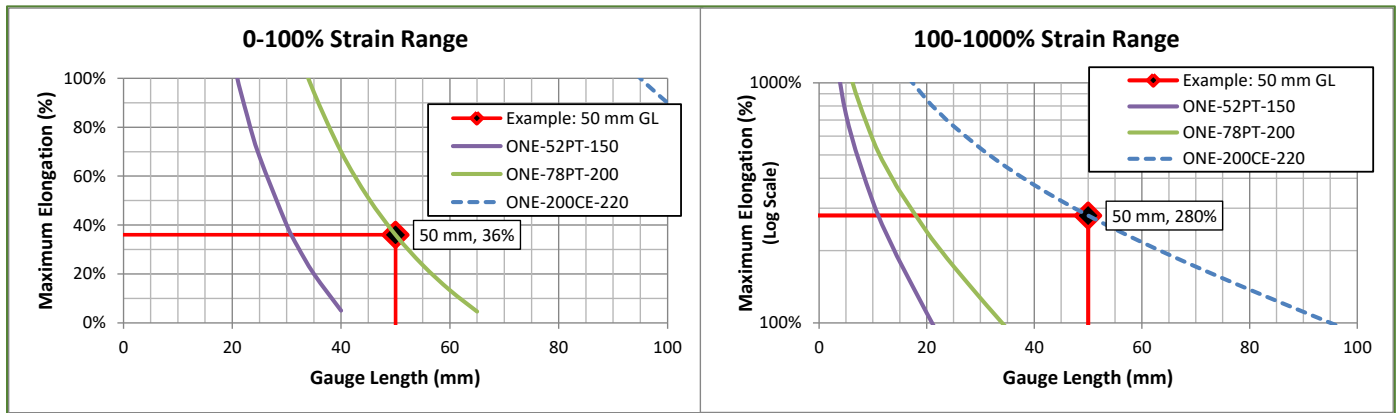


# Epsilon ONE® – Determining Field of View

Optics Package Selection: Determining the necessary Field of View

Author: Wesley Womack, PE, PhD

Listed elongation ranges for Epsilon ONE Optics Packages (pages 3&4) are estimates for typical applications with standard dog bone specimens, *assuming elongation is localized within the gauge length*. Listed elongations include an additional margin of 5-10mm to provide for reasonable ease of use.



**Example:** For a 50mm Gauge Length, **ONE-78PT-200** and **ONE-200CE-220** will accommodate up to 36%(18mm) and 280%(140mm) localized elongation, respectively. **ONE-52PT-150** does not leave enough margin for a 50mm GL.



A minimum margin of 5-10mm is recommended; *more* margin provides better ease of use.

Additionally, elongation outside of the marked gauge length will reduce the measurable elongation range. Account for the fact that *both* marks move during a test using one of the methods below.

## Method 1: Calculate the maximum Elongation or Field of View using an estimated discount factor $k_d$

Discount factor  $k_d$  – an adjustment for elongation outside the marked gauge length – may be estimated from the gauge length  $GL$  and grip spacing  $GD$ , or more precisely using crosshead displacement from a previous test.  $k_d$  is lower when less of the reduced section is included in the marked gauge length, or when there is no reduced section.  $k_d = 0.8$  is typical for reduced-section tensile specimens.

$$k_d = \left( \text{Grip Distance} / \text{Gauge Length} \right)^{-0.7}, \text{ or}$$

$$k_d = \left( \Delta \text{Crosshead} / \Delta L \right)^{-0.7}$$

$GD/GL$	$k_d$
1.5	0.8
2.5	0.5
5	0.3
10	0.2

To calculate the maximum Elongation for a given Field of View

$$\text{Max Elongation} = (\text{FoV} - \text{GL} - \text{Margin}) \times k_d$$

To calculate the minimum Field of View for a given Elongation

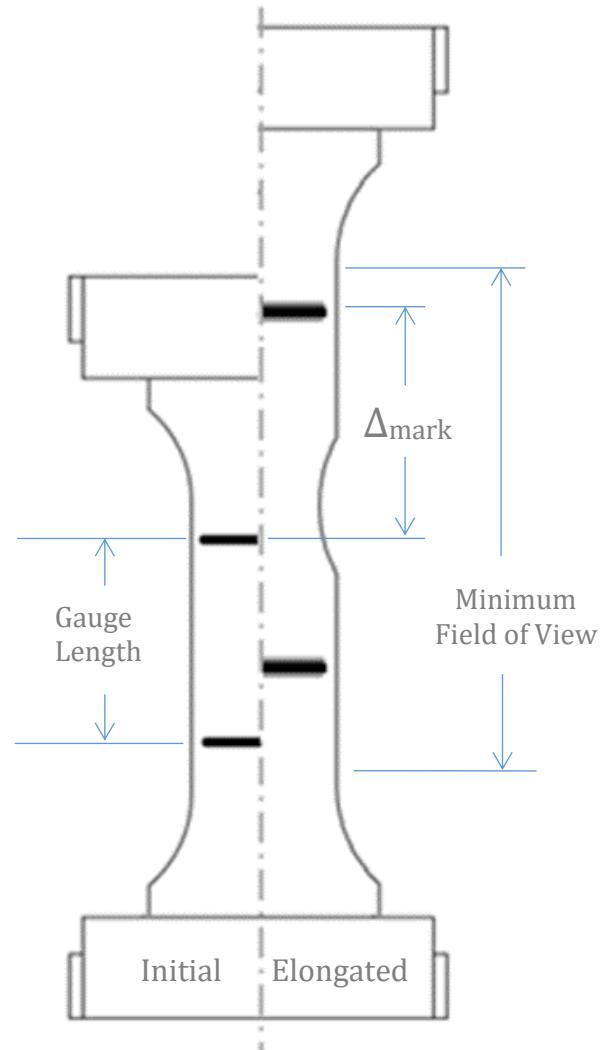
$$\text{Min FoV} = \frac{\text{Elongation}}{k_d} + \text{Margin} + \text{GL}$$

...continued on page 2 →

**Method 2: Empirically assess a test sample.**

A tape measure or similar reference may be used to directly determine the displacement of marked lines made on a reference specimen during a test. The minimum Field of View should include the gauge length, the maximum displacement of either mark, and a suitable margin. A video demonstrating this method is available at <https://www.epsilontech.com/products/optical-extensometer/#resources>

$$\text{Minimum FoV} = GL + \Delta_{\text{mark}} + \text{Margin}$$



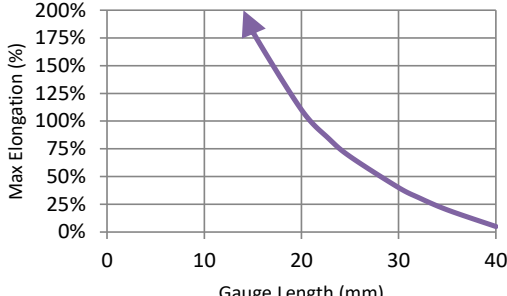
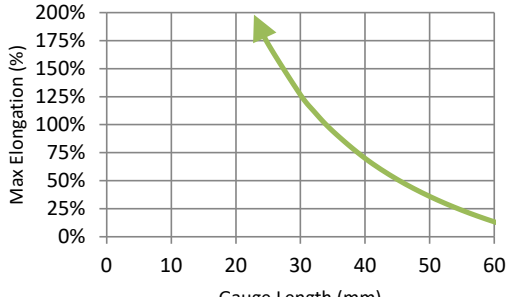
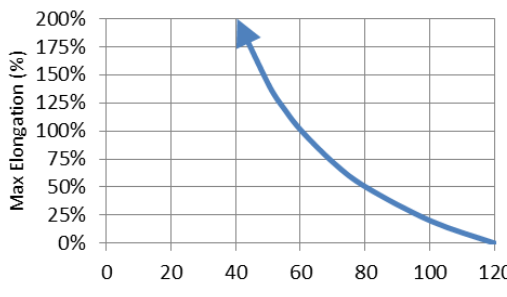
*Precision Telecentric vs Conventional Optics*



An important factor in selection of any optical extensometer is the choice of *Precision Telecentric* or *Conventional Optics*. Be sure to consider the *Out-of-plane Sensitivity* specification when purchasing any optical extensometer, by any manufacturer. See [Epsilon TechNote - Precision Telecentric Optics](#).

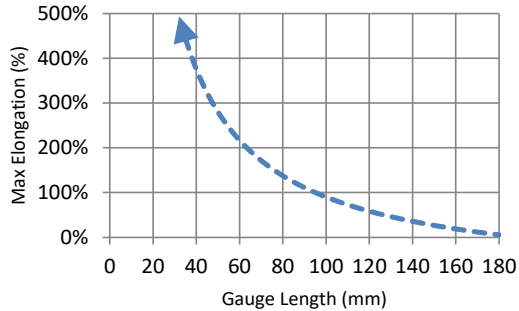
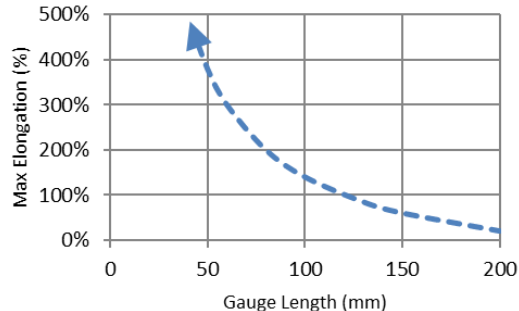
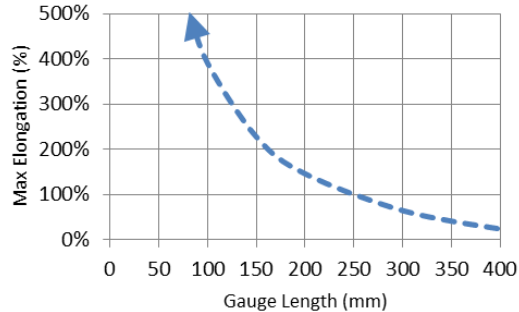
Additional guidance and general recommendations can be found in [Epsilon Guide – ONE Model Selection](#)

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<i>Precision Telecentric Lens Systems</i>																							
<p>Model Number: <b>ONE-52PT-System</b></p> <p>Precision telecentric lens. 52 mm Field of View and 150 mm Working Distance.</p>	<p><b>ONE-52PT-150 Measuring Range</b></p> 	<table border="1"> <thead> <tr> <th>Gauge Length</th> <th>Max Strain</th> <th>Max Elongation</th> </tr> </thead> <tbody> <tr> <td>10 mm</td> <td>320%</td> <td>32 mm</td> </tr> <tr> <td>12 mm</td> <td>250%</td> <td>30 mm</td> </tr> <tr> <td>20 mm</td> <td>110%</td> <td>22 mm</td> </tr> <tr> <td>25 mm</td> <td>65%</td> <td>17 mm</td> </tr> <tr> <td>30 mm</td> <td>40%</td> <td>12 mm</td> </tr> <tr> <td>40 mm</td> <td>5%</td> <td>2 mm</td> </tr> </tbody> </table>	Gauge Length	Max Strain	Max Elongation	10 mm	320%	32 mm	12 mm	250%	30 mm	20 mm	110%	22 mm	25 mm	65%	17 mm	30 mm	40%	12 mm	40 mm	5%	2 mm
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<p>Model Number: <b>ONE-78PT-System</b></p> <p><i>Premium performance and best value</i></p> <p>Precision telecentric lens. 78 mm Field of View and 200 mm Working Distance</p>	<p><b>ONE-78PT-200 Measuring Range</b></p> 	<table border="1"> <thead> <tr> <th>Gauge Length</th> <th>Max Strain</th> <th>Max Elongation</th> </tr> </thead> <tbody> <tr> <td>10 mm</td> <td>580%</td> <td>58 mm</td> </tr> <tr> <td>12 mm</td> <td>470%</td> <td>56 mm</td> </tr> <tr> <td>20 mm</td> <td>240%</td> <td>48 mm</td> </tr> <tr> <td>25 mm</td> <td>170%</td> <td>43 mm</td> </tr> <tr> <td>50 mm</td> <td>35%</td> <td>18 mm</td> </tr> <tr> <td>65 mm</td> <td>5%</td> <td>3 mm</td> </tr> </tbody> </table>	Gauge Length	Max Strain	Max Elongation	10 mm	580%	58 mm	12 mm	470%	56 mm	20 mm	240%	48 mm	25 mm	170%	43 mm	50 mm	35%	18 mm	65 mm	5%	3 mm
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<p>Model Number: <b>ONE-130PT-System</b></p> <p><i>Premium performance.</i></p> <p>Precision telecentric lens. 130 mm Field of View and 210 mm Working Distance.</p>	<p><b>ONE-130PT-210 Measuring Range</b></p> 	<table border="1"> <thead> <tr> <th>Gauge Length</th> <th>Max Strain</th> <th>Max Elongation</th> </tr> </thead> <tbody> <tr> <td>10 mm</td> <td>&gt;1000%</td> <td>110 mm</td> </tr> <tr> <td>12 mm</td> <td>900%</td> <td>108 mm</td> </tr> <tr> <td>25 mm</td> <td>380%</td> <td>95 mm</td> </tr> <tr> <td>50 mm</td> <td>140%</td> <td>70 mm</td> </tr> <tr> <td>75 mm</td> <td>60%</td> <td>45 mm</td> </tr> <tr> <td>100 mm</td> <td>20%</td> <td>20 mm</td> </tr> </tbody> </table>	Gauge Length	Max Strain	Max Elongation	10 mm	>1000%	110 mm	12 mm	900%	108 mm	25 mm	380%	95 mm	50 mm	140%	70 mm	75 mm	60%	45 mm	100 mm	20%	20 mm
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*...continued on page 4 →*

<i>Conventional Entocentric Lens Systems</i>																													
<p>Model Number: <b>ONE-200CE-System</b></p> <p><i>Best value and performance</i></p> <p>Conventional entocentric lens.</p> <p>200 mm Field of View and 220 mm Working Distance.*</p>	<p><b>ONE-200CE-220 Measuring Range</b></p> 	<table border="1"> <thead> <tr> <th colspan="3">ONE-200CE</th> </tr> <tr> <th>Gauge Length</th> <th>Max Strain</th> <th>Max Elongation</th> </tr> </thead> <tbody> <tr> <td>10 mm</td> <td>&gt;1000%</td> <td>180 mm</td> </tr> <tr> <td>25 mm</td> <td>660%</td> <td>165 mm</td> </tr> <tr> <td>50 mm</td> <td>280%</td> <td>140 mm</td> </tr> <tr> <td>75 mm</td> <td>150%</td> <td>115 mm</td> </tr> <tr> <td>100 mm</td> <td>90%</td> <td>90 mm</td> </tr> <tr> <td>150 mm</td> <td>25%</td> <td>40 mm</td> </tr> <tr> <td>180 mm</td> <td>5%</td> <td>10 mm</td> </tr> </tbody> </table>	ONE-200CE			Gauge Length	Max Strain	Max Elongation	10 mm	>1000%	180 mm	25 mm	660%	165 mm	50 mm	280%	140 mm	75 mm	150%	115 mm	100 mm	90%	90 mm	150 mm	25%	40 mm	180 mm	5%	10 mm
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<p>Model Number: <b>ONE-250CE-System</b></p> <p>Conventional entocentric lens.</p> <p>250 mm Field of View and 280 mm Working Distance.*</p>	<p><b>ONE-250CE-280 Measuring Range</b></p> 	<table border="1"> <thead> <tr> <th colspan="3">ONE-250CE</th> </tr> <tr> <th>Gauge Length</th> <th>Max Strain</th> <th>Max Elongation</th> </tr> </thead> <tbody> <tr> <td>10 mm</td> <td>&gt;1000%</td> <td>230 mm</td> </tr> <tr> <td>25 mm</td> <td>860%</td> <td>215 mm</td> </tr> <tr> <td>50 mm</td> <td>380%</td> <td>190 mm</td> </tr> <tr> <td>75 mm</td> <td>220%</td> <td>165 mm</td> </tr> <tr> <td>100 mm</td> <td>140%</td> <td>140 mm</td> </tr> <tr> <td>150 mm</td> <td>60%</td> <td>90 mm</td> </tr> <tr> <td>200 mm</td> <td>20%</td> <td>40 mm</td> </tr> </tbody> </table>	ONE-250CE			Gauge Length	Max Strain	Max Elongation	10 mm	>1000%	230 mm	25 mm	860%	215 mm	50 mm	380%	190 mm	75 mm	220%	165 mm	100 mm	140%	140 mm	150 mm	60%	90 mm	200 mm	20%	40 mm
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<p>Model Number: <b>ONE-500CE-System</b></p> <p><i>Higher elongation applications</i></p> <p>Conventional entocentric lens.</p> <p>500 mm Field of View and 270 mm Working Distance.*</p>	<p><b>ONE-500CE-270 Measuring Range</b></p> 	<table border="1"> <thead> <tr> <th colspan="3">ONE-500CE</th> </tr> <tr> <th>Gauge Length</th> <th>Max Strain</th> <th>Max Elongation</th> </tr> </thead> <tbody> <tr> <td>10 mm</td> <td>&gt;1000%</td> <td>480 mm</td> </tr> <tr> <td>25 mm</td> <td>&gt;1000%</td> <td>465 mm</td> </tr> <tr> <td>50 mm</td> <td>880%</td> <td>440 mm</td> </tr> <tr> <td>100 mm</td> <td>390%</td> <td>390 mm</td> </tr> <tr> <td>200 mm</td> <td>145%</td> <td>290 mm</td> </tr> <tr> <td>300 mm</td> <td>63%</td> <td>190 mm</td> </tr> <tr> <td>400 mm</td> <td>23%</td> <td>90 mm</td> </tr> </tbody> </table>	ONE-500CE			Gauge Length	Max Strain	Max Elongation	10 mm	>1000%	480 mm	25 mm	>1000%	465 mm	50 mm	880%	440 mm	100 mm	390%	390 mm	200 mm	145%	290 mm	300 mm	63%	190 mm	400 mm	23%	90 mm
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\*Additional Working Distance and Field of View options are available in the ONE-CE series.



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