

Belt-Way® Scales, Inc. Universal Conveyor Belt Scale

Instruction and Installation Manual



The Conveyor Belt Scale for:

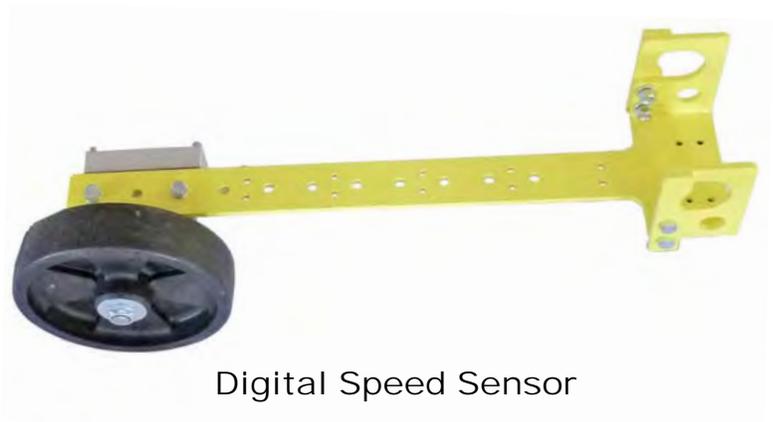
- Standard Conveyors**
- Portable Crushing & Screening Equipment**

**Belt-Way Scales, Inc., One Belt Way, Rock Falls, IL, 61071 USA
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Universal Scale Components



Control Box & Power Supply



Digital Speed Sensor



Universal Load Cell Assemblies



Mounting Pipes & Hardware

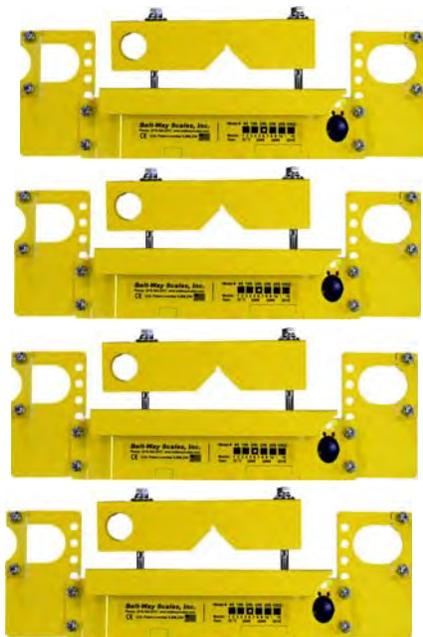
Dual Idler Scale Components



Control Box & Power Supply



Digital Speed Sensor



Load Cell Assemblies X 4



Junction Box
and Extension Cable



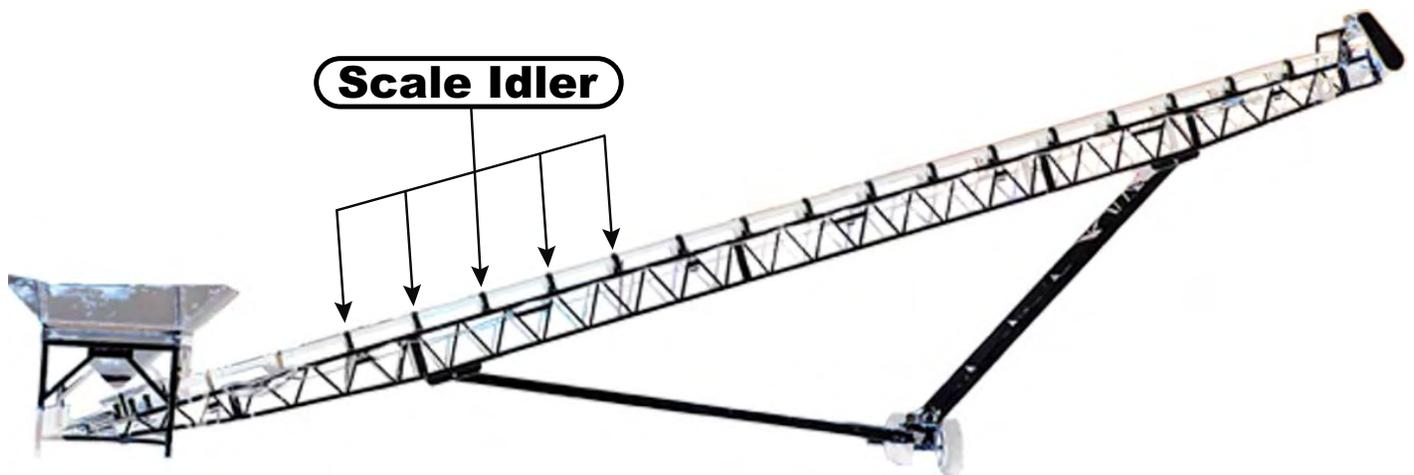
Mounting Pipes X4
& Hardware X 2

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Scale Placement Guidelines

5 idler weighing area



For accessibility, we suggest mounting the scale in the lower third of the conveyor.

Two idlers before and after the scale comprise the weighing area.

These 5 idlers must be in good mechanical condition and be the same width, trough angle, and diameter.

Skirting must not make contact with the belt in this area.

Loading (impacting the belt) must not take place in this area.

Avoid using idlers close to the head or tail pulley.

Conveyor Design Recommendations

Your conveyor may not meet all of these requirements and still give good accuracy readings. Use these as guidelines for good design and realize that violating good design will probably reduce accuracy.

- * Avoid high-speed, lightly loaded belts for scale applications.
Lowering the belt speed, which increases belt load, will cure most scale problems.
- * The idler used at the scale as well as preceding and following the scale should turn true (concentric) and the scale idler should be reasonably balanced (especially with high speed belts) so as not to generate an out of balance vibration.
(Some idler manufacturers make idlers specifically for scale duty.)
- * Idlers should be on equal centers a minimum of two before and two after the scale and must be string lined to be level for this span. Skirt boards must be avoided in the scale area.
- * The conveyor should not exceed 1000 feet in length.
- * The belt speed should not exceed 300 feet per minute on a belt 25 feet long or less.
- * The conveyor should be rigid in design and reasonably free from vibration.
The conveyor must not be subject to stress that will cause structural deflection.
- * The conveyor should have an automatic belt tightener. A gravity take up system is preferred.
- * The belt must be in contact with the scale idler at all times and should track in the center both empty and full.
- * If the conveyor is subject to excessive winds, the scale location should be sheltered by the use of a windbreak.
- * The idler toughing angle should be 35 degrees or less.
- * Conveyor inclination must not exceed the material angle of slide.
- * Conveyor loading should be reasonably uniform and loading cannot take place on the area of belt being used as the weighing platform.
- * Sufficient impact location idlers should be provided under each feeding location so as not to cause any deflection of the belt at the feed point.
- * The conveyor belt should be equipped with a gravity type belt wiper system if material buildup on the belt could be a problem.
- * The conveyor should be designed with a straight run without a vertical curve.
The conveyor may be horizontal, inclining or declining in slope.
- * If the scale is located within 25 feet of the head pulley, the top of the carry rolls within the scale area must be a minimum of 1/2 inch above the crown of the head pulley.

Mechanical Installation

MODEL # 45 100 200 350 500 1000

DATE _____

Before you begin, circle the model number of your scale above. It is located on each load cell tube. Write down the date. Select the idler to mount on the scale.

Be sure to read the previous page.

The bolt on the bottom center of the load cell assembly is an overload stop. There are two shoulder bolts under cover plates at the ends of the idler mounting plate. These are overload and under load stops. **DO NOT ADJUST THESE BOLTS.**

See Photo, Page #5, Step #2 to Install Load Cell Assemblies.

Mount the load cell assemblies on the idler. The end with the cable should be mounted on the low side. Use the bracket with an upside-down "V" notch to attach the load cells to the angle iron frame of the idler. The hole in the V block should be on the high side of the Load Cell Assembly. This hole is used for test weights. Do not tighten the bolts at this time. Position the Load Cell Assemblies on the idler frame to allow for ample clearance between the scale and conveyor frame. If possible, position the Load Cell Assemblies slightly under the belt. This will keep rocks falling off the edge of the belt from hitting the load cells. For installation on a Channel Frame Idler, simply install the "V" notch bracket with the flat side down.

See Photo, Page #5, Step #3, and Page #6, Step #4 to Install Mounting Hardware.

Slide the two pipes through the load cell hangers. See specific pipe alignment instructions on page #5, Step #3. Use the leveling pads as a drill template. Use welding clamps or C clamps to hold the pads and drill through the two inner holes using a 3/8" drill bit. The outer threaded holes are used for the leveling bolts. The frame must not be drilled in these locations. A total of 8 holes are required. See the drawing at the end of this manual for hole details.

See Photo, Page #6, Step #5 for Speed Sensor Installation.

Mount the digital speed sensor on either the front pipe as shown or on the rear pipe with the wheel in contact with the return belt. If it is not possible to mount the speed sensor on either of the pipes because of mechanical obstructions, you may use a third pipe to locate the sensor where it will fit. Cut the 1 1/4" galvanized pipes to fit the outer width of your conveyor.

See Diagram, Page #6, illustrations to align the scale.

Install the leveling bolts and jam nuts in the leveling pads. Install the "U" bolts and leveling pads on both pipes.

DO NOT TIGHTEN THE "U" BOLTS AT THIS TIME.

Tighten Leveling Bolts until the Leveling Pads barely touch the bottom of the pipes.

Warning ... if you tighten the leveling bolts or "U" bolts, at this time damage to the load cells may occur, as the idler is still fastened to the conveyor frame.

Cut the mounting feet off the idler assembly so only the load cells support it. Remove the bolts holding the Idler Mounting Plate to the conveyor. Discard the Idler Mounting Plate.

Mechanical Installation

If you choose not to cut the feet off remove the bolts holding the idler assembly to the conveyor. Use the leveling bolts to raise the idler attached to the load cells so there is at least 1/4" clearance between the foot and the conveyor. Shim at least the two idlers on each side of the scale to align with the idler on the scale. You may need to shim other idlers as well.

Align at least 5 idlers, using a string, so all five idlers are in line within 1/32". You may need to shim the idler assemblies. Use the leveling bolts to align the idler on the scale. The leveling pads should all be about the same height above the conveyor frame. Tighten the "U" bolts and leveling bolt jam nuts.

IMPORTANT: When you are finished you should be able to lift each load cell assembly about 1/32" on each pipe mount. If you cannot, the pipes may not be parallel or may be at different heights. Carefully adjust the leveling bolts and "U" bolts until the load cells are free to move up and down slightly on the pipes. This is important for accurate weighing.

See Photo Page #6, Step #7, install the stainless steel hose clamps.

Install two hose clamps to keep the digital speed sensor from moving on the pipes. The wheel should track near the center of the belt. Install the other four hose clamps on the pipes near the inside of each load cell hanger. You should leave about 1/16" clearance between each load cell hanger and the hose clamps so the entire weigh bridge can move on the pipes. This is important for proper weighing. Install the plastic caps in both ends of the pipe.

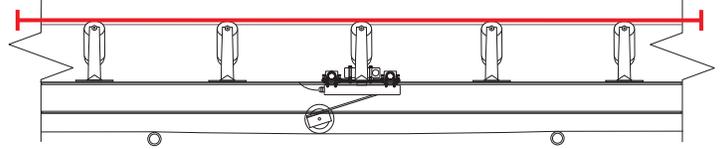
See Basic Electrical Installation, Page 8

Mount the control box near the conveyor. Use the mounting feet supplied. Do not drill through the box. The display will be much easier to read if the sun does not shine directly on it. You can mount the control box and power supply up to 1000 feet away from the conveyor. Extend the two load cell cables, the speed sensor cable, and the angle sensor cable. You should use Belden 8723 or equivalent cable. All splices must be soldered or fastened using screw terminals in a junction box. Do not use wire nuts or crimp connectors. Mount the power supply transformer housing near the control box close enough to be sure the power supply cable will reach the control box. Mount it with the cables at the bottom to prevent water from entering the box. Route the cables from the two load cell assemblies, the digital speed sensor, and angle sensor to the control box. Keep the scale wiring at least 2 feet from any high voltage wiring. Make sure all cables are securely tied and protected so they will not be damaged by falling debris. And be sure they cannot come in contact with any moving parts. Secure the cables to the under side of angles or braces to protect them. You may want to run your load cell cables and speed sensor cable in conduit. In that case you can remove the existing fittings from the ends of the load cell tubes and speed sensor tube and attach your conduit in the same holes.

Belt-Way[®] Scales, Inc. Mechanical Installation

Step 1

IMPORTANT! Use a String to Align Idlers. The Scale Idler Rollers Must be Flush Across the Top with Two Idlers Before and Two Idlers After. The Empty Belt Must Rest Uniformly on All Idlers Within the Weighbridge. This is Essential for Accurate, Repeatable Performance.



Step 2

Bolt Load Cell Assemblies to Conveyor Idler as show (Cable on Down-Hill End)
Leave Ample Clearance between Load Cell Assembly and Conveyor Frame.

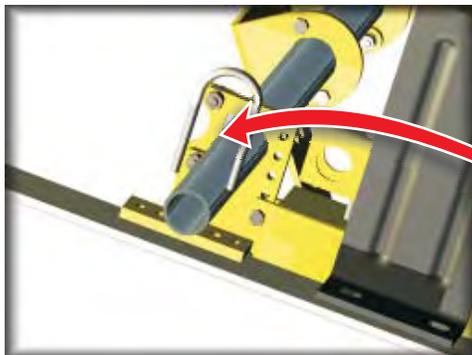
Your Idler



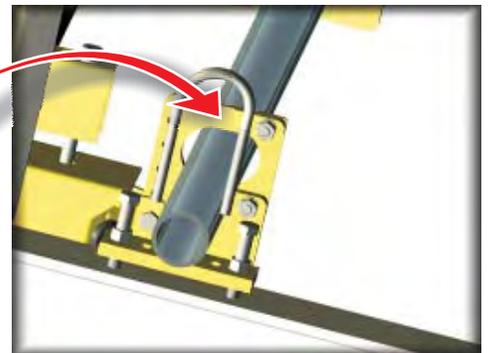
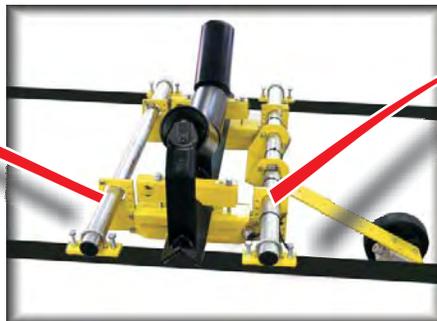
Step 3

Install Scale Support Pipes as Shown

High End of Load Cell Assembly
Pipe Must Touch Front Retaining Strap
on High End of Load Cell Assembly

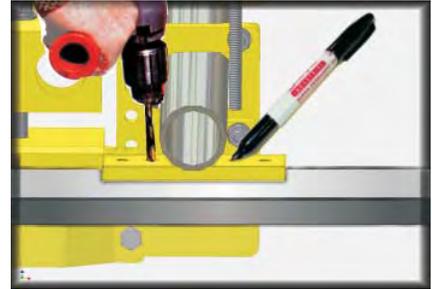


Low End of Load Cell Assembly
Center Pipe in Hanger on Low End
of Load Cell Assembly.



Step 4

Use Leveling Plate as Drill Template for U-Bolts.



Step 5

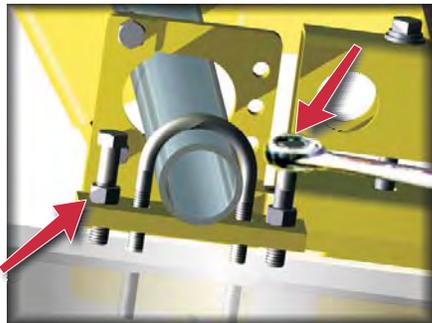
Install Speed Sensor on Either Pipe, or on a Third Pipe in Another Location.



Step 6

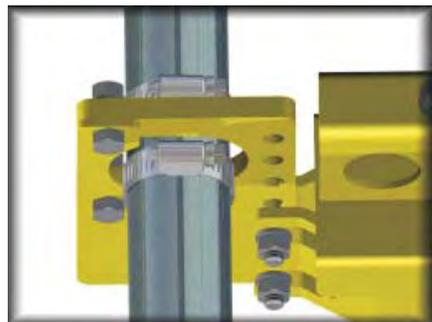
Use Leveling Plates to adjust Scale Idler Height. The Scale Idler Rollers Must be String-Lined with 2 Idlers Before and 2 Idlers After.

Tighten Lock Nuts After Adjustment of Leveling Plate.



Step 7

Align Scale Idler Across Width of Conveyor. Then Install Stainless Steel Hose Clamps (Provided) as Shown.



Electrical Installation

NOTE: If cable splices are required, you must use a junction box or **solder and insulate** each connection.

See Basic Electrical Installation, Page 8

Fold the shield back over the rubber grommet in the cord grip so it is pressed against the metal cord grip. This is important to keep interference from radios or motors from affecting the scale. This applies to load cell, speed sensor, and angle sensor cables.

Speed Sensor - Each of the terminal blocks can be pulled out of the terminal strip for easier access or troubleshooting. Connect the cable from the digital speed sensor to TS1. Route the cable through the cable grip 1. (See photo, page #8). Connect the black wire and the white wire to the terminal marked GND on the digital speed sensor terminal block. Connect the red wire to the terminal marked +5VDC. Connect the green wire to the terminal marked SIG A. SIG B and LED 3 are not used.

Angle Sensor (optional) - If you purchased an angle sensor, route the cable through cable grip 2. Remove the metal disk from the cable grip. Connect the black wire to the angle sensor terminal marked GND. Connect the red wire to the terminal marked +5VDC. Remove the jumper between SIG and GND. Connect the white and black wires to the terminals marked GND. Connect the green wire to the terminal marked SIG.

RS-232 output - If you are using the RS-232 serial port, connect your cable to the RS-232 terminal block. Use cable grip 2 if you do not have an angle sensor. Connect black to GND, red to RXD, and white to TXD. If you are using a printer, you only need GND and TXD. You also need RXD with a modem or PC.

Power Supply - Route the cable from the power transformer through the orange cable grip 3. Connect the positive wire identified by a colored stripe or rib to the terminal marked +12VDC. Connect the other wire to the terminal marked 12V GND. If these wires are connected backwards, (polarity reversed) the control will not work. Don't connect the 120 volt AC power to the transformer yet.

Load Cell #2 - Route one of the load cell cables through cable grip 4. Connect the black wire to the load cell #2 terminal marked -SUP. Connect the red wire to the terminal marked +SUP. Connect the white wire to the terminal marked -SIG. Connect the green wire to the terminal marked +SIG.

Load Cell #1 - Route the other load cell cable through cable grip 5 and connect the wires to load cell #1. Route each cable neatly so it has a little slack and tighten all the cable grips. The terminals marked - and + are switched 12VDC to power the I/O option board. The terminals marked P5 and P6 are not used.

Connect AC power to the Power Supply

After all cables are connected, wire the 120 volt AC power to the transformer. The transformer is housed in a small waterproof electrical box. Connect your 120 volt AC wiring to the socket provided. If you are using a generator for power, install a switch in the 120 volt AC line to the power supply. To prevent possible loss of data at startup turn the generator on first and then the control. At shutdown turn the control off first and then the generator. The 12 volt cable exits the box through a waterproof cord grip. The 120 volt wiring enters the box through a separate cord grip. Replace the cover and tighten the screws.

Basic Electrical Installation



Install all cable shields as shown.
Cut off excess drain wire. Tighten aluminum cap.

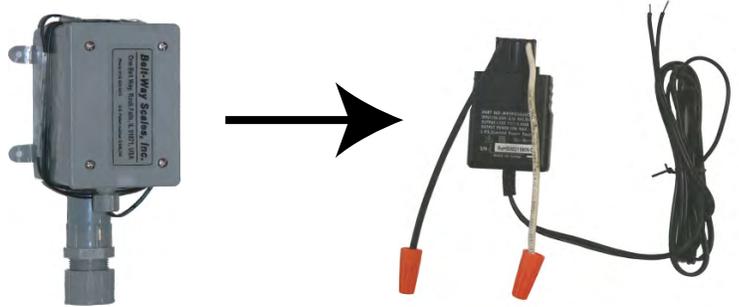


Standard Power Supply

INPUT: 100-240VAC 0.5A Max, 50-60 Hz
OUTPUT: +15V - .666A Nominal, 10W Max.

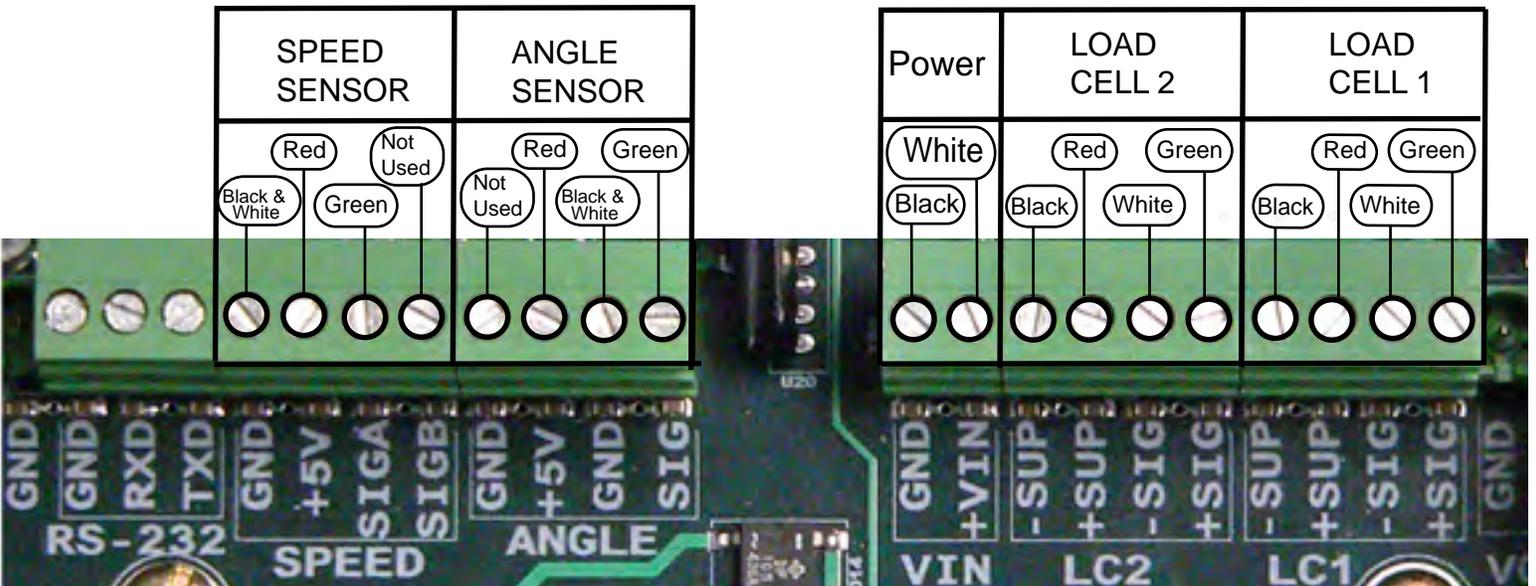
Control Box:

(AKA - Integrator, Totalizer, Display, etc)



DO NOT CONNECT THE CONTROL BOX DIRECTLY TO AC VOLTAGE!

The control box may be powered directly from a 12 to 24 VDC source.
It is a good idea to use an inline switch and external fuse if possible.



Automatic Angle Compensation

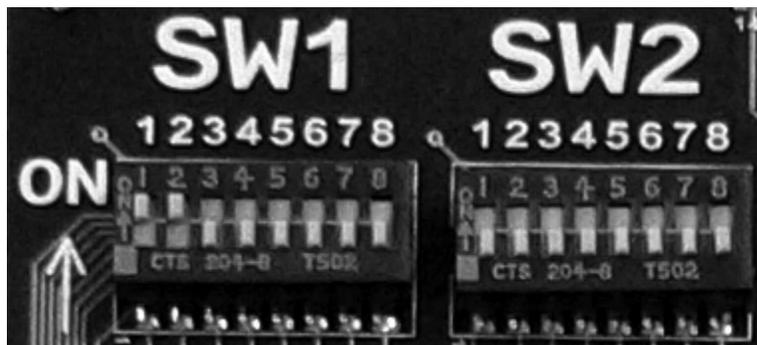


The automatic angle sensor option allows you to change the angle of the conveyor without having to calibrate your scale again. The angle sensor has been calibrated at the factory to read 0.0 degrees when the top of the sensor is level. Simply mount the angle bracket to the top of the conveyor frame using 3/8 bolts and nuts. It should match the angle

of the load cell assemblies. The angle sensor displays a positive angle when mounted on the right hand side of the conveyor and a negative angle on the left hand side of the conveyor. Route the cable to the control box so it won't be damaged by falling material. The control box is shipped with a jumper wire between angle sensor terminals marked SIG and GND. Remove this jumper if you install an angle sensor. Cable grip #2 is shipped with a metal disk installed to keep the box waterproof. Remove this metal disk when you wire the angle sensor. Turn on switch SW1 position 5 to enable the angle sensor. The current angle is shown on the TARE ANGLE screen

Function Switches

Function switches SW1 and SW2 are located on the circuit board on the inside of the door.



SWITCH SW 1	SWITCH SW 2
1 Enable keypad except clear weight	1 Set zero always enabled
2 Enable clear weight	2 Not used
3 Enable clear master total	3 Not used
4 Use special encoder	4 Disable changing load weights
5 Enable angle sensor	5 Enable clearing log time
6 Enable metric units	6 Enable "fast" set zero
7 Enable minute time base	7 Enable load cell test mode
8 Enable I/O & 2 analog outputs	8 Enable speed test mode

If you turn on switch SW1 position 8, or SW2 position 2, but do not have an I/O option board, the display and the keypad will not work. If this condition occurs, turn off the power to the control box. Turn off SW1 position 8, and SW2 position 2. Turn the power on. Switches SW2 position 7 & 8 activate test mode and should be turned off for normal operations.

Display Screens

WEIGHT RATE key

When you turn on the control, the display defaults to the **WEIGHT RATE** display.

```
WEIGHT      2.219
RATE TPH    0.000
SPEED       0.000
NODE 1 LOAD 20.1%
```

You can press the **WEIGHT RATE** key at any time to return to this display. The top line shows the total accumulated weight since you last cleared the weight. To clear the weight, press the **CLEAR WEIGHT** key twice within 2 seconds while viewing this display.

Switch SW1 position 2 must be ON to clear the weight. Line 2 shows the current rate in tons or metric tons per hour.

Line 3 shows the current belt speed.

Line 4 shows the network node (representing the Scale Number) and also the load cell signal as a percent from 0.0% to 102.3%. The load percent is used to calibrate the scale and is also useful in finding load cell problems.

CAL DATA key

The cal data key shows the digital calibration. It is shown below.

```
RATE TPH    0.000
ZERO        290
SPAN        11150
LENGTH      10977
```

Rate TPH represents the Flow Rate of material and mirrors the RATE TPH shown on line 2 of the **WEIGHT RATE** Display.

Zero represents the weight of the empty belt.

Span is what makes the scale accurate with a load on the belt

Length is the number of pulses from the Digital Speed Sensor over one revolution of belt.

Master Total, Time, Date

Press function key F4. The display appears as shown below.

```
MASTER TOTAL IS
140478.384
TIME 09:30:53
DATE 05/17/06
```

Every time you clear the scale weight (line 1 of weight rate screen), the amount of weight cleared is added to the master total. To reset the master total, switch SW1 position 3 must be turned on. To clear the Master Total, press F4, then press the **CLEAR WEIGHT** key twice within two seconds.

To change TIME AND DATE, press the **SELECT** key. A small arrow will appear after the HOURS. Use the UP and DOWN arrow keys on the keypad to adjust to the correct time. Each time you press the **SELECT** key the arrow will move to minutes, seconds, month, date, and finally year.

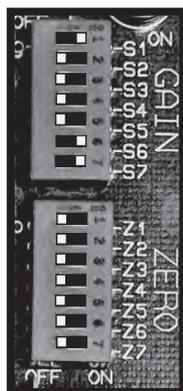
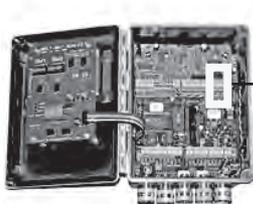
Calibration Instructions

1. Turn on SW1 POSITION 1

2. Confirm Calibration Switch Settings

Scales produced BEFORE June 2006

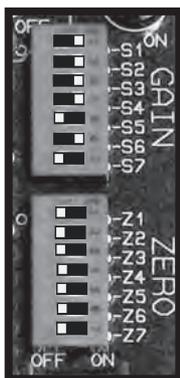
STANDARD SETTING



Gain Switches 1,6 and 7 on all others off.

All Zero Switches off.

IF THE LOAD % ON LINE 4 OF THE WEIGHT RATE SCREEN EXCEEDS 85% WHILE RUNNING MATERIAL, ADJUST TO THE HIGH CAPACITY SETTING SHOWN BELOW AND RECALIBRATE THE SCALE.

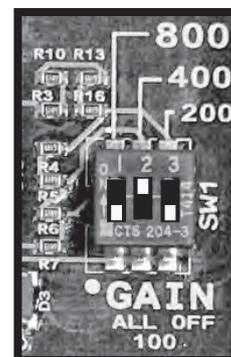
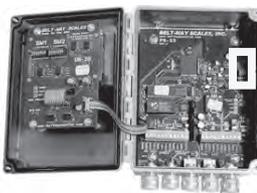


Gain Switches 5 and 7 off, all others on.

All Zero Switches off.

Scales produced AFTER June 2006

STANDARD SETTING



GAIN OF 400 Only Switch 2 is on.

IF THE LOAD % ON LINE 4 OF THE WEIGHT RATE SCREEN EXCEEDS 85% WHILE RUNNING MATERIAL, ADJUST TO THE HIGH CAPACITY SETTING SHOWN BELOW AND RECALIBRATE THE SCALE.



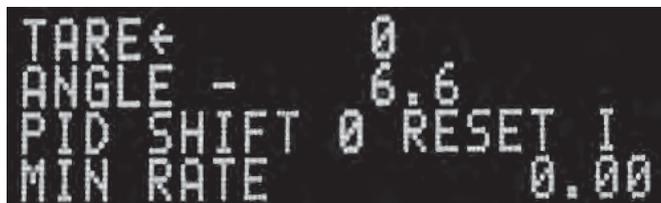
GAIN OF 200 Only Switch 3 is on.

3. Confirm TARE ANGLE

Press the TARE ANGLE key. If TARE number is zero, go to step 4.

If the TARE number is NOT zero, press SELECT until the cursor arrow next to TARE.

Press CLEAR WEIGHT twice to set the TARE number to zero.



4. Confirm AUTO ZERO and BELT LENGTH

Press F6. Confirm that the AUTO ZERO is set to .50%. If it is not, press SELECT until the arrow is next to AUTO ZERO. Use the arrow buttons to adjust the value to .50%.

Now, make sure your TOTAL BELT LENGTH (conveyor length x 2) is LESS THAN the length shown on line 4. To modify belt length, press SELECT until the cursor is next to BELTS UP TO. Again use the arrows to adjust the length to an appropriate setting.

```
TONS PER PULSE      1.0
PULSE ON TIME      50%
AUTO ZERO ←        50%
BELTS UP TO        662 FT
```

5. Performing the initial Set Zero Operation

Start the belt running empty. When a painted mark or splice passes a fixed point on the conveyor frame, press the SET ZERO key. Figure 1 will appear. Press the SET ZERO key again when the mark passes after one revolution of the belt. Figure 2 will appear.

```
WEIGHT      28392
PULSES      4732
PRESS SET ZERO AFTER
1 REVOLUTION OF BELT
```

Figure 1

```
WEIGHT      17796
PULSES      2966
PRESS WEIGHT RATE
KEY TO CONTINUE
```

Figure 2

Press WEIGHT RATE. Watch the weight on line 1 to verify the accuracy of your zero. It is normal for the weight to fluctuate up and down. However, the weight should not continually accumulate or subtract while the belt is running empty. If this happens, a new set zero must be performed.

NOTE: Force of wind on the belt can adversely affect the scales zero. Once the zero is stable, open the door of the control box. Turn SW2 Position 6 on. Turn the box off and restart it after 10 seconds. With the belt running empty, press the set zero key.

Figure 3 will appear. When the zero test is complete Figure 4 will appear.

```
SET ZERO WT      10122
USING 1095 PULSES
SET ZERO IN PROCESS
PLEASE WAIT
```

Figure 3

```
ZERO IS 600
ZERO SHOULD BE 600
PRESS SET ZERO AGAIN
TO CHANGE ZERO
```

Figure 4

Press SET ZERO to complete the set zero function. Figure 5 will appear.

Press WEIGHT RATE. Now you are ready to continue the calibration.

```
NEW ZERO IS 600
OLD ZERO WAS 600
PRESS WEIGHT RATE
KEY TO CONTINUE
```

Figure 5

6. The Check Span Function

Press F1. Figure 1 will appear. Press SELECT. Use the arrows to enter the EXACT amount of test weight you will use including the test bar. Press select again. The arrow will be next to IDLER SPAN. The IDLER SPAN for a Single Idler system is shown in Figure 2-1. The IDLER SPAN for a Dual Idler system is shown in Figure 2-2.



Figure 1

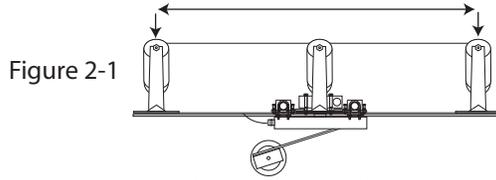


Figure 2-1

SINGLE IDLER

Measure from center of idlers
 Idler Span = Inches / 12

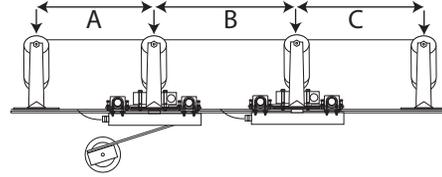


Figure 2-2

DUAL IDLER

Idler Span = A+(Bx2)+C
 The center section must be doubled because it is weighed twice.

Place your test weights on the scale as shown in Figure 3.

If the Load % on line 4 reads OVERLOAD 102.3%, reduce test weight and modify test weight value on F1 display. Start the belt running empty. then press CHECK SPAN. Figure 4 will appear.



Figure 3

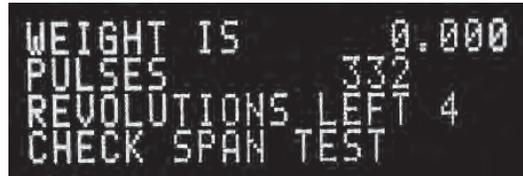


Figure 4

When the Span test is completed, Figure 5 will appear. Press CHECK SPAN. Figure 6 will appear.



Figure 5



Figure 6

Press WEIGHT RATE to return to the main screen.

Test weight calibration is quick and easy, but the most accurate method of calibration is by material test. A material test enables the belt scale to be calibrated to a certified truck scale.

First clear the Weight on Line 1 by pressing CLEAR WEIGHT twice. Then weigh an empty truck. Now run as much material as possible across the belt scale into the truck. Then weigh the loaded truck. Subtract the weight of the empty truck from the weight of the loaded truck. Compare the result with the Weight on Line 1 of the belt scale. Press CAL DATA (Figure 7) and record the SPAN number. Use the following calculation to adjust the Span number:

$$\text{New Span} = \frac{\text{WEIGHT ON TRUCK SCALE}}{\text{WEIGHT ON BELT SCALE}} \times \text{Old Span}$$

Press CAL DATA. Press SELECT until the arrow is next to SPAN. Use the arrow keys to adjust the Span number to the new value. Repeat until the truck scale and belt scale weights are very close.

Write down and save the ZERO, SPAN, and LENGTH numbers.



Figure 7

7. TURN OFF SW1 POSITION 1

Batched Output – Loading Trucks, Barges, or Rail Cars

Function key F5 is used if you want to use the scale for loading trucks, barges, or rail cars. You must have the optional IO board installed in order to use this feature. If you do not have the optional IO board you can still program this screen but the output will not function.

Press the F5 function key. The display appears as shown below.

```
LOAD WT      0.200
WEIGHT      3.087
CUTOFF      0.000
```

Press the **SELECT** key. A small arrow appears after the WT. Set your load weight using the arrow keys. After setting the correct load weight press the **SELECT** key again. Now the arrow appears on line 4. Use the arrow keys to set your cutoff. The cutoff is used to shut off the feeder

early to allow for material already on the belt to cross the scale. You may need to experiment with the cutoff to find the correct value. You may change the values of the load weight and cutoff weight any time. You do not need to have switch SW1 position 1 turned on. This allows you to change load size and cutoff while preventing someone from accidentally changing the scale calibration. If you do not want your operators to be able to change the load weight, turn on switch SW2 position 4. This will disable the adjust keys so the load cannot be changed and selecting one of eight The load weight is the amount you want to put in the truck. In this example it is 25.000 tons. The cutoff weight allows the feeder to turn off before all the material has crossed the scale. Otherwise each load would be over weight.

Press the **SELECT** key again. The display will appear as shown below.

```
LOAD #1 ←   0.200
LOAD #2     0.400
LOAD #3     0.600
LOAD #4     0.800
```

The small arrow will appear after #1. Use the adjust keys to program load 1. Press the **SELECT** key and continue to program loads 2, 3, and 4. When you press the **SELECT** key after the arrow is on #4

the display will change to show loads 5,6,7, and 8. In this manner you can program eight different load weights. Switch SW1 position 1 must be on to program the eight preset load weights. Be sure to turn off switch SW1 position 1 when you are done to prevent somebody from accidentally changing your calibration or preset load weights. Once you have pressed function key F5 the eight function keys are used to select preset load weights 1 - 8. To escape from this feature so that you can use the other function keys to perform their normal functions, press the **WEIGHT RATE** key. Now, when you press any function keys other than F5, they will perform their normal function. Once you press F5 the eight function keys again will select preset load weight 1 - 8. F1 will select load preset 1, F2 will select load preset 2, etc.

If you are not using an angle sensor, the angle sensor input can be used to connect a selector switch which will allow your operators to select preset load weights 1 - 8. Belt-Way Scales, Inc. has available a remote start / stop station which will allow your drivers to load their trucks without ever touching the scale control keypad. If you are using an angle sensor then you must select your preset load using the function keys F1 - F8. You may want to write down the load weight for presets 1-8 and perhaps laminate it to keep it weatherproof.



**Ask about our Remote Start-Stop Station
to automate the load-out process!**

Function Key F1

Test Weight and Idler Span

Press the F1 function key. The display will appear as shown below.

TEST WT	100.000 LB
IDLER SPAN	8.000 F
LOW SPEED ALARM	
SPEED	350.000

If you have turned switch SW1 position 6 on you are using metric units. The LB will be KG and the F will be M. If you do not have the I/O option board the bottom two lines will be blank.

Press the **SELECT** key one time. A small arrow will appear after the word **TEST WT**. This arrow tells you that the arrow keys on the keypad will change the value of the test weight. Use the arrow keys to enter the value of your test weights. Switch SW1 position 1 must be on.

Press the **SELECT** key again. Now the small arrow appears after the word **SPAN**. Use the arrow keys on the keypad to **enter the distance between the idlers on each side of the scale idler. For example, if your idlers are on 4 foot centers you must enter 8.000 feet.** In all the formulas used to calculate gain and to select the correct model of the scale for your applications you use the distance from the scale idler to the next idler which would be 4 feet in this example. But when you enter the idler span in this step you must enter the distance between the idlers on each side of the scale idler which would be 8.000 feet.

Measure your idler spacing in inches. Then divide by 12. Remember, you must enter the distance in feet, not feet and inches.

If you have the I/O option board press the **SELECT** key again. Now the small arrow appears after the word **ALARM**. You can use the arrow keys to change from low speed alarm to speed interlock. Press the select key again. The arrow appears after **SPEED**. You can use the arrow keys to set the value of the belt speed you want to use for the low speed alarm or speed interlock. If you have chosen low speed alarm, whenever the belt speed is below the programmed speed, output P4.3 will be on. When the belt speed is equal or greater than the programmed value output P4.3 will be off. If you selected speed interlock, output P4.3 will be off when the belt speed is below the programmed speed. Output P4.3 will be on if the belt speed is equal to or greater than the programmed speed. Press the **WEIGHT RATE** key to return to the normal display.

Function Key F2

Analog Outputs

Function key F2 is used to control the optional analog outputs. You must have the IO option board installed in the scale and switch SW1 position 8 must be turned on. Otherwise if you press the F2 key the display will say KEY DISABLED on line 4 of the current display.

The following assumes you have the IO option board installed with the two additional outputs. If you do not have the additional two outputs, lines 3 and 4 on the display will be blank.

Press function key F2. The display will appear as show below. No configuration switches need to be on to program setpoints. Using the setpoint, maxrate, output select, and PID loop will be described later.

#1 SETPOINT	100.00%
#2 SETPOINT	10.00%
#3 SETPOINT	5.50%
#4 SETPOINT	2.25%

Press the **SELECT** key. A small arrow will appear after the word **SETPOINT** on line 1. Use the adjust keys to enter your setpoint for analog output 1.

Press the **SELECT** key again. The small arrow appears on line 2. Each time you press **SELECT** the arrow moves to the next line. If the arrow is on the last line the next time you press **SELECT** the arrow will disappear. Program the setpoint for each output. See the examples that follow to use the analog outputs.

Press function key F2 a second time. The display will appear as shown below.

#1 MAXRATE	500.00
#2 MAXRATE	10.00
#3 MAXRATE	7.50
#4 MAXRATE	4.25

Press the **SELECT** key. A small arrow appears after the word **MAXRATE** on line 1. Use the adjust keys to enter the desired maximum rate for output 1. Press the **SELECT** key again and the small arrow appears on line 2. Repeat for lines 3 and 4. Maxrate is normally in tons per hour. Enter values for each output installed. Switch SW1 position 1 must be on.

Press function key F2 a third time. The display will appear as shown below.

#1 OUTPUT 4 TO 20 MA
#2 OUTPUT 0 TO 20 MA
#3 OUTPUT 4 TO 20 MA
#4 OUTPUT 4 TO 20 MA

Press the **SELECT** key. A small arrow appears after the word **OUTPUT** on line 1. Press either up arrow key to select 0 to 20 mA. Press either down arrow key to select 4 to 20 mA. Repeat for all outputs. Switch SW1 position 1 must be on. Normally, if you are using a current loop, you will select 4 to 20 mA. If you are using a voltage output, normally you will select 0 to 20 mA. Then, by inserting a resistor between the current loop - and + outputs, and wiring from + to GND, you will have a voltage output instead of current. The value of the resistor determines the voltage output. See the wiring diagrams for more information on voltage output.

Function Key F2

Analog Outputs

Press function key F2 a fourth time. The display will appear as shown below.

PID CHANNEL OFF

Press the **SELECT** key. A small arrow appears after the word **CHANNEL**. If you want to use one of the IO channels as a PID loop control use either up arrow key to change the word **OFF** to the channel you want to use as a PID loop. For example, if you want to use channel 1, press either up arrow key once. **MAXRATE** is not used for the PID channel. The display will now appear as shown

PID CHANNEL 1
PID ACTION REVERSE
PID SETPOINT LOCAL
P = 10 I = 100 D = 3

After you have selected the desired channel press the **SELECT** key again. The small arrow will appear after the word **ACTION**. Press either down arrow to select reverse action. Press either up arrow to select forward action. Most applications will use reverse action. This means that if the rate goes above the programmed rate the output will go down to slow down the belt or feeder to reduce the rate back to the programmed rate. The electrical output goes in the reverse direction from the rate error. You may find a situation where increasing the electrical output will decrease the rate. In this case if the rate goes above the set rate the electrical signal must also go up to reduce the feed rate. Since the electrical signal goes in the same direction as the rate error the action is called forward action.

Press the **SELECT** key again. The small arrow will appear after the word **SETPOINT**. Press either down arrow to select local setpoint. Press either up arrow to select remote setpoint. Normally you will select local setpoint. This means you will program the rate crossing this scale in this control box. If you have two or more **BELT-WAY** scales you can program one to be the master and several others to be slaves. You then set up each slave as a remote setpoint. Then each slave will run a programmed per cent of the master.

Press the **SELECT** key again. The small arrow will replace the = after the **P**. Use the adjust keys to enter the **P** value. Press the **SELECT** key again. The small arrow will replace the = after the **I**. Use the adjust keys to enter the **I** value. Press the **SELECT** key again. The small arrow will replace the = after the **D**. Use the adjust keys to enter the **D** value. The large arrow keys will change **P**, **I**, and **D** by 50. The small arrow keys will change **P**, **I**, and **D** by 1. The action of **P**, **I**, and **D** are described later.

Press F2 a fifth time. The display will appear as below.

#1 OUTPUT	149
#2 OUTPUT	220
#3 OUTPUT	75
#4 OUTPUT	92

0 = 0 mA	153 = 12 mA
51 = 4 mA	204 = 16 mA
102 = 8 mA	255 = 20 mA

The **SELECT** key is not used with this display since there is nothing to program on this screen.

Function Key F2

Analog Outputs

Press F2 a sixth time. The display appears below. If you are using a PID loop with local setpoint, you can change the set rate here using the **SELECT** key and arrow keys. You can also change the values of P, I, and D. As you make changes you can see what the actual rate is doing in relation to your set rate. You can also see how changes in P, I, and D affect the actual rate as well as the output. Use this screen to tune your PID loop.

SET RATE	120.32
RATE TPH	120.318
#1 OUTPUT	127
P = 10	I = 100
D = 3	

EXAMPLES

A CHART RECORDER

Assume you want to control a chart recorder on output #1 using a 4 to 20 mA signal. First set your setpoint for output 1 to 100.00%. Next assume the maximum rate you will run will be about 475 tons per hour. Set your maxrate for output 1 to 500 tons per hour. This will cause your chart pen to be near 100 % of full scale when you are running near 500 tons per hour. If you set your maxrate to 1000 tons per hour then at 500 tons per hour your pen would be at 50 % of full scale and it would never use the upper 50 % of the chart paper. This makes your chart harder to read because it is compressed. That is the reason you want to set maxrate to slightly more than you normally will be running at full load. Select 4 to 20 mA for the desired output and connect the wires from - and + output #1 to the chart recorder as shown on the wiring diagram at the end of the book.

CONTROLLING A FEEDER (OPEN LOOP)

Assume you have a feeder that is controlled by a 4 to 20 mA signal. At 20 mA the feeder has a maximum rate of 5.00 tons per hour. You want the feeder to add 10 % additive to the material crossing the scale. You are using analog output 2. First set your setpoint for output 2 to 10.00%. Next set your maxrate for output 2 to 5.00 tons per hour. Finally select 4 to 20 mA for output #2. Connect the feeder to the - and + terminals on current loop #2. If you do a material test and find the actual per cent of additive is not 10.00%, adjust MAXRATE until the additive is really 10.00%. Increase MAXRATE to decrease the output. Decrease MAXRATE to increase the output. After getting MAXRATE correct, if you change the setpoint to 5.00% the per cent will remain accurate. Keep in mind that if 100 tons crosses the scale, and your additive is 10%, 10 tons of additive will be used. Your total combined weight is now 110 tons. 10 tons of additive out of a total of 110 tons is 9.09%. So, although you programmed the additive to be 10% of the main ingredient, the additive is only 9.09% of the total mix. If you want the additive to be 10% of the combined mix, use the formula $(100/(100-\%)) * \%$ where % represents the additive per cent of the total combined weight. In the above example, if you want the additive to be 10% of the total weight, $100 \text{ divided by } (100 - 10), \text{ times } 10 = 11.11\%$. Program your setpoint for 11.11%.

USING VOLTAGE OUTPUT

Assume the feeder in example above uses 0 - 5 or 0 - 10 volts DC instead of 4 to 20 mA. Program the setpoint and maxrate the same as above, but select 0 to 20 mA for the output. Put a resistor between

Function Key F2

Analog Outputs

the - and + outputs on current loop #2. The resistor value determines the output voltage. A 375 ohm resistor will give you an output of 10 volts. A 125 ohm resistor will give you an output of 5 volts. Then wire your device from the + output to GND.

Current loops and voltage outputs **ARE NOT ISOLATED** and reference or use a common ground. The negative current loop terminal will vary in voltage above ground from .5VDC at 4 mA to 2.5VDC at 20 mA. The voltage at the positive current loop terminal is dependent on the external resistance of the device it is tied to. If the device you use is also not isolated but has the same ground as the scale, then use the voltage configuration instead of a current loop. If the scale and external device have different ground potentials you must purchase a separate isolation unit to properly isolate the belt scale and the external device.

USING THE PID LOOP (CLOSED LOOP)

The previous example used an open loop to control a feeder. The scale puts out a 4 to 20 mA signal or a voltage signal to control a feeder based on the rate crossing the belt scale. There is no device measuring the actual output of the feeder. The scale has no way of knowing if the additive is even connected.

A PID loop control actually measures the output from the device it controls, and varies the output to keep the actual rate equal to the set rate.

LOCAL SETPOINT

Assume you have one belt scale with some method of controlling the amount of material on the belt. You could be controlling the belt speed or a separate feeder putting material on the belt. Set the PID loop up for local setpoint. You can program the set rate on the sixth press of F2 or on the **WEIGHT RATE** screen. Pressing the **WEIGHT RATE** key a second time will change line 3 from belt speed to set rate if you have an IO board using a PID loop. Now the scale control will constantly compare the rate crossing the scale with your programmed set rate and vary the output to keep the actual rate equal to the set rate.

NETWORK BLENDING (REMOTE SETPOINT)

Assume you have one belt scale and want to add another ingredient on another belt scale to the first ingredient. The main scale will be called the master. The second ingredient will be called the slave. You might have other ingredients being measured by other belt scales, or solids impact flowmeters, or liquid controllers. You want all these ingredients to be added by some per cent to the main ingredient.

You must program the network node for all the slave scales in consecutive order. Assume you have one belt scale which is the master, one solids impact flowmeter, and one liquid control. Program the belt scale as node 1. Program the flowmeter as node 2. Program the liquid control as node 3.

Before setting up the PID loops for blending, calibrate each device. Once you enable the PID loops, it is more difficult to calibrate the devices. Each device must be connected using the BNC connectors at the bottom of the control box. The cable must be RG62A/U coaxial cable. It is a 93 ohm cable. You must have a 93 ohm terminator on one of the BNC connectors at each end of the network.

Function Key F2

Analog Outputs

First program the master scale to send its rate to the slave scales. On the master, press the F3 key. The bottom two lines say
SEND RATE TO NODES
IS TURNED OFF

We need to change this. Turn on switch SW1 position 1 to enable the keypad. This switch is on the inside of the door. Next press the SELECT key 3 times. You should see an arrow after the word OFF. Press the small up arrow key until the number after the word FROM is 2. Press the SELECT key again. The arrow moves to the word TO. Press the small up arrow key until the number after the word TO is 3. Think of the numbers on the bottom line as the beginning and ending numbers of a list of scales that the master is going to send its rate. In this example, the list begins at scale 2 and ends at scale 3, since we have two slaves programmed as node 2 and node 3. Remember, you program this in the master scale, not the slaves.

Now we need to set up the PID loops in the slaves. Normally, you are not using the PID loop in the master, although you could as a local setpoint. Now set up each slave PID loop to be a remote setpoint. If you have wired output #1 to your device, program the PID loop for channel 1 and program the per cent of additive you want as the #1 setpoint. If you wired your device to output #2, use PID channel 2 and #2 setpoint.

Now, three times every second, the master will send the rate crossing the belt scale to the flowmeter and also to the liquid control. The flowmeter will multiply the rate from the master times the setpoint per cent you want to add. This becomes the set rate for the PID loop in the flowmeter. The flowmeter control will vary its output to keep the actual rate equal to the set rate. The same thing occurs in the liquid control. Since each additive is actually measured, the system is called a closed loop.

Once you have completed the programming just described, the PID loops will begin working. If you run material over the belt, the rate from the master will be sent to each slave. If you have disabled the flowmeter or liquid control from actually running material, then the control for that device will try to run the correct per cent you programmed. Since no material can flow because you have not turned on the power to the device, or because you are out of material, the control will increase its output until it reaches maximum. Then the control will display an alarm message MAX OUT NODE x, where x is the node which is putting out its maximum output. When you finally turn on the power, or get more material, the control will try to make up some of what it lost when no material was available. If this occurs, and you do not want the control to make up for lost material, press the TARE ANGLE key. Press the SELECT key until the arrow appears after RESET I. Press the CLEAR WEIGHT key.

You can see if the network is operating by watching the set rate on the WEIGHT RATE screen or the sixth press of the F6 key on each slave scale. If line 3 of the WEIGHT RATE screen shows belt speed, press the WEIGHT RATE key again to change line 3 to set rate. Each slave set rate should be the rate on the master times the setpoint % of the slave. If the set rate is correct for the slave, but the slave product is not running the correct rate, the problem is in the slave, not the network. You can also see what the slave is trying to do by watching the output on the sixth press of the F6 key. If the master is running a rate of 0, the slave should also be running a rate of 0. If the slave output is 0 or 51, the slave is not trying to run anything. If your device is still running, something else is causing it to run. See if your motor control has a minimum speed set which is incorrect.

When a belt on a belt scale runs empty, the rate is never exactly 0.00 tons per hour. It will vary both plus and minus, and the plus variations will be sent

Function Key F2

Analog Outputs

to the slaves. If your master belt never runs empty, there is no problem. But if it does, the slaves will try to run their per cent of the positive belt variations. To prevent this, press the **TARE ANGLE** key. Press the **SELECT** key until the arrow appears on line 4 after **MIN RATE**. If your belt running a full load is 100 tons per hour, and empty it varies up to 2 tons per hour, set **MIN RATE** to about 5 tons per hour. Now, when the belt is empty, any rate below **MIN RATE** will not be sent to the slaves. Instead, a rate of 0 will be sent, which will keep the slaves from running.

If you want to prevent a scale from running its programmed setpoint, you can ground input P4.7. This input tells the control to use a set rate of 0 instead of the actual set rate. Remember, the device still has power applied and could start unexpectedly. When P4.7 is no longer grounded, the programmed set rate will return.

If you are using two or more controls in a master slave setup, there are two conditions when alarm output PWM1 may turn on. First, if any of the controls using the PID loop is running at maximum output, the alarm output will turn on in that control box and also in the master control. Next, if there is a network problem, the alarm output in the master will turn on. The slave that does not receive a message from the master will turn off by itself. The master will detect the problem and force the rest of the slaves to turn off. If the master is running the PID loop, then the master feeder belt will also turn off. However, if the master is not running the PID loop, but is simply measuring what is crossing the scale, then the control cannot shut off the master feeder belt. In this case, you can use the batching output to interlock the master feeder motor starter. First press the F5 key and press the **SELECT** key to

position the small arrow after the words **LOAD WT**. Press the **CLEAR WEIGHT** key to set the load weight to .000. Then press the small down arrow key to set the load weight to 9999999.999. Now the batching output P4.0 will turn on and stay on. If there is a network failure the batching output will turn off until the problem is resolved. You can use this output and a solid state relay to interlock your master feeder motor starter. Now, if there is a network problem, the master not running the PID loop and all slaves will turn off.

You can also use the batching output to actually run a specific amount of material over the master scale. When the master scale reaches the load weight minus the cutoff, the batching output will turn off. This will shut off the master feeder, so the rate will drop to zero. This will cause all the slaves to drop to zero as well.

If you accidentally program the PID loop as a remote setpoint, but you do not have the network cable attached to another scale set up as a master, then if you were looking at **SET RATE** on line 3, the message will be replaced by **NET FAIL** and the set rate will be changed to .00. If you were looking at belt speed on line 3 you will not see the **NET FAIL** message. A remote setpoint PID loop needs the network and the rate from a master scale to determine the correct setpoint.

On the **TARE ANGLE** screen, line 3 shows **PID SHIFT** and a number, normally 0. If you are running very light loads, and your PID loop is not responding fast enough, try increasing **PID SHIFT** one number at a time. If you go too far, the system becomes erratic.

Function Key F2

Analog Outputs

PID LOOP FUNDAMENTALS

The control uses the PID loop to calculate what the output should be to make the actual rate equal to the set rate. The output is calculated by this formula:
 $(P * (\text{set rate} - \text{actual rate})) +$
 $(I * (\text{theoretical weight total} - \text{actual rate total})) -$
 $(D * (\text{present rate} - \text{last rate}))$

The output is made up of 3 components. First, subtract the actual rate from the set rate, and multiply the result by the number entered for P. When the process first starts up, the actual rate is 0 so there is a large difference. When the actual rate is near the set rate, the difference is very small. Increasing the value of P will cause the feeder to start out faster when it is first turned on, but it may start so fast that it overshoots the desired set rate and then slows down too much to compensate and continues to oscillate.

The second component uses your programmed set rate to determine every second how much material should have crossed the scale at that point in time. Then the weight which actually did cross the scale is subtracted. The difference, where you are versus where you should be, is multiplied by the number you entered for I. If the feeder stops running material, either because you ran out of material or you turned off power to a motor, the weight which should have accumulated each second is still added. But no weight is subtracted since no material is running. So the second component of the output will keep getting larger, and the control will drive its output to the maximum of 255 trying to get the material. This "I term" has memory. If you ran out

of material, the I term will simply keep growing until it reaches the maximum. When you finally get more material, the control will keep running at maximum for some time. It is trying to make up for lost time. If you want to stop this, press the **TARE ANGLE** key, use the select key to move the arrow to **RESET I**, and press the **CLEAR WEIGHT** key. The I term will be cleared. To prevent this, when you want to stop the PID loop from running its set rate, ground input P4.7. This will make the control run a set rate of 0.

The third component of the PID output is calculated by subtracting the rate a second ago from the rate now, and multiplying this by the number you entered for D. This component acts like a brake. If the rate is changing too fast, this component will slow it down.

The numbers you enter for P, I, and D are simply multipliers. They let you control how each component contributes to the final output number. We recommend starting with P = 10, I = 100, and D = 3. The PID loop will work even if P and D are 0. It will not work if I is 0. The values for P, I, and D can be too aggressive or too lax. If they are too aggressive, you can get wild oscillations in rate. If they are too lax, it will take too long for the actual rate to equal the set rate. If you are running a very light load, and your PID loop takes too long to respond, press the **TARE ANGLE** key, and increase the **PID SHIFT** by one number at a time, testing the result. A higher number will make the control respond faster. But if you make this number too high, the control will cause the feeder to oscillate. If that happens, reduce the number by one and try again.

Function Key F3

Log Rate and Send Rate

Press function key F3. The display appears as shown below.

LOG RATE 350.00
LOG TIME 12H 45M
SEND RATE TO NODES
IS TURNED OFF

This is the normal mode and this feature must be OFF unless you have one or more additional controls set up as slaves to the master control and the network is connected. If this scale is a master scale in a blending situation see the instructions for Network Blending, in the section under Function Key F2, to program the Send Rate feature.

Press the **SELECT** key. A small arrow appears after the word **RATE**. You can use the **CLEAR WEIGHT** key to set the log rate to .00 or use the adjust keys to enter your desired log rate. Switch SW1 position 1 must be on to change log rate. Be sure to turn switch SW1 position 1 off when you are done setting log rate so nobody can accidentally change your scale calibration. The control will keep track of the hours and minutes that the scale is running at a rate equal to or higher than the log rate you enter. In other words, if you enter a log rate of 300 tons per hour, the log time will show you how many hours and minutes your production was at or above 300 tons per hour.

Press the **SELECT** key again. Now the arrow appears after the word **TIME**. You can use the **CLEAR WEIGHT** key to set the log time to 0H 0M. In order to be able to clear log time switch SW2 position 5 must be turned on.

Press the select key again. The small arrow appears after the word **OFF** or after the word **FROM** if Send Rate To Nodes is turned on. If the word **OFF** appears then the control is not sending its rate to any other controls.

Function Key F3

Special Speed Encoders

Press function key F3 again. The display appears as shown below if you are using English units.

**PULLEY DIAMETER IN
INCHES 7.970
ENCODER PULSES PER
REVOLUTION 200**

If you are using metric units the display appears as shown below.

**PULLEY DIAMETER IN
CENTIMETERS 20.244
ENCODER PULSES PER
REVOLUTION 200**

The standard scale is furnished with a wheel which rolls on the return belt. The new solid plastic wheel is 7.970 inches (20.244 cm) in diameter. If switch SW1 position 4 is off, the control will use the above value. You can change the values shown on the display but when you turn the control off and back on the value shown will return to the default value. The original rubber tired wheel values were 7.719 inches or 19.606cm.

Occasionally a special encoder that may be connected to the head or tail pulley is used. In that case, you must turn on switch SW1 position 4. Otherwise it should be turned OFF. When you turn switch SW1 position 4 on, the values shown on the display will be used. You should enter the diameter of the pulley that the encoder is attached to. This is necessary so the belt speed will be correct.

The standard encoder will generate 200 pulses per revolution. If Belt-Way Scales, Inc. supplies a shaft mounted encoder, it normally will also generate 200 pulses per revolution. If a special encoder is furnished you must set the pulses per revolution to match what the encoder generates.

Any special custom encoders should operate on 5 volts DC and have TTL compatible outputs. If you use a quadrature output encoder, select only one of the channels (either A or B) and wire that to the digital speed sensor SIG A input.

If you are using a special encoder and have turned on switch SW1 position 4, press the **SELECT** key. A small arrow appears after the word **INCHES** (or **CENTIMETERS**). Use the arrow keys to enter the diameter of the pulley your encoder is connected to.

Press the **SELECT** key again. A small arrow appears after the word **REVOLUTION**. If your encoder generates pulses other than 200 use the arrow keys to make this number match the pulses your encoder generates.

Function Key F4

Master Total, Time, and Date

Press function key F4. The display appears as shown below.

MASTER TOTAL IS
1234.567
TIME 11:08:24
DATE 11/16/99

Beginning with version 1.27, if you have the RS-232 port set up to print tickets, you can print the master total. Simply press function key F4 so you are looking at the master total. Then press function key F8 to print a ticket. The ticket will be similar to a normal ticket but line 4 will say MASTER TOTAL and the master total amount will be printed. See the instructions for function key F7 to set the scale up to print tickets.

Every time you clear the scale total weight, the total is added to the master total before it is cleared. If you want to clear the master total, you must have switch SW1 position 3 turned on. Then if you press the CLEAR WEIGHT key twice within two seconds, while you are looking at the master total, it will be set to zero. You can prevent someone from clearing the master total by keeping switch SW1 position 3 turned off. You do not need to press the SELECT key to clear the master total.

If you press the SELECT key a small arrow will replace the : after the hours. At this time you can set the hour to 0 using the CLEAR WEIGHT key or you can use the adjust keys to set the hours to the correct time. Each time you press the SELECT key the arrow will move to minutes, seconds, month, date, and finally year. In this manner you can set the time and date.

Time and date are only used if you are printing tickets, logging data, or using the modem buffer.

Function Key F5

Loading Trucks, Barges, and Rail Cars

Function key F5 is used if you want to use the scale for loading trucks, barges, or rail cars. You must have the optional IO board installed in order to use this feature. If you do not have the optional IO board you can still program this screen but the output will not function.

Press the F5 function key. The display appears as shown below.

LOAD WT	25.000
WEIGHT	12.345
CUTOFF	.000

Press the **SELECT** key. A small arrow appears after the WT. Set your load weight using the adjust keys. After setting the correct load weight press the **SELECT** key again. Now the arrow appears on line 4. Use the adjust keys to set your cutoff. You may need to experiment with the cutoff to find the correct value. The cutoff is used to shut off the feeder early to allow for material already on the belt to cross the scale.

You may change the values of the load weight and cutoff weight any time. You do not need to have switch SW1 position 1 turned on. This allows you to change load size and cutoff while preventing someone from accidentally changing the scale calibration. If you do not want your operators to be able to change the load weight, turn on switch SW2 position 4. This will disable the adjust keys so the load cannot be changed and selecting one of eight preset load weights will also be disabled.

The load weight is the amount you want to put in the truck. In this example it is 25.000 tons. The cutoff weight allows the feeder to turn off before all the material has crossed the scale. Otherwise each load would be over weight.

Press the **SELECT** key again. The display will appear as shown below.

LOAD #1	.000
LOAD #2	.000
LOAD #3	.000
LOAD #4	.000

The small arrow will appear after #1. Use the adjust keys to program load 1. Press the **SELECT** key and continue to program loads 2, 3, and 4. When you press the **SELECT** key after the arrow is on #4 the display will change to show loads 5,6,7, and 8. In this manner you can program eight different load weights. Switch SW1 position 1 must be on to program the eight preset load weights. Be sure to turn off switch SW1 position 1 when you are done to prevent somebody from accidentally changing your calibration or preset load weights.

Once you have pressed function key F5 the eight function keys are used to select preset load weights 1 - 8. To escape from this feature so that you can use the other function keys to perform their normal functions, press the **WEIGHT RATE** key. Now, when you press any function keys other than F5, they will perform their normal function. Once you press F5 the eight function keys again will select preset load weight 1 - 8. F1 will select load preset 1, F2 will select load preset 2, etc.

Function Key F5

Loading Trucks, Barges, and Rail Cars

If you are not using an angle sensor, the angle sensor input can be used to connect a selector switch which will allow your operators to select preset load weights 1 - 8. Belt-Way Scales, Inc. has available a remote start / stop station which will allow your drivers to load their trucks without ever touching the scale control keypad. If you are using an angle sensor then you must select your preset load using the function keys F1 - F8. You may want to write down the load weight for presets 1-8 and perhaps laminate it to keep it weatherproof.

BATCHING WITH A START/STOP STATION

1. Press function key F5 to enter the load mode.
2. Use the rotary selector switch to select 1 of 8 preset load weights.
3. Press the enter load pushbutton. The selected preset load weight will appear on the control display line 1.
4. Press the clear pushbutton on the start / stop station. The scale weight total will go to .000 and the ready light will turn on. Whenever the scale weight total is less than the load weight minus the cutoff weight, the batching output will be on. When the scale weight total is equal to or greater than the load weight minus the cutoff weight, the batching output will be off.
5. Press the start pushbutton. The run light will turn on and the feeder or belt will start running.
6. If you need to stop the feeder or belt for any reason before the load is complete press the stop pushbutton. The feeder or belt will stop and the run light will turn off. The ready light will stay on. Press the start pushbutton to continue loading the truck.
7. When the weight on the scale reaches the load weight minus the cutoff weight, the feeder or belt will turn off automatically. The run light and the

ready light will turn off.

8. If you have a printer connected to the scale you would have already set the control up to print tickets following the instructions for the F7 key. Simply press the print pushbutton to print a ticket.

The batching output must be connected to an optional start / stop station. See the wiring diagram in the section of wiring diagrams for details on how to connect the batching output. You can purchase a start / stop station from Belt-Way Scales, Inc. or make your own. The start / stop station should be mounted next to the scale control box.

Function Key F6

Pulsed Output, Auto Zero, and Long Belts

Press function key F6. The display appears as shown below.

TONS PER PULSE	OFF
PULSE ON TIME	50%
AUTO ZERO	1.0%
BELTS UP TO	662 FT

Press the **SELECT** key. A small arrow appears after the word **PULSE**. You can now use the adjust keys to select from the following options:

TONS PER PULSE OFF .01 .10 1.0 10

If you select **OFF** the pulse output will be disabled. Any other selection requires the optional IO board. If you select **.01** you will get a pulse every time the weight increases **.01** tons. This will work up to about 150 tons per hour. A pulse every **.10** tons will work up to about 1500 tons per hour.

Press the **SELECT** key again. A small arrow appears after the word **TIME**. You can now use the adjust keys to select from the following options:

PULSE ON TIME 50% 10 MS --- 500 MS

If you select **50%** you will have a true quadrature wave output on P4.1 and P4.2. This will drive a remote display or a PLC with quadrature input. The advantage of using quadrature waveform is that if the scale is losing weight the remote counter or PLC will detect this and maintain the correct weight. See the wiring diagram in the wiring section for details.

If you select pulse on times from 10 to 500 milliseconds use either output P4.1 or P4.2. The pulse will remain on for the programmed time. You will not have a true quadrature waveform, so do not select pulse on times other than 50% if you are connecting the pulsed output to a device with a quadrature input.

Press the **SELECT** key again. A small arrow appears after the word **ZERO**. You can now use the adjust keys to select from the following options:

AUTO ZERO 1.0% .75% .50% .25% OFF

Normally you will want the auto zero set at 1.0%. If you occasionally run very light belt loads, you may find the auto zero attempts to zero the weight on the belt because it has decided the belt is empty. In that case you can tighten the tolerance that the computer uses to decide if the belt is empty. The auto zero will still work but the belt must be loaded less as you select a smaller per cent before auto zero will decide that the belt is empty. If you select **OFF** auto zero will be disabled.

Press the select key again. The small arrow appears after the word **TO**. You can use the adjust keys to select from the following options:

BELTS UP TO 662 2648 5297 7945 10594 FT
or
BELTS UP TO 201 807 1614 2421 3229 M

The belt length is the total length of the belt. It is not the length of the conveyor.

Function Key F7

RS-232 Serial Output

Function key F7 is used to control the RS-232 output to a printer, a remote display terminal, a remote scoreboard display, or a PLC using 8 data bits, no parity, 1 stop bit, no handshake. Press the F7 key. The display appears as shown below.

RS-232 OFF

Press the **SELECT** key. A small arrow appears after the word **RS-232**. You can use the adjust keys to select from the following options:

**RS-232 OFF TICKETS WEIGHT RATE
 WEIGHT&RATE ALTERNATE DISPLAY**

Press either of the up arrow keys. The display appears as shown below.

**RS-232 TICKETS
USE 0 LINE FEEDS**

Press the select key again. Now the small arrow appears after the word **USE**. You can use the adjust keys to select from the following options:

**USE 0 - 10 LINE FEEDS or
USE 1 FORM FEED or
USE 1 - 12 SPECIAL CODES**

If you select 1 - 12 **SPECIAL CODES** the following two lines will appear on lines 3 and 4 of the display.

**00 12 54 7A F3 DE
FA 03 1B 45 A0 FF**

In this section of the instructions you are programming the RS-232 output to print tickets.

The ticket can be used for loading trucks. Your ticket printer may need a few line feeds or a form feed to advance the ticket out of the printer. You can select from 0 to 10 line feeds to follow the ticket or you can select one form feed. If you have unusual conditions you can select up to 12 characters to be sent to the printer after the ticket. For example, one printer uses the following codes to advance the paper and cut the ticket off.

ESCAPE "a" n will advance the paper n lines
ESCAPE "d" 0 will cut the paper off

To program the scale to send these codes select 6 special codes. Then use the select key to move the small arrow to follow each of the first 6 codes and use the adjust keys to make them be as follows:
1B 61 8 1B 64 00

This will cause the printer to advance 8 lines and cut the ticket off. The ticket printed appears below. Ticket number was added in version 1.39.

**SCALE # 1
TICKET # 12345
TIME 09:25:42
DATE 07/28/94
WEIGHT 797.504**

The scale number will be the node you programmed the scale. To print the ticket press the function key F8. If you have an IO board, you can connect a pushbutton to the remote print input P4.5. You can use the **CLEAR WEIGHT** key to set any of the special codes to 00 after using the select key to select the code. You cannot use FF for a special code since it is the end of message marker.

Function Key F7

RS-232 Serial Output

Again press the select key until the small arrow is back on line 1. Use either of the up arrow keys to change the word TICKETS to WEIGHT. Now the display appears as shown below.

```
RS-232    WEIGHT  
FORM STX WT CR  
LF AFTER CR OFF  
LOG DATA OFF
```

Use the SELECT key to move the small arrow to line 2 after the word FORM. You can now select from the following options:

FORM STX WT CR or WT CR

This allows you to send an STX if the data is going to a PLC or disable STX if the data is going to some type of display.

Use the select key to move the small arrow to line 3 after the word CR. You can now use the adjust keys to select from the following options:

LF AFTER CR OFF YES BOTH

If you select off no line feed will follow the carriage return. If you select yes a line feed will follow the carriage return at the end of the message. If you select both a line feed will follow each carriage return if you have selected weight and rate.

The above discussion shows you how to send the scale weight out the RS-232 port once each second. You can use the select key to move the small arrow back to line 1 and select RATE instead of WEIGHT.

If you do select RATE, then once each second the current rate will be sent out the serial port. You can also use the adjust keys to select WEIGHT&RATE. If you do then the weight will be sent followed by the rate, once each second. If you select WEIGHT&RATE then you have the following options for the format of the message.

```
STX WEIGHT RATE CR  
WEIGHT RATE CR  
STX WEIGHT CR RATE CR  
WEIGHT CR RATE CR
```

Again, on line 3 LF AFTER CR allows you to select sending no line feed after the carriage return by selecting OFF. You can send one line feed after the final CR by selecting YES. Or you can send a line feed after each CR by selecting BOTH.

Use the select key to move the small arrow to line 4 after the word DATA. If you select OFF then either weight, rate, or weight and rate, depending on what you have selected, will be transmitted once each second. You have the option of using the adjust keys to change LOG DATA from OFF to from 1 to 255 MIN. In that case data will be transmitted once every X minutes where X is the number you have programmed. In addition to the normal message time and date are added. The format of a data log is

```
WEIGHT RATE TIME DATE
```

if you selected sending both weight and rate. Logging data allows you to collect data from the scale in a time frame you can select yourself.

Function Key F7

RS-232 Serial Output

If you press the F7 key a second time the display will appear as shown below.

BAUD 1200
COLOR RED

If you have not turned on switch SW2 position 3 the second line will be blank. Press the **SELECT** key and a small arrow appears after the word **BAUD**. You can use the arrow keys to select 1200, 2400, 4800, or 9600 baud. Keep in mind there is no handshake, so characters may be lost if you select a high baud rate.

The scale control supports a low cost large display called a **COLOR BRITE** sign Model SW-214CR. This display is made up of red and green light emitting diodes. You can select the color you want from red, green, and orange. The characters are two inches high. You can display either the total weight that has crossed the scale or the current rate crossing the scale. The display is updated once each second. This display is designed to be used indoors. It is not waterproof or weather proof so it must be protected by mounting it in a suitable housing. The display is very bright indoors but in direct sunlight you cannot read it. If you use it outdoors, you must shield it from direct sunlight. In spite of its limitations, it will allow you to read the scale from at least 25 feet away and it is very low cost. If you are using this option you must turn on SW2 position 3. This switch is on the door. It must be off if you are not using the sign since the message format is special.

You may contact Belt-Way Scales, Inc. for information on where to purchase this display. You will need a special cable to connect the display to the control. One end has a telephone style connector to plug into the display. The other end connects to terminals in the control box labeled **TXD** and **GND**. You can purchase a cable from Belt-Way Scales, Inc. You must set the baud rate to 2400 to match the **COLOR BRITE** display.

Beginning with Version 1.27, you can print a ticket which includes the master total instead of the weight total. The ticket will appear as shown below.

```
SCALE # 1
TICKET # 12345          version 1.39
TIME 09:25:42
DATE 05/10/00
MASTER TOTAL 797.504
```

Follow the instructions in this F7 section to print tickets. Then, press **F4** so you are looking at the master total. Then press **F8** to print the ticket shown above.

Beginning with version 1.34 you can also choose **ALTERNATE** mode. This allows you to send the weight to an overhead display for a programmed number of seconds and then send the rate. This allows one display to show both weight and rate. The number after **ALTERNATE** is programmable by pressing the select key until the arrow appears after the word **ALTERNATE**. It is the time in seconds to display each message.

Beginning with version 1.37 you can also choose **DISPLAY** which allows you to send the weight rate screen to a separate larger liquid crystal display. The update time is programmable.

Function Key F8

Print a Ticket

Function key F8 is used to print a ticket if you have set the RS-232 port to printing tickets. When you want to print a ticket simply press the F8 key.

You can also print a ticket using the remote print input located on the optional IO board. It is input P4.5. Of course you must have the optional IO board installed.

In this discussion of the RS-232 port STX means start of transmission. It's value is 2. CR means carriage return. It's value is 13. LF means line feed. It's value is 10.

If you are using the 12 special codes to send control codes to your printer you will need to refer to your printer manual to tell you what the codes are. The codes you will program use the hexadecimal number system. You may also need to refer to an ASCII chart to find the hexadecimal values of letters used in the control codes. All the information you need should be in your printer manual.

Beginning with version 1.38, if you press F8 and RS-232 is off, the modem buffer will be sent out the serial port. This allows you to collect the modem buffer data on a Palm Pilot or a printer.

Test Keys T1 T2 T3

Press test key T1. The display appears as shown below.

ANGLE A/D	512
LOAD CELL A/D	750
LC SUPPLY A/D	804
LC ADJUSTED	5865

The angle a/d reading is the value of the data the computer is getting from the angle sensor. It will be a number between 0 and 1023. If you have an angle sensor, this number is used to determine the conveyor angle.

The load cell a/d is the value of the data the computer is getting from the load cells. It will be a number between 0 and 1023. This information can be used in testing load cells.

The load cell supply a/d is measuring the voltage the computer is supplying to the load cells. This number is normally between 800 and 850 and should not vary more than about one number from its value.

The load cell adjusted reading displays the load cell data after the computer has adjusted it for variations in load cell supply voltage and angle changes if you are using the angle sensor.

Press test key T2. The display appears as shown below.

SWITCH SW2	0
SWITCH SW1	3
VERSION	1.39

This display shows what configuration switches are turned on and also the version of the software.

Press test key T3. The display appears as shown below.

BELT LOAD	
25.000 LB/FT	or KG/M
SCALE WEIGHT	
100.000 LB	or KG

This display shows the belt load and also the total weight on the scale. It uses the value you programmed for idler span using the F1 function key to calculate the scale weight.

A properly calibrated scale should show a value near 0 for the scale weight when the belt is empty. When you calibrate the scale this display should be nearly equal to the value of your test weight when your weight is hanging on the scale.

Troubleshooting

Before a belt scale will work you must have a belt speed and a load % which is not 0.0% or 102.3%.

Belt Speed Problems

Belt speed is 0 (line 3 of the weight rate display)

Make sure the belt is running.

1. Is the wheel and shaft turning?
2. Turn the power off and unplug the speed sensor.
3. Turn the power on. Is LED2 on or off?
4. If LED2 is on replace the 7414 (U16).
5. If LED2 is off, put a jumper wire between GND and SIG A on the digital speed sensor terminal strip.
6. If LED2 remains off with the jumper connected, replace 7414 (U16).
7. Measure the voltage between GND and +5VDC on the digital speed sensor terminal. It should be very close to 5.0 volts DC. If not, there is a problem on the processor board.
8. If LED2 turns on with the jumper connected and off with the jumper removed, and the 5.0 volt reading in step 7 is correct, the problem is not in the control box. It is in the speed sensor or wiring.
9. Turn the power off, plug the speed sensor back in, and turn the power on.
10. Again measure the voltage between GND and +5VDC as you did in step 7. If the voltage was near 5.0 volts in step 7 and now it is not, turn the power off. Look for a short in the cable from the control box to the speed sensor. Look for cuts caused by rocks or by the cable rubbing on the belt. If the cable has been extended beyond the 30 feet supplied on the sensor, be sure to check all splices.
11. If the cable is good, the wheel rolls freely, and the shaft is not loose in the bearings, then the problem is on the circuit board inside the speed sensor. This is a small board which can be replaced very easily. If the shaft is loose in the bearings, the sensor will have to be replaced.

Low or intermittent belt speed.

If the speed is low and erratic the encoder disk inside the sensor is probably loose on the shaft. The speed sensor will have to be replaced. If the speed is high and erratic you probably have electronic interference from a motor or radio.

Load Cell Problems

Load % on line 4 of weight rate screen is 0.0% or 102.3%.

1. Chances are one load cell is working properly and one is not.
2. Write down which zero switches SW4 Z1 - Z7 are turned on (slid to the right).
3. Turn off all zero switches.
4. Unplug one load cell.
5. If the load % is still 0.0% or 102.3% there may be a problem with the cell still plugged in.
6. If the load % is no longer 0.0% or 102.3% the cell you unplugged has a problem.
7. Unplug the cell still plugged in and plug in the cell you previously unplugged.
8. If cell 1 reads a normal % and cell 2 reads 0.0% or 102.3%, then cell 2 has a problem.
9. Look for a broken or cut wire from the cell to the integrator.
10. If you extended the cables from the scale to the integrator, check your connections carefully.
11. Be sure the cables are connected to the correct terminals.
12. Any splices must be soldered and insulated or screw terminals must be used.
13. Crimp connectors or wire nuts will not work.
14. Be sure no moisture has penetrated any splices.
15. With both cells plugged in measure the voltage on either cell from -SUP to +SUP (black to red wires). You should get about 9.6 volts DC.
16. With only one cell plugged in, and all the zero switches off, and the belt empty, measure the voltage between -SIG and +SIG (white to green wires). You should get about 2 millivolts DC (.002 volts) The +SIG (green wire) should be positive. Repeat the test for the other load cell.
17. If you still have not isolated the problem unplug one cell. Measure its resistance using a digital voltmeter.
18. Between the red and black wires you should see about 420 ohms.
19. Between the white and green wires you should see close to 350 ohms.

Troubleshooting

Check your belt length on the cal data screen. A very small number may keep the scale auto zeroing.

20. Some auto ranging meters change scales at 399.9 ohms. You may see 350.0 ohms from green to white and .42 k ohms from red to black. The k means thousands of ohms, so .42 k ohms is 420 ohms.

21. Repeat the resistance test for the other load cell.

22. The resistance tests show if a cell has a broken wire or the cell itself may have an electrical problem. Resistance tests will not show if a cell is bent. The millivolt test in item 16 will show if a cell is bent.

Load % is 0.0%.

1. A reading of 0.0% indicates something may be pushing up on the load cell so the reading is negative. Since the integrator cannot read negative numbers, the load appears as 0.0%.

2. Look for a rock wedged under the scale idler.

3. Make sure the bolts holding the "V" block to the idler do not stick through the idler mounting plate so far that they press against the load cell tube, lifting up on the idler.

4. Make sure the overload bolt on the bottom of the load cell assembly has not been tampered with and is pressing up on the load cell. If you can press down on the load cell by pressing down on the idler over the load cell in question, and the voltmeter reading between the green and white wires becomes less negative or more positive, the load cell is not pressing down on the overload bolt.

5. Repeat the above test on the overload bolts at each end of the idler mounting plate. There is a shoulder bolt under each plate bolted on top of the ends of the idler mounting plate. The top and bottom of the bolt head provide additional overload and underload protection. If either shoulder bolt is not aligned properly, the scale may be in a mechanical bind.

6. If you have found one cell is bad, but cannot determine the cause, something has probably bent the cell up and it will no longer return to its normal position. It will have to be replaced.

Load % is 102.3%

1. A reading of 102.3% means something is probably pushing down on the load cell.

2. Look for a rock wedged in a manner that presses down on the scale idler.

3. Be sure the overload bolts at the ends of the idler mounting plate are not adjusted wrong and are pulling down on the idler mounting plate.

4. If you have found one cell bad, but cannot determine the cause, something has probably bent the cell down and it will no longer return to its normal position. It will have to be replaced.

Weight is not consistent

1. If the load % is not 0.0% or 102.3%, and it increases with increasing load, the problem is probably mechanical. Try to lift up on each load cell assembly. Each should move on the mounting pipes about 1/32". If the load cell tubes are in a bind, the mounting pipes are not parallel, or one may be higher than the other. Loosen the "U" bolts, adjust the leveling bolts, and tighten the "U" bolts.

2. If the load % is around 7.5% with the belt empty, and only 10.0 to 15.0% with the belt fully loaded, the scale is not getting enough change in load cell signal to work properly. Try turning on all the gain switches. Remember, on is to the right. Then you will have to reset the zero switches, run a set tare if you have an angle sensor, run a set zero, and run a check span or do a material test. If all the gain switches are already on, the load on the belt is too light for the model scale you have. Try to slow the belt down, if possible, to increase the belt load. You can contact Belt-Way Scales, Inc. to see if a lighter capacity load cell will solve the problem.

3. If the load % wanders all over between 0.0% and 102.3%, make sure moisture has not entered any of the connections. Moisture in splices can cause the load cell signal to drift a great deal. You may also have an intermittent connection on one of the wires in either load cell cable. Look for terminals pressing on insulation instead of wire, loose connections, or a break inside one of the load cell cables.

Troubleshooting

Weight is consistent but wrong.

You have calibrated the scale and the weight is consistent, but it is not correct.

1. Before a scale can be accurate with a full belt load, it must be accurate with an empty belt.
2. Run the belt empty. Is your rate near 0 tons per hour on line 2 of the WEIGHT RATE screen? If the rate is near 0, then you need to adjust the span to get correct readings under load.

Before you can change the calibration, you must turn on switch SW1 position 1. This switch is located on the inside of the door. Be sure to turn it off when calibration is complete.

Rate is near 0 with the belt running empty.

1. Run a CHECK SPAN or material test to adjust the span. If the belt scale is light when compared to a truck scale, the span is too small. If the belt scale is heavy when compared to a truck scale, the span is too large. You can see the span number by pressing the CAL DATA key. See the formula in the digital calibration section to adjust the span.

Rate is not 0 with the belt running empty.

1. When you calibrated the scale, did you write down the following data?

Zero, span, length on CAL DATA screen

Tare on TARE ANGLE key

Load % empty and full belt

If you did, compare the data with current data. Did something change?

2. If you have an angle sensor, run a new SET TARE.
3. Next run a SET ZERO.
4. Finally run a CHECK SPAN or material test.

Remember, zero on the CAL DATA screen is what makes the scale accurate with an empty belt. Span on the CAL DATA screen is what makes the scale accurate under load.

Network Problems

1. Most network problems are caused by cable problems. Make sure you are using RG62A/U cable, which is 93 ohm coaxial cable. If the network has been working and has stopped working, see if a cable has been cut or run over or kinked.
2. The minimum cable length is 6 feet. A shorter cable can cause the network to fail or be intermittent.
3. Make sure the two ends of the network have 93 ohm terminators installed.
4. If a PC is on the network, the network card must be connected using a "T". The center of the "T" goes to the PC. One end of the "T" goes to the scales. Normally, the PC is at one end of the network, so the other end of the "T" must have a 93 ohm terminator installed.
5. Make sure every scale on the network has a different node number.
6. If you have several scales networked to a PC or a remote display, leave the scale connected to the PC or remote display connected. Disconnect the cable from that scale to the rest of the scales. Move the terminator from the last scale to the one scale still connected to the PC or remote display. If you get one scale to work, add the rest, one at a time, moving the terminator as you go. Eventually you may find one scale that causes the network to fail.

Before calling for technical help, try to have the following information with you.

1. Is this a new installation?
2. Is this an installation which worked before but no longer works?
3. Has the scale been moved recently?
4. Has the belt tension been changed recently?
5. Do you have an angle sensor?
6. Do you have a belt speed with the belt running?
7. What is the load % with the belt empty?
8. What is the load % with the belt full?
9. What model scale do you have? A label on each load cell will identify the scale model.
10. What is your zero, span, length, tare?

USING A MODEM TO COLLECT DATA

Beginning with version 1.19, the scale can be used to collect data using the internal memory. This data can be downloaded into a personal computer using a modem from anywhere in the world or you can use a serial cable and a portable computer to collect the data locally.

1. Press the **NODE** key. If you only have one scale at this location you can set the node to 1. If you have several scales at this location you should set each to a different node number. Press the **SELECT** key once to move the programming arrow to the word node. Switch SW1 position 1 must be on to program the node number.

2. Press the **SELECT** key again to move the programming arrow to plant. If you are collecting data from several plants enter a unique number to identify this plant. Switch SW1 position 1 must be on to program the plant number.

3. Press the **SELECT** key again to move the programming arrow to product. If you want to identify each different product crossing this scale enter a unique number to identify this product. Switch SW1 position 1 does NOT need to be on to program the product number. This allows your operator to change the product number when the actual product changes without opening the door on the control. If you do use the product number to identify your different products it is up to your operator to have the correct product number entered for the product being weighed.

4. Press the **SELECT** key again to move the programming arrow to modem time. Enter the time interval you wish to record data. The standard scale will store 120 records. If you set the modem time to 1 minute increments you can store 120 minutes or 2 hours of data. After 2 hours older data will be replaced with new data. If you set your modem time to 6 minutes (.1 hour) you can store 12 hours of data before older data will be replaced. This is because

you will be storing 10 records per hour. Dividing 120 records by 10 records per hour is 12 hours.

The data is in the following format:

```
001,002,003,00007543.142,08:48:01,03/26/97crLf
```

where the scale number is 1, the plant number is 2, the product number is 3, the weight is 7543.142, the time is 08:48:01, and the date is 03/26/97. The crLf at the end of the line is carriage return line feed. The format of this data should be able to be imported into any spread sheet or data base program. The data is in comma delimited ASCII format. Leading zeroes will be replaced with spaces.

Once the data is collected in the scale integrator you must use the RS-232 port to download the data to a personal computer. First press the F7 key twice and set the baud rate to 9600 for the fastest transmission. If you are using a modem it must be programmed to use 9600 baud between the scale integrator and the modem. Let the modem auto detect the speed between the two modems. Program the baud rate from your personal computer to your office modem for as fast as possible. It must be faster than 9600 baud or you may lose characters. If you lose characters you may have to slow down the baud rate at the integrator.

The scale integrator RS-232 port is a simple 3 wire interface. It does not support handshaking signals like RTS, CTS, DCD, etc. Connect our transmit data pin TxD to the modem receive data. Connect our receive data RxD to the modem transmit data. Connect our ground to the modem signal ground. You must connect the modem that will be used with the scale integrator to a personal computer to program the modem. It must be set to the correct baud rate, usually 9600, 8 data bits, 1 stop bit, no parity, using your terminal program. You must program the modem to auto answer, send numeric response, send only short form messages, disable flow control, and DTR assumed on.

USING A MODEM TO COLLECT DATA

If you do not use a modem, you can connect a personal computer directly to your scale integrator using a 3 wire cable. The scale transmit data TxD must be connected to the computer receive data. The scale receive data RxD must be connected to the computer transmit data. The scale ground must be connected to the computer signal ground.

When you use a modem set to auto answer, it will send the scale the number 1 to indicate the modem has connected. The scale sees the 1 and waits 5 seconds and then sends the modem menu. This is why your modem must be set for numeric responses and short form messages. Once you see the menu simply enter the letter of the function you want to download. Your responses MUST be LOWER CASE. If you enter c for current data the data will include the current rate. Before you enter b to download the 120 record buffer you want to set your terminal program to store the buffer data on your hard drive.

Once you have the data on your hard drive you will want to import it into your spread sheet or data base program. Some of the data may be a repeat of data you downloaded last time. This depends on your modem time and how often you actually download the data. You should remove duplicate records from your data base.

If you are not using a modem, but instead are using a direct cable connection, enter a lower case letter a to bring up the menu. If you enter the number 1 the menu will appear after about 5 seconds. Once you see the menu simply enter the lower case command for the function you want to perform.

Example: Configuring a Zoom 360 fax modem

These steps will configure the following settings on a model 360 Zoom fax modem. Other modems will be similar but there will be differences. Consult the manual with your modem. We need to configure the modem as follows:

Auto answer on first ring (S0=1)
Send numeric response (V0)
Send only short form messages (X0)
Disable flow control (&K0)
DTR assumed on (&D0)
Save configuration as profile 0 (&W0)
Use profile 0 on startup (&Y0)
Reset modem to profile 0 (Z0)

Connect the modem to the serial port of a computer.

Start a communication program (Hyperterm, xtalk, Windows Terminal, etc).

Configure the software for 9600 baud, 8 data bits, no parity, 1 stop bit (8,none,1).

Turn the modem on.

Type AT and press the enter key.

The screen should display OK. If not, check your communications program settings.

Type ATV0X0&K0S0=1&D0&W0&Y0Z0 and press the enter key.

A 0 should display on the screen. Turn off the modem and disconnect it from the PC.

Some modems use Y0, not &Y0, to select profile 0 on reset. Some use separate transmit and receive flow controls. In this case you need to disable flow control for both transmit and receive (&H0&R1 for a US Robotics instead of &K0).

Test Mode

Test mode is made up of two components. They are oscillator test and load cell test. Oscillator test mode is activated by turning on switch sw2 position 8. Load cell test mode is activated by turning on switch sw2 position 7. Either can be used by itself or both can be activated for complete test mode. These two switch positions are only read on reset. Therefore, you must turn off the power, then turn on the desired switches, and then turn the power back on. If you change these switches with the power on, they will not have any effect until the computer is reset.

If either switch is on, the word NODE on line 4 of the weight rate screen will be replaced with the word TEST. If switch sw2 position 8 is on, the speed sensor will be ignored. Instead pulses will be generated by a timer in the microprocessor. These pulses will have the same effect on the integrator as pulses which normally come from the speed sensor. You can see the speed on line 3 of the weight rate screen. If switch sw1 position 1 is on, you can press the select key and an arrow will appear after the word speed. You can then use the arrow keys to change the speed. The large arrows will change the speed about 60.6 feet per minute and the small arrows will change the speed about .606 feet per minute. The maximum speed is about 620 feet per minute. The minimum speed is 0. The clear key will set the speed to 0. The next time you turn on the integrator in oscillator test mode the speed will be whatever it was when you last used the oscillator test mode.

If switch sw2 position 7 is on, the load cell signal will be ignored. Each time you enter load cell test mode the load percent will default to 7.5%. You can use the select key to change the % sign to an arrow and then use the arrow keys to change the load percent. The large arrows will change the load by 10% and the small arrows will change the load by .1%. the clear key will set the load percent to 0.0%.

By changing the load percent and belt speed you can simulate any desired rate. All outputs will function as if the scale is actually weighing material. You can run a set zero if desired. You cannot activate the PID loop in the simulation mode because the PID output cannot actually change either the speed or load percent. The result would be the 4 to 20 mA signal would either go to maximum or minimum.

If you want to run a simulation using the actual speed sensor and simulated load cell readings, activate only switch sw2 position 7. If you want to run a simulation using the load cells and simulated speed readings, activate only switch sw2 position 8. If you want to run a simulation using both simulated speed readings and simulated load cell readings, activate both switches.

To exit test mode turn the power off. Turn both switch sw2 position 7 and 8 off. Turn the power back on. The scale will be in normal mode. This feature is not present in versions prior to 1.20.

Warranty

Page 1 of 2

Belt-Way Scales, Inc. ("Belt-Way"), warrants its products *only* on the terms contained herein. No one has the right or authority to assume or create any obligation or responsibility, express or implied, on behalf of or in the name of Belt-Way Scales, Inc., or to bind Belt-Way Scales, Inc., in any manner whatsoever. Products manufactured by Belt-Way are warranted to be free of manufacturing defects for a one year period after the original date of purchase. Belt-Way's liability hereunder is conditioned on dealer, or in the event of a direct sale to a first-end user (then on first-end user) giving notice in writing to Belt-Way of any alleged defect. Such notice must be given immediately upon the discovery of such alleged defect. If, within the warranty period, any machinery or parts shall be proved to the satisfaction of Belt-Way to be defective, the defective item shall be replaced or, at Belt-Way's option, repaired at Belt-Way's factory. The right to have defective machinery or parts, repaired or replaced as set forth above, shall constitute the dealer or first-end user's sole and exclusive remedy. No warranty shall apply to machinery, parts or accessories which have been furnished, repaired or altered by others so as (in the opinion of Belt-Way) to have affected the same adversely. Belt-Way cannot and does not warrant or represent that machinery or parts furnished by it will handle specific materials or will produce specific results from such materials.

This warranty does not include damage to the product resulting from accident, misuse, improper installation or operation. If a component should become defective within the warranty period, we will repair or replace it free of charge at our option. Defective components must be returned freight prepaid to Belt-Way or to an authorized Belt-Way service center.

Complete products included with our system that are not manufactured by Belt-Way such as computers, printers, chart recorders, active hubs for network expansion, etc. are warranted to the extent that they are warranted to us.

The customer's sole remedy shall be such repair or replacement as is expressly provided above, and we shall in no event be liable for any incidental or consequential damages arising out of the use or inability to use this product for any purpose whatsoever.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

For products purchased outside the United States, see your distributor for warranty.

Warranty

Page 2 of 2

This scale is not designed or sold as a legal for trade scale. It does not meet some of the legal for trade scale requirements defined in NIST Handbook 44.

This warranty is in lieu of any and all other warranties, express or implied.

WARRANTY LIMITATIONS AND DISCLAIMER

BELT-WAY SCALES, INC. MAKES NO REPRESENTATION OR WARRANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCTS, WHETHER AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER MATTER, ANY SUCH WARRANTIES BEING HEREBY EXPRESSLY EXCLUDED. BELT-WAY SCALES, INC. DOES NOT AUTHORIZE ANYONE TO MAKE ANY OTHER WARRANTY EXCEPT AS STATED HEREIN.

EXCLUSION OF CONSEQUENTIAL DAMAGES

BELT-WAY SCALES, INC. SHALL IN NO EVENT BE RESPONSIBLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES CAUSED BY ANY PRODUCT SOLD HEREUNDER, WHETHER ON THEORIES OF BREACH OF EXPRESS OR IMPLIED WARRANTIES UNDER THE UNIFORM COMMERCIAL CODE, STRICT LIABILITY, NEGLIGENCE OR ANY OTHER LEGAL THEORY REGARDLESS OF WHETHER THE LOSS RESULTED FROM ANY GENERAL OR PARTICULAR REQUIREMENT OR NEED WHICH BELT-WAY SCALES, INC. KNEW ABOUT OR HAD REASON TO KNOW ABOUT AT THE TIME OF THE SALE OF SUCH PRODUCTS.

BELT-WAY is a registered trademark of Belt-Way Scales, Inc.

FLO-WAY is a registered trademark of Belt-Way Scales, Inc.

Covered by U.S. PATENT 5,696,354

Belt-Way Modem Menu

If you connect the scale to a PC using a modem, this menu should appear on your screen. If you make a direct connection using a cable, enter a lower case letter **a** to see the menu.

```

          BELTWAY MODEM MENU
SCALE # 1  PLANT #2  PRODUCT # 3
a SEND THIS MENU          j F3 KEY
b SEND DATA BUFFER      k F4 KEY
c SEND CURRENT DATA     l F5 KEY
d WEIGHT RATE KEY        m F6 KEY
e CAL DATA KEY          n F7 KEY
f TARE ANGLE KEY         o T1 KEY
g NODE KEY               p T2 KEY
h F1 KEY                 q T3 KEY
i F2 KEY
```

Error Messages

NET FAIL NODE **x** on line 4 of the **WEIGHT RATE** display. Press the F3 key. If lines 3 and 4 do not say **SEND RATE TO NODES IS TURNED OFF**, this control is trying to send its rate to other scales. If you do not have other controls networked, turn on switch SW1 position 1. Press the F3 key. Press the **SELECT** key 3 times so the arrow appears after the word **FROM**. Press the **CLEAR WEIGHT** key. Turn off SW1-1.

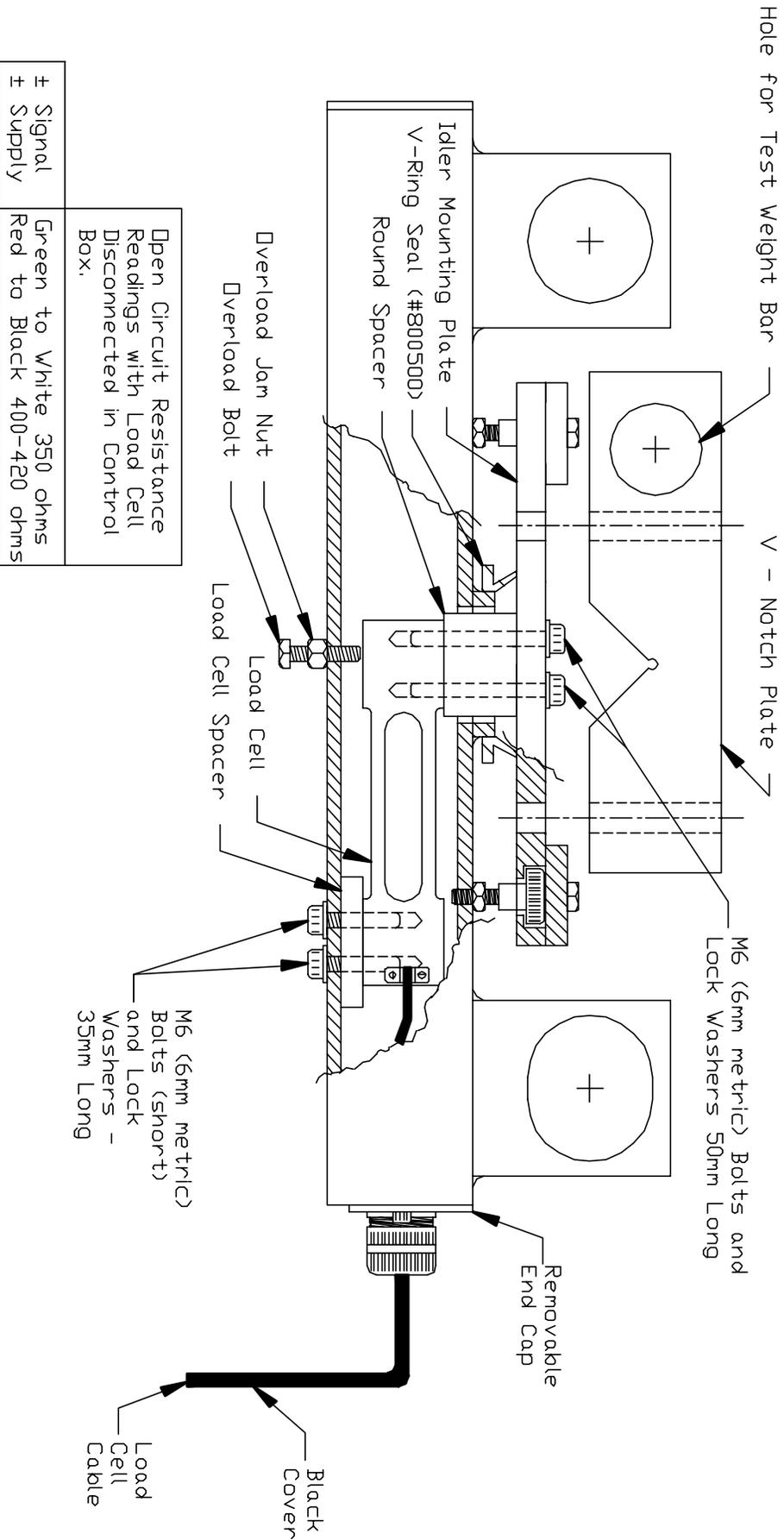
NET FAIL on line 3 of the **WEIGHT RATE** display. The PID loop is set up as a remote setpoint, and the network is not providing a rate from a master scale. See if the master control is turned off, or has its send rates to nodes on the F3 screen turned off. Check the network cable and terminators. If the PID loop is not supposed to be a remote setpoint, change it to local setpoint.

MAX OUT NODE **x** on line 4 of the **WEIGHT RATE** display. If **x** is the node for this scale, the control PID loop is at maximum output and is not getting enough material. If **x** is not this scale, this scale is probably a master and its slave node **x** is at maximum.

KEY DISABLED on line 4. Switch SW1 position 1 is probably off. You must have an IO board for F2.

Wiring Diagrams and Drawings

The following pages contain wiring diagrams for the IO option board and the remote start/stop station used for loading trucks. Use these diagrams in conjunction with the description in the manual to connect the wiring for these options. Also included are drawings showing the hole layout for mounting the scale.

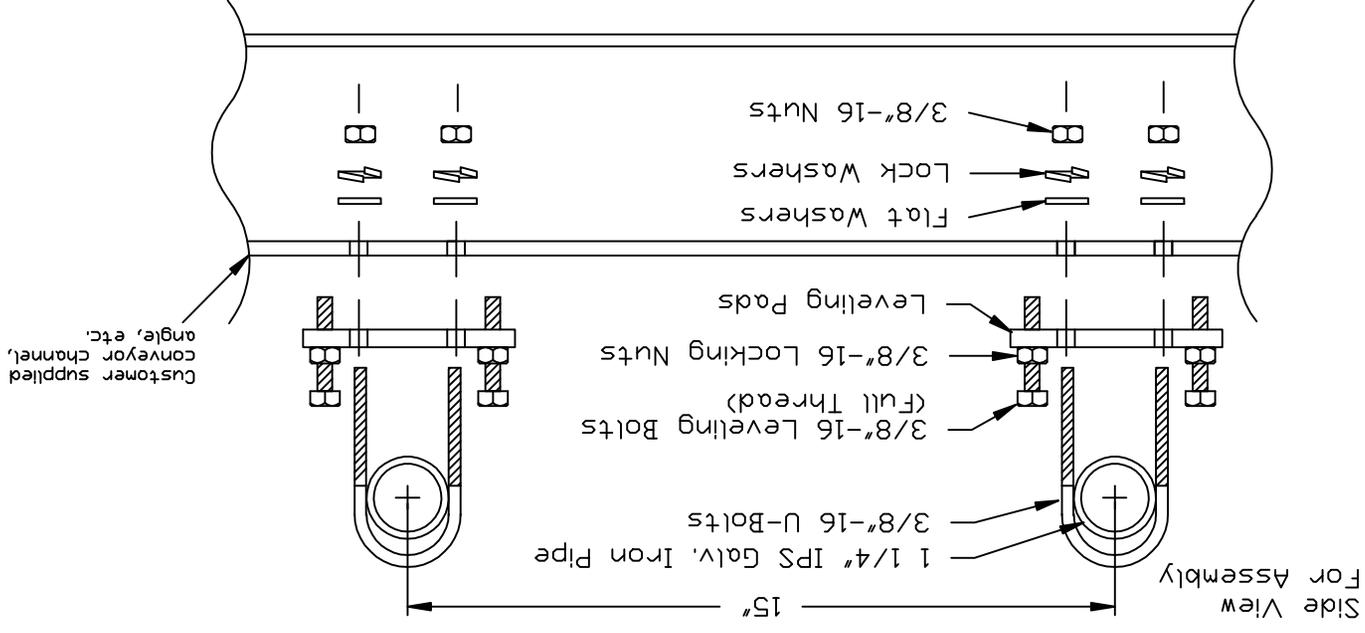
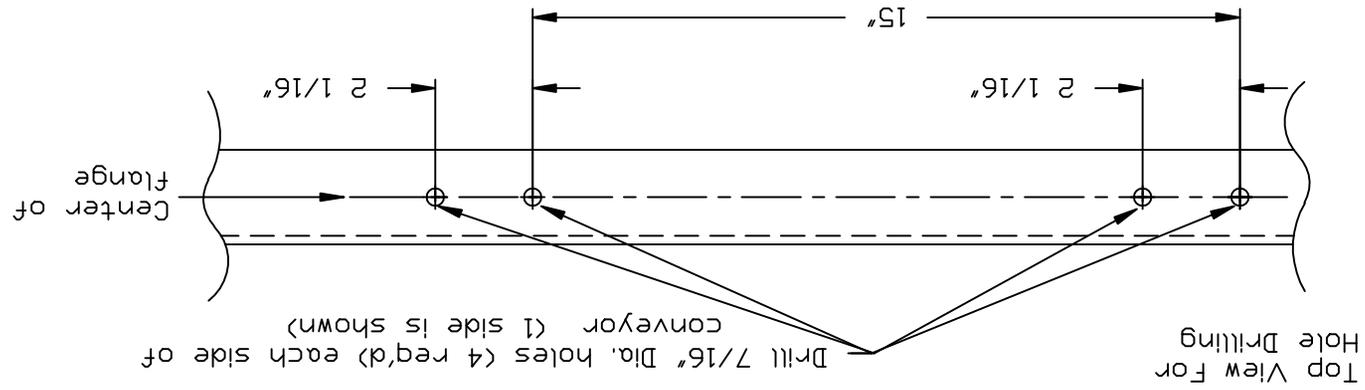


Open Circuit Resistance Readings with Load Cell Disconnected in Control Box.

Belt-Way Scales, Inc.

ONE BELT WAY
ROCK FALLS, IL 61071
PHONE: (815) 625-5573
FAX: (815) 625-5593

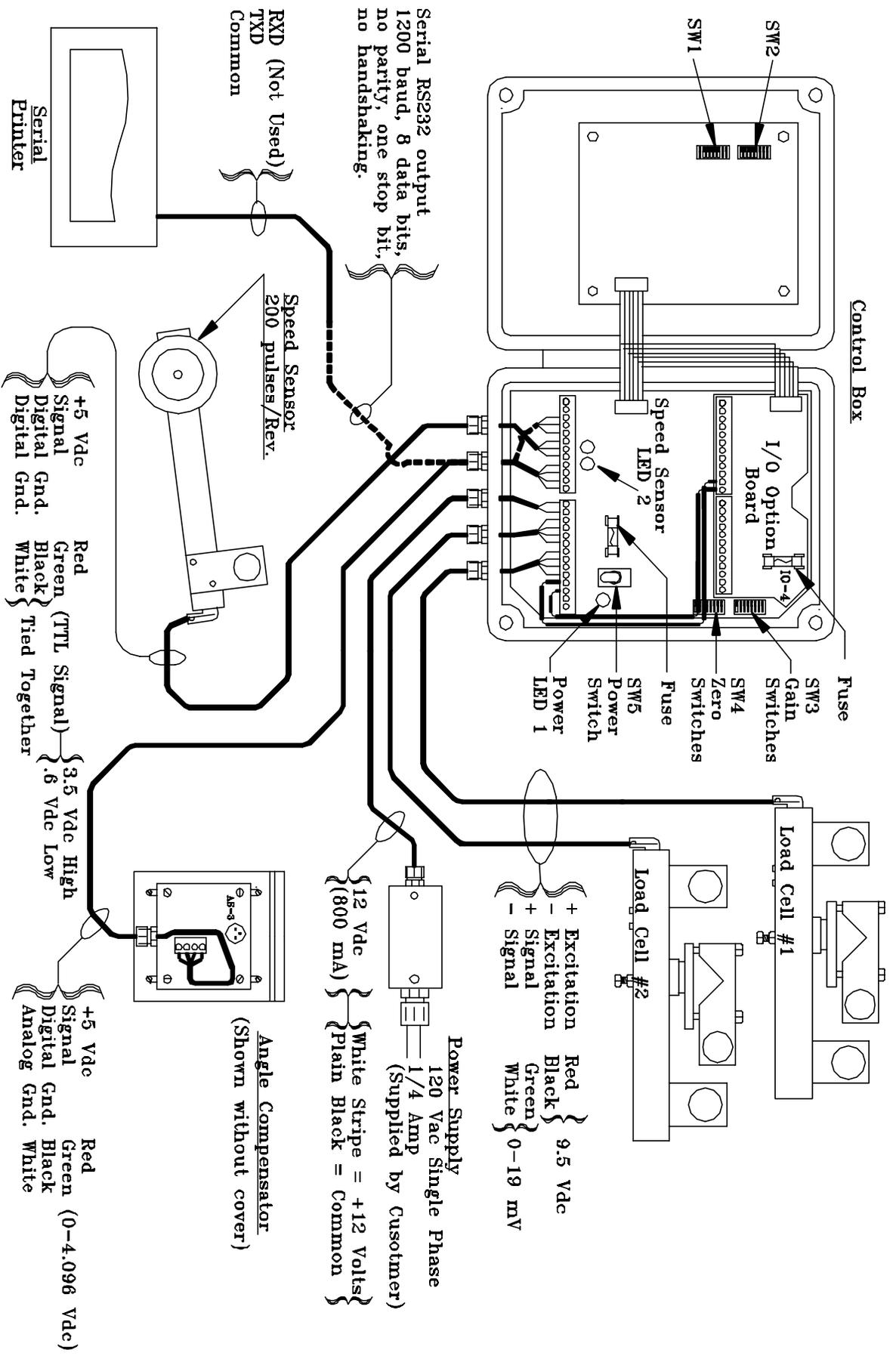
Drawing Name	Load Cell Tube with Overload Stops	REV
Scale	1.2	
Drawn By	09/08/04	DWG No. LC tube with OL Stops



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 ONE BELT WAY
 ROCK FALLS, IL. 61071
 PHONE: (815) 625-5573
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Drawing Name: Hole Locations and Assembly Details
 REV 1.2

Scale	1.00
Drawn By	03/20/13
Date	03/20/13
DWG NO.	drill1.dwg

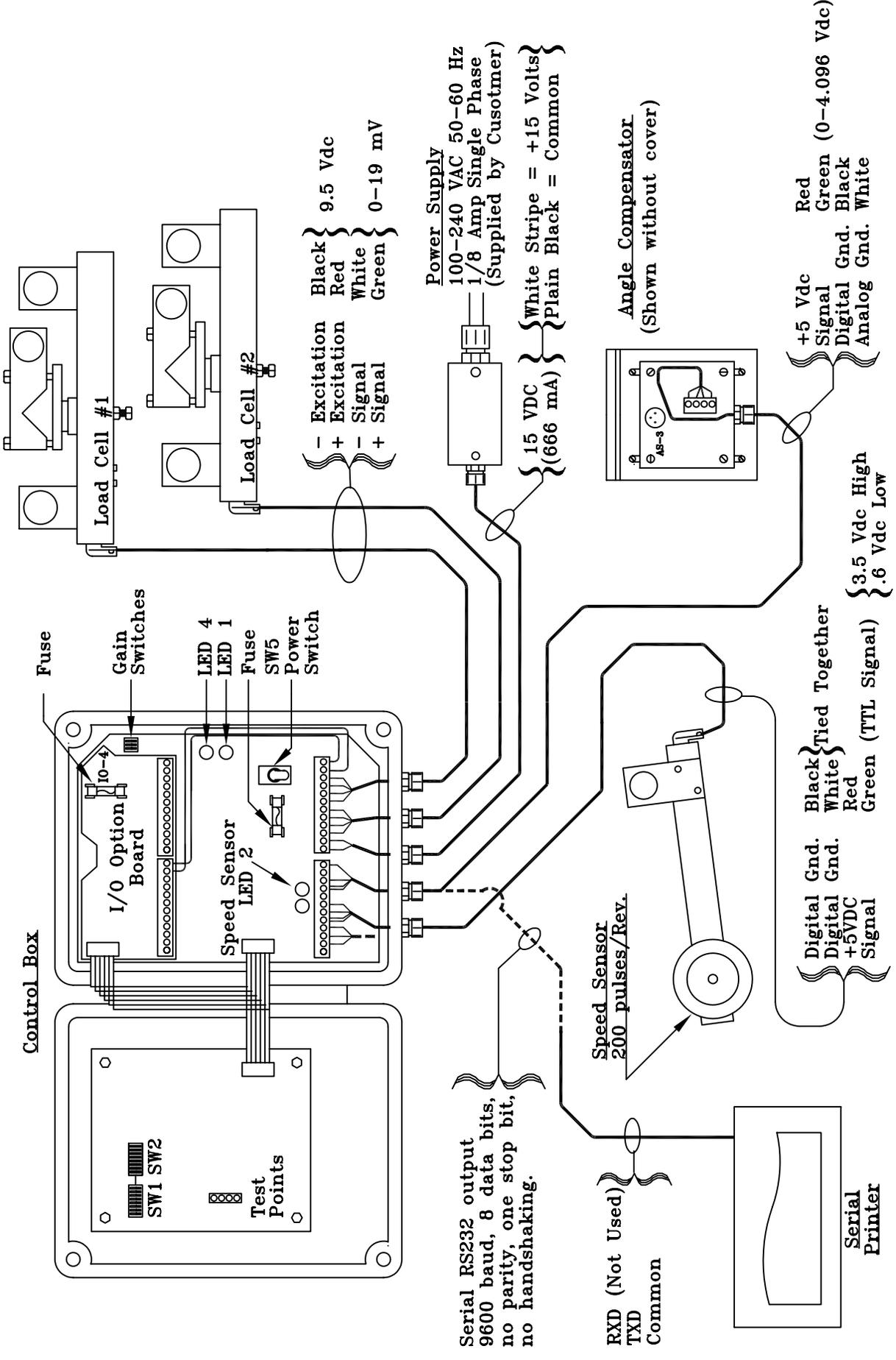


Beh-Way Scales, Inc.

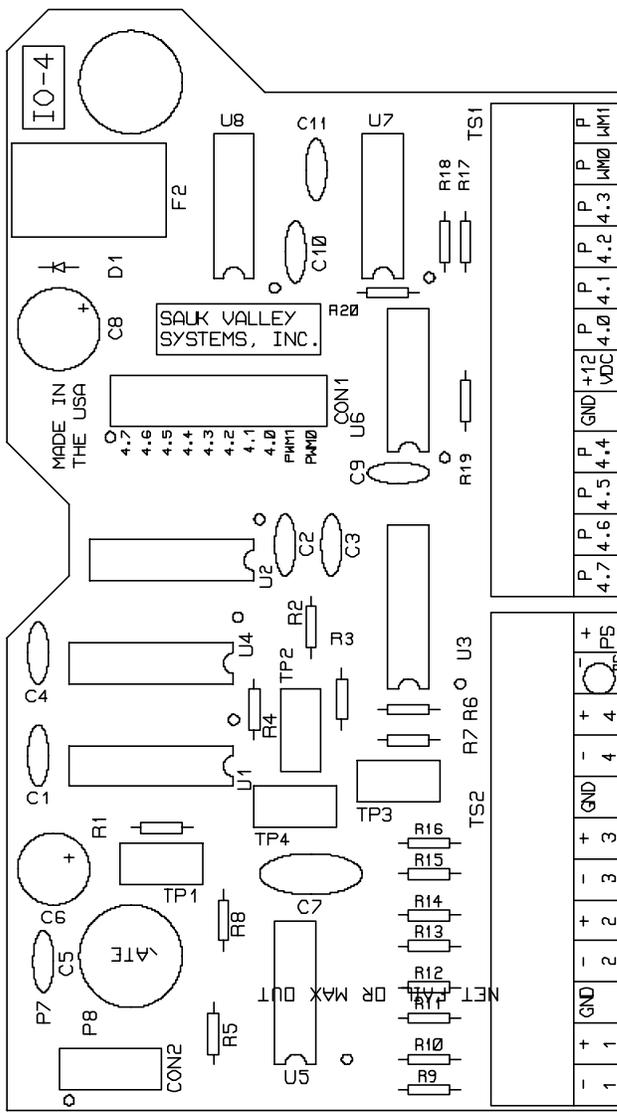
ONE BELT WAY
 ROCK FALLS, IL 61071
 PHONE: (815) 625-5573
 FAX: (815) 625-5593

Drawing Name: General Wiring PB-11
 Scale: Drawn By: Date: 09/08/04 DWG No.: wiring PB-11.dwg

REV 1.4



Serial RS232 output
9600 baud, 8 data bits,
no parity, one stop bit,
no handshaking.

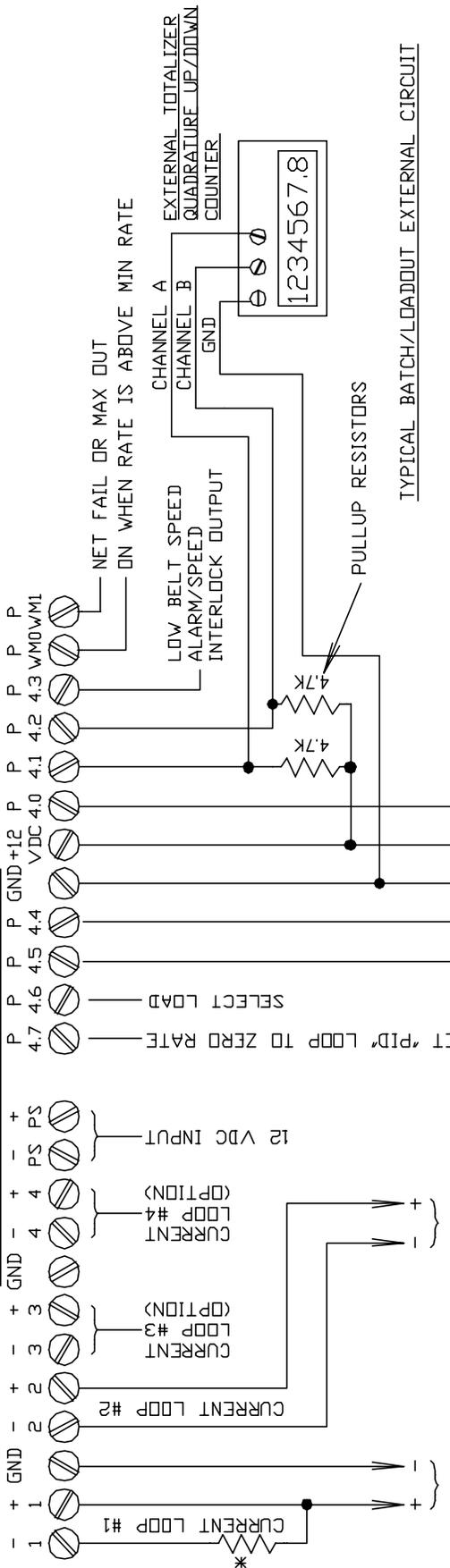


- ON WHEN RATE IS ABOVE MIN P
- OUTPUT #4 LOW BELT SPEED ALARM/SPEED INT
- OUTPUT #3 EXTERNAL COUNTER (CHANNEL B)
- OUTPUT #2 EXTERNAL COUNTER (CHANNEL A)
- OUTPUT #1 BATCHING/LOADOUT
- + SUPPLY FOR OUTPUTS
- COMMON RETURN FOR INPUTS
- INPUT #1 EXTERNAL CLEAR WEIGHT
- INPUT #2 EXTERNAL PRINT
- INPUT #3 SELECT LOAD
- INPUT #4 SET "PID" LOOP TO ZERO RATE
- +12VDC POWER SUPPLY TO IO-4 BOARD
- 12VDC RETURN FOR +12VDC POWER SUPPLY
- CURRENT LOOP #4 + OUTPUT } OPTIONAL
- CURRENT LOOP #4 - OUTPUT }
- CURRENT LOOP #3 + OUTPUT } OPTIONAL
- CURRENT LOOP #3 - OUTPUT }
- CURRENT LOOP #2 + OUTPUT
- CURRENT LOOP #2 - OUTPUT
- CURRENT LOOP #1 + OUTPUT
- CURRENT LOOP #1 - OUTPUT

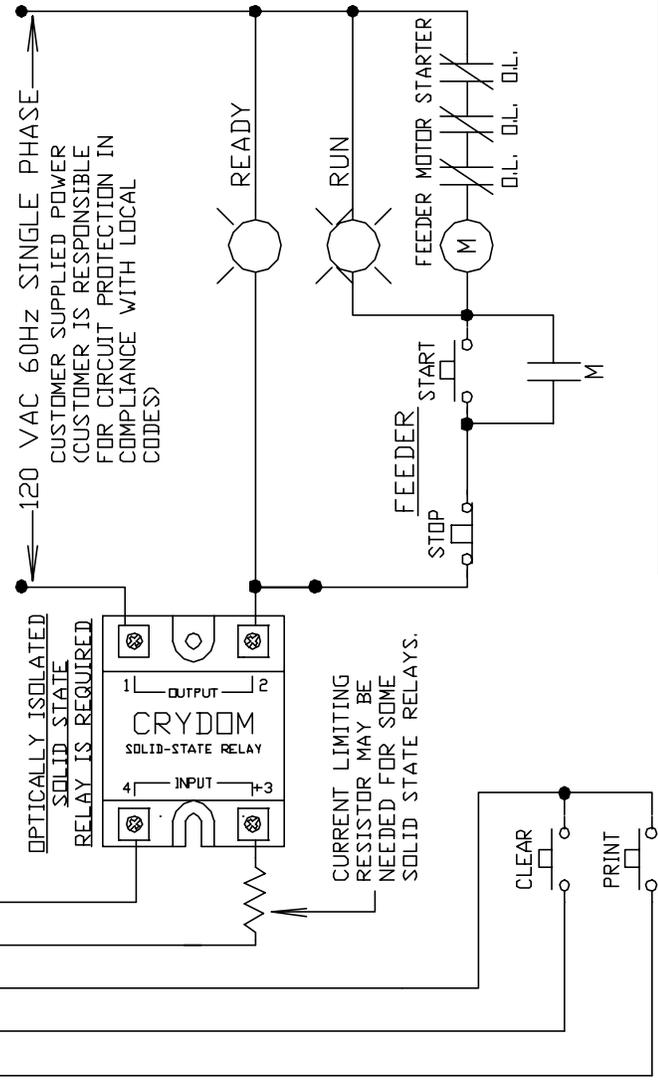
Bolt-Way Scales, Inc.
 ONE BELT WAY
 ROCK FALLS, IL 61071
 PHONE: (815) 625-5573
 FAX: (815) 625-5593

Drawing Name: I/O-4 Option Board Terminals
 Scale: 1.00
 Drawn By: [blank]
 Date: 07/10/02
 DWG NO.: 104.dwg
 REV: 1.2

I/O-4 OPTION BOARD TERMINALS



TYPICAL BATCH/LOADOUT EXTERNAL CIRCUIT



TYPICAL VOLTAGE OUTPUT HOOKUP 0-5VDC, 0-10VDC
 *RESISTOR VALUE

OHMS	VDC OUT
0	0 - 2.5
125	0 - 5
375	0 - 10

TYPICAL CURRENT LOOP HOOKUP - 4 TO 20 MA OUTPUT FOR CHART RECORDERS, CONTROLLER, ETC.

NOTE: KEEP ALL LOW VOLTAGE LOGIC LEVEL WIRING AWAY FROM ALL POWER WIRING TO PREVENT NOISE AND POSSIBLE DAMAGE TO SENSITIVE COMPUTER CIRCUITS.

EXTERNAL PUSHBUTTONS- USE LOGIC LEVEL CONTACT BLOCKS

OPTICALLY ISOLATED SOLID STATE RELAY IS REQUIRED

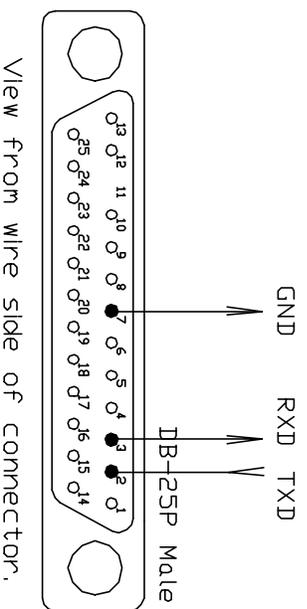
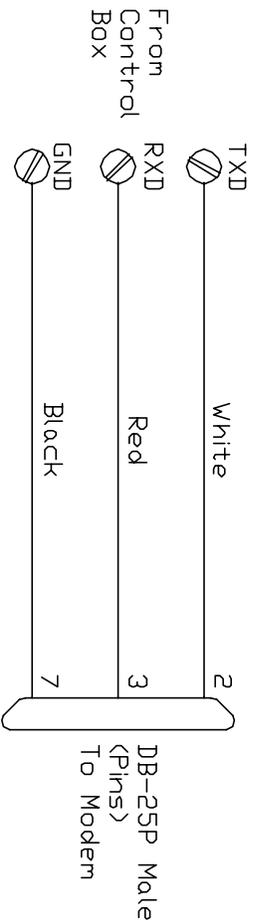
CURRENT LIMITING RESISTOR MAY BE NEEDED FOR SOME SOLID STATE RELAYS.

120 VAC 60Hz SINGLE PHASE
 CUSTOMER SUPPLIED POWER
 (CUSTOMER IS RESPONSIBLE FOR CIRCUIT PROTECTION IN COMPLIANCE WITH LOCAL CODES)

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 ROCK FALLS, IL. 61071
 PHONE: (815) 625-5573
 FAX: (815) 625-5593

Drawing Name	I/O-4 Board Wiring	DWG NO.	10WIRING.dwg
Scale	1.00	Drawn By	Date
			07/10/02
		REV	1.2

Control Box to Modem Cable



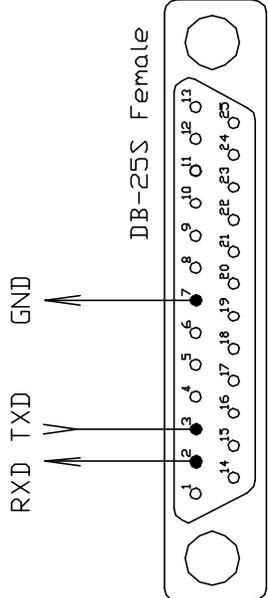
Belt-Way Scales, Inc.

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ROCK FALLS, IL. 61071
PHONE: (815) 825-5573
FAX: (815) 825-5593

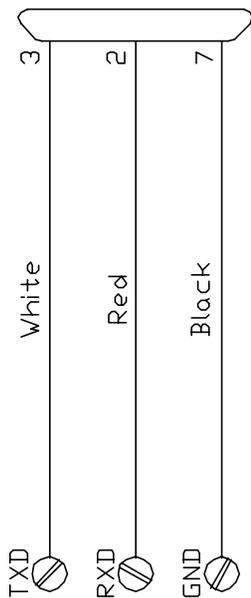
Drawing Name		Control Box to Modem Cable	
Scale	Drawn By	Date	REV
	TJM	07/10/02	2.1
pwg no.		modem to box	

Control Box to Computer

25-Pin Serial Port

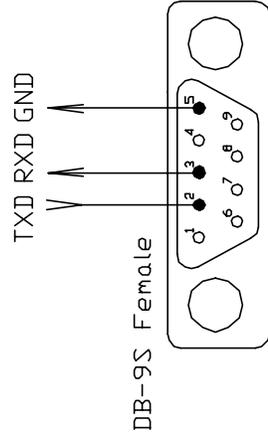


View from wire side of connector.

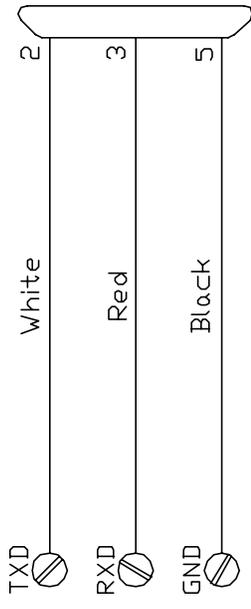


From Control Box
DB-25S Female
To Computer

9-Pin Serial Port



View from wire side of connector.

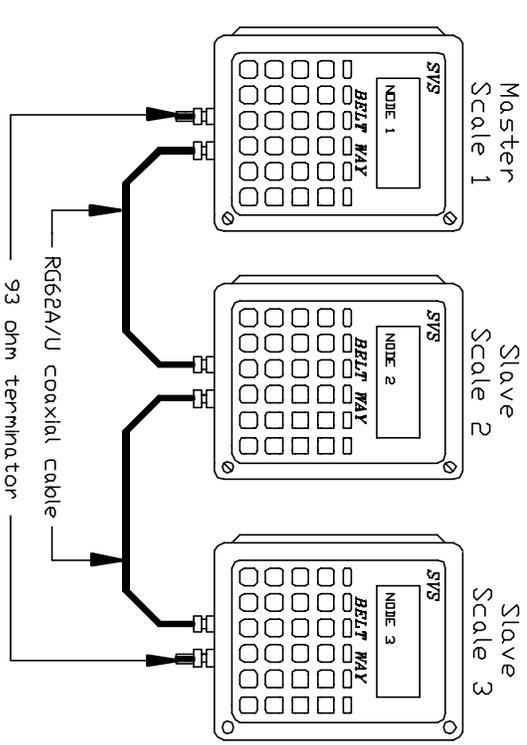
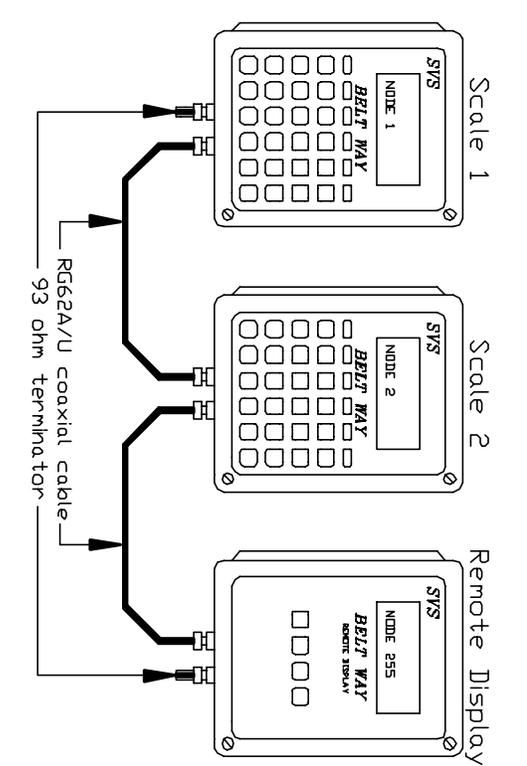
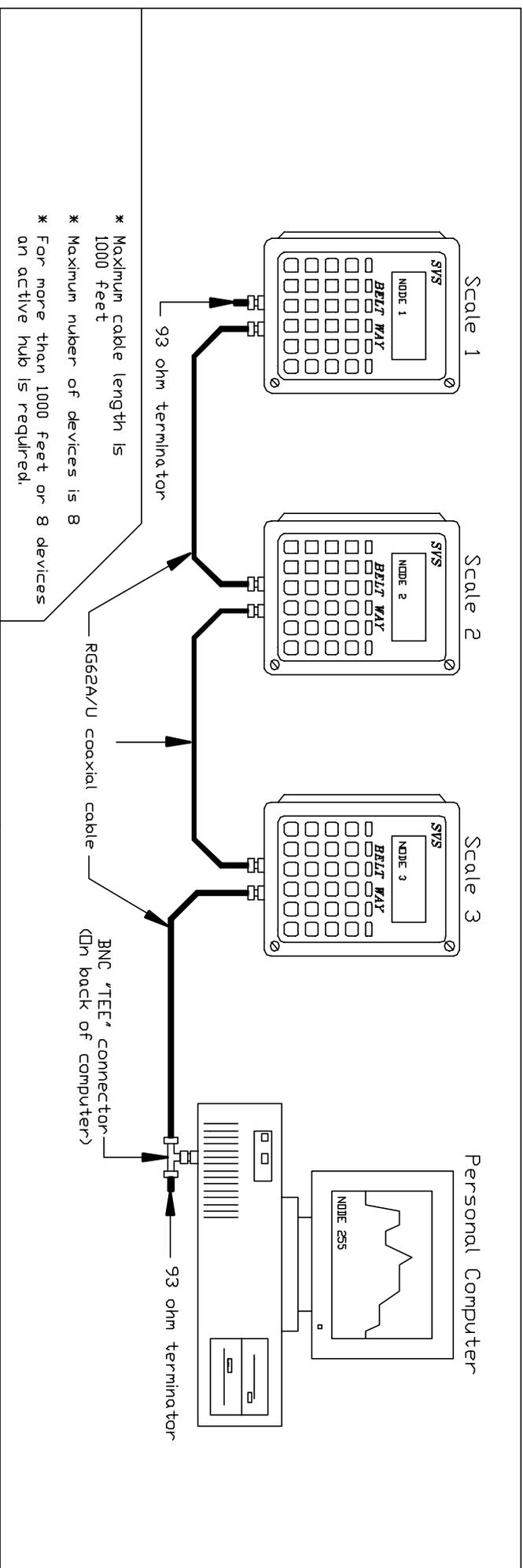


From Control Box
DB-9S Female
To Computer

Belt-Way Scales, Inc.

ONE BELT WAY
ROCK FALLS, IL. 61071
PHONE: (815) 625-5573
FAX: (815) 625-5593

Drawing Name		Control Box to Computer Cable	REV
Scale	Drawn By	Date	2.1
	TJM	07/10/02	DWG NO.
			computer to box



Belt-Way Scales, Inc.
 ONE BELT WAY
 ROCK FALLS, IL 61071
 PHONE: (815) 625-6573
 FAX: (815) 625-5593

Drawing Name: Bus Configurations
 Scale: network1.dwg

Drawn By: Date: 07/10/02
 REV: X.X

Belt-Way Conveyor Belt Scale - Calibration Check-list

Co. Name _____

Contact Name: _____

Address _____

Phone: _____

City, State _____, _____ Zip _____

Fax: _____

Optional Components

Automatic Angle Compensator

2 Channel I/O Option Board

Shaft Mounted Encoder

Scale Application Information

Single Idler Dual Idler

Scale Model Number _____

Maximum Rate in (TPH) _____

Nominal Rate in (TPH) _____

Idler Spacing center to center _____

Conveyor Angle _____°

Conveyor Length _____

Belt Width _____

SW1

1 2 3 4 5 6 7 8

ON

--	--	--	--	--	--	--	--

SW2

1 2 3 4 5 6 7 8

ON

--	--	--	--	--	--	--	--

F1

Test Weight _____

Idler Span _____

Cal Data

Zero _____

Span _____

Length _____

Weight Rate

Speed _____

Load % with Empty Belt

Load % with Test Weights installed

Average Rate (tph) with
Test Weights Installed

Load % at Normal
Operating Rate _____