

Fixed Type Scanner
FD2-HS1000-ERU
FD2-HW1000-ERU

User's Manual

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Preface

Thank you for using DENSO WAVE Fixed Type 2D Code Scanner FD2-HS1000-ERU/FD2-HW1000-ERU.

This manual provides information and instructions for handling, connecting, operating and cleaning FD2-HS1000-ERU/FD2-HW1000-ERU. Please read this manual thoroughly prior to the operation to ensure full use of the scanner's functionality and store safely in a convenient location for quick reference even after reading.

Specifications described in this manual are applicable to FD2-HS1000-ERU/FD2-HW1000-ERU firmware version 1.31 or later.

Liability Limitations

- DENSO WAVE INCORPORATED does not assume any product liability arising out of, or in connection with, the application or use of any product, circuit, or application described herein.
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 - (iii) Any modification of DENSO WAVE's products by other(s) than DENSO WAVE.

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The latest upgrade information

Free exhibitions and event information for new products

Free web-information service “QBdirect”

“QBdirect” Service Contents

Information search service (FAQ)	Offers detailed information on each product.
Download service	Offers downloads of repair modules for the latest system or software, and sample programs.
E-mail inquires	Product related queries can be sent by e-mail.

Please note that these privileges may be subject to change without prior notice.

- How to register

Access the URL below and follow the instructions provided.

<https://www.denso-wave.com/en/>

Safety Precautions

Be sure to observe all these safety precautions.

- Please be sure to observe the followings to use the scanner correctly.
- Always keep this manual nearby for speedy reference.

Strict observance of these warnings and cautions is a MUST for preventing accidents that could result in bodily injury and substantial property damage. Make sure you fully understand all definitions of these terms and symbols given below before you proceed to the next itself.

Warning levels and meaning of symbols are as follows:

 WARNING	Alerts you to those conditions which could cause serious bodily injury or death if the instructions are not followed correctly.
 CAUTION	Alerts you to those conditions which could cause minor bodily injury or substantial property damage if the instructions are not followed correctly.

Meaning of symbols

-  This symbol with a picture inside alerts you to a warning of danger.
Here you see the warning for electric shock.
-  This symbol containing a picture with a diagonal line through a circle warns you of something you should not do. (There may be a case when it does not have a picture inside.)
Here you see a screwdriver inside the circle, meaning that you should not disassemble.
-  This symbol with a picture inside alerts you to something you MUST do.
This example shows that you MUST unplug the power cord.



WARNING

To system designers



- When introducing the scanner in those systems that could affect human lives, develop applications carefully through redundancy and safety design which avoids the feasibility of affecting human lives even if data error occurs.

Handling the scanner

Wrong handling of the scanner may affect normal operation or result in, electric shock, generating heat and smoke, and vision disturbance. Be sure to observe the following.



- Never bring any metals into contact with the terminals in connectors. Doing so could produce a large current through the scanner, resulting in heat or fire, as well as damage to the scanner.
- Never use the scanner on the line voltage other than the specified level. Doing so could cause the scanner to break or burn.
- Never use the scanner where any inflammable gasses may be emitted. Doing so could cause fire.
- Never put the scanner in a microwave oven or high-pressure container.
- Avoid using the scanner in extremely humid or dusty areas, or where there are drastic temperature changes.



- If smoke, abnormal odours or noises come from the scanner, immediately turn off the power, pull out the input/output terminals, and contact your nearest dealer. Failure to do so could cause fire or electric shock.
- If foreign material or water gets into the scanner, immediately pull out the cables and input/output terminals, and contact your nearest dealer. Failure to do so could cause fire or electric shock.
- If you drop the scanner so as to affect the operation or damage its housing, turn off the power, pull out the input/output terminals, and contact your nearest dealer. Failure to do so could cause fire or electric shock.
- Before putting or pulling out cables and input/output terminals to the scanner or the peripheral device, be sure to turn off the power of the scanner or the peripheral device. Failure to do so could cause mechanical failure, fire or electric shock.



CAUTION

Handling the scanner

Wrong handling of the scanner may affect normal operation or result in overheating, smoke generation, failure, and vision disturbance. Be sure to observe the following

 Never disassemble	● Never disassemble or modify the scanner. Doing so could result in an accident such as fire or electric shock.
	● If a cable is damaged (e.g. exposed or broken lead wires), stop using it and contact your nearest dealer. Failure to do so could result in fire or electric shock.
	● Do not put the scanner on an unstable or inclined plane. The scanner may drop, creating injuries. ● Never put the scanner in places where there are excessively high temperature, such as inside closed-up automobiles, or in places exposed to sunlight. Doing so could affect the housing or parts, resulting in fire. ● Avoid using the scanner in extremely humid or dusty areas, or where there are drastic temperature changes. Moisture or dust will get into the scanner, resulting in malfunction, fire or electric shock. ● Do not use the scanner where it may be subjected to salt, oil, oil-mist and corrosive gas. Doing so could allow the entry of gas inside the scanner and result in the mechanical failure, fire and electric shock. ● Do not place the scanner anywhere where it may be subjected to oily smoke or steam, e.g. near a cooking range or humidifier. Doing so could result in fire or electric shock. ● Do not scratch or modify the scanner or a cable. Do not bend, twist, pull or heat a cable. Doing so could damage the scanner or the cable, resulting in a fire. ● Do not insert or drop foreign materials such as metals or anything inflammable through the openings (vents or reading window) into the scanner. Doing so could result in fire or electric shock. ● Do not scratch or modify the scanner. Doing so could damage the scanner, creating a fire hazard. ● Do not put heavy material on the scanner, or allow the cable to get pressed under heavy material. ● Do not use the scanner with wet hands. Doing so could result in electric shock. ● Never use chemicals or organic solvents such as thinner to clean the housing. Do not apply insecticide to the scanner. Doing so could result in a marred or cracked housing, electric shock or fire. ● Do not stare directly into the light source through the scan window of this device, or do not aim the scan window at a person's eye. Doing so may result in eye injuries.



CAUTION

Handling the scanner

Wrong handling of the scanner may affect normal operation or result in overheating, smoke generation, failure, and vision disturbance. Be sure to observe the following:



- During electrical storm activity, always unplug the cable.
Exposure to power surges could result in a damaged scanner or fire.
- Please pull out the power/control connector from the scanner for security on the occasion of care by all means.
Failure to do so could result in electric shock.
- Do not drop the scanner.
The scanner housing may be broken, creating injuries.
Pull out the power/control connector from the scanner and contact your nearest dealer.
Using the scanner whose housing is broken could result in smoke or fire.

Proper Care for the Scanner

Wipe any dirt on the scanner with a dry, soft cloth.

Note

- (1) Do not use substances such as alcohol. Doing so could damage the housing, remove a sticker, or peel the paint.
- (2) When the scanner is excessively dirty, wipe it with a soft cloth soaked in water-diluted detergent and wrung out thoroughly. Then, wipe it with another dry cloth.

Chapter 1 Product Description

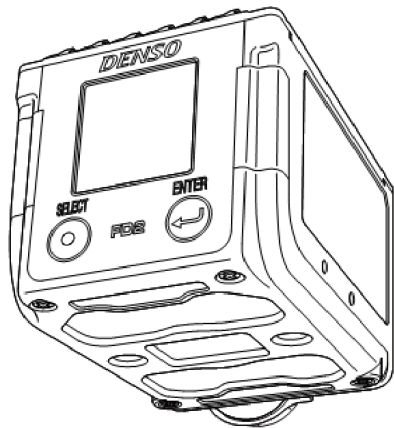
1.1. Checking Package Contents

The following items are included.

- Fixed type 2D code scanner 1
- Operator’s guide 1

Fixed type 2D code scanner
FD2-HS1000-ERU/FD2-HW1000-ERU

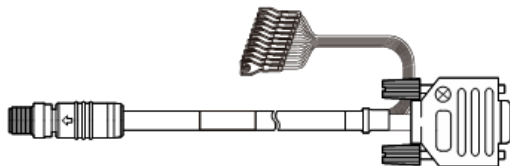
Operator’s Guide



The following optional products are available as optional accessories.

- Power/control cable : Cable for connecting to the power supply, and connecting the upper PLC via RS-232C
- Ethernet cable : Cable for connecting the upper PLC via Ethernet
- USB cable : Cable for connecting to the PC and is used when settings are changed

Power/control cable

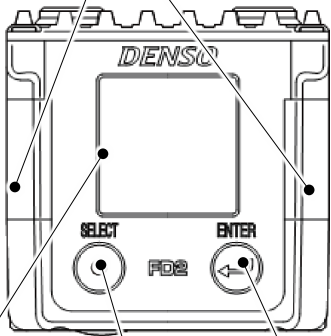


Ethernet cable



1.2. Components and Functions

LED Indicator
Illuminates at the scan completion, etc.
For details, refer to "Chapter 12 Indicator."



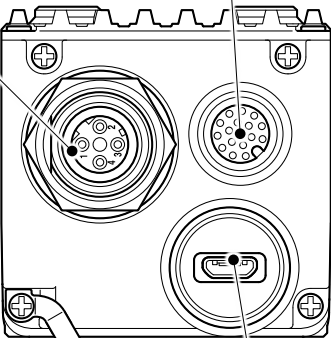
Display
Shows the status of the scanner.
For details, refer to "Chapter 13 Display".

SELECT key
Switches the display screen and selected items.

ENTER key
Determines the selected item.

Ethernet connector
Connects the Ethernet cable.

Power/control connector
Connect the power/control cable.



USB connector cap
Should be tightened when the USB cable is not connected.

USB connector
Connects the USB cable (micro USB type B).

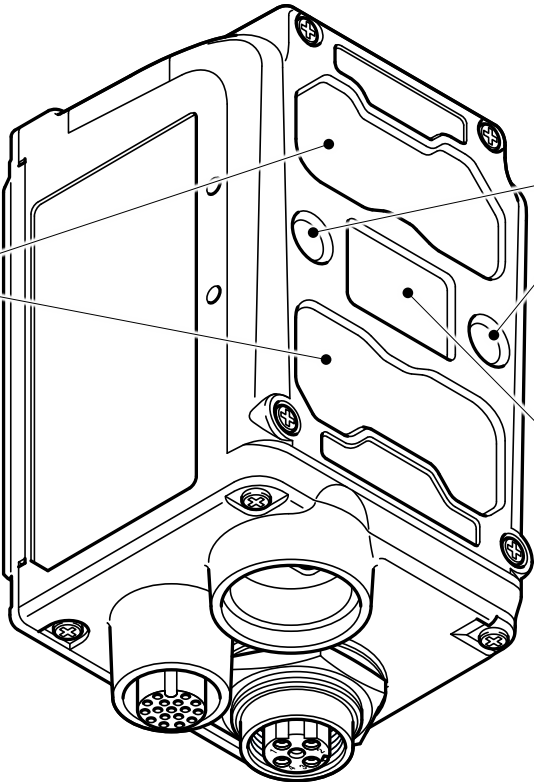


Illumination window
Illumination light is applied from these portions.

Marker lighting
The guide marker is applied from these portions.



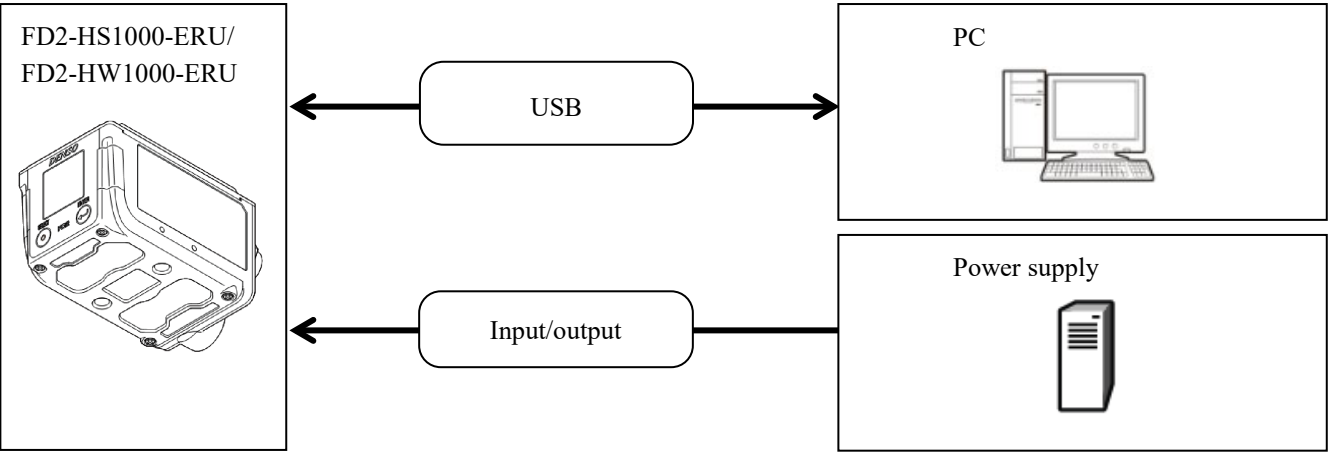
*** DO NOT STARE DIRECTLY INTO ILLUMINATION LIGHT.**



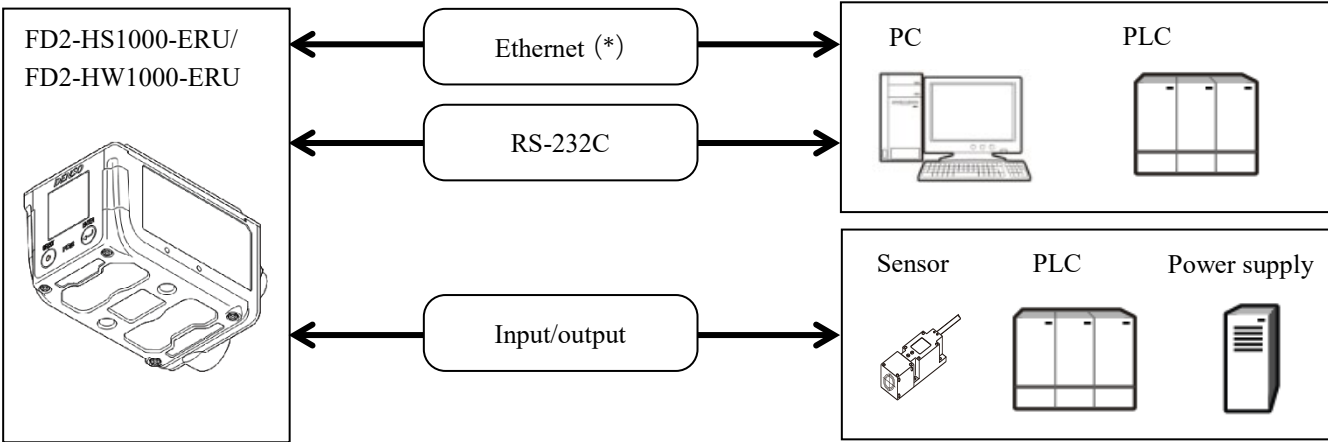
Scan window
Apply this portion to codes for scanning.

1.3. System Configuration

1.3.1. Connections for Installation



1.3.2. Connections for Operations



(*)Before using the Ethernet interface, use the USB interface to execute the network setting such as the IP address.

Initial setting

1

Check the contents of a package

“Chapter 1 1.1. Checking Package Contents”



2

Connect the cable

"Chapter 3 3.1. Installation of Cable"



3

Installation

“Chapter 3 3.2. Installation”



4

Connect to the peripheral devices

“Chapter 3 3.4. Connection with Peripheral Devices”



5

Power on



6

Perform setting and tuning of scanning

"Chapter 5 Scan Settings"



In operation

7

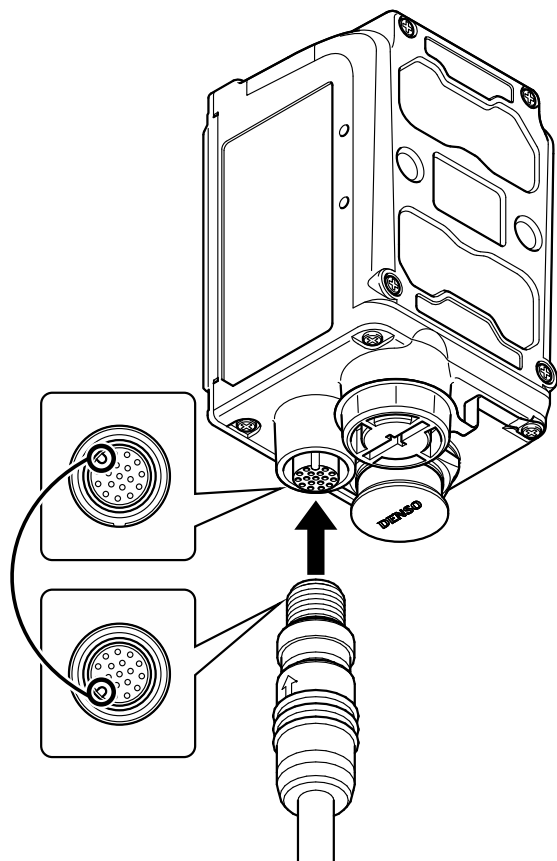
Set up and tune the scanner again

"Chapter 5 Scan Settings"

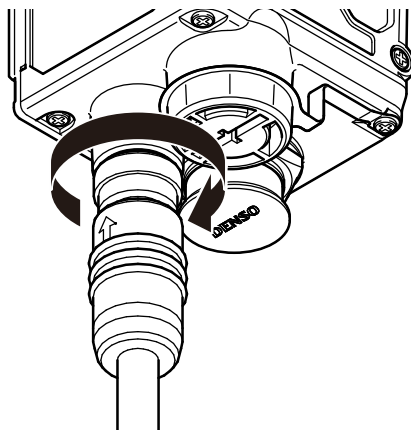
Chapter 3 Preparation Before Use

3.1. Installation of Cable

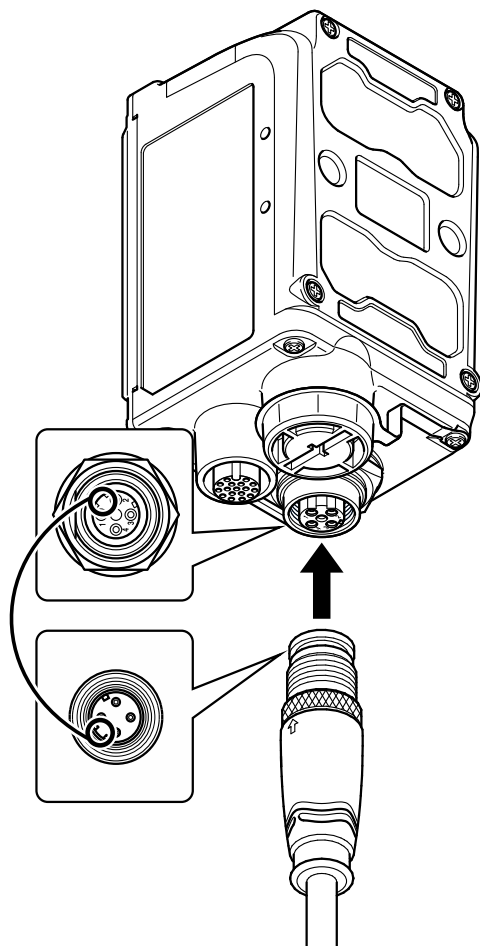
3.1.1. Installation of Power/Control Cable



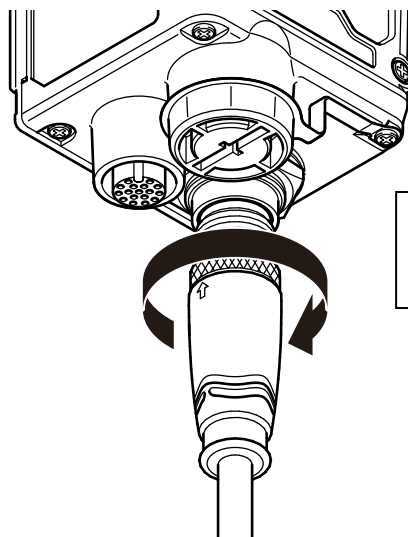
- (1) Remove the power/control connector cap.
- (2) Align the female part of the power/control cable connector with the male part of the cable.
- (3) Insert the cable and turn the connector screw clockwise until there is no looseness of the connector screw.



3.1.2. Installation of Ethernet Cable



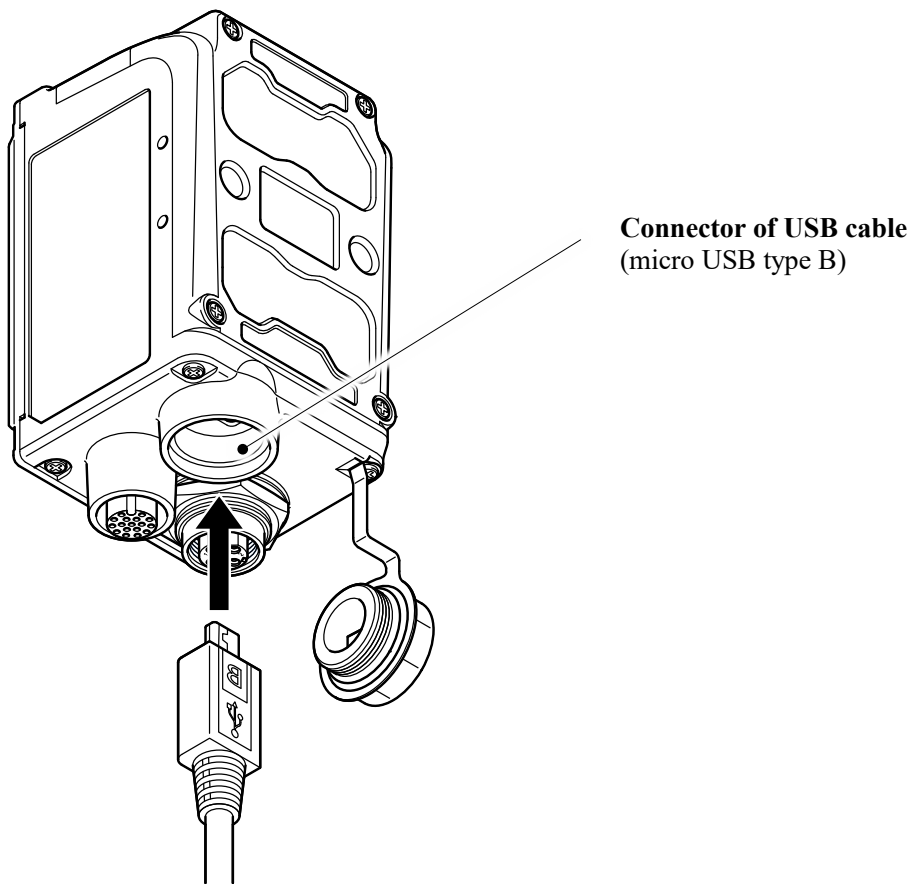
- (1) Remove the cap of the light connector.
- (2) Adjust the dent of the connector of the cable to the position of the projection of the connector of the scanner.
- (3) Insert the cable and turn the connector screw clockwise until there is no looseness of the connector screw.



Tightening torque
0.5 to 1.0 N·m

3.1.3. Connection of USB Cable

- (1) Remove the cap of the USB connector.
- (2) Check the direction of the connector, and insert it straight so that the connector will not incline.



3.2. Installation

Dimensions of screw holes are specified below.

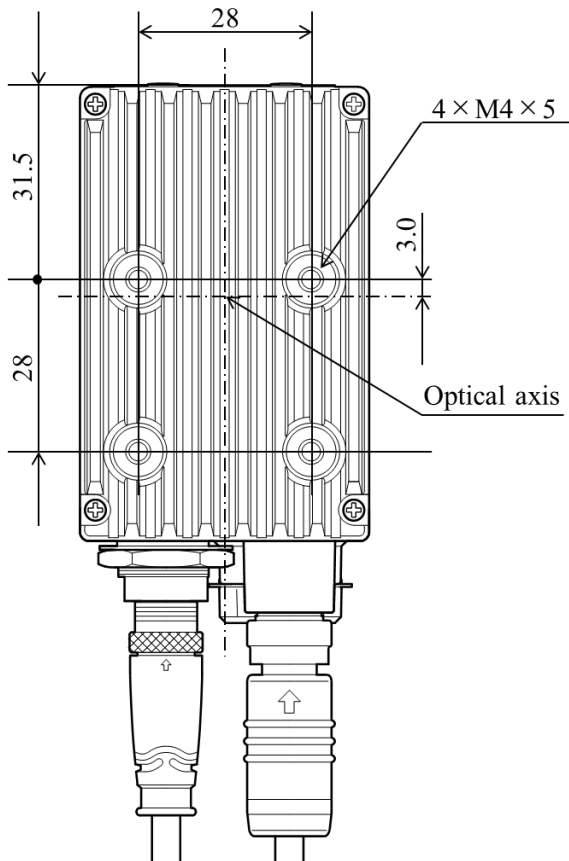
Nominal diameter and pitch of a screw is $M4 \times 0.7$ mm and the depth of thread is 5 mm.

Recommended tightening torque is 1.5 Nm.

Note:

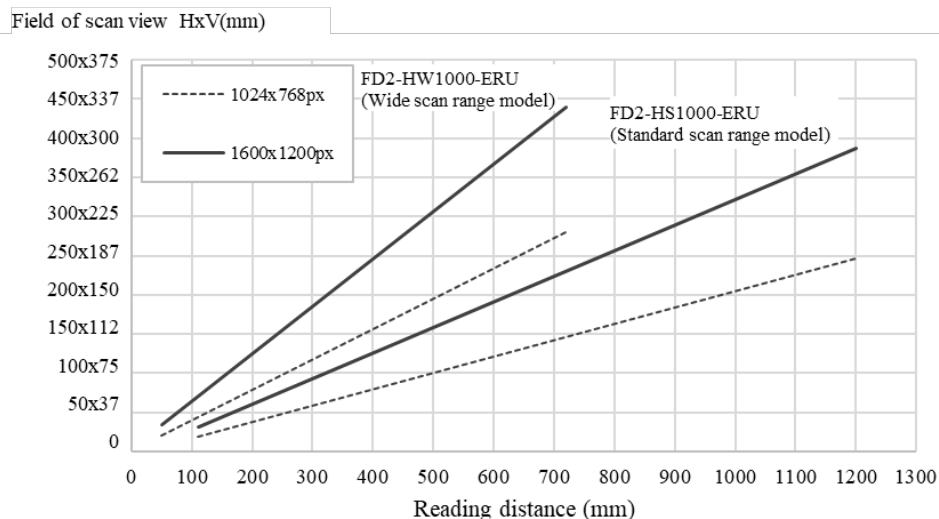
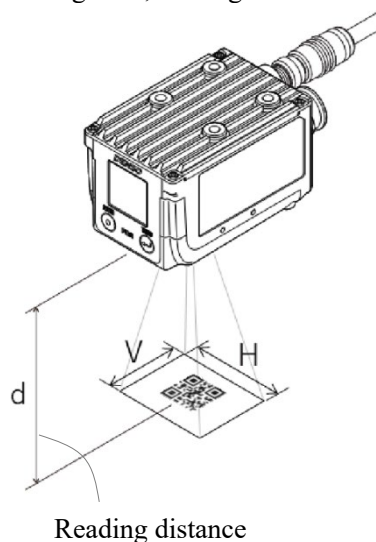
- Install the scanner so as not to apply strong impact or vibration to its body.
- Dimensions without tolerance are reference dimensions.
- When preparing an installation jig, it must be free of burrs on the installation side.

(Unit : mm)



3.3. Adjustment of Installation Position

According to your model, FD2-HS1000-ERU (standard scan range model)/FD2-HW1000-ERU (wide scan range model), adjust the reading field, reading distance and cell/module size of the reading code to the optimum installation position.



Reading distance and the field of scan view (e.g.)

(mm)

Reading distance (e.g.)	FD2-HS1000-ERU Standard scan range model		FD2-HW1000-ERU Wide scan range model	
	1024x768pix (default)	1600x1200pix (full size)	1024x768pix (default)	1600x1200pix (full size)
50	-	-	21x16	34x25
60	-	-	25x19	40x30
70	-	-	29x22	46x34
80	-	-	33x25	52x39
90	-	-	37x27	58x43
100	-	-	41x30	64x48
110	19x14	31x23	44x33	70x52
120	21x16	34x25	48x36	76x57
130	24x18	37x28	52x39	82x61
140	26x19	40x30	56x42	88x66
150	28x21	44x33	60x45	94x70
160	30x22	47x35	64x48	100x75
170	32x24	50x37	68x51	106x79
180	34x25	53x40	72x54	112x84
190	36x27	57x42	75x56	118x88
200	38x28	60x45	79x59	124x93
250	49x36	76x57	99x74	154x116
300	59x44	93x69	118x88	185x138
400	80x60	125x94	157x117	245x184
500	101x76	158x118	195x146	306x229
700	143x107	223x167	273x204	426x320
1200	247x185	387x290	-	-

Code Cell/Module Size and Reading Distance

cell/module size [mm]		Reading distance [mm]	
		FD2-HS1000-ERU	FD2-HW1000-ERU
2D code	0.06	110 - 150	-
	0.08	110 - 200	50 - 100
	0.12	110 - 300	50 - 150
	0.16	110 - 400	50 - 200
	0.20	110 - 500	50 - 300
	0.36	110 - 800	50 - 500
	0.61	110 - 1200	50 - 720
Barcode	0.08	110 - 220	50 - 110
	0.12	110 - 400	50 - 200
	0.16	110 - 600	50 - 300
	0.25	110 - 800	50 - 450
	0.33	110 - 1000	50 - 500

3.4. Connection with Peripheral Devices

3.4.1. Power Supply, Ground, Input/Output Terminals

Connects the power terminal and the ground terminal to the power supply and earths the frame ground terminal.
Other terminals are also connected according to the purposes for use.

Power/control cable

Cable color	Terminal	Signal direction	Description
Red	+24V	-	Power ^(*1)
Black	GND	-	Ground
Brown	IN1	Input	Input terminal 1 ^(*2)
Brown/white	IN2	Input	Input terminal 2 ^(*2)
Purple	COM IN	-	Input common ^(*3)
Green	COM OUT	-	Output common ^(*3)
Pink	OUT1	Output	Output terminal 1 ^(*2)
Black/white	OUT2	Output	Output terminal 2 ^(*2)
Red/white	OUT3	Output	Output terminal 3 ^(*2)
Light green	FG	-	Frame ground ^(*4)

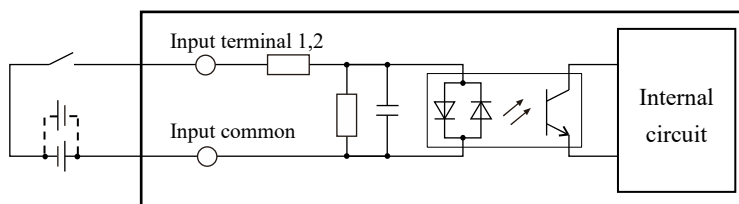
(*1) For the input voltage, see the "Connection of input terminal" shown below.

(*2) For the functions of input and output terminals, refer to "Chapter 10 Input and Output Terminal".

(*3) It is insulated from the power/ground.

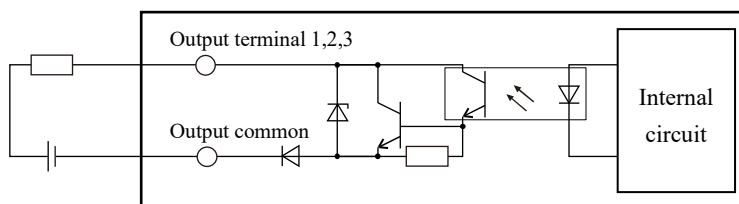
(*4) The FG (frame ground) wire must be grounded.

■ Connection of input terminal



Input specifications (NPN, PNP)	
Maximum input voltage	26.4 V DC
Voltage at ON	15 V DC min.
Voltage at OFF	2 V DC max.
Current at ON	10 mA max.
Current at OFF	0.2 mA max.

■ Connection of output terminal



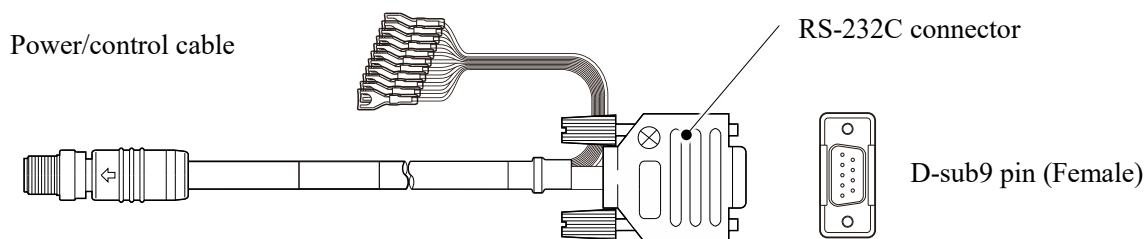
Output specifications (NPN, open collector)	
Rated load	26.4 V DC /50 mA
Residual voltage at ON	1.0 VDC max. (50 mA)
Leaked current at OFF	0.1 mA max.

Note:

- Thoroughly check that all cables are correctly connected, and then power on the scanner and the connected devices.
- Do not apply voltage over the specified range. Doing so may cause a failure in the device.

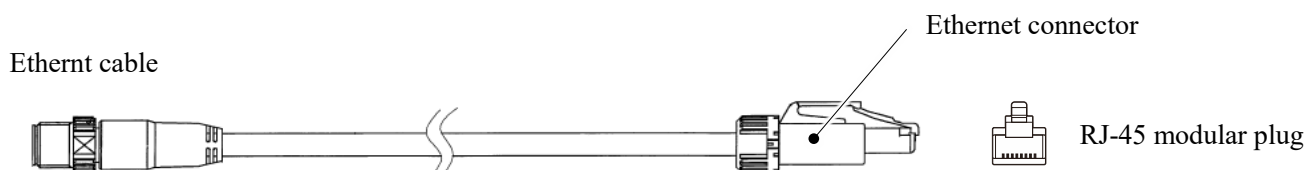
3.4.2. RS-232C Interface

Connect the RS-232C connector to the RS-232C port of PC or PLC.



3.4.3. Ethernet Interface

Connect the Ethernet connector to the Ethernet port of PC or PLC.



3.4.4. USB Interface

Set-up of USB interface

The USB interface will be used when the scanner setting is performed using the configuration tool (Scanner Setting F). To use it, DENSO WAVE's Active USB-COM port is required to be installed on your PC. This driver can be downloaded from the website of DENSO WAVE (<https://www.denso-wave.com/en/>) free of charge.

Precautions when installing and using Active USB-COM port driver

Refer to the “Active USB-COM port driver installation guide” attached to the downloaded driver.

Precaution when connecting USB interface cable

- Plug or unplug the USB connector after an interval of 10 seconds or more because it may take about 10 seconds to recognize and delete a USB device of the PC.
- A USB connector can be plugged and unplugged while the PC is powered on. When the PC is in the standby (suspend) mode, however, do not plug or unplug the USB connector.
- Do not attach or detach other USB devices while the scanner is in the process of connection to a device.

Chapter 4 Setting Up The Scanner

There are two procedures for setting up the scanner; using the configuration tool and using the command.

The configuration tool is used for setting and adjusting the scanner for the first time. The command is used for changing the setting of the scanner after starting its operation.

4.1. Using Configuration Tool

4.1.1. Installing configuration tool (Scanner Setting F)

To use the configuration tool, it is required to install the software provided by DENSO WAVE INCORPORATED in the PC. This software can be downloaded from the website of DENSO WAVE (<https://www.denso-wave.com/en>) free of charge. (The membership registration is required for downloading.)

Note: For the types of the supporting operation systems, see the website of DENSO WAVE.

Precaution when installing and using the configuration tool

- A user with the authority of the administrator should install the configuration tool.

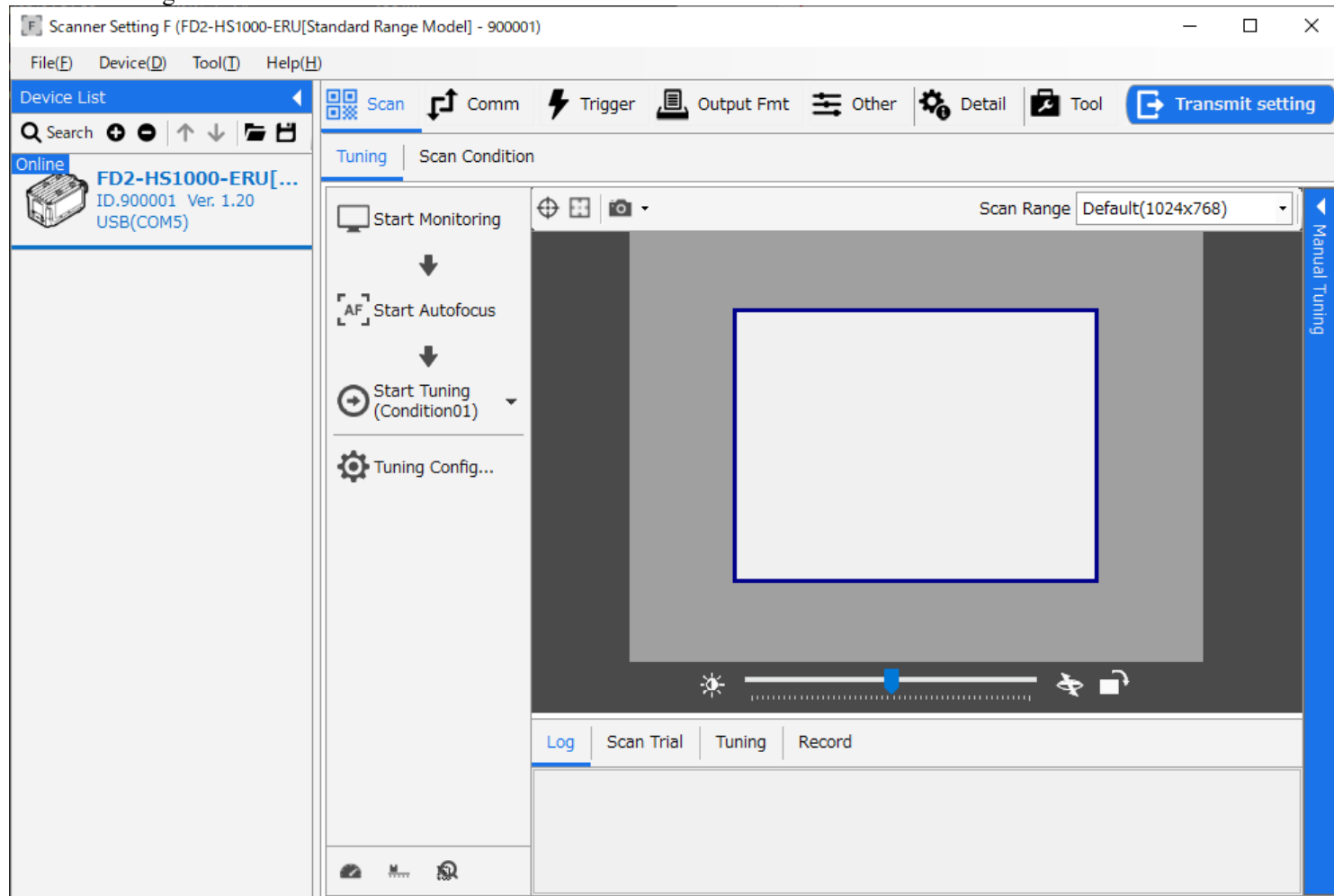
4.1.2. Connection between the Configuration Tool and Scanner

- (1) Connect the scanner to the PC with the USB cable or the Ethernet cable.
- (2) Select [Scanner Setting F] from the [Start] menu and click.

Scanner Setting F will start up.

When starting up, the PC searches the connected scanner and displays it on the screen.

<Scanner Setting F>



For the operation procedure of Scanner Setting F, refer to the User's Manual of Scanner Setting F contained in the package.

Note:

- To search for a scanner via USB, you need to install the Active USB-COM driver first.
- When using the Ethernet, use the UDP port "50000, 50011" If this port is used with different app, it may result in improper operation.

4.2. Using Command

The command is used for changing the setting of the scanner during its operation.

For details of the command, refer to "14.3. Control Command".

4.3. Setting Change by Key Operation

Use key operations to change the settings of a scanner that is running.

Use the keys while checking the information displayed on the display.

For more information, see "Chapter 13 Display".

Chapter 5 Scan Settings

5.1. Autofocus

The FD2 has a function called an autofocus function that allows the scanner to be adjusted to the optimum focus settings for codes. The autofocus function is used as follows:

- Autofocus by the configuration tool (Scanner Setting F)
- Autofocus by key operation

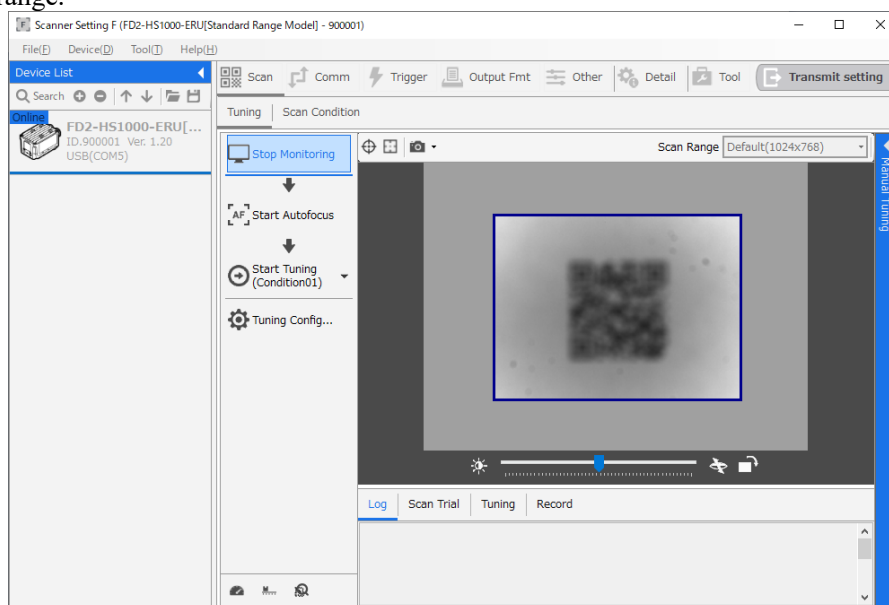
Note:

- If autofocus is performed via Ethernet, use the UDP port “50011” If this port is used with different app, it may result in improper operation.

5.1.1. Autofocus by the Configuration Tool (Scanner Setting F)

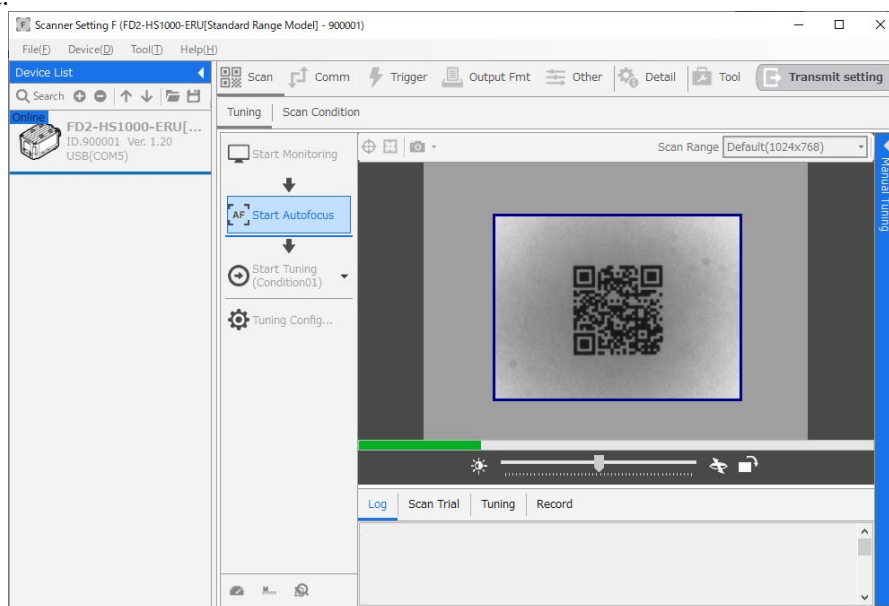
1. Click the "Start Monitoring" button to check a code for its position.

When monitoring starts, an image being taken by the FD2 can be reviewed. Make sure that the entire code to be taken is within the scan range.



2. Click the "Start Autofocus" button and wait until autofocus processing is completed.

When autofocus starts, the optimum setting where the scanner focuses on around the center of the scan range is automatically set.

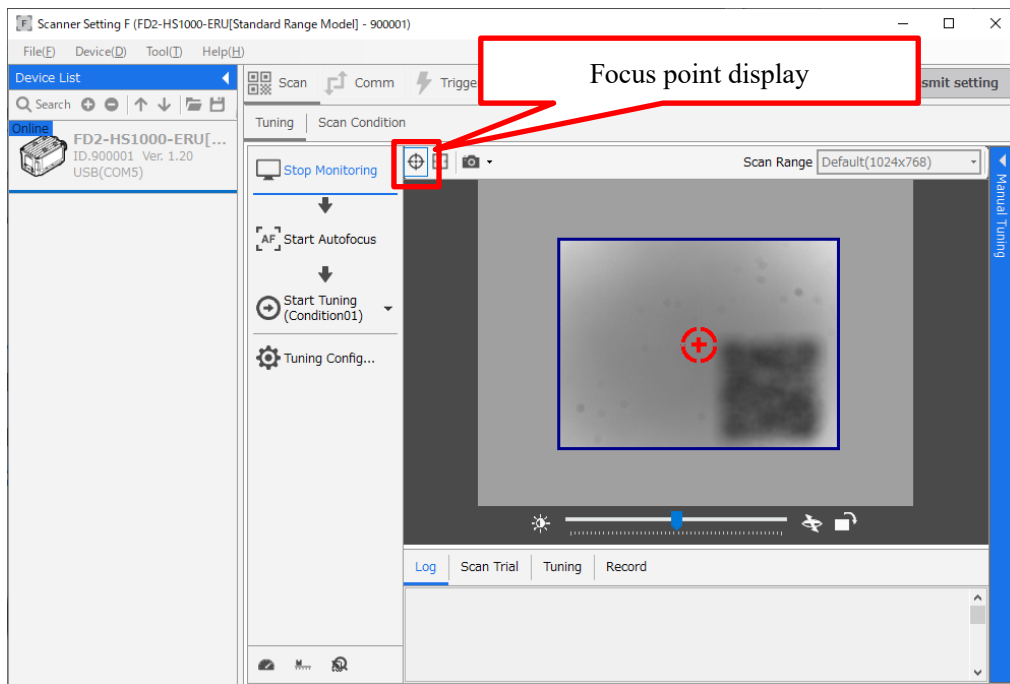


[To focus on positions anywhere you like]

By using the Focus point display function on the monitoring screen upper part, the scanner can focus on a position anywhere you like within the scan range.

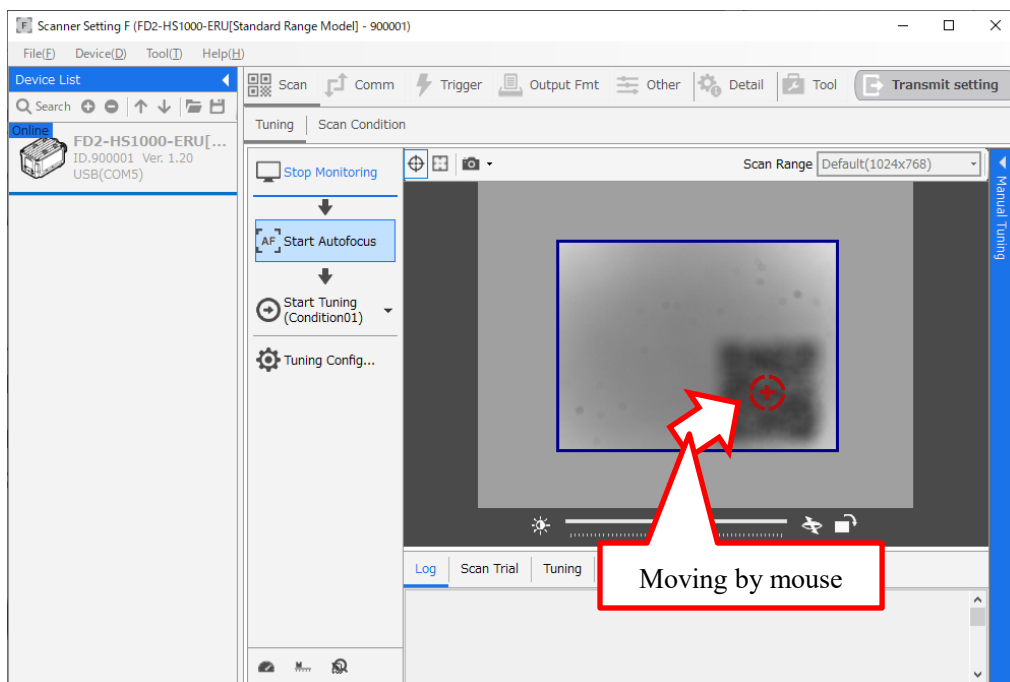
1. Click the "Focus point display" button to display the focus point.

Upon the click of the "Focus point display" button, you will see the position where the FD2 is focusing on within the scan range.



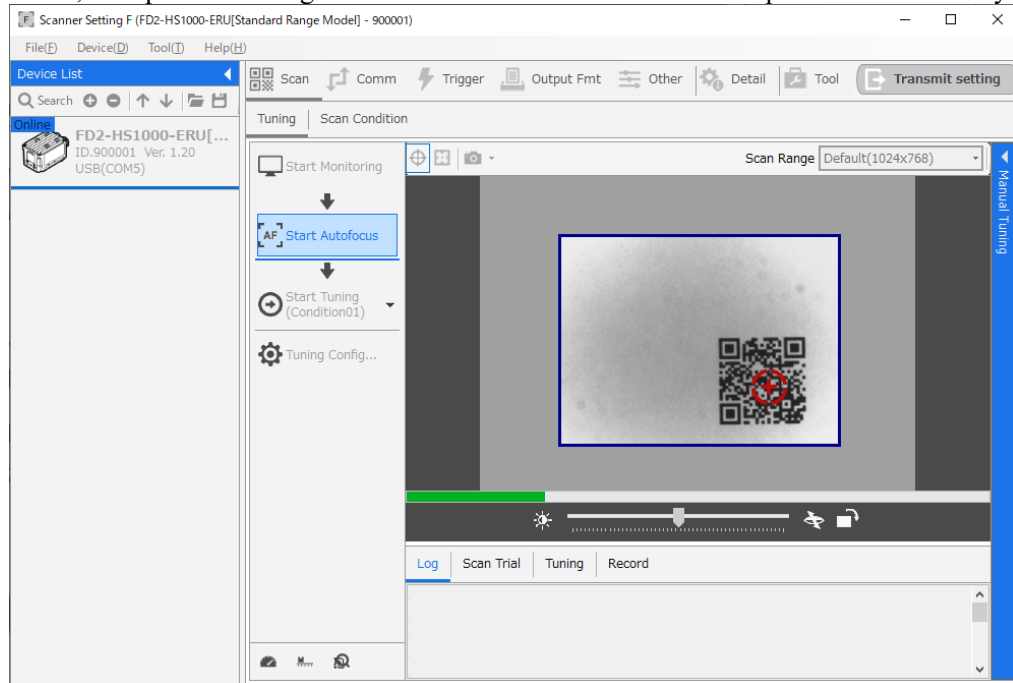
2. Position the focus point over the code to be read.

The focus point can be moved around using the mouse. Move the position of the focus point toward the code to be focused on.

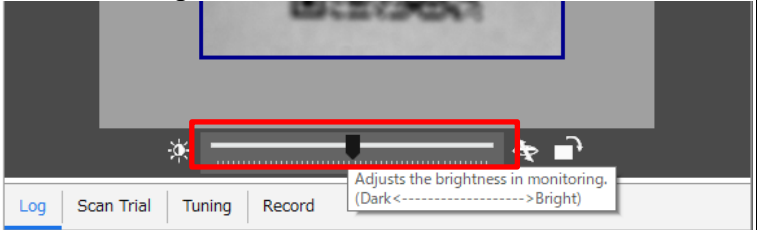
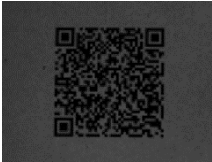


3. Click the "Start Autofocus" button and wait until autofocus processing is completed.

When autofocus starts, the optimum setting where the scanner focuses on the focus point is automatically set.



<If autofocus fails>

Check item	Action
Appropriateness of monitoring brightness	Drag the "Adjust brightness level" slider on the bottom of the monitoring screen to change the brightness level so as to detect the black and light contrast.     Too dark ✓OK Too bright
Appropriate distance between the scanner and codes	Check the distance between the scanner and a code for its appropriateness consulting the references of the reading distance described in this manual. [Ref.: for FD2-HS1000-ERU (Standard scan range model)] Reading distance: 110 to 1200 mm [Ref.: for FD2-HW1000-ERU (Wide scan range model)] Reading distance: 50 to 720 mm
The position of the focus point to detect the contrast	Autofocus is performed based on the black and light contrast. Therefore, the focus point should be positioned over an area of the black and light contrast.   Low contrast ✓ Good contrast

5.1.2. Autofocus by Key Operation

Use the keys while checking the information displayed on the display. See "13.3.4. Autofocus" for more information.

5.2. Tuning

The FD2 is equipped with the tuning function to tune the scanner to the optimum scan settings for codes.

The tuning function is used as follows:

- Tuning using the configuration tool (Scanner Setting F)
- Tuning by key operation

5.2.1. Tuning by the Configuration Tool (Scanner Setting F)

With the following tuning methods, the scan settings can be adjusted.

Tuning method	Description
Auto-tuning	Function to tune the scan settings automatically.
Manual tuning	Function to enable you to fine tune the scan settings, allowing for real time review of the read performance.

The scan settings adjustable by tuning with the configuration tool are as follows.

Setting item		Auto-tuning	Manual tuning
Reading code	Code type	✓ (Note 1)	✓
	Mirror code	✓	✓
	Black-and-white inverted code	✓	✓
Read area		_(Note 2)	✓
Scan time limit		—	✓
Scan trial count		—	—
Imaging control	Polarizing filter	✓	✓
	Shutter (μs)	✓	✓
	Gain level	✓	✓
Image processing filter		✓	✓
Illumination	External light	—	—

✓ . . . Applicable

— . . . Not applicable

(Note 1) If auto-tuning is performed, only the code that has been tuned is readable.

Advanced settings of the code type (e.g., the max. read version of the QR code) will be returned to the default value.

(Note 2) If auto-tuning is performed, this disables the read area designation, with the setting value returned to the default.

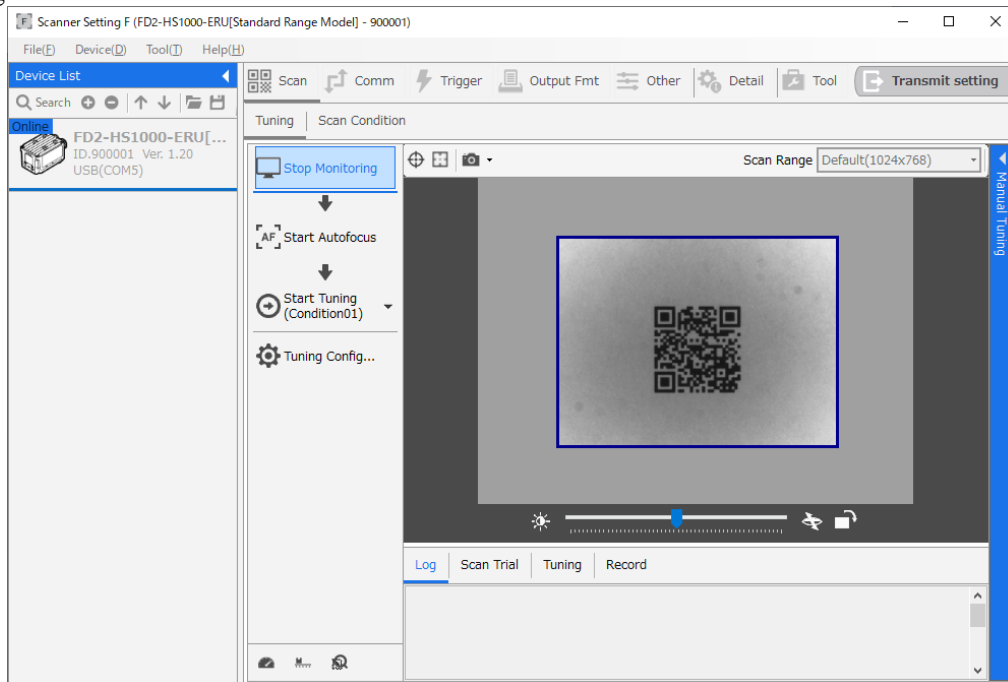
(Note 3) If auto-tuning is performed, this disables the Scan time limit, with the setting value returned to the default.

Note: If auto-tuning is performed via Ethernet, use the UDP port “50011” If this port is used with different app, it may result in improper operation.

Use of auto-tuning

1. Click the "Start Monitoring" button to review the code position.

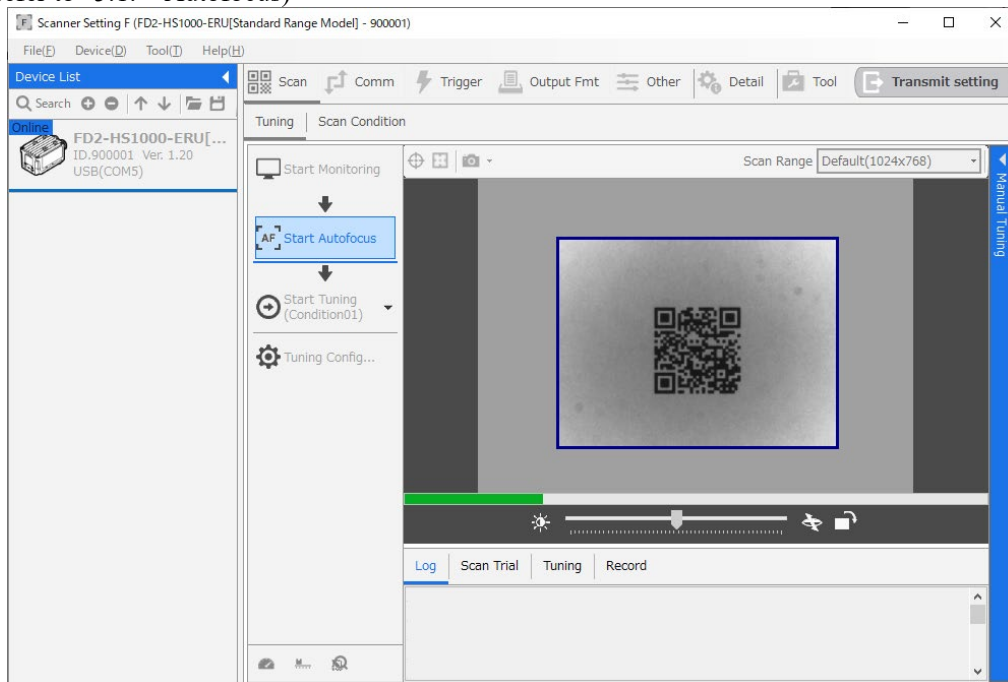
When monitoring starts, an image being taken by the FD2 can be reviewed. Make sure that the entire code to be read is within the scan range.



2. Click the "Start Autofocus" button to adjust focus.

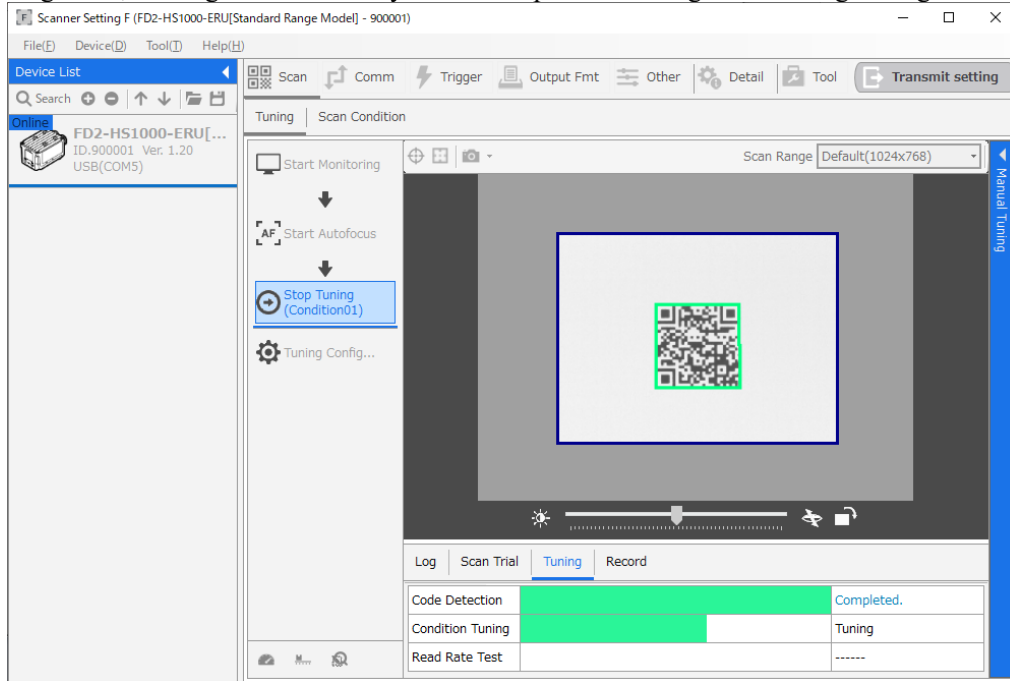
When autofocus starts, focus is automatically adjusted.

(For details, refer to "5.1. Autofocus")

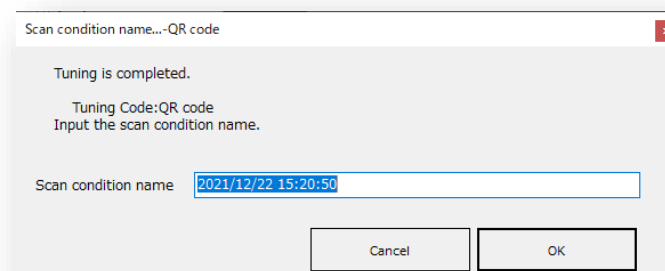


3. Click the "Start Tuning" button and wait until auto-tuning is completed.

When auto-tuning starts, reading is automatically set to the optimum settings for an image being taken by the FD2.

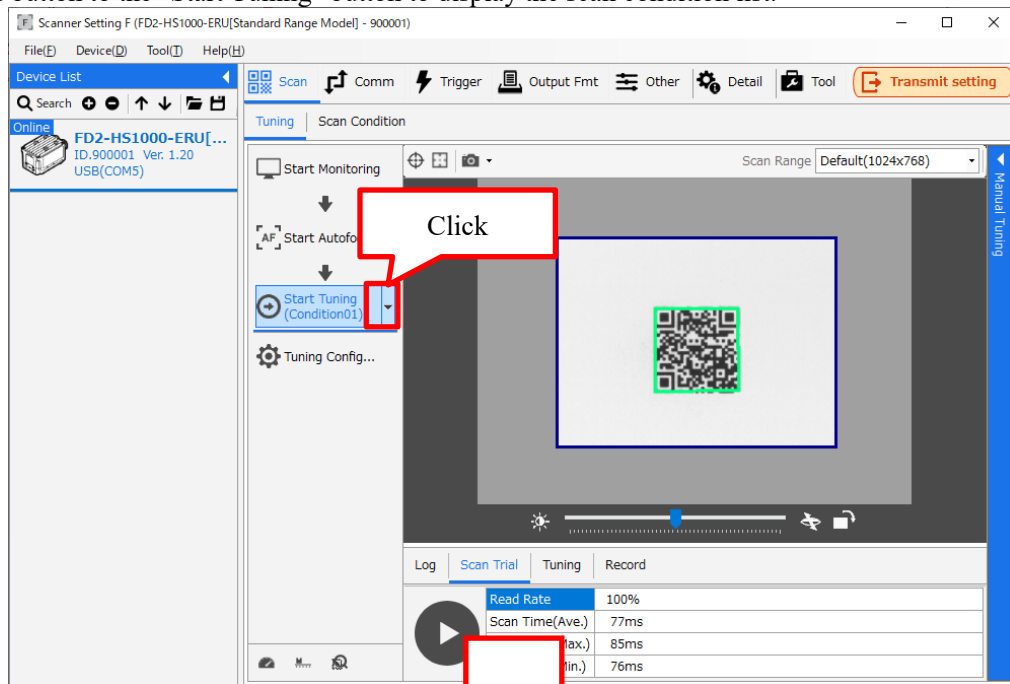


When processing is completed, the following message appears. Save the scan setting with a new name.

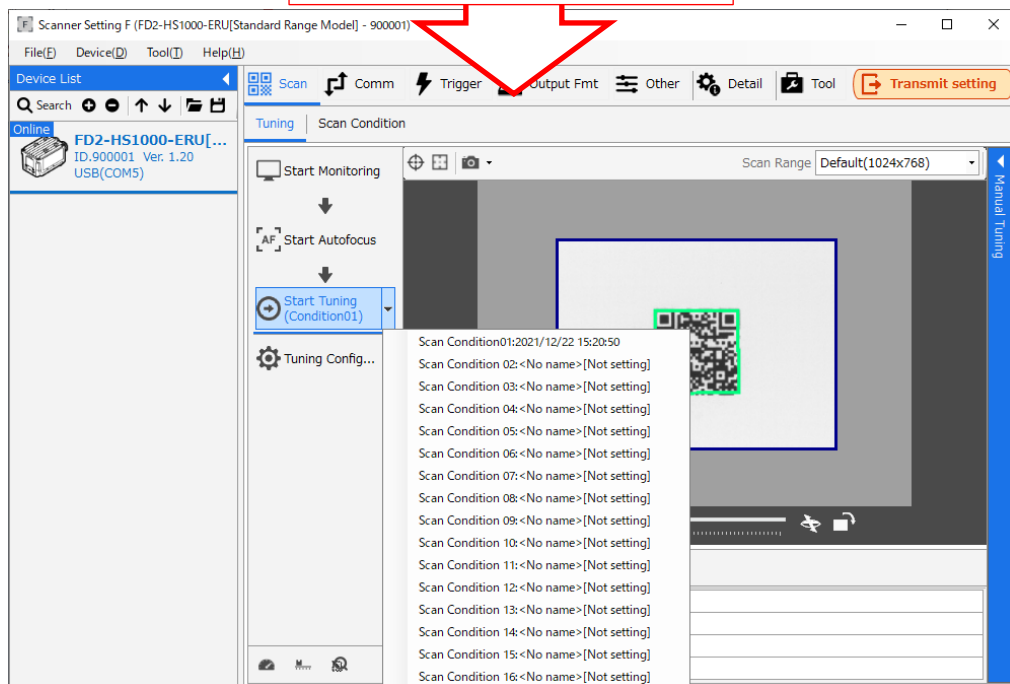


[To change the scan conditions for performing auto-tuning]

Click the expand button to the "Start Tuning" button to display the scan condition list.



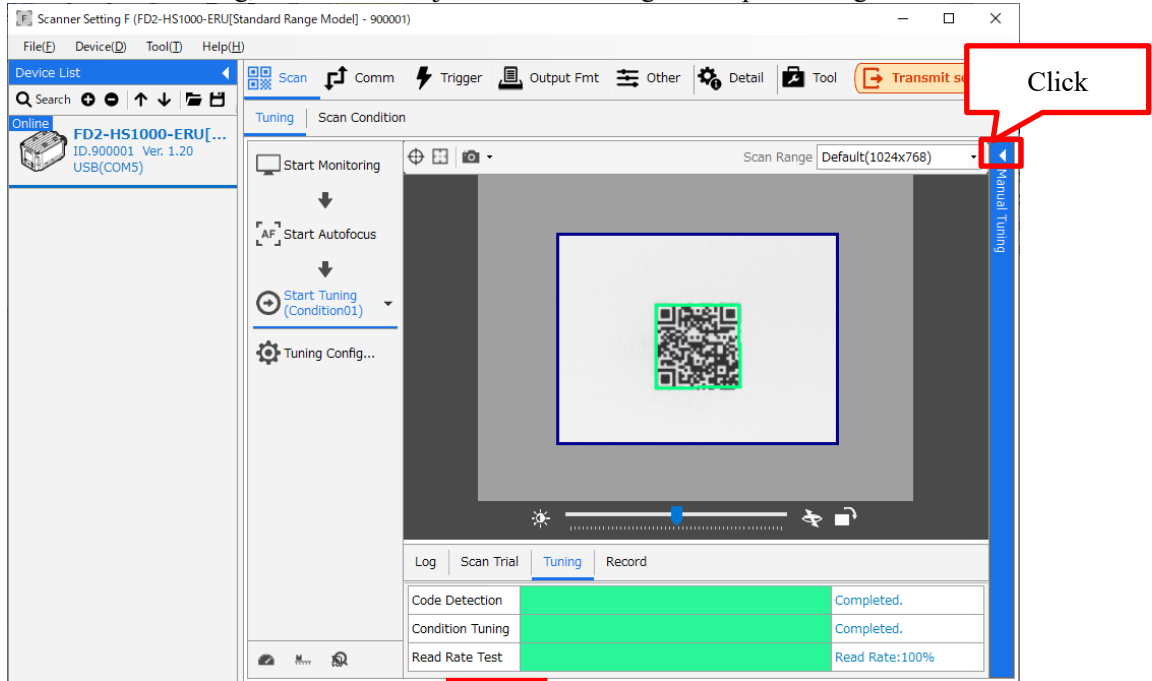
The scan condition list appears



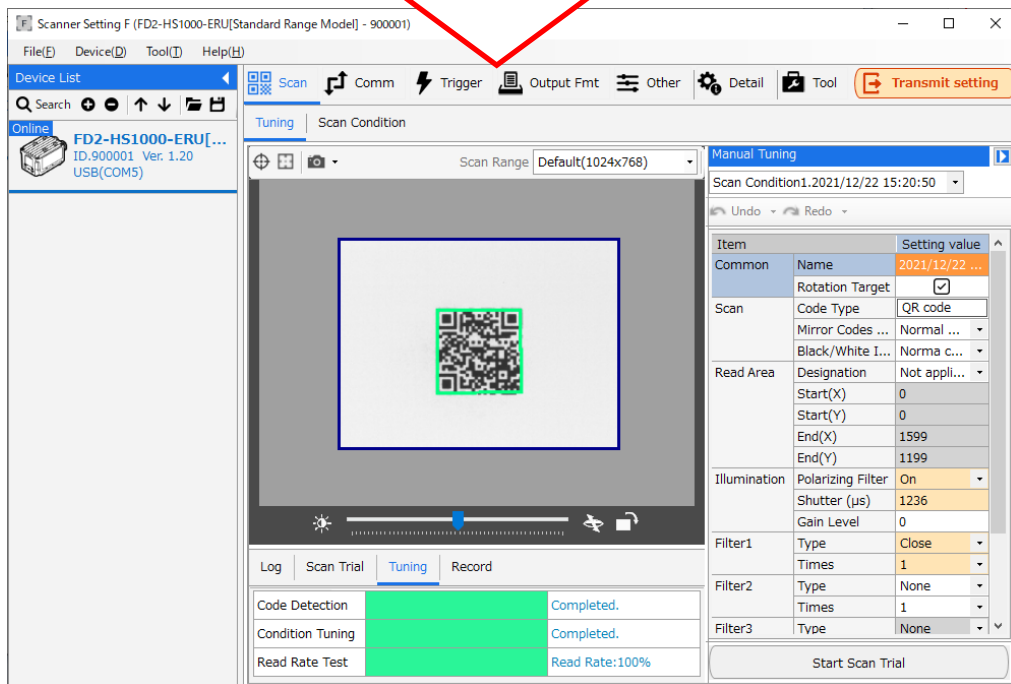
[To fine tune the scan conditions that have been set to auto-tuning]

1. Open the "Manual Tuning" to review the scan settings.

Click the expand button in the "Manual Tuning" on the far-right of the "Tuning" screen. You can review the scan settings that have been adjusted with auto-tuning, and also can adjust the scan settings while performing a scan trial.



Expand the Manual tuning



2. Click the "Start Scan Trial" button to review the read performance.

By clicking the "Start scan trial" button in the "Manual Tuning," the scan settings under the current scan settings can be reviewed.

Scanner Setting F (FD2-HS1000-ERU[Standard Range Model] - 900001)

File(E) Device(D) Tool(T) Help(H)

Device List

Online FD2-HS1000-ERU[... ID.900001 Ver. 1.20 USB(COM5)

Scan Range Default(1024x768)

Manual Tuning

Scan Condition1.2021/12/22 15:20:50

Undo Redo

Item	Name	Setting value
Common	Rotation Target	☒
Scan	Code Type	QR code
	Mirror Codes ...	Normal ...
	Black/White I...	Norma c...
Read Area	Designation	Not appli...
	Start(X)	0
	Start(Y)	0
	End(X)	1599
	End(Y)	1199
Illumination	Polarizing Filter	On
	Shutter (μs)	1236
	Gain Level	0
Filter1	Type	Close
	Times	1
Filter2	Type	None
	Times	1
Filter3	Type	None

Log Scan Trial Tuning Record

Code Detection Completed.

Condition Tuning Completed.

Read Rate Test Read Rate:100%

Start Scan Trial

Click

Scan trial starts

Scanner Setting F (FD2-HS1000-ERU[Standard Range Model] - 900001)

File(E) Device(D) Tool(T) Help(H)

Device List

Online FD2-HS1000-ERU[... ID.900001 Ver. 1.20 USB(COM5)

Scan Range Default(1024x768)

Manual Tuning

Scan Condition1.2021/12/22 15:20:50

Undo Redo

Item	Name	Setting value
Common	Rotation Target	☒
Scan	Code Type	QR code
	Mirror Codes ...	Normal ...
	Black/White I...	Norma c...
Read Area	Designation	Not appli...
	Start(X)	0
	Start(Y)	0
	End(X)	1599
	End(Y)	1199
Illumination	Polarizing Filter	On
	Shutter (μs)	1236
	Gain Level	0
Filter1	Type	Close
	Times	1
Filter2	Type	None
	Times	1
Filter3	Type	None

Log Scan Trial Tuning Record

Read Rate 100%

Scan Time(Ave.) 90ms

Scan Time(Max.) 94ms

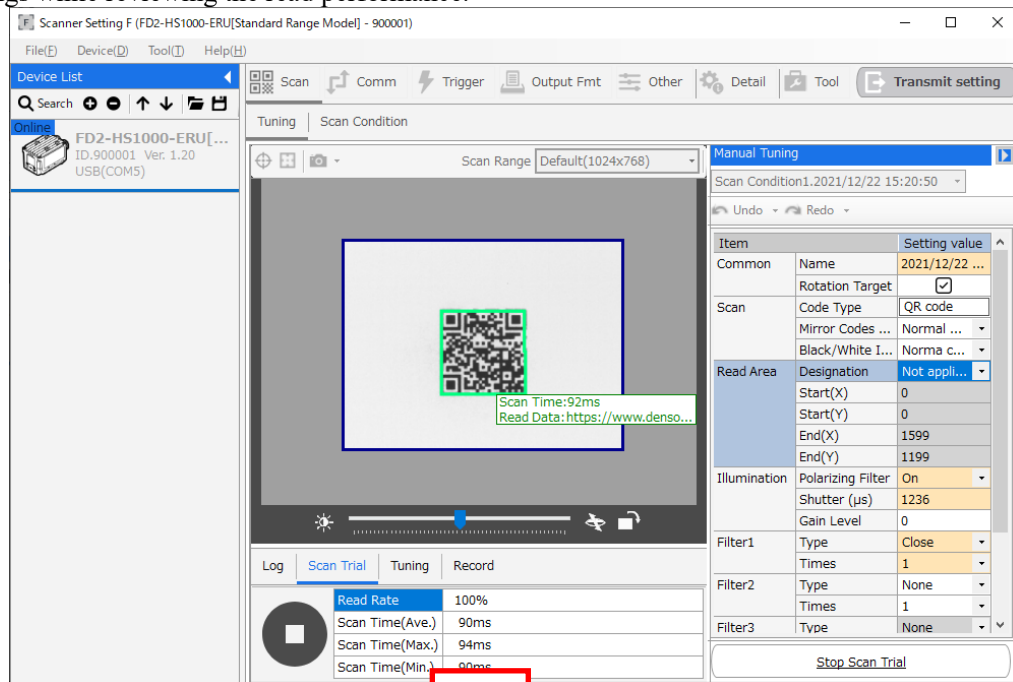
Scan Time(Min.) 90ms

Stop Scan Trial

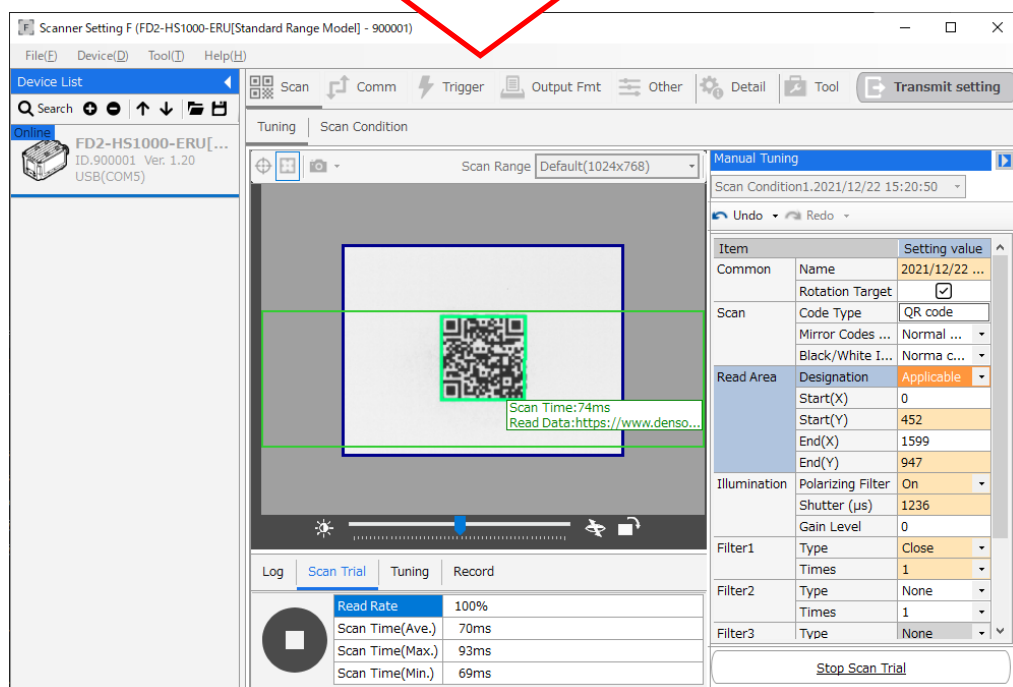
Scan Time:92ms
Read Data:https://www.denso...

3. While the read performance is reviewed, fine tuning of the scan setting is performed.

If a setting value is changed while a "Start Scan Trial" is in progress, the change takes effect in real time. Make a fine tuning to the scan settings while reviewing the read performance.



Change the settings



5.2.2. Auto-tuning by Key Operation

Use the keys while checking the information displayed on the display. See "13.3.5. Auto-tuning" for more information.

5.3. Scan Trial

The FD2 is equipped with the scan trial function where the read performance under the scan settings that have been adjusted to, can be reviewed.

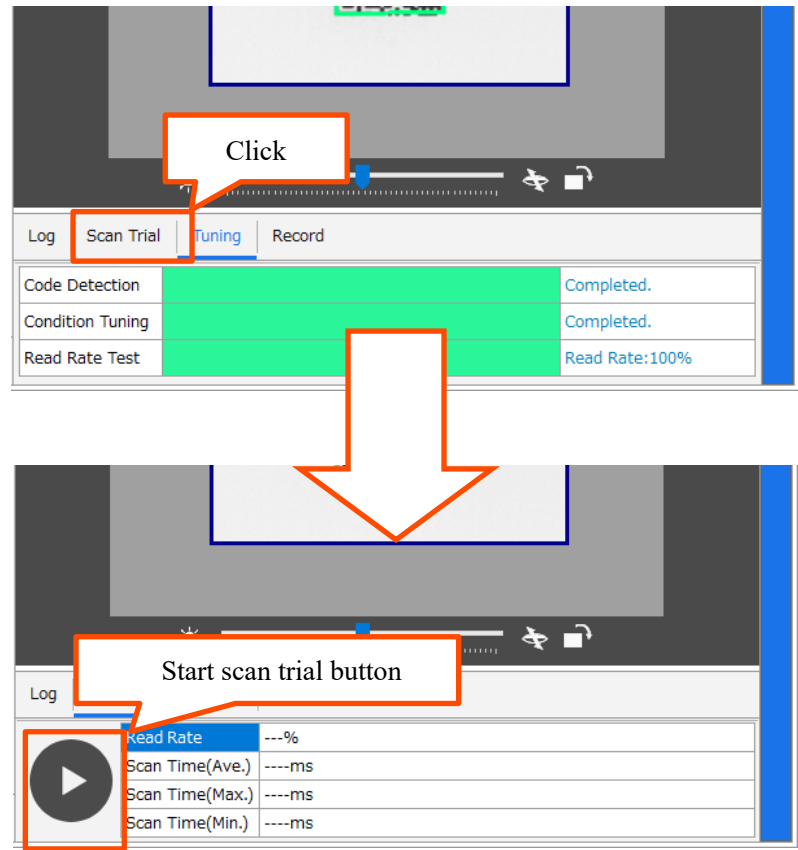
The scan trial unction is used as follows:

- Scan trial by the configuration tool (Scanner Setting F)

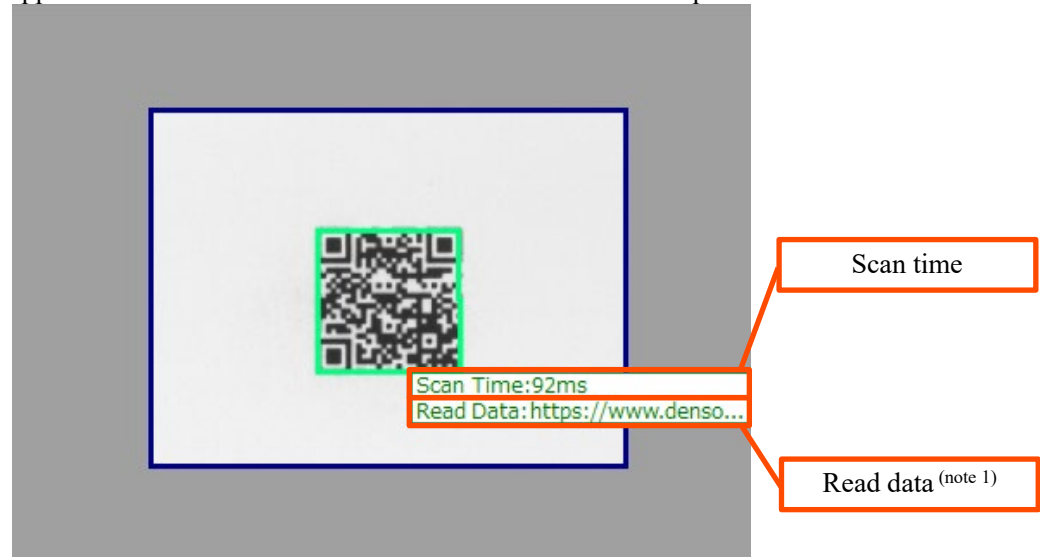
5.3.1. Scan Trial by the Configuration Tool (Scanner Setting F)

Upon the click of the "Scan Trial" tab, the "Scan Trial" panel appears.

Click the start scan trial button to start a scan trial.



When a scan trial starts, results appear on the monitor screen. Review the results for no read problem.



(Note 1) Read data of 20 bytes or more is omitted and displayed.

5.4. Scan Condition Rotation Function

5.4.1. Scan Condition Rotation Operation

The function of scan condition rotation makes it possible to automatically switch scan conditions for read data during scanning. Up to 16 scan conditions can be set.

The scan condition rotation function can be changed with the configuration tool or setting commands.

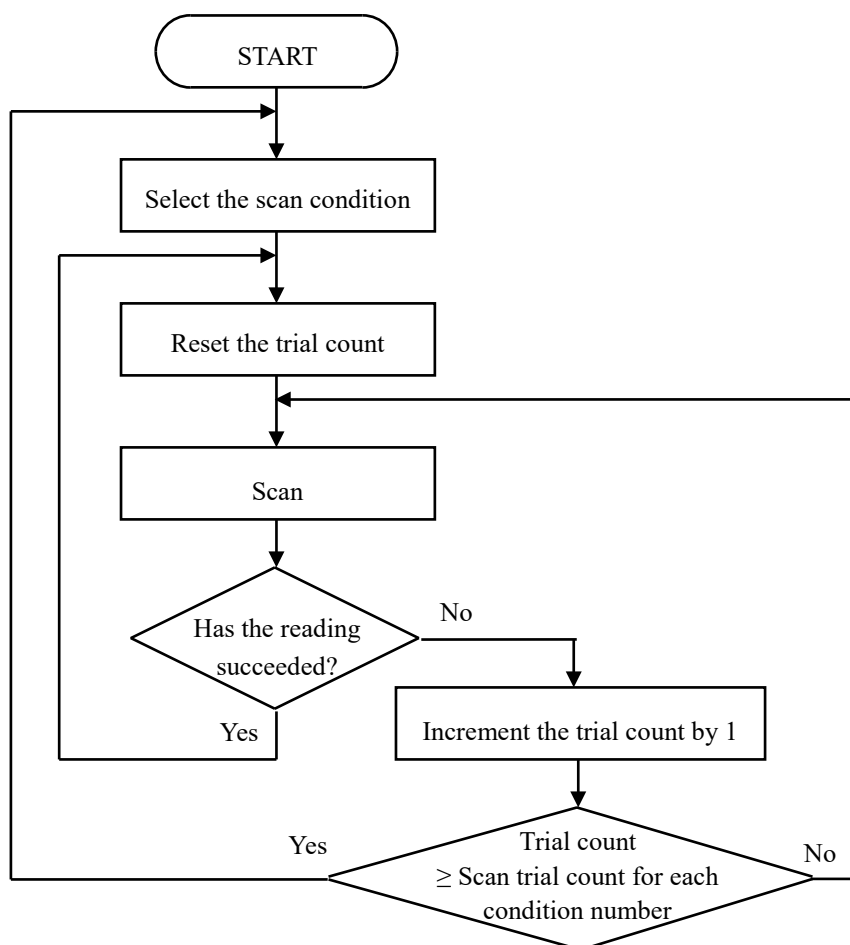
Scan conditions used in the scan condition rotation function are specified with the condition numbers (#1 to #16). With the scan condition rotation function, you can enable or disable the scan condition and set the scan trial count (1 to 15 times), separately for each condition number.

Applicable settings of the scan condition are as follows:

- Read code type
- Mirror-code scan
- Black-and-white inverted code scan
- Read area
- Decode limit time ^(Note 1)
- Scan trial count
- Polarizing filter
- Shutter
- Gain level
- Image processing filter

(Note 1) If a decode limit time is set, the maximum decoding time for each scan condition is "decode limit time" x "number of scanning attempts".

Ex.) A scan flow when the scan condition rotation function is used



5.4.2. Scan Condition Rotation Order

■ Priority given to conditions with lower numbers

Scan conditions that are set to Enabled are cyclically set in ascending order of the condition number. Scan condition rotation orders will not be changed by performing scan trials.

■ Priority given to conditions that have been successfully read

Scan conditions that are set to Enabled are set according to the conditions succeeded in the previous scanning for the next scan. Scan condition rotation orders changes for each successful scan trial.

Ex.) If enabled scan conditions are #1/#2/#3/#4, and the #3 condition is successfully read
#1->#2->#3 (Successfully read)

(Prioritized by conditions with lower numbers) #1->#2->#3->#4-> #1->#2->...

(Prioritized by successfully scanned conditions) #3->#1->#2->#4-> #3->#1->...

The scan conditions are rotated in order shown above.

5.5. Scan Test

The scan test can be executed using the configuration tool (Scanner Setting F), or setting commands.

The test methods are as follows:

- Operation test by the configuration tool (Scanner Setting F)
- Scan test by a test command mode
- Scan test by key operation

5.5.1. Operation Test by the Configuration Tool

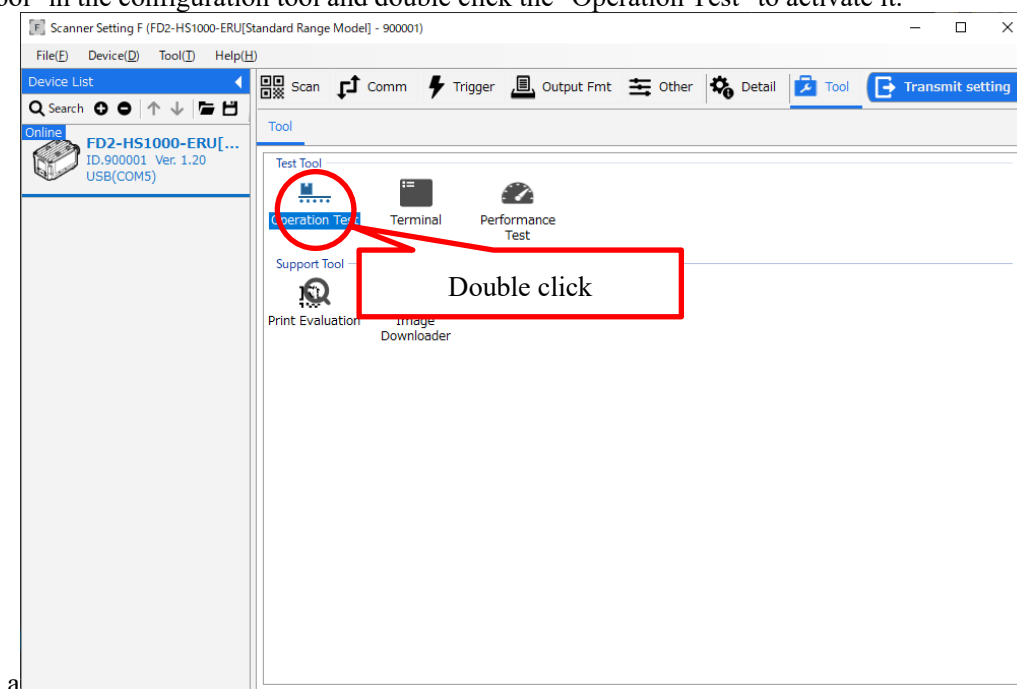
With the configuration tool, you can execute an operation test that scan while switching scan conditions.

Check items for the operation test are as follows.

Item	Description
Read data	Code data that has been successfully read
Scan time	A time between scan start and scan end
Scan count	The number of the successful read and read success rate from the start of the test
Decode rate	A decode rate from the start of the test

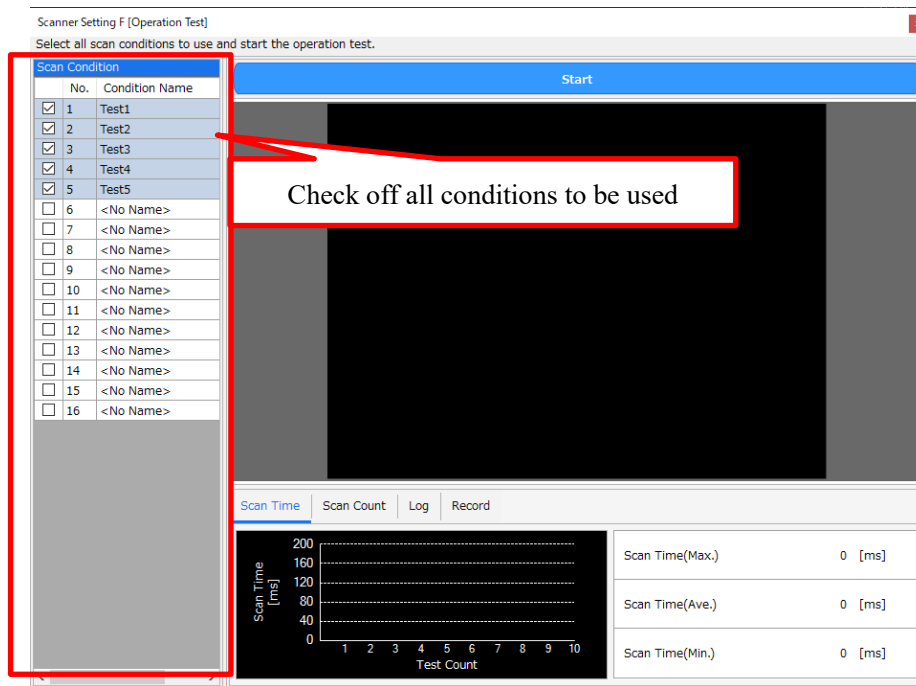
1. Activate the Operation Test in the "Tool."

Select the "Tool" in the configuration tool and double click the "Operation Test" to activate it.



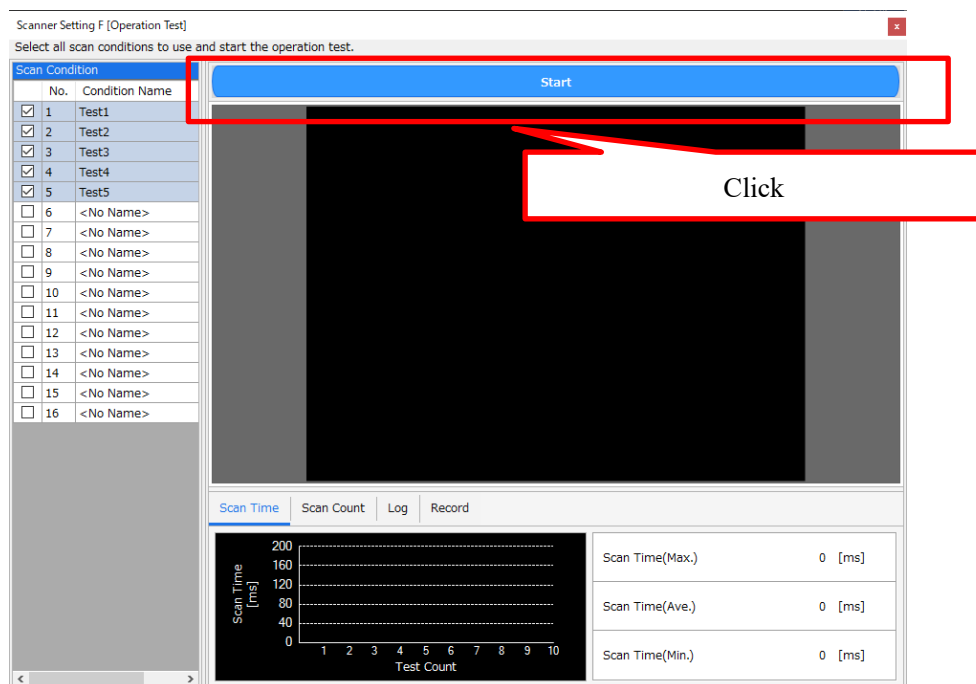
2. Select all scan conditions to be tested.

After activating the "Operation Test," select and check off the scan conditions to be tested.



3. Start the operation test.

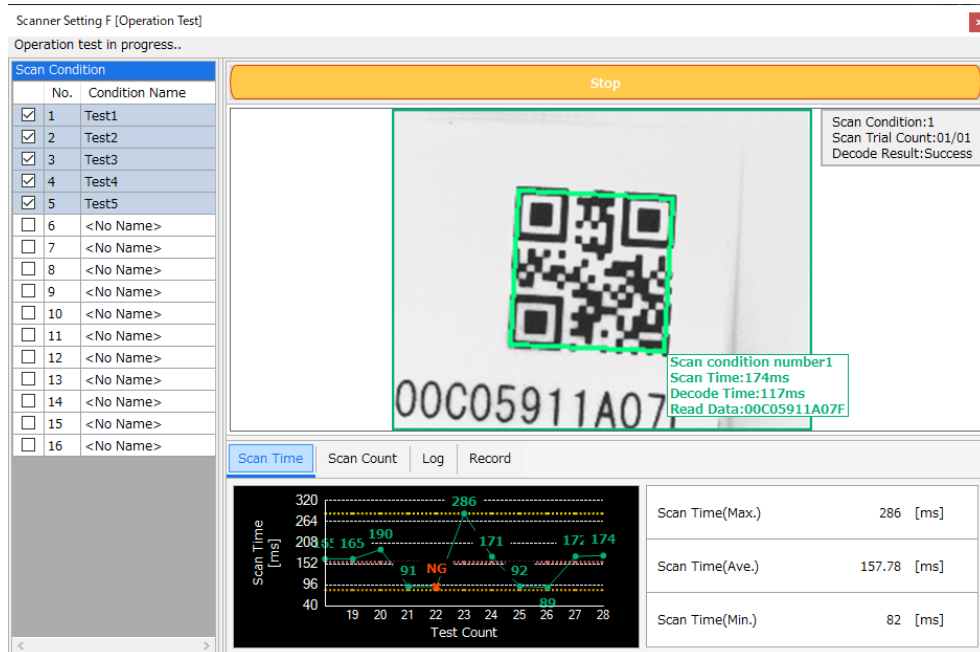
After selecting the scan conditions to be used for the test, click the "Start" button to start the operation test.



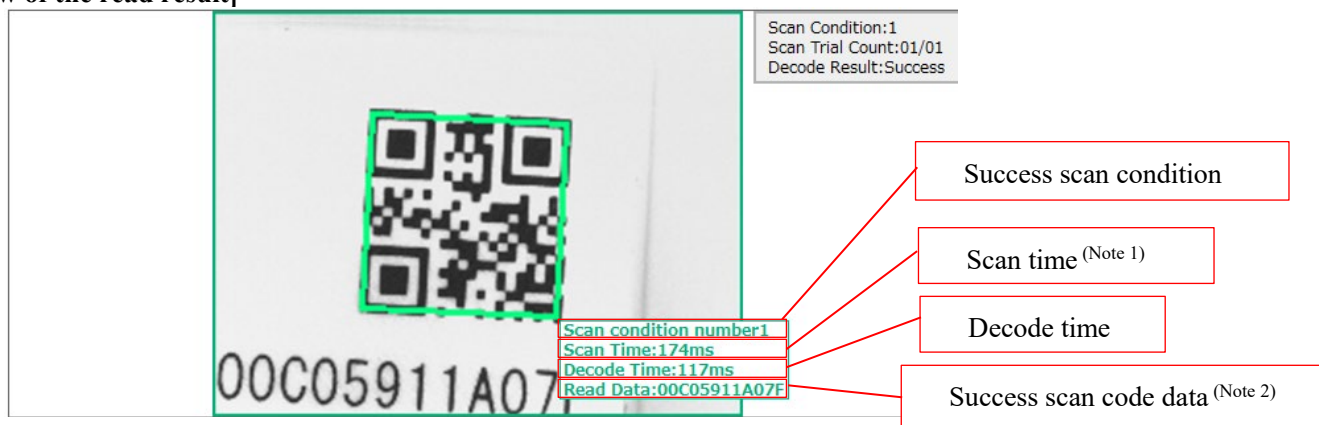
4. Review the test results.

Upon the start of the operation test, the test results appear as follows.

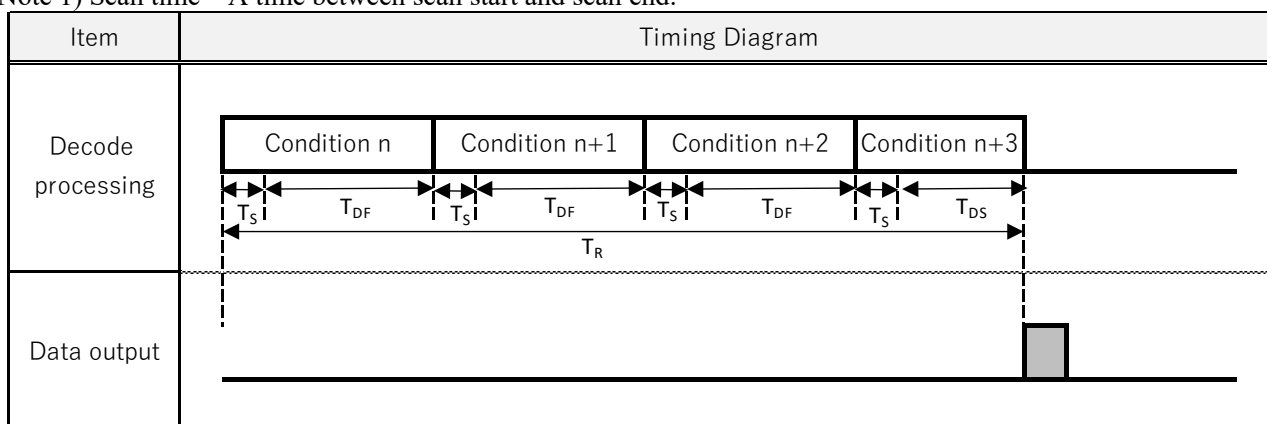
Review the read results.



[Review of the read result]



(Note 1) Scan time---A time between scan start and scan end.



T_s : Time for taking images

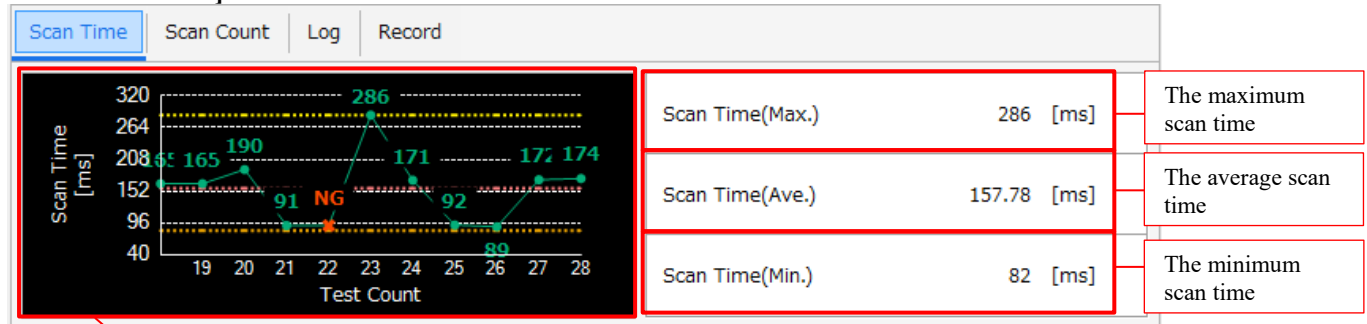
T_{DF} : Decode processing time when decoding fails

T_{DS} : Decode processing time when decoding succeeds

T_R : Scan time

(Note 2) Data of 20 bytes or more is omitted. For details about the read data, see the [Log check].

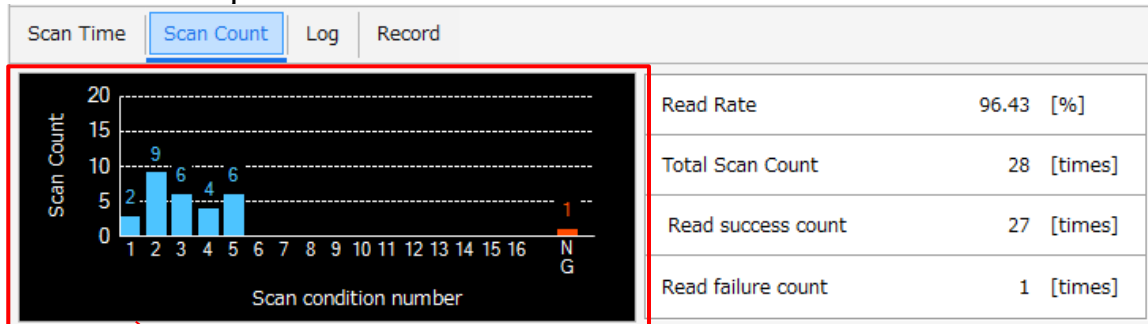
[Review of the scan time]



Scan times for the latest 10 operation tests

- Scan time
- Maximum scan time
- Average scan time
- Minimum scan time

[Review of the scan count]



Read success count by scan condition
NG: Read failure count

[Log check]

Operation test execution log

```

2021/12/23 14:33:32,Read success,00021/00021,100.00%, 91ms,0123456789012345678901234567890123
2021/12/23 14:33:33,Read failed,00021/00022, 95.45%, 337ms
2021/12/23 14:33:34,Read success,00022/00023, 95.65%, 286ms,0123456789012345678901234567890123
2021/12/23 14:33:34,Read success,00023/00024, 95.83%, 171ms,0123456789012345678901234567890123
2021/12/23 14:33:34,Read success,00024/00025, 96.00%, 92ms,0123456789012345678901234567890123
2021/12/23 14:33:35,Read success,00025/00026, 96.15%, 89ms,0123456789012345678901234567890123
2021/12/23 14:33:35,Read success,00026/00027, 96.30%, 172ms,0123456789012345678901234567890123
2021/12/23 14:33:35,Read success,00027/00028, 96.43%, 174ms,0123456789012345678901234567890123
2021/12/23 14:33:36,End the operational test ,Read Rate=96.43(27/28),Scan Time(Ave.)=157.78ms,Scan Time
(Max.)=286ms,Scan Time(Min.)=82ms
  
```

5.5.2. Scan Test by Test Mode Commands

A scan test can be performed by executing test mode commands from the host.
For the test mode command, refer to "14.3.2. Control command List."

Practical example of scan test using test mode commands

- [Prerequisite]
- The trigger type setting is "Command"
 - The trigger mode setting is "Continuous"
 - Response to the scan start/end commands is "Enabled"
 - If the header setting is "None," and the terminator setting is "CR"

■ If the trial count = 000 (infinity), and condition settings = 00 (rotation setting)

Transmission data	Response data
TESTON,000,00[CR] (Start the test mode)	TESTON,00000000[CR] (Command status = "00000000": Successfully processed)
TRGON[CR] (Trigger ON <Start scanning>)	TRGON,00000000[CR] (Command status = "00000000": Successfully processed)
Scanning is performed during this period	(Scan test output format) (Note 1)
Scanning is performed during this period	(Scan test output format) (Note 1)
Scanning is performed during this period	(Scan test output format) (Note 1)
TRGOFF[CR] (Trigger OFF <Stop scanning>)	TRGOFF,00000000[CR] (Command status = "00000000": Successfully processed)
TESTOFF[CR] (Stop the test mode)	TRGOFF,00000000[CR] (Command status = "00000000": Successfully processed)
(Note 1) For details, refer to [Scan test output format]	

[Scan test output format]

For the scan test, the read result output format is as follows ^(Note1).

[Read result]	[Read success count/ Accumulated count]	[Decode time]	[Scan condition number]	
	[Code information]	[Error correction count/ Total codeword count]	Code data	

(Note1) The contents of "8.1. Data Output Format" are not applied to the output format for the scan test.

(1) Read result

OK: Reading succeeded

NG: Reading failed

(2) Read success count/ Accumulated count

For the accumulated count, if the trigger mode is in the "continuous" mode, the accumulated count indicates the number of read operations performed after the start of a scan test. In the "single" mode, it indicates a trigger count. If the accumulated count reaches 999, the count is reset to 1.

(3) Decode time

The decode time is output in the unit of ms. If reading fails, [-] is output.

(4) Scan condition numbers

The scan condition number (1 to 16) that was used in scanning is output.

(5) Code information

This is valid only for the reading of QR code, MicroQR code, rMQR, SQRC, and DataMatrix.

For the QR code, MicroQR code, and SQRC, the model version, error correction level, and mask number are output.

For DataMatrix, and rMQR, the vertical cell, horizontal cell, and error correction level are output. For the other codes, [-] is output.

(6) Error correction count/ Total codeword count

The error correction count is output in units of codeword. Therefore, this value is not equal to the number of actual characters.

This is valid only for the reading of QR code, MicroQR code, rMQR, SQRC, and DataMatrix. For the other codes, [-] is output.

- An example of a scan test data output (which is a successful case where the QR code is read with the condition number #1)

[OK][6/10][60 ms][1][MODEL 2, V1, ECCM, M3][0001/0026]1234567890

.... [The read succeeded]
[Read success count: 6/accumulated count: 10]
[Decode time]
[Scan condition No.: #1]
[QR code is model 2, Ver 1, Error correction level is M, Mask number is 3]
[Error correction count is 1/Total codeword count is 26]
Decoded data is 1234567890

5.5.3. Scan Test by Key Operation

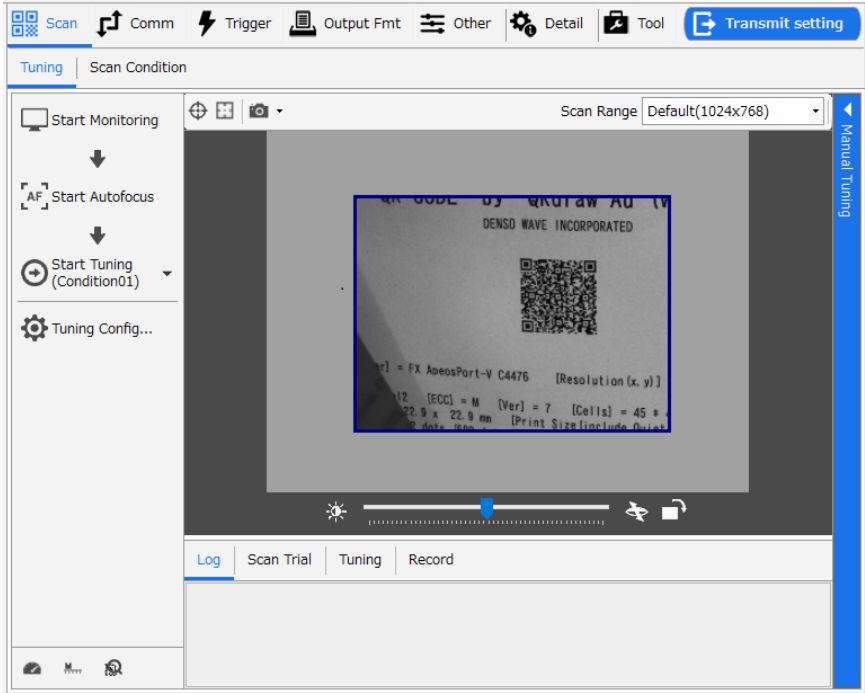
Use the keys while checking the information displayed on the display. See "13.3.6. Scan Test" for more information.

5.6. Scan Advanced Settings

5.6.1. Scan Range

The scan range provides two choices--1024 x 768 pix and 1600 x 1200 pix (full size). By default, the setting is 1024 x 768 pix. The scan range can be changed using the configuration tool.

[For 1024 x 768 pix scan range]



[For 1600 x 1200 pix (full size) scan range]



5.6.2. Scan Marker

You can change lighting settings of the scan marker, which is a guide for the placement of a read target code. The setting values are as follows.

Setting value	Description
Light OFF	The scan marker is always light OFF.
Light ON	The scan marker is always light ON.
Light ON only during scanning codes	The scan marker is light ON only during scanning.

5.6.3. Imaging Control

■ Polarizing filter

By enabling the polarizing filter, specular reflection of the LED light can be reduced. It is effective if a work to be read is a reflective material such as metal, and its specular reflection causes blown highlights, making no black and light contrast in read codes.

The polarizing filter can be set to enable or disable by scan condition.

■ Shutter

The shutter speed can be set within the range from 1 to 10,000 μ s.

If you change the shutter speed, there may be image blur or blown highlights in scanned images, making it impossible to read. If changing, you have to perform the operation test to check the scanning after making an adjustment according to the shutter speed that has been adjusted through the auto-tuning function.

For the operation test, refer to "5.5.1. Operation Test by the Configuration Tool".

■ Gain level

The gain can be set within the range from 0 (dark) to 18 (light).

If you change the gain, there may be image blur or blown highlights in scanned images, making it impossible read.

If changing, you have to perform the operation test to check the reading after making an adjustment according to the gain that has been adjusted through the auto-tuning function.

For the operation test, refer to "5.5.1. Operation Test by the Configuration Tool".

5.6.4. Lighting Control

■ Turning ON of the external light

The external light, which is synchronized with the Output terminal 2, can be set to turn ON while the scanner is taking images.

For setting the synchronous output signal to the Output terminal 2, refer to "10.2. Output Terminal".

5.6.5. Image Processing Filter Function

The scanner is equipped with the image processing filter function to identify poor contrast codes etched on the background having noise (e.g., scratches or uneven substrate). In addition, if cells in a dot pattern are arranged at large intervals, the function can reduce those intervals for better code identification.

Up to five image processing filters can be used in combination.

With the configuration tool or setting commands, you can enable/disable the image processing filter.

Filter type: Dilation in black pixels (erosion in white pixels), Erosion in black pixels (dilation in white pixels), smoothing, opening, and closing.

The number of filtering: 1 to 7 times

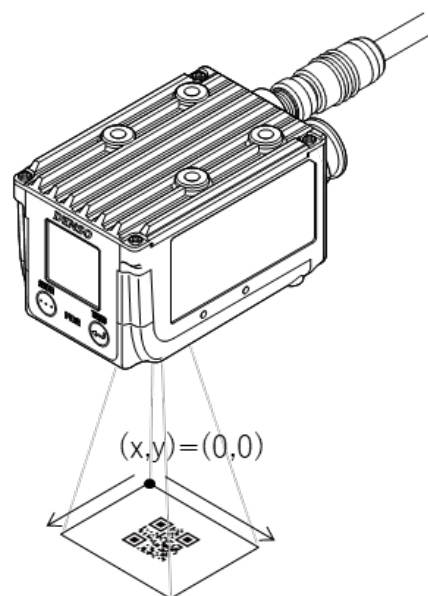
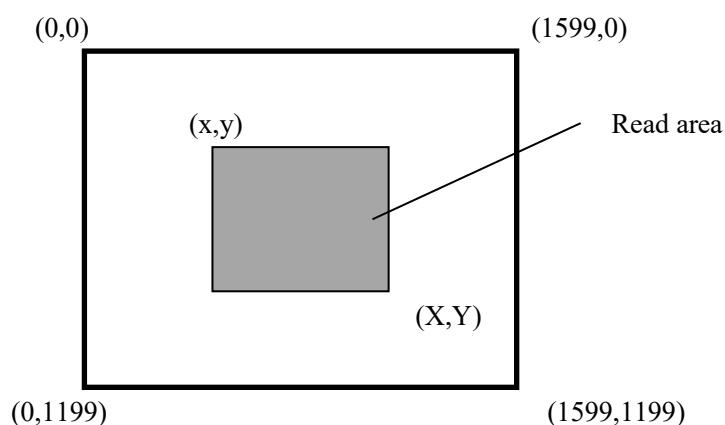
Filter type	Description
Dilation in black pixels (erosion in white pixels)	A process to replace a pixel of interest with corresponding neighborhood of the absolute black pixel.
Erosion in black pixels (dilation in white pixels)	A process to replace a pixel of interest with corresponding neighbourhood of the absolute white pixel.
Smoothing	A process to replace a pixel value of interest with the mean value of its neighbours.
Opening	By the combination of process from erosion in black pixels to dilation in black pixels, black noise can be removed.
Closing	By the combination of process from dilation in black pixels to erosion in black pixels, white noise can be removed.

(Note) When the image processing filter function is used, every scan takes 0.1 second longer than usual.

5.6.6. Read Area Designation

It is possible to read a taken image limited to a specified area. With the configuration tool and setting commands, you can enable or disable the read area designation, and set the read areas. The read area can be set with upper left and lower right coordinates of $x/Y = 0$ to 1599, $y/Y = 0$ to 1199, respectively.

Ex.) If the scan range is 1600 x 1200 pix (full size)



5.6.7. Decode Time Limit

You can set the decode time limit for the captured image ^(Note). The decode limitation time can be set using the configuration tool (Scanner Setting F) and setting commands. The decode limitation time can be set within the range from 10 to 9990 ms.

(Note) If the decoding process is completed within the time limit, the decoding process is terminated without waiting until the time limit.

5.6.8. Specifying the Reading of Codes

■ Black-and-white inverted code

The scanner can read black-and-white inverted codes. The black-and-white inversion is used when black and white are inverted under a certain lighting condition. The scanning of black-and-white normal code (black cells/bars on a white background) and black-and-white inverted code (white cells/bars on a black background) can be set using the configuration tool and or setting commands.

■ Mirror image 2D codes

If you enable the mirror image scanning with the configuration tool or setting commands, the scanner can read a mirror image 2D code as well as a normal image.

■ Structured append codes

QR Code symbology can split data into a maximum of 16 blocks and encode each of them into structured append Code symbol (model 1 or 2). Structured append code reading is possible only with the same Code mode.

In the reading of the structured append code, the scanner provides two modes, the edit mode where the scanner transmits all read data of the structured append codes at once, and the non-edit mode where the scanner transmits read data whenever it reads a code.

The edit mode and non-edit mode can be set using the configuration tool or setting commands.

<Edit mode>

The scanner accumulates and edits the read structured append codes on the scanner and transmits them.

The edit mode supports up to 16 blocks of the structured append codes. If the amount of data exceeds 8K bytes (full-width character is 2 bytes, half-width character is 1 byte), a read error will occur and the stored data will be cleared.

<Non edit mode>

The scanner transmits data each time as it reads a structured append code.

When the scanner scans a structured append code symbol, the Blue LED indicator blinks twice to notify that the scanner has switched to the structured append mode, and the data is transferred to the host.

Then when the scanner scans an individual message in a sequence of the structured append code, accordingly the Blue LED indicator blinks once, and the data is transferred to the host.

On the completion of scanning all of the structured append codes, the Blue LED indicator blinks triple to notify that the structured append mode is completed, and the data is transferred to the host.

In the middle of scanning, when the scanner detects that a code having a different parity bit, the scanner clears the data read being stored on itself, and the Blue LED flashes twice to notify that the scanner has renewed the structured append mode and the data is transferred to the host.

(Note) In the following cases, the scanner clears the past scanning status and terminates the structured append mode even if the mode is not completed.

- When the scanner reads a QR code which is not the structure append mode or a code which is not a QR code.
- When the field of view of the scanner deviates from a code more than 3 seconds.
- When the scanner goes standby (the state not in the trigger ON duration).

■ SQRC symbol

An SQRC symbol refers to a security QR Code symbol.

The SQRC symbol consists of public and nonpublic data. The nonpublic data can be read only when the encryption key configured in the scanner matches the one in the SQRC symbol. To read SQRC, it is required to enable the reading of SQRC.

(Note) When the reading of SQRC is enabled, it is necessary to set an action performed when encryption keys match and an action performed when encryption keys do not match by using the configuration tool or setting commands.

(1) Action performed when encryption keys match

- Send public data + nonpublic data
- Send only nonpublic data

(2) Action performed when encryption keys do not match

- Disable the reading
- Send only public data

SQRC reading requires configuration and encryption key beforehand with the SQRC configuration tool " SQRC Setting (496983-0150)" separately prepared.

6.1. Interface Transmitting Read Data

RS-232C or Ethernet interface can be selected as an interface to transmit read data. You can also use the USB-COM interface to confirm reading. Use the RS-232C or Ethernet interface for operation.

6.2. RS-232C Interface

RS-232C interface is an asynchronous serial interface.

Each communication condition can be set with the setting command and the configuration tool.

(1) Communication procedure

Either no protocol mode or ACK/NAK mode can be selected.

No protocol mode (Default)

When the transmission of CTS signal is enabled, read data are transmitted.

If the configuration tool is used, CTS signal monitoring time can be selected at an interval of 100ms in a range from 100 ms to 9.9 s. As for the CTS signal control, “To control/not to control” can be selected.

ACK/NAK mode ^(Note 1)

When the transmission of CTS signal is enabled, read data are transmitted and then processed according to the responses from a PC.

CTS signal monitoring time and ACK/NAK response confirmation time can be selected by the command and the configuration tool at an interval of 100 ms in a range from 100 ms to 9.9 s.

ACK: Normal end

NAK: Resending

(Note 1) The ACK/NAK mode is not operated when the command response is output.

(2) RTS signal procedure

Either the scanner ready mode or the data ready mode can be selected.

Scanner ready mode (Default)

RTS signal is continuously ON after the power is on and the scanner is enabled. To transmit a command to the scanner from the host, check that RTS signal is ON before transmitting.

Data ready mode

RTS signal is turned ON before the scanner transmits data and turned OFF after the data transfer finishes. To transmit a command to the scanner from the host, the status of RTS signal is not considered. Just after the scanner is powered on, however, there may be time when any commands cannot be received.

(3) Transfer speed

The transfer speed can be selected from 6 types in the range from 4800 bps to 115200 bps (default: 38400 bps).

(4) Transfer character

All transfer characters are ASCII codes and its format can be selected from the combination of items specified below:

Data bit:	7 bit, 8 bit (Default) ^(Note 2)
Parity:	EVEN, ODD, None (Default)
Stop bit:	1 bit (Default), 2 bit

(Note 2) If data contains Kanji-characters and binary data, the top bit is not transferred when the Data bit is set as 7 bit.

6.3. Ethernet Interface

For Ethernet interface, the following communication can be used.

- Socket communication
- EtherNet/IP communication

To use Ethernet interface, the following communication settings need to be implemented.

Item	Description
DHCP enabled/ disabled	Set whether to use DHCP. 0: DHCP disabled (Use static IP address.) 1: DHCP enabled
IP address	Sets IP address. (Note 1)(Note 3)
Subnet mask	Sets subnet mask. (Note 1)(Note 3)
Default gateway address	Sets IP address of the default gateway. (Note 2)(Note 3)

(Note 1) Specify the IP address not on the network environment in operation.

(Note 2) Specify the value on the network environment in operation.

(Note 3) Setting is required only when DHCP is disabled.

6.3.1. Socket Communication

Socket communication enables the command control and the read data transmission.

Protocols used for the command control and the read data transmission are as follows:

Item	Protocol	Description
Command control (Note 1)	UDP	Wait for the command request using the UDP socket. After receiving the command from the host, implement the response transmission to the host.
	TCP (Server)	Wait for the connection from the host using the TCP socket and establish the connection. After the connection, receive the command from the host and transmit the response to the host.
	TCP KeepAlive ^(Note 4)	Set whether to use KeepAlive when connecting to TCP.
Read data transfer (Note 2)	UDP	Transmit the read data using the UDP socket.
	TCP (Server)	Wait for the connection from the host using the TCP socket and establish the connection. After the connection, transmit the read data to the host.
	TCP (Client)	Connect to the stand-by device of the host using the TCP socket. After the connection, transmit the read data to the host.
	EtherNet/IP ^(Note 3)	Transmit the read data using EtherNet/IP.
	TCP KeepAlive ^(Note 4)	Set whether to use KeepAlive when connecting to TCP.

(Note 1) Protocols used for the command control can be changed with the setting command or the configuration tool. For setting items, refer to "Chapter 15 List of Set Items and Setting for Shipping".

(Note 2) Protocols used for the read data transmission can be changed with the setting command or the configuration tool. For setting items, refer to "Chapter 15 List of Set Items and Setting for Shipping".

(Note 3) For EtherNet/IP, refer to "6.3.2. EtherNet/IP."

(Note 4) If KeepAlive is enabled, the connection is discarded if there is no response to the KeepAlive packet for about 60 seconds in the established connection. After discarding the connection, if the scanner is a server, it is put into the connection waiting state again, and if the scanner is a client, it is reconnected to the host.

6.3.2. EtherNet/IP

6.3.2.1. Outline

EtherNet/IP is an industrial network advocated by ODVA, Inc.

EtherNet/IP communication can be used by sharing the network environment with the regular Ethernet communication.

EtherNet/IP communication has two types: the cyclic communication (Implicit message) that transmits and receives data periodically, and the message communication (Explicit message) that transmits and receives commands and responses at an optional timing.

Cyclic communication	:	Transmits and receives data through the memory map periodically. ^(Note 1)
Message communication	:	Communicates necessary commands and responses at the necessary timing. Commands and responses of message communication conform to specifications specified by ODVA, Inc.

(Note 1) For the communication cycle, refer to “6.3.2.2. Cyclic communication”.

6.3.2.2. EtherNet/IP Communication Specification

Cyclic communication (Implicit message)	Number of connections	8 ^(Note 1)
Message communication (Explicit message)	Number of connections	8 ^(Note 1)
	Responding message style	UCMM (Not connecting type) Class 3 (Connecting type)

(Note 1) Cyclic communication and message communication can establish up to eight connections.

6.3.2.3. Cyclic Communication

Through the cyclic communication, the scanner is controlled and read data are confirmed by the bit operation on the memory map. Memory map has the output memory map that controls the start of reading and the input memory map that delivers the reading result.

Memory map type	Instance ID	Size (byte)	Communication period (RPI)
Input (Result data)	0×64 (100)	118~1400	10 to 200 ms
Output (Control data)	0×65 (101)	118~1400	

Details of each memory map are as follows:

■ Output memory map (Instance ID: 0×65)

Transmits data from EtherNet/IP master device (such as PLC) to this product.

Offset	Outline	Bit															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Instruction order								Error clear						Read data buffer clear		Update permission of read data
1																Config file reading completion cleared	Reading completion cleared
2		Reset														Config file reading start	Start of reading
3		Scan condition No.															
4		Config file No.															
~																	
699																	

Control instructions

Offset	Bit	Item	Description	Value
0	0	Update permission of read data	Indicates presence/absence of read data. (Only when the data handshake ^(Note 1) enabled)	0 -> 1: Permission of writing read data in
0	2	Read data buffer clear	Clears read data buffer (Only when the data handshake ^(Note 1) enabled)	0 -> 1: Buffer Clear
0	8	Error clear	Clears the error state of the Input memory (Note 3).	0 -> 1: Clear
1	0	Reading completion cleared	Clears Input memory reading completion. And also, clears the data length of the read data and the read data in the Input memory.	0 -> 1: Clear
1	1	Config file reading completion cleared	Clears reading completion of the Input memory configuration file.	0 -> 1: Clear
2	0	Start of reading	Starts reading ^(Note 2)	0 -> 1: Starts reading 1 -> 0: Stops reading
2	1	Config file reading start	Starts reading a configuration file specified by a configuration file No. Reading is uninterruptible until it is completed.	0 -> 1: Starts reading
2	15	Reset	Resets the scanner. The Input memory BUSY becomes 1 during resetting. After reset is instructed, when the Input memory READY has become 1, restarting can be confirmed.	0 -> 1* RESET
3	-	Scan condition No.	If you specify a scan condition number and start scanning, the scanner reads data according to the specified scan condition.	0: Scan condition rotation operation 1 to 16: Scan condition numbers
4	-	Config file No.	Specifies a configuration file No. of the reading target.	1 to 8 The numbers other than shown above will cause an error at a reading start.

(Note 1) Data handshake: the function for controlling the update timing of read data.

(Note 2) When the Start of reading value changes from 0 to 1 (Starts reading)

Status Reading completed is cleared (0 is set).

(Note 3) When the error is cleared, the read data buffer and buffer over error are also cleared.

■ Input memory map (Instance ID: 0×64)

Transmits data from this product to EtherNet/IP master device (such as PLC).

Offset	Outline	Bit															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Status							Buffer over error	Error							Completed updating of read data	Available updating of read data
1																Config file reading completion	Reading completed
2		READY											IMGSAVE BUSY	READ BUSY	LOCK BUSY	TRG BUSY	BUSY
3																Config file reading error	Reading error
4											OUT3	OUT2	OUT1			IN2	IN1
5~11	Reserve																
12	Error	Reading error code (Numerical value)															
13		Config file reading error (Numerical value)															
14~28	Reserve																
29	Number of times	Number of read data acquisition (Numerical value)															
30~58	Reserve																
59	Data	Read data length															
60		Read data															
~ 699																	

Status

Offset	Bit	Item	Description	Value
0	0	Available updating of read data	Indicates existence or non-existence of read data (Only when the data handshake is enabled ^(Note 1))	0: No read data 1: Read data exists.
0	1	Completed updating of read data	Indicates that updating of read data is completed. (Only when the data handshake is enabled ^(Note 1))	1: Updating of read data is completed.
0	8	Error	Indicates that an error occurs. ^(Note 2)	0: No error 1: Error exists.
0	9	Buffer over error	Indicates that a read data buffer overflow occurs. ^(Note 3)	0: No error 1: Error exists.
1	0	Reading completed	Indicates that reading has completed.	0: 1: Reading has completed.
1	1	Config file reading completion	Indicates configuration file reading completion.	0: 1: Config file reading completion
2	0	BUSY	Indicates BUSY status.	0: 1: BUSY status
2	1	TRG BUSY	Indicates trigger ON status.	0: 1: BUSY status
2	2	LOCK BUSY	Indicates locked status.	0: 1: BUSY status
2	3	READ BUSY	Indicates reading state.	0: 1: BUSY
2	4	IMGSAVE BUSY	Indicates image transmission state	0: 1: BUSY
2	15	READY	Indicates readable (READY) status.	0: 1: READY status
3	0	Reading error	Indicates reading error status.	0: 1: Reading error
3	1	Config file reading error	Indicates config file reading error status.	0: 1: Config file reading error
4	0	IN 1	Indicates input terminal 1 status.	^(Note 2)
4	1	IN 2	Indicates input terminal 2 status.	^(Note 2)
4	4	OUT1	Indicates output terminal 1 status.	^(Note 2)
4	5	OUT2	Indicates output terminal 2 status.	^(Note 2)
4	6	OUT3	Indicates output terminal 3 status.	^(Note 2)

(Note 1) Data handshake: Function for controlling the update timing of read data

(Note 2) Input and output terminal statuses conform to the specifications in “10.1. Input Terminal” and “10.2. Output Terminal”.

(Note 3) If the number of read data in the buffer exceeds 8, a buffer over error will occur.

(Note 4) This function operates only when the output of the failure notification data is permitted.

Read completion is set to 1 when either of the following conditions is met:

- 1) On read success
- 2) One-shot operation time elapses (One-shot operation setting: Permitted)
- 3) When the reading start value of the instruction instruction changes from 1 to 0 (read wait)

(Note 5) The error is set to 1 when a buffer over error occurs.

Error

Offset	Bit	Item	Contents	Value
12	-	Reading error code	Indicates the detailed code of an error that occurred while reading. ^(Note 1)	2-byte numerical value ^(Note 2)
13	-	Config file reading error	Indicates detailed error code when configuration file reading error occurs. ^(Note 1)	2-bytes number ^(Note 2)

(Note 1) For detailed codes, refer to “14.5. Command Status”.

(Note 2) According to the EtherNet/IP specifications, the values are treated in little endian.

Number of times

Offset	Bit	Item	Contents	Value
29	-	Number of times	Indicates the number of read data acquisition.	2-byte numerical value ^(Note 1)

(Note 1) According to the EtherNet/IP specifications, the values are treated in little endian.

Data

Offset	Bit	Item	Contents	Value
59	-	Read data length	Indicates the length of the byte of read data	2-byte numerical value ^(Note 1)
60 - 249	-	Read data	Indicates data when reading.	Byte data ^(Note 2)

(Note 1) According to the EtherNet/IP specifications, the values are treated in little endian.

(Note 2) For the data contents, refer to “8.1. Data Output Format”.

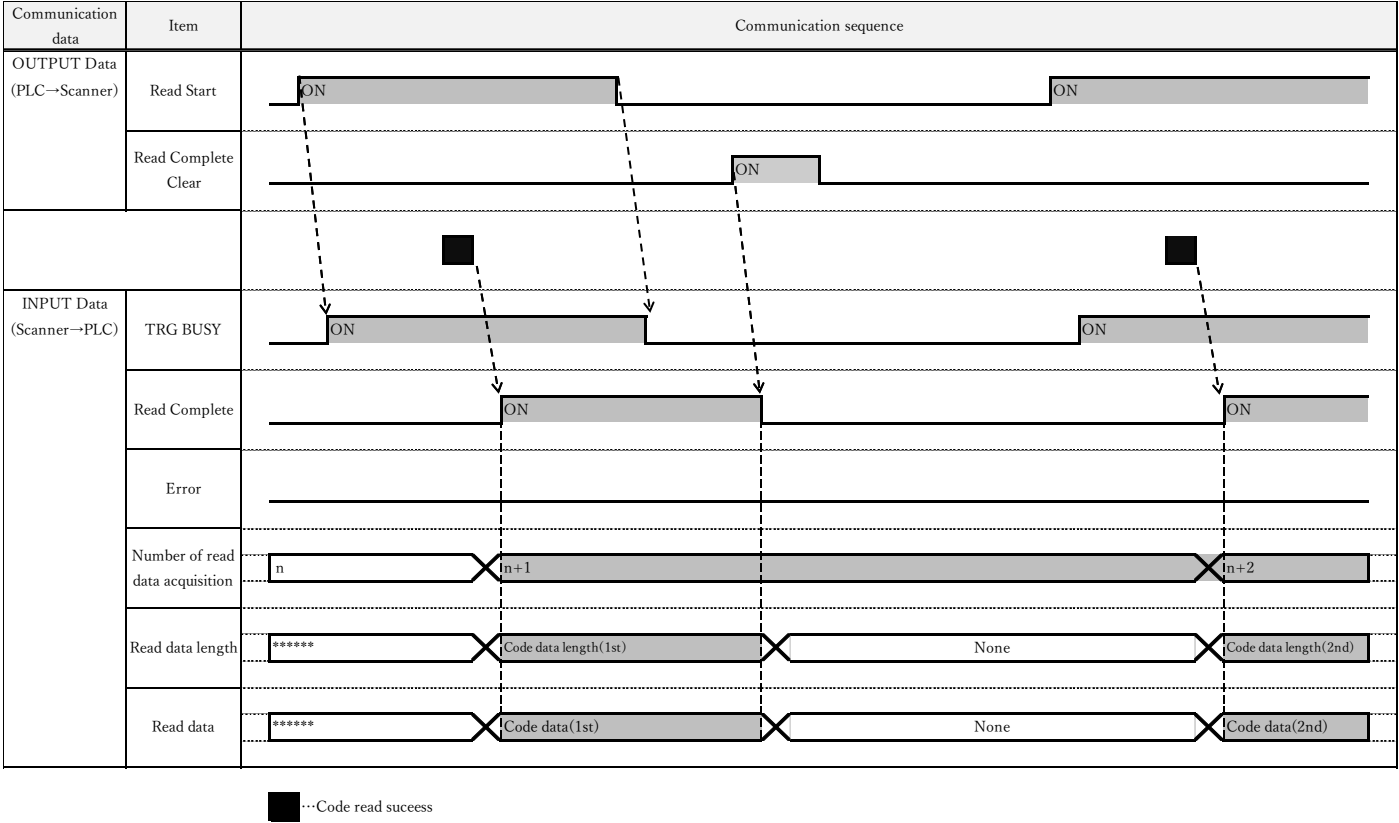
However, “Header/Terminator” and “Data Length” are not output.

■ Other settings

Item	Description
Buffer clear at start of reading	By enabling buffer clear at start of reading, you can clear the read data buffer at the start of reading. Refer to “7.5. Triger ON Duration” for the timing to start reading.
Operation by instruction order during initial communication	When the operation by instruction order during initial communication is set to disable, in the first cyclic communication after the power is turned on, even if there is an instruction order such as a start of reading, this instruction order is not operated.

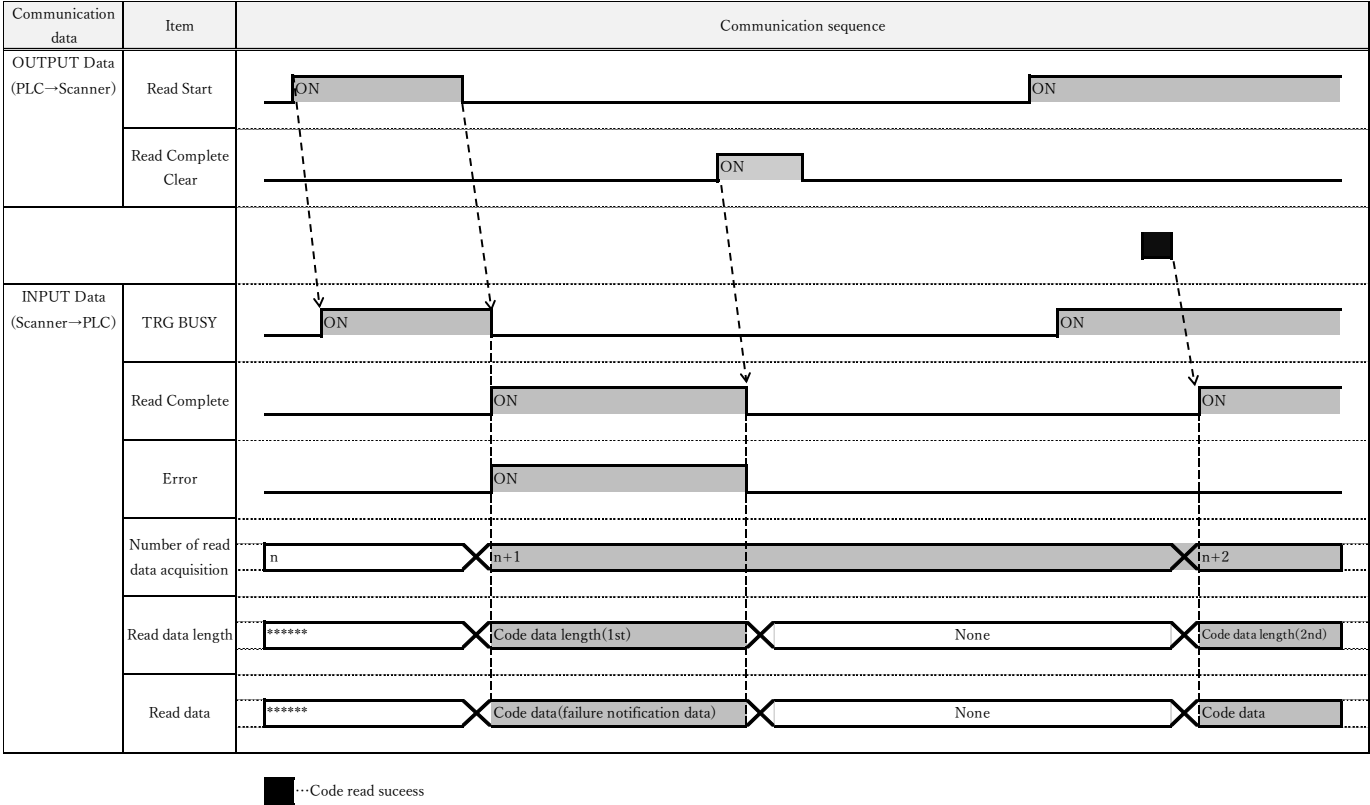
[1] Communication example: Success scan

Trigger mode: Single, Data output timing: Asynchronous mode,
Data handshake: Disabled, Failure notification data output: Enabled



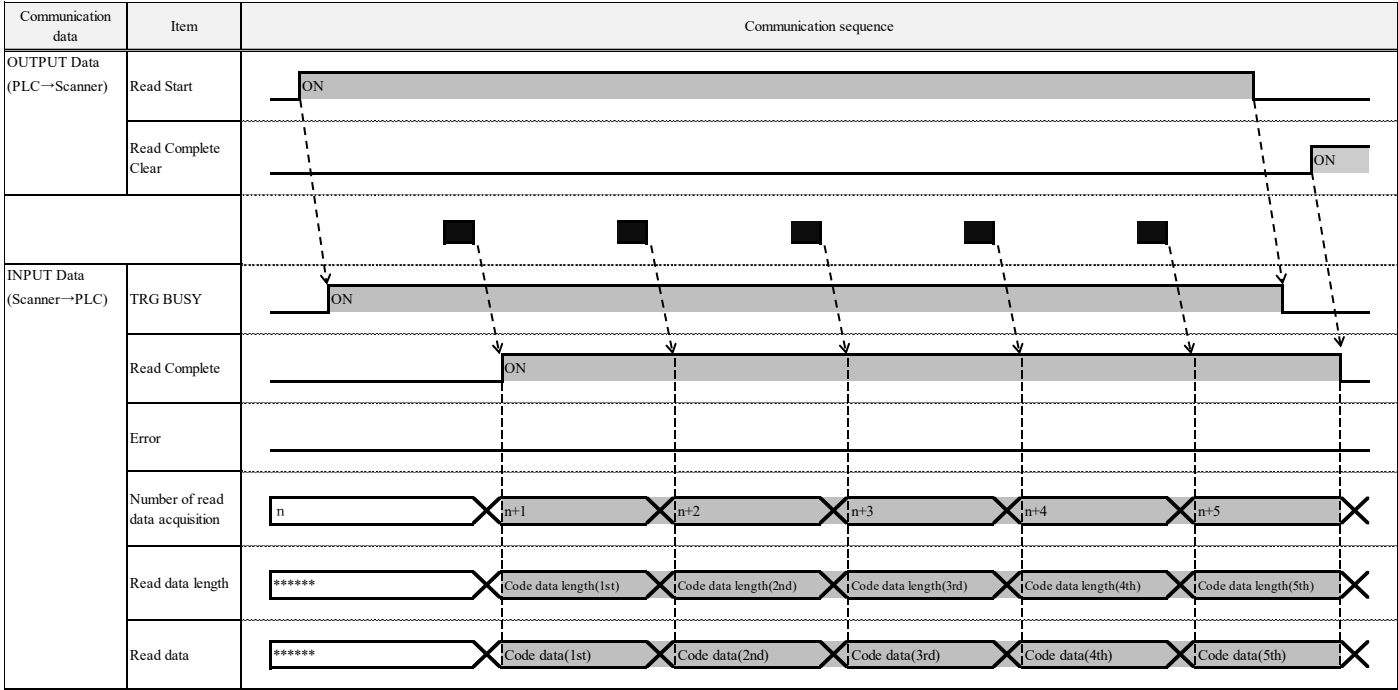
[2] Communication example: Failed scan

Trigger mode: Single, Data output timing: Asynchronous mode,
Data handshake: Disabled, Failure notification data output: Enabled



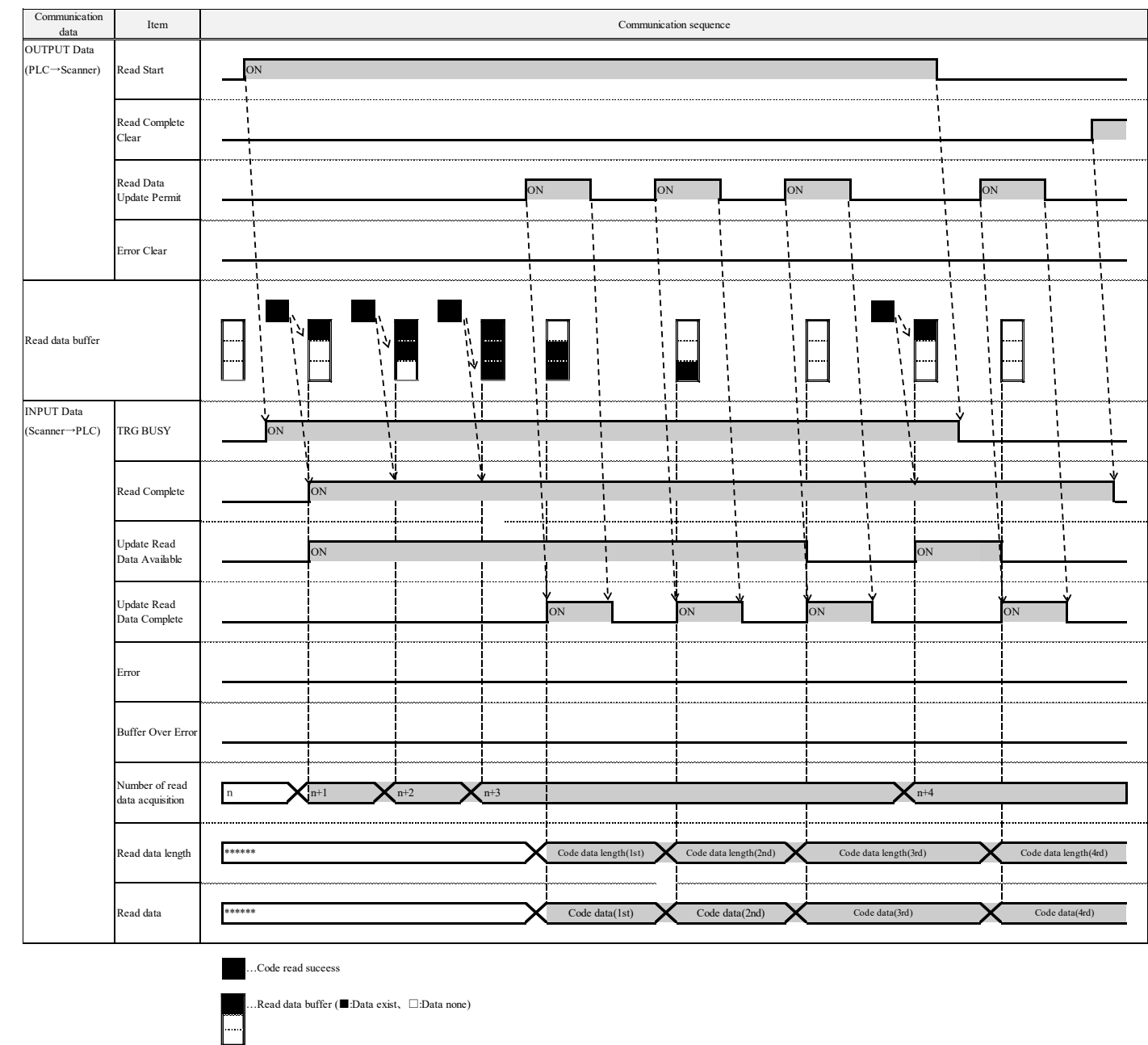
[3] Communication example: Continuous scan (Data handshaking disabled)

Trigger mode: Continuation, Data handshake: Disabled



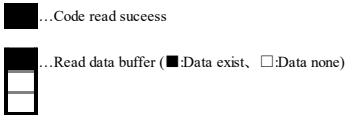
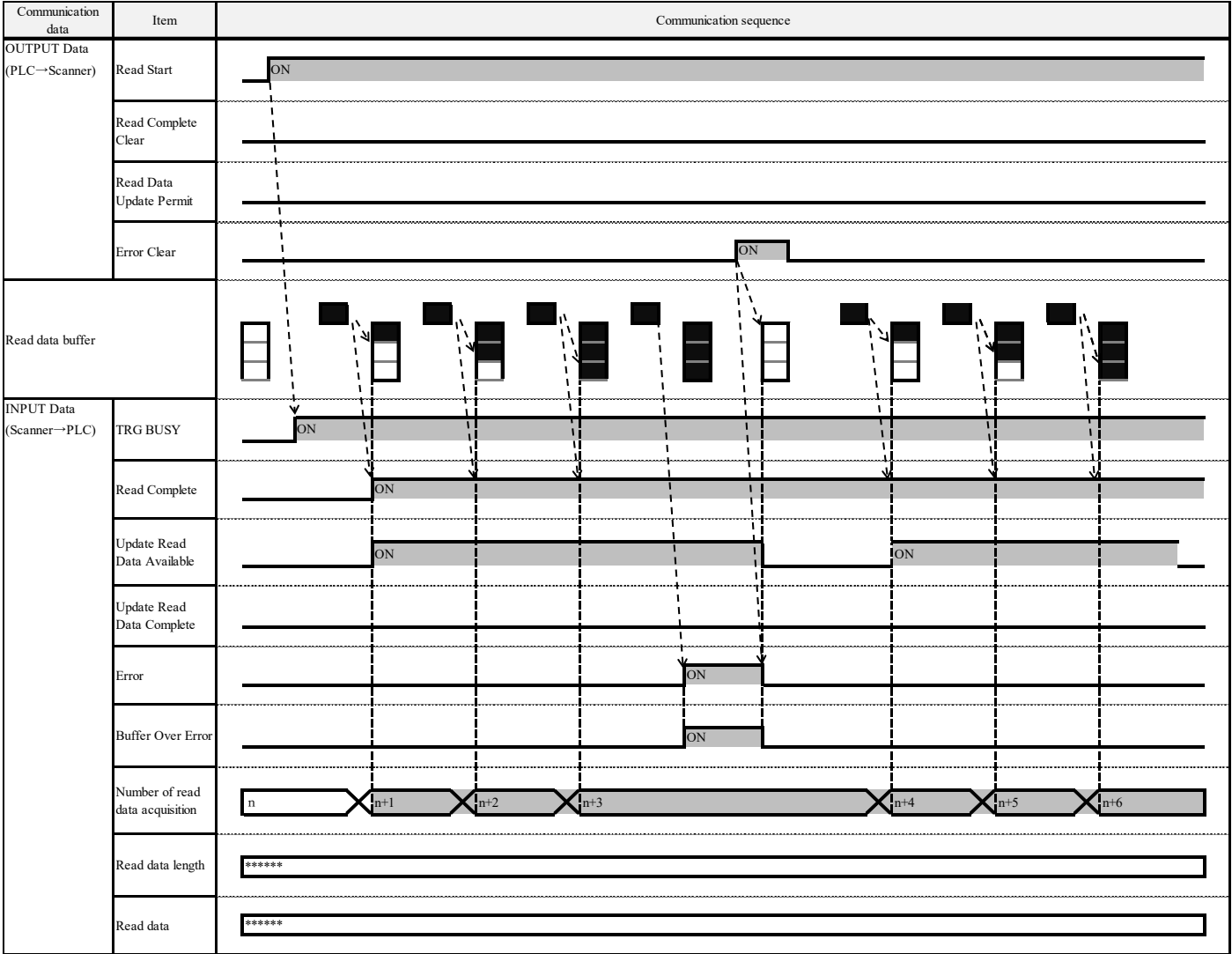
[4] Communication example: Continuous scan (Data handshaking enabled)

Trigger mode: Continuation, Data handshake: Enabled

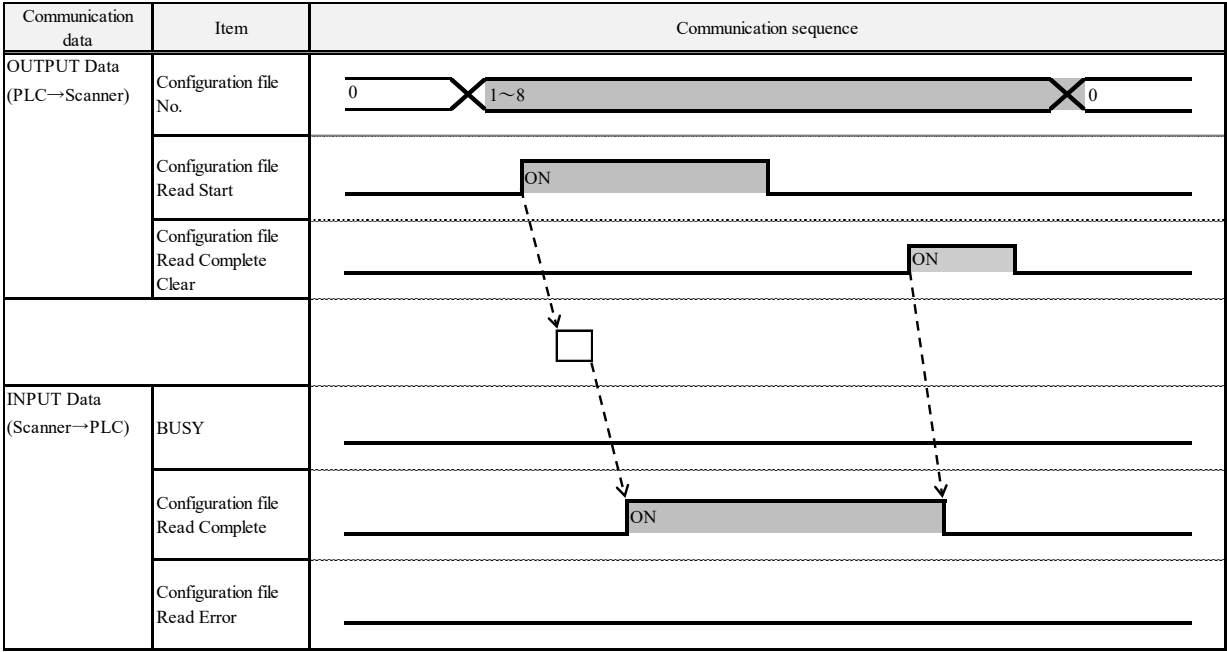


[5] Communication example: Continuous scan (Data handshaking enabled), when buffer over error occurs

Trigger mode: Continuation, Data handshake: Enabled



[6] Communication example: Switching the configuration file



 ...update configuration

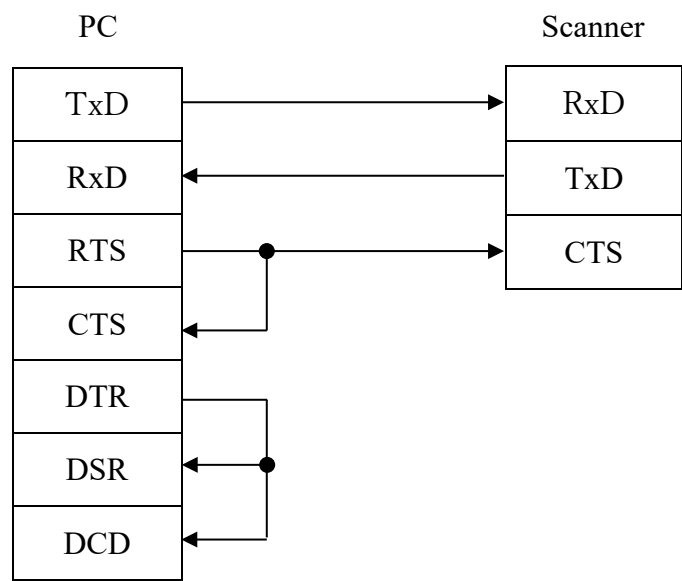
6.4. USB-COM Interface

Installing the dedicated Active USB-COM port driver to the PC allows the USB-COM interface to operate in communications applications using the conventional serial port.

Communications protocol can be set with the configuration tool or setting commands.

■ Notes for use

- In such a case, reboot the PC, open the Device Manager, and check the COM port number actually assigned by OS before use.
- If you want to use two or more communications processors (software) or scanners concurrently on your PC, be sure to assign a unique COM port number to each of them.
- If the PC switches to the suspend mode when any communications software is running and recovers from that suspend mode, the software may freeze in some PCs. Quit and restart the software.
- It is not necessary to make settings such as transmission speed, data bits, parity, and stop bits (which are required for communications software using a conventional serial port) since the USB interface ignores those settings. The flow control should be set to “Hardware (RTS/CTS)” or “None.”
- The virtual COM port on the PC and the scanner are connected with each other as shown below.



(1) Communication procedure

Either no protocol mode or ACK/NAK mode can be selected.

No protocol mode (Default)

When the transmission of CTS signal is enabled, read data are transmitted.

If the configuration tool is used, CTS signal monitoring time can be selected at an interval of 100ms in a range from 100 to 9900 ms. As for the CTS signal control, “To control/not to control” can be selected.

ACK/NAK mode ^(Note 1)

When the transmission of CTS signal is enabled, read data are transmitted and then processed according to the responses from a PC.

CTS signal monitoring time and ACK/NAK response confirmation time can be selected by the command and the configuration tool at an interval of 100 ms in a range from 100 to 9900 ms.

ACK: Normal end

NAK: Resending

(Note 1) The ACK/NAK mode is not operated when the command response is output.

7.1. Trigger Type

The start or end of reading can be instructed by the input terminal or the command.

You can select which of the scan start or end instructions using the Input terminal or setting commands.

Instruction of reading \ Trigger type	Input terminal	Command
Start reading	Signal ON	Trigger ON command
End reading	Signal OFF	Trigger OFF command

7.2. Trigger Mode

The trigger mode has two types: single mode and continuous mode.

Either single or continuous mode can be selected using the configuration tool and setting commands.

(1) Single

The mode to implement one reading in the duration from the instruction to start reading to the instruction to end reading. When processing of one reading is completed, reading ends.

(2) Continuous

The mode to implement reading processing repeatedly in the duration from the instruction to start reading to the instruction to end reading.

7.3. One-shot Operation

One-shot operation is the operation of continuing reading for the specified time from the start of reading (when the trigger is turned on) according to the reading starting instruction. After the one-shot operation time elapses, reading ends automatically.

7.4. Trigger Input Delay Time

The delay time from when the start of reading is instructed to when the reading starts (the trigger is turned on) can be set. Delay time can be set from 0 to 999 ms.

7.5. Triger ON Duration

Trigger ON duration of each trigger setting is as specified below:

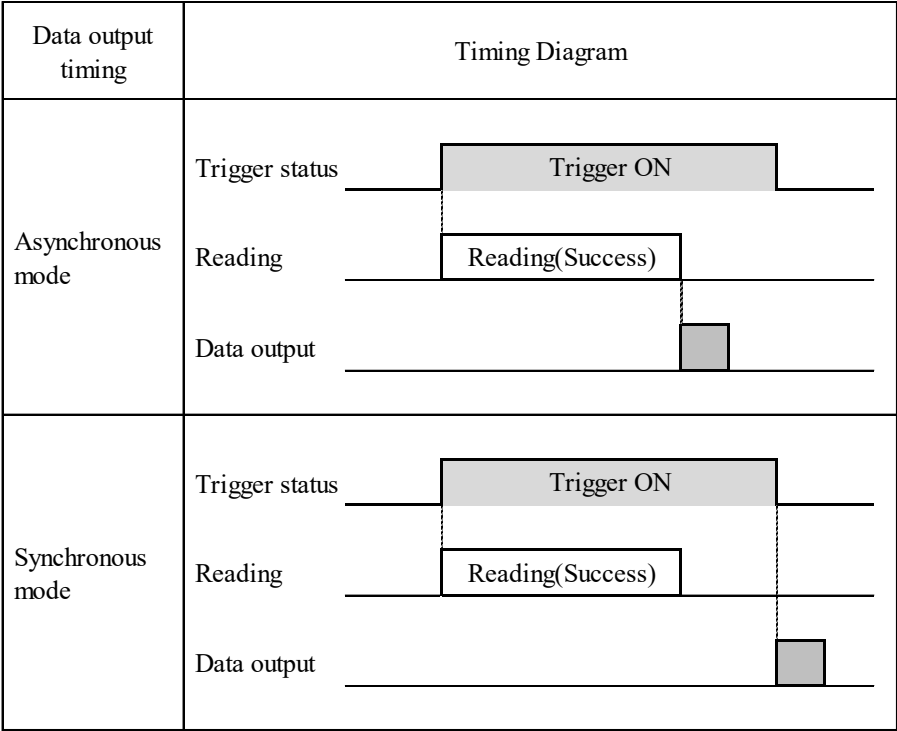
Trigger type	One-shot operation	Timing Diagram
Input terminal	Invalid	Input terminal Trigger status $t_C + t_{TRIG}$ Trigger ON
	Valid	Input terminal Trigger status One-shot operation time $t_C + t_{TRIG}$ Trigger ON
Command	Invalid	Command Trigger status Trigger ON command Trigger OFF command t_{TRIG} Trigger ON
	Valid	Command Trigger status One-shot operation time t_{TRIG} Trigger ON One-shot operation time t_{TRIG} Trigger ON

t_C : Chattering eliminating time
 t_{TRIG} : Trigger input delay time

7.6. Data Output Timing

The data output timing to transfer data to the host after completing reading has two modes: synchronous mode in which read data are output when the trigger ON duration ends, and asynchronous mode in which data are output immediately after the reading succeeds during the trigger ON duration.

If the trigger mode is the continuous mode, it is always asynchronous mode.

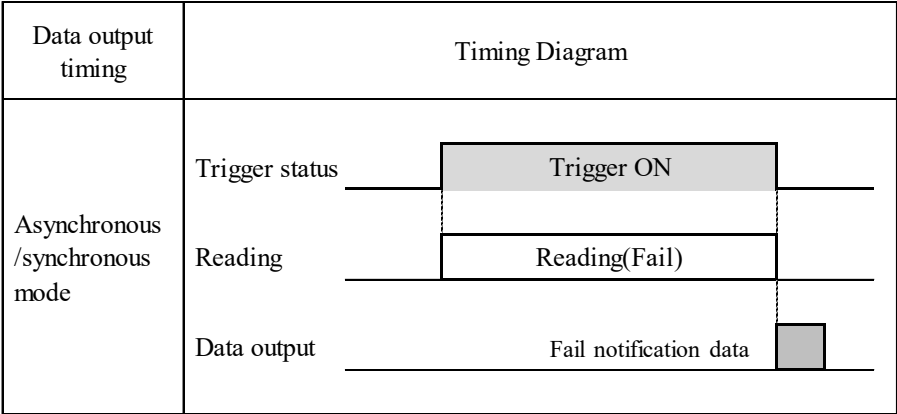


(Note) For the trigger ON duration, refer to “7.5. Triger ON Duration”.

7.7. Failure Notification Data Output

Failure notification data, which transfers information that reading failed at the end of the trigger ON duration, can be output. If the trigger mode is the continuous mode, the failure notification data is not output.

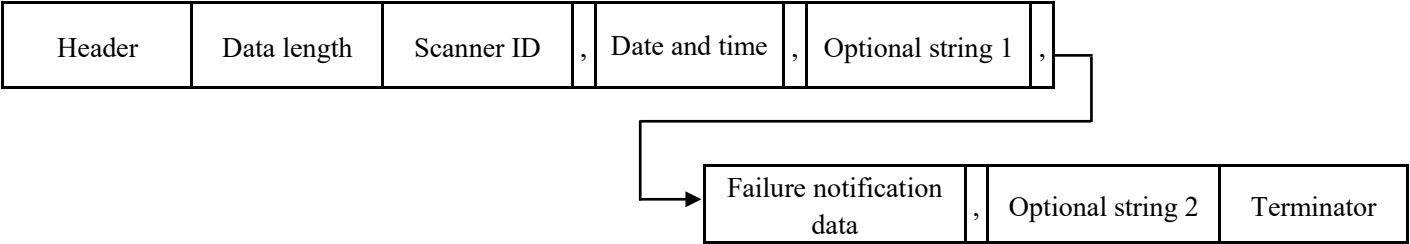
With the configuration tool or setting commands, you can set whether to output of failure notification data and a failure notification character. By default, the failure notification data character is “ERROR.”



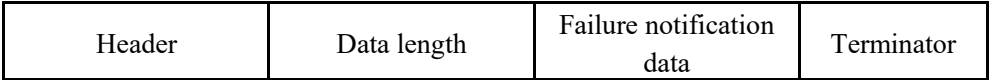
(Note 1) For the trigger ON duration, refer to “7.5. Triger ON Duration”.

Failure notification data output formats are as shown below.

Failure notification data (When the application of output format settings is enabled): Output format



Failure notification data (When the application of output format settings is disabled) : Output format



7.8. Double-read Prevention for The Same Code

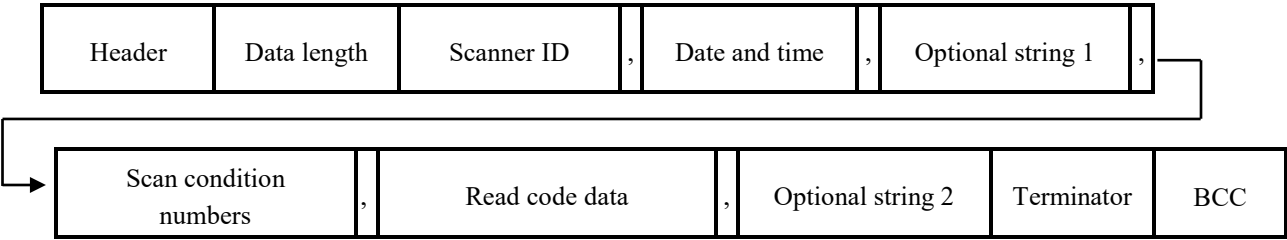
Under continuous scan mode is used, double-read prevention is intended to ensure that the same code is transmitted only once to the host when a code repeatedly enters the scanner field of view.

As a result, to read the same code again after successful code reading, excluding such times as when the scanner is instructed to begin scanning with trigger mode, an operation known as “double-read prevention release” is required that involves either aiming the scanner field of view at a blank surface for over a set length of time, or removing the scanner field of view from the code for over a set length of time. If, however, the scanner is aimed at an unreadable, poor-quality code for over a set length of time, double reading may occur during the interval following the set length of time.

The double-read prevention time can be selected using the configuration tool (Scanner Setting F) and setting commands.

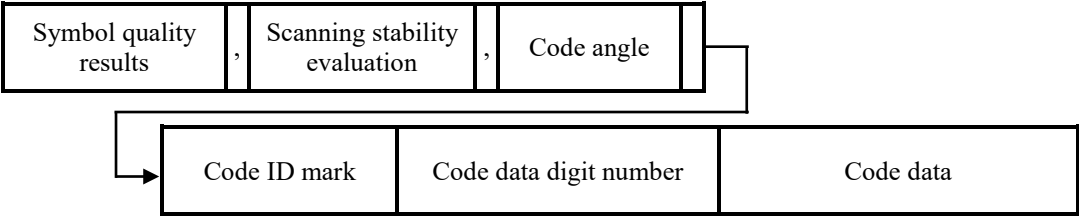
8.1. Data Output Format

Read data: Output format



Read code data formats are as shown below.

Read code data



Commas (,) in the above communication format are separators.

8.1.1. Common Item

[1] Header/terminator

Output the specified header or terminator.

Values that can be specified with the header or the terminator vary according to the communication interface. Details are as follows:

RS-232C/USB-COM interface:

The following combination can be specified.

Header: None/STX

Terminator: CR/ETX/LF/CR+LF

Ethernet interface:

Header: Fixed with "STX" (*1)

Terminator: Fixed with "ETX" (*1)

(*1) Do not output in case of EtherNet/IP.

[2] Data length

As for the data length, the length from the data next to the data length to the data before the terminator is output.

Data length format is 4 bytes (big endian) of hexadecimal number.

Values that can be specified according to whether or not to output the data length vary according to the communication interface.

Details are as follows:

RS-232C/USB-COM interface:

The following values can be specified.

Not to output/ To output (*2)

Ethernet interface:

Fix with "To output." (*3)

(*2) Do not output when the header is set as "None."

(*3) Do not output in case of EtherNet/IP.

e.g.) When the data length is 300 bytes, output "0x00 0x00 0x01 0x2C."

[3] Scanner ID

Output the specific scanner ID (serial number) that is set as the factory default with 6-digit number.

[4] Date and time

Output the date and time when data are output.

The output format is as follows:

YYYYMMDDhhmmss

YYYY : Year

MM : Month

DD : Day

hh : Hour

mm : Minute

ss : Second

[5] Optional string 1/2

Output the combination (8 bytes max.) of the set ASCII characters (00h to FFh).

[6] Reading condition number

Output the reading condition number when reading.

[7] Separator

As a separator, none, comma, and optional ASCII characters (00h to FFh) can be specified.

[8]BCC

The EX-OR of the output data is taken from the next header to the terminator, and 1 byte is output in binary code.

If the data length is allowed to be output, the EX-OR from the data length to the terminator is taken and 1 byte is output in binary code.

However, if none is specified in the header, BCC is not output.

8.1.2. Read Code Data

[1] Symbol quality result

Symbol quality results are output.

The symbol quality result shall be alphabetic [A, B, C, D, F] or numeral characters.

With the configuration tool or setting commands, you can set whether to output a symbol quality result.

For the output format of the symbol quality result, refer to “11.1.2. Symbol Quality Result Output Format.

[2] Scanning stability

Scanning stability is output.

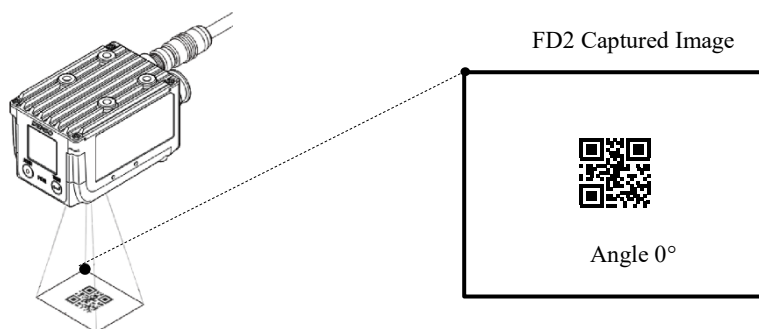
The output format for the scanning stability shall be a 3-digit number from "000" to "100."

With the configuration tool or setting commands, you can set whether to output scanning stability.

[3] Code angle

A QR code ^(Note 1) rotation angle is output in a 3-digit number.

As shown in the figure below, the rotation angle is set to 0° based on the angle at which the angle without the finder pattern is at the lower right of the captured image, and is output clockwise every 10° ^(Note 2).



(Note 1) Only QR code supports code angle output. Unsupported code outputs "---."

(Note 2) Angles are output as 000, 010, 020,..., 340, 350.

[4] Code ID mark

A code ID mark is output.

A code ID mark is a character for identifying a code system.

With the configuration tool or setting commands, you can set whether to output a code ID mark.

As shown in the table below, a code ID mark can be selected from a combination of the code ID mark type (Type 1, Type 2, Type 3, or Type 4) and output mode (combination, or separation).

You can also select a combination of ASCII characters (00h to FEh) (up to 4 bytes) set as a user selection.

Combination of code ID mark type and output mode (1/4)

Code Type			Code ID mark			
			Type 1		Type 2	
			Combination	Separation	Combination	Separation
2D code	QR code		Q		Q	
	QR code (structured append mode)	Edit mode	Q		Q	
		Non-edit mode	S		S	
	Micro QR code		Q		Q	
	rMQR		Q		Q	
	SQRC		Q		Q	
	MaxiCode		X		X	
	PDF417		Y		Y	
	Micro PDF417		Y		Y	
	DataMatrix	Square	Z		Z	
		Rectangle	Z		Z	
Barcode	UPC-A		A		A	
	UPC-E		C		E	
	EAN-13		A		F	
	EAN-8		B		FF	
	Interleaved 2 of 5(ITF)		I		I	
	Code39		M		M	
	Code39 Full ASCII		M		M	
	Codabar (NW-7)		N		N	
	Code128		K		K	
	GS1-128		W		W	
	Code93		L		L	
	GS1 DataBar(RSS) ^(Note 4)		R		R	

Combination of code ID mark type and output mode (2/4)

Code Type			Code ID mark			
			Type 1		Type 2	
			Combination	Separation	Combination	Separation
GS1 Composite	GS1 DataBar CC-A	GS1 DataBar	V	R	V	R
	GS1 DataBar CC-B	CC-A, CC-B	None	Y ^(Note 1)	None	Y ^(Note 1)
	UPC-A CC-A, UPC-A CC-B	UPC-A	V	A	V	A
		CC-A, CC-B	None	Y ^(Note 1)	None	Y ^(Note 1)
	EAN-13 CC-A, EAN-13 CC-B	EAN-13	V	A	V	F
		CC-A, CC-B	None	Y ^(Note 1)	None	Y ^(Note 1)
	UPC-E CC-A, UPC-E CC-B	UPC-E	V	C	V	E
		CC-A, CC-B	None	Y ^(Note 1)	None	Y ^(Note 1)
	EAN-8 CC-A, EAN-8 CC-B	EAN-8	V	B	V	FF
		CC-A, CC-B	None	Y ^(Note 1)	None	Y ^(Note 1)
	GS1-128 CC-A, GS1-128 CC-B, GS1-128 CC-C	GS1-128	V	W	V	W
		CC-A, CC-B, CC-C	None	Y ^(Note 1)	None	Y ^(Note 1)

Combination of code ID mark type and output mode (3/4)

Code Type			Code ID mark			
			Type 3		Type 4 (Note 2)	
			Combination	Separation	Combination	Separation
2D code	QR code		P01		]Qm	
	QR code (structured append mode)	Edit mode	P01		]Qm	
		Non-edit mode	P01		S (Note 3)	
	Micro QR code		P01		Q (Note 3)	
	rMQR		P01		Q (Note 3)	
	SQRC		P01		Q (Note 3)	
	MaxiCode		P02		]Um	
	PDF417		X		]L0	
	Micro PDF417		X		]L0	
	DataMatrix	Square	P00		]dm	
		Rectangle	P00		]dm	
Barcode	UPC-A		A		]X0	
	UPC-E		A		]X0	
	EAN-13		A		]E0	
	EAN-8		A		]E4	
	Interleaved 2 of 5 (ITF)		F		]Im	
	Code39		B		]Am	
	Code39 Full ASCII		B		]Am	
	Codabar (NW-7)		C		]Fm	
	Code128		D		]Cm	
	GS1-128		K		]C1	
	Code93		E		]G0	
	GS1 DataBar (RSS) (Note 4)		R		]e0	

Combination of code ID mark type and output mode (4/4)

Code Type			Code ID mark			
			Type 3		Type 4 ^(Note 2)	
			Coupling	Separating	Coupling	Separating
GS1 Composite	GS1 DataBar ^(Note 4) CC-A	GS1 DataBar	T	R	]e0	
	GS1 DataBar ^(Note 4) CC-B	CC-A, CC-B	None	X ^(Note 1)	None	
	UPC-A CC-A	UPC-A	T	A	]X0	
	UPC-A CC-B	CC-A, CC-B	None	X ^(Note 1)	]e0 ^(Note 1)	
	EAN-13 CC-A	EAN-13	T	A	]E0	
	EAN-13 CC-B	CC-A, CC-B	None	X ^(Note 1)	]e0 ^(Note 1)	
	UPC-E CC-A	UPC-E	T	A	]X0	
	UPC-E CC-B	CC-A, CC-B	None	X ^(Note 1)	]e0 ^(Note 1)	
	EAN-8 CC-A	EAN-8	T	A	]E4	
	EAN-8 CC-B	CC-A, CC-B	None	X ^(Note 1)	]e0 ^(Note 1)	
	GS1-128 CC-A	GS1-128	T	K	]e0	
	GS1-128 CC-B GS1-128 CC-C	CC-A, CC-B, CC-C	None	X ^(Note 1)	None	

(Note 1) The code ID mark with this note is included in the code data.

(Note 2) Code ID mark Type 4 is a code ID mark system conforming to AIM USA's "Guidelines on Symbology Identifiers." The trailing "m" differs depending on the output data format of the barcode system as shown in the following table.

Ex.)]I3]: Flag Character (ASCII 5Dh)

I: Code Character (Interleaved 2 of 5)

3: Modifier Character (the following table)

For example, if Interleaved 2 of 5 is set with reading enabled with C/D and without C/D output, the code ID mark will be "] I3."

(Note 3) For non-compliant code ID marks, use the same character as Type 1.

(Note 4) The description of GS1 DataBar includes all of "GS1 DataBar Omnidirectional, GS1 DataBar Truncated, GS1 DataBar Limited, GS1 DataBar Expanded, GS1 DataBar Stacked, GS1 DataBar Expanded Stacked, and GS1 DataBar Stacked Omnidirectional."

Modifier Character (AIM Symbology Identifiers)

Code Type		Modifier Character	Option
2D code	QR code	0	Model 1
		1	Model 2
		3	Model 2 (The first character from the start code is FNC1)
		5	Model 2 (The first character from the start code is FNC1 second)
	MaxiCode	0	mode 4, mode 5
		1	mode 2, mode 3
	DataMatrix	1	ECC-200
		2	ECC-200 (first or fifth character from start code is FNC1)
		3	ECC-200 (the second or sixth character from the start code is FNC1)
Barcode	Interleaved 2 of 5 (ITF)	0	Reading without C/D
		1	Reading with C/D, with C/D transmission
		3	Reading with C/D, without C/D transmission
	Code39 Code39 Full ASCII	0	Reading without C/D
		1	Reading with C/D, with C/D transmission
		3	Reading with C/D, without C/D transmission
	Codabar (NW-7)	0	Reading without C/D
		1	Reading with C/D, with C/D transmission
		3	Reading with C/D, without C/D transmission
	Code128	0	FNC1 is not included in the first and second characters from the start code
		2	The second character from the start code is FNC1

(Note) C/D : Check digit

[5] Code data digit number

The number of digits for read code is output.

The format of the digit number is 4 digits (4 bytes) / 2 digits (2 bytes) ^(Note).

With the configuration tool or setting commands, you can set whether to output the number of digits, use the configuration tool or setting commands.

For UPC and EAN codes (excluding GS1-128), however, the number of digits is omitted.

(Note) If the number of digits exceeds 99, 99 is output.

[6] Code data

Data of read code is output.

9.1. Data Edit Function

The editing data is a method which allows you to edit and output the data of read codes in the specified format.

The editing data can be set using the configuration tool.

The editing data mode includes the data extraction mode, GTIN format conversion, and the ADF script mode.

9.1.1. Data Extraction

For codes specified in “Code type” of the applicable condition, data specified by the range from the extraction start digit to the extraction end digit is output in the data communication format specified in the scanner.

The extraction start position, extraction end position, and applicable condition can be set as shown in the following patterns.

■ Extraction conditions

Extraction conditions	Choices
Code type	Any code
	QR Code(QR code, Micro QR code, rMQR)
	PDF417
	Data Matrix
	MaxiCode
	UPC-A/EAN-13
	UPC-E
	EAN-8
	Code 128
	GS1-128
	Codabar (NW-7)
	Code 39
	Code 93
	Interleaved 2of5(ITF)
	GS1 DataBar
	GS1 Composite
Transmitting data, regardless of results	Enabled/disabled

If the scanner fails to extract a data string or reads a code not specified by "Code type" when the "Data transfer regardless of error result" is permitted, then it outputs the data read as is without editing.

■ Extraction start and end positions

Extraction start position	Extraction end position
Head position	nth position
Tail position	
nth position	Tail position
	By n positions from the start position
	nth position

The n can be 1 through 9999. Note that if the extraction start position is specified as nth position, the extraction end position should be equal to or greater than the extraction start position.

(Ex.) If the read code is the QR code, read data is 12345, and the following conditions apply

【Code ID mark: Type1, Header: STX, Terminator: ETX, Number-of-digits transmission: 4 digits enabled, and Transmission of BCC: Disabled】

Applicable condition	Extraction start position	Extraction end position	Output data
Code type: QR Data transfer regardless of error result: Prohibit	Head position	3rd position	[STX]Q0003123[ETX]
	Tail position	3rd position	[STX]Q0003345[ETX]
	1st position	Tail position	[STX]Q000512345[ETX]
	1st position	By 3 positions	[STX]Q0003123[ETX]
	2nd position	4th position	[STX]Q0003234[ETX]
	Head position	6th position	Error
	Tail position	6th position	Error
	6th position	Tail position	Error
	6th position	By 10 positions	Error
	1st position	6th position	Error
Code type: QR Data transfer regardless of error result: Permit	Head position	6th position	[STX]Q000512345[ETX]
	Tail position	6th position	[STX]Q000512345[ETX]
	6th position	Tail position	[STX]Q000512345[ETX]
	6th position	By 10 positions	[STX]Q000512345[ETX]
	1st position	6th position	[STX]Q000512345[ETX]
Code type: PDF417 Data transfer regardless of error result: Prohibit	Invalid if specified	Invalid if specified	Error
Code type: PDF417 Outputting data, regardless of results: Enabled	Invalid if specified	Invalid if specified	[STX]Q000512345[ETX]

9.1.2. GTIN Format Conversion

If conversion to GTIN (Global Trade Item Number) format is enabled, UPC-A, UPC-E, EAN-13, EAN-8, and Interleaved 2 of 5 (14-digit) data can be output in GTIN format. It also allows GS1 DataBar (RSS), GS1-128 (EAN-128) data in GTIN format to output in EAN-13 format (product code format).

(Note) When the data edit mode (data extraction mode or ADF script mode) is used, the GTIN conversion is disabled.

(1) Conversion from UPC, EAN, and Interleaved 2 of 5 (14-digit) format to GTIN format

The conversion provides two choices--16- and 14- digit GTIN formats. The former adds the Application Identifier (AI) "01" and Package Indicator PI as a prefix, and the latter, a PI only.

If GTIN format conversion is enabled, however, the output formats available for UPC-A, UPC-E, EAN-13, and EAN-8 do not apply.

UPC-A

- Data read

0 S X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 C/D

0: Padding character for adjustment of the data length

S: Number system character

- Conversion to 16-digit GTIN format (AI "01" and PI added)

0 1 PI 0 S X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 C/D (*1)

(*1) Check digits are calculated again and transferred regardless of the transmission specified.

- Conversion to 14-digit GTIN format (PI added)

PI 0 S X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 C/D (*2)

(*2) Check digits are calculated again and transferred regardless of the transmission specified.

UPC-E

- Data read

0 X1 X2 X3 X4 X5 X6 C/D

0: Padding character for adjustment of the data length

- Conversion to 16-digit GTIN format (AI "01" and PI added)

X6=0-2 0 1 PI 0 0 X1 X2 X6 0 0 0 0 X3 X4 X5 C/D (*1)

X6=3 0 1 PI 0 0 X1 X2 X3 0 0 0 0 X4 X5 C/D (*1)

X6=4 0 1 PI 0 0 X1 X2 X3 X4 0 0 0 0 X5 C/D (*1)

X6=5-9 0 1 PI 0 0 X1 X2 X3 X4 X5 0 0 0 0 X6 C/D (*1)

(*1) Check digits are calculated again and transferred regardless of the transmission specification.

- Conversion to 14-digit GTIN format (PI added)

X6=0-2 PI 0 0 X1 X2 X6 0 0 0 0 X3 X4 X5 C/D (*2)

X6=3 PI 0 0 X1 X2 X3 0 0 0 0 X4 X5 C/D (*2)

X6=4 PI 0 0 X1 X2 X3 X4 0 0 0 0 X5 C/D (*2)

X6=5-9 PI 0 0 X1 X2 X3 X4 X5 0 0 0 0 X6 C/D (*2)

(*2) Check digits are calculated again and transferred regardless of the transmission specified.

EAN-13

- Data read
P1 P2 P3 X1 X2 X3 X4 X5 X6 X7 X8 X9 C/D
Pn: Prefix characters
- Conversion to 16-digit GTIN format (AI "01" and PI added)
0 1 PI P1 P2 P3 X1 X2 X3 X4 X5 X6 X7 X8 X9 C/D^(*1)
(*1) Check digits are calculated again and transferred regardless of the transmission specified.
- Conversion to 14-digit GTIN format (PI added)
PI P1 P2 P3 X1 X2 X3 X4 X5 X6 X7 X8 X9 C/D^(*2)
(*2) Check digits are calculated again and transferred regardless of the transmission specified.

EAN-8

- Data read
P1 P2 P3 X1 X2 X3 X4 X5 C/D
Pn: Prefix characters
- Conversion to 16-digit GTIN format (AI "01" and PI added)
0 1 PI 0 0 0 0 P1 P2 X1 X2 X3 X4 X5 C/D^(*1)
(*1) Check digits are calculated again and transferred regardless of the transmission specified.
- Conversion to 14-digit GTIN format (PI added)
PI 0 0 0 0 P1 P2 X1 X2 X3 X4 X5 C/D^(*2)
(*2) Check digits are calculated again and transferred regardless of the transmission specified.

Interleaved 2 of 5 (14 digits)

- Data read
X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13 C/D
- Conversion to GTIN format (AI "01" added)
0 1 X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13 C/D^(*1)
(*1) Check digits are calculated again and transferred regardless of the transmission specified.

(2) Conversion from GS1 DataBar (RSS)/GS1-128 (EAN-128) in GTIN format to EAN/JAN format

GS1 DataBar or GS1-128 (EAN-128) data read in the GTIN format (16-digit with AI "01") can be converted to the EAN/JAN format if the conversion is enabled. The conversion provides two choices--13- or 14-digit EAN/JAN formats. The former trims the Application Identifier (AI) "01" and Package Indicator PI, and the latter, a PI only.

GS1 DataBar (RSS)

- Data read
0 1 PI X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 C/D
PI: Package indicator
- Conversion to 13-digit EAN format (AI "01" and PI trimmed)
X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 C/D ^(*)
(*1) Check digits are calculated again and transferred regardless of the transmission specified. If the transmission of a code ID mark is enabled in the scanner, the code ID mark of EAN-13 is transferred.
- Conversion to 14-digit EAN format (AI "01" trimmed)
PI X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 C/D

GS1-128 (EAN-128)

- Data read
0 1 PI X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13 C/D
PI: Package indicator
- Conversion to 13-digit EAN format (AI "01" and PI trimmed)
X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13 C/D ^(*)
(*1) Check digits are calculated again and transferred regardless of the transmission specified.
If the transmission of a code ID mark is enabled in the scanner, the code ID mark of EAN-13 is transferred.
- Conversion to 14-digit EAN format (AI "01" trimmed)
PI X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13 C/D

9.1.3. ADF Script

The ADF script refers to a simple program language designed for editing of data read. It enables the following functions.

- (1) Extracting data that is fixed or variable in length
- (2) Supporting Application Identifiers (AIs) in GS1-128 (EAN-128), GS1 DataBar (RSS) and GS1 Composite symbols
- (3) Collating data for verification
- (4) Outputting same data repeatedly
- (5) Performing four arithmetic operations including residue calculation, e.g., transformation of units
- (6) Substituting data
- (7) Comparing character strings

The ADF script can be created using the configuration tool (Scanner Setting F). To set the created ADF script to the scanner, transmit it to the scanner using the configuration tool (Scanner Setting F).

For the specifications and instructions for use of the ADF script, refer to the "ADF Script User's Guide."

(Note) The ADF script cannot be used together with the GTIN format conversion or the other data edit modes (e.g., data extraction) at the same time.

9.2. Collating Data for Verification

The data verification mode verifies the code data read against the master data stored in the scanner and reports the match status with data output.

For the master data used for the comparison, data within the verification range should be registered as preset data. The preset data can be registered using the configuration tool (Scanner Setting F) and setting commands.

The data to be verified against the master data are as follows.

- Data output format (Refer to "8.1. Data Output Format") Code data
- Contents before data editing
- GS1 is the content after conversion
- Contents of divided data (including parity) if consolidation is not edited

For the output of verification results, the following four patterns can be set using the configuration tool (Scanner Setting F) and setting commands.

- "OK"/"NG" output
- "OK" + Read data/"NG" output
- "OK"/"NG" + Read data output
- "OK" + Read data/"NG" + Read data output

Additionally, it is possible to output the OK signal as an output signal when the two data successfully match, and to output the NG signal when the two data do not match.

9.2.1. Registering Preset Data

The preset data should be set using commands or the configuration tool (Scanner Setting F). Up to 99-digit can be registered. The registered master data will be retained even when you turn OFF the power to the scanner. You can clear the data using the configuration tool (Scanner Setting F) or setting commands. After you clear the master data registered in the scanner, you should set new data in the scanner.

9.2.2. Setting the Verification Start Position

There are two verification methods: in one method, preset data and read data are all compared and verified, and in the other method, preset data and read data are partly compared and verified. For the method where preset data and read data are partly compared and verified, it is required to specify the verification start position and the verification end position.

Preset data	Verification start position		End position	Read data (data to be verified)	Verification result
	Designation	Start position			
345	Disabled	-	-	345	Verification match
345	Disabled	-	-	3456	Verification mismatch
345	Enabled	3	3	00345	Verification match
345	Enabled	3	3	00345678	Verification match
345	Enabled	3	3	00346	Verification mismatch
345	Enabled	3	3	0034	Verification mismatch

9.3. Image Save Function

Image save is a function to save images taken by the scanner in certain locations, and the storage locations can be selected from "Save in image memory or Send to image save tool." Images to be saved are the ones where the image processing filter in the scan condition is not applied to. With the "configuration tool (Scanner Setting F)," you can set to enable or disable saving image, and the storage location.

9.3.1. Setting the Storage Location: Save to the Image Memory

If the storage location is set to the image memory, taken images are saved to the image memory. With the configuration tool, the saved images can be acquired from the image memory. The images in the image memory will be cleared when the power to the scanner is turned OFF or reset.

The taken images can be acquired using the configuration tool. Therefore, for instance, if the scanner saves a read failure image, this helps in analyzing the cause of read failure.

If the storage location is the "Save to image memory," settings in the list below can be set using the configuration tool and setting commands.

Setting item	Setting value	Description
Save condition	Save all images	Save all images.
	Save read failure images	Save all read failure images.
	Save read success images	Save all read success images.
	Save the first image	Save only the first image within a trigger ON duration.
	Save the last image (Note 1)	Save only the last image within a trigger ON duration.
	Save the first failure image	Save the first read failure image within a trigger ON duration.
	Save the last failure image	Save the last read failure image within a trigger ON duration.
Save mode	Cyclic	It is always overwritten in the image memory of No. 01 to No. 15. (Note 2) The start memory number cannot be specified.
	Memory designation	It is always overwritten and saved in the specified image memory of No. 01 to No. 15.
Memory No.	1 to 15	A memory number to be saved in when the "save mode" is in the "Memory designation." mode.

(Note 1) Read failure images will be saved only when the trigger mode is in the "single" mode.

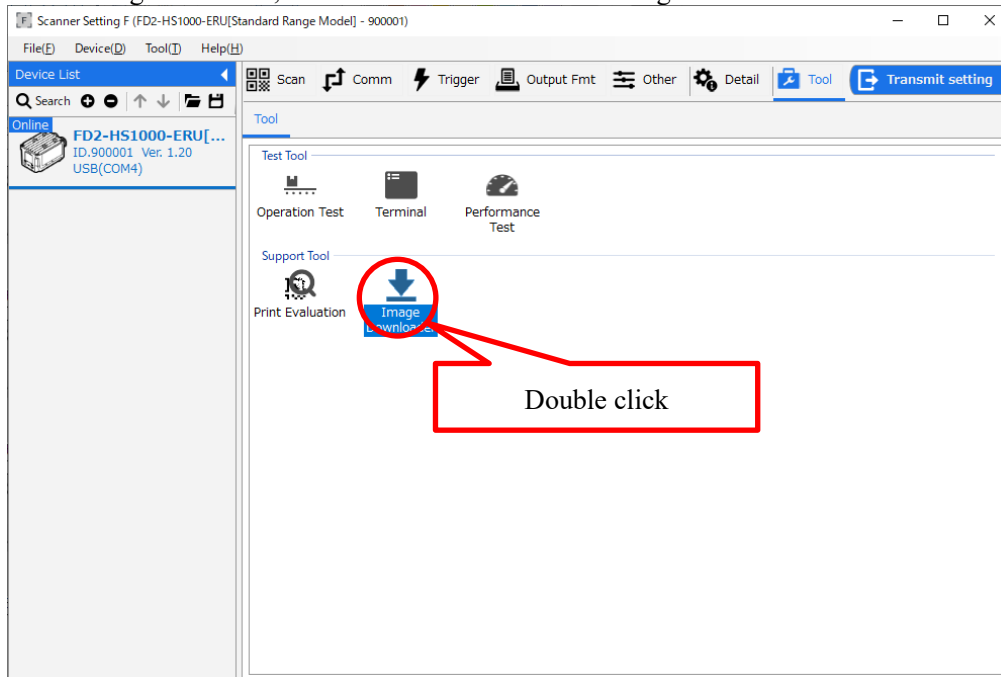
(Note 2) After using No. 15, the memory number is returned to No. 1.

9.3.1.1. Image acquisition

With the "Download image" in the configuration tool, the images saved in the image memory can be acquired.
Instructions to use are as follows.

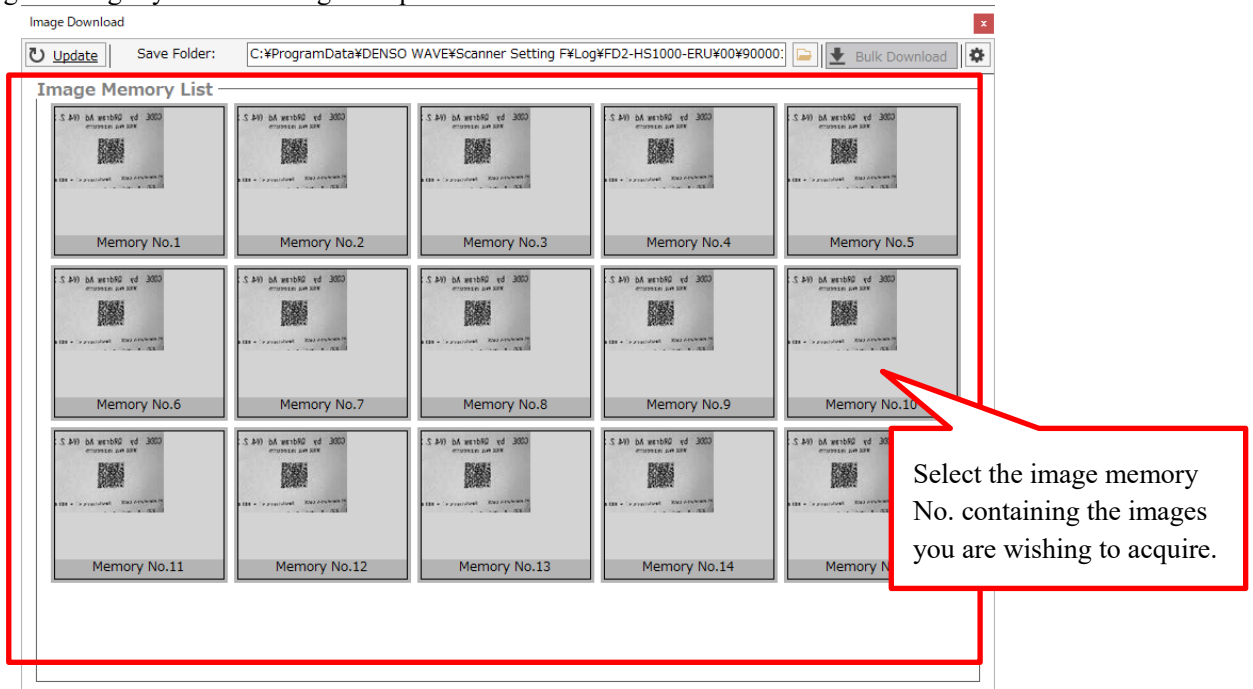
1. Activate "Download image" in the "Tool."

Select "Tool" in the configuration tool, and double click "Download image" to activate it.



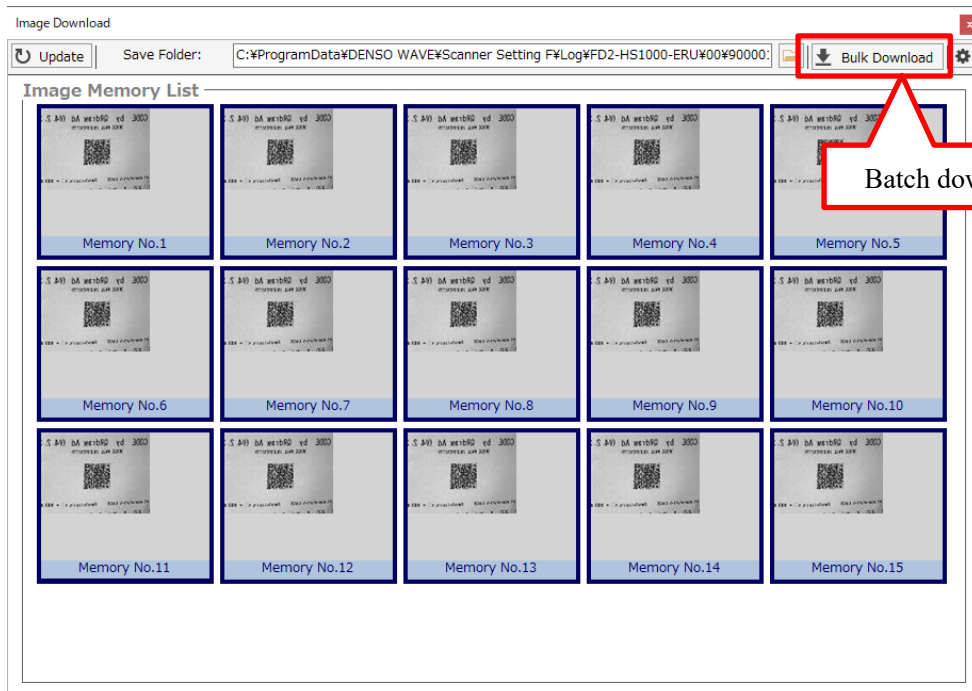
2. Select the image memory to be downloaded.

After Download image is activated, the image memory list of the FD2 is automatically displayed. Select the image memory No. containing the images you are wishing to acquire.



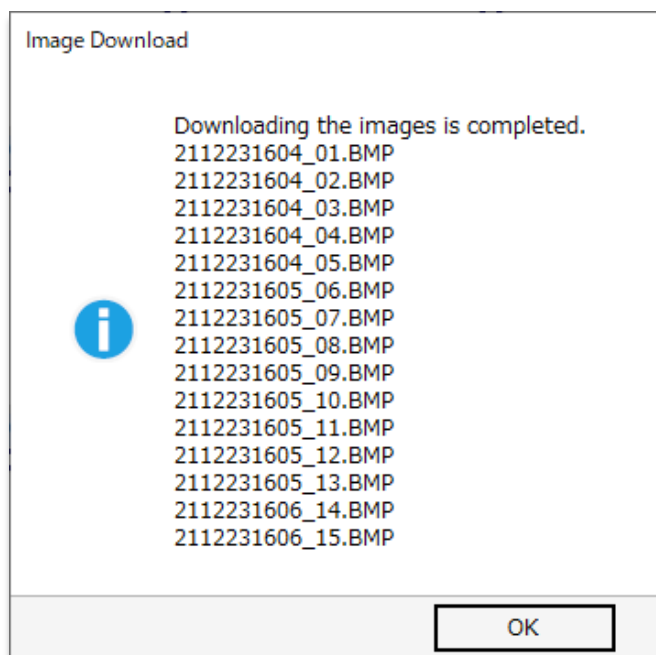
3. Start image acquisition.

After selecting the memory containing the images you are wishing to acquire, click "Batch download" to start image acquisition.



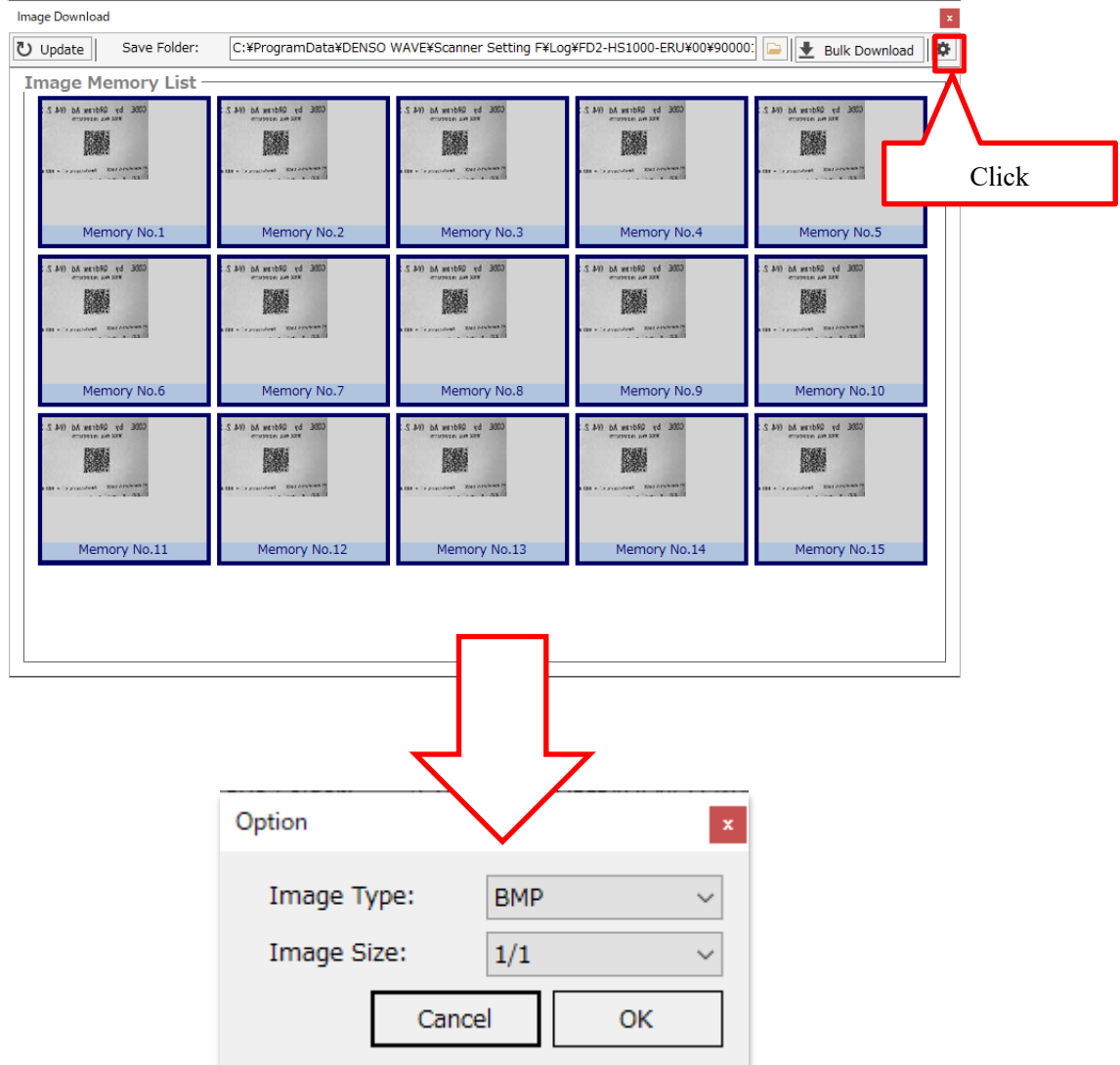
4. Wait until image acquisition is completed.

When image acquisition is completed, the following message appears.



[Changing options for image acquisition]

For the options for the image acquisition, they can be changed by clicking the "Setting" button on the upper right on the "Download image" screen.



Option settings are listed below.

Setting item	Setting value	Description
Image type	BMP	Acquire the image as it is in the bitmap format saved in the image memory.
Image size ^(Note 1)	1/1	Acquire saved image as it is in the scan range size.
	1/4	Acquire saved image in 1/4 of the scan range size.
	1/16	Acquire saved image in 1/16 of the scan range size.

(Note 1) The closer the image size is to the size of imaging scan range, the larger the data size of the image becomes. Therefore, it takes longer when images are acquired.

9.3.2. Setting the Storage Location: Send to Image Save Tool

If the storage location is set to send to image save tool, the taken images are sent to the host^(Note1), and are automatically saved by the "Image save tool (Image Server)" in the host. The save tool supports only Ethernet communication. With the save tool, you can set the transmission to enable or disable. If the transmission is enabled, the taken images are sent to the host upon the end of the trigger ON duration^(Note 2). Transmission to the host is operated only when the trigger mode is in the "single" mode. During image transmission, the scanner is in BUSY state and will not accept the next trigger.

(Note 1) Send to image save tool operates only when the trigger mode is Single.

Transmission is performed only by Ethernet communication.

(Note 2) For the trigger ON duration, refer to "7.5. Trigger ON Duration

If "Send to image save tool" is set to the storage location, the items listed below can be set using the configuration tool and setting commands.

Setting item	Setting value	Description
Save condition (Note 3)	Save read success image	Save read success image.
	Save the first image	Save the first image within a trigger ON duration.
	Save the last image	Save the last image within a trigger ON duration.
	Save the first failure image	Save the first read failure image within a trigger ON duration.
	Save the last failure image	Save the last read failure image within a trigger ON duration.
Image size (Note 4)	1/1	Save taken image as it is in the scan range size.
	1/4	Save taken image in 1/4 of the scan range size.
	1/16	Save taken image in 1/16 of the scan range size.
	1/64	Save taken image in 1/64 of the scan range size.

(Note 3) The taken image is saved only when the trigger mode is in the "Single" mode.

(Note 4) The larger the magnification, the larger the data size, and thus the longer the image transmission time (BUSY state).

9.3.2.1. Types of saved image and timing of transmission start

Types of saved images, and timing of transmission start, depending on setting conditions are listed below.

Trigger mode	One-shot function	Image acquisition mode	Condition for ending the scan	Types of saved image	Timing of transmission start
Single trigger	Disabled	Save read success image	Termination of read	No image saved	-
			Success of read	Read success image	At the read succeeded
		Save the first image	Termination of read	The first image	At the read terminated
			Success of read	The first image	At the read succeeded
		Save the last image	Termination of read	The last image	At the read terminated
			Success of read	Read success image	At the read succeeded
		Save the first failure image	Termination of read	The first failure image	At the read terminated
			Success of read	The first failure image ^(Note 1)	At the read succeeded
		Save the last failure image	Termination of read	The last failure image	At the read terminated
			Success of read	The last failure image ^(Note 1)	At the read succeeded
	Enabled	Save read success image	One-shot time elapsed	No image saved	-
			Success of read	Read success image	At the read succeeded
		Save the first image	One-shot time elapsed	The first image	At the one-shot time elapsed
			Success of read	The first image	At the read succeeded
		Save the last image	One-shot time elapsed	The last image	At the one-shot time elapsed
			Success of read	Read success image	At the read succeeded
		Save the first failure image	One-shot time elapsed	The first failure image	At the one-shot time elapsed
			Success of read	The first failure image ^(Note 1)	At the read succeeded
		Save the last failure image	One-shot time elapsed	The last failure image	At the one-shot time elapsed
			Success of read	The last failure image ^(Note 1)	At the read succeeded

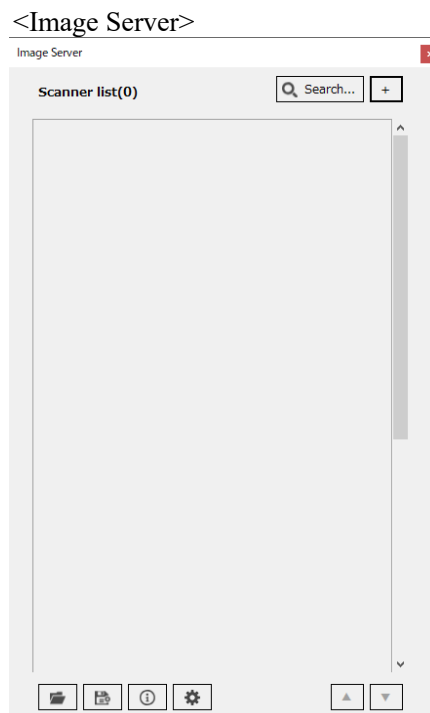
(Note 1) If there are no failure images, the image will not be saved.

9.3.2.2. Use of image save tool

If the taken images satisfy the save conditions, they can automatically be saved by the image save tool.
Instructions to use the image save tool are as follows.

1. Activate the image save tool "ImageServer."

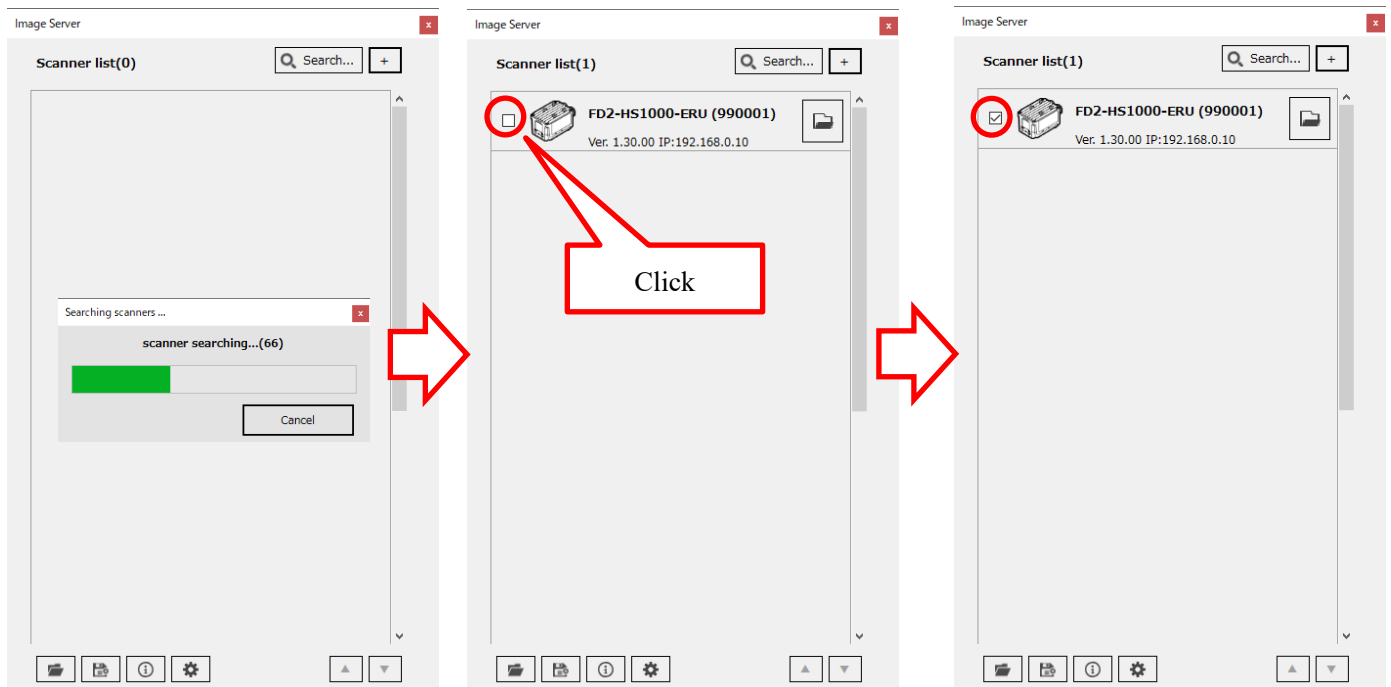
- (1) Make sure that the configuration tool is not activated. If it is, exit the configuration tool ^(Note 1)
- (2) Activate the image save tool.



(Note 1) The image save tool and the configuration tool cannot be used together at the same time. The configuration tool must be exited.

2. Select images to be saved and start to save

- (1) Upon the activation of the image save tool, automatic search for the LAN-connected FD2 is performed. (Note 1) (Note 2)
- (2) Select the scanner from the scanner list to which you want to save the image and check the box.
- (3) When the checkbox is checked on, automatic save of the taken image will be started. (Note 3) (Note 4)



(Note 1) When the message "Do you want to read the previous scanner information?" appears, if you select Yes, the saved scanner list information and the status of the checkbox are reflected, and if you select "No," automatic scanner search is performed.

Also, if you close the message with "Do not ask me again" checked off, the saved scanner list information and checkbox status will be reflected unconditionally at the next startup.

(Note 2) If the FD2 to be used is not detected by automatic search, review the IP address of the FD2 or the host.

If you search for the FD2 one more time, click "Search..."

(Note 3) If the taken image is not applicable to the save condition, neither image transmission nor image save are performed.

(Ex.: If "Save read success image" is selected, and the scan operation is ended in failure, the image will not be saved.)

(Note 4) For time to save the image, if the imaging scan range: the default size, and the image size: 1/1, approx. 15 to 30 seconds are required.

3. Terminate the image save.

- (1) You can terminate the automatic image save by unchecking the box for the scanner, or exiting the image save tool. (Note 1)

(Note 1) When the message "Do you want to use the current scanner information list at the next startup?" appears when the image save tool is closed, select "Yes" to save the current scanner list information and checkbox status, or select "No" to exit without saving anything.

9.4. Changing to the Batch Settings

The FD2 can maintain multiple configuration files including the one for focus positions adjusted by each operating environment. With commands or control instructions from EtherNet/IP, the scanner reads a target configuration file, and settings can be changed (batch setting change).

Settings performed according to the SSAVE command will be saved as a configuration file.

For SSAVE or SLOAD commands, refer to “14.3.2. Control command List”.

Configuration files save all items listed in “Chapter 15 List of Set Items and Setting for Shipping” and focus positions. Up to eight configuration files can be maintained.

(Note) Settings for Ethernet are enabled after the configuration file is read and then reset, or the power is turned on.

10.1. Input Terminal

To input terminals, any of the following functions can be assigned.

(1) Unused

Functions are not assigned to input terminals.

(2) Trigger signal

When the input terminal is assigned to the trigger signal, it can instruct the start and the end of reading.

(3) Reset signal

When the input terminal is assigned to the reset signal, it can reset the scanner.

Note: Except for the setting for unused, the same function cannot be assigned to multiple terminals.
--

The chattering eliminating time of the input terminal is programmable.

The chattering eliminating time can be set for 1 to 10 ms.

10.2. Output Terminal

To output terminals, any of the following functions can be assigned.

(1) Unused

Functions are not assigned to output terminals.

(2) OK signal

The signal is output at the specified timing when reading succeeds.

(3) NG signal

The signal is output at the specified timing when reading fails.

When the trigger mode is the continuous mode, NG signal is not output.

(4) Verification NG signal

When the verification function (9.2. Collating Data for Verification) is used, this signal is output after the reading succeeds if the read data does not match the verification data.

(5) BUSY signal

This signal is output when the scanner is in the BUSY state. The following shows cases where the scanner is in the BUSY state.

- During the trigger ON duration (including the output of data)
- While a mode set by a command is in progress
- While the configuration tool (Scanner Setting F) is being connected
- While the auto-tuning is in progress
- While the scanning test function is in progress
- While an image is being transmitted
- While operating the display

(6) External light synchronous output signal

This signal is output only when the sensor is taking an image, or the signal is always output during the trigger ON duration.

The signal is used for controlling the ON/OFF of light when external light is used. The signal can be assigned only to Output Terminal 2.

10.2.1. Timing for Outputting Signals

For the OK signal, NG signal, and Verification NG signal, the output time as well as the output delay time, which is for outputting signal at the timing later than the output timing, can be set.

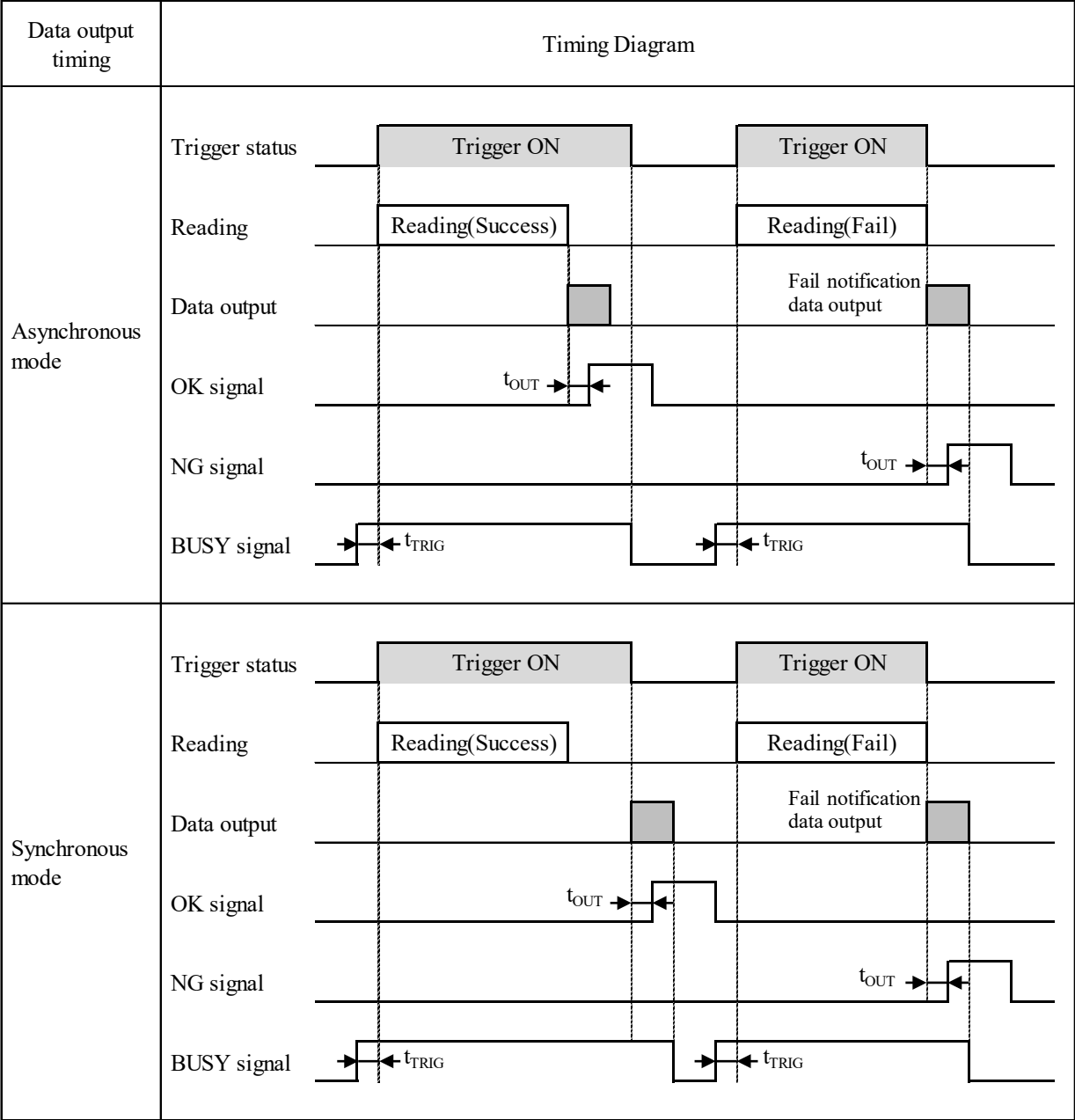
The output time can be set within the range from 10 to 2,550 ms, and the output delay time within the range from 0 to 9,900 ms.

The output time and output delay time can be changed with the configuration tool or setting commands.

10.2.2. Signal Output Timing

For OK signal, NG signal and BUSY signal, the signal output timing varies according to the setting of the data output timing. Examples of OK, NG, or Busy signal output timing is as follows.

(1) Trigger mode: Single (Example of OK, NG, BUSY signal output)

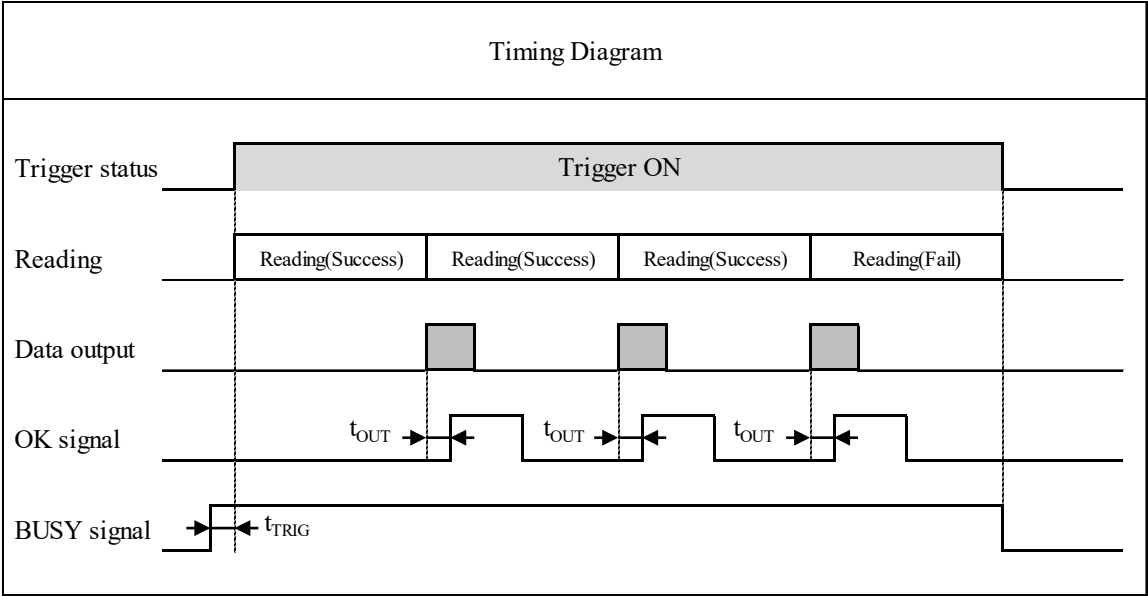


t_{TRIG} : Trigger input delay time

t_{OUT} : Output delay time

(Note) A verification NG signal is output at the same timing of an OK signal if data verification reading is enabled and a verification NG occurs.

(2) Trigger mode: Continuous (Example of OK, BUSY signal output timing)



t_{TRIG} : Trigger input delay time

t_{OUT} : Output delay time

(Note) A verification NG signal is output at the same timing of an OK signal if data verification reading is enabled and a verification NG occurs.

10.3. External Light Synchronous Output Signal Function

If the scanner sets Output Terminal 2 for the external light synchronous output signal, this signal is output only when the sensor is taking an image, or the signal is always output during the trigger ON duration.

The external light synchronous output signal can be set with the configuration tool or setting commands.

The signal provides two output timings: at light ON timing or at light OFF timing, and which can also be set with the configuration tool or setting commands.

Signal polarity	With light on	Without light on
ON	HIGH	LOW
OFF	LOW	HIGH

(Note) An external light to be used shall be the one such as a quick response LED light source. For a light source with a slow start-up time characteristic such as a halogen light, turning on a light may not be in time for taking an image.

(Note) The output format of the external light synchronous output signal terminal is a NPN open collector. Therefore, no power supply is available via the terminal. Be careful that the scanner may be damaged if an electric current larger than a rated current is applied to the external light synchronous output signal terminal.

10.4. Output Setting per Trigger Mode

Choices of the output setting per trigger mode are as follows:

Trigger Mode	Failure notification Data	OK signal	NG signal	Verification NG signal
Single mode	Output enabled	Output enabled	Output enabled	Output enabled
Continuous mode	Disabled	Output enabled	Disabled	Output enabled

Chapter 11 Operation Support Function

11.1. Symbol Quality Function

The scanner includes a function for evaluating the symbol quality of QR codes, micro QR codes, rMQR and DataMatrix according to Direct Part Mark (DPM) Quality Guideline (AIM DPM-1-2006). By reading target codes, the scanner outputs read results and symbol quality results. Based on the evaluation results, you can evaluate the read codes, and improve the code conditions and lighting conditions.

When installing, pay attention to the following points so that the symbol quality is performed correctly.

- (1) Allocation of pixel per cell must be 5 pixels or more
- (2) Place the code in the center of the image and not to rotate
- (3) Secure at least 4 cells on the top, bottom, left, and right of the code (because the surroundings are included in the verification target)
- (4) Do not tilt the scanner with respect to a code and install it in a position facing it.

11.1.1. Setting Method

As shown in the following table, the symbol quality can be set using the configuration tool and setting commands.

Setting items	Setting value	Description
Whether to apply the symbol quality	Applied	The symbol quality is performed after scanning is successfully completed.
	Not applied	The symbol quality is not performed.
Grade notation	Alphabetic characters	The evaluation result is output using an alphabetic character.
	Numeric characters	The evaluation result is output using a numeric character.

(Note) For the following cases, the symbol quality is not performed even if the symbol quality is set to Applied.

- When the reading has failed
- When an unsupported code is read
- While the auto-tuning is in progress
- While the manual tuning is in progress
- While a scan test is performed
- While an operation test is performed

(Note) Even when the alphabetical notation is set, numeric characters are output for some items according to the standard. For unsupported codes and measurement items, one-byte hyphen “-” is output.

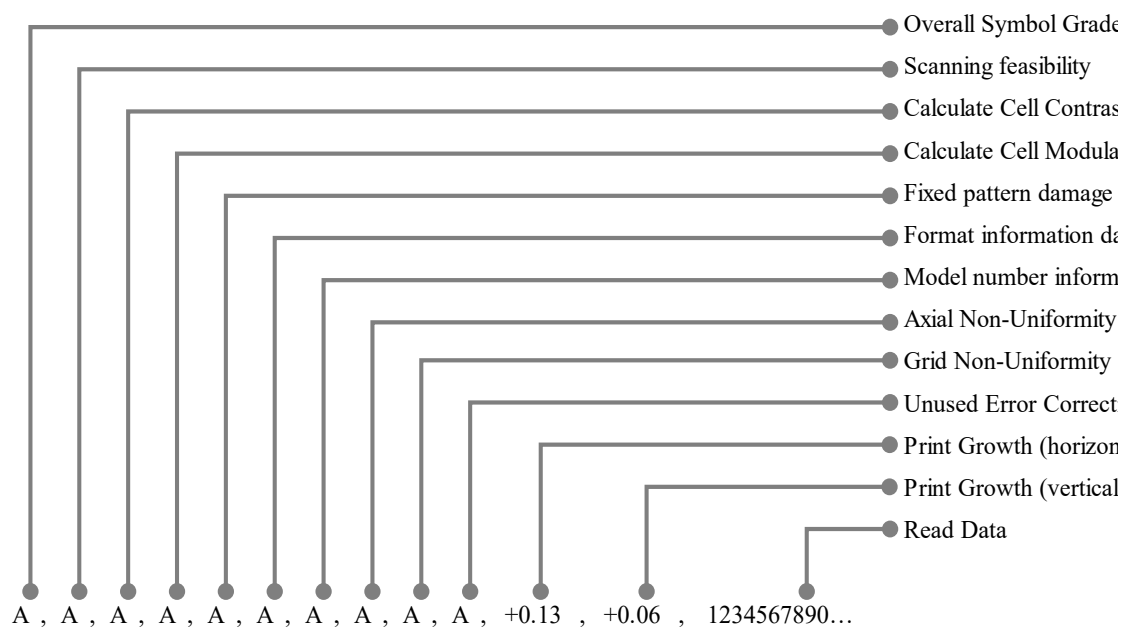
11.1.2. Symbol Quality Result Output Format

Symbol quality results are output in the following output format. The output format of the symbol quality result is shown in the following. The separator is a comma (,) fixed.

(For the data output format, refer to “8.1. Data Output Format”.)

Measurement item 1	Separator	Measurement items 2	Separator	---	Measurement item 12
-----------------------	-----------	------------------------	-----------	-----	------------------------

- Output example of symbol quality results (if the symbol quality is applied, the grade notation is in alphabetic characters, and the QR code read succeeded)



11.1.3. Parameters Used in Verification

The symbol quality function performed the measurement of the following items. For details, refer to Direct Part Mark (DPM) Quality Guideline (AIM DPM-1-2006).

Output order	Item name	Overview
Parameter 1	Overall Symbol Grade	Overall Symbol Grade
Parameter 2	Reading feasibility	Read result
Parameter 3	Calculate Cell Contrast	Difference in brightness between black and white cells
Parameter 4	Calculate Cell Modulation	Brightness value variance of black and white cells
Parameter 5	Fixed pattern damage	Damage status of code-specific fixed patterns
Parameter 6	Format information damage	Damage status of QR code format information area
Parameter 7	Model number information damage	Damage status of QR code model number information area
Parameter 8	Axial Non-Uniformity	Horizontal to vertical ratio of average distances between horizontal cells and between vertical cells
Parameter 9	Grid Non-Uniformity	Maximum error between the center of the ideal grid and the center of an actual cell
Parameter 10	Unused Error Correction	How many error correction codes are not used
Parameter 11	Print Growth (horizontal)	Growth/shrink of the whole code (horizontal)
Parameter 12	Print Growth (vertical)	Growth/shrink of the whole code (vertical)

(Note) If the reading fails, data is not output.

(Note) If unsupported codes are read, “-” is output for all items.

(Note) Depending on the types of read codes and code versions, some items may not be output.

The evaluation is performed according to the items described above. Then, the result is added to the read data.

11.1.3.1. Overall Symbol Grade

The total evaluation shall be the arithmetic average of the grades of measurement items. For the correspondence between the total evaluation and a grade in the alphabetical notation, refer to the following table.

	Total evaluation				
Alphabetic characters	A	B	C	D	F
Numeric characters	4.0	3.0	2.0	1.0	0.0

11.1.3.2. Reading Feasibility

The grade for the decodability is determined according to the table below.

Read result	Grade
Reading succeeded	A (4)
Reading failed	F (0) ^(Note1)

(Note1) When unreadable by Direct Part Mark (DPM) Quality Guideline (AIM DPM-1-2006), and readable by DENSO WAVE's original algorithm, the grade of reading feasibility is “F” and all subsequent verification items are “-“

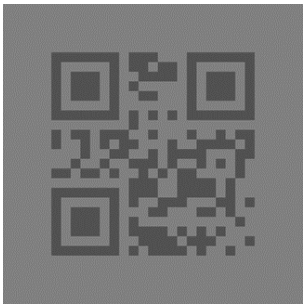
11.1.3.3. Calculate Cell Contrast(CC)

The contrast is measured according to the following expression.

$CC = (ML - MD) / ML$

ML: Average of the brightness values of light cells

MD: Average of the brightness values of dark cells



CC value	Grade
≥ 0.30	A(4)
≥ 0.25	B(3)
≥ 0.20	C(2)
≥ 0.15	D(1)
<0.15	F(0)

11.1.3.4. Calculate Cell Modulation (CM)

The modulation is measured according to the following expression.

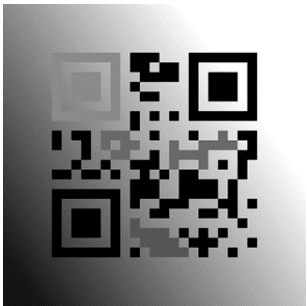
If (R < GT) then CM = (GT - R) / (GT - MD) Else CM = (R - GT) / (ML - GT)

ML: Average of the brightness values of light cells

MD: Average of the brightness values of dark cells

GT: Binary threshold value

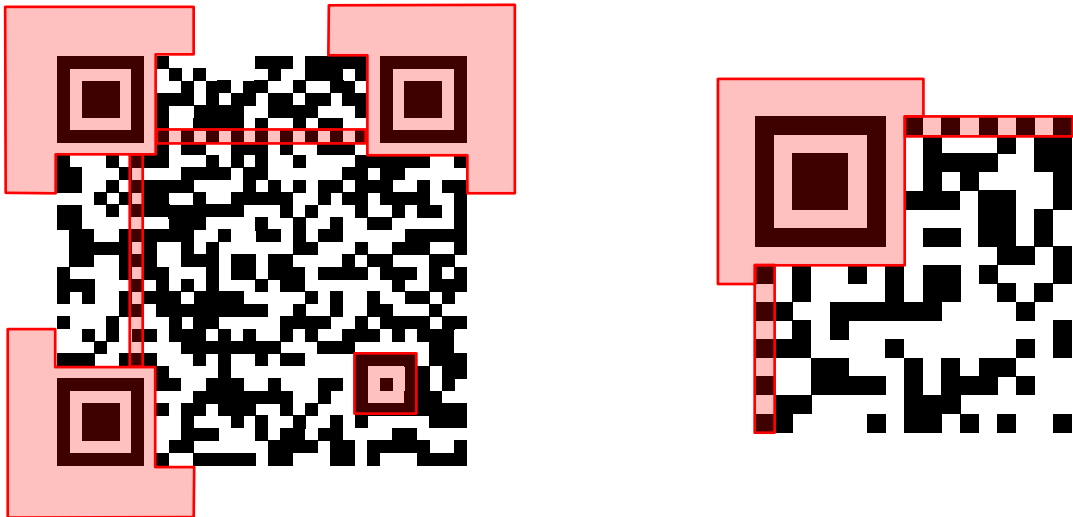
R: Brightness value of module



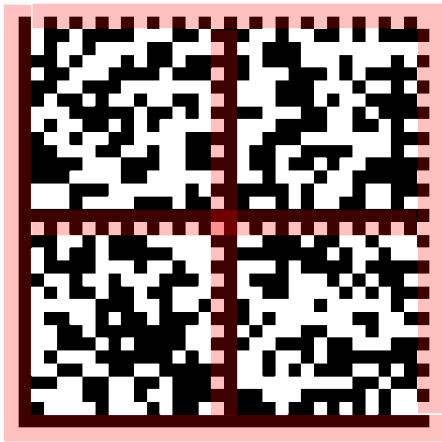
CM value	Grade
≥ 0.50	A(4)
≥ 0.40	B(3)
≥ 0.30	C(2)
≥ 0.20	D(1)
<0.20	F(0)

11.1.3.5. Fixed pattern damage

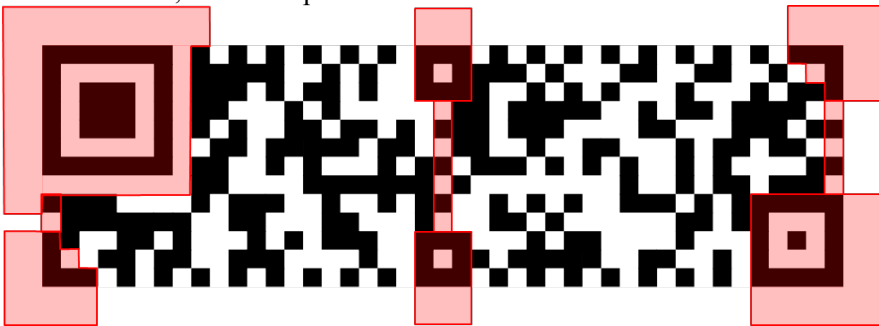
The fixed pattern damage is measured to evaluate the damage level of fixed patterns defined for each code. The following figure shows the fixed patterns to be evaluated.



For the QR code Model 2, the finder pattern, timing pattern, and alignment pattern are evaluated.



For the DataMatrix, the finder patter and clock track are evaluated.

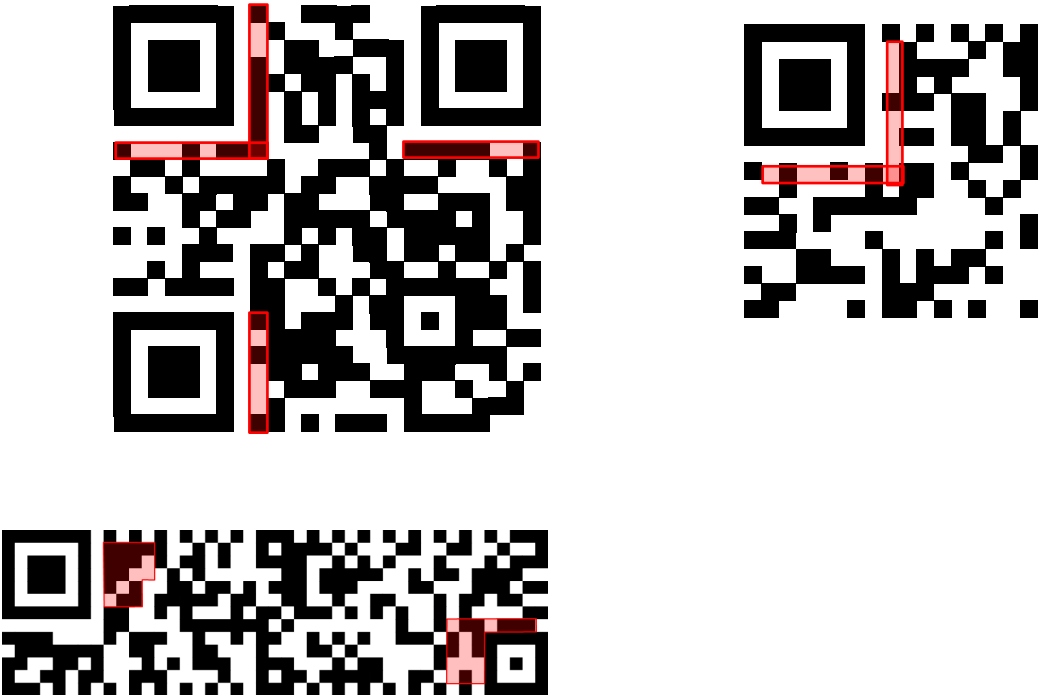


For the rMQR, the finder pattern, the finder sub pattern, the corner finder pattern, timing pattern, and alignment pattern are evaluated.

(Note 1) For QR codes, if there is no enough clear space around the code, the verification may not be performed.

11.1.3.6. Format information damage

The format information damage is measured to evaluate the damage of the QR code. The following figure shows the locations of the format information to be evaluated.



11.1.3.7. Model number information damage

The model number information damage is measured to evaluate the damage level of model information in the QR code. The following figure shows the locations of the version information to be evaluated.

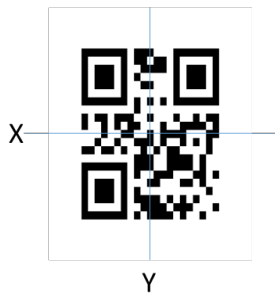


11.1.3.8. Axial Non-Uniformity(AN)

The non-uniformity of axes is measured to evaluate the level of distortion in the horizontal and vertical directions. AN is measured according to the following expression.

$$AN = \frac{\text{abs}(XAVG - YAVG)}{((XAVG + YAVG) / 2)}$$

XAVG: Average cell size in a horizontal direction
YAVG: Average cell size in a vertical direction



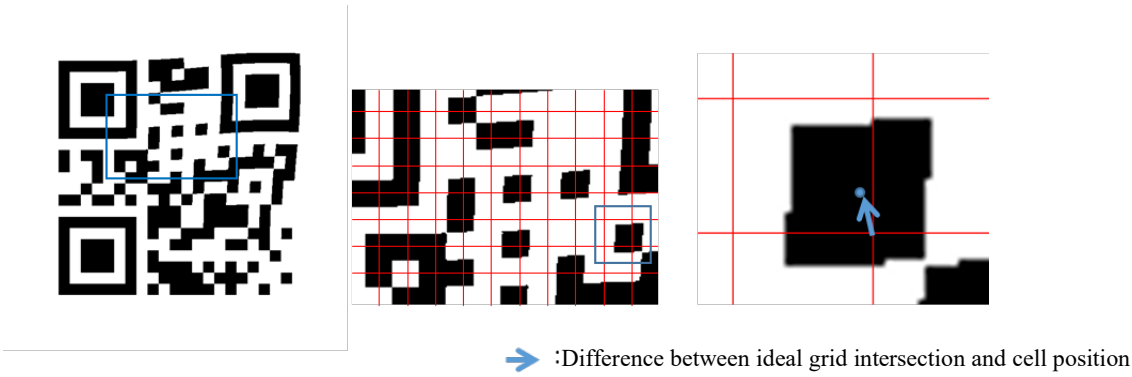
AN	Grade
≤ 0.06	A(4)
≤ 0.08	B(3)
≤ 0.10	C(2)
≤ 0.12	D(1)
> 0.12	F(0)

11.1.3.9. Grid non-uniformity (GN)

The grid non-uniformity is measured to evaluate the level of the position gap between the intersection position of the ideal grid and the position of each cell. GN is evaluated according to the following expression.

$$GN = \frac{\text{Max}}{X}$$

Max: Maximum difference between grids and cells
X: Cell size



➡ :Difference between ideal grid intersection and cell position

GN	Grade
≤ 0.38	A(4)
≤ 0.50	B(3)
≤ 0.63	C(2)
≤ 0.75	D(1)
> 0.75	F(0)

11.1.3.10. Unused error correction (UEC)

The unused error correction rate of read codes is measured to evaluate the contamination and/or damage of the codes.

$UEC=1-((e + 2t) / Ecap)$

e = Total deletion count

t = Total error count

Ecap= Symbol error correction capacity



UEC	Grade
≥ 0.62	A(4)
≥ 0.50	B(3)
≥ 0.37	C(2)
≥ 0.25	D(1)
<0.25	F(0)

11.1.3.11. Print growth measurement

The print growth is measured by measuring the sizes of black and white on the timing patterns of the QR code and micro QR code and rMQR, and then measuring the thickening and thinning of cells. For the DataMatrix, the sizes of black and white on the clock track is measured. In the print growth measurement, the growth is measured in the X direction and Y direction.

For the print growth, measurement values are output.

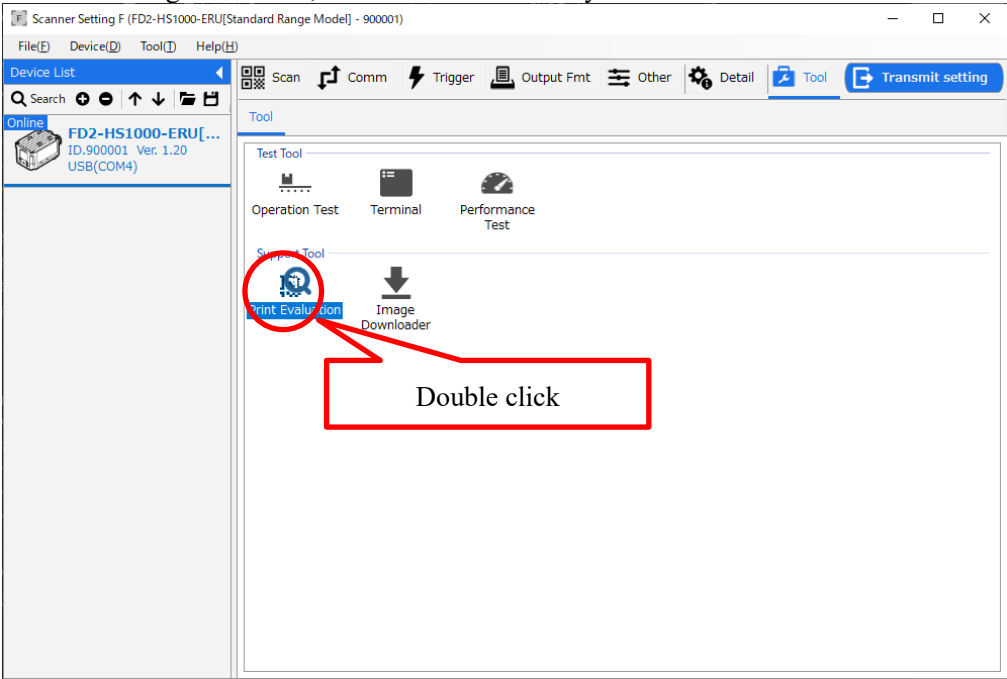


11.1.4. Symbol quality using the configuration tool

The FD2 can check the operation of the symbol quality using the configuration tool.
Instructions to use are as follows.

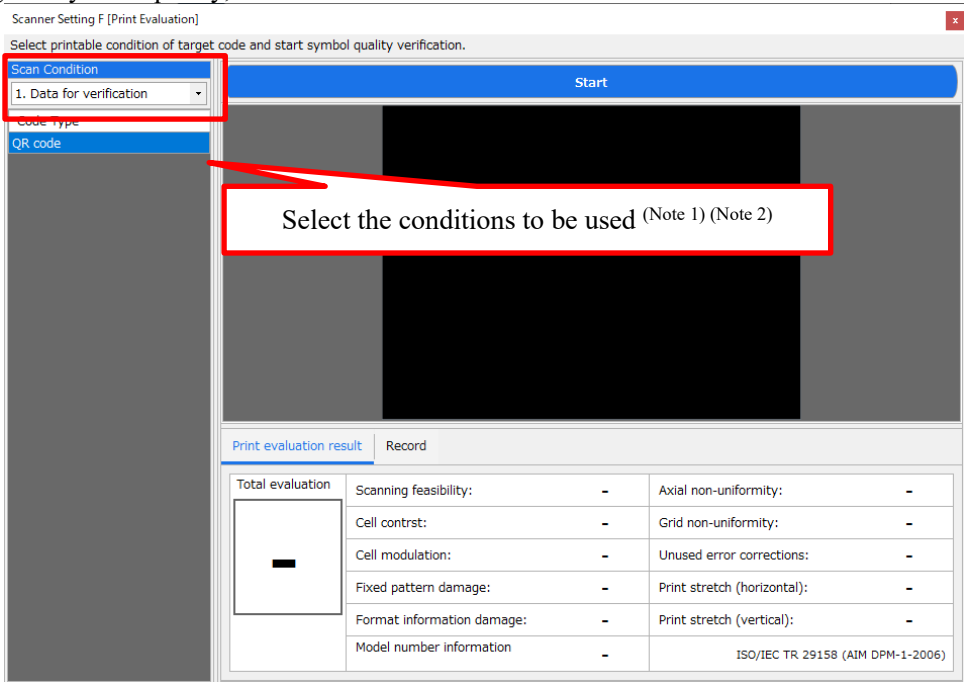
1. Activate the Symbol quality in the "Tool."

Select the "Tool" in the configuration tool, and double click the "Symbol Evaluation" to activate it.



2. Select the scan conditions to be used.

After activating the Symbol quality, select the scan conditions to be used.

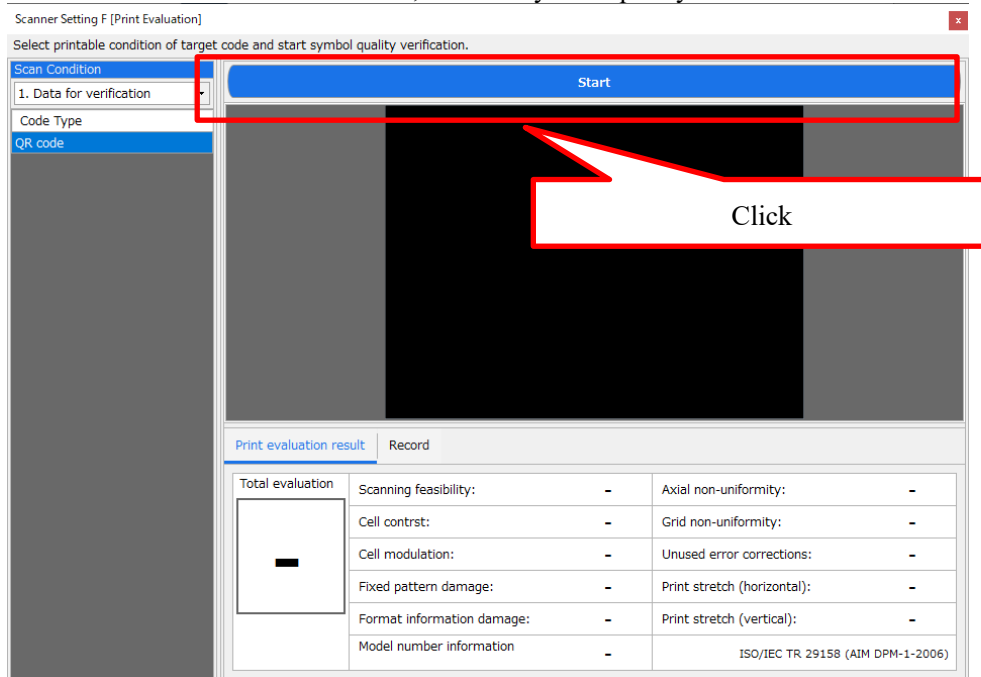


(Note 1) Scan conditions that make the symbol quality possible refers to only the conditions where QR code, Micro QR code, rMQR, and DataMatrix symbols are enabled to be read.

(Note 2) Under the scan condition where the read area designation is out of the scan range, the symbol quality cannot be started.

3. Start the symbol quality.

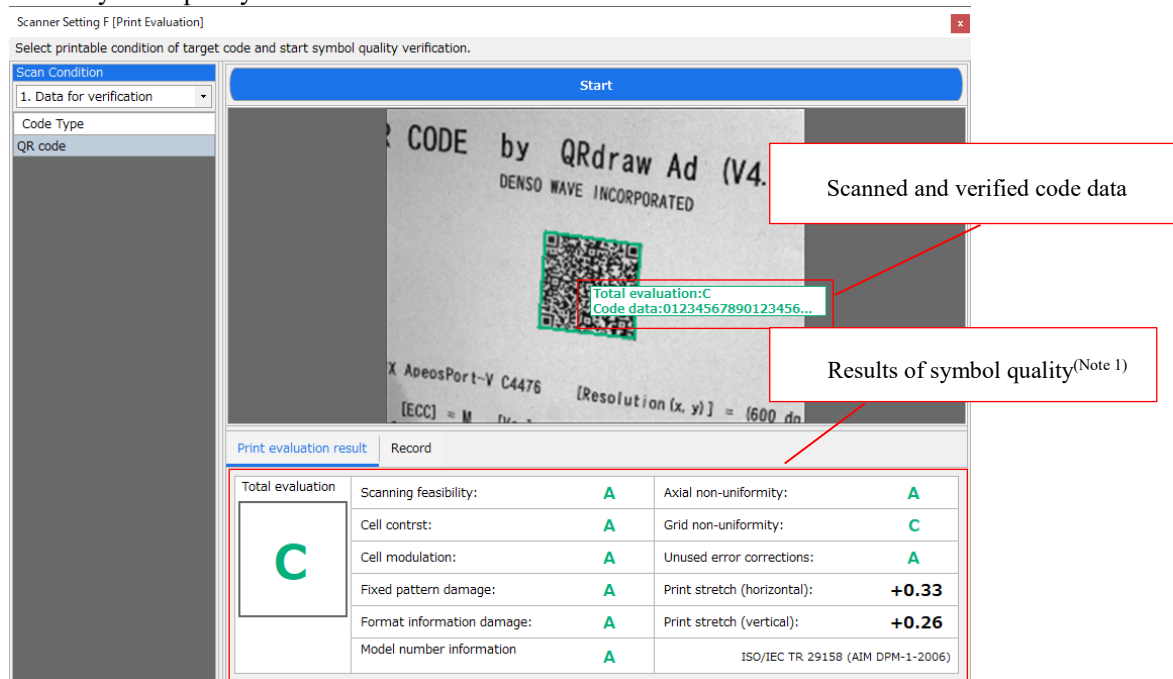
After selecting the scan conditions to be used in a test, start the symbol quality.



4. Review the results of the symbol quality.

Upon the start of the operation test, the results of the symbol quality appear as follows.

Review the results of the symbol quality.



(Note 1) The verification results are output in alphabetic characters, which is fixed, instead of depending on the setting of the output format.

11.2. Scanning Stability

Based on the reading results of QR codes, micro QR codes, rMQR and DataMatrix, the scanning stability evaluation function evaluates how easily codes can be read. The evaluation result is output as a numeric value within the range from 0 to 100. The value indicates 0 (codes cannot be read) to 100 (codes can be read with stability).

(For data output formats, refer to “8.1. Data Output Format”)

The stability is output when the target code has been successfully read. However, in the following case, the stability will be 0.

Chapter 12 Indicator

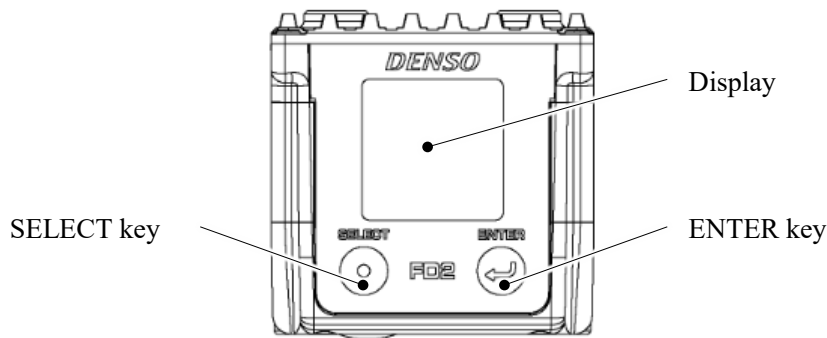
The LED colors notify you of the scanner status.

■ Lighting pattern

Status		Color	Lighting pattern
Power ON		Green	Light-on
Scan control	Scanning completed	Blue	Light-on
	When start/end reading a structured append code symbols	Blue	Refer to “Structured append codes“ in “5.6.8. Specifying The Reading of Codes”
	Reading failure	Red	Light-on
Setup is ongoing	Start the setup (= START)/End the setup (= END)	Blue	Blinking
	Saving settings (= SAVE) succeeds	Blue	Blinking
	Parameter setting with the configuration tool	Blue	Blinking
Firmware update is ongoing		Green	Blinking
An error occurs	When a control command or setting command has terminated abnormally	Red	Blinking
	CTS monitoring timeout	Red	Blinking
	ACK/NAK mode timeout	Red	Blinking
	Firmware update error	Red	Light-on
	Failure to save parameter settings after the setup using the configuration tool	Red	Blinking
	A communication error or timeout occurs during the setup using the configuration tool.	Red	Blinking

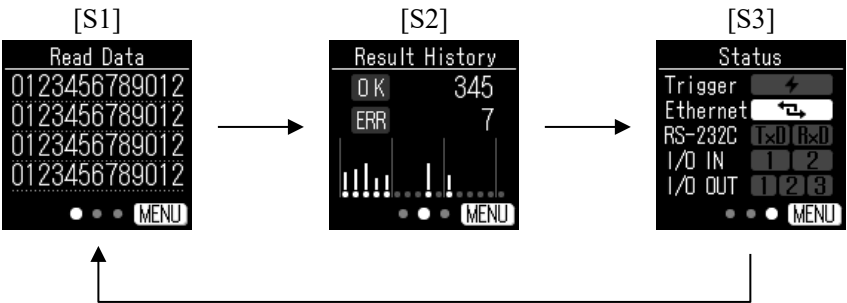
Chapter 13 Display

The display shows the status of the scanner, and you can use the SELECT and ENTER keys to change the display contents or change the scanner settings.



13.1. Operation Screen Configuration

After turning ON the power and displaying the start screen, the screen moves to the screen of "[S1] Read data display". The SELECT key operation cycles between the "[S1] Read data display" screen and the "[S3] Status display" screen.

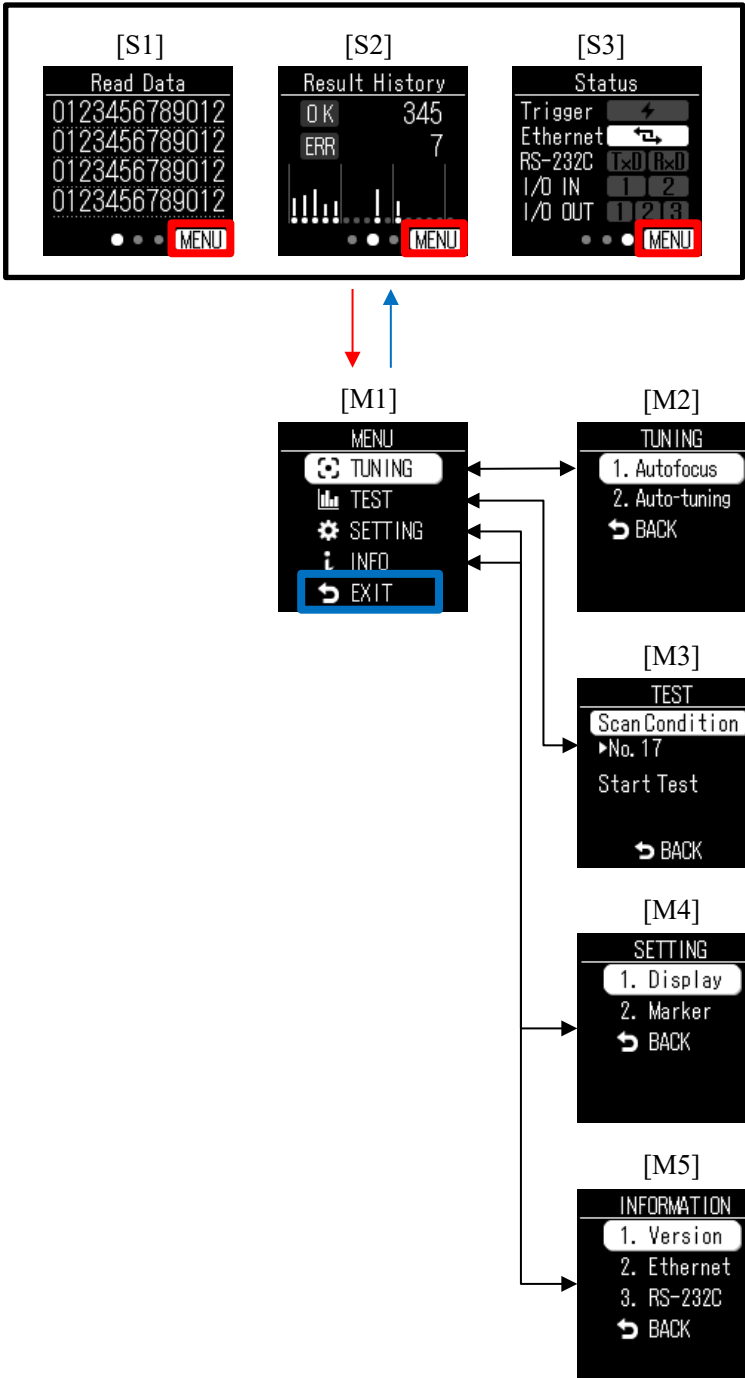


[S1]Read data display	Displays the scanned code data. See "13.3.1. [S1]Read data display" for more information.
[S2]Result history display	Displays the number of successful and failed reads and the usage rate of scan condition. See "13.3.2. [S2]Result history display" for more information.
[S3]Status display	Displays the status of the trigger, input terminal, output terminal, Ethernet communication, and RS -232 C communication. See "13.3.3. [S3]Status display" for more information.

13.2. Menu Screen Configuration

Move from the "MENU" selection on the operation screen to the "[M1] Menu" screen. The display does not change to the "[M1] Menu" screen in the BUSY state, such as when the trigger is ON.

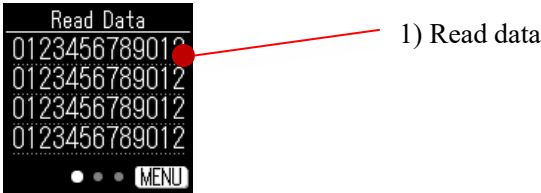
You can return to the operation screen by selecting "EXIT" from the "[M1] Menu". During the transition from the operation screen to the menu screen, you cannot start scanning or connect to the setting tool (Scanner Setting F). After menu processing is complete, be sure to return to the operation screen.



[M1]Menu	This is the top screen of the menu.
[M2]Tuning menu	Performs autofocus or auto-tuning. See "13.3.4. Autofocus" and "13.3.5. Auto-tuning" for more information.
[M3]Scan Test menu	Performs a scan test. See "13.3.6. Scan Test" for more information.
[M4]Settings menu	Here you can change the scanner settings. See "13.3.7. Settings Menu" for more information.
[M5]Information menu	Displays information such as version. See "13.3.8. Information Menu" for more information.

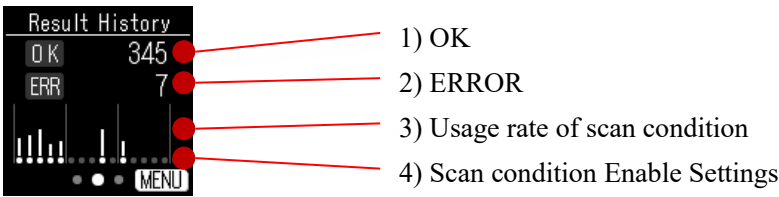
13.3. Screen Details

13.3.1. [S1]Read data display



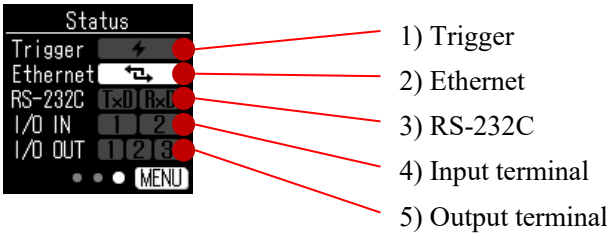
1) Read data	Displays up to 52 bytes of read code data. The part exceeding 52 bytes is not displayed. For the characters that can be displayed, see “13.4. Display Character”. It is cleared when reading is started (trigger ON) and the power is turned OFF.
--------------	--

13.3.2. [S2]Result history display



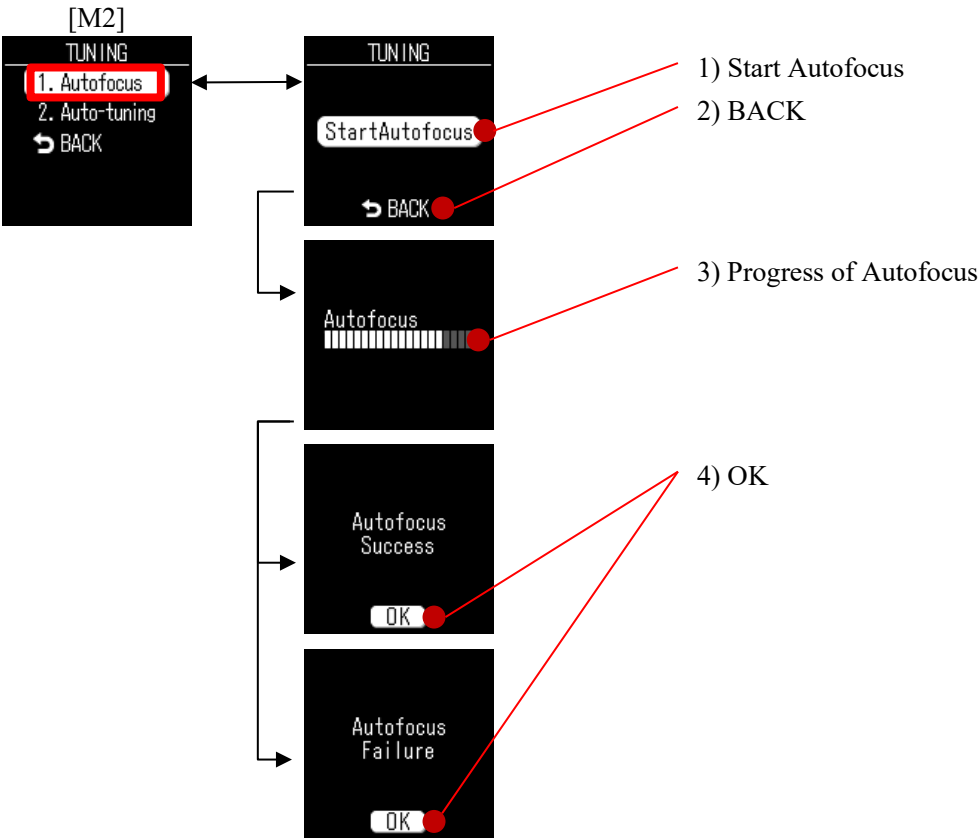
1) OK	Displays the number of successful reads. It is cleared when the power is turned off.
2) ERROR	Displays the number of failed readings at the end of the trigger ON period. It is cleared when the power is turned off. Not counted in the case of continuous trigger mode.
3) Usage rate of scan condition	Displays the read success condition utilization. Scan condition # 1 to condition # 16 are listed from left to right. It is cleared when the power is turned off.
4) Scan condition Enable Settings	Displays whether the scan condition is enabled. Scan condition # 1 to condition # 16 are listed from left to right. When scan condition is enabled, they are displayed in white.

13.3.3. [S3]Status display



1) Trigger	Displays the status of the trigger. Displayed in white when the trigger is ON and in gray when the trigger is OFF.
2) Ethernet	Displays the status of Ethernet communication. Displayed in white when communication is in progress and in gray when communication is not in progress.
3) RS-232C	Displays the send status (TxD) and receive status (RxD) of the RS -232 C communication. Displayed in white when communication is in progress and in gray when communication is not in progress.
4) Input terminal	Displays the status of input terminals 1 and 2. This is not displayed when the input terminal is set to Disabled. Displayed in white when a signal is being input to the input terminal and in gray when it is not.
5) Output terminal	Displays the status of output terminals 1, 2, and 3. This is not displayed when the output terminal is set to Disabled. White indicates that the signal is being output from the output terminal, and gray indicates that the signal is not being output.

13.3.4. Autofocus



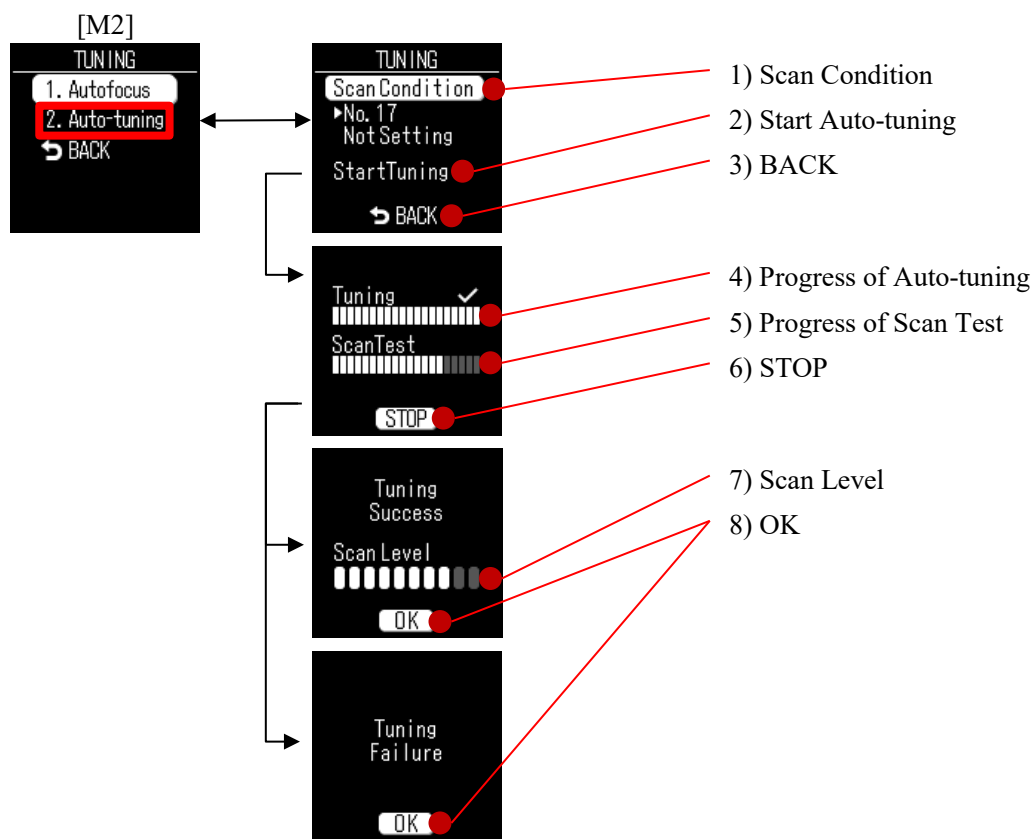
1) Start Autofocus	Starts autofocus and moves to the next screen.
2) BACK	Returns to the previous screen.
3) Progress of Autofocus	Displays the current autofocus progress.
4) OK	Ends autofocus.

The following describes how to use Autofocus by key operation.

- 1. The position is adjusted so that the target code enters the imaging range.
- 2. To start autofocus and wait until autofocus processing is completed.

Select "Start Autofocus" to start autofocus and automatically set the focus to the best position near the center of the field of view.

13.3.5. Auto-tuning



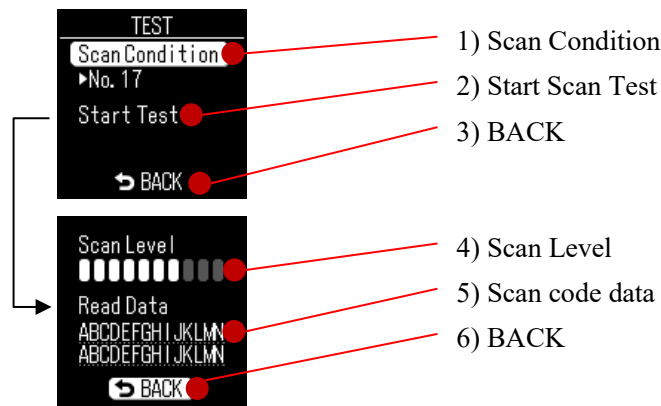
1) Scan Condition	You can set scan conditions for auto-tuning.
2) Start Auto-tuning	Starts auto-tuning and moves to the next screen.
3) BACK	Returns to the previous screen.
4) Progress of Auto-tuning	Displays the current auto-tuning progress. After auto-tuning is complete, perform a read test using the auto-tuned settings.
5) Progress of Scan Test	Displays the progress of the current read test.
6) STOP	Interrupts auto-tuning.
7) Scan Level	Displays the scan stability level.
8) OK	Ends Auto-tuning.

The following shows how to use the Auto-tuning function by key operation.

- 1. The position is adjusted so that the target code enters the imaging range.
- 2. Auto-tuning is started, and it waits until auto-tuning processing is completed.

When you select "Start Tuning," auto-tuning starts and FD2 automatically sets the reading setting to the optimum one for the code being imaged. Also, wait for the scan test to complete, as it automatically starts when auto-tuning is complete. If auto-tuning is interrupted or fails, the setting is not applied. If auto-tuning succeeds and is interrupted during the read test, the setting is applied.

13.3.6. Scan Test

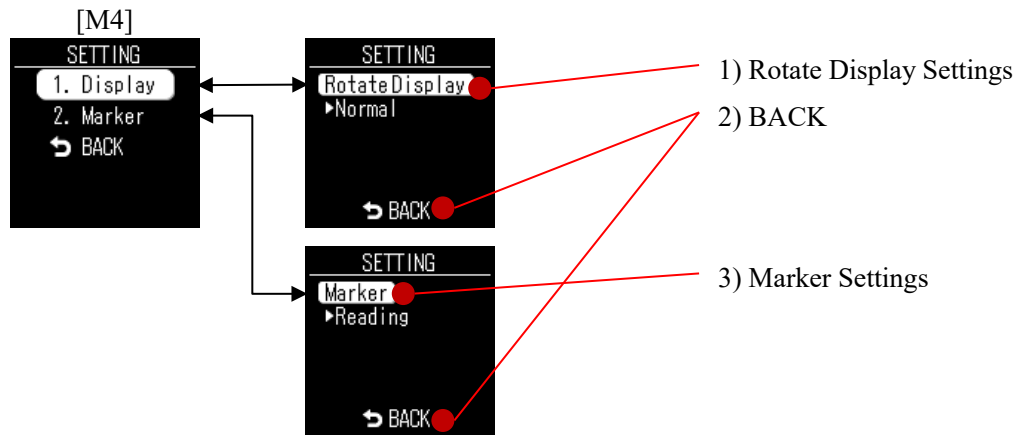


1) Scan Condition	You can set the Scan Condition. You cannot select a scan condition that is disabled.
2) Start Scan Test	Starts the scan test and moves to the next screen.
3) BACK	Returns to the previous screen.
4) Scan Level	Displays the scan level.
5) Scan code data	Displays up to 28 bytes of scan code data. The part exceeding 28 bytes is not displayed. For the characters that can be displayed, see “13.4. Display Character”.
6) BACK	Ends the scan test and returns to the previous screen.

The following describes how to use the scan test function by key operation.

- 1. **Select the scan condition to be tested.**
Select “Scan Condition” to determine the scan condition to test.
- 2. **Start the scan test.**
Select "Start Test" to start the scan test.

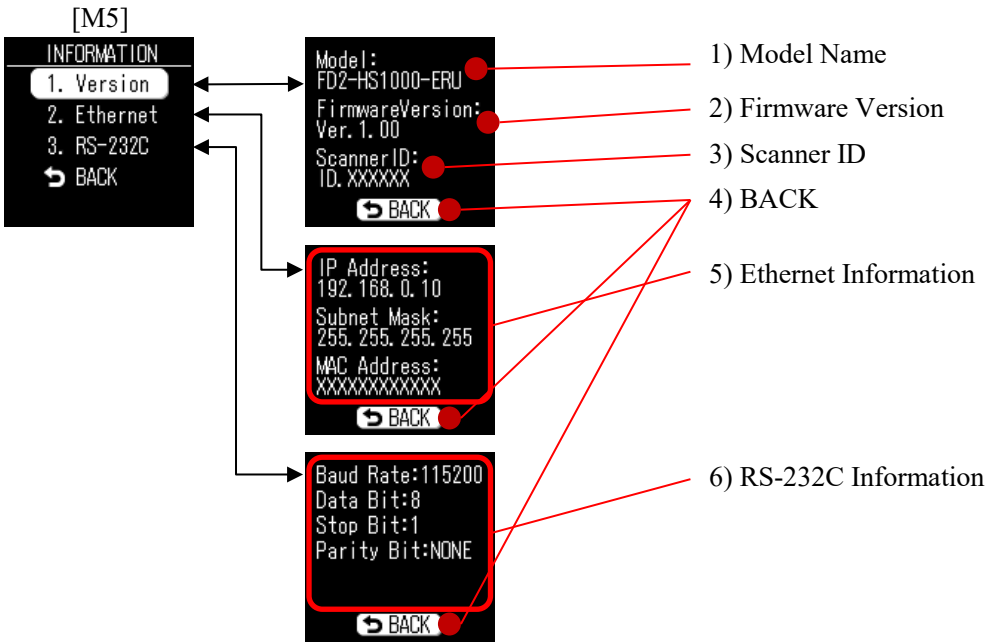
13.3.7. Settings Menu



1) Rotate Display Settings	Change rotate display settings (Note 1).
2) BACK	Returns to the previous screen.
3) Marker Settings	Change marker settings (Note 1).

(Note 1) The scanner will operate according to the changed settings even after the power to the scanner is turned OFF => ON.

13.3.8. Information Menu



1) Model Name	Displays the model name.
2) Firmware Version	Displays the firmware version.
3) Scanner ID	Displays the scanner ID (serial number).
4) BACK	Returns to the previous screen.
5) Ethernet Information	Displays the IP address, subnet mask, and MAC address.
6) RS-232C Information	Displays baud rate and data bits, stop bits, and parity.

13.4. Display Character

The code data is displayed with the characters shown in the table below. Spaces () are not displayed.

		Upper 4 bits															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower 4 bits	0				0	@	P	'	p								
	1			!	1	A	Q	a	q								
	2			"	2	B	R	b	r								
	3			#	3	C	S	c	s								
	4			\$	4	D	T	d	t								
	5			%	5	E	U	e	u								
	6			&	6	F	V	f	v								
	7			'	7	G	W	g	w								
	8			(	8	H	X	h	x								
	9			)	9	I	Y	i	y								
	A			*	:	J	Z	j	z								
	B			+	;	K	[	k	{								
	C			,	<	L	\	l									
	D			-	=	M	]	m	}								
	E			.	>	N	^	n	~								
	F			/	?	O	_	o									

14.1. Available Commands

There are commands to control the scanner through communication.

The commands have two types as follows: the control command and the setting command.

Setting commands are commands for changing various scanner settings. After the state is shifted to the setting state using “Start the setting state (= START),” setting commands can be accepted.

After various setting commands are received in the setting state, setting values are saved when “Save setting values (= SAVE)” is received.

When “End the setting state (= END)” is received, the transition from the setting state to the normal state is made, and the scanner operates according to the conditions that have been set.

(Note 1) If the scanner receives a command during the trigger ON duration, read performance degradation, or delay in command operation may occurs.

(Note 2) Setting values are saved to the scanner only when “Save setting values (= SAVE)” is executed. Even if the power is turned OFF, saved parameter values will be effective when the power is turned ON next time. Even if “End the setting state (= END)” is executed without executing “Save setting values (= SAVE),” the scanner operates according to the settings currently made. However, after the power is turned OFF, the scanner will operate according to the previous settings because the current settings have not been saved.

(Note 3) After “Start the setting state (= START)” is executed, when a control command, except the read, END and information acquisition commands, is received, the scanner handles such a command as an error until “End the setting state (= END)” is executed.

(Note 4) When setting values are saved using the SAVE command, the upper limit of the rewrite count of setting values should be up to 100 thousand times because of the rewrite limit of the flash memory.

(Note 5) You cannot send any commands with EtherNet/IP.

14.2. Command Format

Transmission and response formats of the command used for a scanner are specified below:

Command: Transmission format

Header	Data length	Command request	Terminator
--------	-------------	-----------------	------------

Command: Response format

Header	Data length	Command response	Terminator
--------	-------------	------------------	------------

Header/terminator

A specified header and terminator is output.
Header and terminator values can be changed with the configuration tool or setting commands.
Values that can be specified with the header or the terminator of a data output format vary according to the communication interface.
Details are as follows:

- RS-232C interface:
- The following combination can be specified.
Header
None/STX
Terminator
CR/ETX/LF/CR+LF
Fixed with “STX...ETX” (Note 1)
- Ethernet interface:
- (Note 1) With EtherNet/IP, it is not output.

Data length

As for the data length, the length from the data next to the data length to the data before the terminator is output.
Data length format is 4 bytes (big endian) of hexadecimal number.
Whether or not to output the data length can be set with the setting command or the configuration tool.
Values that can be specified according to whether or not to output the data length vary according to the communication interface.
The interface settings of each communication are as follows:

- RS-232C/USB-COM interface:
- The following values can be specified.
Not to output/ To output
Fix with “To output.” (Note 1)
- Ethernet interface:
- (Note 1) Do not output in case of EtherNet/IP.

Command request/command response

For details, refer to “14.3. Control Command”, “14.4. Setting Command”.

14.3. Control Command

14.3.1. Control command Format

Command request and response formats of the control command are specified below:

Command request: Control command

Control command	,	Parameter
-----------------	---	-----------

Command response: Control command (Status change)

Control command	,	Status	,	Parameter
-----------------	---	--------	---	-----------

Command response: Control command (Information acquisition)

Parameter

Commas (,) in the above control format are separators.
Separators in the control commands are commas (,) fixed.
No separators are required for control commands with no parameters.

14.3.2. Control command List

The following control commands changes “the status of the scanner”:

Description	Control Command	Request	Response	
		Parameter	Status ^(Note 1)	Parameter
Trigger ON command	TRGON ^(Note 2)	TRGON(nn) nn: With setting 00, or omitting a scan condition No., the condition will be switched to the permitted one.	None/available	None
Trigger OFF command	TRGOFF ^(Note 2)	None	None/available	None
Start the scan test mode	TESTON	TESTON, mmm, nn mmm: 001 to 999 No. of test (000 = Infinity) nn: 01 to 16 condition No. (00 = Condition rotation)	Available	None
End the scan test mode	TESTOFF	None	Available	None
Software reset ^(Note 3)	RESET	None	Available	None
Start the setting state ^(Note 4)	START	None	Available	None
End the setting state ^(Note 4)	END	None	Available	None
Save setting state ^(Note 4)	SAVE	None	Available	None
Reading setting state ^(Note 4) ^(Note 6)	LOAD	None	Available	None
Reset setting state ^(Note 4) ^(Note 7)	DEFAULT	None	Available	None
Save the configuration file	SSAVE	SSAVE,nn nn: 01 to 08 Configuration file No.	Available	None
Reading the configuration file	SLOAD	SLOAD,nn nn: 01 to 08 Configuration file No.	Available	None
Date and time setting	TIMESET	TIMESET, YYYY,MM,DD,hh,mm,ss YYYY: Year MM: Month DD: Day hh: Hour mm: Minute ss: Second	Available	None
Date and time confirmation	TIMEGET	None	Available	TIMEGET, YYYY,MM,DD,hh,mm,ss YYYY: Year MM: Month DD: Day hh: Hour mm: Minute ss: Second

- (Note 1) For the command status, refer to “14.5. Command Status”.
- (Note 2) Transmission commands for scan control can be changed with the configuration tool or setting commands. By default, “TRGOFF”.
- (Note 3) When the “RESET” command is executed, the reset is executed immediately, in the same way as the Power ON reset.
- (Note 4) After "Start the setting state (= START)," is executed, the scanner handles a received control command, except "END," "SAVE," "LOAD," and "DEFAULT" as an error until "End the setting state (= END)" is executed.
- (Note 5) The "SAVE" command allows setting values to be written to the flash memory. The maximum write count should be 100 thousand times or less.
- (Note 6) The "LOAD" command makes it possible to read setting values from the flash memory. The setting values will be reflected after the "END" command is executed.
- (Note 7) The “DEFAULT” command resets the scanner. The setting values will be reflected after the "END" command is executed.

The following shows control commands for “information acquisition”.

Description	Control Command (Note 1)	Request	Response	
		Parameter	Status (Note 1)	Parameter
Firmware version	VER	None	None	Ver. n.nn n.nn: Firmware version
Setting parameter version	VERF	None	None	Ver. n.nn.mm n.nn: Firmware version mm: Setting parameter version
Scanner ID (Serial number)	ID	None	None	ID. ynnnnn y: Last digit of prod. year nnnnn: Serial number
Scanner ID (Scanner prod. No. + Serial number)	IDF	None	None	ID. XXXXXXXXXXXXynnnnn XXXXXXXXXXXX: Scanner prod. No. y: Last digit of prod. year Nnnnn: Serial number
MAC address	MAC	None	None	MAC. nnnnnnnnnnnn nnnnnnnnnnnn: MAC address

(Note 1) The "Information acquisition" command response only outputs parameters, with no control commands included.

14.4. Setting Command

The scanner is in the set status after receiving the “START (command for starting the set status)”, and the setting command becomes available. The setting command is used by combining command numbers and set values.

14.4.1. Setting Command Format

The command request and response formats of the setting command are specified below:

Command request: Setting update command (PS command)

PS	,	Command number	,	Set value
----	---	----------------	---	-----------

Command response: Setting update command (PS command)

PS	,	Command number	,	Status
----	---	----------------	---	--------

Command request: Setting confirmation command (PG command)

PG	,	Command number
----	---	----------------

Command response: Setting confirmation command (PG command)

PG	,	Command number	,	Set value
----	---	----------------	---	-----------

For Status, refer to “14.5. Command Status”

14.4.2. Setting Command – Communication Interface

Setting commands for setting communication interface are specified below:

Contents			Command number	Setting value
RS-232C	Baud rate	4800 bps	000000	2
		9600 bps		3
		19200 bps		4
		38400 bps		5
		57600 bps		6
		115200 bps		7
	Parity	None	000001	0
		Even		1
		Odd		2
	Data bit	7 bit	000002	0
		8 bit		1
	Stop bit	1 bit	000003	0
		2 bit		1
	CTS monitoring	No	000004	0
		Monitored		1
	CTS monitoring time (In units of 100ms)		000005	01 to 99 (100 to 9900 ms)
	Communication procedure	No protocol	000006	0
		ACK/NAK		1
	ACK/NAK response time (In units of 100ms)		000007	01 to 99 (100 to 9900 ms)
	RTS signal control procedure	Scanner ready mode	000008	0
		Data ready mode		1

Contents				Command number	Setting value
Ethernet ^(Note 1)	IP address			000300	xxx.xxx.xxx.xxx (xxx: 0 to 255)
	Subnet mask			000301	xxx.xxx.xxx.xxx (xxx: 0 to 255)
	Default gateway			000302	xxx.xxx.xxx.xxx (xxx: 0 to 255)
	Command control protocol			000320	0: UDP 1: TCP server
	DHCP	Disabled		000303	0
		Enabled			1
	DHCP timeout (1s unit)			000304	1 to 32767
	Command control protocol			000320	0: UDP 1: TCP server
	Command control (UDP)	Listening port No.		000305	0 to 65535 ^{(Note 2) (Note 3) (Note 4)}
	Command control (TCP server)	Listening port No.		000306	0 to 65535 ^(Note 2)
	Read data transfer protocol			000321	0: UDP 1: TCP server 2: TCP client 3: EtherNet/IP
	Read data transfer (UDP)	Destination IP address		000316	xxx.xxx.xxx.xxx ^(Note 5) (xxx: 0 to 255)
		Destination port No.		000317	0 to 65535 ^{(Note 2)(Note 3)(Note 4)}
	Read data transfer (TCP server)	Listening port No.		000318	0 to 65535 ^(Note 2)
	Read data transfer (TCP client)	Destination IP address on connection		000307	xxx.xxx.xxx.xxx (xxx: 0 to 255)
		Destination port No. on connection		000308	0 to 65535 ^(Note 2)
TCP KeepAlive	Command control	Disabled	000322	0	
		Enabled		1	
	Read data transfer	Disabled	000323	0	
		Enabled		1	
EtherNet/IP	Data handshake	Disabled		000343	0
		Enabled			1
	Buffer clear at start of reading	Disabled		000346	0
		Enabled			1
	Operation by instruction command during initial communication	Enabled		000347	0
		Disabled			1
Read data transmission interface				003000	0: RS-232C 1: Ethernet 2: USB-COM

(Note 1) The Ethernet settings are enabled by reset, or at power on.

(Note 2) Port number “2222” and “44818” are reserved to be used for EtherNet/IP, and not allowed for any other settings.

(Note 3) Port number “50000”, “50011”, “50020”, and “60002~60017” are reserved to be used for communication with the configuration tool, and not allowed for any other settings.

(Note 4) The same port number cannot be set for command control (UDP) and data read transmission (UDP).

(Note 5) “255.255.255.255 (broadcast address)” cannot be specified as the destination IP address for read data transmission (UDP).

14.4.3. Setting Commands: Data Formats

Setting commands for setting Data formats are specified below:

Description			Command number	Setting value
Data format	Header	None	000400	0
		STX		1
		STX + Data length		2
	Terminator	ETX	000401	0
		CR		1
		LF		2
		CR + LF		3
	Code ID mark	Disabled	000800	0
		Enabled		1
	Code data digit number	Disabled	000803	0
		Enabled (2 digits)		1
		Enabled (4 digits)		2
	BCC	Disabled	000804	0
		Enabled		1
	Scanner ID	Disabled	000808	0
		Enabled		1
	Date and time	Disabled	00080D	0
		Enabled		1
	Code angle	Disabled	000815	0
		Enabled		1
	Optional string 1		000805	x-xxxxxxx (Note 1)
	Optional string 2		000806	x-xxxxxxx (Note 1)
	Scan condition numbers	Disabled	00080E	0
		Enabled		1
	Separator	None	003201	0
		Comma (,)		1
		Selected by the user		2
	Separator character		003203	x (Note 2)

(Note 1) x-xxxxxxx: Up to eight characters can be set in ASCII. Omission disables output.

(Note 2) x: One character can be set in ASCII.

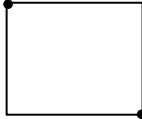
14.4.4. Setting Commands: Scan Setting

The following shows setting commands for setting up the reading.

For scan setting commands, 01 to 16 of the condition numbers can be specified as the command number NN.

Description			Command number	Setting value
QR code	Reading	Disabled	NN0900	0
		Enabled		1
	Read version		NN0901	nn, mm nn ≥ 01, mm ≤ 40, nn ≤ mm
	Reading in the structured append mode	Non-edit mode	NN0904	0
		Edit mode		1
Micro QR code	Reading	Disabled	NN0902	0
		Enabled		1
	Read version		NN0903	nn, mm nn ≥ 01, mm ≤ 04, nn ≤ mm
rMQR	Reading	Disabled	NN0905	0
		Enabled		1
	Vertical cell, horizontal cell version		NN0906	nn,mm,oo,pp nn,mm:vertical cell version nn ≥ 01,mm ≤ 06,nn ≤ mm oo,pp:horizontal cell version oo ≥ 01,pp ≤ 06,oo ≤ pp (Note 3)
SQRC	Reading	Disabled	NN0A00	0
		Enabled		1
	If encryption keys match	Disclosed data + Undisclosed data	NN0A01	0
		Transmit only undisclosed data		1
	If encryption keys do not match	Reading disabled	NN0A02	0
		Transmit only disclosed data		1
	Read version		NN0A03	nn, mm nn ≥ 01, mm ≤ 40, nn ≤ mm
DataMatrix	DataMatrix (Square)	Disabled	NN0C00	0
		Enabled		1
	Square DataMatrix read code number		NN0C01	nn, mm nn ≥ 01, mm ≤ 24, nn ≤ mm(Note 4)
	DataMatrix (Rectangle)	Disabled	NN0C02	0
		Enabled		1
	Rectangle DataMatrix read code number		NN0C03	nn, mm nn ≥ 01, mm ≤ 06, nn ≤ mm(Note 4)

Description				Command number	Setting value
PDF417	PDF417	Disabled		NN0D00	0
		Enabled			1
	Micro PDF417	Disabled		NN0D01	0
		Enabled			1
MaxiCode	Reading	Disabled		NN0E00	0
		Enabled			1
GS1 Composite	GS1 Databar /2D	CC-A	Disabled	NN1000	0
			Enabled		1
		CC-B	Disabled	NN1001	0
			Enabled		1
	UPC/EAN /2D	CC-A	Disabled	NN1002	0
			Enabled		1
		CC-B	Disabled	NN1003	0
			Enabled		1
	GS1-128 /2D	CC-A	Disabled	NN1004	0
			Enabled		1
		CC-B	Disabled	NN1005	0
			Enabled		1
		CC-C	Disabled	NN1006	0
			Enabled		1
UPC/EAN	UPC-A/EAN-13 reading	Disabled		NN1100	0
		Enabled			1
	UPC-E reading	Disabled		NN1101	0
		Enabled			1
	EAN-8 reading	Disabled		NN1102	0
		Enabled			1
Code128	Reading	Disabled		NN1300	0
		Enabled			1
GS1-128	Reading	Disabled		NN1400	0
		Enabled			1
Code39	Reading	Disabled		NN1500	0
		Enabled without C/D			1
		Enabled with C/D			2
Interleaved 2 of 5	Reading	Disabled		NN1600	0
		Enabled without C/D			1
		Enabled with C/D			2
Codabar (NW-7)	Reading	Disabled		NN1800	0
		Enabled without C/D			1
		Enabled with C/D			2
Code93	Reading	Disabled		NN1900	0
		Enabled			1

Description				Command number	Setting value
GS1 DataBar	GS1 DataBar	GS1 DataBar	Disabled	NN1A00	0
			Enabled		1
		GS1 DataBar Stacked	Disabled	NN1A01	0
			Enabled		1
	GS1 DataBar Limited	Disabled		NN1A02	0
		Enabled			1
	GS1 DataBar Expanded	GS1 DataBar Expanded	Disabled	NN1A03	0
			Enabled		1
		GS1 DataBar Expanded Stacked	Disabled	NN1A04	0
			Enabled		1
Scan condition	Black-and-white inverted code scanning	Black-and-White normal code		NN1B00	0
		Black-and-white inverted code			1
	Mirror code scanning	Normal code		NN1B01	0
		Mirror code			1
	Read area designation (Upper left, lower right coordinates) (xxxx,yyyy)  (XXXX,YYYY)		NN1B05	xxxx,yyyy,XXXX,YYYY (xxxx/XXXX = 0000 to 1599, yyyy/YYYY=0000 to 1199 Where xxxx<XXXX, yyyy<YYYY)	
	Scan time limit (unit: 10 ms)	Disabled		NN1B06	000
		Enabled			001 to 999 (10 to 9,990 ms)
	Image processing filter (Filter type, the number of filtering)		NN1B0A	tss, tss, tss, tss, tss ^(Note 1) (t: Filter type ^(Note 2) , ss = 01 to 07)	
	Scan condition rotation	Disabled		NN1B08	0
		Enabled			1
Rotation trial count		NN1B09	01 to 15		
Imaging setting	Polarizing filter	OFF		NN1C03	0
		ON			1
	Shutter (unit: 1μs)		NN1C07	00001 to 10000 (1 to 10,000μs)	
	Gain level (00 Dark to 18 Light)		NN1C01	00 to 18	
Light	External light	OFF		NN1C04	0
		ON			1
Scanning setting	Scan condition rotation order	Rotation in order		001B0B	0
		Prioritized according to the success scan condition			1
	Double-read prevention time (unit: 100 ms)	Enabled		001B02	00
		Disabled			01 to 99 (100 to 9,900 ms)
	Marker lighting	Light on disabled		002700	0
		Light on enabled			1
		Light on only for Trigger ON duration			2

(Note 1) Up to 5 settings are available. For example, two setting are specified as “tss, tss.”

(Note 2) The filter type specifications are as follows:

t	Filtering type:
0	Dilation in black pixels (erosion in white pixels)
1	Erosion in black pixels (dilation in white pixels)
2	Moving average filter
3	Open (Erosion in black pixels -> Dilation in white pixels)
4	Close (Dilation in black pixels -> Erosion in white pixels)

(Note 3) The combinations of vertical and horizontal cells in rMQR is as follows: Specifying a range without ✓ results in a command error.

		Horizontal cell version					
		1	2	3	4	5	6
Vertical cell version	1		✓	✓	✓	✓	✓
	2		✓	✓	✓	✓	✓
	3	✓	✓	✓	✓	✓	✓
	4	✓	✓	✓	✓	✓	✓
	5		✓	✓	✓	✓	✓
	6		✓	✓	✓	✓	✓

The relationship between the vertical cell version and the number of vertical cells is as follows.

Vertical cell version	1	2	3	4	5	6
Number of Vertical cells	7	9	11	13	15	17

The relationship between the horizontal cell version and the number of horizontal cells is as follows.

Horizontal cell version	1	2	3	4	5	6
Number of horizontal cells	27	43	59	77	99	139

(Note 4) DataMatrix defines code numbers as shown in the following table.

< DataMatrix square >

code number	Number of cells ROW × COL	code number	Number of cells ROW × COL	code number	Number of cells ROW × COL	code number	Number of cells ROW × COL
1	10 × 10	7	22 × 22	13	44 × 44	19	88 × 88
2	12 × 12	8	24 × 24	14	48 × 48	20	96 × 96
3	14 × 14	9	26 × 26	15	52 × 52	21	104 × 104
4	16 × 16	10	32 × 32	16	64 × 64	22	120 × 120
5	18 × 18	11	36 × 36	17	72 × 72	23	132 × 132
6	20 × 20	12	40 × 40	18	80 × 80	24	144 × 144

<DataMatrix rect. >

code number	Number of cells ROW × COL	code number	Number of cells ROW × COL	code number	Number of cells ROW × COL
1	8 × 18	3	12 × 26	5	16 × 36
2	8 × 32	4	12 × 36	6	16 × 48

14.4.5. Setting Command: Scanning Evaluation

For the scanning evaluation, setting commands are as follows:

Description			Command number	Setting value
Symbol Quality ^(Note 1)	Disabled		002E00	0
	Enabled			1
	Grade notation	Alphabetic characters	002E01	0
		Numeric characters		1
Scanning stability evaluation ^(Note 1)	Disabled		002F00	0
	Enabled			1

(Note 1) For the output format of the evaluation result, refer to “8.1. Data Output Format”.

14.4.6. Setting Command: Operation Mode Setting

The following shows setting commands for setting operation modes.

Description				Command number	Setting value
Trigger	Trigger type	Input terminal		001D0A	0
		Command			1
	Trigger mode	Single		001D0B	0
		Continuous			1
	One-shot operation	Disabled		001D0C	0
		Enabled			1
	Trigger input delay time (unit 1 ms)			001D01	000 to 999 (0 to 999 ms)
	One-shot operation time (unit: 10 ms)			001D02	010 to 999 (100 to 9990 ms)
	Trigger ON command			001D03	xxxxxxx (Note 1)
	Trigger OFF command			001D04	xxxxxxx (Note 1)
	External light synchronous output signal function	Trigger synchronous lighting (Tr ON)		001D05	0
		Trigger synchronous lighting (Tr OFF)			1
		Continuous lighting (Tr ON)			2
		Continuous lighting (Tr OFF)			3
	Data Output Timing	Asynchronous mode		001D06	0
		Synchronous mode			1
	Failure notification data	Output	Disabled	001D07	0
			Enabled		1
		Failure notification data character		001D08	xxxxxxx (Note 1)
		Output format setting ON	Disabled	001D0F	0
			Enabled		1
	Trigger command response	Disabled		001D09	0
		Enabled			1
Input terminal	Input terminal 1	Not used		001F00	0
		Trigger signal			1 (Note 2)
		Reset signal			2 (Note 2)
	Input terminal 2	Not used		001F01	0
		Trigger signal			1 (Note 2)
		Reset signal			2 (Note 2)

(Note 1) xxxxxx: Up to seven ASCII characters can be set. For the trigger ON command and trigger OFF command, the same character string cannot be set.

(Note 2) This cannot be set if it is set for the other input terminal.

Description			Command number	Setting value	
Output terminal	Output terminal 1	Not used	002000	0	
		OK signal		1	
		NG signal		2	
		Verification NG signal		4	
		BUSY signal		5	
	Output terminal 2	Not used	002001	0	
		OK signal		1	
		NG signal		2	
		Verification NG signal		4	
		BUSY signal		5	
		External light synchronous signal		6	
	Output terminal 3	Not used	002002	0	
		OK signal		1	
		NG signal		2	
		Verification NG signal		4	
		BUSY signal		5	
	Output delay time (unit: 100 ms)		002003	00 to 99 (0 to 9900 ms)	
	Output time (unit: 10 ms)		002004	001 to 255 (10 to 2550 ms)	
	Image saving	Disabled		002D00	0
		Enabled			1
Save condition (Storage location:Save in image memory)		Save all images	002D01	0	
		Save read failure images		1	
		Save read success images		2	
		Save the first image within a trigger period		3	
		Save the last image within a trigger period		4	
		Save the first failure image within a trigger period		5	
		Save the last failure image within a trigger period		6	
Save mode (Storage location:Save in image memory)		Cyclic	002D02	00	
		Fixed memory No.		01 to 15	
Storage location		Save in image memory	002D03	0	
		Send to image save tool		1	
Image size (Storage location: Send to image save tool)		1/ 1	002D05	0	
		1/ 4		1	
		1/ 16		2	
		1/ 64		4	
Save conditions (Storage location: Send to image save tool)		Save read success images	002D06	2	
		Save the first image within a trigger period		3	
		Save the last image within a trigger period		4	
	Save the first failure image within a trigger period	5			
	Save the last failure image within a trigger period	6			

14.4.7. Setting Command: Other Settings

The following shows setting commands for other settings.

Description			Command number	Setting value
Data verification reading	Disabled		002A00	0
	Enabled			1
	Preset data		002A01	xxx ... xxx (Note 1)
	Verification position designation	Disabled	002A02	0
		Enabled		1
	Verification start/end position		002A03	mm, nn 01 ≤ mm, nn ≤ 99, mm ≤ nn
	Verification result transmission	"OK"/"NG"	002A04	0
		"OK" + <Data>/"NG"		1
		"OK"/"NG" + <Data>		2
"OK" + <Data>/ "NG" + <Data>		3		
Data edit (ADF)	Edit mode	Non-edit	002C00	0
		Data extraction mode		1
		ADF script mode		4
	Data extraction mode	Data Extraction start position, the number of digits	002C04	mmmm, nnnn Start position: 0001 ≤ mmmm ≤ 9999, The number of digits: 0001 ≤ nnnn ≤ 9999

(Note 1) xxx ...xxx: Up to 99 ASCII characters can be set.

14.5. Command Status

When the scanner receives a control command and setting command, it returns any of the following status to the upper module according to the state in the scanner.

Description		Setting value
Normal termination		00000000
Abnormal termination	Operation mode error	0000A300
	Execution condition error	0000A301
	Packet format error	0000A303
	Command parameter error	0000A304
	Undefined command error	0000A305
	Execution error	0000A400

14.6. Examples of Command Transmission/Reception

Description of display

Transmission data is data to be transmitted from the host device to the terminal.

Response data is a response to the command from the host device, and the response is sent from the terminal to the host.

[XX] represents binary data. ([00-FF] is a hexadecimal number. [CR], [STX], and [ETX] are control codes.)

14.6.1. Terminal State Change Process: Scan Control via a Command

[Prerequisite]

- “The trigger type setting is "Command”
- Response to the scan start/end commands is “Enabled”

■ If the header setting is “None” and the terminator setting is “CR”

Transmission data	Response data
TRGON[CR]	TRGON,00000000[CR]
	(Command status = “00000000”: Successfully processed)
Reading is performed during this period	
TRGOFF[CR]	TRGOFF,00000000[CR]
	(Command status = “00000000”: Successfully processed)

■ If the header setting is “STX + Data length”and the terminator setting is “ETX”

Transmission data	Response data
[STX][00][00][00][05]TRGON[ETX]	[STX][00][00][00][0E]TRGON,00000000[ETX]
	(Command status = “00000000”: Successfully processed)
Reading is performed during this period	
[STX][00][00][00][06]TRGOFF[ETX]	[STX][00][00][00][0F]TRGOFF,00000000[ETX]
	(Command status = “00000000”: Successfully processed)

14.6.2. Information Acquisition Process: Scanner ID (serial number) Acquisition

[Prerequisite]

- Suppose that Scanner ID is “700001”

■ If the header setting is “None” and the terminator setting is “CR”

Transmission data	Response data
ID[CR]	ID. 700001[CR]
	(represents a one-byte space)

■ If the header setting is “STX + Data length” and the terminator setting is “ETX”

Transmission data	Response data
[STX][00][00][00][02]ID[ETX]	[STX][00][00][00][0A]ID. 700001[ETX]
	(represents a one-byte space)

14.6.3. Setting Change Process: RS-232C Baudrate (which is saved to the flash memory)

[Prerequisite]

Change the baudrate to 115200 bps.
Setting command: [000000]
Setting value : [7]

■ If the header setting is “none” and the terminator setting is “CR”

Transmission data	Response data
START[CR]	START,00000000[CR] (Command status = “00000000”: Successfully processed)
From here, the scanner is in the setting mode	
PS,000000,7[CR]	PS,000000,00000000[CR] (Command status = “00000000”: Successfully processed)
SAVE[CR]	SAVE,00000000 (Command status = “00000000”: Successfully processed)
END[CR]	END,00000000[CR] (Command status = “00000000”: Successfully processed)
Changed settings will be reflected after the setting mode is terminated with the "END" command. The “SAVE” command is executed. Therefore, the scanner will operate according to the changed settings even after the power to the scanner is turned OFF => ON.	

■ If the header setting is “STX + Data length” and the terminator setting is “ETX”

Transmission data	Response data
[STX][00][00][00][05]START[ETX]	[STX][00][00][00][0E]START,00000000[ETX] (Command status = “00000000”: Successfully processed)
From here, the scanner is in the setting mode	
[STX][00][00][00][0B]PS,000000,7[ETX]	[STX][00][00][00][12]PS,000000,00000000[ETX] (Command status = “00000000”: Successfully processed)
[STX][00][00][00][04]SAVE[ETX]	[STX][00][00][00][0D]SAVE,00000000[ETX] (Command status = “00000000”: Successfully processed)
[STX][00][00][00][03]END[ETX]	[STX][00][00][00][0C]END,00000000[ETX] (Command status = “00000000”: Successfully processed)
Changed settings will be reflected after the setting mode is terminated with the "END" command. The “SAVE” command is executed. Therefore, the scanner will operate according to the changed settings even after the power to the scanner is turned OFF => ON.	

Chapter 15 List of Set Items and Setting for Shipping

With setting commands or the configuration tool (Scanner Setting F), you can set parameters shown in the following table. When the scanner is shipped from the factory, all setting values are set to the default values.

Communication interface

Description			Default	Setting method	
				Setting Command	Configuration tool
RS-232C	Baudrate	4800 bps		✓	✓
		9600 bps			
		19200 bps			
		38400 bps	*		
		57600 bps			
		115200 bps			
	Parity	None	*	✓	✓
		Even number			
		Odd number			
	Data bit	7 bits		✓	✓
		8 bits	*		
	Stop bit	1 bit	*	✓	✓
		2 bits			
	CTS monitoring	None	*	✓	✓
		Available			
	CTS monitoring time (ms)		2,000	✓	✓
	Communication protocol	No protocol	*	✓	✓
		ACK/NAK			
	ACK/ NAK response time (ms)		1,000	✓	✓
	RTS signal control protocol	Scanner ready mode	*	✓	✓
		Data ready mode			

Description				Default	Setting method	
					Setting Command	Configuration tool
Ethernet	IP address			0.0.0.0	✓	✓
	Subnet mask			0.0.0.0	✓	✓
	Default gateway			0.0.0.0	✓	✓
	DHCP	Disabled			✓	✓
		Enabled		*		
	DHCP timeout (unit: 1 s)			10	✓	✓
	Command control (UDP)	Listening port number		60000	✓	✓
	Command control (TCP sever)	Listening port number		50001	✓	✓
	Read data transmission (UDP)	Destination IP address		0.0.0.0	✓	✓
		Destination port number		60001	✓	✓
	Read data transmission (TCP server)	Listening port number		50010	✓	✓
	Read data transmission (TCP Client)	Destination IP address		0.0.0.0	✓	✓
		Destination port number		50010	✓	✓
	Command control Protocol	UDP			✓	✓
		TCP server		*		
	Read data transmission protocol	UDP			✓	✓
		TCP server				
		TCP client		*		
		EtherNet/IP				
	TCP KeepAlive	Command control	Disabled		✓	✓
			Enabled	*		
		Read data transmission	Disabled		✓	✓
			Enabled	*		
EtherNet/IP	Data handshake	Disabled		*	✓	✓
		Enabled				
	Buffer clear at reading start	Disabled		*	✓	✓
		Enabled				
	Operations by commands at the initial communication	Enabled				
		Disabled		*		
Read data transmission interface		RS-232C		*	✓	✓
		Ethernet				
		USB-COM				

Data format

Description			Default	Setting method	
				Setting Command	Configuration tool
Data format	Header	None	*		✓
		STX			
		STX + Data length			
	Terminator	ETX			✓
		CR	*		
		LF			
		CR+LF			
	Code ID mark	Disabled	*	✓	✓
		Enabled			
	Code ID mark position	Optional string 1 Frontward			✓
		Optional string 1 Backward	*		
	Code ID mark types	Type 1	*		✓
		Type 2			
		Type 3			
		Type 4			
		Selected by the user			
	Output	Coupling	*		
		Separating			
	The number of digits	Disabled	*	✓	✓
		Enabled (2 digits)			
		Enabled (4 digits)			
	BCC	Disabled	*	✓	✓
		Enabled			
	Scanner ID	Disabled	*	✓	✓
		Enabled			
	Date and time	Disabled	*	✓	✓
		Enabled			
	Code angle	Disabled	*	✓	✓
		Enabled			
	Optional string 1	Disabled	*	✓	✓
		Enabled			
	Optional string 1 character		Unspecified	✓	✓
	Optional string 2	Disabled	*	✓	✓
		Enabled			
	Optional string 2 character		Unspecified	✓	✓
	Scan condition number	Disabled	*	✓	✓
		Enabled			

Description			Default	Setting method	
				Setting Command	Configuration tool
Data format	Separator	None		✓	✓
		Comma (,)	*		
		Selected by the user			
	Separator character		Unspecified	✓	✓
	GTIN format conversion	Disabled	*		✓
		Enabled			
	Conversion type from GTIN to EAN/JAN	Conversion to 14 digits	*		✓
		Conversion to 13 digits			
		Conversion disabled			
	Conversion type from EAN/UPC to GTIN	Conversion to 16 digits	*		✓
		Conversion to 14 digits			
		Conversion disabled			
	Prefix PI in conversion from UPC/EAN to GTIN format		0		✓

Scan setting

Description			Default	Setting method	
				Setting Command	Configuration tool
QR code	Reading	Disabled		✓	✓
		Enabled	*		
	Read version	Min.	1	✓	✓
		Max.	40		
	Reading in the structured append mode	Non-edit mode	*	✓	✓
		Edit mode			
Micro QR code	Reading	Disabled	*	✓	✓
		Enabled			
	Read version	Min.	1	✓	✓
		Max.	4		
rMQR	Reading	Disabled	*	✓	✓
		Enabled			
	Vertical cell version	Min.	1	✓	✓
		Max.	6		
	Horizontal cell version	Min.	1	✓	✓
		Max.	6		
SQRC	Reading	Disabled	*	✓	✓
		Enabled			
	If encryption keys match	Disclosed data + Undisclosed data	*	✓	✓
		Transmit only undisclosed data			
	If encryption keys do not match	Reading disabled	*	✓	✓
		Transmit only disclosed data			
	Read version	Min.	1	✓	✓
		Max.	40		
DataMatrix	DataMatrix (Square)	Disabled	*	✓	✓
		Enabled			
	Square DataMatrix Read code number	Min.	1	✓	✓
		Max.	24		
	DataMatrix (Rectangle)	Disabled	*	✓	✓
		Enabled			
	Rectangle DataMatrix Read code number	Min.	1	✓	✓
		Max.	6		
PDF417	PDF417	Disabled	*	✓	✓
		Enabled			
	Micro PDF417	Disabled	*	✓	✓
		Enabled			
MaxiCode	Reading	Disabled	*	✓	✓
		Enabled			

Description				Default	Setting method	
					Setting Command	Configuration tool
GS1 Composite	GS1 Databar/2D code	CC-A	Disabled	*	✓	✓
			Enabled			
		CC-B	Disabled	*	✓	✓
			Enabled			
	UPC/EAN/2D code	CC-A	Disabled	*	✓	✓
			Enabled			
		CC-B	Disabled	*	✓	✓
			Enabled			
	GS1-128/2D code	CC-A	Disabled	*	✓	✓
			Enabled			
		CC-B	Disabled	*	✓	✓
			Enabled			
		CC-C	Disabled	*	✓	✓
			Enabled			
	Transmitting FNC1	Disabled				✓
		Converted to GS and transmitted		*		
		Selected by the user				
UPC/EAN	UPC-A/EAN-13 reading	Disabled		*	✓	✓
		Enabled				
	Transmitting C/D in UPC-A	Disabled				✓
		Enabled		*		
	Transmitting the number system character in UPC-A	Disabled				✓
		Enabled		*		
	Transmitting leading character(s) for adjusting the number of digits in UPC-A	Disabled				✓
		Enabled		*		
	Transmitting C/D in EAN-13	Disabled				✓
		Enabled		*		
	Transmitting the country code in EAN-13	Disabled				✓
		Enabled		*		
	Converting EAN-13 to ISBN/ISSN	Disabled		*		✓
		Enabled				
	UPC-E reading	Disabled		*	✓	✓
		Enabled				
	Transmitting C/D in UPC- E	Disabled				✓
		Enabled		*		

Description			Default	Setting method	
				Setting Command	Configuration tool
UPC/EAN	Transmitting leading character(s) for adjusting the number of digits in UPC- E	Disabled	*		✓
		Enabled			
	Converting UPC-E to UPC-A	Disabled	*		✓
		Enabled			
	Transmitting the number system character in UPC- E	Enabled	*		✓
		Disabled			
	EAN-8 reading	Disabled		✓	✓
		Enabled	*		
	Transmitting C/D in EAN-8	Disabled			✓
		Enabled	*		
	Converting EAN-8 to EAN-13	Disabled	*		✓
		Enabled			
Code128	Reading	Disabled	*	✓	✓
		Enabled			
	Transmitting FNC1	Disabled			✓
		Converted to GS and transmitted	*		
		Selected by the user			
	Min.number of digits		1 digit		✓
	Max.number of digits		99 digits		✓
GS1-128	Reading	Disabled	*	✓	✓
		Enabled			
	Transmitting FNC1	Disabled			✓
		Converted to GS and transmitted	*		
		Selected by the user			
	Min.number of digits		1 digit		✓
	Max.number of digits		99 digits		✓
Code39	Reading	Disabled	*	✓	✓
		Enabled without C/D			
		Enabled with C/D			
	Transmitting C/D	Disabled			✓
		Enabled	*		
	Transmitting the start and stop codes	Enabled			✓
		Disabled	*		
	Full ASCII conversion	Enabled			✓
		Disabled	*		

Description				Default	Setting method	
					Setting Command	Configuration tool
Code39	Min.number of digits			1 digit		✓
	Max.number of digits			99 digits		✓
Interleaved 2 of 5	Reading	Disabled		*	✓	✓
		Enabled without C/D				
		Enabled with C/D				
	Transmitting C/D	Disabled				✓
		Enabled		*		
	Min.number of digits			4 digits		✓
	Max.number of digits			99 digits		✓
Codabar (NW-7)	Reading	Disabled		*	✓	✓
		Enabled without C/D				
		Enabled with C/D				
	Transmitting C/D	Disabled				✓
		Enabled		*		
	Calculation method of C/D	MOD-16		*		✓
		7-Check				
	Transmitting the start and stop codes	Enabled (a/b/c/d)		*		✓
		Enabled (A/B/C/D)				
		Disabled				
	Min.number of digits			4 digits		✓
	Max.number of digits			99 digits		✓
GS1 DataBar	GS1 DataBar	GS1 DataBar	Disabled	*	✓	✓
			Enabled			
		GS1 DataBar Stacked	Disabled	*	✓	✓
			Enabled			
	GS1 DataBar Limited	Disabled		*	✓	✓
		Enabled				
	GS1 DataBar Limited reading enabled	ISO/IEC 24724:2006		*		✓
		ISO/IEC 24724:2011 ^(Note 1)				
	GS1 DataBar Expanded	GS1 DataBar Expanded	Disabled	*	✓	✓
			Enabled			
		GS1 DataBar Expanded Stacked	Disabled	*	✓	✓
			Enabled			

Description				Default	Setting method	
					Setting Command	Configuration tool
GS1 DataBar	GS1 DataBar Expanded	FNC1 transmission	Disabled			✓
			Transmit GS	*		
			Selected by the user			
		Minimum number of reading digits		1 digit		✓
		Maximum number of reading digits		99 digits		✓
Scan condition	Black-and-white inverted code reading	Black-and-White normal code		*	✓	✓
		Black-and-white inverted code				
	Mirror code reading	Normal code		*	✓	✓
		Mirror code				
	Read area	Upper left (x, y)		0, 0	✓	✓
		Lower right (X, Y)		1599, 1199		
	Scan time limit	Disabled		*	✓	✓
		Enabled				
	Scan time limit (ms)			200	✓	✓
	Image Processing Filter			None	✓	✓
	Scan condition rotation	Invalid		*	✓	✓
		Valid				
	Rotation trial count			1	✓	✓
Imaging setting	Polarizing filter			OFF	✓	✓
	Shutter (μs)			1	✓	✓
	Gain level			0	✓	✓
	Scan range (H x V) ^(Note 2)			1024 x 768		✓
Light	External light			OFF	✓	✓
Scanning setting	Scan condition rotation order	Rotation in order		*	✓	✓
		Prioritized by success scan conditions				
	Double-read prevention time(ms)			1,000	✓	✓
	Marker lighting	Light on disabled		*	✓	✓
		Light on enabled				
		Light on only for Trigger ON duration				

(Note 1) Reading is allowed only when the right-hand guard bar has space for five modules.

GS1 DataBar Limited
(ISO/IEC 24724:2006) model



GS1 DataBar Limited
(ISO/IEC 24724:2011) model



(Note 2) The scan range provides two choices--1024 x 768 pix and 1600 x 1200 pix (full size).

Scanning evaluation

Description			Default	Setting method	
				Setting Command	Configuration tool
Symbol quality	Disabled		*	✓	✓
	Enabled				
	Grade notation	Alphabetic character	*	✓	✓
		Numeric character			
Scanning stability evaluation	Disabled		*	✓	✓
	Enabled				

Operation mode setting

Description				Default	Setting method	
					Setting Command	Configuration tool
Trigger	Trigger type	Input terminal		*	✓	✓
		Command				
	Trigger mode	Single			✓	✓
		Continuous		*		
	One-shot operation	Disabled		*	✓	✓
		Enabled				
	One-shot operation time (unit: 10 ms)			100	✓	✓
	Trigger input delay Time (unit: 1 ms)			0	✓	✓
	Trigger ON command			“TRGON”	✓	✓
	Trigger OFF command			“TRGOFF”	✓	✓
	External light synchronous output signal function	Trigger synchronous lighting (Tr ON)		*	✓	✓
		Trigger synchronous lighting (Tr OFF)				
		Continuous lighting (Tr ON)				
		Continuous lighting (Tr OFF)				
	Data output timing	Asynchronous		*	✓	✓
		Synchronous				
	Failure notification data	Output	Disabled	*	✓	✓
			Enabled			
		Failure notification data character		“ERROR”	✓	✓
		Applying output format setting	Disabled	*	✓	✓
			Enabled			
	Trigger command response	Disabled		*	✓	✓
		Enabled				

Description			Default	Setting method	
				Setting Command	Configuration tool
Input terminal	Input terminal 1	Not used		✓	✓
		Trigger signal	*		
		Reset signal			
	Input terminal 2	Not used	*	✓	✓
		Trigger signal			
		Reset signal			
	Chattering eliminating time (unit: 1 ms)		1	✓	✓
Output terminal	Output terminal 1	Not used	*	✓	✓
		OK signal			
		NG signal			
		Verification NG signal			
		BUSY signal			
	Output terminal 2	Not used	*	✓	✓
		OK signal			
		NG signal			
		Verification NG signal			
		BUSY signal			
		External light sync signal			
	Output terminal 3	Not used	*	✓	✓
		OK signal			
		NG signal			
		Verification NG signal			
		BUSY signal			
	Output delay time (ms)		100	✓	✓
	Output time (ms)		500	✓	✓

Description				Default	Setting method	
					Setting Command	Configuration tool
Image save	Disabled			*	✓	✓
	Enabled					
	Storage location	Save in image memory		*	✓	✓
		Send to image save tool				
	Save in image memory	Save condition	Save all images		✓	✓
			Save read failure images			
			Save read success images			
			Save the first image	*		
			Save the last image			
			Save the first failure image			
			Save the last failure image			
		Save mode	Cyclic	*	✓	✓
			Fixed memory No.			
	Send to image save tool	Save condition	Save read success images		✓	✓
			Save the first image	*		
			Save the last image			
			Save the first failure image			
			Save the last failure image			
		Image size	1/1	*	✓	✓
			1/4			
			1/16			
			1/64			

Other settings

Description			Default	Setting method	
				Setting Command	Configuration tool
Data verification reading	Disabled		*	✓	✓
	Enabled				
	Preset data		Not set	✓	✓
	Verification position designation	Disabled	*	✓	✓
		Enabled			
	Verification start position		1 digit	✓	✓
	Verification end position		99 digits	✓	✓
	Verification result transmission	"OK" / "NG"	*	✓	✓
		"OK" + <Data>/ "NG"			
		"OK"/"NG" + <Data>			
		"OK" + <Data>/ "NG" + <Data>			
Data edit (ADF)	Edit mode	Non-edit	*		✓
		Data extraction mode			
		ADF script mode			
	Data extraction mode	Data extraction	*		✓
		Block extraction			
		AI mode			
	Extraction start position in the data string extraction	From the first digit			✓
		From the end digit			
		Position designation	*		
	Extraction end position in data string extraction	To the end digit	*		✓
		Number-of-digits designation			
		Position designation			
	Extraction start digit in the data string extraction		1 digit	✓	✓
	Extraction end digit in the data string extraction		Not designated	✓	✓
	Number of blocks in the data block extraction (max. 3 blocks)		Not designated		✓
	AI mode	AI delimited mode	*		✓
		AI parenthesizing mode			
	AI delimited mode All designation enabled/disabled	Enabled	*		✓
		Disabled			

Description			Default	Setting method	
				Setting Command	Configuration tool
Data edit (ADF)	AI delimited mode AI2 designation enabled/disabled	Enabled			✓
		Disabled	*		
	AI delimited mode AI3 designation enabled/disabled	Enabled			✓
		Disabled	*		
	AI delimited mode Delimiter characters	Header/terminator	*		✓
		Comma			
		Tab			

Chapter 16 Troubleshooting

Problem 1: Data cannot be smoothly sent/received to/from the scanner.

Check item	Troubleshooting
Has a driver been installed in your PC? (In case of USB interface)	Refer to “3.4.4. USB Interface”.
Have the communication settings been configured properly?	For communication via RS-232C and Ethernet, communication settings have to be configured according to your network environment. For details, refer to Chapter 6 .
Has the settings for the transmission of the read data been properly set?	Data can be output via either RS-232C or Ethernet. However, data cannot be output via USB. For details, refer to Chapter 6.1.

Problem 2: Autofocus may not be possible

Check item	Troubleshooting
Has the autofocus function performed in succession?	If the autofocus function is performed in succession, another autofocus operation may be restricted for a while. Please wait a while and try again.

Problem 3: A black fixed dot appears in the screen image

Check item	Troubleshooting
Is there any fingerprint on the lens?	Clean the lens by referencing "Care and Maintenance."

Problem 4: Codes cannot be read properly

Check item	Troubleshooting
Are codes read properly at the scanning position?	Adjust the position so that codes will be read properly at the scanning position.
Is the focus setting is optimum for codes?	With the auto focus function (Section 5.1.), you can adjust the optimum focus setting for codes.
Is the reading mode properly set?	Depending on the reading mode setting, scanning may be started in the middle of the scanning or at the timing when a code is out of the field of view. For details, refer to Chapter 5.
Is the code clean?	Wipe the code surface to remove any dirt. Additionally, with the symbol quality function (Section 11.1.), you should check whether codes can be read, and then consider how to improve the print quality, if necessary.
Aren't the codes blurred?	With the symbol quality function (Section 11.1.), you should check if codes can be read, and then consider how to improve the print quality, if necessary.
Are the settings correct?	With the auto-tuning function (Section 5.2.), you can set code types and conditions.
Are the codes to be read set to Reading enabled?	Set the codes to be read to Reading enabled.
Are the check digits for read barcodes correct?	Use proper barcodes.

Appendix 1 Specifications

Item			Specification	
Model			FD2-HS1000-ERU (Standard scan range model)	FD2-HW1000-ERU (Wide scan range model)
Reading part	Readable code	2D code	QR Code (model 1, model 2),MicroQR, rMQR, SQRC ^(*) , MaxiCode, DataMatrix, PDF417, MicroPDF417, GS1 Composite	
		Barcode	Interleaved 2 of 5 (ITF), Code 39, Codabar (NW-7), EAN-13/8, UPC-A/E, Code93, Code128, GS1-128 (EAN-128), GS1 DataBar (RSS)	
	Minimum resolution	2D code	0.06 mm ^(*)2)	0.08 mm ^(*)2)
		Barcode	0.08 mm	0.08 mm
	Reading distance		110 to 1200 mm	50 to 720 mm
Interface	RS-232C		RS-232C asynchronous	
	USB		USB-COM interface	
		Standard	Compliant with USB 1.1	
	Connector	micro USB type B		
Ethernet		Compliance to IEEE802.3 10BASE-T/100BASE-TX		
Power source device ^(*)3)	Operating voltage		24 V DC +10%, -15%	
	Consumption current		1.6 A Max.	
Environmental condition	IP code		IP 65 ^(*)4)	
	Operating temperature range		-10 to 45℃	
	Operating humidity range		10 to 95% RH ^(*)5)	
	Storage temperature range		-20 to 60℃	
	Storage humidity range		5 to 95% RH ^(*)5)	
External dimension (W) × (D) × (H)			47 × 47.1 × 74 mm	
Weight			Approx. 220 g	

(*)1 Please consult your dealer when using SQRC in countries other than Japan.

(*)2 It applies to QR codes.

(*)3 For the power supply, use class 2 power supply device, or a circuit free from risk of electric shock or fire, or reinforced or double-insulated from MAINS and is compliant with LIM (Limited Energy Circuit) circuit.

(*)4 Specifications under the following conditions.

■ Power/Control Connector : With the cable connected

■ Ethernet Connector : With the waterproof cap or cable connected

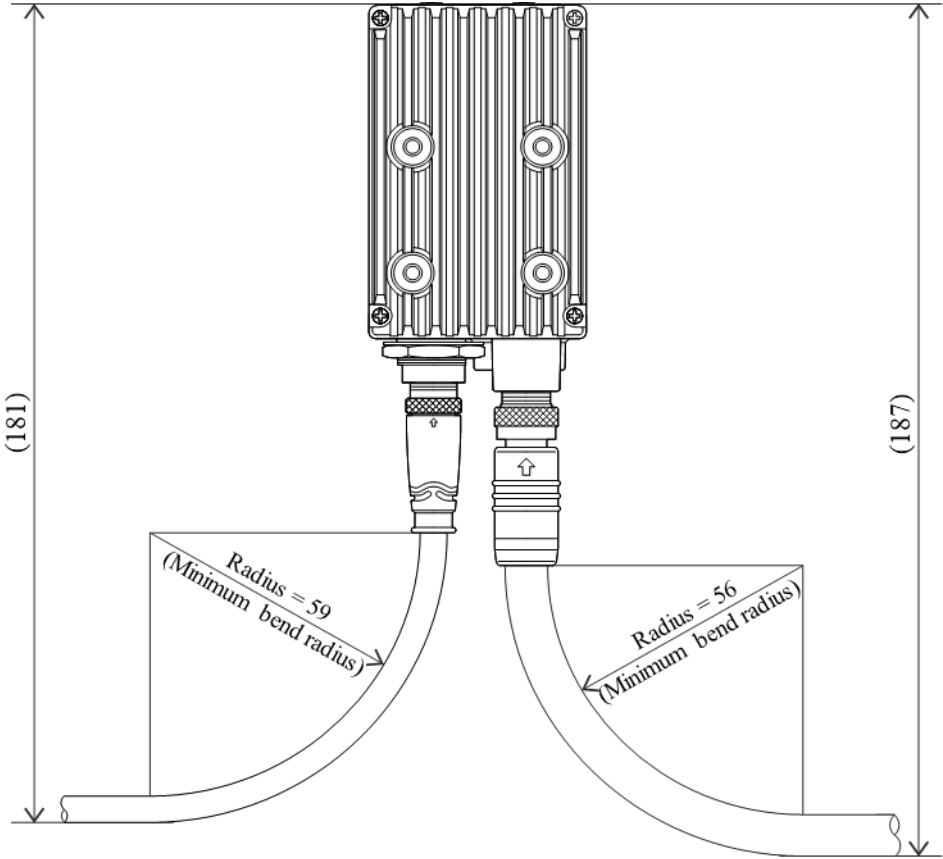
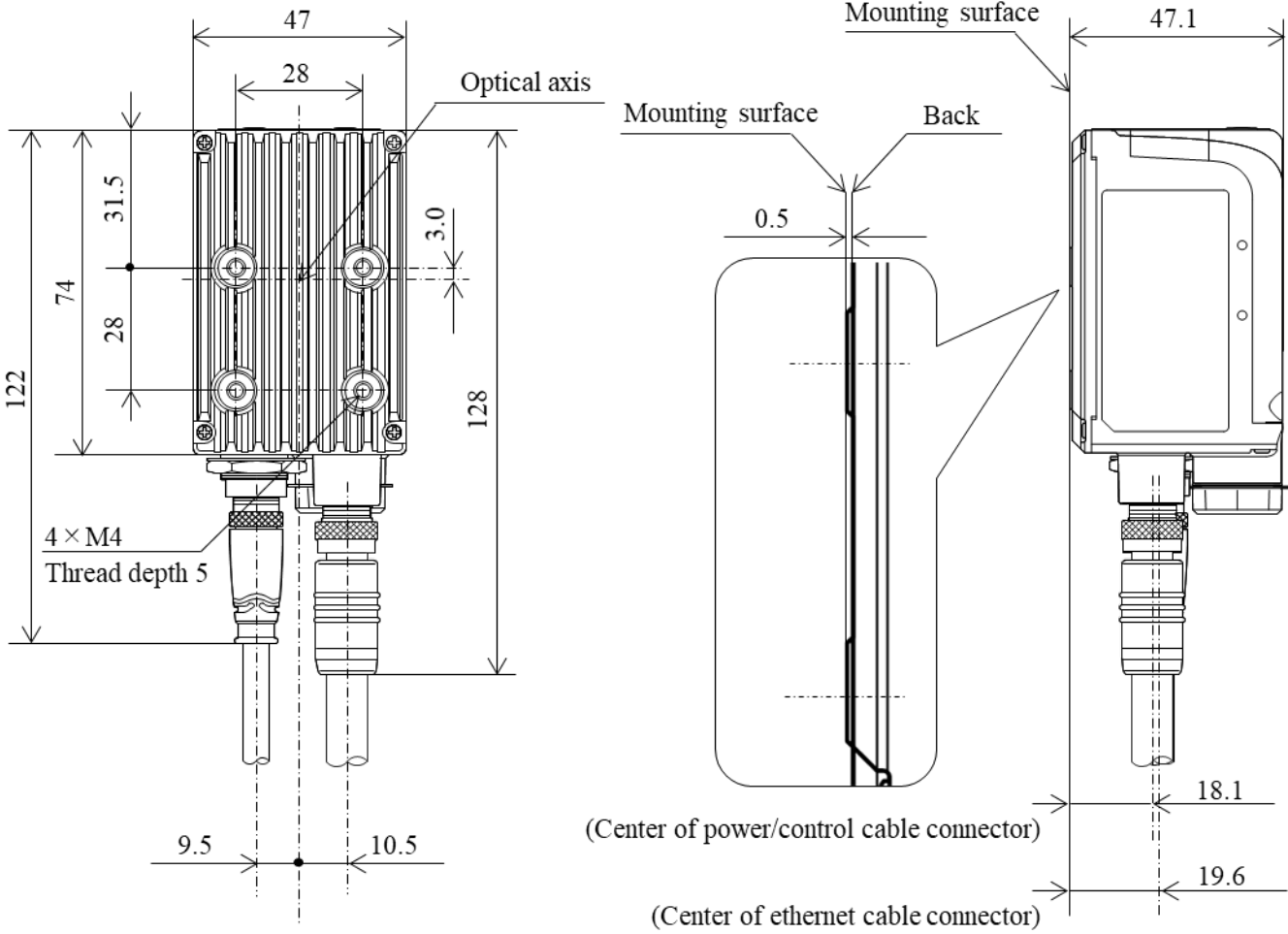
■ USB connector : With the waterproof cap connected.

(Dustproof and waterproof specifications (IP 65) are not satisfied if the USB cable is connected.)

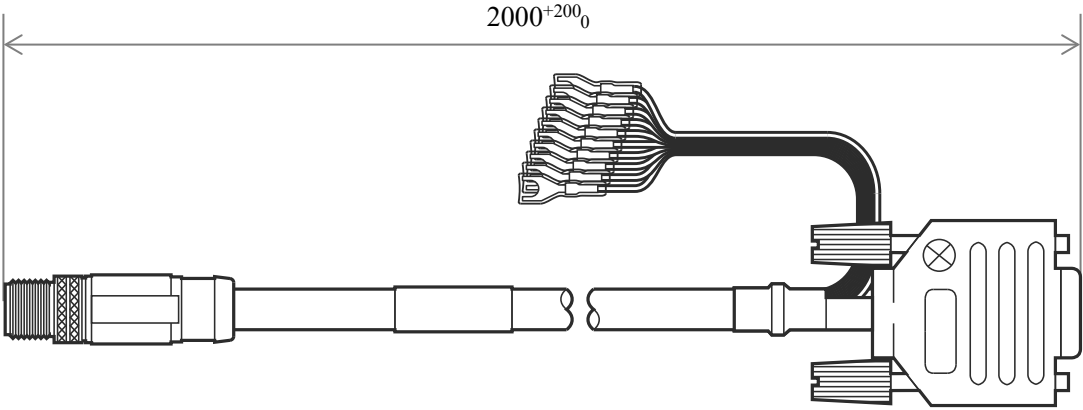
(*)5 Without sudden change in temperature, condensation or frost are not allowed.

Appendix 2 External dimensions

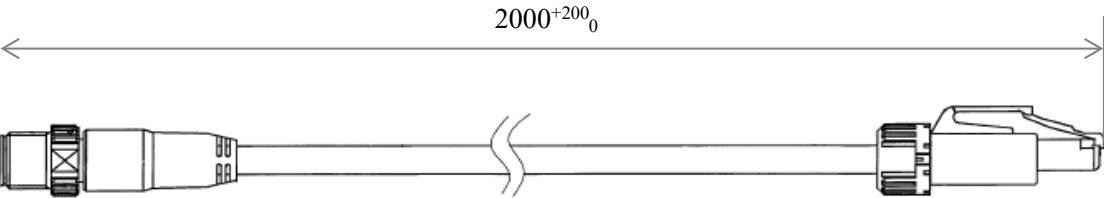
■ FD2-HS1000-ERU/FD2-HW1000-ERU
(Unit : mm)



■ Power/control cable
(Unit : mm)



■ Ethernet cable
(Unit : mm)



Fixed Type Scanner
FD2-HS1000-ERU
FD2-HW1000-ERU

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