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MetService of New Zealand Adopts Vaisala Digital Barometer as Primary Pressure Standard

The Meteorological Service of New Zealand Limited – MetService has never let its location in a small country in a far corner of the planet stand in the way of its vision of being recognized as one of the world’s leading meteorological services. The former government department was transformed into a fully commercial State Owned Enterprise or ‘SOE’ in 1992 and has thrived on commercial and technological innovation ever since. Not only is MetService the world’s first fully commercial national meteorological service, it was also the first to achieve ISO9001 certification for its product development and services.

As part of its continual drive towards modernization in its measurement and calibration services, MetService has reaped benefits by adopting the Vaisala BAROCAP® Digital Barometer PTB220 as Primary Pressure Standard. Apart from safety aspects of the design, deciding factors related to the choice of the device was its robustness, relatively light weight and temperature stability.

In any meteorological service, data acquisition is a significant and costly activity. MetService’s 22 person-strong MetData Service group operates a network

of sixty five automatic weather stations, three Doppler weather radars and eight upper air stations, along with expansive airport, SYNOP, marine and AMDAR observation programmes. MetData Services also supplies and operates data acquisition systems for aviation, maritime, road weather and industrial customers in New Zealand and several other countries.

Operating these networks to stringent WMO, ICAO and ISO9001 standards requires rigorous sensor and system calibration processes with traceability to international measurement standards, and MetService has, for many years, operated a sophisticated calibration facility.

Modernization – a continual process

The modernization of MetService’s pressure calibration began in 1983 when John Burman was appointed as Measurement Standards Engineer. John assembled a pressure calibration system with the object of providing traceable calibrations for MetService instruments over the operational pressure range 800 to 1050hPa.

The calibration system comprised a Ruska DDR6010 Quartz digital pressure gauge with integral pressure controller,

and a Ruska 6005 IEEE488 Interface panel. Vacuum and pressure are fed to the Ruska digital gauge/controller to control pressures in the range zero to 1100hPa absolute. A manifold with multiple outlets connects the various types of barometers and pressure transducers to the controlled pressure test port of the Ruska digital gauge. The Ruska has a resolution of 0.1hPa and an accuracy of 0.2hPa at an estimated 95% confidence level over the range of operating pressures.

Throughout the 1980’s and 1990’s traceability of calibration to National and International pressure standards was maintained by periodic comparisons of the Ruska with the MetService’ Primary Standard for atmospheric pressure – a Hass Type MS3 Primary Standard Mercury Barometer.

John also designed and manufactured a chamber to enable in-house calibration of Kew pattern Station barometers over the

full operating pressure range. Previously Kew barometers were sent to the National Physical Laboratory in England for calibration.

The system’s ability to control at selected pressures for long time intervals enabled MetService to carry out batch calibrations of up to eight of the Negretti & Zambra Precision Aneroid Barometers (PAB’s) as used on NZ VOS ships and as transfer standards for inspections of the SYNOP, VOS and AWS networks. For this mechanical instrument it was essential to calibrate over the pressure range to check for offset and span errors and hysteresis in the movement.

MetService Pressure calibration pre-2001

Until 1991 all barometers and



Figure 1. Previous Pressure Calibration System.

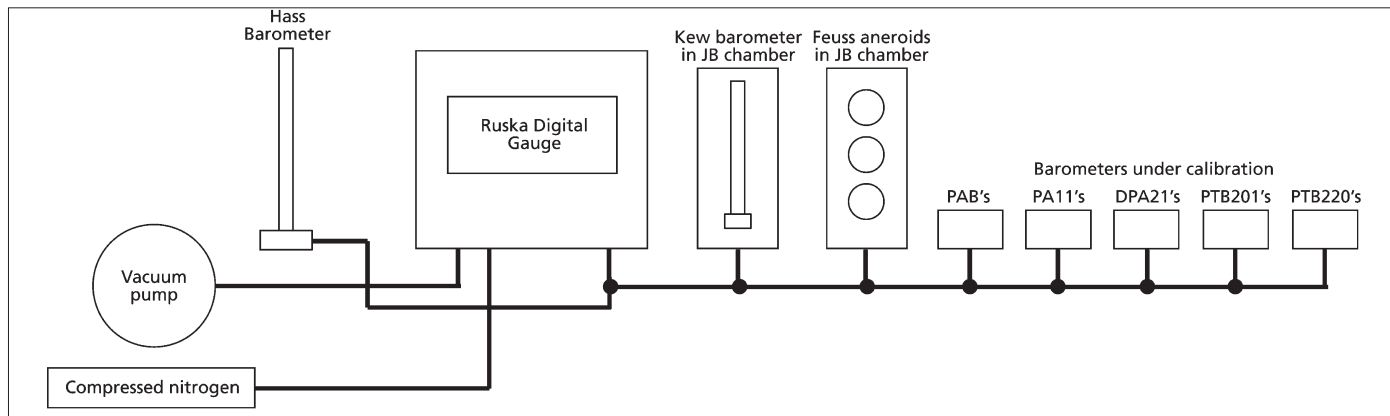


Figure 2. The John Burman Barometer Calibration Chamber

transducers were calibrated manually with keypad entry to the Ruska Interface Panel to select and control pressures (Figure 1). MetService began introducing Vaisala's DPA21 electronic barometers into the AWS network from 1988. The DPA21 with its serial communications meant that calibrations could be automated, and Hypercard™ software was written in-house allowing a Macintosh computer to control the Ruska through the IEEE488 interface bus, and read (and reset) the DPA21's via the RS232 serial interface (Figure 2).

In 1997, MetService first evaluated the PTB220B triple

cell pressure transducer. The accuracy and long-term stability were outstanding, and at the end of 1998 three PTB220 triple cell, class A barometers with displays were purchased for use as Transfer Standards. The robustness, relatively light weight and remarkable temperature stability of the instrument were also deciding factors.

When, around the time of the Millennium, there were rising health and safety concerns about the use and transportation of mercury, MetService decided to eliminate mercury barometers from its network, the obvious replacement for the Kew was the

Vaisala BAROCAP® Digital Barometer PTB220.

The engineers' experience and confidence in the stability and accuracy of the PTB220 family led to the decision to use the PTB220AD to replace the MetService Primary Standard Hass MS3 barometer. Three PTB220AD triple cell transducers were purchased, and one - Serial Number V4040004 - was selected as the MetService Primary Standard. V4040004 is calibrated annually against the national pressure standard at Industrial Research Limited to ensure traceability of absolute pressure measurement. The other ➤

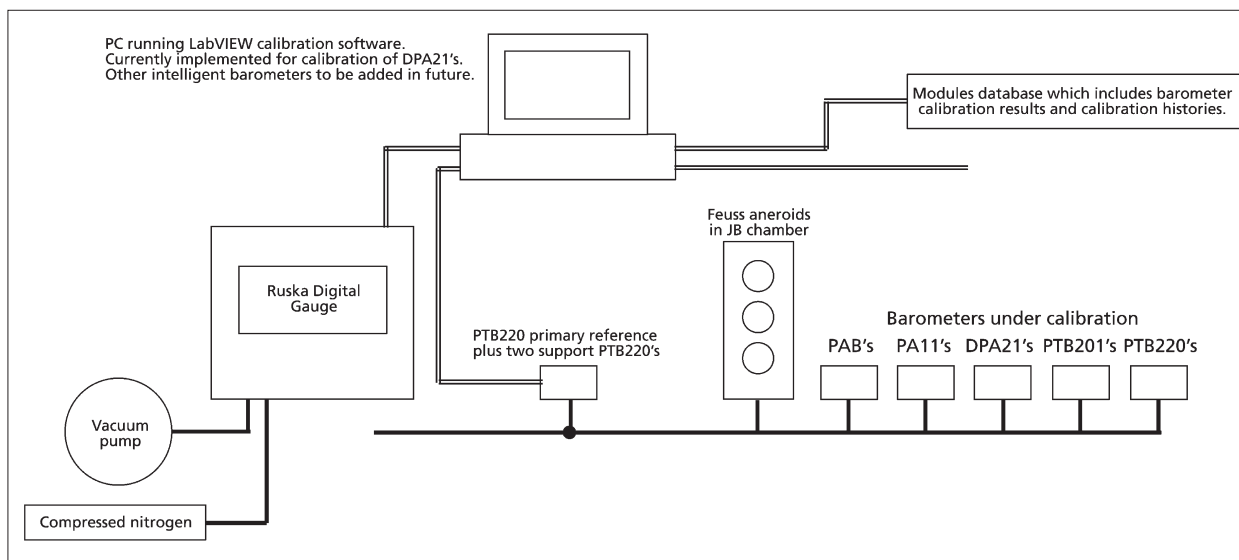


Figure 3. Current Pressure Calibration System

two PTB220AD's are not used in the calibration process, but are operated in parallel ensuring a potential backup is available should the need arise.

Another aspect of the modernization of MetService calibration facility since 2000 has been the replacement of the ageing Macintosh computer system, which was becoming difficult to support, with a new PC-based system developed in LabVIEW™. This enabled a number of enhancements to be implemented.

Integrated with database

The LabVIEW™ DPA21 calibration program, written by Bob Heron, has been in operation since September 2003. The new program is integrated with the maintenance engineers' Modules Database, enabling the barometer and transducer serial numbers to be selected from the database and the calibration results to be passed back to the database along with a calibration history for each sensor. Calibration run results are archived electronically. This has eliminated the need to maintain any hand written records and, by backing up files off-site, removed the risk of record loss. Sensors that pass

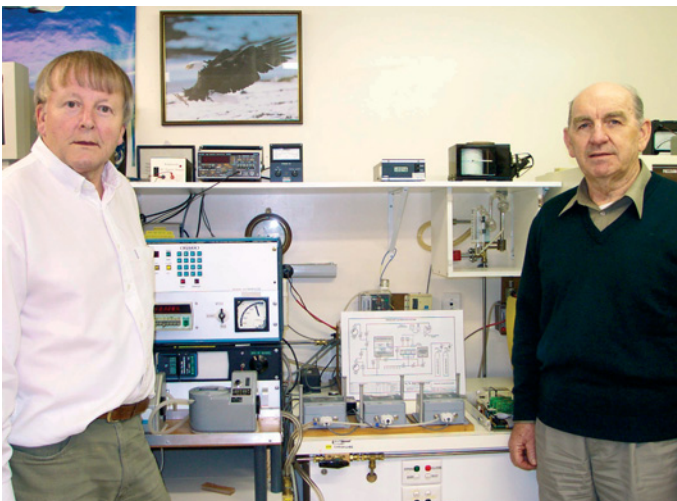
the calibration successfully are marked as serviceable on the database, while any that fail are flagged as unserviceable.

Another benefit of the new system is that the Ruska is no longer used as a working standard but simply as a pressure controller. The barometers being calibrated are now compared directly to the Primary Standard PTB220AD, rather than the Ruska, removing one step in the traceability chain. At present, only DPA21 barometers are calibrated with this new system, but enhancements for handling the PTB220 series, along with other intelligent barometers, are in the pipeline.

New pressure calibration system

MetService's Manager of Met-Data Services, Tony Quayle, is delighted with the advances achieved with the new calibration systems (Figure 3). Replacing the Hass mercury barometer with PTB220ADs as the primary standard has made for a safer workplace and removed the need for costly maintenance and recertification of the Hass. The PTB220s used at observing stations have also proved to be a cost-effective and reliable alternative to mercury barometers. ●

Figure 4. MetService engineers John Burman (left) and Bob Heron with the new pressure calibration system.



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