ADVANTAGES OF MODEL T16 FLUID DAMPED LOAD CELL FOR DYNAMIC WEIGHING APPLICATIONS

The intent of this technical note is to provide a description of the advantages of the Model T16 fluid damped load cell for use in dynamic weighing applications.

For dynamic weighing applications, such as check-weighing, the Model T16 load cell is ideal because it consists of a highly accurate, repeatable single point platform load cell housed within a stainless steel enclosure filled with a special hydraulic fluid with a viscous damping behaviour. This fluid acts as a damper, reducing the mechanical vibrations in the load cell created due to a weight suddenly being applied to it. The load cell records the initial weight applied and then reaches its zero point very quickly after the load has been removed, so the load cell will be stable and ready to weigh the next product more quickly than if the hydraulic oil had not been surrounding the load cell. The products being weighed can arrive at the weighing platform and depart at high speed, whilst being accurately weighed.

Another benefit of the hydraulic fluid is that the number of vibration cycles experienced by the load cell in service is much less than if the same load cell had been used in air without any oil present. Therefore a fluid damped load cell is the best solution to ensure long service life with minimal fatigue loading. The use of a non-damped load cell with complex filtering electronics can result in a shorter service life of the load cell.

Response of the Model T16 Load Cell in a Real Impact Loading Test

Below are the results of a comparative test performed on the Model T16 load cell, which contains the hydraulic fluid, and on an equivalent un-damped Model T16 load cell.

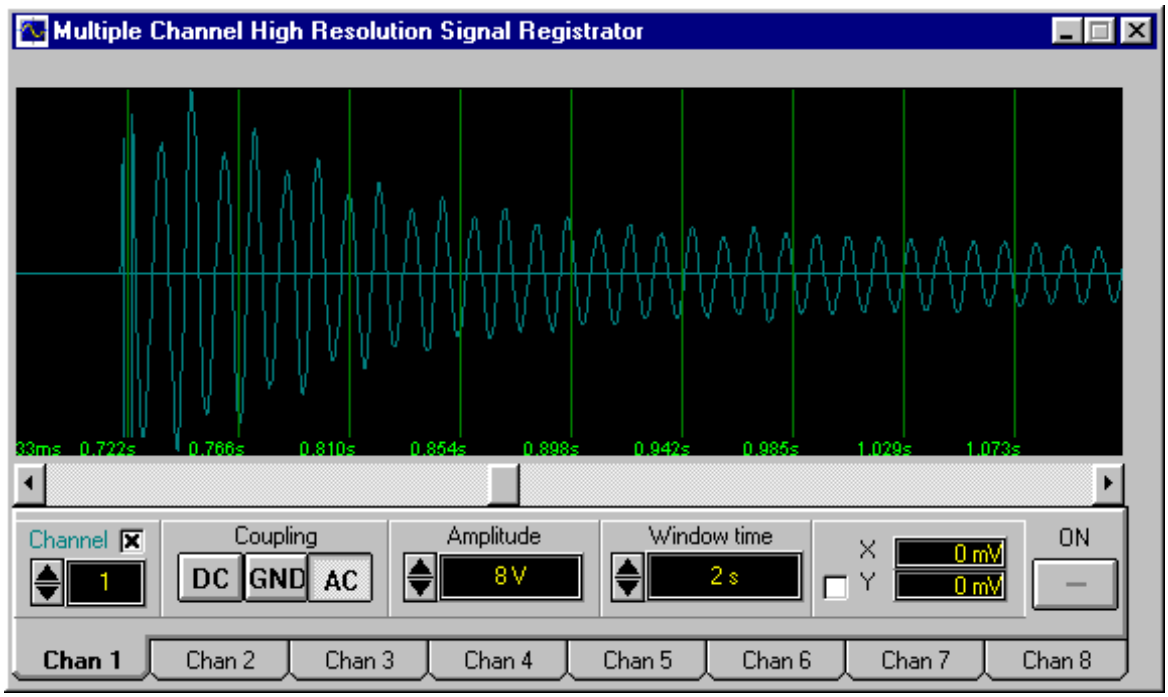
The “response to impact loading” was tested by recording the mV output of each load cell subjected to an impact from a steel ball of weight 210 grams being dropped from a height of 100 mm. Each load cell was pre-loaded with an object of fixed weight 2kg (to represent a typical weighing platform weight) which received the impact of the falling ball. The 2kg dead load remained on the load cell during the entire test, while the ball made only a single impact and did not remain on the load cell during the test.

Electrically, the load cells were each connected to an analogue amplifier with a high frequency response, in order to condition the signal for display on a digital oscilloscope. Each amplifier and oscilloscope had the same specifications and settings. The trace observed on each oscilloscope was as follows.

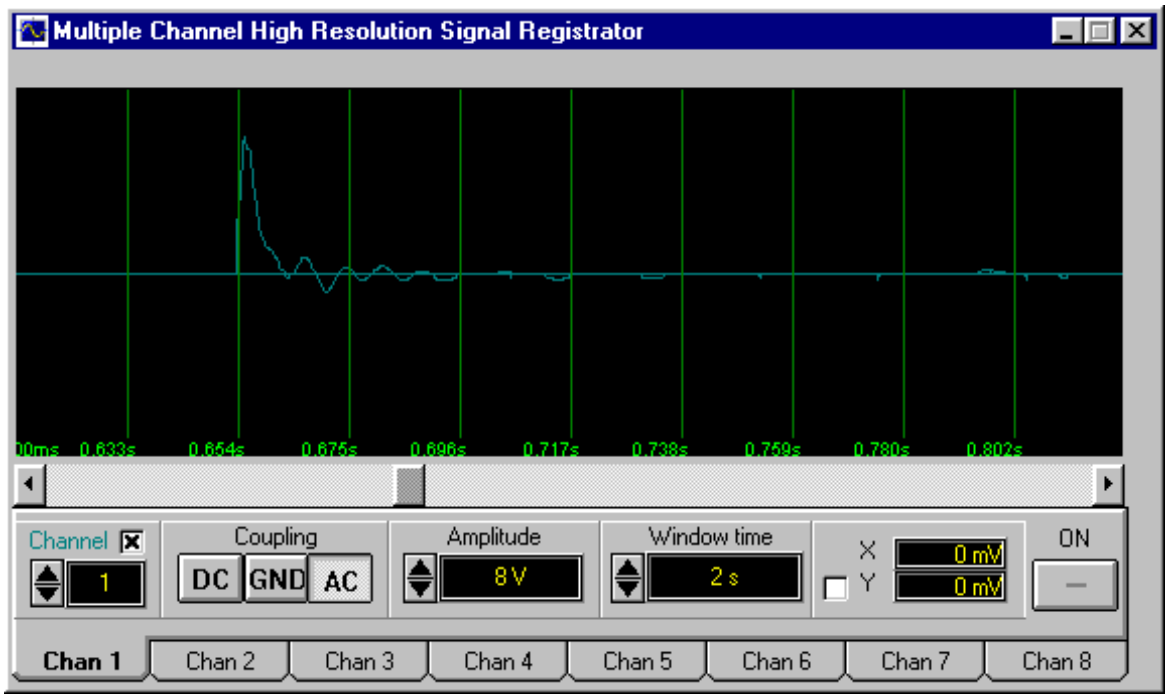
In summary, the 210 gram steel ball made only a single impact on the load cell (having a dead load of 2 kg) and the signal from the load cell was recorded.

Dynamic Impact Test

Model T16 Load Cell <u>without</u> Hydraulic Fluid, 2kg dead load
Capacity (Emax) = 10 kg, Natural Frequency ≈ 83 Hz, Settling time ≈ 900 ms



Model T16 Load Cell <u>with</u> Hydraulic Fluid, 2kg dead load
Capacity (Emax) = 10 kg, Natural Frequency ≈ 120 Hz, Settling time ≈ 40 ms



Dynamic Impact Test – Conclusions

From these tests, comparisons can be made about how the amplitude of the oscillations decreases and the time required to reach a certain amount of stabilization in the weight reading.

In the tests, for one specific criteria of amplitude stabilization we obtained a setting time of 900 milliseconds with a dry load cell (Model T16 load cell but not submerged in hydraulic fluid) compared with a settling time of 40 milliseconds with the oil damped load cell (Model T16). So the settling time reduction factor is 20 times.

Advantages of Fluid Damping using the Model T16 Load Cell

It is important to note that the mechanical stress experienced by the load cell is also strongly reduced by this ***mechanical*** (fluid) filtering of the oscillations, which provides for a **longer fatigue life** of the load cell when compared with an umdamped 'dry' solution. The use of undamped 'dry' load cells, with electronic methods of filtering, can perform averaging of the weight signal, but they cannot reduce the real mechanical oscillations of the load cell, which will inevitably limit the life of the cell.

As a general rule, a factor of 10 times shorter settling time can be expected with fluid damped load cells, when compared with 'dry' solutions. In some cases, the settling time can be reduced by a larger factor. The fatigue life increases by an even greater factor, because fatigue life is not a linear function of the mechanical stress experienced.

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