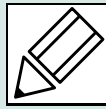


# Quick Guide to Precision Measuring Instruments



## Vision Measuring Machines

### Vision Measurement

Vision measuring machines mainly provide the following processing capabilities.

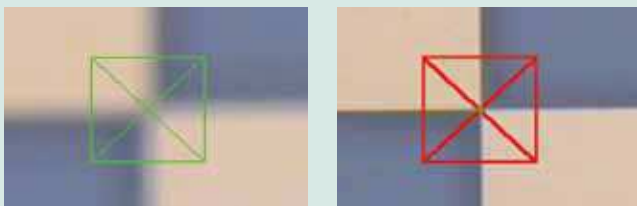
#### ■ Edge detection

Detecting/measuring edges in the XY plane



#### ■ Auto focusing

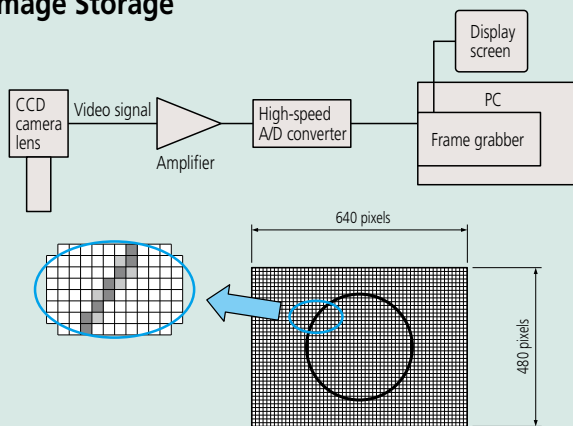
Focusing and Z measurement



#### ■ Pattern recognition

Alignment, positioning, and checking a feature

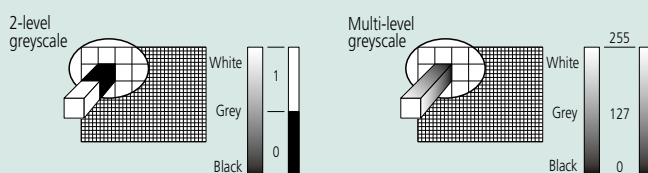
### Image Storage



An image is comprised of a regular array of pixels. This is just like a picture on fine plotting paper with each square solid-filled differently.

### Greyscale Images

A PC stores an image after internally converting it to numeric values. A numeric value is assigned to each pixel of an image. Image quality varies depending on how many levels of greyscale are defined by the numeric values. The PC provides two types of greyscale: two-level and multi-level. The pixels in an image are usually displayed as 256-level greyscale.



Pixels in an image brighter than a given level are displayed as white and all other pixels are displayed as black.

Each pixel is displayed as one of 256 levels between black and white. This allows high-fidelity images to be displayed.

### Difference in Image Quality

Difference between 2-level and 256-level greyscale images



Sample image displayed in 2-level greyscale

Sample image displayed in 256-level greyscale

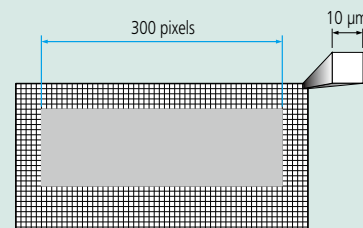
### Variation in Image Depending on Threshold Level



These three pictures show how the same 2-level greyscale image can appear vastly different depending on the slice levels (threshold levels) used. Therefore, 2-level greyscale imaging is not used for high-precision vision measurement since pixel numeric values will change depending on the threshold level that is set.

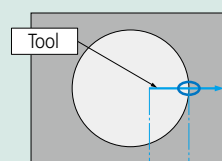
### Dimensional Measurement

An image consists of pixels. If the number of pixels in a section to be measured is counted and is multiplied by the size of a pixel, then the section can be converted to a numeric value in length. For example, assume that the total number of pixels in the lateral size of a square workpiece is 300 pixels as shown in the figure below. If a pixel size is 10  $\mu\text{m}$  under imaging magnification, the total length of the workpiece is given by 10  $\mu\text{m}$  x 300 pixels = 3000  $\mu\text{m}$  = 3 mm.



### Edge Detection

How to actually detect a workpiece edge in an image is described using the following monochrome picture as an example. Edge detection is performed within a given domain. A symbol which visually defines this domain is referred to as a tool. Multiple tools are provided to suit various workpiece geometries or measurement data.



The edge detection system scans within the tool area as shown in the figure at left and detects the boundary between light and shade.

|     |     |     |     |    |    |    |    |    |    |
|-----|-----|-----|-----|----|----|----|----|----|----|
| 244 | 241 | 220 | 193 | 97 | 76 | 67 | 52 | 53 | 53 |
| 243 | 242 | 220 | 195 | 94 | 73 | 66 | 54 | 53 | 55 |
| 244 | 246 | 220 | 195 | 94 | 75 | 64 | 56 | 51 | 50 |

Example of numeric values assigned to pixels on the tool

