



MTE™ Series Encoders



Sensor Installation Manual and Reference Guide

Table of Contents

MTE™ Sensor Installation

Introduction

Introduction (Precautions, Patents, Manual Revision)	3
Recommendations for Power, Installation Considerations	4
Items Required for sensor installation	5

MTE, Top Mount Configuration

System Overview diagram	6
Sensor head installation	7
Sensor head alignment	8

MTE, Side Mount Configuration

System Overview diagram	9
Sensor head installation	10
Sensor head alignment	12

Appendix

A. Specifications	13
B. Wiring Diagrams	14
C. Interface Cable Requirements	15,16
D. RS-422 Compliance	17
E. Troubleshooting	18
F. Order Guide	19

Contacting MicroE Systems

Contact MicroE.....	20
---------------------	----

Manual Version Numbers

MTE-IM Sensor Installation Rev B, issued February 2014

Changes: Added Side Mount Configuration.

MTE-IM Sensor Installation Rev A, issued November 2013

Changes: N/A

Related Documents

- MTE Data Sheet
- MTE Interface Drawing
- Compact Encoder Tape (CET™) Scale Installation for MTE Series Encoders

Precautions

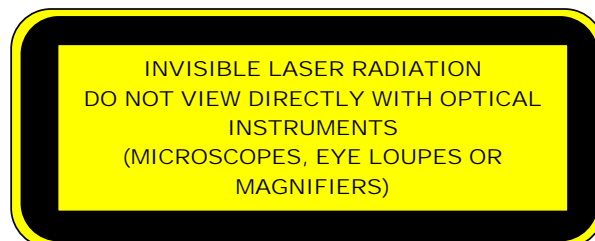


- 1 Follow standard ESD precautions. Turn power off before connecting the sensor. Do not touch the electrical pins without static protection such as a grounded wrist strap.
- 2 Do not touch the tape/glass scale unless you are wearing talc-free gloves or finger cots. Please read this installation manual for full instructions.

LASER SAFETY INFORMATION: MTE Series

This product is sold solely for use as a component (or replacement) in an electronic product; therefore it is not required to, and does not comply with, 21 CFR 1040.10 and 1040.11 which pertain to complete laser products. The manufacturer of the complete system-level electronic product is responsible for complying with 21 CFR 1040.10 and 1040.11 and for providing the user with all necessary safety warnings and information.

MicroE encoders contain an infrared laser diode or diodes. Emitted invisible laser radiation levels have been measured to be within the CDRH Class 1 range, which is not considered hazardous; however, to minimize exposure to the diverging beam, the encoder sensor should be installed in its operational configuration in close proximity to the encoder scale before power is applied.



- Invisible laser radiation; wavelength: 850 nm
- Max power 2.4 mW CW
- CAUTION – The use of optical instruments with this product will increase eye hazard. DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS (MICROSCOPES, EYE LOUPES OR MAGNIFIERS).
- All maintenance procedures such as cleaning must be performed with the MicroE encoder turned off.
- Do not insert any reflective surface into the beam path when the encoder is powered.
- Do not attempt to service the MicroE encoder.

Patents

Covered by the following patents: US 5,991,249; EP 895,239; JP 3,025,237; US 6,897,435; and EP 1,451,933. Additional patents and patents pending may apply.

RoHS MTE models are CE and RoHS compliant.



Recommendations for Power; Installation Considerations

MTE™ Series Encoders

1.

Recommendations for Power

MTE™ encoders require a minimum of 4.75V DC continuously. When designing circuits and extension cables, be sure to account for voltage loss over distance and tolerances from the nominal supply voltage so that at least 4.75V DC is available to the MTE encoder under all operating conditions. The input voltage should not exceed 5.25V DC.

2.

Installation Considerations

The MTE encoder is a precision electronic instrument. It has been designed to function in a wide range of applications and environments. To take full advantage of the modular system design, considerations should be made to allow easy access to the sensor for service and/or replacement.

For optimal performance and reliability:

DO follow standard ESD precautions while handling the sensor and interpolator.

DO allow proper alignment clearance for sensor head alignment.

DO follow setup instructions for the encoder system.

DO, where possible, install the scales in an
“upside down” or vertical position to minimize accumulation of dust.

DO consider redundant encoders or additional feedback devices as part of an overall risk management program for medical applications.

DO NOT store sensors in an uncontrolled environment.

DO NOT electrically overstress the sensor (Power supply ripple/noise).

DO NOT intentionally “hot swap” the sensor if the device is energized.

DO NOT use in high contamination applications (dust, oil, excessive humidity, or other airborne contaminants.).

System Overview

MTE™ Series Encoders

Refer to encoder model data sheets for detailed ordering guide and more information about MicroE Part Numbers.

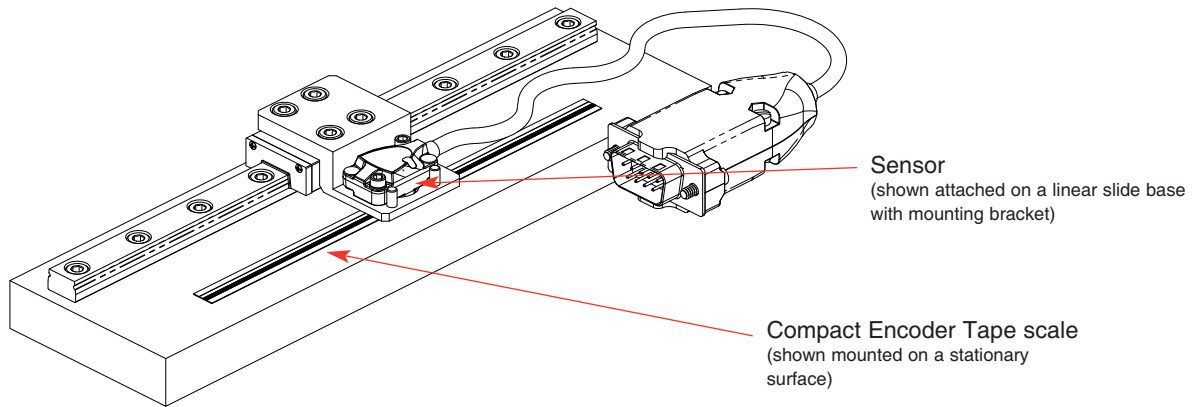
Items Required for MTE Encoder Installation Using Compact Encoder Tape (CET) Scales

- Hex wrench (M2.5 for Top Mount, 5/64", M3.5 and M2.5 for Side Mount)
- For MTE, Top Mount configuration
 - Z height spacer Model Number: ZG-CET (ships with each sensor)
- For MTE Side Mount
 - Side Mount Bracket Kit, Model Number: BK-SM-MTE
 - Z height spacer shim (ships with each bracket kit - 1.00mm (red) for use with CET scales)
- Optional: MK-FFA bracket kit for installation into industry-standard mounting hole patterns.

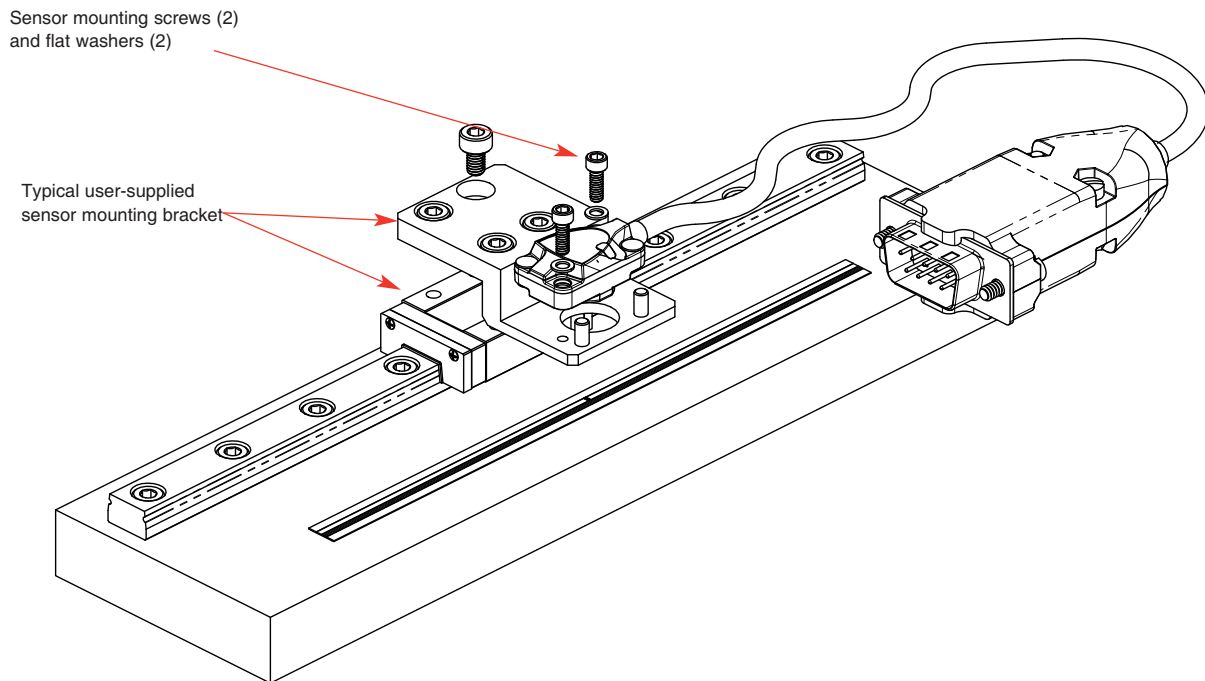
System Overview, (Top Mount Configuration)

MTE™ Series Encoders

MTE™ Series System View



Expanded View



Sensor Head Installation (Top Mount Configuration)

MTE™ Series Encoders

1. Verify Sensor Mounting Surface Height

Verify that the distance between the mounting surface of the sensor and the top of the scale is as follows:

Tape scale after blue protective film is removed:
3.84 mm \pm 0.15 mm.

MicroE's Z-axis height gauge can be used to easily verify this distance. (P/N: ZG-CET)

Use the gauge to check that there are no gaps between:

1. The mounting surface of the gauge and the mounting bracket, or
2. The bottom surface of the gauge and the scale.

Place the gauge in position and use the mounting screws as guides. If the bottom of the gauge hits the tape, you will see the gap between the gauge bottom mounting surface and your mounting bracket surface.

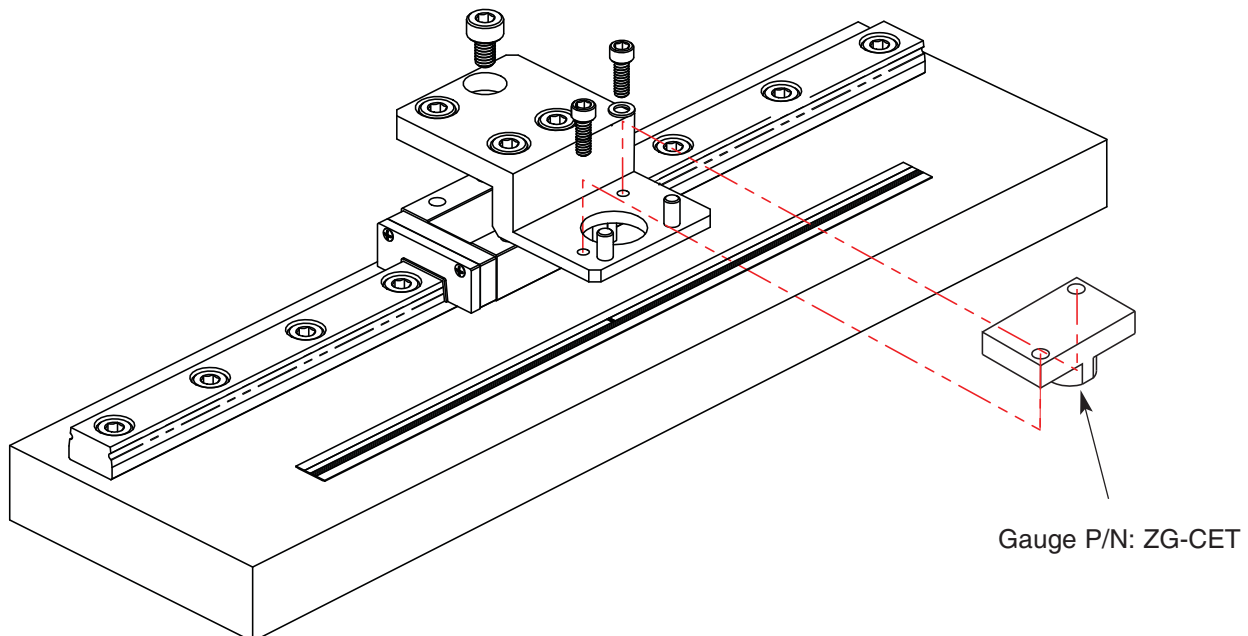
If you hand tighten the sensor mounting screws, there should be no gap between the tape scale and the bottom of the plastic gauge tool.

2. Install Sensor

Install the sensor on the mounting surface referencing the appropriate datum surface as shown on the Interface Drawing. Use two M2 or 2-56 screws to loosely affix the sensor. A benching edge is recommended to locate the sensor to meet the mechanical mounting tolerances. Refer to the Interface Drawing for recommended location and height of edge.

MTE Sensor Alignment Tolerances	
Axis	Alignment Tolerance
X	Direction of Motion
Y	$\pm 0.15\text{mm}$
Z	$\pm 0.15\text{mm}$
θ_X	$\pm 1.0^\circ$
θ_Y	$\pm 2.0^\circ$
θ_Z	$\pm 2.0^\circ$

Note: Tolerance for each axis is specified independently, assuming nominal alignment in all other axes.



Sensor Head Alignment (Top Mount Configuration)

MTE™ Series Encoders

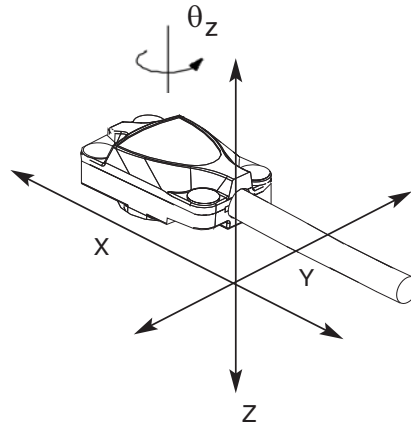
1.

Proper sensor alignment may require minor adjustments to the sensor position with respect to the scale. This can be performed easily using the sensor's LED indicator.

The red, yellow, or green Signal LED's will light depending on sensor alignment. Slowly move the sensor by allowing it to slide on the mounting surface until the green Signal LED, is illuminated. Optimal alignment will be displayed as a "bright green" Signal LED.

Confirm that the green Signal LED blinks when passing over the index. If not, readjust the sensor in the Y direction and repeat the above procedure.

When alignment is completed, tighten the sensor mounting screws (0.37Nm [3.3 inch-lbs.] maximum torque).



Green:
Optimal
Performance



Yellow:
Marginal
Performance

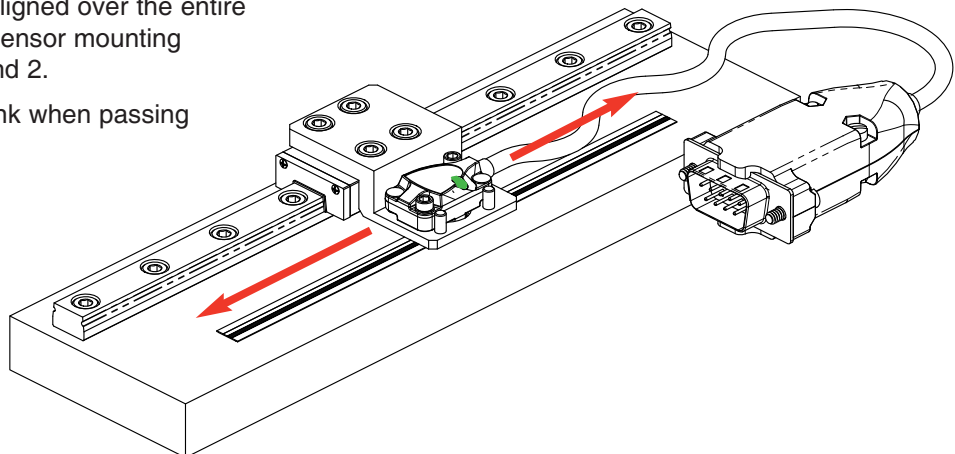


Red:
Improper
Performance

2.

Confirm that the Signal LED remains green over the full range of motion by sliding the scale past the sensor. The green Signal LED must remain on over the entire range. If not aligned over the entire range of motion, loosen the sensor mounting screws and repeat steps 1 and 2.

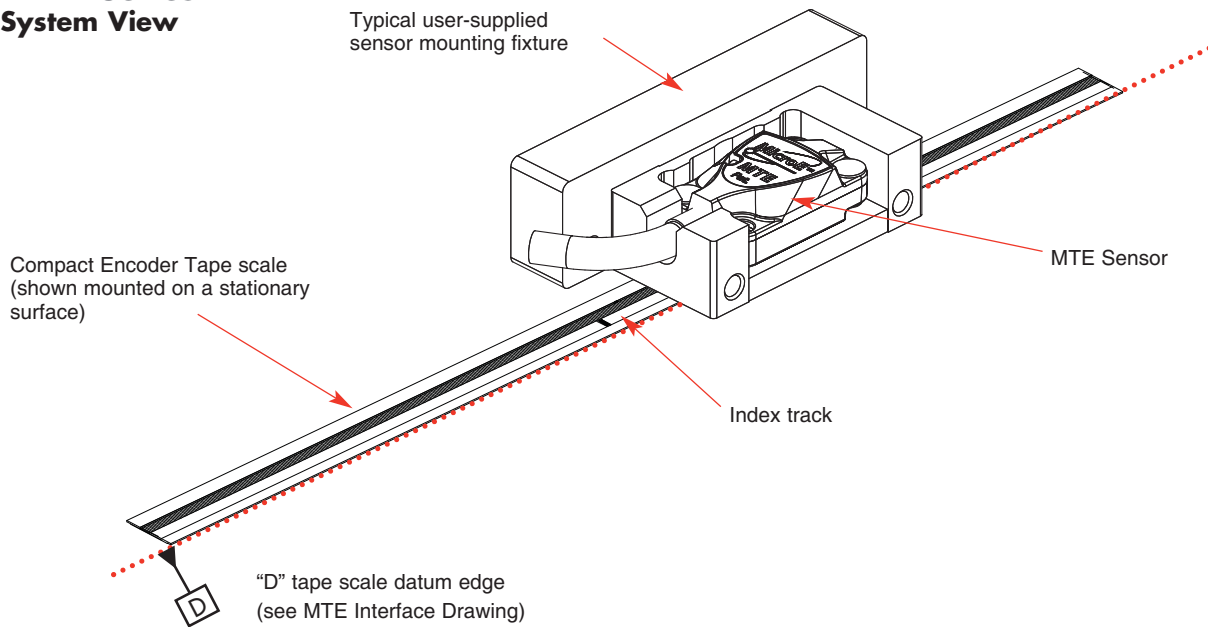
The LED will, and should, blink when passing the index mark.



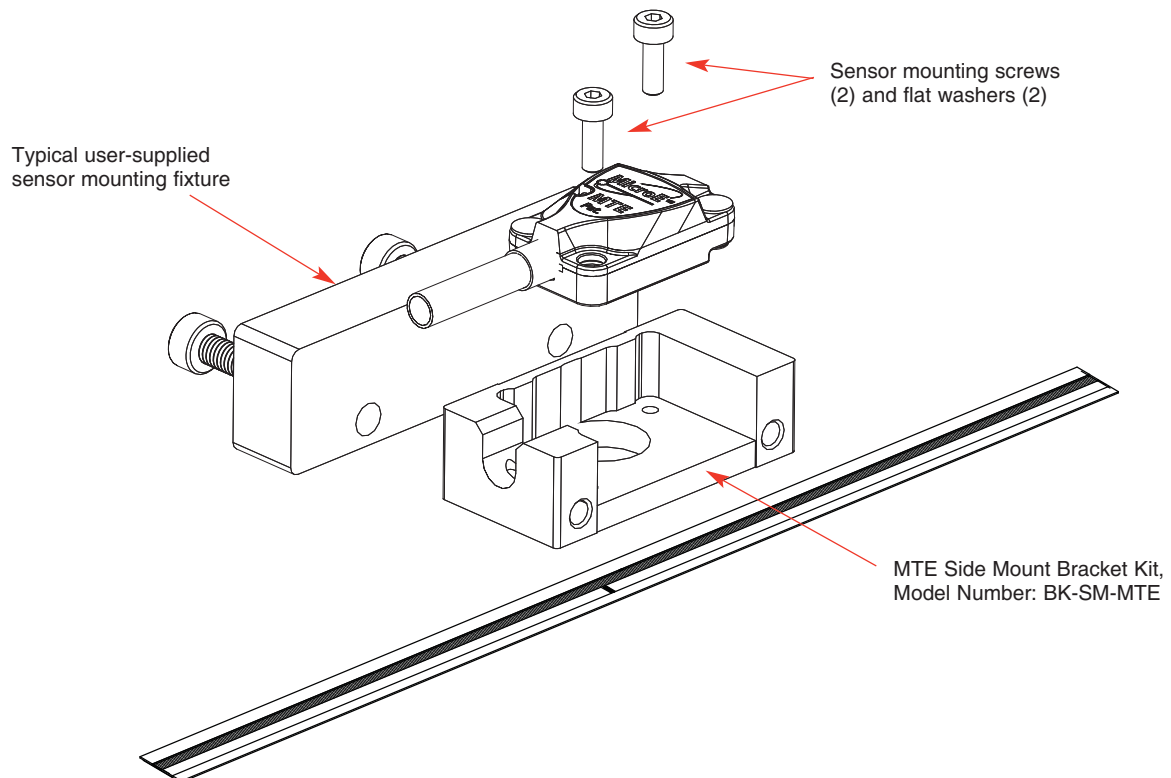
System Overview, (Side Mount Configuration)

MTE™ Series Encoders

MTE™ Series System View



Expanded View

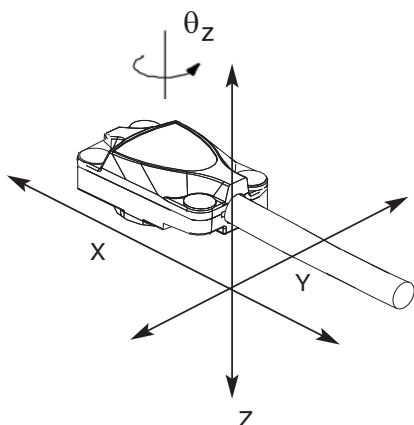


Sensor Head Installation (Side Mount Configuration)

MTE™ Series Encoders

Sensor Mounting Orientation and Tolerances

Axis diagram (Side mount bracket not shown.)

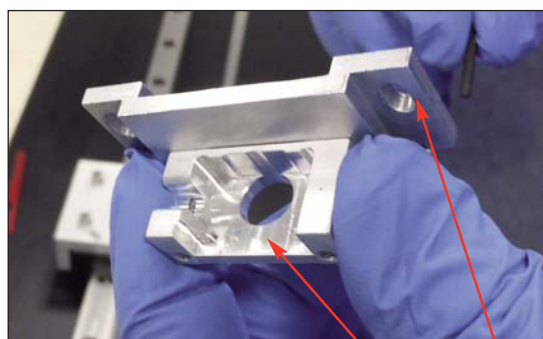


MTE Sensor Alignment Tolerances	
Axis	Alignment Tolerance
X	Direction of Motion
Y	$\pm 0.15\text{mm}$
Z	$\pm 0.15\text{mm}$
θ_X	$\pm 1.0^\circ$
θ_Y	$\pm 2.0^\circ$
θ_Z	$\pm 2.0^\circ$

1.

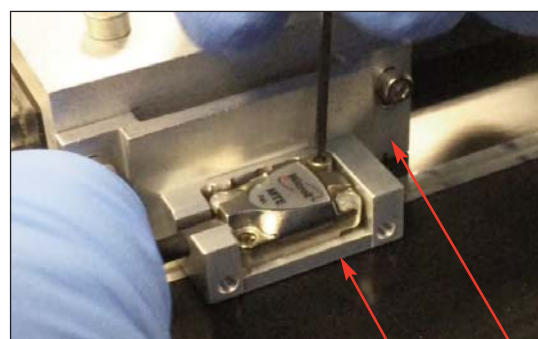
Install the Sensor

Use a wrench and M2, M3 screws to install the sensor and Side Mount Bracket Kit. Refer to the interface drawing to make sure sensor is oriented properly with reference to the scale.



1.1 Install the Side Mount Bracket Kit on to the customer mounting fixture.

Customer mounting fixture
Side Mount Bracket Kit,
Model Number: BK-SM-MTE



1.2 Install the sensor into the Side Mount Bracket Kit.

Customer mounting fixture
Side Mount Bracket Kit

Sensor Head Installation (Side Mount Configuration)

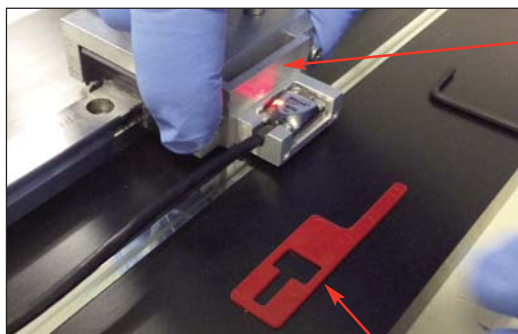
MTE™ Series Encoders

2.

Verify Sensor Mounting Surface Height

Refer to the MTE interface drawing for detailed dimensions.

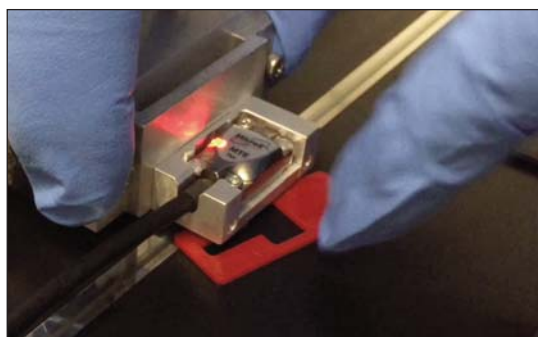
Use the Z-Height red spacer shim (1.00mm) to set the proper Z-height distance between the bottom surface of the Side Mount Bracket Kit/MTE Sensor and the top of the scale.



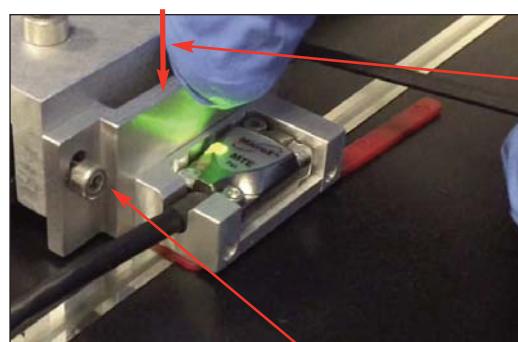
2.1 Loosen the Mounting Fixture in the Y-axis.

Z-Height (red) spacer

Mounting fixture loose in the Y-axis.



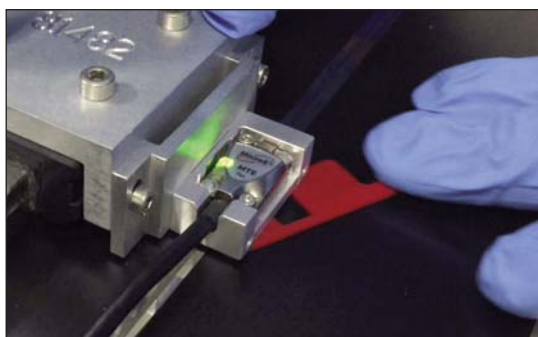
2.2 Place shim between the bottom of the Bracket Kit Adaptor and the top of the scale.



2.3 Press down gently in the Z-axis and tighten the mounting fixture screws.

Mounting fixture screws

Gently push the mounting fixture/Bracket Kit and sensor against the top of the tape scale in the Z-axis.



2.4 Carefully remove the shim by rotating it off the scale with the shim's handle.

Sensor Head Alignment (Side Mount Configuration)

MTE™ Series Encoders

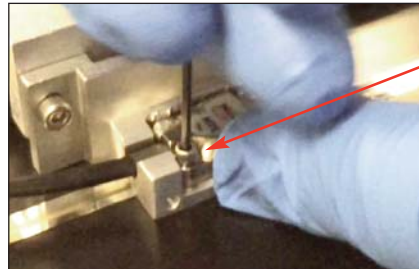
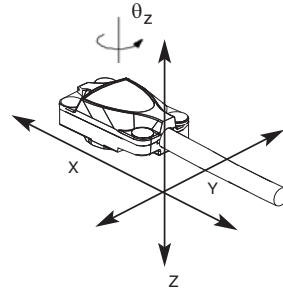
1.

Proper sensor alignment may require minor adjustments to the sensor position with respect to the scale. This can be performed easily using the sensor's LED indicator.

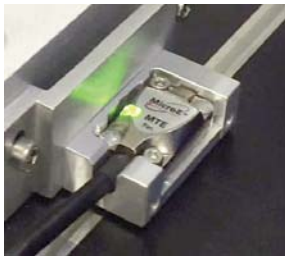
The red, yellow, or green Signal LED's will light depending on sensor alignment. Optimal alignment will be displayed as a "bright green" Signal LED.

Confirm that the green Signal LED blinks when passing over the index. If not, readjust the sensor in the Y-direction and repeat the above procedure.

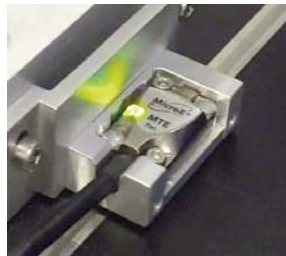
When alignment is completed, tighten the sensor mounting screws (0.37Nm [3.3 inch-lbs.] maximum torque).



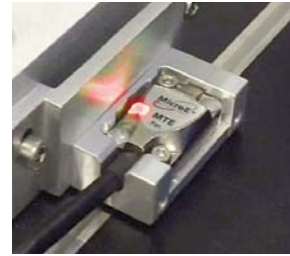
Loosen the sensor mounting screws/washers to reposition the sensor in the Y-axis if needed.



Green:
Optimal
Performance



Yellow:
Marginal
Performance

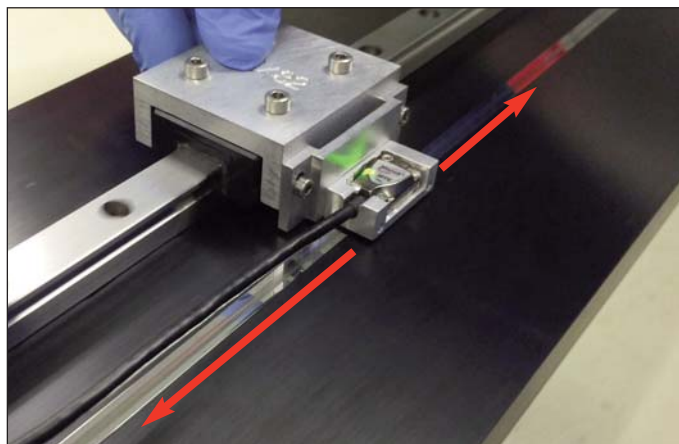


Red:
Improper
Performance

2.

Confirm that the Signal LED remains green over the full range of motion by sliding the scale past the sensor. The green Signal LED must remain on over the entire range. If not aligned over the entire range of motion, loosen the sensor mounting screws and repeat step 1.

The LED should blink when passing the index mark.



Appendix A

Specifications

System

MTE sensors are compatible with PurePrecision™ Compact Encoder Tape (CET™) Scale.

Scale Pitch 20µm

System Resolution 5µm, 2.5µm, or 1µm
(specify at time of ordering)

Linearity

Compact Encoder Tape Scale Linearity $\leq \pm 10\mu\text{m/m}^*$

*After two point correction in the customer's controller.

Sensor Size & Weight

Height	Width	Length
0.33 [8.4mm]	0.50 [12.7mm]	0.81 [20.6mm]
Weight	5g (without cable)	

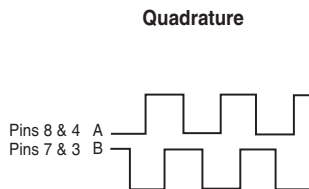
Reliability Information

5 Year Expected Reliability >99.8% under normal operating conditions

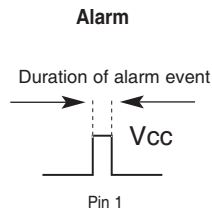
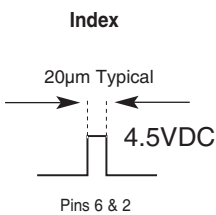
Operating and Electrical Specifications

Power Supply	5VDC $\pm 5\%$ @ 135mA max. when used with recommended termination, 80mA max. unterminated
Temperature	
Operating	0 to 70°C
Storage	-20 to 85°C
Humidity	10 to 90% RH non-condensing
Agency Standards Conformance: In accordance with Electromagnetic Compatibility Directive 2004/108/EC: EN 55011:2007	
EN 61000-4-2, -3, -4, -6	
Shock	300G 0.5 ms half sine
Vibration	30G at 17Hz
Sensor Cable	Double Shield Diameter 3.6mm (0.142") Flex Life 20x10 ⁶ cycles @ 20mm bending radius Standard 9 pin D-sub connector
Outputs	Digital A-quad-B, Index Window; A, B and IW outputs are differential. Alarm is single ended open drain.
Signal Level	A/B/I (differential): RS-422 compatible A/B/I (single ended): High >4.2VDC, Low <0.2VDC Alarm: 0.2VDC-Vcc

Digital Output Signals



Inverse signals are not shown for clarity.

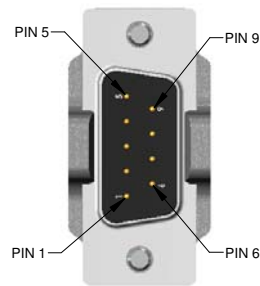


Open drain, requires external pull-up.

Appendix B

Wiring Diagrams

Connector Pin Configuration

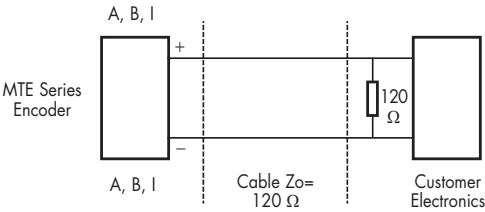


MTE 9P D-Sub Pinouts	
Pin#	Function
1	Alarm
2	Index Window +
3	B+
4	A+
5	5V
6	Index Window -
7	B-
8	A-
9	GND/Inner Shield

NOTE: GND and INNER SHIELD ARE INTERNALLY CONNECTED.

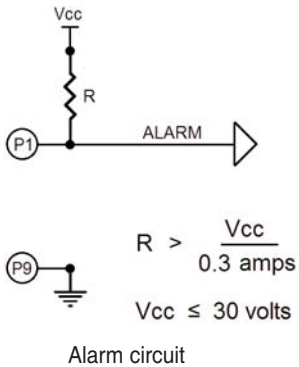
Recommended Signal Termination

Digital Outputs:



Standard RS-422 Line Receiver Circuitry

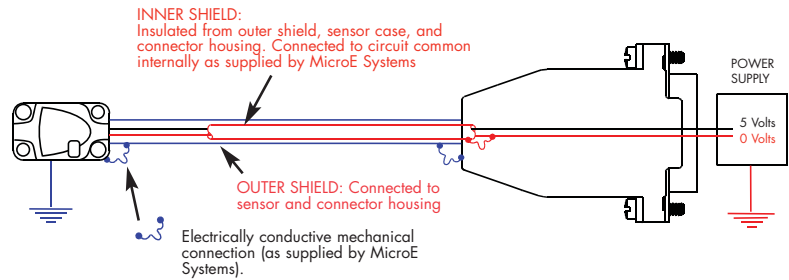
Alarm:
Alarm output is an open drain, N-channel MOSFET. Drain circuit is normally closed (current flows) and opens when the encoder signal is too low. Alarm requires the use of an external pull-up resistor. See customer supplied circuit example on right.



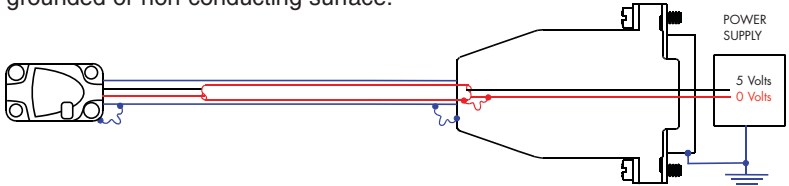
Max cable length: 5m. Contact MicroE Applications Engineering if longer length required.

Grounding Considerations

Sensor mounted with good electrical contact to well grounded surface (preferred):



Sensor mounted to poorly grounded or non-conducting surface:



Appendix C

Interface Cable Requirements

1. Customer Interface Cable Requirements

Customer cables that interface to MTE™ series encoders must have the following characteristics:

- Twisted pair signal wiring.
- Characteristic impedance of 100-120 ohms.
- Sufficient wire gauge to meet the minimum voltage requirement at the encoder, for example 24AWG gauge wire for a 2m length cable. Examples of acceptable cables with 24AWG gauge wire and 4 twisted pairs are Belden 9831, 8104, and 9844 or other manufacturer's equivalents.
- Single shield cable with a minimum of 90% coverage. Note that a double shielded cable may be required in high-noise applications.

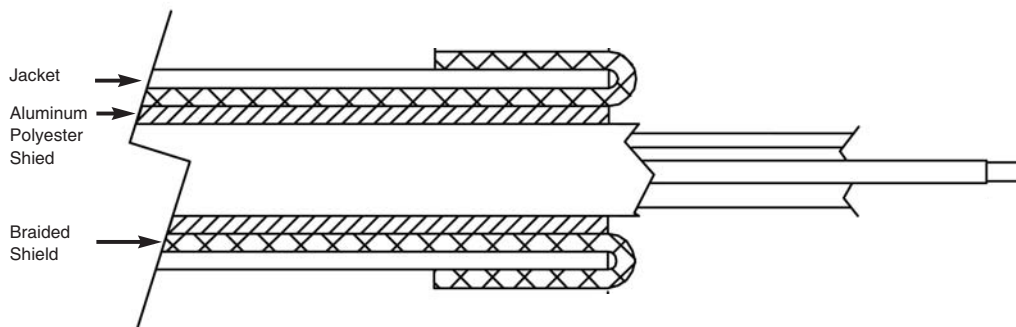
2. Signal Wiring

Each differential signal should be connected to a corresponding twisted pair as follows:

MTE	
Signal	Twisted Pair
A+	Pair 1
A-	
B+	Pair 2
B-	
Index+	Pair 3
Index-	
+5V	Pair 4
GND	

3. Shield Termination:

The customer's cable shield should be in 360° contact with the connector shroud and the connector shell to provide complete shielding. The connector shell should be metal with conductive surfaces. Suggested metal connector shells for use with MTE™ encoders: AMP 748676-1 or equivalent. The shield should be terminated as illustrated in the following diagram.



Fold braided shield back over jacket. Example shows double-shielded cable. Dimensions shown are for illustration only.

Appendix C

Interface Cable Requirements

4. Grounding:

The diagrams below show how to make the connections when the encoder's connector is plugged into the customer's controller chassis. If a customer-supplied extension cable is used, it should be a double shielded cable with conductive connector shells and must provide complete shielding over the conductors contained within it over its entire length. Furthermore, the shields should be grounded at the connection to the controller chassis the same way as the encoder connectors in the diagrams below.

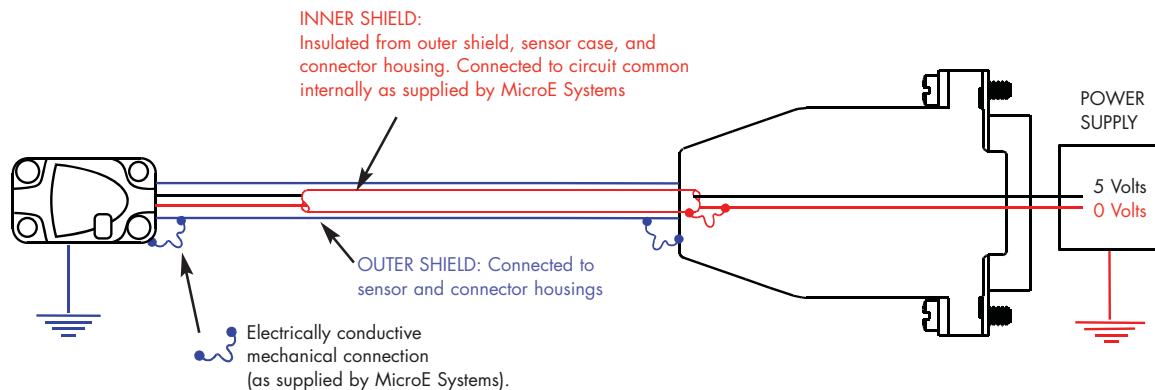
NOTE:

For best performance, isolate the encoder outer shield from motor cable shields and separate the encoder cable as far as possible from motor cables.

4.1 Sensor mounted with good electrical contact to a well-grounded surface (preferred)

9-pin D-sub connector grounding: The encoder's connector shell must be in contact with the customer-supplied mating connector, which must be isolated from the controller's ground. If a customer-supplied shielded cable connects the encoder to the controller, then the outer shield on the customer-supplied cable must be isolated from the controller's ground.

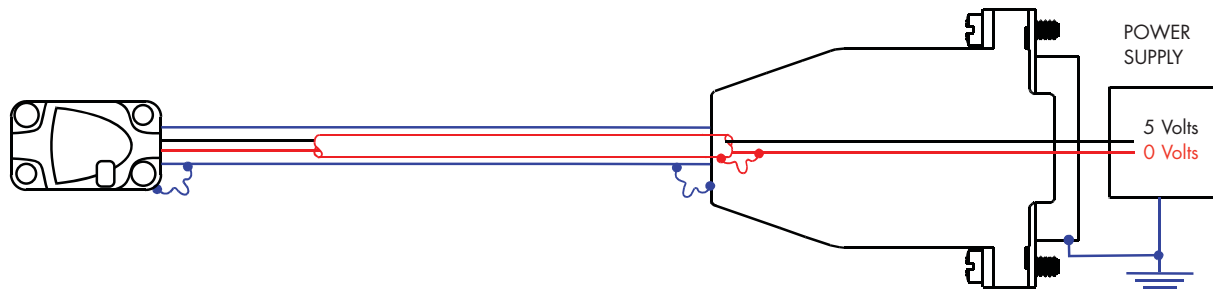
The sensor mounting surface must have a low impedance (DC/AC) connection to ground. The encoder sensor mounting surface may have to be masked during painting or anodizing to insure good electrical contact with the sensor.



4.2 Sensor mounted to a surface that is grounded through bearings or a poorly-grounded surface, or mounted to a non-conducting surface

9-pin D-sub connector grounding: The encoder's connector shell must be in contact with the customer-supplied mating connector, which must be connected to the controller's ground. If a customer-supplied shielded cable connects the encoder to the controller, then the outer shield on the customer-supplied cable must be connected to the controller's ground. The controller must be grounded to earth at the point of installation.

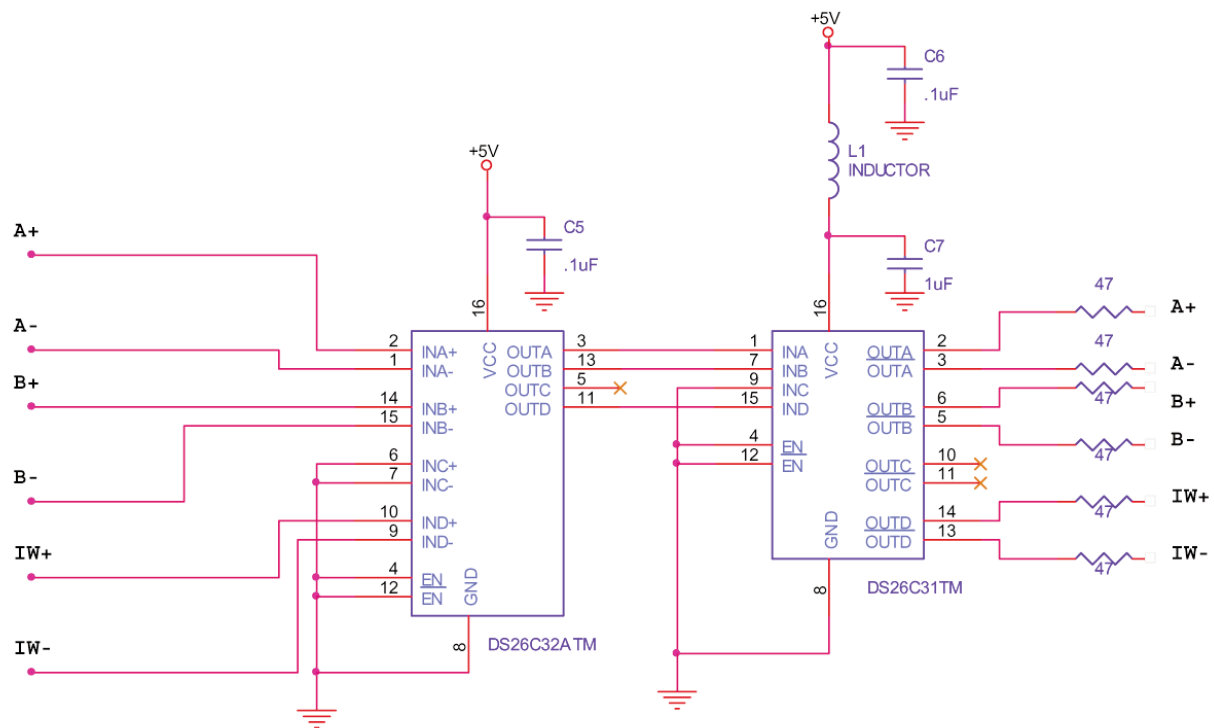
The encoder sensor must be mounted so that it is electrically isolated from ground.



Appendix D

RS-422 Compliance

The MTE is RS-422 compatible. Encoder signals are “sending end terminated.” Therefore customer receiving terminations are not required. If you elect to use them, the supply current will increase. Optional RS-422 compliant circuitry for long cable runs in harsh electrical environments is illustrated below.



Appendix E

Troubleshooting

Problem

The Sensor LED indicator won't turn on.

Solution

- Make sure that the MTE Series electronics' 9-pin D-sub connector is fully seated and connected.
- Confirm that +5 Volts DC is being applied to the MTE Sensor. Refer to the MTE interface drawing for proper pinouts.

Problem

Can't get the MTE Series electronics' "Signal" LED better than red or yellow; or the green, " Proper Alignment" indicator doesn't stay illuminated over the full length of the scale.

Solution

- Verify that the sensor is mounted in the correct orientation with reference to the scale and scale mounting reference edge. Refer to the Interface Drawing.
- Verify that the sensor has been aligned to the scale and that the mounting screws are tight. Check the dimensions for the mechanical mounting holes (and clamps if any) to make sure that the sensor is correctly located over the scale in the Y and Z dimensions. Refer to the Interface Drawing.
- Check that the scale is firmly mounted and can't jiggle or move in any direction.
- Make sure that the scale is clean over its entire length or circumference.

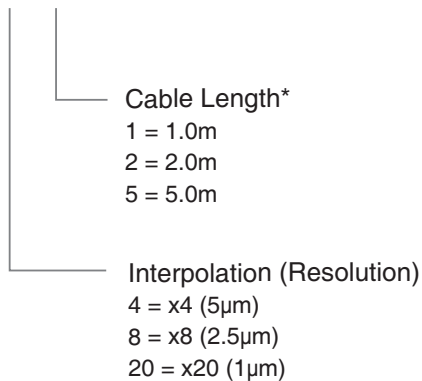
Appendix F

Order Guide

How to Order

Sensor

MTE – 20 – 2



* Custom cable lengths and connectors are available. Contact MicroE Applications Engineering.

Sensor Installation Tools

ZG-CET Z-Height Gauge, Compact Encoder Tape, top mount configuration

MTE Side Mount Bracket Kit

BK-SM-MTE Side Mount Bracket Kit. Reference design is available upon request.

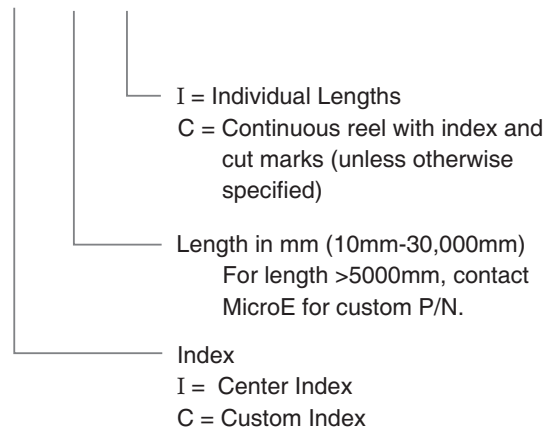
FlexFit™ Adaptor

MK-FFA FlexFit Adaptor Mounting Kit. Reference design is available upon request.

Scales

Compact Encoder Tape (CET™)

CET20 – N – A – I – xxxx – C



Example 1: CET20-N-A-I-4550-C
= 4550mm long, single center index (2775mm from cut marks), continuous

Example 2: CET20-N-A-C-5xxx-I
= Multiple indexes, individually cut, with index dimensions per factory issued part # 5xxx (e.g., index at 50mm and 350mm, segment length 400mm)

Example 3: CET20-N-A-C-5xxx-C
= Single index which is offset from center of segment, continuous, with index dimensions per factory issued part # 5xxx (e.g., index at 50mm from left cut mark, segment length 400mm)

CET™ Tape Scale Applicator Tools (use for lengths >1m)

TSAT-CET Tape Applicator Tool for MTE, top mount configuration

TSAT-SM-PPT Tape Applicator Tool for MTE, side mount configuration

End Cap Kit, PurePrecision Tape Scales

EC Optional Tape Scale End Caps

Contacting MicroE

MicroE Systems is a world leader in optical encoder technology with offices in major industrial centers around the globe.

To learn more about MicroE Systems products, visit:
www.microesystems.com.

Our products have been used by thousands of companies worldwide to solve a wide range of motion control applications. Our advanced encoder technology and application expertise has driven innovations in the design of machinery, equipment and instrumentation in many industries, including medical, industrial, robotics, automation, metrology, semiconductor manufacturing, packaging equipment, entertainment, energy, military, and scientific research.



MicroE Systems
125 Middlesex Turnpike
Bedford, MA 01730 USA
T 781-266-5700
F 781-266-5112
info@microesys.com
www.microesystems.com