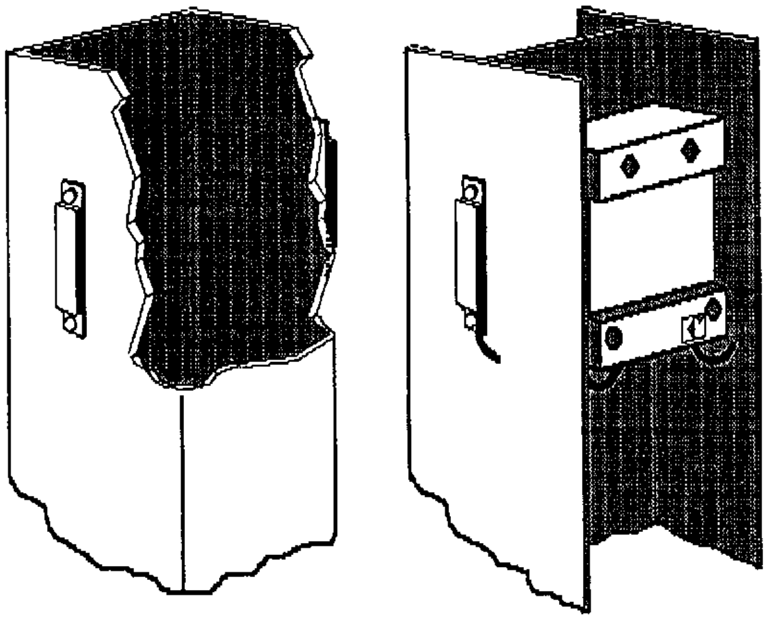
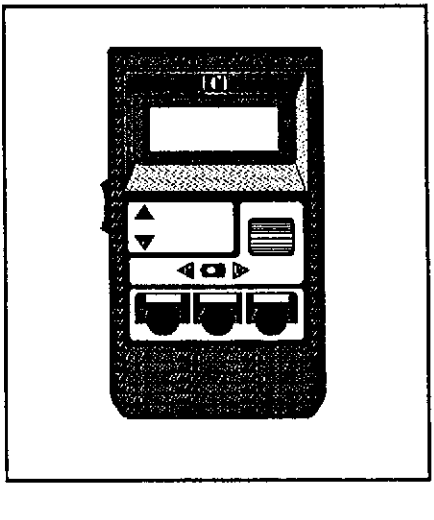
Kistler-Morse® Microcell® Installation and Maintenance Kit Manual





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Microcell® Installation and Maintenance Kit Manual

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Chapter 1. Equipment Description

INTRODUCTION

The Kistler-Morse Microcell® Installation and Maintenance Kit allows you to try Microcells in a specific application before purchasing a large system. If you already have a Microcell system in place, the kit can be used to replace an existing Microcell(s) that has been damaged.

The Microcell can be mounted on just about any metal structure where measurement of strain and stress caused by compression, bending, shear, torsion, or tension of the metal is desired. When a metal structure is subjected to loading, the structural members elastically deform. The Microcell measures the change in the metal (whether it be stress, strain, compression, etc.) and converts it to a proportional voltage output. The voltage output can then be converted to a weight measurement.

FEATURES AND BENEFITS

Sensor

Sensor Output 900 mV at 10,000 psi - Highly sensitive, can be used with common voltmeters, data acquisition, and signal conditioners

Half Bridge Design - Easily incorporated into measurement systems

Bolt-On Installation - Simple installation that needs no special tools. No glue or special procedures needed for installation. Sensor is reusable for multiple applications.

Linearity 0.1%, Nonrepeatability and Hysteresis 0.05% - Accurate enough for laboratory and industrial use.

Temperature Compensated 0° to 100° F - Will perform within specification over broad temperature range

Nickel plated AISI 1018 Carbon Steel Base - For use on a broad range of applications made of steel. (Aluminum sensor is available on request for alumiminum applications.)

Test Meter

Readout Shows Millivolt Output of Sensor - Monitor sensor output during installation: no overload.

Battery Operation - Can be used as primary indicator for temporary or remote inspection of stress values.

PARTS LIST

Table 1-1 lists all of the components in the Microcell Installation and Maintenance Kit.

1. Case	10. Case Label
2. Test Meter	11. Plastic Vial and Cap
3. 2 #503 Microcells	12. Gasket Sealant
4. Steel Template	13. hex Wrench
5. Silicon Grease	14. 4 Socket-Head Screws, 8-32 x 5/16
6. Flat Cover	15. 4 #8 Washers
7. Curved Cover, 3" x 6"	16. #29 Drill Bit
8. Curved Cover, 6" x 8"	17. 8-32 Tap
9. Case Label	18. Manual

Table 1-1. Microcell Installation and Maintenance Kit Parts List.

Chapter 2. Applications

INTRODUCTION

This chapter lists different applications where a Microcell sensor can be applied. Also provided in this chapter are pictoral discriptions of the different forces to which a metal structure can be subjected.

APPLICATION EXAMPLES

The following is a list of different applications where a Microcell can be used.

Laboratory

- Force and deflection measurement sized to suit any application and load range.

OEM/Components

- Provide electrical feedback from mechanical events
- Machine Tools - presses, rollin mills

Structural

- Crane overload monitor
- Structure overload monitor

Clamping Force Monitor

- Injection molding clamping force

Force Measurement

- Dynomometer
- Rolling forces in steel mill

Torsion Measurement

- Large rotating machinery

Tension Measurement

- Cable tension
- Lifting force

Structural Analysis

- Determine direction of stress
- Determine magnitude of stress

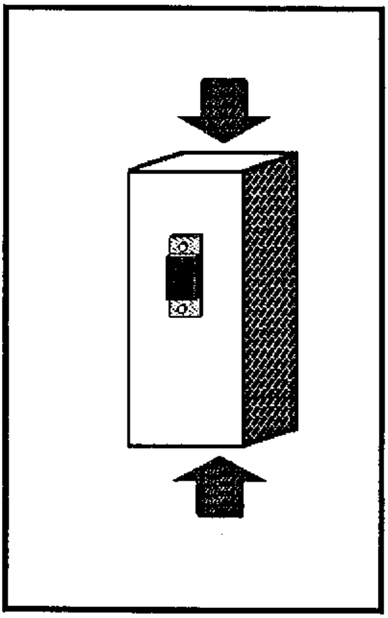
MICROCELL MOUNTING LOCATIONS

The illustrations in this section depict the different forces to which a metal structure can be subjected. The illustrations also show the ideal mounting location of the Microcell on the structure to provide optimum measurement of each type of force. Refer to these illustrations to identify the type of force your Microcell will be measuring and the proper mounting location before following the installation procedure in chapter 3.

Compression

To measure strain from compressive loads:

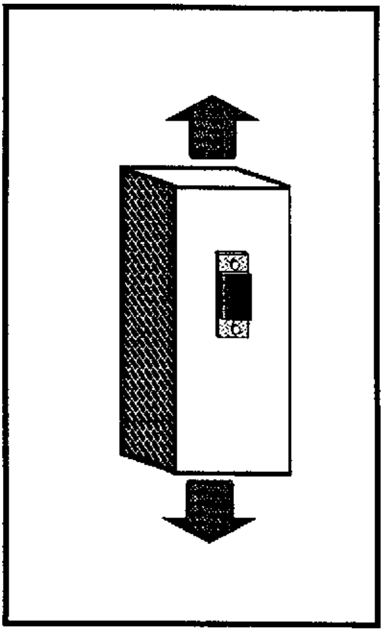
- Orient sensor along axis of deflection. Avoid areas with bending or buckling.
- Mount sensor on axis of symmetry, if possible, to minimize sensitivity to bending.



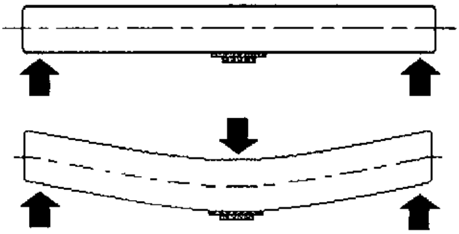
Tension

To measure strain from tensile loads:

- Orient sensor along axis of deflection.
- Apply force in a way that does not introduce moments of bending.

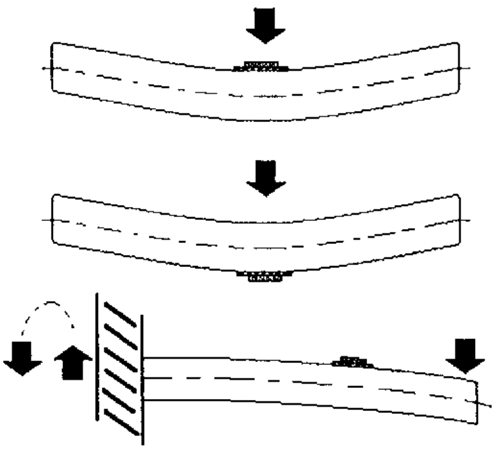


Bending



Stress and strain:

- Any shape when loaded and bent has a neutral fibre and regions of tension and compression.
- The resulting strain will be greatest the furthest distance from the neutral axis.

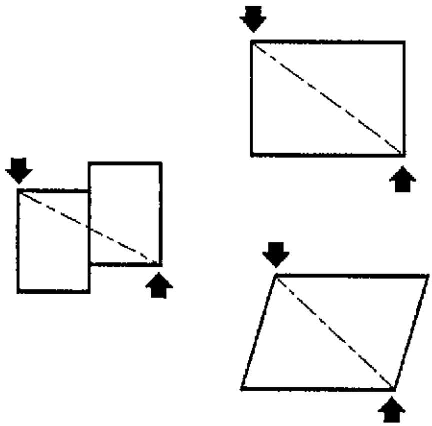


To measure strain from bending loads:

- Sensor mounted in areas where tension or compression fibres exist.
- Usually mounted farthest away from meutral axis for highest output.

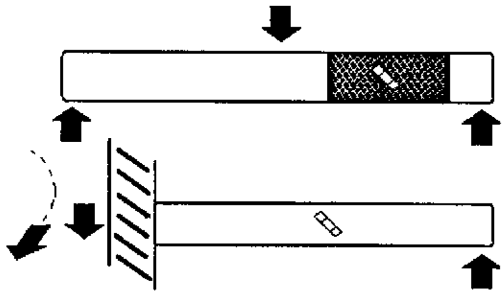
Shear

Stress and strain:

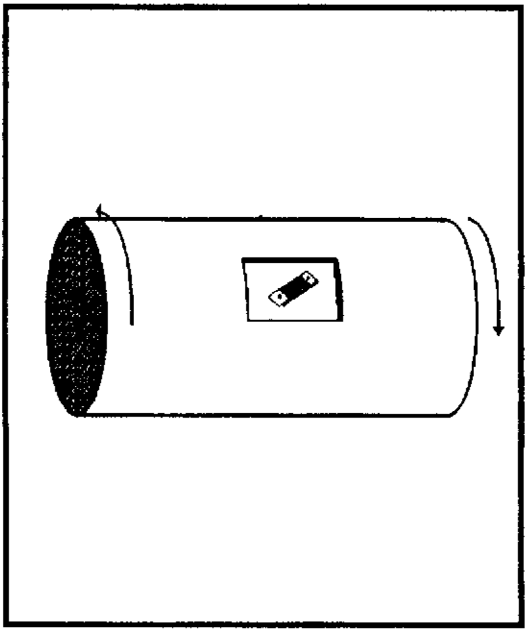


- Two opposing forces cause a shearing deflection which displaces the metal as if by cutting:
- Strain is measured as pure compression along the principal axis of stress. This axis, line in the illustration, is compressed when forces act on the body.

To measure strain from shear loads:



- Orient sensor 45° from vertical which is the principal stress/strain axis.
- Sensor is inclined in a direction that roughly connects applied force and reaction point
- Sensor may be placed anywhere between the two applied forces. (shaded region)



Torsion

To measure torsion in large shafts:

- Position sensor between opposing loads.
- Orient at 45° with respect to longitudinal axis.
- Mount on machined flat.

Chapter 3. Installation and Calibration

This chapter describes how to install the Microcell(s) to a structure. Calibration procedures once the Microcell is installed are also provided.

INSTALLATION

If you have yet to do so, review the application examples in chapter 2 and identify the one that best illustrates your particular application. Locate the most suitable area on your structure to install your Microcell by observing the placement of the Microcell in the example. Once you have done so, follow this procedure to install the Microcell.

Note

Installing the Microcell is a simple, straightforward process that can be done with standard tools.

1. Position the Microcell drill template on your structure at the chosen location and angle. Drill a hole with the #29 drill bit provided in the kit. (Using a good quality drilling lubricant will make the job easier.)
2. Tap the hole to a depth of four complete threads using the 8-32 tap and screw the template tightly in place with the 8-32 socket-head screw.
3. Drill and tap the other hole using the template as a guide.
4. Remove the template. Use a grinder to grind off the structure's finish to the bare metal. Grind a rectangular area about 1/4-inch larger than the Microcell on all four sides. The metal surface should be smooth and flat.
5. Apply rust-inhibiting silicon grease on the metal surface directly beneath the Microcell. Be careful not to get grease on the area of the structure where the cover will adhere.
6. Attach the Microcell loosely to the structure with the 8-32 socket-head screws and #8 washers provided.
7. Connect the test meter to the Microcell by pressing the terminals down and threading the wires through the holes. Be sure to connect red wire to red terminal, black wire to black terminal, and white wire to white terminal. Position the switch to DISPLAY STRAIN and turn on the power.

8. Zero the test meter with the ADJUST dial. Observe the output while tightening the Microcell hardware with the 9/64" hex wrench provided in the kit. The reading should remain within 50 millivolts of the base reading.

9. Tighten the two screws alternately until they are both snug. If the test meter voltage remains within the 50 millivolts of the starting point, the Microcell is attached correctly.

10. If the reading goes strongly negative, the Microcell is being tightened into tension. The remedy is to loosen both screws. Retighten one screw and, while squeezing the Microcell to provide an artificial offset, retighten the second screw.

11. If the reading went strongly positive when the Microcell was first tightened down, loosen both screws. Retighten the screw that is away from the electrical cable. Pull downward on the case and retighten the second screw.

12. If the remedies described in steps 10 and 11 do not bring the voltage into tolerance (+/- 50 millivolts from the base reading), remove the Microcell and regrind the structure's surface to make sure it is flat and that there is no mechanical interference. Also check the alignment of the holes

13. Once the Microcell is properly attached to the support, apply the special K-M moisture-proof gasket sealant to the rim of the cover. Place the cover firmly in place over the Microcell.

Caution

If the moisture-proof gasket sealant provided in the kit is not used, use a sealant that is not acidic.

14. Smooth the sealant bead with your finger so that water cannot build-up along the bead.

Your Microcell is now completely installed and ready for use.

CALIBRATION

Converting the millivolt reading on the test meter to a weight measurement is a simple procedure. The example in this procedure describes a Microcell installed on the leg of a vessel. The principle of this calibration procedure is the same no matter where the Microcell is installed.

Calibration by Adding Material

This procedure describes how to calibrate the millivolt reading to weight by adding material to the vessel.

1. Once you have completely installed the Microcell per the installation procedure above, connect the test meter to the Microcell.

2. Zero the test meter display with the ADJUST dial.

3. Add a known amount of weight and observe the test meter reading. This gives you the millivolt-to-weight ratio needed to calculate weight in the vessel.

   For example, if you add 100 lbs of material to the vessel and the millivolt reading increases 75 mV, 200 lbs of material will increase the reading to 150 mV, etc. Knowing this ratio will allow you to calculate the weight in the vessel at any given time.

Calibration by Removing Material

Calibration can be done by removing material instead of adding material. This may be a more preferable method if the vessel is full.

1. Once the Microcell has been completely installed per the installation instructions, connect the test meter to the Microcell.

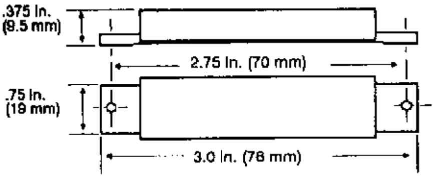
2. Zero the test meter display with the ADJUST dial.

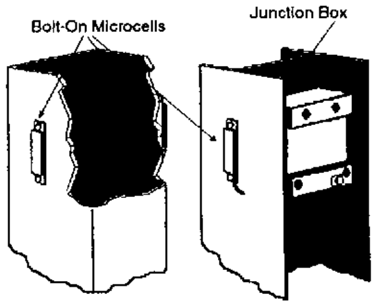
3. Remove a known amount of weight and observe the test meter reading. This gives you the millivolt-to-weight ratio needed to calculate weight in the vessel.

   For example, if you remove 100 lbs of material from the vessel and the millivolt reading decreases by 75 mV, removing 200 lbs of material will decrease the reading by 150 mV, etc. Knowing this ratio will allow you to calculate weight in the vessel at any given time.

Appendix A. Microcell Sensor Specifications

MOUNTING DIMENSIONS





Tubular Steel Application — I-Beam Application

SPECIFICATIONS

Input

Maximum Stress Level: 10,000 psi (7.0 kg/mm^2)

Electrical Excitation: Standard - 12V; Maximum - 30V

Excitation Current @ 12V: 4.0 mA @ 0° F (-18° C) to 2.7 mA @ 100° F (38° C)

Insulation Resistance: 2 Megohms

Output (for 12V excitation)

Rated Output: 1000 mV @ 10,000 psi (7.0 kg/mm^2) from bridge completion point

No Load Output: +/- 25 mV from bridge completion point

Nonlinearity: 0.1% rated output

Repeatability & Hysteresis: 0.05% rated output

Fatigue Life: In excess of one million cycles; load and unload

Environmental

Operating Temperature: -30° to 140° F (-34° to 60° C)

Compensated Temperature: 0° to 100° F (-18° to 38° C)

Temperature Sensitivity Shift: +/- 0.02%/$^\circ$F (AT = 50° F), (+/- 0.04%/$^\circ$C [AT = 30° C])

Temperature Zero Shift: +/- 0.05 mV/$^\circ$F (+/- 0.1 mV/$^\circ$C)

Humidity: 95%

Physical

Size: 3.0 x 0.75 x 0.375 in. (76 x 19 . 9.5 mm)

Weight: 3 oz. (90 gm)

Cable: 3-conductor, 22 gauge

Steel Base: AISI 1018 carbon steel matched to A36