



SMART FORCE AND TORQUE SENSORS

User's Guide

Thank you...

Thank you for purchasing a Mark-10 Plug & Test™ remote sensor, designed for use with a Mark-10 model 5i or 3i force/torque indicator.

With proper usage, we are confident that you will get many years of great service with this product. Mark-10 sensors are ruggedly built for many years of service in laboratory and industrial environments.



This User's Guide provides setup, safety, and operation instructions for each individual sensor series. Instructions for using models 5i and 3i indicators are available in their respective user's guides. For additional information or answers to your questions, please do not hesitate to contact us. Our technical support and engineering teams are eager to assist you.

Before use, each person who is to use Mark-10 sensors and indicators should be fully trained in appropriate operation and safety procedures.

TABLE OF CONTENTS

| | |
|---------------------------------|----|
| OVERVIEW | 2 |
| SAFETY / PROPER USAGE | 3 |
| MECHANICAL SETUP | 4 |
| SERIES R01 FORCE SENSORS | 5 |
| SERIES R02 FORCE SENSORS | 6 |
| SERIES R03 FORCE SENSORS | 7 |
| SERIES R04 FORCE SENSORS | 8 |
| SERIES R05 FORCE SENSORS | 9 |
| SERIES R50 TORQUE SENSORS | 10 |
| SERIES R51 TORQUE SENSORS | 11 |
| SERIES R52 TORQUE SENSORS | 12 |
| SERIES R53 TORQUE SENSORS | 13 |
| SERIES R54 TORQUE SENSORS | 14 |

1 OVERVIEW

1.1 General Overview

Several series of Plug & Test™ sensors are available to accommodate numerous force and torque measurement requirements – from 0.25 to 10,000 lbF (1 N to 50 kN) of force, and from 10 ozFin to 5,000 lbFin (7 Ncm to 550 Nm) of torque. These sensors can be handheld or mounted to a fixture or test stand for more sophisticated testing requirements.

Plug & Test™ sensors are used with Mark-10 5i and 3i indicators. They may be disconnected from one indicator and connected to another without the need for re-calibration or re-configuration. All such data is saved within a PCB located inside the smart connector.

The model number, serial number, and capacity of the sensor are identified in the rectangular label located on the Plug & Test™ connector. The model and serial numbers are also identified in the **Information** screen of the indicator. Refer to the indicator user's guides for more information.

1.2 Accuracy and Resolution

When evaluating the accuracy of a sensor, the system accuracy must be calculated by also taking into consideration the indicator accuracy, as follows:

| Indicator Model | Accuracy |
|-----------------|------------------------------|
| 5i | ±0.1% of full scale ±1 digit |
| 3i | ±0.2% of full scale ±1 digit |

“±1 digit” refers to the least significant digit shown on the indicator display. This is equivalent to one increment of resolution. The resolution may be different for some sensors depending on whether a 5i or 3i indicator is being used. For example, a Series R01 force sensor will display finer resolution when connected to a 5i indicator than when connected to a 3i indicator. Resolution information is shown in the following pages for each sensor series.

The total system accuracy can be calculated by adding the sensor accuracy, indicator accuracy, and one count of resolution. Refer to the following examples:

Example 1

Model MR01-100 sensor with Model M5i Indicator

| | | | | |
|---|---|---|---|--|
| MR01-100 ±0.15% of full scale | + | M5i ±0.1% of full scale ±1 digit | = | Total ±0.25% of full scale ±1 digit |
|---|---|---|---|--|

This translates into a fixed error of as high as:
 $0.25\% \times 100 \text{ lbF} = 0.25 \text{ lbF} + 0.05 \text{ lbF} = 0.30 \text{ lbF}$

Example 2

Model MR50-50Z sensor with Model M3i Indicator

| | | | | |
|---|---|---|---|--|
| MR50-50Z ±0.35% of full scale | + | M3i ±0.2% of full scale ±1 digit | = | Total ±0.55% of full scale ±1 digit |
|---|---|---|---|--|

This translates into a fixed error of as high as:
 $0.55\% \times 50 \text{ ozFin} = 0.275 \text{ ozFin} + 0.02 \text{ ozFin} = 0.295 \text{ ozFin}$

Because accuracy is defined as a *percentage of full scale*, the fixed error is possible anywhere on the scale from 0 to the capacity. As such, this value represents an increasingly large error as *percentage of reading* towards the low end of the scale. It is, therefore, recommended that a sensor is selected with capacity as close as possible to the expected load.

2 SAFETY / PROPER USAGE

Read through the following safety instructions thoroughly before using a sensor:

1. Note the sensor's capacity before use and ensure that the capacity is not exceeded. Producing a load greater than the indicated safe overload value can damage the sensor. An overload can occur whether the sensor's indicator is powered on or off.
2. In order to extend the life of the sensor, avoid repetitive shock and impact loading.
3. When moving the sensor to another location, never lift from the cable or strain relief. This can cause damage to the sensor. Always lift the sensor housing itself.
4. Always ensure that load is applied axially with respect to the sensor.
5. Ensure that the sensor is kept away from water or any other electrically conductive liquids at all times.
6. The sensor and indicator should be serviced by a trained technician only. AC power must be disconnected and the indicator must be powered off before the housing is opened.
7. Always consider the characteristics of the sample being tested before initiating a test. A risk assessment should be carried out beforehand to ensure that all safety measures have been addressed and implemented.
8. Typical materials able to be tested include many manufactured items, such as springs, electronic components, fasteners, caps, films, mechanical assemblies, and many others. Items that should not be used with the sensor include potentially flammable substances or products, items that can shatter in an unsafe manner, and any other components that can present an exceedingly hazardous situation when acted upon by a force. Always wear eye and face protection when testing, especially in aforementioned hazardous cases. Extra bodily protection should be worn if a destructive failure of a test sample is possible.
9. In aforementioned hazardous situations, it is strongly recommended that a machine guarding system be employed to protect the operator and others in the vicinity from shards or debris.
10. Sensors have threaded holes or chucks, designed for the mounting of grips, fixtures, or attachments. If any such accessories are used, ensure they are mounted firmly to prevent a potential safety risk to the operator and others in the vicinity. If using an accessory from a supplier other than Mark-10, ensure that it is constructed of suitably rugged materials and components. Similar precautions should be taken when mounting the sensor to a test stand, work bench, or other piece of equipment.

3 MECHANICAL SETUP

The Plug & Test™ connector must be inserted into the receptacle of the 5i or 3i indicator with the side marked "Plug & Test™ Technology" facing up (see Fig. 3.1). When fully inserted, the connector will lock into place with a "click".



Fig. 3.1
Appropriate orientation of Plug & Test™ connector.

To release the connector, press both buttons on either side of the indicator housing to release the sensor (see Fig. 3.2). Pull the connector completely out of the indicator by holding the curved aluminum section. **DO NOT** pull on the cable or strain relief.



Fig. 3.2
Press both buttons on either side of the indicator housing to release the Plug & Test™ connector.

4 SERIES R01 FORCE SENSORS



4.1 Unpacking and Assembly

Carefully remove the sensor from the box. No assembly is required.

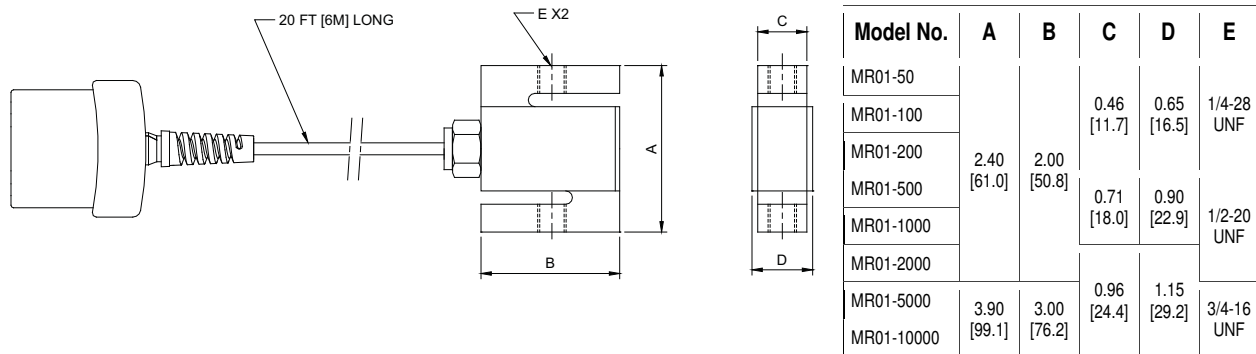
4.2 Overview

Tension and compression force may be applied to the surfaces with threaded holes. Attachments may be threaded into these holes. These holes also allow for mounting as required.

4.3 Specifications

| | |
|------------------------|---|
| Accuracy: | ±0.15% of full scale |
| Safe overload: | 150% of full scale |
| Operating temperature: | 40°F – 110°F [5°C – 45°C] |
| Operating humidity: | 96% max. (non-condensating) |
| Weight: | 1.9 to 3.0 lb [0.9 to 1.4 kg], depending on model |

4.4 Dimensions (in[mm])



4.5 Capacity x Resolution

| Model No. | With Model 5i Indicator | | | | | | With Model 3i Indicator | | | |
|------------|-------------------------|------------|------------|------------|------------|-------------|-------------------------|-----------|------------|-----------|
| | lbF | ozF | gF | kgF | N | kN | lbF | kgF | N | kN |
| MR01-50 | 50 x 0.02 | 800 x 0.5 | 25000 x 10 | 25 x 0.01 | 250 x 0.1 | - | 50 x 0.05 | 25 x 0.02 | 250 x 0.2 | - |
| MR01-100 | 100 x 0.05 | 1600 x 1 | 50000 x 20 | 50 x 0.02 | 500 x 0.2 | - | 100 x 0.1 | 50 x 0.05 | 500 x 0.5 | - |
| MR01-200 | 200 x 0.1 | 3200 x 2 | - | 100 x 0.05 | 1000 x 0.5 | 1 x 0.0005 | 200 x 0.2 | 100 x 0.1 | 1000 x 1 | - |
| MR01-500 | 500 x 0.2 | 8000 x 5 | - | 250 x 0.1 | 2500 x 1 | 2.5 x 0.001 | 500 x 0.5 | 250 x 0.2 | 2500 x 2 | - |
| MR01-1000 | 1000 x 0.5 | 16000 x 10 | - | 500 x 0.2 | 5000 x 2 | 5 x 0.002 | 1000 x 1 | 500 x 0.5 | 5000 x 5 | - |
| MR01-2000 | 2000 x 1 | 32000 x 20 | - | 1000 x 0.5 | 10000 x 5 | 10 x 0.005 | 2000 x 2 | 1000 x 1 | 10000 x 10 | - |
| MR01-5000 | 5000 x 2 | - | - | 2500 x 1 | 25000 x 10 | 25 x 0.01 | 5000 x 5 | 2500 x 2 | - | 25 x 0.02 |
| MR01-10000 | 10000 x 5 | - | - | 5000 x 2 | 50000 x 25 | 50 x 0.02 | 10000 x 10 | 5000 x 5 | - | 50 x 0.05 |

5 SERIES R02 FORCE SENSORS



5.1 Unpacking and Assembly

Carefully remove the sensor from the box. No assembly is required.

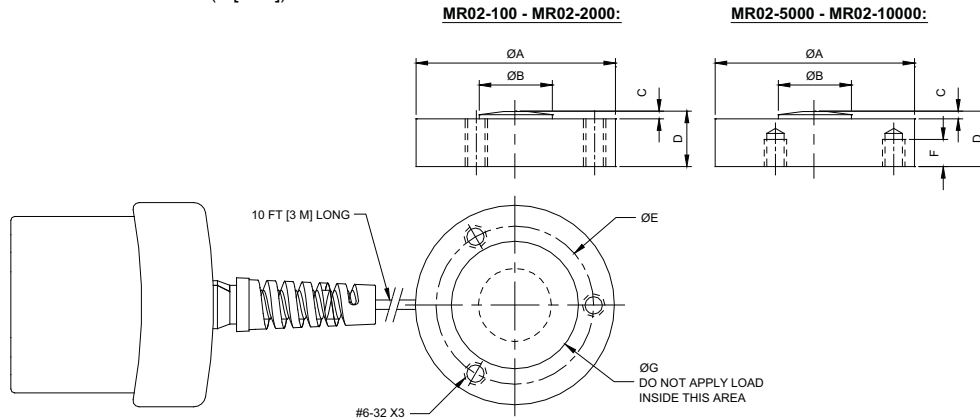
5.2 Overview

Compression force may be applied to the button in the center of the top surface of the sensor (visible in the picture above). **DO NOT** apply load to the cover on the underside of the sensor. Threaded holes are supplied to permit mounting to various surfaces.

5.3 Specifications

| | |
|------------------------|--|
| Accuracy: | ±0.5% of full scale |
| Safe overload: | 150% of full scale |
| Operating temperature: | 40°F – 110°F [5°C – 45°C] |
| Operating humidity: | 96% max. (non-condensating) |
| Weight: | MR02-100 - MR02-2000: 0.3 lb [0.1 kg] MR02-5000 - MR02-10000: 0.5 lb [0.2 kg] |

5.4 Dimensions (in[mm])



| Model | ØA | ØB | C | D | ØE | F | ØG |
|---------------------------|----------------|----------------|---------------|----------------|----------------|---------------|----------------|
| MR02-100 – MR02-2000 | 1.23 [31.3] | 0.32 [8.1] | 0.05 [1.3] | 0.39 [9.9] | 1.0 [25.4] | - | 0.83 [21.1] |
| MR02-5000 – MR02-10000 | 1.48 [37.6] | 0.43 [10.9] | 0.07 [1.8] | 0.62 [15.8] | 1.25 [31.8] | 0.25 [6.4] | 1.08 [27.4] |

5.5 Capacity x Resolution

| Model No. | With Model 5i Indicator | | | | | | With Model 3i Indicator | | | |
|------------|-------------------------|------------|------------|------------|------------|-------------|-------------------------|-----------|------------|-----------|
| | lbF | ozF | gF | kgF | N | kN | lbF | kgF | N | kN |
| MR02-100 | 100 x 0.05 | 1600 x 1 | 50000 x 20 | 50 x 0.02 | 500 x 0.2 | - | 100 x 0.1 | 50 x 0.05 | 500 x 0.5 | - |
| MR02-200 | 200 x 0.1 | 3200 x 2 | - | 100 x 0.05 | 1000 x 0.5 | 1 x 0.0005 | 200 x 0.2 | 100 x 0.1 | 1000 x 1 | - |
| MR02-500 | 500 x 0.2 | 8000 x 5 | - | 250 x 0.1 | 2500 x 1 | 2.5 x 0.001 | 500 x 0.5 | 250 x 0.2 | 2500 x 2 | - |
| MR02-1000 | 1000 x 0.5 | 16000 x 10 | - | 500 x 0.2 | 5000 x 2 | 5 x 0.002 | 1000 x 1 | 500 x 0.5 | 5000 x 5 | - |
| MR02-2000 | 2000 x 1 | 32000 x 20 | - | 1000 x 0.5 | 10000 x 5 | 10 x 0.005 | 2000 x 2 | 1000 x 1 | 10000 x 10 | - |
| MR02-5000 | 5000 x 2 | - | - | 2500 x 1 | 25000 x 10 | 25 x 0.01 | 5000 x 5 | 2500 x 2 | - | 25 x 0.02 |
| MR02-10000 | 10000 x 5 | - | - | 5000 x 2 | 50000 x 25 | 50 x 0.02 | 10000 x 10 | 5000 x 5 | - | 50 x 0.05 |

6 SERIES R03 FORCE SENSORS



6.1 Unpacking and Assembly

Carefully remove the sensor from the box. Extra care should be taken for very low capacity models. No assembly is required.

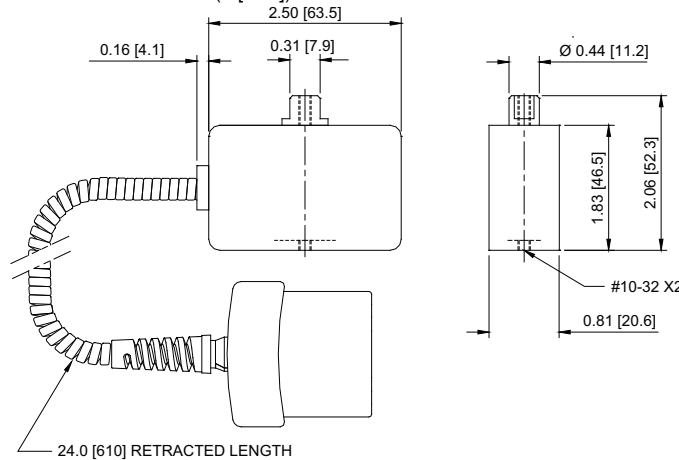
6.2 Overview

Tension and compression force may be applied to the threaded holes in the load cell shaft and opposite flat surface. Attachments may be threaded into these holes. **Finger-tighten only**. These holes also allow for mounting as required.

6.3 Specifications

| | |
|------------------------|--|
| Accuracy: | ±0.15% of full scale |
| Safe overload: | MR03-025 – MR03-2: 200% of full scale MR03-5 – MR03-100: 150% of full scale |
| Operating temperature: | 40°F – 110°F [5°C – 45°C] |
| Operating humidity: | 96% max. (non-condensating) |
| Weight: | 0.4 lb [0.2 kg] |

6.4 Dimensions (in[mm])



6.5 Capacity x Resolution

| Model No. | With Model 5i Indicator | | | | | | With Model 3i Indicator | | | |
|-----------|-------------------------|-----------|------------|-------------|-------------|------------|-------------------------|-----------|-------------|-------------|
| | lbF | ozF | gF | kgF | N | mN | lbF | gF | kgF | N |
| MR03-025 | 0.25 x 0.0001 | 4 x 0.002 | 100 x 0.05 | - | 1 x 0.0005 | 1000 x 0.5 | 0.25 x 0.0002 | 100 x 0.1 | - | 1 x 0.001 |
| MR03-05 | 0.5 x 0.0002 | 8 x 0.005 | 250 x 0.1 | - | 2.5 x 0.001 | 2500 x 1 | 0.5 x 0.0005 | 250 x 0.2 | - | 2.5 x 0.002 |
| MR03-2 | 2 x 0.001 | 32 x 0.02 | 1000 x 0.5 | 1 x 0.0005 | 10 x 0.005 | - | 2 x 0.002 | - | 1 x 0.001 | 10 x 0.01 |
| MR03-5 | 5 x 0.002 | 80 x 0.05 | 2500 x 1 | 2.5 x 0.001 | 25 x 0.01 | - | 5 x 0.005 | - | 2.5 x 0.002 | 25 x 0.02 |
| MR03-10 | 10 x 0.005 | 160 x 0.1 | 5000 x 2 | 5 x 0.002 | 50 x 0.02 | - | 10 x 0.01 | - | 5 x 0.005 | 50 x 0.05 |
| MR03-20 | 20 x 0.01 | 320 x 0.2 | 10000 x 5 | 10 x 0.005 | 100 x 0.05 | - | 20 x 0.02 | - | 10 x 0.01 | 100 x 0.1 |
| MR03-50 | 50 x 0.02 | 800 x 0.5 | 25000 x 10 | 25 x 0.01 | 250 x 0.1 | - | 50 x 0.05 | - | 25 x 0.02 | 250 x 0.2 |
| MR03-100 | 100 x 0.05 | 1600 x 1 | 50000 x 20 | 50 x 0.02 | 500 x 0.2 | - | 100 x 0.1 | - | 50 x 0.05 | 500 x 0.5 |

7 SERIES R04 FORCE SENSORS



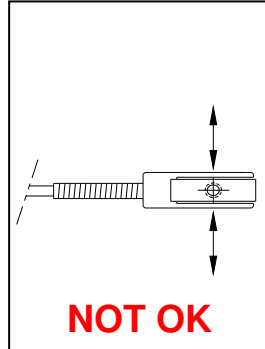
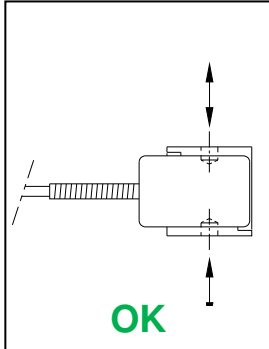
7.1 Unpacking and Assembly

Carefully remove the sensor from the box. Extra care should be taken for very low capacity models. No assembly is required.

7.2 Overview

Tension and compression force may be applied to the surfaces with threaded holes. Attachments may be threaded into these holes.

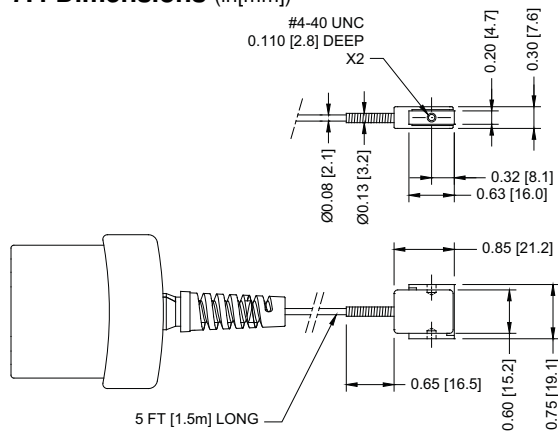
Finger-tighten only. These holes also allow for mounting as required.



7.3 Specifications

| | |
|------------------------|-----------------------------|
| Accuracy: | ±0.2% of full scale |
| Safe overload: | 200% of full scale |
| Operating temperature: | 40°F – 110°F [5°C – 45°C] |
| Operating humidity: | 96% max. (non-condensating) |
| Weight: | 0.015 lb [0.007 kg] |

7.4 Dimensions (in[mm])



7.5 Capacity x Resolution

| Model No. | With Model 5i Indicator | | | | | | With Model 3i Indicator | | | |
|-----------|-------------------------|-----------|------------|-------------|-------------|------------|-------------------------|-----------|-------------|-------------|
| | lbF | ozF | gF | kgF | N | mN | lbF | gF | kgF | N |
| MR04-025 | 0.25 x 0.0001 | 4 x 0.002 | 100 x 0.05 | - | 1 x 0.0005 | 1000 x 0.5 | 0.25 x 0.0002 | 100 x 0.1 | - | 1 x 0.001 |
| MR04-05 | 0.5 x 0.0002 | 8 x 0.005 | 250 x 0.1 | - | 2.5 x 0.001 | 2500 x 1 | 0.5 x 0.0005 | 250 x 0.2 | - | 2.5 x 0.002 |
| MR04-2 | 2 x 0.001 | 32 x 0.02 | 1000 x 0.5 | 1 x 0.0005 | 10 x 0.005 | - | 2 x 0.002 | - | 1 x 0.001 | 10 x 0.01 |
| MR04-5 | 5 x 0.002 | 80 x 0.05 | 1000 x 0.5 | 2.5 x 0.001 | 25 x 0.01 | - | 5 x 0.005 | - | 2.5 x 0.002 | 25 x 0.02 |
| MR04-10 | 10 x 0.005 | 160 x 0.1 | 5000 x 2 | 5 x 0.002 | 50 x 0.02 | - | 10 x 0.01 | - | 5 x 0.005 | 50 x 0.05 |
| MR04-20 | 20 x 0.01 | 320 x 0.2 | 10000 x 5 | 10 x 0.005 | 100 x 0.05 | - | 20 x 0.02 | - | 10 x 0.01 | 100 x 0.1 |
| MR04-50 | 50 x 0.02 | 800 x 0.5 | 25000 x 10 | 25 x 0.01 | 250 x 0.1 | - | 50 x 0.05 | - | 25 x 0.02 | 250 x 0.2 |
| MR04-100 | 100 x 0.05 | 1600 x 1 | 50000 x 20 | 50 x 0.02 | 500 x 0.2 | - | 100 x 0.1 | - | 50 x 0.05 | 500 x 0.5 |

8 SERIES R05 FORCE SENSORS



8.1 Unpacking and Assembly

Carefully remove the sensor from the box. No assembly is required.

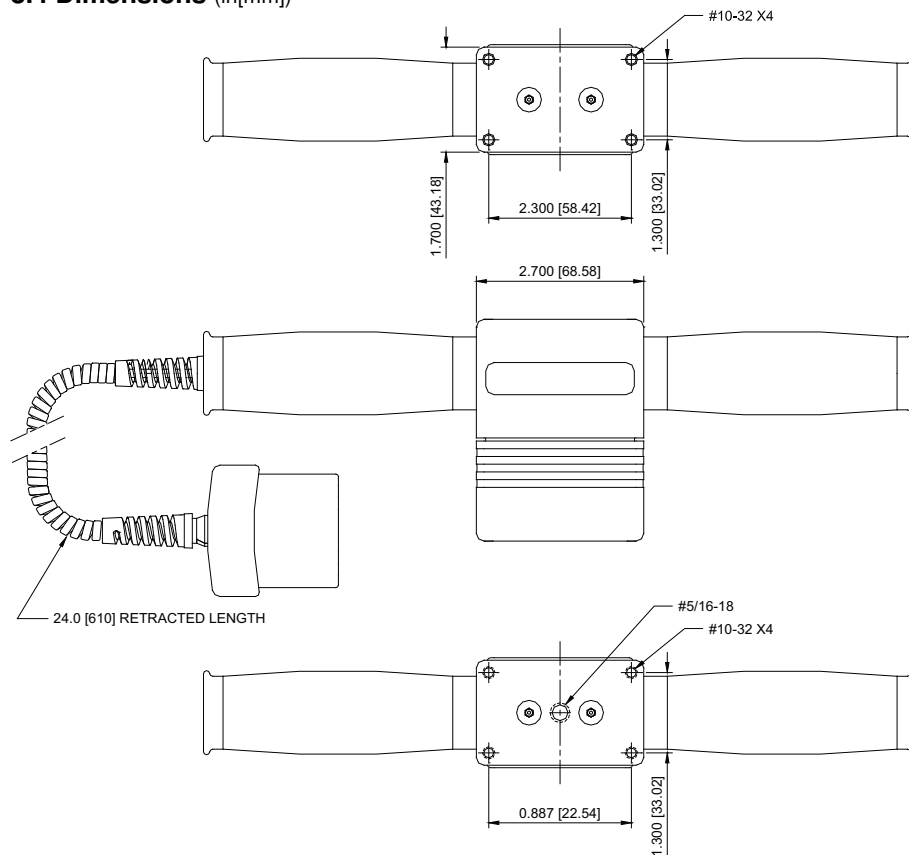
8.2 Overview

Designed for pull and push testing. Firmly grip the handles when producing tension or compression force. Force may be applied to the surface with threaded hole. Attachments may be threaded into these holes. **Finger-tighten only.**

8.3 Specifications

Accuracy: $\pm 0.15\%$ of full scale
 Safe overload: 150% of full scale
 Operating temperature: 40°F – 110°F [5°C – 45°C]
 Operating humidity: 96% max. (non-condensating)
 Weight: 2 lb [0.9 kg]

8.4 Dimensions (in[mm])



8.5 Capacity x Resolution

| Model No. | With Model 5i Indicator | | | | | With Model 3i Indicator | | |
|-----------|-------------------------|----------|-----------|----------|-------------|-------------------------|-----------|----------|
| | lbF | ozF | kgF | N | kN | lbF | kgF | N |
| MR05-500 | 500 x 0.2 | 8000 x 5 | 250 x 0.1 | 2500 x 1 | 2.5 x 0.001 | 500 x 0.5 | 250 x 0.2 | 2500 x 2 |

9 SERIES R50 TORQUE SENSORS



9.1 Unpacking and Assembly

Carefully remove the sensor from the box. For models MR50-10Z, MR50-20Z, and MR50-50Z, remove the protective tubing inserted around the chuck. Save it for future transportation needs. No assembly is required.

9.2 Overview

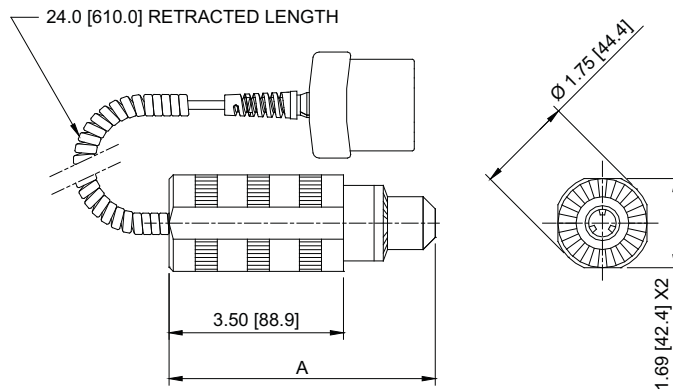
Designed for clockwise and counter-clockwise torque testing. The sensor may be handheld or mounted to a test stand, fixture, or other equipment.

Bits or fixtures may be placed in the chuck, although extra care should be taken when handling low capacity models.

9.3 Specifications

| | |
|------------------------|--|
| Accuracy: | ±0.35% of full scale |
| Safe overload: | MR50-10Z - MR50-50Z: 300% of full scale |
| | MR50-12 - MR50-100: 150% of full scale |
| Chuck opening range: | MR50-10Z - MR50-50Z: 0.062 - 0.375 in [1.6 - 9.5 mm] |
| | MR50-12 - MR50-100: 0.078 - 0.5 in [2.0 - 12.7 mm] |
| Operating temperature: | 40°F – 110°F [5°C – 45°C] |
| Operating humidity: | 96% max. (non-condensating) |
| Weight: | From 1.4 lb [0.6 kg] |

9.4 Dimensions (in[mm])



| Model No. | A |
|---------------------|--------------|
| MR50-10Z - MR50-50Z | 4.82 [122.4] |
| MR50-12 - MR50-100 | 5.19 [131.8] |

9.5 Capacity x Resolution

| Model No. | With Model 5i indicator | | | | | | | | With Model 3i indicator | | | |
|-----------|-------------------------|------------|------------|-----------|------------|-----------|------------|--------------|-------------------------|-----------|-----------|-----------|
| | ozFin | lbFin | lbFft | gFcm | kgFmm | Nmm | Ncm | Nm | ozFin | lbFin | kgFmm | Ncm |
| MR50-10Z | 10 x 0.005 | - | - | 700 x 0.5 | 7 x 0.005 | 70 x 0.05 | 7 x 0.005 | - | 10 x 0.01 | - | 7 x 0.005 | 7 x 0.005 |
| MR50-20Z | 20 x 0.01 | - | - | 1400 x 1 | 14 x 0.01 | 140 x 0.1 | 14 x 0.01 | - | 20 x 0.02 | - | 14 x 0.01 | 14 x 0.01 |
| MR50-50Z | 50 x 0.02 | - | - | 3600 x 2 | 36 x 0.02 | 350 x 0.2 | 35 x 0.02 | - | 50 x 0.05 | - | 36 x 0.05 | 35 x 0.05 |
| MR50-12 | - | 12 x 0.005 | 1 x 0.0005 | - | 140 x 0.1 | - | 135 x 0.1 | 1.35 x 0.001 | - | 12 x 0.01 | 140 x 0.1 | 135 x 0.1 |
| MR50-50 | - | 50 x 0.02 | 4 x 0.002 | - | 580 x 0.5 | - | 570 x 0.5 | 5.7 x 0.005 | - | 50 x 0.05 | 580 x 0.5 | 570 x 0.5 |
| MR50-100 | - | 100 x 0.05 | 8 x 0.005 | - | 1150 x 0.5 | - | 1150 x 0.5 | 11.5 x 0.005 | - | 100 x 0.1 | 1150 x 1 | 1150 x 1 |

10 SERIES R51 TORQUE SENSORS



10.1 Unpacking and Assembly

Carefully remove the sensor from the box. Series R51 sensors are available with three interchangeable chuck attachments and bit holder. To attach the chuck or bit holder, align the pin located on the end of the sensor body with the hole located on the attachment (see Fig. 10.1). Thread the ring onto the sensor body to keep the attachment in place.



Fig. 10.1
The attachment and main sensor body mate with a pin and threaded ring.

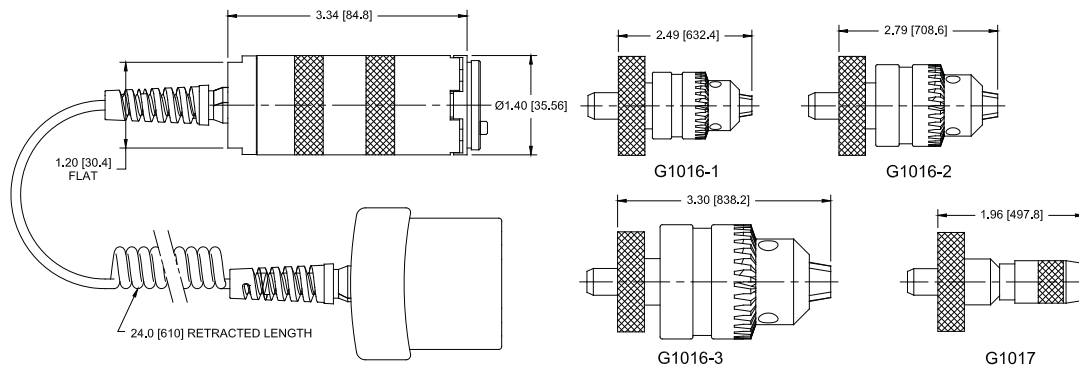
10.2 Overview

Designed for clockwise and counter-clockwise torque testing. The sensor may be handheld or mounted to a test stand, fixture, or other equipment. Bits or fixtures may be placed in the chuck, although extra care should be taken when handling low capacity models.

10.3 Specifications

Accuracy: $\pm 0.35\%$ of full scale
 Safe overload: MR50-10Z - MR50-50Z: 300% of full scale
 MR50-12 - MR50-100: 150% of full scale
 Chuck opening range: MR50-10Z - MR50-50Z: 0.062 - 0.375 in [1.6 - 9.5 mm]
 MR50-12 - MR50-100: 0.078 - 0.5 in [2.0 - 12.7 mm]
 Operating temperature: 40°F – 110°F [5°C – 45°C]
 Operating humidity: 96% max. (non-condensating)
 Weight: From 1.4 lb [0.6 kg]

10.4 Dimensions (in[mm])



10.5 Capacity x Resolution

| Model No. | With Model 5i indicator | | | | | | | | With Model 3i indicator | | | |
|-----------|-------------------------|------------|------------|-----------|------------|-----------|------------|--------------|-------------------------|-----------|-----------|-----------|
| | ozFin | lbFin | lbFft | gFcm | kgFmm | Nmm | Ncm | Nm | ozFin | lbFin | kgFmm | Ncm |
| MR51-10Z | 10 x 0.005 | - | - | 700 x 0.5 | 7 x 0.005 | 70 x 0.05 | 7 x 0.005 | - | 10 x 0.01 | - | 7 x 0.005 | 7 x 0.005 |
| MR51-20Z | 20 x 0.01 | - | - | 1400 x 1 | 14 x 0.01 | 140 x 0.1 | 14 x 0.01 | - | 20 x 0.02 | - | 14 x 0.01 | 14 x 0.01 |
| MR51-50Z | 50 x 0.02 | - | - | 3600 x 2 | 36 x 0.02 | 350 x 0.2 | 35 x 0.02 | - | 50 x 0.05 | - | 36 x 0.05 | 35 x 0.05 |
| MR51-12 | - | 12 x 0.005 | 1 x 0.0005 | - | 140 x 0.1 | - | 135 x 0.1 | 1.35 x 0.001 | - | 12 x 0.01 | 140 x 0.1 | 135 x 0.1 |
| MR51-50 | - | 50 x 0.02 | 4 x 0.002 | - | 580 x 0.5 | - | 570 x 0.5 | 5.7 x 0.005 | - | 50 x 0.05 | 580 x 0.5 | 570 x 0.5 |
| MR51-100 | - | 100 x 0.05 | 8 x 0.005 | - | 1150 x 0.5 | - | 1150 x 0.5 | 11.5 x 0.005 | - | 100 x 0.1 | 1150 x 1 | 1150 x 1 |

11 SERIES R52 TORQUE SENSORS



11.1 Unpacking and Assembly

Carefully remove the sensor from the box. No assembly is required.

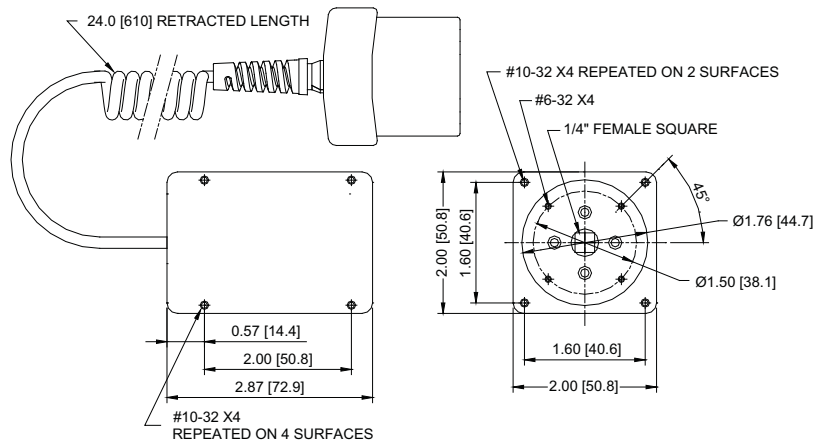
11.2 Overview

Designed for clockwise and counter-clockwise torque testing. The sensor contains threaded holes on each side to permit mounting to a larger testing system.

11.3 Specifications

Accuracy: ±0.35% of full scale
 Safe overload: MR52-10Z – MR52-50Z: 300% of full scale
 MR52-12 – MR52-100: 150% of full scale
 Operating temperature: 40°F – 110°F [5°C – 45°C]
 Operating humidity: 96% max. (non-condensating)
 Weight: 1.2 lb [0.5 kg]

11.4 Dimensions (in[mm])



11.5 Capacity x Resolution

| Model No. | With Model 5i indicator | | | | | | | | With Model 3i indicator | | | |
|-----------|-------------------------|------------|------------|-----------|------------|-----------|------------|--------------|-------------------------|-----------|-----------|-----------|
| | ozFin | lbFin | lbFft | gFcm | kgFmm | Nmm | Ncm | Nm | ozFin | lbFin | kgFmm | Ncm |
| MR52-10Z | 10 x 0.005 | - | - | 700 x 0.5 | 7 x 0.005 | 70 x 0.05 | 7 x 0.005 | - | 10 x 0.01 | - | 7 x 0.005 | 7 x 0.005 |
| MR52-20Z | 20 x 0.01 | - | - | 1400 x 1 | 14 x 0.01 | 140 x 0.1 | 14 x 0.01 | - | 20 x 0.02 | - | 14 x 0.01 | 14 x 0.01 |
| MR52-50Z | 50 x 0.02 | - | - | 3600 x 2 | 36 x 0.02 | 350 x 0.2 | 35 x 0.02 | - | 50 x 0.05 | - | 36 x 0.05 | 35 x 0.05 |
| MR52-12 | - | 12 x 0.005 | 1 x 0.0005 | - | 140 x 0.1 | - | 135 x 0.1 | 1.35 x 0.001 | - | 12 x 0.01 | 140 x 0.1 | 135 x 0.1 |
| MR52-50 | - | 50 x 0.02 | 4 x 0.002 | - | 580 x 0.5 | - | 570 x 0.5 | 5.7 x 0.005 | - | 50 x 0.05 | 580 x 0.5 | 570 x 0.5 |
| MR52-100 | - | 100 x 0.05 | 8 x 0.005 | - | 1150 x 0.5 | - | 1150 x 0.5 | 11.5 x 0.005 | - | 100 x 0.1 | 1150 x 1 | 1150 x 1 |

12 SERIES R53 TORQUE SENSORS



12.1 Unpacking and Assembly

Carefully remove the sensor from the box. Install the four posts in the desired positions on the sliders. If alternative gripping fixtures were purchased, install them using the supplied hardware.

12.2 Overview

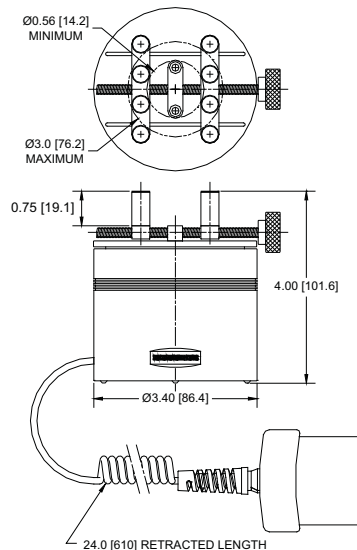
Designed for clockwise and counter-clockwise bottle cap torque testing. Turning the knob moves the sliders along the length of the screw to engage to disengage the sample. The posts or alternative gripping fixtures secure the sample while the cap is twisted by hand. The sensor contains threaded holes on the underside of the base for bench mounting.

12.3 Specifications

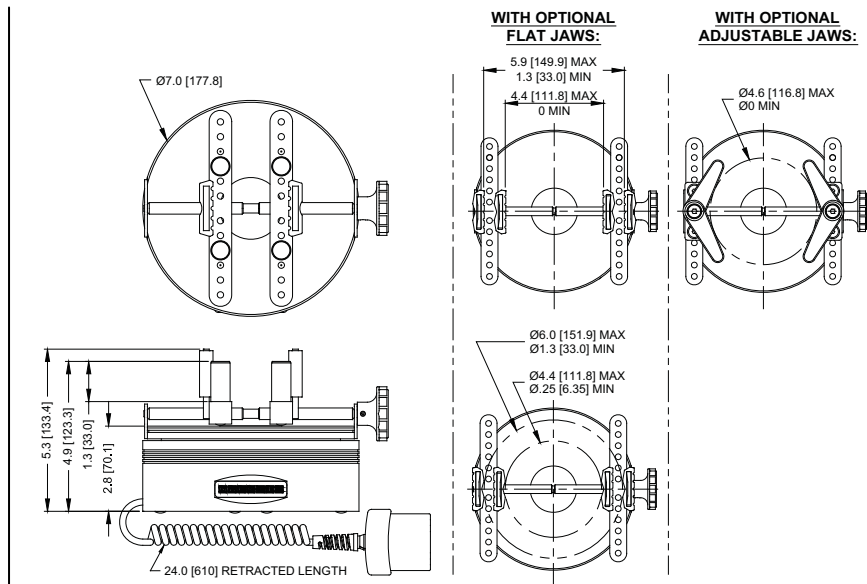
Accuracy: ±0.5% of full scale
 Safe overload: MR53-10Z - MR53-50Z: 300% of full scale / MR53-12 - MR53-100: 150% of full scale
 Operating temperature: 40°F – 110°F [5°C – 45°C]
 Operating humidity: 96% max. (non-condensating)
 Weight: MR53-10Z - MR53-50Z: 2.2 lb [1.0 kg] / MR53-12 - MR53-100: 5.4 lb [2.5 kg]

12.4 Dimensions (in[mm])

MR53-10Z - MR53-50Z:



MR53-12 - MR53-100:



12.5 Capacity x Resolution

| Model No. | With Model 5i indicator | | | | | | | | With Model 3i indicator | | | |
|-----------|-------------------------|-----------|-----------|-----------|-----------|-----------|-----------|--------------|-------------------------|-----------|-----------|-----------|
| | ozFin | lbFin | lbFft | gFcm | kgFmm | Nmm | Ncm | Nm | ozFin | lbFin | kgFmm | Ncm |
| MR53-10Z | 10 x 0.01 | - | - | 700 x 0.5 | 7 x 0.005 | 70 x 0.05 | 7 x 0.005 | - | 10 x 0.01 | - | 7 x 0.005 | 7 x 0.005 |
| MR53-20Z | 20 x 0.02 | - | - | 1400 x 1 | 14 x 0.01 | 140 x 0.1 | 14 x 0.01 | - | 20 x 0.02 | - | 14 x 0.01 | 14 x 0.01 |
| MR53-50Z | 50 x 0.05 | - | - | 3600 x 5 | 36 x 0.05 | 350 x 0.5 | 35 x 0.05 | - | 50 x 0.05 | - | 36 x 0.05 | 35 x 0.05 |
| MR53-12 | - | 12 x 0.01 | 1 x 0.001 | - | 140 x 0.1 | - | 135 x 0.1 | 1.35 x 0.001 | - | 12 x 0.01 | 140 x 0.1 | 135 x 0.1 |
| MR53-50 | - | 50 x 0.05 | 4 x 0.005 | - | 580 x 0.5 | - | 570 x 0.5 | 5.7 x 0.005 | - | 50 x 0.05 | 580 x 0.5 | 570 x 0.5 |
| MR53-100 | - | 100 x 0.1 | 8 x 0.01 | - | 1150 x 1 | - | 1150 x 1 | 11.5 x 0.01 | - | 100 x 0.1 | 1150 x 1 | 1150 x 1 |

13 SERIES R54 TORQUE SENSORS



13.1 Unpacking and Assembly

Carefully remove the sensor from the box. No assembly is required.

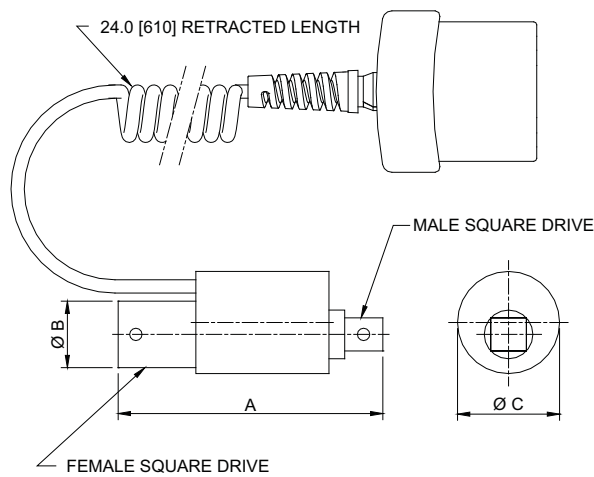
13.2 Overview

Designed for clockwise and counter-clockwise torque testing. Square drives at both ends of the sensor permit inline testing or mounting to a test stand or other equipment.

13.3 Specifications

Accuracy: $\pm 0.6\%$ of full scale
 Safe overload: 150% of full scale
 Operating temperature: 40°F – 110°F [5°C – 45°C]
 Operating humidity: 96% max. (non-condensating)
 Weight: 0.6 - 2.0 lb [0.3 - 0.9 kg], depending on model

13.4 Dimensions (in[mm])



13.5 Capacity x Resolution

| Model No. | With Model 5i indicator | | | | | With Model 3i indicator | | |
|-----------|-------------------------|-------------|----------------|------------|-------------|-------------------------|----------------|--------------|
| | lbFin | lbFft | kgFmm | Ncm | Nm | lbFin | kgFmm | Ncm |
| MR54-20 | 20 x 0.02 | 1.5 x 0.002 | 230 x 0.2 | 220 x 0.2 | 2 x 0.002 | 20 x 0.02 | 230 x 0.2 | 220 x 0.2 |
| MR54-50 | 50 x 0.05 | 4 x 0.005 | 580 x 0.5 | 570 x 0.5 | 5.7 x 0.005 | 50 x 0.05 | 580 x 0.5 | 570 x 0.5 |
| MR54-100 | 100 x 0.1 | 8 x 0.01 | 1150 x 1 | 1150 x 1 | 11.5 x 0.01 | 100 x 0.1 | 1150 x 1 | 1150 x 1 |
| MR54-200 | 200 x 0.2 | 16 x 0.02 | 2300 x 2 | 2200 x 2 | 22 x 0.02 | 200 x 0.2 | 2300 x 2 | 2200 x 2 |
| MR54-400 | 400 x 0.5 | 32 x 0.05 | 4600 x 5 | 4500 x 5 | 45 x 0.05 | 400 x 0.5 | 4600 x 5 | 4500 x 5 |
| MR54-1000 | 1000 x 1 | 80 x 0.1 | 11500 x 10 | 11000 x 10 | 110 x 0.1 | 1000 x 1 | 11500 x 10 | 11000 x 10 |
| MR54-5000 | 5000 x 5 | 400 x 0.5 | 55 x 0.05 kgFm | 55000 x 50 | 550 x 0.5 | 5000 x 5 | 55 x 0.05 kgFm | 550 x 0.5 Nm |