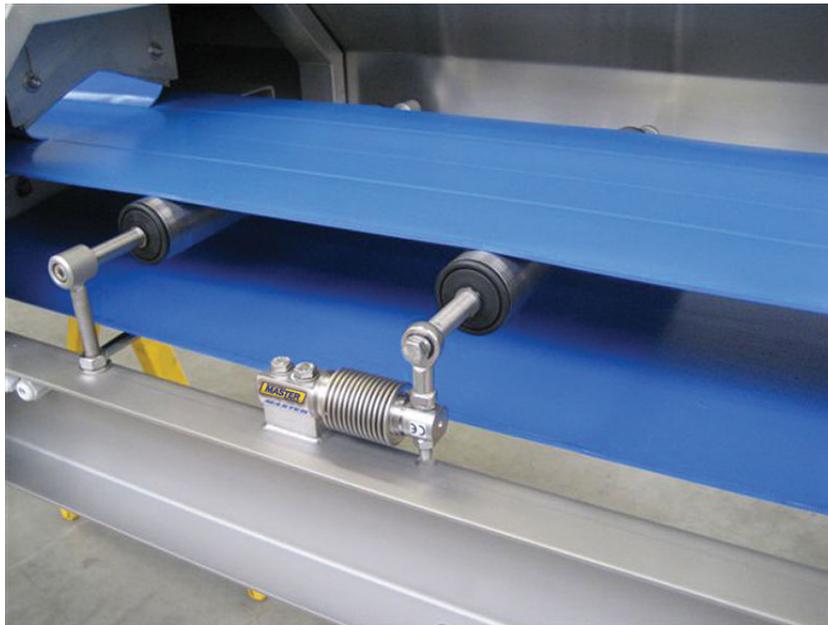


# MASTER<sup>TM</sup> 421

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*Belt Scale Weigh Frame*

## Installation Manual



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# Revision History

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

Revision	Date	Description
B	June 23, 2025	Established revision history; updated Selection Criteria

*Table i. Revision Letter History*



Technical training seminars are available through Rice Lake Weighing Systems. Course descriptions and dates can be viewed at [www.ricelake.com/training](http://www.ricelake.com/training) or obtained by calling 715-234-9171 and asking for the training department.

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# 1.0 Introduction

Belt scales measure 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 sensor/pickup and the integrator electronics.

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



Manuals are available from Rice Lake Weighing Systems at [www.ricelake.com/manuals](http://www.ricelake.com/manuals)

Warranty information is available at [www.ricelake.com/warranties](http://www.ricelake.com/warranties)

## 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.

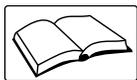


**CAUTION:** Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury.



**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 than weight taking.**

**Do not place fingers into slots or possible pinch points.**

**Do not use any load bearing component that is worn beyond 5 percent 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.**

## 1.1 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.

## 1.2 Overview

The *MASTER Series 421 Belt Scale* is designed for applications with flat belts, where the belt-load is low.

The dimensions are extracted from the construction of the existing, or to-be built, belt conveyor.

### Theory of Operation

The material is carried by the belt and underlying rollers or idler stations. One or more of these idlers are mounted on the weigh frame and are used to weigh the material going across the belt. The material carried on the belt is weighed and the belt speed is measured. Both values (belt load and belt speed) are calculated in an integration function. The integrator totals and calculates the mass flow. These values are displayed and transmitted through outputs or other forms of communication to a control system or network.

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

## 1.3 Selection Criteria

Load cell capacity is calculated based on the maximum belt load plus the dead load of the weigh 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 = (20,000 lb per minute / 400 ft per minute) x 4 ft spacing*

*Net load = (50 lb per ft) x 4 ft spacing*

*Net load = 200 lb*

*Gross load = 200 lb + (175 lb idler + 48 lb belt + 24 lb hardware)*

*Gross load = 447 lb*



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

### 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*



**NOTE: A minimum of 250 kg load cells should be used in this example.**

## 1.4 Calibration and Test Weight Device

Mounting points can be provided to apply static test weights. Test weights are used to test repeatability and the state of the belt scale after initial calibration.

To determine absolute accuracy, it is necessary to do a test with material. For this procedure, 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, 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.*



### **IMPORTANT:**

- \* *The load cell is very sensitive to damage by welding. The welding ground clamp must be attached to the same side of the weigh frame where welding. When in doubt, remove the load cell(s).*
- \* *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 good quality and a single splice. A vulcanized splice will provide the best accuracy. The weight per foot (meter) should be consistent 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 supported 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.*
- \* *String alignment should be used on all idlers in the scale system. If following the rule of three before and three after, seven idlers (including the weigh idler) should be checked during the alignment process.*
- \* *Rollers should not have a concentricity exceeding +/- 0.012 in (0.3 mm).*
- \* *The speed sensor should be mounted on a non-driven roller or drum.*
- \* *The inclination angle of the belt conveyor must not exceed 12%.*
- \* *Proper covers may be required to prevent air flow from interfering with the belt scale.*
- \* *Side guards and belt skirting should not be in contact with the weighing area of the belt scale.*

## 2.1 Mechanical Installation

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

### 2.1.1 Weigh Frame Installation

Use the following instructions to install the *MASTER Series 421 Belt Scale*.

1. Determine the location for the belt scale. For the 421, this location should be at least one idler after the load point of the conveyor and at least five idlers before the head pulley. More would be better, but that may not be possible on short conveyors.

2. While holding the weigh frame against the conveyor, align the axle with the arm of the idler and mark drill holes on the conveyor.

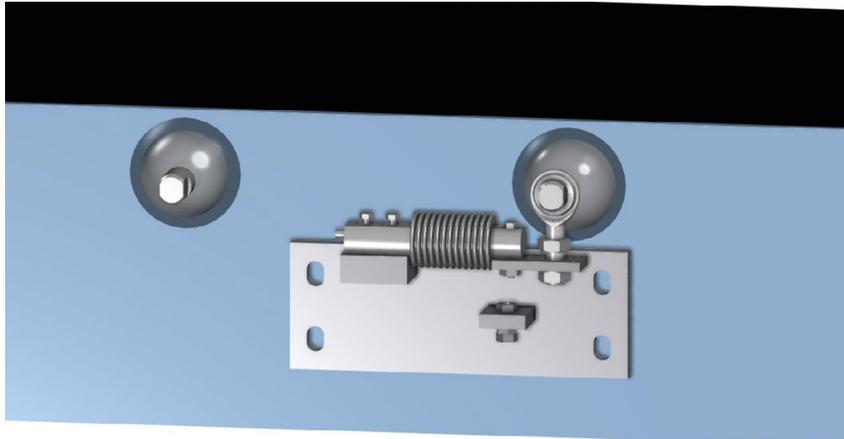


Figure 2-1. Align Rod with Idler

3. Remove the weigh frame.
4. Drill the appropriate holes in the conveyor.

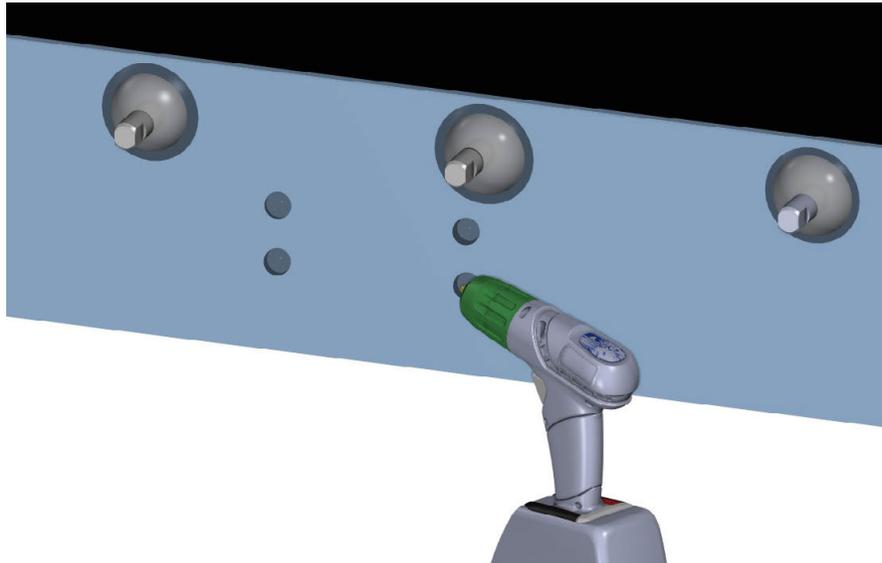


Figure 2-2. Drill Holes

5. Align the weigh frame with the holes in the conveyor and secure to the conveyor using the appropriate hardware.

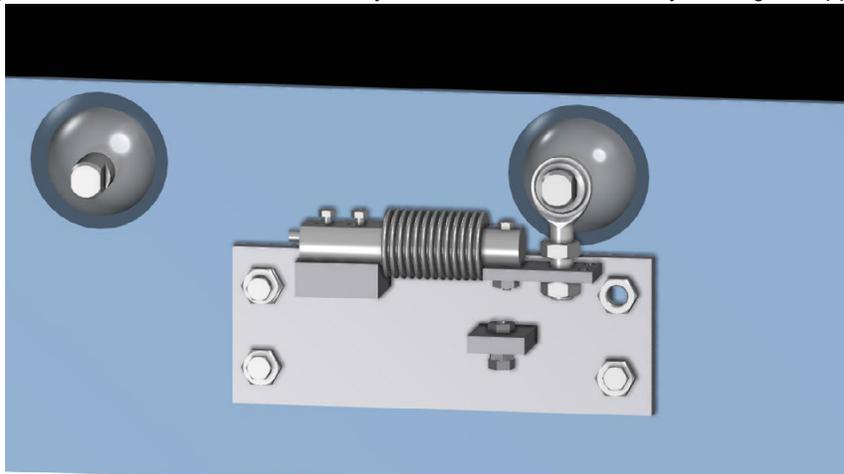


Figure 2-3. Secure the Weigh Frame

**!** **IMPORTANT:** Ensure that the axle is secured tightly on only one side of the idler, leaving the other side loose.

- Repeat weigh frame installation (steps 1-7) on the opposite side of the conveyor.

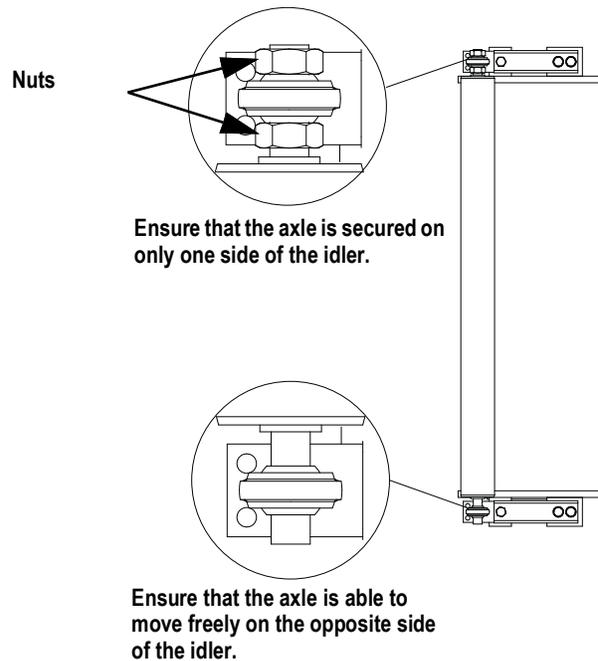


Figure 2-4. Secure Axle on Only One Side of Idler

### 2.1.2 Side Bracket Installation

Use the following instructions to install the side brackets on the leading and trailing idlers.

- While holding the side bracket against the conveyor, align the axle with the arm of the leading idler and mark out drill holes.

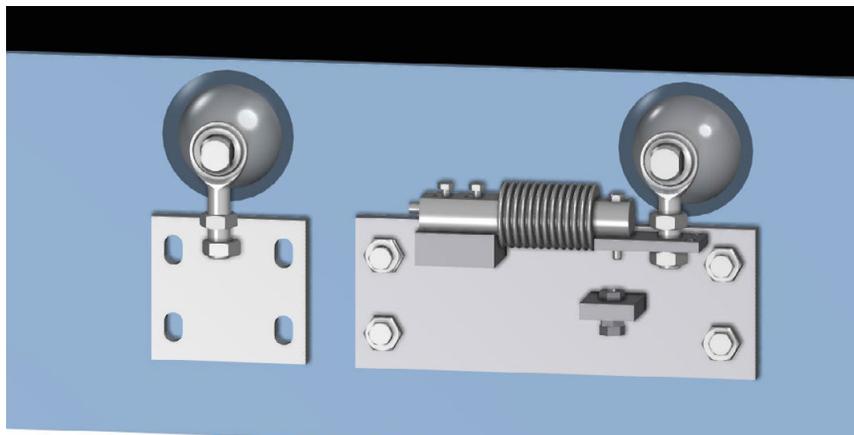


Figure 2-5. Align Axle with Idler

- Remove the side bracket.

3. Drill the appropriate holes in the conveyor.

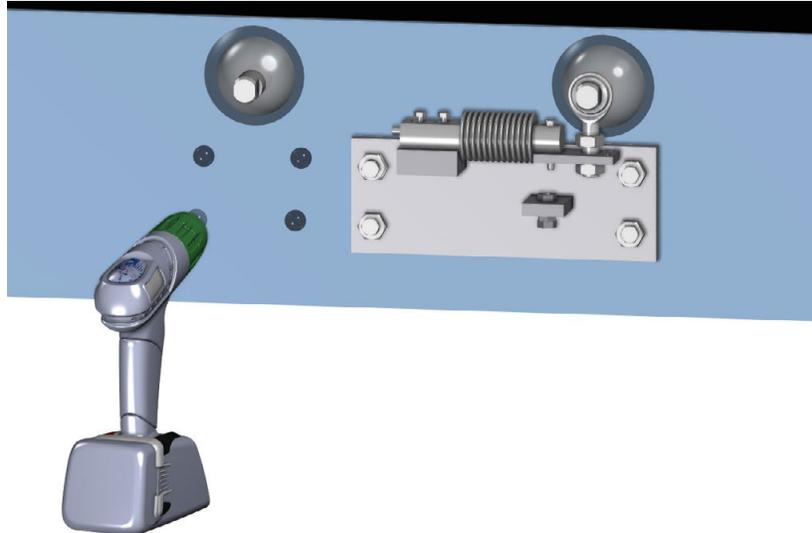


Figure 2-6. Drill Holes

4. Align the side bracket with the holes in the conveyor.
5. Secure the side bracket with the appropriate hardware and secure the axle tightly on the idler.

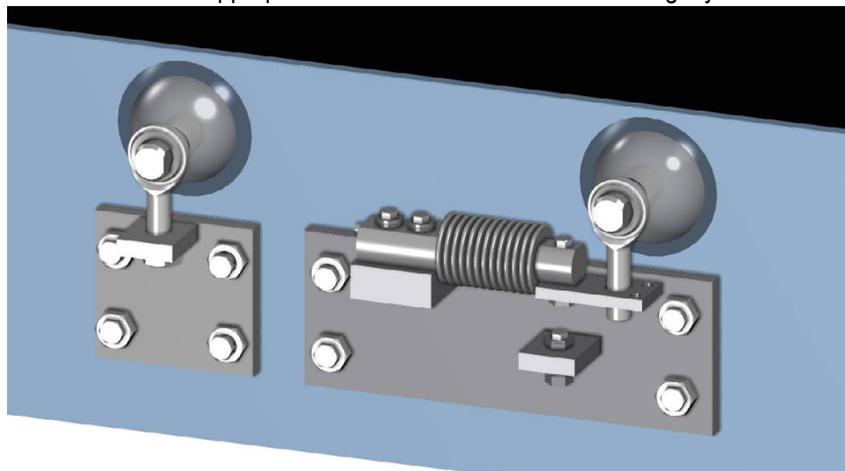


Figure 2-7. Secure Side Bracket

6. Repeat side bracket installation on the trailing idler and ensure that the center line of the axles are all aligned.

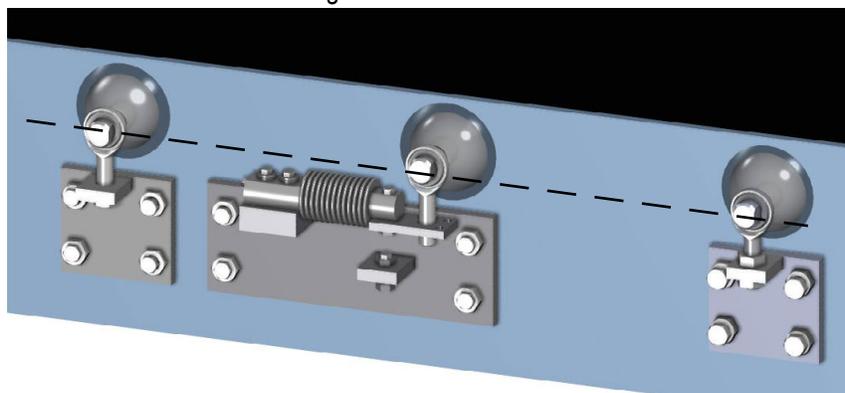


Figure 2-8. Install Side Bracket on Trailing Idler



**NOTE:** Ensure the center line of the axles are aligned.

Repeat the side bracket installation on the opposite side of the leading and trailing idlers, ensuring that they are parallel with the first side.

## 2.2 Electrical Installation

The wiring and connections between the weigh frame, speed pickup and the electronics are shown in the applicable scheme. See [Section 3.2 on page 13](#).

The load cell is provided with a fixed cable; do not alter the length. If necessary, use an additional junction box with screw terminals to extend the cable length.

### Cable Types

Load cell:

If the length is more than 197 ft (60 m), use shielded 6 wire cable 20 AWG gauge (0.5 mm<sup>2</sup>).

Speed pickup:

Use shielded 3 wire cable 20 AWG gauge (0.5 mm<sup>2</sup>).

Cable shielding:

Cable shielding must be connected to one side only. If connected to the instrument side, then it is preferred to use the same ground as the power supply.

## 2.3 Commissioning

Commissioning should be performed by service engineers who are trained and experienced with the subject.

### 2.3.1 Mechanical Adjustments

Mechanical adjustments must be made to ensure the scale is free of any tension. If necessary, the load cell can be adjusted.

## 3.0 Maintenance

---

Regular maintenance is essential to prevent errors or unnecessary down time. The supplier does not accept any responsibility for the consequences of not performing the maintenance recommended in this section.

### 3.1 Maintenance



**WARNING:** 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 conveyor's working area.*

#### 3.1.1 Periodical Maintenance

To keep the belt scale in optimal condition, it is important to perform periodical maintenance.

- Ensure there is not a build up of debris on the belt.
- Inspect the weigh frame for damaged areas and repair as necessary.
- 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 Dimensional Drawings

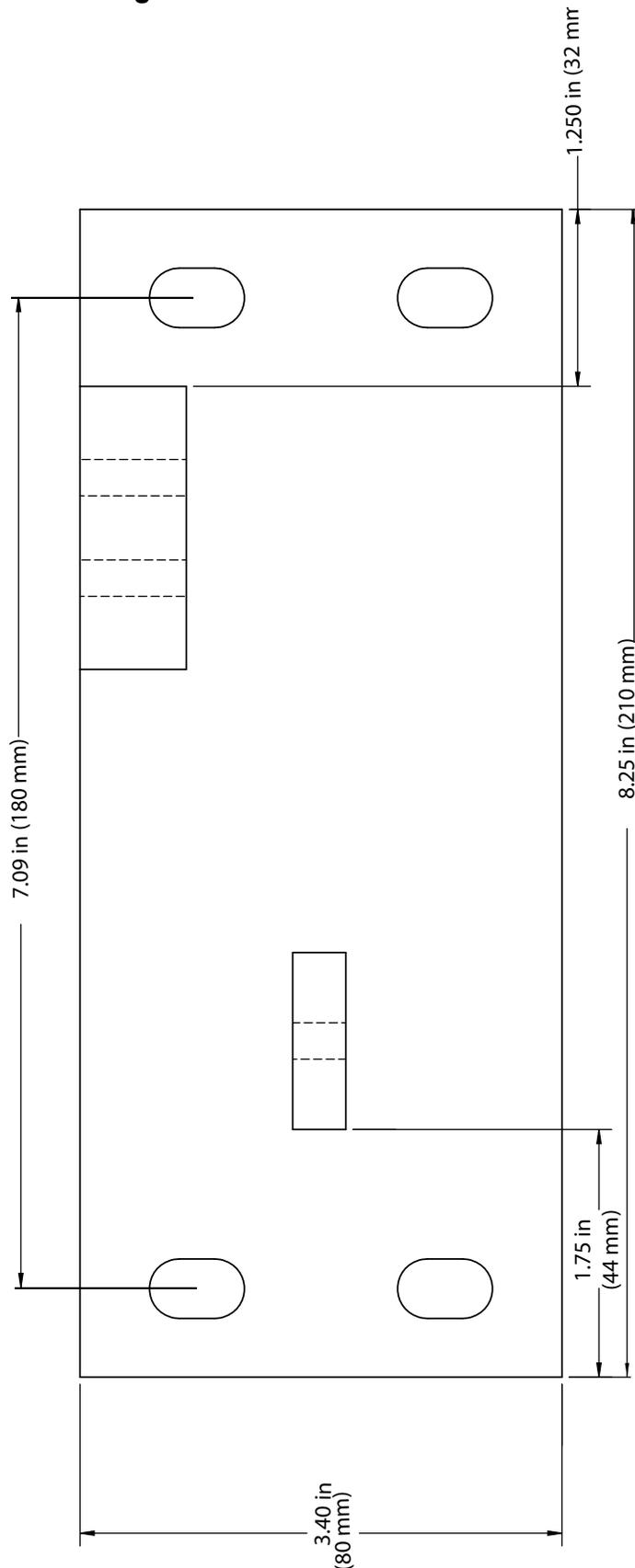
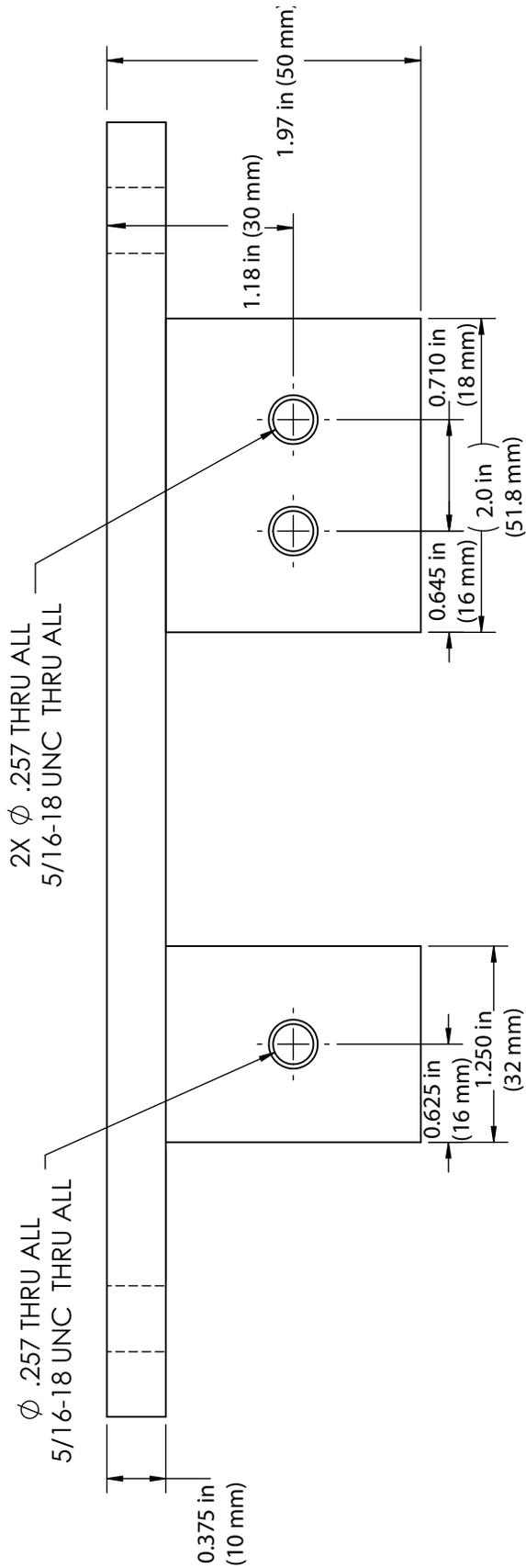


Figure 3-1. Weigh Frame Dimensions



NOTE: ASSEMBLIES ARE MIRRORS.

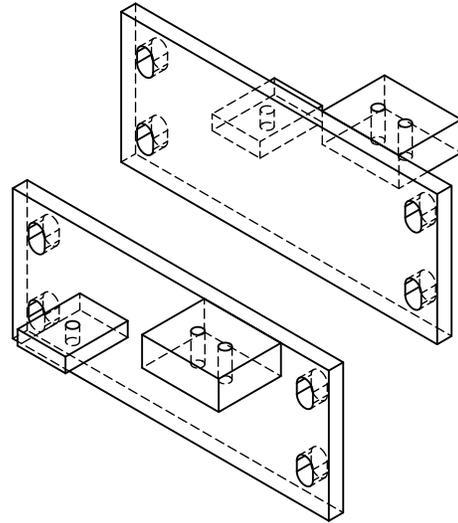


Figure 3-2. Weigh Frame Dimensions (Continued)

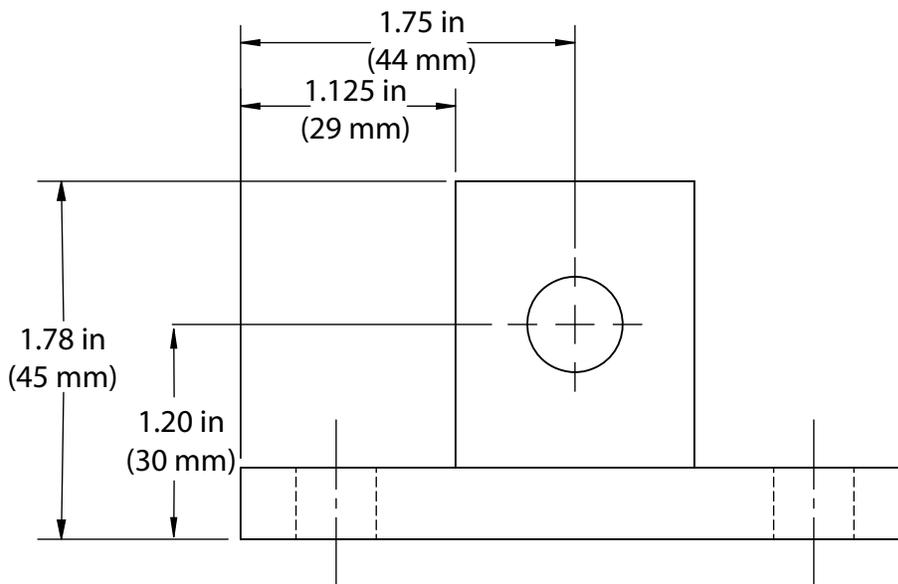
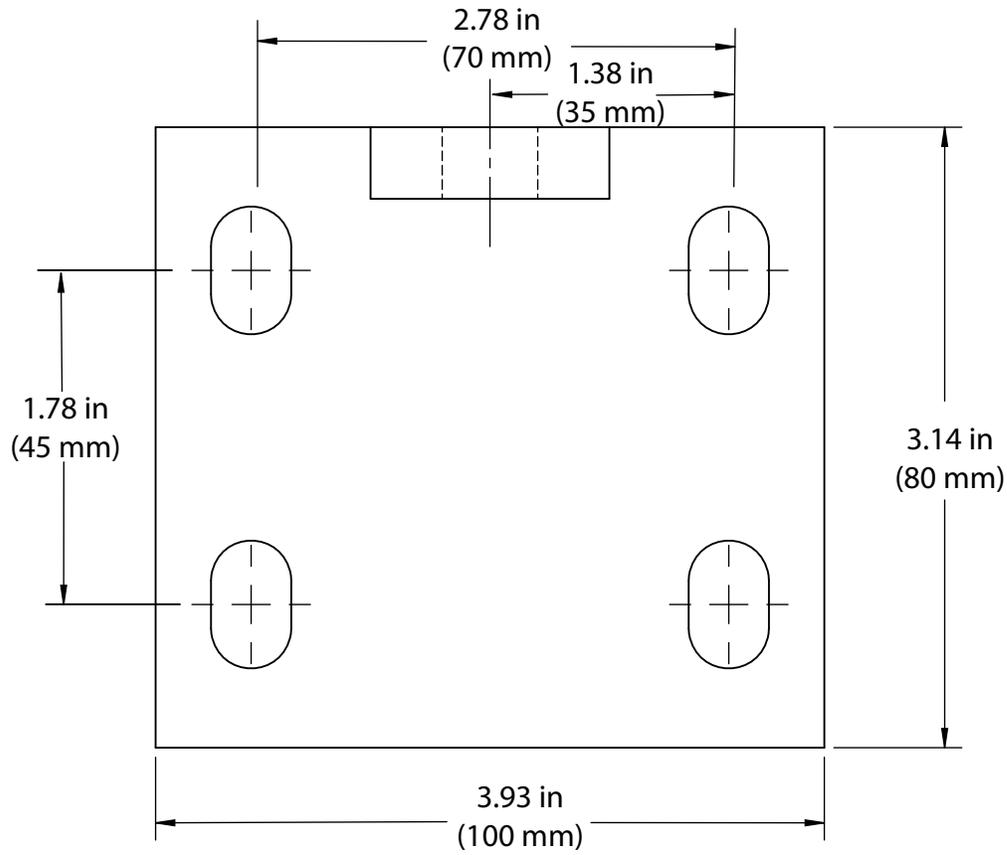


Figure 3-3. Side Bracket Dimensions

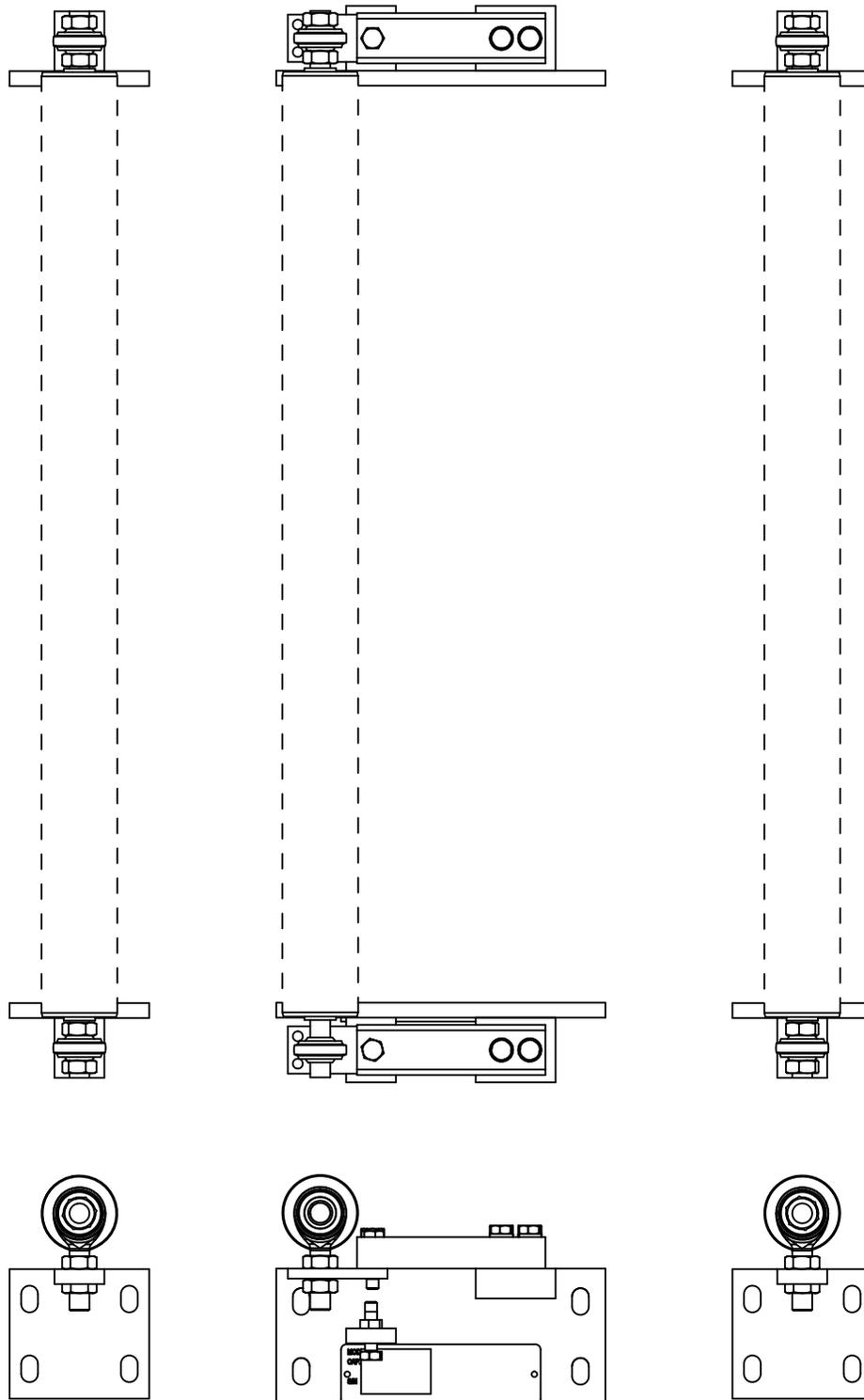


Figure 3-4. MASTER Series 421 Belt Scale Layout

### 3.3 List Parameters for Belt Scale

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

CUSTOMER	_____
ORDER NUMBER	_____
INSTALLATION	_____
REFERENCE	_____
TYPE WEIGH FRAME	_____
TYPE SPEED PICKUP	_____
TYPE ELECTRONICS	_____
DATE	_____
FILLED IN BY	_____

Parameter	Unit	Entered	Change
Nominal capacity (flow)	lb/hr (kg/hr)	_____	_____
Maximum capacity (flow)	lb/hr (kg/hr)	_____	_____
Minimum capacity (flow)	lb/hr (kg/hr)	_____	_____
Ratio weigh frame		_____	_____
Number of load cells		_____	_____
Load cell capacity (per load cell)	lb (kg)	_____	_____
Load cell sensitivity	mV/V	_____	_____
Idler spacing	in (mm)	_____	_____
Belt angle of incline	°	_____	_____
Belt speed	ft/s (m/s)	_____	_____
Speed pickup:		_____	_____
Pulses per revolution		_____	_____
Non-driven drum	in (mm)	_____	_____
Total belt length	ft (m)	_____	_____

## 4.0 Appendix

### 4.1 Specifications

#### Standard

Weigh Frame Material	Powder coated mild steel or Stainless Steel SS304 / 316
Weight	Approximately 15 lb (7.5 kg) not including the idler
Load Cells	2 single ended beam (stainless steel, IP66/IP68) Capacity 5 — 50 kg (each) Power supply 5-15 VDC (stabilized from electronics) Signal nominal 2 mV/V at 100% load

### 4.2 Total Load Cell Build Conversion

The *Master Series 421 Belt Scale* uses two load cells which must be summed for the total load cell build for proper calibration. There are two load cells in each weigh frame system. See [Table 4-1](#).

Individual Load Cell Capacity	Imperial	Metric
5 kg x 2	22 lb	10 kg
10 kg x 2	44 lb	20 kg
20 kg x 2	88 lb	40 kg
50 kg x 2	220 lb	100 kg

Table 4-1. Total Load Cell Build Conversion





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