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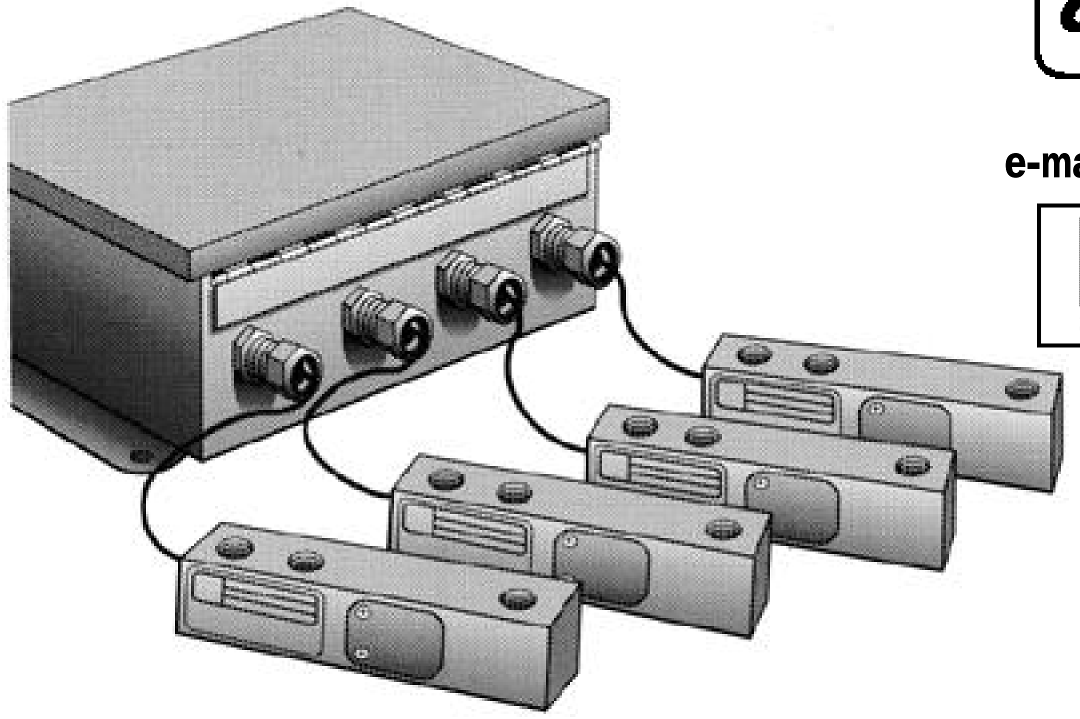

JBOX-2, JBOX-4
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OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

NOTES

TABLE OF CONTENTS
JBOX-2/JBOX-4

SECTION 1 INTRODUCTION

The OMEGA® JBOX takes the input from multiple load cells and sums them in parallel to form a single output equal to the sum of the forces on the load cells. Summing is a common practice in industry as most tanks, bins, hoppers, and platforms are often supported by 2, 3 or 4 load cells which are used to give the total weight being monitored. All load cells should be of the same capacity and have interchangeability rated outputs within 3.3% of each other. OMEGA load cells LCC, LCCA, LCCB, LCJ, LCJA, LCJB, LCD, LCDA, and LCDB have interchangeability specifications better than 3.3%. Load cells with larger interchangeability specifications can be used with the JBoxes, however, user supplied external resistors must be used.

The JBOX-2 is designed to sum the electrical outputs of 2 load cells. The JBOX-4 will sum up to 4 load cells. Load cells of any capacity or type may be used with the JBOX-2 or JBOX-4.

NOTE

The load cells should be of the same capacity and millivolts per volt sensitivity.

All JBOXES have span screws which must be adjusted (depending on characteristics of load cells used) to give a proper output. Follow Section 4 or 5 for adjusting span screws.

Figure 1-1 shows the JBOX hooked up to various load cells.

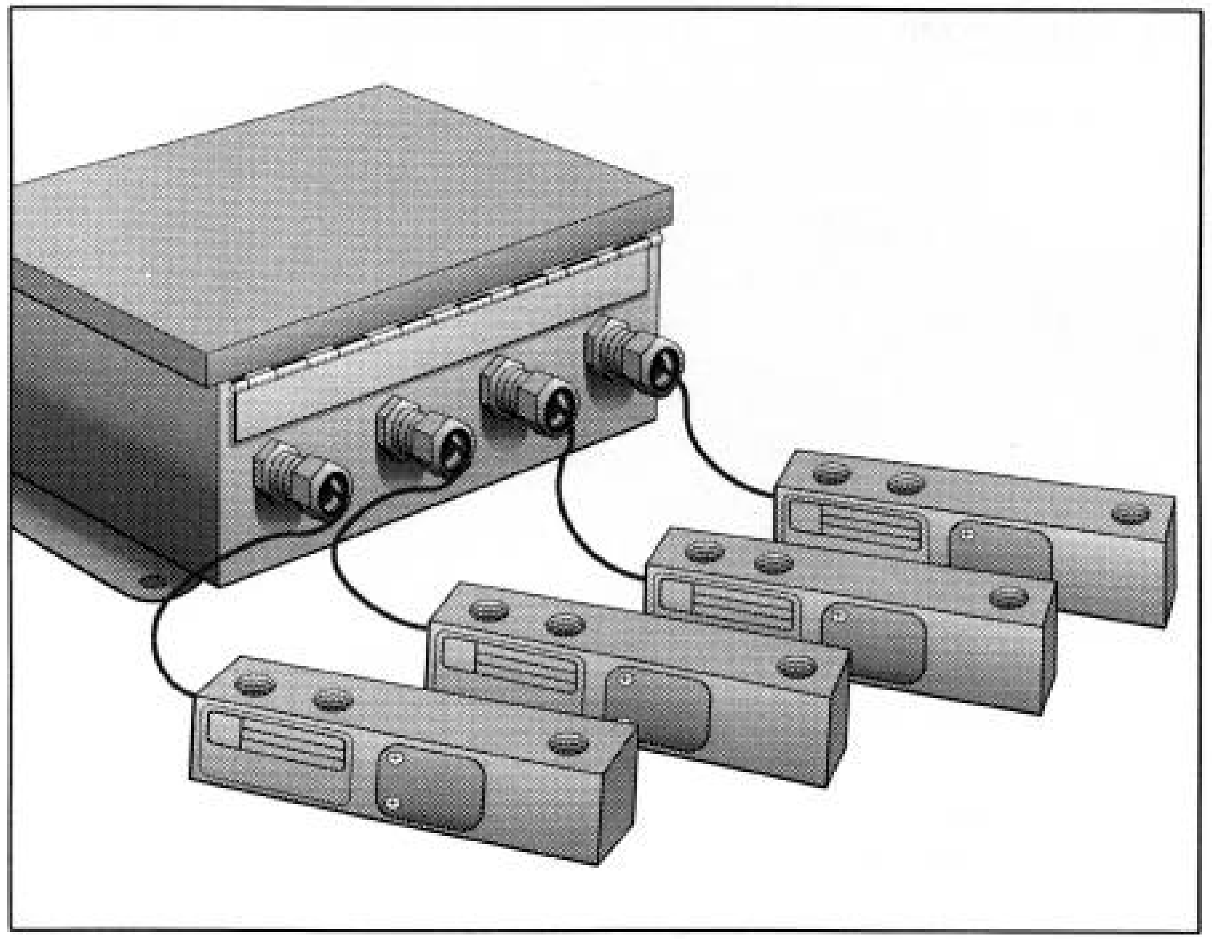

Figure 1-1. JBOX with 4 Load Cells Attached

SECTION 2 UNPACKING

Remove the Packing list and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department at 1-800-622-2378.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

1

For schematic refer to Figure 7-2.

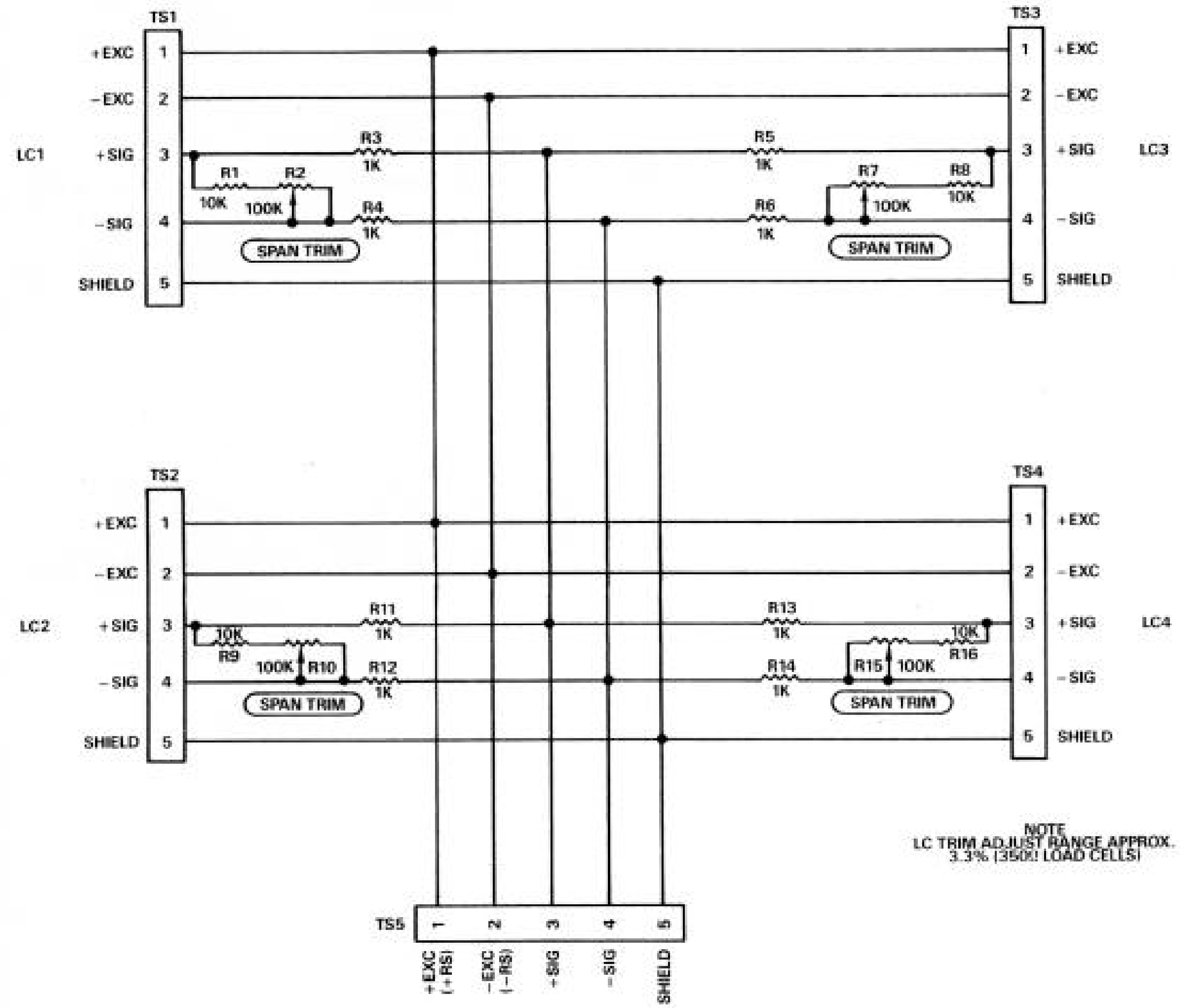

Figure 7-2. Schematic

3. Record the output of the load cell when the unknown weight is placed on it, again using the multimeter on the output leads of the load cell.
4. The unknown weight is determined by using the following equation:

$$\text{Unknown weight} = \frac{(\text{mV output @ unknown load}) - (\text{mV output at no load})}{(\text{excitation voltage})\ (\text{rated mV/V output of load cell})} \times (\text{Load Cell Capacity})$$

For example: no load condition produces 1.102 mV
unknown weight produces 11.143 mV
excitation is 10.32 volts
rated output is 1.9854 mV/V
load cell capacity is 500 pounds

$$\text{unknown weight} = \frac{11.143 - 1.102}{(10.32)\ (1.9854)} \times (500) = 245.03$$

SECTION 6 SETUP INFORMATION FOR YOUR RECORDER, METER, ETC.

In Section 4 or 5, you scaled the JBOX which resulted in a specific output rating in mV/V. Remember that the mV/V output is the change in output from a no load condition to full capacity. Full capacity or full scale of a JBOX system is the sum of all the load cell's full scale capacities.

Example: 4 cells all 2000 pound capacity are connected to a JBOX. After scaling the JBOX the rated output is 2.334 mV/V. The excitation, measured at the screw terminals to the weighmeter, is 10.045 volts. The output at no load is 2.345 mV.

In scaling the meter, recorder, etc., the above information means that at 2.345 mV, the pen or display should read zero, and at 25.790 mV (2.334 x 10.045 + 2.345 = 25.790), the pen or display should register 8000 pounds.

SECTION 7 SPECIFICATIONS

WEIGHT:	15 pounds
SPAN:	3.3% adjustment; larger adjustment requires external resistors
FEEDTHROUGHS:	Compression, 0.125'' to 0.25 dia. wire (male thread portion (0.950-18, UNS-2A))
LEAD WIRE:	22 feet, 6 conductor shielded jacketed wire, 22 gage
CASE:	epoxy coated carbon steel
DIMENSIONS:	refer to Figure 7-1

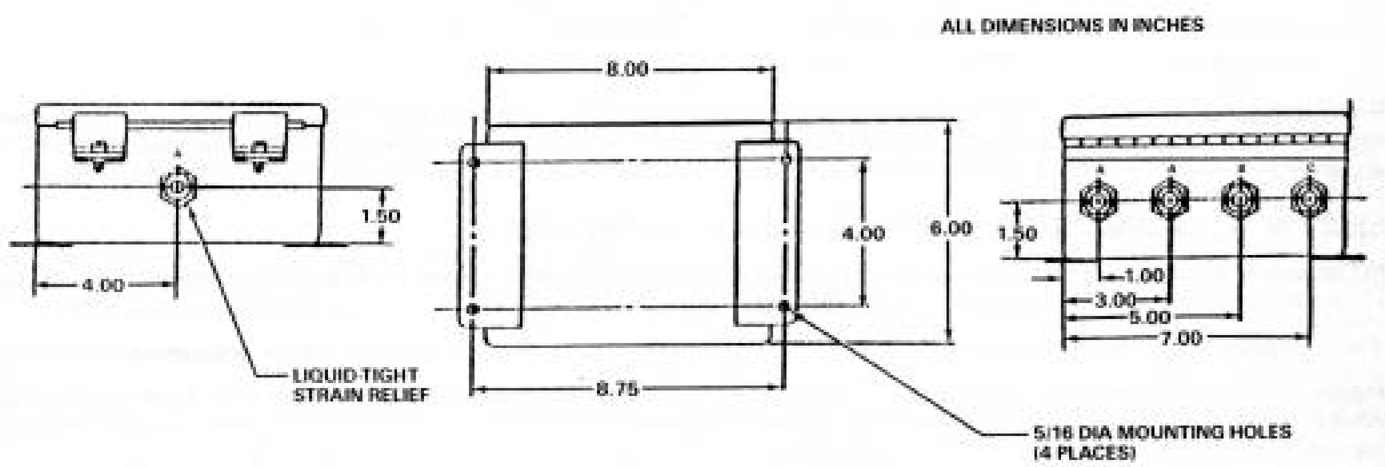

Figure 7-1. Dimensions

SECTION 3 ELECTRICAL CONNECTION

1. Connect the load cells cables to the junction box and junction box output cable to the associated readout. The positive and negative remote sense lines should be used for all junction boxes to readout cable runs. Refer to Figure 3-1.
2. Be sure that all terminal strip connections are tight and that the cables are not cut or damaged.

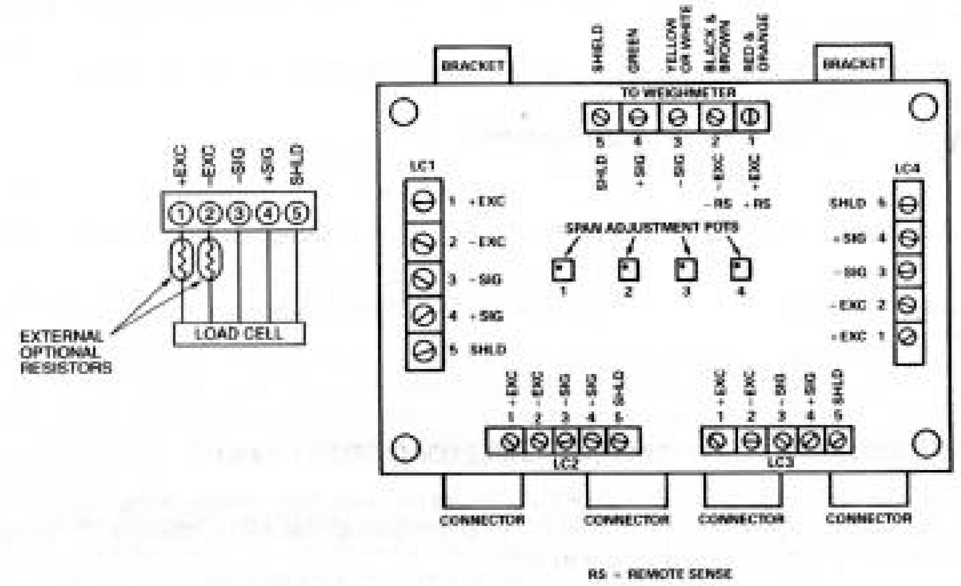

Figure 3-1. Location of Terminal Strips and Span Pots

SECTION 4 SETUP AND ADJUSTMENT

4.1 INTRODUCTION

Interchangeability means that the load cells have almost the same rated output.

Performing the following steps will ensure the JBOX gives you the most accurate summation possible.

1. The Junction Box should be mounted in a location where water will not directly drip on it. Use of drip loops on all cables is recommended. Drip loops are nothing more than a loop in a cable which acts as a point where water would collect and drip off instead of running down into the JBOX.
2. Turn all span adjusting pots in the JBOX clockwise (to increase span) until they click.

NOTE
The pots are 25 turn units.

3. Each load cell comes with a calibration sheet stating its ''rated output'' (sometimes referred to as ''calibration factor'', or ''output at full scale''). This cal sheet is important and the mV/V output values should be recorded along side the serial number of each load cell in Table 4-1.

TABLE 4-1

LOAD CELL	SERIAL NUMBER	RATED mV/V OUTPUT	*INTER %	*INPUT RESISTANCE	*EACH EXTERNAL RESISTANCE	mV OUTPUT @ KNOWN LOAD
1						
2						
3						
4						

Output @ no load ________ **mV**
Matched output @ known load ________ **mV**
Excitation voltage used ________ **volts**
* **columns only used with** > 3% interchangeable spec load cells.

4. Circle the load cell with the lowest mV/V rated output. Don't worry about the other columns until you get to Section 4.2 OR 4.3 depending on your results from the following equation.

NOTE

A JBOX trims the output of a load cell to make it identical to another load cell. A JBOX can only reduce the output from a load cell, it can never increase it. The JBOX will trim all the load cells' outputs to make them identical to the lowest load cell's rated mV/V output.

5. Compute if the rated outputs are within 3% of each other by the following equation (computing if the cells have an interchangeability within 3%):

$$\text{Interchangeability \%} = \frac{\text{highest rated mV/V} - \text{lowest rated mV/V}}{\text{lowest rated mV/V}} \times 100$$

6. If the interchangeability is less than 3% (< 3%), proceed to Section 4.2, Setup and Adjustment, for Interchangeable Load Cell (< 3%).

If the interchangeability is greater than 3% (> 3%), proceed to Section 4.3, Setup and Adjustment, for Non-interchangeable Load Cell (> 3%).

4.2 SETUP AND ADJUSTMENT FOR INTERCHANGEABLE LOAD CELLS (< 3%)

1. Connect all load cells, power supply, and meter to JBOX. Record the excitation voltage being used, in Table 4-1. The excitation voltage should be measured across the (+) EXC and (−) EXC terminal on the JBOX, labelled "To Weighmeter". Measuring at the terminals eliminates any voltage drop due to lead wire.
2. With excitation power connected to the JBOX (red and black leads on the output cable), measure the output of the JBOX with no load applied and record the value in Table 4-1.
3. Load one load cell at a time with a known weight that is approximately 75% of a load cell's rated capacity. Make a note of the output of each load cell in Table 4-1.
4. Find the lowest mV output of all the load cells. Load the other load cells one at a time again, as in Step 3 and using the span adjustment pots in the JBOX. Adjust the outputs of all the other load cells to match the output of the load cell which has the lowest mV output.

NOTE

All the pots are slightly interactive (each pot is not independent of each other).

5. Load each load cell again and check the output to make sure they are all balanced to the same output. JBOX and load cells are now setup for use with your readout device (meter, recorder, interface board, etc). Record the matched output at known load in Table 4-1.
6. The rated mV/V of the calibrated JBOX system is computed as follows:

$$\text{Rated mv/V output of JBOX} = \left(\frac{\text{matched output @ known load} - \text{output @ no load}}{\text{Excitation voltage}} \right) \left(\frac{\text{summation capacity of all load cells}}{\text{known load used}} \right)$$

NOTE

For a more accurate mV/V rated JBOX output, load the system with a known weight that is approximately ½ or ¾ the system's capacity, and recompute the rated mV/V JBOX output. The system's capacity is the sum of the individual load cell capacities. When applying the known load of the ½ or ¾ system capacity try to keep the load in approximately the center of the system.

For explanation on how to scale meter, recorder, etc., refer to Section 6.

4.3 SETUP AND ADJUSTMENT FOR NON-INTERCHANGEABLE LOAD CELLS (> 3%)

(THIS SECTION PERTAINS TO USING A JBOX WITH LOAD CELLS WHOSE RATED OUTPUT DIFFERS BY MORE THAN 3%).

1. Compute each load cell's interchangeability difference, in percentage, from the lowest mV/V load cell, using the following formula:

$$\text{Interchangeability \%} = \left(\frac{\text{Rated mV/V} - \text{lowest rated mV/V}}{\text{lowest mV/V}} \right) \times 100$$

2. List each of the interchangeable % differences from step 1 above in Table 4-1, column labelled "Inter %". Any load cell that differs by more than 3% will need 2 external resistors added to the circuit for the JBOX to work. If any of the values are less than 3%, no additional resistors are needed.

NOTE

A JBOX can only adjust for a 3% difference; that is why external resistors will be added to drop the excitation going to the load cell, thereby dropping the output.

3. For all the load cells with a greater than 3% interchangeability, you must compute the required resistors to be added, to the excitation leads of the load cells. Measure the internal input resistance of each load cell and list it in Table 4-1 in column "Input Res" (stands for Input Resistance). Measure this reistance across the excitation leads of each load cell when it is not connected to the JBOX.
4. Calculate the external resistors needed using the following equation:

$$\text{External Resistors} = \left(1 - \frac{\text{lowest mV/V output}}{\text{Z's mV/V output}} \right) \left(\frac{\text{Z's input resistance}}{2} \right)$$

where Z are the values of the load cell for which you are calculating the external resistors. The division of 2 occurs because you want to add 2 resistors. One resistor is placed in series with the positive excitation lead, between the JBOX and the load cell. The other resistor is placed in series with the negative excitation lead, between the JBOX and the load cell. Refer to Figure 3-1. The resistor should be a metal film resistor with as low a ppm as possible (100 ppm or less is acceptable). PPM is parts per million of ohm per °C of change.

The resistor value choosen should be the next higher commercially available resistor. The solution to the above equation is really a repetitious (iterative) process. You could solve for the exact resistance required by solving the equation a few times substituting the input resistance as the original input resistance plus the two new external resistor values.

Another alternative to calculating the external resistor in Step 4, is to use a decade box or potentiometer. Hook up the potentiometer between the excitation lead of the load cell and the JBOX. Perform steps 5 through 8 using the decade box as a coarse span adjustment and the span screw as a fine span adjustment. After achieving the proper span, replace the decade box with the appropriate resistor.

5. Connect all load cells, external resistors, power supply and meter to the JBOX. Record the excitation voltage being used in Table 4-1. The excitation voltage should be measured across the (+) EXC and (−) EXC terminal on the JBOX, labelled "To Weighmeter". Measuring at the terminals eliminates any voltage drop due to the lead wire.
6. Measure the output from the JBOX in a no load condition, and record it in the appropriate space in Table 4-1.
7. Place a known weight, approximately ½ to ¾ of an individual load cell's rated capacity, on each load cell one at a time. Record the output from the JBOX as the weight is put on each cell, in the column marked "mV output @ known load".
8. Note that the load cell with the lowest mV/V rated output also has the lowest "mV output". Place the weight back on each of the load cells and turn the span adjustment until it gives an output equal to the lowest mV output. The system is now calibrated. Recheck all the cells with the weight to ensure they are reading correctly. Note that the pots are interactive, therefore, the system's mV/V rated output will differ slightly from the lowest mV/V rated load cell's output.
9. The rated mV/V output of the JBOX system is computed as follows:

$$\text{Rated mV/V output of JBOX system} = \frac{\text{(matched output @ known load)}}{\text{excitation voltage}} \cdot \frac{\text{(summation capacity of all load cells)}}{\text{known load used}}$$

For a more accurate mV/V rated JBOX output, load the system with a known weight that is approximately ½ or ¾ the system's capacity, and recompute the rated mV/V JBOX output. The system's capacity is the sum of the individual load cell capacities. When applying the known load of the ½ or ¾ system capacity try to keep the load in approximately the center of the system.

SECTION 5 CALIBRATING THE JBOX WITHOUT A KNOWN LOAD

In Sections 4.2 and 4.3, a known load was used to calibrate the JBOX. Using a known load insures the optimum results, but if a known load cannot be used, the system can still be calibrated.

The solution to not having a known load is solved by using an unknown load and then weighing the unknown load.

Proceed through all of Section 4, except when it mentions a known load, and use any load that is approximately the correct weight. After adjusting all the span pots so that all the load cells give the same output, the trick is to weigh the unknown weight. The unknown weight is weighed by performing the following steps.

1. Disconnect the output leads from the load cell, with the lowest mV/V rating, and the JBOX.
2. Record the output of the load cell in a no load condition by using a multimeter on the output leads of the load cell.