

Flo-Way[®] Solids Impact Flow Meter

- Measure Granular or Powdered Material
- Stand Alone or Connect to Other Devices for Blending
- Used by Successful Producers World-Wide

Visit our website:
www.beltwayscales.com

*Expected margin of error $\pm 2\%$
at rates from 30%-100%
of maximum rated capacity
(see reverse side for capacity
ranges by Model) with consistent,
free-flowing, dry, granular,
or powdered material.*

Solids Impact Flow Meters are not suitable for all applications.



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Flo-Way Solids Impact Flow Meter

The Flo-Way solids flow meter offers continuous in-line monitoring and weighing of granular or powdered material. Better quality control, operating efficiency, and tracking capability give a competitive edge to users worldwide.

How It Works

Material flows down the intake pipe striking an impact plate. Only the horizontal component of the impact force is measured by 2 single point suspension load cells. Impact forces are integrated over time to give flow rate, total weight accumulated, and load on the sensing plate.

Easy Calibration

The system is easily calibrated in short tons or metric tons and includes an auto zero function. A sophisticated microcomputer and a four line by twenty character Vacuum Fluorescent display are housed in a NEMA 4X waterproof fiberglass enclosure. An RS-232 serial port is included to interface to printers, computers, scoreboard displays, and data loggers.

Applications

Batch control, PID loop control, and blending are accomplished with the low cost I/O Option Board, which has digital I/O and two 4-20 mA outputs. The built in Belt-Way network interconnects all Belt-Way products. A controlled amount of ingredient may be blended with material crossing a belt scale or material flowing through another flow meter.

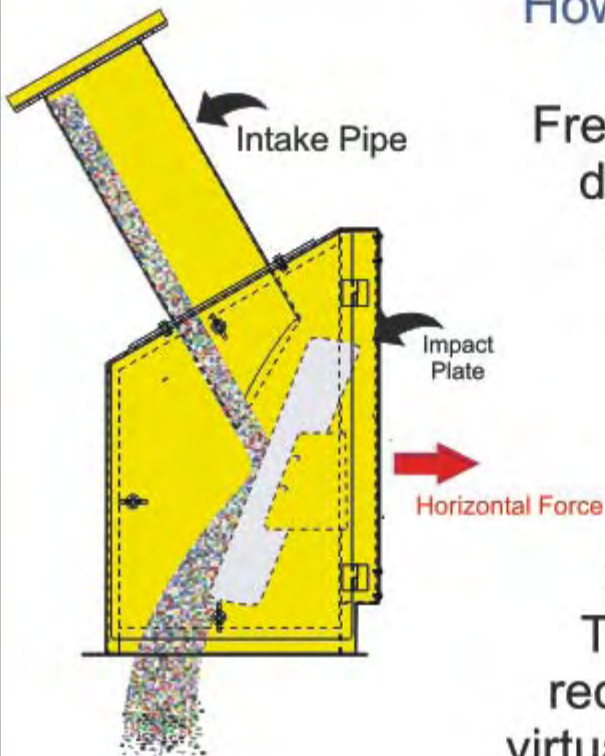
Model Selection

FLO-WAY solids flow meters include an integrator and power supply. "Tons per hour" ratings, shown below, are based on material density of 100 lb. / ft.

Size	Tons/Hour
6 inch _____	5-40
8 inch _____	20-90
10 inch _____	50-150
12 inch _____	100-250
18 inch _____	225-575

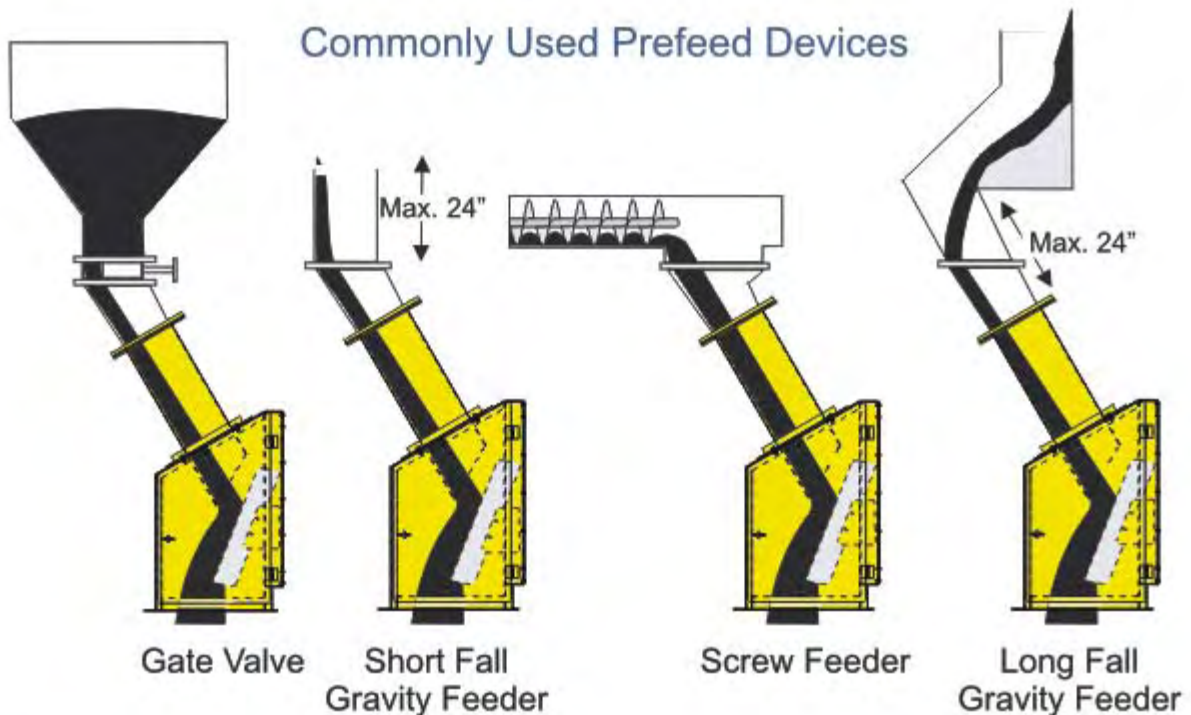
Flo-Way[®]

How Does the Flo-Way Work?



Free flowing dry bulk materials are directed into the FLO-WAY through an inlet pipe measuring from 6" to 12" in diameter. Material strikes the impact plate generating a force on the horizontal plane (only). When mounted plumb, static buildup on the sensing plate has no effect on accuracy. Therefore the need for recalibration due to zero shift is virtually eliminated.

Commonly Used Prefeed Devices



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Flo-Way[®]

Calibration Summary

1. The GAIN switches, to right of center on the processor board, control the signal strength from the load cells. The default GAIN setting is 400. This is a medium capacity setting. Reduce GAIN to 200 if the load percent on line 4 of the display exceeds 80% at max flow rate. Increase the GAIN setting to 800 if the change in load % from no material running, to the max flow rate of material, is 5% or less.
2. Enter the test weight value on F1 (amount of material to be run through the Flow Meter). Note - switch SW1 position 1 must be on.
3. Press SET Zero key with no material running through the Flow Meter. This test measures the "dead load" (weight of the Impact Plate and connecting hardware). Follow the instructions on the display to complete this test. The test is complete when the display indicates "PRESS WEIGHT RATE TO CONTINUE".
4. Press the SET SPAN key.
5. Run the test weight material through the Flow Meter.
6. Press SET SPAN key again .
7. Enter the test weight value on line 2 of the display after "SHOULD BE" .
8. Press SET SPAN key again .
9. Press WEIGHT RATE key .
10. Repeat steps 5 through 10 until the SPAN adjusts by only a few numbers .

If a known amount of material is not available, turn on SW1, Position 2. Clear the Weight on line 1 of the display by pressing the CLEAR WEIGHT key twice within 2 seconds. Run material through the flow meter, then weigh it on a certified scale. Adjust the span number (on line 3 of the CAL DATA display) using the following formula:

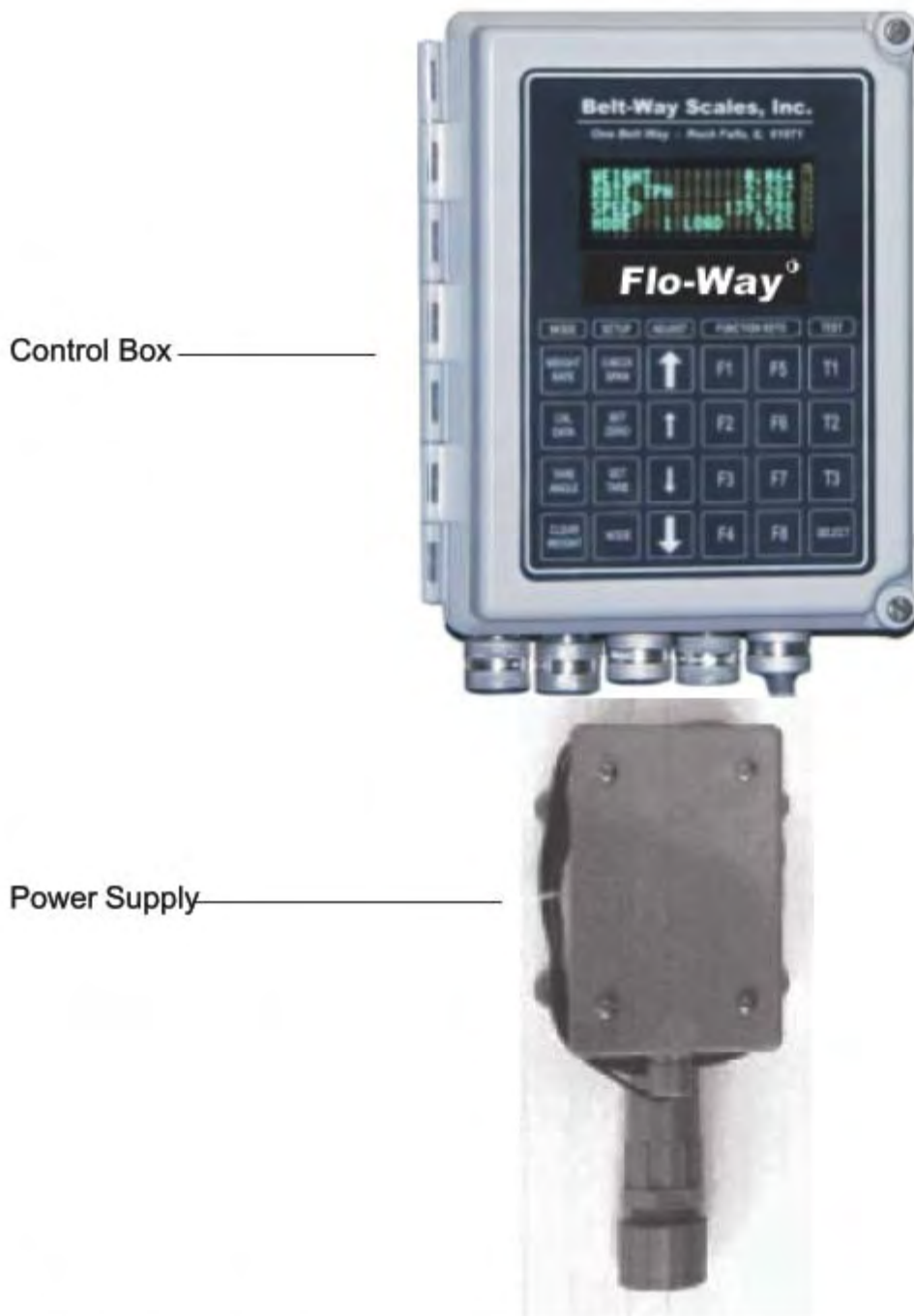
$$\text{weight from certified scale} / \text{weight from flow meter} \times \text{old span} = \text{new span}.$$



Mechanical Parts



Control Parts



Mechanical Installation

Your flow meter has been shipped with the impact plate not installed. This has been done to protect the load cells from damage in shipping. You must locate the impact plate and install it.

Open one of the hinged side panels on the flow meter housing.

Remove the two 5/16" bolts which hold one of the multiple hole side mounting plates from the load cell block.

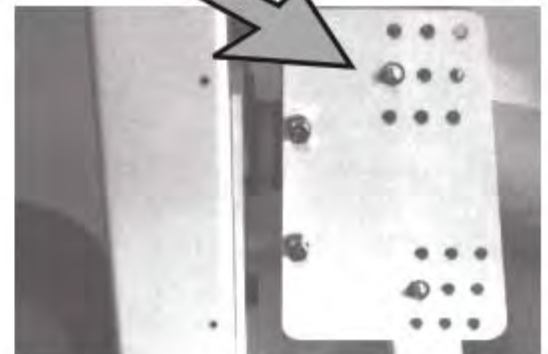
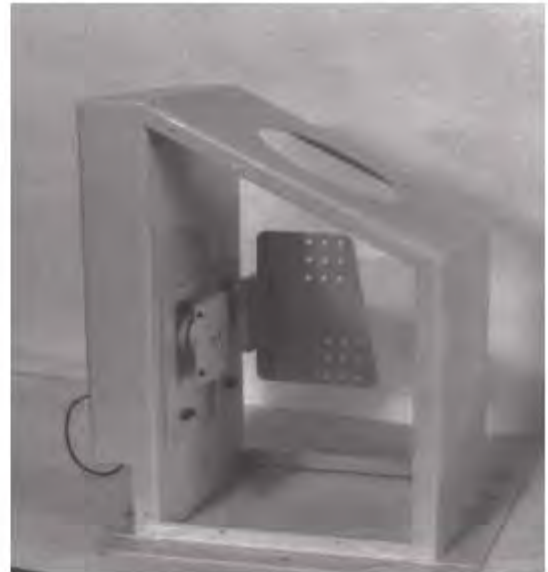
Install the inlet pipe using the hardware provided if it has been shipped separate from the base.

Install the impact plate with the bolts passing through the holes identified with black circles around the holes. The multiple hole pattern allows the impact plate to be located in several positions in relation to the inlet pipe.

NOTE: This is a floating plate mounting system. The impact plate bolts, used as mounting studs, are not bolted solidly to the multiple hole side mounting plates. Do NOT remove the nuts and washers that secure the suspension bolts to the impact plate. These are your mounting studs.

Install the multiple hole side mounting plate that you removed, putting the circled holes over the studs on the impact plate. Do NOT over torque these mounting bolts, since they are connected to the load cells which are rated at 22 pounds maximum load.

Close and latch the side panel you opened.



Mechanical Installation

The flow meter can be mounted using the holes in the flange on the bottom of the meter. If your model has a flange on the inlet pipe you can mount the flow meter using the holes in this flange as well. In this case you should provide additional support either from the top plate on the flow meter or the flange on the bottom of the flow meter. Do not simply hang the flow meter from the flange on the inlet pipe since the meter is too heavy to be supported only by the flange on the inlet pipe.

To get the best accuracy the load cells should be mounted so they are vertical. This will make the load cells ignore any load caused by material build up on the impact plate. To be sure the load cells are vertical use a level or plumb line to align the steel plate at the back of the flow meter. The load cells are attached to this plate.

In order for the flow meter to be accurate and consistent the material must flow through the inlet pipe in a consistent manner. Your piping into the flow meter and your method of feeding the material into the pipe should provide a consistent flow pattern. Then the material striking the impact plate will be consistent and the load cell output will accurately reflect the flow rate.

Mount the control box near the flow meter. The liquid crystal display is rated to operate from -20 C (-4 F) to +70 C (158 F). If you are in a very warm climate try to mount the control box so the sun will not shine directly on the display. If the sun does shine directly on the display the display can reach a temperature much higher than the air temperature.

If the display does overheat the background will darken until the display is no longer readable. As the display cools the background will return to normal and the display will be readable again.

Mount the power supply transformer housing near the control box close enough to be sure the power supply cable will reach the control box. It must be mounted with the cables at the bottom to prevent water from entering the box.

Make sure the cables are securely tied and protected so they will not be damaged. Route the load cell cables to the control box.

Remove the screws which hold the back cover on the flow meter. Route your load cell cable through the cord grip. Connect the green, white, red, and black wires and shield to the terminals marked GWRBS on the shorter connector marked load cell #1. Replace the back cover and mounting screws.

You may want to run your load cell cable in conduit. In that case you can remove the existing fitting and use the hole to mount your conduit.

Basic Electrical Installation



Cut off excess drain wire. Tighten aluminum cap.



110VAC to 12VDC

Power Supply



110-220VAC to 15VDC

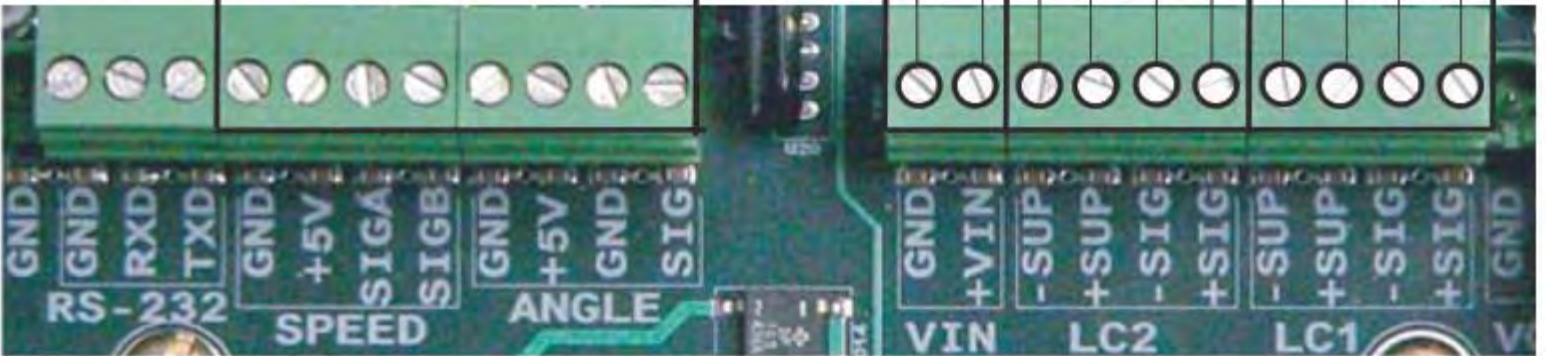


Control Box



NOT USED

Power	LOAD CELL 2		LOAD CELL 1	
Striped	Red	Green	Red	Green
Solid	Black	White	Black	White



Enable Selected Functions

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



- | | |
|-------------------------------------|---------------------------------|
| 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 Not Used | 4 Disable changing load weights |
| 5 Enable selecting 1 of 8 materials | 5 Enable clearing log time |
| 6 Enable metric units | 6 Not Used |
| 7 Enable minute time base | 7 Not Used |
| 8 Enable I/O & 2 analog outputs | 8 Not Used |

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.

The WEIGHT RATE DISPLAY



When you turn on the control, the WEIGHT RATE display appears. Press the WEIGHT RATE key any time to return to this display. The top line shows the accumulated weight in TONS since the total was last cleared. Line 2 shows the flow rate in Tons per Hour.

To clear the weight total, turning on Sw1 Position 2, then press the CLEAR WEIGHT key twice within 2 seconds.

Line 4 shows the Network NODE (representing the scale number) and the percentage of load on the scale.

The CAL DATA DISPLAY



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 dead load of the empty flow meter.

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

Pulses is used to calculate the zero number. The default setting is 10000.

Calibration Instructions

1. Turn on SW1 POSITION 1
2. Confirm Calibration Switch Settings

Scales produced BEFORE June 2006

STANDARD SETTING

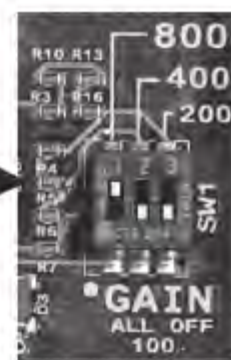


Gain Switches 1 and 3 off, all others on.

All Zero Switches off.

Scales produced AFTER June 2006

STANDARD SETTING



GAIN OF 800 Only Switch 1 is on.

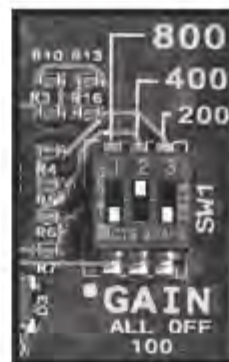
IF THE LOAD % ON LINE 4 OF THE WEIGHT RATE SCREEN EXCEEDS 80% WHILE RUNNING MATERIAL, ADJUST TO THE HIGH CAPACITY SETTING SHOWN BELOW AND RECALIBRATE THE SCALE.



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 80% WHILE RUNNING MATERIAL, ADJUST TO THE HIGH CAPACITY SETTING SHOWN BELOW AND RECALIBRATE THE SCALE.



GAIN OF 400 Only Switch 2 is on.

3. Confirm Calibration Switch Settings



Press F1 to get to the test weight screen. Enter the amount of material to be used for the calibration test. Press SELECT to get the arrow next to TEST WT and use the large and small arrows to adjust the TEST WT to the correct weight in tons.

Calibration Instructions (Continued)

4. Performing the initial Set Zero Operation

With no material flowing through the meter, press the SET ZERO key. Figure 1 will appear. The display shows the weight accumulating during the test. This weight represents the dead load felt by the load cells. The integrator performs the test until it reaches 10000 PULSES. Note: Figure 2 is only an example, the WEIGHT should not be 0 at the end of this test.



Figure 1



Figure 2

Press WEIGHT RATE. Watch the weight on line 1 to verify the accuracy of your zero. The weight should not continually accumulate or subtract with no material flowing through the meter. If this happens, a new set zero must be performed.

5. Performing Set Span Function

Now press the SET SPAN key. Figure 3 will appear. Run a known amount of material through the meter. When test is complete, press SET SPAN again (Figure 4). If the SHOULD BE weight is the same as the total of material that passed through the meter, press SET SPAN. If the amounts are different, press SELECT and use the arrows to change the SHOULD BE amount to equal the weight of the test material. Then press SET SPAN to complete.



Figure 3



Figure 4

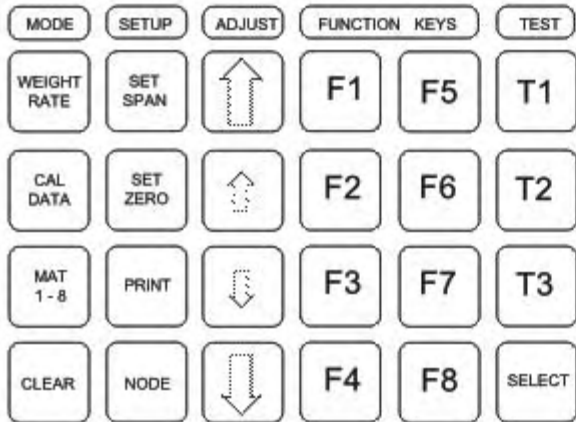
Figure 5 will appear. Press WEIGHT RATE to confirm the changes and return to the main screen.



Figure 5

6. Calibration is complete. Turn off SW1 Pos Number 1

The Keypad



Mode Keys

1. The mode keys run from top to bottom in the first column. The top key is the normal mode. It is the **WEIGHT RATE** mode. The display shows the accumulated weight, the current rate, the scale node number, and the per cent of maximum load. The control will be in this mode when it is turned on.
2. The next key down is the **CAL DATA** key which shows calibration data. The display shows the current rate, digital zero, digital span, and pulses. You can use the **SELECT** key to select digital zero, digital span, or pulses and then use the arrow adjust keys to change the value. When an item is selected a small arrow appears after the item that will be adjusted. You control this arrow with the **SELECT** key.
3. The next key down is the **MAT 1-8** key. If you are running more than one material through the flow meter this key allows you to program the span for eight different materials.

4. The lower key in the first column is the **CLEAR** key. It is used to clear several items. If you are looking at the normal display seen by pressing the **WEIGHT RATE** key, then the **CLEAR** key will set the total weight back to 0. Switch SW1 position 2 must be on and you must press the key twice within 2 seconds to clear the total weight.

If you press the **CAL DATA** key you can use the select key to select zero, span, or pulses and set the value to 0 using the **CLEAR** key. Switch SW1 position 1 must be on. In a similar manner, you can select node and set it to 1 using the key.

If you press the F1 key you can select test weight and set it to 0 using the **CLEAR** key. Switch SW1 position 1 must be on.

If you press the F2 key you can use the **SELECT** key to select any of the setpoints and use the **CLEAR** key to set them to 0. No configuration switches need to be on so you can always change your formula without accidentally changing calibration.

You can also set any of the maxrate values to 0 using the **CLEAR** key but switch SW1 position 1 must be on. Once you set the correct maxrate values you would not want them changed accidentally.

The Keypad

If you press the F3 key you can use the **SELECT** key to choose log rate or log time and set either to 0 using the **CLEAR** key. Switch SW1 position 1 must be on to clear log rate. SW2 position 5 must be on to clear log time.

If you press the F4 key to view the master total you can press the **CLEAR** key twice within two seconds to clear the master total. Switch SW1 position 3 must be on. You can also use the select key to select hours, minutes, seconds, month, date, or year and set each to 0 using the **CLEAR** key. To do this switch SW1 position 1 must be on.

If you press the F5 key you can use the **SELECT** key to choose load weight or cutoff weight. You can set either to 0 any time using the **CLEAR** key. No configuration switches need to be on. This allows you to change your load size and still prevent accidental changes to the scale calibration.

If you press the F7 key you can use the **SELECT** key to choose log data and turn it off using the **CLEAR** key. You can also select any of the 12 special codes and use the **CLEAR** key to set each to 00. Switch SW1 position 1 must be on.

Setup Keys

Using the setup keys is described in calibration.

1. The top key in column 2 is the **SET SPAN** key. It is used to set the digital span.

2. The next key down is the **SET ZERO** key. It is used to automatically determine and set digital zero.

3. Next is the **PRINT** key. It is used to print a ticket if you have a serial printer connected to the control.

4. The bottom key is the **NODE** key. It is used to set the scale node number for use on the network.

Adjust Keys

The adjust keys change the item you have chosen using the select key. Depending on what screen you are viewing the select key will cause a small arrow to appear next to the items you will be able to adjust.

1. The **LARGE UP ARROW** increases most items by 256. It increases load weight and cutoff weight by .200. On items limited to 256 possibilities or items where you select from a few options the large up arrow key increases the item by 1 just as the small up arrow key does.

2. The **SMALL UP ARROW** increases the item by 1.

3. The **SMALL DOWN ARROW** decreases the item by 1.

4. The **LARGE DOWN ARROW** decreases most items by 256. It decreases load weight and cutoff weight by .200. On items limited to 256 possibilities or items where you select from a few options the large down arrow key decreases the item by 1 just as the small down arrow key does.

The Keypad

Pressing any of the arrow keys will cause the described action to occur. Holding any of the arrow keys down will cause the key to repeat until you release the key.

The arrow keys are disabled if switch SW1 position 1 is turned off except you can still adjust the setpoints for analog outputs, load weights, and cutoff weights. This allows you to prevent someone from accidentally changing your calibration but you can change your formula if you are using the analog output and you can change your batch size and cutoff weight if you are loading trucks.

Function Keys

Each function key is described on a separate page later in this manual.

Test Keys

The test keys are used to view data to diagnose any problems that might occur. They are described later in this manual.

Select Key

The **SELECT** key is used to select various item which you can program. When you press the **SELECT** key a small arrow will appear after the item you can program. Some items can be set to zero using the **CLEAR** key. Use the arrow adjust keys to program the item you have selected.

Network Station Address

If you are using the network to collect data in a PC or you are using a remote display you must set each control box to a unique station address. Address 0 is not allowed. Address 255 is reserved for the central PC. Valid addresses you can use are 1 to 254. We suggest using address 1 for scale 1, address 2 for scale 2, etc.

To set the network station address press the node key. Then press the select key and a small arrow will appear after the word **NODE**. Use the arrow keys to set the node for this scale. Be sure no two scales are set to the same address. If any two scales have the same address the network will not work.

When you press the node key the display appears as shown below.

NETWORK NODE	1
CONFIG	56
DIAGNOSTICS	114
STATUS	119

You can only change the network node. The other data is for troubleshooting the network if there are problems. The normal data will be 56 for config. Diagnostics will be 114 if the PC was on before the scale was turned on, or 122 if the scale is turned on before the PC. Status normally will be 119. If the scale is not connected to any other network device diagnostics will alternate between 34 and 162. Status will be 116.

MAT 1-8 KEY

Programming Spans for Materials 1 - 8

Press the **MAT 1-8** key. The display appears as shown below.

MATERIAL # 1	1234
MATERIAL # 2	2750
MATERIAL # 3	5400
MATERIAL # 4	3221

Press the **SELECT** key. A small arrow appears after the # 1. Use the adjust keys to enter the correct span for material #1. Switch SW1 position 1 must be on. Be sure to turn it off when you are done so nobody can accidentally change your flow meter calibration.

To determine the correct span for material #1 you must actually run material #1 through the flow meter and calibrate the flow meter for that material. When you calibrate the flow meter you are determining the correct values for digital zero and also digital span. The digital zero will not change for different materials. The digital span will change, depending on the material density and how it flows through the meter. If different materials are dropped from different heights or are fed by different feeding methods these factors will also affect the span.

In order to use the feature which allows you to choose 1 of 8 materials you must calibrate the flow meter for each material. The press the **CAL DATA** key and write down the span for each material. Now follow the above procedure to enter the span for each material. Use the **SELECT** key to move the arrow to the material you want to enter and use the adjust keys to enter the span value for each material. When the arrow is on line 4 and you press the **SELECT**

key again the display will appear as shown below.

MATERIAL # 5	1357
MATERIAL # 6	4200
MATERIAL # 7	3751
MATERIAL # 8	2187

You can repeat the process used on materials 1 - 4 for materials 5 - 8. Remember that all you are doing is entering the span you got when you calibrated the flow meter for each material. The span numbers you enter here are simply stored in memory. They are not actually used until you select a different material using the function key F5.

Normally you will use this feature in conjunction with loading trucks. You would press the F5 key to enter the load mode. Then you would select the material using the **SELECT** key and use the adjust keys to choose material 1 - 8. When you change the material number the span will be changed to the span stored for the selected material. If you press the **CAL DATA** key you will see that the span is the same as the span number you stored for the selected material.

If you are not loading trucks but are running different materials through the flow meter you can still press the F5 function key and change materials. Then press the **WEIGHT RATE** key to return to the normal display.

The ability to select a different span for 8 different materials makes the flow meter more versatile. It also introduces a chance to make an error by selecting the wrong material. It is your responsibility to be sure the span matches the material running. If you want to use this feature switch SW1 position 5 must be on. Otherwise this feature is disabled.

Print Key

Printing a Ticket

The print key 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 **PRINT** 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.

Function Key F1

Test Weight

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

TEST WT	100.000 TN
----------------	-------------------

If you have turned switch SW1 position 6 on you are using metric units. The TN will be MT to indicate metric tons instead of short tons.

Press the **SELECT** key one time. A small arrow will appear after the word **TEST WT**. This arrow tells you that the adjust keys on the keypad will change the value of the test weight. Use the adjust keys to enter the value of the weight you will run through the flow meter during the set span test. If you do not know how much material you will run before you run the test simply enter the amount during the set span test as described in the section on digital calibration. If you enter a test weight using the F1 key that value will appear as the "should be" weight in the set span test. You can change the value after you run the material if necessary.

Function Key F2

Analog Outputs

1. The F2 function key is used to control the meter analog outputs. You must have the IO option board installed in the flow meter 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. You may also have the optional additional two outputs installed. If you do then switch SW2 position 2 must also be turned on.

If you do not have the IO option board installed and you turn on switch SW1 position 8 the keypad and the display will lock up. If you do not have the additional two outputs installed and you turn on switch SW2 position 2 the keypad and display will lock up. If this happens turn the meter off. Turn off the switch that is causing the problem. Turn the flow meter on again. The keypad and display will function.

The following assumes you have the IO option board installed with the two additional outputs. Switch SW1 position 8 and switch SW2 position 2 are turned on. If you do not have the additional two outputs lines 3 and 4 on the display will be blank.

Press the F2 function key. The display will appear as show below. No configuration switches need to be on to program setpoints.

#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. This means you can 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 for a guide.

2. Press the F2 function key 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.

3. Press the F2 function key 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.

Function Key F2

Analog Outputs

4. Press the F2 key 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. The display will now appear as shown below.

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. Forward and reverse action are described later.

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. Local and remote setpoints are described later.

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 below.

USING THE PID LOOP CONTROL

You can use the built in PID loop control to control the rate material is running through the flow meter. The first step is to select the channel you want to use as described above. If you have a two channel IO board you can select channel 1 or 2. If you have a four channel IO board you can select channel 1,2,3, or 4. The other channels can be used for their standard functions.

Next you must select the PID action. Most applications will use reverse action. This means that if the rate goes up above the programmed rate the output will go down to slow down the feeder to reduce the rate back to the programmed rate. The electrical output goes in the reverse direction from the rate error. If the rate is too high the electrical output will go down. If the rate is too low the electrical output will go up. You may find a situation where increasing the electrical output will decrease the rate. An example would be a system controlled by air pressure and more air pressure reduces the feed 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 the action is called forward action.

Function Key F2

Analog Outputs

Next you must select local or remote setpoint. Normally you will select local setpoint. This means you will program the rate through this flow meter in this control box. First you will press the **WEIGHT RATE** key. Line 3 will show be blank. Press the **WEIGHT RATE** key again. Line 3 will change to show **SET RATE** .00. Press the **SELECT** key and the small arrow will appear after the word **RATE**. Use the adjust keys to enter the rate you want in tons per hour. If you are using metric units the rate will be in metric tons per hour. If you have turned on switch SW1 position 7 to display your rate in tons per minute then your set rate will also be in tons per minute.

If you have two or more **FLO-WAY** meters you can program one to be the master and several others to be slaves. The master can either be a wild flow or you can use the PID loop on the master to control the rate using the local setpoint. You then set up each slave as a remote setpoint. Next you program the setpoint percent using the F2 key for each slave. Enter the percent you want to add of the slave ingredient compared to the material flowing through the master flow meter. Be sure to enter the percent for the channel you have selected to be the PID channel.

You must connect the network using RG62A/U coaxial cable between the master and all slave controls. The order that the controls are connected together does not matter. Put a 93 ohm terminator on the two control boxes at opposite ends of the cable. In other words, if you have one master and one slave, each will have a terminator. If you have a master and two slaves, two of the three controls

will have 93 ohm terminators. See the wiring diagrams and drawings at the end of the manual.

If you are using the PID loop as a local setpoint then the setpoint percent and maxrate for that channel are not used. You program the desired set rate on line three of the weight rate display. If line three is blank press the **WEIGHT RATE** key again to display set rate. If you are using the PID loop as a remote setpoint then the setpoint percent for that channel is programmed to the percent you want to add in relation to the rate flowing through the master. The maxrate for that channel is not used. If you are using any controls as remote setpoints then you must program the master control to send its rate to the controls with remote setpoints. See the section on the F3 key for details.

If there is any problem with the network the alarm output P4.3 will turn on. If the master control is using the PID loop and the output is at its maximum the alarm output P4.3 will turn on. If a control is set up as a master and any of the slaves are at maximum output the master will turn on alarm output P4.3. If there is a problem with the network the master and all slaves will run a setpoint of 0.00 and turn off.

Function Key F2

Analog Outputs

You can use input P4.7 to tell the PID loop to run at a setpoint of 0.0 which will stop the feeder. If the control is set up as a master all slaves will also stop. **Important**..if you stop the system in this manner any motors still have power applied and could start up unexpectedly. Before attempting to work on any of the feeders in the system be sure to disconnect power so the feeder cannot start up unexpectedly.

Now you must select the values for P, I, and D. The PID loop stands for proportional, integral, and derivative. Mathematically, the control equation looks like this:

$$\text{Output} = (P * (\text{setpoint rate} - \text{actual rate})) + (I * (\text{theoretical weight total} - \text{actual weight total})) - (D * (\text{present rate} - \text{last rate}))$$

The control works something like your car. The output is the gas pedal and the instruments are the speedometer and odometer. You look at your speedometer and see how fast you are going and compare that to how fast you want to go. If there is a large difference, you press hard on the gas. If there is a little difference, you press a little bit. This is the P term in your car control equation. You also look at your odometer and check to see how many miles you have traveled and compare that to how many miles you should have gone had you been going fast enough. This is the I term in your car equation. You also do not want to accelerate and decelerate too fast and be real jerky in your driving. The D term looks at your change of speed or acceleration rate such as when you are going down hill. This helps to restrain you from accelerating too fast. If you are

going uphill it lets you give it more gas to keep from slowing down too much. It has a kind of damper action and keeps you smooth.

Any or all of these control terms can be too aggressive or too lax in their application to your control. If they are too aggressive, you can get wild oscillations and jerky control like pushing hard on the gas and then backing off, back and forth like the teenage hot rodder. If they are too lax, you will be like the 90 year old that takes forever to get up to speed. You want to tune your PID control to give you a responsive yet smooth control. Also, an important point to remember is that once you are up to speed, the P term and the D term will basically be zero and do no controlling. The I term will be doing the work with very small changes coming from the P and D terms.

We recommend starting with P = 10, I = 100, and D = 3. 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. If that happens the value of P is probably too large. The I term works on the difference of where you are versus where you should be. The D term acts as a brake. If either is too large the response time may be too fast and again the control may begin oscillating. If the set rate is very low you may need to make all three terms larger to increase the response time. If you are running very high set rates you may need to make all three terms smaller. A value of 0 will disable that term. The maximum number is 255. The PID loop will work using only an I term. Never set I = 0.

Function Key F2

Analog Outputs

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

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

This display shows the digital value of each analog output. If the output is 4 to 20 mA then this number will be from 51 which is 4 mA to 255 which is 20 mA. If the output is 0 to 20 mA then this number will be from 0 which is 0 mA to 255 which is 20 mA. The **SELECT** key is not used with this display since there is nothing to program on this screen.

EXAMPLES

1. 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 to the chart recorder as shown on the wiring diagram at the end of the book.

2. 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 flowing through the flow meter, 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 your output. Connect the feeder as shown on the wiring diagram at the end of the book.

3. USING VOLTAGE OUTPUT

Assume the feeder in example 2 uses 0 - 5 volts DC instead of 4 to 20 mA as the control signal. Program the setpoint and maxrate the same as example 2. Select 0 to 20 mA for the output. Connect the feeder as shown on the wiring diagram at the end of the book. Note that when you connect the output as a voltage you must add a resistor which determines the output voltage. The connections are different than they are for current outputs.

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 flow meter and external device have different ground potentials you must purchase a separate isolation unit to properly isolate the flow meter and the external device.

Function Key F2

Analog Outputs

4. USING THE PID LOOP (CLOSED LOOP)

Assume you have one flow meter and you want to control the feed rate to maintain some rate through the meter. First press the F2 key and set up the PID loop. Select the desired channel, reverse (or forward) action, and local setpoint. Begin with P = 10, I = 100, and D = 3. Next press the **WEIGHT RATE** key. If line 3 is blank press the **WEIGHT RATE** key again to display set rate. Then press the **SELECT** key and use the arrow keys to enter the desired set rate. If you intend to change the time base from tons per hour or tons per minute by turning switch SW1 position 7 on or off you must set the switch before entering your set rate.

You can use input P4.7 to make the feeder stop but remember that there is still power on the feeder motor and the feeder could start unexpectedly.

If the control is at maximum output alarm output P4.3 will turn on. This can be used in conjunction with a solid state relay to turn on an alarm horn.

5. CONTROLLING ADDITIVES WITH THE PID LOOP (SLAVE OUTPUTS)

Assume you have two meters. The first one is set up to weigh the main product. The second meter is going to be used to add 15% of another ingredient. You can set the first scale to use its PID loop to control the feed rate of the main material as described above or you can simply use the meter to measure the main flow. Assume you have used the **NODE** key to make the first meter node 1 and the second meter node 2. You must press the F3 key and set the first meter to send rate to nodes from 2 to 2. Now set the PID loop for the second meter to remote setpoint.

This tells the second meter that it is going to get the rate from a master meter over the network. It will then multiply the rate from the master by the setpoint percent you enter into the second meter. Assume the second meter is set to use channel 2 for the PID loop. Press F2 to display the setpoint percents and enter 15% for setpoint #2. Connect the two meters using RG62A/U coaxial cable. Install a 93 ohm terminator on the unused BNC connector of each meter.

PID NOTES

1. You can have several meters set up as slaves to one master which will allow you to blend materials. You must set the nodes for the slaves so they are in consecutive order. For example, you could have three slaves at nodes 4,5, and 6. You could not have the three slaves to one master at nodes 4,5, and 7 because you have to tell the master to send rate to nodes from some value to some value. You can enter from 4 to 6 but if you enter 4 to 7 the master will detect no meter at node 6 and shut down all the feeders.

2. You can have one master and several slaves and then have another master with its own slaves on the same network cable. They will be completely independent and one will not be aware of the existence of the other.

3. You can also continue the cable to a personal computer and do data collection from the masters and all slaves as well as from other meters not using the PID loop. You can also network **Belt-Way** Systems **Belt-Way** belt scales as masters or slaves with **Flo-Way** solids impact flow meters.

Function Key F2

Analog Outputs

4. If you are using two or more controls in a master slave setup there are two conditions when the alarm output 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 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 will also turn off. However, if the master is not running the PID loop but is simply measuring rate then the control cannot shut off the master feeder. 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 through the flow meter. When the master flow meter 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.

5. If you are running two or more controls as master and slaves you must set them all to display rate in tons per hour or tons per minute. They must all be in the same units. Switch SW1 position 7 is used to select the time base.

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	

Press the **SELECT** key. A small arrow appears after the word **RATE**. You can use the **CLEAR** 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 meter calibration. The control will keep track of the hours and minutes that the meter 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. If you want to have your rate displayed in tons per minute instead of tons per hour you must turn on switch SW1 position 7 before you enter your log rate. Otherwise your log time will be incorrect.

Press the **SELECT** key again. Now the arrow appears after the word **TIME**. You can use the **CLEAR** 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 rates to nodes is turned on. If the word **OFF** appears

then the control is not sending its rate to any other controls. 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. Assume you do have one additional control set up as a slave and this control is the master. Assume that the slave control is programmed to be node 4. Using the **SELECT** key position the small arrow after the word **OFF**. Then use either up arrow key change the word **OFF** to **FROM 4**. Press the **SELECT** key again. The arrow appears after the word **TO**. Use either up arrow key to enter 4. Now this control is set up as a master and node 4 must be set up as a slave to this master. Any control set up as a slave or set up as a stand alone control must have the feature send rates to nodes turned off. Only a master should have this feature turned on and then it must be set up to send rate to nodes from and to the slaves you have connected. Assume you have three slaves set up as nodes 4, 5, and 6. You would program the master to send rate to nodes from 4 to 6. The display would appear as shown below.

LOG RATE	350.00
LOG TIME	12H 45M
SEND RATE TO NODES	
FROM 4	TO 6

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 07/28/94

Every time you clear the flow meter 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** 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** 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 or are logging data.

Beginning with version 5.06, 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 the **PRINT** key 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.

Function Key F5

Loading Trucks, Barges, and Rail Cars

Function key F5 is used if you want to use the flow meter 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. If switch SW1 position 5 is off line 3 will be blank.

LOAD WT	25.000
WEIGHT	12.345
MATERIAL # 1	
CUTOFF	.000

Press the **SELECT** key. A small arrow appears after the WT. The arrow means you can set your load weight using the adjust keys. After setting the correct load weight press the **SELECT** key again. If you have switch SW1 position 5 off the arrow will appear on line 4 after CUTOFF. If you have switch SW1 position 5 turned on the arrow will appear after the MATERIAL #. You can use the adjust keys to select material 1-8. You should have already programmed the span for the different materials you intend to use. See the instructions for the **MAT 1-8** key. If you press the **SELECT** key the arrow will appear on line 4 after CUTOFF.

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 flowing to reach the flow meter.

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 reached the flow meter. Otherwise each load might 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

Function Key F5

Loading Trucks, Barges, and Rail Cars

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 key 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.

The angle sensor input can be used to connect a selector switch which will allow your operators to select preset load weights 1 - 8. Sauk Valley Systems has available a remote start / stop station which will allow your drivers to load their trucks without ever touching the flow meter control keypad. You can also 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.

Material going into the truck must pass through the flow meter. The batching output P4.0 should be connected to a feeder which feeds material to the flow meter.

Whenever the flow meter weight total is less than the load weight minus the cutoff weight the batching output will be on. When the flow meter weight total is equal to or greater than the load weight minus the cutoff weight the batching output will be off.

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 Sauk Valley Systems or make your own. The start / stop station should be mounted next to the flow meter control box.

HOW TO BATCH IN GENERAL

1. Program your eight spans for materials 1 - 8 if you have enabled selecting different materials. Use the **MAT 1-8** key, **SELECT** key, and adjust keys.
2. Press function key F5 to enter the load mode.
3. Program your cutoff using the **SELECT** and adjust keys.
4. Select material 1 - 8 using the **SELECT** and adjust keys if this feature is enabled.
5. Program your load weight using the **SELECT** and adjust keys or select from load 1-8 using the function keys F1 - F8 or remote start / stop station.
6. Clear the flow meter total using the keypad **CLEAR** key or remote clear button on the start / stop station connected to P4.4. The total will be added to the master total.
7. As soon as you clear the total the batching output will turn on. The feeder will not turn on until you press start on the start / stop station.
8. Press start on the start / stop station when you are ready. If you need to stop the feeder before the load is complete press the stop button.

Function Key F5

Loading Trucks, Barges, and Rail Cars

9. When the flow meter total reaches the load weight minus the cutoff the batching output will turn off.
10. If you are printing tickets press the remote print button connected to P4.5 or press the **PRINT** key.
11. Repeat the sequence from step 4 for each new load.

HOW TO USE THE START / STOP STATION

1. Press function key F5 to enter the load mode.
2. If enabled select material 1 - 8 using the **SELECT** and adjust keys on the control keypad. You can not select different materials using the remote station.
3. Use the rotary selector switch to select 1 of 8 preset load weights.
4. Press the enter load pushbutton. The selected preset load weight will appear on the control display line 1. If the load weight is not correct repeat 3-4.
4. Press the clear pushbutton on the start / stop station. The flow meter weight total will go to .000 and the ready light will turn on.
5. Press the start pushbutton. The run light will turn on and the feeder will start running.
6. If you need to stop the feeder for any reason before the load is complete press the stop pushbutton. The feeder 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 flow meter reaches the load weight minus the cutoff weight the feeder 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.

Belt-Way Scales One Belt Way Rock Falls, IL 61071 Phone 815 625-5573 Fax 815 625-5593

Function Key F6

Pulsed Output and Auto Zero

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

TONS PER PULSE	OFF
PULSE ON TIME	50%
AUTO ZERO	1.0%

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. If you select a pulse every **.10** tons this 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 with quadrature input or a PLC. The advantage of using quadrature waveform is that if the flow meter 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 loads you may find the auto zero attempts to zero the weight on the impact plate because it has decided no material is flowing. In that case you can tighten the tolerance that the computer uses to decide if there is material flowing. The auto zero will still work but the impact plate must be loaded less as you select a smaller per cent before auto zero will decide that no material is flowing. If you select **OFF** auto zero will be disabled.

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 at 1200 baud, 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 or
WEIGHT&RATE

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 flow meter 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.

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

The scale number will be the node you programmed the flow meter. To print the ticket press the **PRINT** key or connect a pushbutton to the remote print input P4.5. You can use the **CLEAR** 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.

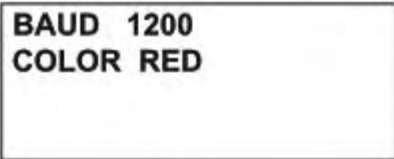
Use the select key to move the small arrow to line 4 after the word DATA. If you select OFF then either weight, rate, or weight and rate, depending on what you have selected, will be transmitted once each second. You have the option of using the adjust keys to change LOG DATA from OFF to from 1 to 255 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.

This version of 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 switch 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 Sauk Valley Systems 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 Sauk Valley Systems. You must set the baud rate to 2400 to match the **COLOR BRITE** display.

Function Key F8

Function key F8 is not currently used.

Test Keys T1 T2 T3

1. 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 input. It will be a number between 0 and 1023. If you do not have a remote start / stop station this number will mean nothing. If you do have a remote start /stop selector switch connected to the angle sensor input then this number is used to select different loads.

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.

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

SWITCH SW2	0
SWITCH SW1	3
VERSION	5.04

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

3. Test key T3 is used to access PID SHIFT, RESET I, and MIN RATE.

PID SHIFT is a method of making the PID loop more sensitive with light loads. Normally a shift of 0 works fine. With very light loads a number from 1 to 8 may work better. If you increase the number too much the PID loop will become unstable. In that case, use a smaller shift number.

RESET I is a method of clearing the accumulated I term. This might be necessary if you run out of material. If that happens, when you get more material the PID loop may try to make up some of the loss. If you want to prevent this, press the **SELECT** key to place the arrow after RESET I and press the **CLEAR** key.

MIN RATE is a used if this scale is a master sending its rate to other scales. In order to prevent slight rate fluctuations from zero tons per hour from sending small error rates to the slaves, set min rate to some rate well below the normal flow rate, but above the empty rate. Then small variations from zero will not be sent to the slave scales.

Display Summary

Weight Rate Key (Normal Display)

WEIGHT	3248.962
RATE TPH	350.451
SPEED	300.187
NODE 1 LOAD	89.5%

Set Zero Key (First Press)

WEIGHT	123
PULSES	56
SET ZERO IN PROCESS	
PLEASE WAIT	

Cal Data Key (Calibration Data)

RATE TPH	350.451
ZERO	600
SPAN	2450
LENGTH	14461

Set Zero Key (Second Press)

WEIGHT	70166
PULSES	10000
PRESS WEIGHT RATE	
KEY TO CONTINUE	

Set Span Key (First Press)

WEIGHT IS	.123
PRESS SET SPAN KEY	
AGAIN WHEN DONE	
RUNNING MATERIAL	

Node Key

NETWORK NODE	1
CONFIG	56
DIAGNOSTICS	114
STATUS	119

Set Span Key (Second Press)

WEIGHT IS	6.750
SHOULD BE	7.468
ENTER CORRECT WEIGHT	
THEN PRESS SET SPAN	

Function Key F1

TEST WT	100.000 TN
----------------	-------------------

Set Span Key (Third Press)

NEW SPAN IS	2323
OLD SPAN WAS	2100
PRESS WEIGHT RATE	
KEY TO CONTINUE	

Display Summary

Function Key F2 (First Press)

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

Function Key F2 (Fifth Press)

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

Function Key F2 (Second Press)

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

Function Key F3

LOG RATE	350.00
LOG TIME	12H 45M
SEND RATE TO NODES	
FROM 4 TO 6	

Function Key F2 (Third Press)

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

Function Key F4

MASTER TOTAL IS	
1234.567	
TIME 11:08:24	
DATE 07/28/94	

Function Key F2 (Fourth Press)

PID CHANNEL	OFF
-------------	-----

Function Key F5

LOAD WT	25.000
WEIGHT	12.345
MATERIAL # 1	
CUTOFF	.000

Function Key F2 (Fourth Press)

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

Function Key F5

LOAD #5	.000
LOAD #6	.000
LOAD #7	.000
LOAD #8	.000

Display Summary

Function Key F6

TONS PER PULSE	OFF
PULSE ON TIME	50%
AUTO ZERO	1.0%

Function Key F7

RS-232	RATE
FORM STX RT CR	
LF AFTER CR	OFF
LOG DATA	OFF

Function Key F7

RS-232	OFF
---------------	------------

Function Key F7

RS-232	WEIGHT & RATE
FORM STX WT RT CR	
LF AFTER CR	OFF
LOG DATA	OFF

Function Key F7

RS-232	TICKETS
USE	0 LINE FEEDS

Test Key T1

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

Function Key F7

RS-232	TICKETS
USE 6 SPECIAL CODES	
00 12 54 7A F3 DE	
FA 03 1B 45 A0 FF	

Test Key T2

SWITCH SW2	0
SWITCH SW1	3
VERSION	5.04

Function Key F7

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

Maintenance

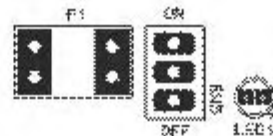
Mechanical

1. The metal parts have been coated with a high quality finish. You may want to touch up the surface if it gets scratched to prevent rust.

2. The flow meter should have been mounted so the load cells are vertical. If you find your accuracy seems to be changing check to see if the mounting has shifted and the load cells are no longer vertical. Also check to be sure the bolts holding the load cells are still tight. You need a 5mm Allen wrench to tighten them. The load cells are aluminum so be sure the bolts are tight but do not over tighten them since you could strip the threads or break the bolts off. Tighten the bolts to approximately 10 foot pounds of torque.

3. For each load cell there is a bolt in the frame used as load cell overload stop bolt. Each bolt has a lock nut which prevents material from pressing down on the load cell so hard that the cell is permanently bent. There is another lock nut which prevents anything from pulling up on the load cell so far that the cell is permanently bent. You should not change the settings on these lock nuts but be sure there is no material build up around them which might prevent the load cell from normal movement. The lock nuts are set so the maximum signal from the load cell in the direction of the impact on the plate is +16mV and in the reverse direction -8mV. To measure the signal only one load cell can be plugged in, all the zero switches must be turned off, and the biasing resistor across one of the load cells must be removed. Measure across the green(+) and white(-) wires.

Electrical



When you installed the flow meter if you needed to add wire to the load cell cable you were instructed to solder the connections. Crimped connections or wire nuts alone will not provide adequate connections. If your flow meter seems to be drifting and you did add cable be sure all joints are soldered and insulated.

Check the wiring terminals periodically to be sure the screws are still tight. If your flow meter fails to operate the following steps may help determine the problem.

1. Is the red light emitting diode LED 1 on? If not, there is a problem with the 12 volt power. Make sure there is 120 volts AC at the socket for the transformer. Make sure the power switch SW5 is turned on. Make sure the fuse F1 is not blown. If it is, replace it with a 1 amp 2AG fuse. This fuse is difficult to find locally. On circuit boards marked PB-9 or higher the fuse is a 5x20 mm 1 amp slow blow fuse. Use Littlefuse number 2180001 or Radio Shack 270-1063. If there is power coming in to the transformer, the fuse is good, and the switch is turned on, but the red light still is not on, there is a problem with the transformer. It should be replaced.

Maintenance

If the red power on light is on but there is nothing displayed on the computer liquid crystal display, then there is a problem with the computer. The fastest way to repair it is to replace the two circuit boards in the control. A replacement set is available with instructions. You will receive credit for the old boards if you return them.

2. If the display does work then the computer is working. If you are not recording weight as product passes through the flow meter the problem is most likely the load cell.

To check the load cells, press the **WEIGHT RATE** key. The display shows the load cell signal as load percent. As you press down on the load cells the number should change. The number should be somewhere near 7.5% with no material flowing since that is how you calibrated the flow meter. The number should go up as you press down on the impact plate connected to the load cells.

If the load cell signal does not respond as described above you may have one or two defective load cells. You can check each cell separately. Unplug one of the cells. Turn all the zero switches off. Remove the resistor connected with load cell #1. You are now testing the cell still plugged in. It may show a 0 at all times or some number that does not change when you press on the impact plate. Then unplug that cell and plug in the other cell. Compare the two results. If one of the load cells appears defective it can be replaced. Make sure there are no broken, loose, or disconnected wires at the terminal strip.

Test Points

Processor Board

TEST
POINTS
□ □ □
GND +5VDC LC-VOLT

The processor board is located in the control box. It has test points marked as shown above on the left. If you have a voltmeter you can check the +5 volt and LC-VOLT power supplies using these test points. The test point marked LC-VOLT is the load cell supply voltage. It should be about 9.5 volts DC.

Display Board

TEST
POINTS
□ □ □
+5VDC GND

The display board is located on the control box door. It also has test points as shown above on the right. You can check to see if there is +5 volts on this circuit board.

Troubleshooting

If your flow meter is not working at all refer to the electrical maintenance section. It will show you how to test for the power being on and how to test for a blown fuse. It will also give you some help in testing your load cells. This section is intended to give you more information on testing your load cells and help you find the cause of a change in the scale over time or erratic readings from load to load if you are using the scale to load trucks or rail cars.

If you are experiencing erratic readings the causes could be mechanical or electrical. The first thing to do is compare the current readings with the readings you wrote down when the flow meter was calibrated. Has someone accidentally changed the digital span or digital zero?

The next thing to look at is the load cell signal by pressing the **WEIGHT RATE** key. The load was about 7.5% when you calibrated the flow meter with no material flowing Has it changed? If it has, is it higher or lower?

If the load is near 0.0% with the no material flowing something has reduced the weight on the load cells. Has the flow meter been hit so the load cells are no longer vertical? Is something out of alignment? Has material built up under the load cells preventing the impact plate from moving freely? Perhaps something has actually bent a load cell in the upward direction. Are the two bolts holding each load cell in place still tight? Are the overload bolts still in place?

If the load cell signal is near 102.3% there is a good chance something has bent a load cell in the downward direction.

If the load with no material flowing is still about the same as when you calibrated the flow meter check it with a full load. If the fully loaded signal is much less than it was when you calibrated the flow meter perhaps one of the load cells is not functioning properly. This can be caused by a bent or loose load cell, material build up, by a broken wire, or a defective cell.

If the flow meter is working but running some rate with the no flow the digital zero is not correct. If the rate is positive then the digital zero is too small. If the rate is negative then the digital zero is too big. Press the **T1** key. LC Adjusted represents the weight of the empty impact plate. Digital zero should be about the same as this number. Press the **CAL DATA** key. Zero should be about the same as the LC Adjusted reading. If it is not about the same press the **SELECT** key to select zero and use the adjust keys to change zero to match the LC Adjusted reading. Even though the flow meter does have an auto zero which will adjust zero, under certain conditions auto zero may not work properly. If the flow meter never runs empty auto zero will not work. If something mechanical changes the zero may shift too far and the control thinks there is material flowing. By changing zero to match LC Adjusted you are correcting the digital zero. This will remove any rate showing with no flow. Remember, to change any data using the adjust keys turn on switch SW1 position 1 on the door.

Troubleshooting

If you have gotten this far and still have not determined the cause of the problem you can use a digital voltmeter to examine each load cell. To do this first write down the settings on the zero switches SW4 in the control box. Now turn off all the zero switches. No material should be flowing. Remove the resistor plugged into the terminal marked load cell #1. Unplug one of the load cells.

Measure the voltage on the load cell connector still plugged in between the black and red wires. The red wire is positive. You should see about 9.5 volts DC. Now measure the voltage between the white and green wires. The green wire is positive. You should see about 0 to 1 millivolt DC. In order to do this your meter must be able to measure DC millivolts. A new load cell with no weight on it will read 0.0 millivolts output. Since the impact plate is attached you will probably see a reading slightly above 0.0.

These load cells have an output of 2 mV per volt of supply voltage at rated output. That means with our supply voltage of 9.5 volts you will see about $9.5 \times 2 = 19$ millivolts when the load cell has its maximum rated load applied.

If you see a reading over about 1 millivolts either something unusual is pressing down on the load cell or it is bent. If you remove it the output with no weight applied should be 0.0. If you see a positive reading the cell is bent in the downward direction.

If you see a negative reading the load cell has been bent in the upward direction. Bent cells can be caused by something hitting the impact plate very hard.

Repeat the test with the other cell. When you are finished be sure to plug in both cells and put the resistor back in the connector marked load cell #1 and reset the zero switches SW4 to the positions you wrote down.

A low reading on the cell may be caused by the bolts holding the cell coming loose or material building up under the impact plate or load cell.

If a load cell is bent you can sometimes correct the problem. If it is bent up you can bend it down. If it is bent down you can bend it up. First remove the overload stop bolts. Be sure to replace them and set them so the cell can not be pressed down to read over 20mV and can not be pulled up over about -2.0mV using a digital voltmeter. Bending a cell to correct it should be a temporary measure and the cell should be replaced as soon as possible.

You can check the resistance of each load cell using an ohmmeter. The resistance test will NOT show you if a load cell has been bent. You must measure the millivolt output as described previously to determine if a cell is bent. The resistance check will show you if the load cell is electrically correct and if the cable to the load cell is not broken or shorted. It will also help find faulty cable splices and faulty junction box connections. Unplug the load cell. Use your ohmmeter to test the cell you just unplugged. Polarity does not matter. You should see approximately 420 ohms between the red and black wires. You should see approximately 350 ohms between the green and white wires. If you do not get these results look for a broken wire or perhaps a bad

Troubleshooting

connection somewhere between the terminals at one end to the load cell at the other.

If everything checks out all right but the flow meter is not as accurate as it should be or readings are erratic check your load percent at maximum flow. Press the **WEIGHT RATE** key and read the load on line 4. If your load is well under the 80.0% range you may be able to increase your gain if it is not already at maximum. This would involve resetting the gain switches to turn more of them on assuming they are not all on now. You will need to recalibrate the flow meter if you change the gain switches. This will involve resetting the zero switches, running the set zero, and running the set span.



Photo showing the plates attached to the load cells.

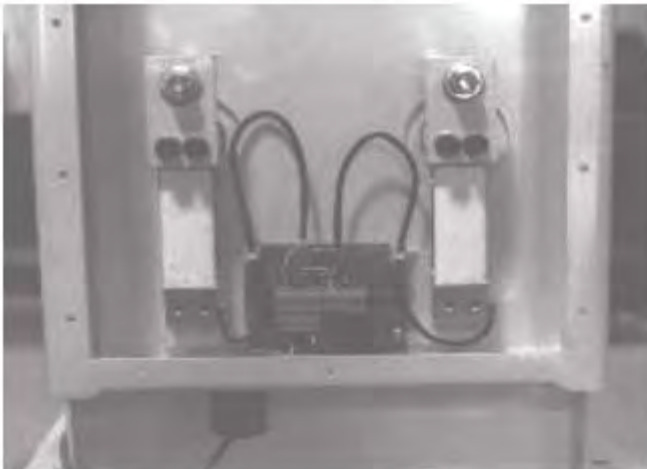


Photo showing the load cells and overload bolts, and load cell junction board with one load cell cable.

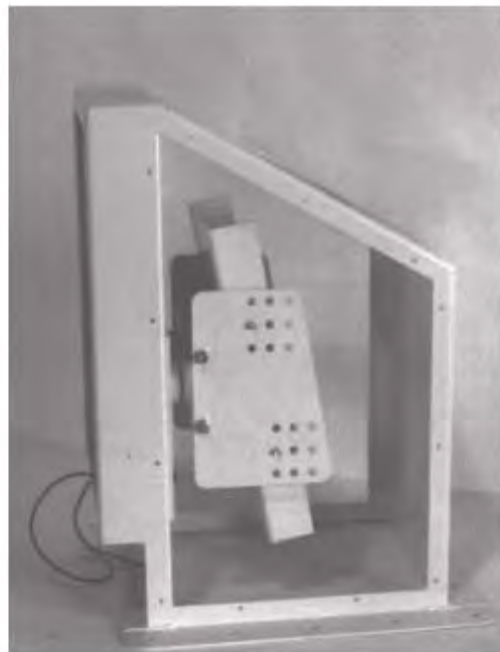


Photo with both side panels removed.

Belt-Way Scales One Belt Way Rock Falls, IL 61071 Phone 815 625-5573 Fax 815 625-5593

USING A MODEM TO COLLECT DATA

Beginning with version 5.03 the flow meter 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 ASCII format. Leading zeroes will be suppressed by being 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. See the example

USING A MODEM TO COLLECT DATA

at the end of this manual. This data must be written into the modem memory as shown in the example.

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 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 for 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.

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 product is not designed or sold as a legal for trade device.

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

WARRANTY LIMITATIONS AND DISCLAIMER

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

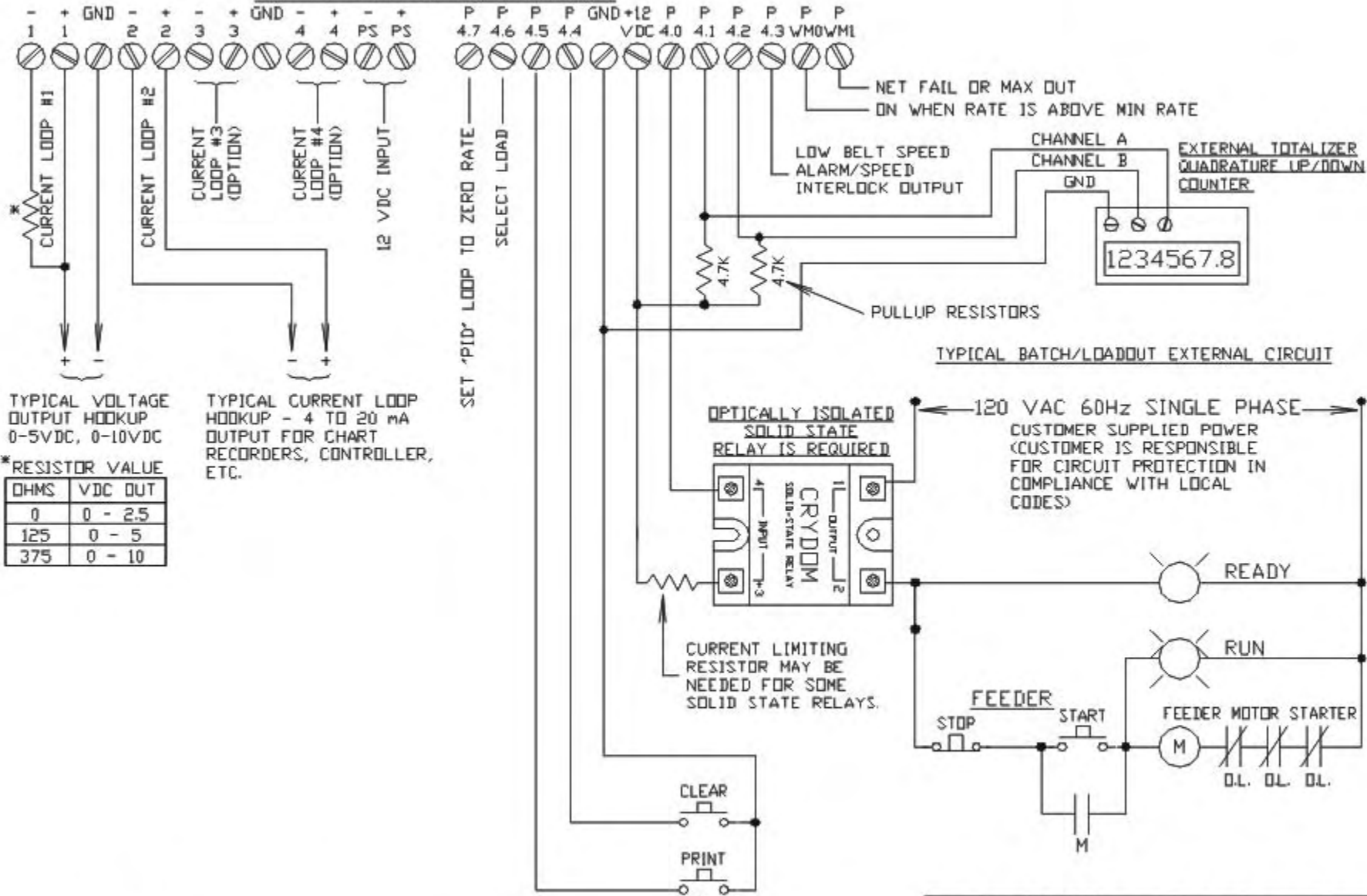
Covered by U.S. PATENT 5,696,354

Belt-Way Scales One Belt Way Rock Falls, IL 61071 Phone 815 625-5573 Fax 815 625-5593

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.

1/0-4 OPTION BOARD TERMINALS



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.

SET 'PID' LOOP TO ZERO RATE
SELECT LOAD

NET FAIL OR MAX OUT
ON WHEN RATE IS ABOVE MIN RATE

LOW BELT SPEED
ALARM/SPEED
INTERLOCK OUTPUT

CHANNEL A
CHANNEL B
GND

EXTERNAL TOTALIZER
QUADRATURE UP/DOWN
COUNTER

PULLUP RESISTORS

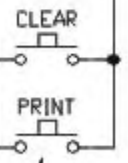
TYPICAL BATCH/LOADOUT EXTERNAL CIRCUIT

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

OPTICALLY ISOLATED
SOLID STATE
RELAY IS REQUIRED



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



EXTERNAL PUSHBUTTONS-
USE LOGIC LEVEL
CONTACT BLOCKS

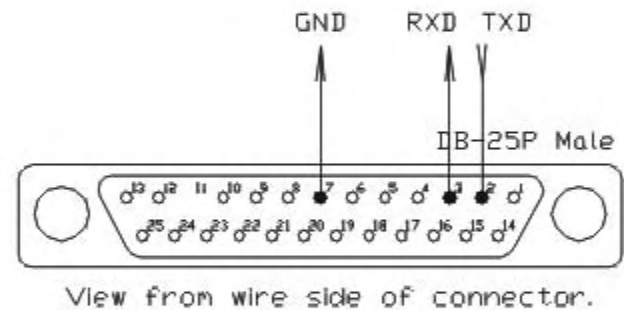
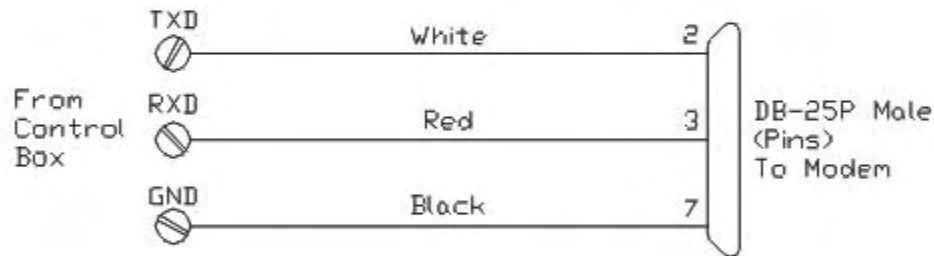
NOTE: KEEP ALL LOW VOLTAGE LOGIC LEVEL WIRING AWAY FROM ALL POWER WIRING TO PREVENT NOISE AND POSSIBLE DAMAGE TO SENSITIVE COMPUTER CIRCUITS.

Belt-Way Scales, Inc.

ONE BELT WAY PHONE: (815) 825-5573
ROCK FALLS, IL. 61071 FAX: (815) 825-5583

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

Control Box to Modem Cable



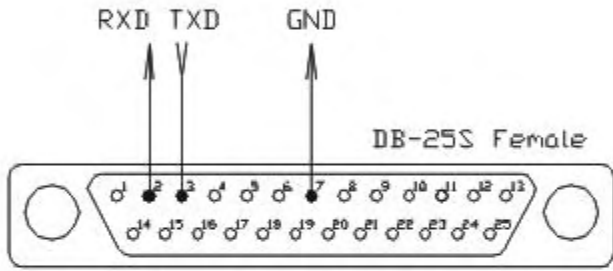
Belt-Way Scales, Inc.

ONE BELT WAY PHONE: (815) 625-5573
ROCK FALLS, IL. 61071 FAX: (815) 625-5595

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

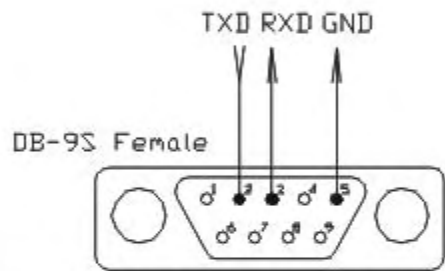
Control Box to Computer

25- Pin Serial Port

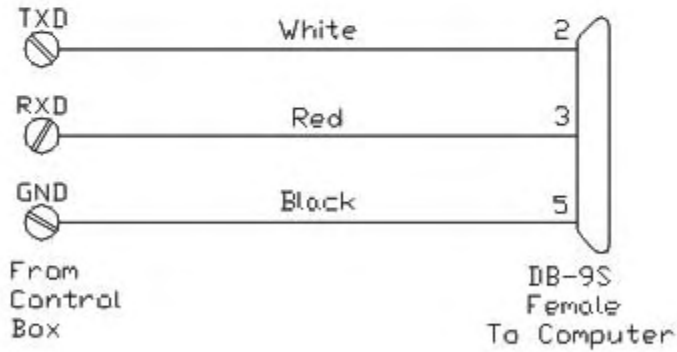
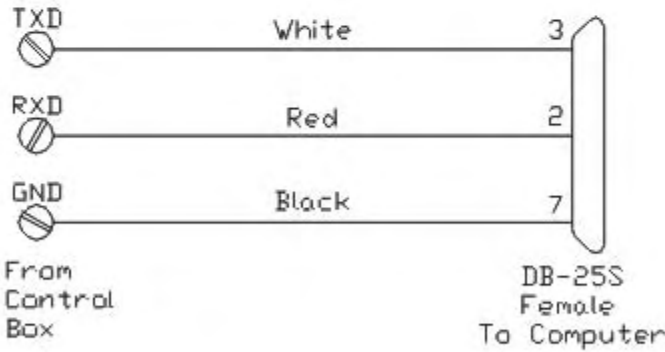


View from wire side of connector.

9-Pin Serial Port

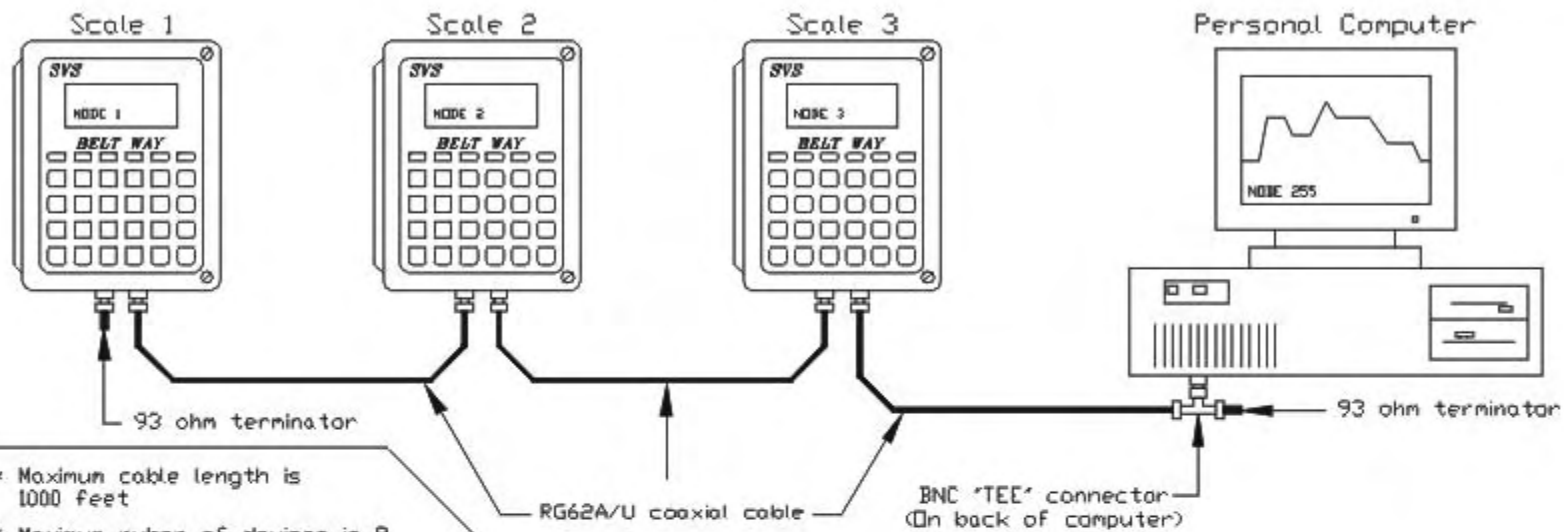


View from wire side of connector.

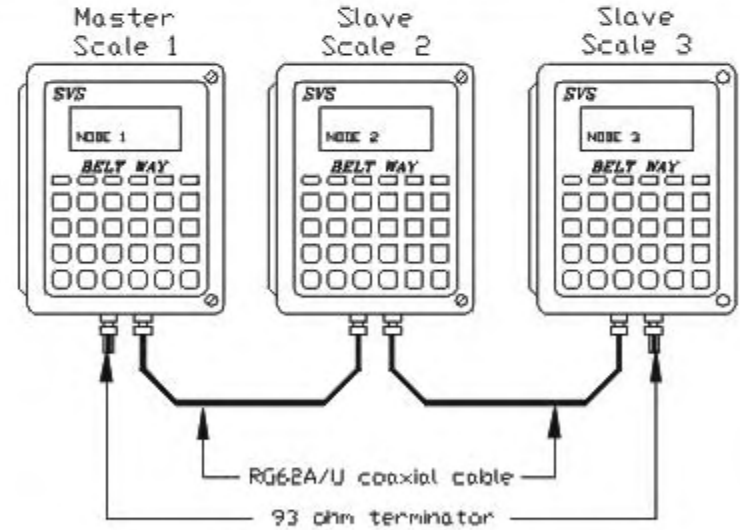
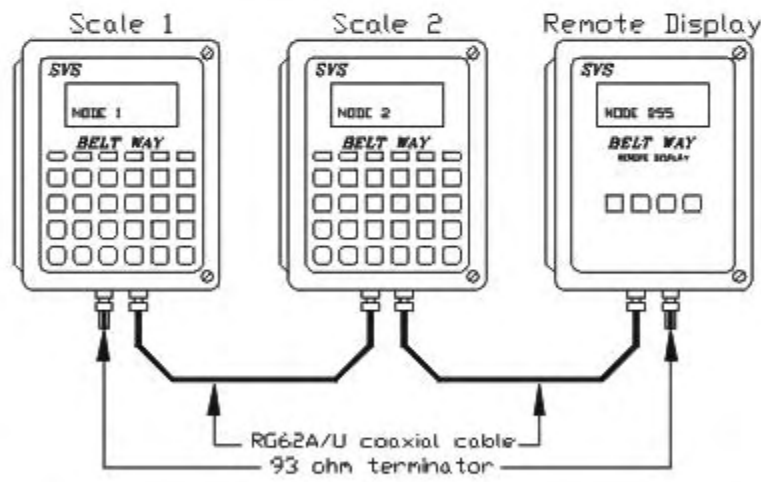


Belt-Way Scales, Inc.
 ONE BELT WAY PHONE: (815) 625-5573
 ROCK FALLS, IL. 61071 FAX: (815) 625-5585

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



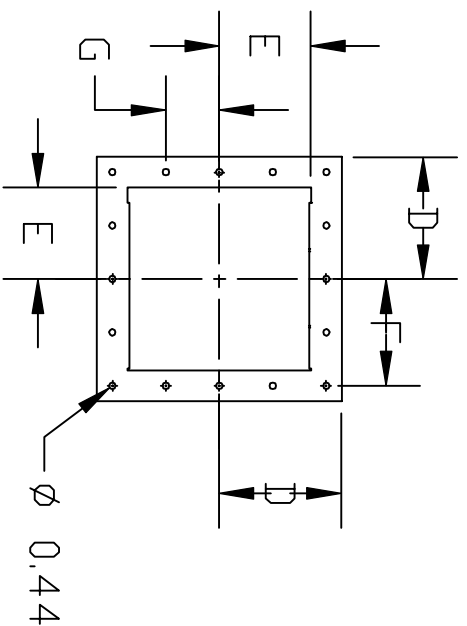
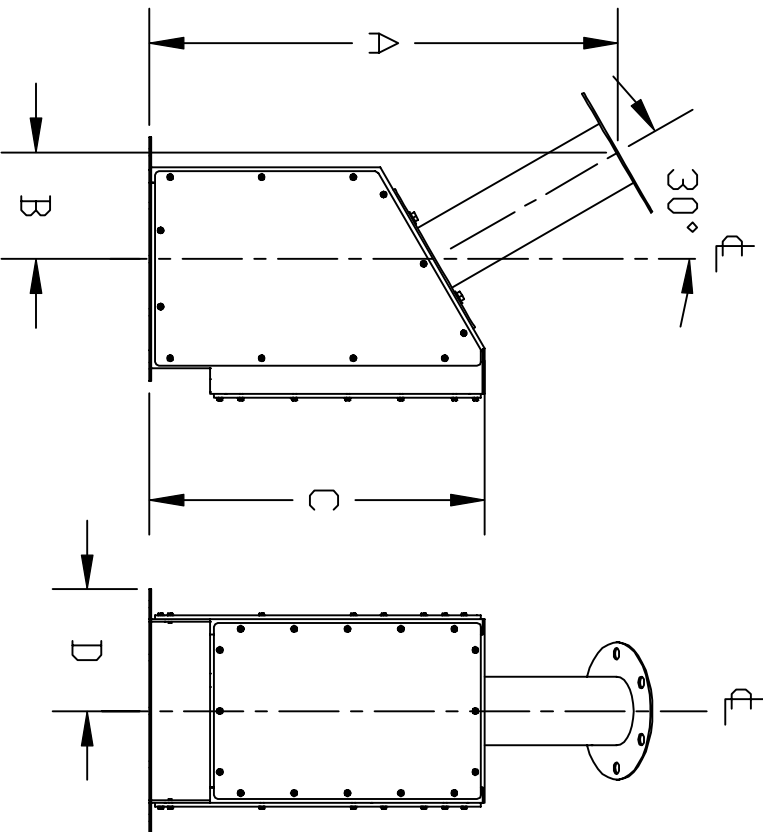
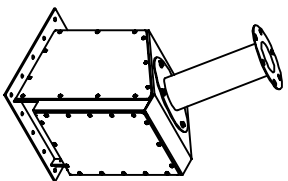
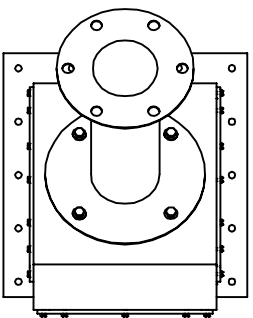
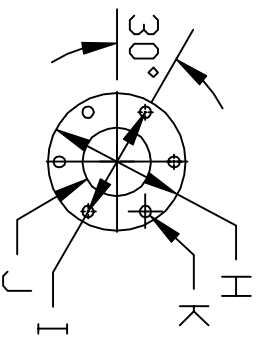
- * Maximum cable length is 1000 feet
- * Maximum number of devices is 8
- * For more than 1000 feet or 8 devices an active hub is required.



Belt-Way Scales, Inc.

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

Drawing Name		Bus Configurations		REV
Scale	Drawn By	Date	DWG NO.	X.X
		07/10/02		
				network1.dwg



Note: All dimensions are in inches.

Belt-Way Scales, Inc.

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

Drawing Name	SVS Flo- Way Solids Impact Flo-Meters		REV
Drawn By	Date	DWG NO.	1.1
Scale	TJM	05/22/00	allmodels

MODEL	A	B	C	D	E	F	G	H	I	J	K
6	30.74	7.00	22.00	8.00	6.00	7.00	3.50	Ø11.00	Ø9.50	Ø6.63	Ø0.88
8	45.64	10.25	33.00	11.00	9.00	10.00	5.00	Ø13.50	Ø11.75	Ø8.63	Ø0.88
10	45.64	10.25	33.00	11.00	9.00	10.00	5.00	Ø16.00	Ø14.25	Ø10.75	Ø1.00
12	45.64	10.25	33.00	11.00	9.00	10.00	5.00	Ø19.00	Ø17.00	Ø12.75	Ø1.00
18	60.89	13.89	44.00	14.00	12.00	13.00	6.50	Ø25.00	Ø22.75	Ø18.063	Ø1.313