

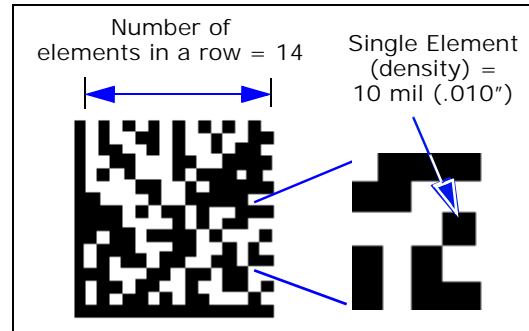
Choosing the Right Quadrus EZ Configuration

1. Determine maximum symbol size for your application.

Multiply your symbol's row size by its element size (density).

Example:

For a 10 mil symbol with 14 rows, multiply .010" x 14 = 0.14" (3.56mm) symbol size.



2. Determine maximum FOV.¹

The table to the right is intended to familiarize you with the maximum fields of view (FOVs) for various symbol densities from 3 to 20 mil.

Note: The FOVs shown here are independent of focal distances and lens types. This data is based on having enough resolution to consistently decode the symbol in any orientation.

Maximum Field of View (in inches)
by Symbol Density

| Symbol Density | 2D Maximum Field of View | 1D Maximum Field of View |
|----------------|--------------------------|--------------------------|
| 3 mil | 0.38 | 0.64 |
| 5 mil | 0.64 | 1.07 |
| 7.5 mil | 0.96 | 1.60 |
| 10 mil | 1.28 | 2.13 |
| 15 mil | 1.92 | 3.20 |
| 20 mil | 2.56 | 4.27 |

3. Determine minimum FOV.

In order to be decoded, the entire symbol—including quiet zones—must fit within the FOV.

The minimum FOV for a given symbol size can be found by the following formulas:

2D Matrix based symbologies:

$$\text{Minimum FOV} = (\text{Symbol Size excluding quiet zone} + (2 \times \text{Density})) \times 1.39$$

1D Width based symbologies:

$$\text{Minimum FOV} = (\text{Symbol Size excluding quiet zone}) + (20 \times \text{Density}) \times 1.05$$

1. While FOV (Field of View) technically is the area in which a symbol can be read, the longer dimension is conventionally referenced as the FOV. For example, a 10 mil 2D symbol can be read at 1.28" FOV. For Quadrus EZ, the shorter dimension of the FOV is always 0.75 times the longer dimension.

4. Find your lens and distance options.

In the tables below, you can quickly identify the focal distances and lens options for the six symbol density sizes indicated by color codes. The numbers inside the table cells are the FOVs (the longer dimension of the FOV area).

| Focal Distance | Narrow Lens | Focal Distance | Medium Lens | Wide Lens | ExWide Lens |
|----------------|-------------|----------------|-------------|-----------|-------------|
| 3.25 | 0.26 | 2.00 | 0.40 | 0.51 | 1.10 |
| 3.50 | 0.34 | 3.00 | 0.59 | 0.73 | 1.49 |
| 3.75 | 0.41 | 4.00 | 0.78 | 0.95 | 1.88 |
| 4.00 | 0.49 | 5.00 | 0.95 | 1.16 | 2.20 |
| 4.25 | 0.53 | 6.00 | 1.12 | 1.37 | 2.51 |
| 4.50 | 0.58 | 7.00 | 1.29 | 1.59 | 2.83 |
| 4.75 | 0.63 | 8.00 | 1.46 | 1.80 | 3.14 |
| | | 9.00 | 1.63 | 2.01 | 3.46 |
| | | 10.00 | 1.80 | 2.22 | 3.77 |

| |
|---------|
| 3 mil |
| 5 mil |
| 7.5 mil |
| 10 mil |
| 15 mil |
| 20 mil |

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| | | 10.00 | 1.80 | 2.22 | 3.77 |

Example:

When you compare options for 10 mil symbols (see cells outlined in diagonal stripes above), you can see that a medium lens will read this symbol density at a focal distance of 6", while a wide angle lens reads it at 4" and 5", and an extra-wide lens reads it at 2 inches.

5. Consider your application needs before choosing a lens type.

- Do you expect to read more than one symbol type? If so, you might want to select a lens type that reads most or all of them.
- Is your application static or dynamic? If dynamic, you will almost certainly need to enable Rapid Capture. See the white paper titled, "[Fundamentals of Rapid and Continuous Capture Modes.](#)"
- Do space requirements restrict you to a specific focal distance?

For Static Applications

For static applications, select a FOV that is close to the minimum FOV since the smaller the FOV the higher the resolution at which it can be read.

Example:

From the [2D Focal Range Table](#) above, a symbol inside a 0.95" FOV (10 mil @ 4") will read at a higher resolution than one inside a 1.16" FOV (10 mil @ 5").

For Dynamic, Single Capture

For moving applications with a single capture enabled, you will still want to select a small FOV, but with a little extra room to allow for a slight "jiggle" in the images due to triggering.

For Dynamic, Multiple Captures

For multiple captures, a larger FOV will give you an opportunity for more captures. (See step 6 for calculating the number of rapid captures in a dynamic environment.)

6. Calculate the FOV for a dynamic Rapid Capture application.

A. First calculate the distance between multiple captures

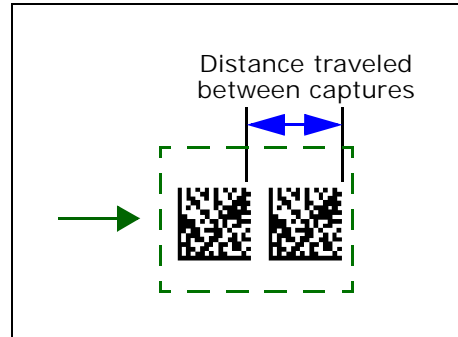
For multiple captures in **Rapid Capture** mode, you can calculate the distance between successive symbols by multiplying the line speed by the capture time.

For CCD:

$$\text{Travel Distance} = \text{Line Speed} \times 15\text{mS}$$

For CMOS:

$$\text{Travel Distance} = \text{Line Speed} \times 30\text{mS}$$



Capture time is a fixed “overhead” that includes the time of capture and transfer of the image.

Example:

A symbol moving at 10 ips (inches per second) past a CCD reader travels $0.010''/\text{mS} \times 15\text{mS} = 0.15$ inches between captures.

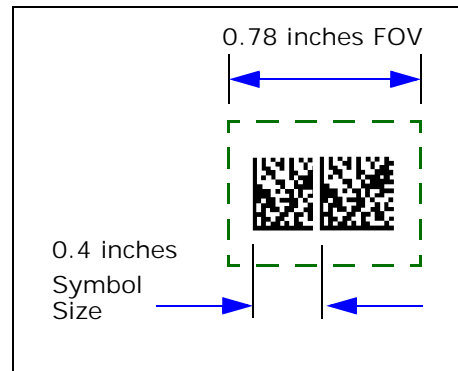
B. Next calculate FOV or number of captures

Once the travel time is known, you can easily calculate the number of captures you can expect to occur inside a FOV by subtracting the symbol size from the FOV and dividing the result by the travel time.

$$\text{Number of Captures} = \frac{(\text{FOV} - \text{Symbol Size})}{\text{Travel Distance}}$$

Following up on the example from Step 6A:

$$0.78'' - 0.4'' / 0.15'' = 2.5 \text{ captures}$$



If a required number of captures has been determined, you can also work the formula backwards and determine the minimum FOV by:

$$\text{FOV} = (\text{Number of Captures} * \text{Travel Time}) + \text{Symbol Size}$$