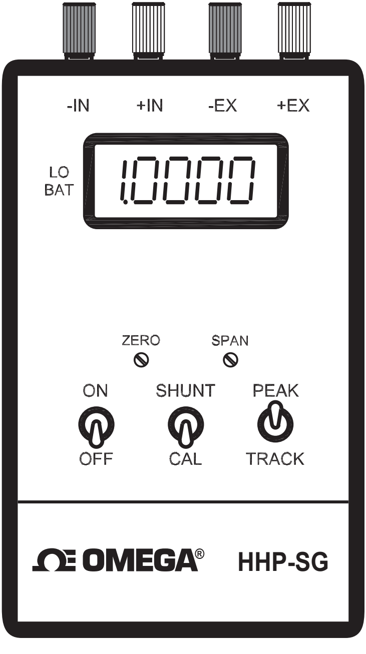
User's Guide



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HHP-SG

Handheld Strain Gage Indicator
Operator's Manual

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FIGURES

TABLES

1.1 Unpacking

Remove the packing list and verify that you have received all equipment. If you have any questions, contact the Customer Service Department nearest you.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Note 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.

Please ensure that a 9 Volt battery is included.

1.2 General Description

The hand held calibrator is a digital indicator for strain gage type transducers such as load cells, torque sensors, or millivolt pressure sensors. It provides excitation voltage for the transducer and displays the readings on a liquid crystal display (LCD). The LCD has a 3 1/2 active digits (0-1999 counts) and an additional dummy zero if needed. The calibrator can display either the actual value of the signal (tracking mode) or the peak value (peak mode). It operates on a standard 9 Volt battery and provides an indication of low battery.

1.2 General Description (continued)

It has two internal reference voltages for powering the bridge. The 1.24 Volt reference is used with the 1K Ohm bridge and below whereas the 2.5 Volt with the 2.5K/5K Ohm bridges and above. Failure to properly select the excitation voltage can result in the calibrator drawing excessive current.

(The calibrator provides amplification, common-mode rejection and controls the LCD Display).

The calibrator is designed for 0.5 to 4.0 mV/V bridge sensitivity range. A ZERO POT and SPAN POT is provided for calibration. See Section 4 for more details.

1.3 Features

- Portable, hand held indicator for bridge type transducers
- 9 Volt battery powered
- Scalable display with dummy zero
- Built-in transducer excitation
- Track/peak modes available
- Selectable decimal point
- Low battery indication
- Blanking overrange

SAFETY CONSIDERATIONS 2

This device is marked with the international Caution symbol. It is important to read this manual before installing or commissioning this device as it contains important information relating to Safety and EMC (Electromagnetic Compatibility).

Note ☞

Unpacking & Inspection

Unpack the instrument and inspect for obvious shipping damage. Do not attempt to operate the unit if damage is found.

Note ☞

- Always disconnect power before changing signal and power connections.
- Do not use this instrument on a work bench without its case for safety reasons.
- Do not operate this instrument in flammable or explosive atmospheres.
- Do not expose this instrument to rain or moisture.
- Allow for adequate ventilation to ensure instrument does not exceed operating temperature rating.
- Use electrical wires with adequate size to handle mechanical strain and power requirements. Install without exposing bare wire outside the connector to minimize electrical shock hazards.

EMC Considerations

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use signal wire connections with twisted-pair cables.
- Install Ferrite Bead(s) on signal wires close to the instrument if EMC problems persist.

3 INSTALLATION AND OPERATION

3.1 Front of the Meter

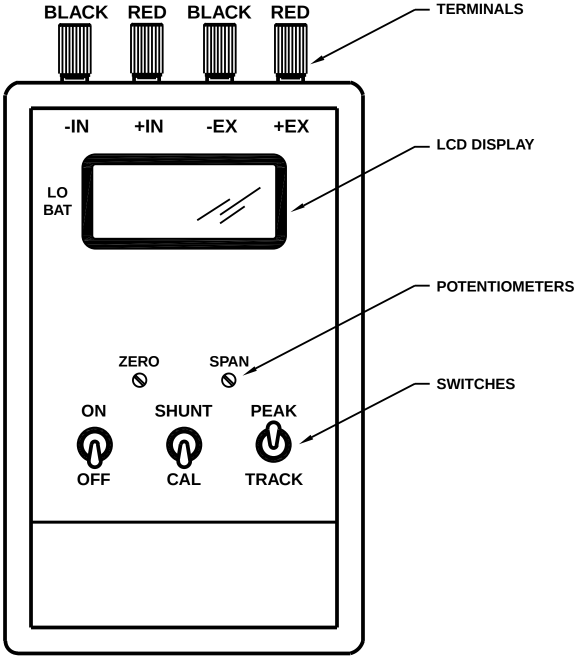

Figure 3.1 — Front Panel

DESCRIPTION

ON/OFF Switch — controls power flow from the battery to all circuits.

SHUNT CAL Switch — places a known resistor (59 K Ohm) across the transducer, so that a known output (half scale, 1000 count approximately) is seen, and is used to self-calibrate the instrument.

Note: a count of 1000 is applicable only to a 350 Ohm bridge.

PEAK/TRACK Switch — selects the mode of operation of the instrument. In the PEAK mode, the instrument will retain the reading of the most positive value detected during the operation. In the TRACK mode, the instrument will continuously follow the variations of the input signal. To reset the peak (when in peak mode), merely switch the instrument to the track mode.

ZERO Potentiometer — is used to obtain a zero indication, thus compensating for drifts and electrical offsets that may exist in the transducer or the instrument.

SPAN Potentiometer - adjusts the fine gain of the amplifier. It is used to assure proper gain-level setting per given transducer.

LCD Display — appears through a window on the front panel. The LO-BATT indication appears at the upper left side of the display and indicates when the 9 Volt battery has dropped below 5.2 Volts.

TERMINALS — Above the front panel are four connectors used to power and read from the transducer. The front-panel label describes the function of each terminal.

3.2 Back of the Meter

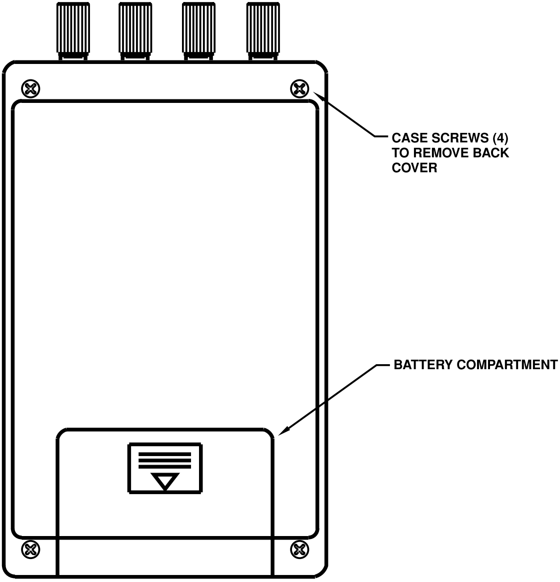

Figure 3.2 — Rear View

3.3 Factory Setting

The calibrator is factory configured to:

- 1XXX.0 decimal point location
- No dummy zero
- 2.5 Volt Transducer excitation
- 3 mV/V sensitivity

If any of the previous characteristics do not suit your application, follow steps in Section 4 of this manual to reconfigure to your needs.

3.4 Battery Installation or Replacement

3.4.1 Turn off the calibrator.

3.4.2 Remove the battery compartment door located on the rear of the unit, sliding the door in the direction of the arrow.

3.4.3 Remove the battery from the compartment and carefully remove it from the battery clip. Do not pull on the wires on either end.

3.4.4 Attach a new battery to the battery clip observing polarity and place the battery back into its recess in the case.

3.4.5 Replace the battery compartment door.

Note If you see (LO-BAT) in the upper left of the LCD, the battery voltage is 5.2 Volts or less. It is time to replace the battery.

3.5 Transducer Hookup

Connect the transducer to the calibrator using the binding post connectors shown in Figure 3.1. Observe proper color coding as shown on the Transducer Information Sheet provided with your transducer. Allow the transducer to warm up for a few minutes, to stabilize the drift.

CALIBRATION, GAIN SELECTION AND ADJUSTMENTS

4.1 ZERO CALIBRATION

Close appropriate switches to obtain desired gain. See Table 4.1 and 4.2 for proper selection. Gain selection is the initial step for ZERO calibration. This also provides course SPAN calibration as well.

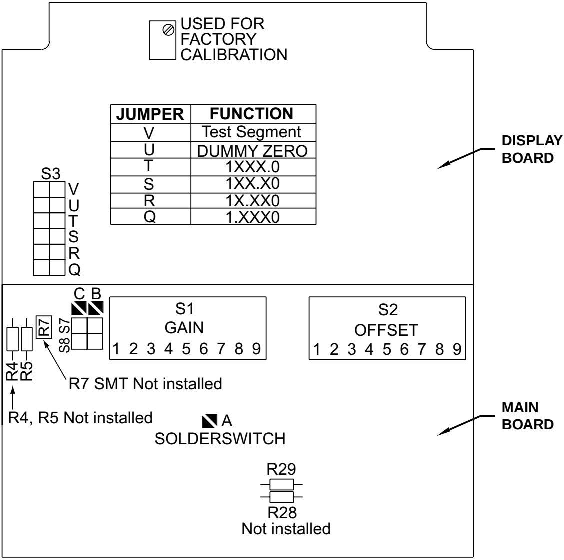

Figure 4.1 — Switches & Jumper Locations

Table 4.1

GAIN RESISTOR SELECTION FOR 1.24 VOLTS EXCITATION VOLTAGE

SENSITIVITY (mV/V)	S8	S1-7	S1-6	S1-5	S1-4	S1-3	S1-2	S1-1
0.45 to 0.49	C	C	C	C	C	C	C	C
0.50 to 0.54	C	C	C	C	O	C	C	O
0.55 to 0.59	C	C	C	O	O	O	C	O
0.60 to 0.65	C	C	O	C	O	O	O	O
0.66 to 0.72	C	O	C	C	O	C	C	O
0.73 to 0.79	C	O	O	C	O	C	C	C
0.80 to 0.87	C	O	O	C	C	O	O	O
0.88 to 0.96	C	O	O	O	C	O	O	O
0.97 to 1.05	O	C	C	C	C	O	O	C
1.06 to 1.16	O	C	C	O	C	O	C	O
1.17 to 1.27	O	C	O	C	C	O	C	O
1.28 to 1.40	O	C	O	O	O	C	C	C
1.41 to 1.54	O	C	O	O	O	O	C	C
1.55 to 1.70	O	C	O	O	O	O	C	O
1.71 to 1.87	O	O	C	C	O	C	C	C
1.88 to 2.06	O	O	C	C	C	O	O	C
2.07 to 2.27	O	O	O	C	C	C	C	C
2.28 to 2.49	O	O	C	O	C	O	C	O
2.50 to 2.74	O	O	O	C	C	C	O	C
2.75 to 3.02	O	O	C	C	O	O	O	O
3.03 to 3.32	O	O	C	O	O	C	O	O
3.33 to 3.65	O	O	O	O	C	O	C	C
3.66 to 4.02	O	O	O	O	O	C	C	C
4.03 to 4.42	O	O	O	C	O	O	C	O
4.43	O	O	O	O	C	C	O	O

Note ☞ (C=CLOSE / O=OPEN)

FOR 1.24V EXCITATION S1-8 CLOSED.

Table 4.2

GAIN RESISTOR SELECTION FOR 2.50 VOLTS EXCITATION VOLTAGE

SENSITIVITY (mV/V)	S8	S1-7	S1-6	S1-5	S1-4	S1-3	S1-2	S1-1
0.45 to 0.49	O	C	C	C	C	C	O	C
0.50 to 0.54	O	C	C	O	C	O	C	C
0.55 to 0.59	O	C	C	O	O	C	C	O
0.60 to 0.65	O	C	C	O	O	C	O	O
0.66 to 0.72	O	C	C	O	O	O	O	O
0.73 to 0.79	O	C	O	O	O	C	O	C
0.80 to 0.87	O	C	O	O	O	C	O	O
0.88 to 0.96	O	O	C	O	C	C	C	C
0.97 to 1.05	O	O	C	C	O	O	C	C
1.06 to 1.16	O	O	C	C	C	O	O	O
1.17 to 1.27	O	O	C	O	C	C	O	O
1.28 to 1.40	O	O	C	O	O	C	O	C
1.41 to 1.54	O	O	C	O	C	O	O	O
1.55 to 1.70	O	O	O	C	O	C	C	O
1.71 to 1.87	O	O	O	O	C	C	O	C
1.88 to 2.06	O	O	O	C	C	O	O	O
2.07 to 2.27	O	O	O	O	C	O	C	O
2.28 to 2.49	O	O	O	O	C	C	O	O
2.50 to 2.74	O	O	O	O	O	O	C	C
2.75 to 3.02	O	O	O	O	O	C	O	C
3.03 to 3.32	O	O	O	C	O	O	O	O
3.33 to 3.65	O	O	O	O	C	O	O	O
3.66 to 4.02	O	O	O	O	O	O	C	O
4.03 to 4.42	O	O	O	O	O	C	O	O
4.43	O	O	O	O	O	O	O	C

(C=CLOSE / O=OPEN)

Note ☞ FOR 2.50V EXCITATION S1-9 IS CLOSED.
See NOTES 1, 2, and 3 at end of section.

4.1.1 Apply zero signal.

4.1.2 Using Table 4.3, select and Close the appropriate switches. (if any)

Table 4.3

ZERO RESISTOR SELECTION

FUNCTION			
SWITCH	**ZERO OFFSET VOLTAGE**	**DISPLAY COUNT (1.24 VOLT EXC.)**	**DISPLAY COUNT (2.50 VOLT EXC.)**
S2-1	-40 mV	-757 (±3)	-729 (±3)
S2-2	-20 mV	-373 (±3)	-358 (±3)
S2-3	-10 mV	-184 (±3)	-177 (±3)
S2-4	-5 mV	-90 (±3)	-86 (±3)
S2-5	+5 mV	+92 (±3)	+87 (±3)
S2-6	+10 mV	+186 (±3)	+177 (±3)
S2-7	+20 mV	+373 (±3)	+357 (±3)
S2-8	+40 mV	+756 (±3)	+726 (±3)
S2-9	+80 mV	+1543 (±3)	+1478 (±3)
S2-None	0 mV	0 (±3)	0 (±3)

4.1.3 This will provide coarse adjustment.

4.1.4 Use ZERO POT to fine tune to a display count of 000.

4.2 SPAN CALIBRATION

4.2.1 Adjust ZERO POT to a 000 display count as suggested in section 4.1.

4.2.2 Apply full scale signal per given strain gage. For 3mV/V and 1.24 V excitation, apply 3.720 mV at ± SIGNAL input.

4.2.3 Use SPAN POT to fine tune to a 1999 display count.

4.3 After proceeding through the steps above, apply a ZERO signal again and check for a 000 display count. If the ZERO has shifted, repeat the steps for ZERO and SPAN calibration.

Table 4.4

S3 JUMPER SWITCH DESCRIPTION

JUMPER SWITCH	FUNCTION SELECTED DECIMAL POINT POSITION
V	TEST SEGMENT
U	DUMMY ZERO
T	1XXX.0
S	1XX.X0
R	1X.XX0
Q	1.XXX0

Table 4.5

SOLDER SWITCH DESCRIPTION

SOLDER SWITCH	FUNCTION
A	Output is connected to SPAN POT. See NOTE 4.
B	Gain Resistor R6 (750 Ohm) is selected. See Table 4.1 and 4.2.
C	Gain Resistor R7 (OPEN) is selected. Default OPEN. See NOTE 5.

CALIBRATION & GAIN SELECTION

Note ☞

1 The sensitivities increase in 10% increments. The SPAN POT range is ±10% which should cover the entire sensitivity range from 0.5 to 4.0 mV/V. Two extra through-hole resistor locations R4, R5 and one surface mount resistor, R7 are available for covering any sensitivity value not covered by resistors in the tables above. (See Figure 4.1).

2 The required through hole resistor value can be calculated by using the following formulas:

R-gain (Gain setting resistor) = 60,000/(Gain-4) where

Gain (Design gain) = V-out/(V-sensitivity x V-excitation)

Units are in Volts and Ohms.

3 The formulas above will give you the correct output when the SPAN POT is connected to the circuit. With the SPAN POT in the circuit, it will give you twice the desired output. Therefore V-out equal to half the required output should be used. Examples are shown below:

Example: V-out = 100 mV (a V-out of 100mV will give you an actual output of 200mV) (1999 counts on the LCD Display)

V-sensitivity = 3 mV/V
V-excitation = 1.24 Volts

Gain = 100 mV/(3 mV/V x 1.24) = 26.9
R-gain = 60,000/(26.9-4) = 2.62 K Ohms

4 For SPAN POT to be connected and the output adjustable, solder switch "A" needs to be Open.

5 R4, R5 can be any through-hole resistor value as required.

R7 can be any surface mount resistor value as required.

5.1 CUSTOM SCALING PROCEDURE

Use this procedure if you desire to scale your Strain Guage Indicator with other than the standard default scaling of 1999 counts equaling a full-scale reading.

1 Determine the full-scale reading you desire in terms of counts. This must be between 0 and 1999 counts.

Example: You desire a full-scale reading of 500 counts to correspond to an actual reading of 50.0 in/lbs.

2 Divide the number of counts determined in step 1 by 10 to obtain the number of mV required to achieve the desired counts.

Example: $\frac{\text{500 counts}}{10} = \text{50 mV}$

3 Divide the number of mV obtained in step 2 by 2.

Example: $\frac{\text{50 mV}}{2} = \text{25 mV}$

4 Determine the full-scale output of your device (load cell, strain gage, etc.) in terms of mV.

Example: You have a torque cell with a full-scale output sensitivity of 2.2249 mV/V. Multiply this value by the excitation voltage you have selected. (e.g. 1.24V or 2.50V)

2.2249 mV/V x 1.24V = 2.7588 mV

5 Divide the result of step 3 by the result of step 4.

Example: $\frac{\text{25 mV}}{2.7588} = 9.06$

(This value is the amplifier gain that is necessary to give you the full-scale reading you desire.)

6 Look up the gain value calculated in step 5 and find the closest gain value in Table 5.1. (If the value of gain required is not contained in Table 5.1, skip to step 14)

7 Read across the table to find the gain desired and the gain switch settings necessary to give you that value.

Table 5.1 (partial)

Example:

S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S8	GAIN
C	O	O	O	O	O	O	O	9

8 Open up the Indicator case by removing the four screws which hold the rear cover in place. (see Figure 3.2)

9 Set the gain resistor switches to the positions indicated in step 7. (open is up, and closed is down)

10 Select the decimal point location (if desired) by using the push-on jumpers “Q” through “T” on the display circuit board. Also select the dummy zero (if desired) by installing the push-on jumper “U” on the display circuit board.

11 Close the Indicator case by installing the four screws removed in step 8.

12 Connect your device to the Indicator terminals.

13 Adjust the ZERO and SPAN pots on the Indicator as necessary to obtain the exact reading you desire.

ALTERNATE PROCEDURE FOR GAINS OUTSIDE OF TABLE 5.1 RANGE

14 Use this procedure if the gain value calculated in step 5 is not contained within Table 5.1.

15 Insert the result of step 5 into the following formula:

$$\text{Rgain (ohms)} = \frac{60{,}000}{(\text{step 5 result} - 4)}$$

Example: $\text{Rgain (ohms)} = \frac{60{,}000}{(9.06 - 4)} = 11{,}857 \text{ ohms}$

16 Obtain the nearest standard 1% resistor value that is closest to the step 15 result.

Example: 11,857 ohms = 11,800 ohms

17 Open up the Indicator case by removing the four screws which hold the rear cover in place. (see Figure 3.2)

18 Solder the resistor obtained in step 16 into the Indicator main circuit board R4 or R5 location. (The main circuit board is the one with the two 9-position DIP switches located on the board.)

19 Open up all other gain resistors by opening up S1-1 through S1-7 switches (open is up, closed is down) and also open up solder switches "B" and "C" and remove push-on jumpers S7 and S8 all on the main circuit board.

20 Select the decimal point location (if desired) by using the push-on jumpers "Q" through "T" on the display circuit board. Also select the dummy zero (if desired) by installing the push-on jumper "U" on the display circuit board.

21 Close the Indicator case by installing the four screws removed in step 17.

22 Connect your device to the Indicator terminals.

23 Adjust the ZERO and SPAN pots on the Indicator as necessary to obtain the exact reading you desire.

Table 5.1 Gain Switch Settings

S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S8	GAIN
C	C	C	C	C	C	C	C	176
C	C	C	O	O	C	C	C	159
C	C	C	O	O	O	C	C	143
C	O	C	C	C	C	O	C	129
O	C	O	C	O	C	O	C	116
C	C	O	C	O	O	O	C	104
O	O	O	O	C	O	O	C	93
O	O	O	O	O	O	O	C	84
O	C	O	C	O	C	C	O	76
O	O	C	C	C	O	C	O	68
O	O	O	O	O	C	C	O	61
O	O	O	O	C	O	C	O	54
C	O	C	C	C	C	O	O	49
O	O	C	C	C	C	O	O	44
C	O	C	C	O	C	O	O	40
O	C	O	C	O	C	O	O	36
C	C	O	O	O	C	O	O	32
O	O	O	C	O	C	O	O	29
C	O	O	O	O	C	O	O	26
C	O	C	C	O	O	O	O	23
O	O	O	C	C	O	O	O	21
O	C	O	C	O	O	O	O	19
O	C	C	O	O	O	O	O	17
C	O	C	O	O	O	O	O	15
O	O	O	O	C	O	O	O	13
O	O	O	C	O	O	O	O	12
O	C	O	O	O	O	O	O	11
O	O	C	O	O	O	O	O	10
C	O	O	O	O	O	O	O	9
O	O	O	O	O	O	O	O	4

(C=CLOSE / O=OPEN)

Accuracy:	± 0.1 %
Supply Voltage:	9 Vdc Transistor Battery
Battery Life:	15 hours minimum with 350 ohm bridge transducer
Supply Current:	20 mA Maximum (350 Ohm Bridge)
Display Output:	3 1/2 Digit LCD Display with Dummy Zero, (1999 counts FS)
Digit Height:	0.4”
Bridge Resistance:	350 ohm to 5K ohm
MinimumTransducer Resistance:	350 ohms
Transducer Excitation:	1.24 Vdc or 2.50 Vdc
Input Signal Sensitivity:	0.5 TO 4 mV/V for full-scale indication of 1999 counts
Conversion Rate:	3 Readings per second
Rollover Error:	± 1 Count maximum
Linearity:	± 1 Count maximum
CMRR:	100 dB
Overvoltage Protection:	15 Vdc Maximum
Excitation Output:	5 mA Maximum (not short circuit protected)
Operating Temp. Range:	0ºC to 70ºC (32ºF to 158ºF)
Storage Temp. Range:	-15ºC to 85ºC (5ºF to 185ºF)
Humidity Level:	85% or less

6 SPECIFICATIONS

Features:
- Scalable display with dummy zero
- Selectable decimal point
- Low voltage indication @ 5.2 Volt
- Blanking overrange
- Peak Detector, < 0.03% per minute bleed-off

Case: Molded ABS Plastic

Dimensions: 3.6" X 6.6" X 1.4"
(91.4 X 167.6 X 35.6mm)

M3369/0516