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**MTE™ Sensor Installation**

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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.

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 4.75VDC 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 4.75VDC is available to the MTE encoder under all operating conditions. The input voltage should not exceed 5.25VDC.

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 Recommended 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 (sold separately).
- 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

Sensor (shown attached on a linear slide base with mounting bracket)

Compact Encoder Tape scale (shown mounted on a stationary surface)

Expanded View

Sensor mounting screws (2) and flat washers (2)

Typical user-supplied sensor mounting bracket
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 ± 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.

<table>
<thead>
<tr>
<th>MTE Sensor Alignment Tolerances</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Axis</th>
<th>Alignment Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Direction of Motion</td>
</tr>
<tr>
<td>Y</td>
<td>± 0.15mm</td>
</tr>
<tr>
<td>Z</td>
<td>± 0.15mm</td>
</tr>
<tr>
<td>θX</td>
<td>± 1.0°</td>
</tr>
<tr>
<td>θY</td>
<td>± 2.0°</td>
</tr>
<tr>
<td>θZ</td>
<td>± 2.0°</td>
</tr>
</tbody>
</table>

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 LEDs 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).

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

Typical user-supplied sensor mounting fixture

Compact Encoder Tape scale (shown mounted on a stationary surface)

"D" tape scale datum edge (see MTE Interface Drawing)

Expanded View

Sensor mounting screws (2) and flat washers (2)

Typical user-supplied sensor mounting fixture

MTE Side Mount Bracket Kit, Model Number: BK-SM-MTE
**Sensor Head Installation** (Side Mount Configuration)

MTE™ Series Encoders

**Sensor Mounting Orientation and Tolerances**

Axis diagram (Side mount bracket not shown.)

<table>
<thead>
<tr>
<th><strong>Axis</strong></th>
<th><strong>Direction of Motion</strong></th>
<th><strong>Alignment Tolerance</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Z</td>
<td>± 0.15mm</td>
</tr>
<tr>
<td>Y</td>
<td>Z</td>
<td>± 0.15mm</td>
</tr>
<tr>
<td>Z</td>
<td></td>
<td>± 1.0°</td>
</tr>
<tr>
<td>θx</td>
<td></td>
<td>± 2.0°</td>
</tr>
<tr>
<td>θy</td>
<td></td>
<td>± 2.0°</td>
</tr>
<tr>
<td>θz</td>
<td></td>
<td>± 2.0°</td>
</tr>
</tbody>
</table>

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.

1.2 Install the sensor into the Side Mount Bracket Kit.

Customer mounting fixture

Side Mount Bracket Kit, Model Number: BK-SM-MTE
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.

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.

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 LEDs 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).

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\textsuperscript{TM} Compact Encoder Tape (CET\textsuperscript{TM}) Scale.

<table>
<thead>
<tr>
<th>Scale Pitch</th>
<th>20µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Resolution</td>
<td>5µm, 2.5µm, or 1µm <em>(specify at time of ordering)</em></td>
</tr>
</tbody>
</table>

#### Linearity
Compact Encoder Tape Scale Linearity \( \leq 10\mu m/m^* \)

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

#### Sensor Size & Weight
<table>
<thead>
<tr>
<th>Height</th>
<th>Width</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.33 [8.4mm]</td>
<td>0.50 [12.7mm]</td>
<td>0.81 [20.6mm]</td>
</tr>
<tr>
<td>Weight</td>
<td>5g (without cable)</td>
<td></td>
</tr>
</tbody>
</table>

#### Reliability Information
5 Year Expected Reliability >99.8% under normal operating conditions

#### Operating and Electrical Specifications

| Power Supply | 5VDC ±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 |


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.

<table>
<thead>
<tr>
<th>Signal Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/B/I (differential): RS-422 compatible</td>
</tr>
<tr>
<td>A/B/I (single ended): High&gt;4.2VDC, Low &lt;0.2VDC</td>
</tr>
<tr>
<td>Alarm: 0.2VDC-Vcc</td>
</tr>
</tbody>
</table>

#### Digital Output Signals

**Quadrature**

- Pins 8 & 4
- Pins 7 & 3

**Index**

- 20µm Typical
- 4.5VDC

**Alarm**

- Duration of alarm event
- Vcc
- Pin 1

Inverse signals are not shown for clarity.

Open drain, requires external pull-up.
Appendix B

Wiring Diagrams

Connector Pin Configuration

<table>
<thead>
<tr>
<th>MTE 9P D-Sub Pinouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin#</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
</tbody>
</table>

NOTE: GND and INNER SHIELD ARE INTERNALLY CONNECTED.

Recommended Signal Termination

Digital Outputs:

- 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):

- INNER SHIELD: Insulated from outer shield, sensor case, and connector housing. Connected to circuit common internally as supplied by MicroE Systems.

Sensor mounted to poorly grounded or non-conducting surface:

Alarm circuit:

\[ R > \frac{V_{cc}}{0.3 \text{ amps}} \]

\[ V_{cc} \leq 30 \text{ volts} \]
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:

<table>
<thead>
<tr>
<th>Signal</th>
<th>Twisted Pair</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>Pair 1</td>
</tr>
<tr>
<td>A-</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>Pair 2</td>
</tr>
<tr>
<td>B-</td>
<td></td>
</tr>
<tr>
<td>Index+</td>
<td>Pair 3</td>
</tr>
<tr>
<td>Index-</td>
<td></td>
</tr>
<tr>
<td>+5V</td>
<td>Pair 4</td>
</tr>
<tr>
<td>GND</td>
<td></td>
</tr>
</tbody>
</table>

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 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.
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

<table>
<thead>
<tr>
<th>Cable Length*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = 1.0m</td>
</tr>
<tr>
<td>2 = 2.0m</td>
</tr>
<tr>
<td>5 = 5.0m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interpolation (Resolution)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 = x4 (5µm)</td>
</tr>
<tr>
<td>8 = x8 (2.5µm)</td>
</tr>
<tr>
<td>20 = x20 (1µm)</td>
</tr>
</tbody>
</table>

Scales

Compact Encoder Tape (CET™)

CET20 – N – A – I – xxxx – C

<table>
<thead>
<tr>
<th>I = Individual Lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>C = Continuous reel with index and cut marks (unless otherwise specified)</td>
</tr>
</tbody>
</table>

Length in mm (10mm-30,000mm)
For length >5000mm, contact MicroE for custom P/N.

<table>
<thead>
<tr>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>I = Center Index</td>
</tr>
<tr>
<td>C = Custom Index</td>
</tr>
</tbody>
</table>

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)

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.

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

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSAT-CET</td>
<td>Tape Applicator Tool for MTE, top mount configuration</td>
</tr>
<tr>
<td>TSAT-SM-PPT</td>
<td>Tape Applicator Tool for MTE, side mount configuration</td>
</tr>
</tbody>
</table>

End Cap Kit, PurePrecision Tape Scales

EC Optional Tape Scale End Caps
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.
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Compact Encoder Tape (CET™) Scale Installation

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- Pre-Installation Information and Precautions ..................................................................................5
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- Mounting Surface Preparation for Top Mount and Side Mount Sensors ..........................................7
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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 scale unless you are wearing talc-free gloves or finger cots. Please read this installation manual for full instructions.

RoHS  MTE models are CE and RoHS compliant.
Overview

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

This manual applies to the installation of the following scale types.

• PurePrecision Compact Encoder Tape (CET™) for MTE Series, Model CET20-

Items Required for CET Scale Installation

You will need the following items available:

• Shears (recommend, Clauss, Item# 18003)
• Tape Applicator Tool, for applications >1000mm (not required for installations <1000mm)
  MTE Top Mount Configuration tool Model Number: TSAT-CET
  MTE Side Mount Configuration tool Model Number: TSAT-SM-PPT
• Finger Cots or talc-free gloves
• Acetone or isopropyl alcohol
• Lint-free cotton cloths or wipes
• End caps (optional)
• Two-part epoxy (Tra-Con Tra-Bond 2116)
• Stick and disposable surface for stirring epoxy
Pre-Installation Information and Precautions

Read all instructions completely before beginning the installation process.

The CET™ Scale is a precision metrological device. Handle it with the utmost care at all times.

Avoid bending the tape scale to a radius less than 90mm (3.5 inches)
Avoid twisting the CET Scale.
Do not let any sharp object touch the tape scale after the blue protective film is removed.
The CET Scale is protected by a blue film on the top that prevents contamination and damage to the grating pattern during installation.
Once the adhesive on the tape scale is exposed (by removing the adhesive liner), do not touch the adhesive or allow any contamination to come into contact with it.
CET Scale is designed for one time installation only.
If removed from the mounting surface for any reason, it should not be used for any kind of reapplication. This will affect the performance and reliability of the encoder system.

The adhesive on the CET Scale is permanent.
Do not touch the adhesive once the adhesive liner is removed.
Do not remove the tape scale from the mounting surface once it has been installed.
Do not reinstall the tape scale if it has already been installed once.
Avoid any contamination to the adhesive. Any particulate matter or other contamination that is trapped between the scale and the mounting surface will affect encoder performance.

NOTE:
MicroE does not recommend installing CET Scale on a curved (cylindrical) surface.
Design Guidelines

1. Verify the tolerances of the scale’s mounting surface given in the Interface Drawing.

2. Verify the dimensions of the scale benching edge (groove or straight edge) given in the Interface Drawing.

3. Calculate the length of CET™ Scale required for your application. Refer to the Interface Drawing.

4. Tape scales less than 1000mm can be installed by hand against a straight edge. For lengths greater than 1000mm, tape scale applicator tools are needed:

   Top Mount Configuration:
   - Applicator tool Model Number: TSAT-CET

   Side Mount Configuration:
   - Applicator tool Model Number: TSAT-SM-PPT

5. If the tape scale is being installed into a 6mm groove, it must be installed by hand (regardless of scale length). Refer to the Interface Drawing.

6. If machining the mounting surface is undesirable, or not possible, a temporary straight edge can be used that meets the dimensions and tolerances specified in the Interface Drawing.

Two kinds of temporary straight edge can be used -

- **Type I (thin)**-
  Temporary Straight Edge of thickness 0.76 ± 0.05 mm (0.030 ± 0.002 inches). Refer to the Interface Drawing for additional dimensional requirements. A steel rule may be one of the options for this type of temporary straight edge.

- **Type II (thick)**-
  Temporary straight edge with minimum thickness 9.53mm (0.375 inches). Refer to the Interface Drawing for additional dimensional requirements.

NOTE:
See the appropriate section on Tape Applicator Tool installations.
Mounting Surface Preparation

1. Inspect the mounting surface for any machining irregularities. MicroE Systems recommends a surface finish of better than 1.6 micrometers Ra.

2. The straight edge (either permanent or temporary) must be sharp on the benching side in order to use it as a guide in hand mounted applications. In order for the tape scale to be mounted close to the straight edge, the maximum radius of 0.127 mm (0.005 inches) should be used where the edge meets the bottom of the mounting surface.

3. Thoroughly clean the scale mounting surface and reference edge using a cotton swab or lint-free cloth dampened with isopropyl alcohol or acetone. Remove all dust and particles.

4. Mark the starting location on the mounting surface where the tape scale will be applied.
Cutting the CET™ Scale

1. **NOTE:** When working with any encoder scale, it is important to use either finger Cots or talc-free gloves.

Uncoil the tape scale and cut it to the required length using shears. Note: check the interface drawing to make sure the scale is cut to the right length.

Securely hold the tape scale close to the shear (at an approximate distance of 40mm (1½ inches)) near the point of cutting.

Orient the tape scale perpendicular to the shear.

Cut the tape scale in a smooth, continuous motion.
CET™ Scale, MTE Top/Side Mount Configurations
Installation By Hand

**NOTE:**
For best system performance, talc-free gloves or finger cots should be worn during all steps of tape scale installation.

Thoroughly clean the scale mounting surface and reference edge using a cotton swab or lint-free cloth dampened with isopropyl alcohol or acetone. Remove all dust and particles.

1. **Scale direction/orientation**

Orient the scale such that the "arrowheads" on the blue protective film are pointing towards the mounting surface reference edge “D” as shown in the interface drawings for your sensor model.

Refer to the correct model number Interface Drawing for reference edge “D” dimensions and sensor orientation. Download the latest Interface Drawing at www.microesys.com/products/documentation

![Diagram showing orientation](image)

D = Mounting Surface Reference Edge

2. **Removing/peeling the bottom adhesive liner.**

CET Scales have 3 layers, blue protective film, steel scale, and adhesive backing.

Remove/peel back approximately 25mm (1 inch) of the bottom adhesive liner, taking care not to touch the adhesive or allow any particulate contamination.

**NOTE:**
Do not peel the blue protective film off at this time.
CET™ Scale, MTE Top/Side Mount Configurations
Installation By Hand

3. 
Flip the tape over with the 25mm (1 inch) exposed adhesive surface facing down. Be sure not to touch or contaminate the exposed adhesive surface. Be sure the orientation arrows on the blue protective film point to the “D” reference edge.

4. 
Place the CET™ Tape Scale against the mounting surface “D” reference edge.

Place the 25mm (1 inch) exposed adhesive end of the tape scale against the mounting surface “D” reference edge as shown and press firmly on the end.

**NOTE:**
Adhesive exposed by removing the adhesive bottom liner can touch the mounting surface only once.
5. **Install the CET Scale along the remaining length of the mounting surface.**

Press the remaining tape on to the mounting surface with a sliding motion as shown below. Pull the adhesive liner out of the way during the sliding motion.

**NOTE:**
Make sure that the tape scale is tight against the “D” reference edge.
CET™ Scale, MTE Top/Side Mount Configurations
Installation By Hand

6. Once the scale is applied to the mounting surface, and before the blue protective film is removed, it is recommended that even pressure be applied over the entire tape scale length by sliding a glove or cot protected finger across the scale. The applied pressure will ensure that the adhesive is evenly and permanently set.

7. Peel off the blue protective film.
Start the peeling process using a sharp tool, being careful not to damage the scale. Pull off the remaining blue protective film.

**NOTE:**
After removing the blue protective film, the scale is ready for use and will perform to specification.
The encoder will not function properly with the blue protective film installed. It must be removed for proper encoder operation.
CET™ Scale, MTE Top Mount Configuration
Installation By Mounted Applicator Tool

1. **Overview of CET Scale Applicator Tool (Model Number: TSAT-CET)**

   The CET Scale Applicator Tool mounts into the MTE’s sensor mounting holes.

   Tool orientation arrows
   CET scale entry channel

   Applicator tool spring loaded contact cylinder Up/Down position knob
   Spring loaded contact cylinder

   The CET Scale Applicator Tool corresponds to the MTE encoder as shown below. The benching surfaces correspond to the B and C faces shown in the MTE interface drawing.

2. **Applicator Tool benching faces**

   The orientation of the CET Applicator Tool corresponds to the MTE encoder as shown below. The benching surfaces correspond to the B and C faces shown in the MTE interface drawing.

3. **Applicator Tool - mounting**

   Shown below is the MTE Sensor head mounted in its fixture.

   The CET Applicator Tool mounted in the same MTE Sensor fixture, ready for CET Scale installation.

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**NOTE:**
For best system performance, talc-free gloves or finger cots should be worn during all steps of tape scale installation.

Thoroughly clean the scale mounting surface and reference edge using a cotton swab or lint-free cloth dampened with isopropyl alcohol or acetone. Remove all dust and particles.
CET™ Scale, MTE Top Mount Configuration
Installation By Mounted Applicator Tool

4. Applicator Tool - bottom view

While mounted in the MTE sensor’s fixture, CET Scale is fed through the entry channel and pressed onto the mounting surface with the spring loaded contact cylinder.

The contact cylinder has two positions, Up and Down, controlled by the black position knob on the side of the Applicator Tool.

Up, allows clearance for feeding of the CET Scale through the entry slot into the “start” position. Down, locks the tape scale onto the “start” position. Moving the Applicator Tool along in the Down position will automatically press the CET Scale to the mounting surface.

5. Applicator Tool / CET Scale Orientation

The correct end of the tape to insert is shown below.

Both Tape Scale arrows, and Applicator Tool orientation arrows need to point in the same direction, while the tape is being applied.

In the example above, the side of the tape scale that needs to go into the tool entry channel first is called the “correct” end.

6. Install the Applicator Tool into the MTE Mount

Tighten the mounting screws.
CET™ Scale, MTE Top Mount Configuration
Installation By Mounted Applicator Tool

7. Tape Scale Preparation
Using a sharp tool or fingernail, peel off a short section of bottom adhesive backing, approximately 50mm (2 inches) from the “correct” end of the scale to be inserted into the applicator tool.

Take care not to touch the adhesive or allow any particle contamination.

NOTE: Do not peel the blue protective film off at this time.

8. Tape Scale Insertion
Turn the tool contact cylinder knob to the UP position.

Insert the “correct” end of the tape scale into the applicator tool, making sure the clear backing tape curls out of the way.

The orientation arrows on the Tape Scale and Applicator Tool need to point in the same direction.

Also note, the “D” reference edge is determined from the MTE interface drawing. The tape scale orientation arrows always point to the “D” reference edge. In the example, the dotted red line shown is the measured “D” reference edge. When the tape scale is finally installed, the orientation arrows will be pointing to the calculated “D” reference edge.
CET™ Scale, MTE Top Mount Configuration
Installation By Mounted Applicator Tool

9. **Tape Scale Insertion**
Push the scale slowly into the Applicator Tool until the tape scale emerges from the side of the mounting fixture to a desired end location. Press down on this exposed 3-5mm section of tape.

10. **Rotate Contact Cylinder Knob to Down**
Turn the applicator tool contact cylinder knob to the DOWN position.

Turning the knob to the DOWN position, applies firm pressure to the tape scale under the applicator tool. This action presses the adhesive side of the tape scale firmly onto the scale mounting surface.
11. **Apply the Tape Scale**

Push the Applicator Tool and fixture assembly in the direction of tape application. Use a slow and steady motion.

Once the tool begins moving, it automatically separates the clear adhesive backing tape from the scale.

Pull the clear adhesive backing tape out of the way to prevent the backing tape from clogging the applicator tool.

![Applicator Tool and fixture direction of motion](image)

Be sure to pull the adhesive backing film out of the way to prevent a tool jam.
12. Once the scale is applied to the mounting surface, and before the blue protective film is removed, it is recommended that even pressure be applied over the entire tape scale length by sliding a glove or cot protected finger across the scale. The applied pressure will ensure that the adhesive is evenly and permanently set.

13. Peel off the blue protective film.

Start the peeling process using a sharp tool, being careful not to damage the scale. Pull off the remaining blue protective film. Clean the tape scale using alcohol or acetone and a lint-free cotton cloth.

**NOTE:**
Make sure you have on finger cots or talc-free gloves.

**NOTE:**
After removing the blue protective film, the scale is ready for use and will perform to specification. The encoder will not function properly with the blue protective film installed. It must be removed for proper encoder operation.
**CET™ Scale, MTE Side Mount Configuration**

Installation By Mounted Applicator Tool

**NOTE:**
For best system performance, talc-free gloves or finger cots should be worn during all steps of tape scale installation.

Thoroughly clean the scale mounting surface and reference edge using a cotton swab or lint-free cloth dampened with isopropyl alcohol or acetone. Remove all dust and particles.

1. **MTE Side Mount Tape Scale Applicator Tool (Model Number: TSAT-SM-PPT)**

   The mounted application tool is needed for scale lengths greater than 1000mm. It is mounted in the same fixture as the MTE Side Mount Sensor in the MTE Side Mount Bracket Kit (BK-SM-MTE) or customer fabricated adaptor.

   ![Tape Scale Applicator Tool and Bracket Kit](image)

   **Bracket Kit Mounting Surface “A”**
   **MTE Side Mount Bracket Kit, Model Number: BK-SM-MTE**
   **Mounting Surface for MTE Sensor/Bracket Kit and Tape Applicator Tool**

2. **TSAT-SM-PPT Side Mount Applicator Tool orientation to the “B” sensor mounting surface**.

   The “B” MTE sensor benching surface is shown in the MTE interface drawing, along with the “D” tape scale mounting edge. The corresponding “A” reference mounting surface of the Applicator Tool and Bracket Kit adapter is shown below.

   ![Mounting Surface](image)

   *The MTE Side Mount Tape Scale Applicator Tool (model number: TSAT-SM-PPT), will only work properly when mounted in the configuration shown in Step 2.*
3. **Mount the Applicator Tool.**

Mount the Applicator Tool in the Side Mount Bracket Kit/Sensor mounting holes. Rotate the knob that controls the contact cylinder plunger to the **UP** position (See Step 6.). Use the red spacer (1.00mm) Z-height shim to set up the approximate Z-height, to ensure proper Applicator Tool function.

4. **Note tape scale orientation with arrows and the “D” reference edge.**

The applicator tool is shown mounted to the MTE/Bracket Kit Adaptor Sensor mount. Both Tape Scale arrows, and Applicator Tool orientation arrows need to point in the same direction for proper configuration. Also note, the “D” reference edge is determined from the MTE interface drawing. The tape scale orientation arrows always point to the “D” reference edge. In the example below, the dotted red line shown is the measured “D” reference edge. When the tape scale is finally installed, the orientation arrows will be pointing to the calculated “D” reference edge.

In the example shown, the left side of the tape scale needs to go into the applicator tool entry channel first.
CET™ Scale, MTE Side Mount Configuration
Installation By Mounted Applicator Tool

5. Peel off a short section of bottom adhesive backing approximately 50mm (2 inches).
Compact Encoder Tape (CET) Scales have 3 layers, blue protective film, steel scale, and adhesive backing. Using a sharp tool or fingernail, initiate the peeling of the adhesive liner from the end of the tape scale that will be inserted into the applicator tool entry channel.

NOTE: Do not peel the blue protective film off at this time.

6. Turn Applicator Tool to the “Up” position and insert tape into applicator tool.
Rotate the knob that controls the contact cylinder plunger to the UP position. This allows you to insert the first section of adhesive exposed tape, into the applicator tool. Be sure that both the tape scale orientation arrows and the applicator tool arrows point in the same direction.

Close-up of plunger knob in the UP position. The position of the keyways indicates UP or Down. Rotating the knob will both move the plunger up or down.
CET™ Scale, MTE Side Mount Configuration
Installation By Mounted Applicator Tool

7. Insert a short section of tape scale into the tool, approximately 50mm (2 inches).
Insert the first short section of tape scale so that it emerges just past the plunger knob to a desired end location. Press down on this exposed 3-5mm section of tape.

8. Rotate the pressure plunger knob to the “Down” position.
Rotate the plunger knob so that the key-way notch is in the position shown.
**CET™ Scale, MTE Side Mount Configuration**
Installation By Mounted Applicator Tool

9. **Move the tool in a steady motion to apply the tape scale.**
Push the applicator tool in the direction of tape application. Be sure to pull the adhesive backer out of the way while the applicator is in motion.

10. Once the scale is applied to the mounting surface, and before the blue protective film is removed, it is recommended that even pressure be applied over the entire tape scale length by sliding a glove or cot protected finger across the scale. The applied pressure will ensure that the adhesive is evenly and permanently set.
11. Peel off the blue protective film.

Start the peeling process using a sharp tool, being careful not to damage the scale. Pull off the remaining blue protective film. Clean the tape scale using alcohol or acetone and a lint-free cotton cloth.

**NOTE:**
Make sure you have on finger cots or talc-free gloves.

*NOTE:*
After removing the blue protective film, the scale is ready for use and will perform to specification.

The encoder will not function properly with the blue protective film installed. It must be removed for proper encoder operation.
End Cap Installation for CET™ Scales

Optional

1. Epoxy Setup

- Mix the two-part epoxy and place it in a syringe or on the end of a stick. Do not use a cotton swab to apply the epoxy.
- Put epoxy on the end of the scale. Make sure that the epoxy touches both the mounting surface and the scale across the width of the scale.

Only apply epoxy at the ends of the tape scale. Do not get any epoxy on the tape scale in the measuring area.

- Perform Step 2, immediately while the epoxy is still in a liquid state.

2. Installing the End Caps on the Mounting Surface

- Remove the adhesive liner from end cap.
- Place the end cap on the top of the scale and epoxy so that the end of the scale is in the middle of the end cap.
- Press down lightly to ensure adhesion and let cure for 24 hours.
Final Cleaning, Inspection and Cure Time

Before using the encoder for servo control, clean the tape scale using alcohol or acetone and a lint-free cotton cloth or swab. Finally, inspect the tape scale's surface for scratches, adhesive spots or smears in the measuring length.

A cure time of 12 hours is required for the tape scale's pressure sensitive adhesive to achieve the best performance and reliability.

Reworking to Correct Mistakes

Once installed, the tape scale cannot be moved or removed and reinstalled. Reworking will require removal and discarding of the old tape and installation of a new one.
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: 

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.