



VTAJB JUNCTION BOX

ANALOGUE JUNCTION BOX
FOR STRAIN GAUGE LOAD CELLS

Technical Manual

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1 INTRODUCTION

VTAJB_4/6 is a summing box designed for the parallel connection of analogue load cells. It contains the wire terminals for 4 or 6 strain gauge load cells, surge arresters and corner trimming circuits. The load cell connectors are 4-wire, while the indicator connector is 6-wire. Corner trimming may be done by resistor(s) or potentiometers in series with the signal lines.

Resistance is added to the +SIG line, by removing copper track short-circuits next to the component(s).

The enclosure has been designed for use in industrial environments and is EMC safe to EN45501 standards.

Two enclosure variants are offered, a four input version for low profile scales and a six input version for bigger scales.

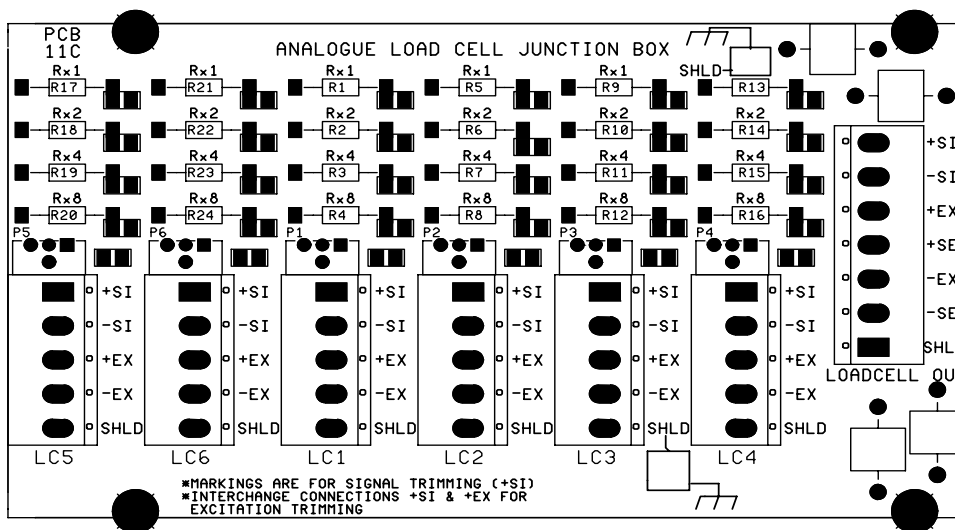
The cables enter the box via IP67 cable glands.

The connectors are marked **LC1** to **LC6**, corresponding to load cell 1 to 6.

The connector for the indicator cable is marked **LOAD CELL OUT**.

Load cell connectors are marked as follows:

+Ex – Excitation positive	+Se – Sense positive	+Si – Signal positive
-Ex – Excitation negative	-Se – Sense negative	-Si – Signal negative



The excitation and sense terminals are connected together on the LOAD CELL OUT connector.

2 INSTALLATION

Normally VTAJB_4/6 comes in a sealed stainless steel enclosure, suitable for wash down environment. Entry of connecting cable is through sealed cable glands.

2.1 Mounting

- The mounting location should be such that the unit is not subject to excessive vibrations or heat.
- Select the right location based on environmental conditions NOT on the ease of installation.
- Provide dripping loop on cables to avoid liquids entering the cable glands.
- The top panel should be accessible.

2.2 Wiring

- Remove the lid by undoing the four screws.
- Insert cables via the cable glands. Strip the cables and connect the load cells to respective connectors.
- If the load cell cables are 6-wire connect together the excitation and sense leads (+Ex with +Sen) and (-Ex with -Sen).
- Connect the shields of the cables on SHLD terminal or directly on the chassis screws using eyelet terminals.
- Connect the earth wire (6-10mm, multi-thread) on the external M4 screw and tighten the butterfly nut.
- When wiring is completed pull out any excessive cable and tighten the cable glands to ensure a firm grip on the cables. Re-install the lid and tighten the screws until the side edges are recessed 2mm from the lid edges.
- FOR OPTIMUM EMC PERFORMANCE KEEP THE LENGTH OF THE SHIELD INSIDE THE ENCLOSURE AS SHORT AS POSSIBLE.

2.3 Earth - Shield

Normally the shield is floating on the VTAJB side and connected on the indicator side. Where the maximal protection must be provided for the load cells and the electronics the shield may be connected to earth by bridging the two solder pads on the surge arrester side SGAP4 and next to LC4 connector.

CAUTION : *Do not run load cell cables together with power cables.*

Connect the shielding where indicated on the drawing only.

Never use a megger to check wiring.

Never use insulating tape on load cell connections.

3 CORNER ADJUSTMENT

This is the procedure where the output of each load cell is corrected so that the weight indication will be the same wherever the load is placed on the platform.

Corner adjustment must be performed before calibration of the scale.

- All load cells should be leveled and load distribution equal before trimming the outputs.
- The corner adjustment is performed by successively placing a test weight on each quadrant of the platform and trimming the higher indicating corners until all indications are the same.
- Because the load cells are summed the corners interact with each other and any adjustment will affect all corner indications. Prior to corner trimming the indicator must have been connected and an approximate calibration performed.
- The principle of trimming is “CURRENT CALIBRATION” where the load cells are rationalized in terms of current output into the common resistance.
- Four resistors 0.33R (Rx1), 0.68R (Rx2), 1.3R (Rx4), 2.7R (Rx8) and 1 potentiometer (20R) are available for each load cell terminal. By removing copper track short-circuits next to the component(s) resistance is added to the +SIG line.

3.1 Pre-trimming

Corner trimming is a tedious and time consuming operation. Thus, “PRE-TRIMMING” should be exercised if the load cell data are known.

- Measure the output resistance (R_{out}) of each load cell using a 4-1/2 digit multi-meter.
- Calculate the I_{out} of each load cell: $I_{out} = (V_{out}) / (R_{out})$.
- The lower value (I_{ref}) is the reference load cell which is not trimmed. Add series resistance on the signal lines of the remaining load cells so that the current out (I_{out}) matches the reference one.
- The incremental resistance may be calculated by: $R_i = (V_{out} / I_{ref}) - (R_{out})$.

3.2 Resistor trimming

The corner adjustment is performed by successively placing a test weight, (0.4 of full scale maximum), on each quadrant of the platform and trimming the higher indicating corners until all indications are the same.

The value of the incremental correction resistance may be calculated by:

$$R_i = [(I_c - I_l) / I_l] * (R_{out})$$

where:

I_c = Corner indication

I_l = the lower corner indication

R_{out} = Load cell's output resistance.

3.3 Potentiometer trimming

The corner adjustment is performed by successively placing a test weight, (0.4 of full scale maximum), on each quadrant of the platform and trimming the higher indicating corners until all indications are the same.

- Turn all potentiometers on PCB 11C clockwise ($R_i = 0$).
- Place the test weight at each of the designated corners (centre of each quadrant). Record the displayed indications. The load cell with the lowest indication is not trimmed.

- Place the test weight at each corner in sequence .Adjust the potentiometer corresponding to that location to obtain the “non trimmed” indication.
- Repeat the procedure until all indications are the same.

Notes:

- The default principle used in VTAJB_4/6 is signal trimming which has negligible effect on span stability but some effect on zero temperature stability, as only one side of the bridge is trimmed.
- Excitation trim is sometimes preferred, despite the span effect, as the overall performance looks more stable in temperature changes.
- To perform excitation trimming simply interchange +EX and +SIG connections as shown in the following table:

Load Cell Cable	Load Cell Connector (JB)	Indicator cable	Indicator Connector (JB)
+Exc	+Si	+Exc	+Si
-Exc	-EX	+Sen	+Si
+Sig	+EX	+Sig	+EX
-Sig	_Si	_Sig	_Si
		-Sen	-Se
		-Exc	_EX

4 TROUBLESHOOTING

A warming up of at least 15 minutes for the load cell is recommended before calibration of a weighing system.

Symptom	Action to be taken
Calibration does not proceed	<ul style="list-style-type: none"> - Check load cells connected and setup parameters of indicator. - Place a test weight on each load cell and verify that there is a positive change in indication. - Use calibration weight equal to 10-30% of each load cell capacity. - Check load cell connector screw terminals (if not tight push with a tool from the opposite side of the screw)
Weight indication is not stable	<ul style="list-style-type: none"> - Check calibration data. - Reduce external divisions or lower conversion rate or increase digital filter, check number of load cells. - Check power supply, check load cell connection(s) and cable(s). - Check input and output resistance and resistance between any terminal and shield. - If they deviate from the original values it is an indication of a bad electrical circuit. - Check that the scale is mechanically OK and it is free on all sides. - Check whether moisture has entered the junction box. - Check if corrosion has degraded load cell performance. - Check shock resistance by lightly rapping on the load cell with a small mallet.
Weight indication is not the same on each corner	<ul style="list-style-type: none"> - Check that the scale is mechanically OK and it is free on all sides. - Check load cell connection(s) and cable(s). - Check input and output resistance and resistance between any terminal and shield. - Adjust the corners and recalibrate.

5 SPECIFICATIONS and MAINTENANCE

5.1 Technical specifications

EMC compatibility	Compliant to EN45501 standards.
Cable fittings	Cable glands PG9 (acceptable cable diameter 3-9 mm).
Connector type	Screw terminal
Trimming	Current calibration principle with resistor(s) (Max. 5R totally), or potentiometer (Max. 20R).
Surge protection	90V clamp. Withstands up to 20kV and up to 10kA.

5.2 Environmental considerations

Ambient temperature	Storage: -10 to +70 Deg. C Operating: -10 to +40 Deg. C
Humidity	40 to 90% RH (non condensing)
Vibration	Severe vibration can affect the accuracy of weighing and damage electric / electronic components.
Air	The surrounding air should not contain any corrosive gasses or materials which could adversely affect the equipment.
Protection	IP67

NOTES:

- WELDING on or in the vicinity of the equipment is strictly prohibited.
- STATIC loads, caused by thunderstorms, have to be prevented from developing by use of reliable lightning conductors.
- ENSURE that the cooling of the equipment is not obstructed.

5.3 Maintenance

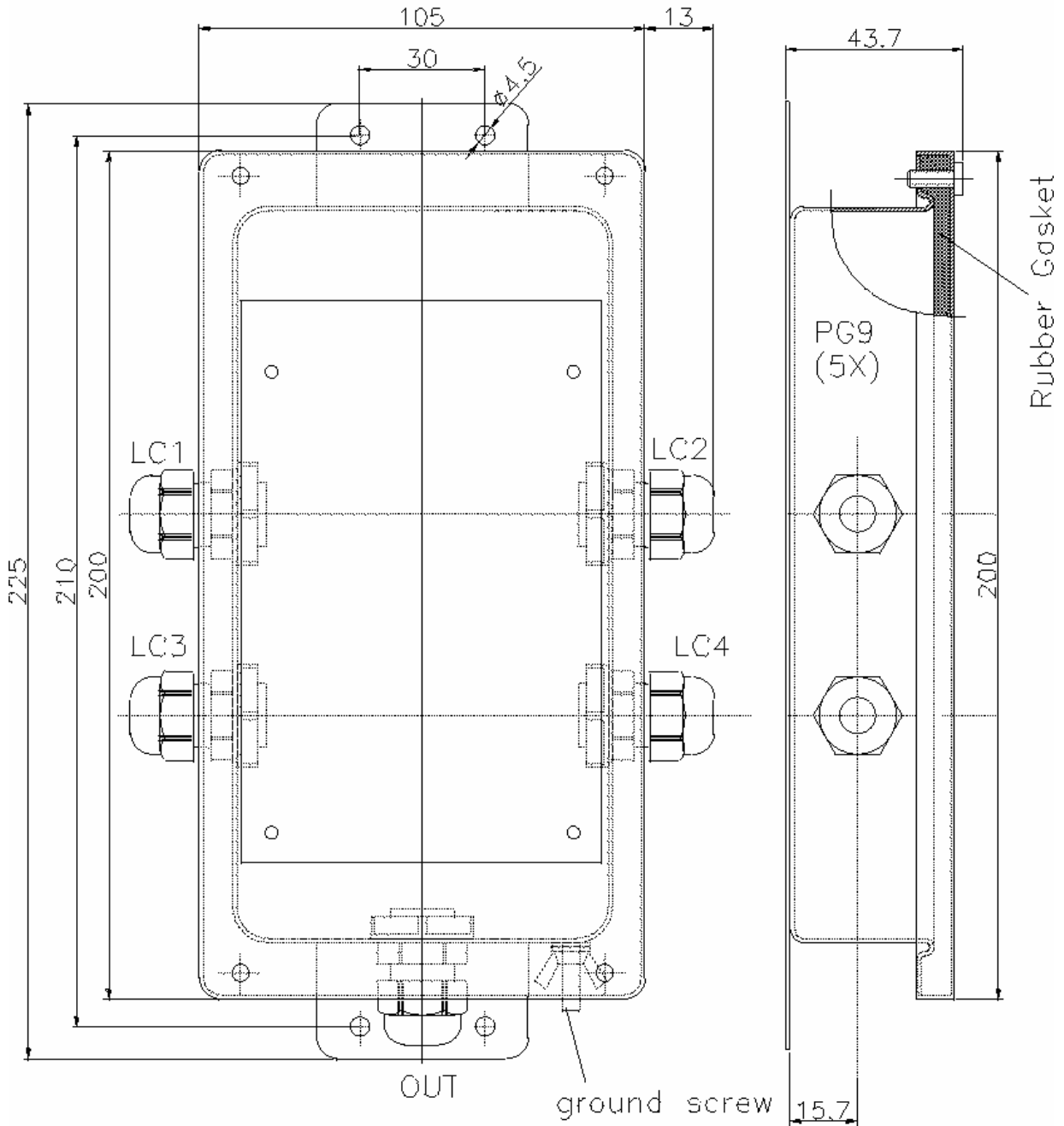
The unit does not require any routine maintenance. It may be necessary to perform periodic check of the calibration of the scale due to mechanical reasons. The frequency of the calibration checks depends on the application condition and on the required measuring accuracy.

5.4 Service

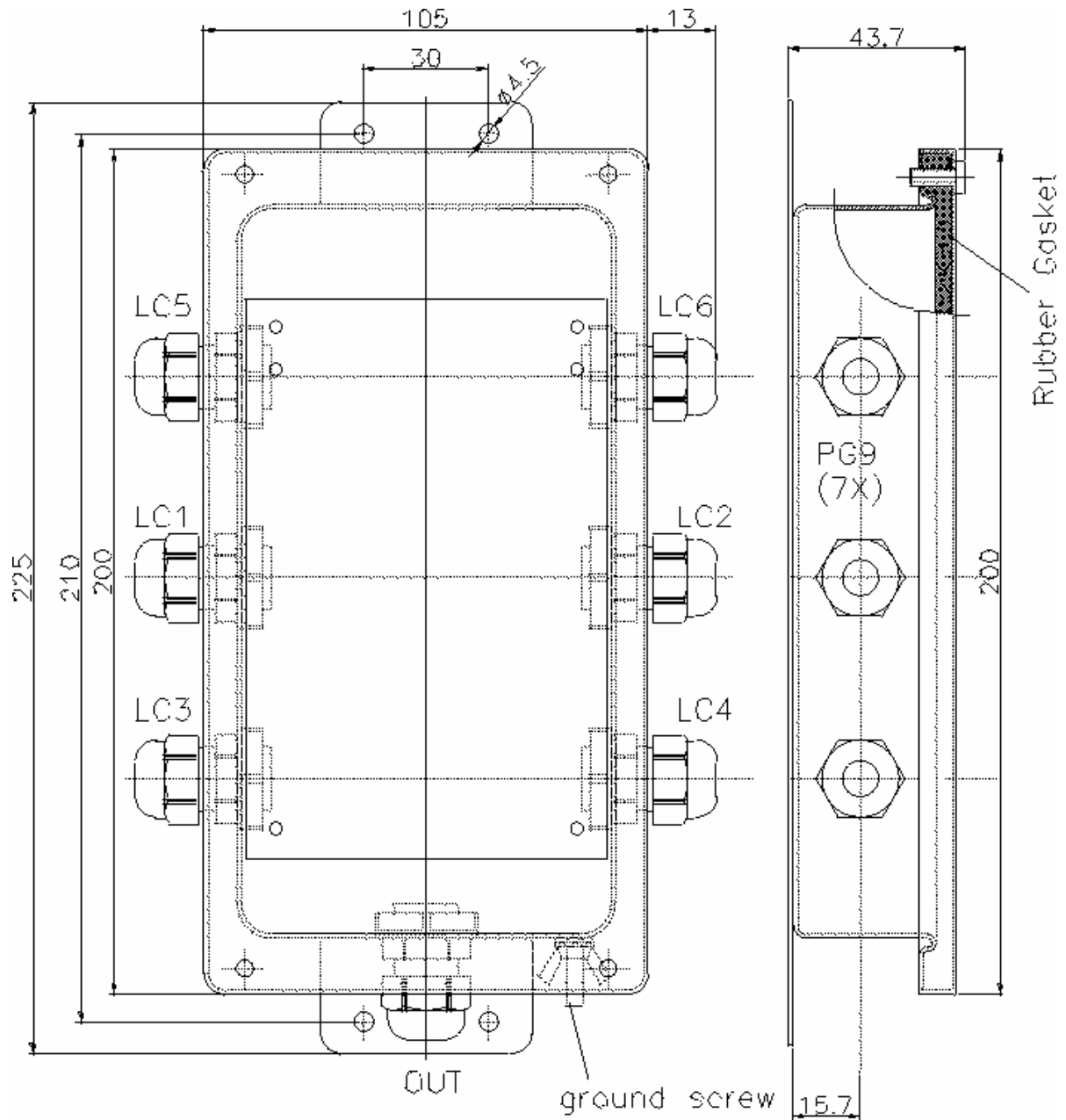
There are no serviceable parts. The unit may be repaired by trained service personnel only. The user may check load cell connections and power supply.

- **LOAD CELLS**
Load cells are reliable and very rarely present errors. Check input and output resistance and resistance between any terminal and shield. Check load cell connection and cable.

5.5 Enclosure dimensions – VTAJB_4



5.6 Enclosure dimensions – VTAJB_6



6 LOAD CELL COLOUR CODE

This is a cross reference table of the colour code specification of commonly used load cells.

MANUFACTURER BRAND	+INPUT +EXC	+INPUT +SEN	OUTPUT		-INPUT -SEN	-INPUT -EXC	SOLD
TEDEA-HUNTLEIGH	GRN	BLUE	RED	WHT	BRN	BLK	Bare
BLH	GRN		WHT	RED		BLK	Yellow
CELTRON	RED		GRN	WHT		BLK	Orange
REVERE	GRN	YEL	WHT	RED	BLUE	BLK	Orange
SENSORTRONICS	RED		GRN	WHT		BLK	Bare

Abbr. GRN=Green YEL=Yellow BLK=Black WHT=White

Notes:

1. Unidirectional load cells (Compression only or Tension only) – Positive output in the direction of the load.
2. Universal load cells (Compression or Tension) – Positive output in the direction of compression loading.
3. To correct the weight reading in the wrong direction, reverse the output (signal) polarity.