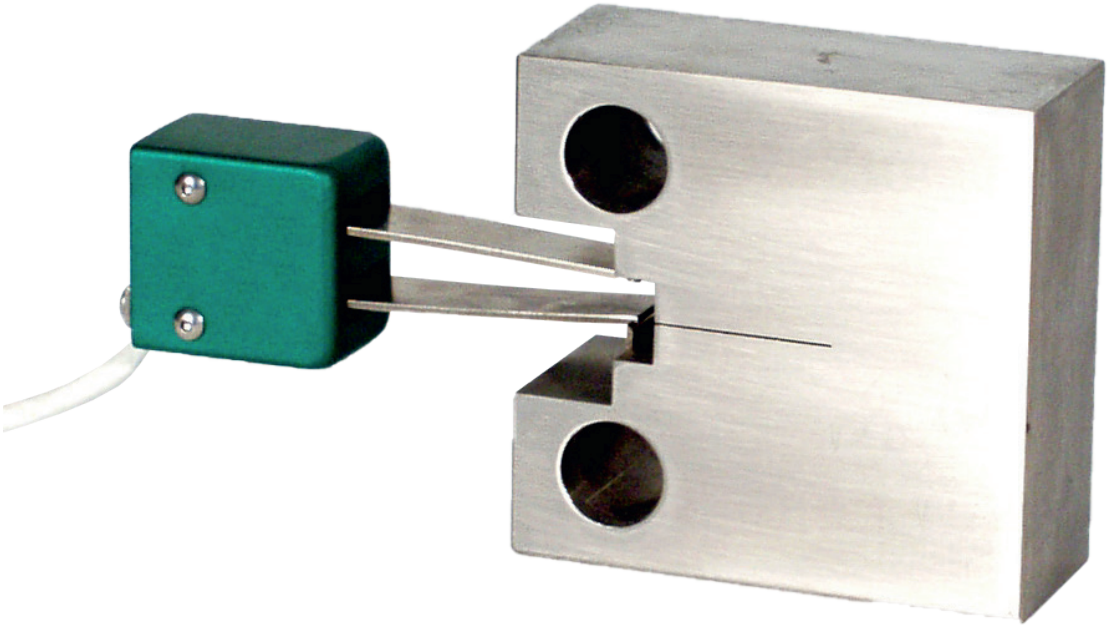
# Fracture Mechanics
# Crack Opening Displacement (COD) Gages
## Series 3541

**The 3541 Clip-On Displacement Gages are designed to perform standard static and cyclic ASTM, ISO and BS fracture mechanics tests to determine fracture mechanics parameters such as JIC, KIC, R-curve, fatigue crack growth rate (da/dN), and testing to standards such as E1820, E399, E647, ISO 12737, ISO 12135, ISO 15653, BS 7448, etc.**

These COD gages conform to the requirements of E1820 (the replacement for E813 and E1737) for JIC and R-curve determination. Special configurations are available to meet the requirements of ASTM E399 for fracture toughness (please consult the factory for these configurations). In addition, the modified groove design complies with E1820 tests where greater stability and accuracy results from the sharper groove root. Clip-on gages are used for a variety of fracture mechanics tests, including compact tension, arc shaped, disk shaped, bend specimens or other specimen geometries in compliance with ASTM and other standards organization's test methods. Clip-on gages can be used directly on test specimens where the knife edges are integral with the test specimen or, alternately, with optional bolt-on knife edges mounted on the test specimen.



These crack opening displacement gauges are rugged designed to withstand the high energy release that can occur and provide accurate linearity.
Available are units that can be used at both elevated and sub ambient temperatures from -270°C to +200°C.
The knifes are easy to replace and available upon request.

These units can be immersed in a wide variety of non-conductive fluids without special precautions.

For application in water or saline solutions the submersible extensometers series 4030COD are available.

### Features

- May be left on through specimen failure.
- Full bridge, 350 ohm strain gaged design for compatibility with nearly any test system.
- Fully enclosed gages are protected from accidental damage.
- Sharp grooves per ASTM E1820, E813, and E399 for improved stability when mounted.
- For da/dN testing or pre-cracking, where maximum frequency (>50 Hz) is required, minimum measuring ranges are recommended.
- For KIC/JIC testing, maximum accuracy is achieved with the smallest measuring range and the largest gauge length that will perform the test.
- Maximum operating frequency may be from 5 Hz to >200 Hz depending on COD gage and test apparatus configurations.
- Option for Shunt Calibration System for on-site electrical calibration.
- Includes high quality foam lined case.

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## Specification:

| | |
|---|---|
| Excitation: | 5 to 10 VDC recommended, 12 VDC or VAC max. |
| Output: | 2 to 4 mV/V nominal, depending on model |
| Accuracy Class: | All standard units meet ASTM E1820, ISO 12135, and ISO 9513 Class 1 requirements for accuracy. A test certificate is included. Models that additionally meet ASTM E399 accuracy requirements are available in 2.5 and 4.0 mm (0.10 and 0.15 inch) measuring ranges. A test certificate for ASTM E399 is included with those models. |
| Linearity: | ≤0.2% of full scale measuring range |
| Temperature Range: | Standard (-ST) is -40 °C to +100 °C (-40 °F to 210 °F) Optional (-LHT) is -270 °C to +200 °C (-454°F to 400 °F) |
| Cable: | Integral, ultra-flexible cable, 2.5 m (8 ft) standard |
| Operating Force: | 9 to 14 N (2 to 3 lbs), depending on model |

## Technical Data

Model 3541 Available Versions: ANY combination of gauge length, measuring range and temperature range listed below is available, except as noted. *Other configurations may be available with special order; please contact Epsilon to discuss your requirements..*

**Model Number 3441** **010M** **005** **LT**

Gage Length

Travel

Temperature Ranges

| Gage Length: | |
|---|---|
| **-003M** | 3.0 mm |
| **-005M** | 5.0 mm |
| **-008M** | 8.0 mm |
| **-010M** | 10.0 mm |
| **-012M** | 12.0 mm |
| **-020M** | 20.0 mm |

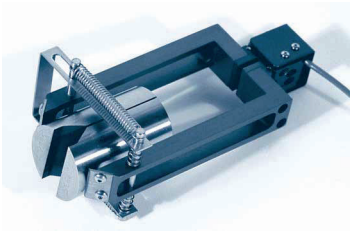
| Measuring Range (Travel) | |
|---|---|
| **-025M**[1] | +2.5 mm/-1.0 mm |
| **-040M**[1] | +4.0 mm/-1.0 mm |
| **-070M** | +7.0 mm/-1.0 mm |
| **-100M** | +10.0 mm/-1.0 mm |
| **-120M** | +12.0 mm/-2.0 mm |
| | |

| Temperature Ranges: | | |
|---|---|---|
| Low | **LT** | - 270°C to + 100 °C |
| Standard | **ST** | - 40 °C to + 100 °C |
| High 1 | **HT1** | - 40 °C to + 150 °C |
| High 2 | **HT2** | - 40 °C to + 200 °C |
| Low-High | **LHT** | -270 °C to + 200 °C |

[1] Available with special configuration to meet the requirements of ASTM E399. Please consult the factory.

## Options:

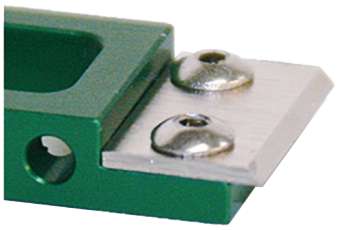
Connectors to interface to nearly any brand of test equipment
Available in special versions, including setups for narrow grips or severe environments
Bolt on knife edges



## Special Models for Other Fracture Mechanics Testing

Special units are available for other fracture mechanics tests. For example, the photo to the right shows a gage for ASTM E1304, Standard Test Method for Plane-Strain (Chevron-Notch) Fracture Toughness of Metallic Materials. This example was produced for a 1 inch diameter bar, with 0.4 inches of measuring range. Its performance, design, and accuracy is an enhancement of the design recommended in E1304.

## Standard Knife Edges



PART NO. 350210-01

## For Submersible Model 4030COD

This model is well suited for submersible applications. The unit is made from 300 series stainless steel and can be used in any liquids compatible with the material of construction as water, saline solutions etc.
The extensometer uses a special LVDT-like sensor to measure strains on samples submersed in water or other compatible liquids. The unit is provided with the signal conditioning electronics. The extensometer is a semi-custom design, which is available in smaller measuring ranges up to 5 mm (0.2 inches). These are made entirely of stainless steel with Teflon cables.

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