thermo scientific

A practical guide to belt scales and bulk weighing

ThermoFisher SCIENTIFIC

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Overview

What is a belt scale?

Belt scales measure a load as it passes along a conveyor.

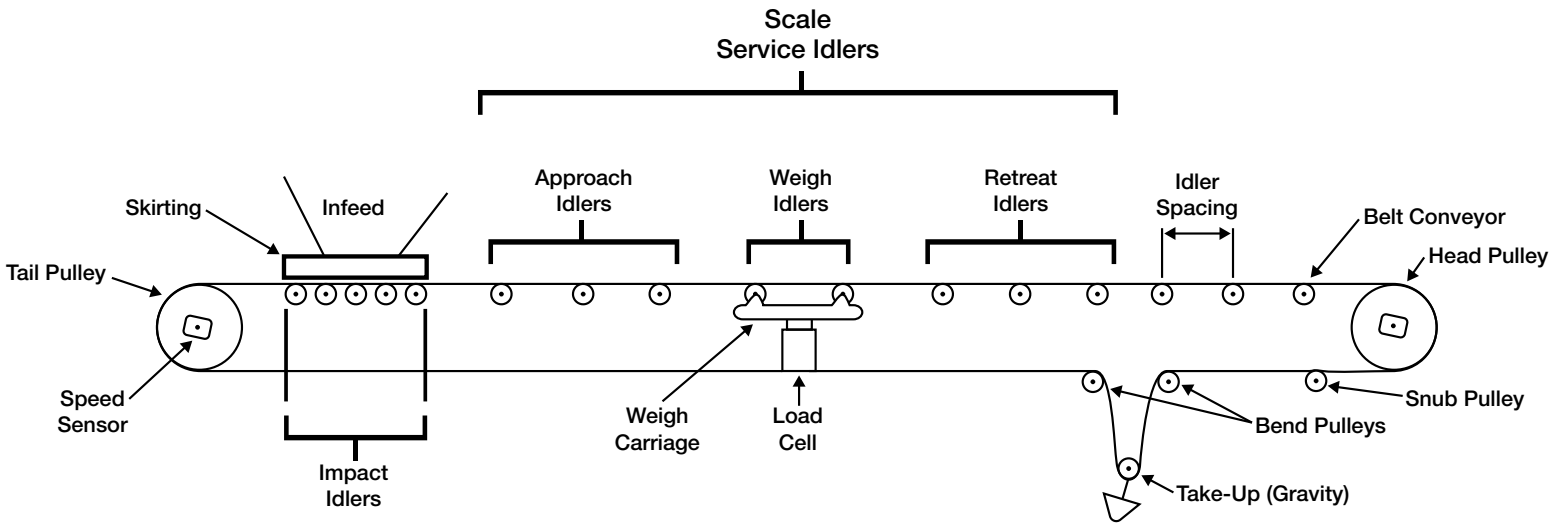
Belt scales - also known as belt weighers, weightometers, conveyor belt scales or continuous weighers - are an important part of most bulk material handling facilities. A conveyor belt scale weighs items on a moving conveyor belt by weighing the belt load and measuring belt speed.

These dynamic scales provide a rate of flow of bulk materials passing a defined point on a moving conveyor. This belt load and belt speed are integrated into mass per time.

What is a belt scale?

A belt scale system consists of four major elements:

1. The **weighing carriage** with load cell(s) measures the weight (mass) of the material on the belt and sends the signal to
2. The **digitizer** or junction box
3. The **speed sensor** monitors the speed of the conveyor belt
4. The **integrator** takes the outputs from the digitizer and the speed sensor to calculate the total material mass passed over the scale



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Why use belt scales?

- Plant efficiency
- Inventory Control
- Material Blending
- Fee or Custody Transfer of Bulk Materials (Basis of Payment)

Applications

Process monitoring	Process management	Fee of custody transfer
• Crusher feed	• Production rate (coal prep, minerals and more)	• Basis of payment (rail loadout, as-fired power, shiploading)
• Stockpiling (i.e. aggregates, lower value materials)	• Blending (asphalt, coal, cement)	• Inventory control
• Flow rate (sampling efficiency)	• Stockpiling (coal, higher value materials)	• Metallurgical accounting
	• Truck loadouts	

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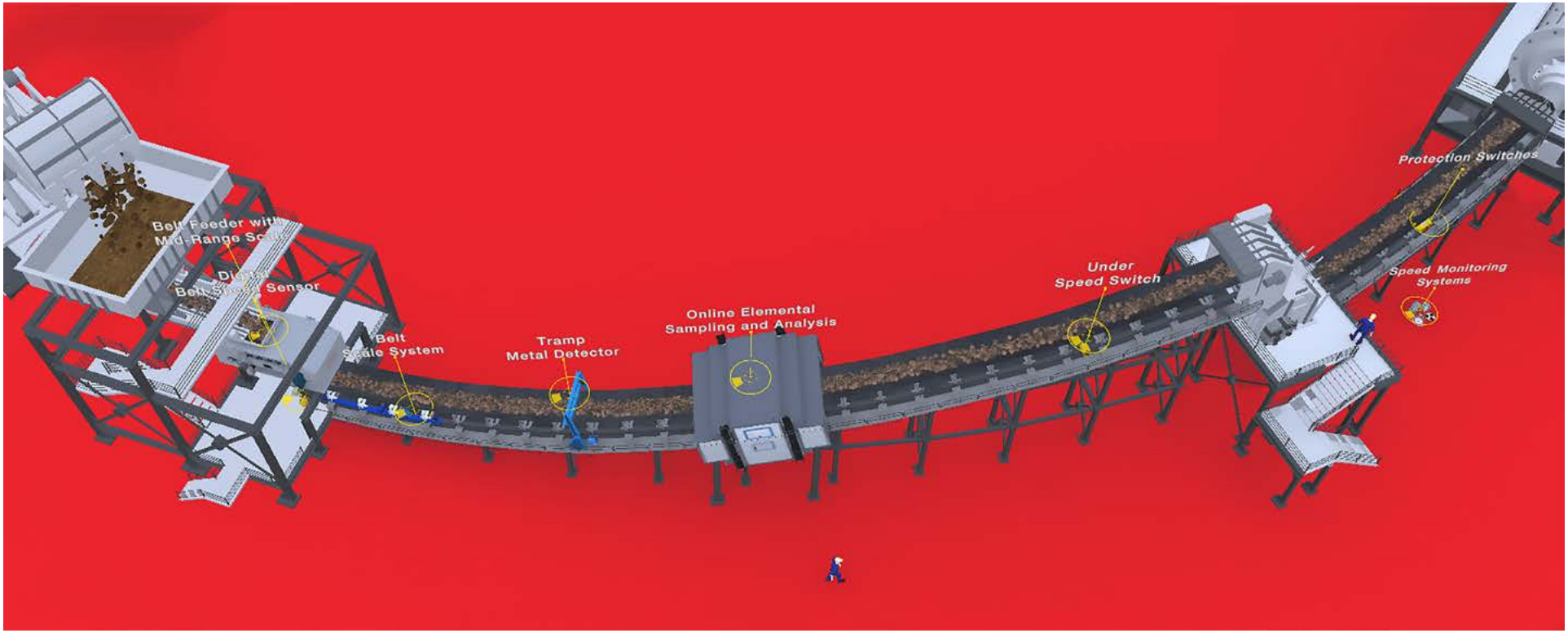
Applications

See belt scales in action in our interactive apps for cement, coal, steel, and minerals.



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Belt scale regulations: basis of payment applications

Certifications of conformance are required for belt scale systems (also known as Trade Scales) used in applications where selling, purchasing, exchanging or custody transfer of materials is taking place and is determined by the basis of measurement.

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United States
National Type Evaluation Program (NTEP)

European Union
Measuring Instruments Directive (MID)

Canada
Canadian Weights & Measures

Australia
National Measurement Institute (NMI)

The importance of accuracy

Material value	Tons per year	Cost of 2% error	Cost of ¼% error
$2.00 per ton	1,000,000	$40,000	$5,000
$100.00 per ton	1,000,000	$2,000,000	$250,000

This table shows the effect of accuracy and how much it can cost based on material value.

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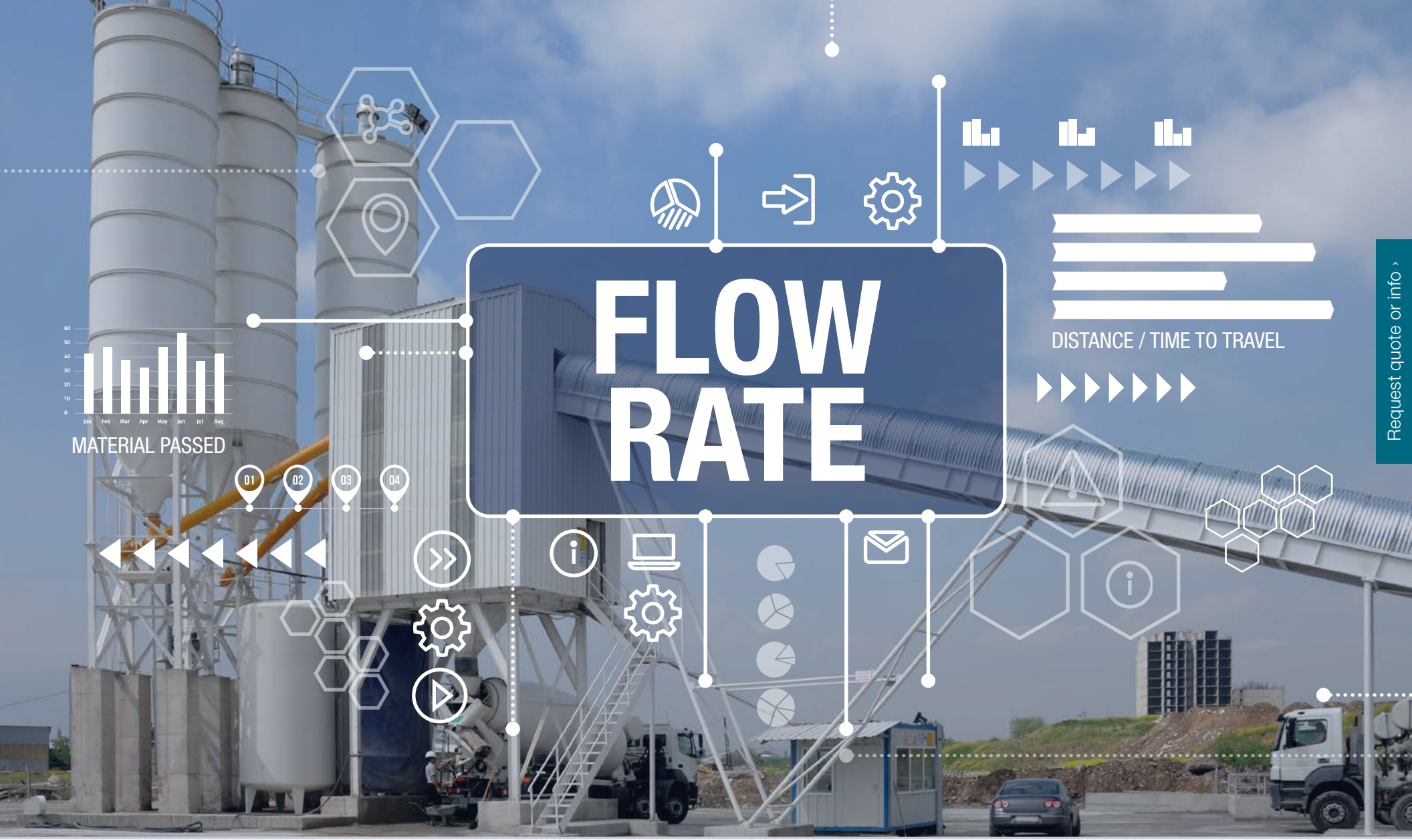
Typical accuracies

Process monitoring	Process management	Fee of custody transfer
Typical accuracy: +/- 0.5% to 5%	Typical accuracy: +/- 0.25% to 1%	Typical accuracy: +/- 0.125%



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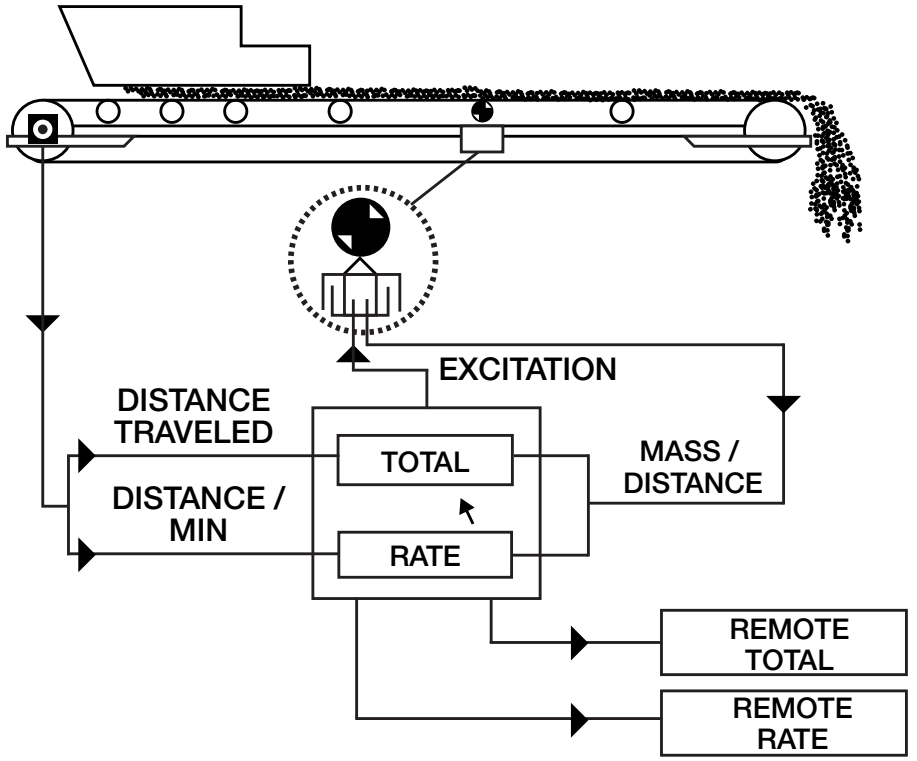
Technology

How a belt scale works

1. The weight on the conveyor belt is measured by sensing the force on one or more conveyor idlers via load cell(s).
2. The motion of the material is measured using a speed sensor which produces an “output” representing the speed of belt travel.
3. Because the measured force represents weight per unit length (i.e., kg/m or lbs/ft), it can be multiplied by the belt travel to acquire total weight. (Example: kg/m x m = kg; lbs/ft x ft = lbs) This function can be accomplished with an electronic integrator.



$$\text{TOTAL} = \frac{\text{MASS}}{\text{FOOT}} \times \text{DISTANCE TRAVELED}$$

$$\text{RATE} = \frac{\text{MASS}}{\text{FOOT}} \times \frac{\text{DISTANCE}}{\text{MIN}}$$

Verifying accuracy through calibration

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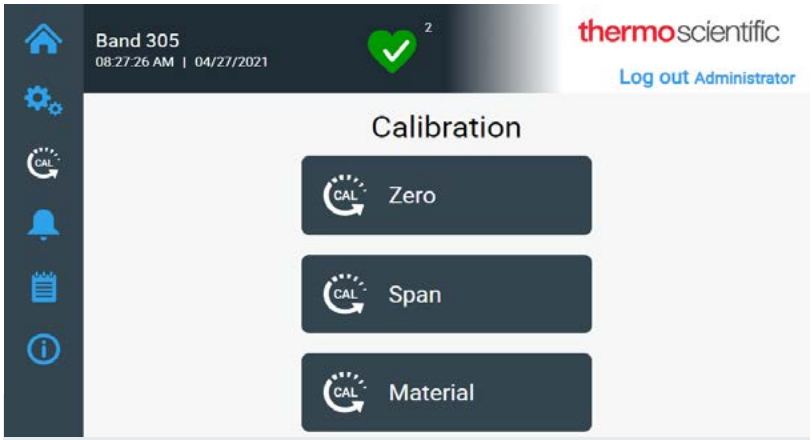
Basic methods of calibration



Resistance calibration (R-Cal) or electronic calibration

Advantages	Disadvantages
• Is self-contained within the Integrator	• Does not detect all types of load cell failures
• Checks all electronics including electrical circuit of load cell	• Does not simulate conveyor belt effects
• Quickest and easiest of all calibration methods	
• Acceptable simulated test (some regulatory agencies)	

Calibration chains

Advantages	Disadvantages
• Simulates some conveyor belt effects	• Chains do not provide a traceable conveyor scale calibration standard
• Acceptable simulated test	• Heavy chains can be difficult to handle and costly
	• Conveyor belt must be stopped to apply and remove

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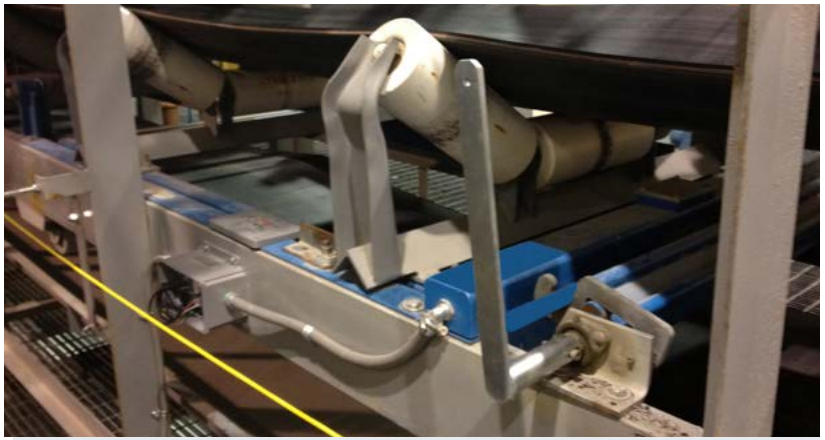
Basic methods of calibration



Static weights

Advantages	Disadvantages
• Simulates some conveyor belt effects	• Weights do not provide a traceable conveyor scale calibration standard
• Easy to apply	• Does not simulate conveyor belt effect
• Conveyor belt does not have to be stopped to apply	
• Detects load cell failures and applies force to the load cell	
• Acceptable simulated test	

Material calibration

When choosing a high accuracy scale, specify whether it is required for fee for custody transfer. Trade certified scales must be calibrated using the material calibration method.

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How to keep belt scales in top performance

Continued maintenance

Regardless of the accuracy capability of the scale design, it is unlikely that these devices will perform as promised if simple maintenance procedures are not strictly adhered to. The following are some recommended maintenance checks to ensure optimum performance of your belt scale system.

Note: *There are also quarterly and annual maintenance check recommendations (see Thermo Scientific Belt Scale Maintenance Guide for more information).*

Maintenance check	Frequency	Details
Scale Area - Debris	Daily	Clean scale area. Determine cause of debris and take steps to remedy
Zero Cal	Daily	Perform Auto Zero procedure. Accept and record any changes. If change is >0.25%, identify cause and correct.
Idler Roll Condition	Weekly	Inspect idlers for wear / damage. Replace rolls or bearings as needed
Span Cal	Weekly	Perform Auto SPAN simulated load tests. Check repeatability.
Belt Scraper	Weekly	Check operation, adjust or replace blades if worn
Belt Condition	Weekly	Visual inspection for cuts, tears or worn edges
Take-Up	Monthly	Inspect for free travel (bearings, sheaves, etc.)
Speed Pulley	Monthly	Inspect for wear, material build-up, belt wrap. Check bearings
Speed Sensor	Monthly	Inspect coupling for tightness, wobble and corrosion

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Equipment

Solutions for bulk weighing

Thermo Scientific™ Ramsey™ Series 14 Belt Scale System

This system is specifically designed for high accuracy or basis-of-payment applications requiring certification by government and regulatory agencies. It is extremely accurate to within +/-0.125% and is the most widely certified belt scale in the world.

Product details ›

Thermo Scientific™ Ramsey™ Series 17 Belt Scale System

This belt scale system is specifically designed for plant and process operations that run at high rates of speed or require high accuracy. Its unitized multi-idler weighbridge permits more scale-borne time, which minimizes alignment errors, allowing this model to be offered as a highly accurate ±0.25% scale system.

Product details ›

Thermo Scientific™ Ramsey™ Series 20 Belt Scale System

This system monitors feed to crushers, mills, screens and other processes with an accuracy of ±0.5%, even in the most demanding industrial applications. It is designed for general in-plant belt conveyor weighing and lets you monitor production output and inventory, or regulate product loadout.

Product details ›

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Solutions for bulk weighing

Thermo Scientific™ Ramsey™ IDEA Belt Scale System

This belt scale system provides basic rate information and totalization functions in processes involving non-critical or lower value materials with an accuracy of ±1%. Its highly compact design makes it ideal for operations where economy and ease of installation are important considerations.

Product details ›

Thermo Scientific™ Ramsey™ Series 10-30 Belt Scale

The belt scale system is ideally suited for applications in processes involving either non-critical or lower value materials, with an accuracy of +/-1%. It provides basic rate and totalization functions which can be used for process control and/or production output monitoring. It is specifically designed for operations where economy and ease of installation are important considerations.

Panel mount with touchscreen HMI

Field mount with touchscreen HMI

Blind without HMI

Thermo Scientific™ Ramsey™ Flex Belt Scale Integrator

This belt scale integrator drives weighing systems that you can depend on and will work reliably for decades, weighing materials with accuracy, every day. Integrators are suitable for retrofit.

Product details ›

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Which system is right for you?

	Ramsey IDEA Belt Scale System	Ramsey Series 30 Belt Scale System	Ramsey Series 20 Belt Scale System	Ramsey Series 17 Belt Scale System	Ramsey Series 14 Belt Scale System
					
Accuracy	+/-1%	+/-1%	+/-0.5%	+/-0.25%	+/-0.125%
Number of idlers	1	1	1 or 2	2 or 4	3, 4, or 6
Number of load cells	1 or 2	1 or 2	1 or 2	2	4
Belt widths	10-101-R1 max 914 mm (36 in) 10-101-R2 max 1524 mm (60 in)	Single Load Cell version 381-914 mm (15-36 in) Dual Load Cell version 635-1524 mm (25-60 in)	406-1981 mm (16–78 in)	457-2590 mm (18-102 in)	457-2590 mm (18-102 in) HD version available for larger sizes
Belt speed range: Material must spend at least 0.5 seconds in the weigh area; varies depending on # of idlers and idler spacing.					
Belt loading	Model 10-101-R1: 7.5-114 kg (16.5–250 lb) Model 10-101-R2: 13.6-340 kg (30–750 lb)	Single Load Cell version 15.8-227 kg (35-500 lb) Dual Load cell version 29.5-907 kg (65-2000 lb)	Model 10-20 1: 22.7-816 kg (50–1800 lb) Model 10-20-CWT: 9-22.7 kg (20–50 lb)	Contact a rep for calculation	11.9-1116 kg/m (8–750 lbs/ft)
Idler spacing	R1 - Larger than 533 mm (21.5 in) R2 - larger than 571 mm (22.5 in)	Standards 900 mm, 1000 mm and 1200 mm (36 in, 42 in, 48 in)	812 mm (32 in) minimum	Standards 900 mm, 1000 mm and 1200 mm (36 in, 42 in, 48 in)	Standards 900 mm, 1000 mm and 1200 mm (36 in, 42 in, 48 in)
Types of applications	Cost-effective weighing for non-critical or lower value materials, modular installation	Cost-effective weighing for non-critical or general in plant or in-process	General in plant or in-process	High-accuracy weighing	High-value materials High quality and high accuracy requirement Certifiable or basis-of-payment

Note: Thermo Scientific conveyor belt scales are available in the below range of specifications:

- Up to +/-0.125% in accuracy
- Factory-installed and calibrated overload protection
- Pivotless design with no linkages to introduce errors
- Compact design for easy installation and alignment (Ramsey Series 10-14, IDEA and 10-30)
- Belt width from 400 mm (16 inch) to 2600mm (100 inch). All of our conveyor belt scales provide vital information for the effective management and efficient operation of your business
- No moving or wearing parts to cause potential maintenance problems

Contact us for customized application assessment.

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Solutions for conveyor monitoring and safety

Thermo Scientific™ Ramsey™ Series 60-200 Motion Monitoring Systems

Improve monitoring of underspeed, overspeed and zero-speed conditions on machinery and systems to increase productivity. These motion monitoring systems reduce downtime, increase productivity and add to your bottom line as they sense the speed variations of rotating parts.

Product details ›

Thermo Scientific™ Ramsey™ Oretronic IV Tramp Metal Detector

Protect expensive crushers, conveyors and other process equipment from damage by tramp metal. Designed for belt conveyors moving coal, iron pellets, minerals, aggregates and other bulk materials, these instruments detect tramp metal even when buried in wet conductive materials.

Product details ›

Thermo Scientific™ Ramsey™ Safety Cable Pull Switch

Protect your people, equipment, prevent accidents and reduce unscheduled shutdowns. These switches help to identify potentially hazardous situations with your process equipment.

Product details ›

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