WinMark Pro Application Note

Spot-type 2D Data Matrix codes

Traditionally, 2D Data Matrix codes are laser marked by filling in square cells using a raster-scanning technique. This rasterized mark, shown in Figure 1, is suitable for many products that require a code large enough to be readily identified from a distance.

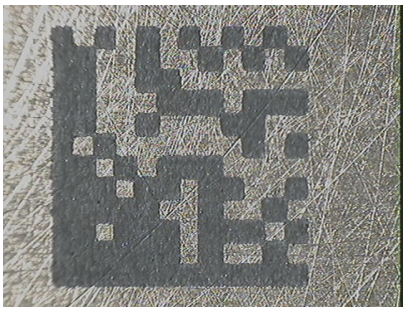

Figure 1 Standard 2D Data Matrix code

In addition, WinMark Pro can invert the standard 2D code for applications where readable codes must be marked on dark objects (provided of course, that the material produces a lighter contrast when laser marked). The primary disadvantages of raster-filled codes are longer mark times and higher heat input into the material.

A combination of new features in WinMark Pro, versions 2.0.0.3033 and later, allows WinMark to create very small, very fast, vector-style 2D Data Matrix codes by marking a single laser spot for each cell instead of marking slower raster-filled squares. Code size is dependent upon how large or how small the required lens can mark a cell. Figure 2 shows a 2 mm × 2 mm square "spot-type" 2D Data Matrix code containing 20 alphanumeric characters.

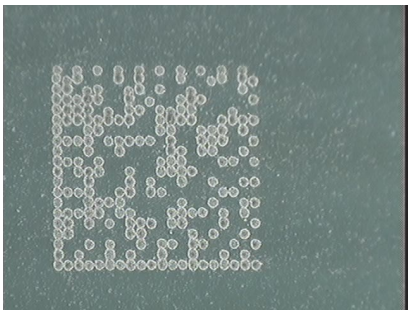

Figure 2 "Spot-type" 2D Data Matrix code

Unlike normal 2D Data Matrix codes, this fast code has the potential to be marked using FH Tracker's "on-the-fly" marking at reasonably fast, continuous line speeds. In addition to its high marking speeds, the “spot-style” 2D code puts far less heat into the material making it perfect for PCB and glass marking applications where penetration into underlying layers or fracturing is an issue.

To set up a “spot-type” 2D Data Matrix code, start WinMark Pro and perform the following steps:

1. Open a new drawing and set measurement units to millimeters (Tools/General Settings…/Application Settings – *Show Units Type*). Click *OK*.

2. Select the *2D Data Matrix Code Tool* and click to set an insertion point.

3. On the *Format* tab, in the *2D Barcode Text* field, click the ellipsis (…). The *Text Caption Editor* dialog box appears.

4. Enter the desired information to be coded and click *OK*.

5. Set *2D Barcode Fixed Cell Size* to No.

6. From Table 1, find the spot size for your focusing lens. Multiply lens spot size by the total number of cells across the 2D code.

7. Divide the result from Step 6 by 1000 to convert to millimeters. This is the width and height of the 2D Data Matrix code.

Note: 1000 microns (µm) equals 1 mm.

8. Select the 2D code on the *Drawing Canvas* and then from the *Objects* menu, click *Transformations…*. Enter the bar code size calculated in Step 7 as both *New Width* and *New Height* in the *Object Transformations* dialog box. Click *Apply*, and then click *OK*.

9. Set *2D Barcode Bitmap* to No. This changes cell marking from raster-filled squares to unfilled vector circles.

10. Click the *Marking* tab and set marking *Velocity*.

11. From Table 1, find the starting resolution for your focusing lens. Enter this number for marking *Resolution*.

12 Set *Pline Start Delay*, *Pline End Delay*, and *Interseg Delay* to 0. Set *Off Vector Delay* to 500.

13 Set *Spot Marking Style* to Yes and set *Spot Mark Duration* to a suitable value for the material to be marked (usually between 1 and 10).

14 Test mark the 2D code and, if necessary, adjust 2D bar code size (using the *Object Transformations* dialog box) and *Resolution* to obtain one spot per cell with equal cell spacing across the code.

15 Adjust *Power* to produce the desired mark. When marking glass, try a lower *Power* setting and use multiple *Mark Passes* to obtain the desired mark.

16 Perform a reader test of the 2D code to verify that the code is being properly scanned.

Further improvement in mark quality or mark speed may be achieved by adjusting *Resolution* or marking delays, primarily *Pline Start Delay*. To eliminate any observed tailing or ghost marking that may appear around the spot, increase *Off Vector Delay* slightly.

Table 1 Lens spot sizes

Lens Focal Length	**Spot Size ($1/e^2$), µm**	**Starting Resolution**
SH/DH/Fenix/FH 370 mm	540	47
SH/DH/Fenix/FH 200 mm	290	88
SH/DH/Fenix/FH 125 mm	180	141
Fenix/FH 125HP*	180	141
Fenix/FH 80 mm	116	219
SH/DH 69 mm	100	254

* 125 mm lens for use with lasers 50 W and higher.

In applications where cell sizes must be larger than the laser spot size, 2D Data Matrix codes can be created as described above and then scaled up to the necessary size. The “spot” mark now becomes a vector circle as shown in Figure 3. Note how the center of the circle is open, or unmarked, as compared with Figure 2 where just a spot is marked.

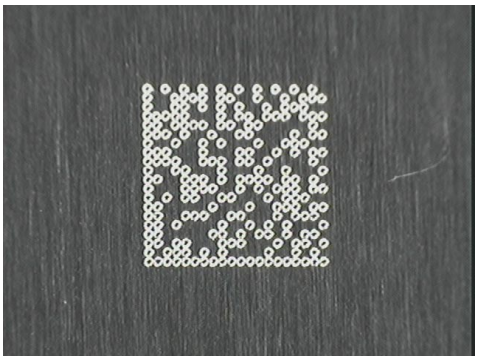

Figure 3 “Circle-type” 2D Data Matrix code.

If the circle outline is marked with distinct spots instead of a smooth arc, then increase *Resolution*. Perform a reader test of the 2D code to verify that the circles are being properly read as cells, if not, reduce 2D code size slightly and retest.

Example calculations for setting up a “spot-type” 2D Data Matrix code:

Step 4 *2D Barcode Text* is: ABC123456789 JUNE 25, 2000. This produces a code 20 cells by 20 cells square.

Step 6 From Table 1, the 80 mm FH lens spot size is 116 µm. 116 µm × 20 cells = 2320.

Step 7 Divide 2320 by 1000. The result, 2.32 mm, is the overall width and height of the 2D Data Matrix code.

Step 11 From Table 1, the starting resolution for the FH 80 mm lens is 141.

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