Load Cell Combiner
Model TP-SG-SUM
Operation
and
Instruction Manual

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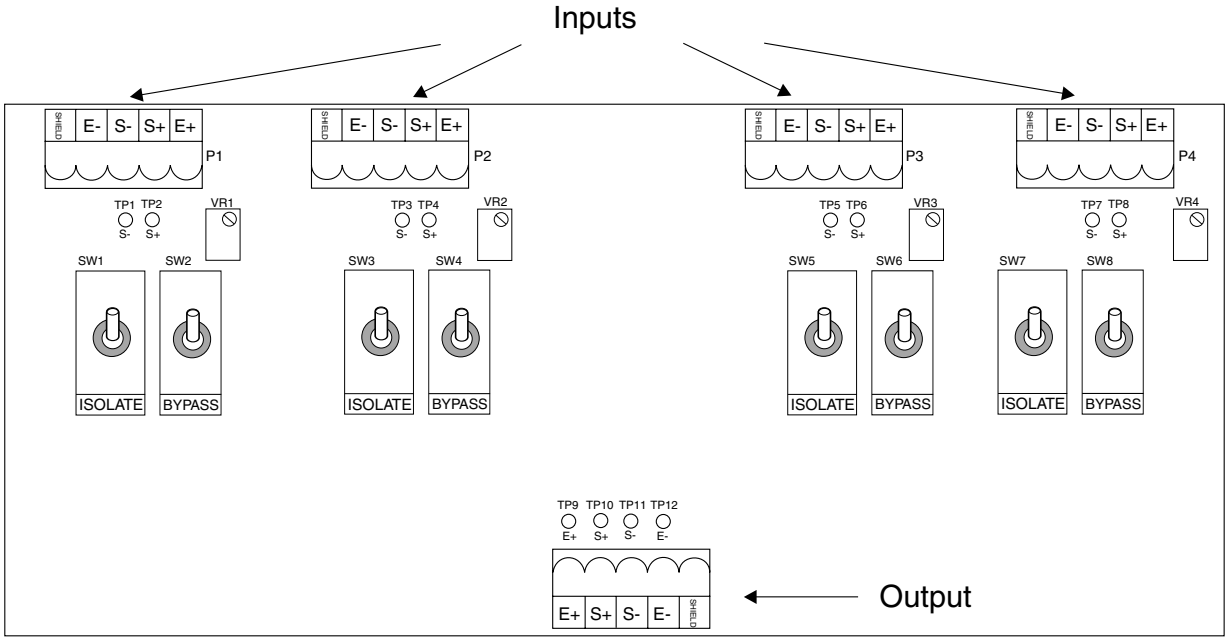
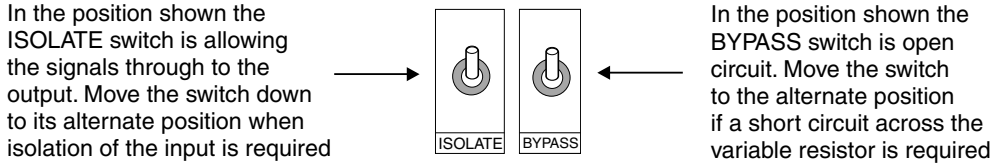
1 Introduction

The load cell combiner is used to equalise the mV/V output of two, three or four load cells allowing them to be balanced and combined at the output. The combiner circuit board contains four input connectors and one output connector, each connector is of the plug in, screw terminal type. Each input has an isolation switch which may be used to isolate the two signal lines for each cell from the output. There is also a variable resistor for each channel. These variable resistors allow for the individual adjustment of the excitation voltage, and hence the mV output, for each cell to be passed on to the output. Each variable resistor has a bypass switch which may be used to place a short circuit across the variable resistors. Test points are provided to allow convenient measurement of input and output signals, variable resistance values and excitation voltage.





Two methods of setting up the combiner are described. Method 1 is the easiest and fastest method for most applications:

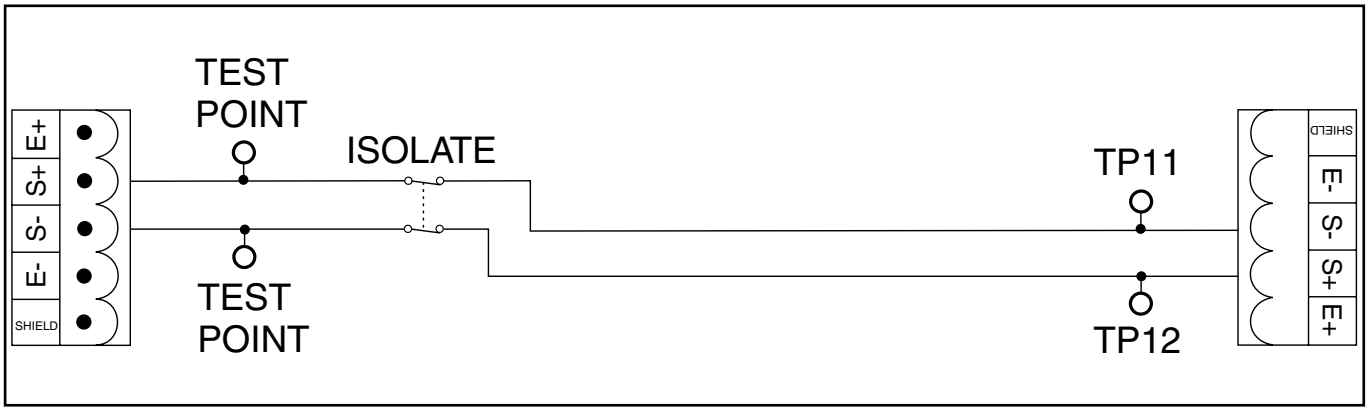
Method 1 - By putting a “live” input onto each cell and adjusting the individual outputs until they equal the lowest output.

Method 2 - By calculating and setting the required variable resistor values.

1 .1 Isolation Switches

A double pole, double throw isolation switch is fitted at each input. These switches allow each input to be disconnected from the output to allow individual measurement of the mV input for each cell. The switches can also be used to check the mV signal at the output connector. e.g. if the isolation switches for inputs 1, 2 and 3 are open and the isolation switch for input 4 is closed then the mV output for input 4, which has been balanced by the variable resistor, may be viewed.

1 .2 Setup Method 1 - Live Input



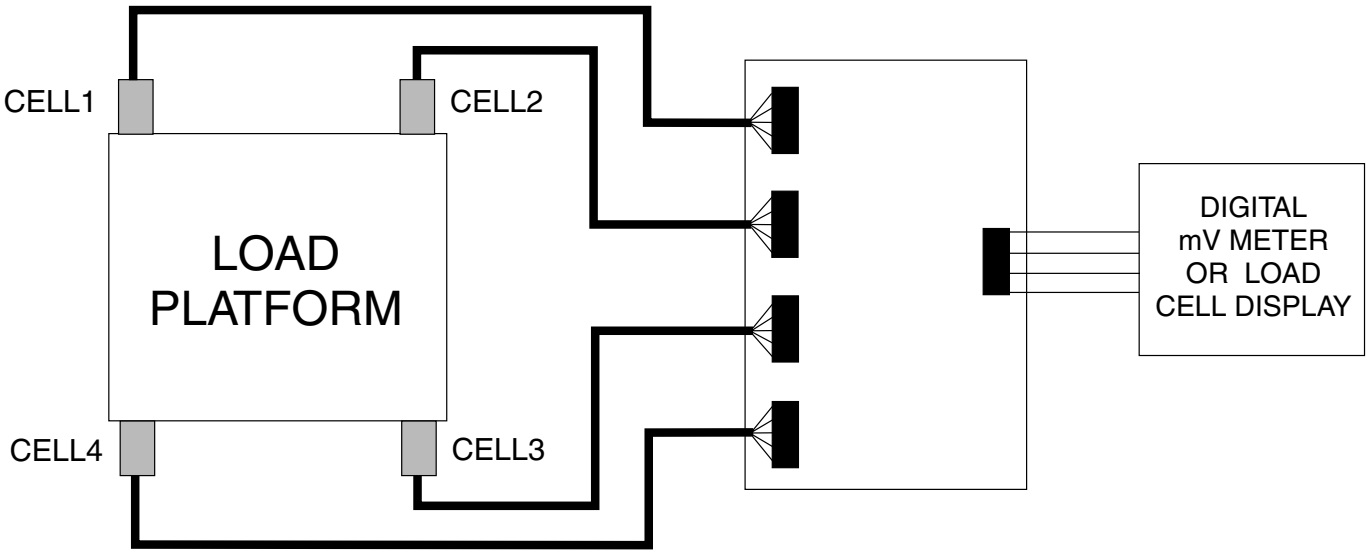
In this method the cell with the lowest output is used as the reference input and the other cells are balanced to match the reference. The setup procedure is listed below:

1. Connect all four cells to the combiner inputs and either use a load cell display at the output or view the mV output via a digital meter across TP11 and TP12. Put all BYPASS switches into the BYPASS position i.e. the variable resistors are shorted out for all inputs.
2. Measure and note the output mV signal due to cell 1only by isolating the other inputs. To accomplish this use the isolation switch on the remaining inputs i.e. these inputs are open circuit. Apply a fixed load to the cell being measured.
3. Repeat step 2 for all the other inputs.
4. Leave the BYPASS switch in the BYPASS position for the cell with the lowest mV output. For the other cells open the BYPASS switch.
5. The variable resistors are now adjusted for each of the remaining inputs. Use the isolating switch to open circuit all but the cell being measured and adjust the variable resistor for this cell until the reading equals that from the lowest input.
6. Repeat step 5 for all remaining cells.
7. Check the output of each individual cell by isolating all other inputs. All outputs should now be balanced i.e. giving the same reading.

1 .3 Method 1 - Example

The diagram below shows a load platform with four load cells connected to the combiner. The output is being monitored either via a load cell display or via the mV output.

A load is placed in the centre of the load cell platform



All variable resistors are bypassed via the BYPASS switches

Cells 2, 3 and 4 are isolated at the combiner

A reading is taken of the output for cell 1 input

Cells 1, 3 and 4 are now isolated

A reading is taken of the output for cell 2 input

Cells 1, 2 and 4 are now isolated

A reading is taken of the output for cell 3 input

Cells 1, 2 and 3 are now isolated

A reading is taken of the output for cell 4 input

Assume that cell 2 had the lowest output - the bypass switch remains closed for cell 2 and all other bypass switches must be opened

Cells 2, 3 and 4 are isolated

Adjust the variable resistor for cell 1 until the output reading is the same as the minimum reading (cell 2 reading in this example)

Cells 1, 2 and 4 are isolated

Adjust the variable resistor for cell 3 until the output reading is the same as the minimum reading (cell 2 reading in this example)

Cells 1, 2 and 3 are isolated

Adjust the variable resistor for cell 4 until the output reading is the same as the minimum reading (cell 2 reading in this example)

All cell outputs are now balanced

1 .4 Setup Method 2 - Calculation of variable resistance

1. Record the bridge resistance for each cell, this should be available on individual calibration sheets for each cell. If resistance is not known, measure and record the bridge resistance of each cell by placing a digital ohmmeter across the excitation leads of each cell (bridge disconnected from the circuit board and no excitation).

2. Record the mV/V output for each cell, this should be available on individual calibration sheets for each cell. If the mV/V output is not known then with excitation voltage applied measure the mV/V output of each cell. This can be done by placing a known load on the cell and measuring the mV output with a digital voltmeter. e.g. a 50kg load cell at 10V excitation, with a quoted 2mV/V output will, theoretically, give 20mV output with a 50kg load. A 10kg load will give 4mV etc. Use the known load and actual readings to calculate the mV/V output for each cell.

Example - the table below shows typical measurements taken for 4 load cells to be used as inputs to the combiner.

	mV Output measured at 20kg load	Calculated mV/V	Measured Bridge Resistance
Cell number 1	8.20	2.050	352.4
Cell number 2	8.35	2.088	351.0
Cell number 3	8.12	2.030	353.2
Cell number 4	8.32	2.080	351.2

As an example the mV/V output was calculated in the following way: Assume 50kg load cells are used and for cell number 1 the rated minimum output is known to be 2mV/V. At 10V excitation a 20kg load is used, this gives 2/5 (or 20/50) of the maximum load for a 50kg cell.

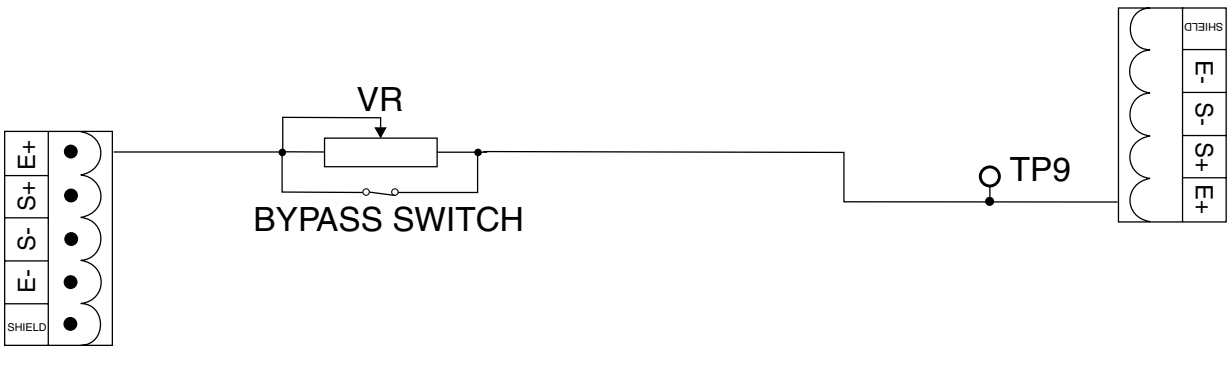
Theoretical output voltage would be 2/5 x 2mV/V x 10V = 8mV.

If the measured output is 8.20mV then the mV/V output can be calculated from 5/2 x 8.2/10 = 2.050mV/V.

Cell number 3 has the lowest mV/V output, this will be used as the reference input and all other inputs will be adjusted, via the variable resistors, to match this output. The BYPASS switch for cell number 3 should now be closed, short circuiting the variable resistor for input 3.

The required value for each of the other variable resistors can now be calculated and the resistors adjusted to these values.

CLOSE THE BYPASS SWITCH FOR THE INPUT WITH THE LOWEST mV/V OUTPUT TO GIVE ZERO OHMS ACROSS THE VARIABLE RESISTOR FOR THIS INPUT



The formula for calculating the resistance values of the remaining inputs is:

$$Rv = \frac{Rb(Eb - Er)}{Er}$$

Where: Rv is the required resistance of the variable resistor in Ohms.
Rb is the bridge resistance in Ohms.
Eb is the mV/V output
Er is the mV/V output of the reference input.

The values of the three variable resistors in our example can now be calculated as follows:

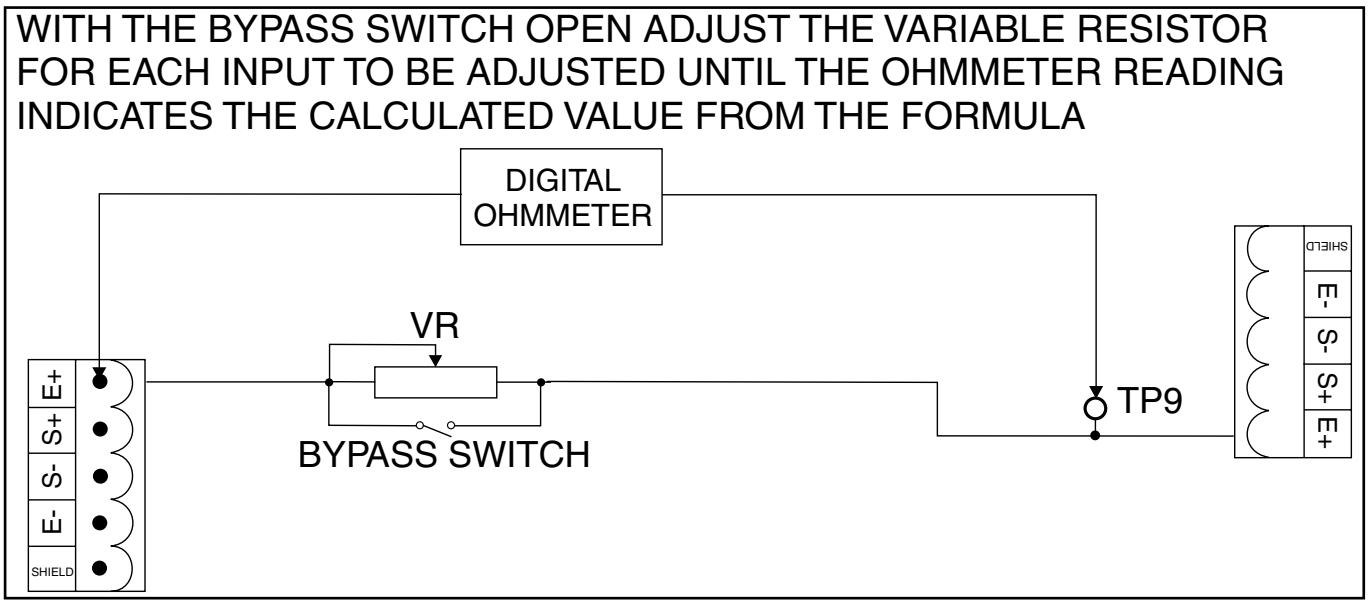
Cell 1 Rv = 352.4 (2.050 - 2.030)/2.030
Rv = 3.47Ω

Cell 2 Rv = 351 (2.088 - 2.030)/2.030
Rv = 10.03Ω

Cell 3 Rv = Reference input = 0Ω (via BYPASS switch)

Cell 4 Rv = 351.2 (2.080 - 2.030)/2.030
Rv = 8.65Ω

Adjust the variable resistor for each of the three inputs. A digital voltmeter should be used with the reading taken between TP9 and the E+ input for each of the three inputs. The adjustments must be made with no wiring connected to the circuit board. i.e. no load cells or other test equipment connected.



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