

Application Note

Check weighing Solutions by Hardy

How they fulfill customer needs

Who is this application note for?

Process Control Engineers, Automation Engineers, Systems Integrators, OEM's or anyone who intends to design, install, commission, support, purchase or offer process weighing solutions for the purpose of manufacturing or processing product.

What is discussed?

Traditionally, cost effective strain gauge technology (analog) has been used in applications below about 100 ppm (Pack per Minute). Above this pack rate OEM's, Systems Integrators, and their customers have had to turn to more advanced measurement sensors such as oil damped strain gauge load cells (faster settling time), the much more costly magnetic force restoration load cells (more speed, faster settling time and higher accuracy), and the like.

This application note discusses all five application types, customer needs and a newer sensor and controller technology - ceramic sensor technology.



WHAT IS CERAMIC SENSOR TECHNOLOGY?

Ceramic sensor technology measures mechanical deflection caused by a product being placed on, or traveling over the load cell by measuring the change in "reactance" (combination of capacitance and inductance). The advantages of using this technology are: reaction times 3 to 5 times faster than strain gauge load cells, 3 times the overload capability, better stability using two stage signal filtering (one stage in the load cell the 2nd in the controller) and package edge detection, to name a few of the key advantages.

CHECK WEIGHING APPLICATIONS BY HARDY

Check weighing can be used for a wide variety of applications including verifying package contents, checking product tolerances, identifying parts, classifying product and checking for overload safety.

Hardy Check Weighing Equipment

Hardy check weighing controllers with analog (strain gauge technology) or digital (ceramic sensor technology) are used to check weigh static or dynamic

(in-motion) parts, products and packages. Simple platform scales are used for static check weighing. Load points (load cells and mounting hardware) or platform scales are incorporated with conveyors to provide in-motion check weighing.

In-motion check weighing is made easier with Hardy's WAVERSAVER® technology, which ignores plant and process mechanical vibrations such as those created by the conveyor belts.

Using Hardy's EDGE® technology the Check Weigher can be configured to help sequence items on and off the scale, divert out-of-tolerance material, or separate classified product.

CHECK WEIGHING APPLICATIONS

1. Verify package contents
2. Check product tolerance
3. Classify product
4. Identify parts
5. Overload safety check

Under/Accept/Over lights can be used to notify the operator of the weight status.

Controls

Check weighing system controls range from manual to fully automatic. A manual (static) check weighing operation requires an operator, or a mechanically automated piece of equipment, to place the item on the scale and observe Under/Accept/Over lights. A fully automated system is where the item is automatically weighed in-motion. The check weight controller then directs downstream diverter gates to route product based on weight. Automated control is done by a host computer or a PLC program communicating with a Hardy front-end.

Data Collection

In addition to verifying the weight and directing product flow, a check weighing system can also provide valuable statistical information. This information can be used for SPC (Statistical Process Control) to support the requirement for quality records.

Usually the check weighing station is an inspection station after the manufacturing or packaging process. By analyzing and feeding back the results of the check weighing operation, the source process can be adjusted to optimize quality and lower costs. Automatic or manual feedback, or information is downloaded to a printer, computer or PLC for control, SPC calculation or data storage.

TYPICAL USE OF CHECK WEIGHING APPLICATIONS

1. Verify Package Contents

Hardy Process Solutions check weight controllers and load point(s)/platform scales are used to weigh packages to confirm that they have been filled to the proper level or that they contain the correct number of parts. A wide variety of products ranging from boxed food, bagged grain and glass bottles to gas cylinders can be weighed to verify the contents. Check weighing can determine whether or not the correct numbers of items are in a box, the right numbers of boxes are in a carton,

and the correct numbers of cartons are on a pallet.

For example, the beverage industry weighs kegs and canisters to make sure they are empty prior to filling and full within tolerance after filling.

2. Check Product Tolerance

Checking a manufactured product's weight verifies if it is within design tolerances. For example, an injection molding company can detect improperly produced product by using a Hardy weight controller and load point(s)/platform scale to check weigh each part as it falls out of the mold. In a coating process, the quality and thickness of the coating can be verified by the additional weight.

3. Classify Product

A mix of different items can be sorted by weight and diverted to the proper packaging station for classifying or grading purposes. For example, variable weight products such as fruit and vegetables can be classified or graded by their weight class using a Hardy weight controller and load point(s)/ platform scale. If the check weighing process is in-motion, relays from a Hardy weight controller can be set to divert the product to the proper station.

4. Identify Parts

Items with different weights can be identified automatically by a check weighing system. For example, assembly processes use Hardy Process Solutions weight controllers and load point(s)/platform scales to verify the correct parts have been delivered.

5. Overload Safety Check

Items are often weighed to ensure they don't violate safety limits. For example, a train car is weighed with a Hardy weight controller and load point(s)/platform scale to make sure it doesn't exceed the weight tolerance of an upcoming bridge.

CUSTOMER NEEDS

Due to the advances in PLC and SENSOR technology, an opportunity to use process control and process weighing tools for more demanding checkweighing applications exists.

The table below illustrates (from most demanding to least) the typical range of current end user checkweighing requirements by capacity; accuracy and speed (these numbers are intended to be illustrative only and therefore may vary in unique situations in the field). The areas of opportunity the Hardy 4050CW challenges, and displaces the proprietary check weigher solutions in that currently use Magnetic Force Restoration (MFR) technology, is highlighted below in YELLOW.

Weight (kg)	+/- Accuracy (% of piece weight)	Read Speed (ppm)	Weight Sensor Method	Proprietary Yesterday (pre 2012)	Proprietary Today
<0.6	<?	<800	MFR	Yes	Yes
<0.6	<0.01	<600	MFR	Yes	Yes
<0.6	<0.01	<400	MFR	Yes	Yes
<3.5	<1	<250	MFR/LC	Yes	No
3.5 to 6	<0.1	<100	MFR/LC	Yes	No
6 to 35	<0.1	<55	MFR/LC	Maybe	No
35 to 60	<0.05	<31	MFR/LC	Maybe	No
60 to 120	<0.1	<31	MFR/LC	No	No

MFR = Magnetic Force Restoration weight sensing technology
 LC = Strain Gauge or Ceramic weight sensing technology

There is an opportunity to address manufacturer's changing needs in the low to mid-range check weighing applications using off the shelf process control and measurement equipment.

WHAT DO MANUFACTURERS HAVE TODAY?

Custom Hardware & Software that is proprietary, obsolete or unreliable. The current hardware being used by manufacturers is mostly custom system comprising of obsolete or proprietary circuit boards,

custom networks, custom HMIs, and proprietary embedded programming that in-house engineering groups or technicians have no access to.

Troubleshooting is very difficult, parts are long lead time or unavailable, OEM support is slow, and not familiar with the system due to the custom nature of the application. Other systems on the market have similar designs, with custom hardware, proprietary programs, and no guarantee of long term support or availability.

WHAT DO MANUFACTURERS WANT?

Check Weighers that are developed using standard, off-the-shelf technology.

Solutions that use known and readily available technology: For example - PLC's, HMI's and weight measuring components such as load cells and indicators.

Solutions that can be retrofitted into existing equipment: They must require little to no modifications to the production lines or lanes within which the check weighing is required. If possible, should be able to use existing enclosures and HMI locations.

Above all they the must be easy to use, modify and fix.

Easy to use:

- A system that the operating technicians understand, can easily monitor, easily maintain, and easily troubleshoot.
- A system that requires little training to operate.
- A system design that looks and operates similar to the existing system.

Easy to modify & fix:

- A system that the Electrical & Instrumentation (E&I) technicians can monitor, access the programming, easily pinpoint a failure and replace the appropriate component within minutes vs hours or days.
- A system that increases MTBF and decreases MTTR.

In house Engineers, Technicians or contracted Systems Integrators are trained and are very capable at using PLC Software.

WHAT ARE THE BENEFITS?

Reliability and lower life cycle costs. Accelerated ROI.

- Off the shelf components that are readily available and supported ongoing.
- Familiar components/technology that are well known.
- Component cost is considerably less than the current hardware components.
- Less dependence on vendor resources for upgrades, modifications, and troubleshooting.
- Components are robust and not subject to failure due to handling.
- Limited set of cost effective spares can be kept on-site
- Easier swap out of hardware
- Easier upload of software, configuration and calibration parameters dramatically reduces MTTR (mean time to repair) in the event of a failure.
- Inter component communication via industry standard fieldbus protocols such as EthernetIP
- One HMI can display the production data for multiple rows
- The open platform allows for unlimited data collection and transfer to our MES system.
- Future loop control for weight control, and other controls enhancements are easily added.
- Depending on application: ROI can be reduced from years to months or months to weeks.

WHAT'S THE SOLUTION THAT PUSHES HARDY UP TO 250PPM?

The Hardy high speed HI 4050CW CHECK WEIGHING Bundle can process up to 250 high resolution weight measurements per minute per lane. The 4050CW bundle consists of a special version of the HI 4050 weight controller, a digital load cell interface card and a high speed Digital Sensor Point (DSP) capable of 0.5 gram resolution. The bundle is perfect for building new systems for both static and dynamic check weighing or retrofitting the weight measurement electronics of older,

controller, a digital load cell interface card and a high speed Digital Sensor Point (DSP) capable of 0.5 gram resolution. The bundle is perfect for building new systems for both static and dynamic check weighing or retrofitting the weight measurement electronics of older, less reliable systems.

The Hardy DSP (LOAD CELL) is designed for industrial applications requiring a fast, accurate and repeatable response to change in weight conditions. With no moving parts and laser welded assembly, the hermetically sealed DSP is rated to IP69k will provide a robust and long lasting solution to the most challenging environments.

- **Lower Total Cost of Ownership** - It's not a black box, it is an off-the-shelf solution. It integrates to Rockwell and other PLC's.
- **Up to 250 packs per minute** - It breaks the traditional analog strain gauge "speed barrier", without the cost of MFR (Magnetic Force Restoration or Other similar high speed/resolution technologies)
- **Smart Features** - It offers advanced EDGE DETECTION (weight on & weight off) and operator indication of DATA QUALITY

PROOF OF CONCEPT WITH CUSTOMER

Research, Validation & Testing

This concept of using known, and readily available technology: For example - PLC's, HMI's and weight measuring components such as load cells and indicators was researched and validated with a large US based Consumer Packaged Goods manufacturer. The Hardy 4050CW solution was retrofitted into existing equipment. It required minimal modification to the production lines/lanes within which the check weighing was required. The customer was able to use their existing enclosures and HMI locations. The Hardy 4050CW Check weighing case study (this document can be found at www.hardysolutions.com) illustrates the success story and value delivered.