



Configuration Software for 2D Code Reading Sensor

# PDTOOL HELP

<PDF Version>

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# Overview and Basic Functions

PDTOOL is software that allows users to set a reading method for the PD Series with use of the PC. In addition, the software can display and save reading results.

## 1. Setting the reading method for the PD Series

Left click on the [[Easy](#)] [[Detail](#)] buttons for teaching.

## 2. Displaying the reading results for the PD Series

Left click on the [[Reading](#)] button.

## 3. Saving the reading results



Select [Option] > [[PDTOOL Result Save](#)] from the menu bar.

# System Requirements

<b>OS</b>	: Windows® 98 SE / Windows® Me / Windows® 2000 / Windows® XP
<b>Hardware</b>	: DOS/V
<b>Required hard-disc space</b>	: 20MB or more
<b>CPU</b>	: PentiumIII 600MHz or more
<b>Installed memory</b>	: 128MB or more
<b>Resolution</b>	: 1024 x 768 or more
<b>Display color</b>	: High Color (16 bits) or more
<b>Communication configuration</b>	: USB Ver1.1

# A List of PDTOOL Functions

<b>FILE</b>	
Writes the setting data saved as a file to the PD Series	Menu->File-> <a href="#">PD&lt;-File</a> 
Saves the setting data in the PD Series as a file	Menu->File-> <a href="#">PD-&gt;File</a> 
Saves the setting data in the PD Series as a text file (For documentation, printing, etc.)	Menu->File-> <a href="#">Export</a> 
Collects the reading results.	<a href="#">PD Image Save</a>
Collects the read captured images in bitmap format.	<a href="#">PD Image Save</a>
Saves the record of changes for [PD Configuration]	<a href="#">PDTOOL Configuration</a>
Saves the record of changes that have been made while executing a teaching	<a href="#">PDTOOL Configuration</a>
Saves a captured image in the memory of the PD Series as a bitmap file	<a href="#">PD Image Save</a>
<b>DISPLAY</b>	
Displays an image that the PD Series is reading	<a href="#">PDTOOL Configuration</a>
Displays the reading (data) area while reading an image	<a href="#">PDTOOL Configuration</a>
Sets threshold values for Error Correction Rate bar and Reading Rate bar.	<a href="#">PDTOOL Configuration</a>
Initializes the reading rate	<a href="#">Initialize Reading Rate</a> 
Displays the list of recorded reading result data	<a href="#">List of Reading Data</a> 
Displays a captured image saved in the PD Series	<a href="#">PD Image Save</a>
Changes the display direction of a captured image	Icon <a href="#">Rotete Counterclockwise</a>  <a href="#">Rotete Clockwise</a> 
Displays preprocessed images.	<a href="#">Pre-process operation</a>
<b>PD Series</b>	
Configures the settings for the PD Series	<a href="#">PD50 PD Configuration</a> <a href="#">PD60 PD Configuration</a> <a href="#">PD65 PD Configuration</a>
Turns the light of the PD Series on and off	<a href="#">PD50 PD Configuration Lighting</a>
Sets the internal or external trigger	<a href="#">PD50 PD Configuration</a> <a href="#">PD60 PD Configuration</a>
Stores a captured image in the memory of the PD Series	<a href="#">PD50 PD Configuration</a> <a href="#">PD60 PD Configuration</a> <a href="#">PD65 PD Configuration</a>
Initializes the PD Series	<a href="#">Initialize PD</a>
Executes a teaching by using an image in the PC (in Debug mode)	<a href="#">Image Transfer</a>
Reads an image in the PC (in Debug mode)	<a href="#">Image Transfer</a>
Stores all of the captured images in the PC when the PD Series retries to read the 2D code (in Test mode)	<a href="#">PD60 PD Configuration</a> <a href="#">PD65 PD Configuration</a>
Turns some of the lighting off	<a href="#">Lighting</a>

<b>2D CODE</b>	
To set the exposure time	<a href="#">Teaching Easy</a> <a href="#">Teaching Detail</a>
To set a reading area	<a href="#">Teaching Easy</a> <a href="#">Teaching Detail</a>
To select the type of the 2D code (DataMatrix or QR code)	<a href="#">Teaching Detail</a>
Inverts black/white or right/left of the 2D code	<a href="#">Teaching Detail</a>
<b>Other</b>	
Not allows for users to change the saved settings	<a href="#">Input Prohibition</a>
Executes external trigger	<a href="#">Reading Trigger Execution</a>  <a href="#">PD50 PD Configuration</a> <a href="#">PD60 PD Configuration</a>
To set the allowable fluctuation range of the settings for consecutively reading a 2D code	<a href="#">Reading Retry Setting</a> 
Executes Teaching with all types of cell form.	<a href="#">Pre-process operation</a>

# Saving the Record of Changes

With use of the PDTOOL , you can save the record of changes made to the setting data for [PD Configuration] [Teaching] and to the reading result data for [Reading].

## -PD Configuration

Select [Settings] > [PDTOOL Configuration] > the check box next to "Take the record of the setting data of the PD configuration" from the menu bar.

The PD saves the record of changes made to the setting data for [PD Configuration] as a text file (in CSV format) in the current folder specified for [\[PDTOOL Configuration\]](#).

## -Teaching

Select [Settings] > [PDTOOL Configuration] > the check box next to "Take the record of the teaching data" from the menu bar.

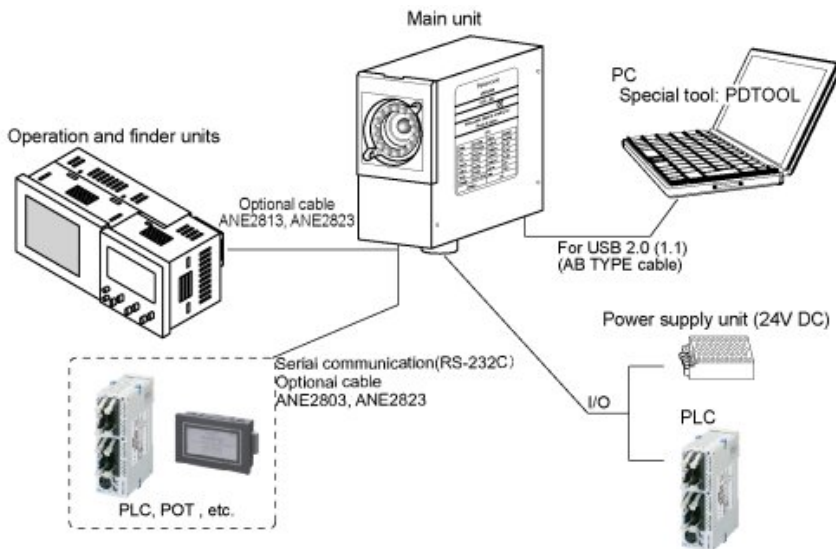
When executing a teaching, the PD saves the record of changes made to the setting data for [Teaching] a text file (in CSV format) in the current folder specified for [\[PDTOOL Configuration\]](#).

## -Reading

Select [Option] > [PDTOOL Result Save] > [Reading Data Save] > "All" or "NG" from the menu bar.

When reading, the PD60 saves the reading result data as a text file data (in CSV format) in the folder specified for [PDTOOL Result Save]. You can check the record of changes made to the reading result data by selecting [Tool] > [\[List of Read Data\]](#) from the menu bar.

# PD50 Hardware Configuration



## Operation/Finder Unit

For setting inspection conditions and displaying an image

## I/O - Power/PLC

Power supply

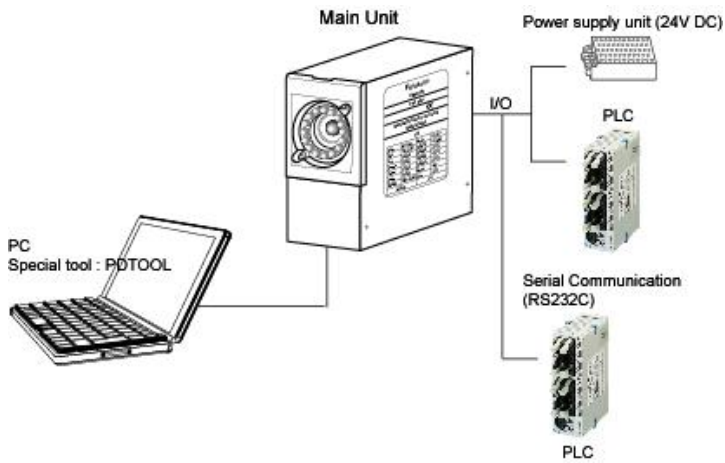
## Serial (RS232C)- Indicator(GT),PLC

Inspection result output and PD50 control with various commands

## The PC installed PDTOOL

Setting up reading conditions and operation status of the PD50.  
(The PC fully controls the main unit without using the operation/finder unit.)

# PD60 Hardware Configuration



## I/O - Power/PLC

Power supply

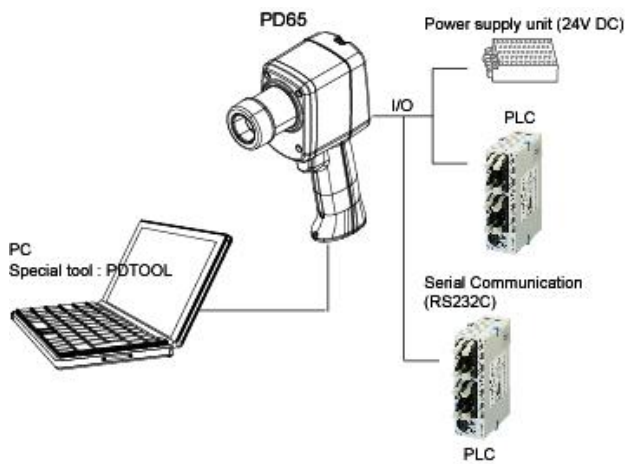
## Serial (RS232C) - PLC

The PD60 reads and outputs the information about reading results in the PD60 using various commands.

## The PC installed PDTOOL

Setting up reading conditions and operation status of the PD.

# PD65 Hardware Configuration



## I/O - Power/PLC

Power supply

## Serial (RS232C) - PLC

The PD65 reads and outputs the information about reading results in the PD65 using various commands.

## The PC installed PDTOOL

Setting up reading conditions and operation status of the PD65.

# Supported 2D Code

The PD series supports the following 2D Codes; QR code and Data Matrix. Here are the features of the codes.

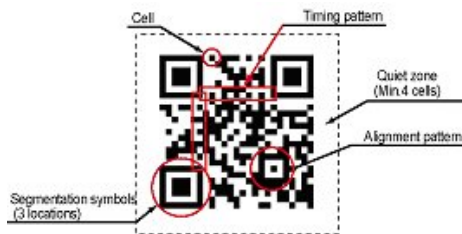
## QR code

Quick Response code

The QR code is a 2D code developed by Denso Wave in 1994.

The key feature of the QR code system is the capability to read 2D codes quickly.

### Main elements of QR code symbol:



### Condition:

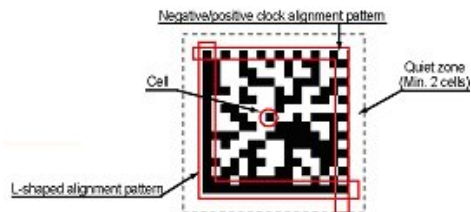
Model	Model 1 and Model 2
Matrix size	- Model 1: 21 x 21 - 49 x 49 cells (Versions 1 - 8) - Model 2: 21 x 21 - 49 x 49 cells (Versions 1 - 8)
Quiet zone	Consisting of at least four cells
Error correction level	H, M, Q, L
Others	- Supports only one loss of clock alignment pattern The PD cannot recognize the code with more than two losses of alignment pattern. - Supports both negative/positive and horizontally inverted code symbols (use the reread (retry) function for a mixture of inverted and noninverted code symbols*1)

\*1) If a mixture of the products with negative/positive inverted 2D codes and the ones with noninverted 2D codes move down the assembly line, with the reread (retry) function, you can have the PD read both inverted and noninverted 2D codes by saving noninverted code and inverted code to product type 1 and 2 respectively. The same holds for a mixture of the products with horizontally inverted 2D codes and the ones with noninverted 2 D codes.

## Data Matrix code

The Data Matrix code is a 2D code developed by ID Matrix.  
It can handle alphanumeric characters only and hold the same amount of information in a downsized code.  
It is mainly used for components.

### Main elements of the Data Matrix code:








### Condition:

Matrix size	- Square symbol: 10 x 10 to 44 x 44 cells - Rectangular symbol: 8x18, 8x32, 12x26, 12x36, 16x36, 16x48 cells
Quiet zone	Consisting of at least two cells
Others	- No stain in L-shaped alignment patterns - Supports only one loss of clock alignment pattern (up to 25% /side) - Supports negative/positive inverted and horizontally inverted code symbols (use the reread (retry) function for a mixture of inverted and noninverted code symbols*1)

\*1) If a mixture of the products with negative/positive inverted 2D codes and the ones with noninverted 2D codes move down the assembly line, with the reread (retry) function, you can have the PD read both inverted and noninverted 2D codes by saving noninverted code and inverted code to product type 1 and 2 respectively. The same holds for a mixture of the products with horizontally inverted 2D codes and the ones with noninverted 2D codes.

# Unreconizable 2D Code Symbols

The PD50 cannot recognize the following 2D code symbols even if they were the codes or conditions saved in TEACHING mode.

Item	Example symbol	Description
Shortage of quiet zone		Not enough quiet zone (space around the symbol)  Required conditions: A quiet zone within a reading area must fulfill the following conditions: - At least two cells (Data Matrix code) - At least four cells (QR code)
Stained and cracked alignment pattern	Data Matrix code 	Stained and cracked alignment patter (L-shape straight line or clock)  Required conditions: - No stain and crack in L-shaped alignment pattern - One or less loss in the clock alignment pattern
	QR code 	Cannot distinguish two segmentation symbols  Required conditions: At least two out of three segmentation symbols must be distinguished. (Can support stains or cracks in one out of three segmentation symbols.)
Stains and damages exceeding the error correction level		Stains and cracks exceeding the error correction rate (or error correction level for QR code) in the code symbol
Aspect ratio of the cell out of the allowable range		Aspect ratio of the cell is out of the allowable range.

**Note:** When two valid 2D codes exist within a reading area, the PD reads either.

# About processing mode -PD50-

PD50 has processing modes as follows.

Normal Mode: The PD50 is normally in this mode. For capturing 2D Code, configuring the settings, and executing reading.

- RUN/RUNVIEW: In RUN mode, the PD50 captures and reads 2D Code.
- TEACHING Mode: In TEACHING mode, you can configure the settings for reading.
- SET mode: In SET mode, you can configure the settings for the PD50 using the operation unit.

DEBUG Mode: For configuring the settings and executing reading with images downloaded to the PD50, which has captured and stored with PDTOOL, without capturing another 2D Code.

- RUN mode: In RUN mode, the PD50 reads the downloaded image data.
- TEACHING mode: In TEACHING mode, you can configure the settings for reading.
- SET mode: In SET mode, you can configure the settings for the PD50 using the operation unit.

In Debug mode, the PD series allows off-site adjustment of the pre-process settings to read 2D codes.

Using the image data saved at the site, you can adjust the Teaching settings.

Refer to "[PDTOOL Result Save](#)" for more information about how to save image data.

\*To switch between Normal mode and Debug mode, select [[Debug mode](#)] from the menu bar.

\*To download the images in Debug mode, select [Debug mode]> [[Image Transfer](#)] from the menu bar.

## About processing mode -PD60-

Processing mode consists of Normal mode and Debug mode, and each mode also has RUN and TEACHING modes.

Normal Mode: The PD60 is normally in this mode. For capturing 2D Code, configuring the settings, and executing reading.

• RUN Mode: In RUN mode, the PD60 captures and reads 2D Code.

• TEST Mode: In TEST mode, the PD60 stores captured images and reading results, which are in process of Retry reading, in the computer.

• TEACHING Mode: In TEACHING mode, you can configure the settings for reading.

DEBUG Mode: For configuring the settings and executing reading with images downloaded to the PD60, which has captured and stored with PDTOOL, without capturing another 2D Code.

• RUN mode: In RUN mode, the PD60 reads the downloaded image data.

• TEACHING mode: In TEACHING mode, you can configure the settings for reading.

In Debug mode, the PD series allows off-site adjustment of the pre-process settings to read 2D codes.

Using the image data saved at the site, you can adjust the pre-process settings.

Refer to "[PDTOOL Result Save](#)" for more information about how to save image data.

\*To switch between Normal mode and Debug mode, select [[Debug mode](#)] from the menu bar.

\*To download the images in Debug mode, select [Debug mode]> [[Image Transfer](#)] from the menu bar.

# About processing mode -PD65-

PD65 has Operation Mode and Trial Mode as processing mode.

Operation Mode consists of Normal Mode and Debug Mode, and each of them has RUN Mode and Teaching Mode.

At "Reading Mode" from [Settings] a [PD configuration], you can switch between Trial Mode and Operation Mode.

To execute teaching, select Operation Mode.

## Operation Mode

This mode is for full-scale introduction of PD65.

Using PDTOOL, you can register the condition of 2D Code to read and the other configurations, and execute reading.

And also Debug Mode is available, which is for adjustment of settings and reading test with a stored 2D Code image.

**Normal Mode:** The PD65 is normally in this mode. For capturing a 2D Code, configuring the settings, and executing reading.

• **RUN Mode:** In RUN mode, the PD65 captures and reads 2D Codes.

• **TEST Mode:** In TEST mode, the PD65 stores captured images and reading results, which are in process of Retry reading, in the computer.

• **TEACHING Mode:** In TEACHING mode, you can configure the settings for reading.

**DEBUG Mode:** For configuring the settings and executing reading with images downloaded to the PD65, which has captured and stored with PDTOOL, without capturing another 2D Code.

• **RUN mode:** In RUN mode, the PD65 reads the downloaded image data.

• **TEACHING mode:** In TEACHING mode, you can configure the settings for reading.

In Debug mode, the PD series allows off-site adjustment of the pre-process settings to read 2D codes.

Using the image data saved at the site, you can adjust the pre-process settings.

Refer to "[PDTOOL Result Save](#)" for more information about how to save image data.

\*To switch between Normal mode and Debug mode, select [[Debug mode](#)] from the menu bar.

\*To download the images in Debug mode, select [Debug mode]> [[Image Transfer](#)] from the menu bar.

## Trial Mode

This mode is for trial reading before introduction.

You can execute Teaching and Reading by only pressing a trigger button. At the time, the condition of reading code is automatically registered or updated.

In this mode, 2D Code cannot be always read depending on printing condition.

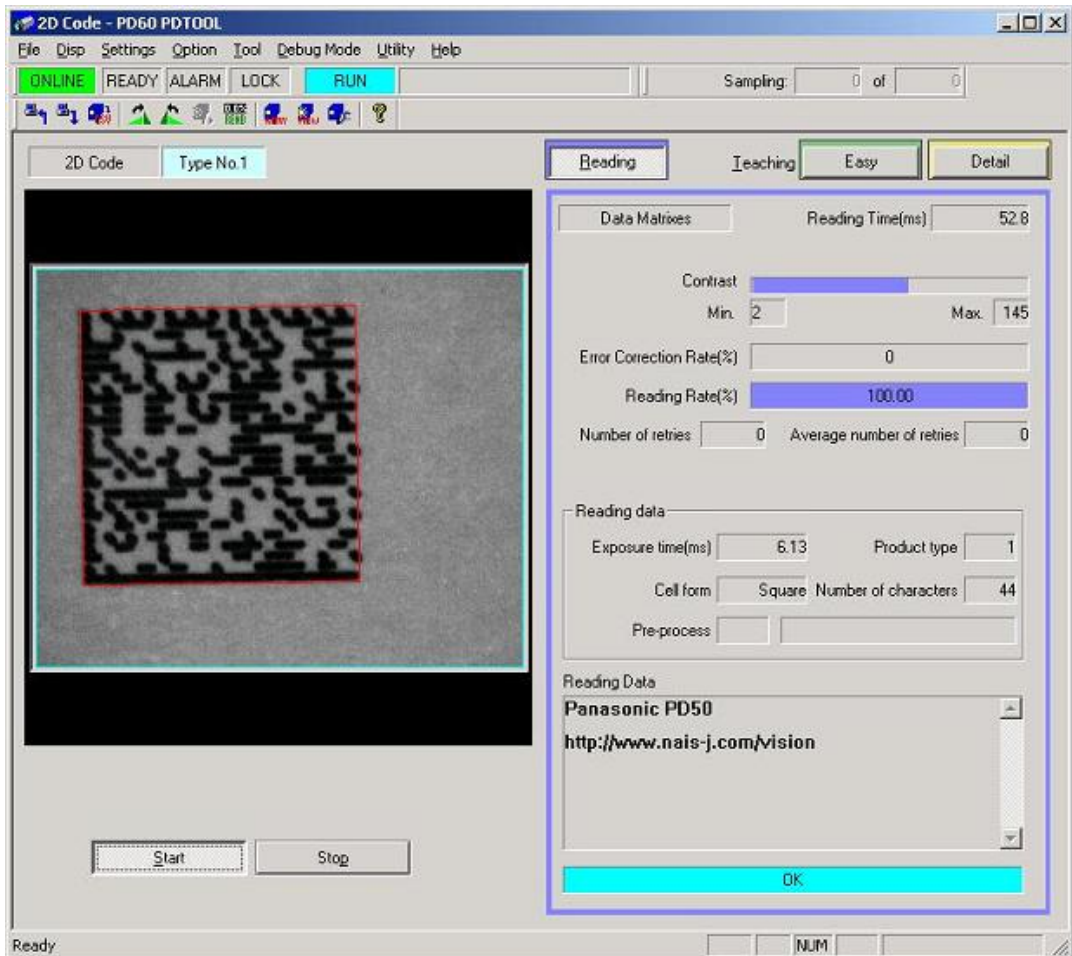
Even once reading failed, it might take longer at the next reading, because Teaching performs again automatically.

Details of the Teaching are registered in Product Type No.7.

# Reading Overview and Screen Description

The PDTOOL is used for reading and displaying 2D codes. Reading 2D codes are executed per product type. If you want to save a different product type (2D code), change the product types by selecting **Initial Settings > Product type** from the menu bar.

\* The following image is a window for PD60. A displayed window differs depending on which PD series you use.



## Menu bar

### -File

**PD <- File:** Downloads the setting data contained in a file from the PD Series to the PD Series

**PD -> File:** Saves the setting data stored on the PD Series as a file

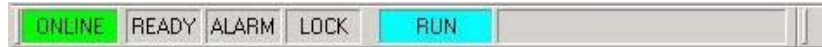
### [PD Image Save](#)

**Export:** Saves the setting data as a text file (in CSV format)  
(Use the Export command when you create a document or print the setting data.)

**Exit:** Terminates the PDTOOL.

## -Disp

**PD Status Bar:** Select when displaying the status of PD Series.



**ONLINE:** If communication is established between the PD Series and the PDTOOL properly, the ONLINE lamp lights up.

**READY:** If the PD Series does not execute processing, "READY" is highlighted. Inspection can be performed only while "READY" is highlighted.

**ALARM:** If a teaching failed, "ALARM" is highlighted.

**LOCK:** If the main unit is locked, "LOCK" is highlighted. The LOCK function is used for protecting the current settings. Any setting and product type cannot be changed as long as the LOCK function is activated.


**RUN / RUN-VIEW / TEACH / SET:** The current mode in which the PD Series is RUN-VIEW / SET Mode is only for PD50.


**Number of Sampling (display bar):** Check this item to display the bar of Number of Samplings.



**Tool bar:** Check this item to display the tool bar showing the icons.



 **Rotate Clockwise:** Turns an image clockwise by 90 degrees. (90 d a 180 d a 270 d)

 **Rotate Counterclockwise:** Turns an image counterclockwise by 90 degrees. (270 d a 180 d a 90 d)

**Status bar:** Check this item to display the status of PDTOOL.



## -Settings

**Select Type:** To select a product type for which you want to execute a teaching operation or an inspection.  
For PD65, this is not available in Trial Mode.  
In Trial Mode, the PD series perform Teaching and Reading with Product Type No.7.

### [PDTOOL Configuration](#)

#### PD Configuration

[-PD50](#)

[-PD60](#)

[-PD65](#)

### [Gain Value](#)

**Initialize the settings:** Initializes the data saved on the PD50.  
Cancels the current settings

## -Option

[Lighting](#) (Not available in PD65.)

[Pre-process operation](#)

[Reading Retry Setting](#)

[PDTOOL Result Save](#)

[Input Prohibition](#)

## -Tool

[List of Reading Data](#)

**Reading Trigger Execution:** Activated if [Trigger settings - Internal trigger] set to "OFF" from [Settings] a [PD Configuration].  
The PD series start performing reading after receiving the trigger signal from the external signal.

**Initialize Reading Rate:** Activated when the PD series perform reading.  
Reading Rate indicates the ratio of successful reading of 2D Codes.  
Clicking this resets the Reading Rate to start a measurement.

## -Debug Mode

**Switch to Debug mode / Switch to Normal mode:** In Debug mode, transfers saved 352x288 sized bitmap file and 24 or 32 bit data to the PD series and displays them.  
In Normal mode, displays the currently capturing image.

[Image Transfer](#)

## **-Utility**

### **[Image Analysis](#)**

## **-Help**

**Help:** Opens the HELP file

**Version Info.:** Displays version information

**PD system information:** Displays the system information of the PD Series.

**Direct Lighting:** Displayed only in PD65.  
Displayed when executes Teaching or Reading with Direct Lighting.

**Low-angle Lighting:** Displayed only in PD65.  
Displayed when executes Teaching or Reading with Low-angle Lighting.

**Start:** Shows reading results for the currently selected product type and unit.

**Stop:** Stops showing reading results.

## **[Reading](#)**

Carries out a reading operation following the settings and displays the reading results.

## **Teaching ( [Easy](#) / [Detail](#) )**

Registers the settings of reading conditions.

# Teaching -Easy-

Registers the range of inspection criteria

**Direct Lighting** Illuminates a 2D Code from directly above.  
(Available only for PD65.)

**Low-angle Lighting** Illuminates a 2D Code from lateral side.  
(Available only for PD65.)

Low-angle Lighting helps reading for shiny objects, such as mirror surface.  
Both Direct/Low-angle Lightings are available in Teaching. When you select "Both" of them in "Capture setting" of "PD Configuration", either Teaching result will be valid.

## Exposure

**Automatically adjust exposure:** Check this box to adjust exposure automatically.

**Exposure time:** Sets a background and contrast of 2D code so that the PD can read it easily. The shorter the exposure time, the darker the image. The longer the exposure time the brighter the image. If you make the exposure time longer, the reading time also will be longer.

**Read defective codes (available for Data Matrix codes):** When the PD series read defective Data Matrix codes, which are having insufficient quiet zones or cracked L-shaped alignment patterns, the devices perform adequate process before reading codes.

This function is available only for Data Matrix codes.

Example:



## Pre-process

The Pre-process tab is inactivated in PD50. Press [Detail] teaching button and configure the Pre-process settings from "Other" tab.

## Reading area (Not available for PD65.)

**Reading area:** Sets a reading area within the left part of the display area by using the mouse or by inputting the setting values.

**Run teaching:** Carries out a teaching operation following the settings.

# Teaching -Detail-

Registers the range of inspection criteria

**Direct Lighting** Illuminates a 2D Code from directly above.  
(Available only for PD65.)

**Low-angle Lighting** Illuminates a 2D Code from lateral side.  
(Available only for PD65.)

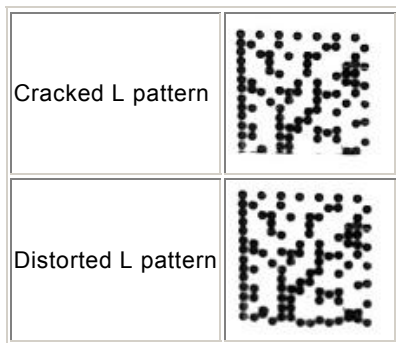
Low-angle Lighting helps reading for shiny objects, such as mirror surface.  
Both Direct/Low-angle Lightings are available in Teaching. When you select "Both" of them in "Capture setting" of "PD Configuration", either Teaching result will be valid.

## Exposure

**Exposure time:** Sets a background and contrast of 2D code so that the PD can read it easily. The shorter the exposure time, the darker the image. The longer the exposure time the brighter the image.  
If you make the exposure time longer, the reading time also will be longer.

**Read defective codes (available for Data Matrix code):** When the PD series read the defective Data Matrix codes, which are having insufficient quiet zones or cracked L-shaped alignment patterns, the devices perform adequate process before reading codes.  
This function is available only for Data Matrix codes.

Example:



## Pre-process

The Pre-process tab is inactivated in PD50. Click "Other" tab described below and set "Advanced Teaching Settings".

## Cell form

Normal... Normal print

Narrow...Narrow distance between dots

Wide...Wide distance between dots

Square...Equal distance between dots. Available only when "Data Matrix code" for "Code".

## **Cell size**

**[When selects "QR code" for "Code"]**

Small (5 dot)...For a captured image with approximately 5 pixels (dots) per cell  
Large (8 dot)...For a captured image with 8 or more pixels (dots) per cell

To estimate the cell size, move the mouse cursor onto a 2D Code image shown on the left of the screen.

## **Code**

Select the type of 2D Code to be read, "Data Matrix code" or "QR code".

## **Set Inversion**

**Reverse White/Black:** For a 2D Code described in white.

**Reverse Left/Right:** For a mirror inversed 2D Code.

## **Reading area (Not available for PD65.)**

**Reading area:** Sets a reading area within the left part of the display area by using the mouse or by inputting the setting values.

## **Other**

**Other:** Opens a window for advanced teaching settings. Each of "Data Matrix code" and "QR code" has each setting.  
This window is mainly for PD50.

**Run teaching:** Carries out a teaching operation following the settings.

**Registration of settings (Do not teaching):** Registers settings of Teaching in the PD series without performing a Teaching.

## Other (Advanced Settings for Teaching)

**Type:** Displays the current product type

**Code:** Displays the type of the current 2D code

**Lighting:** Displays the type of lighting

### Preprocess

**Smoothing:** Select this check box to read 2D coded printed on uneven (or rusted) surface easily.

**Size Reduction:** Select this check box to read 2D code in which fine foreign objects present, so that the PD50 can read it easily.

**Contrast Adjustment:** For the low contrast image, check this item to adjust the contrast according to the setting values

### Data Matrix code

### Postprocess

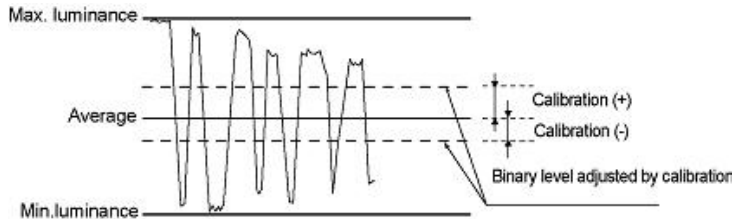
**PCS Level:** Sets a PCS level

**Max. Bright:** After excluding erasing luminance more than the specified luminance value, set the intermediate value between min. luminance and max. luminance as a binary level.

**Perform post-process smoothing:** If defective pixels may exist in the L-shaped line type alignment pattern, Check this check box to increase the reading probability of the code.

## Calibration

Calibration is a function that adjusts (increases/decreases) the binary level calculated by the "Normal" or "Luminance limit" function. If you change the calibration value by the time of completion of teaching, teaching may complete properly.



**Normal:** Available if you selected "Normal" for cell form  
To set the correction value of binary threshold for an unsaturated image. Set to a negative calibration value to read bold black print easily. Set to a positive calibration value to read fine black print easily.

**Saturation:** Available if you selected "Normal" for cell form  
To set the correction value of binary threshold for an unsaturated image. If the image is saturated, the maximum gray scale becomes less than the value that should be, (because even if the gray scale value that should be is more than 255 (the maximum gray scale value), the maximum gray scale value is 255). Therefore, increasing the calibration value makes the image easy enough to read.

**Contrast:** Sets contrast when the [Cell form] is set to "Normal".

## Binarization by Controlling Threshold Values:

To select a procedure for binarization  
Selecting "Default" sets an intermediate value of Max./Min. luminance as a binary level.  
Selecting "Fixed value" sets a binary level as a fixed binary level.  
Selecting "Luminance Limit" sets a binary level following the same procedures used for "Normal" after erasing luminance values more than the max. limit and less than the min. limit.

**Fixed threshold level:** Sets a fixed threshold level when the Binarization by Controlling Threshold Value is set to "Fixed".

**Min. luminance:** Sets a min. luminance when luminance limit for the Binarization by Controlling Threshold Values function is set.

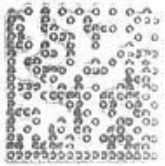
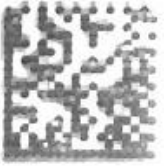


**Max. luminance:** Sets a max. luminance when luminance limit for the Binarization by Controlling Threshold Value function is set.

# Preprocess

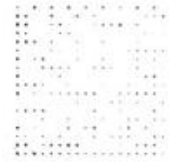
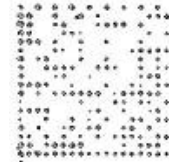

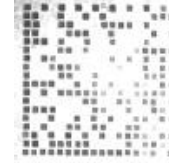


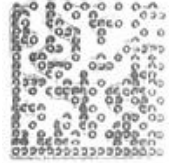



With use of the preprocess function, the PD series can easily read even the 2D codes, which are regarded as difficult to read. Preprocessed image is displayed only when performing teaching. The captured original image that is not processed, is displayed while being reading.

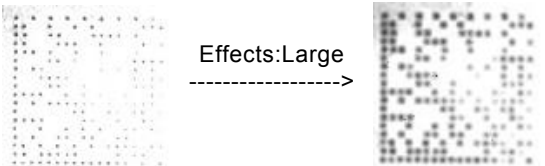
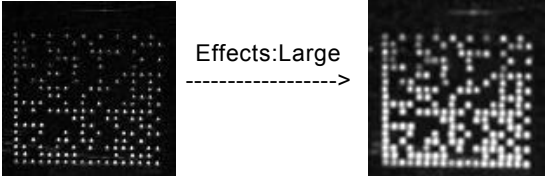
**Perform preprocessing:** Performs preprocessing following the settings for this item B

**Order:** Select "Methods" and press the "Add" button to add a process to the present pre-process method. Process the image in the saved pre-process order. When you want to rearrange the order of the pre-process methods, use the arrow button. If you checked the "Displays the preprocessed image" item by selecting "OPTION" > "Teaching" > "Pre-process operation" from the menu bar, a preprocessed image is displayed. If not, only the captured original image is displayed.

Type of preprocess	
1	<p>Make darker cells more black</p> <p>Makes darker cells close to black. This function is effective for the white cells on a black background.</p> <p>Example)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Original image</p>  </div> <div style="text-align: center;"> <p>Effects:Large -----&gt;</p> </div> <div style="text-align: center;"> <p>Processed image</p>  </div> </div>
2	<p>Make brighter cells more white</p> <p>Makes brighter cells close to white. This function is effective for the black cells on a white background.</p> <p>Example)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Original image</p>  </div> <div style="text-align: center;"> <p>Effects:Large -----&gt;</p> </div> <div style="text-align: center;"> <p>Processed image</p>  </div> </div>

<p>3</p> <p>Make darker and brighter cells more black</p>	<p>White (255) &lt;--&gt; Black (0) Changes the cells that are more than the maximum value to black (0) and the ones that are less than the minimum value to black (0). Even if reflection of light makes the cells brighter or darker, using this function changes them to black.</p> <p>255(White) _____</p> <p>Upper value -----</p> <p>Lower value -----</p> <p>0(Black) _____</p> <p>Example)</p> <p>Original image</p> <p>Effects Min.:130 Max.:255</p> <p>Processed image</p>
<p>4</p> <p>Equalize</p>	<p>Effective if the surface on which a 2D code symbol is printed is uneven.</p> <p>Example)</p> <p>Original image</p> <p>Effects:Large</p> <p>Processed image</p>
<p>5</p> <p>Cut gray</p>	<p>Converts the maximum and minimum values into the ratio of the maximum value to 255 and to 0 respectively The values between the maximum value and 255 are converted into 255 and the ones between the minimum value and 0 are converted into 0.</p> <p>255(White) _____</p> <p>Upper value -----</p> <p>Lower value -----</p> <p>0(Black) _____</p> <p>Example)</p> <p>Original image</p> <p>Effects Min.:0 Max.:150</p> <p>Processed image</p>

6	Highlight edges	<p>Emphasizes the cells between white cells and black cells</p> <p>Example)</p> <p>Original image</p>  <p>Processed image</p>  <p>-----&gt;</p>
7	Expand black points	<p>Expand the black pixels</p> <p>Example)</p> <p>Original image</p>  <p>Processed image</p>  <p>Effects:Large</p> <p>-----&gt;</p>
8	Expand white points	<p>Expand the white pixels</p> <p>Example)</p> <p>Original image</p>  <p>Processed image</p>  <p>Effects:Large</p> <p>-----&gt;</p>
9	Equalize darker cells	<p>Sequentially performs preprocessing 1 and 4 in this table</p> <p>Example)</p> <p>Original image</p>  <p>Processed image</p>  <p>Effects:Large</p> <p>-----&gt;</p>
10	Equalize brighter cells	<p>Sequentially performs preprocessing 2 and 4 in this table</p> <p>Example)</p> <p>Original image</p>  <p>Processed image</p>  <p>Effects:Large</p> <p>-----&gt;</p>

11	(Large) black points, equalization	<p>Sequentially performs preprocessing 7 and 4 in this table</p> <p>Example)</p> <p>Original image                      Processed image</p> 
12	(Large) white points, equalization	<p>Sequentially performs preprocessing 8 and 4 in this table</p> <p>Example)</p> <p>Original image                      Processed image</p> 
13	Return to the captured image	<p>Return to the image captured before preprocessing Use this function if you want to execute different preprocess after returning to the just captured image. Refer to the sample shown below.</p>
14	Execute reading	<p>Select this function to let the PD series read the image while preprocessing.</p> <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <p>Reading OK: Preprocess completed</p> <p>Reading NG: Continues process</p> <p>Reading OK: Preprocess completed</p> <p>Reading NG: Continues process</p> </div> <div style="border: 1px solid gray; padding: 5px;"> <p>Methods: (Large) black points, equalization</p> <p>Effects: Small</p> <p>Order <span style="float: right;">Add</span></p> <ul style="list-style-type: none"> <li>Make the darker cells black &lt;Small&gt;</li> <li>Cut gray &lt;100-200&gt;</li> <li>Execute reading</li> <li>Highlight edges &lt;Small&gt;</li> <li>Execute reading</li> <li>Return to the captured image</li> <li><b>(Large) black points, equalization &lt;Small&gt;</b></li> </ul> </div> </div> <p>*After finishing performing preprocessing in the "Order" box, be sure to let the PD series read the code.</p>

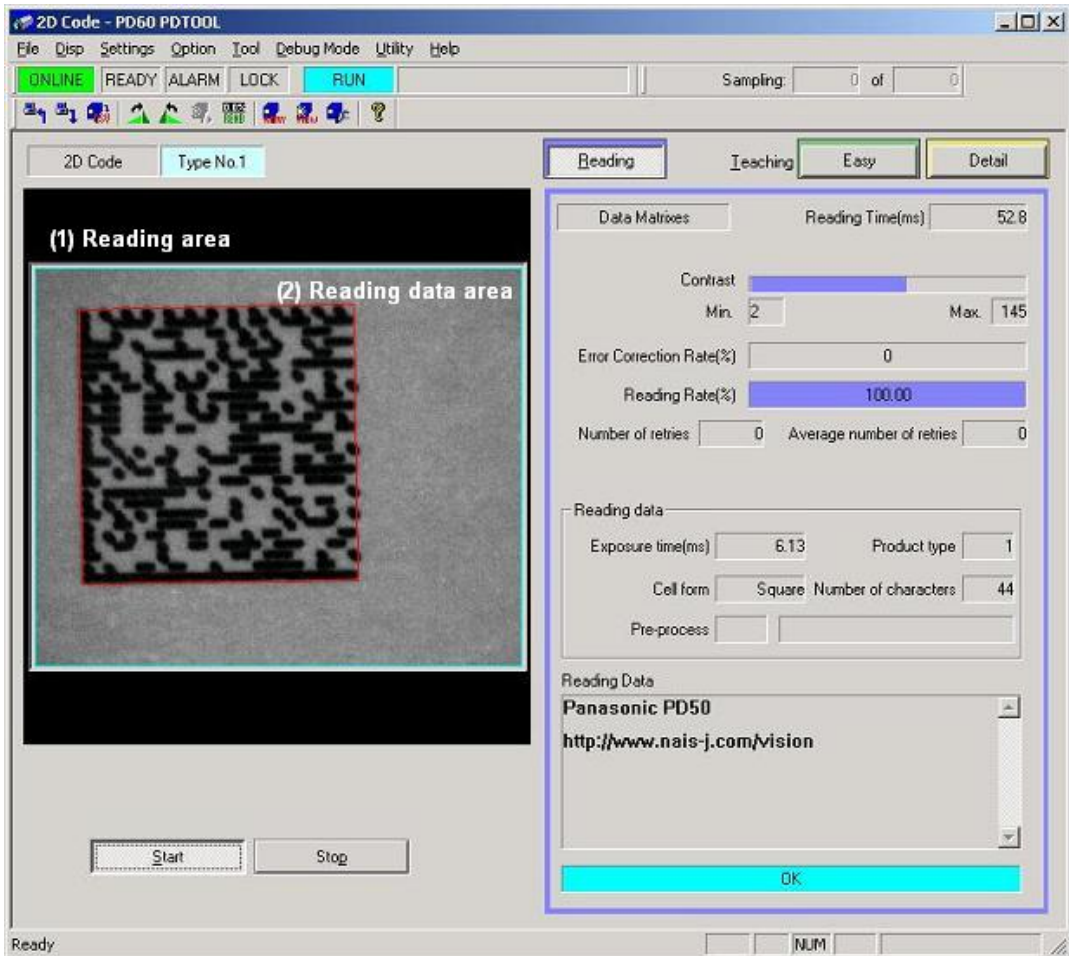
**Image Save:** Saves the image displayed in the right area of the PDTOOL screen to the PC

**Form of the cells to be read:** If you checked the "Preprocess the cells in every form at teaching" check box by selecting "OPTION" > "Teaching" > "Pre-process operation" from the menu bar, displays the cells of cell form (Normal/Narrow/Wide/Square) in which the PD series could read. If not, the PD series read the image according to the selected cell forms.

# Reading

Displays output status of reading results.

The following image is a window for PD60. A displayed window differs depending on which PD series you use.



## (1) Reading area (Not available in PD65)

The outline of the search area is shown as blue line.

The size can be set at the "Reading area" tab, in the "Easy" or the "Detail" Teaching settings.

## (2) Reading data area

The boundary of the reading data is shown as red line.

The type of the 2D Code is displayed.

**Inspection Time(ms):** The time required for reading the object

**Contrast:** Indicates the Max. luminance (upper limit) and Min. luminance (lower limit).

Available luminance is within the range between 0 and 255.

**Error Correction Rate(%):** Indicates the rate of error correction at the time of 2D code reading.

The correctable error rate differs depending on the number of target codes or cells. The maximum correctable error rate is 100.

The lower the error correction rate, the lower the frequency of error correction.

The color of the "Error Correction Rate" bar can be set to turn to red when the rate exceeds the setting value (%).

You can specify in the [\[PDTOOL configuration\]](#).

**Reading Rate(%):** Indicates the rate of successful reading of 2D codes.

Reading rate = number of successful reading / number of reading execution.

To reset the Reading Rate, click [Initialize Reading Rate] from [TOOL] menu.

The color of the "Reading Rate" bar can be set to turn to red when the rate does not reach at the setting value (%).

You can specify in the [\[PDTOOL configuration\]](#).

**Number of retries:** Displays how many times reading repeated. You can configure the settings for Retry from [OPTION] a [Reading Retry Settings].

**Average number of retries:** Shows average number of the past 50 retries.

Average number of retries is reset at the following timings:

1. When processing mode switches from RUN mode to TEACHING mode.
2. When product type switches to another.
3. When initializes the PD series.
4. When Reading Retry Settings changes.
5. When the settings for TEST mode changes.

## Reading data

**Exposure time:** Displays the exposure time at reading.

**Product type:** Displays the product type No. at reading.

**Cell form:** Displays the cell form at reading.

**Number of characters:** The number of characters that the PD series have read.

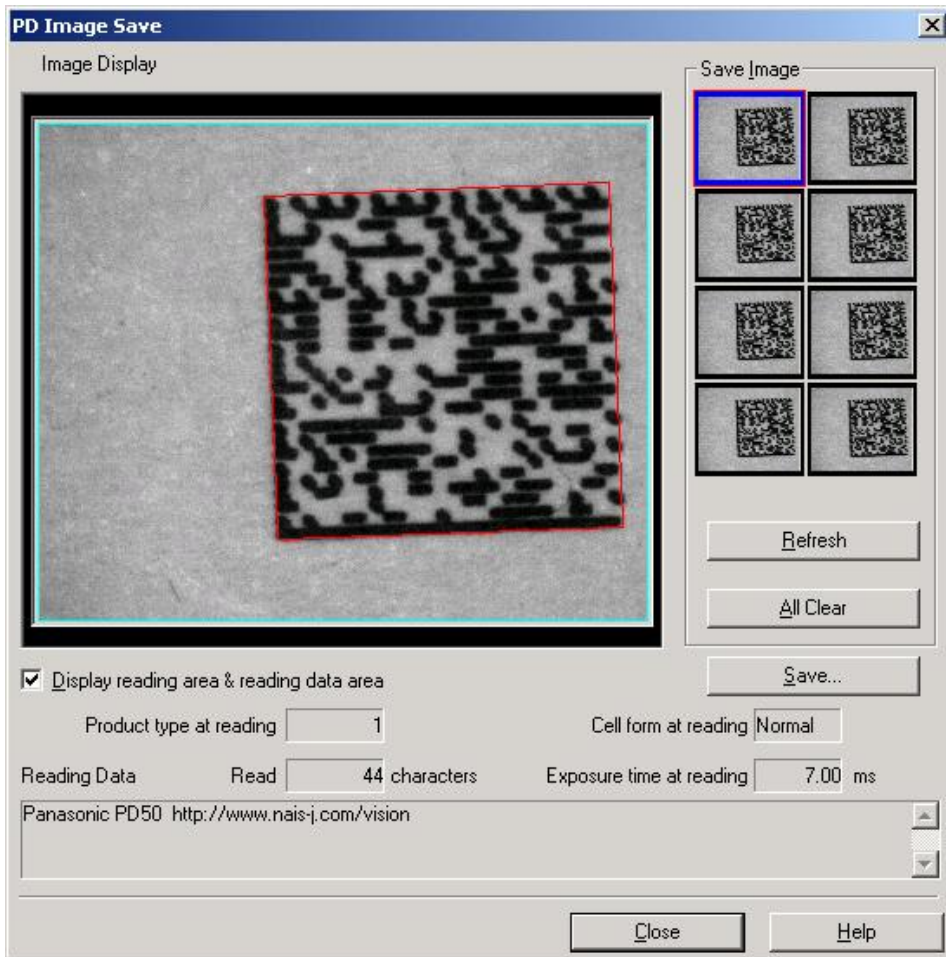
**Pre-process:** Displays the type of pre-process when it has done.

**Reading Data:** Displays the data that the PD has read.

## Note:

For the PD50, the "Average number of retries" and "Pre-process" functions are deactivated.

# PD Image Save



If you select "All" or "NG" by opening the PD Configuration window, up to 8 saved images can be displayed.

**Refresh:** Reloads the images saved in the PD Series.

**All Clear:** Deletes all images

**Save:** Saves the image as a file

**Display reading area & reading data area:** Displays the reading (data) areas.

**Reading Data:** Displays the 2D code data that the PD has read.

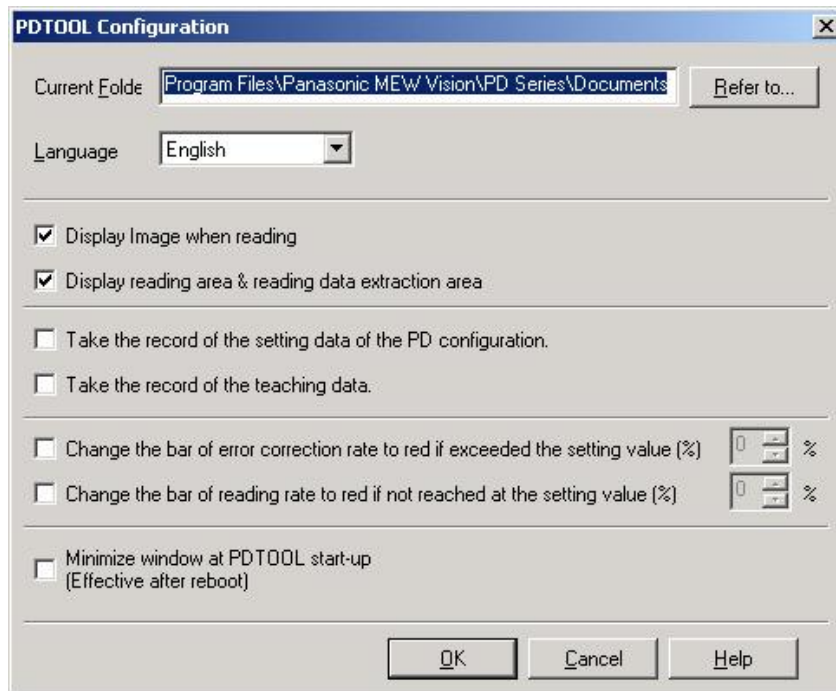
**Product type at reading:** Displays the product type No. when the PD read the 2D code.

**Read:** Displays the number of characters contained in the reading 2D code.

**Cell form at reading:** Displays the dot that had been already set when the PD read the 2D code.

**Exposure time at reading:** Displays the exposure time when the PD read the 2D code.

# PDTOOL Configuration



**Current Folder:** Initial folder for executing **PD -> File command** or **Export** command

**Display image when reading:** If you want to display an image in the left part of the display area when reading, select this check box. Note: If you activate this function, it takes more time to read.

**Display reading area & reading data extraction area:** If you want to display the frame borders of the reading area and reading data area in the left part of the display area, select this check box.

**Take the record of the setting data of the PD configuration:** Saves the setting data of the PD configuration to the current folder as a text file (in CSV format)

File name: ConfigYYYYMMDDhhmmss.csv

YYYY	: year
MM	: month
DD	: day
hh	: hour
mm	: minute
ss	: second

**Take the record of the teaching data:** Saves the setting data for teaching as a text file (in CSV format) in the current folder when teaching execution and setting registration.

File name: TeachingYYYYMMDDhhmmss.csv

YYYY	:	year
MM	:	month
DD	:	day
hh	:	hour
mm	:	minute
ss	:	second

**Change the bar of error correction rate to red if exceeded the setting value (%):** If error correction rate exceeds the setting value, the bar shows in red at reading.

**Change the bar of reading rate to red if not reached at the setting value (%):** If reading rate does not reach the setting value, the bar shows in red at reading.

**Minimize PDTOOL window at start-up (Effective after reboot):** PDTOOL boots up, minimizing a window.

# PD50 PD Configuration

PD Configuration

Unit No.  (1-99)

Baud rate  bps

Initial type

Output delay  ms

Capture delay  (0-160) ms

Trigger Settings

Internal trigger  ON  OFF(External trigger signal ON)

External trigger when teaching  OFF(G)  ON(M)

Image Save

All  NG(B)  None

Continues Output

Continues output ON

Terminate code:

Operation Unit

Backlight settings

Answer back ON

Light ON

Auto save  ON(Y)  OFF(W)

OK Cancel Help

**Note** You cannot open the configuration file while setting judgement criteria.

**Unit No.:** Lets you specify the unit of the PD50.

**Baud rate:** Lets you specify RS232C serial communication speed.

**Initial type:** Product type No. that is selected when opening the configuration file.

**Output delay:** The delay time from the end of reading to the result output .

**Capture delay:** The delay time from the reading start to the image capture start.

## Continues Output

**Continues output ON:** Outputs the reading characters via RS232 (NEWTOL communication is not available if this function is set to ON.)

**Terminate Code:** Allows you to select a terminal code to output the scanned data continuously(or automatically)

**Light ON:** If the check box is selected, the built-in LED lamp is used. If the check box is cleared, the built-in LED lamp is not used.

## Trigger Settings

**Internal trigger:** -When this function is set to ON, the PDTOOL starts reading immediately after it starts, then continues reading.  
-When this function is set to OFF, the PDTOOL starts reading after it received a trigger signal from the external device per reading.

**External trigger when teaching:** If you set **Internal trigger** to **External**, you can turn the external trigger teaching function **ON/OFF**.

**Image Save:** Selecting "All" saves all images.

Selecting "NG" saves only NG images.

Selecting "None" saves no images.

The saved images are displayed by opening the PD50 Image Save window.

### **Operation Unit**

**Backlight settings:** OFF-TIMER function for backlight

When the function is activated, the backlight keeps lighting and it will not go off.

If you set to **OFF10**, **OFF30** or **OFF60**, the backlight goes off after each setting time.

**Answerback ON:** When you want to add a reading data area (red) to the image data on the finder unit, set this function to "ON" (no relationship with the display images on the PDTOOL).

**Auto Save:** If you turned this function on, the setting data are automatically saved at the time of mode switch.

# PD60 PD Configuration

**PD Configuration**

Baud rate: 9600 bps

Initial type: 1

Output delay: 0 ms

Capture delay: 0 (0-1000) ms

Continues Output

Continues output ON

Terminate code: CR

Trigger Settings

Internal trigger:  ON  OFF (External trigger signal ON)

Image Save

All  NG(B)  None

TEST mode

Test Mode can not be set in Debug Mode

Read in TEST mode  
(The Image Save function is not available in TEST mode)

Retry after successful reading

Time limit of reading: 0 (0-5000)ms  
(The value "0" means there is no time limit.)

OK Cancel Help

**Note** You cannot open the configuration file while setting judgement criteria.

**Baud rate:** Lets you specify RS232C serial communication speed.

**Initial type:** Product type No. that is selected when opening the configuration file.

**Output delay:** The delay time from the end of reading to the result output .

**Capture delay:** The delay time from the reading start to the image capture start.

## Continues Output

**Continues output ON:** Outputs the reading characters via RS232 (NEWTOOL communication is not available if this function is set to ON.)

**Terminate Code:** Allows you to select a terminal code to output the scanned data continuously(or automatically)

## Trigger Settings

### Internal trigger:

-When this function is set to ON, the PDTOOL starts reading immediately after it starts, then continues reading.

-When "Internal trigger" signal is set to "OFF (external trigger signal ON)", the PD series starts reading by inputting a trigger signal from external device.

Select [TOOL] a[Reading Trigger Execution] to start reading.

## Image Save:

Saves reading images to the PD series memory.

Selecting "All" saves all images.

Selecting "NG" saves only NG images.

Selecting "None" saves no images.

The saved images are displayed by opening the PD Image Save window.

## TEST mode

In TEST mode, you can save all the images and the results of retry reading in order to check the validity of the "[Reading retry settings](#)".  
The processing time takes approximately 10 times longer than in Normal mode because the PD saves all the images and results.

### **Read in TEST mode (The Image Save function is not available in TEST mode):**

Checking this box allows reading images on a trial basis. All the images and the result data of NG object are displayed and saved until reading is OK.

Image Save function mentioned above is not available.

To save images, configure "[Result Save Settings](#)" from "PDTOOL Result Save".

### **Retry after successful reading:**

Checking this box allows to continue retry reading even if a reading succeeds, and you can save reading results and images.

### **Time limit of reading:**

Limits the time required for reading.

This function is effective when the PD series processes retry reading.

If runs over the time limit, the device stops retry reading and returns "Over-time error".

**Note 1:** In TEST mode, there is no Time Limit of reading.

**Note 2:** As a matter of processing, an Over-time error might occur by running over the Time Limit by about 100ms.

# PD65 PD Configuration

**PD Configuration**

Baud rate: 9600 bps

Initial type: 1

Output delay: 0 ms

Capture delay: 0 (0-1000) ms

Use light guides

Buzz when Reading Succeeded

Continues Output

Continues output ON

Terminate code: CR

Image Save

All  NG(B)  None

TEST Mode

Test Mode can not be set in Debug Mode

Read in TEST mode  
(The Image Save function is not available in TEST mode)

Retry after successful reading

Capture Setting

Both  Only direct lighting  Only low-angle lighting

Reading Mode

Trial Mode  Operation Mode

Time limit of reading: 0 (0-5000) ms  
(The value "0" means there is no time limit.)

OK Cancel Help

**Note** You cannot open the configuration file while setting judgement criteria.

**Baud rate:** Lets you specify RS232C serial communication speed.

**Initial type:** Product type No. that is selected when opening the configuration file.

**Output delay:** The delay time from the end of reading to the result output .

**Capture delay:** The delay time from the reading start to the image capture start.

**Use light guides:** Turns on the light for adjusting focus of 2D Code to read.

**Sounds beep when Reading Succeeded:** At reading, sounds the beep of PD65 when reading succeeded.

## Continues Output

- Continues output ON:** Outputs the reading characters via RS232 (NEWT00L communication is not available if this function is set to ON.)
- Terminate Code:** Terminate code can be selected among the flowing five variations, at continuous output or auto output of reading data; CR / CR+LF / EOT / ETX / None

## Image Save:

Saves reading images to the PD series memory.

Selecting "All" saves all images.

Selecting "NG" saves only NG images.

Selecting "None" saves no images.

The saved images are displayed by opening the PD Image Save window.

## TEST mode

In TEST mode, you can save all the images and the results of retry reading in order to check the validity of the "[Reading retry settings](#)".

The processing time takes approximately 10 times longer than in Normal mode because the PD saves all the images and results.

When Reading Mode is set to Trial Mode, Test Mode is not available.

### **Read in TEST mode (The Image Save function is not available in TEST mode):**

Checking this box allows reading images on a trial basis. All the images and the result data of NG object are displayed and saved until reading is OK.

Image Save function mentioned above is not available.

To save images, configure "[Result Save Settings](#)" from "PDTOOL Result Save".

### **Retry after successful reading:**

Checking this box allows to continue retry reading even if a reading succeeds, and you can save reading results and images.

## Capture setting

When "Both" is set, the PD65 reads with both of Low-angle lighting and Direct lighting.

When "Only direct lighting" is set, the PD65 reads with only direct lighting.

When "Only low-angle lighting" is set, the PD65 reads with only low-angle lighting.

## Reading Mode

In "Trial Mode" that is default mode, only reading is executed.

When "Operation Mode" is set, conditions of 2D Code to read and the other configurations can be registered (this procedure is called Teaching), and read them.

### **Time limit of reading:**

Limits the time required for reading.

This function is effective when the PD series processes retry reading.

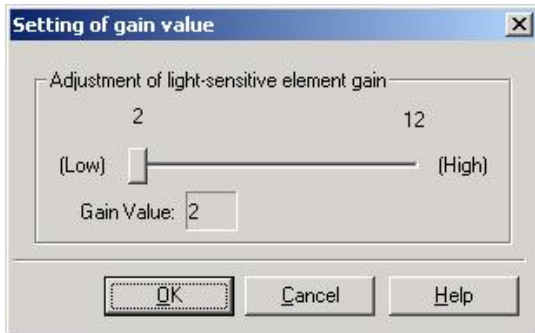
If runs over the time limit, the device stops retry reading and returns "Over-time error".

**Note 1:** In Test Mode, there is no Time Limit of reading.

**Note 2:** As a matter of processing, an Over-time error might occur by running over the Time Limit by about 100ms.

# Gain Value

Adjust gain value only if you cannot capture the 2D code when adjusting the exposure time.

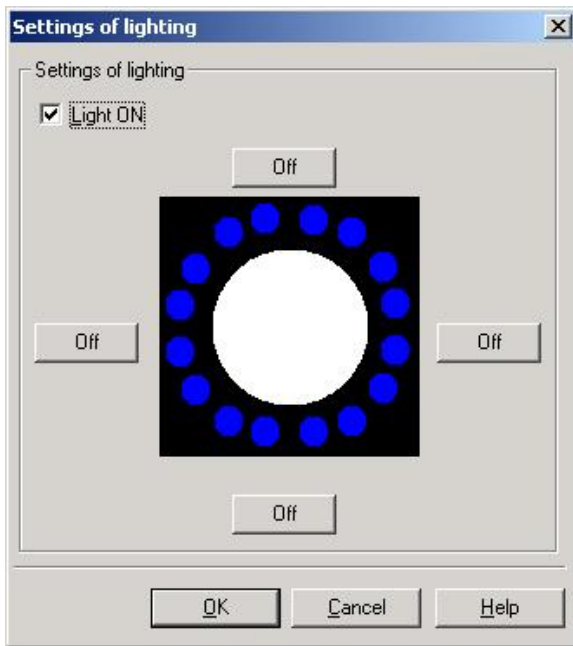


This function amplifies the signals in the circuit so that the image can look brighter even in a darker space. But the higher the gain value, the poorer the image quality because of generation of more noise.

Increasing the setting value makes the captured image brighter, whereas decreasing the setting value makes the captured image darker.

# Settings of lighting

\*Not available in PD65.

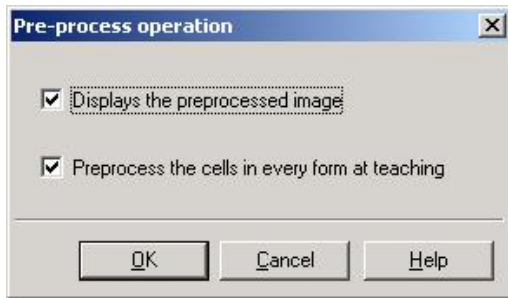


## Settings of lighting

### Light ON:

Check the "Light ON" box to turn on the light.  
Clicking On/Off buttons on the screen turns on/off the light in the selected quarter area.

# Pre-Process Operation



Check the "Perform preprocessing" check box to turn on the function when performing teaching.

**Display the preprocessed image:** Displays the preprocessed image when performing teaching.

**Preprocess the cells in every form at teaching:** Performs teaching in every cell form. You can check the effective cell forms.

# Reading Retry Settings

The screenshot shows the 'Reading Retry Settings' dialog box. It features a title bar with the text 'Reading Retry Settings' and a close button. The main area is divided into several sections. The first section has a checked checkbox labeled 'Adjust exposure time'. To its right, there are two spinners for 'Fluctuation range of exposure time' with values '+ 6' and '- 6', both with '(0-25) ms' next to them. Below these is a dropdown for 'Fluctuation interval of exposure time' set to '2' with 'ms' next to it. The second section has an unchecked checkbox 'Execute a fine search' and a spinner for 'Number of fine searches' set to '3'. The third section has an unchecked checkbox 'Switch product types' and a dropdown for 'Product type No. to execute a reading operation' set to '1 to 2'. The fourth section is titled 'Select another Cell Form at retry reading' and contains four options: 'Square' (checked), 'Narrow' (checked), 'Wide' (unchecked), and 'Normal' (unchecked). Each option has a small icon representing the cell form. At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Help'.

If reading failed, the PD series automatically repeat changing settings and reading. At the time, changed data is registered.

**\*In PD65, Reading Retry Settings can be set with Low-angle lighting and Direct lighting respectively.**

**Adjust exposure time:** Checking this box changes the exposure time within the ranges of the following setting.

**Fluctuation range of exposure time:** Allows you to set a fluctuation range based on the exposure time you have already set.

**Fluctuation interval of exposure time:** Allows you to set a fluctuation interval of exposure time.

**Execute a fine search:** Not available in PD50.

The PD series perform fine searches the "Number of fine searches" of times, at interval of ["Fluctuation interval of exposure time" divided by 10 (ms)] beginning with the exposure time at when "symbol segmentation error 2" or "read error" occurred.

**Number of fine searches:** Sets the number of fine searches.

Refer to "[Performing a Retry by Changing Exposure Time](#)" for more details of exposure time change.

**Switch product type:**

Check this box to continuously perform reading from product type No.1 to the specified product type.

When the PD series successfully read the code, they terminate reading.

For the PD50, checking this item saves the settings of up to seven product types automatically when [Start teaching] executes in [Easy] Teaching. The PD series automatically perform smoothing processing when smoothing is considered as necessary.

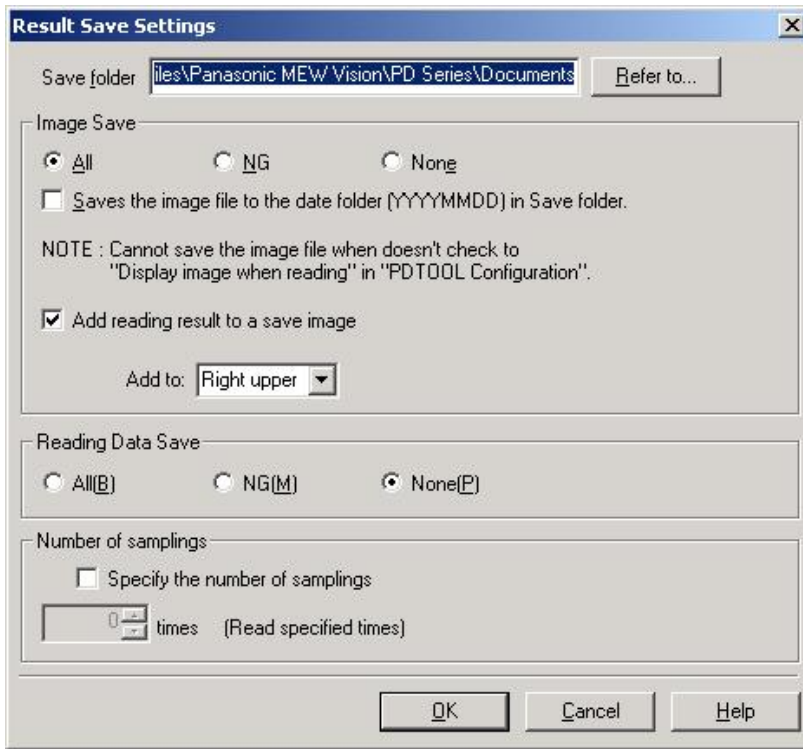
In [Detail] Teaching, however, settings of product types are not saved automatically. Pre-process Smoothing

Un-checking the box saves automatically only the settings of product type used for teaching. You can execute "[Pre-process Smoothing](#)" from [Other] tab in [Detail] Teaching.

**Product type No. to execute a reading operation:** If you selected the check box next to "Switch product types", set the product type number for which you want to execute a reading operation

**Select another Cell Form at retry reading:** If the PD series failed to read with the cell form selected in settings for teaching, they reread the code with another form selected here.

# PDTOOL Result Save



This Read Save function saves the captured images and reading results.

**Save folder:** Specify the folder in which you want to store the following files. If you do not specify the folder, these files are stored in the current folder for "Configure PDTOOL".

## Image Save:

Selecting "All" saves all of the data that the PD has read.  
Selecting "NG" saves only images the PD series failed to read.  
Selecting "None" saves no images.

-Images are saved as bitmap files.  
-File names are displayed in the following format:

YYYYMMDDhhmmss\_XX.bmp

YYYY : Year

MM : Month

DD : Day

hh : Time

mm : Min.

ss : Sec.

XX : Sequence No. for the file name  
above.

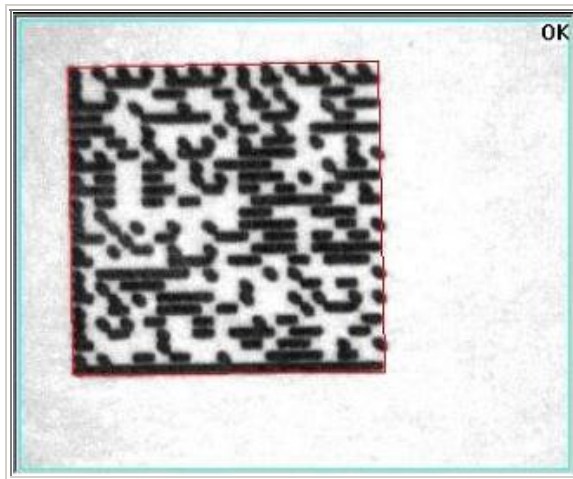
**Save the image file to the date folder (YYYYMMDD) in Save folder:**

When you selected this check box, a date folder is created in the specified save folder, and the image files are stored in the folder.

**Add reading result to a save image:** Checking the box adds reading result to the image file when saving it.

**Add to:** Selects where to add reading result on an image to be saved.

Example: If the "Add to" is set to "Right upper" and reading result is "OK", the image as below is saved in bitmap format.



**Reading Data\* Save:**

Selecting "All" saves all of the data that the PD has read.

Selecting "NG" saves the only NG results the PD series failed to read.

Selecting "None" saves no images.

File names are displayed in the following format:

YYYYMMDD.csv

YYYY : Year

MM : Month

DD : Day

**Note 1:** When reading result is OK, the PD series save a value from 0 to 100 as Error Correction Rate (%). When fail to read the code, they save the following value.

Read error : 110

Symbol detection error 2 : 120

Symbol detection error 1 : 130

Overtime error : 140 (This error is not for PD50.)

These values help to distinguish between OK result and NG result in the graph form which refers to Error Correction Rate.

**Note 2:** In order to save captured or reading results data, at least 40MB storage capacity is required. When the capacity became less than 40 MB, you cannot save images any more, and the "Result Save Settings" is automatically set to off. Reserve enough storage capacities to save more images and try again.

\* "Reading data" consists as listed below.

Number of retries  
Date  
Time  
Reading data  
Reading time (ms)  
Exposure time at reading (ms)  
Cell form at reading  
Product type at reading  
Error correction rate (%)  
Average number of retries  
Lighting for reading  
Reading Pre-process No.  
Reading Pre-process  
Name of saved bitmap file

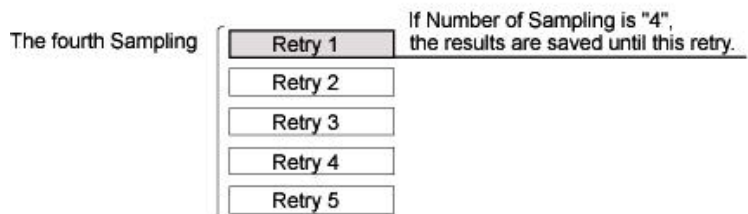
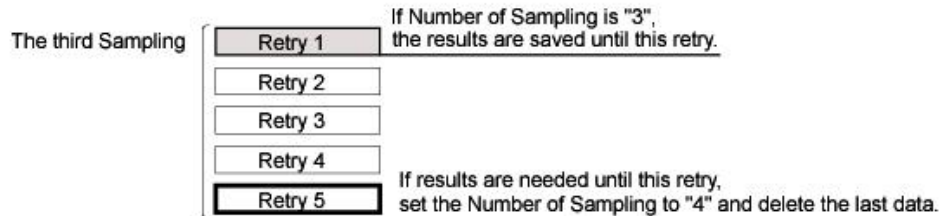
### **Number of samplings**

**Specify the number of samplings:** Checking the box activates the function. The PD series automatically stop reading after executions of the specified number of times set here. This function limits the number of readings which is performed by PDTOOL and also stops saving both captured images and reading result data.

**Note:**

When using Test Mode from PD configuration ([PD50](#), [PD60](#), [PD65](#)) at the same time, the result data of the last Retry is not saved. In this case, add 1 to the value of the times you need for "Number of samplings" and delete the last data.

For example, if you want to save Retry results of three samplings, you need set "Number of Sampling" to "4" and delete the last data.



# Input Prohibition



## Password:

Prevents alternation of the settings stored in the PD series.

If you connect to another PC, the password will be canceled because this setting relies on PCs.

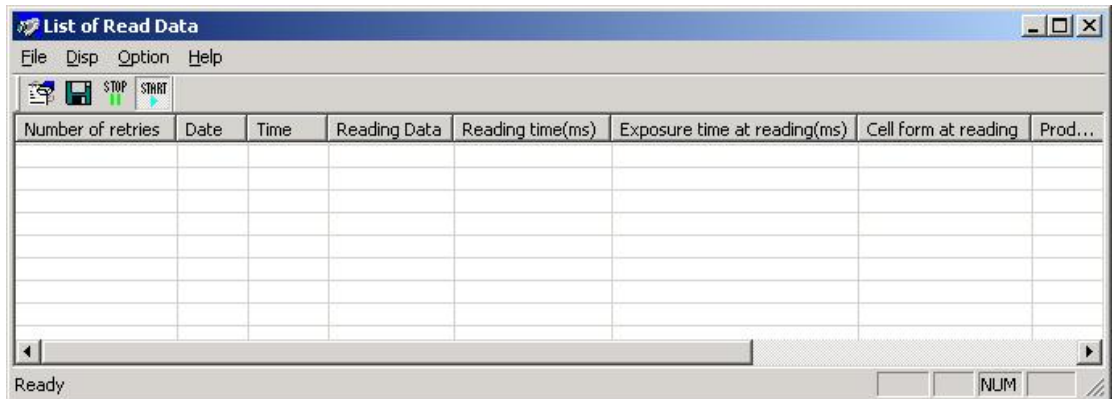
To set password, enter alphanumerical characters and press the "ON" button.

To cancel it, enter the password and press the "OFF" button.

## Note:

Reinstall PDTOOL if you forget the password or if you want to cancel it forcibly.

# List of Read Data



The list shows the latest 1,000 reading results from PDTOOL start-up.

## File

**Save:** Saves data in CSV format.

File name: ResultYYYYMMDDhhmmss.csv

YYYY : Year  
MM : Month  
DD : Day  
hh : Hour  
mm : Minute  
ss : Second

**Close:** Exits the list and closes the window.

## Display

**Stop updating read data:** Check this item to abort updating the read data.

**Tool bar:** Check this item to display the tool bar with icons.

**Status bar:** Check this item to display status of PDTOOL.

## Option

**Delete the displayed read data:** Clears the currently displayed data.

**Note:** When reading result is OK, the PD series save a value from 0 to 100 as Error Correction Rate (%). When fail to read the code, they save the following value.

Reading error : 110

Symbol segmentation error 2 : 120

Symbol segmentation error 1 : 130

Overtime error : 140 (PD50 does not return this error)

These values help to distinguish between OK result and NG result in the graph form which refers to Error Correction Rate.

# Image Transfer

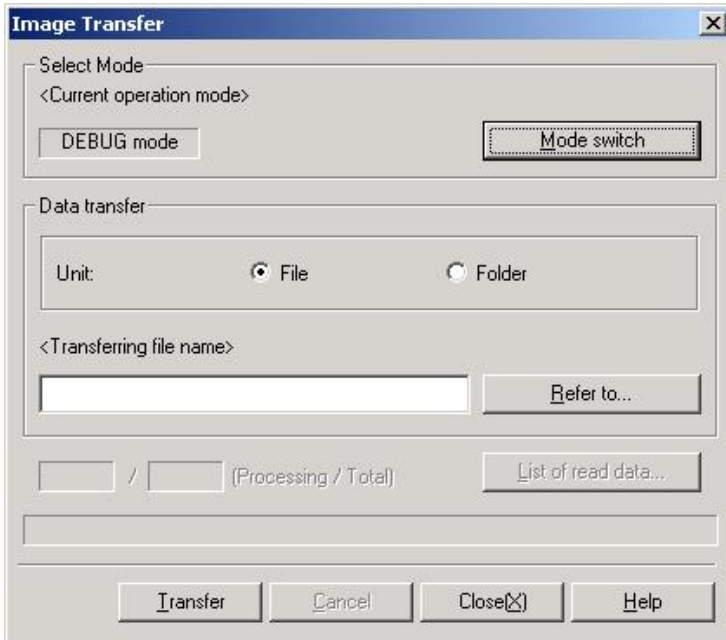


Image Transfer function transfers the captured images which are saved in memory to the PD series to read the images.

## Select Mode

**<Current operation mode>**

The PD series can transfer images in DEBUG mode only.  
When in NORMAL mode, switch to DEBUG mode by pressing the [Mode switch] button.

## Data transfer

**Unit:** Select "File" or "Folder".

**<Transferring file name>** shown when "File" is selected.

Select a file to transfer.  
(You can transfer 352x288 bitmap or 24- or 32-bit data.)

Pressing the [Transfer] button transfers the specified file to the PD series and executes reading.

<Folder location> shown when "Folder" is selected.

Select the folder that stores the file to transfer by pressing the "Refer to" button.

(You can transfer 352x288 bitmap and 24- or 32-bit data.)

Pressing the [Transfer] button transfers the all files in the specified folder to the PD series.

To cancel transferring, press the [Cancel] button. However, the function transfers the file in the process of transferring at the time.

**List of read data:** To confirm the details of the reading results in the process of transferring.

## DEBUG mode

In DEBUG mode, you can execute readings of stored image data. Follow the procedure below.

### 1. Image Save

Save image data in PDTOOL by setting "Result Save Settings" from [Option] a [PDTOOL Result Save].

### 2. Transfer of a file or a folder

1. Transfer the stored images from PDTOOL to the PD series using the menu of [Debug mode] a [Image Transfer].

At transfer, reading is also executed.

When you select "Folder" for "Data transfer unit", the function transfers all files in the folder one by one, executing reading.

To set Teaching on the files before reading,

1. Change "Unit" to "File".

2. Specify the file to transfer. (Press the [Refer to] button to select a file.)

3. Click the [Transfer] button. (Transfers the image file to the PD series.)

4. Select [Easy] or [Detail] for Teaching to set reading conditions.

After that, change "Unit" to "Folder" and transfer the folder. The process setting for the single file becomes effective to all files.

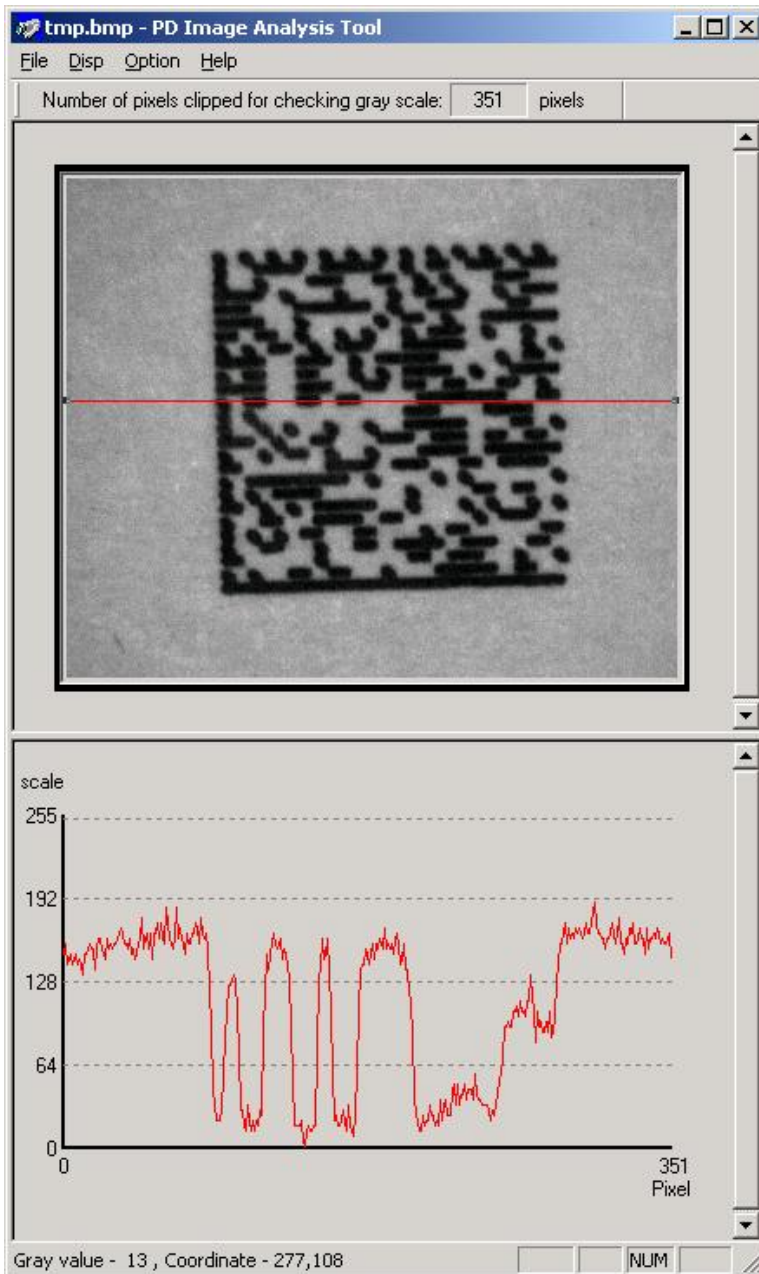
\* View the [List of read data] to confirm the reading results of transferred image files.

During transferring, the list adds a reading result data one at a time.

## NOTE:

The PD series can read only transferred image files in DEBUG mode. To read another 2D Code, switch to NORMAL mode.

# Image Analysis



The Image Analysis tool is used for viewing the gray scale of the displayed image.

## Menu bar

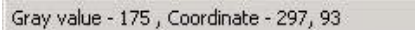
### -File

**Select a bitmap file:** Displays the saved image file

**Exit:** Terminates the Image Analysis tool


## -Display

**Status bar:** Check this item to display the status of the Image Analysis tool.



Gray value - 175 , Coordinate - 297, 93

**The number of pixels:** Check this item to display the number of pixels clipped for checking gray scale



Number of pixels clipped for checking gray scale: 351 pixels

In Clipping mode: For checking gray scale, the number of pixels in a clipped line on the displayed image appears in this field.  
For checking gray scale distribution, the number of pixels arranged both horizontally and vertically in the frame of the displayed image appears in this field.

## -Option

### Clipping mode:

[Clipping gray scale]: Displays a line on the displayed image. You can change the length and position of the line freely.

[Gray scale distribution]: Displays a frame on the displayed image. You can change the size and position of the frame freely.

**Magnification:** Displays the image file magnified twice or four times

**Color of clipped line:** Choose the color of a clipped line on the display image from red, green and blue.

**Color of gray scale line:** Choose the color of the gray scale line from red, green and blue.

## -Help

**Help:** Displays Help

**About:** Displays the version information

# Basic Operations

The PD series read and display the target 2D code.

## 1. Teaching

Click on the "[Easy](#)" button.

Focus the camera on the 2D code and click on the "Start Teaching" button.

If OK message is displayed, go on to the next step.

If the PD series failed to perform teaching, they perform teaching again.

If the PD series still failed to perform teaching, press the "[Detail](#)" button and specify the setting values of each condition to perform teaching.

-The image got out of focus.

Adjust the distance of the object

-Slightly dark image.

Make the exposure time a little bit longer so that a slightly bright image can be displayed.

Then, select the check box for "Do not automatically set exposure time." to execute a teaching operation.

Uncheck the "Automatically adjust exposure" check box to manually adjust the exposure time.

In the case where the PD series do not have the two problems above, configure proper settings under the [Preprocess](#) tab to perform teaching.

\*Refer to "[Unrecognizable 2D code symbols](#)" for details of type of unrecognizable 2D code.

## [2. Reading](#)

Carrying out a reading operation.

A reading image is displayed in the left part of the display area.

You can change the conditions of the reading image by selecting "Setting" > "PDTOOL Configuration".

If the PD series failed to read the 2D code following the basic sequence, you can let them retry to read the code using the [Reading Retry function](#).

# Reread (Retry) Function

## Overview

If the PD could not read a code following the base sequence, the device can reread (or perform a retry for) the code after changing the conditions. If you use this function; however, the reading time will increase in proportion to the number of retries.

Configure the settings from the menu of [Option] a [\[Reading Retry Settings\]](#).

## Types

The types of retry are as the table shown below.

No.	Sequence	Description	Use
1	<a href="#">Change cell conditions of code</a>	If the PD could not read the code following the base sequence, the device reads it several times after changing the cell conditions (square/narrow/wide/normal)	For the cases where the PD cannot read a code marked by way of dot impact method and consists of different cell space and cell size, and the device may not be able to read following just one cell condition
2	<a href="#">Change exposure time</a>	If the PD could not read the code following the base sequence, the device rereads it several times after changing exposure time.	For the cases where there is a great deal of variation in contrast in the code, and the PD may not be able to read it within a certain exposure time
3	<a href="#">Switch product types</a>	If the PD could not read the code following the base sequence, the device rereads it several times after switching the product types.	For the case where the codes having different reading conditions except those of retry types 1 and 2 are mixed Examples) <ul style="list-style-type: none"> <li>- Mixture of QR codes and Data Matrix codes</li> <li>- Mixture of negative/positive inverted codes and noninverted codes</li> <li>- Mixture of horizontally inverted codes (mirror images) and noninverted codes</li> <li>- Mixture of the codes having different teaching conditions except those of retry types 1 and 2</li> </ul>
4	Combination of types 1-3	If the PD could not read the code following the base sequence, the device rereads it several times after combining some or all of retry types 1, 2 and 3.	For the cases where there are multiple conditions for individual retry types 1 - 3 in this table

# Performing a Retry by Changing Cell form

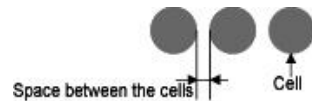
## Purposes and related items

This function will be effective if the code to be read is marked by way of dot impact method and consists of different cell space and shape. The PD reads the code following the Cell form setting value selected at teaching. If the PD fails to read the code, the device will perform a retry after changing the DotMark setting value. If the PD successfully reads the code on the first attempt, the device will turn on OUT1 and finish reading the code. If the PD still cannot read the code after performing retries following all of the selected values, reading of the code will end in failure.

## Cell form setting value options

Retrying is accomplished in order, down from the selected dot setting.

- Square : Printed codes
- Narrow : Narrow space between the cells (or close contact with individual cells)
- Wide : Wide space between the cells
- Normal : Standard space (between Narrow and Wide)



## Setting items

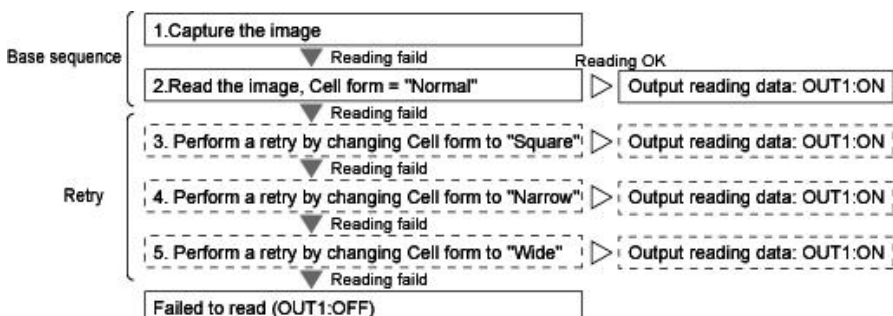
1. Execute a teaching operation.
2. Select a Cell form value with which you want to read the code: [Reading Retry Setting] -> [\[Select another Cell Form at retry reading\]](#)

## Example of sequence

### Conditions:

- Cell Form at teaching: Normal
- Retry value: if all of the Cell Form are available

### Sequence:



**Reading time:**

Exposure, transmission and calculation times are required for both base sequence and retries.

Reading time	1 Exposure time	0.03 - 50.00 ms : Set in TEACHING mode
	2 Transmission time	4 ms : Fixed
	3 Calculation time	30 - 200ms Varies depending on the code symbol type and condition

Example)

- Conditions:
  - Exposure time: 5ms, fixed
  - Calculation time: Approx. 50ms
  - Retry Cell form: All (the number of retries: 3)
  - No display
- Reading time:
  - Approx. 210 ms (=5 ms x 1 retry + 4 ms x 1 retry + 50 ms x 4 retries = 5ms + 4 ms + 200 ms)

**Note:**

If you have the PD perform measurement while monitoring an image or measurement results, measurement time will be 0.6 to 1.2 second longer than the times shown in the table above.

# Performing a Retry by Changing Exposure Time

## Overview

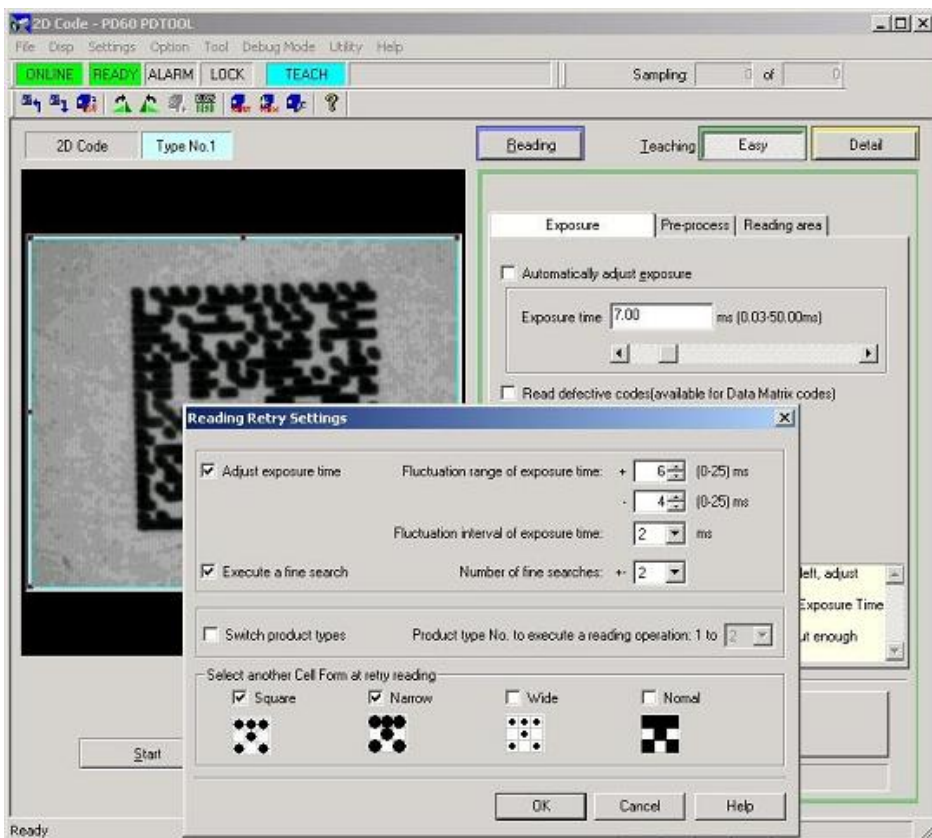
This function will be effective if the PD cannot read a 2D code within a certain exposure time for the reason of the variation in contrast (brightness difference between cells and background) in the code. If the PD cannot read the code within the exposure time selected at teaching, the device performs a retry for it after changing the exposure time. If the PD can successfully read it on the first attempt, it will turn on OUT1 and finish reading the code. If the PD still cannot read the code after retrying several times by changing exposure time within the selected exposure range, reading of the code will end in failure.

Fluctuation range and interval of exposure time can be specified in CONFIGURATION mode, and the PD50 first performs a retry for the code using a shorter exposure time at each changed exposure time interval. Refer to an example of sequence described below for more details.

## Setting items

1. Teaching execution.
2. Turn on the Exposure Time Change function: [Reading Retry Setting](#)
3. Set exposure time interval and exposure time minus/plus : [Reading Retry Setting](#)

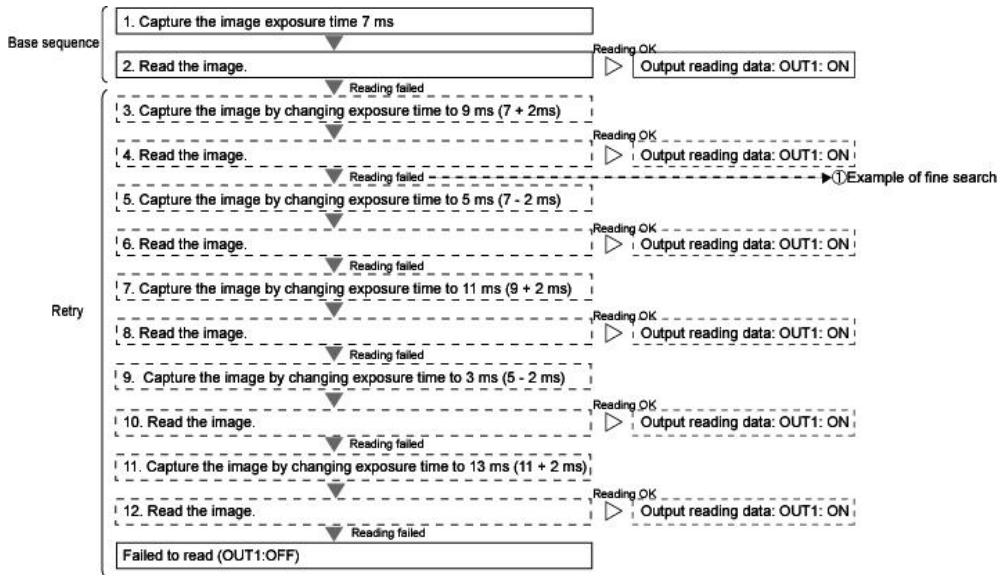
## Example of sequence



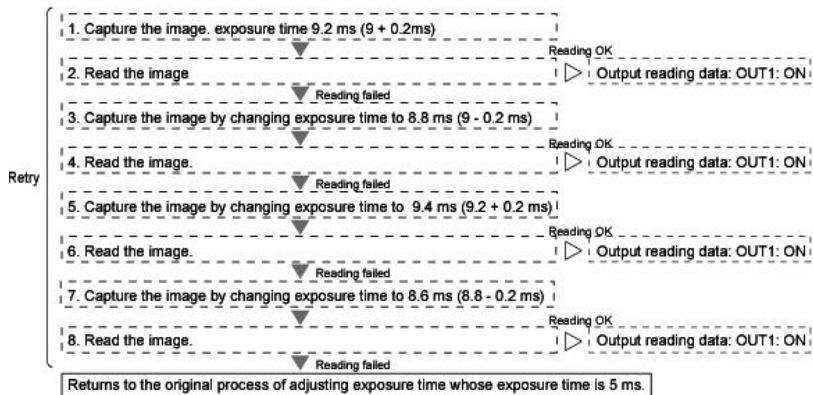
## Conditions

- Exposure time at teaching: 7 ms
- Fluctuation range- Plus: 6ms Maximum exposure time at retry  $7+6=13\text{ms}$
- Fluctuation range- Minus: 4ms Minimum exposure time at retry  $7-4=3\text{ms}$
- Exposure Time Interval: 2ms
- Number of fine searches: +/- 2 Fluctuation of exposure time is 0.2ms at fine search.  
(Fluctuation interval of exposure time 2ms/10)

## Sequence:



If the PD series fails to read because of "symbol segmentation error 2" or "reading error" at "1" in the above figure, the Fine Search automatically activates and performs reading with the following exposure times.



## Sequence for exposure time adjusting retry

If "Adjust exposure time" function changes the exposure time to be able to read a code, the interval of exposure time in the above sequence will change.

- If a code could be read with 5ms of exposure time, changing the interval based on 5ms at the second retry, the PD series will perform reading in the following order.

5ms -> 7(5+2)ms -> 3(5-2)ms -> 9(7+2)ms -> 11(9+2)ms -> 13(11+2)ms

- If a code could be read with 9ms of exposure time, the sequence will be as follow.

9ms -> 11(9+2)ms -> 7(9-2)ms -> 13(11+2)ms -> 5(7-2)ms -> 3(5-2)ms

### Reading time:

Exposure, transmission and calculation times are required for both base sequence and retries.

Reading time	1 Exposure time	0.03 - 50.00 ms: Set in TEACHING mode
	2 Transmission time	4 ms: Fixed
	3 Calculation time	30 - 200ms Varies depending on the symbol type and condition

### Example)

Processing time for fine search is excluded from the reading time.

- Conditions:

- Exposure time at teaching: 7 ms,  
Fluctuation range- Plus: 6ms  
Fluctuation range- Minus: 4ms  
Fluctuation interval : 2 ms

- Calculation time: Approx. 50 ms

- No display

- The number of retries = 6 (one base sequence and five retries)

- Reading time:

365ms (=7ms + 9ms + 5ms+ 11ms + 3ms + 13ms + 4ms x 6retries  
+ 50ms x 6retries = 41ms + 24ms + 300 ms)

### Note:

If you have the PD perform measurement while monitoring an image or measurement results, measurement time will be 0.6 to 1.2 second longer than the times shown in the table above.

# Performing a Retry by Switching Product Types

## Overview

This function will be effective if the codes having different conditions other than those such as negative/positive inversion, horizontal inversion, dot setting (cell condition), and exposure time are mixed. Before using this function, you have to run teaching for each product type or save the reading settings. If the PD successfully reads the code when the device read it using product type 1, the device will turn on OUT1 and finish rereading it. The PD does not read it using the rest of the product types any more. If the PD fails to read the code using the product type 1, it will continuously perform retries until the selected product type after switching to the product type 2. If the PD still cannot read the code after doing that, reading of the code will end in failure.

## Setting items and the order

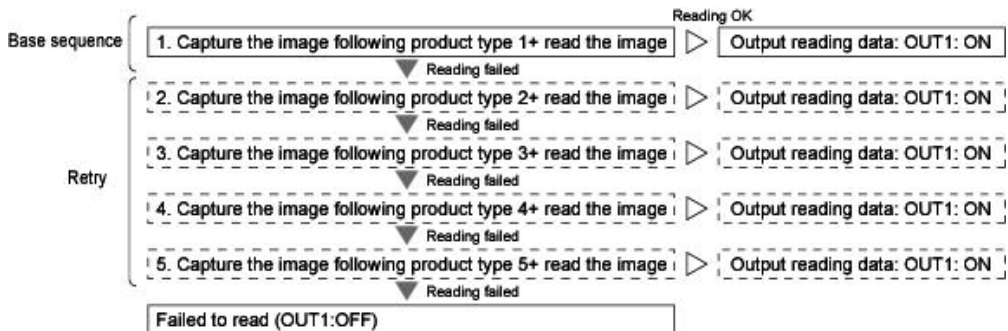
1. Execute a teaching operation for the required product types.  
(If you know the setting values for teaching, set and save them.)
2. Activates [Switch product types] in [[Reading Retry Settings](#)].

## Example of sequence

### Condition:

- Setting product type to be executed: 1 - 5

### Sequence:



**Reading time:**

Exposure, transmission and calculation times are required for each time that the PD reads the code.

Reading time	1 Exposure time	0.03 - 50.00 ms: Set in TEACHING mode
	2 Transmission time	4 ms: Fixed
	3 Calculation time	30 - 200ms Varies depending on the symbol type and condition

Example)

- Conditions:
  - Product type setting for retry: 1 - 5
  - Exposure time: 5 ms
  - Calculation time: 50 ms
- Reading time:
  - Approx. 245 ms (=5 ms x 5 retries + 4 ms x 5 retries+ 50 ms x 5 retries = 25ms + 20 ms + 250 ms)

**Note:**

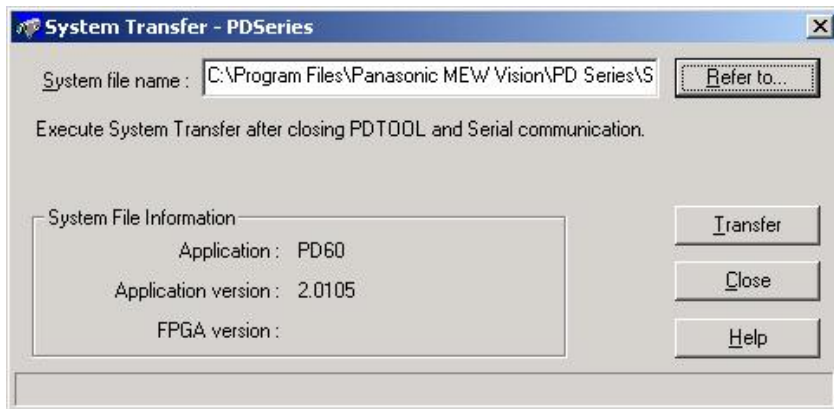
If you have the PD perform measurement while monitoring an image or measurement results, measurement time will be 0.6 to 1.2 second longer than the times shown in the table above.

# System Transfer

System transfer function allows upgrading the functions of the PD series by replacing the programs.

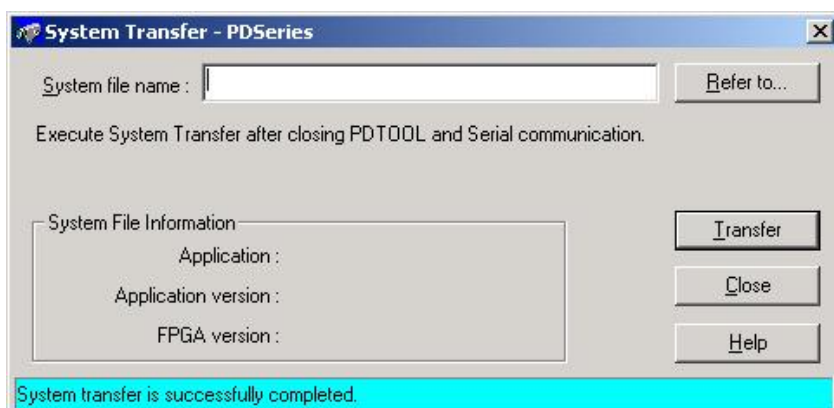
## [Operation procedure]

1. If you open PDTOOL, terminate it in RUN mode.  
Turn on the PD series firstly.
2. Open the following window for system transfer by selecting **Start -> Program -> Panasonic Mew Vision -> PD Series -> System Transfer**



3. System file name field shows a name of the latest system file. Click the Transfer button.

Check the version information on the following screen before transmitting the data. The system file of the selected version is transmitted to the PD Series.



\*When the following message appears, check to make sure that the PD Series is connected.



After transferring the data, activate the PDTOOL to perform an inspection.

## Teaching results

<b>-Symbol segmentation error 1</b>	<b>QR code</b>	Cannot detect a segmentation symbol.
	<b>Data Matrix code</b>	Cannot detect an L-shaped alignment pattern.
<b>-Symbol segmentation error 2</b>	<b>QR code</b>	Cannot detect a clock or alignment pattern.
	<b>Data Matrix code</b>	Cannot detect a clock pattern.
<b>-Reading Error</b>	Could detect each pattern described above, but cannot read the data.	
<b>-Time-out error</b>	Shown at only reading. The error occurs if it runs over the time limit set in PD configuration. (PD50 does not return this error.)	

# A List of Error Messages

<p><b>Could not communicate with PD. Confirm connection status.</b></p>	<p>Check to make sure that the USB cable is connected and the PD is turned on. Refer to the <a href="#">USB Driver Installation Instructions</a> for more details.</p>
<p><b>Failed to send the command to PD. Confirm connection status.</b></p>	<p>The USB cable is not properly connected or the PD is turned off.</p>
<p><b>Failed to receive the data from PD. Confirm connection status.</b></p>	
<p><b>Thread for communication with PD already exists.</b></p>	<p>PDTOOL is in abnormal status. After terminating the PDTOOL, reboot your PC and start the PDTOOL.</p>
<p><b>Failed to create thread for communication with PD.</b></p>	
<p><b>Error in the information received from PD. (Error in the BCC.)</b></p>	<p>Noise may exist in the communication path. Change use environment or take countermeasure against noise.</p>
<p><b>Error in the information received from PD. (Error in the response length.)</b></p>	
<p><b>Error in the data sent to PD. (Error in the BBC has occurred)</b></p>	
<p><b>Error in the data sent to PD. (Error in the format of the sending command has occurred)</b></p>	
<p><b>Error in the data sent to PD. (Error in the parameter of the sending command has occurred)</b></p>	
<p><b>Error in the data sent to PD. (Error in the sending data has occurred)</b></p>	
<p><b>Error in the data sent to PD. (Error in the registration of the sending command has occurred)</b></p>	
<p><b>Error in the data sent to the PD. (Error in assigning an address of the specified data)</b></p>	
<p><b>Error has occurred in communication with PD. ( Error Code = %d )</b></p>	
<p><b>Error in the data received from PD. ( The time-out error has occurred .)</b></p>	
<p><b>PD currently connected is locked.</b></p>	<p>PD50 is in SET mode. Change to RUN mode.</p>
<p><b>PD cannot receive any commands. ( PD is in SET mode. )</b></p>	
<p><b>There is not enough working area to save the file. You cannot save the file.</b></p>	<p>PC memory is running short. Terminate any other application than PDTOOL and try again.</p>
<p><b>There is not enough working area to save the file. You cannot read the file.</b></p>	
<p><b>Cannot open the file.</b></p>	<p>The file is used by other applications or the hard disk is in abnormal state.</p>
<p><b>Failed to read the file. The file data may be broken.</b></p>	

<b>(Cannot obtain the application information about PD currently connected.)</b>	AE20 is not connected to the PD.
<b>Cannot read the file due to broken file or invalid file format.</b>	The file has not been created with the "PD -> File" command of PDTOOL or the hard disk is in abnormal state.
<b>Cannot write due to non-compatibility with PD currently connected.</b>	If you want to change applications (Color Area, Color Judgement, Color Pattern, etc.), carry out system transmission, select the desired application, then download it to the PD.
<b>Cannot write due to different field of view between the PD currently connected and the file.</b>	Select the correct saved file of the same field of view as the PD.
<b>Cannot read the file because it is not supported.</b>	This file is not available on PDTOOL.
<b>Failed to write to PD.</b>	PD was changed to SET mode or turned off, or the USB cable was removed. When the device is in SET mode, set to RUN mode. In other cases, restore the system and try again.
<b>Cannot write due to different application type.</b>	Select the same saved file as the application (Color Area, Color Judgement, Color Pattern, etc.) or execute system transmission and download the same application as the saved file to the PD.
<b>Cannot initialize the PD currently connected.</b>	Change to RUN mode and try again.
<b>The file you selected is not a 32- or 24-bit bitmap file. Please select a bitmap file of correct size.</b>	Please select a 32- or 24-bit bitmap file.
<b>The selected bitmap file size is not supported. Please select a bitmap file of correct size.</b>	

\* Displayed only in PD50.

# PD50 Precautions

1. The operations of the PDTOOL when the settings of PD50 were changed using Operation unit, serial (GT) or I/O

To prevent slow performance and deteriorated operability, the PDTOOL does not always read the setting data saved on the PD50. For example, if the judgement criteria (refers to Max./Min. area for Color Area) are changed by using the Operation unit, the data before updated are displayed on PDTOOL. If you want to update the setting data, enter the setting values for the Judgement Criteria again. But, units, product types and inspection results shown at the bottom of the screen during inspection are always updated. In addition, if you changed the product type with any other software than PDTOOL, each setting is canceled and you can exit the setting.

2. The operations of the PDTOOL when PD50 is in SET mode

You cannot make any of settings when the PD50 is in SET mode. If you use PDTOOL, be sure to exit SET mode.

3. The operations of the PDTOOL when internal trigger of PD50 is OFF

-For Judgement Criteria

Since the PDTOOL executes an image capture while displaying the image, it does not start an inspection until it receives the trigger signal from the I/O or Operation unit and then it captures image data from the PD50. In similar manner, when run a test, you need to input the trigger signal externally.

-For Inspection Execution or Display

Since the PDTOOL always captures image data and inspection results from the PD50, it does not start an inspection until it receives the trigger signal from the I/O or Operation unit.

4. The operations of the PDTOOL when teaching was executed by using external devices (Operation unit or I/O)

If PDTOOL is in the image display state such as inspection execution (display), communication error is occurred. In this case, the message "Communication Error" is displayed in red in the status/display area on PDTOOL screen, but the PDTOOL is restored immediately. This is not because the PDTOOL has any problems. You can continue to make settings. If teaching is externally executed when the PDTOOL is just about to capture images from the PD50, the PD50 starts a teaching process. As a result, the PDTOOL cannot send the image data and timeout is occurred at the PDTOOL side.

5. The operations when "Continues output" ON

It cannot always response to serial commands.

Check off "Continues output ON" in PD configuration to use serial commands. Refer to PD50 User's Manual for further detail of serial commands.

# PD60 Precautions

## 1. The operations of the PDTOOL when internal trigger of PD Series is OFF

-For Inspection Execution or Display

Since the PDTOOL always captures image data and inspection results from the PD Series, it does not start an inspection until it receives the trigger signal from the I/O or Operation unit.

## 2. Function limit in Debug Mode

In Debug Mode, the following functions are not available.

- Capturing 2D Code
- Setting [Adjust exposure time] and [Execute a fine search] in [Option] a [Reading Retry Settings]
- Setting [TEST mode] in [Settings] a [PD Configuration]
- Aborting the following input/output operation.
  - Input signal: Trigger Input, Select Type
  - Output signal: Ready output, Alarm output, Successful reading output
  - Serial communications never accept commands.

## 3. The operation when "Continues output" ON

It cannot always response to serial commands.  
Check off "Continues output ON" in PD configuration to use serial commands.  
Refer to User's Manual for further detail of serial commands.

# PD65 Precautions

## 1.The operation when "Continues output" ON

It cannot always response to serial commands.  
Check off "Continues output ON" in PD configuration to use serial commands.  
Refer to User's Manual for further detail of serial commands.

## 2.Function limit in Debug Mode

In Debug Mode, the following functions are not available.

- Capturing 2D Code
- Setting [Adjust exposure time] and [Execute a fine search] in [Option] a [Reading Retry Settings]
- Setting [TEST mode] in [Settings] a [PD Configuration]
- Aborting the following input/output operation.  
Input signal: Trigger Input, Select Type  
Output signal: Ready output, Alarm output, Successful reading output  
Serial communications never accept commands.

## 3. Function limit in Trial Mode

- In Trial Mode, the following functions are not available.
- Switching to Debug Mode.
  - Setting [Option] a [Teaching] a [Pre-process Operation].
  - Setting [Configuration] a [Test Mode].
  - Setting [Configuration] a [Time Limit of reading].

## Detailed Specifications of 2D Code Reading

Item	Value	Condition
Allowable aspect ratio of cells	110 % or less (= longer side / shorter side)	Read depth : $h=0\text{mm}$ Screw : $\alpha=\beta=0^\circ$ Curvature : $r = \infty$
PCS <sup>*1)</sup>	More than 0.6	Space reflection : More than 60 % Read depth : $h = 0 \text{ mm}$ Skew : $\alpha=\beta=0^\circ$ Rotation : $\theta=0^\circ$ Curvature : $r = \infty$ Aspect ratio of cells : 100 % <sup>*2)</sup>
Read depth h	ANPD050-02	+/- 0.5 mm
	ANPD050-05	+/- 1 mm
	ANPD050-10	+/- 2 mm
	ANPD050-15	+/- 3 mm
	ANPD050-20	+/- 4 mm
	ANPD050-25	+/- 5 mm
	ANPD050-30	+/- 5 mm
	ANPD060-12	+/- 5.5 mm
	ANPD060-25	+/- 10 mm
	ANPD060S25	+/- 5.5 mm
ANPD065-25	Contact type	PCS <sup>*1)</sup> : 0.9 or more Skew : $\alpha=\beta=0^\circ$ Rotation : $\theta=0^\circ$ Curvature : $r = \infty$ Aspect ratio of cells : 100 % <sup>*2)</sup>
Skew Longitudinal inclination: a Latitudinal inclination: b	a = +/- 5° b = +/- 5°	PCS <sup>*1)</sup> : 0.9 or more Read depth : $h = 0 \text{ mm}$ Rotation : $\theta=0^\circ$ Curvature : $r = \infty$ Aspect ratio of cells : 100% <sup>*2)</sup>
Rotation $\theta$	$\theta = 0 \text{ to } 360^\circ$	PCS <sup>*1)</sup> : 0.9 or more Read depth : $h = 0 \text{ mm}$ Skew : $\alpha=\beta=0^\circ$ Curvature : $r = \infty$ Aspect ratio of cells : 100 % <sup>*2)</sup>
Curvature r	R (radius) = 30 mm	PCS <sup>*1)</sup> : 0.9 or more Read depth : $h = 0 \text{ mm}$ Skew : $\alpha=\beta=0^\circ$ Rotation : $\theta=0^\circ$ Aspect ratio of cells : 100 % <sup>*2)</sup>

\*1) Print Contrast Signal value, which is used for evaluation of contrast of 2D code.  
Differs from the PCS value of the parameter in TEACHING mode.

\*2) White fluorescent light (1000 lx) was used.

# Data Capacity of 2D Codes

## QR Code

Version	Number of cells	Error level	Number	Chinese character	Alphanumeric character	Binary
1	21 x 21	L	41	10	25	17
		M	34	8	20	14
		Q	27	7	16	11
		H	17	4	10	7
2	25 x 25	L	77	20	47	32
		M	63	16	38	26
		Q	48	12	29	30
		H	34	8	20	14
3	29 x 29	L	127	32	77	53
		M	101	26	61	42
		Q	77	20	47	32
		H	58	15	35	24
4	33 x 33	L	187	48	114	78
		M	149	38	90	62
		Q	111	28	67	46
		H	82	21	50	34
5	37 x 37	L	255	65	154	134
		M	202	52	122	106
		Q	144	37	87	74
		H	106	27	64	58
6	41 x 41	L	322	82	195	154
		M	255	65	154	122
		Q	178	45	108	66
		H	139	36	84	64
7	45 x 45	L	370	95	224	192
		M	293	75	178	152
		Q	207	53	125	108
		H	154	39	93	84
8	49 x 49	L	461	118	279	230
		M	365	93	221	180
		Q	259	66	157	130
		H	202	52	122	98

## Data Matrix code

<b>Code size</b>	<b>Error correction rate (%)</b>	<b>Number</b>	<b>Alphanumeric character</b>	<b>Binary</b>
10 x 10	25	6	3	1
12 x 12	25	10	6	3
14 x 14	28-39	16	10	6
16 x 16	25-38	24	16	10
18 x 18	22-34	36	25	16
20 x 20	23-38	44	31	20
22 x 22	20-34	60	43	28
24 x 24	20-35	72	52	34
26 x 26	19-35	88	64	42
32 x 32	18-34	124	91	60
36 x 36	16-30	172	127	84
40 x 40	15-28	228	169	112
44 x 44	14-27	288	214	142

# Table of ASCII Codes

								b7								
								b6								
								b5								
								b4								
								b3								
								b2								
								b1								
								b0								
b7	b6	b5	b4	b3	b2	b1	b0	C	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0	NUL	DEL	SPACE	0	@	P	`	p	
0	0	0	1	1	1	1	1	SOH	DC1	!	1	A	Q	a	q	
0	0	1	0	0	2	2	2	STX	DC2	*	2	B	R	b	r	
0	0	1	1	3	3	3	3	ETX	DC3	#	3	C	S	c	s	
0	1	0	0	4	4	4	4	EOT	DC4	\$	4	D	T	d	t	
0	1	0	1	5	5	5	5	ENQ	NAK	%	5	E	U	e	u	
0	1	1	0	6	6	6	6	ACK	SYN	&	6	F	V	f	v	
0	1	1	1	7	7	7	7	BEL	ETB	'	7	G	W	g	w	
1	0	0	0	8	8	8	8	BS	CAN	(	8	H	X	h	x	
1	0	0	1	9	9	9	9	HT	EM	)	9	I	Y	i	y	
1	0	1	0	A	LF	SUB	*	:	J	Z	j	z				
1	0	1	1	B	VT	ESC	+	;	K	[	k	[				
1	1	0	0	C	FF	FS	.	<	L	Y	l					
1	1	0	1	D	CR	GS	-	=	M	]	m	!				
1	1	1	0	E	SO	RS	.	>	N	^	n	~				
1	1	1	1	F	SI	US	/	?	O	_	o	DEL				

# Record of changes

Date	Description of changes
August 2006	First Edition