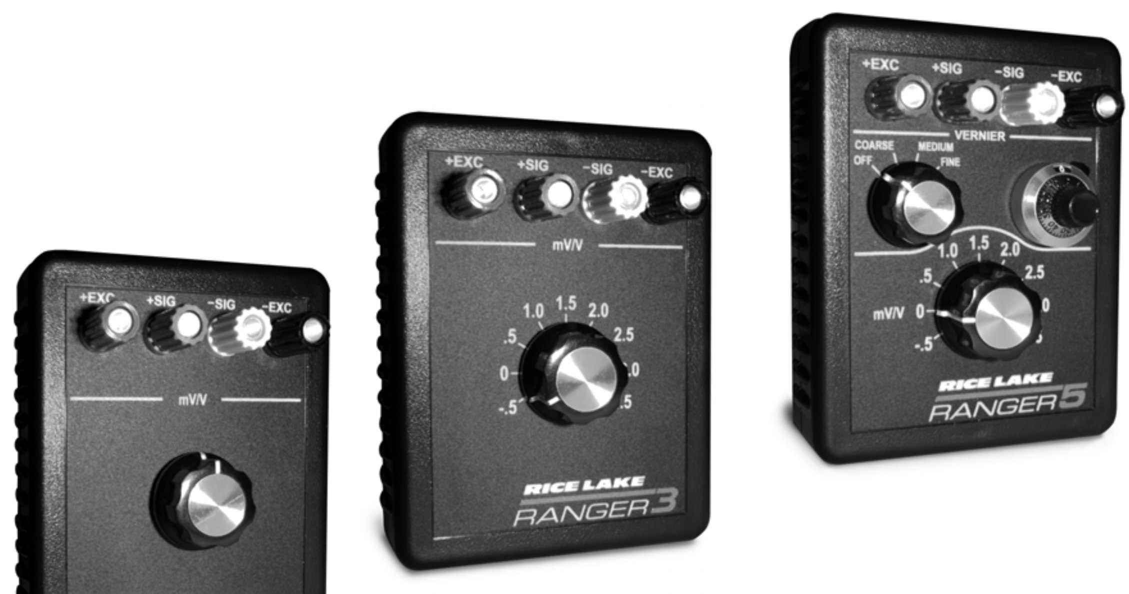
Ranger

Load Cell Simulator

Operation Manual



RICE LAKE WEIGHING SYSTEMS
Commitment Beyond Measurement®
ISO 9001 REGISTERED

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1.0 Introduction

The Rice Lake Weighing Systems Ranger load cell simulators are precision instruments designed to provide millivolt level signals for testing, calibration and troubleshooting strain gage instrumentation and systems. Accuracy and stability are obtained through the use of a “Star Bridge” circuit comprised of four temperature stable, precision resistors.

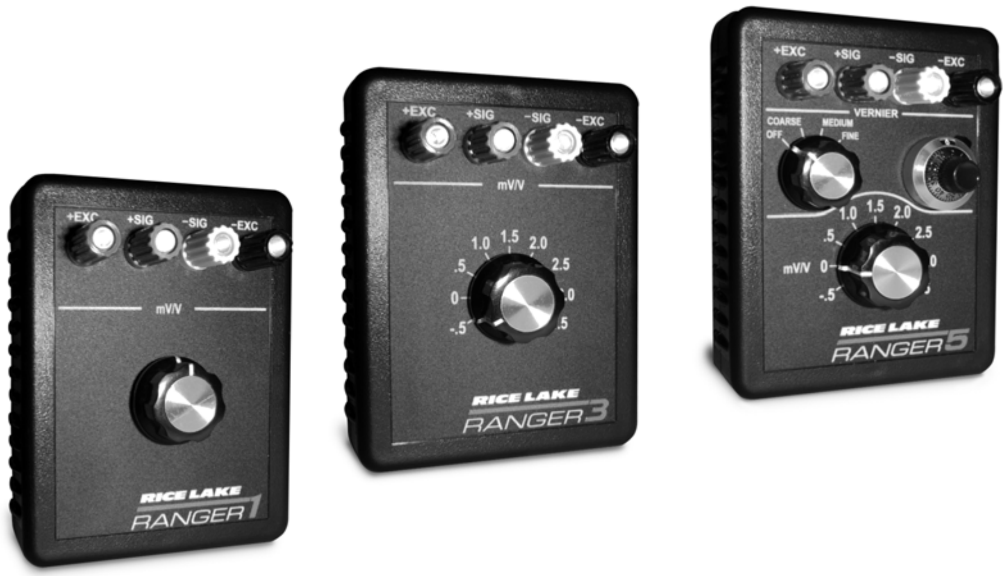

Figure 1-1. Ranger Series Simulators

Rice Lake Weighing Systems offers three models of the Ranger Series Simulators (shown in Figure 1-1).

Features include:

Ranger 1:

- Bridge impedance of 700 ohms
- 10-turn continuously variable output from 0 to 3 mV/V.

Ranger 3:

- Bridge impedance of 350 ohms
- Nine calibrated outputs - eight 0.5 mV/V steps from -0.5 mV/V to 3.0 mV/V and an additional +4.5 mV/V step. The -0.5 and +4.5 mV/V settings are useful for performing A/D offset and gain calibrations in Rice Lake indicators.

Ranger 5:

- This has the same features as the Ranger 3 with the addition of a 3-range, 10-turn locking vernier.

All three Ranger Series Simulators connect using binding posts color coded to the ISA S37.8 standard, and will accept standard banana plugs or up to 14 gauge wire.

2.0 Using the Ranger Simulators

To get the most out of the simulator, remember the following:

- Dampness, water, or other contaminants on the face of the simulator can cause leakage current between terminals. Keep the face and the terminals clean and dry when using the Ranger Series simulator.
- The binding posts are heavily plated, but should some corrosion occur, clean the posts before attempting to use the unit.
- If the simulator has been at an unusual temperature environment for many hours (ie: left in a truck during winter or summer), allow several minutes for the unit to stabilize to the ambient temperature of the scale before using.
- Excitation voltage should not exceed 15 volts DC or AC (RMS). Higher voltages will degrade the accuracy and possibly damage your simulator.
- When using the Ranger 5 simulator for testing stability or drift, or when recalibrating an indicator, make sure the vernier range select switch is in the Off position.

NOTE: *The vernier is included as a diagnostic and setup tool only.*

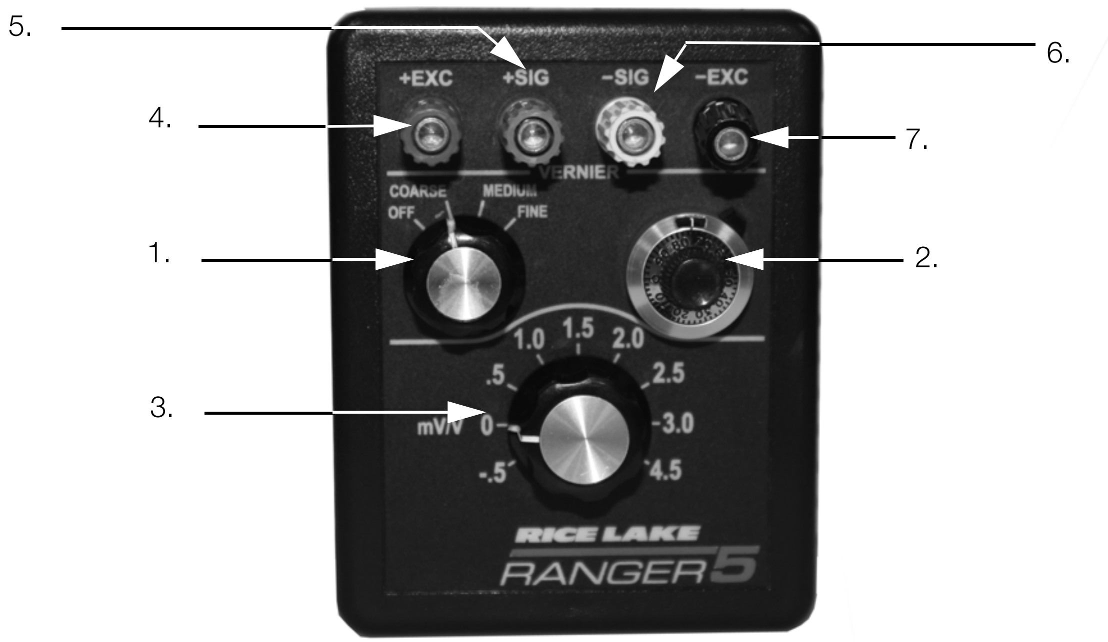

Figure 2-1. Ranger 5 Control Location

1. Vernier Range Selector

OFF:	Rotary Selector value
FINE:	Rotary Selector value -0.02 mV/V to +0.5 mV/V
MEDIUM:	Rotary Selector value -0.05 mV/V to +1.5 mV/V
COARSE:	Rotary Selector value -0.12 mV/V to +3.0 mV/V

2. Locking Vernier Dial: 10-turn adjustment of selected ranges listed above
3. Rotary Selector: Fixed calibration steps of 0.5 mV/V from -0.5 to 3.0 mV/V + 1.5mV/V step to 4.5 mV/V
4. +Excitation Input terminal post
5. +Signal Output terminal post
6. -Signal Output terminal post
7. -Excitation Output terminal post

3.0 Troubleshooting With a Simulator

The most common use for load cell simulators is diagnosing problems with electronic scale indicators or with a strain gauge load cell scale installation. Many problems in measurement systems involve drift or other situations, which are not repeatable. A simulator gives a fixed point from which all other system components can be judged to be properly working. Below are some tips for using a Ranger Series simulator as a troubleshooting tool.

1. Is the indicator working correctly? Connect the simulator directly to the indicator and see if the indicator is operational. If the indicator's display is drifting, or not what is expected, there may be a problem with the analog input stage, the excitation supply, or the sense circuitry. Several simulators may be connected in parallel to effectively "load" down the excitation supply circuits to check for correct operation with multiple load cells.
2. What is the number of display graduations with the simulator output set to different settings? By measuring the excitation voltage and multiplying by the setting on the simulator, the actual input signal to the indicator can be accurately calculated. This may help determine whether or not there is sufficient gain and low signal sensitivity in the indicator for operation with low output systems. The linearity of the indicator may also be checked this way. Also, if after installation and calibration of a system, a simulator is substituted for the load cells and the value displayed for the zero and one of the other calibrated settings (ie: 1 mV/V) are recorded, later recalibration or repair can be greatly simplified by direct comparison of the displayed value with the previously recorded values.
3. Does the displayed value change or start drifting, after other equipment or load cells are connected? Problems with transient protection boards, junction boxes, auxiliary power supplies and load cell cables can be tracked down step by step by starting at the indicator and moving the simulator(s) down the line to the load cells. When testing a portion of the system, make sure all other un-tested parts of the system are not connected.
4. When using the vernier (Ranger 1 or 5), do setpoint outputs and the display change as expected? Problems with output boards, setpoint routines and batching equipment can easily be found by using the variable vernier output of the Range 1 or 5 to simulate the effect of changing amounts of weight on the system. In addition, inappropriate filtering settings that may not be apparent normally, may sometimes be identified this way.
5. Are the load cells working properly? By substituting a simulator for each load cell in a system, drifting cells, unevenly loaded cells, or other cell related problems can be identified. After installation of a simulator in place of a load cell, note the zero and span readings for the simulator in that particular position (vernier turned off). If the zero and span readings are substantially different when the simulator is moved from cell to cell, and these differences are not consistent with the design of the scale, suspect cells can be easily identified.

4.0 Sample Calculations

A Ranger simulator may be used to perform calibration of scale systems prior to installation, or for testing installations prior to installation. These are NOT procedures that can be used to certify a scale, but they will provide calibration results satisfactory for most process weigh scales. Checking the scale calibration with known weights, or product substitution (with a verified value) is recommended.

Using a simulator, digital voltmeter, and calculator to calibrate a scale

The following tools are required:

- Ranger simulator
- Digital voltmeter (4 digit minimum, 5 digit recommended)
- Calculator

Use the following steps to calibrate a scale using a simulator, digital voltmeter and calculator.

1. millivolt Output Average Calculation: If load cell calibration certificates are available for the system load cells, add the full scale millivolt output values, and divide the sum by the number of load cells in the system.

   Example: 2.997 + 3.002 + 2.995 + 2.999 = 11.993 / 4 = 2.99825 mV

   If the load cell calibration certificates are not available, the nominal full scale millivolt output of the load cells is used as the average millivolt output (2mV/V or 3mV/V most common).

   Unless the system load cells vary significantly from the nominal value, the calibration results will be very similar.
2. With your digital volt meter in the volts setting, measure the excitation voltage at the junction box home run cable +/- excitation connections, and record the value.
3. Full Scale Output Signal Calculation: Multiply the millivolt output average value from step 1, by the excitation voltage value from step 2.

   Example: 2.99825 x 9.9875 = 29.945 mV.

   This is the full scale millivolt output of the scale at the total load cell capacity (individual load cell capacity x the number of load cells in the scale).
4. Total Load Cell Capacity: Multiply the individual load cell capacity by the number of load cells in the system.

   Example: (10,000 lb x 4 = 40,000 lb) 40,000 lb is the Total load cell capacity.
5. Signal per Scale Division: Divide the total load cell capacity from step 4 by the scale resolution value (if the scale is to be calibrated to 25,000 x 5 lb, the scale resolution value is 5 lb). 40,000 / 5 = 8,000. This is the number of divisions over the total load cell capacity. Divide the full scale millivolt output value from step 3 by this value.

   Example: (29.945 mV / 8,000 = 0.003743 mV) this is the signal per division (signal change for each 5 lb scale change, based on the example).
6. Span Range Signal Calculation: Multiply the signal per division value from step 5 by the number of divisions over the calibrated range of the scale (25,000 lb / 5 - 5000 x 0.003743 - 18.715625 mV). This is the span signal range to which the scale will be calibrated.
7. With the scale empty, perform the normal ZERO calibration procedure (refer to the indicator manual). Enter the calibrated scale capacity as the SPAN value (25,000 in the example in Step 6).
8. With your digital volt meter set to the millivolt range, measure the signal at the junction box home run cable +/- signal connections, and record the value. this is the scale millivolt output value at calibrated ZERO. Example: 4.245 mV (this is a random value selected for this exercise).
9. Span Calibration Signal Calculation: Add the calibrated ZERO millivolt value from Step 8 to the Span Range value from Step 6 (18.715625 + 4.245 = 22.960). This is the Span Calibration Signal value.
10. Power down the digital weight indicator and disconnect the home run cable at the junction box. Connect the home run cable to your scale simulator. Reapply power to the digital weight indicator. With your digital volt meter set to the millivolt range, measure across the +/- signal terminals of the scale simulator,

and adjust the simulator until your volt meter value equals the Span Calibration Signal value calculated in Step 9.

11. Perform the indicator SPAN calibration procedure (refer to the indicator manual). The load cell simulator adjusted to the value from Step 9, is simulating the test weight load at the calibrated capacity (25,000 lb in this example).
12. Return the indicator to the normal weigh mode. Power down the indicator, disconnect the simulator, and reconnect the home run cable at the junction box. Reapply power to the indicator. Provided that the scale is still empty, the indicator should read 0 lb. Re-zero the scale if necessary. The scale is now calibrated.

Pre-Calibrating an Indicator Using a Simulator (Ranger 3 and 5 Only)

For this example we will pre-calibrate an indicator that will be connected to a single load cell application. The cell capacity is 500 lbs, rated output is 2 mV/V, and the actual output on the cell's certificate is 2.002 mV/V.

1. Calculate the units per millivolt: Divide the load cell capacity (500) by the actual output (2.002) to get 249.7502 lbs per millivolt.
2. Calculate the actual weight expected for the 2 mV/V setting on your simulator by multiplying the value from Step 1 (249.7502) with the mV/V setting of the simulator and get 499.5005.
3. Connect the simulator to the weight indicator and allow the indicator to warm up for 5-10 minutes.
4. Set the simulator mV/V selector switch to 0 (vernier off) and calibrate for Zero.
5. Set the simulator mV/V selector switch to the setting used in Step 2 (for this example, 2 mV/V).
6. Calibrate the span of the indicator using the actual weight expected value from Step 2 as the weight value (WVal for most Rice Lake indicators), 499.5005 lbs. for this example.
7. When the indicator is connected to the actual scale, use the calibration REZERO function to account for any deadload on the load cell.

5.0 Product Specifications

Impedance:	Ranger 1:	700 ohms nominal
	Ranger 3 & 5:	350 ohms nominal
Output Ranges:	Ranger 1:	0 to 3 mV/V continously variable
	Ranger 3 & 5:	-0.5, 0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, and 4.5 mV/V
Vernier (Ranger 5 only):	Fine:	-0.02 to +0.5 mV/V of selected range
	Medium:	-0.05 to +1.5 mV/V of selected range
	Course:	-0.12 to +3.0 mV/V of selected range
Accuracy (Ranger 3 & 5):	+/-0.02% of selected range	
Zero Offset (Ranger 3 & 5):	Ranger 1 +0.005 mV/V Max	
	Ranger 3 & 5 +0.0005 mV/V Max	
Normal Operating Temp.:	-10°C to + 40°C	
Temperature Coefficient:	Ranger 1:	100 ppm/ °C
	Ranger 3 & 5:	5 ppm/ °C
Excitation Voltage:	15 VDC/AC Max	
Unit Size:	3.5"W x 4.5"L x 2.2"D	
Weight:	0.55 lbs (Ranger 5)	
Enclosure:	Flame retardant ABS plastic	