BCi

In-Motion Belt Scale System
Version 1.0

Installation & Operation Manual

RICE LAKE WEIGHING SYSTEMS
To be the best by every measure®

ISO 9001 REGISTERED

94805

Contents

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

Version 1.0 February 2010

About This Manual

This manual is intended for use by service technicians responsible for installing and servicing the BCi In-Motion Belt Scale System Operation Manual.

Authorized distributors and their employees can view or download this manual from the Rice Lake Weighing Systems distributor site at **www.rlws.com**.

Warning Some procedures described in this manual require work in and around working parts of the belt scale. These procedures are to be performed by qualified service personnel only.

1.0 Introduction and Overview

A belt conveyor scale is a device that continuously measures bulk material as it moves along a conveyor. The system requires two general parameters to operate:

- It needs to know the weight of the material being moved along the conveyor belt
- It needs to know the speed at which it's moving along the conveyor belt.

The weight of the material on the belt is determined by weighing a section of conveyor belt loaded with material and then subtracting the average weight of the unloaded belt. The speed at which the material is moving is determined by measuring the speed of an idler or wheel in contact with the conveyor belt. The weight and speed is combined to give a running total and a rate of flow of the material. The correct operation of the scale system requires the components to be installed correctly, periodically calibrated, and properly maintained.

Typical applications where a belt conveyor scale can be used are:

- Mining
- Quarries
- Bulk Material Blending
- Truck/Barge/Rail Loading
- Process Control Applications

A belt conveyor scale is also able to compute the total mass of the material that is conveyed over a given period of time and while it is in motion.

1.1 Belt Conveyor Scale System Components

The main components of a basic belt conveyor scale include:

- Scale carriage
- Load cells
- Belt travel pickup speed sensor (not shown)
- Electronic integrator

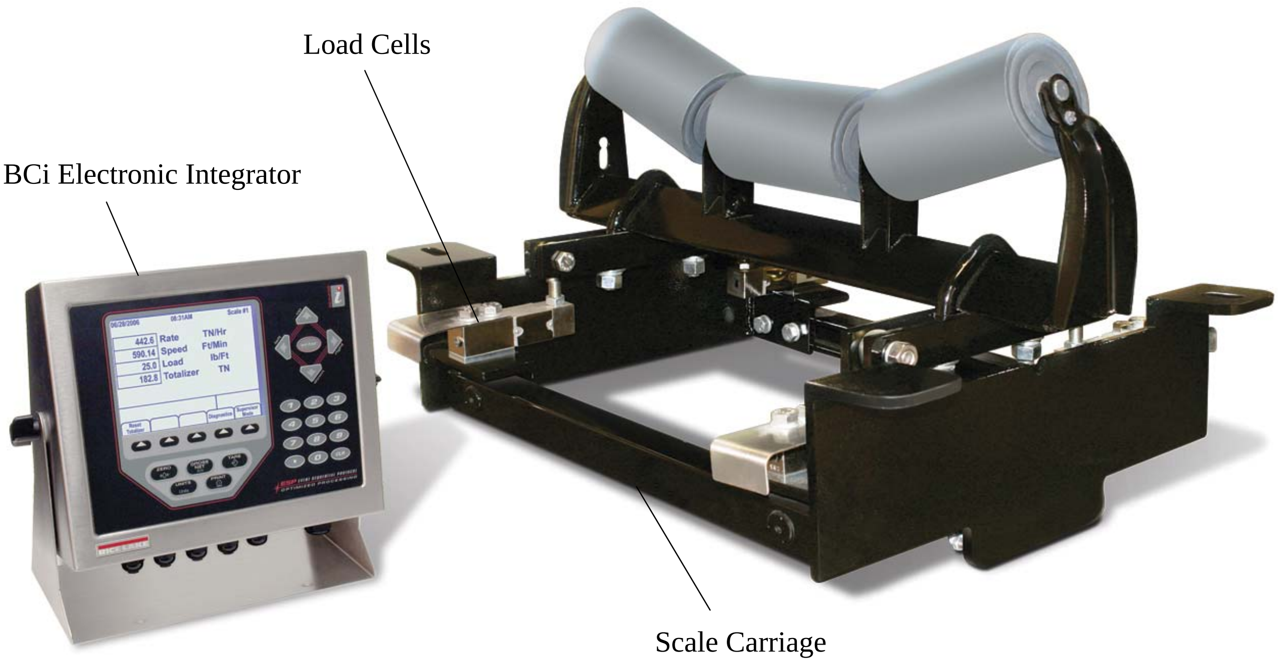

Figure 1-1. Component Parts of the BCi Belt Conveyor Scale System

1.1.1 Scale Carriage

The scale carriage is mounted to a conveyor structure and transmits the forces resulting from the belt load and directs those forces to the load sensor(s). The following picture and table illustrate the component parts shipped with the scale carriage.

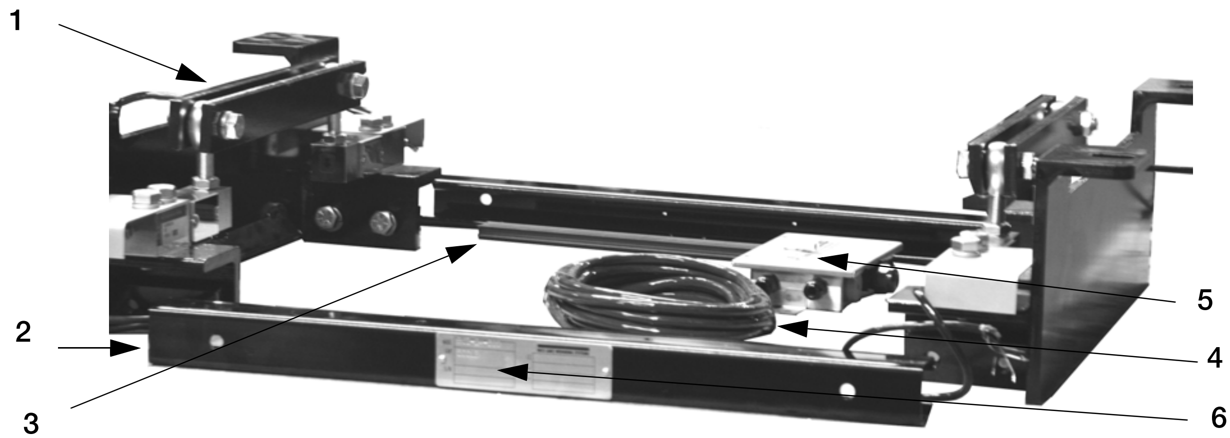

Figure 1-2. Scale Carriage Components

	RLWS Part Number	Description (Qty.)
1	- - - - -	End Plate Assembly (2)
2	- - - - -	Uni-Strut Middle Bars (2)
3	- - - - -	Uni-Strut Closure Strips (2)
4	38557	Home Run Cable (1)
5	88956	Junction Box w/ Grounding Lug (1)
6	16863	Metal Serial Tag (1)
		Nuts (2)
		Bolts (2)
		Lock Washers (2)
	97416	Shim Kit

Table 1-1. Scale Carriage Component Part Numbers

1.1.2 Load Cells

There are four strain gauge load cells located on the corners of the weigh idler. These sensors support the weight of the conveyor belt and the material moving along on the belt. The weight signals from the load cells are combined and processed by the integrator.

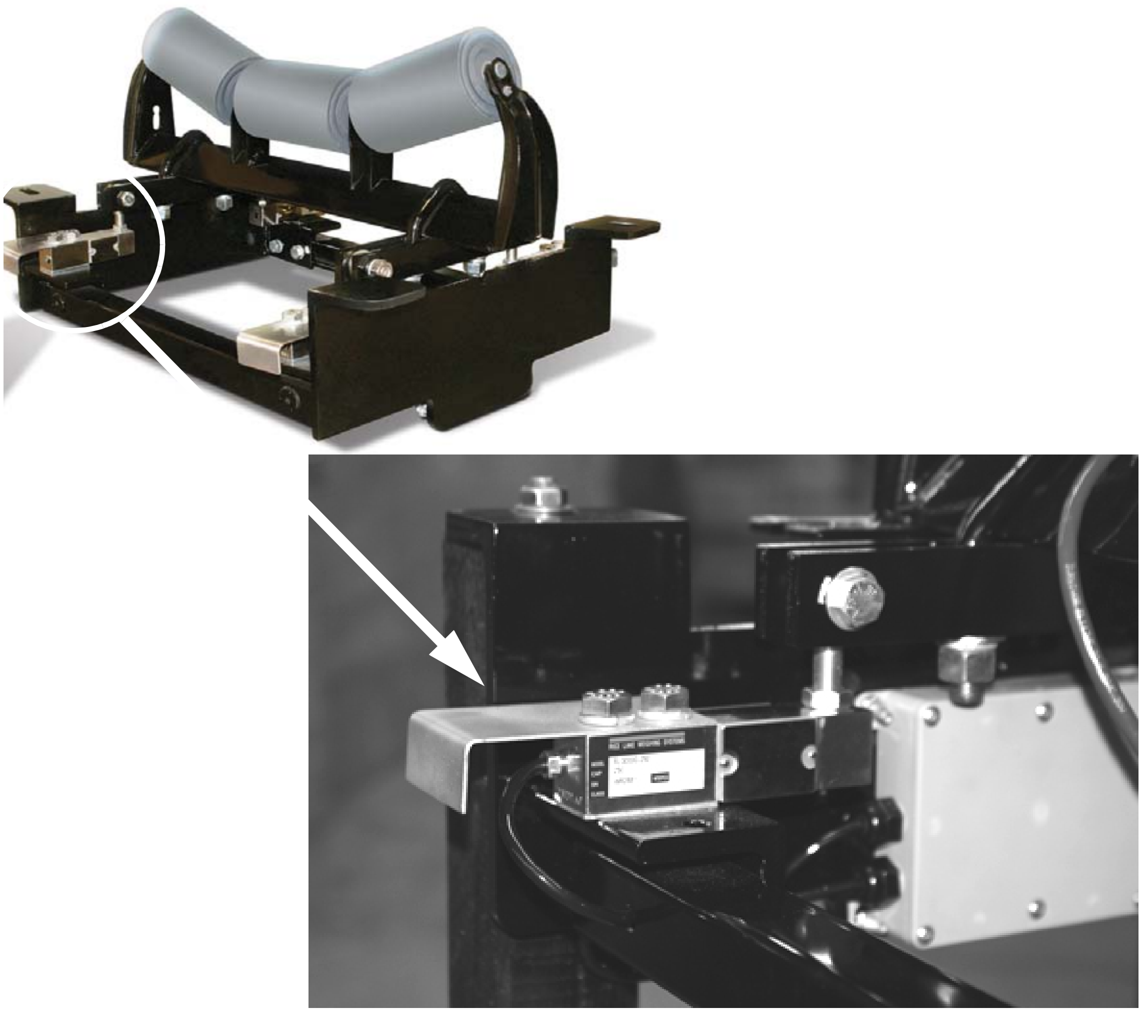

Figure 1-3. Load Cell Location on Scale Carriage

1.1.3 Belt Travel Speed Wheel - Optional

The belt travel speed wheel is located near the weigh frame. Positive contact must be maintained between the roll and the belt for proper operation. The speed sensor should never come in contact with material that is being conveyed along the belt nor the belt itself. The signal generated by the speed wheel is converted by the integrator into a value that represents belt travel distance. Various devices used for sensing belt travel include AC and DC generators, mechanical belt or chain drives, photo-optical segmented disks, and electromagnetic pulse generators. Installation procedures for the speed wheel are explained in detail in Section 2.5 on page 22. Figure 1-4 illustrates the major component parts of the speed wheel.

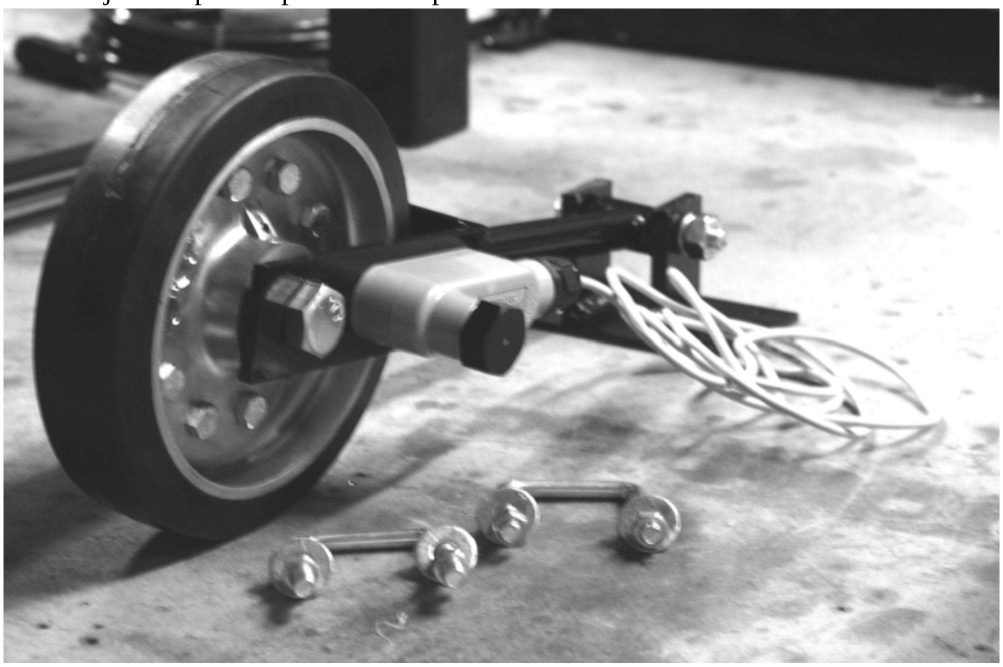

Figure 1-4. Speed Wheel

RLWS Part Number	Description (Qty)
94969	Complete Speed Wheel Assembly (1)
96543	Speed Wheel (1) (wheel only)
94979	Speed Proximity Sensor (1)
94970	Speed Wheel Bracket Assembly (1) (wheel not included)
	Cabling to integrator (1)
94980	U-Bolts (2)
21161	Splice Box (1)
98501	Expansion Cable - 20’
100038	Magnetic Shaft Encoder

Table 1-2. Speed Wheel Assembly Component Part Numbers

1.1.4 Magnetic Shaft Encoder - Optional

Another option besides the belt travel speed wheel is a magnetic shaft encoder which can also be used to determine belt travel distance like the speed wheel. The magnetic shaft encoder should never come in contact with material that is being conveyed along the belt nor the belt itself. The signal generated by the encoder is converted by the integrator into a value that represents belt travel distance.

1.1.5 Electronic Integrator

Outputs from the belt travel speed sensor and from the load cell carriage are combined in the integrator to produce a running total of material passed over the belt conveyor scale. Using the BCi HMI as a calibrated electronic integrator allows signals to be converted into values that represent the weight and speed of the material that is traveling on the conveyor.

1.2 Operation

The BCi front panel, shown in Figure 1-5 consists of a 27-button keypad with a large backlit LCD display. The keys are grouped as five configurable softkeys, five primary scale functions keys, four navigational keys, and numeric entry keys. It should be noted that the scale parameters and calibration values cannot be changed without first pressing the **TARE** key and unlocking the parameters. After pressing the **TARE** key, press **enter** to unlock the settings. Pressing **ZERO** when the display is on the main menu will clear the *Reset Total*.

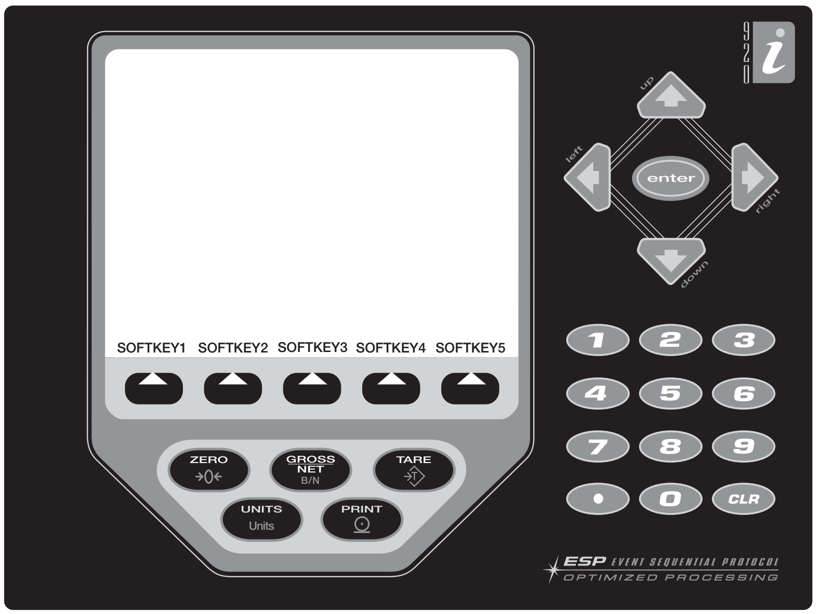

Figure 1-5. BCi Front Panel

The following sections describe the front panel key operation of the belt scale integrator.

1.2.1 Zero

This parameter will zero the conveyor belt scale integrator if the load is within the zero range.

1.2.2 Print

This will print the custom ticket if the print port is configured.

1.2.3 Reset Totalizer

Often during this operation of a belt scale, the totalizer will need to be reset. This is known as the reset totalizer. Press the **Reset Totalizer** softkey to access this parameter. The integrator will prompt the user, "*Clear Totalizer*?" The operator will press **Yes** to clear the totalizer, or **No** to leave the accumulated weight in the totalizer.

1.2.4 Diagnostics

This softkey displays the current mV input, PPS (pulses per second from the speed sensor), current analog output (if installed), current A/D counts, and the master total. This is just informational data that the operator or a technician can use from troubleshooting purposes.

1.2.5 Supervisor Mode

Use this softkey to enter the Supervisor Mode. If there is no passcode configured the BCi will enter into the Setup Mode. If a passcode is configured, the operator will need to enter the passcode before the BCi will switch to the Supervisor Mode. To configure a passcode, see Section 4.1

1.3 Application Brief

There are four factors used to determine a suitable belt scale application on a given conveyor.

- Load cell size
- Belt speed
- Idler spacing
- Belt splicing

1.3.1 Load Cell Size

The capacity of the belt scale is rated on the maximum continuous load that can be carried across the weigh idler. The capacity of the conveyor should be known prior to determining the components of the scale system. The load cells should be sized to operate across a loading range with a marginal safety factor. The minimum net loading should be greater than 10% of the rated capacity and the maximum loading should be less than 65%. The load applied to the loadcell can be calculated with the following formula:

```
Net load = (conveyor capacity / belt speed) x idler spacing
Gross load = net load + (idler weight + belt weight + mounting hardware)
```

Examples:

```
Net load = (50,000 lbs per minute / 400 feet per minute) x 4 foot spacing
Net load = (125 lbs per foot) x 4 foot spacing
```

Net Load = 500 lbs.

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

Gross Load = 747 lbs.

Net Load > 10% of total load cell capacity

(4) x 500 lb load cells x 10% = 200 lbs	500 lbs > 200 lbs (500 lb load cells are okay)
(4) x 1000 lb load cells x 10% = 400 lbs	500 lbs > 400 lbs (500 lb load cells are okay)
(4) x 2000 lb load cells x 10% = 800 lbs	500 lbs > 800 lbs (2000 lb load cells are too large)

Gross Load < 65% of total load cell capacity

(4) x 250 lb load cells x 65% = 650 lbs	747 lbs > 650 lbs (250 lb load cells are too small)
(4) x 500 lb load cells x 65% = 1300 lbs	747 lbs < 1300 lbs (500 lb load cells are okay)
(4) x 1000 lb load cells x 65% = 2600 lbs	747 lbs < 2600 lbs (1000 lb load cells are okay)

The example listed would require 500 lb or 1000 lb load cells.

1.3.2 Belt Speed

The belt speed is defined as the maximum velocity of the unloaded conveyor belt. The belt speed can be variable, but for sizing requirements the maximum speed is required.

1.3.3 Idler Spacing

The spacing between idlers should conform to the recommendations of the idler manufacturer and the Conveyor Equipment Manufacturer's Association specifications. A general rule of thumb is the idler supports the belt half the distance from the previous idler to half the distance to the following idler as shown in the example below.

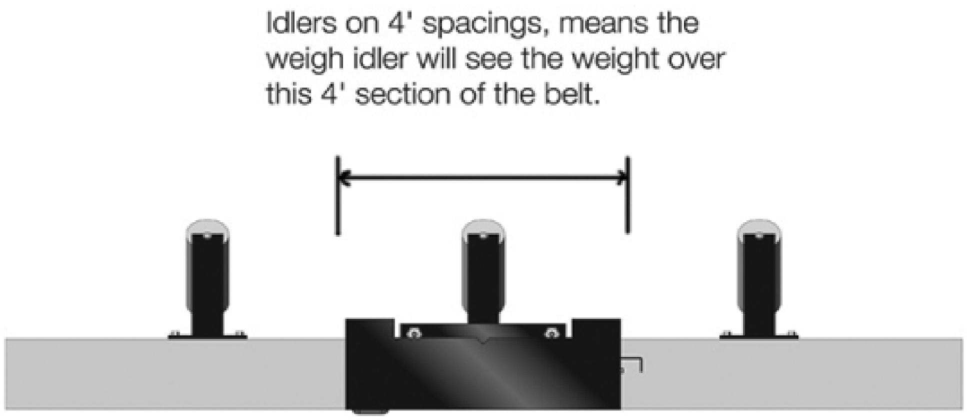

Figure 1-6. Idler Spacing Example

The number of weigh idlers required to accurately weigh the material being conveyed is determined by the velocity of the conveyor belt. The scale born time of the material should be greater than 400 mSec. If the belt speed multiplied by the idler spacing is less than 400 mSec, the idler spacing must be increased or multiple weigh idlers must be used. Scale born time can be calculated with the following formula:

```
Scale Time = (Idler Spacing / Belt Speed)
```

Example: *Scale Time = (4 feet / 8.33 fps) = 480 mSec*

1.3.4 Belt Splicing

Belt splices also have a contributing factor in limiting the belt scale's capacity. Mechanical belt splices can shock load and damage load cells on high speed conveyors. Vulcanized splices are preferred for proper scale operation.

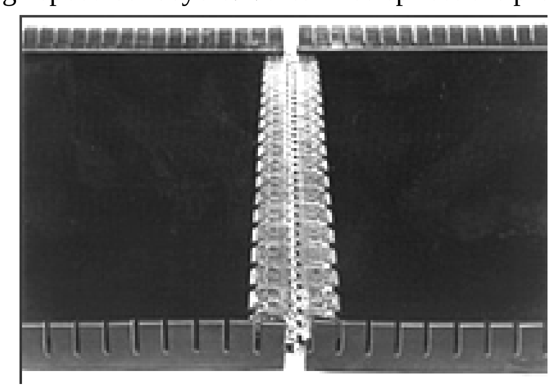

Figure 1-7. Mechanical Belt Splicing Example

1.4 Selecting a Mounting Location

It is very important to select the right mounting location for the scale carriage along the conveyor structure and the location of the speed sensor. There are several factors that must be taken into consideration when selecting a mounting location. Those factors will determine the overall long-term and short-term accuracy you might expect. Those factors include the following:

- Tension
- Uniform Belt Loading
- Single Load Point on Belt
- Material Slippage
- Convex Curves
- Concave Curves
- Trippers
- Speed Sensor Mounting Location
- Electronic Wiring Location
- Speed Wheel
- Troughing Angle

1.4.1 Tension

The transfer of weight along the conveyor belt can be greatly affected by belt tension. By locating the scale carriage in an area of the conveyor with the **least amount of tension,** the scale will be more accurate and achieve better performance. An ideal location to mount the scale carriage is near a tail section of the conveyor, but far enough forward so as not to be influenced by infeed skirts boards, etc. Figure 1-8 illustrates the proper belt tension.

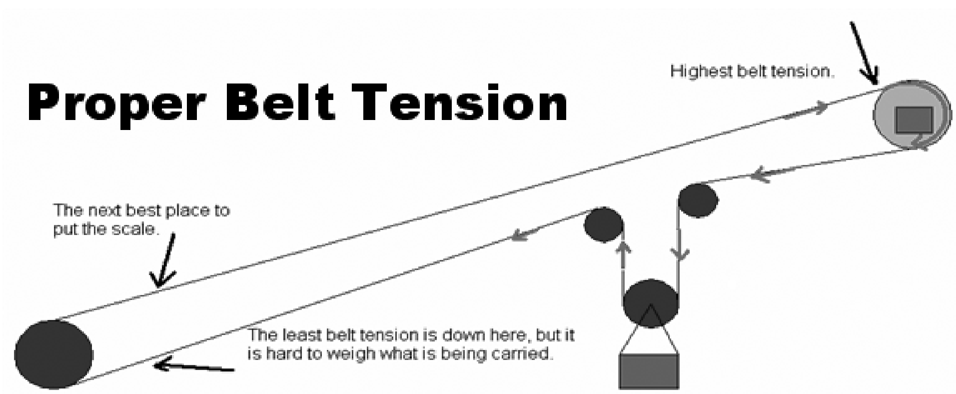

Figure 1-8. Proper Belt Tension Example

1.4.2 Uniform Belt Loading

It is desirable that the belt loading be as uniform as possible to prevent unequal shifts in material. To minimize surges or feed variations, hoppers should be equipped with depth limiting gates or other flow control devices such as a feeder.

1.4.3 Single Load Point on Belt

On high accuracy installations, the conveyor should be loaded at one and the same point. This assures constant belt tension at the scale during all loading conditions.

1.4.4 Material Slippage

The belt scale system processes belt loading and belt travel to arrive at an accurate weight. Product speed must be equal to the belt speed at the scale. So the conveyor speed and slope should not exceed that at which material slippage occurs. This is typically less than a 20% pitch for most materials.

1.4.5 Convex Curves

Conveyors that have convex curves should be avoided or the scale should be located in a section of the conveyor that is not affected by the curve.

Convex curves are permissible at a distance of 20 feet or a minimum of five idler spaces beyond the scale area idlers.

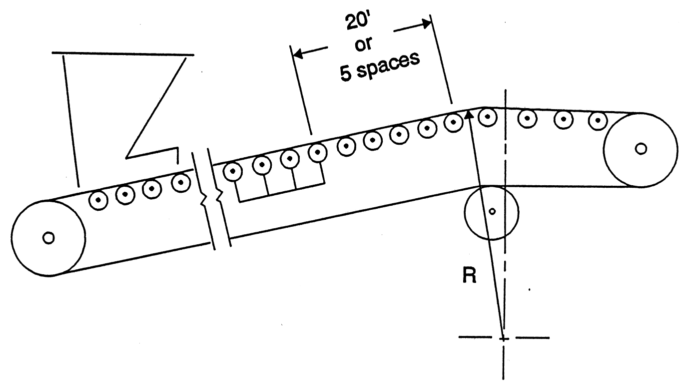

Figure 1-9. Convex Curved Conveyor

1.4.6 Concave Curves

Conveyors that have concave curves should be avoided or the scale should be located in a section of the conveyor that is not affected by the curve. If there is a curve, the belt must remain in contact with the idler rollers at all times for at least 20 feet (6m).

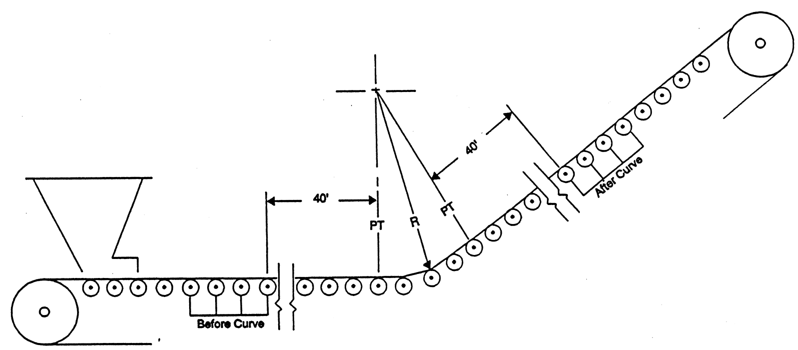

Figure 1-10. Concave Curved Conveyor

1.4.7 Trippers

Tripper belts, mechanical sweep samplers, training idlers, feed points, skirt boards and other device that also affect belt tension should be located away from the scale carriage.

If the scale must be installed on a conveyor with a tripper, then the same rules apply as for an installation in a concave conveyor.

The following table offers basic guidelines for minimum distances and applies to both horizontal and incline conveyors.

Type of Conveyor	Distance from Scale Carriage
End of skirt boards or feed point	15’ or 4 idler spaces whichever is greater
Training idler or sweep sampler	30’ or 8 idler spaces, whichever is greater
Tripper or concave curve	40’ from the first idler affected by the curve
Convex curve or head pulley	20’ or 5 idler spaces

Table 1-3. Distance Points from Conveyor to Scale Carriage

1.4.8 Speed Sensor or Magnetic Shaft Encoder Mounting Location - (Optional items)

The optional speed sensor location is not as critical as scale carriage location, however improper installation of the speed sensor will significantly affect the performance of the scale system. The speed sensor must give an accurate representation of the speed of the material and travel of the belt.

The favorable location for the speed sensor is the tail roll of the conveyor, provided that the conveyor is not driven from the tail, and that the tail roll is accessible.

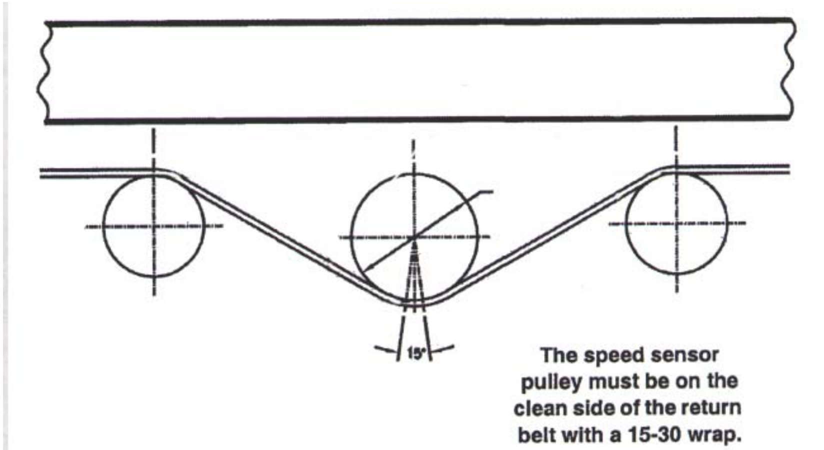

Figure 1-11. Speed Sensor Pulley

If the tail roll is not accessible then the speed sensor can be mounted on a tailing wheel that rides on the return side of the belt, or on a live shaft roller. If a trailing wheel is used, the wheel should be located on a section of the belt in which belt vibration will not add movement to the wheel. The preferable location would be directly opposite a conveyor return roll.

If a live shaft roller is installed to sense the belt speed, the roller should have positive contact with the belt. The preferred location would be between two return idlers with the speed roller being installed on the top side of the returning belt and the return idlers installed on the bottom side.

1.4.9 Electronic Wiring Location

The location for the electronics to be mounted is determined by accessibility, wire routing, and environment. The scale electronics require a clean and stable 120 VAC supply. The enclosure for the electronics is rated NEMA 4X. The electronics can be mounted up to 2000’ away from the scale carriage provided the optional load cell sense wiring is installed. If the electronics are to be installed within 200’ of the scale carriage, the optional sense wiring is not required. To reduce the effects of signal interference, the scale signals should not be run in conduit or cable trays in conjunction with high voltage cables.

The digital input and output signals are compatible with OPTO 22 G4 5VDC relay modules and can be controlled with AC, DC or dry contact signals. The analog output signal for rate of flow can be wired for 0-10 VDC, 2-10 VDC, 0-20mA current or 4- 20mA current. The printer signal can be RS-232, RS-485, or 20mA current loop.

1.4.10 Speed Wheel

If an optional speed wheel is used, the wheel should be located on a section of the belt in which belt vibration will not add movement to the wheel. The preferable location would be directly opposite a conveyor return roll.

Figure 1-12. Optional Speed Wheel Assembly

1.4.11 Troughing Angle

The use of idlers with steep troughing angles causes many problems. Not only does the bean or catenary effect of the belt become more pronounced as the toughing increases, but the effect of idler misalignment is amplified as well. Figure 1-13 shows an example of a correct and an incorrect troughing angle.

Troughing angles of 35 degrees or less are preferred for all high accuracy installations. Troughing angles of 45 degrees are acceptable under certain conditions.

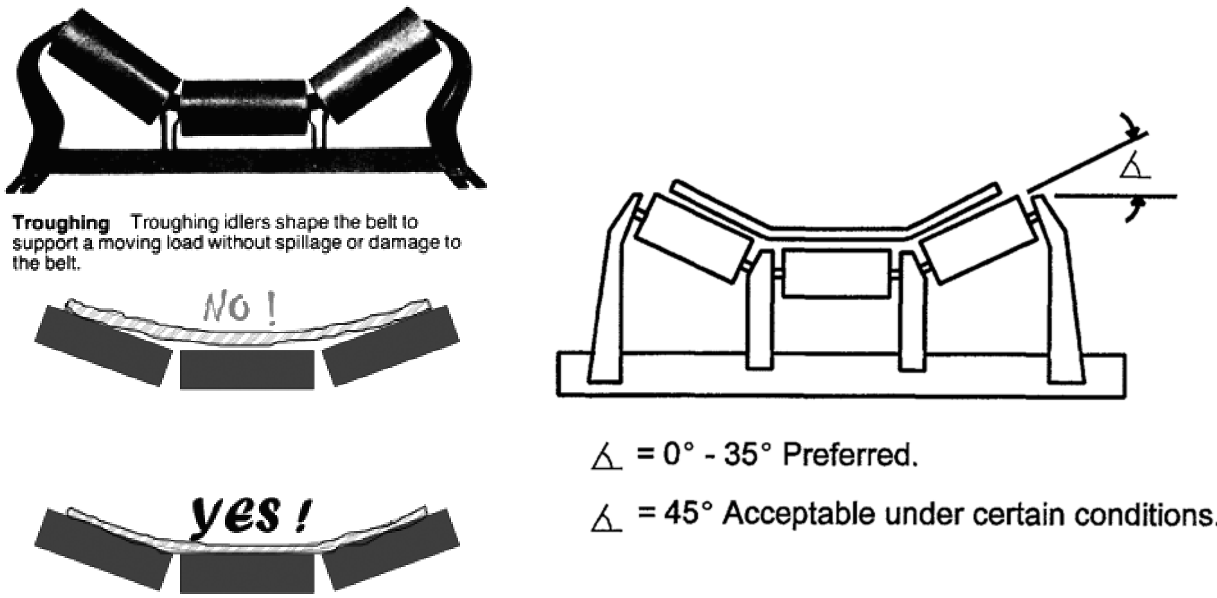

Figure 1-13. Troughing Angle Examples

1.5 Poor Choices for Belt Scale Installations

There are several instances where a belt scale installation would not be the best solution. The following list points these out.

- Conveyors with multiple loading points
- Conveyors with convex or concave curves (Sections 1.4.5 and 1.4.6)
- Conveyors with different stringer members in troughing rolls
- Conveyors that do not receive periodic inspections and housekeeping
- Conveyors where there is no facility to conduct a simulated test
- Conveyors that are used in cold weather that are not installed in a heated conveyor gallery
- Tripper conveyors (Section 1.4.7)
- Radial stacking conveyors
- Applications where the belt scale results are compared with a marine draft survey
- Applications where the belt scale weighment is subject to certification but the conveyor does not meet Handbook 44 requirements.
- Applications where plant personnel are unwilling or unable to perform routine conveyor maintenance
- Conveyors with more than 2-ply belting
- Conveyors that are installed outdoors, but are not equipped with a cover over the carry belt.

1.6 Handbook 44 Requirements for Belt Scales

The following is a listing of various Handbook 44 requirements for belt scales.

- Minimum divisions shall not be greater than 0.1 of the minimum totalized load.
- On test, the recorder must show the initial totalizer reading; the final totalizer reading, the unit of measure and the quantity delivered along with the time and date.
- The integrator master totalizer shall not be reset the master totalizer without breaking a security seal.
- In the event of loss of power of up to 24 hours, the accumulated measured quantity on the master totalizer shall be retained in memory during that power loss.
- An audio or visual alarm indication shall be activated when the flow rate equals or falls below 35% or is in excess of 98% of the rated capacity.
- The totalizer can only advance when the belt conveyor is running (ie: if the belt is shut down with coal on the belt, the totalizer could not register).
- The master totalizer shall not be re-settable without breaking a security seal.
- Means shall be provided that the totalizer reading shall be retained for a minimum of 24 hours in the event of a power failure.
- The belt scale integrator must factor in belt speed as a function of calculating tons per hour weight.
- Zero is to be limited to +/- 2% without breaking the security seal.
- Auto zero mechanism shall be designed to operate only after a whole number of belt revolutions.
- An indication shall be provided for when the auto zero adjustment has reached its maximum limit.
- Belt speed device shall be designed so that there is no slip.
- An event logger must provide an audit trail of all calibration adjustment with a printed copy available on demand. It shall have the capacity to retain records equal to ten times the number of sealable parameters in the device, but not more than 1000 records are required, (ie: time and date of change; the parameter value; the parameter ID).
- A zero circuit should provide for an average of one belt revolution (track +/-).
- Remote outputs record for (digital and analog), the total tons, rate in% of full cap, and the belt speed.
- Front panel calibration that is password protected w/ audit trail.
- Ability to enter the belt length and indicate in feet.
- Ability to accept pulse input for belt speed indication.

2.0 Integrator Hardware Installation

This section describes procedures for assembling the scale carriage, adding the idlers to the scale carriage, speed sensor connections, and any associated wiring.

Installation instructions for the integrator (BCi) are explained in Section 3.0 on page 26.

Warning *Take all necessary safety precautions when setting up the BCi In-motion belt scale system, including wearing safety shoes, protective eyewear and using the proper tools.*

2.1 Unpacking and Assembly

Upon receipt of the shipping pallet, visually inspect all components to make sure that they are included and undamaged. The shipping carton should contain the scale carriage, the integrator, this manual, and a parts kit. If any parts were damaged in shipment, notify Rice Lake Weighing Systems and the shipper immediately.

NOTE: ***To ensure that all products received from the manufacturer are in good shape upon arrival, it is recommended to fully inspect all contents and properly complete the bill of lading.***

2.2 Scale Carriage Installation

The proper location must be chosen for installation of the scale carriage prior to installation. Refer to Section 1.4 on page 9 for information on choosing the correct location for the scale carriage.

Once the correct location for the scale carriage is chosen, use the following steps to assemble the carriage as there is minimal assembly required. Tools required for assembly include a 3/4" wrench and a small screwdriver to work with the junction box. Figure 2-1 shows the component parts for the scale carriage that need to be assembled.

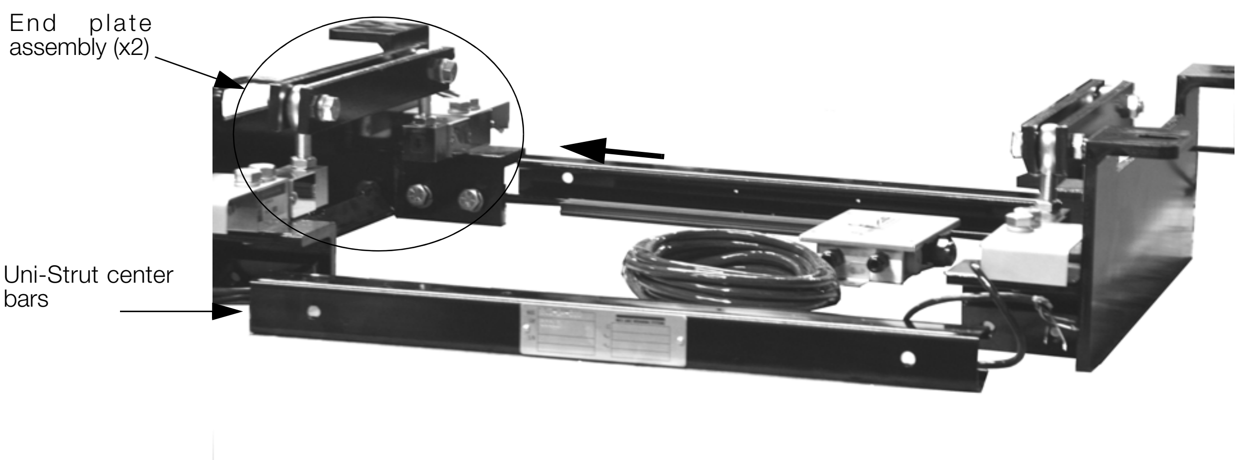

Figure 2-1. Scale Carriage Component Parts

The exact steps for assembling the scale carriage may vary depending on the site location and size of carriage.

1. Space the two end plate assemblies far enough apart so that the uni-strut center bars will slide into the channels on the end plate assembly making sure that the uni-strut center bar is centered equally from both ends.

NOTE: ***There should be roughly a 5/8" gap on each side and the drilled mounting holes (for junction box placement), should be facing upwards.***

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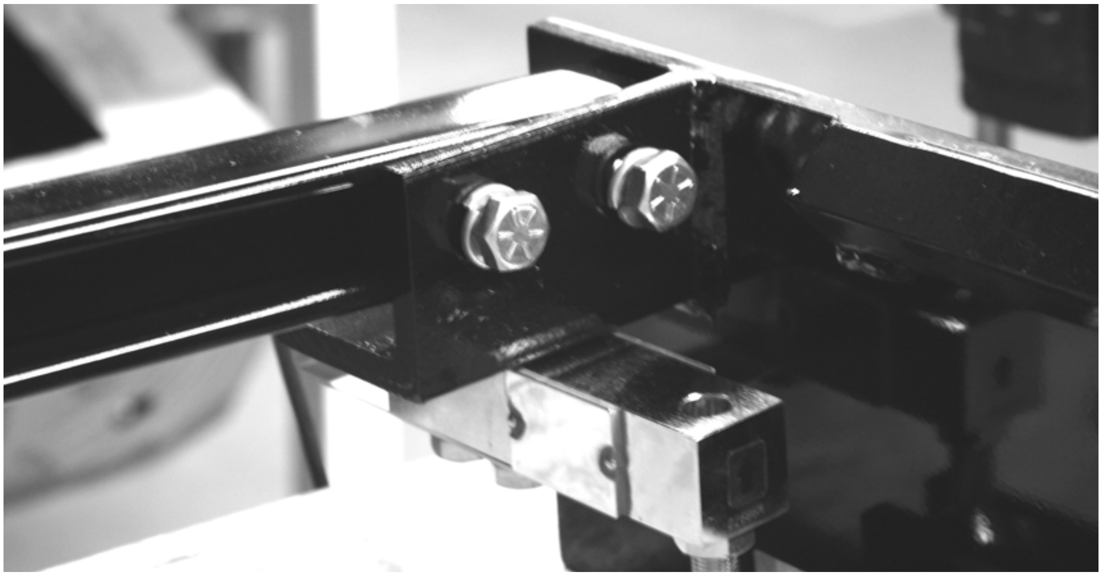


Figure 2-2. Slide the Uni-Strut Center Bars onto the End Plate Assembly

2. Using a 3/4" wrench, tighten the bolts on each end of the uni-strut center bars on both ends of the end plate assembly.

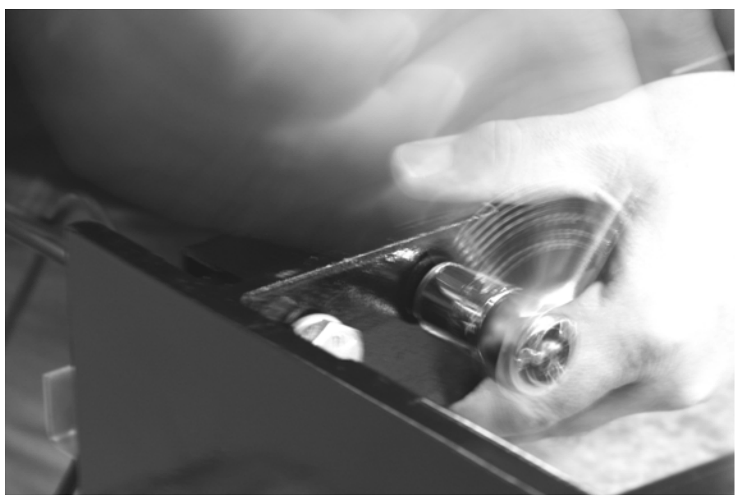


Figure 2-3. Tighten Bolts

2.3 Junction Box Installation

The BCi In-Motion Belt Scale uses the TuffSeal® JB4SS (PN 88956) junction box. It is a four-channel signal trim junction box with an expansion board enclosed. The junction box is a stainless steel NEMA 4X enclosure that comes with a standard Prevent® breather vent which inhibits the buildup of pressure cause by sudden temperature or environmental changes.

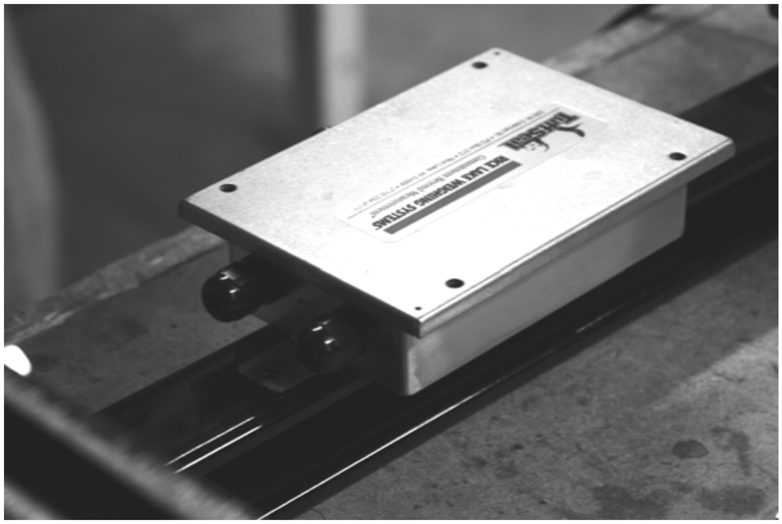


Figure 2-4. TuffSeal Junction Box

Use the following steps to install the junction box.

1. Set the junction box onto the uni-strut center bar and attach to the bar using the enclosed screws.
2. Attach the ground lug (shown in Figure2-5).

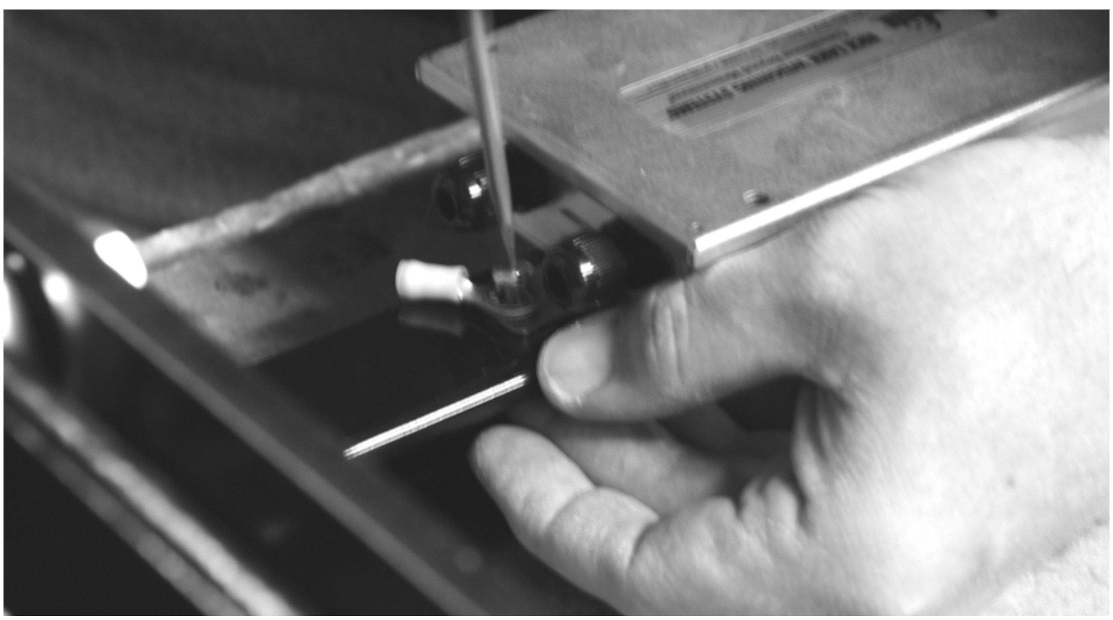


Figure 2-5. Attach the Ground Lug onto the Junction Box

2.3.1 Wiring the Junction Box

The four channel TuffSeal JB4SS has been designed to connect and trim up to four load cells per board. However, it is possible to use this junction box with other combinations.

Run the load cell cables from the load cells through the channels on the scale carriage over to the junction box.

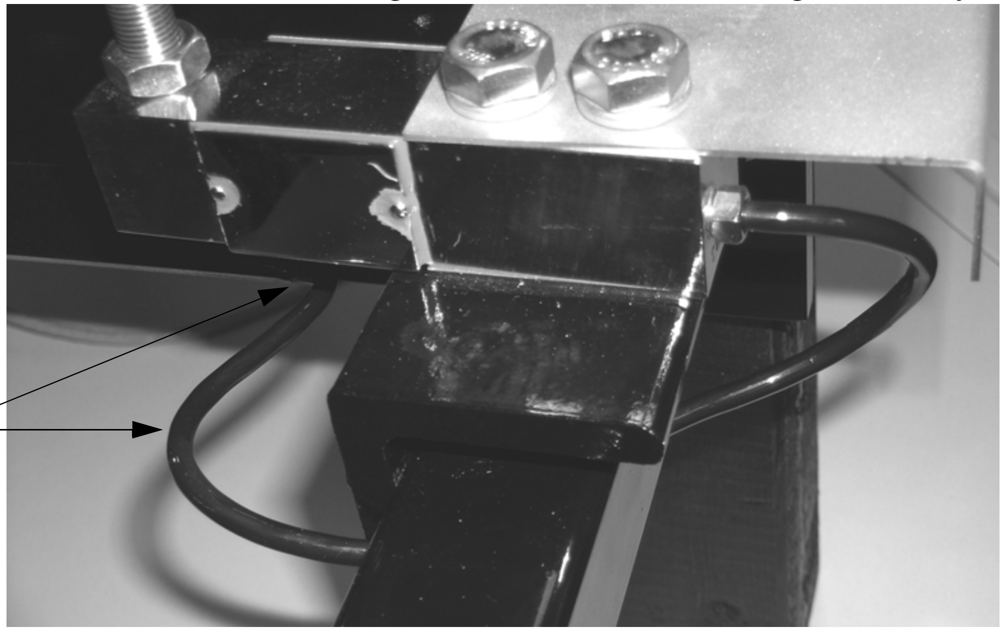


Figure 2-6. Route Load Cell Cable From Load Cell to Junction Box

3. Open the cover to the junction box to expose the interior.
4. Wire the junction box by running the load cell cable inside of the junction box.

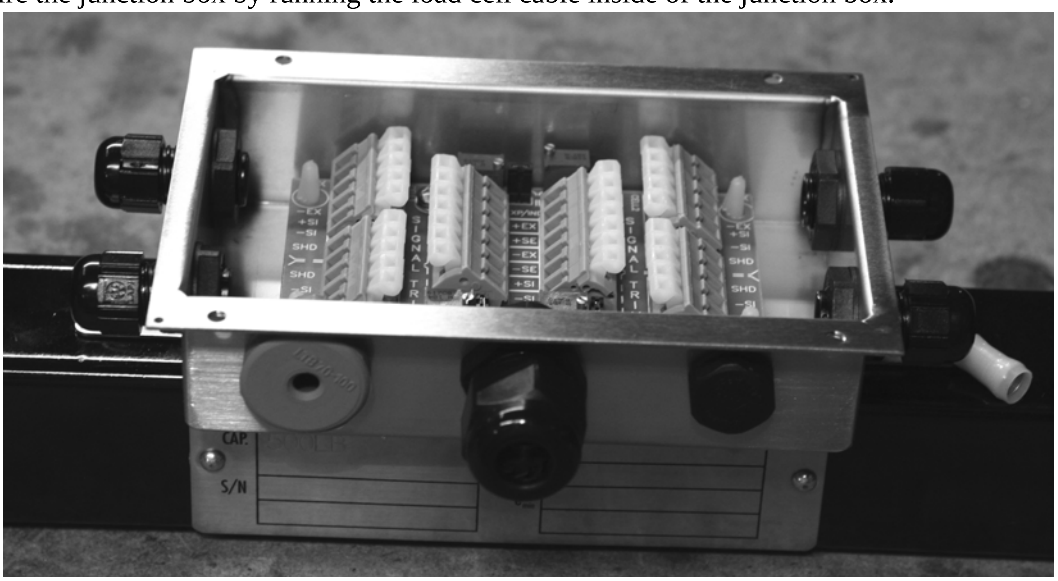


Figure 2-7. Junction Box Interior

Use the following table to wire the load cell cables.

Wire Color	Signal
Red	+EX
Black	-EX
Green	+SIG
White	-SIG
Silver Braid	SHIELD

Table 2-1. Load Cell Wiring

5. Use the expansion port on the main board to connect multiple junction boxes in series to accommodate applications that have more than four load cells. Figure 2-8 illustrates the expansion port wiring location.

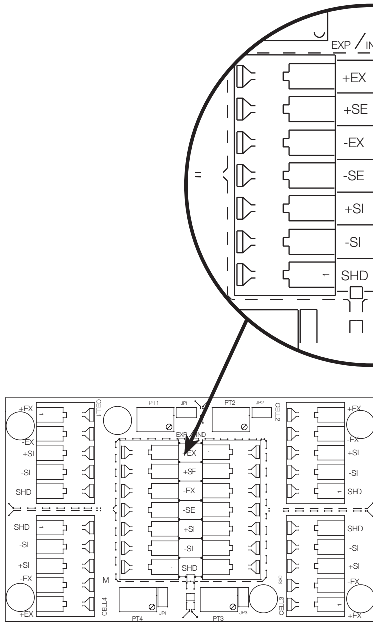


Figure 2-8. Expansion Port Location

2.3.2 Trimming Procedure

Trimming is a process of equalizing the output from multiple individual load cells. If needed, load cell output can be individually trimmed with potentiometers.

Whenever a substantial amount of trim (more than 5% of normal output), seems necessary to equalize output, check for other possible problems. The best trim is always the least amount of trim. When all errors except cell mismatch and cable extensions or reductions have been corrected, continue on with the trimming.

Use the following steps to properly trim the JB4SS junction box.

1. Determine the number of load cells needed.
2. Make sure jumpers are in place to enable trimming of the cells corresponding to each load cell. See Figure 2-9 for the location of jumpers JP1, JP2, JP3 and JP4. Note that you will need to remove jumpers for any unused cells.
3. Set all potentiometers fully clockwise to give maximum signal output from each cell (see below for location of potentiometers).

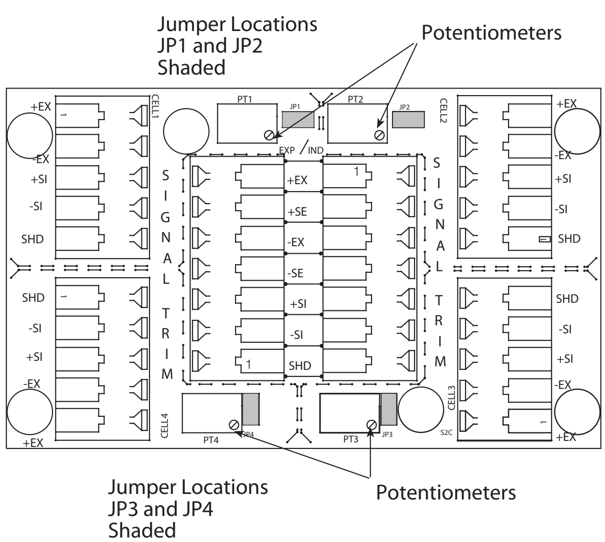


Figure 2-9. Potentiometer Location

Refer to the TuffSeal Installation manual (PN 91909) for additional information on the junction box.

Once all of the cables are attached and the scale carriage is completely assembled, take the uni-strut closure strip and seal up the middle bars.

Figure 2-10. Insert Uni-strut Closure Strip

2.4 Attaching the Idlers to the Scale Carriage

Once the scale carriage is assembled, you can mount the idlers to the carriage.

Mount the idlers to the carriage using the V-bolts and bolting them to the carriage frame.

Note:

V-bolts can be purchased separately from RLWS.

PN 98806 - fits 3" angles

PN 99323 - fits 4" angles

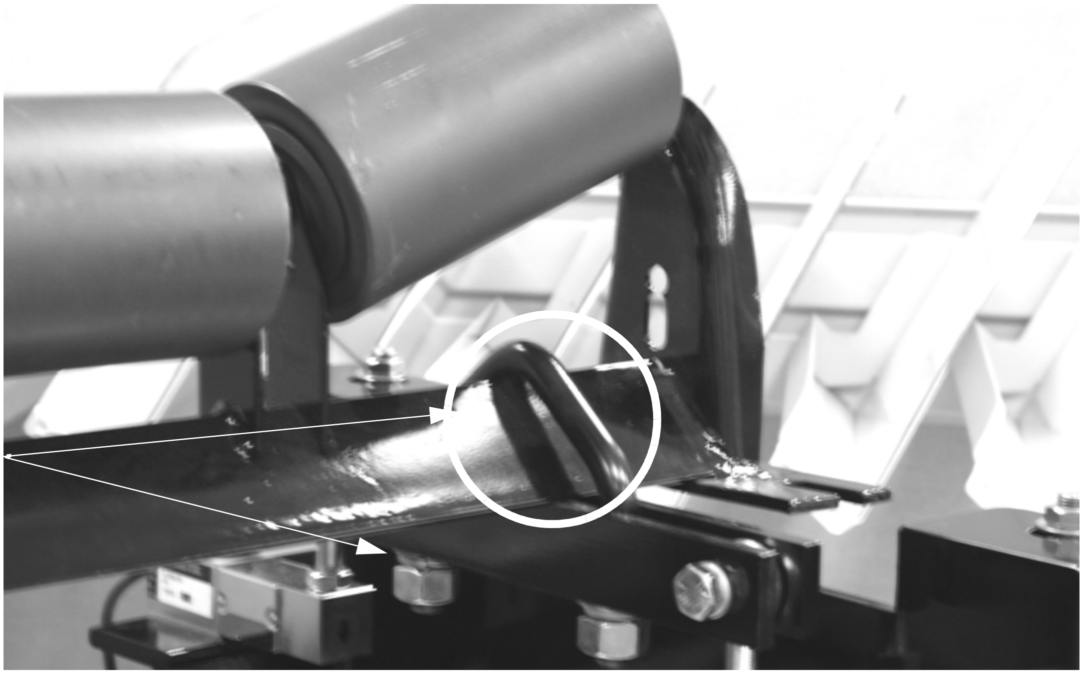
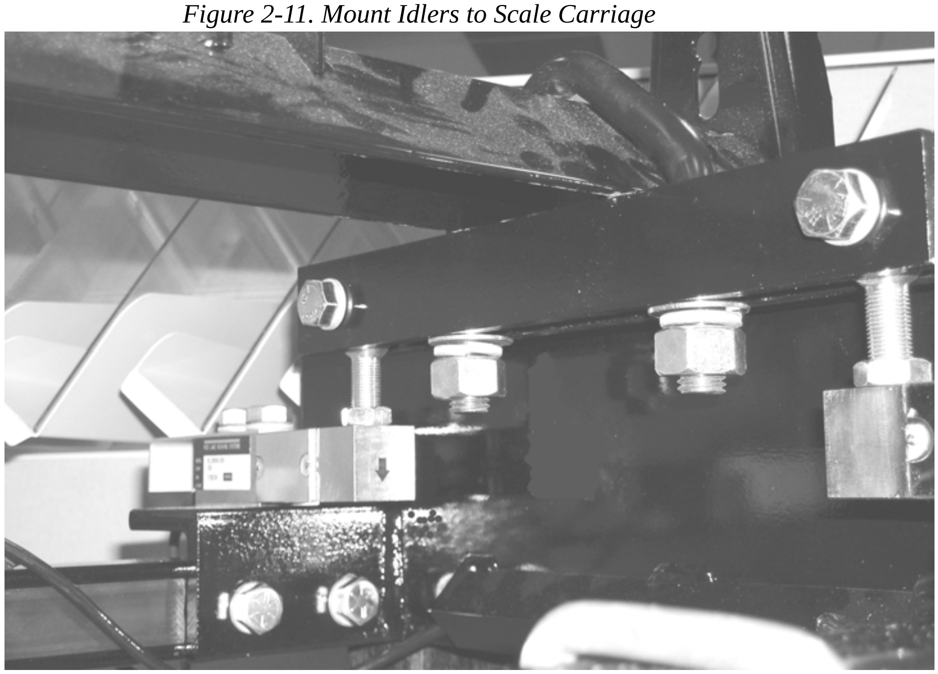


Figure 2-11. Mount Idlers to Scale Carriage



Mount the idlers to the scale carriage using the large V-bolts and bolting them to the scale carriage frame.

If the scale carriage requires the relocation of cross bracing directly under the scale. Any bracing that is removed should be relocated or replaced as to not reduce the structural integrity of the conveyor. The minimum clearance under the scale is 6.50" as measured from the top mounting surface. If the return conveyor belt is less than 6.50" from the top of the frame, then the scale carriage will require extra shimming or the return idlers will require relocation. The return side of the conveyor belt must not contact the bottom of the scale when the conveyor is operating.

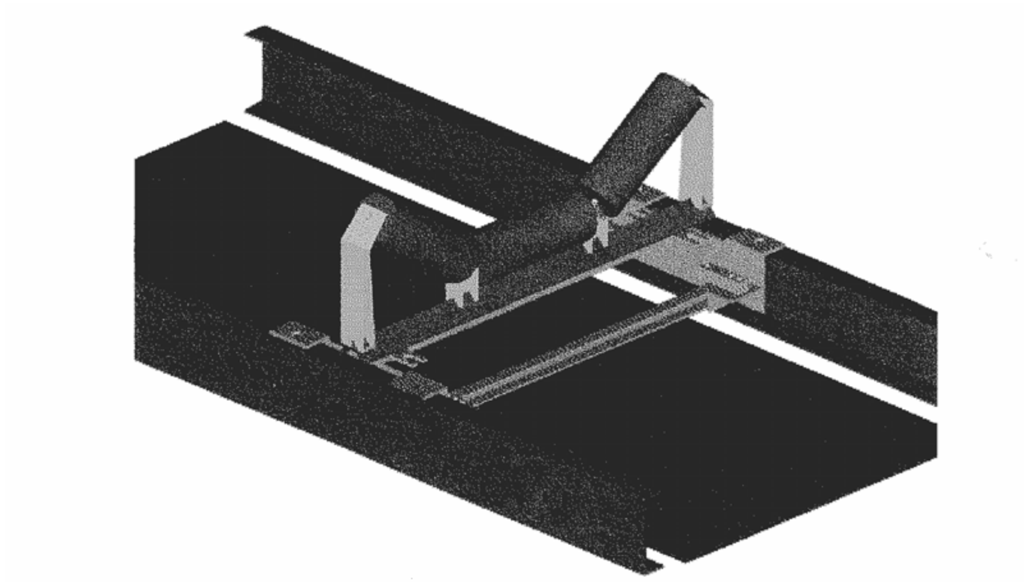


Figure 2-12. Scale Carriage Location May Need Cross-Bracing

The idler spacing for the scale has been predetermined, and the three idlers before and after the scale should be moved to match the same spacing.

Any splices in the conveyor frame work in the scale area are required to be permanently joined. Additional bracing may be required under the conveyor frame work to minimize deflection and vibration under the load as any additional bouncing will decrease the scale's accuracy.

The 3rd idler before and the 3rd idler after the scale should be shimmed 1/4" higher than the adjacent idlers. These will be the first and last idlers in the scale area.

The first and last scale idlers should be shimmed level across the conveyor. If the idlers adjacent to the scale area are greater than 1/4" lower than the scale area, the adjacent idlers should be shimmed to ramp up to the scale area in 1/4" increments.

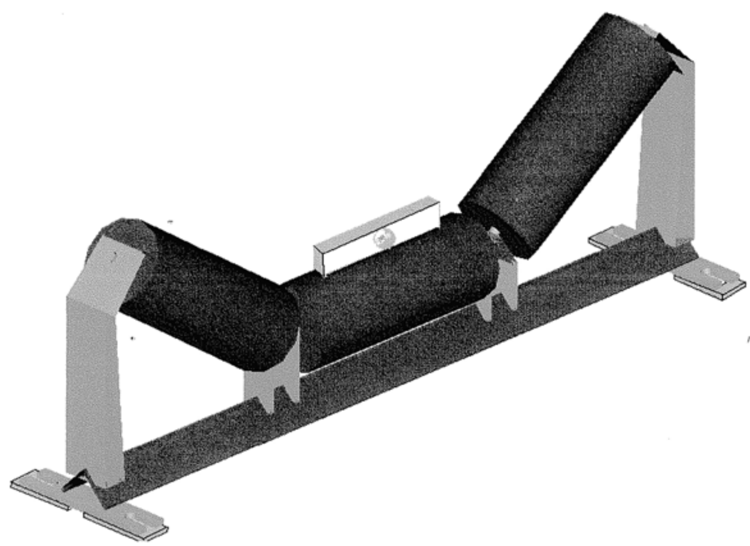


Figure 2-13. Idlers Should be Level

The idler on the scale should be mounted to the scale weigh pads. The existing mounting feet should be removed and the new feet welded on at the correct spacing for the pads.

Apply alignment string lines across the scale area idlers, stretching over the 3rd before and the 3rd idler after the scale carriage.

The scale frame should be shimmed to match the weigh idler to the plane drawn by the alignment strings.

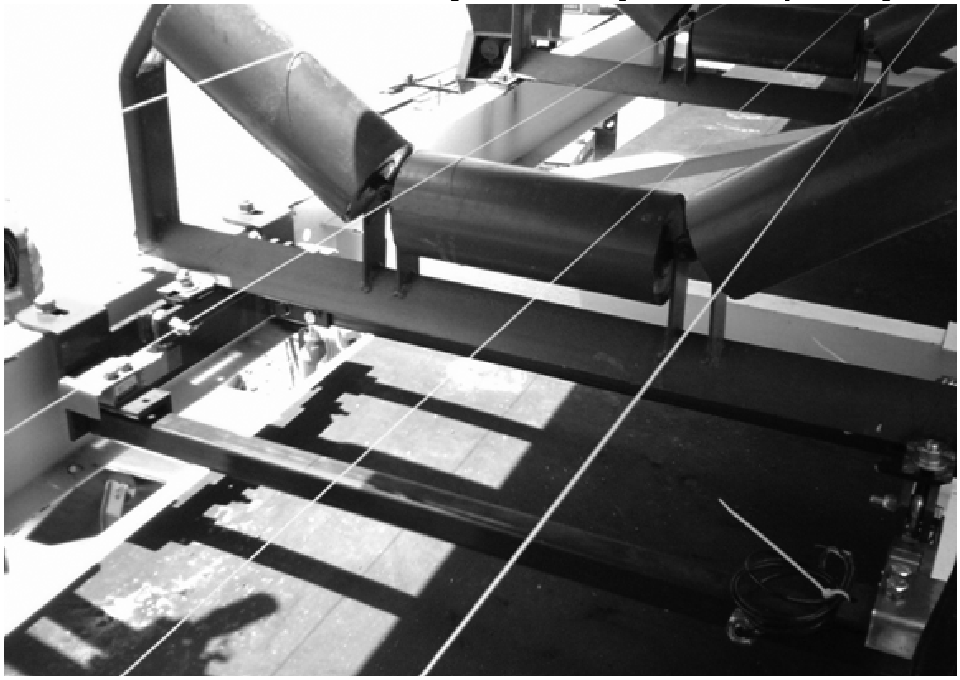


Figure 2-14. Shim Carriage if Needed

Recheck the level of the scale carriage and weigh idler.

The other idlers in the scale area should be shimmed to match the alignment strings. The finished aligned scale area idlers should be equally spaced, level, and in a plane 1/4" higher than the adjacent idlers on the conveyor.

2.5 Speed Sensor Installation

The installation of the speed sensor will vary based upon accessibility to the tail roller, belt speed and distance from the electronic integrator (BCi).

There are a variety of scenarios that can be used to install the speed sensor depending on accessibility. The following steps go through various types of speed sensor installations but individual applications vary for each job.

2.5.1 Encoder Speed Sensor Located on the Tail Pulley or Live Shaft Roller

1. Drill and tap a 3/8" hole centered on the tail roll shaft.
2. Prepare a mounting stud by removing the head of 3/8" x 1 1/2" bolt.
3. Thread the mounting stud into the tail roll shaft.
4. Install the 3/8" to 10mm encoder coupling to the mounting stud.
5. Install the encoder to the coupling.
6. Fabricate a mounting bracket to support the encoder.

2.5.2 Proximity Sensor Located on Idler Pulley

1. Measure the diameter of the idler to be used for the speed sensor.
2. Determine the number of targets to give a pulse a minimum of every 4" of travel.
3. Install steel targets equal around the idler.
4. Mount the proximity sensor within 1/4" of the targets.

2.5.3 Proximity Sensor Located on Wheel

1. The wheel speed sensor should be mounted to ride against the inside of the return conveyor belting.
2. Install the wheel bracket assembly to the tail end side of the scale carriage. The belt travel should pull the

wheel away from the scale carriage.

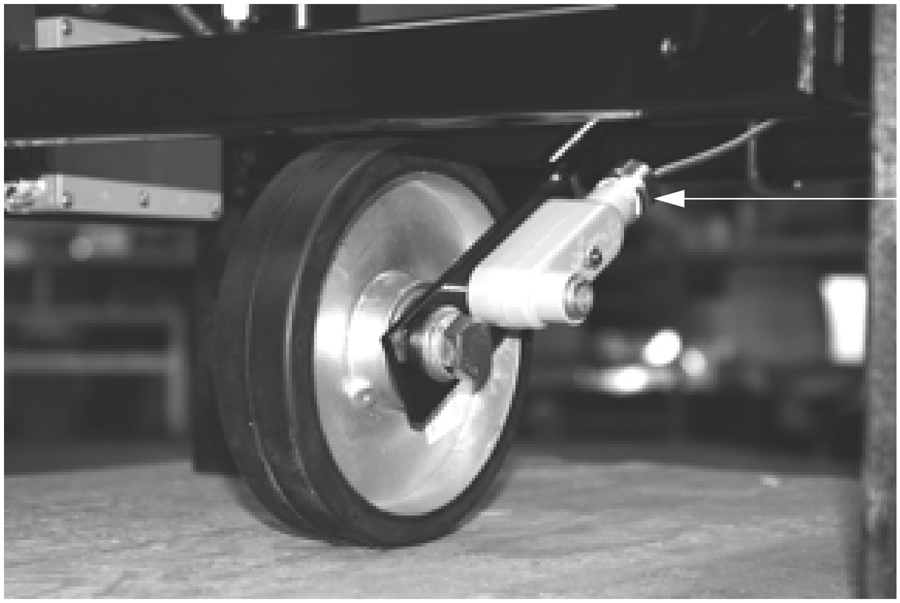


Figure 2-15. Speed Wheel Sensor

3. Mount the wheel arm to the cross brace closest to the tail of the conveyor. The wheel assembly must be free to move in the vertical direction and must maintain contact with the belt at all times.

2.6 Scale Carriage Replacement Parts

Table 2-2 lists replacement parts for the BCi In-Motion Belt Scale System.

Ref Number	Part Number	Description (quantity)	500 Lb Capacity	1000 Lb Capacity
1	- - - - -	Unistrut spacer bar (2) Consult Factory	Consult Factory	
2	- - - - -	Unistrut closure strip (2) Consult Factory	Consult Factory	
3	94969	Speed wheel assembly (1)		
4	- - - - -	End plate assembly (2)	96730	96732
5	88956	TuffSeal stainless steel junction box (1)		
6	22066	Machine screws, 10-32NF (2)		
7	14878	Machine screws, 10-32 x 1/2 (2)		
8	16863	Label (1)		
9	14905	Drive screws, 4 x 3/8 (2)		
10	31546	Lock washer, 1/4 (2)		
11	43810	Connecting ring terminal, 1/4 inch (1)		
12	-	Load cell (2)	17341	17342

Table 2-2. Scale Carriage Replacement Parts

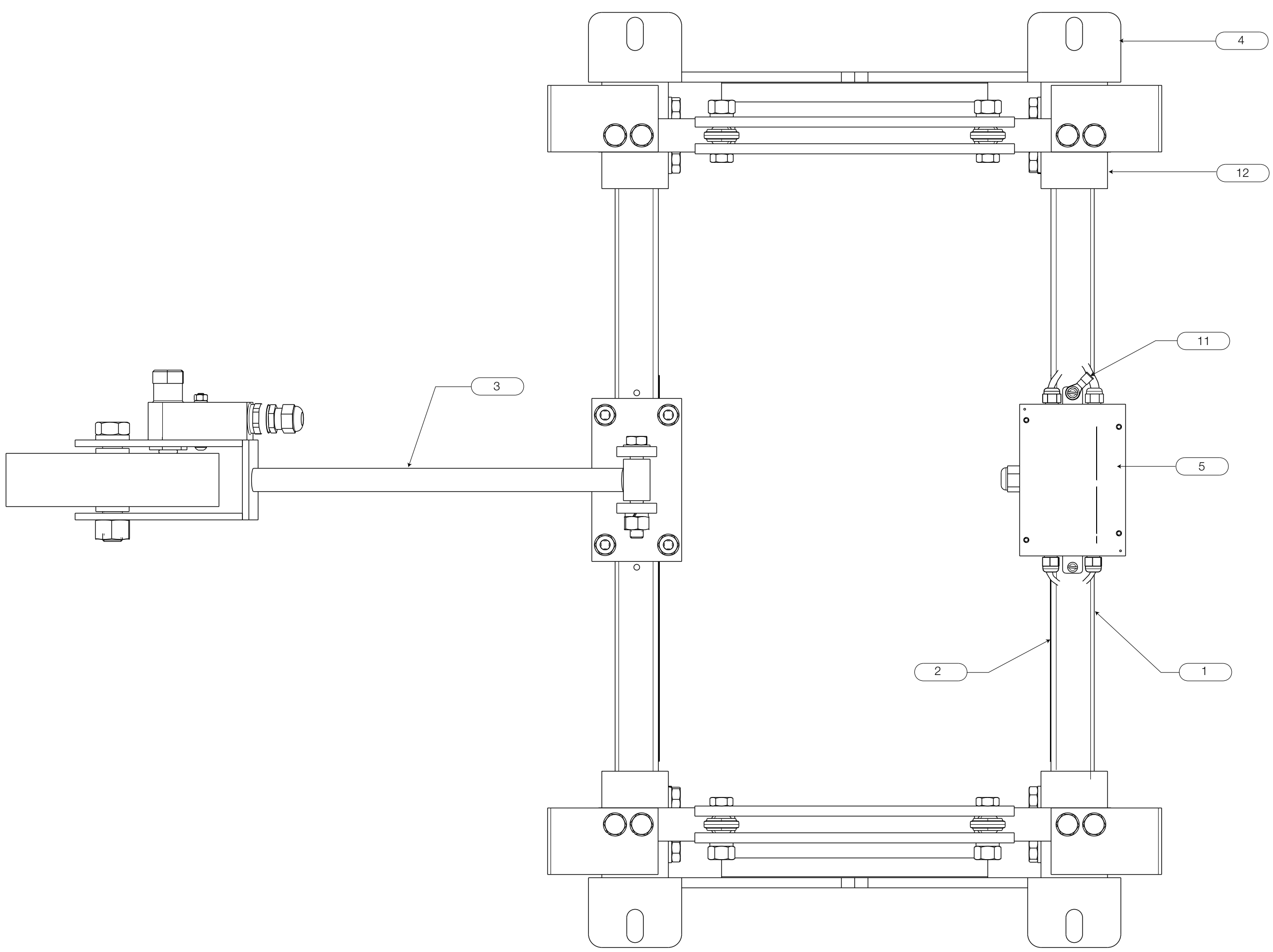


Figure 2-16. Belt Scale Assembly, Top View A

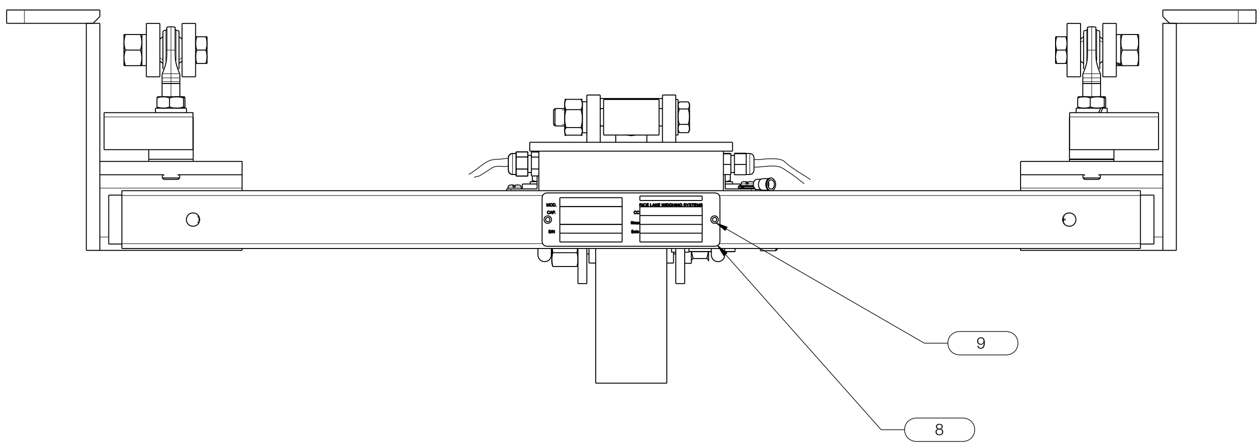


Figure 2-17. Belt Scale Assembly, View B

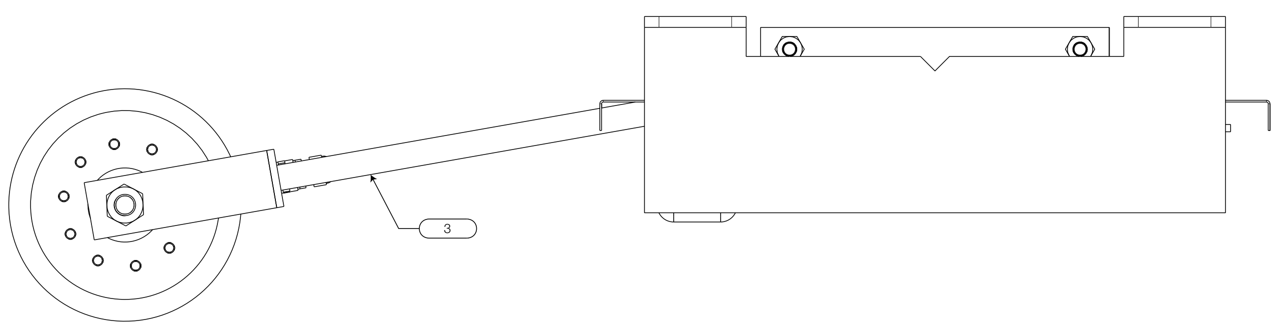


Figure 2-18. Belt Scale Assembly, View C

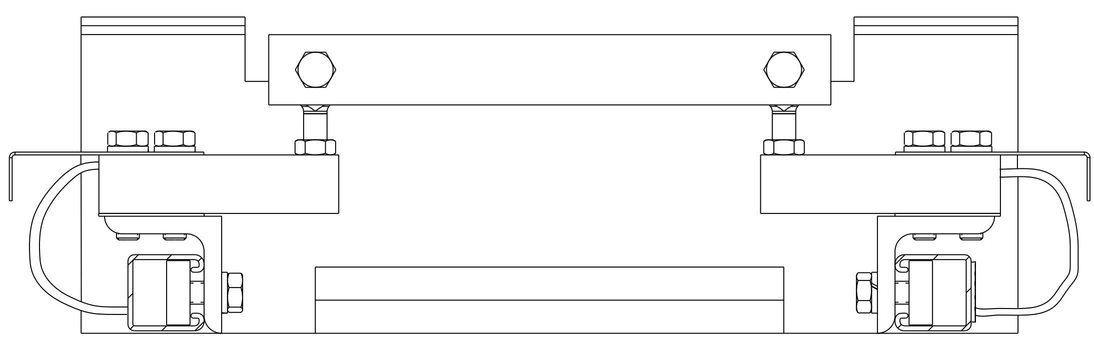


Figure 2-19. Belt Scale Assembly, View D

3.0 Integrator Hardware Setup

3.1 Enclosure Disassembly

The integrator enclosure must be opened to install option cards and to connect cables for installed option cards.

Warning *The BCi has no on/off switch. Before opening the unit, ensure the power cord is disconnected from the power outlet.*

Ensure power to the integrator is disconnected, then place the integrator face-down on an antistatic work mat. Remove the screws that hold the backplate to the enclosure body, then lift the backplate away from the enclosure and set it aside.

3.2 Cable Connections

The universal model of the *BCi* provides six cord grips for cabling into the integrator: one for the power cord, five to accommodate cabling for option cards. Install plugs in all unused cord grips to prevent moisture from entering the enclosure.

3.2.1 Cable Grounding

Except for the power cord, all cables routed through the cord grips should be grounded against the integrator enclosure. Do the following to ground shielded cables:

- Use the lockwashers, clamps, and keep nuts provided in the parts kit to install grounding clamps on the enclosure studs adjacent to cord grips. Install grounding clamps only for cord grips that will be used; do not tighten nuts.
- Route cables through cord grips and grounding clamps to determine cable lengths required to reach cable connectors. Mark cables to remove insulation and shield as described below:
  - For cables with foil shielding, strip insulation and foil from the cable half an inch (15 mm) past the grounding clamp (see Figure 3-1). Fold the foil shield back on the cable where the cable passes through the clamp. Ensure silver (conductive) side of foil is turned outward for contact with the grounding clamp.
  - For cables with braided shielding, strip cable insulation and braided shield from a point just past the grounding clamp. Strip another half inch (15 mm) of insulation *only* to expose the braid where the cable passes through the clamp (see Figure 3-1).

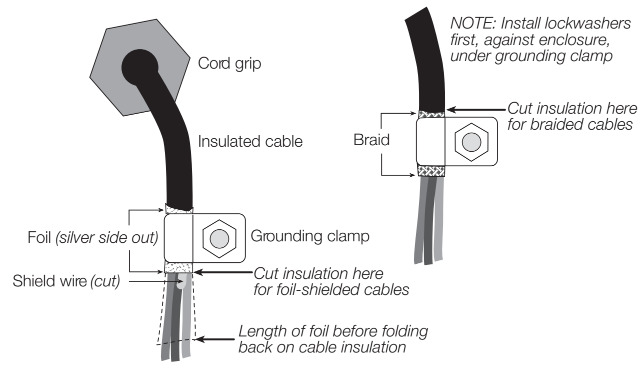


Figure 3-1. Grounding Clamp Attachment for Foil-Shielded and Braided Cabling

- For load cell cables, cut the shield wire just past the grounding clamp. Shield wire function is provided by contact between the cable shield and the grounding clamp.
- Route stripped cables through cord grips and clamps. Ensure shields contact grounding clamps as shown in Figure 3-1. Tighten grounding clamp nuts.
- Finish installation using cable ties to secure cables inside of integrator enclosure.

3.2.2 Load Cells

To attach cable from a load cell or junction box to an installed A/D card, route the cable through the cord grip and ground the shield wire as described in Section 3.2.1 on page 26.

Next, remove connector J1 from the A/D card. The connector plugs into a header on the A/D card (see Figure 3-2). Wire the load cell cable from the load cell or junction box to connector J1 as shown in Table 3-1.

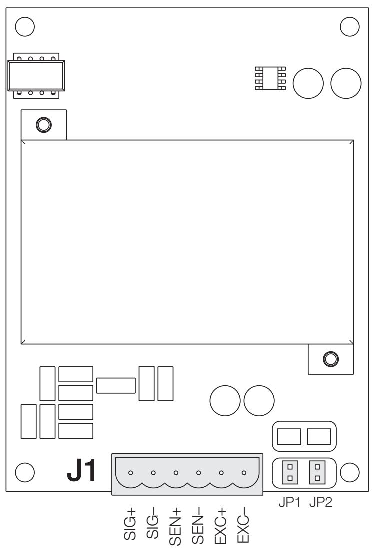


Figure 3-2. Single-Channel A/D Card

If using 6-wire load cell cable (with sense wires), remove jumpers JP1 and JP2 before reinstalling connector J1. For 4-wire installation, leave jumpers JP1 and JP2 on. For 6-wire load cell connections on dual-channel A/D cards, remove jumpers JP3 and JP4 for connections to J2.

When connections are complete, reinstall load cell connector on the A/D card and use two cable ties to secure the load cell cable to the inside of the enclosure.

A/D Card Connector Pin	Function
1	+SIG
2	–SIG
3	+SENSE
4	–SENSE
5	+EXC
6	–EXC

Table 3-1. A/D Card Pin Assignments

A/D Card Connector Pin	Function
• For 6-wire load cell connections to connector J1, remove jumpers JP1 and JP2.	
• For 6-wire load cell connections to connector J2 (dual A/D cards), remove jumpers JP3 and JP4. 2.	

Table 3-1. A/D Card Pin Assignments (Continued)

3.2.3 Pulse Input Card

Use the following procedure to install pulse input cards in *BCi* integrator:

1. Disconnect integrator from power source.

Warning ***Disconnect power before removing integrator backplate.***

2. Place integrator face-down on an antistatic work mat. Remove screws that hold the backplate to the enclosure body.

Caution ***Use a wrist strap to ground yourself and protect components from electrostatic discharge (ESD) when working inside the integrator enclosure.***

3. Carefully align the large option card connector with connector J5 or J6 on the *920i* CPU board. Press down to seat the option card in the CPU board connector.

Use the screws and lockwashers provided in the option kit to secure the other end of the option card to the threaded standoffs on the CPU board.

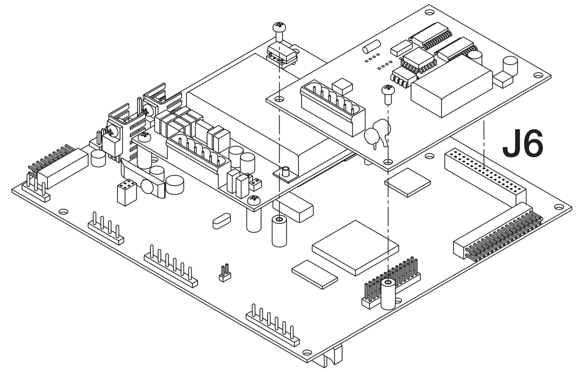


Figure 3-3. Pulse Input Card

4. Make connections to the option card as required.

Wire Color	Function
Brown	+12 V
Black	Pulse In
Blue	Ground

Table 3-2. Speed Wheel Pulse Input Wiring Colors

5. Use cable ties to secure loose cables inside the enclosure. Once cabling is complete, position the backplate over the enclosure and reinstall

the backplate screws. Use the torque pattern shown in Figure 3-8 to prevent distorting the backplate gasket. Torque screws to 15 in-lb (1.7 N-m).

6. Ensure no excess cable is left inside the enclosure and tighten cord grips.

Reconnect power to the integrator.

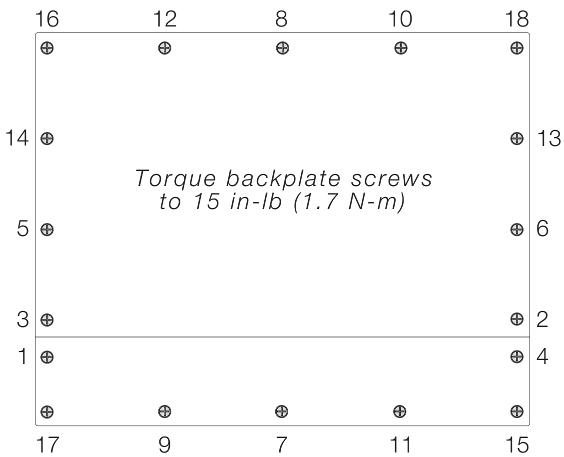


Figure 3-4. Backplate Torque

The integrator automatically recognizes all installed option cards when the unit is powered on. No hardware-specific configuration is required to identify the newly-installed card to the system.

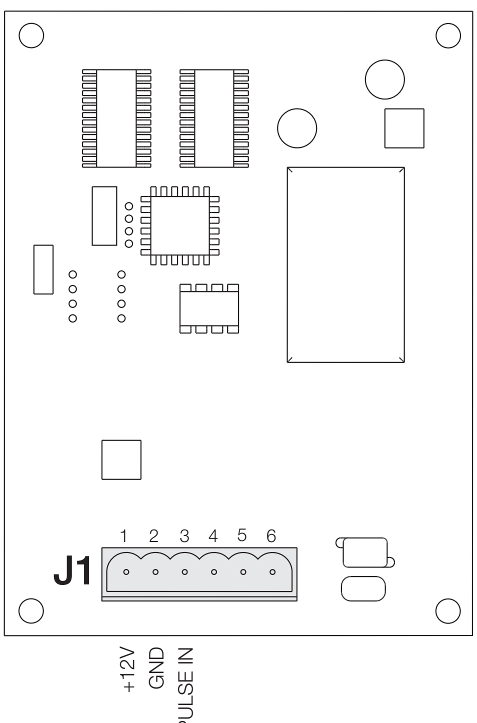


Figure 3-5. Pulse Input Board Option Card

3.2.4 Serial Communications

The four communications ports on the *BCi* CPU board support full duplex RS-232, 20 mA output, or RS-485 communications at up to 115200 bps.

To attach serial communications cables, route the cable through the cord grip and ground the shield wire as described in Section 3.2.1 on page 26. Remove the serial connector from the CPU board and wire to the connector. Once cables are attached, plug the connector into the header on the board. Use cable ties to secure serial cables to the inside of the enclosure.

Table 3-3 shows the pin assignments for Ports 1, 3, and 4. Port 2 provides DIN-8 and DB-9 connectors for remote keyboard attachment of PS/2-type personal computer keyboards (see Figure 3-6). The DB-9 connector pin assignments for Port 2 are shown in Table 3-4.

Connector	Pin	Signal	Port
J11	1	GND	1
	2	RS-232 RxD	
	3	RS-232 TxD	
J9	1	GND / –20mA OUT	3
	2	RS-232 RxD	
	3	RS-232 TxD	
	4	+20mA OUT	
J10	1	GND / –20mA OUT	4
	2	RS-232 RxD	
	3	RS-232 TxD	
	4	+20mA OUT	
	5	RS-485 A	
	6	RS-485 B	

Table 3-3. Serial Port Pin Assignments

Serial ports are configured using the SERIAL menu.

An optional dual-channel serial communications expansion card, PN 67604, is also available. Each serial expansion card provides two additional serial ports, including one port that supports RS-485 communications. Both ports on the expansion card can support RS-232 or 20mA connections.

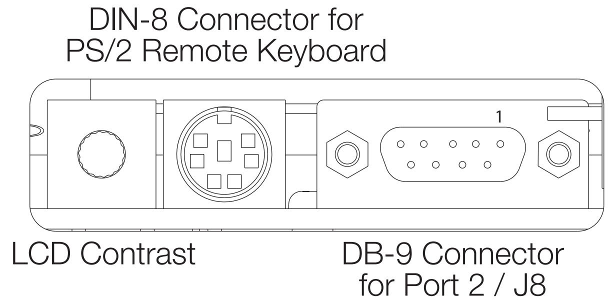


Figure 3-6. Interface Board Connections

DB-9 Pin	Signal
2	TxD
3	RxD
5	GND
7	CTS
8	RTS

Table 3-4. DB-9 Connector Pin Assignments

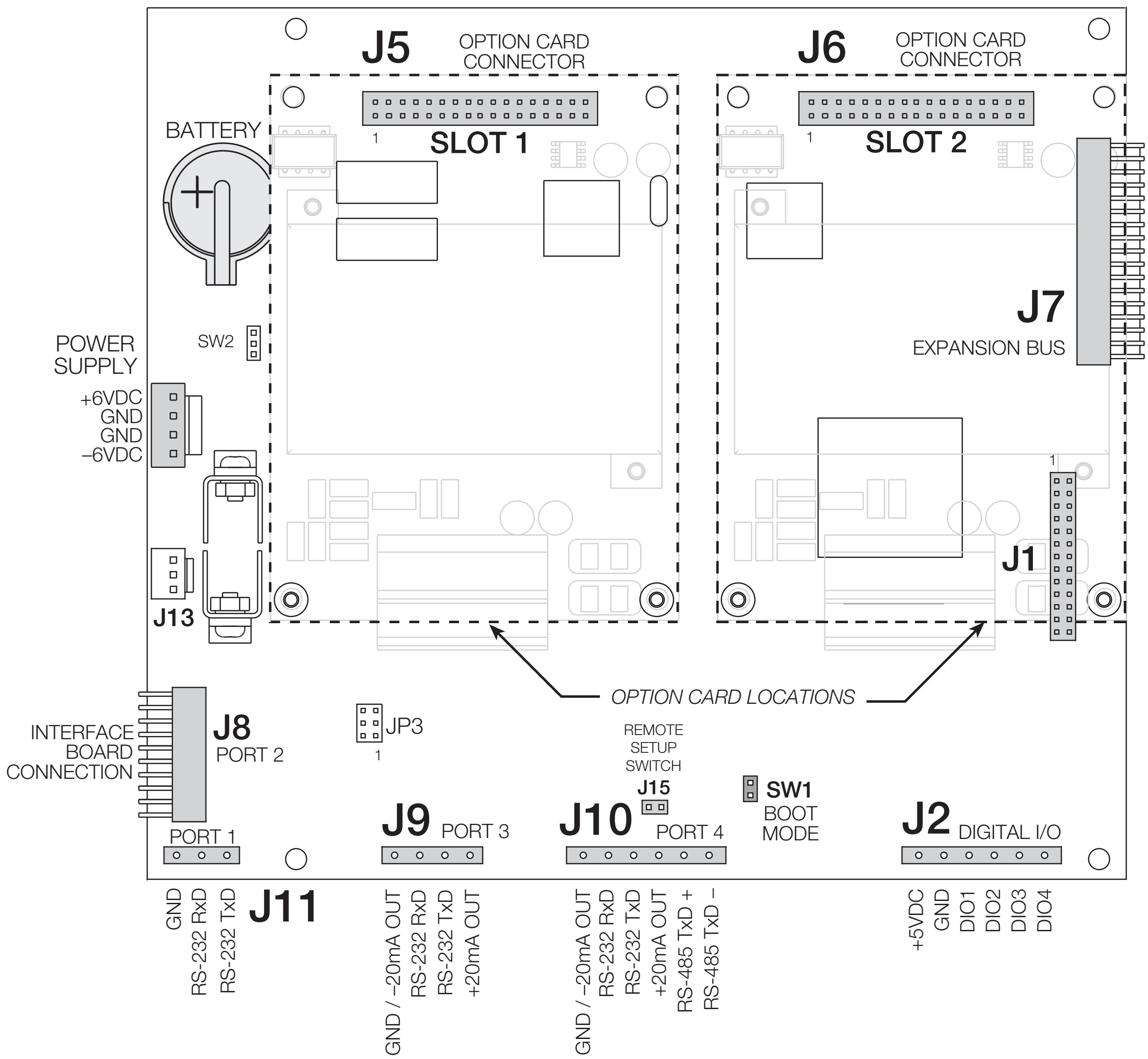


Figure 3-7. *BCi CPU Board, Showing Option Card Locations*

3.2.5 Digital I/O

Digital inputs can be set to provide many integrator functions, including all keypad functions. Digital inputs are active low (0 VDC), inactive high (5 VDC).

Digital outputs are typically used to control relays that drive other equipment. Outputs are designed to sink, rather than source, switching current. Each output is a normally open collector circuit, capable of sinking 24 mA when active. Digital outputs are wired to switch relays when the digital output is active (low, 0 VDC) with reference to a 5 VDC supply.

Table 3-5 shows the pin assignments for connector J2.

J2 Pin	J2 Signal
1	+5 VDC
2	GND
3	DIO 1
4	DIO 2
5	DIO 3
6	DIO 4

Table 3-5. J2 Pin Assignments (Digital I/O)

Digital inputs and outputs are configured using the DIG I/O menu.

An optional 24-channel digital I/O expansion card, PN 67601, is available for applications requiring more digital I/O channels.

NOTES:

- The maximum number of option board slots is fourteen: two onboard slots, plus two six-card expansion boards.
- The two-card expansion board is always placed at the end of the expansion bus. No more than one two-card expansion board can be used in any system configuration.
- The panel mount enclosure can accommodate a single two-card expansion board.
- The wall mount enclosure can accommodate a two-card or a six-card expansion board.
- Systems using two expansion boards are housed in a custom enclosure.

3.3 Enclosure Reassembly

Once cabling is complete, position the backplate over the enclosure and reinstall the backplate screws. Use the torque pattern shown in Figure 3-8 to prevent distorting the backplate gasket. Torque screws to 15 in-lb (1.7 N-m).

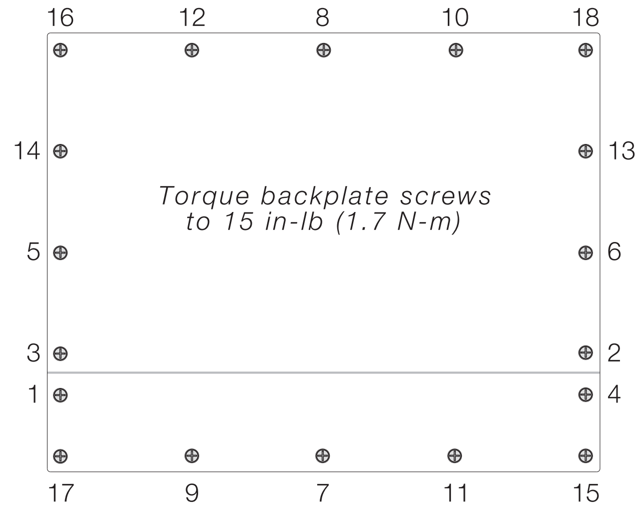


Figure 3-8. BCi Enclosure Backplate

3.4 CPU Board Removal

If you must remove the *BCi* CPU board, use the following procedure:

1. Disconnect power to the integrator. Remove backplate as described in Section 3.1 on page 26.
2. Unplug connectors J9, J10, and J11 (serial communications), J2 (digital I/O), P1 (power supply), and connectors to any installed option cards.
3. Remove any installed option cards.
4. Remove the five phillips head screws and two kep nuts from the CPU board.
5. Gently lift up the CPU board, then disconnect connectors J12 (power to display), J4 (ribbon cable, J3 (keypad connector), then the cable J8 (Port 2 serial port).
6. Remove CPU board from the enclosure. If necessary, cut cable ties to shift cables out of the way.

To replace the CPU board, reverse the above procedure. Be sure to reinstall cable ties to secure all cables inside the integrator enclosure.

3.5 Fuse Replacement

Fuses for the universal and deep enclosure models of the *BCi* are located under a cover plate on the outside of the enclosure. Remove the cover plate, replace the fuses, and reinstall the cover plate (see Figure 3-9).

Caution ***To protect against the risk of fire, replace fuses only with same type and rating fuse.***

Caution ***Interface board and fuse access cover plates must be in place for use in NEMA 4X/IP66 applications.***

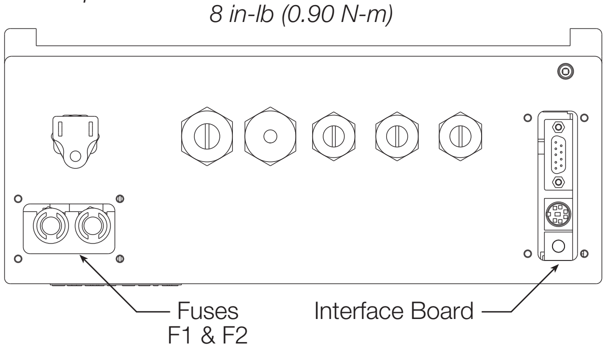


Figure 3-9. Interface Board and Fuse Locations, Universal Model

3.6 Battery Replacement

The lithium battery on the CPU board maintains the real-time clock and protects data stored in the system RAM when the integrator is not connected to AC power.

Data protected by the CPU board battery includes time and date, truck and tare memory, onboard database information, and setpoint configuration.

Use *iRev* to store a copy of the integrator configuration on a PC before attempting battery replacement. If any data is lost, the integrator configuration can be restored from the PC.

NOTE: ***Memory option card data is also protected by a lithium battery. All database information stored on a memory card is lost if the memory card battery fails.***

Watch for the low battery warning on the LCD display and periodically check the battery voltage on both the CPU board and on any installed memory option cards. Batteries should be replaced when the integrator low battery warning comes on, or when battery voltage falls to 2.2 VDC. Life expectancy of the battery is ten years.

See Figure 3-7 on page 30 for CPU board battery location and orientation (positive side up).

Caution ***Risk of explosion if battery is replaced with incorrect type. Dispose of batteries per manufacturer instruction.***

3.7 Parts Kit Contents

Table 3-6 lists the parts kit contents for the universal model of the *BCi*.

PN	Description
14626	Kep nuts, 8-32NC (4)
14862	Machine screws, 8-32NC x 3/8 (12)
75068	Sealing washers (14)
15133	Lock washers, No. 8, Type A (4)
30623	Machine screws, 8-32NC x 7/16 (2)
15631	Cable ties (4–single A/D, 6–dual A/D)
15665	Reducing glands for 1/2 NPT cord grips (2)
15887	6-position screw terminal for load cell connection (1–single A/D, 2–dual A/D)
19538	Cord grip plugs (4–single A/D, 3–dual A/D)
42350	Capacity label (1–single A/D, 2–dual A/D)
53075	Cable shield ground clamps (4)
70599	6-position screw terminals for J2 and J10 (2)
71126	4-position screw terminal for J9 and optional keyboard connection (2)
71125	3-position screw terminal for J11 (1)
42149	Rubber feet for tilt stand (4)
15144	Nylon washers for tilt stand, 1/4 x 1 x 1/16 (2, universal model only)
68403	Wing knobs for tilt stand (2)

Table 3-6. Parts Kit Contents

3.8 Replacement Parts and Assembly Drawings

Table 3-7 lists replacement parts for the *BCi* universal enclosure model.

Ref Number	PN	Description (Quantity)	See Figure
1	67529	Enclosure, universal (1)	3-10
2	68598	Protective lens (1)	
3	67614	LCD display (1)	
4	68425	Fuse access coverplate (1)	
5	68621	Fuse access coverplate gasket (1)	
6	67886	Standoffs, short (4)	
7	68661	Standoffs, long (2)	
8	70912	CPU board (1)	
9	14618	Kep nuts, 4-40NC (2)	
10	67613	Power supply, ±6VDC, 25W (1)	
11	67536	Power supply bracket (1)	
12	16861	High voltage warning label (1)	
13	14624	Lock nuts, 6-32NC, nylon (2)	
14	14822	Machine screws, 4-40NC x 1/4 (11)	
15	67530	Interface board connector plate (1)	
16	67535	Interface board gasket (1)	
17	14862	Machine screws, 8-32NC x 3/8 (4)*	
18	75068	Sealing washers (12)*	
19	32365	Setup switch access screw, 1/4 x 20NC x 1/4 (1)	
20	44676	Sealing washer for setup switch access screw (1)	
21	15626	Cord grips, PG9 (3)	
22	15627	Lock nuts, PCN9 (3)	
23	30375	Nylon seal rings for PG9 cord grips (3)	
25	15134	Lock washers, No. 8, Type A (3)	
26	14626	Kep nuts, 8-32NC (3)*	
27	45043	Ground wire, 4 in w/ No. 8 eye connector (1)	
28	68424	Enclosure backplate, universal (1)	3-10
29	67532	Backplate gasket, universal (1)	3-10
30	15631	Cable tie, 3-in nylon (1)*	
31	67795	Power cord assembly, 115 VAC and 230 VAC North American units (1)	3-10
	69998	Power cord assembly, 230 VAC European units (1)	—
32	67796	Power supply cable assembly, to CPU board (1)	
33	68662	Ribbon cable to interface board, universal (1)	
34	16892	Ground/Earth label (1)	
35	15650	Cable tie mounts, 3/4 in. (4)	
40	53308	Model/serial number label (1)	
41	68532	Single-channel A/D card (1, can be single- or dual-channel A/D)	—
	68533	Dual-channel A/D card (1, can be single- or dual-channel A/D)	
43	71027	Fuses (115 VAC models), 2 A Time-Lag TR5 (2)	3-10
	71026	Fuses (230 VAC models), 2 A Time-Lag TR5 (2)	

Table 3-7. Replacement Parts

Ref Number	PN	Description (Quantity)	See Figure
45	67869	Interface board (1)	
46	14832	Machine screws, 4-40NC x 3/8 (2)	
47	22086	Machine screws, 6-32NC x 1/4 (8)	3-10
50	15628	Cord grips, 1/2 NPT (2)	
52	30376	Nylon seal rings for 1/2 NPT cord grips (2)	
53	15630	Lock nuts for 1/2 NPT cord grips (2)	
54	70069	3V Lithium coin battery	
55	69898	Nylon spacers (4)	3-10
—	66502	Switch panel membrane (1)	

* Additional parts included in parts kit.

Caution *To protect against the risk of fire, replace fuses only with same type and rating fuse.*

Table 3-7. Replacement Parts (Continued)

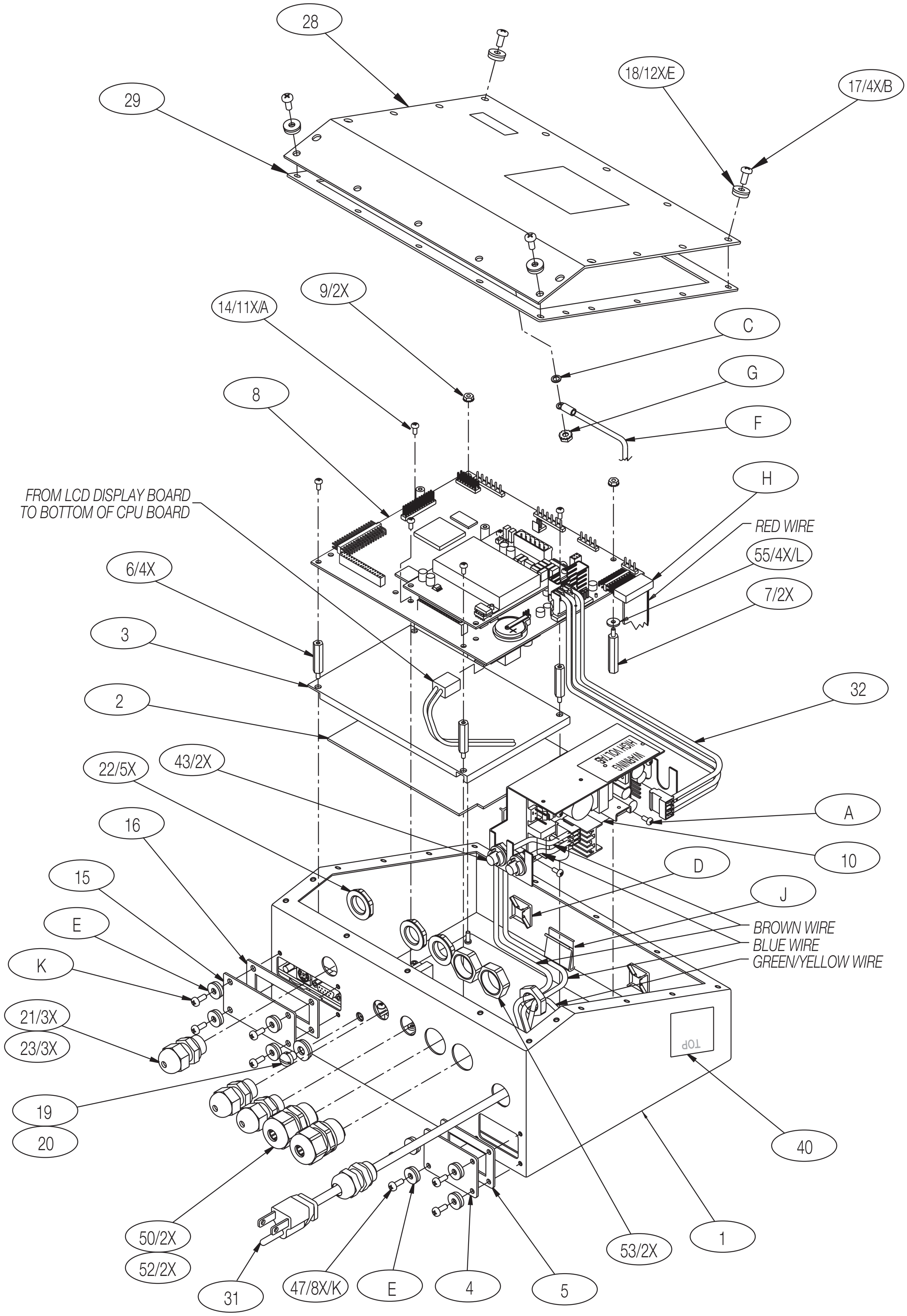


Figure 3-10. BCi Universal Model Assembly

4.0 Supervisor Mode Parameters

Various parameters can be set by using the **Supervisor Mode** softkey from the main menu.

NOTE: ***All parameters must be entered prior to calibrating the unit.***

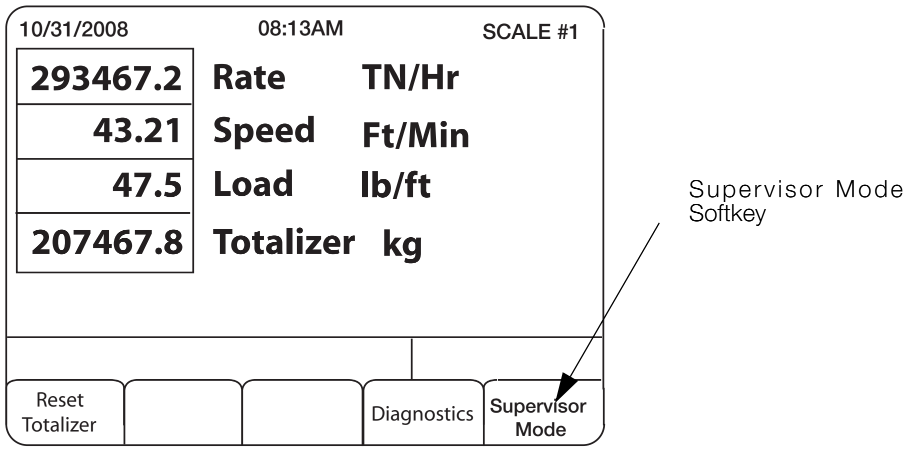


Figure 4-1. .Supervisor Softkey Location

Press the **Supervisor Mode** softkey to access the following screen.

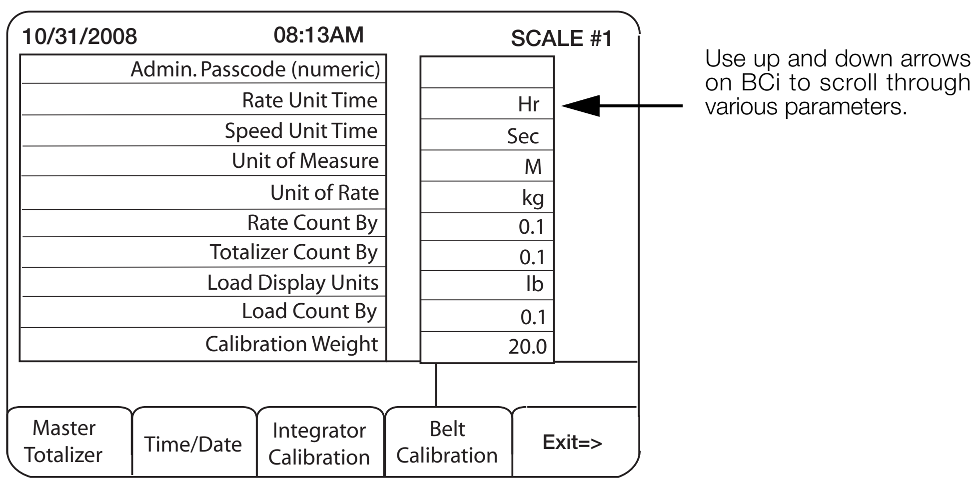


Figure 4-2. Supervisor Mode Parameters

Use the **up** and **down** arrow keys on the BCi to navigate the parameter list. Use the **enter** key to select the parameter to edit. If the parameter is a value that can be entered, a user prompt will open. The operator can then key in the new value and press **enter** to accept the new value. If the parameter has a list of available values, the value will scroll through all available selections.

4.1 Admin. Passcode (numeric)

This parameter allows the administration password to be configured. It prevents unauthorized changes to system parameters and calibration.

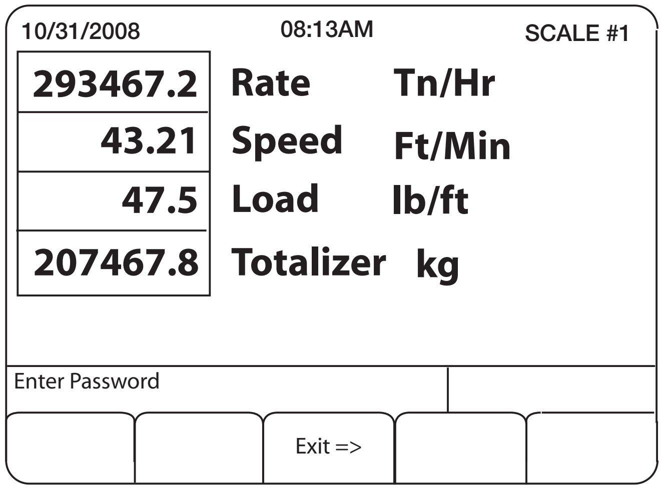


Figure 4-3. Enter Password

Once the password is entered into the BCi, the following menu screen appears. There are several parameters that can be entered and are explained in the following sections.

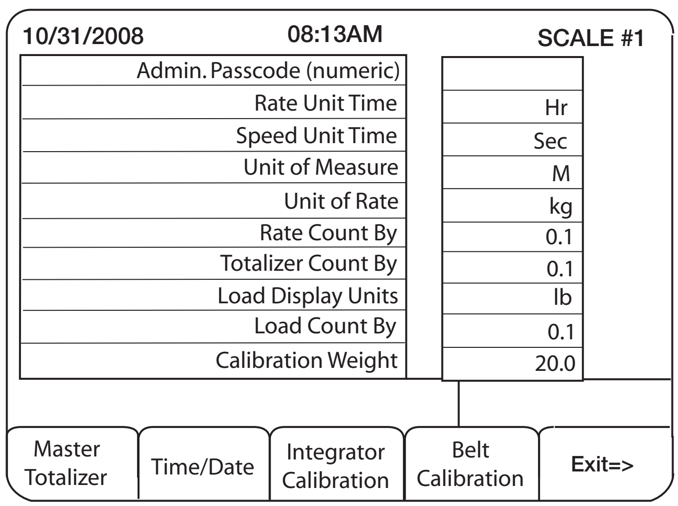
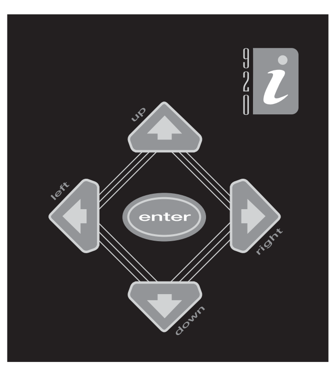


Figure 4-4. Main Supervisor Screen

Use the **up** and **down** arrows on the BCi to scroll through the menu items. The available parameters are displayed by pressing the **enter** key on the BCi.



Note: *There are many parameters in the Supervisor Mode (shown in the following sections), but most will not be used for a basic installation. The parameters that must be set prior to calibration include the following:*

Calibration Weight (if using static weights to calibrate) - Section 4.10 on page 39.

Idler Spacing - Section 4.15 on page 40.

Number of Idlers - Section 4.16 on page 40

Belt Length - Section 4.19 on page 40

The other parameters that are commonly set are the filtering values but they can be done after setup and calibration.

4.2 Rate Unit Time

This parameter defines what unit of time the rate will be displayed in on the BCi. Available selections are:

- **Hr. - hour (default)**
- Min - minute
- Sec - seconds

Press the **enter** key to toggle between the listed choices above. The default rate unit time is Hr.

4.3 Speed Unit Time

This parameter defines how the belt speed is displayed on the BCi. The selections are displayed in the following units.

- Hr. - hour
- **Min - minute (default)**
- Sec - seconds

Press the **enter** key to toggle between the listed choices above. The default speed unit time is displayed in minutes.

4.4 Unit of Measure

The unit of measure parameter defines how the belt is measured and speed calculated. The selections are displayed in the following units.

- **Ft - feet (default)**
- M - meters

Press the **enter** key to toggle between the listed choices above. The default speed is shown as Ft/Min.

4.5 Unit of Rate

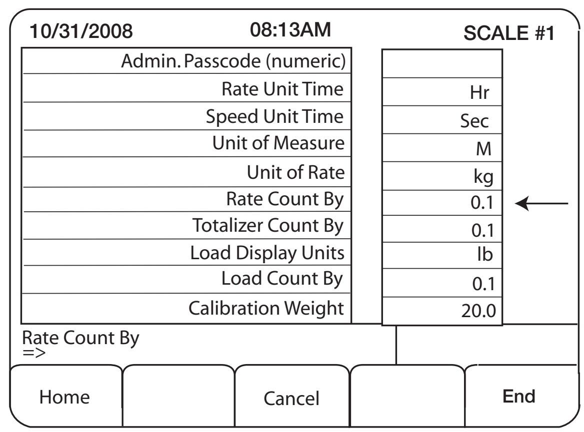
The unit of rate parameter defines how the rate is displayed. The selections are displayed in the following units:

- **TN (tons) - (default)**
- lb (pounds)
- kg (kilograms
- T (metric tons)
- LT (long ton)

Press the **enter** key to toggle between the listed choices above. The default rate display is TN/Hr.

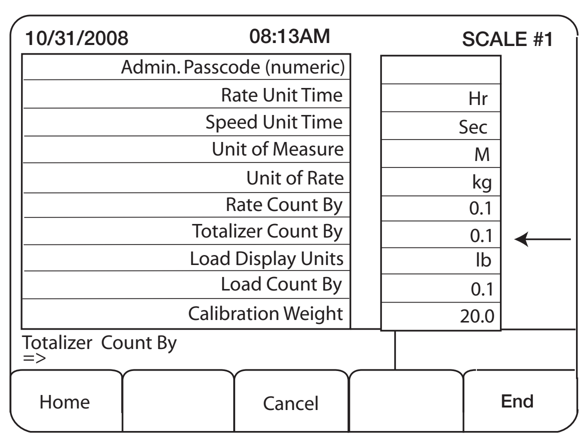
4.6 Rate Count By

This parameter defines what count by and decimal divisions the rate will be displayed. This is a value that can be keyed in using the numeric keypad on the display, 1,2, 0.1, 0.01, etc. To change the rate count by value, press the **enter** key on the integrator and a *rate count by* prompt appears. Using the numeric keypad on the integrator, enter the value and press **enter** again to save that value.



4.7 Totalizer Count By

This parameter is defined by what the count by and decimal divisions the totalizers will be displayed. This is a value that can be keyed in such as 1, 2, 0.1, 0.01, etc. To change the totalizer count by value, press the **enter** key on the integrator and a *totalizer count by* prompt appears. Using the numeric keypad on the integrator, enter the value and press **enter** again to save that value.



4.8 Load Display Units

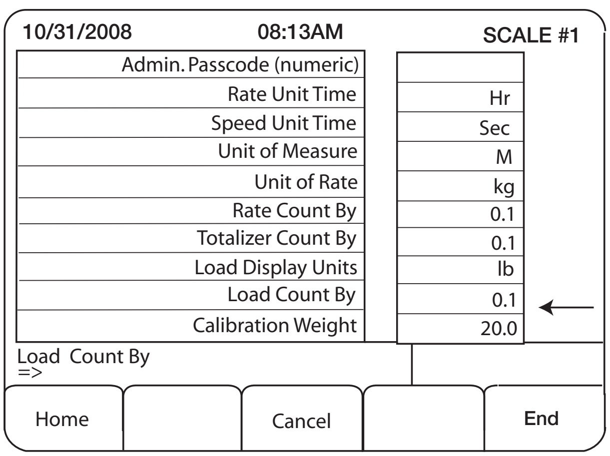
This parameter defines what weight units the belt loading is displayed in. The selections are displayed in the following units:

- **lb - (default)**
- kg

Press the **enter** key to toggle between the listed choices. The default load display unit is lb.

4.9 Load Count By

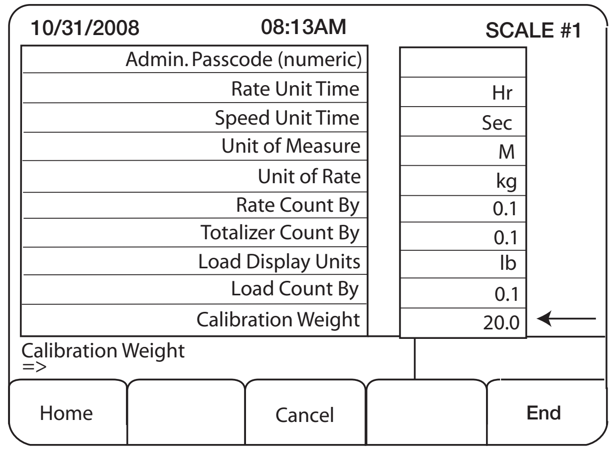
This parameter is defined by what count by and decimal divisions the load is to be displayed in. This is a value that can be keyed in using the numeric keypad on the BCi such as 1, 2, 0.1, 0.01, etc. To change the load count by value, press the **enter** key on the integrator and a *load count by* prompt appears. Using the numeric keypad on the integrator, enter the value and press **enter** again to save that value.



4.10 Calibration Weight for Static Weight

NOTE: *The calibration weight needs to be entered prior to calibrating the scale.*

This parameter is defined as the value of weight used to calibrate the belt scale. This value is based on weight units per measured units and can be used for Auto Calibration and Timed Calibration. The default value is measured in lbs/ft. This parameter would change on all the above measurement and weight parameters. An example would be: If you have the belt idler spacing of 8 feet and 80 lbs across the weighing area, you have 10 lbs per foot.



4.11 Calibration Load

NOTE: ***The calibration load <u>does not</u> need to be entered prior to calibrating the scale.***

This parameter is the amount of material used in a material test and is used with the Material Calibration.

Enter the calibration load weight value using the same units label as the totalizer. An example would be if the totalizer is in TN, then you would enter the value as a TN value. Use the numeric keypad and press **enter** to save that value.

4.12 Material Factor

This parameter is used for adjusting the totalized weight value in a comparison test. During a test, the product may be weighed statistically after being loaded out on the belt scale. There may be a difference in the actual (static) weight versus the totalized weight from the integrator. The material factor can be used to adjust this value up or down. If the totalized weight is light, the material factor should be increased, and if it is heavy, the material factor should be decreased. The default for this value is 100.00%.

An example of calculating the material factor is:

$$\frac{6{,}000\ \text{lbs}}{100\%} \qquad \frac{5850}{X}$$

X = Material Factor

4.13 Zero Counts

This parameter illustrates the raw dead load counts of a calibrated system. This value can be recorded and entered manually in the event of a complete integrator replacement.

The default value for this parameter is: 217457.

4.14 Span Counts

This parameter defines the raw span counts of a calibrated system. This value can be recorded and entered manually in the event of a complete integrator replacement.

The default value of this parameter is: 654484.

4.15 Idler Spacing

This parameter defines the spacing between the idlers. It also determines the weighing surface of the belt scale.

Refer to section 1.3.3 on page 7 to determine your idler spacing. That number is the number that is entered into the integrator Idler Spacing parameter.

The default value of this parameter is: 48 inches.

4.16 Number of Idlers

This parameter defines the number of idlers in a system.

Enter the number is idlers being used in the system using the numeric keypad and press **enter**.

The default value for this parameter is: 1.

4.17 Belt Test Revolutions

This parameter defines the number of conveyor belt revolutions the unit will make after the belt speed calibration is done. The operator will key in the number of full belt revolutions the unit will make for the deadload and span calibrations. The deadload, or zero calibration is a calibration that runs for a pre-determined amount of time during which the belt is running with no material on it. The span calibration is a calibration that runs for the same pre-determined amount of time with a known weight applied to the scale.

The default value for this parameter is: 1.

4.18 Pulses per Revolution

This value is the number of pulses recorded for a complete revolution of the belt. This value can be recorded and entered manually in the event of a complete integrator replacement.

The default value for this parameter is: 3600.

4.19 Belt Length

This is the total length of the conveyor belt. This value can be recorded and entered manually in the event of a complete integrator replacement. An easy way to measure the belt length is to spray paint a marking on the belt. Run a tape measure down to the other end and times it by two to get the total belt length.

Enter the total belt length being used in this system using the numeric keypad. Press the **enter** key to save that value.

The default value for this parameter is: 600.

4.20 Pulses Per Unit Measure

This parameter is a result of how many pulses the integrator needs to count for the belt to move just one unit of measure. The BCi calculates this during a speed calibration. This number may be recorded and entered manually in the event of a complete integrator replacement.

The default value for this parameter is: 6.0.

4.21 Test Duration

This parameter is the value used for a timed calibration. This value is represented in seconds. Enter the desired length of time to run the timed calibration using the numeric keypad and press **enter** to save that value.

It should be noted that per Handbook 44, the requirement to test at least three revolutions of the belt. So based on the length of time it takes for a complete revolution, times that by three to get your parameter.

The default value for this parameter is: 60 seconds.

4.22 Tons per Pulse (output)

This parameter defines how many tons are accumulated to generate a pulse output for a remote totalizer. This is a numeric value that can be keyed in using the BCi numeric keypad and sends a pulse out of slot 0, bit 2 on the main CPU board of the BCi.

The default value for this parameter is 0.1.

4.23 Pulse Duty Cycle (in seconds)

This parameter defines how long the above output (tons per pulse) stays on. This is required for older model PLC's in order for the pulse to be recognized. This is a numeric value that can be keyed in using the BCi numeric keypad.

The value is a representation of seconds and its default value is 0.25 seconds.

4.24 Low Tons Per Hour

This parameter defines the lowest rate of material moving along per unit of time allowed. If the material rate falls below this value then the low rate alarm is triggered. A widget on the BCi display indicates if there is a low rate. If a digital output is configured for the low rate alarm, this will become energized as well.

The default value for this parameter is: 2.0.

4.25 Capacity Tons Per Hour

This parameter defines the maximum capacity of material allowed to accumulate per unit of time. If the rate exceeds this amount a high rate alarm will be triggered. A widget on the BCi also indicates the high rate. If a digital output is configured for the high rate alarm, this will become energized as well.

The default value for this parameter is: 50 T/hr.

4.26 Alarms

There are several alarm parameters that are set in place for the proper operation of the BCi belt scale. These alarms are needed for the proper operation of the scale and can be used for troubleshooting purposes. Those alarms that are needed are explained in the next five sections.

Special digital input/output option cards must be installed for the alarms to work.

4.26.1 Speed Alarm Value

This parameter defines the maximum belt speed allowed before the speed alarm will be triggered. A widget on the BCi will indicate the high belt speed as well. If a digital output is configured for the high speed alarm, this will become energized as well.

The default value for this parameter is: 300ft/minute.

4.26.2 Low Rate Alarm Bit

This parameter defines which output will energize for the low rate alarm.

The default value for this parameter is: 0.

4.26.3 High Rate Alarm Bit

This parameter defines which output will energize for the high rate alarm.

The default value for this parameter is: 0.

4.26.4 Speed Alarm Bit

This parameter defines which output will energize for the high speed alarm.

The default value for this parameter is: 0.

4.27 Zero Tracking Limit

This parameter defines the maximum graduations of weight that can be automatically zeroed off because the load on the scale has exceeded the pre-determined limit for auto zero. Using the numeric keypad on the BCi, enter the zero tracking limit and press **enter**.

The default value for this parameter is: 0.0.

An example of the zero tracking limit is;

$$\frac{6\ \text{lb/ft}}{20\ \text{tons/hr.}}$$

4.28 Maximum Zero Tracking Rate

This parameter determines what rate the integrator will stop attempting to zero the tracking weight. This value needs to be set below the actual rate of material going across the scale or the totalizer will not accumulate.

The default value for this parameter is: 0.0.

4.29 Print Functions

There are several print functions that can be set up through the BCi and connecting to a serial printer. Those parameters that need to be set up in the BCi are listed in the following sections below.

4.29.1 Print Output Port

This parameter defines which serial port the print format will be sent from.

The default value for this parameter is: 0.

4.29.2 Remote Print Input

This parameter defines which digital input bit will work the same as the Print key on the front of the BCi.

The default value for this parameter is: 0.

4.29.3 Print Format

This parameter defines the print format for the belt scale integrator.

The default value for this parameter is:

TIME: <TI><NL>DATE: <DA><NL>MASTER TOTAL: <MT><NL>RESET TOTAL: <RT><NL>RATE: <R>

4.30 Stream Output Port

This parameter defines which serial port the stream format will be sent from. The BCi will only stream if this is set to a valid port with a value greater than zero.

The default value for this parameter is: 0.

4.31 Stream Format

This parameter defines the stream format for the belt scale integrator.

The default value for this parameter is:

<R><NL>

4.32 Maximum Tracked Tons Per Hour

This optional parameter value represents the maximum rate that the analog output will track. If the rate goes above this value, the analog output will just put out the maximum signal.

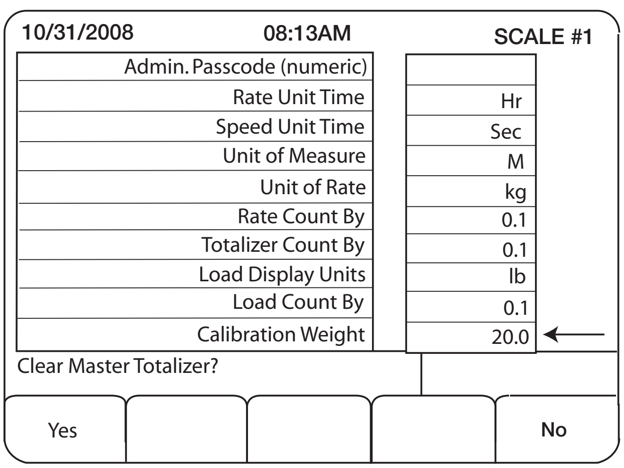
The default value of this parameter is: 20.0 T/hr.

4.33 Remote Totalizer Reset Input

This parameter defines a digital input that can reset the reset totalizer. This only affect the reset totalizer and not the master totalizer. The master totalizer can only be reset through the supervisor menu.

The default value of this parameter is: 0.Master Totalizer Reset

To reset the Master Totalizer, press the **Master Totalizer** softkey from the Supervisor Mode to access this parameter. The BCi prompts *Clear Master Totalizer*?



Press **Yes** to clear the totalizer or **No** to leave the accumulated weight in the master totalizer.

4.34 Setting Time and Date

Press the **Time/Date** softkey from the supervisors mode to access this parameter. The BCi prompts *Enter Date XX/XX/20XX MMDDYY=>*. Enter in a new date in MMDDYY format and press **enter.** The integrator then prompts *Enter Time XX:XX AM/PM HHMM*. Enter in a new time in 24 hour format and press **enter.**

4.35 Interfacing a PLC to the Belt Scale System

Within the *920i*, there are setpoints which contain four numeric variables:

- Value (target)
- Bandwidth
- Preact
- Hysteresis

These setpoints can be written and read by a user program. They can also be read or written from a PLC. The command for a write value is a 304 and a read value is a 320. The other write values are 305, 306, and 307 for the hysteresis, bandwidth and preact. The read values are 321, 322, and 323. You will only be using the value variables in each setpoint.

The only step in the setpoint menu of the *920i* is to enable the setpoints to a Gross (KIND) and they will be ready to act as “mailboxes”.

The following setpoints will contain these values from the variable needed in the belt scale:

Setpoint Value	Description
SP3	Rezero the scale. A non-zero value will do a rezero.
SP4	Clear totalizer any non-zero value.
SP97	Return belt speed
SP98	Return TN/HR (rate)
SP99	Return load
SP100	Return totalizer value

Table 4-1. Setpoint values

5.0 Calibration

There are two components of the Belt Scale Conveyor system need to be calibrated for the system to work. Those component parts include:

- Speed sensor
- Integrator (BCi)

Note: ***The speed sensor calibration must be done prior to the BCi calibration.***

5.1 Speed Sensor Calibration

A belt conveyor scale shall be equipped with a belt speed or travel sensor that will accurately sense the belt speed or travel whether the belt is empty or loaded.

Use the following steps to calibrate the speed sensor.

1. Select the **Belt Calibration** softkey from the Supervisors menu.
2. The integrator will change the softkeys to **Start**, **Stop**, and **Exit**.
3. A reference point needs to be marked on the conveyor belt and a reference needs to be marked on the conveyor frame. This will give the operator a reference to count the number of revolutions the belt travels during the speed calibration. The more revolutions in a test, the better the speed and distance accuracy.
4. Press the **Start** softkey. This will cause the integrator to change screens displayed the number of pulses counted, the frequency of the pulses and the time the test is running as shown below.

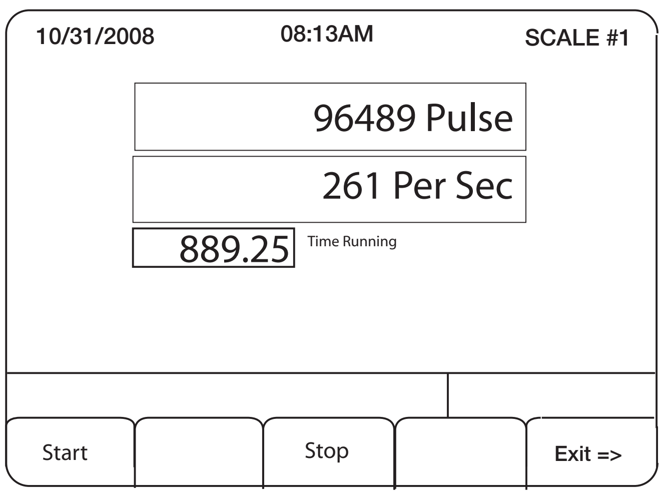


Figure 5-1. Pulses Counted

   The screen illustrates a live display of how the belt is working. If the pulses and frequency are not changing then there is a problem with the speed sensor and can be a sign that either the wiring or the sensor itself is bad. During this cycle of the calibration procedure, the operator needs to count the number of belt revolutions.

5. Pressing the **Stop** softkey will stop the speed sensor calibration. The integrator will then prompt the user

to enter the number of belt revolutions.

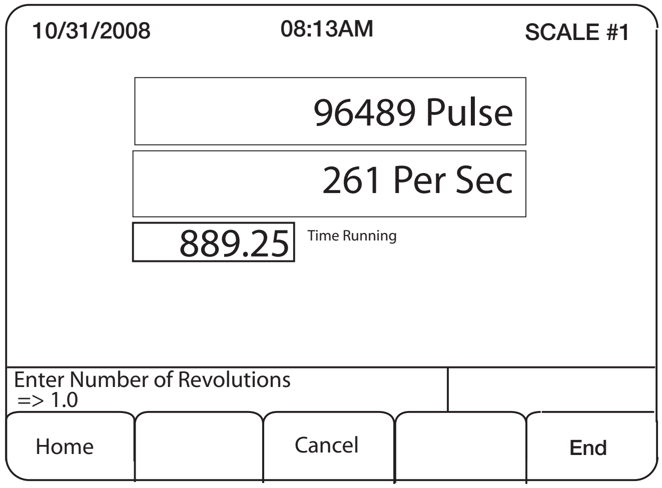


Figure 5-2. Enter Number of Revolutions

6. The operator will key in the number of times the belt traveled past the reference point.
7. The integrator will then calculate the pulses per unit of measure. This will be used for displaying the speed of the belt and totalizing the weight during operation.
8. The number of belt revolutions is stored as the test duration. This value is used for auto calibration when the integrator is being calibrated to the load cell.

5.2 Integrator Calibration

There are three modes of integrator calibration:

- Auto Cal
- Material Cal
- Timed Cal

All three calibration methods are described in the following sections starting on page 40. There are two types of tests that are also used in conjunction with calibrating the complete system. They are:

- Material testing
- Simulated (resistor) load testing.

Material testing is used only with the material calibration and the simulated (resistor) load testing is used only with the Auto Calibration and the Timed Cal.

The following sections describe how to perform a material test and a simulated load test.

5.2.1 Material Testing

Material testing is the only known way to establish repeatability and traceable accuracy of a conveyor belt scale system. Normally three or more successive material tests are required to achieve acceptance accuracy and demonstrate repeatability of the belt scale system. Once the material test is complete, one or more methods of simulated testing is also done to ensure accuracy. Material tests should be done at least every six months. Material tests should also be done immediately following any type of conveyor maintenance that may affect the scale.

The test itself consists of passing previously weighed - or material to be weighed, over the belt conveyor scale. Care must be taken to see that all material is weighed both on the reference scale and on the belt conveyor scale. The two weights are compared, the differences figured, and the error is percentage computed.

The following steps are involved in doing a material test.

1. The reference scale (track scale, truck scale, dumper scale, hopper scale, etc) is checked to determine that it is in compliance with the applicable regulatory agency or Handbook 44 and must not leak or be overloaded to the point that material will be lost. According to Handbook 44 instructions, the test shall

not be less than 1000 scale divisions, must run at least three revolutions of the belt scale and must run for at least 30 minutes or more (below 41°F, the belt should be run longer).

2. After running the belt empty (to warm up the belt), a reading is taken from the integrator.
3. The belt is run for a period of time equal to that required to deliver the minimum totalized load, approximately 10 minutes and the reading is again taken. It should not vary more than +/- increment of the scale. If the reading varies more, the zero must be adjusted. This process is repeated until an acceptable zero condition is achieved.
4. After taking the integrator reading, material is introduced onto the scale belt and the rate of flow should be carefully watched to rise to better than 35% of the rated capacity. The ideal operating and weighing range is 50 to 85% of the rated capacity. A rule of thumb is if the time the scale is operated under 35% of rated capacity, after the infeed is opened and closed, doesn’t exceed 10% of the running time, acceptable weighing is present.
5. After the weighing has been completed, the belt should be running and empty (do not stop the belt).
6. The reading is taken from the master totalizer again. The “start” figure is subtracted from the “stop” figure, which shows tons (or pounds) weighed. This figure is compared with the printer. The printer may show +/- increment difference.
7. Compute the percent error. If the belt conveyor scale is out of tolerance, adjust the span by the computed error. Repeat the material test again, steps 4-6. If the scale is in tolerance, the accuracy is established; and proceed to step 8. If not, compute the error and again, adjust the belt conveyor span. If the accuracy tolerance cannot be obtained, determine the problem before proceeding.
8. Conduct a final material test following steps 4-7 (do not adjust the span). If the belt scale is in tolerance, its repeatability is established. Note: on the initial verification, two additional test are required, total three to establish repeatability.

There are several advantages and disadvantages to material testing. They are listed in the following table.

Advantages of Material Testing	Disadvantages of Material Testing
This is the only method that can establish traceable conveyor scale accuracy.	Requires availability of accurate static scale.
It readily permits testing at several feed rates to test linearity.	Requires accumulation, transportation to static scales, and static weighing of the test load material.
It tests the entire system; electronics, scale carriage, and the conveyor effects.	

Table 5-1. Advantages and Disadvantages to Material Testing

5.2.2 Simulated Testing

A simulated load test consisting of at least three consecutive test runs should be conducted as soon as possible, but not more than 12 hours after the completion of the material test, to establish the factor to relate the results of the simulated load test to the results of the material tests. The results of the simulated load test should repeat within 0.1 percent.

Simulated testing is used only on auto and timed calibration of the integrator.

There are three different simulated load testing techniques that can be used. They are:

- Roller test chains
- Static test weights
- Resistor calibration

There are several advantages and disadvantages to each of the list simulated testing techniques. They are listed in table 5-2.

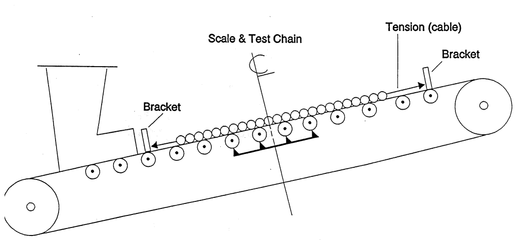
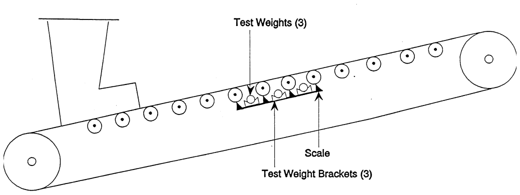
Simulated Testing Type	Advantages	Disadvantages
Roller (chain)  	Simulates some conveyor belt effects	Chains do not provide a traceable conveyor scale calibration standard.
	Acceptable simulated test	Heavy chains are difficult to handle.
		Conveyor belt must be stopped to apply and remove.
		Linearity test requires several chains.
		Chains are costly.
Static  	Simulates some conveyor belt effects	Weights do not provide a traceable conveyor scale calibration standard
	Easy to apply	Does not simulate conveyor belt effects
	Conveyor belt does not have to be stopped to apply	
	Linearity test is easy to perform	
	Detect load cell failures, and applies force to the load cell	
	Acceptable simulated test	
Electronic - Resistor	Can be self-contained within the electronics	Does not detect all types of load cell failures; does not apply force to load cell.
	Checks all electronics including electrical circuit of load cell	Does not simulate conveyor belt effects.
	Quickest and easiest of all calibration checks.	Requires calculated factor for incline.
		Electronic calibration does not provide a traceable conveyor scale calibration standard.

Table 5-2. Advantages and Disadvantages to Simulated Testing

Maintenance Testing

A belt scale should be tested weekly using one of the simulated testing devices, like test chains or test weights. They need to be conducted at periodic maintenance intervals between the material tests to provide a reasonable assurance that the scale is performing correctly. Records of these tests should be kept for use by the applicable regulatory agency. The following steps should be performed when doing maintenance testing.

1. A visual inspection should be made to insure the equipment is in good mechanical condition: scale area clean, no obstructions, the idlers turn, the bearings are sound, etc.
2. Zero test the scale system. Adjust zero until within the tolerance of the applicable regulatory agency. An idle belt should run 30 minutes or more depending on the temperature prior to the zero test.
3. Span test the scale system (span testing explained in the Auto Cal Mode section shown on page 39), using the selected simulated test device. Adjust the span until it's within the tolerance of the applicable regulatory agency. Perform three to five repeatability tests. The scale should repeat to the given tolerance.
4. Remove the simulated testing device and check zero per step 2.
5. The system is now ready for normal operation.

NOTE: ***If a convenient material test method is available, the simulated test need not be performed. The material test is then performed on a weekly basis. Test results should be kept for the applicable regulatory agency.***

Auto Cal Mode

By selecting the Auto Cal mode, the BCi will calibrate the zero and span using the number of calibration revolutions as the reference for the calibration duration. Zero and span calibrations are based on belt length defined by the number of revolutions and use either static weights or test chains. Use the following steps to perform an auto calibration.

1. Press the **Auto Cal** softkey on the BCi display. The BCi will display **Zero Cal**, **Span Cal**, **Load Resistors**, and **Exit** softkeys.
2. By pressing the **Zero Cal** softkey will initiate the calibration sequence for the dead load calibration. To initiate this calibration sequence, press the **Start** softkey. When the zero calibration is running, the integrator is taking an average of the belt weight and using that as the zero reference and will run this sequence for approximately 10 seconds and will automatically stop when the test time has expired. This process is measuring the distance the belt travels. This is another reason why more belt revolutions are better for the calibration. The integrator can average the belt longer and calculate a better reference as the zero.
3. After the integrator has run the zero cal, a zero percentage error is displayed.

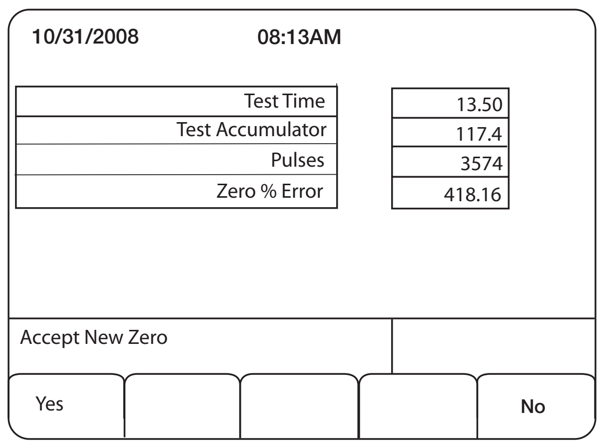


Figure 5-3. Zero Percentage Error Display

The operator has the option of accepting this error and setting the new dead load value or reject it with no change made to the dead load.

4. The **Span Cal** softkey will initiate the calibration sequence for the span calibration. This is similar to the zero cal but there is a load applied to the scale during this process. The load can be static weights, test chains, or the load resistors. To initiate this calibration sequence, press the **Start** softkey.

NOTE: ***If using resistors as the load, they must be enabled before initiating the span calibration.***

5. After the integrator has run the span cal, the BCi will display the percentage of span error.

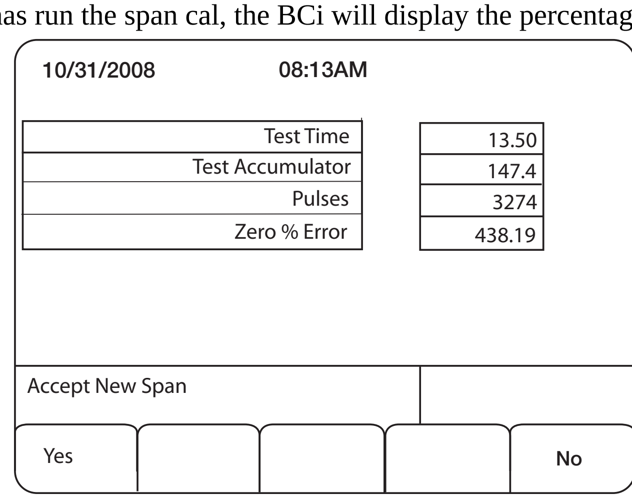


Figure 5-4. Percentage of Span Error Display

The operator can accept the error and the new span value will be stored, or the operator can reject it with no change made to the span value.

6. The zero and span cal process can be stopped and restarted by pressing the **Stop** softkey and then press **Start**. The process can be aborted by pressing the **Exit=>** softkey.

Material Calibration Mode

Use this calibration mode if you want to start and stop the calibration process similar to the belt speed calibration. The calibration process does not stop automatically; again this method might be useful when the belt length is very long.

Use the following steps to perform a manual calibration.

1. Press the **Manual Cal** softkey on the BCi display. The BCi will display **Zero Cal**, **Span Cal**, **Load Resistors** and **Exit =>** softkeys.
2. The **Zero Cal** softkey initiates the calibration sequence for the dead load calibration.
3. Press the **Start** softkey when the zero calibration is running and the integrator is taking an average of the belt weight and using that as the zero reference. The operator then presses the **Stop** softkey to end the sequence.
4. The zero percentage error is displayed. The operator has the option of accepting this error and setting the new dead load value or it can be rejected with no change made to the dead load.

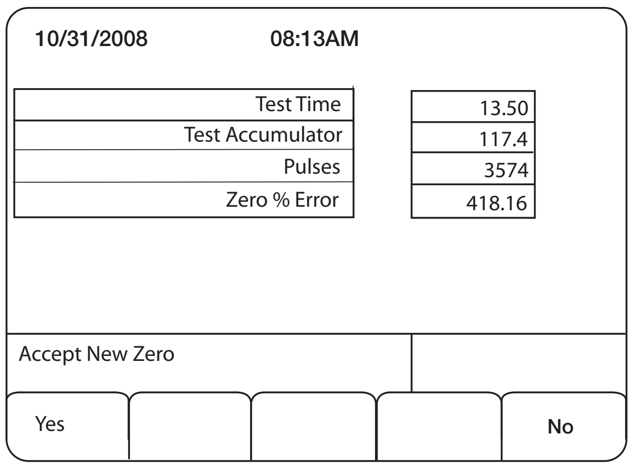


Figure 5-5. Accept New Zero

5. The **Span Cal** softkey will initiate the calibration sequence for the span calibration. This is similar to the zero cal but there is a load applied to the scale during this process. The load may be static weights, test chains, or the load resistors.
6. The operator will press **Start**, the integrator will start taking span averages. At some point the operator will then press the **Stop** softkey to end the sequence.
7. The BCi will prompt the operator for the amount of material that was weighed. The operator may key in

the new value and press **enter** or cancel to exit with no changes.

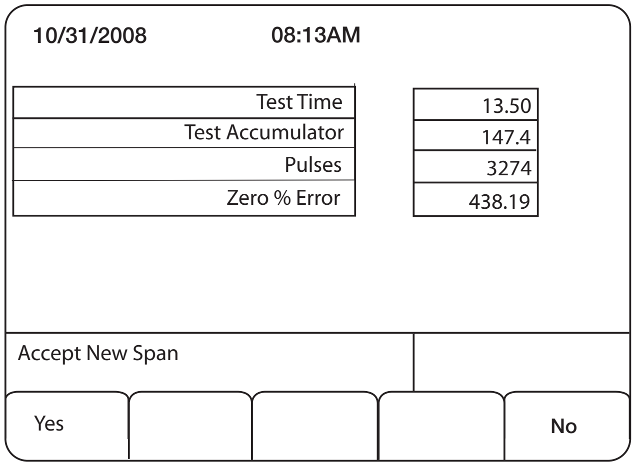


Figure 5-6. Accept New Span

8. The zero and span cal process can be stopped and restarted by pressing the **Stop** softkey then pressing **Start**. The process can be aborted by pressing the **Exit =>** softkey.

Timed Calibration Mode

By selecting this mode will calibrate the integrator based on time rather than the number of belt revolutions. This method is useful for long belt lengths of over 1000 feet due to the length of time it takes to complete a full belt revolution and uses static weights or test weights.

Use the following steps to perform a timed calibration.

1. Press the **Timed Cal** softkey on the BCi display. The BCi will display **Zero Cal**, **Span Cal**, **Load Resistors**, and **Exit** softkeys.
2. The **Zero Cal** softkey initiates the calibration sequence for the dead load calibration. To initiate this calibration sequence, press the **Zero Cal** softkey and the following screen is displayed

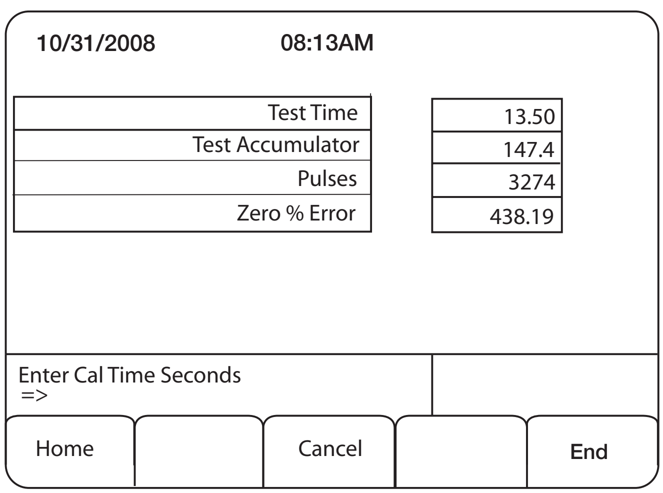


Figure 5-7. Enter Cal Time

3. Enter the amount of time you wish to have the calibration time run using the numeric keypad on the BCi. Press **Enter** then press the **Start** to perform the timed calibration sequence. When the zero calibration is running the integrator is taking an average of the belt weight and using that as the zero reference. This process runs off a timer, not the distance the belt travels.

4. After the integrator has run the zero cal, a zero percentage error is displayed.

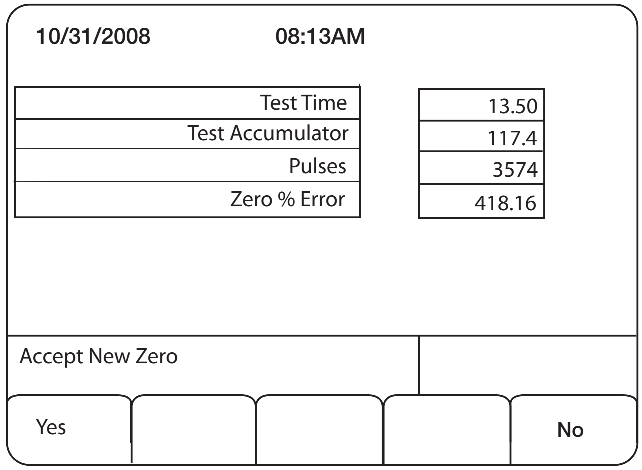


Figure 5-8. Zero Percentage Error Display

The operator has the option of accepting this error and setting the new dead load value, or he can reject it with no change made to the dead load.

5. Press the **Span Cal** softkey to initiate the calibration sequence for the span calibration. This is similar to the zero cal but during this process product will be transferred across the scale. To initiate this calibration sequence, press the **Start** softkey.

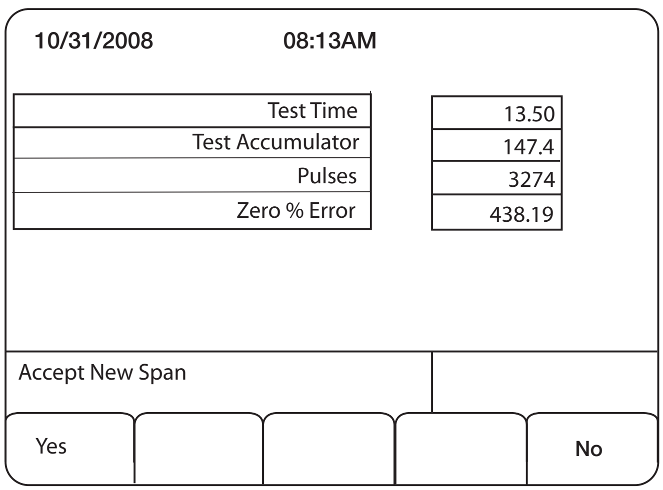


Figure 5-9. Accept New Span

6. After the integrator has run the span cal, the BCi displays the percentage of the span error. The operator can accept the error and the new span value is stored or he can reject it with no change made to the span values.
7. The zero and span calibration process can be stopped and restarted by pressing the **Stop** softkey, then pressing **Start**. The process can be aborted by pressing the **Exit =>** softkey.

6.0 Handbook 44 Requirements for Belt-Conveyor Scales

A belt conveyor scale system must be tested after it is installed according to Handbook 44. It must be tested on the conveyor system with which is to be used and under such environmental conditions as may normally be expected. Each test shall be conducted with test loads no less than the minimum test load.

Material testing is the only known way to establish repeatability and traceable accuracy of a belt scale system. Normally three or more successive material tests are required to achieve acceptance accuracy and demonstrate repeatability of the belt scale system.

Following a material test, one or more methods of simulated testing is employed to ensure repeatability and maintenance accuracy. Material tests should be conducted at least every six months. Material tests should also be done immediately after conveyor maintenance that could affect the scale.

Once the belt scale is installed properly, use the following procedures to material test the scale.

6.1 Reference Test

Reference scale is used to pre-weigh or post-weigh the actual material that will be used for calibration of the belt scale. The different types that may be used are:

- Static vehicle scale
- Static track scale
- A certified belt scale
- Uncoupled full bridge in-motion track scale
- Uncouple double draft in-motion track scale
- Test weigh bin
- Garner system

The following scales and methods are not acceptable for material testing.

- Coupled in motion track scale
- Marine draft survey
- Truck or bucket count

6.2 Conditions of Test

A belt scale needs to be tested after it's installed on the conveyor system that it's to be used with. It also needs to be tested under the same environmental conditions as may normally be expected. It needs to be tested at normal use capacity and can be tested at any other rate of flow that may be used at the installation. Three tests are required. Each test shall be conducted for the following.

6.2.1 Handbook 44

- Not less than 1000 scale divisions
- At least three revolutions of the belt
- At least 10 minute's operation or for a normal weighment

6.2.2 AAR Scale Handbook

- Not less than 1000 scale divisions
- At least three revolutions of the belt
- At least 10 minute's operation or sufficient time to deliver a normal weighment.

7.0 Maintenance

The maintenance information in this manual is designed to cover all aspects of maintaining and troubleshooting the BCi in-motion belt scale. Should you encounter a problem that requires technical assistance, you can call Rice Lake Weighing Systems' service department at 1-800-472-6703.

NOTE: ***Have your scale model number and serial number available when you call in for assistance.***

7.1 Maintenance Checkpoints

The scale should be checked frequently to determine when calibration is required. It is recommended that zero calibration be checked every other day and that calibration be checked every week for several months after installation. Observe the results and lengthen the period between calibration checks, depending upon the accuracy desired.

7.1.1 Housekeeping Tips

There are several maintenance issues that need attention to maintain the general well being of the belt scale. They are listed below.

Cleaning

Keep the scale area clean of rocks, dust and material build-up.

Lubrication

The weigh idlers should be greased one to two times yearly. Overloading the weigh idlers with grease can change the tare weight and place the scale out of calibration. A zero calibration is necessary after greasing.

Belt Training

The belt must be trained to run true to the center line of the idlers in the area of the scale while running empty, as well as under loaded conditions. Where this cannot be accomplished due to off-center loading, the loading should be modified. Where a belt does not train while empty but does train while loaded, it will be necessary to train the belt over the scale area at least during the calibration checks.

Belt Tension

It is important that the conveyor conditions remain constant at all times. Therefore, gravity-type take-ups are recommended on all conveyors where belt scales are installed. Conveyors which do not have a constant tension device will require calibration whenever the belt tension changes and the take-up is readjusted.

Belt Loading

Extreme loading conditions which cause flow rate of material to be above 125% of the instrument range must be avoided. Any load capacity above this amount can't be measured. Belt loading should be adjusted to stay within the instrument range. On the other hand, very low flow rates, with respect to full scale range, can produce low accuracy.

Material Sticking to the Belt

Material can form a film on the belt which is carried continually around the belt and is never discharged. This condition is often true when handling wet, fine material. Belt scrapers may correct this condition. If the film can't be removed, the zero will have to be adjusted. Any change in the build-up of the film adhering to the belt will require further adjustment.

Skirtboards and Covers

Skirtboards should not be placed closer to the weigh idlers than the +3 or -3 idler. If skirts or covers are necessary in the weighing area, they must not place any external forces on the scale. Even though the skirts are clear of the belt under "no load" conditions, material will jam or slide between the boards and the belt when the conveyor is operating. Errors of several percent can be expected where such conditions exist.

7.2 Belt Scale Troubleshooting Tips

The following section covers basic troubleshooting tips for the belt scale. If the BCi in-motion belt scale fails to operate properly during or after performing set up and calibration, it's suggested to perform the procedure again, and if the problem still persists, follow the troubleshooting procedures listed in the following sections.

7.2.1 Calibration Shifts

Frequent calibration shifts should be isolated to zero shifts or span shifts.

7.2.2 Zero Calibration Shifts

Zero shifts are normally associated with the conveying system. When a zero shift occurs, the span will shift by a like number of TPH, this then appears as a span shift.

Common causes of zero shifts:

- Material buildup on the carriage/weighbridge assembly
- Rocks lodged in the carriage/weighbridge
- Conveyor belt tracking
- Non-uniform conveyor training
- Conveyor belt belting stretch due to material temperature variations
- Trouble in the electronic measuring components
- Severely overloaded load cell

7.2.3 Span Calibration Shifts

Span shifts are normally associated with the electronic measuring of components of the system, with one exception, which is conveyor belt tension. A span shift is present if both points change by the same percentage TPH.

Common cause of span calibration shifts:

- Change in conveyor belting tension
- Speed sensor roll build-up and/or slipping
- Conveyor scale alignment
- Severely overloaded load cell
- Trouble in electronic measuring components

7.2.4 Field Wiring

If you suspect a problem with the wiring of the belt scale, use the following points to double check the electrical portion of the scale.

- Check for proper interconnections between the components of the system. All the wiring must be as specified on the installation drawings.
- Check all wiring and connections for continuity, shorts, and grounds using an ohmmeter.
- Loose connections, poor solder joints, shorted or broken wires and unspecified grounds in wiring will cause erratic readings and shifts in weight readings.
- Check that the grounding of all cable shields is made at only the locations as specified in the installation drawings.

7.3 BCi Integrator Troubleshooting Tips

Table 7-1 lists general troubleshooting tips for various hardware and software error conditions regarding the BCI in-motion belt scale.

Symptom	Remedy
integrator does not power up	Possible blown fuse or bad power supply. Check fuses and replace if necessary. If fuses are good, check all voltages on CPU board. Power supply should output both +6V and –6V levels to the CPU board (see Figure 2-5 on page 11). If power supply appears bad, check the small glass fuse (2.5A, 5x20mm) on the power supply board.
Front panel power integrator blinking ( )	Power supply overloaded. Check for shorts in A/D card regulators or in the DC-to-DC converter of any installed analog output or pulse input cards.
"Blue screen"	Check LCD contrast pot (under interface board access cover; possible corrupt core software; reset or reload software.
Tare and truck data pointers are corrupt, *Tare storage is corrupt* error messages at startup	Possible dead battery. Perform configuration reset then check for low battery warning on display. If battery is low, replace battery, perform another configuration reset, then reload files.
Divide by zero error message at startup	User program error.
Dashes in weight display	Overrange or underrange scale condition. Check scale. For out-of -range conditions in total scale display, check all scale inputs for positive weight values.
Display reads *0.000000*	Scale not updating. Check for bad option card hanging the bus.
Cannot enter setup mode	Possible bad switch. Test switch; replace interface board if necessary.
Serial port not responding	Possible configuration error. For command input, ensure port INPUT parameter is set to CMD.
A/D scale out of range	Check source scale for proper mechanical operation. Check load cell and cable connection. Possible bad load cell: check integrator operation with load cell simulator.
Locked — Scale in use	Scale is assigned as an input to a total scale or is the source for a serial scale, analog output, or setpoint. If not correct, deconfigure this scale assignment and reconfigure as required.
Option *x* Error	Field bus card (Profibus, DeviceNet, or Remote I/O) in slot *x* failed to initialize.
Option card failure	Possible defective card or slot. Disconnect power, install card in different slot, then apply power again.

Table 7-1. Basic Troubleshooting for the BCI In-Motion Belt Scale

8.0 Appendix

BCi Data Sheet

Belt Scale Questionnaire

Contact: ______________________________ Prepared By: ______________________
Company: ______________________________ Date: ______________________
Address: ______________________________ Notes of the Application: ______________________
City: ______________________________ ______________________
State/Zip: ______________ Country: ______________ ______________________
Email: ______________ Phone: ______________ ______________________
Fax: ______________

Material

Material being measured: ______________ Bulk Density (lbs/cu.ft): ______________

Corrosive state of material: ❐High ❐Moderate ❐Not corrosive *(choose one)*

Conveyor

(Supply sketch where possible) ❐Sketch attached

Application: ❐Inventory ❐Load out ❐Control ❐Blending ❐Legal for trade

Material Feed rate: __________ minimum t/hr Accuracy required: +/- ______________%

__________ maximum t/hr

Constant feed rate: ❐Yes ❐No Automatic Tensioning Apparatus: ❐Yes ❐No

Access side: *(looking in direction of belt travel)* ❐Left ❐Right ❐Both

Electrical classification at scale location: ______________________ (Class Division Group if Applicable)

Profile: ❐Horizontal ❐Incline/decline ______ (degrees) ❐Variable Incline ______(degrees) ❐Curved

Belt Speed: __________ minimum ft/min.

__________ maximum ft/min.

Belt length: __________ feet Belt width: __________ inches Conveyor Length: ________feet

Idler diameter __________ inches Tail pulley dia.: ________ inches Belt Cleaning Device ❐Yes ❐No

Trough angle: ________ degrees Idler spacing: ________ inches

Integrator Requirements

(Indicate all that apply) Power available: ______________________

Outputs required:	Communications:	
❐4-20 mA	❐AB Remote I/O	Remote Display Totalizer: ❐Panel Mount ❐Wall Mount
❐RS-232	❐DeviceNet	Remote Display Rate: ❐Panel Mount ❐Wall Mount
❐Ethernet TCP/IP	❐Profibus-DP	❐Load Out Control Explain Details ______________
	❐Ethernet IP	______________________________
		❐Printer Model ______________________

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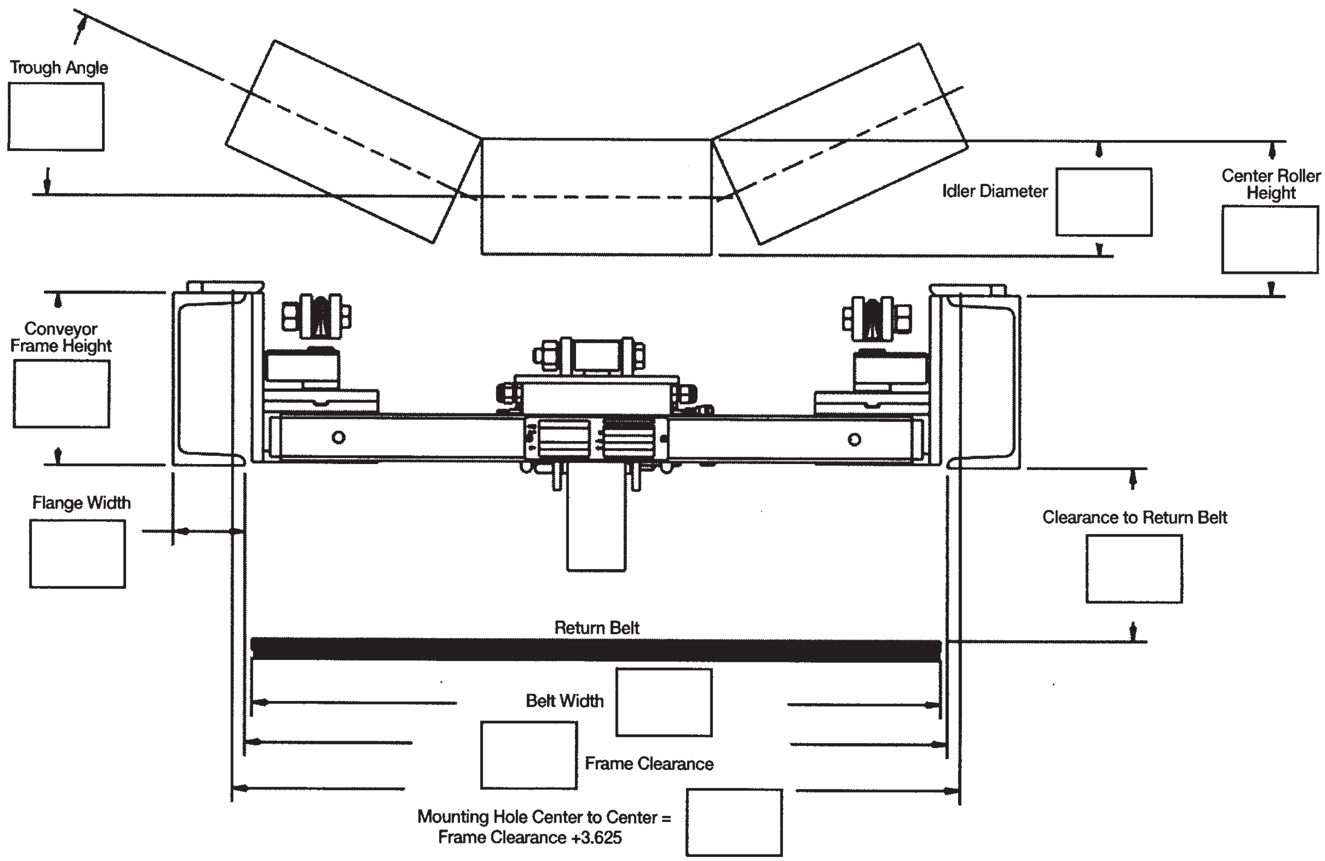
Belt Scale Questionnaire



Note: Please attach conveyor profile drawing or photographs of actual conveyor. Indicate direction of belt travel, automatic tensioning apparatus and belt cleaning device locations.

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8.1 BCi integrator Specifications

Power

Line Voltages	115 or 230 VAC
Frequency	50 or 60 Hz
Power Consumption	
115 VAC	400 mA (46 W)
230 VAC	250 mA (53 W)
Fusing	
115 VAC	2 x 2A TR5 subminiature fuses Wickmann Time-Lag 19374 Series UL Listed, CSA Certified and Approved
230 VAC	2 x 2A TR5 subminiature fuses Wickmann Time-Lag 19374 Series UL Recognized, Semko and VDE Approved

A/D Specifications

Excitation Voltage	10 ± 0.5 VDC, 32 x 700Ω load cells per A/D card
Sense Amplifier	Differential amplifier with 4- and 6-wire sensing
Analog Signal Input Range	–10 mV to +40 mV
Analog Signal Sensitivity	0.3 µV/grad minimum @ 7.5 Hz 1.0 µV/grad typical @ 120 Hz 4.0 µV/grad typical @ 960 Hz
A/D Sample Rate	7.5–960 Hz, software selectable
Input Impedance	>35 M¾ typical
Internal Resolution	8 000 000 counts
Wt Display Resolution	9,999,999
Input Sensitivity	10 nV per internal count
System Linearity	±0.01% of full scale
Zero Stability	±150 nV/°C, maximum
Span Stability	± 3.5 ppm/°C, maximum
Input Voltage Differential	±800 mV referenced to earth ground
Input Overload	Load cell signal lines ±10 V continuous, ESD protected
RFI/EMI Protection	Communications, signal, excitation, and sense lines protected

Digital Specifications

Microcomputer	Motorola ColdFire® MCF5307 main processor @ 90 MHz
Digital I/O	4 I/O channels on CPU board; optional 24-channel I/O expansion cards available
Digital Filter	Software selectable: 1–256, enhanced Rattletrap® hybrid digital filtering

Serial Communications

Serial Ports	4 ports on CPU board support up to 115200 bps; optional dual-channel serial expansion cards available
Port 1	Full duplex RS-232
Port 2	RS-232 with CTS/RTS; PS/2 keyboard interface via DB-9 connector
Port 3	Full duplex RS-232, 20 mA output
Port 4	Full duplex RS-232, 2-wire RS-485, 20 mA output

Operator Interface

Display	320x240 pixel VGA LCD display module with adjustable contrast, 75Hz scan rate 26000 cd/m^2 brightness
Keyboard	27-key membrane panel, PS/2 port for external keyboard connection

Environmental

Operating Temperature	
Legal	–10 to +40°C (14 to 104°F)
Industrial	–10 to +40°C (14 to 104°F)
Storage Temperature	–10 to +70°C (14 to 158°F)
Humidity	0–95% relative humidity

Enclosure

Enclosure Dimensions	
Universal enclosure (without tilt stand)	10.56 in x 8.51 in x 4.61 in 268 mm x 216 mm x 117 mm
Deep enclosure (without tilt stand)	10.76 in x 8.51 x 5.25 in 273 mm x 216 mm x 133 mm
Panel mount enclosure	11.5 in x 9.1 in x 5 in 292 mm x 231 mm x 127 mm
Wall mount enclosure	14 in x 18 in x 6.75 in 356 mm x 457 mm x 171 mm
Weight	
Universal enclosure	9.5 lb (4.3 Kg)
Deep enclosure	10.75 lb (4.9 Kg)
Panel mount enclosure	8.5 lb (3.9 Kg)
Wall mount enclosure	23 lb (10.4 Kg)
Rating/Material	NEMA 4X/IP66, stainless steel

Certifications and Approvals

NTEP
CoC Number01-088
Accuracy ClassIII/IIILn_{max}: 10 000

Measurement Canada
Approval AM-5426
Accuracy Class III n_{max}: 10 000

UL

Universal model
File Number:E151461

Panel mount model
File Number:E151461, Vol 2

Wall mount model
UL 508A control panel approved
File Number:E207758

OIML
GB-1140 n_{max}: 6 000
GB-1135 n_{max}: 10 000

BCi Limited Warranty

Rice Lake Weighing Systems (RLWS) warrants that all RLWS equipment and systems properly installed by a Distributor or Original Equipment Manufacturer (OEM) will operate per written specifications as confirmed by the Distributor/OEM and accepted by RLWS. All systems and components are warranted against defects in materials and workmanship for two (2) years.

RLWS warrants that the equipment sold hereunder will conform to the current written specifications authorized by RLWS. RLWS warrants the equipment against faulty workmanship and defective materials. If any equipment fails to conform to these warranties, RLWS will, at its option, repair or replace such goods returned within the warranty period subject to the following conditions:

- Upon discovery by Buyer of such nonconformity, RLWS will be given prompt written notice with a detailed explanation of the alleged deficiencies.
- Individual electronic components returned to RLWS for warranty purposes must be packaged to prevent electrostatic discharge (ESD) damage in shipment. Packaging requirements are listed in a publication, *Protecting Your Components From Static Damage in Shipment*, available from RLWS Equipment Return Department.
- Examination of such equipment by RLWS confirms that the nonconformity actually exists, and was not caused by accident, misuse, neglect, alteration, improper installation, improper repair or improper testing; RLWS shall be the sole judge of all alleged non-conformities.
- Such equipment has not been modified, altered, or changed by any person other than RLWS or its duly authorized repair agents.
- RLWS will have a reasonable time to repair or replace the defective equipment. Buyer is responsible for shipping charges both ways.
- In no event will RLWS be responsible for travel time or on-location repairs, including assembly or disassembly of equipment, nor will RLWS be liable for the cost of any repairs made by others.

THESE WARRANTIES EXCLUDE ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. NEITHER RLWS NOR DISTRIBUTOR WILL, IN ANY EVENT, BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

RLWS AND BUYER AGREE THAT RLWS' SOLE AND EXCLUSIVE LIABILITY HEREUNDER IS LIMITED TO REPAIR OR REPLACEMENT OF SUCH GOODS. IN ACCEPTING THIS WARRANTY, THE BUYER WAIVES ANY AND ALL OTHER CLAIMS TO WARRANTY.

SHOULD THE SELLER BE OTHER THAN RLWS, THE BUYER AGREES TO LOOK ONLY TO THE SELLER FOR WARRANTY CLAIMS.

NO TERMS, CONDITIONS, UNDERSTANDING, OR AGREEMENTS PURPORTING TO MODIFY THE TERMS OF THIS WARRANTY SHALL HAVE ANY LEGAL EFFECT UNLESS MADE IN WRITING AND SIGNED BY A CORPORATE OFFICER OF RLWS AND THE BUYER.