MASTER™ 211

Belt Scale Weigh Frame

Installation Manual

RICE LAKE®
WEIGHING SYSTEMS

June 23, 2025

PN 165455 Rev B

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www.ricelake.com

Revision History

This section tracks and describes manual revisions for awareness of major updates.

Revision	Date	Description
A	September 8, 2023	Established revision history; added lever ratio details
B	June 23, 2025	Updated Selection Criteria; added disposal information

Table i. Revision Letter History

Contents

1.0 Introduction

A belt scale measures a continuous mass flow, which is transported over a belt conveyor. A complete belt scale is composed of a weigh frame, which contains one or more load cells, a speed pickup and the Integrator electronics (see drawing WBF-S0000).

Not every application is suited for a belt scale, this has to be analyzed by a Rice Lake Weighing Systems specialist. A series of weigh frames have been developed for a number of applications and for every type of conveyor, to achieve the optimum result.

The Master BS211 Belt Scale System must be installed by qualified service technicians only, according to this manual.

Manuals are available from Rice Lake Weighing Systems at www.ricelake.com/manuals

Warranty information is available at www.ricelake.com/warranties

1.1 Safety

Safety Definitions:

DANGER: Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. Includes hazards that are exposed when guards are removed.

WARNING: Indicates a potentially hazardous situation that, if not avoided, could result in serious injury or death. Includes hazards that are exposed when guards are removed.

CAUTION: Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury.

IMPORTANT: Indicates information about procedures that, if not observed, could result in damage to equipment or corruption to and loss of data.

General Safety

Do not operate or work on this equipment unless this manual has been read and all instructions are understood. Failure to follow the instructions or heed the warnings could result in injury or death. Contact any Rice Lake Weighing Systems dealer for replacement manuals.

WARNING

Failure to heed could result in serious injury or death.

Some procedures described in this manual require work inside the enclosure. These procedures are to be performed by qualified service personnel only.

Take all necessary safety precautions when installing the scale carriage including wearing safety shoes, protective eye wear, and using the proper tools.

Keep hands, feet and loose clothing away from moving parts.

DO NOT approach a running conveyor from underneath.

DO NOT bend over a running conveyor.

DO NOT allow minors (children) or inexperienced persons to operate this unit.

DO NOT operate without all shields and guards in place.

DO NOT jump on the scale.

DO NOT use for purposes other then weight taking.

DO NOT place fingers into slots or possible pinch points.

DO NOT use any load bearing component that is worn beyond 5% of the original dimension.

DO NOT use this product if any of the components are cracked.

DO NOT exceed the rated load limit of the unit.

DO NOT make alterations or modifications to the unit.

DO NOT remove or obscure warning labels.

DO NOT use near water.

1.2 Disposal

Product Disposal

The product must be brought to appropriate separate waste collection centers at the end of its life cycle.

Proper separate collection to recycle the product helps prevent possible negative effects on the environment and to health, and promotes the recycling of the materials. Users who dispose of the product illegally shall face administrative sanctions as provided by law.

1.3 Overview

The weigh frame model BS211 is designed for heavier applications in the process industry, where good accuracy and/or legal approval is demanded.

The dimensions are generated from the construction of the existing or to be build belt conveyor.

Optionally this belt scale can be supplied with the approval according to the ATEX directive in the categories II2D or II3D.

Theory of Operation

The material is carried by the belt and the under laying rollers. One or more of these rollers is mounted on the weigh frame and is weighed. Therefore the amount of material lying on the belt is weighed. The belt speed is measured as well.

Both values (belt load and belt speed) are calculated in an integration function in the electronics. These electronics totalize, calculate the mass flow, displays these and transfers it through outputs or any other way of communication to a control system or network.

For the operation, we refer to the manual of the electronics installed.

1.4 Selection Criteria

Load cell capacity is calculated based on the maximum belt load plus the dead load of the weight frame and the weight of the rollers.
Net load = (conveyor capacity / belt speed) x idler spacing
Gross load = net load + (idler weight + belt weight + mounting hardware)

Example (Imperial):

Net load = (50,000 lb per minute / 400 feet per minute) x 4 foot spacing

Net load = (125 lb per foot) x 4 foot spacing

Net load = 500 lb

Gross load = 500 lb + (175 lb idler + 48 lb belt + 24 lb hardware)

Gross load = 747 lb

Because the 211 is a pivoted weigh frame, the Lever Ratio must be factored into the total load cell build (see Section 4.3 on page 15)

Total load cell build: 747 lb x 0.75 = 560 lbs.

NOTE: The 211 uses the RL20000 S-Beam load cell. In this example, the 750 lb size load cell should be used.

Example (Metric)

Net load = (24,000 kg per minute / 120 meters per minute) x 1 meter spacing

Net load = (200 kg per meter) x 1 meter spacing

Net load = 200 kg

Gross load = 112 kg + (90 kg idler + 15 kg belt + 7 kg hardware)

Gross load = 312 kg

Because the 221DB is a pivoted weigh frame, the Lever Ratio must be factored in to the total load cell build (See Section 4.3 on page 15).

Total load cell build: 312 kg x 0.75 = 234 kg

NOTE: A minimum of a 500 kg load cell should be used in this example.

1.5 Calibration and Test Weight Device

The weigh frame can be provided with mounting points to apply test weights. This is to check accuracy, after the initial calibration has been done. Then the reproducibility and the state of the belt scale can be determined.

To determine absolute accuracy, it is necessary to do a test with material. For this procedure, we refer to the manual of the electronics installed.

2.0 Installation

Installation procedures generally should be a combination of the end user's best engineering practices in compliance with local codes and the manufacturer's recommendations. To achieve maximum performance within the parameters designed into the system, the following precautions should be observed.

WARNING: Take all necessary safety precautions when installing the scale carriage including wearing safety shoes, protective eye wear, and using the proper tools.

Always turn off the power supply, before any connection is made or removed.

Before welding, the power supply must be off and the connectors removed.

The load cell is very sensitive to damage by welding. The welding ground clamp must be fixed to the same side of the load cell (the weigh frame), where welding. When in doubt, remove the load cell(s).

IMPORTANT: Follow the recommendations given when the application was checked.

Belt conveyor must be installed in a stable and rigid area, free from vibrations.

The construction of the belt frame must be stiff enough to prevent torsion or bending at the maximum load (including the weigh frame).

The weigh frame must be mounted free of mechanical tensions.

No vibrations in the conveyor should be allowed to carry over to the weigh frame. If needed, these must be filtered.

The belt must be of a good quality and the weld must not influence the weighing. A good fit consists of more than one part and welds, the weight per meter must be constant over the whole length.

The belt must not track out of the center and no steering idler must be placed near the weighing area.

The belt support must not be provided with two part (v-shape) idler stations.

At least three idler stations before and three idler stations after the weigh frame (the weighing section) have to be adjustable in height. For short belt conveyors this can be reduced to one roller before and one roller after the weigh frame.

Every roller or idler station must be water leveled in cross direction on the frame carriers. A tolerance of +/- 0.5 mm is accepted, measured between the ends of the middle carrier roller.

Rollers should not have a concentricity exceeding +/- 0.3 mm.

It must be possible to mount a speed pickup on an non driven drum or roller. We strongly recommend not using a measuring wheel.

The inclination angle of the belt conveyor should not exceed 15º.

Air flowing along should not have any effect on the weighing.

A possible side guiding should not have any effect on the weighing.

ATEX: If the system is placed in zone 21 or zone 22, it must be connected to earth as indicated on the drawings.

2.1 Mechanical Installation

The mechanical installation of a belt scale consists of mounting the weigh frame, the speed pickup and the junction box.

2.1.1 Installation Weigh Frame

The design and the installation of the weigh frame depend on the type of conveyor. The weigh frame is supplied in one part and it also must be mounted in one part, according to the specific drawing.

Use drawing BS211-M0200 or the specific project drawing.

1. Determine the location of the weighing roller station(s).
2. Determine from the hart of the weighing roller, the position of the load cell carriers and pivots. Point out the position of the holes and drill the holes Ø18 mm.
3. Mount the weigh frame.
4. Place the weighing roller station on the mounting plates and point out its location for welding.
5. Weld the plates to the weighing roller station, after taking them off the weigh frame. Do not weld on the weigh frame, to prevent damage to the load cell.
6. Adjust the rollers in the weighing section (three before, one on and three after the weigh frame) against the rollers (or any other belt support) both before and after the weigh section.

2.1.2 Installation Speed Pickup

1. Mount the speed pickup, according to the drawing, at a (non-driven) tail drum or running roller.

2.1.3 Installation Junction Box

1. Mount the junction box near the weigh frame, not further than 0.5 meter from it. The cable glands must point downwards.

2.2 Electrical Installation

The wiring and connections between weigh frame, speed pickup and the electronics are shown in the applicable scheme, see Section 4.1 on page 14.

The load cell is provided with a fixed cable; do not alter the length. An additional junction box with screw terminals is provided to extend cable length.

2.2.1 Cable Types

Load cell

- If the length is less than 60 meters, use shielded 4 wire cable 0.75 mm².
- If the length is more than 60 meters, use shielded 6 wire cable 0.75 mm².

Speed pickup

- Use shielded 3 wire cable 0.75 mm².

Shielding

- The cable shielding must be connected to one side only. If connected to the instrument side, then preferably use the same ground as the power supply.

ATEX

If the system is placed in zone 21 or zone 22, it must be connected to a ground as indicated on the drawings:

- If metal parts are mounted isolated (by paint, plastic or rubber materials), then an earth strip or other form of grounding must be placed from the weighed part to the fixed part of the weigh frame.
- An earth strip must be placed from the fixed part of the weigh frame to the conveyor construction.
- The conveyor must be grounded to a central or local earth pin.
- The belt must be manufactured of an anti-static material.

NOTE: If the weigh frame consists of two parts, earthing must be provided on both sides. Earth leads or any other form of grounding must never affect the weighing function.

2.3 Commissioning

This part should be done by service engineers, who are trained and experienced on the subject.

2.3.1 Mechanical Adjustments

This part is limited to the adjustment (free of mechanical tension), after the transportation security has been removed.

If necessary, the load cell will be adjusted mechanically.

2.3.2 Electronics Setup

Refer to the manual of the electronics installed.

2.3.3 Calibration

Perform a test with material.

Let the installation run and totalize for a duration of at least 5 minutes. Collect the material during this period and compare the totalized value with a measurement on a static scale.

If necessary, adjust the calibration parameter in the electronics.

Refer to the manual of the electronics installed.

3.0 Maintenance

Regular maintenance is essential to prevent predictable errors or unnecessary out of orders. The supplier does not accept any responsibility for the consequences of maintenance that was not performed according to the recommendations in this section.

3.1 Maintenance

WARNING: It is important to guarantee the safety of personnel during maintenance work and to assure no accidents will happen. Before any work on electrical systems is started, be sure to remove the main power supply.

The conveyor must be shut off before any work on the conveyor is started. Any goods on the conveyor must be removed first. No unauthorized persons are allowed in the conveyors working area.

3.1.1 Periodical Maintenance

To keep the belt scale in an optimum condition, it is important to do periodical maintenance.

- Check to ensure there is not a build up of debris on the belt.
- Inspect the weigh frame for damaged areas and repair immediately to prevent rusting. The method of application and the specifications of the painting may be customer specific and therefore have to be requested.
- Regularly perform an Auto Zero and a weight check with certified test weights to determine if the belt scale weighs correctly. For this procedure, refer to the manual of the electronics installed.

3.2 List Parameters for Belt Scale

Complete the information below. Remove this page and store in a secure location.

CUSTOM _____

ORDER NUMBER _____

INSTALLATION _____

REFERENCE _____

TYPE WEIGH FRAME _____

TYPE SPEED PICKUP _____

TYPE ELECTRONICS _____

_____

DATE _____

FILLED IN BY _____

Parameter	Unit	Entered	Change
Nominal capacity (flow)	kg/hr		
Maximum capacity (flow)	kg/hr		
Minimum capacity (flow)	kg/hr		
Ratio weigh frame			
Number of load cells			
Load cell capacity (per load cell)	kg		
Load cell sensitivity	mV/V		
Roller distance	mm		
Inclination angle belt conveyor	°		
Belt speed	m/s		
Speed pickup:			
Pulses per turn			
Diameter drum or running roller	mm		
Beltlength per belt turn	m		

4.0 Appendix

4.1 Installation and Wiring

Weigh Frame Drawings

WBF-S0000
BS211-M0200

Junction Box Drawings

JBB-M0200
JBL-ATEX -M0200

Speed Pickup Drawings

SPU260-M0200

Wiring Diagrams

BS211-E0299

4.2 Declarations

CE-Declaration

Model	BS211
Serial number	0

ATEX-Declaration

Zone	21	22
Category	II2D IP65 T70°C	II3D IP65 T70°C
Temperature	T_A= -10°C / + 40°C	

4.3 Total Load Cell Build Conversion

The 211 Belt Scale has a lever ratio which must be applied to the total load cell build for proper calibration.

Formula: L / E = Lever Ratio

E = effort distance from center fulcrum

L = load distance from center fulcrum

Example: 23.62 / 31.50 = 0.75 x 100 = 75%

This reconciles expected mV signal at the integrator with actual mV signal experienced at the effort point of the lever.

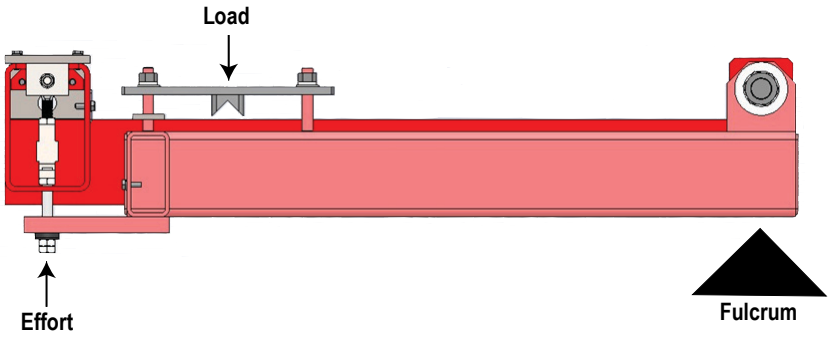

Figure 4-1. Belt Scale Lever Ratio

4.4 Specifications

Standard

Material	Weigh Frame	Steel St.37 or Stainless Steel SS304 / 316
	Rollers	Aluminum, Steel St.37 or SS304 / 316
Weight	Dependent on the belt width	
Load Cells	1 or 2 piece model B3G-9363 (SS/IP66/67)	
	Capacity 50 to 2500 kg (each)	
	Power supply 5-15 VDC (stabilized from electronics)	
	Signal nominal 2 mV/V at 100% load	
Junction Box	Model JBB (PC / IP65)	
Speed Pick-up	Standard model SPU5020	(Alu / IP66)
	Optional model SPU5826	(SS / IP66)
	Optional model SPU2160N	(Alu / IP64)

ATEX cat. II2D or II3D

Load Cells	1 or 2 piece model BM11-SHB (SS / IP66/68 / ATEX II2D T70°C)	
	Capacity 50 to 200 kg (each)	
	or	
	1 or 2 piece model BM8H-ACB (SS/IP66/68/ATEX II2d T70°C)	
	Capacity 500 to 2000 kg (each)	
Junction box	Model JBL-ATEX (ABS / IP65 / ATEX II2D IP6X T80°C)	
Speed Pick-up	Std. model SPU5020	(Alu / IP66 / ATEX II3D IP6X T=120°C)
	Opt. model SPU5826	(SS / IP66 / ATEX II3D IP6X T=120°C)
	Opt. model SPU7030HSR	(SS / IP66 / ATEX II2D T70°C)

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