



MICHIGAN CUSTOM MACHINES, INC.

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Product Highlight:
**PRESSURE SENSOR
CALIBRATION SYSTEM**

The purpose of the MCM pressure sensor calibration system is to calibrate and test production pressure sensors in large volumes. This particular system takes data at room temperature, then heat soaks the parts in an oven and then takes data again at an elevated temperature before finally flashing calibration coefficients to the sensors. The system conducts a final test and performs a leak test before considering the part is good.



Background

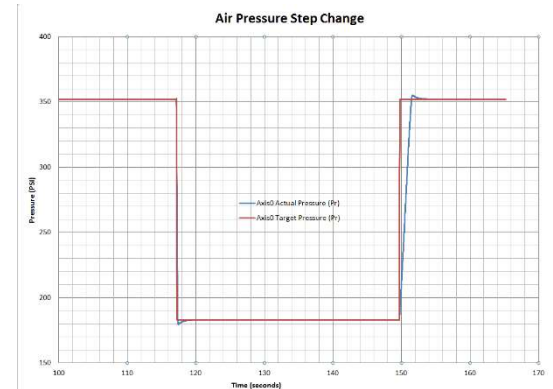
A typical automotive pressure sensor is also sensitive to temperature and many of them are temperature compensated. In order to properly calibrate one of these sensors in manufacturing, pressure data needs to be collected from the sensor at ambient conditions and then again at a high temperature condition. When data is collected, the pressure that is applied to the sensor must be held extremely well during this time. Our system is able to maintain stability better than 0.03% of range in this application.

System Features:

- Accommodates two different styles of sensor
- 12 parts or 18 parts calibrated at once on automated pallets
- Calibration environment is temperature controlled to ± 1 degree C in the range 27-150 Celsius.
- Pressure control up to 3000 Bar (44,100 PSI)
- Machine communicates with plant database to store interim and final results.
- Machine selectively performs calibration, flash programming, verification and leak test.
- System consists of an ambient test machine, oven, and high temperature test machines connected by a conveyor.
- Ambient and high temperature machines are interchangeable so that batch processing with one machine is possible
- Individual floating seals on each part to accommodate manufacturing tolerances.
- Zero leak masters allow quick verification of fixture integrity.

Pressure Control Approach

Managing pressures to 3000 Bar is no easy task. In this application, air was not an option at these pressures so fluid had to be used. The customer requirement that the parts exit dry and cannot contain fluid in the next process. Testing also needed to be performed at 150 Celsius, so the fluid could not flash at this temperature. A fluid was designed for cooling electronics was chosen as the test medium because of its ability to evaporate, high flash point and bulk modulus that supports high compression. A specially designed and built intensifier, controlled by servo valves, was used to boost the pressure to the range that was needed. We have also built machines for this same purpose, but using air at 50 Bar pressures, while maintaining the required stability. The graph to the right shows a step change with air that stabilizes within 0.02% in 3.5 seconds or better.



Please contact us at sales@mcm1.com for more information.



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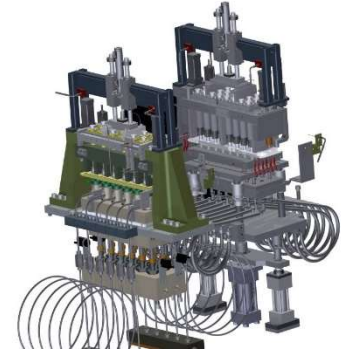
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Flexibility

Our machines are designed for the future so that the investment up front can go a long way. This machine could accommodate two completely different pressure sensors populated on different pallets in different densities. Depending on the product being run, the system would pass the pallet to the appropriate fixture for testing. At a later date as product demands a change and new products are being developed, one of the fixture sets can be changed out for a newly designed one, so that the calibration system can still be utilized and capital expenditure is minimized.



Specifications

Controlled Feature	Control Type	Description
Pressure	Programmable through part parameters	The fluid supply is controlled in the range 1 – 3000 Bar \pm 10 KPa during calibration. Pressure is controlled with a high-performance servo valve to an intensifier.
Stability	Programmable through product parameters.	This is the amount of drift once the target pressure has been achieved. It is maintained at less than 0.03% of range
Temperature	Programmable through operator interface.	Controlled from 27° C to 150° C \pm 1° C. Ambient in the first test machine, then higher temperature in the oven and then maintained in the second test machine throughout the chamber.
Clamp Load	Programmable/manually adjustable	This is the load that the part sees in the fixture when clamped. It is controlled from 8000 N to 32000 N \pm 10 N

Measurements

Feature	Method	Min	Max	Resolution
Pressure	Measured by thermally conditioned pressure transducers in four ranges for accuracy	0.000 Bar	Varies	0.001 Bar
Temperature	RTD and thermocouples throughout the test chamber and oven	20 °C	200 °C	\pm 0.01 °C
Leakage	Leak decay using pressure transducer and controlled cavity volume.	n/a	3000 Bar	0.1 Bar/Second

Options

Although we can make anything to suit your needs, the following have been popular variations of this machine.

- Different Pressure targets
- One or multiple heads
- Cell control integration
- Different Mediums
- Laser Marking
- Sorting/Trafficking of individual parts