MDI-4xx0

2D Imager

MDI-40x0

MDI-41x0

Serial Interface Specificaiton Manual – Rev 5.0

The information in this document is subject to change without notice.

Document History

Model Number:	MDI-4xx0	Specification Number:	SI17166
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Limited Warranty and Disclaimers

Please read this manual carefully before installing or using the product.

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Revision History

Document Name : MDI-4xx0 [分類]

Edition	Date	Section	Description of Changes	Supported Firmware
1st	2018/06/11	-	Initial release	BD01J07
2nd	2020.11.09	1.2	Added UniversalTuningTool	BD01J11
		4.3	Added Multi Byte Character Output	
		6.1.5	Added Dot code and Data Matrix ECC (0-140)	
		6.2.3	Changed Quiet Zone to Smart Quiet Zone	
		7.2.9	Added Bank Number	
		8.1.1	Corrected the description of Read Modes	
		8.1.2	Added Read Mode Not Using Trigger	
		8.1.6	Added Central Reading Range	
		8.5.2	Added Data Edit Reading	
		8.6	Added Tuning Function	
		8.10	Added Bank Function	
		10.2.1	Added readable OCR font E-13B(MICR)	
		10.3	Added and changed sample code and font	
		-	Correct errors, adjust format.	
3rd	2022.02.14	3.2	Added the functions that the setting will be maintained when updating the firmware and the versions.	BD01J12 and later
		3.5.1	Added software trigger command	BD01J12 and later
		5.6.1	Added the read effective time numeric setting	
		5.6.5	Added the decode timeout	
		6.1.7	Changed “Other Options for Codes” to “Code Type Settings” and added an initializing menu for code type	BD01J12 and later
		6.2.8	Added DPM (Dot Peen Marking) reading	BD01J12 and later
		7.2.7	Added function of adding code tilt angle	BD01J12 and later
		8.1.1	Added the command to stop reading when reaches the number of codes for multiple read 1.	BD01J12 and later
		8.1.2	Added high-speed slide reading mode	BD01J12 and later
		8.1.3	Added toggle trigger mode	BD01J12 and later
		8.1.4	Changed “Read mode not using trigger” to “Disable Trigger (Stay Reading All the Time)”	
		8.3.5	Changed “Auto Trigger Sleep” to “Auto Trigger Sleep Transition Time”	
		8.4.1	Added minimum brightness to the illumination and aiming, and changed the low brightness to a note.	BD01J12 and later
		8.7	Added exposure fixation	
		8.8	Added decode area	
		8.10.1	Added each bank registration example	
		8.11	Added error message	BD01J12 and later

Edition	Date	Section	Description of Changes	Supported Firmware
3rd	2022.02.14	9.3	Added indicator timing when read timeout to good read aiming and update example.	BD01J12 and later
		10.3.5	Added DMRE (Datamatrix Rectangular Extension)	BD01J12 and later
		-	Update to latest images, correct errors, adjust format.	
4th	2023.06.15	2.1.1	Corrected model description.	
		2.1.2	Corrected model description.	
			Made copy editing and formatting updates.	
5th	2024.07.17	-	Updated to new layout	

Contents

1 Abstract

This document provides the serial interface specifications for the MDI-4xx0 imager scan engine.

1.1 Features of the Scan Engine

The MDI-4xx0 is a low-profile, imager-based bar code scan engine that enables high speed scanning of 1D (linear) and 2D bar codes, as well as OCR fonts.

Main features:

- World's thinnest 2D imager scan engine
  The MDI-4xx0 scan engines are ultra-low profile. At a height of only 9.7 mm, the MDI-4150 can be easily integrated into even the most compact equipment such as PDA's, data collectors, and ticket readers.
- High-speed reading
  The extremely high-performance decoder used in the MDI-4xx0 ensures stress-free scanning and fast response, even in the case of poor quality bar codes (damaged, low contrast, etc.), movement and vibration, and poor lighting conditions.
- Low power consumption
  The power consumption in operating, standby, and low power states is extremely low. Various power saving settings can be configured to optimize the power consumption for your particular situation.
- High-speed image sensor
  The high-speed CMOS image sensor in the MDI-4xx0 captures images at a speed of up to 100 fps. Combined with the fastest global shutter speed in the industry, this feature enables fast and accurate scanning.
- The fastest Image processing in the industry
  The high-performance and low-power 800 MHz CPU enables a smooth response by processing the vast amount of information transferred by the 100fps CMOS image sensor in a very short time.
- Batch reading/Data Edit Function
  Capable of batch reading and data edit output of 1D bar codes, 2D bar codes and OCR fonts. GS1 data conversion and bar code coordinate output is also supported.
- Green LED aiming and Warm-White LED Illumination
  A well-defined single line of green LED light and efficient warm-white LED illumination makes it easy to aim the scan engine while providing safety and long-life.
- RoHS compliance
  The MDI-4xx0 is a RoHS compliant product, as declared by OPTOELECTRONICS CO.,LTD.

1.2 Flow to Integrate

This section describes the general flow to integrate.

1. Examine and Select the Scan Engine

Review the technical introduction:

- Before using — See Chapter 2: Before Using.
- Product specification overview — See section 10.2: MDI-4xx0 Specification Overview.

"Communication" — UART/USB

"Reading Code"

2. Download Tools

Based on the operation, download the appropriate tools from the Opticon website:

- Setting, Image acquisition, confirm communication — "UniversalConfig"
- Tuning configuration for stationary — "UniversalTuningTool"
- USB-COM — "USB Driver"
- COM output → HID output conversion — "WIME"

UniversalConfig UniversalTuningTool WIME

3. Setting and Testing

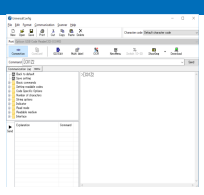
In the actual enviroment, evaluate the optimum settings based on the operation and perform a reading test:

- Evaluation board — See section 2.3.
- Configurations — See Chapter 3.
- Interface — See Chapter 4.
- Power Management and Timing — See Chapter 5.
- Code Options — See Chapter 6.
- String Option — See Chapter 7.
- Read Options — See Chapter 8.
- Sample codes — See section 10.3.

4. Create Setting Menu

Create a command or 2D menu code suitable for operation:

- Configurations — See section 3.2.



Integrate

Refer to the “MDI-4xx0_Integration Guide”.

2 Before Using

This section describes the required items you need before using the scan engine.

2.1 Model Details

2.2 Scan Area

2.3 Optional Accessories

2.1 Model Details

The scan engine model is a combination of model name, focus, and interface.

Model Name		Focus		Interface
MDI-4150 MDI-4050 MDI-4100 MDI-4000		SR HD UD		B
				DC
				D

2.1.1 Standard Product Specifications

Standard	Description
MDI-4150 SRB	Decoder board integrated, Standard focus, Interface: UART
MDI-4050 SRB	Decoder board separated, Standard focus, Interface: UART
MDI-4100 SRB	Decoder board integrated, Standard focus, Interface: UART
MDI-4000 SRB	Decoder board separated, Standard focus, Interface: UART

Note: Other combinations are available by special order. For help, contact your local sales office.

2.1.2 Model Description

Scan Engine Layout

Symbol	Description
MDI-4150	Decoder board integrated scan engine. Low power consumption mode installed.
MDI-4050	Decoder board separated scan engine. Low power consumption mode installed.
MDI-4100	Decoder board integrated scan engine
MDI-4000	Decoder board separated scan engine

Focus

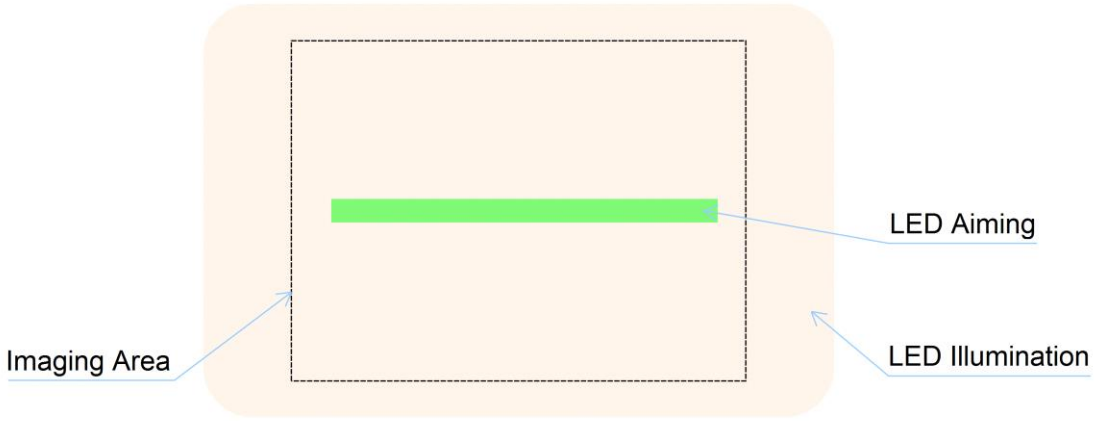
Symbol	Description
SR	Standard focus (115 mm)
HD	High resolution focus (65 mm)
UD	Ultra high resolution (45 mm)

Factory Interface Initial Setting

Symbol	Description
B	UART
DC	USB-COM
D	USB-HID

2.2 Scan Area

The scan engine acquires an image to read the bar code.

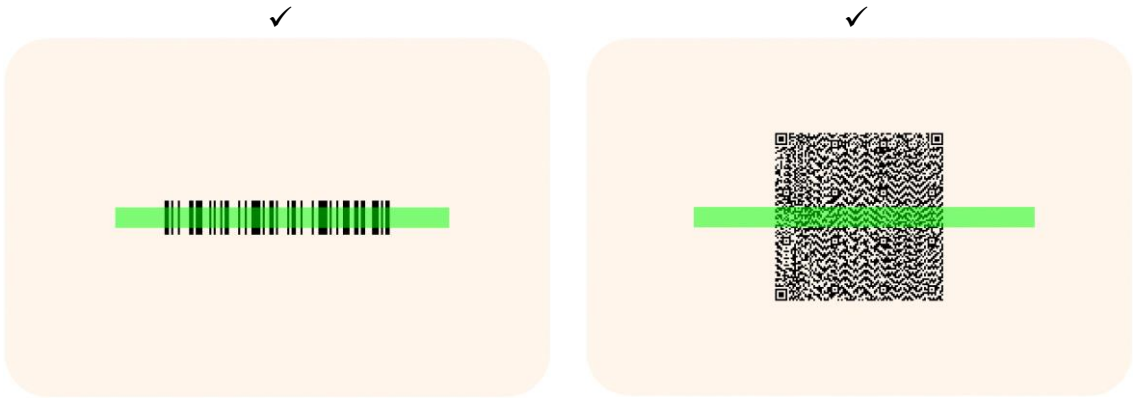


The dotted line in the diagram is not actually visible. LED aiming is the target when reading bar codes.

Notes:

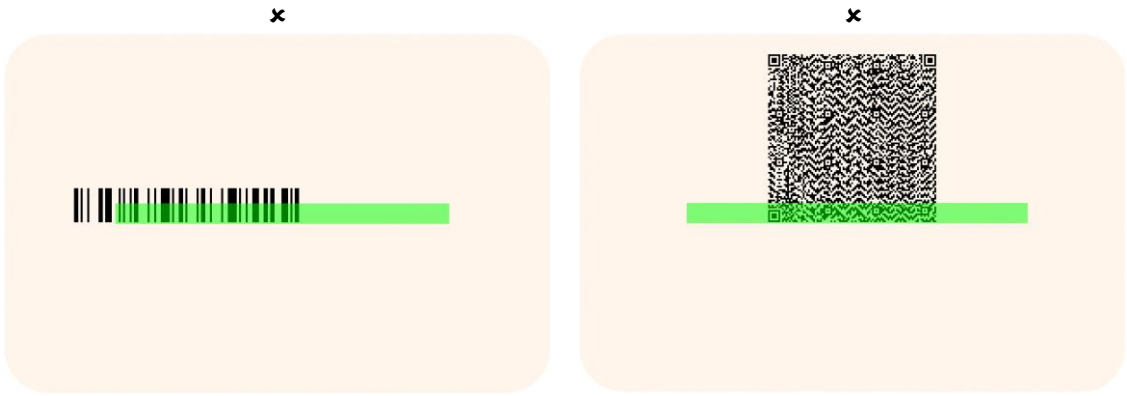
- For reading depth of field, see section 10.2.2: Technical Specifications.
- For reading only the center of LED aiming, see section 8.1.5: Central Reading.

These diagrams illustrate correct LED aiming.



Note: If the code including quiet zone is within the view angle, 360° rotation reading is possible.

These diagrams illustrate incorrect LED aiming.



2.3 Optional Accessories

2.3.1 Evaluation Board (MEK-3100)

Use the evaluation board to perform these actions:

- Confirm connection: The MEK-3100 connected to the scan engine can connect to the host via RS-232C or USB interface. The board can then observe each signal in the connection.
- Confirm connection/reading functionality: Use the terminal emulator or Opticon software “UniversalConfig” for Windows to confirm communication or reading functionality.
- Evaluate power consumption: The MEK-3100 can be used for electricity evaluation, such as the scan engine power consumption.

These accessories are available:

- MEK-3100 interface evaluation board
- FFC (for connecting the scan engine)
- RS-232C cable
- AC adapter (for RS-232C)
- USB cable
- Accessories (screws, etc.)

3 Configurations

This chapter describes the scan engine configuration, default setting and saving setting, and basic commands.

3.1 Configuring with Commands

The scan engine can be configured by sending commands via the serial interface or by reading 1D or 2D menu labels. This section describes the serial commands.

3.1.1 Command Packet

This section describes the command packet, from header to terminator.

Command Header*2	Command ID*1		Command Terminator*2
<ESC> (0x1B)	None	1 - 2 digits (ASCII)	<CR> (0x0D)
	[(0x5B)	3 digits (ASCII)	

*1 It is possible to send multiple command IDs between a single header and terminator, except for single digit IDs.

*2 A combination of command header <STX>(0x02) and terminator <ETX>(0x03) is also possible.

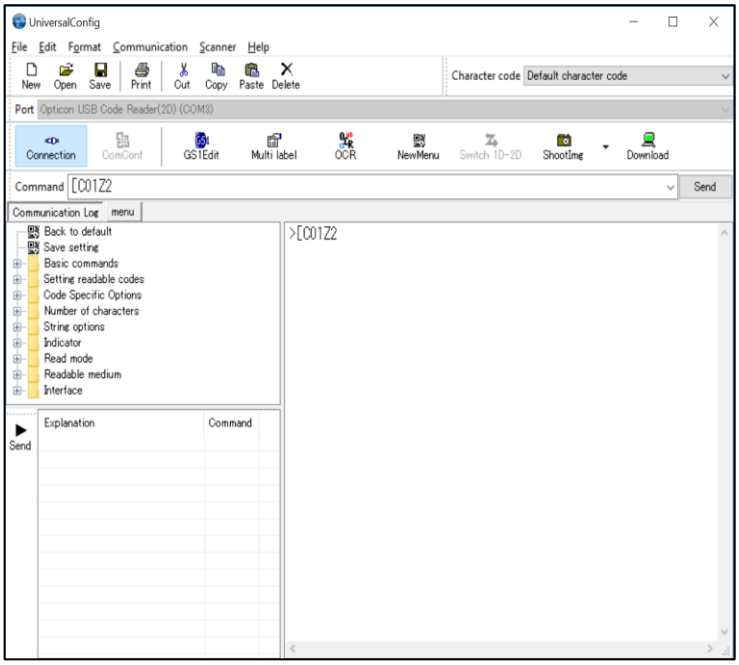
Input examples:

1-digit command	<ESC>Δ<CR>
2-digit command	<ESC>ΔΔ<CR>
3-digit command	<ESC>[ΔΔΔ<CR>
Two 2 digit commands	<ESC>ΔΔΔΔ<CR>
2 and 3 digits command	<ESC>ΔΔ[ΔΔΔ<CR>

The command can be sent via “UniversalConfig”.

To configure the scan engine, enter the command in the “command:” box with a character string and click **Send**.

Note: For UniversalConfig, enter the command as a character string, not an ASCII code. Commands entered in the “command:” box do not require <ESC> or <CR>.



3.1.2 Command Packet Sending Precautions

When sending packets of 32 or more characters, a transmission condition will occur under these conditions. The command may be missed.

Power Mode (UART)	UART Baud Rate [bps]							
	9600	19200	38400	57600	115200	230400	460800	921600
Standby	-	-	-	-	-	-	*	*
Low Power Standby	See section 5.4.							

Note: When sending packets of 32 or more characters, there is command packet transmission condition.

Transmission Condition: Send "Null" Characters First, and Then Send the Command After 10 ms

The maximum length of any command packet is 1000 characters. When more than 1000 characters are sent, some characters may be lost and the execution will not be performed correctly.

When a multiple command packet is sent, a subsequent command will not be received while the previous command is still being executed. To workaround this issue and get the correct timing:

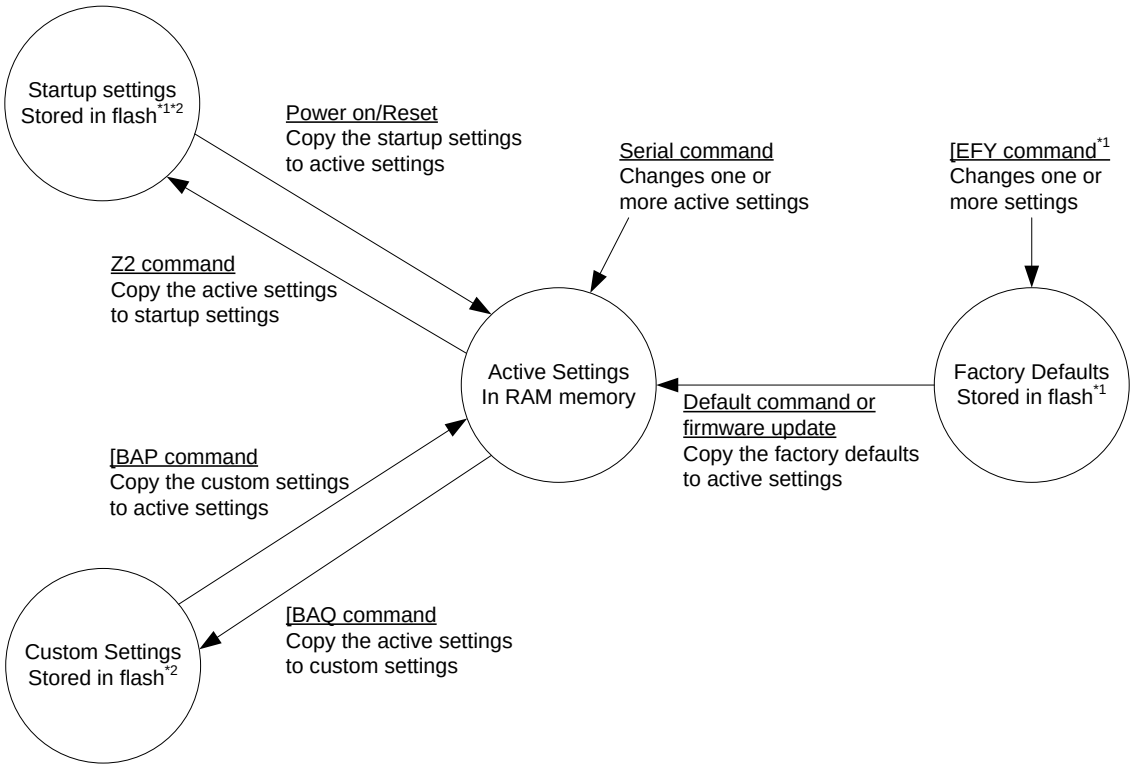
- Use a form of Handshake, BUSY/READY or MODEM, because then the RTS output will be in busy state while a command is executed making it possible to refer to this signal for the right timing. See section 4.1.6: Handshaking (Flow Control).
- Use 'ACK/NAK for serial commands'. See section 3.5.3: ACK/NAK for Serial Commands. When ACK/NAK is enabled, the scan engine will send an ACK after a command is received and processed.

Settings configured by commands are not retained in non-volatile memory. Therefore, these settings will be lost when the power is turned off and on again, and the scan engine will be in the configuration state saved in non-volatile memory. To save the settings made with commands, end the configuration by sending the Z2 command to save all the parameters in non-volatile memory.

These interface settings may disrupt communication, so they will not be reflected until they are written in non-volatile memory using Z2: Baud Rate, Data Length, Parity, and Stop Bit.

Note: Settings made by reading 1D or 2D menu codes will be saved in non-volatile memory. Any previously made settings using commands will also be saved. See section 3.6: Configuring with 2D Menu Codes and section 3.7: Configuring with 1D Menu Codes.

3.2 Command Packet Sending Precautions



*1 Only configures the factory default settings in an environment where power is stable.
*2 These regions are cleared when a firmware update is loaded for firmware up to BD01J11. For BD01J12 and later versions, it will not be cleared and will maintain the settings.

Versions that **initialize** the settings when updating	Versions that **maintain** the settings when updating
BD01J09 → BD01J12, BD01J11 → BD01J12	BD01J12 → BD01J12x, BD01J12 → BD01J13
BD01J12 → BD01J09, BD01J12 → BD01J11	BD01J13 → BD01J14

*3 They can be rewritten up to 30,000 times.

3.2.1 Description of Settings

Active Settings
Active Settings are in an area in RAM, so they are lost after a power cycle. This area contains the settings that are currently active, so the scan engine operates according to these settings. These settings are loaded from one of the other areas, and contain new settings added via serial commands or menu labels.

Startup Settings
Startup Settings are in an area in non-volatile memory. When the scan engine is powered on, the data in this area is copied to the Active Settings area in RAM.

Custom Settings
Custom Settings are in an area in non-volatile memory. When the [BAP command is sent to the scan engine, the data in this area is copied to the Active Settings area in RAM.

Note: When reading or sending the command "[BAQ", this area is overwritten with the current Active Settings.

Factory Default Settings
Factory Default Settings are in an area in non-volatile memory. These are the default settings for the scan engine and are loaded to Active Settings when the default command (U2) is read or sent. Factory Default Settings can be modified via Custom Command Line Settings. See section 3.3: Custom Command Line Settings (Change the Factory Default Settings).

3.2.2 Interface Default Settings

The Active Settings can be returned to the factory default settings. Set the command that corresponds to the interface being used.

Factory Default Setting Commands

Command	Interface	Description
U2	UART	Set back to UART Factory Default Settings
[C01	USB-COM	Set back to USB-COM Factory Default Settings
SU	USB-HID	Set back to USB-HID Factory Default Settings

3.2.3 Save Settings

The Active Settings can be written to the “Startup Settings.”

Save Settings Command

Command	Description	Remark
Z2	Save the Active Settings as Startup Settings	Command only

Notes:

- Add “Z2” to the end of command packet to be saved.
- Saving settings more than 30,000 times may destroy memory. Avoid saving every time.
- Some settings, such as Baud Rate, will not be enabled until “Save settings” is sent.

3.2.4 Custom Settings

Command	Description
[BAP	Read out Custom Settings
[BAQ	Save to Custom Settings

Notes:

- Add “[BAQ” to the end of the command packet to be saved.
- To save Custom Settings and Active Settings at the same time, send “[BAQZ2”.
- Saving settings more than 30,000 times may destroy memory. Avoid saving every time.

3.3 Custom Command Line Settings (Change the Factory Default Settings)

The Factory Default Settings the scan engine was shipped with can be permanently changed via Custom Command Line commands. These settings will even survive a firmware update. The new Factory Default Settings become active after a reboot and initialization of the scan engine.

Be careful with Custom Command Line commands, because they may corrupt flash memory if the power is turned off during the setting operation. Make sure your environment has a stable power source.

Recommended settings for Custom Command Line commands:

- Fast Boot Mode. See section 3.4: Fast Boot Mode.
- Image settings. See section 3.5.7: Image Settings.
- Baud Rate, Data Length, Parity, Stop Bit, etc. See section 4.1: UART.

Command Header	Command	Separator	Command IDs (*1)	Separator	Command Terminator
<ESC>	[EFY	, (0x27)	Custom Commands	, (0x27)	<CR>

*1 Multiple commands are allowed.

To activate the new Factory Default Settings, the ”RV” command must be sent or scanned, which will reset the scan engine. To load the new Factory Default Settings, send or scan the U2 command to save the new settings so that they will be loaded after a power on.

Custom Command Line settings examples:

- Set “Fast Boot Mode” enable. “[EFXQ1”
- Set “ACK/NAK” enable. “WC”
- Set “2D Menu Code“ disable. “[D1Z”
- Set “Upside Down Image” enable. “[EFV[E8I”
- Set “Baud rate” to 115200bps. “SZ”
- Set “Low Power standby” enable. “[EB8”
- Set “Low Power standby Transition Time” to 2 seconds. “[EBAQ0Q0Q0Q2”
- Reboot the scan engine “RV”
- Initialize the scan engine “U2”

Packets sent to configure Custom Command Line settings examples:

- <ESC>[EFY'[EFXQ1WC[D1Z[EFU[E8ISZ[EB8[EBAQ0Q0Q0Q2'<CR>
- <ESC>RV<CR>
- <ESC>U2Z2<CR>

Output Configured Custom Command Line Commands
Currently configured commands in Custom Command Line settings can be output.

Item	Command	Description
Output commands	[EFZ	Output configured commands in custom command line

Example of output
[EFXQ1WC[D1Z[EFU[E8ISZ[EB8[EBAQ0Q0Q0Q2

Note: The scan engine will not send anything if no Custom Command Line commands have been configured.

3.4 Fast Boot Mode

Fast Boot Mode reduces the time from power-on to ready. However, when this mode is used, all settings that were saved with the “Z2” command will be ignored and the scan engine starts with the default settings. (See section 3.2.1: Description of Settings.) This default behavior can be changed with Custom Command Line commands. (See section 3.3: Custom Command Line Settings (Change the Factory Default Settings).

Fast Boot Mode Commands

Command		Description
[EFX		Get the current mode (*)
	Q0 (default)	Disable Fast Boot Mode
	Q1	Enable Fast Boot Mode

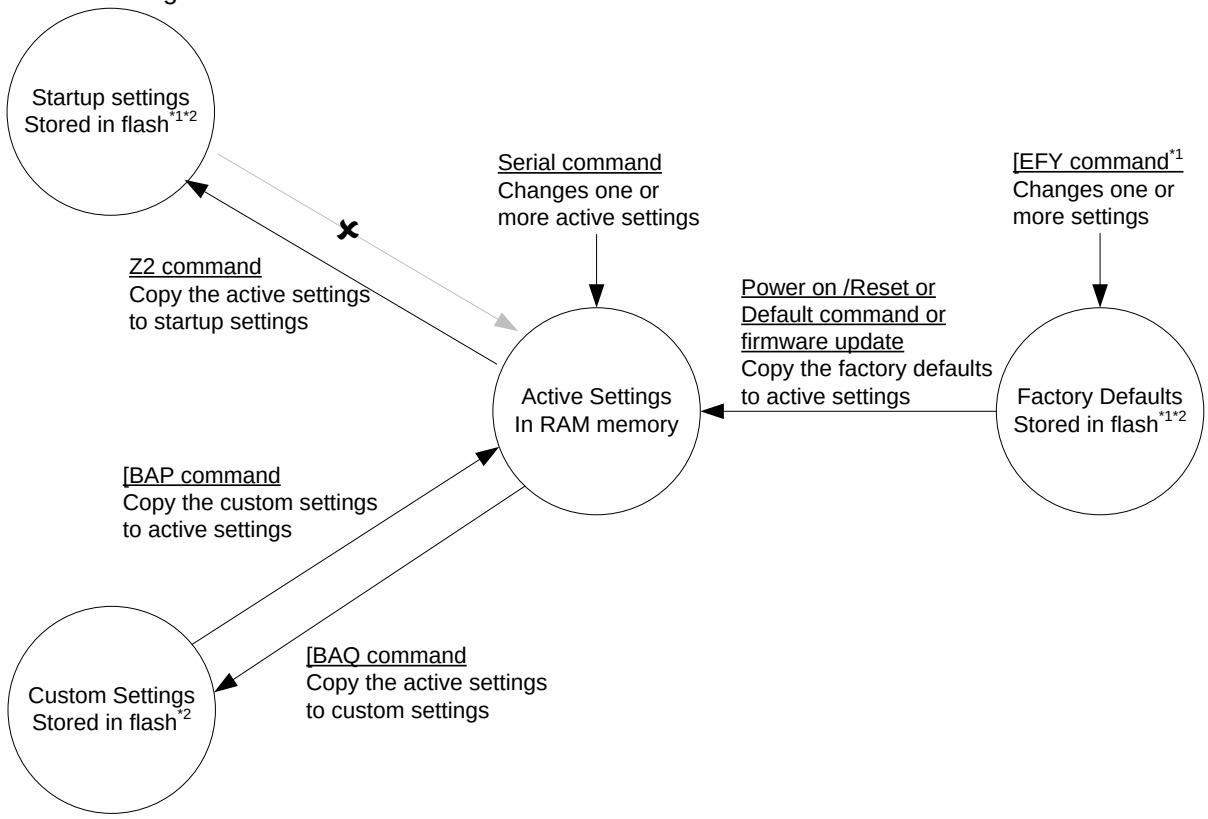
*Return value is:
Disable Fast Boot Mode<CR>
Enable Fast Boot Mode<CR>

Boot Time Specification Mode

(IF:UART/USB, VCC = 3.3V, 5.0V TA = 25°C)

Mode	Description	Min	Typ	Max	Unit
Normal Boot	Time taken to be ready after supplying power	-	510		ms
Fast Boot Mode		-	425		ms

Transition diagram in fast boot mode:



*1 Only configures the factory default settings in an environment where power is stable.
*2 Depending on the firmware version, these areas are erased when a firmware update is loaded. They can be rewritten up to 30,000 times.

3.5 Basic Commands

3.5.1 Trigger Command

The reading operation can be started and terminated by sending commands. When the read cycle timeout is set to 0 seconds (Y0 command), the read time with the Z command will be 'Indefinitely' and reading will continue until a Y command is received. For timeout limited reading, use the Yx commands. (See section 5.6: Read Timing.)

Trigger Command Commands

Command	Description	Remark
Z	Start the read cycle	Command only
Y	Stop the read cycle	

Add New Software Trigger Command

In addition to the trigger commands, a new command using any character string to start or stop the read cycle can be added.

Set Character String to Start or Stop the Read Cycle

Command		Description
[EHK	Available characters	Set the start read cycle command by entering the [EHK command followed by the ASCII command.
	ASCII (*)	
	0 – 32 characters	
[EHL	Available characters	Set the end read cycle command by entering the [EHL command followed by the ASCII command.
	ASCII (*)	
	0 – 32 characters	

Notes:

- NULL, STX, ETX, CR, and ESC cannot be set.
- The trigger commands "Z" and "Y" will always operate, even if these settings are created.
- To clear the start read cycle command character string, set only [EHK without the ASCII command.
- To clear the end read cycle command character string, set only [EHL without the ASCII command.

The command string with the previous settings can also be executed without the command header (ESC or STX) or command terminator (CR or ETX).

Execute With or Without Command Header or Terminator

Command		Description
[EHN	Q0	Without command header/terminator
	Q1 (default)	With command header/terminator

Setting Example 1

Start the read cycle "<ESC>STR<CR>", stop the read cycle "<ESC>STP<CR>"
Command: [EHK0S0T0R[EHL0S0T0P

Setting Example 2

Start the read cycle "E", stop the read cycle "D"
Command: [EHK0E[EHL0D[EHNQ0

3.5.2 Diagnostic Commands

These commands can be used to get diagnostics information from the scan engine.

Diagnostics Commands

Command	Description
Z1	Transmit software version
Z3	Transmit settings*
[EAR	Transmit only changes from default
ZA	Transmit ASCII printable string
YV	Transmit ASCII control string

* The Z3 output result is subject to change when the firmware version is changed.

Device Information Commands

Command		Description	Example	Possible Values
[EFK	Q0	Model Number	MDI-4150	MDI-4050, MDI-4150, MDI-4000, MDI-4100
	Q1	Firmware Version	BD01J01	BD01Jxx, where xx=revision number.
	Q2	Interface	U2	U2 = Serial Standard I/F mode U* = Serial S-Mode I/F mode SU = USB (HID/Keyboard) I/F mode C01 = USB-Virtual COM I/F mode
	Q3	Focus type	SR	SR = Standard Range (115 mm fixed focus) HD = High Density (65 mm fixed focus) UD = Ultra-High Density (45 mm fixed focus)
	Q4	ID (32 digits)	765987D894CA53918218 FB0D31A54AAF	Unique number for every scan engine
	Q5	Serial number	1000001	Serial number of the scan engine

3.5.3 ACK/NAK for Serial Commands

When "ACK/NAK for serial commands" is enabled, the scan engine will send an ACK (0x06) when a command is received and accepted, and a NAK (0x15) when a command is rejected.

ACK/NAK Commands

Command	Description
WC	Enable ACK/NAK for serial commands
WD (default)	Disable ACK/NAK for serial commands

3.5.4 Reboot the Scan Engine

Use this command to restart the scan engine.

Note: The “Custom Factory Default Settings” operation requires a reboot.

Software Reboot Command

Command	Description
RV	Reboot the scan engine

3.5.5 Enable/Disable 2D Menu Code

To enable or disable processing 2D menu codes, use these settings. Setting ‘Disable 2D menu codes’ is recommended when 2D menu codes are not used.

Enable/Disable 2D Menu Code

Command	Description
[D1Y (default)	Enable 2D menu code
[D1Z	Disable 2D menu code*

* Disable indicates that 2D menu codes will be read as normal 2D codes. 2D menu code data will be output when reading is successful.

3.5.6 Enable/Disable 1D Menu Code

To enable or disable decoding 1D menu codes, use these settings. Setting ‘Disable 1D menu codes’ is recommended when 1D menu codes are not used.

Enable/Disable 1D Menu Code

Command			Description	Default
[DFB	Q0	Q1	Enable 1D menu code when using TRIGn signal.	✓
	Q0	Q0	Disable 1D menu code when using TRIGn signal.*	
	Q2	Q1	Enable 1D menu code when using software trigger.	
	Q2	Q0	Disable 1D menu code when using software trigger.*	✓

* Disable indicates that 1D menu code reading is prohibited.

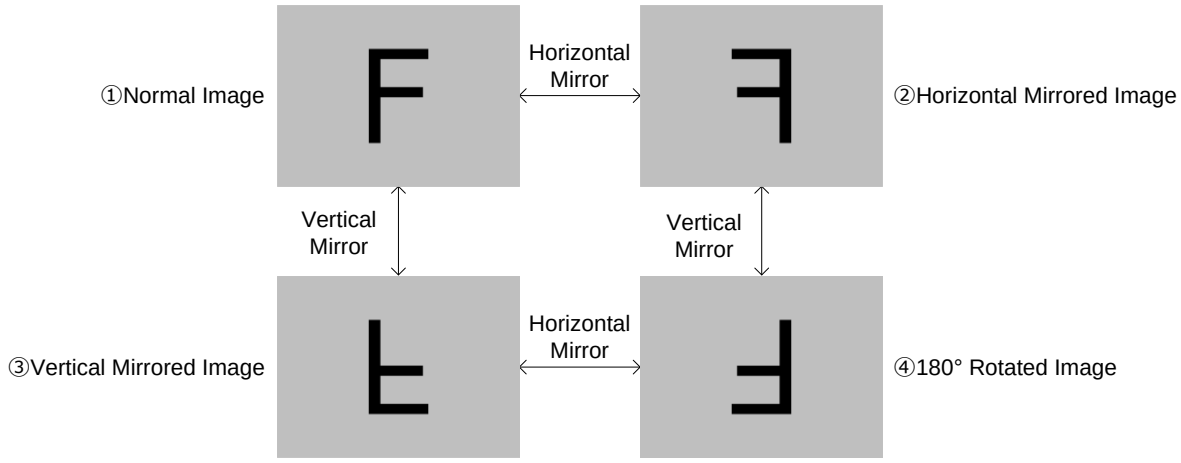
3.5.7 Image Settings

When the scan engine is mounted upside down, the sensor data is rotated 180º. This configuration is required, especially for image acquisition and OCR reading.

When an external mirror is installed in front of the scan engine, the scan engine mirrors the sensor data. Two options are available: horizontal mirror and vertical mirror.

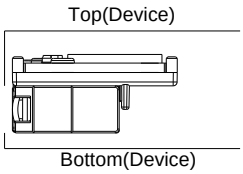
Mirrored Image Commands

Item	Command	Description	Default
Horizontal mirrored image	[EFU	Disable horizontal mirrored image configuration	✓
	[EFV	Enable horizontal mirrored image configuration	
Vertical mirrored image	[E8J	Disable vertical mirrored image configuration	✓
	[E8I	Enable vertical mirrored image configuration	

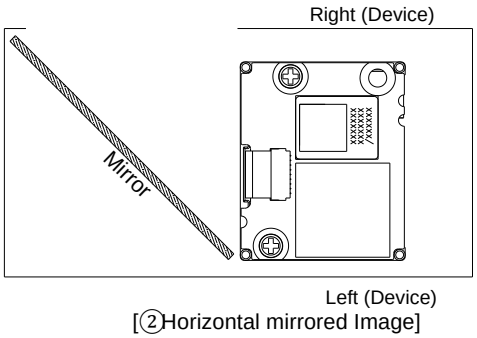


Mirrored Image Configuration Commands

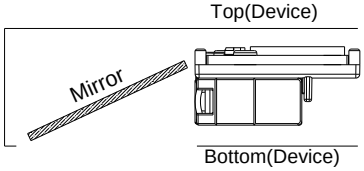
Style	Commands	Horizontal Mirror	Vertical Mirror
① Normal image	[EFU[E8J	Disable	Disable
② Horizontal mirror image	[EFV[E8J	Enable	Disable
③ Vertical mirror image	[EFU[E8I	Disable	Enable
④ 180°rotated image	[EFV[E8I	Enable	Enable



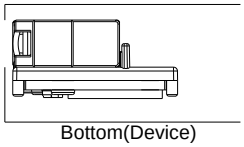
[①Normal Image]



[②Horizontal mirrored Image]



[③Vertical mirrored Image]



[④180 ° rotated image]

3.5.8 Disable Reading Operation

Use these settings to enable or disable reading bar codes. When reading is disabled:

- Auto trigger and TRIGn signal operation are invalid.
- Menu labels cannot be read.
- Only commands via serial communication are supported.

Reading Operation Enable/Disable

Command	Description	Remark
[EAT (default)	Enable module reading operation	Command only
[EAU	Disable module reading operation	Command only

3.5.9 Buzzer and Indicators

These commands describe the Buzzer and Status LED. See sections 9.1: Buzzer (BUZZERn Signal) and 9.2: Good Read LED (GR_LEDn Signal).

Buzzer and Status LED Commands

Item	Command	Description	Remark
BUZZERn	B	Send the confirm buzzer signal from BUZZERn.	Command only
	E	Send the error buzzer signal from BUZZERn.	
GR_LED	L	Flash the GR_LEDn.	

3.5.10 Direct Numerical Input Command

Use these commands when a command requires additional numerical input. Use the commands in one packet with the command that requires the numerical input.

Direct Numerical Input Commands

Command	Description	Remark
Q0	0	Input in a specified format
Q1	1	
Q2	2	
Q3	3	
Q4	4	
Q5	5	
Q6	6	
Q7	7	
Q8	8	
Q9	9	

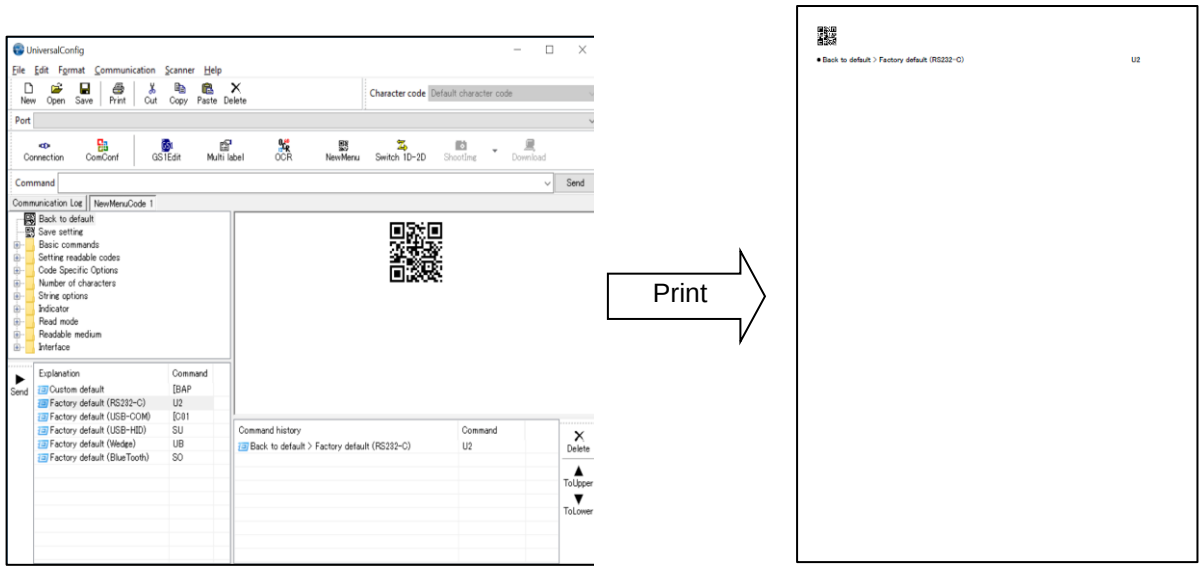
3.6 Configuring with 2D Menu Codes

A single 2D menu code can contain multiple settings that will be processed in order, in one operation. Therefore, you can configure the scan engine with multiple settings by reading only one 2D menu code. Scanning a 2D menu code will always 'save settings' upon completion, so a Z2 command to save current settings is not needed.

Data Packet:
@MENU_OPTO@ZZ@MenuCommand 1@MenuCommand 2@ZZ@OTPO_UNEM@

"@MENU_OPTO"	(Start key)	
"@"	(Separator)	
"ZZ"	(Start menu)	
"@" "Any menu command"	(Separator) (U2 etc)	← Multiple sets allowed
"@"	(Separator)	
"ZZ"	(END menu)	
"@"	(Separator)	
"OTPO_UNEM@"	(Stop key)	

You can use "UniversalConfig" to create a 2D menu code. To get "UniversalConfig", contact your local sales office.



3.7 Configuring with 1D Menu Codes

By scanning a series of 1D menu codes specifically designed to configure the required functions, you can set up the scan engine to optimize its performance for your situation.

Basic procedure:

Scan SET menu code (ZZ). The scan engine enters menu mode.

↓

Scan one or more options.

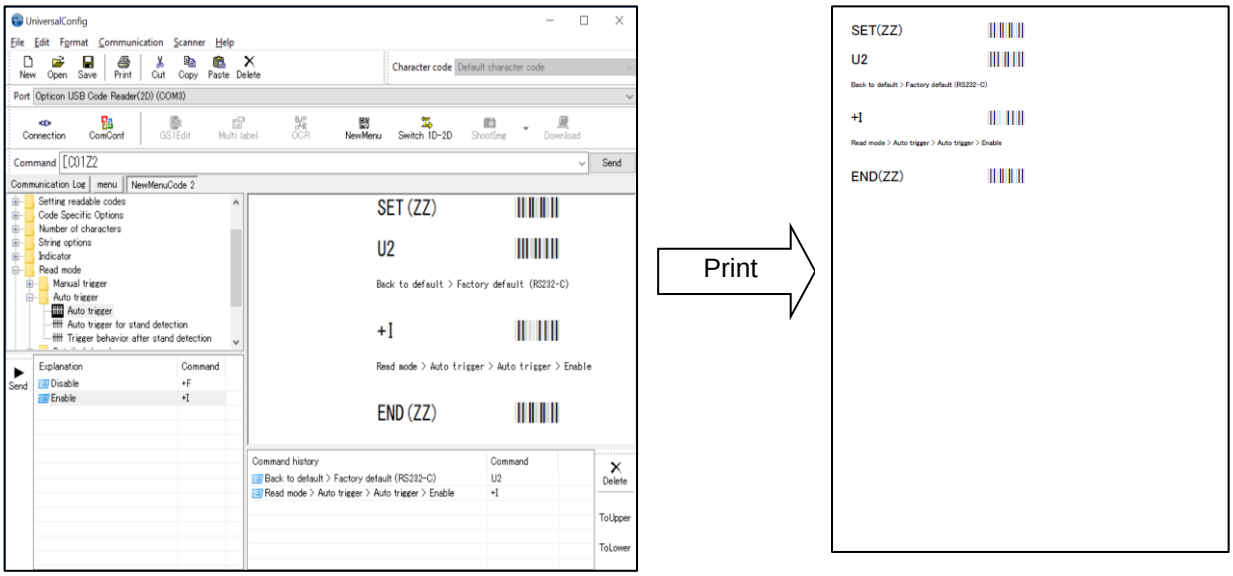
Multiple menu codes can be read to configure more than one option.

↓

Read END menu code (ZZ). All settings are saved in non-volatile memory.

Note: 1D menu codes encode an ID consisting of two to three alphanumeric characters. 1D menu codes are Code 39 bar code labels with modified start/stop characters, so the scan engine will not acknowledge a 1D menu code as a normal bar code.

You can use “UniversalConfig” to create a Menu bar code. To get “UniversalConfig”, contact your local sales office.



3.8 Forced Initialization

If the scan engine becomes misconfigured due to a combination of settings and interface wiring, use forced initialization.

To use forced initialization:

1. Turn off the scan engine at once, and turn on the power while keeping TRIGn Low. (Keep TRIGn low)
2. Wait for 10 seconds or more with TRIGn low. TRIGn becomes effective and the scan engine is readable.

4 Interface

The scan engine supports USB-COM, USB-HID, and UART interfaces.

4.1 UART

This chapter describes UART interface settings.

4.1.1 Switch the Interface to UART

When switching the interface to UART from USB, send this command or read the 2D menu code. Make sure the 12-pin FFC cable is connected to UART signals when using the UART interface.

Caution: UART is standard in the scan engine's factory default setting. If the host side is a USB connection circuit, communication will fail.

Change to UART

Item	Command	Menu Code	Remark
Switching Interface to UART	[X.ZU2[X.ZZ2	@MENU_OPTO@ZZ@X.Z@U2@X.Z@ZZ@OTPO_UNEM@	*

* This setting will survive a firmware update.

4.1.2 UART Interface Signal

IRISO Electronics co.,ltd 9681-12(12PIN) (bottom contact) equivalent connector is used.

No.	Name	Function	I/O	Conditions	State	Note
1	TRIGn	Trigger	In		L: Start operation H: No action	100kΩ pull up on module
2	AIM/WAKEn	Recovery signal from Low Power state	In		L: Recover from low power state H: No action	100kΩ pull up on module
		Aiming control signal in other states than Low Power	In		L: Aiming LED on H: Aiming LED off	
3	GR_LEDn	Good read LED	Out		L: LED on H: LED off	4.7kΩ pull up on module
	EX_ILLUM	Control of an external light source.	Out	Configured[*1]	L: External Illumination On H: External Illumination Off	
4	BUZZERn	Buzzer	Out			100kΩ pull up on module[*2]
5	POWERDWN	Indicates Low Power state	Out		L: Normal state H: Low Power state	100kΩ pull up on module
6	RTS	Communication control signal to host system	Out			10kΩ pull up on module
7	CTS	Communication control signal from host system	In			100kΩ pull up on module
8	TxD	Transmitted data signal	Out			10kΩ pull up on module
9	RxD	Received data signal	In			100kΩ pull up on module

10	GND	System ground				
11	V_{CC}	Power input	In		3.3V or 5.0V	
12	Reserve		In			N.C

*1 When EX_ILLUM is set, Good Read LED cannot be used.
*2 Tone/sound pressure is adjustable by PWM signal.

4.1.3 UART Basic Information

Item	Description	Default
Transfer speed	300 to 921600 bps	9600 bps
Data length	7/8 bits	8 bit
Parity bit	None/Even/Odd	None
Stop bit	1/2 bits	1 bit
Handshake	None, BUSY/READY, Modem, ACK/NAK	None
Other option	Flow control, Inter character delay	

4.1.4 Baud Rate (Transfer Speed)

The baud rate is the rate at which bits are transmitted from the scan engine to the host and vice versa. Both the reader and the host must be set to the same baud rate.

Use these commands to configure the baud rate. To activate and save the new configuration, use "Z2" (save settings in non-volatile memory) after these commands.

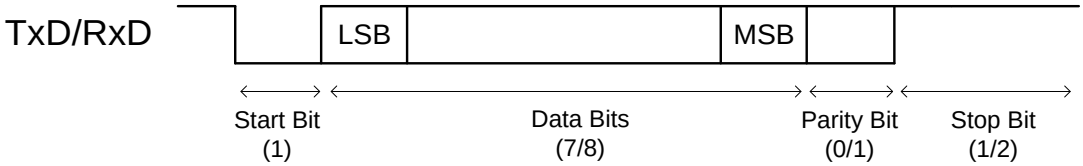
Baud Rate Commands

Command	Description	Default	Condition	Remark
K1	300 bps			Enabled only with “Z2”*
K2	600 bps			
K3	1200 bps			
K4	2400 bps			
K5	4800 bps			
K6	9600 bps	✓		
K7	19200 bps			
K8	38400 bps			
K9	57600 bps			
SZ	115200 bps			
[D90	230400 bps			
[D91	460800 bps		Command packet Condition (See section 3.1.2: Command Packet Sending Precautions.)	
[D92	921600 bps			

*You should configure these settings at “Custom Factory Default”.

4.1.5 Character Format

The data characters are transferred in this format. A party bit is added to every character so the total number of 1's in the data bits, together with the parity bit, is odd for odd parity and even for even parity.



These commands are provided to set the number of data bits, type of parity bit, and number of stop bits. Use the Z2 command (save settings in non-volatile memory) after these commands to activate and save the new configuration.

Data Bit, Parity Bit, and Stop Bit Commands

Item	Command	Description	Default	Remark
Data bit	L0	7 data bits		Enabled after sending "Z2"
	L1	8 data bits	✓	
Parity bit	L2	No parity	✓	
	L3	Even parity		
	L4	Odd parity		
Stop bit	L5	1 stop bit	✓	
	L6	2 stop bits		

4.1.6 Handshaking (Flow Control)

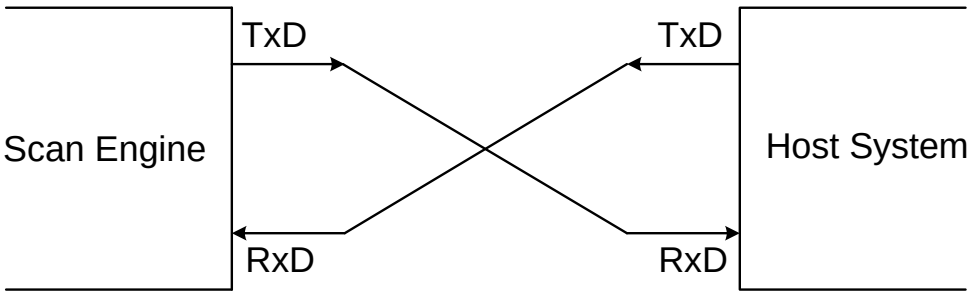
The communication control method can be set using these commands. Use the "Z2" (save command in non-volatile memory) after these commands to activate and save the new configuration.

Handshaking Commands

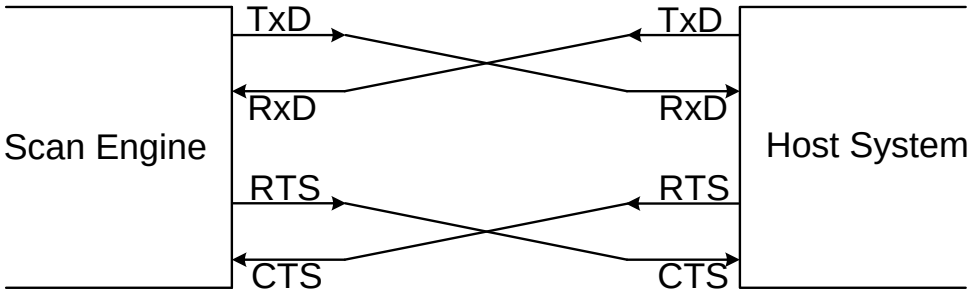
Command	Description	Remark
P0 (default)	No handshake	Enabled after sending "Z2"
P1	Busy/ready	
P2	Modem	
P3	ACK/NAK	
P4	ACK/NAK NO RESPONSE	

A) No Handshaking
The scan engine communicates regardless of the state of the host system.

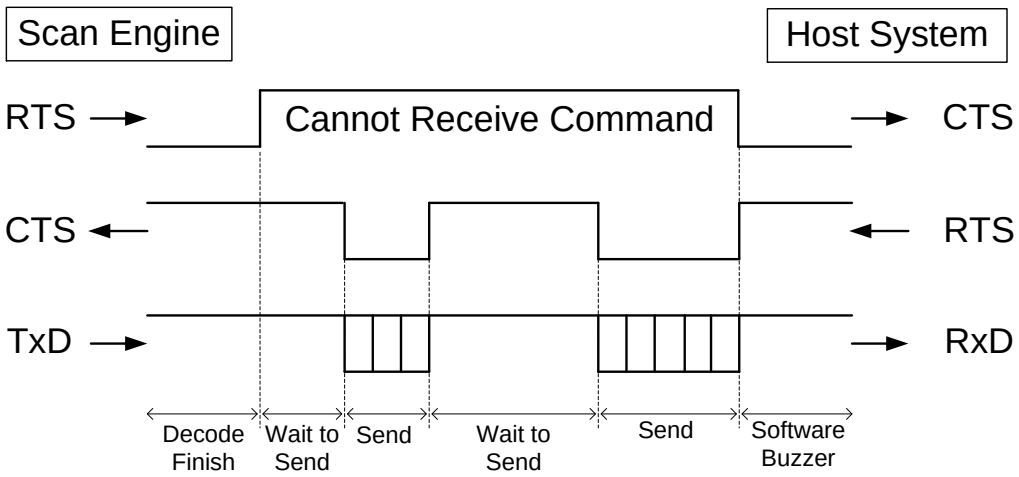
Note: In this setting, the commands from the host system may not be received correctly.



B) BUSY/READY
The scan engine and the host system notify each other when they are ready to receive data (BUSY/READY) via their RTS line. When they are connected, the CTS line can be used to check if the other side is busy (off) or ready to receive data (on).



The scan engine's RTS is typically on (ready to receive data) except during the processing of received data, while transmitting data, and while it is busy processing 1D/2D menu codes. When the scan engine wants to send data, it first checks if its CTS line is on (to be sure that the host is ready to receive data). If the CTS line is off, the scan engine does not send the data but waits for a specific timeout period for the CTS line to be turned on. If the CTS line is not turned on within the time specified, the data transmission will be aborted.



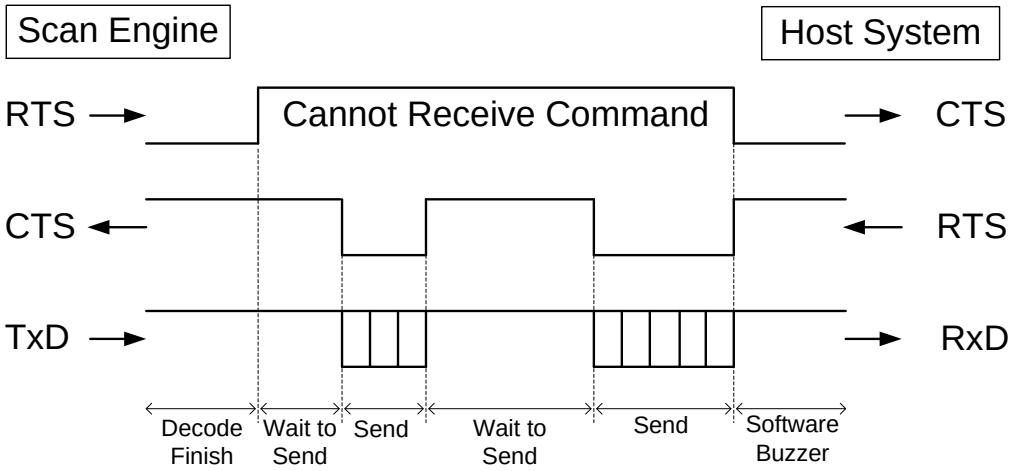
<CTS, TxD signal timing>
When the CTS line (RTS signal on the host side) is turned off during a TxD signal transmission, the scan engine stops the transmission. When the CTS signal is turned on during signal transmission, characters are transmitted.

These menu codes (commands) are provided for the CTS line timeout setting. You need to use "Z2" (save settings in non-volatile memory) after these commands to activate and save the new configuration.

CTS Timeout Commands

Command	Description	Remark
I0 (default)	Flow Control timeout Indefinitely	Enabled only with “Z2”
I1	Flow Control timeout 100 ms	
I2	Flow Control timeout 200 ms	
I3	Flow Control timeout 400 ms	

C) MODEM
The scan engine’s RTS is OFF as soon as power is supplied to the scan engine. The scan engine turns RTS ON when it wants to transmit data to the host. The host should respond with CTS ON when it is ready to receive data. While the host CTS is ON the scan engine is allowed to transmit data. When all data has been transmitted, the scan engine turns RTS OFF. In response, the host should turn OFF the scan engine’s CTS. If, while RTS is ON, the CTS line is not ON for a certain configurable period, the scan engine will terminate the transmission and indicate an error with the buzzer.



D) ACK/NAK Control

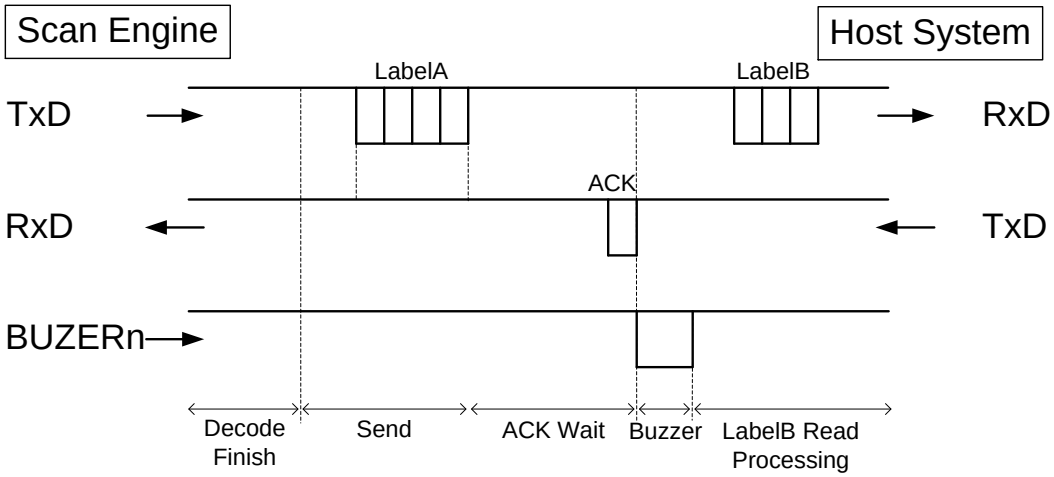
In ACK/NAK mode, the scan engine will transmit data and expects to receive one of these responses from the host:

- Response: "ACK" (ASCII:0x06)
  The scan engine terminates transmission with the good-read buzzer.

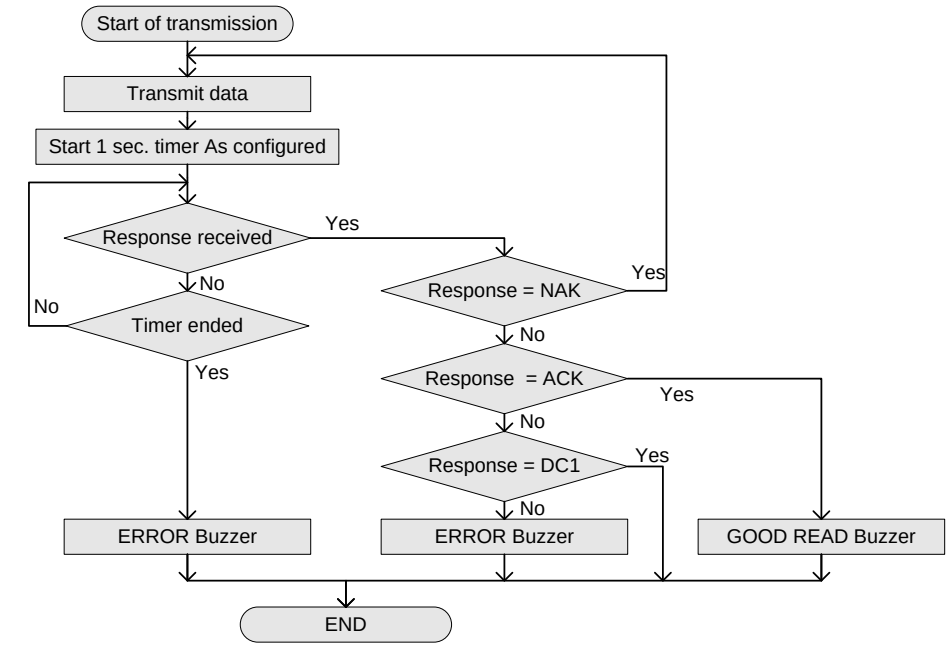
- Response: "NAK" (ASCII:0x15)
  The scan engine sends the data again.

- Response: "DC1" (ASCII:0x11)
  The scan engine terminates transmission without the good-read or error buzzer.

- Timeout
  If there is no response within 1 second, the scan engine terminates transmission with the error buzzer.



<ACK/NAK Flow Chart>



ACK/NAK Timeout Commands

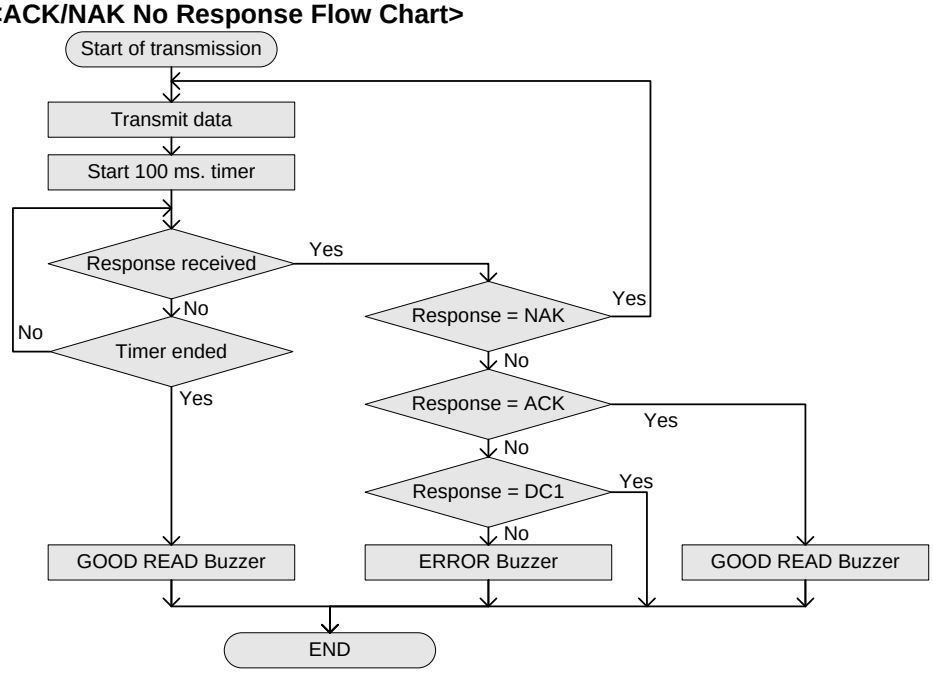
Command	Description
[XI4	ACK/NAK timeout, Indefinitely
[XI5	ACK/NAK timeout, 100 ms
[XI6	ACK/NAK timeout, 500 ms
[XI7 (default)	ACK/NAK timeout, 1s

E) ACK/NAK No Response

ACK/NAK No Response differs from ACK/NAK mode in that when no response from the host is received within 100 ms, the scan engine assumes that the data has been received correctly by the host.

- Response: "ACK" (ASCII:0x06)
  The scan engine terminates transmission with the good-read buzzer.
- Response: "NAK" (ASCII:0x15)
  The scan engine sends the data again.
- Response: "DC1" (ASCII:0x11)
  The scan engine terminates transmission without a good-read or error buzzer.
- Timeout
  If there is no response within 100 ms then the scan engine terminates transmission with the good read buzzer.

<ACK/NAK No Response Flow Chart>



4.1.7 Inter Character Delay (UART)

Inter character delay introduces a configurable delay after each transmitted character. This function may be used if the host does not support flow control and is not capable of handling the received data.

Inter Character Delay Commands

Command	Description	Remark
KA (default)	No delay	Activated only after “Z2”
KB	20 ms delay	
KC	50 ms delay	
KD	100 ms delay	

4.1.8 Troubleshooting UART

Use these possible solutions to troubleshoot UART problems.

Problem	Possible Solutions
Cannot communicate No response when sending command	• Verify communication settings. For example, see sections 4.1.4: Baud Rate (Transfer Speed) and 4.1.5: Character Format. • After changing communication settings, send the Z2 command. Most communication settings are not applied until the Z2 command is sent. • Verify the handshaking setting. See section 4.1.6 Handshaking (Flow Control).
Garbled characters	• Verify communication settings. For example, see sections 4.1.4: Baud Rate (Transfer Speed) and 4.1.5: Character Format. • Verify that the bar code to be read matches to the character code of the communication tool.
Line-break is doubled	Check the line-break setting of the communication tool.

4.2 USB-COM

This chapter explains USB-COM interface related settings.

4.2.1 Switch the Interface to USB

When switching the interface to USB-COM from UART or USB-HID, send this command or read a 2D menu code. Make sure the 12-pin FFC cable is connected to USB signals when using the USB-COM interface.

Caution: UART is standard in the scan engine's factory default setting. If the host side is a UART connection circuit, communication will fail.

Change to USB-COM

Item	Command	Menu Code	Remark
Switching Interface to USB-COM	[X.Z[C01[X.ZZ2	@MENU_OPTO@ZZ@X.Z@C01@X.Z@ZZ@OTPO_UNEM@	*

* This setting will survive a firmware update.

4.2.2 USB Interface Signal

IRISO Electronics co.,ltd 9681-12(12PIN) (bottom contact) equivalent connecter is used.

No.	Name	Function	I/O	Conditions	State	Note
1	TRIGn	Trigger	In		L: Start operation H: No action	100kΩ pull up on module
2	AIM/WAKEn	Recovery signal from Low Power state	In		L: Recover from low power state H: No action	100kΩ pull up on module
		Aiming control signal in other states than Low Power	In		L: Aiming LED on H: Aiming LED off	
3	GR_LEDn	Good read LED	Out		L: LED on H: LED off	4.7kΩ pull up on module
	EX_ILLUM	Control of an external light source.	Out	Configured*1	L: External Illumination On H: External Illumination Off	
4	BUZZERn	Buzzer	Out			100kΩ pull up on module*2
5	POWERDWN	Indicates Low Power state	Out		L: Normal state H: Low Power state	100kΩ pull up on module
6	RTS	Communication control signal to host system	Out		Put it to Open.	10kΩ pull up on module
7	USB+	Communication control signal from host system	In/Out			100kΩ pull up on module
8	TxD	Transmitted data signal	Out		Put it to Open.	10kΩ pull up on module

9	USB-	Received data signal	In/Out			
10	GND	System ground				
11	V_{CC}	Power input	In		3.3V or 5.0V	
12	Reserve		In			N.C

*1 When EX_ILLUM is set, Good Read LED cannot be used.
*2 Tone/sound pressure is adjustable by PWM signal.

4.2.3 USB-COM Basic Information

Item	Description	Note
Transfer Speed	Full Speed USB 2.0 (FS mode)	
Required power supply capability	500 mA	Actual current value is different.
Vendor ID	065A	
Product ID	A002	
Suspend mode Remote wakeup	Used when the host system is using suspend.	Default: Valid
Other	CDC-ACM compliance	
Fixed COM number	Fixing COM number is possible.	Default: not fix

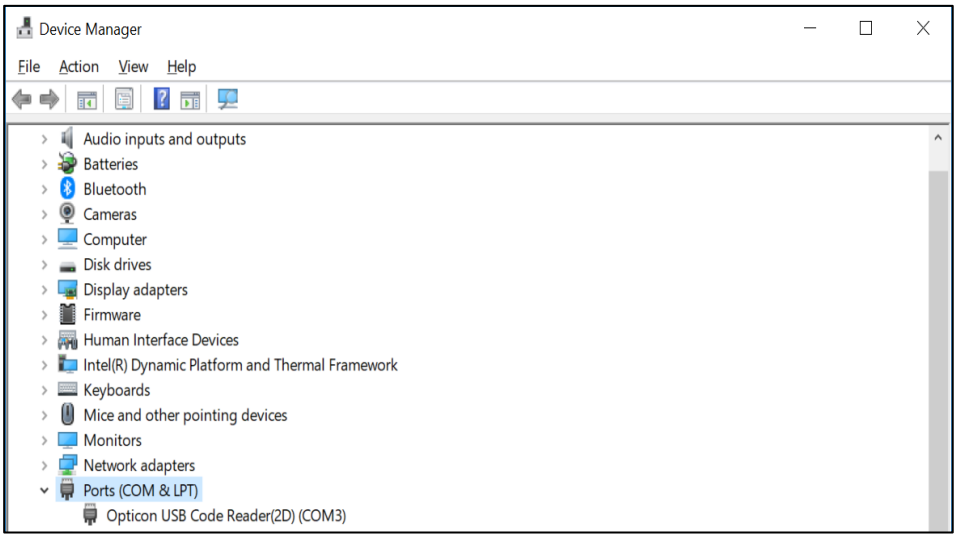
4.2.4 Integration (USB Driver)

A USB driver is required to connect to the PC via USB-COM interface. Please download the USB driver from our website, and install it appropriately according to the attached documents.

4.2.5 Confirm the USB-COM Connection

For the USB-COM interface, confirm the connection:

1. Make sure your PC is running Windows 10.
2. Install the Opticon USB driver.
3. Connect the scan engine to the PC.
4. Right-click the Windows icon and click **Device Manager**.
5. Open “Ports(COM & LPT).”



4.2.6 Fixed USB-COM Port

This option enables a fixed USB-COM Port number. The COM port number to which the USB connected Windows PC is assigned will always be the same port number.

Note: Fixed USB-COM Port settings will become active after a reboot and initialization of the scan engine.

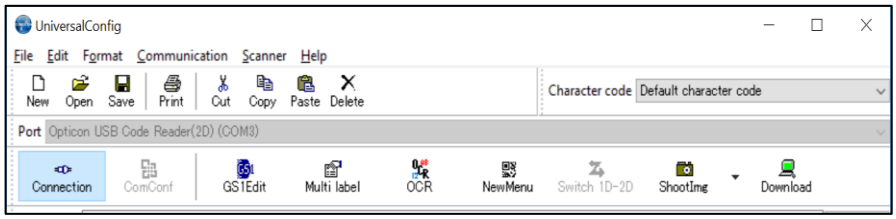
Fixed USB-COM Port Number and Driver Selection Commands

Command		Description
[EGC	Q0 (default)	Not to fix assigned COM port number
	Q1	Fix assigned COM port number

4.2.7 Connect to the Host PC

To connect to the host PC:

1. Start the tool to serial communicates (emulator or UniversalConfig).
2. Connect to the COM port confirmed at 4.2.3 Connection.

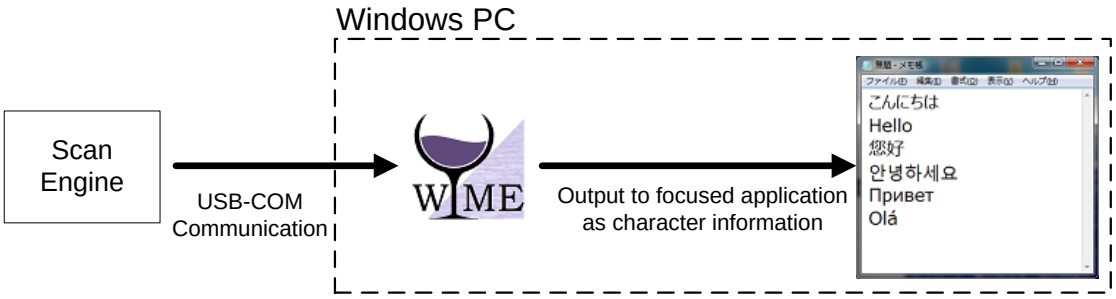


Note: For the Command packet, see section 3.1.1: Command Packet.

4.2.8 COM to HID Output (WIME)

WIME, a Windows .NET application, converts data received by the scan engine via the virtual COM port (USB-COM) to HID-like data and transfers the data to the application that has focus.

If a multi-byte character is not correctly output using USB-HID, WIME may be able to resolve the issue.



4.2.9 Troubleshooting USB-COM

Use these possible solutions to troubleshoot USB-COM problems.

Problem	Possible Solution
Not recognized by the PC (Scan engine does not appear in the device manager)	• Check that USB cable is properly connected. • Ensure that connected USB port is operating properly. • If you are connecting to wireless devices, like Bluetooth, disconnect once. • Verify the USB port power supply capability. When using a laptop or hub, power supply capacity may not be sufficient. • Remove from the USB port at once, and after a while, insert again. • Insert to different port.
Error beep sounds and does not output by reading	• Try the possible solutions for the previous problem. • Open the COM port with the communication tool.
Cannot connect (Cannot open COM port)	• Verify the COM port number by device manager. For help, see section 4.2.5: Confirm the USB-COM Connection. • Close the tool and re-open it. Operation and countermeasures vary depending on the tool. Please refer to the tool help or manual. • Reboot the PC.
Garbled characters	Verify that the bar code to be read matches the character code of the communication tool.
Line-break is doubled	Check the line-break setting of the communication tool.

4.3 USB-HID

This chapter explains USB-HID interface related settings.

4.3.1 Switching the Interface to USB-HID

When switching the interface to USB-HID from UART or USB-COM, send this command or read the 2D menu code. Make sure the 12-pin FFC cable is connected to USB signals when using the USB-COM interface.

Caution: UART is standard in the scan engine's factory default setting. If the host side is a UART connection circuit, communication will fail.

Change to USB-HID

Item	Command	Menu Code	Remark
Switching Interface to USB-HID	[X.ZSU[X.ZZ2	@MENU_OPTO@ZZ@X.Z@SU@X.Z@ZZ@OTPO_UNEM@	Confirm host

4.3.2 USB Interface Signal

IRISO Electronics co.,ltd 9681-12(12PIN) (bottom contact) equivalent connecter is used.

No.	Name	Function	I/O	Conditions	State	Note
1	TRIGn	Trigger	In		L: Start operation H: No action	100kΩ pull up on module
2	AIM/WAKEn	Recovery signal from Low Power state	In		L: Recover from low power state H: No action	100kΩ pull up on module
		Aiming control signal in other states than Low Power	In		L: Aiming LED on H: Aiming LED off	
3	GR_LEDn	Good read LED	Out		L: LED on H: LED off	100kΩ pull up on module
	EX_ILLUM	Control of an external light source.	Out	Configured*1	L: External Illumination On H: External Illumination Off	
4	BUZZERn	Buzzer	Out			100kΩ pull up on module
5	POWERDWN	Indicates Low Power state	Out		L: Normal state H: Low Power state	100kΩ pull up on module
6	RTS	Communication control signal to host system	Out		Put it to Open.	10kΩ pull up on module
7	USB+	Communication control signal from host system	In/Out			100kΩ pull up on module
8	TxD	Transmitted data signal	Out		Put it to Open.	10kΩ pull up on module

9	USB-	Received data signal	In/Out			100kΩ pull up on module
10	GND	System ground				
11	V_{CC}	Power input	In		3.3V or 5.0V	
12	Reserve		In			N.C

*1 When EX_ILLUM is set, Good Read LED cannot be used.
*2 Tone/sound pressure is adjustable by PWM signal.

4.3.3 USB-HID Basic Information

Items	Description	Notes
USB	USB2.0 Full Speed	
Required power supply capacity	500 mA	Differs from actual power consumption.
Vendor ID	065 A	
Product ID	A001	
Num/Caps Lock control	Set when using NumLock/CapsLock	Initial value: No control
Data transmit speed	Use when outputting data with high speed.	Initial setting: 4 ms (Setting range 1 ms -16 ms)
Data transmit interval (Inter-character delay)	Use when data is missing.	Initial value: no interval
Suspend mode Remote wakeup	Use when host system is using suspend.	Initial value: Valid
Keyboard language	Set according to the keyboard language.	Initial value: English (USA)
Character code	Set according to reading symbol encode data.	Initial value: not use character code
Output mode	Set when outputting Chinese-character.	Initial value: output as it is

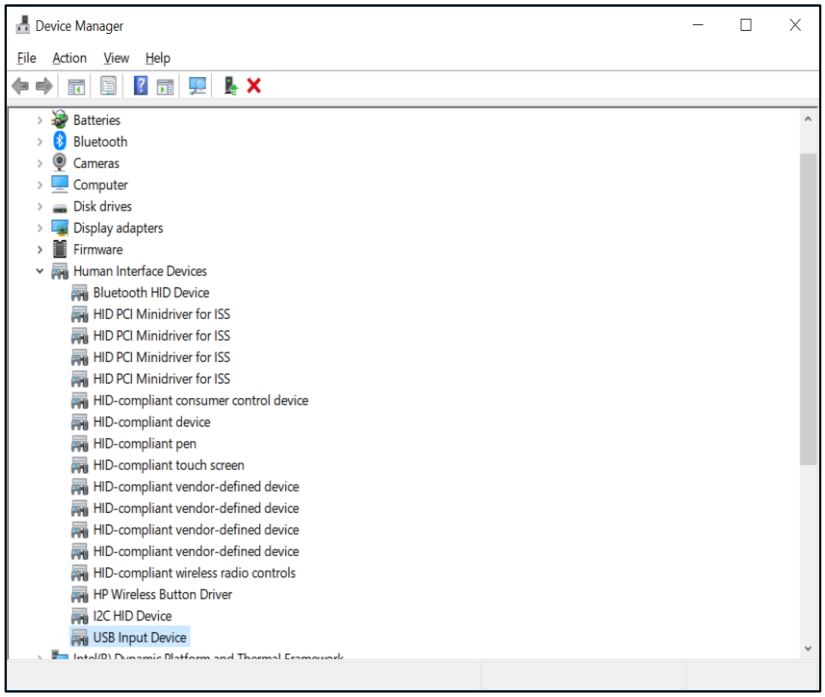
4.3.4 Confirm the USB-HID Connection

USB-HID functions just by connecting to the PC.

To confirm the USB-HID connection:

- Make sure your PC is running Windows 10.
- Connect the scan engine to the PC.
- Right-click the Windows icon and click **Device Manager**.
- Open “Human interface device”. The “USB input device” is added.

Note: If you are using other USB connected device, such as a mouse or keyboard, multiple devices will be displayed.



4.3.5 NumLock and CapsLock Control

Set NumLock and CapsLock control when sending data.

NumLock and CapsLock Control Commands

Command	Description	Initial Setting	Notes
RN	Numeric value does not use numeric keypad	✓	
RM	Numeric value use numeric keypad		
/A	Follow NumLock status		*1
5Q	No control	✓	
8A	Invert CapsLock status		*2
2U	CapsLock automatic control		*3

*1. Only use the numeric keypad when NumLock is ON.
*2. When starting transmits, send CapsLock and invert status. Use this function when CapsLock is always ON. Return to CapsLock status when sending is completed.
*3. CapsLock status is controlled to display as the original string. Return to original CapsLock status when transmit is complete.

4.3.6 Data Output Speed (USB-HID)

Adjust data output speed in USB-HID. Selecting a shorter time makes the output faster. But, depending on the host system, outputting all characters may fail.

To enable this setting, you need to reboot after saving the setting.

USB-HID Data Transfer Interval Command

Command			Command description	Default (Effective range)
[E9M	Qa	Qb	Set transfer interval Interval: (10a+b) ms「Unit」	4 ms 1 – 16 ms

Example: Setting Data Output Speed

- Set the transmit interval to 1 ms (fastest). Command: [E9MQ1
- Set the transmit interval to 10 ms. Command: [E9MQ1Q0

4.3.7 Inter Character Delay (USB-HID)

The inter character delay introduces a configurable delay after each transmitted character. This function may be helpful if the host does not support flow control and is not capable of handling the received data at full speed.

Inter Character Delay Commands

Command	Description
LA	No delay (default)
LB	Delay = 1
LC	Delay = 2
LD	Delay = 3
LE	Delay = 4
LF	Delay = 5
LG	Delay = 6
LH	Delay = 7
LI	Delay = 8
LJ	Delay = 9
LK	Delay = 10

4.3.8 Keyboard Language

Set the keyboard language used on the host PC with the scan engine to be connect. Keyboard arrangement differs depending on the country or language. If the keyboard setting does not match, the output will be incorrect.

Keyboard Language Commands

Command	Description
KE	USA (code page)
KV	UK
KG	German
KI	French
OW	Italian
KJ	Spanish
PH	Portuguese
PL	Swiss French
PK	Swiss German
PI	Dutch
PJ	Belgian
PD	Swedish
PG	Finnish
KK	Danish
PE	Norwegian
WF	Czech
[BAY	Hungarian
[BPJ	Turkish
[EF4	Russian English
[EF5	Russian Cyrillic
[BAZ	Brazilian
[E76	Chinese
[E77	Korean
[E78	Taiwanese
PM	Japan
[EGK	Croatia
[BPP	Poland (214)
[BP2	Poland (programmer)
[EGS	Greece
[EGT	Greece (English)
[EGU	Greece (Latin)
[EGV	Greece (220)
[EGW	Greece (319)
[EGX	Greece (220 Latin)
[EGY	Greece (319 Latin)
[EGZ	Greece (polytonic)
[EHD	Indonesia
[EHE	Latin America
[EHF	Vietnam
[EHG	America (International)
[EHH	Canada (France)
[EHI	Canada (France) Legacy
[EHJ	Canadian Multilingual Standard

4.3.9 Multi-Byte Character Output

If the bar code to read contains multi-byte characters or country-specific characters, the data cannot be output with the default setting. To output the data, you need to configure the scan engine to output multi-byte characters.

Configure Multi-Byte Character Output

STEP 1 **Set the Keyboard Language**

Set the keyboard language based on the connected PC. For example, set “USA” when connecting to a PC using US OS. For help, see section 4.3.8: Keyboard Language.

STEP 2 **Confirm the Firmware Version**

The multi-byte character output is supported by version BD01J11 and later. To verify the firmware version, read this bar code:

Multi byte character output initialization code

Version BD01J11 and later is recognized as a menu code. The buzzer sounds 3 times. See section 4.3.10: Multi-Byte Character Output Setting.

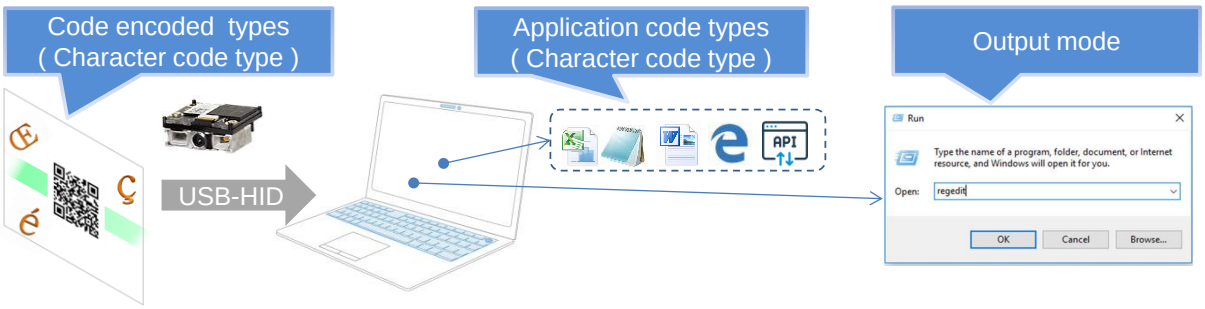
Versions earlier than BD01J11 are recognized as Code 128. The buzzer sounds 1 time → Unsupported version (*).

STEP 3 **Other Settings**

Configure additional necessary settings.

4.3.10 Multi-Byte Character Output Setting

In a multi-byte character output setting, two types of “Character code type” (code encoded type and application code type) and “Output mode” are set.



With this setting, bar codes created in UTF-8 can be output to Notepad (Windows 1252).

4.3.10.1 Character Code Type

The Character Code Type includes a code encoded type and an application code type.

Code Encoded Type

The encoding type of the bar code with multi-byte characters differs based on its purpose and the bar code label creation tool. For example, in the US, select “Windows 1252” or “UTF-8“.

Application Code Type

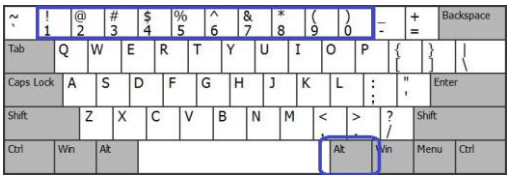
The application code type depends on the application. For US English, select “Windows 1252” or “UFT-16”.

Application	Character Code Type*
Microsoft® Excel®	Default character code type (Windows 1252)
Microsoft® Notepad	Default character code type (Windows 1252)
Microsoft® Word	UTF-16
Web application	Refer to “How to confirm application code type”
Own application	Refer to “How to confirm application code type”
Etc.	Refer to “How to confirm application code type”

* The character code type description may differ due to future Windows updates.

How to Confirm the Application Code Type

1. With the application you want to check in focus, press and hold **Alt** and use the numeric keypad to type “0128”. If the character “€” is displayed, “Windows1252” is supported.
2. With the application you want to check in focus, press and hold **Alt** and use the numeric keypad to type “8364”. If the character “€” is displayed, “UTF-16” is supported.



Character Code Type Setting Command Format and Parameters

Command					Description
[CCL	Qa	Qb	Qc	Qd	
	a	b			Set code encoding type: QaQb
			c	d	Set application code type: QcQd

Character Code Type	Characters and Regions Mainly Used	Parameter
Windows 1250	Central Europe	Q0Q0
Windows 1251	Cyrillic	Q0Q1
Windows 1252	Western Europe, USA	Q0Q2
Windows 1253	Greece	Q0Q3
Windows 1254	Turkey	Q0Q4
Windows 1255	Hebrew	Q0Q5
Windows 1256	Arabia	Q0Q6
Windows 1257	Baltic	Q0Q7
Windows 1258	Vietnam	Q0Q8
Windows 874	Thai	Q0Q9
Windows 932 (Shift-JIS)	Japan	Q1Q0
Windows 936 (GB2312)	China	Q1Q1
Windows 949 (UHC)	Korea	Q1Q2
Windows 950 (Big-5)	Taiwan	Q1Q3
UTF-8	Universal	Q5Q0
UTF-16		Q5Q1
No character code	Default setting	Q9Q9

4.3.10.2 Output Mode

Set the output mode when outputting multi-byte characters. If “Keyboard language” and “Character code type” are set, select “Alt decimal number mode (characters other than keyboard layout)”.

Output Mode Setting Commands

Command		Description
[C20	Qx	Select output mode: Qx

Output Mode	Output Method	Parameter
Output all values as is	Default setting	Q0
Alt decimal number mode (characters other than keyboard layout)	While pressing the Alt key, press the numeric keypad to output the specific character. Characters in the keyboard layout are output by normal key pressing.	Q4
Alt decimal number mode (always)	While pressing the Alt key, press the numeric keypad to output the specific character. The characters in the keyboard layout are output in the same way.	Q5
Alt + hexadecimal number mode (characters other than keyboard layout)	While pressing the Alt key, press the Full key to output the specific character. Characters in the keyboard layout are output by normal key pressing. (registry setting is required)	Q6
Alt + hexadecimal number mode (always)	While pressing the Alt key, press the Full key to output the specific character. The characters in the keyboard layout are output in the same way. (registry setting is required)	Q7

Output Mode Details

In standard function for Windows OS (NT series); characters can be output by entering numerical values while pressing the Alt key.

Keys to operate in each output mode:

- Alt decimal number mode: Below keyboard keys in the green box.
  (Left Alt key and numeric keypad 0 to 9 keys)
- Alt hexadecimal number mode: Below keyboard keys in the red box.
  (Left Alt key, numeric keypad + key, 0 to 9 keys and A to F keys)

Example: Output “€”

- Alt decimal number mode:
  While pressing Alt key, press “0128” keys (decimal number of Windows1252 0x80)
- Alt hexadecimal number mode:
  While pressing Alt key, press “+ 2 0 A C” keys (UTF-16[Unicode] U+20AC)

Output Mode Characteristics

Characteristics	Alt Decimal Number Mode	Alt + Hexadecimal Number Mode
Code type of output application	Set according to application	Optional *(Set to UTF-16)
Registry value setting	Not required	Required

*Normal output for all applications is not guaranteed.

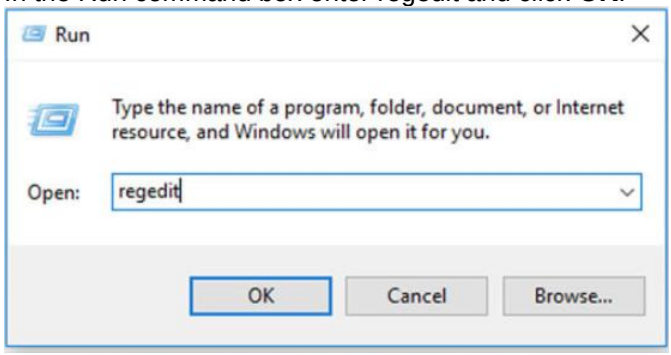
Alt decimal number mode must be configured based on the application to output, but setting the PC registry is not required. However, in Alt + hexadecimal number mode, configuring based on the application to output is optional, but setting the PC registry is required in addition to the scan engine. Many Japanese multi-byte characters, including Chinese characters, can be supported by the output of Alt decimal number mode. Use Alt + hexadecimal number mode when special cases occur, such as “Some Chinese character output fail” or “Output result differs in each application which is scheduling to use”.

Setting the Alt + Hexadecimal Number Mode Registry

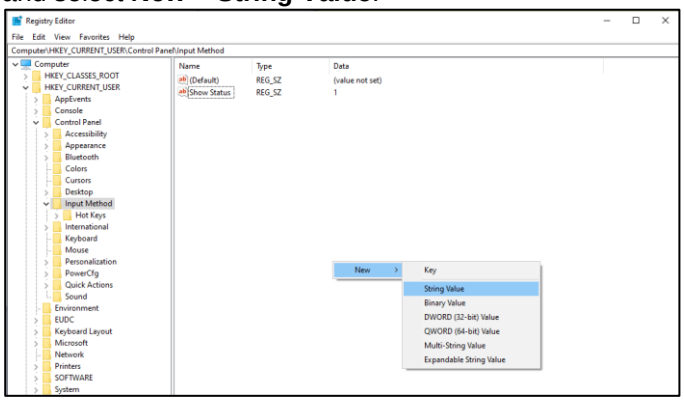
To set the registry, start the registry editor and create or change this key. After execution, reboot the PC.

Path	HKEY_CURRENT_USER\Control Panel\Input Method
Key	EnableHexNumpad (String value)
Value	1

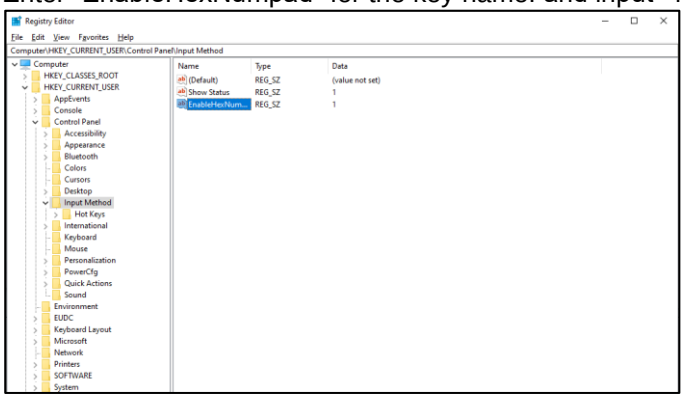
1. In the Run command box enter regedit and click **OK**.



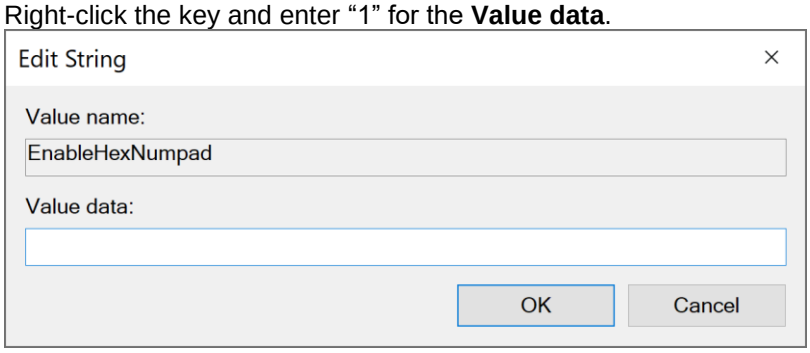
2. Go to **HKEY_CURRENT_USER** > **Control Panel** > **Input Method**. Right-click in the window and select **New** > **String Value**.



3. Enter “EnableHexNumpad” for the key name. and input “1” for the value.



4. Right-click the key and enter “1” for the **Value data**.



5. Click **OK**.

4.3.11 Troubleshooting (USB-HID)

Use these possible solutions to troubleshoot USB-COM problems.

Problem	Possible Solution
Output is not correct Garbled characters	• Make sure the keyboard language and output destination application are correctly configured. • If the host processing speed is not sufficient, insert an inter character delay. • If the control string is included, make sure that Ctrl +"any alphabet key" does not overlap with the shortcut key on the host side.
Line-break is doubled	Set the additional suffix setting based on the host application's line-break.
Cannot output images	Images cannot be transferred.
Scan engine does not appear in Device Manager. Restart unexpectedly Error beep sounds and data is not output when reading a bar code	• Make sure that the USB cable is properly connected. • Make sure that the connected USB port is operating properly. • Verify the USB port power supply capability. When using a laptop or hub, power supply capacity may not be sufficient. • Remove from the USB port at once, and after a while, insert again. • Insert to different port.

4.3.12 Precautions

When emulating keyboard operation, the output destination environment affects the result, especially when using control character output (Ctrl + "any alphabet key") and multi-byte output setting. Carefully review the code to use and evaluate the output destination environments.

4.4 Data Buffer Mode

The Data Buffer Mode setting is common to all interfaces. Data Buffer Mode lets you specify whether to read an object during data output. When buffer mode is enabled, the scan engine can perform other operations, such as bar code scanning, while outputting decoded data. However, the reading performance may degrade during the data output. When buffer mode is disabled, the scan engine stops other operations until the completion of decoded data output.

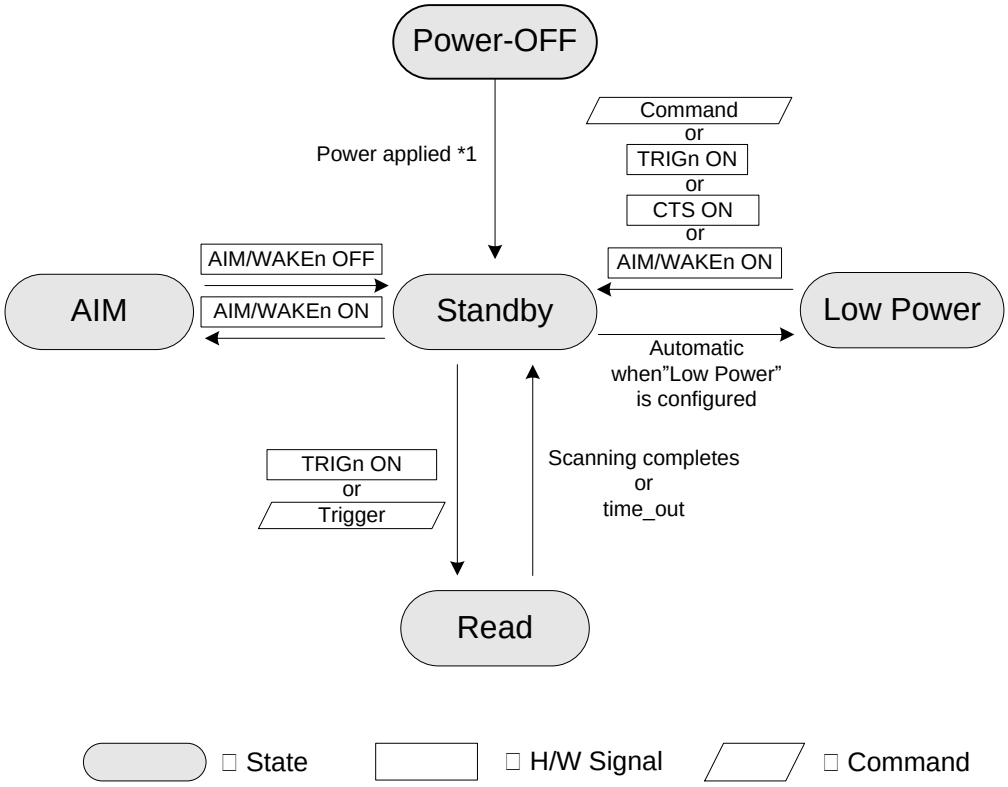
Data Buffer Mode Commands

Command	Description
[D80	Data buffer disable
[D81 (default)	Data buffer enable

5 Power Management and Timing

This chapter describes power management and various timings of the scan engine.

5.1 Power Mode Transition



*1 These options adjust the start-up time: Fast Boot and Normal Boot
*2 When Low Power is enabled, the MDI-4x50 automatically enters Low Power mode when Standby state passes the specified time.

Power Status

Status	Description
Read	White LED illumination and green aiming light and process reading.
Standby	Ready to read. The state that can read immediately.
Low Power	Low current consumption status. The time to shift from standby is configurable.
AIM	With AIM signal is ON, green aiming lights.

5.2 Current Consumption

Each electrical specifications of the scan engine are as follows.

5.2.1 Absolute Maximum Ratings

Item	Symbol	Rated Value	Unit
Power Supply Voltage (V_{CC} to GND)	V_{CC}	-0.3 to 7.0	V
Input Voltage	V_I	-0.3 to V_{CC} +0.3	V

5.2.2 Recommended Operating Conditions

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage		V_{CC}		3.0	3.3/5.0	5.5	V
Input Voltage	Low	V_{IL}		0	-	0.15	V
	High	V_{IH}		V_{CC} -0.4	-	V_{CC}	V
Output Voltage	Low	V_{OL}	I_{OL} = 600µA		-	0.55	V
	High	V_{OH}	I_{OH} = -20µA	0.67*V_{CC}	-	V_{CC}	V
Output current	Low	I_{OL}	V_{cc} = 3.0V			-4	mA
	High	I_{OH}	V_{cc} = 3.0V			4	mA

5.2.3 Peak Current Consumption

(V_{CC} = 3.3V/5.0V T_A = 25°C)

Item	State	Symbol	Conditions	Min.	Typ.	Max.	Unit
Peak Rush Current *	Boot		-	-	800	1000	mA

* Measured at the MDI-4xx0 connector. Peak current width is 800µs (Typ).

5.2.4 Current Consumption of the MDI-4x00

UART

[V_{CC} = 3.3V] (IF:UART, T_A = 25°C)

Item	State	Recovery time*1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read			-	-	300	450	mA
Standby Current	Standby			-	-	26		mA
	Low Power			Configured	-	9		mA

[V_{CC} = 5.0V] (IF:UART, T_A = 25 °C)

Item	State	Recovery time*1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read			-	-	210	320	mA
Standby Current	Standby			-	-	23		mA
	Low Power			Configured	-	10		mA

*1 Recovery time is time until ready to scan.

USB

[V_{CC} = 3.3V] (IF:USB, T_A = 25°C)

Item	State	Recovery time*1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read			-	-	300	450	mA
Standby Current	Standby			-	-	46		mA
	Low Power			Configured	-	28		mA
Low Power Current	Suspend			Configured	–	9		mA

[V_{CC} = 5.0V] (IF:USB, T_A = 25°C)

Item	State	Recovery time*1	Symbol	Conditions	Min.	Typ.	Max.	Unit

Operating Current	Read			-	-	210	320	mA
Standby Current	Standby			-	-	32		mA
	Low Power			Configured	-	20		mA
Low Power Current	Suspend			Configured	–	10		mA

*1 Recovery time is time until ready to scan.

5.2.5 Current Consumption of the MDI-4x50

UART

[V_{CC} = 3.3V] (IF:UART, T_A = 25°C)

Item	State	Recovery time*1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read			-	-	300	450	mA
Standby Current	Standby			-	-	26		mA
Low Power Current	Low Power			Configured	-	1		mA

[V_{CC} = 5.0V] (IF:UART, T_A = 25 °C)

Item	State	Recovery time*1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read			-	-	210	320	mA
Standby Current	Standby			-	-	20		mA
Low Power Current	Low Power			Configured	-	0.9		mA

*1 Recovery time is time until ready to scan.

USB

[V_{CC} = 3.3V] (IF:USB, T_A = 25°C)

Item	State	Recovery time*1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read			-	-	300	450	mA
Standby Current*2	Standby			-	-	28		mA
Low Power Current*2	Low Power			Configured*2	-	1.5		mA

[V_{CC} = 5.0V] (IF:USB, T_A = 25°C)

Item	State	Recovery time*1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read			-	-	210	320	mA

Low Power Current	Standby			-	-	20		mA
Low Power Current*2	Low Power			Configured*2	-	1.2		mA

*1 Recovery time is time until ready to scan.
*2 Current value when USB is in “Selective Suspend” mode. When using as USB-COM (USB as virtual COM), use USB driver “Opticon USB Code Reader driver” version 3.x.x.x.

5.3 Low Power

Low power mode helps to further reduce power consumption when in the Standby mode. Also, the contents set in the scan engine will not be disposed when shifting to the low power mode.

5.3.1 Enable/Disable Low Power

The following commands are provided for the low power standby setting.

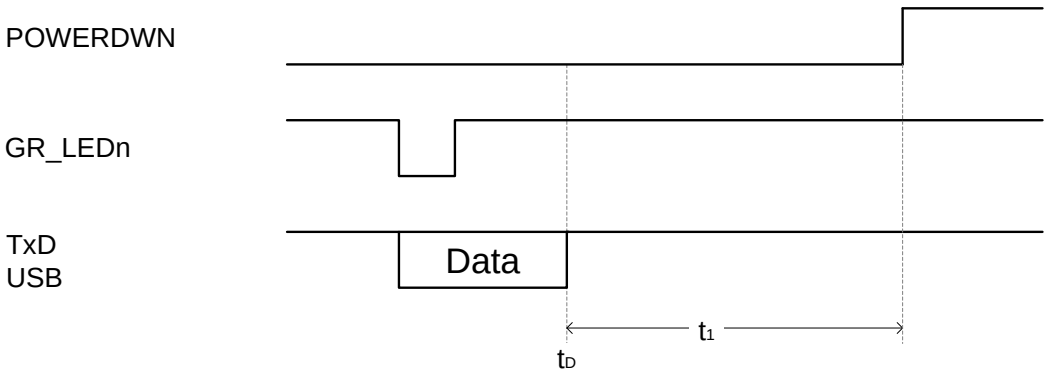
Low Power Mode Enable/Disable Commands

Command	Description
[XSC	Disable low power mode (default)
[EB8	Enable low power mode

* When you enable low power mode, the initial value of the transition time is set to 5 seconds.

5.3.2 Transition Time

You can set the transition time t_1 to low power. The transition time t_1 means that the scan engine is in "Standby mode". After the transition time t_1, low power mode becomes effective and the POWERDWN signal becomes high.



Low Power Transition Time

Command					Description	Default
[EBA	Qa	Qb	Qc	Qd	Set low power transition time with numerical values. (1000a+100b+10c+d [s])	5 s (0 - 9999)

* When 0, transition time is set to 150 ms.

Example: Command Input

Enable "low power mode" and set the transition time to low power to 3 seconds

<ESC>[EB8[EBAQ0Q0Q0Q3<CR>

Note: You should configure these setting at the factory default settings. For help, see section 3.3.

5.3.3 USB Low Power Mode Transition Condition

For USB, the scan engine transitions to low power mode when these conditions are met:

- The scan engine's low power mode is enabled.
- The scan engine passed the specified time (transition time) in standby state.
- The USB bus shifted to SUSPEND mode*1.

*1 USB bus can be placed in SUSPEND mode when effective USB communication, such as read data or command data is not performed for a certain period of time. The USB host device controls the management of this mode.

Using as USB-COM (USB Virtual COM)

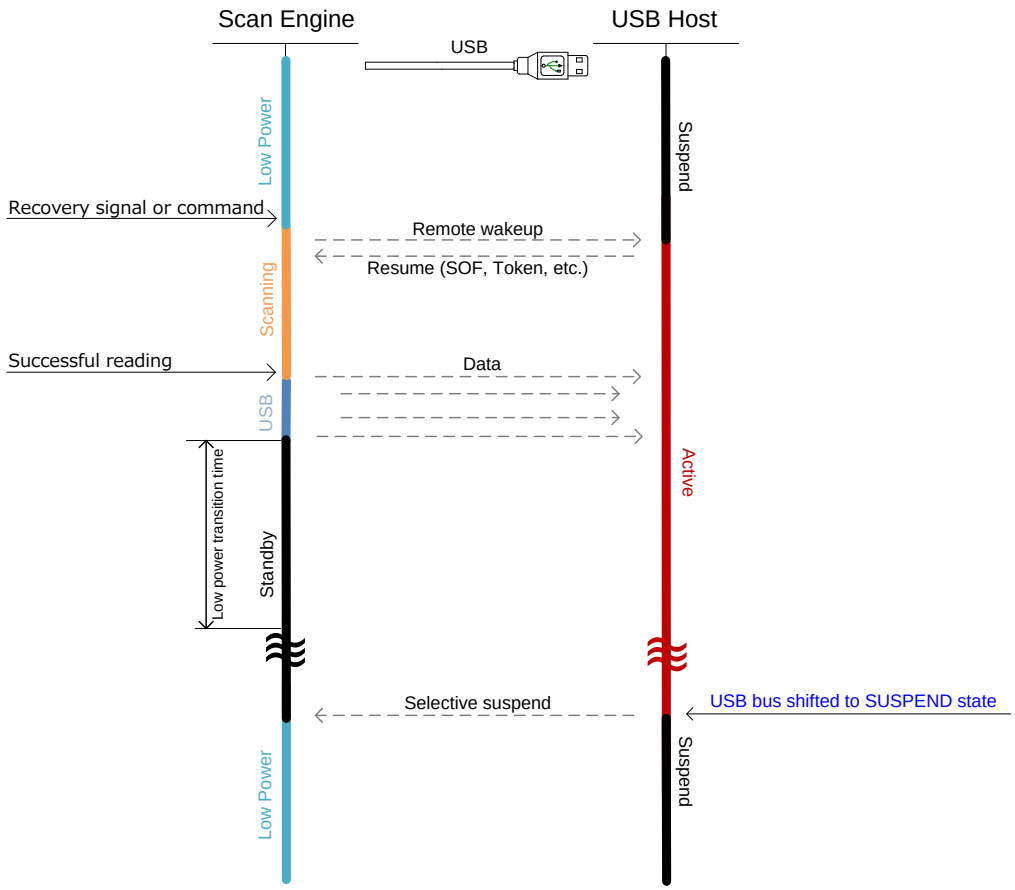
By using Opticon USB Code Reader drive Version 3.0.0.0 or after and enabling USB Selective suspend function, shifting USB bus to the SUSPEND mode when valid communication is not placed is possible. Refer to Opticon USB Code Reader drive install manual.

Using as USB-HID (Key Code Input)

When connecting a scan engine and PC that has Windows OS installed, HID connection is done by the Windows inbox driver. By controlling the registry that controls the inbox driver, you can enable the Selective suspend function. For more information, see the Microsoft HID USB peripherals page (https://msdn.microsoft.com/library/dn672268(v=vs.85).aspx).

5.3.4 USB Low Power Mode Communication Sequence

The scan engine detects USB bus shifting to SUSPEND mode and transitions to low power mode. This diagram illustrates the scan engine and USB host device communication sequence.



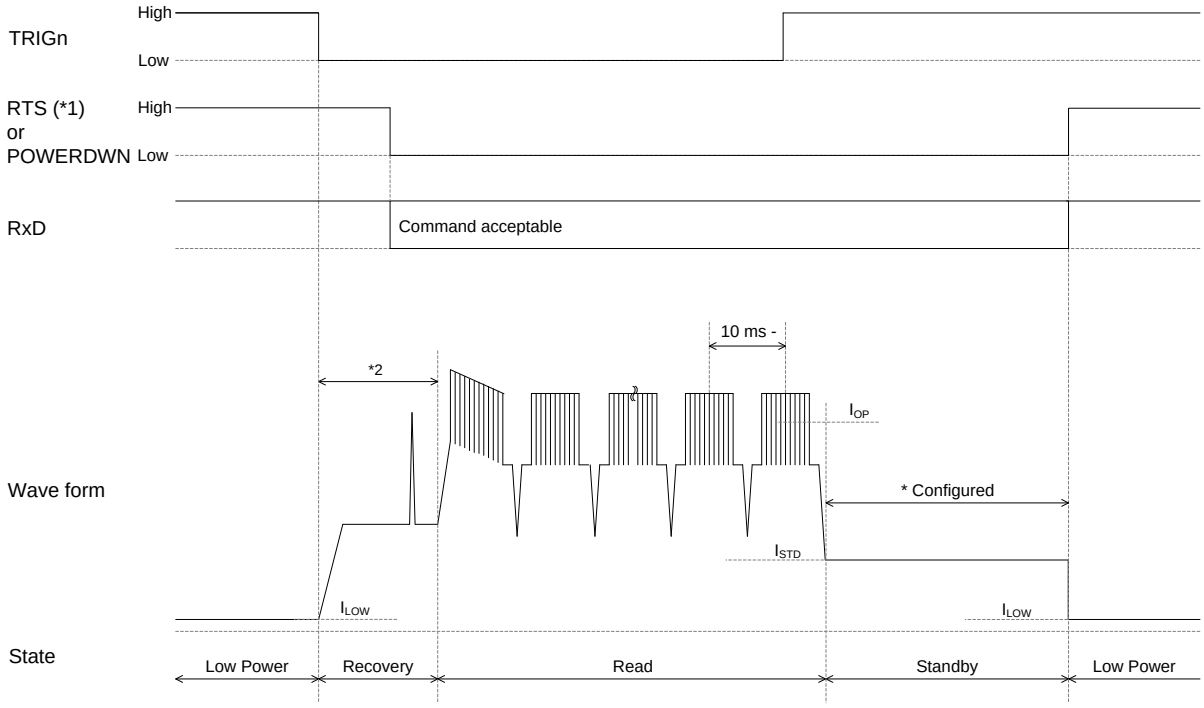
5.4 Recovery from Low Power Mode

To recover from low power mode, certain conditions, such as the signal to use and timing, must be met.

5.4.1 Recovery from Low Power Mode by Signal (UART)

To recover from low power mode, you can use a signal (TRIGn, CTS, and AIM/WAKEn). If additional commands are required, these commands will be acceptable from the time when the RTS or POWERDWN signal becomes low.

Example: Recover from Low Power Mode Using TRIGn Signal



* To configure low power mode, see section 5.3: Low Power.

*1 When communication control is set to “MODEM”, these signals cannot be used because the RTS signal becomes “High”.

*2 The MDI-4x00 and MDI-4x50 have different recovery times:
MDI-4x00 recovery time: 18 ms
MDI 4x50 recovery time: 41 ms

5.4.2 Recovery from Low Power Mode by Command (UART)

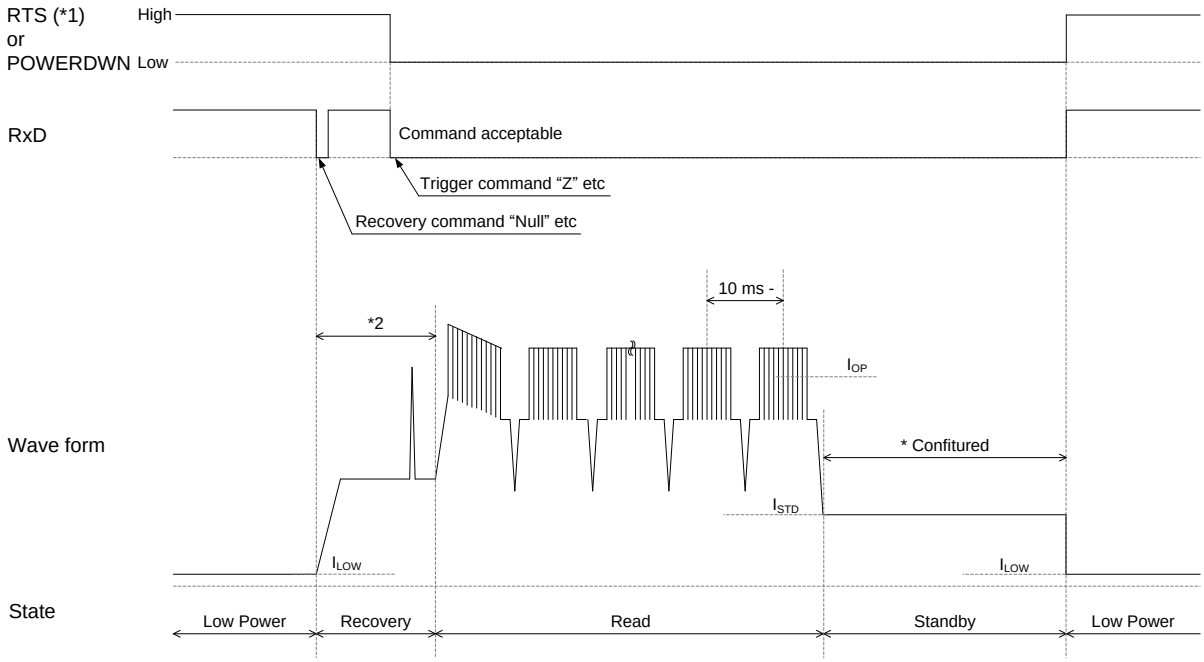
To recover from low power mode, you can use commands.

1. To start the recovery process, send Null or dummy data. The command becomes acceptable from the time the RTS or POWERDWN signal becomes low.
2. To start reading, send the trigger command “Z”.

Note: If there is no RTS or POWERDWN signal, send the command 30 ms after starting recovery.

Example: Recover from Low Power Mode Using Command

If additional commands are required, confirm the RTS or POWERDWN signal and then send the commands.



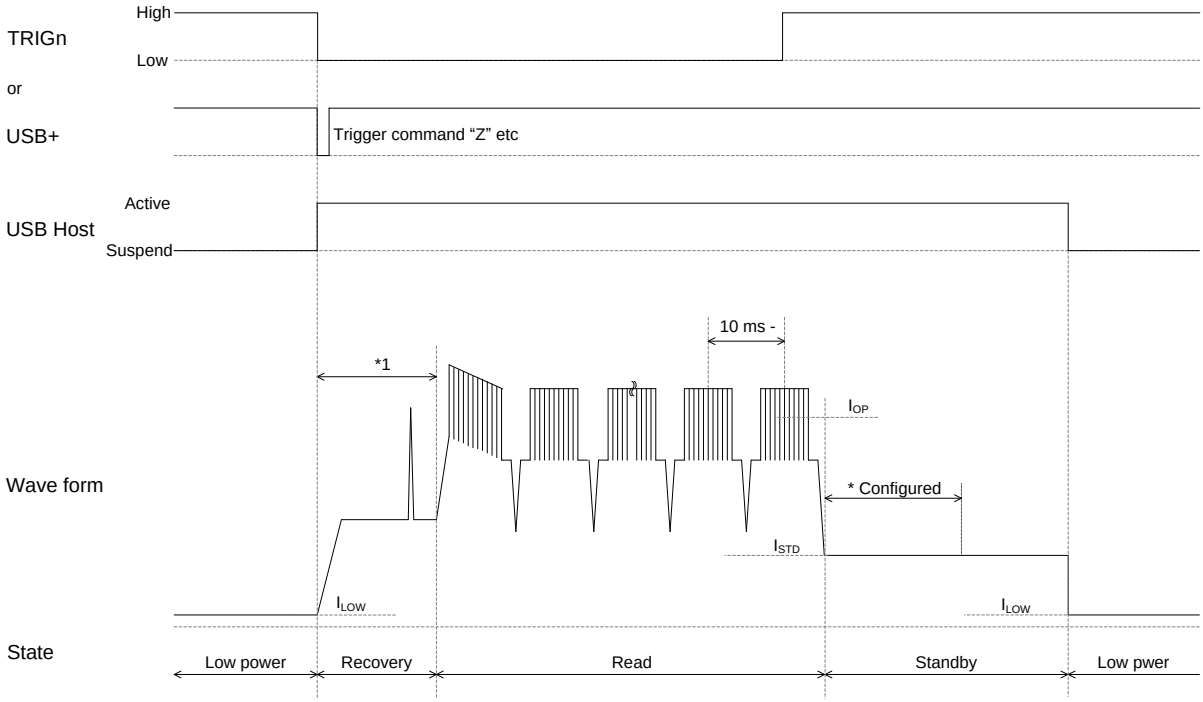
* To configure low power mode, see section 5.3: Low Power.

*1 When communication control is set to “MODEM”, these signals cannot be used because the RTS signal becomes “High”.

*2 The MDI-4x00 and MDI-4x50 have different recovery times:
MDI-4x00 recovery time: 18 ms
MDI 4x50 recovery time: 41 ms

5.4.3 Recovery from Low Power Mode (USB)

To recover from low power mode, you can use a signal (TRIGn, CTS, and AIM/WAKEn) and a command. Recovery starts with a signal and becomes readable in about 43 ms. USB always accepts the command. USB shift to Active after sending the command.



* To configure low power mode, see section 5.3: Low Power.

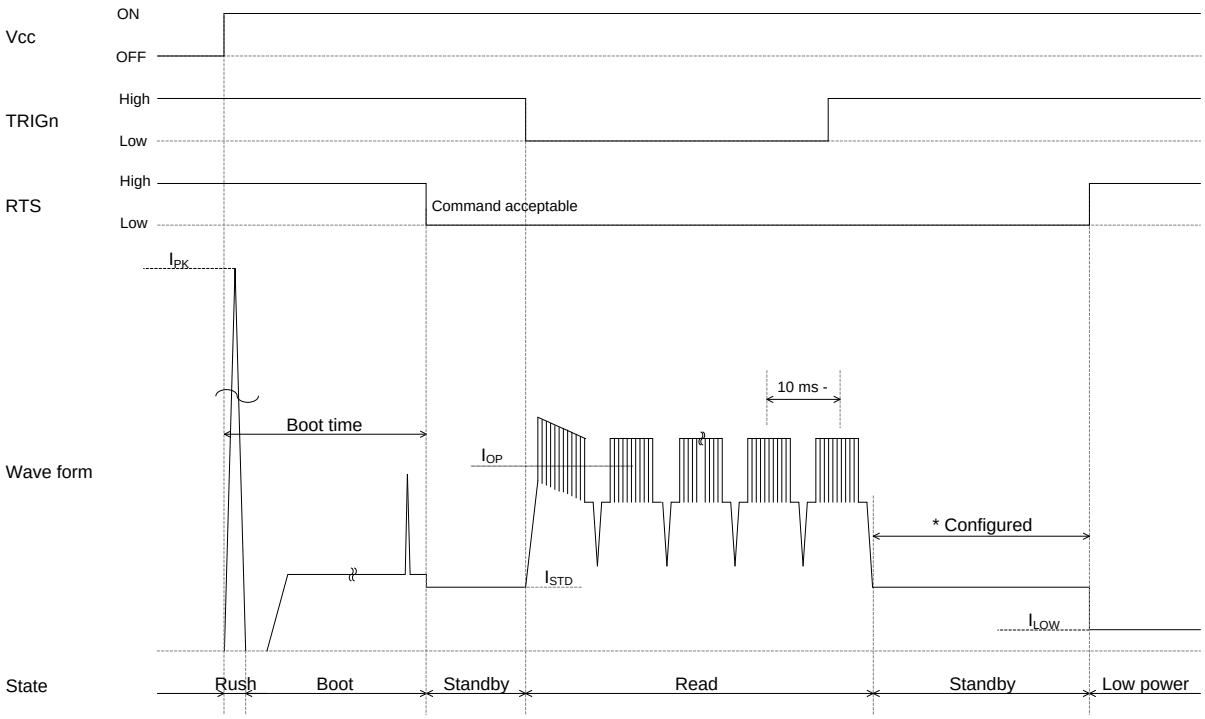
*1 The MDI-4x00 and MDI-4x50 have different recovery times:
MDI-4x00 recovery time: 18 ms
MDI 4x50 recovery time: 43 ms

5.5 Power ON/OFF Timing

This section describes the power on/off timing of the scan engine.

5.5.1 Power-On Timing

Power-on timing indicates the time from power on until the scan engine can read bar codes.



*1 When communication control is set to “MODEM”, these signals cannot be used because the RTS signal becomes “High”.

Startup Time Modes

(IF:UART/USB VCC = 3.3V/5.0V TA = 25° C)

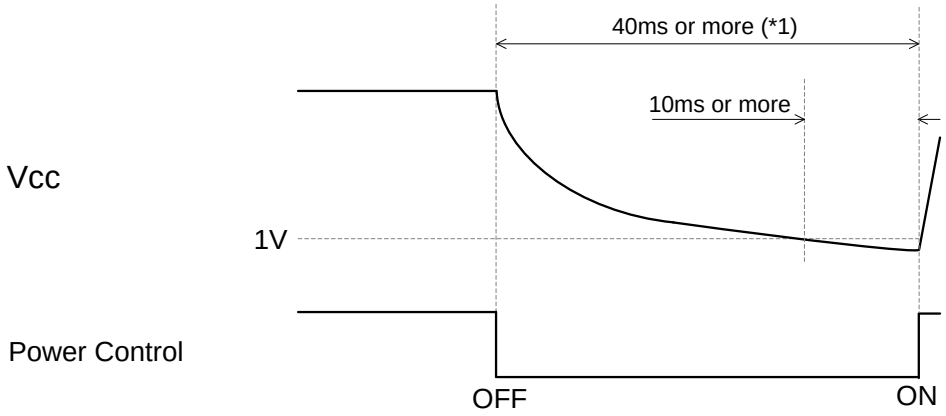
Mode	Condition	Min	Typ	Max	Unit
Normal Boot		-	510	-	ms
Fast Boot Mode	Configured*1		425	-	ms

*For more information about fast boot mode, see section 3.4: Fast Boot Mode.

5.5.2 Power-Off Timing

When the power is turned off while an input signal to the scan engine is high, leakage current will be drawn from that signal. Therefore, all input signals to the scan engine should be set to “High impedance” or “Low”.

The interval between scan engine powers off to on, the time for 10 ms or more with Vcc 1V or lower is required.



*1 For MEK-3100 circuit configuration, 40 ms or more is required.

Caution: For power off when saving configurations, the settings are stored in the scan engine:

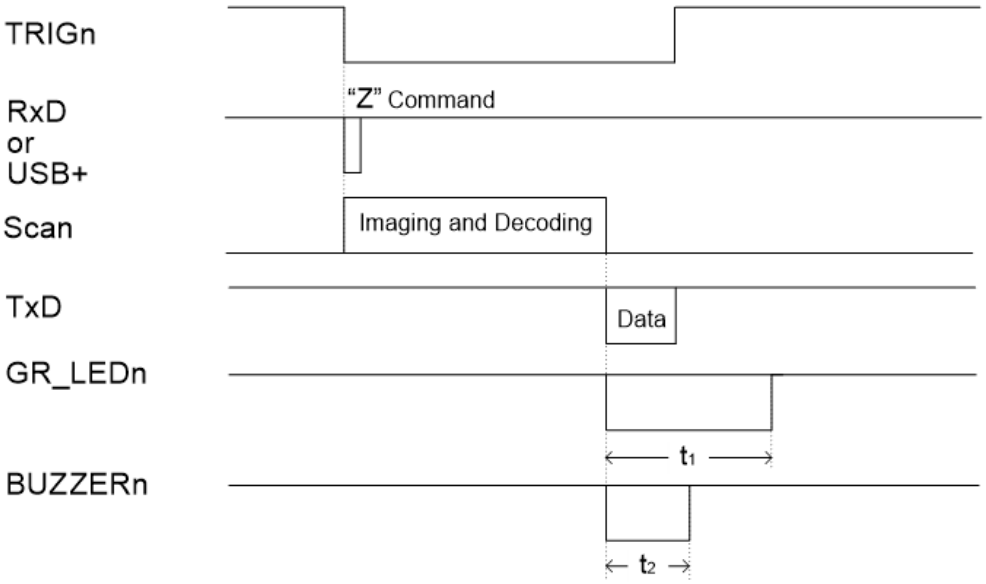
- when the Z2 command is sent to save the parameters.
- after 1D or 2D menu codes are processed.

Writing the settings to the flash ROM can take up to 10 seconds. Make sure the power is not turned off during this period or the settings may be corrupted.

Note: When the Z2 command is sent, if the option “ACK/NAK for serial command” is enabled, the scan engine will send an ACK after writing the configuration data is completed. This function lets you get the correct timing.

5.6 Read Timing

The read timing of the scan engine is as follows.



Symbol	Description	Min	Typ	Max	Unit
t_1	GR_LEDn signal period		200*1	-	ms
t_2	BUZZERn signal period	-	50*2	-	ms

*1 GR_LEDn signal period can be set. See section 9.2: Good Read LED (GR_LEDn Signal).
*2 BUZZERn signal period can be set. See section 9.1: Buzzer (BUZZERn Signal).

5.6.1 Read Effective Time

Read effective time sets the reading time of 1 reading operation. Readout operation starts after the trigger signal is on or when the readout command “Z” is sent. If no data is output within the specified time, the readout operation stops.

Read Effective Time

Command	Description
Y0	Trigger signal synchronization or “Z” “Y” command control (default)
Y1	1 second
Y2	2 seconds
Y3	3 seconds
Y4	4 seconds
Y5	5 seconds
Y6	6 seconds
Y7	7 seconds
Y8	8 seconds
Y9	9 seconds
YM	Read time infinite
YL	Read time 10 times

Note: When auto trigger is set and the command “Y0” is set, the read effective time is automatically set by image processing.

Read effective time can also be set with a specific time in increments of 10 ms. To set read effective time with a specific time, enter the command followed by a 4-digit numeric command.

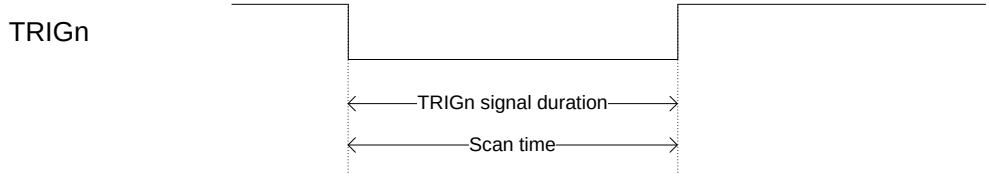
Read Effective Time Numeric Setting

Command					Description	Default (Effective range)
[EF7	Qa	Qb	Qc	Qd	Set read effective time (1000a+100b+10c+d) [x10 ms]	Trigger synchronize

Example: Setting Read Effective Time, Numeric Setting
Read effective time 500 ms
<Esc>[DF7Q0Q0Q5Q0<CR>
0050 x10 = 500 ms (This setting is in increments of 10 ms.)

5.6.2 Trigger Signal Control

By default, trigger signal synchronization is set to (Y0). The TRIGn signal determines the reading time. If TRIGn signal is active, the scan engine will read bar codes.

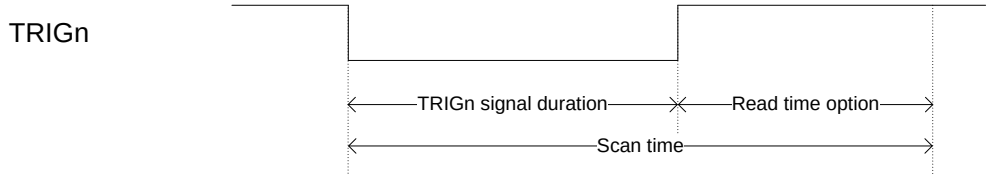


Effective Read Time

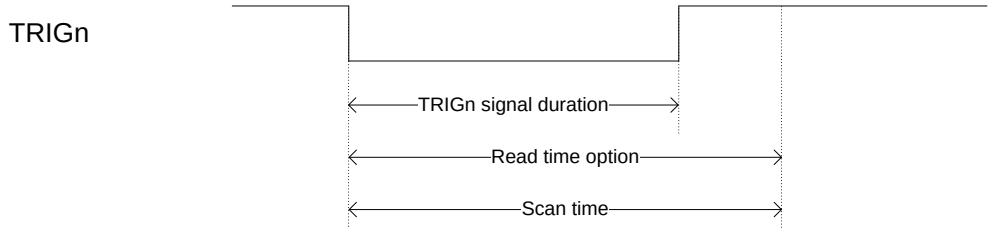
Command	Description
+O (default)	Counting starts from TRIGn signal end
+P	Counting starts from TRIGn signal start

Note: For more information, see section 5.6.1: Read Effective Time.

Counting starts from the TRIGn signal end.

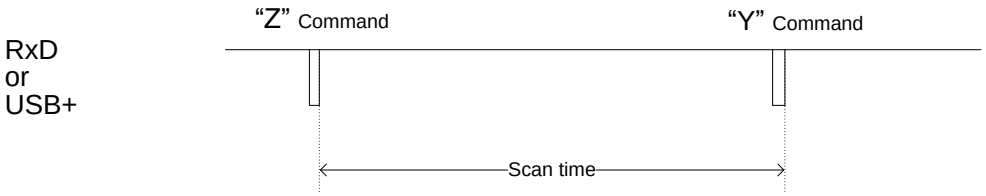


Counting starts from the TRIGn signal start.

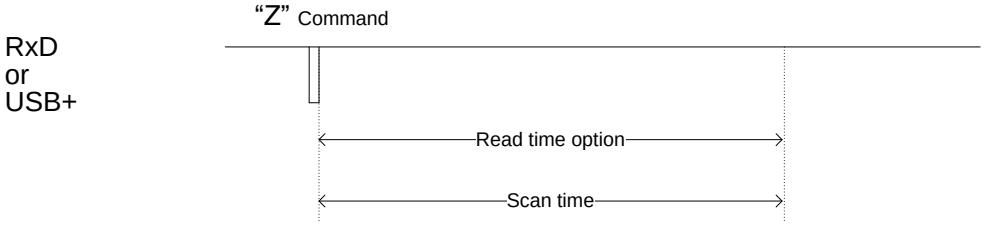


5.6.3 Command Trigger Control

When reading with a command, start reading with the trigger “Z” command and stop reading by sending the “Y” command.



When effective read time is set, reading stops when the set time elapses. Reading also stops when the “Y” command is sent.



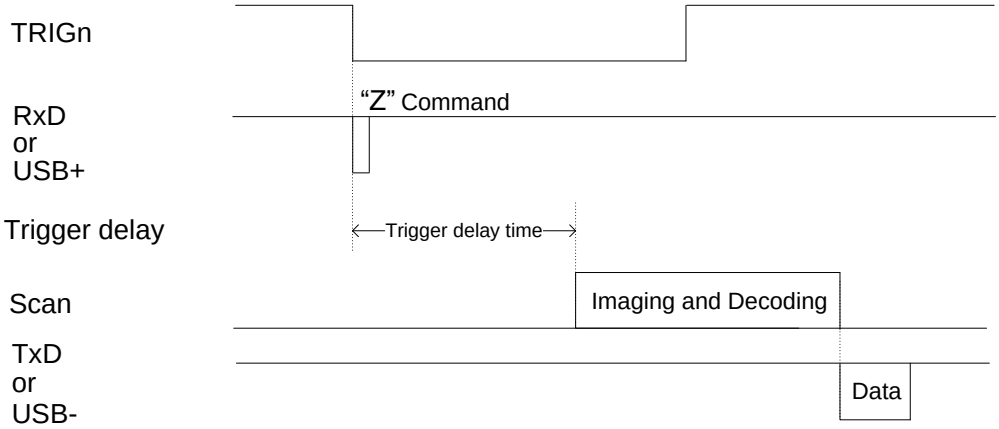
5.6.4 Trigger Delay

Trigger delay can start reading from after the trigger delay set time to the trigger.

Trigger Delay

Command					Description	Default
[DEC	Qa	Qb	Qc	Qd	Trigger delay time (1000a+100b+10c+1d)x[10ms]	0 ms

Timing diagram of the trigger delay:



5.6.5 Decode Timeout

Decode timeout limits decode processing time for one image. When reading bar codes continuously, decoding a poor quality bar code image and peripheral symbols may take time. By limiting the decode time, the scan engine will try to decode the next image and may stabilize the reading.

Decode Timeout

Command							Description	Default
[EAV	Q7	A4	Qa	Qb	Qc	Qd	Decode timeout (1000a+100b+10c+1d)x[1ms]	0 ms *

* Decode timeout = 0 means that the function is disabled and processes decoding for one image until the end. The processing time depends on the image.

6 Code Options

The code options for the scan engine let you configure the enabled bar code types, bar code specific options, and number of characters to be read.

For best reading performance, you should only enable the bar codes and options you need. These settings do not affect the reading of the 1D menu codes.

For more information, see section 10.3 Sample Codes.

6.1 Setting Readable Codes

Configuration commands are classified by one of these categories:

- **Single:** Only the specified symbology will be enabled. All other symbologies will be disabled.
- **Multiple:** The specified symbology will be enabled in addition to the symbologies that are already enabled.
- **Disable:** The specified symbology will be disabled. All other enabled symbologies stay enabled.

6.1.1 1D Bar Codes

Symbologies	Enable/Disable Command			Default					
	Single	Multiple	Disable	Enable	Mini Length	Positive Negative Image	ST/SP Transmission	CD check	Suffix
UPC	J1	R1	[X4B	✓	-	Positive Image Only	-	✓	USB-HID "ENTER" USB-COM UART "CR"
UPC-A	[J1A	[R1A	[V1A	✓	-		-	✓	
UPC-E	[J1B	[R1B	[V1B	✓	-		-	✓	
EAN/JAN	J4	R4	[X4E	✓	-		-	✓	
EAN/JAN-13	JG	JU	[DDM	✓	-		-	✓	
EAN/JAN-8	JA	JO	[DDN	✓	-		-	✓	
Code 39	A2	B2	VB	✓	1		×	×	
Tri-Optic	JD	JZ	[DDJ	✓	-				
Codabar	A3	B3	VC	✓	2		×	×	
Industrial 2 of 5	J7	R7	[X4K	✓	5		-	×	
Interleaved 2 of 5	J8	R8	[X4L	✓	6		-	×	
S-Code	RA	R9	[DDK		5				
Code 128	A6	B6	VE	✓	1		-	✓	
Code 93	A5	B5	VD	✓	1		-	✓	
IATA	A4	B4	VH	✓	5		-	×	
MSI/Plessey	A7	B7	VF		3		-	✓	
UK/Plessey	A1	B1	VA		2		-	✓	
Telepen	A9	B9	VG		1		-	✓	
Code 11	[BLB	[BLC	[BLA		1		-	✓	
Matrix 2 of 5	AB	BB	[DDL		5		-	×	

* GS-128 will read as Code 128. To convert GS1-128 to GS1, see section 6.2.1: GS1 Convert.

6.1.2 Postal Code

Symbologies	Enable/Disable command			Default	
	Single	Multiple	Disable	Enable	Suffix
Chinese Post Matrix 2 of 5	JE	JS	JT		USB-HID "ENTER" USB-COM UART "CR"
Korean Postal Authority	JL	WH	WI		
Intelligent Mail Barcode	[D5H	[D5F	[D5G		
POSTNET	[D6C	[D6A	[D6B		
PLANET	[DG2	[DG3	[DG4		
Japan Postal	[D5R	[D5P	[D5Q		
Netherland KIX Code	[D5M	[D5K	[D5L		
Australian Postal	[D6O	[D6M	[D6N		
UK Postal (Royal mail)	[DG7	[DG8	[DG9		
4-State Mailmark Barcode	[DGS	[DGT	[DGU		

6.1.3 GS1 DataBar

Symbologies	Enable/Disable command						Default	
	Single		Multiple		Disable		Enable	Suffix
GS1 DataBar • GS1 DataBar Omnidirectional • GS1 DataBar Truncated • GS1 DataBar Stacked • GS1 DataBar Stacked Omnidirectional	J9	[BC6	JX	[BCI	SJ	[BCU	✓	USB-HID “ENTER” USB-COM UART “CR”
GS1 DataBar Limited	JJ		JY		SK		✓	
GS1 DataBar Expanded • GS1 DataBar Expanded • GS1 DataBar Expanded Stacked	JK		DR		SL		✓	

Note: To convert to GS1, see section 6.2.1: GS1 Convert.

6.1.4 GS1 Composite Code

Symbologies	Enable/Disable command		Default	
	Multiple	Disable	Enable	Suffix
Composite GS1 DataBar • CC-A • CC-B • Limited CC-A • Limited CC-B • Expanded CC-A • Expanded CC-B	[BHE	[BHF	✓	USB-HID “ENTER” USB-COM UART “CR”
Composite GS1-128 • CC-A • CC-B • CC-C			✓	
Composite EAN • EAN-13 CC-A • EAN-13 CC-B • EAN-8 CC-A • EAN-8 CC-B	[D1V	[D1W		
Composite UPC • UPC-A CC-A • UPC-A CC-B • UPC-E CC-A • UPC-E CC-B				

Notes:

- To convert to GS1, see section 6.2.1: GS1 Convert.
- When composite EAN or composite UPC is enabled, EAN or UPC only cannot be read.

6.1.5 2D Codes

Symbologies	Enable/Disable Command			Default	
	Single	Multiple	Disable	Enable	Suffix
PDF417	[BC3	[BCF	[BCR	✓	USB-HID "ENTER" / USB-COM UART "CR"
MicroPDF417	[BC4	[BCG	[BCS		
Codablock F	[D4R	[D4P	[D4Q		
QR Code	[BC1	[BCD	[BCP	✓	
Micro QR	[D38	[D2U	[D2V	✓	
Data Matrix (ECC 200)	[BC0	[BCC	[BCO	✓	
Data Matrix (ECC 000-140)	[BG2	[BG0	[BG1		
Aztec Code	[BC5	[BCH	[BCT	✓	
Aztec Runes	[BF4	[BF2	[BF3		
Chinese-sensible code	[D4K	[D4L	[D4M		
Maxi Code	[BC2	[BCE	[BCQ		
Dot Code	[DOC	[DOD	[DOE		

Note: To convert to GS1 and read GS1 QR codes and GS1 Data Matrix, see section 6.2.1: GS1 Convert.

6.1.6 OCR

ICAO Machine Readable Travel Documents Charts

Documents	Enable/Disable command			Default	
	Single	Enable	Disable	Enable	Suffix
Machine readable Passports	[DJ1	[DJ2	[DJ3		USB-HID "ENTER" / USB-COM UART "CR"
Machine readable Visa-A	[DJ4	[DJ5	[DJ6		
Machine readable Visa-B	[DJ7	[DJ8	[DJ9		
Official Travel Documents 1	[DJA	[DJB	[DJC		
Official Travel Documents 2	[DJD	[DJE	[DJF		

Note: Because the format is fixed, ICAO travel documents can be read regardless of the image direction.

To free edit and read standard OCR fonts see section 6.2.7: OCR Free Edit. For advanced settings, see the "Data Edit Programming Manual".

6.1.7 Code Type Settings

Symbologies	Initialize Command	Enable (Single)	Enable (Multiple)	Disable
All 1D Bar Codes	[DX1	[BCA*1	[BCM*1	[BCY
All 2D Codes	[DX2	[BCB	[BCN	[BCZ
All Codes (1D, 2D)	[DX0*2	A0*3		B0

*1 Add-on code will also be added. The Add-on delay timer will be activated and requires a longer time to read.
*2 OCR will also be initialized.
*3 OCR and Add-on will not be added.

6.2 Setting Code Common Options

6.2.1 GS1 Convert

Because the FNC1 character is not included in ASCII, when it is used, variable length termination will not be transmitted when reading GS1 symbols (GS1-128, GS1 DataBar, GS1 DataBar Composite, GS1 DataMatrix, GS1 QR Code, GS1 Dot Code) with the default setting. For GS1 conversion, to analyse the GS1 data at the host, convert variable length data termination FNC1 to ”Ctrl+]” and key outputs for USB-HID. For USB-COM and RS-232C, you need to convert to GS(0x1D) and outputs. However, if the last of variable length data is AI data, FNC1 does not exist and GS is not output.

<Initial Setting Status>

FNC1 (non-output)	AI	Data (fixed length)	AI Data (variable length)	**FNC1 (non-output)**	・・・	AI	AI Data (variable length)

↓

<GS1 After Conversion>

For USB-HID

AIM-ID (output)	AI	Data (fixed length)	AI Data (variable length)	**Ctrl+]** (key output)	・・・	AI	AI Data (variable length)

For USB-COM and UART

AIM-ID (output)	AI	Data (fixed length)	AI Data (variable length)	**GS(0x1D)** (output)	・・・	AI	AI Data (variable length)

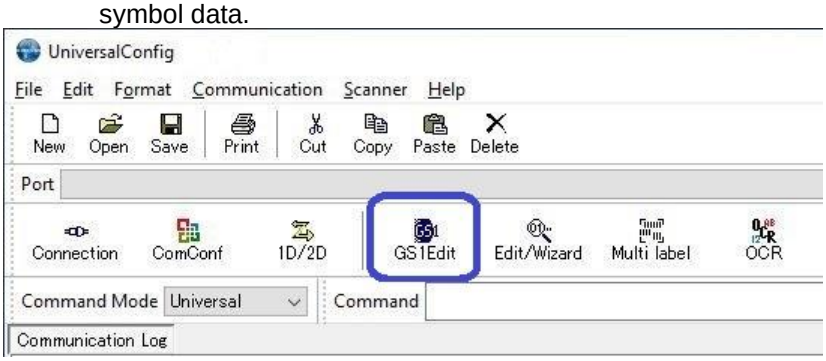
* For AIM-ID, see section 9.1.2: Good Read Buzzer.

GS1 Convert

GS1 Conversion Supported Symbologies	Command	Command Description
GS1-128 GS1 DataBar GS1 DataBar Composite GS1 Data Matrix GS1 QR Code GS1 Dot Code	[X/0 (initial setting)	Disable GS1 conversion
	[X/4	Enable GS1 conversion

To process and output GS1 conversion data in the scan engine:

- Use the Opticon application tool “UniversalConfig” to enable processing and outputting GS1 symbol data.

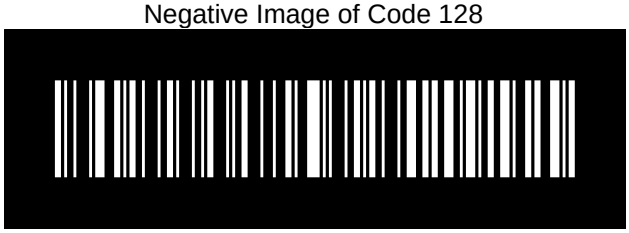


6.2.2 Positive and Negative Image of Bar Codes (1D Code Common)

Typically, bar codes are printed in black on a white background (normal/positive bar code). But there may be instances where they are printed in white on a black background (negative bar code).

Positive Image of Code 128

Negative Image of Code 128



Positive and Negative Bar Code Image

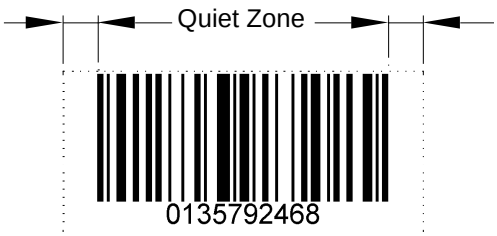
Code	Command		Description
1D	[DLA	Q0	Decode positive bar codes only. (default)
		Q1	Decode negative bar codes only.
		Q2	Decode positive bar codes and negative bar codes.

Note: For best reading performance, only enable the required codes and options.

.

6.2.3 Smart Quiet Zone (1D Code)

The required margin on the left and right of the bar code is called the quiet zone. If the quiet zone is narrow or the flame line is too close, enabling the smart quiet zone will adjust to the maximum performance for reading various 1D bar codes. This setting does not comply with bar code standards, so the possibility of misreading may increase. If misreading occurs, disable this setting.



Smart Quiet Zone Enable/Disable Commands

Item	Command			Description
Enable smart quiet zone	[DLY	Qa	Qb	Enable the code specified by QaQb
Disable smart quiet zone	[DLZ			Disable the code specified by QaQb

1D Bar Code Settings for Smart Quiet Zone

Symbologies	ab	Default
EAN/UPC	01	✓
Code 39	02	✓
Codabar	03	
Industrial 2 of 5	04	
Interleaved 2 of 5	05	
S-Code	06	
Code 128	07	✓
Code 93	08	✓
IATA	09	
MSI/Plessey	10	
UK/Plessey	11	
Telepen	12	✓
Code 11	13	✓
Matrix 2 of 5	14	
Chinese Post Matrix 2 of 5	15	✓

6.2.4 Redundancy (1D Code Common)

When redundancy is enabled, a 1D bar code must be scanned and decoded multiple times and the results must be the same before it is considered correctly decoded. The redundancy count is the number of times that the bar code must be scanned in addition to the first scan. Selecting a higher redundancy count reduces the probability of reading errors but makes the output response slower. The default setting can reliably read high-quality printed bar codes.

Note: This setting only affects reading 1D Bar Codes.

Redundancy Commands

Command	Description
X0	Read 1 time, redundancy = 0
X1	Read 2 times, redundancy = 1
X2	Read 3 times, redundancy = 2
X3	Read 4 times, redundancy = 3 (default)
BS	Read 5 times, redundancy = 4
BT	Read 6 times, redundancy = 5
BU	Read 7 times, redundancy = 6
BV	Read 8 times, redundancy = 7
BW	Read 9 times, redundancy = 8

6.2.5 Add-On Waiting Time

The scan engine searches for valid UPC/EAN add-on codes within the selected amount of time. If an effective add-on code is found, the scan engine immediately sends the data. If there is nothing to read after the code, the scan engine sends the data without an add-on. If there is something to read after the code but it is not a valid add-on code, the scan engine ignores the code.

Supported codes:

- UPC 2 digits/5 digits add-on and GS1 composition symbol
- EAN/JAN 2 digits/5 digits add-on and GS1 composition symbol

Add-On Waiting Time Commands

Command	Description
XA	Add-on standby mode invalid
XB	Add-on standby mode 0.25 seconds
XC	Add-on standby mode 0.5 seconds (initial setting)
XD	Add-on standby mode 0.75 seconds

6.2.6 ECI Protocol Output

ECI Protocol Output determines whether to output data related to ECI (Extended Channel Interpretation) protocol in 2D codes (QR Code, Data Matrix, Aztec Code, Maxi Code, and Dot Code).

If ECI protocol exists for data, the ECI number is indicated by a 6-digit number following the backslash and two backslashes indicating a backslash.

To not output ECI protocol, change the data career identifier to ID not use ECI protocol, delete the 6-digit number following the backslash, and replace the two backslashes with one backslash.

Supported codes: QR Code, Data Matrix, Aztec Code, Maxi Code, and Dot Code.

Example Output

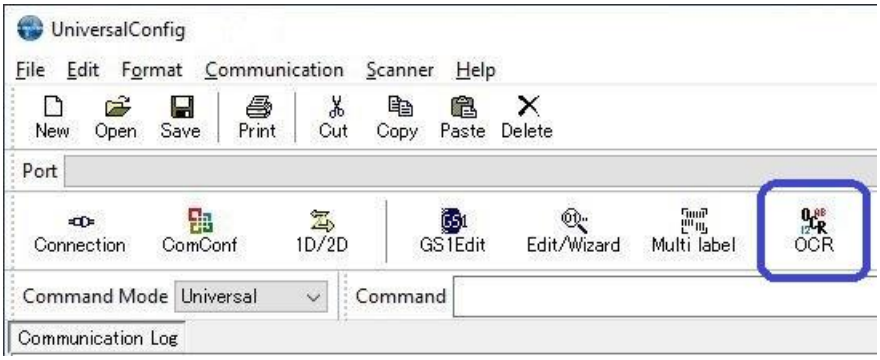
```
 Output:         ]Q2\000001test\\test
 Not output:     ]Q1test\test
*Backslash: ’\’
```

ECI Protocol Output Commands

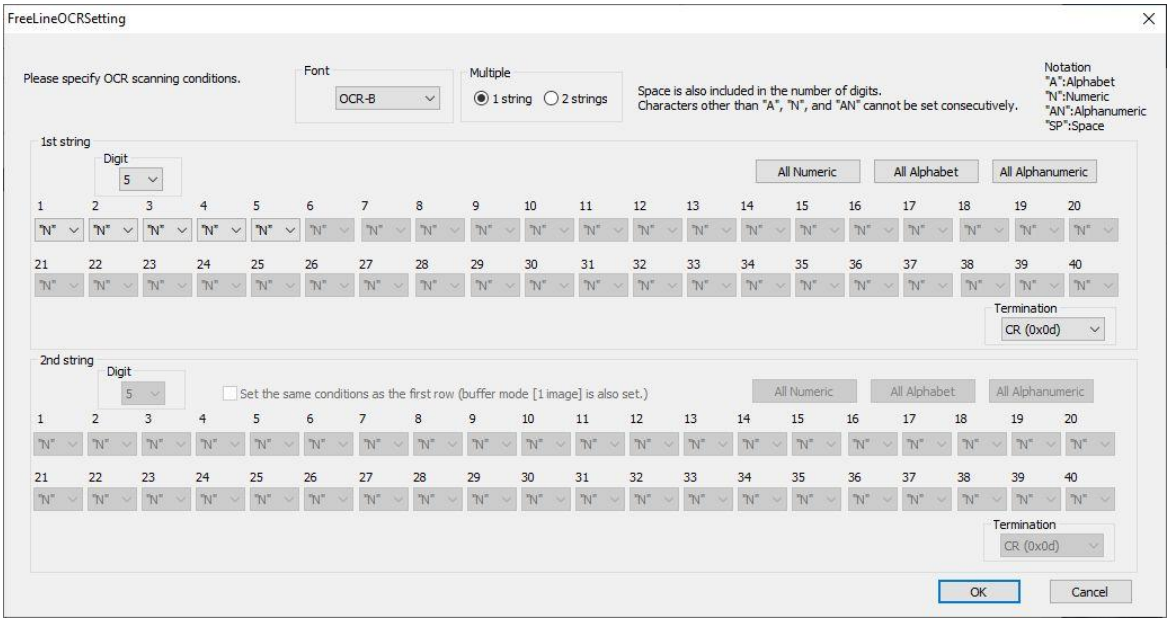
Command	Description
[DLE	Do not output ECI protocol (default)
[DLF	Output ECI protocol

6.2.7 OCR Free Edit

To read OCR standard format, use the UniversalConfig tool to configure OCR free edit.



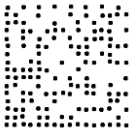
You can set up to 40 digits (2 rows) of numbers, alphabets, and symbols. For advanced settings, see the “Data Edit Programming Manual”. For items that cannot be set, please contact your local sales office.



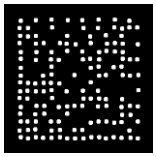
6.2.8 DPM (Dot Peen Making) Code Reading

DPM reading is used to read codes that are imprinted directly on metal or other materials in the form of dots.

DataMatrix in dot print



DataMatrix in negative dot print



Normal DataMatrix

The scan engine may not be able to read theses codes due to specular reflection or contrast reduction due to materials or curved surfaces.

DPM Reading Commands

Command		Description
[DPF	Q0 (default)	Do not read DMP patterns.
	Q1	Execute processing of multiple DPM patterns.
	Q2	Execute processing of multiple DPM patterns and fixate to the process where reading was successful. *

* Fixating the DPM pattern process stabilizes the reading. To initialize the fixated process, resend [DPFQ2.

6.3 Setting Code Specific Options

6.3.1 UPC

UPC code is a bar code established by the United States Uniform Code Council Inc. and used by the distribution industry.

6.3.1.1 UPC-A

UPC-A Configuration

Item	Overview
Character set	Numeric (0 - 9)
Number of digits	12 digits (11 digits +CD1 digit) fixed length
CD (check digit) check method	Modulus 10/Wait 3

UPC-A Transfer Data Format

Leading "0"	Data 11 digits	CD 1 digit

* If you set to 13 digits transfer data format that transfers a leading “0” and CD, the format becomes compatible with JAN/EAN-13.

UPC-A Add-On 2 Digits/5 Digits

UPC-A Add-On 2 Digits/5 Digits is a UPC-A bar code of plus a 2-digit or 5-digit supplemental code. When add-on is enabled. The add-on code must be within the reading range of the scan engine. If it is not within range, after the add-on waiting time the scan engine reads the code as UPC or EAN. When add-on is allowed and the scan engine is only reading UPC or EAN, reading response will decrease.

Transfer Data Format (UPC-A Add-On 2 Digits)

Leading "0"	Data 11 digits	CD 1 digit	Add-on 2 digits

Transfer Data Format (UPC-A Add-On 5 Digits)

Leading "0"	Data 11 digits	CD1 digit	Add-on 5 digits

UPC-A CD Transfer/Front “0” Transfer

Use this command to determine whether to transmit a CD (check digit) and a leading “0”. If you set the 13 digits transfer data format that transfers a leading “0” and CD, the format becomes compatible with JAN/EAN-13.

6.3.1.2 UPC-E

UPC-E Configuration

Item	Overview
Character set	Numeric (0 - 9)
Number of digits	7 digits (6 digits + CD 1 digit) fixed length
CD (check digit) check method	Modulus 10/Wait 3

Transfer Data Format

Leading "0"	Data 6 digits	CD 1 digits

UPC-E Add-On 2 Digits/5 Digits
UPC-E Add-On 2 Digits/5 Digits is a UPC-E bar code plus a 2-digit or 5-digit supplemental code.

Transfer Data Format (UPC-E Add-On 2 Digits)

Leading "0"	Data 6 digits	CD 1 digit	Add-on 2 digits

Transfer Data Format (UPC-E Add-On 5 Digits)

Leading "0"	Data 6 digits	CD 1 digit	Add-on 5 digits

UPC-E CD Transfer/Front “0” Transfer
Use this command to determine whether to transmit a CD (check digit) and a leading “0”. If you set the 8-digit transfer data format that transfers a leading “0” and CD, the format becomes compatible with JAN/EAN-8.

Convert UPC-E to UPC-A Format
You can convert UPC-E to UPC-A format.

UPC-A and UPC-E Settings

Code	Item	Command	Description	Default
UPC-A	UPC-A Leading zero CD transmission	E2	UPC-A, Leading zero, transmit CD	
		E3	UPC-A, No leading zero, transmit CD	✓
		E4	UPC-A, Leading zero, do not transmit CD	
		E5	UPC-A, No leading zero, do not transmit CD	
	Add-on 2 digits	J2	Enable single UPC Add-on 2	
		R2	Enable UPC Add-on 2	
		[X4C	Disable UPC Add-on 2	✓
	Add-on 5 digits	J3	Enable single UPC Add-on 5	
		R3	Enable UPC Add-on 5	
		[X4D	Disable UPC Add-on 5	✓
UPC-E	UPC-E Leading zero CD transmission	E6	UPC-E , Leading zero, transmit CD, transfer digits 8 digits	
		E7	UPC-E , No leading zero, transmit CD, transfer digits 7 digits	✓
		E8	UPC-E , Leading zero, do not transmit CD, transfer digits 7 digits	
		E9	UPC-E , No leading zero, do not transmit CD, transfer digits 6 digits	
	UPC-A, E conversion	6Q	Transmit UPC-E	✓
		6P	Transmit as UPC-A	

6.3.2 EAN/JAN

EAN/JAN-13 and EAN/JAN-8 are standardized, common product symbols in the distribution industry. The 13-digit version is the standard version and the 8-digit version is the shortened version.

6.3.2.1 EAN/JAN-13

EAN/JAN-13 Configuration

Item	Overview
Character set	Numeric (0 - 9)
Number of digits	13 digits (12 digits +CD1 digit) fixed length
CD (check digit) check method	Modulus 10/Wait 3

Transfer Data Format

Data 12 digits	CD 1 digit

EAN/JAN-13 Add-On 2 Digits/5 Digits

EAN/JAN-13 Add-On 2 Digits/5 Digits is an EAN/JAN -13 bar code plus a 2-digit or 5-digit supplemental code. When add-on is enabled. The add-on code must be within the reading range of the scan engine. If it is not within range, after the add-on waiting time the scan engine reads the code as UPC or EAN. When add-on is allowed and the scan engine is only reading UPC or EAN, **reading response will decrease**.

Transfer Data Format (EAN/JAN -13 Add-On 2 Digits)

Data 12 digits	CD 1 digit	Add-on 2 digits

Transfer Data Format (EAN/JAN -13 Add-On 5 Digits)

Data 12 digits	CD 1 digit	Add-on 5 digits

EAN/JAN -13 CD Transfer

Use this command to determine whether to transfer EAN/JAN-13 CD (check digit).

EAN-13 Forced Add-On

You can force EAN-13 with leading 3 digits (378/379/529/414/419/434/439/977/978) to be handled as “with add-on”. When enabled, the bar code without the add-on (which is the condition of leading 3 digits) cannot be read.

ISBN Conversion

When ISBN conversion is enabled, it converts data with an EAN-13 leading “978” or “979”. ISBN conversion re-calculates the CD by omitting the leading 3 digits and outputs 10 digits. If CD is 10, X is output.

Examples:

- ISBN conversion of EAN-13 “9791230671184”; converts to “1230671188” and outputs this data.
- ISBN conversion of EAN-13 “9780123782830”; converts to “012378283X” and outputs this data.

ISSN Conversion
When ISSN conversion is enabled, it converts data with an EAN-13 leading “977”. ISSN conversion re-calculates the CD by omitting leading 3 digits and outputs 8 digits.

ISMN Conversion
When ISMN conversion is enabled, it converts data with an EAN-13 leading “9790”. ISMN conversion converts the leading 4 digits to “M” and outputs 10 digits. When ISMN conversion is disabled and ISBN conversion is enabled, EAN-13 with a leading “9790” will be converted to ISBN format.

Example:

- ISMN conversion of EAN-13 “9790230671187”; converts to “M230671187” and outputs this data.

6.3.2.2 EAN/JAN-8

EAN/JAN-8 Configuration

Item	Overview
Character set	Numeric (0-9)
Number of digits	8 digits (7 digits + CD1 digit) fixed length
CD (check digit) check method	Modulus 10/Wait 3

Transfer Data Format

Data 7 digits	CD 1 digit

EAN/JAN -8 Add-on 2 Digits/5 Digits
EAN/JAN-8 Add-On 2 Digits/5 Digits is an EAN/JAN-8 bar code plus a 2-digit or 5-digit supplemental code. When add-on is enabled. The add-on code must be within the reading range of the scan engine. If it is not within range, after the add-on waiting time the scan engine reads the code as UPC or EAN. When add-on is allowed and the scan engine is only reading UPC or EAN, **reading response will decrease**.

Transfer Data Format (EAN/JAN-8 Add-On 2 Digits)

Data 7 digits	CD 1 digit	Add-on 2 digits

Transfer Data Format (EAN/JAN-8 Add-On 5 Digits)

Data 7 digits	CD 1 digit	Add-on 5 digits

EAN/JAN -8 CD Transfer
Use this command to determine whether to transfer EAN/JAN-8 CD (check digit).

EAN/JAN-13 Optional Settings

Symbologies	Item	Command	Description	Default
EAN/JAN-13	CD Transmission	6K	Transmit EAN/JAN -13 CD	✓
		6J	Do not transmit EAN/JAN-13 CD	
	Add-on 2 digits	JH	Singly enable EAN/JAN -13 Add-on 2 digits	
		JV	Add enable EAN/JAN -13 Add-on 2 digits	
		[X4N	Disable EAN/JAN -13 Add-on 2 digits	
	Add-on 5 digits	JI	Singly enable EAN/JAN -13 Add-on 5 digits	
		JW	Add enable EAN/JAN -13 Add-on 5 digits	
		[X4P	Disable EAN/JAN -13 Add-on 5 digits	
EAN -13	EAN-13 Forced add-on	-G	When EAN-13 starts at 378/379/529; enable EAN forced add-on	
		-H	When EAN-13 starts at 378/379/529; disable EAN forced add-on	✓
		-C	When EAN-13 starts at 434/439/414/419/977/978; enable EAN forced add-on	
		-D	When EAN-13 starts at 434/439/414/419/977/978; disable EAN forced add-on	✓
	ISBN Conversion	IB	Disable ISBN conversion	✓
		IA	Enable ISBN conversion	
		IK	When possible, enable ISBN conversion	
	ISSN Conversion	HN	Disable ISSN conversion	✓
		HO	Enable ISSN conversion	
		4V	When possible, enable ISSN conversion	
	ISMN Conversion	IO	Disable ISMN conversion	✓
		IP	Enable ISMN conversion	
		IQ	When possible, enable ISMN conversion	

EAN/JAN-8 Optional Settings

Symbologies	Item	Command	Description	Default
EAN/JAN-8	CD Transmission	6I	Transmit EAN/JAN-8 CD	✓
		6H	Do not transmit EAN/JAN-8 CD	
	Add-on 2 digits	JB	Singly enable EAN/JAN-8 Add-on 2 digits	
		JP	Add enable EAN/JAN-8 Add-on 2 digits	
		[X4M	Disable EAN/JAN-8 Add-on 2 digits	
	Add-on 5 digits	JC	Singly enable EAN/JAN-8 Add-on 5 digits	
		JQ	Add enable EAN/JAN-8 Add-on 5 digits	
		[X4O	Disable EAN/JAN-8 Add-on 5 digits	

6.3.3 Code 39 and It. Pharm

Code 39 is a bar code developed by Intermec and has been standardized as ISO/IEC 16388. It is mainly used in the industrial fields.

Code 39 Configurations

Item	Overview
Character set	Numeric (0 - 9) Symbol (- , Space $ / + %) Alphabet (A to Z)
Start/Stop code	*
Digits	Variable length

Transfer Data Format

Start code “*”	Data Variable length	CD	Stop code “*”

Calculate Code 39 CD

This command determines whether to check the CD (check digit) is configurable.

Transfer Code 39 CD

Whether to transfer CD (check digit) or not is configurable.

Transfer Code 39 Start/Stop Code

Whether to transfer Start/Stop code or not is configurable.

Code 39 Conversion Settings

Setting	Description
Standard Code 39	Sends the data character as is.
Full ASCII Code 39	Converts the correct combination of the data character to Full ASCII and transmits it. If an incorrect combination is found in the character, it will not be transmitted.
When Possible Full ASCII Code 39	Converts the specified combination of the data character to Full ASCII and transmits it. If a combination is incorrect, it will be transmitted without converting, as is.
Italian Pharmaceutical	Converts Code 39 data to Italian Pharmaceutical format. Italian Pharmaceutical format is fixed length containing 1 digit of mandatory check digit after 8 digits of numeric data. When not converting to Italian Pharmaceutical, the bar code will not be sent.
When Possible Italian Pharmaceutical	Convert Code 39 data to Italian Pharmaceutical format. When not converting to Italian Pharmaceutical, the bar code will be sent as standard Code 39.

Code 39/It. Pharm Optional Settings

Item	Command	Description	Default
CD check	C1	Do not check CD	✓
	C0	Check CD	
CD transmission	D9	Transmit Code 39 CD	✓
	D8	Do not transmit Code 39 CD	
ST/SP transmission	D1	Do not transmit ST/SP	✓
	D0	Transmit ST/SP	
Full ASCII conversion	D5	Normal Code 39	✓
	D4	Full ASCII Code 39	
	+K	Full ASCII Code 39 if possible	
It. Pharm	D6	It. Pharmaceutical only	
	D7	It. Pharmaceutical if possible	
	DA	Do not transmit leading A for It. Pharm	✓
	DB	Transmit leading A for It. Pharm	
Concatenation	+M	Disable concatenation	✓
	+L	Enable concatenation	

6.3.4 Codabar

Codabar is a relatively early-stage bar code developed by Monarch Marking Company in 1972, following 2 of 5.

Codabar Configurations

Item	Overview
Character set	Numeric (0 - 9) Symbol (- $: / , +)
Start/Stop code	A, B, C, or D
Digits	Variable length
CD (check digit) check method	Check digits are generally not often used.

Transfer Data Format

Start code 1 digit	Data Variable length	CD	Stop code 1digit

Codabar (NW-7) Read Mode

Mode	Description
Standard mode	Consists of 1 bar code.
ABC mode	Acronym for the American Blood Commission. This mode consists of 2 side-by-side bar codes. (Margin is necessary.) When the bar code's first stop character and the second start character is D, it will be concatenated and sent. Two D characters will not be sent.
CX mode	Consists of 2 side-by-side bar codes. (Margin is necessary.) When the bar code's first stop character is C and the second start character is B, it will be concatenated and sent. B and C characters will not be sent.

Codabar CD Check

In Codabar, Modulus 16 is generally used.

Codabar CD Transfer

Determines if transferring the CD (check digit) is configurable.

Start / Stop Code Transfer

Determines if transferring the start/stop code is configurable. It can also convert the code and transfer when transferring the start/stop code.

Codabar Optional Settings

Item	Command	Description	Default
CD check	H7	Do not check CD	✓
	H6	Check CD	
CD transmission	H8	Transmit Codabar CD	✓
	H9	Do not transmit Codabar CD	
ST/SP transmission	F0	Do not transmit Start/Stop code	✓
	F1	Start/Stop code: ABCD/TN*E	
	F2	Start/Stop code: abcd/tn*e	
	F3	Start/Stop code: ABCD/ABCD	
	F4	Start/Stop code: abcd/abcd	
	HJ	Start/Stop code: <DC1><DC2><DC3><DC4> /<DC1><DC2><DC3><DC4>	
Space insertion	HE	Disable space insertion	✓
	HD	Enable space insertion	
ABC, CX conversion	HA	Enable only Codabar normal mode	✓
	H4	Enable only ABC code	
	H5	Enable only CX code	
	H3	Enable Codabar/ABC and CX	

6.3.5 Interleaved 2 of 5 and S-Code

Interleaved 2 of 5 is a symbol standardized by ISO/IEC 16390 as the standard distribution symbol ITF.

Interleaved 2 of 5 Configurations

Item	Overview
Character set	Numeric (0 - 9)
Start/Stop code	Hidden character
Digits	Variable length (even number)
CD (check digit) check method	Modulus 10/Wait 3

Transfer Data Format

Data variable length	CD

Interleaved 2 of 5 CD Check

Determines if checking the CD (check digit) is configurable. This setting also configures whether to check Interleaved 2 of 5, Industrial 2 of 5, S-Code, and Matrix 2 of 5 CD.

Interleaved 2 of 5 CD Transmit

Determines if transferring the CD (check digit) is configurable. This setting also configures whether to transfer Interleaved 2 of 5, Industrial 2 of 5, S-Code, and Matrix 2 of 5 CD.

Industrial 2 of 5 Space Check

Determines whether to enable/disable the space (inter-character gap) check of Industrial 2 of 5.

Interleaved 2 of 5 and Industrial 2 of 5 Optional Settings

Code	Item	Command	Description	Default
Interleaved 2 of 5 S-Code	CD check	G0	Do not check CD	✓
		G1	Check CD	
	CD transmission	E0	Transmit CD	✓
		E1	Do not transmit CD	
	Space check	GK	Disable space check for Industrial 2 of 5	
		GJ	Enable space check for Industrial 2 of 5	✓
	S-Code conversion	GH	Do not transmit S-Code as Interleaved 2 of 5	✓
		GG	Transmit S-Code as Interleaved 2 of 5	

6.3.6 Code 128

Code 128 was developed by Computer Identix Inc. in the USA in 1981. Code 128 is a symbol standardized as USS-CODE128. Because it can encode ASCII128 characters, it is called Code 128.

Code 128 Configurations

Item	Overview
Character set	ASCII128 character Function character (FNC1 – 4) Code set selection character (A, B, C and Shift)
Start/Stop code	Hidden character Start pattern 3 types (A,B and C), Stop pattern 1type
Digits	Variable length
CD (check digit) check method	Modulus 103

Transfer Data Format

Data (variable length)

GS1 Conversion

You can disable or enable GS1-128 GS1 conversion. For more information, see section 6.2.1: GS1 Convert.

Concatenation of Code 128

When Code 128 data has a leading FNC2 character, you cannot concatenate the data. To concatenate the data, you need to omit the leading FNC2.

When the scan engine reads a bar code that does not contain the leading FNC2 character, it concatenates the data to the end of the data that is buffering to the scan engine and sends the entire buffer.

The reading time is updated each time a label is read. If the reading is not completed within the reading time, the buffered data will be discarded.

A maximum of 400 characters can be concatenated.

Code 128 Optional Settings

Item	Command	Description	Default
GS1 conversion	OF	Disable GS1-128	✓
	JF	Enable GS1-128 only	
	OG	Enable GS1-128 if possible	
Concatenation	MP	Disable concatenation	✓
	MO	Enable concatenation	

6.3.7 IATA

The standards for bar codes and magnetic stripes on boarding passes are published by the International Air Transport Association (IATA).

IATA Settings

Item	Command	Description	Default
CD check	4H	Do not check CD	✓
	4I	Check FC/SN only	
	4J	Check FC/CPN/SN	
	4K	Check FC/CPN/AC/SN	
CD transmission	4M	Do not transmit CD	
	4L	Transmit CD	✓

6.3.8 MSI/Plessey

MSI/Plessey is a numeric-only, variable-length symbology that is a variant of Plessey Code, which was originally developed by the Plessey Company of England in 1971. This bar code is used on shelves in supermarkets, as well as warehouses and other storage facilities for inventory purposes.

MSI/Plessey Settings

Item	Command	Description	Default
CD check	4A	Do not check CD	
	4B	Check 1 CD = MOD 10	✓
	4C	Check 2 CD = MOD 10/MOD 10	
	4D	Check 2 CD = MOD 10/MOD 11	
	4R	Check 2 CD = MOD 11/MOD 10	
	4S	Check 2 CD = MOD 11/MOD 11	
CD transmission	4G	Do not transmit CD	
	4E	Transmit CD 1	✓
	4F	Transmit CD 1 and CD 2	

6.3.9 UK/Plessey

UK/Plessey Code, originally developed by the Plessey Company of England in 1971 is a continuous, variable-length symbology that is used to encode hexadecimal data.

UK/Plessey Settings

Item	Command	Description	Default
CD transmission	4O	Not transmit CD	
	4N	Transmit CD	✓
Space insertion	DO	Disable space insertion	✓
	DN	Enable space insertion	
X conversion	DP	Conversion A -> X disable	✓
	DQ	Conversion A -> X enable	

6.3.10 Telepen

Telepen is designed to express all 128 ASCII characters without using shift characters for code switching, and using only two different widths for bars and spaces.

Telepen Settings

Item	Command	Description
Conversion output mode	D2 (default)	Numeric mode
	D3	ASCII mode

6.3.11 Code 11

Code 11 was developed by Intermec in 1977 and is primarily used in telecommunications.

Code 11 Settings

Item	Command	Description	Default
CD check	BLF	Do not check CD	
	BLG	Check 1CD	
	BLH	Check 2CD	
	BLI	Check auto 1 or 2 CD	✓
CD transmission	BLJ	Do not transmit CD	✓
	BLK	CD transmit	

6.3.12 Korean Postal Authority

The Korean Postal Authority bar code encodes a 6-digit Zip code plus a mod 10 check digit.

Korean Postal Authority Settings

Item	Command	Description	Default
CD transmission	*+	CD transmit	
	*-	Do not transmit CD	✓
Transmit dash	*.	Transmit dash	✓
	*/	Do not transmit dash	
Upside-down reading	*9	Upside-down reading enabled	
	*8	Upside-down reading disabled	✓

6.3.13 GS1 DataBar

GS1 DataBar (formerly RSS) is a relatively new bar code, developed close to GS1 and standardized by ISO/IEC 24724:2011. It has 3 types and 7 kinds. GS1 DataBar can hold information in a smaller space and is often used to label fresh foods.

GS1 DataBar Configuration

Item	Overview
Character set	GS1 DataBar Omnidirectional and GS1 DataBar Limited: Numeric (0 - 9) GS1 DataBar Expanded: capital/small character alphabet, numbers, 20 types symbol, function character (FNC1)
Digits	GS1 DataBar Omnidirectional and GS1 DataBar Limited: Application identifier ”01” and 14 digits GS1 DataBar Expanded: number 74 digits and alphabet 41 digits
Check sum	Check sum is always checked, but not sent. GS1 DataBar Omnidirectional: Modulus 79 GS1 DataBar Limited: Modulus 89 GS1 DataBar Expanded: Modulus 211
CD check	GS1 DataBar Omnidirectional and GS1 DataBar Limited: Modulus 10/ Wait 3

Transfer Data Format (GS1 DataBar Omnidirectional and GS1 DataBar Limited)

AI “01”	Data (13 digits)	CD (1 digit)

Transfer Data Format (GS1 DataBar Expanded)

Data (1 - 74 digits)

GS1 Conversion

You can disable or enable GS1 DataBar’s GS1 conversion. For more information, see section 6.2.1: GS1 Convert.

6.3.14 Composite GS1 DataBar

Composite GS1 DataBar is a bar code developed by GS1 for medical use and standardized by ISO/IEC 24723. The 2D bar code symbol is included above a GS1 DataBar, GS1-128 or UPC/EAN to encode additional data.

Composite GS1 DataBar Configuration

Item	Overview
Character set	ASCII value 0 - 127 (ISO 646) ASCII value 128 - 255 (ISO 8859, Alphabet No.1, Extend ASCII) Using ECI: many other character sets
Composite	CC-A is a revised version of MicroPDF417. CC-B is normal MicroPDF417. CC-C is normal PDF417.
Maximum digits	CC-A: 56 characters CC-B: 338 characters CC-C: 2361 characters
Symbol size	1D part: refer to GS1 DataBar and UPC/EAN Composite part: CC-A and CC-B are the same as MicroPDF417. CC-C is the same as PDF417.
Error correction	1D part: error detection only Composite part: Reed Solomon error correction
Link flags	GS1 DataBar and GS1-128 composite have link flags. UPC/EAN composite does not have link flags.

Transfer Data Format (CC-A)

1D data (1 – 74 digits)	Composite data (1 – 56 digits)

Transfer Data Format (CC-B)

1D data (1 – 74 digits))	Composite data (1 – 338 digits)

Transfer Data Format (CC-C)

1D data (1 – 74 digits)	Composite data (1 – 2361 digits)

GS1 Conversion

You can disable or enable Composite GS1 DataBar conversion. For more information, see section 6.2.1: GS1 Convert.

6.3.15 PDF417

PDF417 is a stacked linear barcode developed by Symbol Technologies, and is standardized by ISO/IEC 15438:2006. PDF417 is used for international logistics, ID cards (overseas), and parts labelling.


PDF417 sample


Micro PDF417 sample

PDF417 Configurations

Item	Overview
Character set	ASCII value 0 – 127 (ISO 646) ASCII value 128 – 255 (ISO 8859-1, Alphabet No.1, Extended ASCII) For Macro PDF417: many other character sets
Maximum digits (PDF417)	Text compression: 1850 characters Byte compression: 1108 characters Numeric compression: 2710 characters
Maximum digits (MicroPDF417)	Text compression: 250 characters Byte compression: 150 characters Numeric compression: 366 characters
Symbol size (PDF417)	Number of lines: 3 - 90 Number of rows: 1 - 30
Symbol size (MicroPDF417)	Number of lines: 4 - 44 Number of rows: 1 - 4
Error correction (PDF417)	Error correction level 8. The option for error detection only.
Error correction (MicroPDF417)	Number of code words for error correction is fixed by the symbol and cannot be changed.

Transfer Data Format

Data (variable length)

MicroPDF417

For MicroPDF417, the default is not valid. To enable the setting, see section 6.1.5: 2D Codes.

6.3.16 QR Code

QR code is a matrix type 2D code developed by DENSO WAVE INC. and is standardized to ISO/IEC 18004:2000. QR code supports high-speed reading and is used in a wide range of fields.

QR Code Configurations

Item	Overview
Character set	Numeric data (Numbers 0-9) Alphanumeric data (Numbers 0-9, Capital letters A-Z, 9 special characters: space, $, %, *, +, -, ., /, :) 8-bit byte data (Latin characters based on JIS X 0201, character set of 8-bit code for Katakana characters.) Chinese characters (Character specified by the shift-coded expression of JIS X 0208)
Maximum digits	Alphanumeric data: 4296 characters 8 bit data: 2953 characters Numeric data: 7089 characters Chinese character data: 1817 characters
Symbol size	Minimum: 21 x 21 module Maximum: 177 x 177 module
Error correction	Reed Solomon error correction level 4, L:7% M:15% Q:25% H:30%
Negative barcode, mirror printing	Negative and mirror printed QR code is readable.
Concatenated code	Outputs after reading all concatenated codes.

Transfer Data Format

Data (variable length)

GS1 Conversion

You can disable or enable GS1 QR code conversion. For more information, see section 6.2.1: GS1 Convert.

ECI Protocol Output

You can enable or disable output of QR code ECI protocol data. For more information, see section 6.2.6: ECI Protocol Output.

Micro QR Code

Micro QR code is a variant of QR code. Micro QR codes have a restricted size and capacity to limit the data.

Micro QR Code Configurations

Item	Overview
Character set	Numeric data (numbers 0-9) Alphanumeric data (numbers 0-9, capital characters A-Z, 9 special characters: space, $, %, *, +, -, ., /, :) 8-bit byte data (Latin character based on JIS X 0201, character set of 8-bit code for Katakana character.) Chinese characters (Character specified by the shift-coded expression of JIS X 0208)
Maximum digits	Alphanumeric data: 21 characters 8-bit data: 15 characters Numeric data: 35 characters Chinese character data: 9 characters
Symbol size error correction	Version M1: 11 x 11 module – Error detection only Version M2: 13 x 13 module – Reed Solomon error correction 2 steps (L, M) Version M3: 15 x 15 module – Reed Solomon error correction 2 steps (L, M) Version M4: 17 x 17 module – Reed Solomon error correction 3 steps (L, M, Q)
Negative barcode, mirror printing	Negative and mirror printed QR codes are readable.

Transfer Data Format

Data (variable length)

6.3.17 Data Matrix

Data Matrix is a matrix type 2D code developed by Idymatrix Corporation and is standardized in ISO/IEC 16022. Data Matrix has an L-shaped finder and a symbol capable of miniaturizing. It is mainly used for industrial purposes but is used in a wide range of fields at overseas.

Data Matrix Configurations

Item	Overview
Character set	ASCII value 0 – 127 (ISO 646) ASCII value 128 – 255 (ISO 8859-1, Alphabet No.1, Expand ASCII) Using ECI: many other character sets
Maximum digits (ECC200 square)	Alphanumeric data: 2335 characters 8-bit data: 1556 characters Numeric data: 3116 characters
Maximum digits (ECC200 rectangle)	Alphanumeric data: 98 characters 8-bit data: 47 characters Numeric data: 72 characters
Symbol size (ECC200)	Even rows and even columns, square or rectangle. Square: minimum 10 x 10, maximum 144 x 144 module Rectangle: minimum 8 x 18, maximum 16 x 48 module (6 patterns)
Error correction (ECC200)	Set automatically.
Negative bar code, mirror printing	Negative and mirror printed Data Matrix are readable.

Transfer Data Format

Data (variable length)

ECC 000-140
You can enable or disable (default) ECC 000-140.

GS1 Conversion
You can disable or enable GS1 Data Matrix conversion. For more information, see section 6.2.1: GS1 Convert.

ECI Protocol Output
You can enable or disable output of Data Matrix ECI protocol. For more information, see section 6.2.6: ECI Protocol Output.

6.3.18 Aztec Code

Aztec Code is a matrix type 2D code developed by Welch Allyn Company. Aztec Code has a fender in the center of the code and does not require a quiet zone. Aztec Code is mainly used for tickets and in the medical industry.

Aztec code

Aztec Code Configurations

Item	Overview
Character set	ASCII value 0 – 127 (ISO 646) ASCII value 128 – 255 (ISO 8859-1, Alphabet No.1, Expand ASCII) Using ECI: many other character sets
Maximum number of digits	Alphanumeric data: 3067 characters Number: 3832 characters Byte: 1914 characters
Symbol size	Minimum: 15 x 15 module Maximum: 151 x 151 module
Error correction	The selectable error correction level is 5% to 95% of the data area.

Transfer Data Format

Data (variable length)

ECI Protocol Output

You can enable or disable output of Aztec Code ECI protocol. For more information, see section 6.2.6: ECI Protocol Output.

6.4 Setting Number of Characters

To read fixed-length bar codes, you should configure the scan engine for the fixed number of characters. The scan engine will verify that codes read are of the correct length and reject codes that do not have the specified length. The advantage of setting a fixed length is that it provides protection against spurious short scans of codes, which is possible with code types that do not provide sufficient security against partial scans (e.g. Interleaved 2 of 5). The length checking is done on the code data and is not affected by options such as (do not) transmit start/stop character or check digit. Setting the number of characters does not affect fixed-length codes, such as EAN-13.

6.4.1 Fixed Length ON, Minimum/Maximum Length for Selected Codes

This option enables fixed length and minimum/maximum length checking for each code type and will only affect the specified code types.

Fixed-Length Configuration Commands

Command					Description	Default (valid range)
Specify Code	Input length of digits				Fixed length for selected codes Length: (1000a+100b+10c+d)	(0 - 8000)
See section 6.4.2: Command List: Fixed Length ON/Minimum/Maximum Length.	Qa	Qb	Qc	Qd		

Fixed-Length Configuration Examples

Example	Command
Fix Code 39 length to 6 digits	<ESC>[DC1Q6<CR>
Fix Code 39 length to 6 digits and 12 digits	<ESC>[DC1Q0Q0Q0Q6Q0Q0Q1Q2<CR>
Fix Code 39 length to 6 digits and Interleaved 2 of 5 to 12 digits	<ESC>[DC1Q6[DC4Q1Q2<CR>
Clear fixed length for Code 39	<ESC>[DC1<CR>
Set minimum length for Interleaved 2 of 5 to 4 digits	<ESC>[DB4Q4<CR>
Clear minimum length for Interleaved 2 of 5	<ESC>[DB4<CR>
Set maximum length for Code 39 to 12 digits	<ESC>[DA1Q1Q2<CR>
Clear max length for Code 39	<ESC>[DA1<CR>
Set max length for PDF417 to 20 digits and QR code 125 digits	<ESC>[DALQ2Q0[DAJQ1Q2Q5<CR>

6.4.2 Command List: Fixed Length ON/Minimum/Maximum Length

To set the length of each bar code, enter the appropriate command followed by the value of the length of each code. When you reset the settings, the length currently set becomes the default.

Fixed Length Commands

Code Type	Fixed Length	Min Length	Max Length
Reset settings	[DC0	[XQG	[XNG
Code 39	[DC1	[DB1	[DA1
Codabar	[DC2	[DB2	[DA2
Industrial 2 of 5	[DC3	[DB3	[DA3
Interleaved 2 of 5	[DC4	[DB4	[DA4
Code 93	[DCD	[DBD	[DAD
Code 128	[DCB	[DBB	[DAB
MSI/Plessey	[DC8	[DB8	[DA8
IATA	[DC7	[DB7	[DA7
PDF417	[DCL	[DBL	[DAL
QR code	[DCJ	[DBJ	[DAJ
Data Matrix	[DCH	[DBH	[DAH
Dot Code	[DCU	[DBU	[DAU
Maxi code	[DCK	[DBK	[DAK
Aztec code	[DCI	[DBI	[DAI
MicroPDF417	[DCM	[DBM	[DAM
RSS-Expanded (GS1 DataBar)	[DCF	[DBF	[DAF
Composite	[DCG	[DBG	[DAG
GS1-128	[DCC	[DBC	[DAC
S-Code	[DC5	[DB5	[DA5
UK/Plessey	[DCA	[DBA	[DAA
Matrix 2 of 5/Chinese Post	[DC6	[DB6	[DA6
Telepen	[DC9	[DB9	[DA9
Codablock F	[DCO	[DBO	[DAO
Code 11	[DCE	[DBE	[DAE
Chinese Sensible Code	[DCN	[DBN	[DAN

7 String Options

This chapter describes changes that can be made to the transmitted data string.

7.1 Case Conversion

7.2 Prefix/Suffix

7.1 Case Conversion

Decoded data may be converted to either all lower case or all upper case, or the case may be exchanged. These options may be used if the host requires upper or lower case characters only.

Upper Case/Lower Case Conversion Examples

Description	AbCd
No case conversion (default)	AbCd
Convert to upper case	ABCD
Convert to lower case	abcd
Exchange case	aBcD

Upper Case/Lower Case Conversion Commands

Command	Description
YZ (default)	No case conversion
YW	Convert to upper case
YX	Convert to lower case
YY	Exchange case

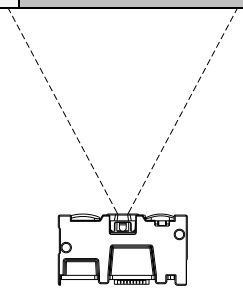
7.2 Prefix/Suffix (Appending Character Function)

Additional functions can place informational characters just before the decoded data (pre-data) or be transmitted immediately after the data (post-data).

Output Format:

- Prefix/suffix (up to 4 digits). Specified characters can be added in front of or at the end of the data for each specific symbology. By default, the prefix is empty and the suffix of all codes is a “CR” character. Prefix/suffix cannot be set when using OCR Free Edit or Data Edit Reading. For more information, see sections 6.2.7: OCR Free Edit and 8.5.2: Data Edit Reading.
- Preamble/Postamble (up to 8 digits). Specified characters can be added in front of or at the end of the data for all codes. By default, the prefix and suffix are empty.

Preamble	**Prefix for Each Code**	Decoded Data	**Suffix (*1) for Each Code**	**Postamble**
Max 8 digits	Max 4 digits		Max 4 digits	Max 8 digits



Note: By default, <CR> is added to the suffix with all codes “RZ” command.

Program Values

Value	Description
ASCII (See section 7.2.3: ASCII Prefix/Suffix Values)	All 128 characters.
Code identification	The code identification is transmitted in OPTICON ID, ISO15424 standard, or AIM-ID.
Code length	The code length is the number of characters after the output format that is configured with options in section 6.3: Setting Code Specific Options.
Code coordinate	The code coordinate is transmitted as the pixel coordinate of the image sensor.
Code tilt angle	The tilt angle of the read code can be added to the prefix and suffix.
Scan time	The scan time is the time from the trigger pull until the data output starts.
Bank Number	The current operating bank number can be added to the prefix and suffix.

7.2.1 Set Prefix/Suffix

To add a Prefix/Suffix, use the Prefix/Suffix commands. You can also set a Prefix/Suffix with a menu bar code or 2D menu code.

Notes:

- The prefix and suffix setting commands clear the current values and configure new ones. The default suffix CR is also cleared.
- To clear the default suffix CR, scan the RZ menu code (set suffix for all codes) without codes for the suffix or the PR menu code (clear suffix).
- When the number of configured prefix/suffix characters exceeds the maximum limit (4 digits), the configuration will be ignored.

Prefix/Suffix Commands

Command			Description	Default
Set Commands	Value Commands	See Section		
See section 7.2.2: Prefix/Suffix Settings.	ASCII	7.2.3	Set character to Prefix/Suffix	All codes Suffix USB-HID: “Enter” USB-COM:“CR” UART:“CR”
	Code ID	7.2.4		
	Code Length	7.2.5		
	Code Coordinates	7.2.6		
	Code Tilt Angle	7.2.7		
	Scan Time	7.2.8		
	Bank Number	7.2.9		

Example: To set “C39:” as the prefix and “CR” and “LF” as the suffix for Code 39, set this command:
<ESC>M40CQ3Q96AO41M1J<CR>

7.2.2 Prefix/Suffix Settings

All Codes Prefix/Suffix

Prefix Command	Suffix Command
RY	RZ

Note: By default, “CR” (“Enter” for USB-HID) is added to the suffix of all bar codes. To clear “CR” or “Enter”, send the “RZ” command only.

Individual Bar Code Prefix/Suffix Commands

Bar Code	Prefix Command	Suffix Command
UPC-A	N1	N6
UPC-A add-on	M0	O0
UPC-E	N2	N7
UPC-E add-on	M1	O1
EAN-13	N3	N8
EAN-13 add-on	M2	O2
EAN-8	N4	N9
EAN-8 add-on	M3	O3
Code 39	M4	O4
Tri-optic	MC	PN
Codabar	M5	O5
Industrial 2 of 5	M6	O6
Interleaved 2 of 5	M7	O7
S-Code	MB	OB
Matrix 2 of 5	GL	GM
Chinese Post Matrix 2 of 5		
IATA	I8	I9
MSI/Plessey	N0	N5
Telepen	L8	L9
UK/Plessey	MA	OA
Code 128	M9	O9
GS1-128	[XMX	[XOX
Code 11	[BLD	[BLE
Korean Postal Authority	*$	*%

Individual Bar Code Prefix/Suffix Commands (continued)

Bar Code	Prefix Command	Suffix Command
Intelligent Mail Barcode	[D5I	[D5J
POSTNET	[D6D	[D6E
PLANET	[DG5	[DG6
Japan Postal	[D5S	[D5T
Netherlands Kix Code	[D5N	[D5O
UK Postal (Royal Mail)	[DGA	[DGB
4-state Mailmark barcode	[DGV	[DGW
Australian Postal	[D6P	[D6Q
GS1 DataBar	OE	PQ
GS1 DataBar	[D6J	[D6G
GS1 DataBar Limited	[D6K	[D6H
GS1 DataBar Expanded	[D6L	[D6I
GS1 Composite code	RR	RS
Codablock F	[D4S	[D4T
Data Matrix	MD	PO
Dot Code	[DOF	[DOG
Aztec	[BF0	[BF1
Chinese Sensible Code	[D4N	[D4O
QR Code	MK	PW
Maxi Code	ML	PX
PDF417	OC	PY
MicroPDF417	OD	PZ
Machine Readable Passports	[DJJ	[DJP
Machine Readable Visas-A	[DJK	[DJQ
Machine Readable Visas-B	[DJL	[DJR
Official Travel Documents 1	[DJM	[DJS
Official Travel Documents 2	[DJN	[DJT
ISBN	[DJO	[DJU

Preamble/Postamble Commands

Code	Preamble Command	Postamble Command
Preamble/Postamble	MZ	PS

7.2.3 ASCII (Prefix/Suffix Values)

ASCII	Command	ASCII	Command	ASCII	Command	ASCII	Command
<SPACE>	5A	A	0A	a	$A	^@ (NULL)	9G
!	5B	B	0B	b	$B	^A (SOH)	1A
"	5C	C	0C	c	$C	^B (STX)	1B
#	5D	D	0D	d	$D	^C (ETX)	1C
$	5E	E	0E	e	$E	^D (EOT)	1D
%	5F	F	0F	f	$F	^E (ENQ)	1E
&	5G	G	0G	g	$G	^F (ACK)	1F
'	5H	H	0H	h	$H	^G (BEL)	1G
(	5I	I	0I	i	$I	^H (BS)	1H
)	5J	J	0J	j	$J	^I (HT)	1I
*	5K	K	0K	k	$K	^J (LF)	1J
+	5L	L	0L	l	$L	^K (VT)	1K
,	5M	M	0M	m	$M	^L (FF)	1L
-	5N	N	0N	n	$N	^M (CR)	1M
.	5O	O	0O	o	$O	^N (SO)	1N
/	5P	P	0P	p	$P	^O (SI)	1O
:	6A	Q	0Q	q	$Q	^P (DLE)	1P
;	6B	R	0R	r	$R	^Q (DC1)	1Q
<	6C	S	0S	s	$S	^R (DC2)	1R
=	6D	T	0T	t	$T	^S (DC3)	1S
>	6E	U	0U	u	$U	^T (DC4)	1T
?	6F	V	0V	v	$V	^U (NAK)	1U
@	6G	W	0W	w	$W	^V (SYN)	1V
[	7A	X	0X	x	$X	^W (ETB)	1W
\	7B	Y	0Y	y	$Y	^X (CAN)	1X
]	7C	Z	0Z	z	$Z	^Y (EM)	1Y
^	7D	0	Q0			^Z (SUB)	1Z
_	7E	1	Q1			^[(ESC)	9A
`	7F	2	Q2			^\ (FS)	9B
{	9T	3	Q3			^] (GS)	9C
|	9U	4	Q4			^^ (RS)	9D
}	9V	5	Q5			^_ (US)	9E
~	9W	6	Q6			DEL (ASCII127)	9F
		7	Q7				
		8	Q8				
		9	Q9				

7.2.4 Code ID

To add Code ID, send the Code ID command after the prefix/suffix setting command.

Code ID Command

Command	Description	Default
$2	Code identification using OPTICON ID	
$1	Code identification using AIM ID/ ISO 15424	

Use one of these methods to add Code ID:

- Use OPTICON Code ID. For more information, see section 10.1.1: Opticon Code ID Prefix/Suffix Values.
- AIM/ISO Code ID. For more information, see section 10.1.2: Code Option AIM/ISO15424 Code ID Prefix/Suffix Values. The code identifier is transmitted in ISO 15424 format:

  ]cm

  where:
  ] is ASCII value decimal 93
  c is the code character
  m is modifier character

  Example: Add “<OPTICON Code ID>” to the all codes prefix.
  Configure with this command:
  <ESC>RY$2<CR>

7.2.5 Code Length

For 1D bar codes, the code length is transmitted as 2 digits, excluding prefix and suffix characters. For 2D bar codes the code length is transmitted as 6 digits. You can also send the length as 6 digits for both 1D and 2D bar codes. These direct input characters count as 1 entry of the 4 permissible entries for a prefix and suffix.

You can add code length by sending a Code Length command after the prefix/suffix setting command.

Code Length Commands

Command	Description
$3	Code length (1D/2D: 2/6 digit)
$6	Code length (1D/2D: 6/6 digit)

Example: Set the prefix for all codes to <Code length (1D/2D: 2/6 digit)>:
Configure with this command:
<ESC>RY$3<CR>

7.2.6 Code Coordinates

The code coordinate is transmitted as the pixel coordinate of the image sensor. You can output the vertexes or the center of the code within the image.

Code Coordinates Commands

Command	Description
[DDX	Code vertex coordinate
[DDY	Code center coordinate

Vertexes output format:

$X_1/Y_1:X_2/Y_2:X_3/Y_3:X_4/Y_4$

Center output format:

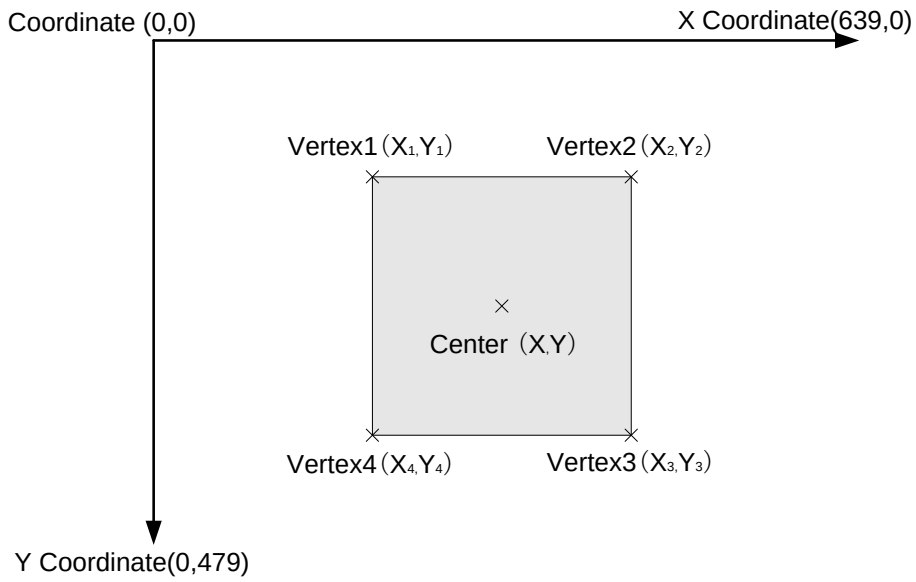
X/Y

X Y format:

X: 1 to 3 digits
Y: 1 to 3 digits

The range of the coordinate is illustrated in the next diagram.

X: 0 to 639
Y: 0 to 479



7.2.7 Code Tilt Angle

To add tilt angle, send the Code Tilt Angle command after the prefix/suffix setting command.

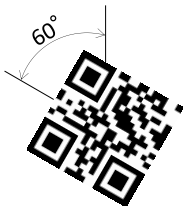
Code Tilt Angle Command

Command	Description
[DPS	Outputs the tilt angle of the scanned code.

Output format +000 to +179, -001 to -180

QR Code

Output: +000



-060

Bar Code

Output: +000

+030

Example: Add the angle to a common prefix:
<ESC>MZ[DPS<CR>

7.2.8 Scan Time

The scan time is the time from the trigger pull until data output starts.

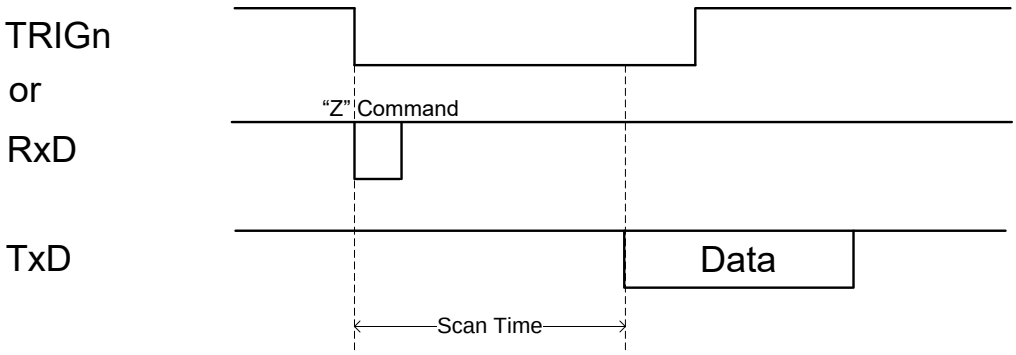
Scan Time Command

Command	Description
[EDG	Scan time

Scan time output format:

Tms

Where T is flexible length, and the max string length is 4.



7.2.9 Bank Number

To output the bank number (BankIndex) currently being, set the Bank Number command to prefix/suffix.

Bank Number (BankIndex) Command

Command	Description	Default
[EDJ	Bank number currently used.	00

Note: The range of the bank number is 00 (when bank not registered) or 01 – 07.

Output format: XX = 2-digit number 00 - 07

8 Read Options

This chapter describes the read options for the scan engine.

8.1 Read Modes

Code reading starts when the trigger signal (TRIGn) is pulled low, when the trigger command (“Z”) is received, or when an object is detected while in auto trigger mode.

8.1.1 Read Modes

Read modes includes “single read”, “multiple read 1” and “multiple read 2”.

Read Mode Commands

Item	Command	Description
Single Read	S0 (default)	Single read in a single trigger
Multiple Read 1	[D3P	Multiple read in a single trigger, the scan engine saves the read data in memory and does not read the same data.
Multiple Read 2	S1	Multiple read in a single trigger, the scan engine reads the same data.

8.1.1.1 Single Read

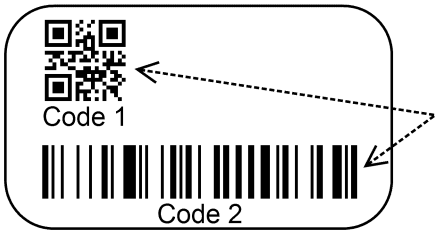
The scan engine starts reading after a trigger pull and continues reading until a bar code is successfully decoded or until the read time expires. For more information, see section 5.6.1: Read Effective Time.

8.1.1.2 Multiple Read 1

The scan engine starts reading after a trigger pull and continues reading (even after a bar code is successfully decoded) until the read time expires. To prevent a bar code from being read twice, the scan engine saves the read bar codes in memory and checks if they have been read before. The list in memory is 20 bar codes long. So, after 20 different bar codes are read, the same bar code can be read again.

If there is more than one bar code in the read area, Multiple Read 1 can help prevent reading the same bar code twice (see the next illustration).

Example: Read multiple bar codes continuously with a single trigger pull.



To prevent a bar code from being read twice, the scan engine saves the read bar codes in memory and checks if the bar code has been previously read.

To set the number of bar codes to be saved in memory and prevent the bar code from being read twice, use the Multiple Read 1 commands. Set the scan engine to stop reading when the number of reads reaches the number of bar codes saved in memory.

Multiple Read 1 Commands

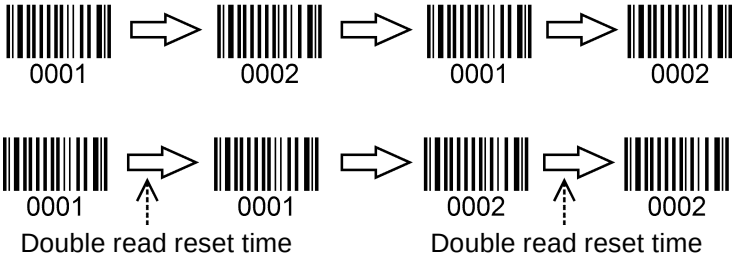
Item	Command				Description	Default (Effective Range)
Multiple Read 1 (number of bar codes that do not have the same data)	[D3P	Qa	Qb	Qc	Set the number of codes to be saved in memory to prevent a bar code from being read twice. Set a:100 digits, b:10 digits, c:1 digit	Default: 20 (Effective range: 1 to 200)
Stop reading when number is reached	[DPE				Enable stop reading when reaches the number	
	[DPD				Disable stop reading when reaches the number	✓

8.1.1.3 Multiple Read 2

The scan engine starts reading after a trigger pull and keeps reading (even after a bar code is successfully decoded) until the read time expires. The same bar code cannot be read twice unless another bar code is read in between or when “Double read reset time” has past.

If the same bar code remains in the same position in the image, the bar code will not be read even if the double read reset time is canceled.

Example: Read multiple codes sequentially with a single trigger pull.



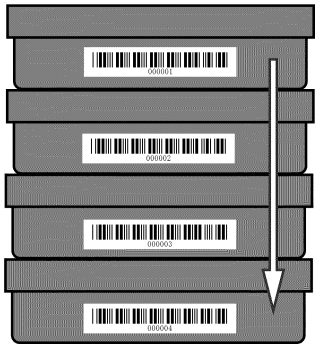
8.1.2 High-Speed Slide Read Mode

High-speed slide read mode speeds up reading by optimizing exposure adjustment and decoding when sliding multiple codes in multiple read areas attached to trays.

Note: The response may be improved by setting readable codes to limit the bar codes to read. Fore more information, see section 6.1: Setting Readable Codes.

High-Speed Slide Reading Mode Commands

Command	Description
[DPA (default)	Disable high-speed slide reading mode when multiple reading
[DPB	Enable high-speed slide reading mode when multiple reading*



8.1.3 Toggle Trigger Mode

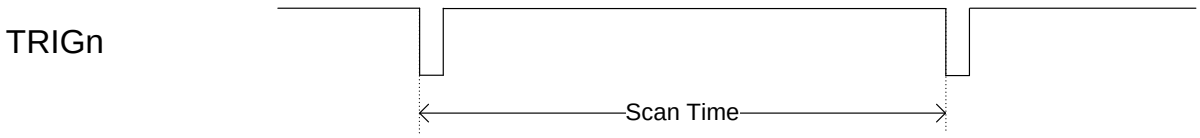
Toggle trigger mode switches the scan start and stop by the TRIGn signal. This mode reduces the load of pressing the trigger for a long period of time like when performing multiple reads.

Toggle Trigger Mode Commands

Command	Description
[DPW (default)	Disable toggle trigger
[DPX	Enable toggle trigger*

Notes:

- The toggle trigger disabled with these settings: Single read and Trigger signal synchronization (Y0), read start mode without using trigger (S1), and Auto trigger (+I).
- Trigger repeat is disabled when the toggle trigger is set.



8.1.4 Disable Trigger (Read All the Time)

You can configure the scan engine to read multiple bar codes without a trigger signal when the scan engine starts. When this command is set, the read mode is Multiple Read 2 (S1: the scan engine reads the same data).

Disable Trigger Commands

Command	Description
S7	Always operate in reading mode*
S8 (default)	Starts reading by trigger signal or software trigger

Note: You can change this setting to “Multiple Read 1 (Do not read the same data)” from “Multiple read 2 (allow reading the same data)”.

8.1.5 Central Reading

This function can be used to read a specific target bar code when multiple bar codes are closely positioned. Only the code in the central part of the image will be read.

Central Reading Commands

Command	Description
[D00	Enable central reading; read only a code at the center of aiming LED
[D0Z (default)	Disable central reading; read within entire image

Examples of readable positions in central reading:

Examples of unreadable positions in central reading.

Note: When several codes are tightly packed, use the Trigger Repeat function to Improve reading performance. See section (See section 8.2 Manual Trigger (Trigger Repeat).

8.1.6 Central Reading Range

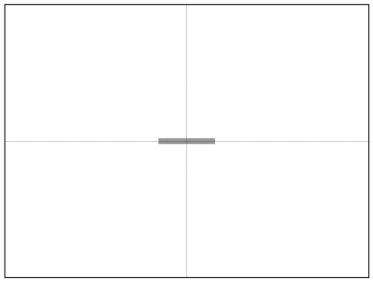
Adjust the Central Reading Range make it easier for the scan engine to read bar codes (widen) or reducing misreading of near bar codes (narrow). This function is available with Firmware BD01J11 and later.

Central Reading Range Commands

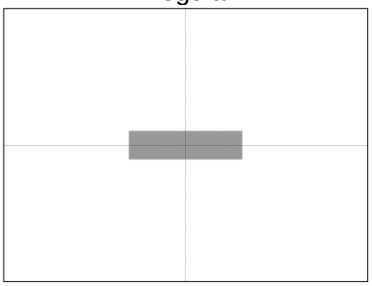
Command		Command Description
[DMQ	Q0	Central reading range: Narrow
	Q1 (default)	Central reading range: Regular
	Q2	Central reading range: Wide

The range (grey bar) indicates the angle of view.

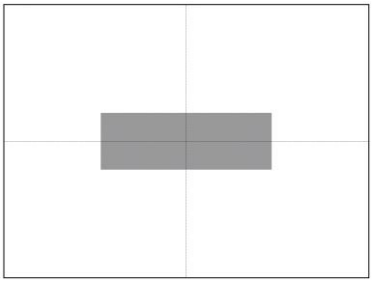
Narrow



Regular



Wide



8.2 Manual Trigger (Trigger Repeat)

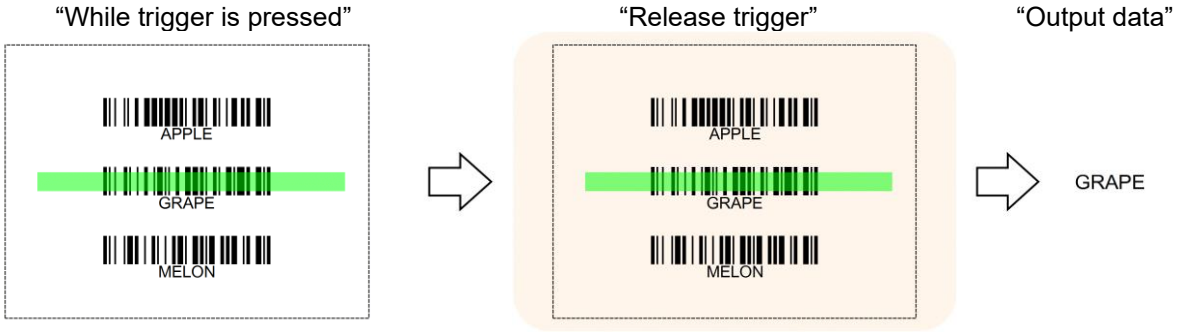
Trigger repeat helps the user properly aim the scan engine before it starts scanning. This feature can be very helpful in situations where several bar codes are printed close to each other. The actual behavior depends on the configuration of Central Reading. For more information, see section 8.1.5: Central Reading.

Trigger Repeat Commands

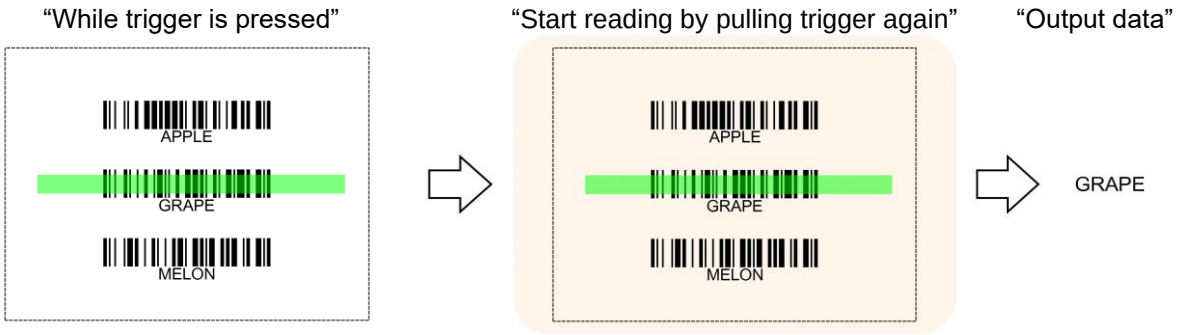
Command	Description
/K (default)	Disable trigger repeat
/M	Enable trigger repeat

The operation varies depending on the Read Time. For more information, see section 5.6.1: Read Effective Time.

Example: Read time option when the trigger key is synchronized (Default).



Example: Read time option is 1 second or more.



8.3 Auto Trigger

When auto trigger is enabled, the scan engine automatically detects an object in front of it and starts reading.

8.3.1 Normal Auto Trigger

There are two modes for auto trigger

- Presentation auto trigger mode: for applications where the scan engine is fixed and bar codes are presented.
- Handheld auto trigger mode: for applications where the scan engine is not fixed.

Auto Trigger Commands

Item	Command	Description	Default
Auto trigger	+F	Disable presentation auto trigger	✓
	+I	Enable presentation auto trigger	
Auto trigger mode	[DL5	Presentation auto trigger mode	✓
	[DL6	Handheld auto trigger mode	

8.3.2 Auto Trigger Sensitivity

The detection sensitivity varies with the ambient environment and made need to be adjusted.

Auto Trigger Sensitivity

Command	Description
[XMF	Sensitive
[XMH (default)	Normal
[XMJ	Insensitive

8.3.3 Double Read Reset Time

In auto trigger mode, set the time before the same bar code can be decoded again. When a code with different data is read, this command is reset.

Double Read Reset Time

Command					Description	Default (valid range)
[D3R	Qa	Qb	Qc	Qd	Double read reset time (1000a+100b+10c+d) [10 ms]	700 ms (0 - 9999)

Note: When 0 seconds is set, the same bar code will not be decoded.

8.3.4 Read Time Adjustment

The time to end the auto trigger scanning can be adjusted.

Auto Trigger Read Time Adjustment

Command	Description
[EFH	Long time
[EFI (default)	Normal
[EFJ	Short time

Note: This command is affected by a fixed read time. For more information, see section 5.6.1: Read Effective Time.

8.3.5 Auto Trigger Sleep Transition Time

In auto trigger mode, when the scan engine does not detect a bar code after a specific configurable period of time, the scan engine goes into sleep mode. In sleep mode, the scan engine performs presence detection at specified time intervals. When a target is detected or an event (such as a trigger pull occurs), the scan engine exits sleep mode. Setting a time of 0 seconds disables sleep mode.

Auto Trigger Sleep Transition Time Commands

Command					Description	Default (valid range)
[EBW	Qa	Qb	Qc	Qd	Transition time to sleep mode (1000a+100b+10c+d) [s]	5 s (0 - 9999)

8.3.6 Detection Mode

There are three modes for detecting a target bar code.

Method	Description
Warm white illumination detection	When a target bar code falls within the range of the field of view of the warm white light, the target is detected. This mode is preferred in a dark environment.
Green aiming detection	When a target bar code falls within the green aiming light, the target is detected. This mode is recommended for indoor use only, because target detection is reduced in environments with higher illumination levels than typically found indoors.
No illumination detection	A target bar code is detected without illumination light. Power consumption is reduced, but the effectiveness of detection is also reduced. In this mode, ambient light is used for detection. So this mode should not be used in a dark environment and is best used in a well-lit area.

Auto Trigger Commands

Command	Description
[DDG (default)	Green aiming detection
[DDH	Warm white illumination detection
[DDI	No illumination detection

8.4 Illumination and Aiming

Warm white illumination for reading and Green LED aiming can be enabled or disabled.

8.4.1 Reading LED Illumination

Warm White LED illumination can be enabled or disabled You can also set the illumination method and brightness for reading bar codes.

LED Illumination Mode

Command	Description
[D39	LED illumination → Enable
[D3A	LED illumination → Disable When illumination is disable, reading performance may decrease. Reading performance may improve when reading only the code displayed on the LCD screen.
[D3B	LED illumination → Automatic switching In this mode, floodlight ON and OFF are alternated. The scan engine remembers the illumination in which a bar code was read and is is prioritized for subsequent reading. This function is recommended when reading a target where specular reflection easily occurs.
[D3Q (default)	LED illumination → Prevent specular reflection Disable illumination only when specular reflection from the LED illumination occurs and read the bar code.

LED Illumination Brightness

Command	Description
[DPV (default)	LED brightness → Standard brightness Standard LED illumination control mode.
[DPU	LED brightness → Minimum brightness Provides minimum illumination brightness required for reading. Motion tolerance performance will decrease. This setting is recommended for a built-in system when the LED illumination area faces the operator.

Note: The standard brightness: [DDB and low brightness: [DDC described in firmware version BD01J11 are supported, but they are omitted because these commands provide a higher-level function.

8.4.2 External LED Illumination

In some applications, you may need external LED illumination. The scan engine can provide an output signal on pin-3. The Z2 command (Save settings in non-volatile memory) needs be used after these commands are set to activate them and save the new configuration.

LED Output Mode (PIN3)

Command	Description
[D26 (default)	Disable external LED illumination signal (Enable Good Read Output Signal)
[D28	Enable external LED illumination signal (Disables Good Read Output Signal)

8.4.3 LED Aiming

The Green LED floodlight used for aiming can be enabled or disabled. And, you can configure the brightness.

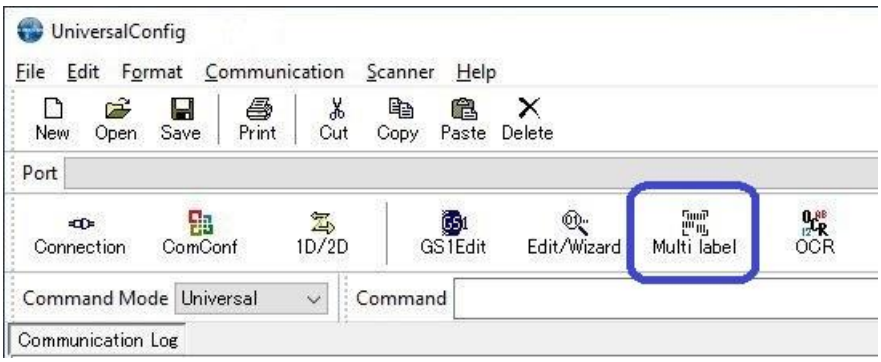
LED Aiming Commands

Item	Command	Description
LED aiming ON/OFF	[D3D (default)	Enable LED aiming
	[D3E	Disable LED aiming
LED aiming brightness	[DDD (default)	Brightness "High"
	[DDE	Brightness "Standard"
	[DDF	Brightness "Low"

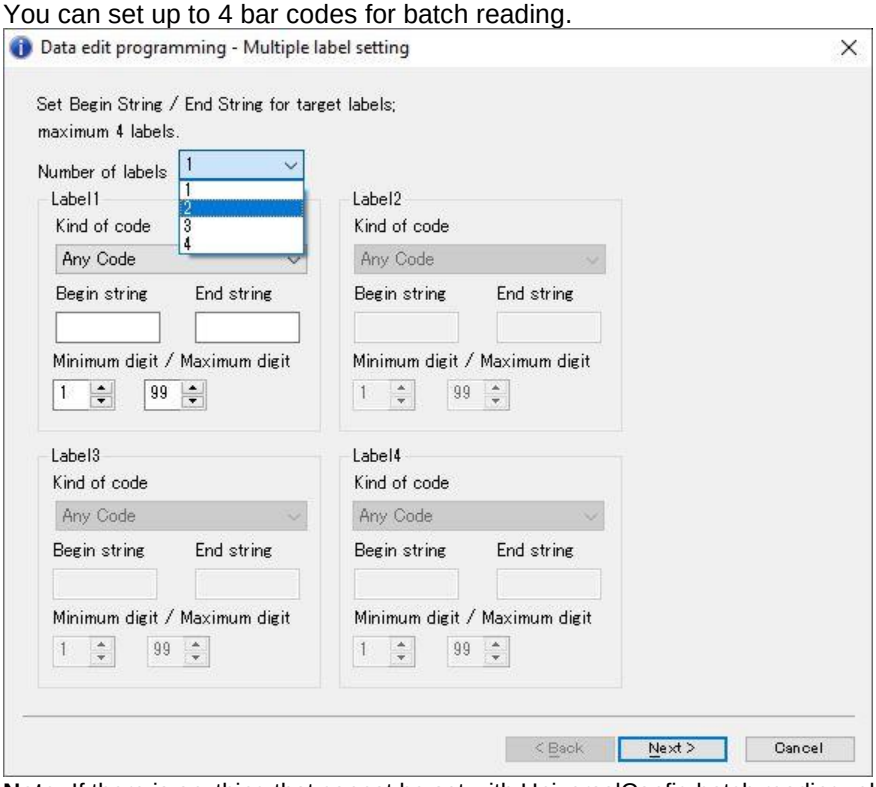
8.5 Batch Reading/Data Edit Function

8.5.1 Batch Reading

You can use the UniversalConfig batch reading function to configure the scan engine to read fixed format bar codes in a batch.



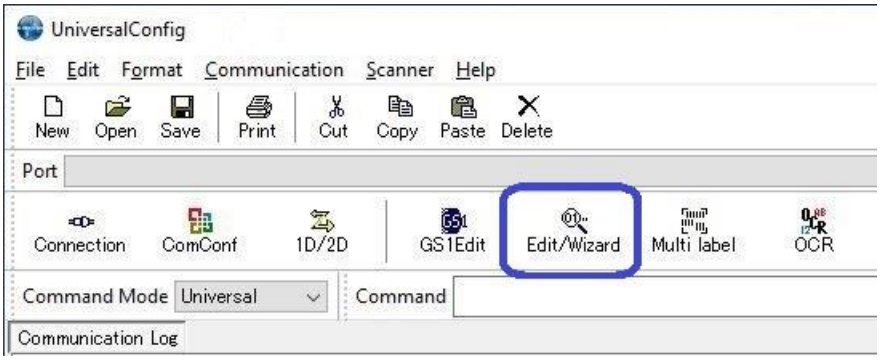
You can set up to 4 bar codes for batch reading.



Note: If there is anything that cannot be set with UniversalConfig batch reading, please contact your local sales office.

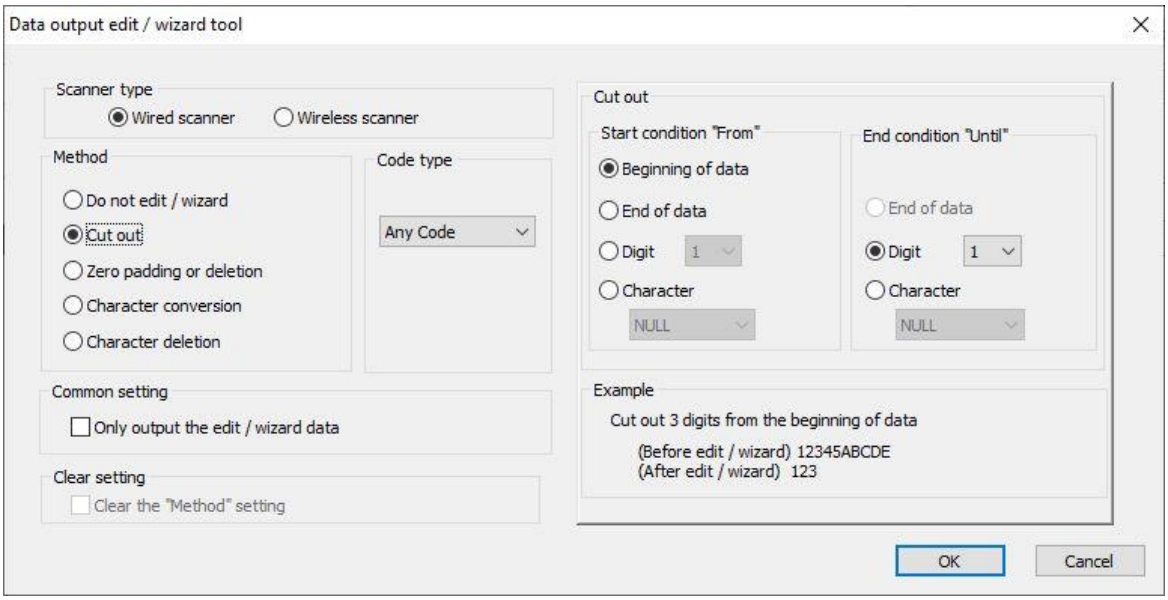
8.5.2 Data Edit Reading

The typical data edit/wizard of data editing function is installed as the Output Edit Function in the UniversalConfig 2.10 or later version. If you cannot configure a setting with the Output Edit Function, please contact your local sales office.



Types of data output editing:

- Cut out
- Zero padding or deletion
- Character conversion
- Character deletion



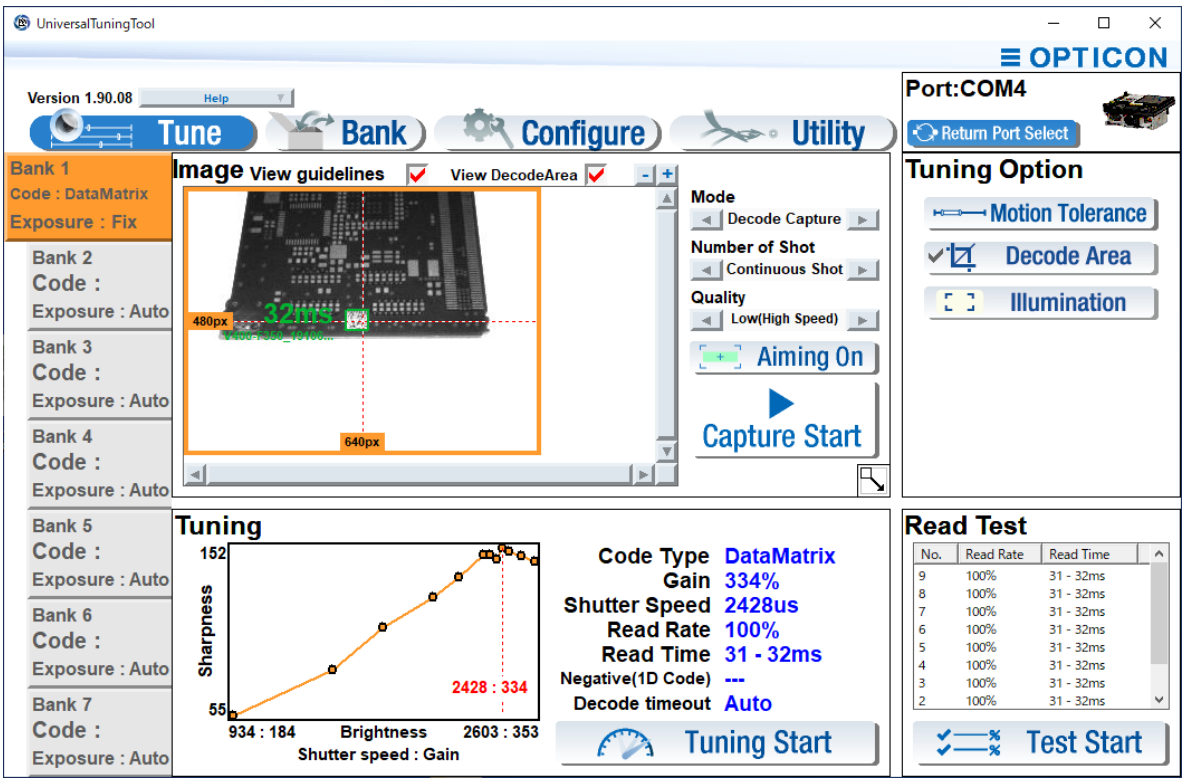
8.6 Tuning Function

8.6.1 Tuning Function Overview

The tuning function limits the bar codes to be read to adjust to the optimal exposure and achieve optimal and stable reading in a stationary environment. By adjusting the exposure range, the user can improve the performance of scan-in-motion applications.

Note: The tuning function is supported by firmware BD01J11 and later.

This function can be configured by command. But, configuring using the Opticon UniversalTuningTool makes it easier to find optimal installation conditions. For help, contact your local sales office.



8.6.2 Tuning Setting Flows

The tuning setting follows an “Examination” flow and an “Integration” flow.

Examination Flow	
Examine installation requirements and confirm operable condition.	
1. Determine the scan engine focus model by code resolution and installation distance. ⇩ 2. Examine optimum installation condition without reflection etc. using UniversalTuningTool. ⇩ 3. Perform tuning. ⇩ 4. Perform a test and confirm whether it is a stable reading. ⇩ 5. Examine “require setting for operation”.	See section 10.2.2: Technical Specifications. See section 8.6.3: Execute Tuning. See section 8.9 Reading Test Command. Refer to each section.

Integration Flow	
Set the scan engine in the indicated order.	
1. Configure settings that are required in advance, like interface setting. ⇩ 2. Configure “require setting for operation”. ⇩ 3. Perform tuning. **(Caution)** ⇩ 4. Set additional codes if necessary.*	See Chapter 4: Interface. Refer to each section. See section 8.6.3: Execute Tuning. See Chapter 6: Code Options.

Caution: The tuning adjustment value differs for each scan engine, so you should performing tuning for each scan engine.

Note: When setting an additional bar code, make sure the bar code has the same distance and reflectance.

8.6.3 Execute Tuning

Tuning can be configured by command.

Execute Tuning Commands

Item	Command	Description	Remark
Execute Tuning	[DT1	Start tuning.	*1
	[DT2	Stop tuning.	*2

*1. When tuning is successful, “Tuning complete” is output. After a line break, each output item (when tuning) is separated by the colon character “:”.
*2. The output when tuning failed or stopped.

Tuning complete<CR>							
Indicate tuning success and line brake.							
BANK 1:CODETYPE QRCode:SHUTTER 177[us]:GAIN 648[%]:RATE 100[%]:TIME 25 - 26[ms]:123456789<CR>							
Bank No.	Code Type	Shutter Speed	Sensor Gain	Read rate in 10 times	Min/Max of read times in 10 times	Read Data	Line Break

Tuning failed<CR>
Indicates tuning failed or stopped, and a line break.

8.6.4 Motion Tolerance Setting (Setting the Exposure Adjustment Range of Tuning)

Tuning adjusts “Shutter time” and “Sensor Gain”. The range can also be set. Adjusting the range can:

- Support tuning of motion tolerance by shortening the adjustment upper limit time of the shutter time.
- Reduce the adjustment upper limit value of the sensor gain, which may reduce noise and make it easier for the scan engine to read bar codes.

Note: The tuning function is supported by firmware BD01J11 and later.

Exposure Adjustment Range Commands

Command							Description
[DT3	Qa	Qb	Qc	Qd	Qe	Qf	Set lower/upper limit value of “Shutter time” and “Sensor gain” at tuning.

Note: For “a / b / c / d / e / f”, set with the parameters in the next table.

Shutter Time and Sensor Gain Settings

Setting Item	a	b	c def	Adjustment range
Shutter time Adjustment lower limit value [µs]	0	0	Set to d.ef x 10^{c} [µs]	From 30µs
Shutter time Adjustment upper limit value [µs]	0	1		To 9000µs
Sensor gain Adjustment lower limit value [times]	1	0	Set to cd.ef [times]	From 1 time
Sensor gain Adjustment upper limit value [times]	1	1		To 10 times

Example: Set adjustment upper limit value of shutter time to 400 µs.
<ESC>[DT3Q0Q1Q2Q4Q0Q0<CR>

To output current exposure adjustment range, use the Output Exposure Adjustment Range command.

Output Exposure Adjustment Range Command

Command	Description
[DT4	Outputs lower/upper limit value of “Shutter time” and “Sensor gain” at tuning.

Output of Exposure Adjustment Range

Shutter speed 100 - 400[us] <CR>	Indicates adjustment of shutter time and line break.
Gain 100 - 1000[%]<CR>	Indicates adjustment of sensor gain and line break.

To reset exposure adjustment range, use the Reset Exposure Adjustment Range command.

Reset Exposure Adjustment Range Command

Command	Description
[DT5	Reset the exposure adjustment range of the current bank to the initial setting.

8.7 Exposure Fixation

Exposure is determined by the exposure time and gain of the sensor sensitivity (amplification factor). Use Exposure Fixation to configure each of these settings. By default, the scan engine evaluates the brightness of the image and automatically adjusts the exposure. By using the tuning function, you can fix the optimal exposure for the reading environment.

Note: When applying exposure fixation to multiple scan engines; exposure varies depending on the device. Please evaluate carefully before use.

8.7.1 Fixing the Exposure Time

You can fix the exposure time to a specific time from automatic adjustment.

Fix Exposure Time and Adjust Exposure Time Automatically Commands

Item	Command					Description	Default	Bank
Fix exposure time	[D23	Qa	Qb	Qc	Qd	Set the exposure time by following value: (1000a+100b+10c+1d) x [10μs] Setting range: 30 ~ 99990μs	-	Enable
Adjust exposure time automatically	[D24					Enable automatic adjustment of the exposure adjustment time.	✓	

Example: Setting fix exposure time to 1400μs (1.4 ms).
Command: [D23Q0Q1Q4Q0

8.7.2 Fixing the Sensor Gain (Amplification Factor)

You can fix the sensor gain to a specific time from automatic adjustment.

Fix Sensor Gain and Adjust Sensor Gain Automatically Commands

Item	Command					Description	Default	Bank
Fix sensor gain	[E70	Qa	Qb	Qc	Qd	Set the sensor gain by following value: Sensor gain=ab.cd times(x100%) Setting range: x1.00 ~ x15.93	-	Enable
Adjust sensor gain automatically	[E71					Enable automatic adjustment of the sensor gain	✓	

Example: Setting fix sensor gain to 8.5 times.
Command: [E70Q0Q8Q5Q0

8.7.3 Confirm the Fixed Status of Exposure Time and Sensor Gain

You can confirm the fixed status of the exposure time and sensor gain.

Confirm the Fixed Status of Exposure Time and Sensor Gain Commands

Item	Command			Response	Description	Default	Bank
Confirm the fixed status of the exposure time	[XUL	Q1	Q0	OK<CR>、 NG<CR>	OK = Fixed NG = Auto	NG	Enable
Confirm the fixed status of the sensor gain			Q2	OK<CR>、 NG<CR>	OK = Fixed NG = Auto	NG	

8.7.4 Confirm the Fixed Values of the Exposure Time and Sensor Gain

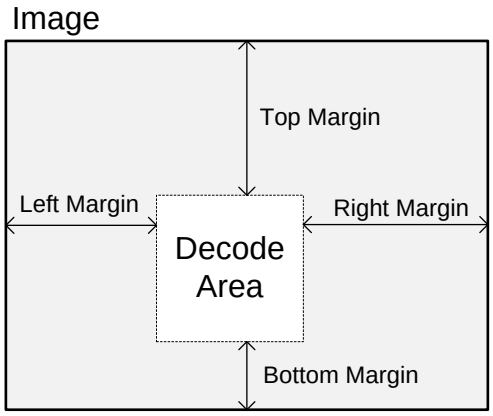
You can confirm the fixed values of the exposure time and sensor gain.

Confirm the Fixed Values of Exposure Time and Sensor Gain Commands

Item	Command		Response	Description	Default	Bank
Confirm the fixed values of the exposure time	[XUL	Q0	OK,nnnn<CR>	nnnn x0.01[ms]	nnnn=0000 (Auto exposure)	Enable
Confirm the fixed values of the sensor gain		Q2	OK,nnnn<CR>	nnnn x0.01[times]	nnnn=0100 (Including auto exposure)	

8.8 Decode Area

The decode area can be configured to set a readable range by configuring the image pixel range with the top, bottom, left and right margin. With the decode area setting, you can disable the scanning areas where you do not want to scan or improve the scanning speed by limiting the area.



The decode area is set by inputting each direction's margin with 4 digits (numeric).

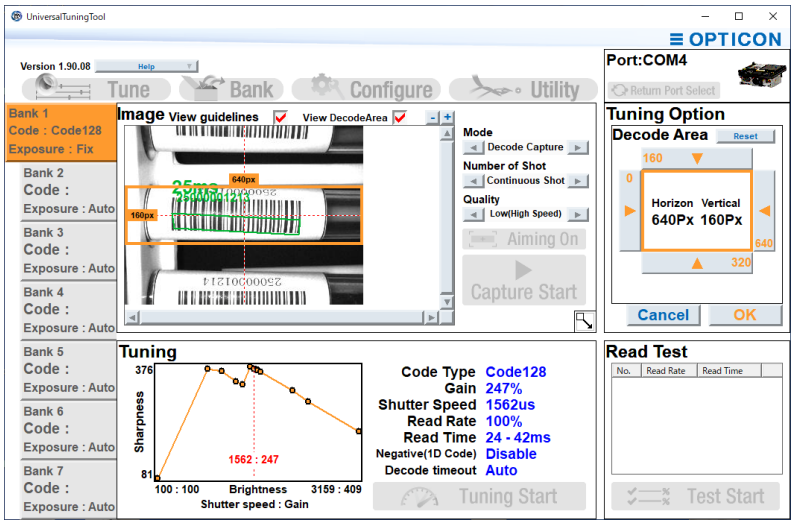
Decode Area Commands

Command						Function	Description	Bank
[DF8	Qa	Qb	Qc	Qd	Qe			Enable
	a					Setting Item	0: Top margin 1: Right margin 2: Bottom margin 3: Left margin 4: Initialize all directions	
		b	c	d	e	Numeric setting	Enter a value for each direction margin in 4-digits *The sensor image is b=0 Top and bottom margin range: 0 − 479 Left and right margin range: 0 − 639 4: When setting initializing for all directions, enter 0 for all	

* This can also be set with the Universal Tuning Tool.

Example:
Set the decode area top margin: 100, right margin: 70, bottom margin: 25, and left margin: 125.
Command: [DF8Q0Q0Q1Q0Q0[DF8Q1Q0Q0Q7Q0[DF8Q2Q0Q0Q2Q5[DF8Q3Q0Q1Q2Q5

Initialize the decode area.
Command: [DF8Q4Q0Q0Q0Q0


UniversalTuningTool
OPTICON
Version 1.90.08
Help
Tune
Bank
Configure
Utility
Port:COM4
Return Port Select
Bank 1
Code : Code128
Exposure : Fix
Bank 2
Code :
Exposure : Auto
Bank 3
Code :
Exposure : Auto
Bank 4
Code :
Exposure : Auto
Bank 5
Code :
Exposure : Auto
Bank 6
Code :
Exposure : Auto
Bank 7
Code :
Exposure : Auto
Image
View guidelines
View DecodeArea
640px
160px
Mode
Decode Capture
Number of Shot
Continuous Shot
Quality
Low(High Speed)
Aiming On
Capture Start
Tuning Option
Decode Area
Reset
160
0
640
320
Horizon Vertical
640Px 160Px
Cancel
OK
Tuning
376
81
Sharpness
1562 : 247
100 : 100
Brightness
3159 : 409
Shutter speed : Gain
Code Type Code128
Gain 247%
Shutter Speed 1562us
Read Rate 100%
Read Time 24 - 42ms
Negative(1D Code) Disable
Decode timeout Auto
Tuning Start
Read Test
No.
Read Rate
Read Time
Test Start

8.9 Reading Test Command

After tuning, use a test command to confirm that the integration condition and tuning work properly.
The reading test outputs 1 result after reading 10 times for each image. And output this continuously.

Reading Test Start/End Commands

Command	Description
.V	Start reading test.
.W	End reading test.

The reading test outputs this data continuously.

BANK 1:RATE 100[%]:TIME 25 - 26[ms]:123456789<CR>
BANK 1:RATE 100[%]:TIME 24 - 28[ms]:123456789<CR>
BANK 1:RATE 100[%]:TIME 24 - 27[ms]:123456789<CR>
BANK 1:RATE 100[%]:TIME 24 - 26[ms]:123456789<CR>

Bank No.	Read rate in 10 times	Max/Min read time in 10 times	Read data	Line break

8.10 Bank Function

The bank function is used to register various setting parameters to bank No.1 - 7 (default: No. 0). You can register the bank based on the operation.

Parameters that can register to the bank: Tuning value, Read code setting, String option, etc.

Parameters that cannot register to the bank: Interface setting, Read operation setting, etc.

8.10.1 Bank Selection

The initial value of the bank operates at No. 0.

Bank Selection Commands

Command			Description	Default
[BRA	Qa	Qb	Select bank ab Effective value: a=0, b=1-7	a=0, b=1

Notes:

- To register settings for each bank, send the bank selection command after the corresponding bank setting command.
- The last bank No. sent in the command string becomes the bank No. for subsequent operation.

Example: Set QR limited, exposure setting (exposure time: 350 µs, sensor gain: 7.00 times) to bank 1, and set Code 12 limited, exposure setting (exposure time: 400 µs, sensor gain: 8.50 times) to bank 2. (For help, see section 8.8: Decode Area.)

Command:
[BRAQ0Q1[BC1[D23Q0Q0Q3Q5[E70Q0Q7Q0Q0[BRAQ0Q2A6[D23Q0Q0Q4Q0[E70Q0Q8Q5Q0

QR limited, decode area left half of the image (320 x 480) to bank 1, and set QR limited, decode area right half of the image (320 x 480) to bank 2. (For help, see section 8.8: Decode Area.)

Command:
[BRAQ0Q1[BC1[DF8Q0Q0Q0Q0Q0[DF8Q1Q0Q3Q2Q0[DF8Q2Q0Q0Q0Q0[DF8Q3Q0Q0Q0Q0[BRA
Q0Q2[BC1[DF8Q0Q0Q0Q0Q0[DF8Q1Q0Q0Q0Q0[DF8Q2Q0Q0Q0Q0[DF8Q3Q0Q3Q2Q0

8.10.2 Bank Specify Trigger

The bank specify trigger operates as a combination of bank selection and trigger “Z” command, which allows executing with 1 command.

Bank Specify Trigger Command

Command			Description	Default
[TRG	Qa	Qb	Bank specify trigger Effective value: a=0, b=1-7	a=0, b=1

Note: To end reading, use the “Y” command just like “Z” command.

8.10.3 Confirm Current Bank

Note: In default mode with bank initialized, “00” will be displayed as the bank default.

Confirm Current Bank Command

Command	Description
[DGQ	Display the current bank with 2 digits (00-07).

8.10.4 Initialize Bank

Notes:

- Settings that are not included in the bank parameters will not be initialized.
- When the bank is initialized, the scan engine operates with the default bank as long as the bank with an effective parameter is not selected.

Initialize Bank Commands

Command			Description
[BRB	Qa	Qb	Initialize bank ab setting parameter Effective value: a=0, b=1-7
[BRC			Initialize all banks setting parameter.

8.11 Error Message

The scan engine can send an error message when a code is not read during scanning and is stopped with a stop condition, such as read time expires.

Error Message Commands

Command		Description
	Available characters	Set the error message with specified characters.
TH	ASCII (*)	
	0 to 8 characters	

Notes:

- NULL cannot be set.
- To clear the error message, only set TH.

Example 1: Setting error message “NG”.
Command: TH0N0G

Example 2: Setting error message “ERROR<CR>”.
Command: TH0E0R0R0O0R1M

The common prefix/common suffix set in the read data will also be added to the error message, which allows the header/terminator of the read data and error message to be the same.

Apply Common Prefix/Common Suffix Commands

Command		Description
[EHM	Q0 (default)	Do not add common prefix/common suffix to the error message
	Q1	Add common prefix/common suffix to the error message

Example: Setting Apply Common Prefix/Common Suffix
<STX>Read data<ETX>
<STX>Error message<ETX> (Error message”ERROR")

Command: RYRZMZ1BPS1C[EHMQ1Q1TH0E0R0R0O0R

9 Indicator Options

This chapter describes the options for Buzzer and Good Read LED.

9.1 Buzzer (BUZZERn Signal)

BUZZERn controls the buzzer tone and sound pressure with the PWN signal.

9.1.1 Buzzer Loudness

Buzzer loudness is applied to all buzzers.

Buzzer Loudness Commands

Command	Description
T0 (default)	Buzzer loudness : Maximum
T1	Buzzer loudness : Loud
T2	Buzzer loudness : Normal
T3	Buzzer loudness : Minimum

9.1.2 Good Read Buzzer

The good read buzzer is activated when a bar code is successfully read. The good read buzzer can be disabled or enabled with three types of tones and five durations.

Buzzer Disable/Enable Commands

Command	Description
W0	Disable buzzer
W8 (default)	Enable buzzer

Buzzer Duration Commands

Command	Description
W7 (default)	Buzzer duration: 50 ms
[EFW	Buzzer duration: 75 ms
W4	Buzzer duration: 100 ms
W5	Buzzer duration: 200 ms
W6	Buzzer duration: 400 ms

Buzzer Tone Commands

Command	Description
W1 (default)	Middle frequency buzzer (3000 Hz)
W2	2 steps buzzer (high - low buzzer)
W3	2 steps buzzer (low - high buzzer)

Note: The good read buzzer tone (frequency) can be set with numerical parameters by entering the command followed by a 4-digit numerical command.

Buzzer Tone Frequency Commands

Command					Description	Default
[DF0	Qa	Qb	Qc	Qd	Numerical setting of buzzer tone frequency (1000a+100b+10c+d)[Hz]	3000 Hz (1 - 9999)

9.1.3 Start-Up Buzzer

The start-up buzzer determines whether the scan engine emits a beep when it is powered on.

Start-Up Buzzer Commands

Command	Description	Remark
GD (default)	Disable startup buzzer	Enabled only with “Z2”
GC	Enable startup buzzer	Enabled only with “Z2”

9.1.4 Read Timeout Buzzer

If a bar code is not read within the timeout period, an error buzzer sounds when the read operation ends.

Read Timeout Buzzer Commands

Command	Description
[EAP (default)	Disable read timeout buzzer
[EAQ	Enable read timeout buzzer

9.1.5 Intermediate Buzzer

When one bar code is decoded, an intermediate buzzer sounds to indicate that the bar code had been decoded but has not yet meet the conditions to output data.

For example, if five-codes reading is set in buffer mode, the intermediate buzzer sounds after the decoding of the 1st, 2nd, 3rd, and 4th bar codes A good read buzzer finally sounds when the last code is decoded and the data is output. Data is not output when the 1st to 4th bar codes are decoded, but reading each code can be confirmed by the intermediate buzzer. When the good read buzzer is disabled, this setting is forcibly disabled.

Intermediate Buzzer Commands

Command		Description
[EBY	Q0	Disable intermediate buzzer
	Q1 (default)	Enable intermediate buzzer

Note: Intermediate buzzer frequency is 5000 Hz (5 KHz), duration 10 ms.

9.1.6 Idle Level of BUZZERn Pin

The idle level of the BUZZERn pin can be configured so that the buzzer electronics do not keep drawing current when the buzzer is not active. That is, when a PNP transistor is used to drive the buzzer, the transistor is 'open' when the BUZZERn signal is low. In this case, the idle level should be low. This configuration is a good candidate for a Custom Command Line command so that it will become the default.

BUZZERn Idle Level Commands

Command	Description	Remark
[BAW	Idle level low (Active high)	Enable only With “Z2”
[BAX (default)	Idle level high (Active low)	

To load the BUZZER idle level, send the Z2 command to save the new settings so that they will be loaded after a power up.

9.2 Good Read LED (GR_LEDn Signal)

You can configure Status LED settings to successfully read bar code. This section assumes that a LED is connected to the GR_LEDn pin. Note that a transistor is required in most cases due to the limited output current that the scan engine can supply through this pin.

9.2.1 Good Read LED

The good read LED lights up after a code was successfully decoded. This can be disabled or set for several durations.

Good Read LED Commands

Command	Description
T4	Disable indicator
[XTH	Indicator duration: 60 ms
[XT8	Indicator duration: 100 ms
T5 (default)	Indicator duration: 200 ms
T6	Indicator duration: 400 ms
T7	Indicator duration: 800 ms

9.2.2 Inversion of Good Read LED

Good Read LED Inversed Mode inverts the GR_LEDn.

Inversion of Good Read LED

Command	Description
[E6Y (default)	Good Read LED normal mode
[E6Z	Good Read LED inverted mode

9.3 Good Read Aiming

The green good read aiming LED lights up after a bar code is successfully read or after a read timeout.

Aiming indicator frequency, indicator durations after reading, and indicator timing are configurable.

Good Read Aiming Commands

Command				Function	Description	Default
[EF3	Qa	Qb	Qc			
	a			Setting items	0: Indicator frequency 1: First Indicator durations after reading 5: Indicator timing	
		b		Numerical setting 10b + c	a=0; 00 – 99 times a=1: 00 - 99 [x10 ms] a=5: 00 → reading success 01 → reading timeout	a=0:0 times a=1:50 ms a=5: reading success
			c			

Examples:

- Setting lights aiming 2 times when reading success.
  Command: [EF3Q0Q0Q2[EF3Q5Q0Q0
- Setting lights aiming 2 times when reading time out. Go to the previous indicator frequency setting.
  Command: [EF3Q0Q0Q2[EF3Q5Q0Q1

9.4 Indicator in General

You can configure common settings for both buzzer and good read LED.

9.4.1 Indicator Timing

The indicators can be activated after decoding a bar code and before or after transmitting the data.

Indicator Timing Commands

Command	Description	Remark
VY (default)	Before data transmission	soon after decoding
VZ	After data transmission	

10 Appendix

This appendix contains useful reference data.

10.1 Code ID Table

These Code ID values can be added to the prefix/suffix.

10.1.1 Opticon Code ID Prefix/Suffix Values

Code	Code ID	Symbology	Code ID
UPC-A	C	Code 128	T
UPC-A +2	F	GS1-128	
UPC-A +5	G	GS1 DataBar	y
UPC-E	D	CC-A	m
UPC-E +2	H	CC-B	n
UPC-E +5	I	CC-C	l
EAN-13	B	Korean Postal Authority	c
EAN-13 +2	L	Intelligent mail	0
EAN-13 +5	M	Postal-TNT, KIX	1
EAN-8	A	Japanese postal code	2
EAN-8 +2	J	Postnet	3
EAN-8 +5	K	Australia postal code	4
Code 39	V	US Planet	6
Code 39 Full ASCII	W	UK Postal (Royal mail)	7
Italian Pharmaceutical	Y	4-state Mailmark barcode	8
Codabar	R	Codablock F	E
Codabar ABC	S	Data Matrix	t
Codabar CX	f	Dot Code	k
Industrial 2 of 5	O	Aztec	o
Interleaved 2 of 5	N	Aztec Runes	
S-Code	g	Chinese Sensible Code	e
Matrix 2 of 5	Q	QR Code	u
Chinese Post	w	Micro QR Code	j
Code 93	U	Maxi Code	v
IATA	P	PDF417	r
MSI/Plessey	Z	MicroPDF417	s
Telepen	d	ICAO Travel Documents (OCR)	9
UK/Plessey	a	ISBN and Other OCR Font B	z
Code 11	b		

10.1.2 Code Option AIM/ISO15424 Code ID Prefix/Suffix Values

AIM/ISO15424 Code ID			
Symbology	Code ID	Symbology	Code ID
UPC-A	]E0	UK/Plessey	]P0
UPC-A +2	]E3	Code 128	]C0
UPC-A +5	]E3	GS1-128	]C1
UPC-E	]E0	Code 93	]G0
UPC-E +2	]E3	Code 11	]H*
UPC-E +5	]E3		]X0
EAN-13	]E0	Korean Postal Authority	]X0
EAN-13 +2	]E3	Intelligent Mail Barcode	]X0
EAN-13 +5	]E3	POSTNET	]X0
EAN-8	]E4	GS1 DataBar	]e0
EAN-8 +2	]E7	CC-A	]e1
EAN-8 +5	]E7	CC-B	]e1
Code 39	]A*	CC-C	]e1
Code 39 Full ASCII	]A*	GS1 DataBar with CC-A	]e0
Tri-Optic	]X0	GS1 DataBar with CC-B	]e0
Code 39 lt. Pharmaceutical	]X0	GS1 DataBar with CC-C	]e0
Codabar	]F*	Codablock F	]O*
Codabar ABC	]F*	DataMatrix	]d*
Codabar CX	]X0	Dot Code	]J**
Industrial 2 of 5	]S0	Aztec	]z*
Interleaved 2 of 5	]I*		]X0
S-Code	]X0	QR Code	]Q*
Matrix 2 of 5	]X0	Micro QR Code	]Q*
Chinese Post	]X0	Maxi Code	]U*
IATA	]R*	PDF417	]L0
MSI/Plessey	]M*	MicroPDF417	]L0
	]X0	OCR	]X0
Telepen	]B*		

Notes:
* These Code IDs are described differently depend on code type. For more information, see the next table.
** These Code IDs are described differently depend on code type.

Code Option	]AIM-ID	Code Option	]AIM-ID
Code 39 Option AIM/ISO15424 Code ID: A*			
Normal Code 39 (D5) Do not check CD (C1) Transmit CD (D9)	]A0	Full ASCII Code 39 (D4) or Full ASCII Code 39 if pos. (+K) Do not check CD (C1) Transmit CD (D9)	]A4
Normal Code 39 (D5) Check CD (C0) Transmit CD (D9)	]A1	Full ASCII Code 39(D4) or Full ASCII Code 39 if pos. (+K) Check CD (C0) Transmit CD (D9)	]A5
Normal Code 39 (D5) Do not check CD (C1) Do not transmit CD (D8)	]A2	Full ASCII Code 39(D4) or Full ASCII Code 39 if pos. (+K) Do not check CD (C1) Do not transmit CD (D8)	]A6
Normal Code 39 (D5) Check CD (C0) Do not transmit CD (D8)	]A3	Full ASCII Code 39 (D4) or Full ASCII Code 39 if pos. (+K) Check CD (C0) Do not transmit CD (D8)	]A7
Codabar Option AIM/ISO15424 Code ID: F*			
Codabar normal mode (HA) Do not check CD (H7) Transmit CD (H8)	]F0	Codabar normal mode (HA) Do not check CD (H7) Do not transmit CD (H9)	]F4
Codabar ABC (H4) or (H3) Do not check CD (H7) Transmit CD (H8)	]F1	Codabar ABC (H4) or (H3) Do not check CD (H7) Do not transmit CD (H9)	]F5
Codabar normal mode (HA) Check CD (H6) Transmit CD (H8)	]F2	Codabar normal mode (HA) Check CD (H6) Do not transmit CD (H9)	]F6
Codabar ABC (H4) or (H3) Check CD (H6) Transmit CD (H8)	]F3	Codabar ABC (H4) or (H3) Check CD (H6) Do not transmit CD (H9)	]F7
Interleaved 2 of 5 Option AIM/ISO15424 Code ID: I*			
Do not check CD (G0) Transmit CD (E0)	]I0	Do not check CD (G0) Do not Transmit CD (E1)	]I2
Check CD (G1) Transmit CD (E0)	]I1	Check CD (G1) Do not Transmit CD (E1)	]I3

Code Option	]AIM-ID	Code Option	]AIM-ID
IATA Option AIM/ISO15424 Code ID: R*			
Do not check CD (4H) Transmit CD (4L)	]R0	Do not check CD (4H) Do not transmit CD (4M)	]R2
Check FC and SN only (4I) or Check CPN,FC and SN (4J) or Check CPN,AC,FC and SN (4K) Transmit CD (4L)	]R1	Check FC and SN only (4I) or Check CPN,FC and SN (4J) or Check CPN, AC, FC and SN (4K) Do not transmit CD (4M)	]R3
MSI/Plessey Option AIM/ISO15424 Code ID: M*/X0			
Check 1CD = MOD 10 (4B): (4B) + Transmit CD1 (4E) or (4B) + Do not transmit CD (4G) or (4B) + Transmit CD1 and CD2 (4F)	]M0]M1]X0	Check 2CD's = MOD 10/MOD 11 (4D): (4D) + Transmit CD1 (4E) or (4D) + Do not transmit CD (4G) or (4D) + Transmit CD1 and CD2 (4F)	]X0
Check 2CD's = MOD 10/MOD 10 (4C): (4C) + Transmit CD1 (4E) or (4C) + Not transmit CD (4G) or (4C) + Transmit CD1 and CD2 (4F)	]X0	Check 2CD's = MOD 11/MOD 10 (4R): (4D) + Transmit CD1 (4E) or (4D) + Do not transmit CD (4G) or (4D) + Transmit CD1 and CD2 (4F)	]X0
Telepen Option AIM/ISO15424 Code ID: B*			
Telepen (numeric or ASCII only): ASCII mode (D3) Numeric mode (D2)	]B0]B1	Telepen (numeric followed by ASCII): ASCII mode (D3) Numeric mode (D2)	]B0]B2
Telepen (ASCII followed by numeric) (not supported): ASCII mode (D3) Numeric mode (D2)	]B0]B2		
Code 11 Option AIM/ISO15424 Code ID: H*/X0			
Check 1CDs (BLG) or Check auto 1 or 2CDs (BLI) (length > 12) Transmit $CD_{(S)}$ (BLK)	]H0	Check 1CDs (BLG) or Check 2CDs (BLH) or Check auto 1 or 2CDs (BLI) (length > 12) Do not Transmit $CD_{(S)}$ (BLJ)	]H3
Check 2CDs (BLH) or Check auto 1 or 2CDs (BLI) (length > 12) Transmit $CD_{(S)}$ (BLK)	]H1	Do not check CD (BLF) Do not transmit CD (BLJ)	]X0
Codablock F Option AIM/ISO15424 Code ID: O*			
FNC1 not used	]O4	FNC1 in 1st position	]O5

Code Option	]AIM-ID	Code Option	]AIM-ID
DataMatrix Options AIM/ISO15424 Code ID: d*			
ECC000-ECC140	]d0	ECC200, supporting ECI protocol	]d4
ECC200	]d1	ECC200, FNC1 in 1st or 5th position and supporting ECI protocol	]d5
ECC200, FNC1 in 1st or 5th position	]d2	ECC200, FNC1 in 2nd or 6th position and supporting ECI protocol	]d6
ECC200, FNC1 in 2nd or 6th position	]d3		
Aztec Options AIM/ISO15424 Code ID: z*			
No structure/other	]z0	Structured append header included, FNC1 following an initial letter or pair of digits	]z8
FNC1 preceding 1st message character	]z1		
FNC1 following an initial letter or pair of digits	]z2	Structured append header included and ECI protocol implemented	]z9
ECI protocol implemented	]z3		
FNC1 preceding 1st message character and ECI protocol implemented	]z4	Structured append header included, FNC1 preceding 1st message character, ECI protocol implemented	]zA
FNC1 following an initial letter or pair of digits, ECI protocol implemented	]z5	Structured append header included, FNC1 following an initial letter or pair of digits, ECI protocol implemented	]zB
Structured append header included	]z6		
Structured append header included and FNC1 preceding 1st message character	]z7	Aztec runes	]zC
QR Code Option AIM/ISO15424 Code ID: Q*			
Model 1	]Q0	Model 2, ECI protocol implemented FNC1 in first position	]Q4
Model 2, ECI protocol not implemented	]Q1		
Model 2, ECI protocol implemented	]Q2	Model 2, ECI protocol not implemented FNC1 in second position	]Q5
Model 2, ECI protocol not implemented FNC1 in first position	]Q3		
		Model 2, ECI protocol implemented FNC1 in second position	]Q6
Maxi Code Option AIM/ISO15424 Code ID: U*			
Symbol in mode 4 of 5	]U0	Symbol in mode 4 of 5, ECI protocol implemented	]U2
Symbol in mode 2 of 3	]U1	Symbol in mode 2 of 3, ECI protocol implemented	]U3

10.2 MDI-4xx0 Specification Overview

MDI-4xx0 specifications overview is as follows.

10.2.1 Common Specification Overview

Item			Specification	Note
Control Section	CPU		CPU : ARM Cortex-A7	Core : Max. 800 MHz
	LPDDR2 RAM		1 G	DDRCLK : 400 MHz
	Flash ROM		1 G Flash Memory	
Interface	UART		300 bps to 921600 bps	Default: 9600 bps
	USB		Full Speed 12 Mbps (HID/COM)	
Optical Section	Scanning method		Monochrome CMOS area sensor	Frame rate: 100 fps
	Scanning light source		1 warm white LED	
	Aiming light source		Single line green LED	
	Effective pixels		0.30 million pixels (H: 640 x V: 480)	
	View angle		Horizontal : about 38.0° Vertical : about 26.4° Diagonal : about 46.4°	
Supported 1D Symbologies	Symbologies	1D	UPC-A, UPC-E, UPC-A Add-on , UPC-E Add-on, EAN-13, EAN-8, EAN-13 Add-on/EAN-8 Add-on, JAN-8, JAN-13, Code 39, Codabar, Industrial 2 of 5, Interleaved 2 of 5, Code 93, Code 128, GS1-128, MSI/Plessey, Code 11,	
		Postal	Japanese Postal, Intelligent Mail Barcode, POSTNET, PLANET, Netherlands KIX Code, UK Postal, Australian Postal, Korean Postal Authority code	
GS1/Composite	Symbologies		GS1 DataBar, GS1 DataBar Limited, GS1 DataBar Expanded, Composite GS1 DataBar, Composite GS1-128, Composite EAN, Composite UPC	GS1 DataBar: formerly called “RSS”
	Minimum resolution		GS1 DataBar : 0.169 mm Composite Code : 0.169 mm	PCS 0.9
Supported 2D Symbologies	Symbologies		PDF417, MicroPDF417, Codablock F, QR Code , Micro QR Code, DataMatrix(ECC 0 - 200), MaxiCode, Aztec Code, Chinese Sensible Code, Dot Code	Disable Code 128 when Codablock F is enabled.
OCR	OCR font		Machine Readable Travel Documents OCR –A/B, E-13B(MICR)	

Item			Specification	Note
Power	Range of operating voltage		3.3/5.0 V (3.0～5.5V)	
	Current consumption		MDI-4x00: See section 5.2.4: Current Consumption of the MDI-4x00. MDI-4x50: See section 5.2.5: Current Consumption of the MDI-4x50.	Ambient temperature: 25 °C
Environmental Specifications	Temperature	Operating	-20 to 60 °C	AC adapter 0 to 40 °C
		Storage	-40 to 70 °C	
	Humidity	Operating	5 to 90% (no condensing, no frost)	
		Storage	5 to 90% (no condensing, no frost)	
	Ambient light immunity	Fluorescent	10,000 lx or less	UPC 0.33 mm
		Sunlight	100,000 lx or less	

10.2.2 Technical Specifications

Standard Range Model (SR) Reading Characteristics

Item		Specification	Notes
SR model	Minimum Resolution	Code 39 : 0.1 mm GS1 DataBar : 0.169 mm Composite Code : 0.169 mm PDF417 : 0.169 mm QR Code : 0.169 mm Data Matrix : 0.169 mm	OPTOELECTRONICS test chart
	Barcode width	Possible to read: Width 100 mm Code 39 Resolution 0.2 mm (DOF: 170 mm)	
	Motion tolerance	Possible to read: UPC 100% moving at 2.54 m/s (DOC: 130 mm)	

Standard Range Model (SR) Reading Depth of Field

(T_A = 25°C)

Resolution mm (mil)	Symbology type	PCS (MRD)	Guaranteed Value		Typical Value	
			Near	Far	Near	Far
0.127 mm (5 mil)	Code 39	0.9 (0.8)	66 mm (2.6″)	112 mm (4.4″)	55 mm (2.1″)	128 mm (5.0″)
0.254 mm (10 mil)	Code 39	0.9 (0.8)	64 mm (2.5″)	211 mm (8.3″)	54 mm (2.1″)	239 mm (9.4″)
0.508 mm (20 mil)	Code 39	0.9 (0.8)	86 mm (3.4″)	373 mm (14.6″)	71 mm (2.8″)	435 mm (17.1″)
0.2 mm (7.9 mil)	Code 128	0.9 (0.8)	79 mm (3.1″)	167 mm (6.6″)	64 mm (2.0″)	193 mm (7.6″)
0.33 mm (13 mil)	UPC/EAN	0.9 (0.8)	64 mm (2.5″)	250 mm (9.8″)	52 mm (2.0″)	293 mm (11.5″)
0.169 mm (6.7 mil)	PDF417	0.9 (0.8)	59 mm (2.3″)	131 mm (5.1″)	51 mm (2.0″)	148 mm (5.8″)
0.254 mm (10 mil)	PDF417	0.9 (0.8)	55 mm (2.1″)	185 mm (7.3″)	44 mm (1.7″)	213 mm (8.4″)
0.169 mm (6.7 mil)	QR Code	0.9 (0.8)	75 mm (2.9″)	99 mm (3.9″)	62 mm (2.4″)	113 mm (4.4″)
0.381 mm (15 mil)	QR Code	0.9 (0.8)	29 mm (1.2″)	216 mm (8.5″)	24 mm (1.0″)	252 mm (9.9″)
0.169 mm (6.7 mil)	Data Matrix	0.9 (0.8)	77 mm (3.0″)	103 mm (4.0″)	64 mm (2.5″)	118 mm (4.6″)
0.254 mm (10 mil)	Data Matrix	0.9 (0.8)	57 mm (2.2″)	151 mm (5.9″)	45 mm (1.8″)	175 mm (6.8″)

Notes:

- The depth of field is the typical value measured by tilting the test chart 15° from the optical axis.
- The depth of field is a determined while using the OPTOELECTRONICS test chart PCS 0.9, without specular reflection and at room temperature and room humidity.

High Density Model (HD) Reading Characteristics

Item		Specification	Notes
HD model	Minimum Resolution	Code 39 : 0.076 mm GS1 DataBar : 0.127 mm Composite Code : 0.127 mm PDF417 : 0.127 mm QR Code : 0.127 mm Data Matrix : 0.127 mm	OPTOELECTRONICS test chart
	Barcode width	Possible to read: Width 80 mm Code 39 Resolution 0.2 mm (DOF: 140 mm)	
	Motion tolerance	Possible to read: QR code 0.381 mm moving at 1 m/s (DOC: 130 mm)	

High Density Model (HD) Reading Depth of Field

(T_A = 25°C)

Resolution mm (mil)	Symbology type	PCS (MRD)	Guaranteed Value		Typical Value	
			Near	Far	Near	Far
0.076 mm (3 mil)	Code 39	0.9 (0.8)	55 mm (2.2″)	65 mm (2.5″)	47 mm (1.9″)	74 mm (2.9″)
0.127 mm (5 mil)	Code 39	0.9 (0.8)	45 mm (1.8″)	104 mm (4.1″)	37 mm (1.5″)	121 mm (4.8″)
0.254 mm (10 mil)	Code 39	0.9 (0.8)	64 mm (2.5″)	157 mm (6.2″)	57 mm (2.3″)	181 mm (7.1″)
0.2 mm (7.9 mil)	Code 128	0.9 (0.8)	79 mm (3.1″)	140 mm (55″)	70 mm (2.8″)	161 mm (6.3″)
0.33 mm (13 mil)	UPC/EAN	0.9 (0.8)	64 mm (2.5″)	173 mm (6.8″)	50 mm (2.0″)	202 mm (8.0″)
0.127 mm (5.0 mil)	PDF417	0.9 (0.8)	48 mm (1.9″)	97 mm (3.8″)	41 mm (1.6″)	111 mm (4.4″)
0.254 mm (10 mil)	PDF417	0.9 (0.8)	53 mm (2.1″)	137 mm (5.4″)	48 mm (1.9″)	156 mm (6.1″)
0.127 mm (5.0 mil)	QR Code	0.9 (0.8)	51 mm (2.0″)	81 mm (3.2″)	45 mm (1.8″)	93 mm (3.7″)
0.381 mm (15 mil)	QR Code	0.9 (0.8)	33 mm (1.3″)	155 mm (6.1″)	26 mm (1.0″)	182 mm (7.2″)
0.127 mm (5.0 mil)	Data Matrix	0.9 (0.8)	57 mm (2.3″)	65 mm (2.5″)	50 mm (2.0″)	80 mm (3.1″)
0.254 mm (10 mil)	Data Matrix	0.9 (0.8)	37 mm (1.5″)	122 mm (4.4″)	30 mm (1.2″)	141 mm (5.6″)

Notes:

- The depth of field is the typical value measured by tilting the test chart 15° from the optical axis.
- The depth of field is a determined while using the OPTOELECTRONICS test chart PCS 0.9, without specular reflection and at room temperature and room humidity.

Ultra-High Density Model (UD) Reading Characteristics

Item		Specification	Notes
UD model	Minimum Resolution	Code 39 : 0.051 mm QR Code : 0.084 mm Data Matrix : 0.084 mm	OPTOELECTRONICS test chart
	Barcode width	Possible to read: Width 40 mm Code 39 Resolution 0.2 mm (DOF: 75 mm)	

Ultra-High Density Model (UD) Reading Depth of Field

(T_A = 25°C)

Resolution mm (mil)	Symbology type	PCS (MRD)	Guaranteed Value		Typical Value	
			Near	Far	Near	Far
0.076 mm (3 mil)	Code 39	0.9 (0.8)	37 mm (1.5″)	58 mm (2.3″)	30 mm (1.2″)	67 mm (2.6″)
0.127 mm (5 mil)	Code 39	0.9 (0.8)	37 mm (1.5″)	70 mm (2.8″)	25 mm (1.0″)	84 mm (3.3″)
0.254 mm (10 mil)	Code 39	0.9 (0.8)	66 mm (2.6″)	95 mm (3.7″)	55 mm (2.2″)	110 mm (4.3″)
0.33 mm (13 mil)	UPC/EAN	0.9 (0.8)	68 mm (2.7″)	104 mm (4.1″)	52 mm (2.1″)	122 mm (4.8″)
0.084 mm (3.3 mil)	QR Code	0.9 (0.8)	44 mm (1.7″)	47 mm (1.9″)	35 mm (1.4″)	57 mm (2.2″)
0.381 mm (15 mil)	QR Code	0.9 (0.8)	31 mm (1.2″)	94 mm (3.7″)	24 mm (0.9″)	111 mm (4.4″)
0.084 mm (3.3 mil)	Data Matrix	0.9 (0.8)	45 mm (1.8″)	50 mm (2.0″)	37 mm (1.5″)	57 mm (2.2″)
0.254 mm (10 mil)	Data Matrix	0.9 (0.8)	35 mm (1.4″)	74 mm (2.9″)	24 mm (0.9″)	88 mm (3.5″)

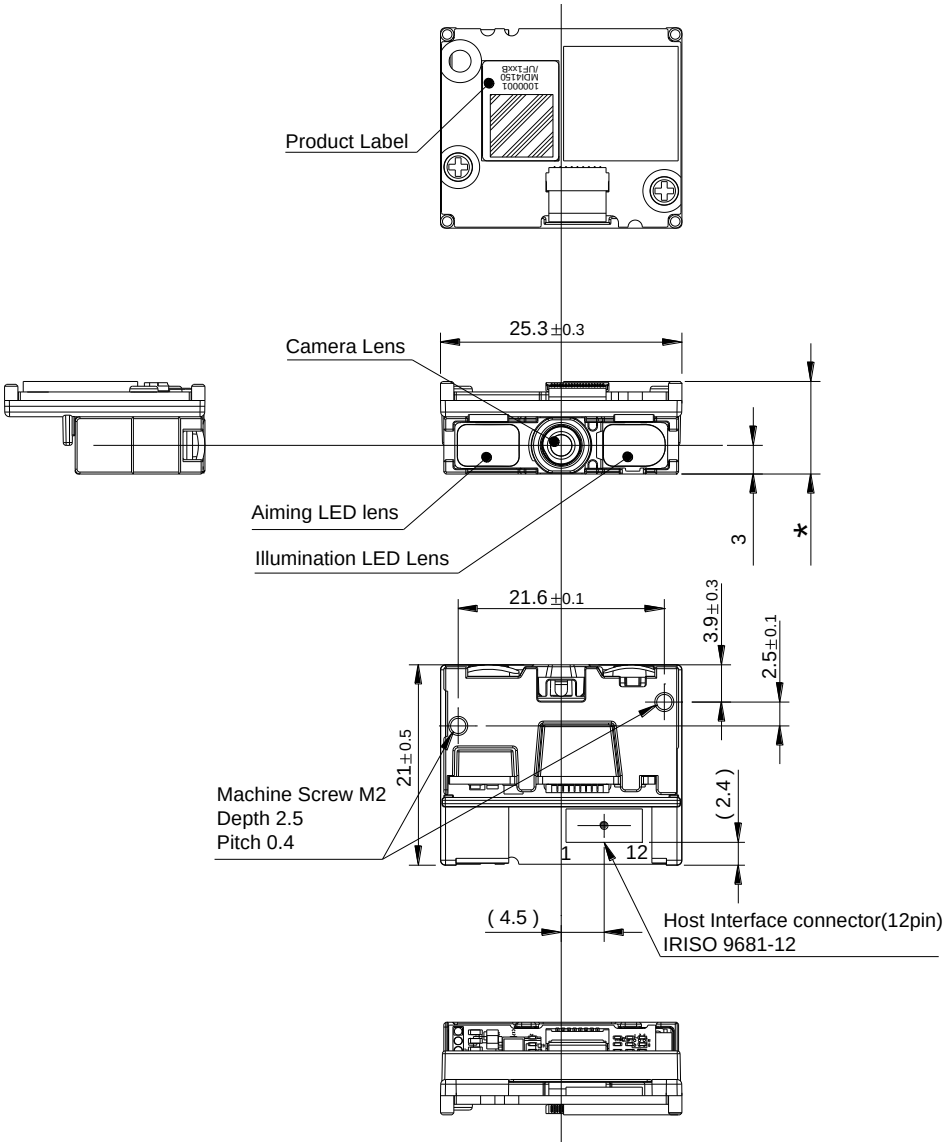
Notes:

- The depth of field is the typical value measured by tilting the test chart 15° from the optical axis.
- The depth of field is a determined while using the OPTOELECTRONICS test chart PCS 0.9, without specular reflection and at room temperature and room humidity.

10.2.3 MDI-4xx0 Detailed View

MDI-4150 Detailed View

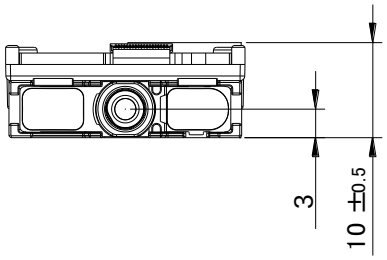
Dimensions (MDI-4100): Approx. 21 mm (D) × 25.3 mm (W) × 10.0 mm (H)
Dimensions (MDI-4150): Approx. 21 mm (D) × 25.3 mm (W) × 9.5 mm (H)
Weight: Approx. 5.5 g
Mechanical Drawing



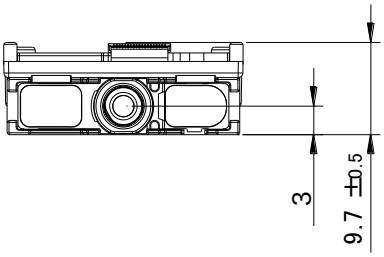
* Height of the MDI-4100 and the MDI-4150

The MDI-4100 and MDI-4150 have different circuit board thicknesses.

MDI-4100



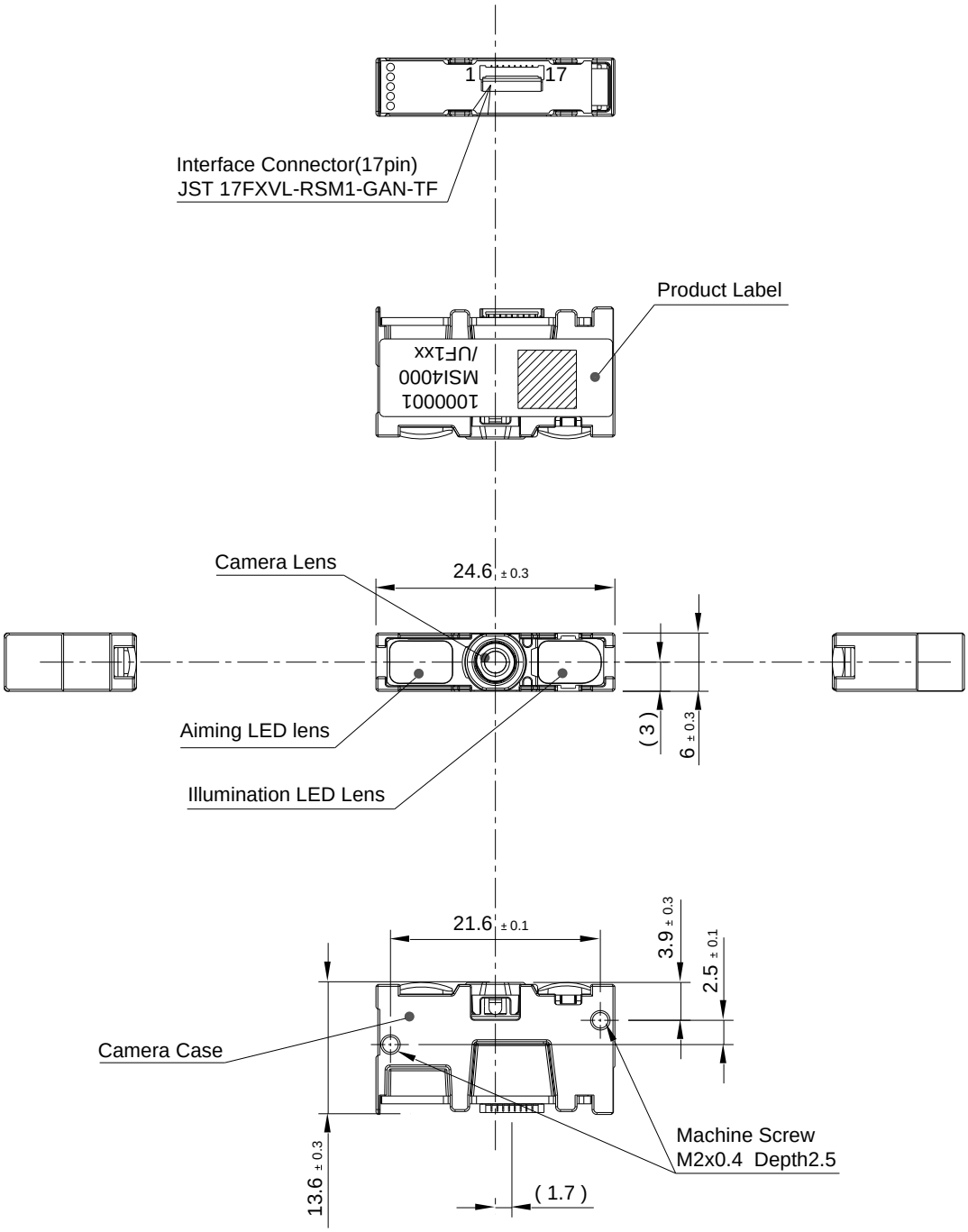
MDI-4150



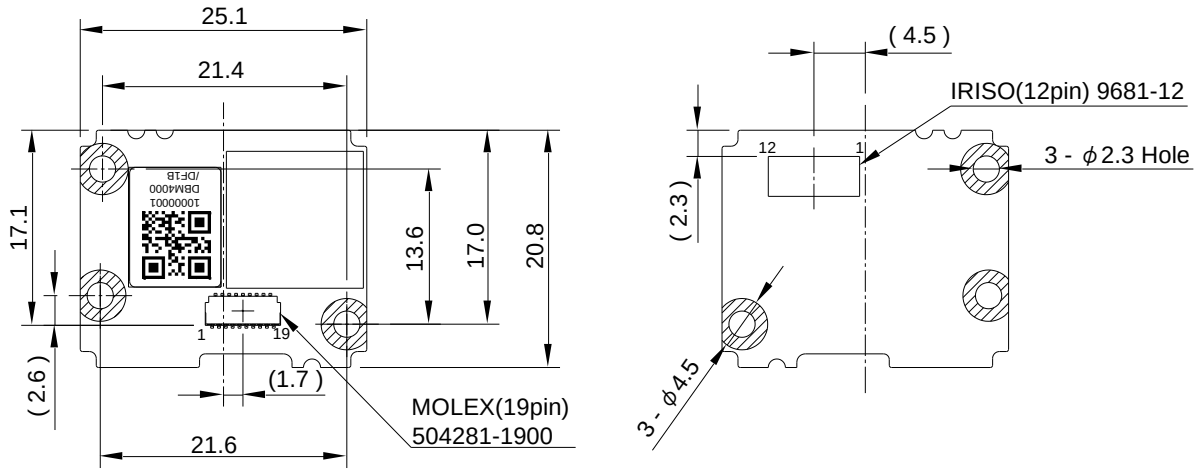
MDI-4050 Detailed View

Dimensions	Camera:	Approx. 13.6 mm (D) × 24.6 mm (W) × 6 mm (H)
	Decoder board (DBM-4050):	Approx. 20.8 mm (D) × 25.1 mm (W) × 3.5 mm (H)
	Decoder board (DBM-4050):	Approx. 20.8 mm (D) × 25.1 mm (W) × 3.2 mm (H)
Weight:		Approx. 5.5 g

Mechanical Drawing



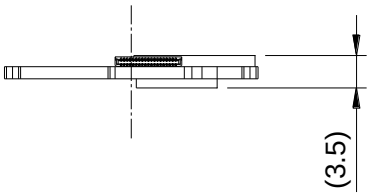
Decoder Board



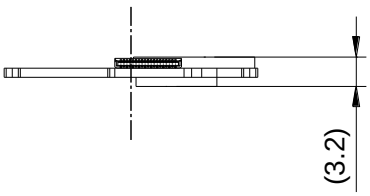
Height of the DBM-4000 and the DBM-4050

The DBM-4000 and DBM-4050 have different circuit board thicknesses.

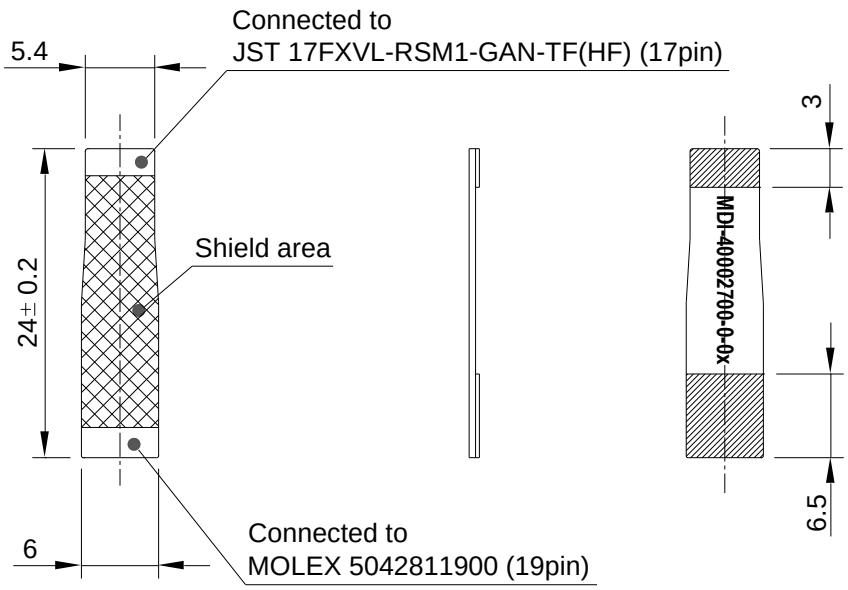
DBM-4000



DBM-4050



FPC Cable



10.3 Sample Codes

10.3.1 1D Code

UPC

UPC-A

UPC-A +2

UPC-A +5

UPC-E

UPC-E +2

UPC-E +5

EAN/JAN

EAN/JAN-13

EAN/JAN-13 +2

EAN/JAN-13 +5

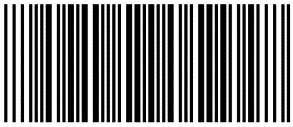
EAN/JAN-8

EAN/JAN-8 +2

EAN-8 +5

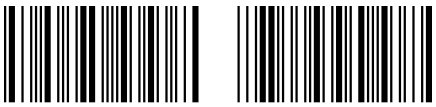
Code 39

Code 39	Code39 Italian Pharmaceutical
 CODE39	 A908557705

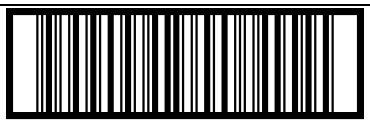
Code 39 Full ASCII	Tri-Optic
 Code 39	 R01260

Codabar

Codabar	Codabar ABC
 01235	 01234 56789

Codabar CX
 12344 56784

Industrial 2 of 5 / Interleaved 2 of 5

Industrial 2 of 5	Interleaved 2 of 5
 1234567895	 14901234567891

S-Code
 987654326

Code 128

Code 128

GS1 128

Code 93

Code 93

IATA

IATA

MSI/Plessey

MSI/Plessey

UK/Plessey

UK/Plessey

Telepen

Telepen

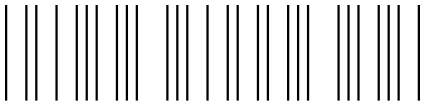
Code11

Code11

Matrix 2 of 5

Matrix 2 of 5

10.3.2 Postal Code

Chinese Post Matrix 2 of 5	Korean Postal authority
 01647100611	 345-678

Intelligent Mail Barcode
 94765432101234567890

POSTNET
 012340

PLANET
 012345678905

Japan Postal
 33500024-12-17

Netherland KIX Code
 3992RK28

Australian Postal
 56439111ABA9

UK Postal(Royal mail)
 12345678

4-State Mailmark Barcode
 410384224165637 62EF61AH8T

10.3.3 GS1 DataBar

GS1 DataBar Omnidirectional	GS1 DataBar Truncated
	
GS1 DataBar Stacked	**GS1 DataBar Stacked Omnidirectional**
	
GS1 DataBar Limited	**GS1 DataBar Expanded**
	
GS1 DataBar Expanded Stacked	
	

10.3.4 GS1 Composite Code

CC-A

CC-B

Limited CC-A

Limited CC-B

Expanded CC-A

Expanded CC-B

Composite GS1-128

CC-A

CC-B

CC-C

Composite EAN

EAN-13 CC-A	EAN-13 CC-B
0123456789548 (17) 120304 (10) EANCCA 	0123456789548 (17) 120304 (10) EANCCB (240) 21U16C19A876B54T3210ean13cc-b 

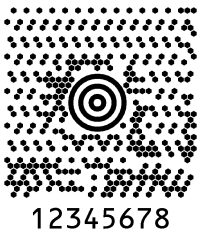
EAN-8 CC-A	EAN-8 CC-B
12345670 (17) 160401 (10) EAN08CCA 	12345670 (17) 170408 (10) EAN08CCB (240) 12345678ean8ccb 

Composite UPC

UPC-A CC-A	UPC-A CC-B
314159265358 (17) 170809 (10) UPCACCA 	314159265358 (17) 170809 (10) UPCACCB (240) 21U16C19A876B54T3210UPCACCB 

UPC-E CC-A	UPC-E CC-B
01234565 (17) 040104 (10) UPCECCA 	01234565 (17) 040104 (10) UPCECCB (240) 12345678upceccb 

10.3.5 2D Code

PDF417	MicroPDF417
	
Codablock F	**QR Code**
	
Micro QR	**Data Matrix(ECC 200)**
	
Data Matrix(ECC 140)	**DMRE (Datamatrix Rectangular Extension)**
	
Aztec Code	**Aztec Runes**
	
Chinese-sensible code (Han Xin Code)	**Maxi Code**
	

Dot Code
 3UP2FYHLE3FB

10.3.6 OCR Font (Machine Readable Travel Document)

ICAO Travel Documents

Machine readable Passports
P<JPNABCDEFG<<HIJKLMN<OPQRSTU<VWXYZ<<<<<<<<< L898902C<3JPN4209247M1609271134567890<<<<78

Machine readable Visa-A
V<UTOERIKSSON<<ANNA<MARIA<<<<<<<<<<<<<<<<<< L8988901C4XXX4009078F96121096ZE184226B<<<<<<

Machine readable Visa-B
V<UTOERIKSSON<<ANNA<MARIA<<<<<<<<<< L8988901C4XXX4009078F9612109<<<<<<<<

Official Travel Documents 1
I<UTOD231458907<<<<<<<<<<<<<< 7408122F1204159UTO<<<<<<<<<<<6 ERIKSSON<<ANNA<MARIA<<<<<<<<<<

Official Travel Documents 2
I<UTOERIKSSON<<ANNA<MARIA<<<<<<<<<< D231458907UTO7408122F1204159<<<<<<<6

OCR Font

OCR-B

349427154

OCR-A

3 4 9 4 2 7 1 5 4

E-13B (MICR)

349427154

10.3.7 OCR Font (Free OCR Edit)

OCR-A		OCR-B	
OCR-A Free Edit Enable		OCR-A Free Edit Enable	
4567890 0123456789012 DEFGHIJ 23456CDEFGH		345678 89012345678 FGHIJKLMN 56789012ABCD	
Free Edit Disable			