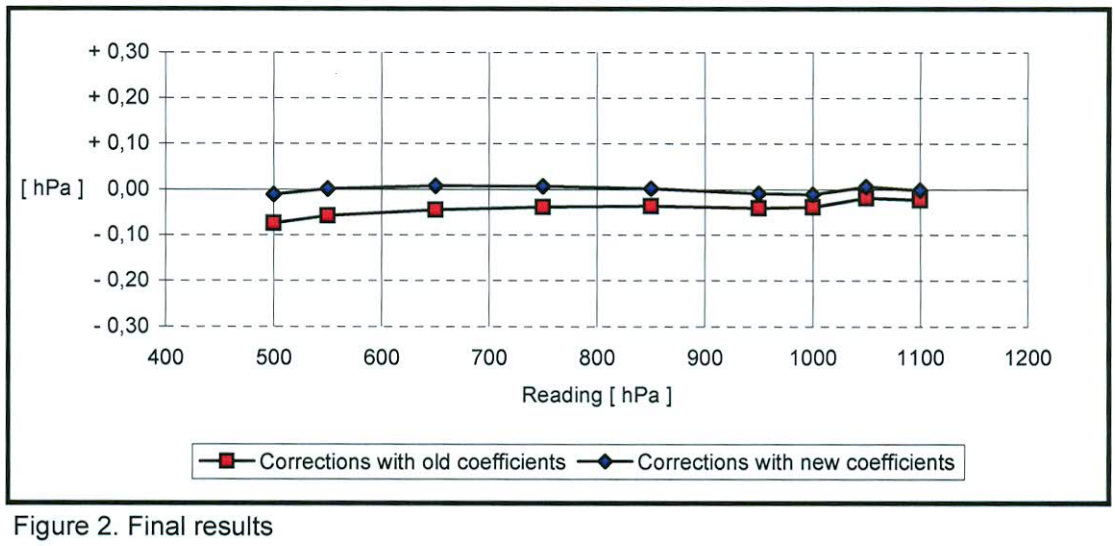

Figure 2. Final results

Conditions

Pressure	988,7 hPa ± 0,5 hPa
Temperature	+ 23,0 °C ± 0,3 °C
Humidity	37 %RH ± 3 %RH