User Solution:
50 TON Load Cell Testing System

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The National Standards Commission (NSC) performs pattern approval type testing on measuring instruments used for trade purposes in Australia. Part of this process involves the use of a 50 Ton Load Cell, with two temperature controlled chambers, used to test and calibrate third party load cells. An International Recommendation (OIML R60 - from the International Organization of Legal Metrology) prescribes the principal metrological static characteristics and static evaluation procedures to follow.

The Solution

The NSC requested a general improvement to the load cell and the environmental control parameters, with database control and comprehensive data logging features, which proved impossible with currently available low-cost off-the-shelf solutions. The Load Cell consists of an Inner Stack containing ten 500kg weights and an Outer Stack containing ten 150kg weights. Test loads of 50t are possible as a result of the Balance Arm, which amplifies the load using a 10:1 ratio when test objects are placed inside the Large Test Chamber.

The NVSI solution was written with two LabVIEW RT executables residing in two separate National Instruments Field Point modules (one controlling the temperature environment of the chambers, the other providing control of the motors used to apply the load). LabVIEW real-time PID controls were used in both of these Field Point systems. The LabVIEW database connectivity toolkit was used to communicate to the NSC SQL server, which stored test profiles and recorded test results.

The National Instruments Field Point modules used included:

- NI FP-QUAD-510, Four Axis Quadrature Encoder Input Module
- NI FP-RTD-124, 4 Wire RTD Input Module, 8 Channel, 16 Bit
- NI FP-AI-100, Analog Input Module, 8-Channel, 12-Bit
- NI FP-AI-110, Analogue Input Module, 8-Channel, 16-Bit
- NI FP-DI-330, Universal Discrete Input Module
- NI FP-AO-210, 8-Channel Voltage Output Module
- NI FP-RLY-420, 8-Ch. SPST Relay Output Module
- NI FP-PG-522, 8 Channel Pulse Generator Module

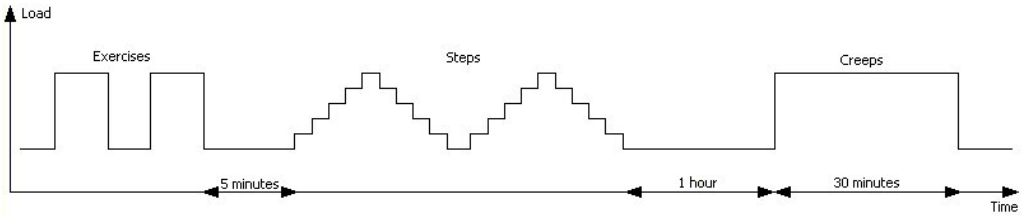
Two Allen Bradley motors control the loading and unloading of the weights on the Inner and Outer Stacks, and the National Instruments FP-QUAD-510 module was used to determine the position of the stacks. Setpoints stored in the SQL database indicate the position required for the addition of each of the weights.

A further motor lowers and raises the Balance Arm to ensure that it is horizontal at all times. A Schick Laser Displacement Sensor provides the input parameter passed to a LabVIEW PID which controls the motor speed profile as the Balance Arm is adjusted.

A test typically consists of *exercises* (the maximum load of the test is loaded during a short time, as defined by the OIML R60 recommendation), *steps* (the maximum load of the test is gradually applied in a series of steps, a profile of which is contained in the SQL database) and/or *creeps* (the maximum load of the test is loaded during 30 minutes). A standard test can last anywhere between a few hours and several days, containing numerous cycles, and operating without user intervention.

Temperature, load and pressure are recorded in the SQL database during the test, at intervals defined by the test profile. Temperature setpoints are attained to an accuracy of ±0.1°C, reusing code that had been developed on the NSC Environmental Chamber Monitoring System. This code is modular, and easily extendable to incorporate the monitoring and control of other physical phenomena, including humidity.

A test is executed at different temperatures controlled by the environmental portion of the software. A typical test may require the load tests to be applied when stability has been achieved at +20°C, +40°C, -10°C, +10°C and again at +20°C.



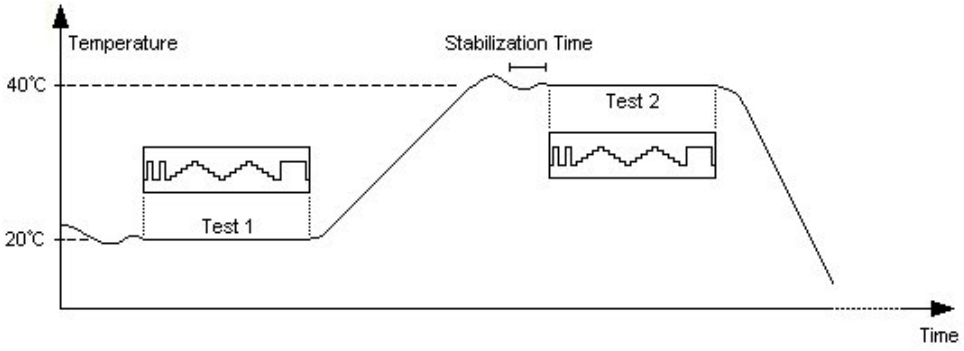
The environmental control systems used in this solution was developed using an existing NVSI user solution, currently used by the National Standards Commission. By leveraging the existing modular code and documentation, NVSI was able to deliver the overall solution at a significant time and fiscal saving, as opposed to creating the solution from scratch. NVSI is committed to providing its partners and clients with a range of modular and easily upgradeable project components to increase module confidence, and decrease time-to-market.

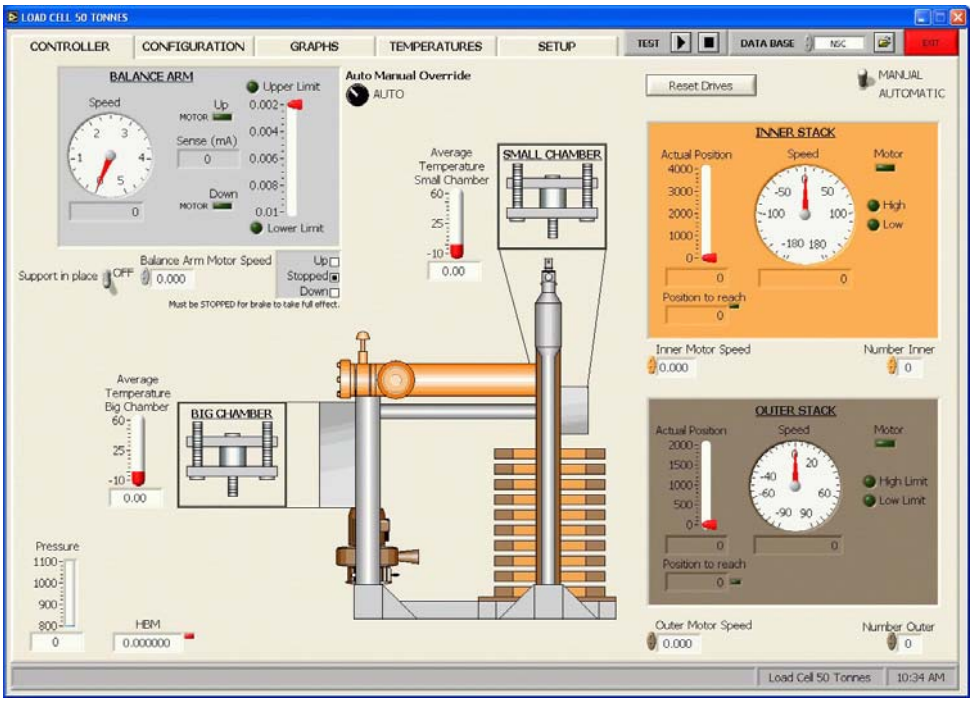
Similarly, the code produced for this system is currently being ported to a smaller 500kg Load Cell Test Rig at the National Standards Commission site in North Ryde, and with only minor adjustments to suit differing hardware.

The technique of modular code reuse also significantly decreases the incidence of call-outs, simplifies user training and documentation.

Conclusion

The system is easily configurable using a database front-end, and can be quickly altered using the LabVIEW RT development system and Field Point hardware. The system can perform user-customisable tests on load cells up to 50 ton, with strict environmental control and monitoring of the load cell itself, satisfying regulatory recommendations and constraints.





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