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# Caster Load Cell System Technical Details

## **Preface**

With the recent introduction of Nicol Scales' Caster Load Cell system for accurate weighing of portable vessels, we have received numerous requests for more information. Some of the technical aspects of the system are discussed below.

## **Introduction**

Applications exist for weighing systems on transportable vessels where loadcells are mounted between the regular casters and the frame of the vessel. An early solution to this problem consisted of four such standard loadcells mounted on the vessel and connected to conditioning electronics designed to compensate (remove or minimize error readings such as side-load errors) for the limitations of the loadcells to accurately display a stable weight reading to the control process.

Such a system presents several unique challenges:

Moving a loaded vessel on casters produces substantial impact and side loads on the load cells. Thus the cells need to be of robust construction and specified at a high enough capacity to be able to withstand the impact loading.

The nature of the caster swivel means that the load introduction is off-center with the load cell measurement axis, and since the caster can come to rest at any angle, the load cell needs to be designed to deal with significant variable off-center loads.

The vast majority of these systems are installed in food processing and pharmaceutical applications, and consequently need to be easy to clean and be dust-and water-resistant. The load cells themselves need to be hermetically sealed and constructed from corrosion resistant stainless steel.

The system, by its nature with four loadcells all rated at a high enough load capacity to deal with overload conditions during tank relocation, presents very low signal strength to the conditioning electronics. The overall system performance is determined by the stability of these electronic components.

Connectivity of the weighing electronics to the downstream processing equipment is site and customer-specific. The electronics must therefore support a variety of interfaces,

including legacy analogue outputs of 4-20mA and 0-10V, along with the capability to support future digital interfaces, such as Modbus TCP, Ethernet IP, Profibus dp, and others.

## Hardware Description

A custom loadcell is proposed with the following characteristics:

Hermetically sealed stainless steel construction, with welded glass/metal seals for cable introduction.

Triple beam single point sensing section:



This results in:

Superior off-center load introduction compensation capability.

Triple beam design ensures that side loads are taken primarily by the non-sensing top and bottom beams in the sensing section. This gives superior overload protection against side loads. Load cells are rated to withstand repeated side loads of up to 50% capacity introduced at the bottom of the caster wheel.

Any residual side loads are cancelled by the triple beam geometry and therefore do not impact the accuracy of the load measurement.

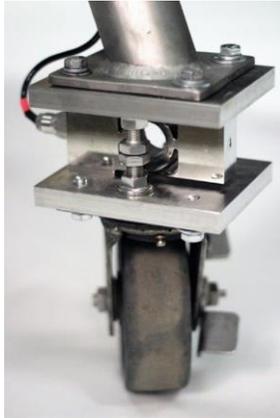
By adjusting the thickness of the beams in the design, it is possible to support a wide range of capacities in the same load cell form factor, which is particularly important in lower capacities. The design can be built in capacities from 20kg up to 500kg.

Load cell matching

By factory matching the signal output and impedance of the load cells in a process called mV/V/ohm calibration, all load cells come from the factory with equivalent signal outputs. This means that the load cells can be connected in parallel directly. There is no need to corner-balance the load cells with trimming resistors in an adjustable junction box. This saves

a significant amount of installation and service time, and improves the overall stability and integrity of the system, both in terms of electrical noise and temperature stability.

## Caster Mount Module



The addition of top and bottom plates enables a weighing module to be created that inserts directly in place of the existing caster, without any modification required to the caster or the vessel frame.

Overload stops are built in to the caster mount to provide load shunting, which protects the loadcells from damaging side impact loads.

For new applications, the caster wheel can be pre-mounted to the lower plate.

## Summary

For more information and to view a video, please visit <https://nicolscales.com/rinstrumcells/>