20MP Smart Code Reader

Depth of Field Performance

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Chapter1 Introduction

A kind of barcode with the specific width is tested with different conveyor speed. So the documentation is written with several code reading diagrams corresponding to different barcodes. In order to use the diagrams, please check the minimum barcode unit first. The way to calculate the value refers to Appendix A.

The documentation introduces 10mil, 12mil, 15mil and 17mil barcodes which are common in the logistics industry. And 16mm, 20mm and25mm lenses are used for different code reading performance.

Note

- The test is executed with the MV-LB-200-200-4030WL-A.
- Unit: 1mil=0.0254mm

Chapter2 Single Camera Code Reading Performance

2.1 16mm Lens 10mils Bar code

Table2.1 Hardware and software configuration

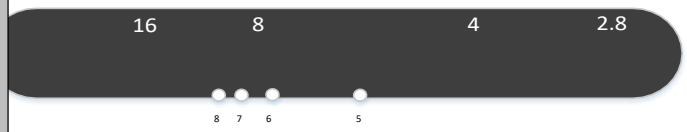
Hardware Configuration	Camera Model	MV-ID6200M-00C-NNG				
	Lens Model	MVL-KF1628M-12MP				
	Focal Length	16mm				
	Light Source	MV-LB-200-200-4030WL-A				
	Light Type	Constant Light Source				
Conveyor Speed		0.5m/s	1.0m/s	1.5m/s	2.0m/s	2.5m/s
Grabbing Image Setting	Exposure Time(μs)	422	211	140	105	84
	Gain	20	23	25	25	30
	Gamma	0.6				
	Iris Position	8	7	6	7	5
	Note	Iris position shown as below： Lens Iris Schematic Diagram 				

Table2.2 Depth of field (DOF) performance

Conveyor Speed	DOF	Range of DOF	Near FOV	Far FOV
0.5m/s	655mm	756-1411mm	650mm	1240mm
1.0m/s	555mm	856-1411mm	730mm	1240mm
1.5m/s	480mm	931-1411mm	800mm	1240mm
2.0m/s	420mm	991-1411mm	840mm	1240mm
2.5m/s	350mm	1061-1411mm	900mm	1240mm

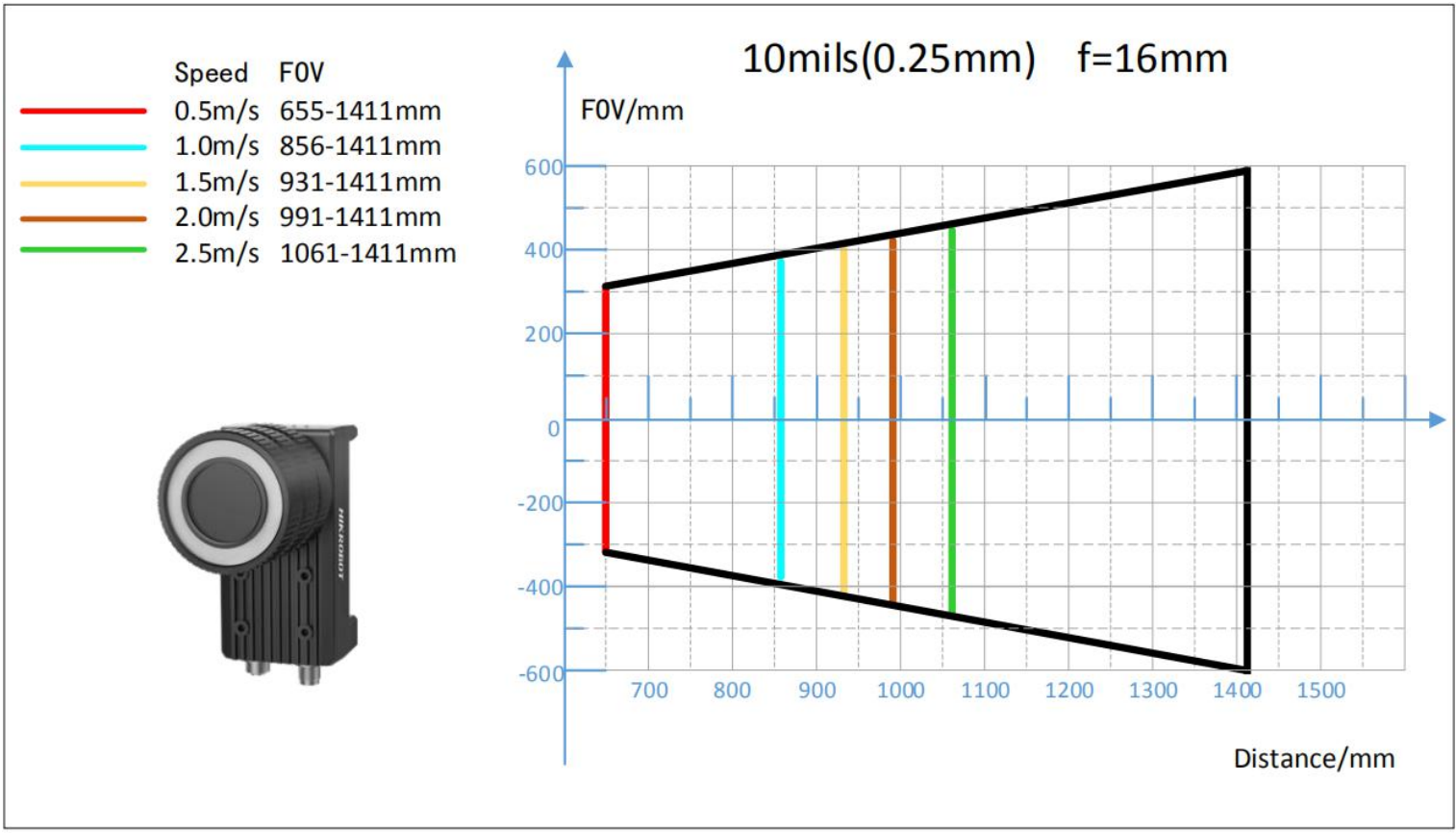


Figure2-1 DOF Performance

2.2 20mm Lens 10mils Barcode

Table2.3 Hardware and software configuration

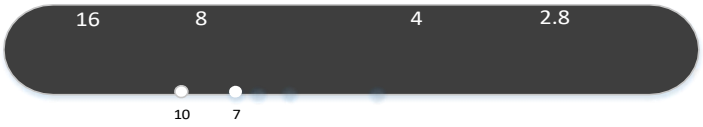
Hardware Configuration	Camera Model	MV-ID6200M-00C-NNG				
	Lens Model	MVL-KF2028M-12MP				
	Focal Length	20mm				
	Light Source	MV-LB-200-200-4030WL-A				
	Light Type	Constant Light Source				
Conveyor Speed		0.5m/s	1.0m/s	1.5m/s	2.0m/s	2.5m/s
Grabbing Image Setting	Exposure Time(μs)	422	211	140	105	84
	Gain	20	25	25	30	30
	Gamma	0.6				
	Iris Position	10	7	7	7	7
	Note	Iris position shown as below： Lens Iris Schematic Diagram 				

Table2.4 Depth of field (DOF) performance

Conveyor Speed	DOF	Range of DOF	Near FOV	Far FOV
0.5m/s	715mm	1049-1764mm	720mm	1075mm
1.0m/s	640mm	1124-1764mm	765mm	1075mm
1.5m/s	560mm	1204-1764mm	830mm	1075mm
2.0m/s	500mm	1264-1764mm	855mm	1075mm
2.5m/s	415mm	1349-1764mm	915mm	1075mm

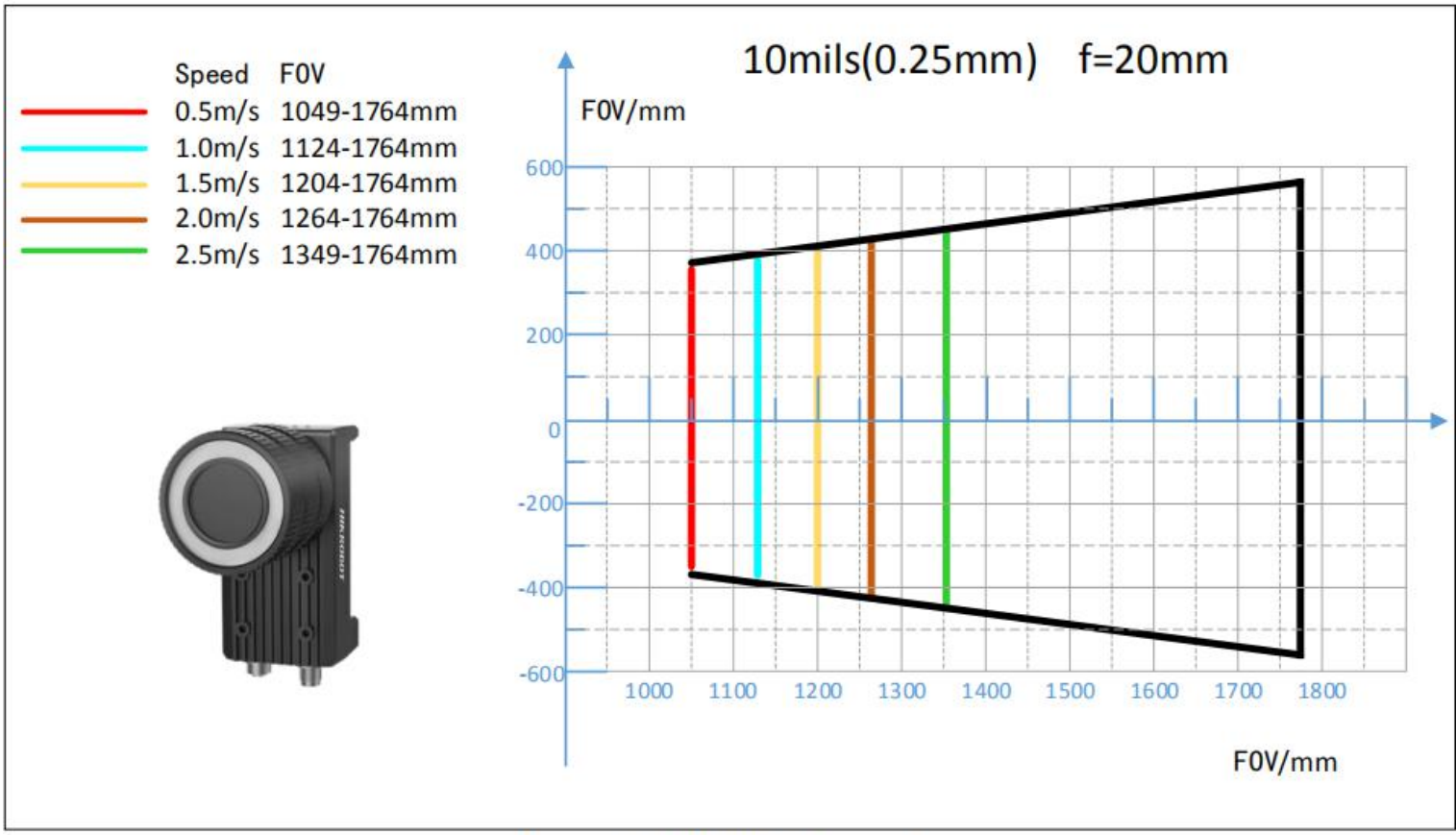


Figure2-2 DOF Performance

2.3 25mm Lens 10mils Bar code

Table2.5 Hardware and software configuration

Grabbing Image Setting	Camera Model	MV-ID6200M-00C-NNG				
	Lens Model	MVL-KF2528M-12MP				
	Focal Length	25mm				
	Light Source	MV-LB-200-200-4030WL-A				
	Light Type	Constant Light Source				
Conveyor Speed		0.5m/s	1.0m/s	1.5m/s	2.0m/s	2.5m/s
Hardware Configuration	Exposure Time(μs)	422	211	140	105	84
	Gain	25	25	25	30	30
	Gamma	0.6				
	Iris Position	14	10	10	10	8
	Note	Iris position shown as below： Lens Iris Schematic Diagram 				

Table2.6 Depth of field (DOF) performance

Conveyor Speed	DOF	Range of DOF	Near FOV	Far FOV
0.5m/s	1050mm	1155-2205mm	595mm	1100mm
1.0m/s	1000mm	1205-2205mm	640mm	1100mm
1.5m/s	900mm	1305-2205mm	690mm	1100mm
2.0m/s	860mm	1345-2205mm	715mm	1100mm
2.5m/s	770mm	1435-2205mm	760mm	1100mm

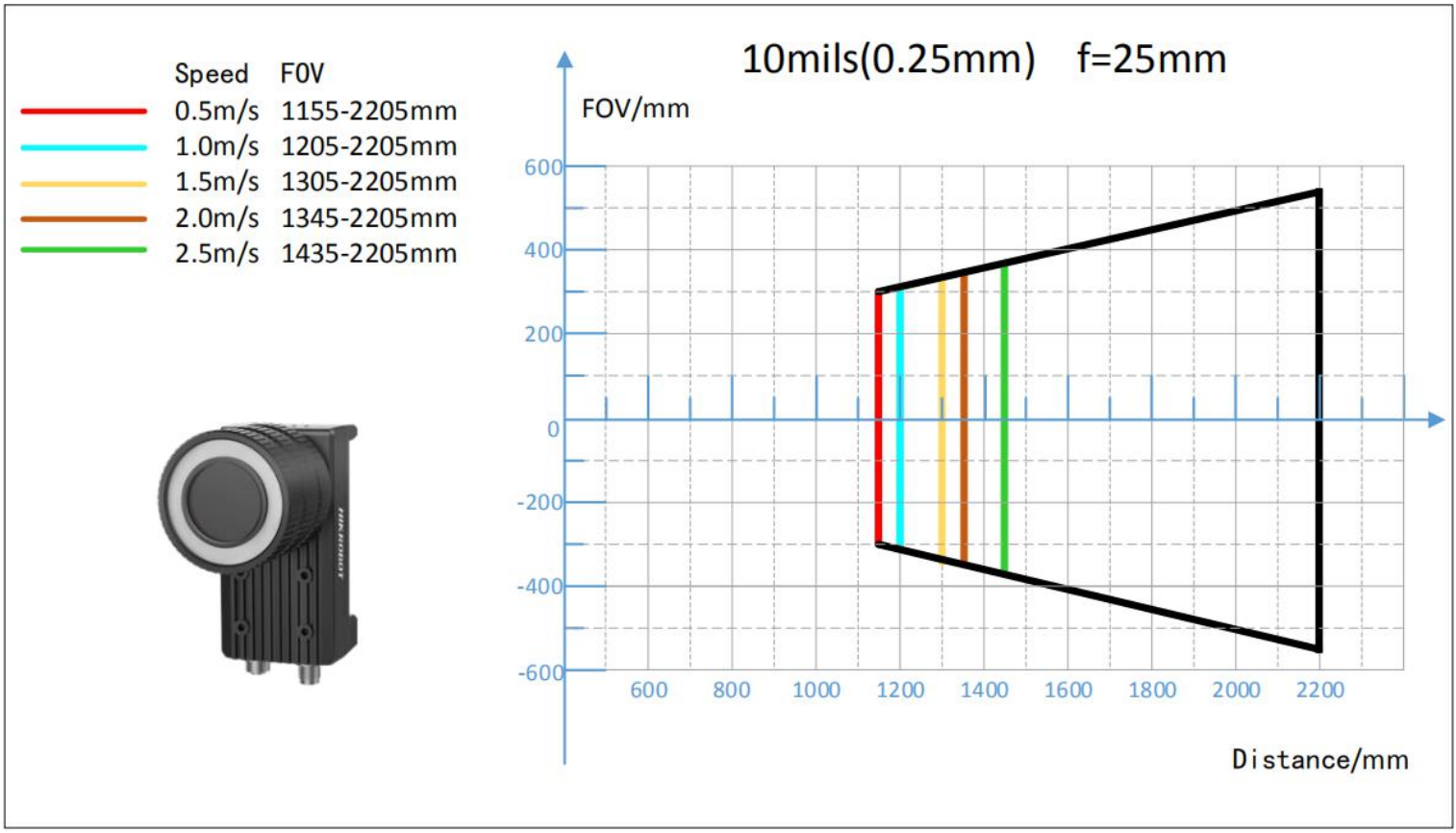


Figure2-3 DOF Performance

2.4 16mm Lens 12mils Bar code

Table2.7 Hardware and software configuration

Grabbing Image Setting	Camera Model	MV-ID6200M-00C-NNG				
	Lens Model	MVL-KF1628M-12MP				
	Focal Length	16mm				
	Light Source	MV-LB-200-200-4030WL-A				
	Light Type	Constant Light Source				
Conveyor Speed		0.5m/s	1.0m/s	1.5m/s	2.0m/s	2.5m/s
Hardware Configuration	Exposure Time(μs)	508	253	169	126	102
	Gain	18	23	30	30	30
	Gamma	0.6				
	Iris Position	8	7	7	6	6
	Note	Iris position shown as below： Lens Iris Schematic Diagram 				

Table2.8 Depth of field (DOF) performance

Conveyor Speed	DOF	Range of DOF	Near FOV	Far FOV
0.5m/s	1050mm	1155-2205mm	595mm	1100mm
1.0m/s	1000mm	1205-2205mm	640mm	1100mm
1.5m/s	900mm	1305-2205mm	690mm	1100mm
2.0m/s	860mm	1345-2205mm	715mm	1100mm
2.5m/s	770mm	1435-2205mm	760mm	1100mm

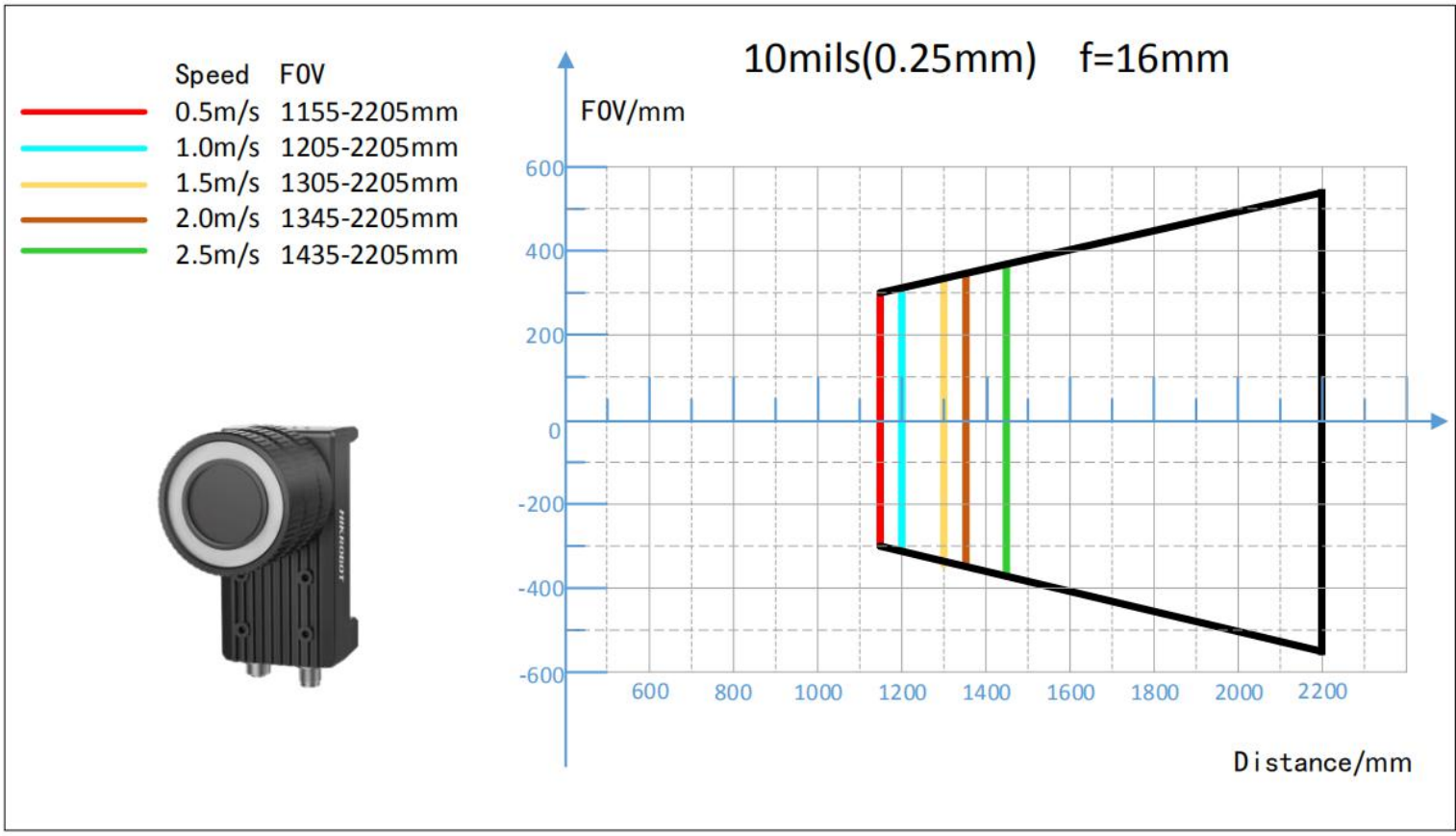


Figure2-4 DOF Performance

2.5 20mm Lens 12mils Bar code

Table2.9 Hardware and software configuration

Grabbing Image Setting	Camera Model	MV-ID6200M-00C-NNG				
	Lens Model	MVL-KF2028M-12MP				
	Focal Length	20mm				
	Light Source	MV-LB-200-200-4030WL-A				
	Light Type	Constant Light Source				
Conveyor Speed		0.5m/s	1.0m/s	1.5m/s	2.0m/s	2.5m/s
Hardware Configuration	Exposure Time(μs)	508	253	169	126	102
	Gain	18	28	30	32	32
	Gamma	0.6				
	Iris Position	8	9	9	9	7
	Note	Iris position shown as below： Lens Iris Schematic Diagram 				

Table2.10 Depth of field (DOF) performance

Conveyor Speed	DOF	Range of DOF	Near FOV	Far FOV
0.5m/s	1000mm	1116-2116mm	765mm	1440mm
1.0m/s	900mm	1216-2116mm	820mm	1440mm
1.5m/s	800mm	1316-2116mm	895mm	1440mm
2.0m/s	750mm	1366-2116mm	940mm	1440mm
2.5m/s	580mm	1536-2116mm	1060mm	1440mm

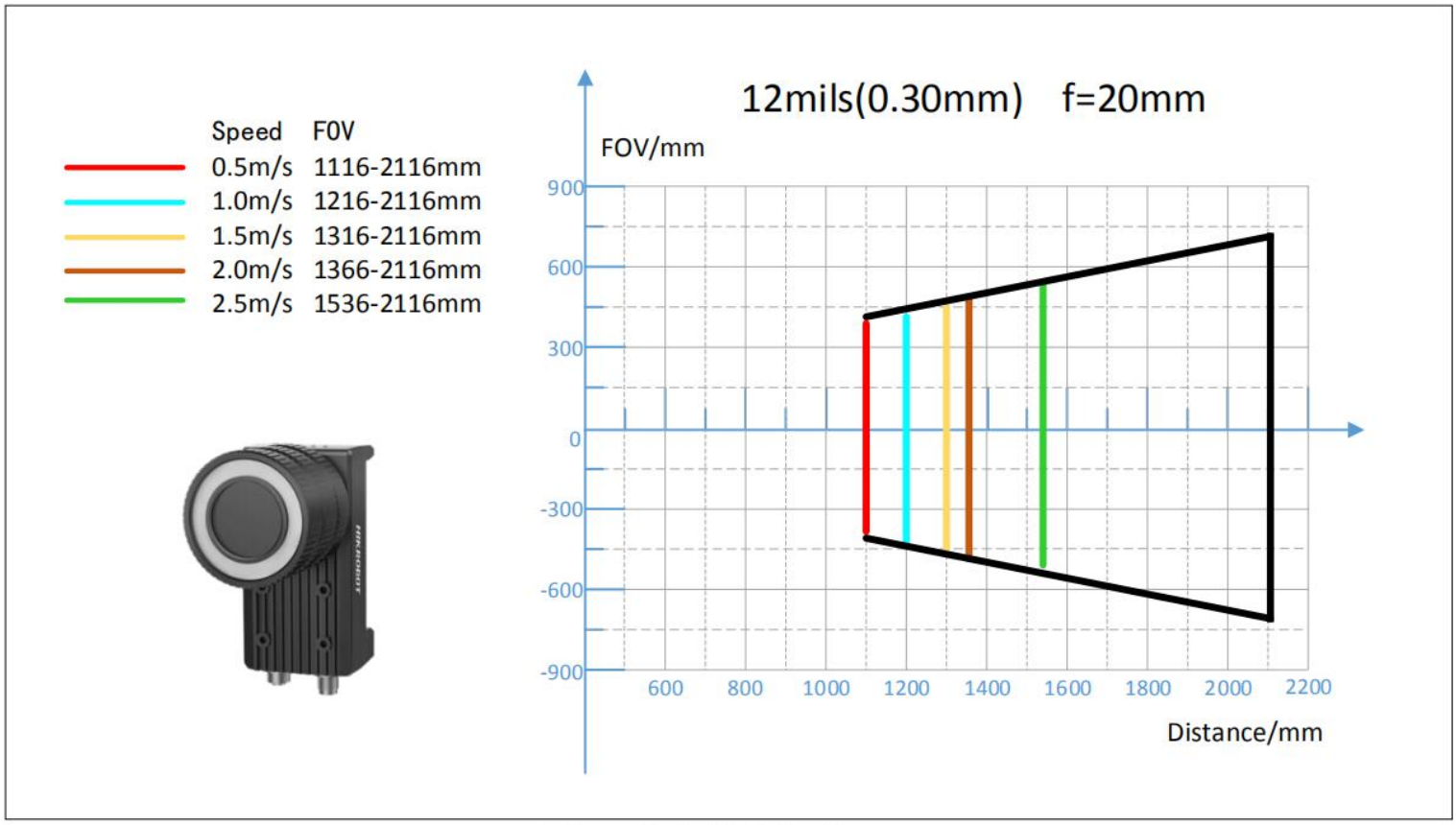


Figure2-5 DOF Perfrmance

2.6 16mm Lens 15mils Bar code

Table2.11 Hardware and software configuration

Grabbing Image Setting	Camera Model	MV-ID6200M-00C-NNG				
	Lens Model	MV-KF1628M-12MP				
	Focal Length	16mm				
	Light Source	MV-LB-200-200-4030WL-A				
	Light Type	Constant Light Source				
Conveyor Speed		0.5m/s	1.0m/s	1.5m/s	2.0m/s	2.5m/s
Hardware Configuration	Exposure Time(μs)	635	317	211	159	126
	Gain	22	25	30	30	30
	Gamma	0.6				
	Iris Position	9	7	7	6	6
	Note	Iris position shown as below： Lens Iris Schematic Diagram 				

Table2.12 Depth of field (DOF) performance

Conveyor Speed	DOF	Range of DOF	Near FOV	Far FOV
0.5m/s	1300mm	816-2116mm	665mm	1750mm
1.0m/s	1200mm	916-2116mm	760mm	1750mm
1.5m/s	1100mm	1016-2116mm	840mm	1750mm
2.0m/s	1000mm	1116-2116mm	930mm	1750mm
2.5m/s	900mm	1216-2116mm	1010mm	1750mm

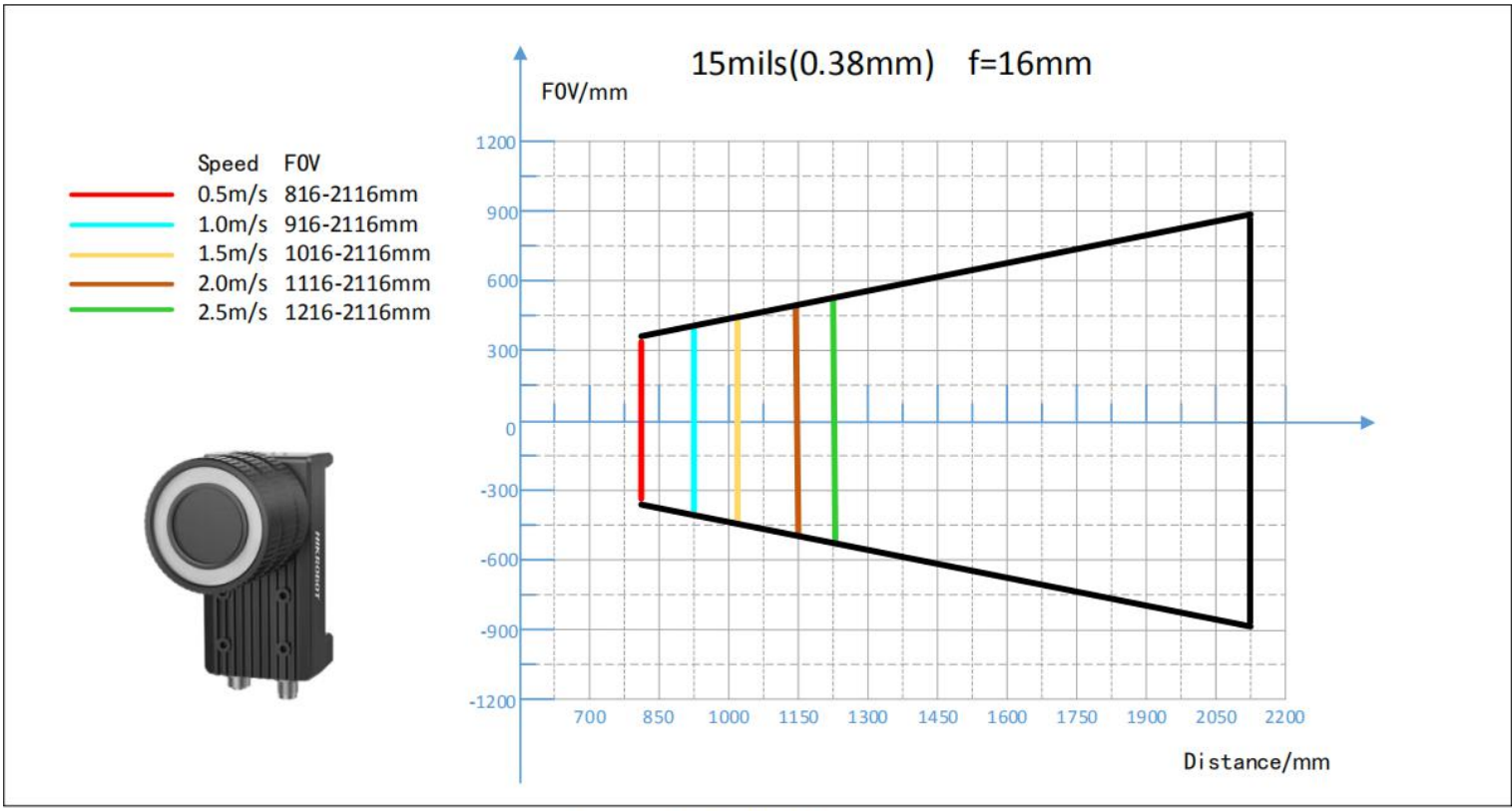


Figure2-6 DOF Performance

Appendix A Minimum barcode unit calculation method

A.1 Minimum Barcode unit calculation method

1. Capture Image

Figure A-1 Barcode

Requirement: The barcode interval in the picture is clearly visible, and it is best to ensure that there is only one barcode in the whole image, and the barcode occupies most of the range of the image.

2. Measure the pixels occupied by the minimum unit and the pixels occupied by the width of barcode

Open the image with Paint. After enlarging the image, select the minimum unit and display the pixel in the lower left corner. As shown in Figure A-2, the number of the smallest unit is 6.

Figure A-2 Calculation of the occupied

pixels Similarly, the number of pixels occupied by the barcode size

can be measured

3. Calculate minimum barcode unit size:

$$\frac{\text{Pixel number of minimum barcode unit}}{\text{Real size of minimum barcode unit}} = \frac{\text{Barcode pixel number}}{\text{Barcode size}}$$

Therefore, the real size of minimum barcode unit:

$$\text{Real size of minimum barcode unit} = \frac{\text{Barcode size}}{\text{Barcode pixel number}} \cdot \text{Pixel number of minimum barcode unit}$$

And,

1mil=0.0254mm

Example:

In Figure A-1, barcode size is 52mm, barcode pixel number is 680 and pixel number of minimum barcode unit is 6.
So the real size of minimum barcode unit is 52*6/680=0.46mm=18mil

A.2 FOV calculation method

- Given horizontal FOV under a certain height, and calculate the height of the vertical FOV (X86 code reading camera, assuming resolution of 2592 * 2048) :

$$\frac{\mathrm{H1}}{\mathrm{W1}} = \frac{2048}{2592}$$

Given that the horizontal FOV is W1 at a certain height, the vertical FOV H1 at that height is 2048* w1/2592.

Similarly, if you know the vertical field of view at a certain height, you can figure out the horizontal field of view at that height.

Example:

When the horizontal FOV at the height of 2100mm is 740mm, the vertical FOV is 740*2048/2592=585mm

- Given horizontal FOV under a certain height, calculate horizontal FOV at any height:

$$\frac{h1}{\mathrm{W1}} = \frac{h2}{\mathrm{W2}}$$

Given that the horizontal FOV at the height of h1 is W1, the horizontal FOV at the height of h2 is W1*h2/h1.

Example:

The horizontal FOV under the height of 2100mm is 740mm, while the height of 800mm is 740*800/2100=282mm.

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