MDI-4000 Series

MDI-4000, MDI-4050, MDI-4100, MDI-4150

Low Profile, High-Performance, 2D Imager Engine

Serial Interface Manual

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We scan, connect and communicate

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

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

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Revision History

Product Name: MDI-4000 Series Serial Interface Manual

Edition	Date	Page	Section	Description of Changes
2nd	February 28, 2020	-	-	Applied new template. Rewrote text for clarity.
1st	June 11, 2018	-	-	Initial release. Supported firmware: BD01J07

Contents

Table of Figures

1 Overview

This manual provides the serial interface specifications for the MDI-4000 Series 2D scan engine, which includes these models:

- MDI-4000 SR/HD/UD
- MDI-4050 SR/HD/UD
- MDI-4100 SR/HD/UD
- MDI-4150 SR/HD/UD

Use these specifications to smoothly integrate the MDI-4000 Series scan engine with your product and maximize performance of the scan engine.

Unless otherwise noted, all features apply to all models.

1.1 MDI-4000 Series Scan Engine Features

The MDI-4000 Series includes a multitude of 2D scan engines to meet your needs. These low-profile, high-performance scan engines can be integrated into any product to perform high-end tasks.

The MDI-4000 Series contains these features:

- **Super thin 2D imager scan engine:** The MDI-40x0 and MDI-41x0 with a separate decoder have ultra low-profiles: 6 mm and 9.7 mm, respectively. This minimal height allows the scan engines to be easily integrated into even the most compact equipment, such as PDAs, data collectors, and ticket readers.
- **High-speed reading:** The extreme high-performance decoder ensures stress-free scanning and fast response, even in the case of poor-quality barcodes (such as damaged or low-contrast), movement/vibration, and poor lighting conditions.
- **High-speed image sensor:** The high-speed CMOS image sensor captures images at a speed of up to 100 fps, which when combined with the fastest global shutter speed in the industry, enables fast and accurate scanning.
- **Ultra-fast image processing:** The high-performance and low-power 800MHz CPU enables a smooth response by processing the vast amount of information transferred by the 100fps CMOS image sensor in a very short time.
- **Editing function:** Captures up to 16 barcodes at a time on multiple images. The output editing process, such as GS1 format, can also be configured easily.
- **Data Edit Programming:** Capable of batch reading 1D codes (up to 16 barcodes), 2D barcodes, and OCR. The combined output is highly configurable using regular expressions. Also supports GS1 data conversion and code coordinate output.
- **Low power consumption:** The power consumption in operating, standby, and low power states has been drastically minimized. Various power saving settings can be configured to optimize the power consumption for your particular application. The MDI-4x50 is specifically designed to save power in Sleep low power mode, which is why the MDI-4x50 is recommended for battery-powered devices.
- **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 scanner while providing safety and long life.
- **RoHS compliance:** The scan engines are RoHS compliant products, as declared by Optoelectronics Co., Ltd.

1.2 Integration Flow

To integrate the scan engine, you need to follow these steps.

1. Learn About the Scan Engines and Select a Scan Engine

Review technical information:

- “
- **About the MDI-4000 Series Scan** Engines” **on page 3**.
- **“MDI-4xx0 Specification Overview” on**

Communications

UART/USB

Reading Barcodes

2. Download Tools

Download the necessary tools from the Opticon website:

- Opticon UniversalConfig: For configuration, image acquisition, and communication.
- USB Driver: For USB-COM.
- WIME: For COM output to HID output conversion.

3. Configure and Test the Scan Engine

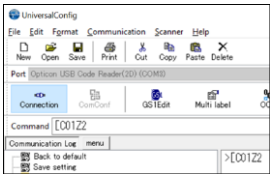
Evaluate the scan engine settings in your scanning environment and perform a read test:

- **“Optional MEK-3100 Evaluation Board Accessory” on page 5.**
- **“Configuration” on page 6.**
- **“Interface” on page 19.**
- **“Power Management and Timing” on page 37.**
- **“Barcode Options” on page 51.**
- **“Data String Options” on page 83.**
- **“Read Options” on page 90.**
- **“Indicator Options” on page 97.**
- **“Sample Barcodes” on page 116.**

4. Create Setting Menu

Create a configuration command or 2D menu barcode:

- **“Configuration” on page 6.**



5. Integrate the Scan Engine

See the “MDI-4xx0 Integration Guide.”

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2 About the MDI-4000 Series Scan Engines

Before configuring or using the MDI-4000 Series scan engines, make sure that you are familiar with their physical details and specifications.

2.1 Model Details

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

Scan Engine Model Details

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

Focus Description

Focus	Description
SR	Standard Range (115 mm)
HD	High-Density (65 mm)
UD	Ultra High-Density (45 mm)

Interface Description

Interface	Description
B*	UART
DC	USB-COM
D	USB-HID

* Default factory setting.

2.1.1 Standard Product Description

The standard scan engine models have these configurations. Additional configurations are available by special order. For help, contact your Opticon Sales Representative.

The standard scan engine model configuration is a scan engine with an integrated decoder board, Standard Range focus, and a UART interface:

- MDI-4150 SRB
- MDI-4050 SRB
- MDI-4100 SRB
- MDI-4000 SRB

2.1.2 Model Name Description

The model name indicates the shape of the scan engine. The shape describes whether the decoder board is separate from or mounted to the camera, as well as whether low-power consumption mode is installed.

Model Name Descriptions

Model Name	Description
MDI-4150	Decoder board separate from camera. Low-power consumption mode installed.
MDI-4050	Decoder board mounted to camera. Low-power consumption mode installed.
MDI-4100	Decoder board separate from camera.
MDI-4000	Decoder board mounted to camera.

2.2 Scan Area

The scan engine reads a barcode by acquiring its image. The imaging area is not actually visible. So, position the LED Aiming beam over the barcode.

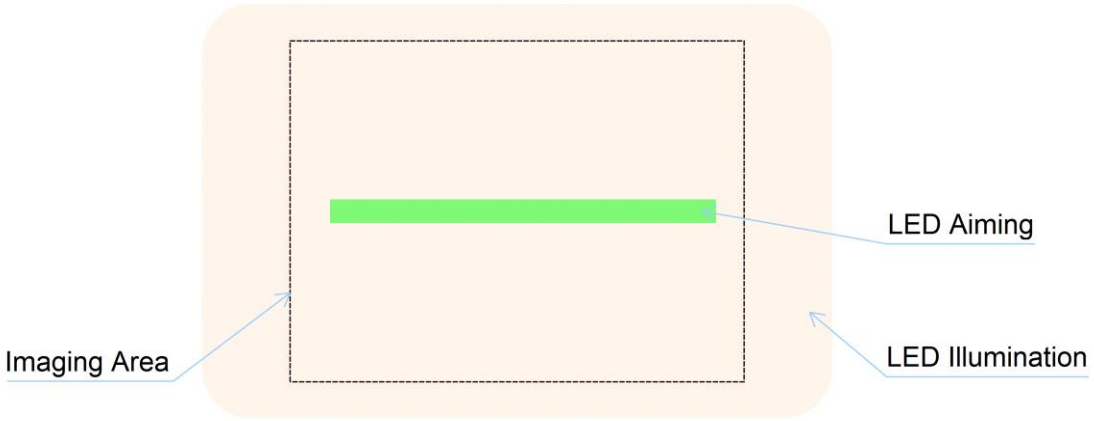


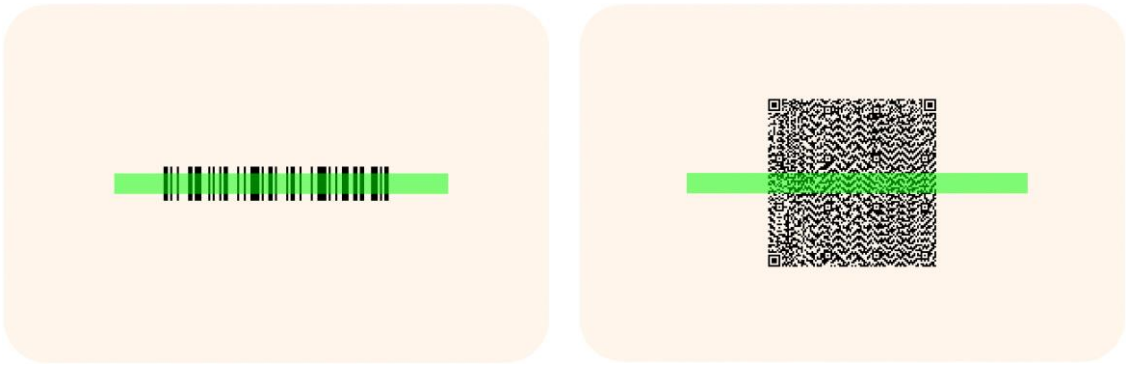
Figure **1***: Scan Area*

For information about reading the depth of field, see **“Technical Specifications” on page 108**. To configure the scan engine to only read the center of the LED Aiming beam, see **“Central Reading” on page 91**.

To scan a barcode, direct the LED Aiming beam so that it falls across the center of the barcode label.

Note: If the barcode and the quiet zone (the blank margin on either side of the barcode) is within the view angle, the barcode can be read from 360 degrees.

Correct LED Aiming



Incorrect LED Aiming

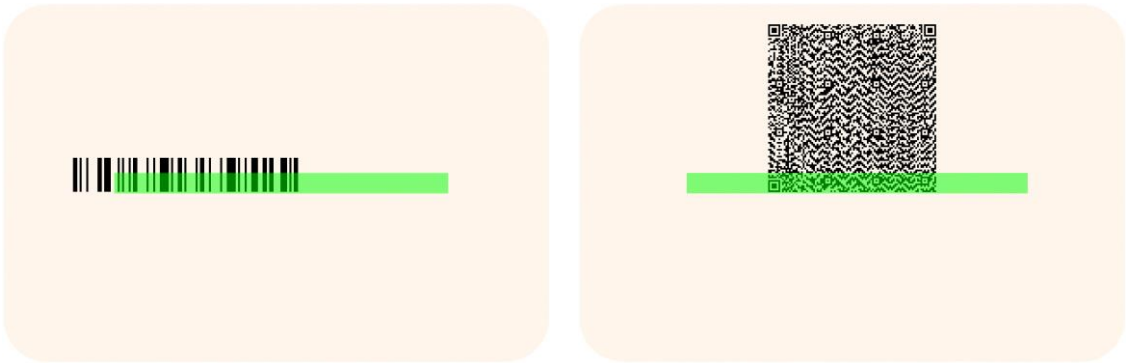


Figure **2***: Correct and Incorrect LED Aiming*

2.3 Optional MEK-3100 Evaluation Board Accessory

The MEK-3100 evaluation board can perform these tasks:

- Confirm the connection: Connects the scan engine to the host through an RS-232C or USB interface and monitors each signal in the connection.
- Confirm communications and barcode reading: Uses a terminal emulator or the Opticon UniversalConfig tool to confirm communications and barcode reading.
- Evaluate power consumption: Monitor power use, such as scan engine power consumption.

The MEK-3100 evaluation board kit includes:

- MEK-3100 evaluation board
- FFC (to connect the scan engine)
- RS-232C cable
- AC adapter (for RS-232C)
- USB cable
- Hardware

Figure **3***: MEK-3100 Evaluation Board*

Figure **4***: MEK-3100 Evaluation Board Kit*

3 Configuration

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

3.1 How to Configure the Scan Engine with Commands

You can configure the scan engine by sending commands through the serial interface or by reading 1D or 2D menu labels. This section describes the serial commands.

3.1.1 Command Packet

This table defines the command packet from header to terminator.

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

*1 Except for single digit IDs, you can send multiple command IDs between a single header and terminator.
*2 You can also send a combination of command header <STX>(0x02) and terminator <ETX>(0x03).

Input examples:

1-digit command	<ESC>Δ<CR>
2-digit command	<ESC>ΔΔ<CR>
3-digit command	<ESC>[ΔΔΔ<CR>
Two 4-digit commands	<ESC>ΔΔΔΔ<CR>
2-digit and 3-digit command	<ESC>ΔΔ[ΔΔΔ<CR>

You can send the command through Opticon's "UniversalConfig." For help, contact your Opticon Sales Representative.

Note: In UniversalConfig, <ESC> is automatically sent.

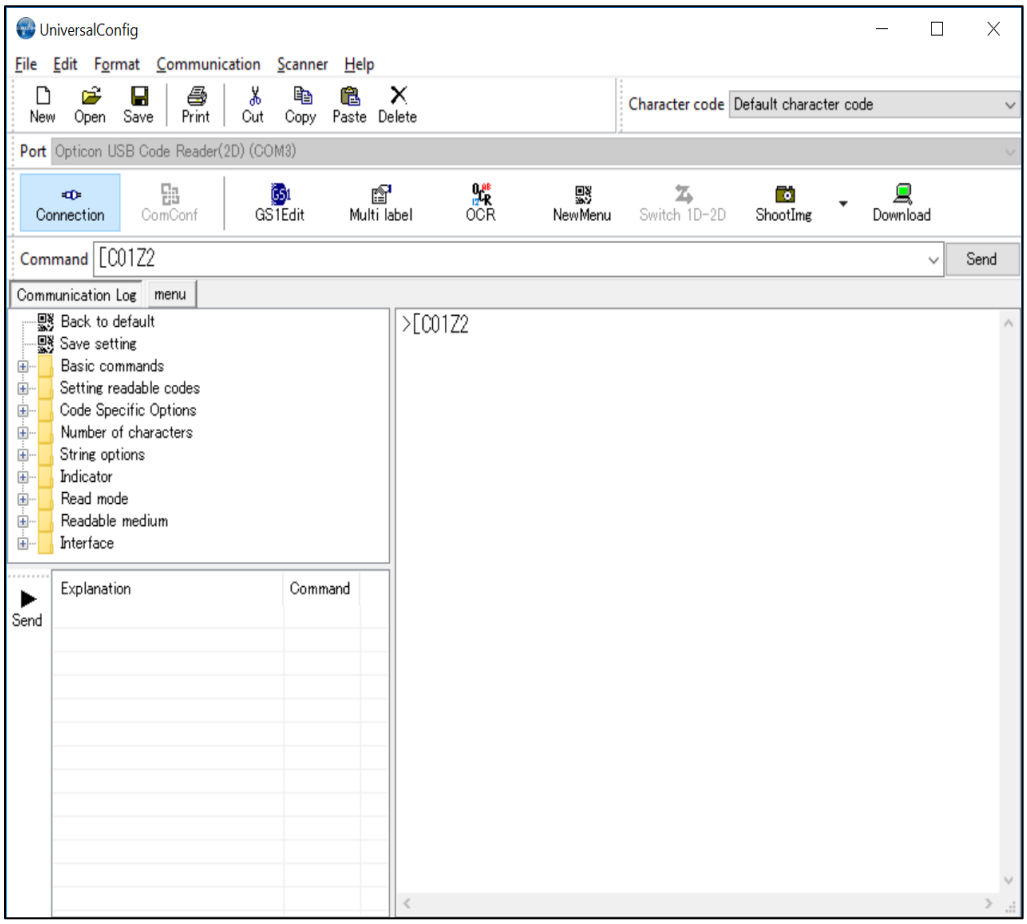


Figure **5***: Opticon's "Universal Config"*

3.1.2 Sending Command Packets

The maximum length of a command packet is 1000 characters. If more than 1000 characters are sent, the scan engine may lose some characters and the command packet may not be processed correctly.

If you send a packet that contains 32 or more characters and the baud rate is set to 460800 or 921600, the scan engine may miss part of the command. To use these baud rates, split up commands into packets that contain less than 32 characters.

Power Mode (UART)	UART Baud Rate [bps]							
	9600	19200	38400	57600	115200	230400	460800	921600
Standby	-	-	-	-	-	-	*	*
Low Power Standby	For more information, see **"How to Recover from Low Power Mode" on page 43**.							

If you are sending "Null" characters, send these characters first and wait at least 10 ms to send the command.

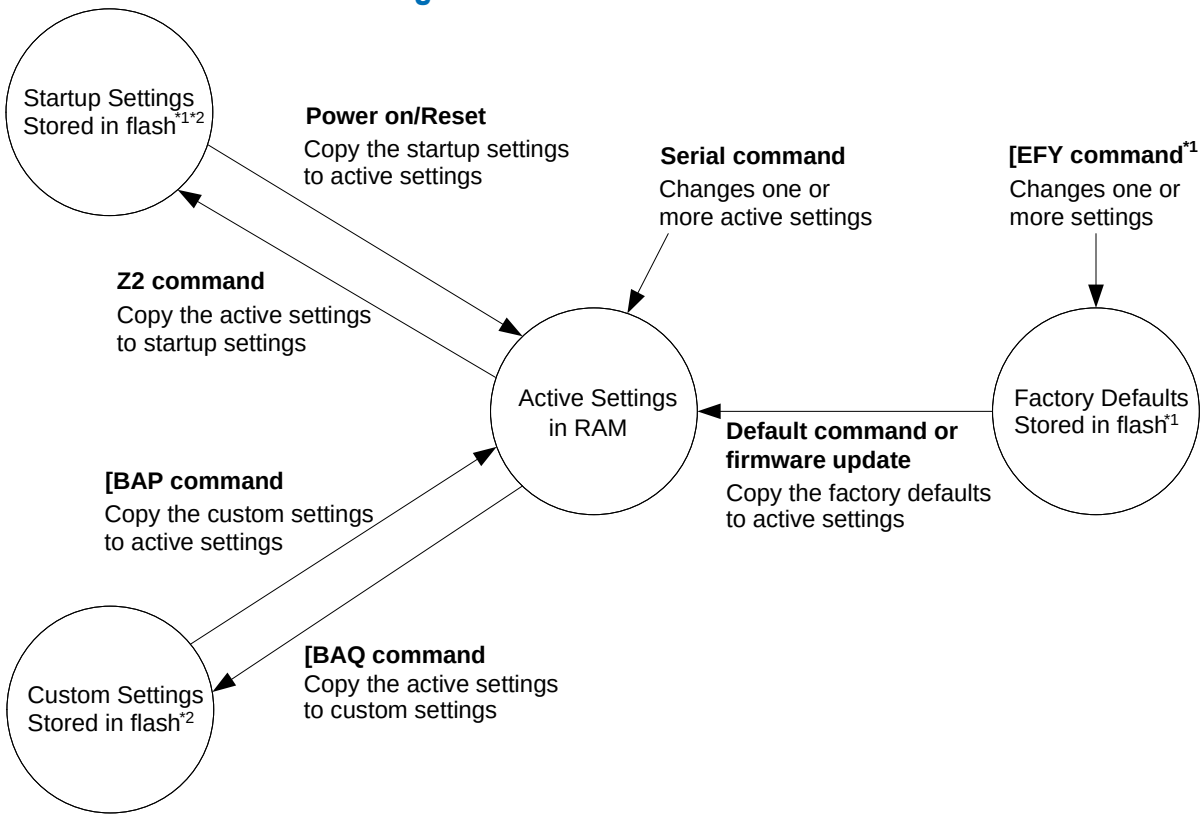
If a multiple command packet is sent, subsequent commands cannot be received while the previous command is being executed. Use one of these methods to receive commands simultaneously:

- Use a Handshake command, such as BUSY/READY or MODEM. When you use handshaking, the RTS output is in a busy state while a command is being executed, which makes it possible to refer to this signal for the correct timing. For more information, see **"Handshaking (Flow Control)" on page 22**.
- Use ACK/NAK for serial commands. When this command is enabled, the scan engine sends an ACK after a command is received and processed. For more information, see **"ACK/NAK for Serial Commands" on page 14**.

Settings configured by commands are not retained in non-volatile memory, so these settings are lost after a power cycle. To save settings made with commands, send the Z2 command at the end of the command packet. When you send the Z2 command, all parameters are saved in non-volatile memory.

Note: Settings configured by reading 1D or 2D barcodes are saved in non-volatile memory. Previous settings configured by command are also saved. For more information, see **"How to Configure the Scan Engine with a 1D Menu Barcode" on page 17** and **"How to Configure the Scan Engine with a 2D Menu Barcode" on page 18**.

3.2 Precautions for Sending Command Packets



*1 Only configures the factory default settings in an environment where power is stable.
*2 These areas are cleared when a firmware update is loaded. They can be rewritten up to 100,000 times.

Figure **6***: Precautions for Sending Command Packets*

Settings Descriptions

Setting	Description
Active Settings	Contains the current active settings. The scan engine operates according to these settings. Active Settings include settings loaded from another areas, as well as new settings added through serial commands or menu labels. Active Settings resides in RAM, so they are lost after a power cycle.
Startup Settings	When the scan engine is powered up, data in Startup Settings is loaded to Active Settings in RAM. Startup Settings is in non-volatile memory.
Custom Settings	When the [BAP command is sent to the scan engine, data in Custom Settings is loaded to Active Settings in RAM. Custom Settings is in non-volatile memory. **Note:** When reading or sending the [BAQ command, Custom Settings is overwritten with the current Active Settings.
Factory Default Settings	Factory Default Settings are the default settings for the scan engine. When the default command (U2) is read or sent, these settings are loaded to Active Settings. You can modify Factory Default Settings through Custom Command Line Settings. For more information, see **"How to Permanently Change the Factory Default Settings" on page 11**. Factory Default Settings is in non-volatile memory.

3.2.1 Factory Default Settings

To return Active Settings to Factory Default Settings, set the command that corresponds to the interface being used.

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

3.2.2 Save Settings

To save Active Settings to Startup Settings, send the Z2 command at the end of the command packet you want to save.

Command	Description	Notes
Z2	Save Active Settings as Startup Settings.	Command only

* Saving settings over 100,000 times may destroy memory. If you need to configure these settings frequently, avoid saving every time.

* Some options, like baud rate settings, may not be enabled until "Save Settings" is sent.

3.2.3 Custom Settings

To save Active Settings to Custom Settings, send the [BAQ command at the end of command packet you want to save. To save Custom Settings and Active Settings at same time, send the [BAQZ2 command.

Custom Settings Commands

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

* Saving Custom Settings over 100,000 times may destroy memory. If you need to configure these settings frequently, avoid saving every time.

3.3 How to Permanently Change the Factory Default Settings

You can use the Custom Command Line commands to permanently change the Factory Default Settings. The new Factory Default Settings become active after the scan engine is rebooted and initialized and persist through a firmware update.

Note: Custom Command Line commands may corrupt flash memory if power is turned off while they are being configured. Only use these commands in an environment where the power is stable.

Recommended Custom Command Line Settings:

- Fast Boot Mode (See **"Fast Boot Mode" on page 12**.)
- Image settings (See **"Mirrored Image" on page 15**.)
- Serial communication commands like baud rate, data length, parity, and stop bit. (**See "UART" on page 19**.)

Custom Command Line Commands

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

* Multiple commands are allowed.

To activate the new Factory Default Settings, send or scan the RV command to reset the scan engine.

To load the new Factory Default Settings, send or scan the U2 command to save the new settings and load them after the scan engine is powered up.

Example Custom Command Line Settings

Setting	Command
Enable Fast Boot Mode.	[EFXQ1
Enable ACK/NAK.	WC
Disable 2D Menu Barcode.	[D1Z
Enable Upside Down Image.	[EFV[E8I
Set Baud Rate to 115200 bps.	SZ
Enable Low Power Standby.	[EB8
Set Low Power Standby Transition Time to 2 seconds.	[EBAQ0Q0Q0Q2
Reboot the scan engine.	RV
Initialize the scan engine.	U2

Example packets sent to configure Custom Command Line Settings:

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

<ESC>RV<CR>

<ESC>U2Z2<CR>

You can also output currently configured commands in Custom Command Line Settings.

Output Commands

Command	Description
[EFZ	Output configured commands in custom command line

Example output:

[EFXQ1WC[D1Z[EFU[E8ISZ[EB8[EBAQ0Q0Q0Q2

Note: If no Custom Command Line commands have been configured, the scan engine will not send anything.

3.4 Fast Boot Mode

Fast Boot Mode reduces the time from power-on to ready. When this mode is used, all settings saved with the Z2 command are ignored and the scan engine starts with the default settings. For more information, see **“Factory Default Settings” on page 10**.

You can change the default settings with Custom Command Line commands. For more information, see **“How to Permanently Change the Factory Default Settings” on page 11**.

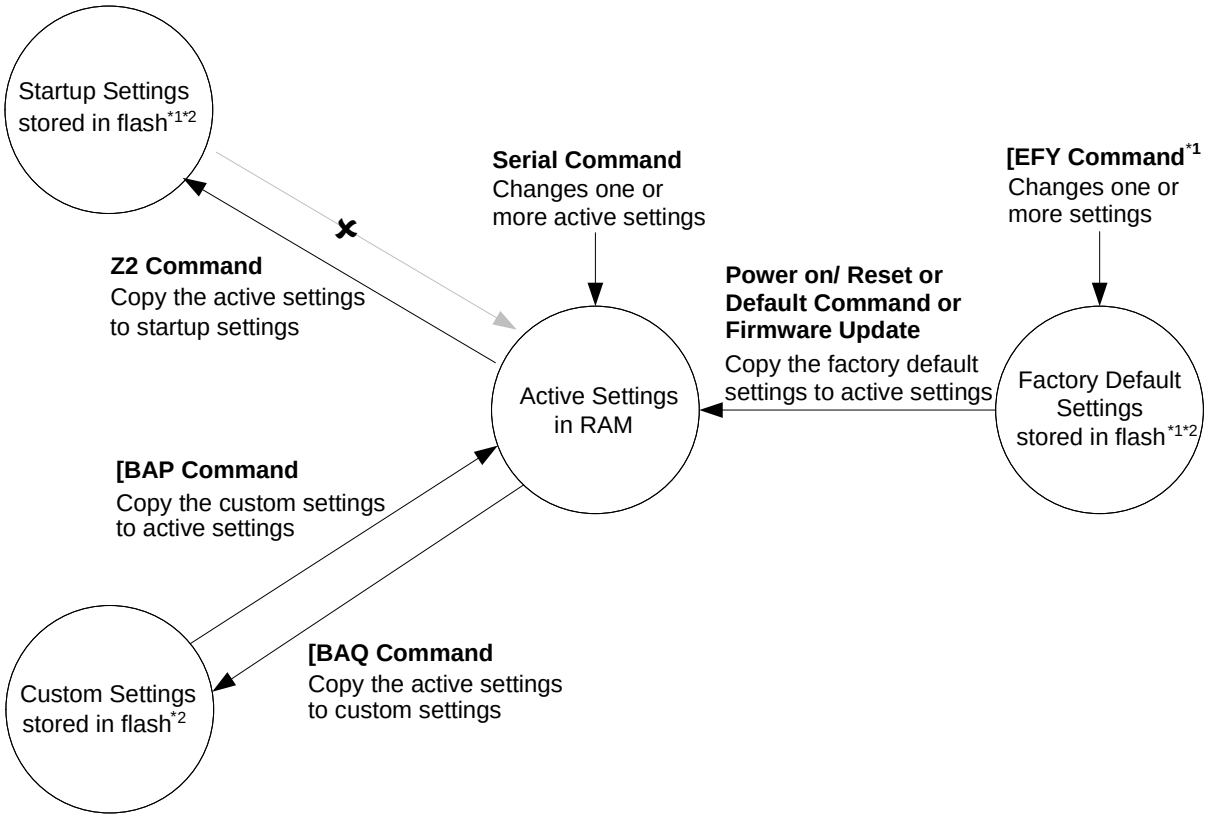
Fast Boot Mode Enable/Disable

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

* The return values are: Disable Fast Boot Mode<CR>, Enable Fast Boot Mode<CR>.

Boot Time Specification (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 the power	-	510		ms
Fast Boot Mode		-	425		ms



*1 Only configures the factory default settings in an environment where power is stable.
*2 These areas are erased when a firmware update is loaded and can be rewritten up to 100,000 times.

Figure **7***: Transition Diagram in Fast Boot Mode*

3.5 Basic Commands

3.5.1 Trigger Command

You can start and stop reading by sending commands. When the read cycle timeout is set to 0 seconds (Y0 command), the read time with the Z command is set to 'Indefinitely' and reading continues until a Y command is received. For timeout limited reading, use the Yx commands. For more information, see **"Read Timing" on page 48**.

Trigger Commands

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

3.5.2 Diagnostic Commands

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

Diagnostics Commands

Command	Description	Notes
Z1	Transmit software version	
Z3	Transmit settings	The Z3 output result is subject to change when the firmware version is changed.
[EAR	Transmit only changes from default	
ZA	Transmit ASCII printable string	
YV	Transmit ASCII control string	

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)	765987D894CA5391 8218FB0D31A54AAF	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 sends an ACK (0x06) when a command is received and accepted and a NAK (0x15) when a command is rejected.

ACK/NAK Commands

Command	Description	Default
WC	Enable ACK/NAK for serial commands	
WD	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	Notes
RV	Reboot the scan engine	

3.5.5 Enable/Disable 2D Menu Barcodes

Use these settings to enable or disable decoding 2D menu barcodes. When you are not using 2D menu barcodes, you should disable this setting.

Enable/Disable 2D Menu Barcodes

Command	Description	Notes
[D1Y	Enable 2D menu barcode	✓
[D1Z	Disable 2D menu barcode	The 2D menu barcode is read as a normal 2D barcode. When the barcode is successfully scanned, the output is 2D menu barcode data.

3.5.6 Enable/Disable 1D Menu Barcodes

Use these settings to enable or disable decoding 1D menu barcodes. When you are not using 1D menu barcodes, you should disable this setting.

Enable/Disable 1D Menu Barcodes

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

* Indicates that 1D menu barcode reading is prohibited.

3.5.7 Mirrored Image

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

When an external mirror is installed in front of the scan engine, the scan engine should mirror the sensor data. The scan engine can mirror the sensor data horizontally or vertically.

Mirrored Image Settings

Setting	Command	Description	Default
Horizontal Mirrored Image	[EFU	Disable horizontal mirrored image.	✓
	[EFV	Enable horizontal mirrored image.	
Vertical Mirrored Image	[E8J	Disable vertical mirrored image.	✓
	[E8I	Enable vertical mirrored image.	

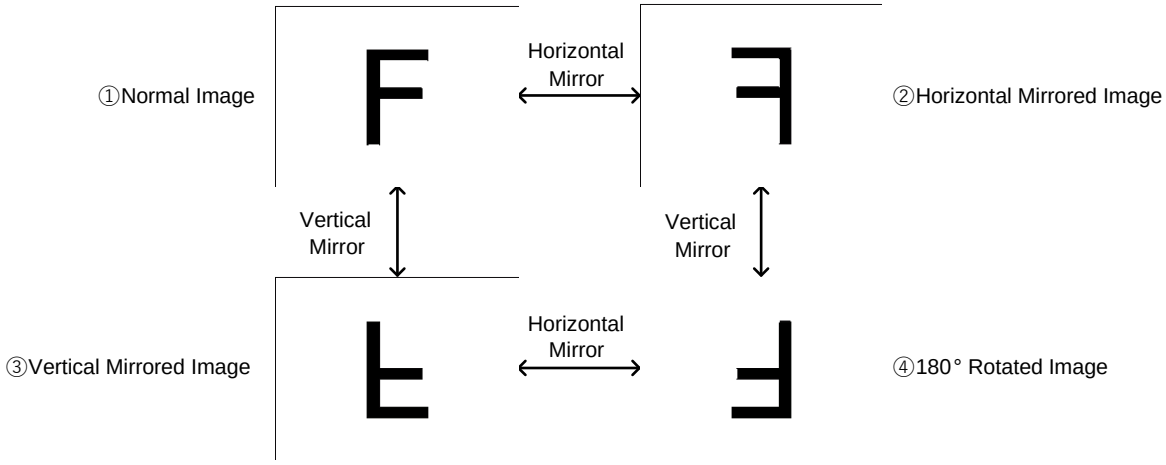


Figure **8***: Mirrored Image Styles*

Mirrored Image Configuration Commands

Style	Command	Horizontal Mirror	Vertical Mirror
① Normal Image	[EFU[E8J	Disable	Disable
② Horizontal Mirrored Image	[EFV[E8J	Enable	Disable
③ Vertical Mirrored Image	[EFU[E8I	Disable	Enable
④ 180° Rotated Image	[EFV[E8I	Enable	Enable

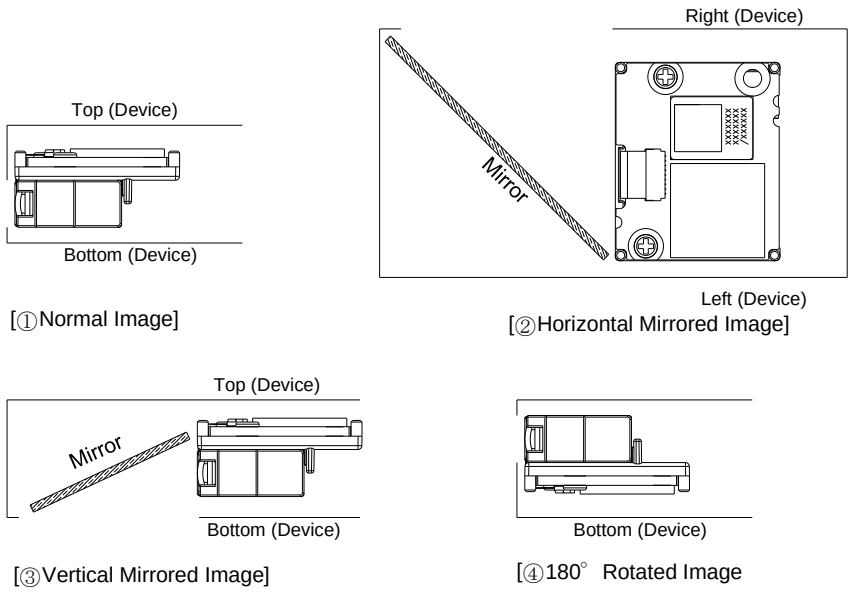


Figure **9***: Mirrored Image Configurations*

3.5.8 Reading Operation

Use these settings to enable or disable the reading operation.

When reading is disabled, auto trigger and the TRIGn signal operation are invalid. Also, menu labels cannot be read. That is, only commands through serial communication are supported.

Enable/Disable Reading Operation

Command	Description	Default	Notes
[EAT	Enable module reading operation	✓	Command only
[EAU	Disable module reading operation		Command only

3.5.9 Buzzer and Indicator

These commands apply to **"Buzzer" on page 97** and **"Good Read LED" on page 99**.

Item	Command	Description	Notes
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_LED n	

3.5.10 Direct Numerical Input

Use these commands if a command requires additional numerical input. Include these commands in a single packet with the command that requires the numerical input.

Direct Input Numerical Values

Command	Description	Notes
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 How to Configure the Scan Engine with a 1D Menu Barcode

You can configure the scan engine to optimize its performance for your particular application by scanning a series of 1D Menu barcodes specially designed to configure the required functions.

Note: 1D Menu barcodes encode an ID consisting of two to three alphanumeric characters. 1D Menu barcodes are Code 39 labels with modified start/stop characters and therefore the scan engine will not acknowledge a 1D menu barcode as a normal barcode.

Configure the Scan Engine with a 1D Menu Barcode

1. Scan the SET menu barcode, ZZ. The scan engine enters menu mode.
2. Scan the options you want to configure.
3. Scan the END menu barcode, ZZ. All settings are saved in non-volatile memory.

You can use Opticon's "UniversalConfig" to create the 1D menu barcodes. For help, contact your Opticon Sales Representative.

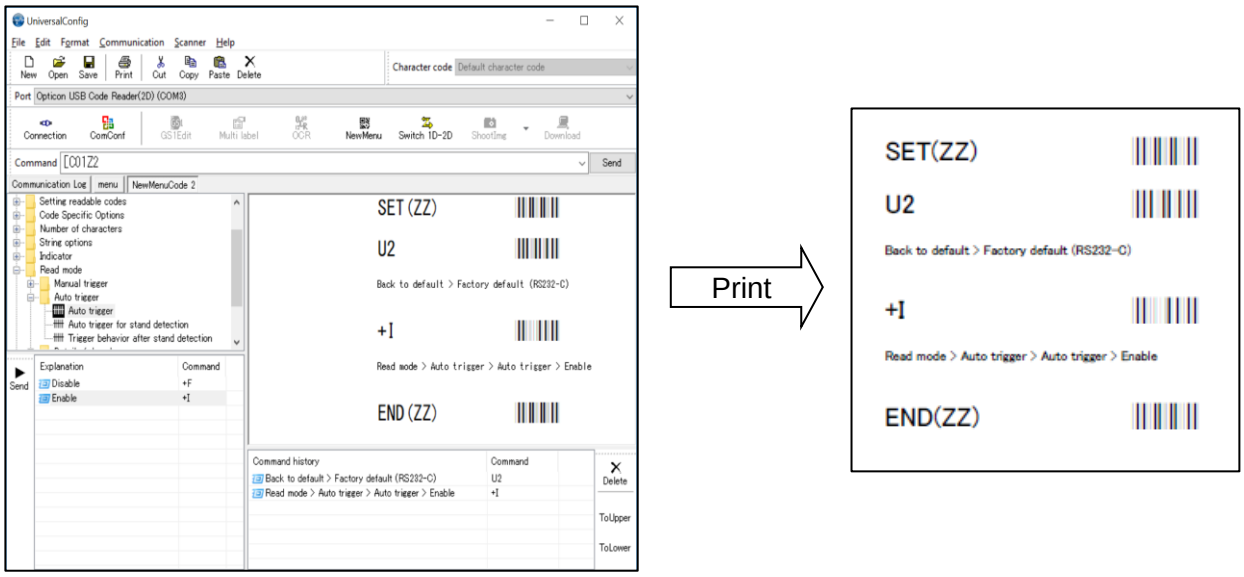


Figure **10***: Creating 1D Menu Barcodes with Opticon's "UniversalConfig."*

3.7 How to Configure the Scan Engine with a 2D Menu Barcode

A 2D menu barcode can contain multiple settings that are processed in order in a single operation. So, you can configure multiple settings for the scan engine by reading a single 2D menu barcode. Scanning a 2D menu barcode automatically saves setting, so you do not need to include a Z2 command.

A 2D menu barcode is a QR Code with this data:

@MENU_OPTO@ZZ@MenuCommand 1@MenuCommand 2@ZZ@OTPO_UNEM@

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

You can use Opticon's "UniversalConfig" to create the 2D menu barcode. For help, contact your Opticon Sales Representative.

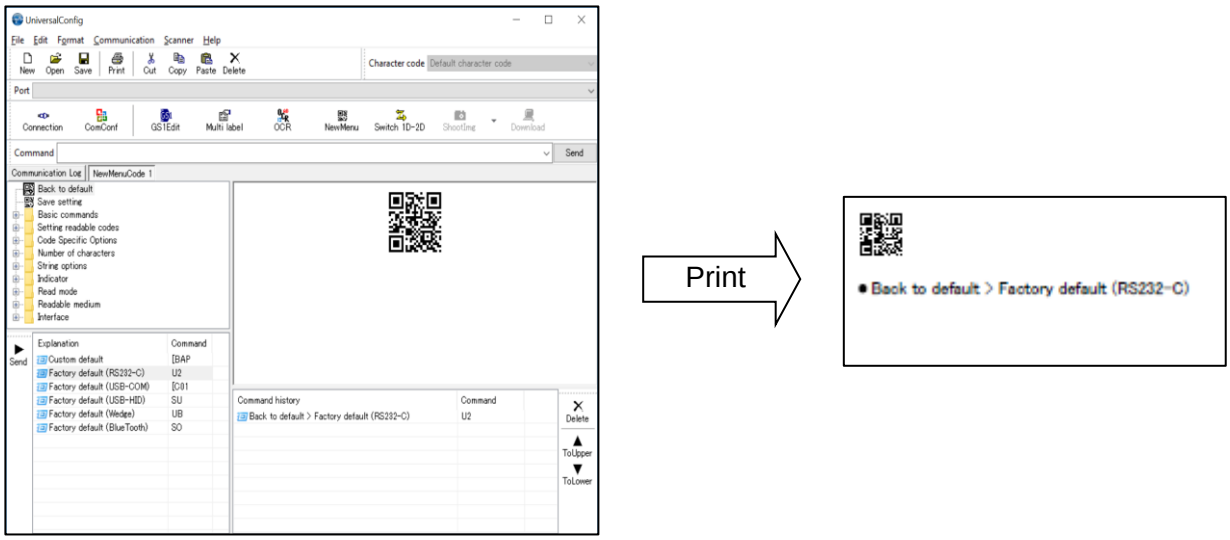


Figure **11***: Creating a 2D Menu Barcode with Opticon's "UniversalConfig."*

3.8 Forced Initialization

If the scan engine is unresponsive, you can force the scan engine to initialize.

Note: When initialization is forced, data read by the scan engine is not sent to the host device.

Force the Scan Engine to Initialize

1. Turn off the scan engine.
2. While keeping TRIGn Low, turn on the power.
3. With TRIGn low, wait for at least 10 seconds. TRIGn becomes active and the scan engine can read barcodes.

4 Interface

The scan engine supports these serial interfaces:

- UART
- USB-COM
- USB-HID

4.1 UART

UART is one of the most commonly used serial interface protocols. When using the UART interface, make sure the 12-pin FFC cable is connected to UART signals.

Caution: UART is a standard factory default setting. If the host is using a USB connection circuit, communication will fail.

4.1.1 How to Switch to UART from USB

When you change the interface to UART from USB, the configuration change persists through a firmware update.

Use one of these methods to change the serial interface to UART from USB:

- Send this command:

  [X.ZU2[X.ZZ2

- Read this 2D menu barcode:

@MENU_OPTO@ZZ@X.Z@U2@X.Z@ZZ@OTPO_UNEM@

4.1.2 UART Interface Signal

An IRISO Electronics Co., Ltd. 9681-12(12PIN) (bottom contact) equivalent connector is used.

No.	Name	Function	I/O	Conditions	State	Notes
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	VCC	Power input	In		3.3V or 5.0V	
12	Reserve		In			N.C

[*1] When this is set, Good Read LED cannot be used.

[*2] Tone and sound pressure are controlled by the pulse-width modulation (PWM) signal.

4.1.3 UART Basic Information

These are the basic UART Settings.

UART Settings

Setting	Description	Default
Transfer speed	300 to 115200 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.

To activate and save the new configuration, you need to use the Z2 command (save settings in non-volatile memory).

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

Baud Rate Commands

Command	Description	Default	Condition
K1	300bps		
K2	600bps		
K3	1200bps		
K4	2400bps		
K5	4800bps		
K6	9600bps	✓	
K7	19200bps		
K8	38400bps		
K9	57600bps		
SZ	115200bps		
[D90	230400bps		
[D91	460800bps		See **“Sending Command Packets” on page 7**.
[D92	921600bps		

4.1.5 Character Format

When data characters are transferred, a parity bit of 1 or 0 is added to each character so that the total number of 1’s in the data bits is either even (even parity) or odd (odd parity).

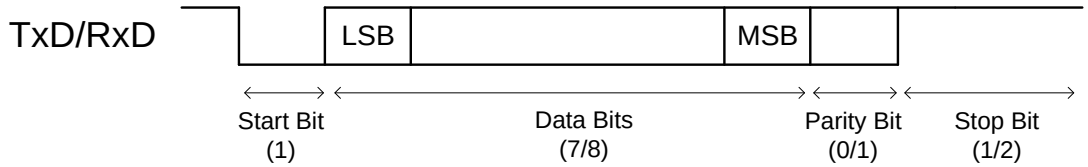


Figure ***12****: Data Character Transfer Format*

Use these commands to set the number of data bits, type of parity bit, and number of stop bits.

To activate and save the new configuration, you need to use the Z2 command (save settings in non-volatile memory).

Data Bit, Parity Bit, and Stop Bit Commands

Data, Parity, and Stop Bit	Command	Description	Default
Data bit	L0	7 data bits	
	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)

Handshaking is a communication control method.

To activate and save the new configuration, you need to use the Z2 command (save settings in non-volatile memory).

Handshaking Commands

Command	Description	Default
P0	No handshake	✓
P1	Busy/ready	
P2	Modem	
P3	ACK/NAK	
P4	ACK/NAK NO RESPONSE	

4.1.6.1 No Handshake:

The scan engine communicates regardless of the state of the host system. In this setting, the commands from the host system may not be received correctly.

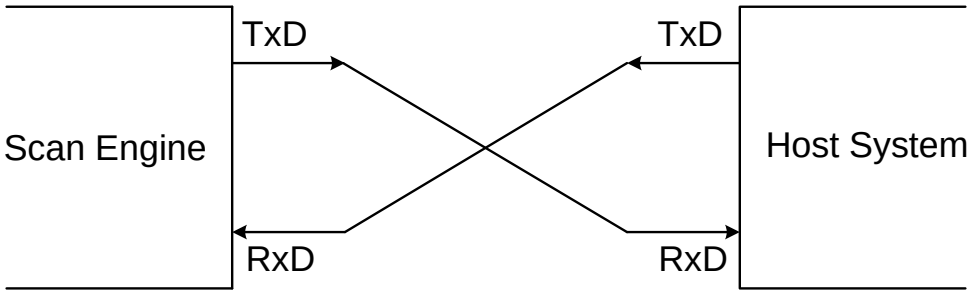


Figure **13***: No Handshake*

BUSY/READY

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

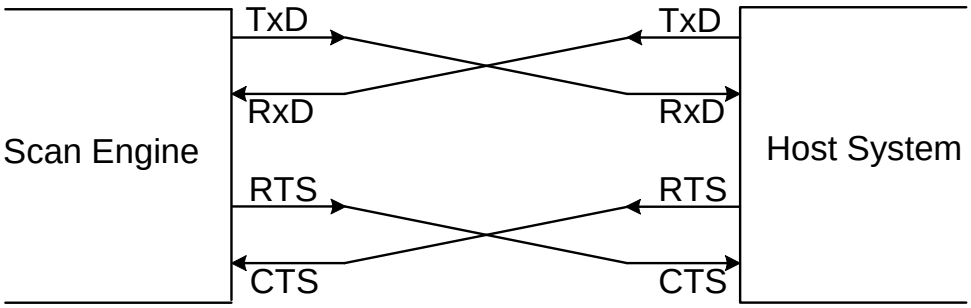


Figure **14***: BUSY/READY*

The scan engine's RTS line is normally on (ready to receive data) except when processing received data, transmitting data, and processing 1D or 2D menu barcodes. When the scan engine wants to send data, it makes sure that the host is ready to receive data by seeing if its CTS line is on. If the CTS line is off, the scan engine does not send the data and waits for a specific timeout period for the CTS line to be turned on. If the CTS line is not turned on within the specified time, the data transmission is canceled.

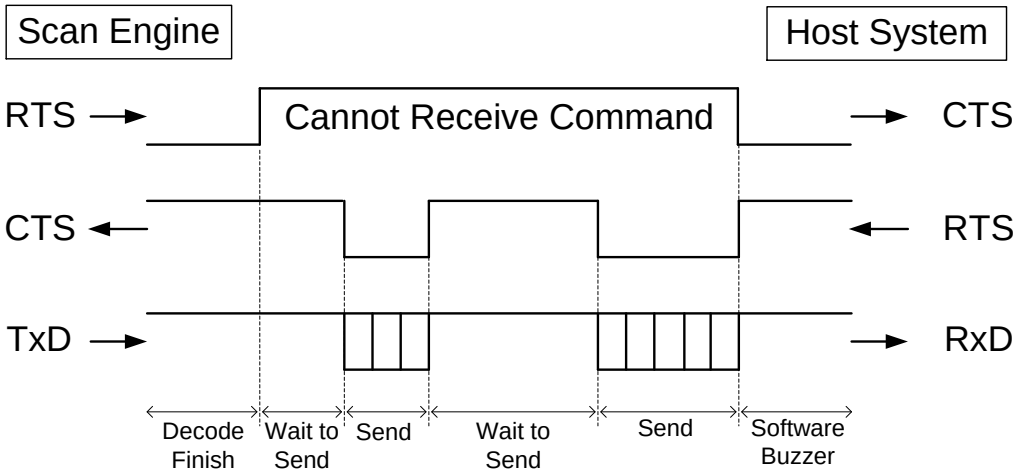


Figure **15***: RTS/CTS Data Transmission*

4.1.6.2 CTS, TxD Signal Timing

When the CTS line is pulled low during a transmission, the transmission stops. When the CTS line is pulled high again, the transmission continues.

Figure **16***: CTS, TxD Signal Timing*

To activate and save the new configuration, you need to use the Z2 command (save settings in non-volatile memory).

CTS Timeout Commands

Command	Flow Control Timeout	Default
I0	Indefinitely	✓
I1	100 ms	
I2	200 ms	
I3	400 ms	

Modem Link

As soon as power is supplied to the scan engine, the scan engine's RTS line is OFF. When the scan engine wants to transmit data to the host, it turns the RTS line ON. When the host is ready to receive data, it responds with CTS ON. While the host CTS line is ON, the scan engine is allowed to transmit data. When all data has been transmitted, the scan engine turns the RTS line OFF. In response, the host turns the scan engine's CTS line OFF. While the RTS line is ON, if the CTS line is not ON for a certain configurable period, the scan engine ends the transmission and uses the buzzer to indicate an error.

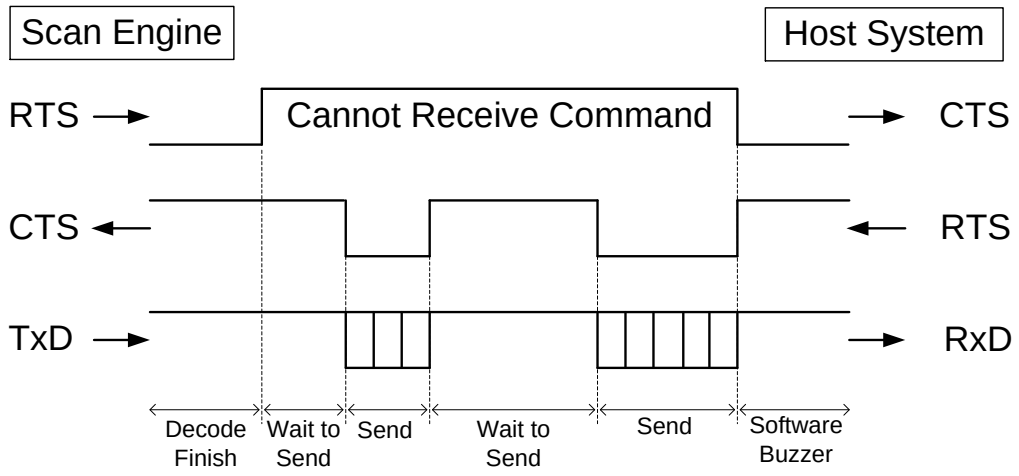


Figure **17***: Modem RTS/CTS Data Transmission*

ACK/NAK Control

In ACK/NAK mode, the scan engine transmits data and expects to receive a specific response from the host.

ACK/NAK Host Responses

Response	Description
"ACK" (ASCII:0x06)	The scan engine terminates transmission with the good read buzzer.
"NAK" (ASCII:0x15)	The scan engine sends the data again.
"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.

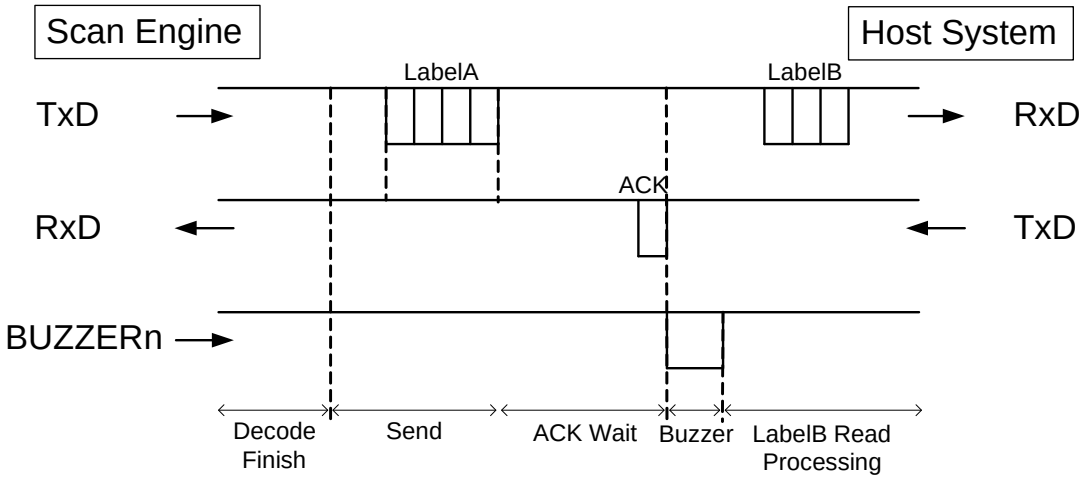


Figure **18***: ACK/NAK Transmission*

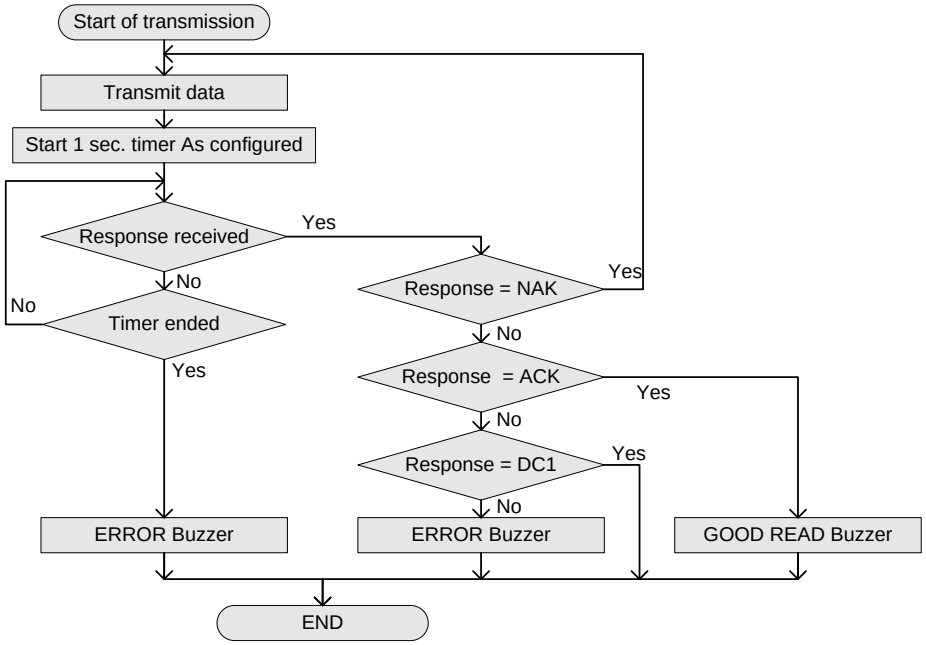


Figure **19***: ACK/NAK Flowchart*

ACK/NAK Timeout Commands

Command	ACK/NAK Timeout	Default
[XI4	Indefinitely	
[XI5	100 ms	
[XI6	500 ms	
[XI7	1 s	✓

ACK/NAK No Response

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

ACK/NAK No Response Host Responses

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

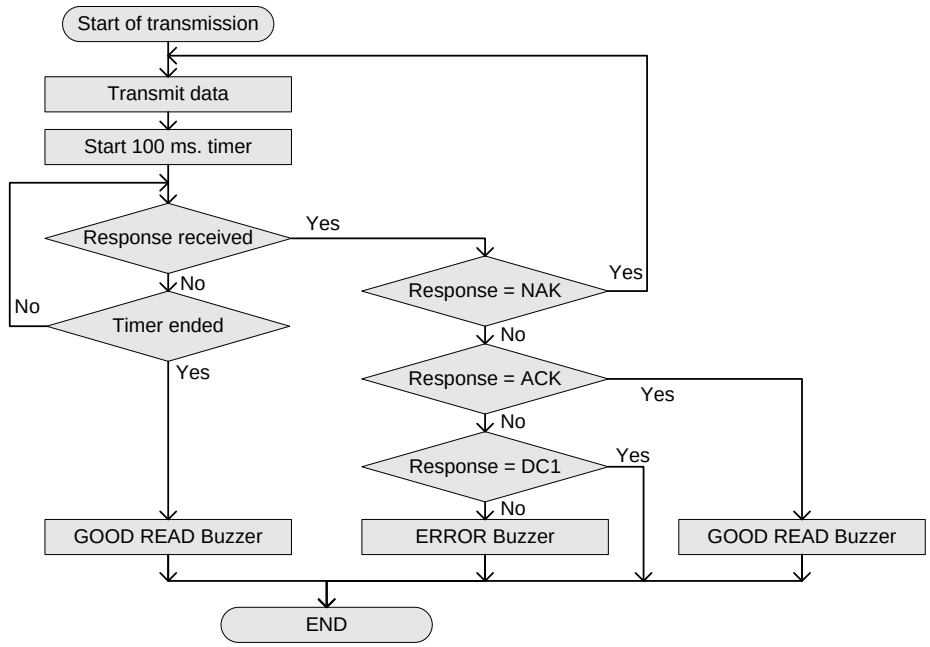


Figure **20***: ACK/NAK No Response Flowchart*

4.1.7 Inter Character Delay (UART)

Inter character delay adds a configurable delay after each transmitted character. This delay can be helpful if the host does not support flow control and is not capable of handling the received data.

To activate and save the new configuration, you need to use the Z2 command (save settings in non-volatile memory).

Inter Character Delay Commands (UART)

Command	Delay	Default
KA	No delay	✓
KB	20 ms	
KC	50 ms	
KD	100 ms	

4.1.8 Troubleshooting UART

Use this table to find possible solutions to common UART problems.

UART Troubleshooting

Problem	Possible Solutions
Cannot communicate	• Make sure communication settings, such as transfer speed and character format, are correct. • Send the Z2 command. Most communication settings do not take effect until the Z2 command is sent. • Verify the handshake setting.
No response when sending command	• Make sure communication settings, such as transfer speed and character format, are correct. • Make sure that the code to be read matches to the character code of the communication tool.
Nonsensical characters	• Make sure the communication settings are correct. • Check the line-break setting of the communication tool.

4.2 USB-COM

When using the USB-COM interface, make sure the 12-pin FFC cable is connected to the USB signals. For more information, see **“USB-COM Interface Signal” on page 28**.

Caution: UART is a standard factory default setting. If the host is using a UART connection circuit, communication will fail.

4.2.1 How to Switch to USB-COM

When you change the interface to USB-COM, the configuration change persists through a firmware update.

Use one of these methods to change the serial interface to USB-COM:

- Send this command:

  [X.Z[C01[X.ZZ2

- Read this 2D menu barcode:

@MENU_OPTO@ZZ@X.Z@C01@X.Z@ZZ@OTPO_UNEM@

4.2.2 USB-COM Interface Signal

An IRISO Electronics Co., Ltd. 9681-12(12PIN) (bottom contact) equivalent connector is used.

No.	Name	Function	I/O	Conditions	State	Notes
1	TRIGn	Trigger	In		L: Start operation	
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	VCC	Power input	In		3.3V or 5.0V	
12	Reserve		In			N.C

*1 When this is set, Good Read LED cannot be used.
*2 Tone and sound pressure are controlled by the pulse-width modulation (PWM) signal.

4.2.3 USB-COM Basic Information

These are the basic USB-COM settings.

USB-COM Settings

Setting	Description	Notes
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		Default: Valid
Remote wakeup	Used when the host system is using suspend.	
Fixed COM number	You can assign a fixed COM number.	Default: not fixed

4.2.4 Integration (USB Driver)

To connect to the PC through the USB-COM interface, you need to download and install a USB driver. If you are running Microsoft® Windows®, the driver is automatically downloaded when the host connects to the Internet. If you are running Linux, the driver should already be installed.

Download the USB Driver

1. Go to the Downloads page on the Opticon website at: **https://opticon.com/downloads/**.
2. Scroll down until you see the Software column on the right.
3. Continue to scroll until you see USB Drivers in the Software column.
4. Click **USB Drivers**. The USB Drivers Installer is downloaded.
5. Open the USB Drivers Installer application and follow the instructions.

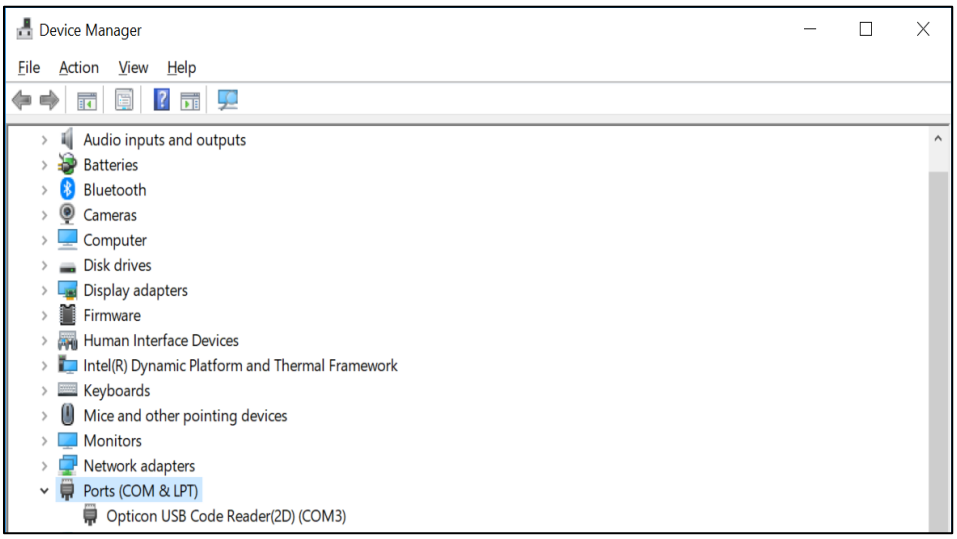
4.2.5 Connection Confirmation (USB-COM)

Before you can use the USB-COM interface, you need to confirm the connection (Windows 10).

Install the Driver and Confirm the USB-COM Connection

1. Connect the scan engine to the PC.
2. Right-click the Microsoft Windows icon and select **Device Manager**.

3. Expand **Ports (COM & LPT)**. All ports recognized by the PC are listed.



4. Make sure the Opticon USB Code Reader appears in the list of ports.

4.2.6 Fixed USB-COM Port

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

You need to reboot and initialize the scan engine to make fixed USB-COM Port settings active.

Fixed USB-COM Port Number and Driver Selection Commands

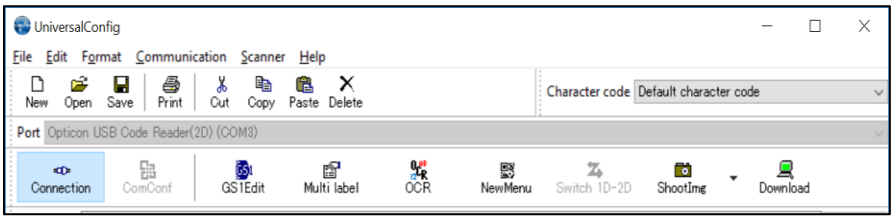
Command		Description	Default
[EGC	Q0	Do not assign a fixed COM port number.	✓
	Q1	Assign a fixed COM port number.	

4.2.7 Connection Method

After you install the driver and configure the fixed USB-COM port setting, you can connect the scan engine to the host PC.

Connect to the Host PC

1. Start the serial communications tool (emulator or UniversalConfig).
2. Connect to the COM port configured with the basic settings. For more information, see **"USB-COM Basic Information" on page 29**.



3. Send the command packet. For help, see **"Command Packet" on page 6**.

4.2.8 COM to HID Output (WIME)

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

WIME may be able to resolve issues when multi-byte characters are not correctly output with USB-HID.

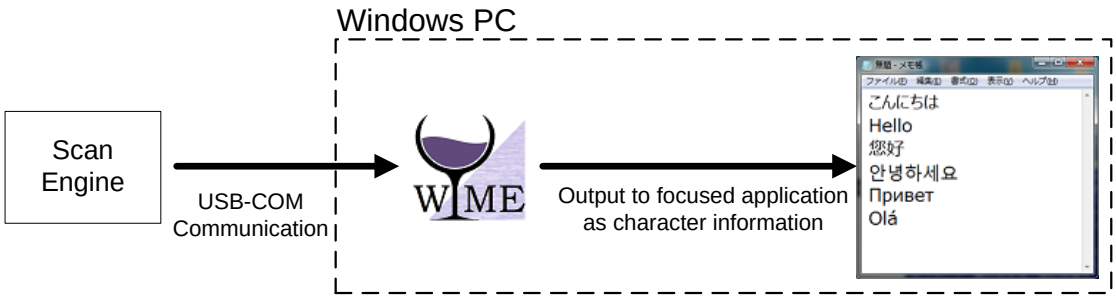


Figure **21***: COM to HID Output Through WIME*

4.2.9 Troubleshooting USB-COM

Use this table to find possible solutions to common USB-COM problems.

USB-COM Troubleshooting

Problem	Possible Solutions
Scan engine is not recognized by the PC	• Make sure the USB cable is properly connected. • Make sure that the connected USB port is operating properly. • If you are connecting to wireless devices, like Bluetooth, disconnect and reconnect to the device. • Make sure that the USB port power supply is providing enough power. Laptops or hubs may not be able to supply sufficient power. • Remove the scan engine from the USB port, and then re-connect the scan engine. • Connect the scan engine to a different port.
Scan engine does not appear in the device manager	• Try the possible solutions for the previous problem. • Open the COM port with the communication tool.
Error beep sounds and there is no output after reading a barcode	• On the PC, open Device Manager and confirm the COM port number. For help, see **"Connection Confirm" on page 29**. • Close and re-open the communication tool. For help, see the communication tool documentation. • Reboot the PC.
Characters are out of order	Make sure that the 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.

4.3 USB-HID

When using the USB-HID interface, make sure the 12-pin FFC cable is connected to USB signals.

Caution: UART is a standard factory default setting. If the host is using a UART connection circuit, communication will fail.

4.3.1 How to Switch to USB-HID

When you change the interface to USB-HID, the configuration change persists through a firmware update.

Use one of these methods to change the serial interface to USB-HID:

- Send this command:
  [X.ZSU[X.ZZ2
- Read this 2D menu barcode:

@MENU_OPTO@ZZ@X.Z@SU@X.Z@ZZ@OTPO_UNEM@

4.3.2 USB-HID Interface Signal

An IRISO Electronics Co., Ltd. 9681-12(12PIN) (bottom contact) equivalent connector is used.

No.	Name	Function	I/O	Conditions	State	Notes
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 *2
5	POWERDWN	Indicates Low Power state	Out		L: Normal 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	VCC	Power input	In		3.3V or 5.0V	
12	Reserve		In			N.C.

*1 When this is set, Good Read LED cannot be used.
*2 Tone and sound pressure are controlled by the pulse-width modulation (PWM) signal.

4.3.3 USB-HID Basic Information

These are the basic USB-HID settings.

USB-HID Settings

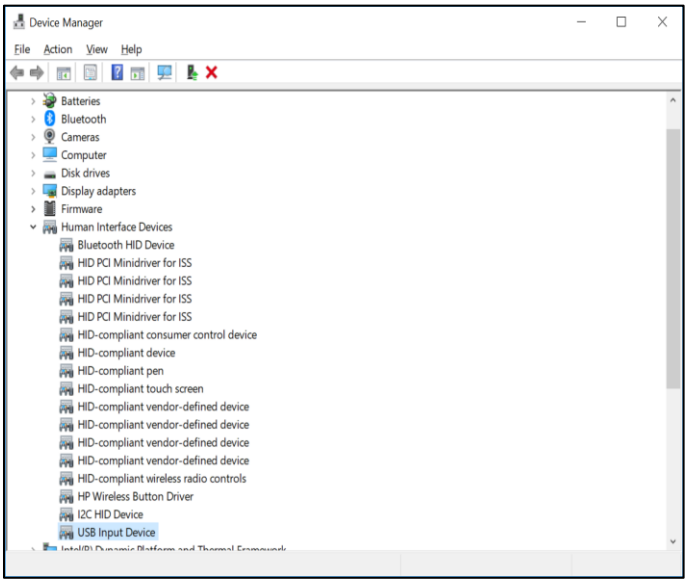
Setting	Description	Notes
USB	USB2.0 Full Speed	
Required power supply capacity	500 mA	Differs from actual power consumption.
Vendor ID	065 A	
Product ID	A001	
Num/Caps Lock control	Set when using NumLock/CapsLock	Initial value: No control
Data transmit speed	Use when outputting data with high speed.	Initial setting: 4 ms (setting range 1 ms to 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 the reading symbol encoded data.	Initial value: Do not use character code
Output mode	Set when outputting Chinese characters.	Initial value: Output as is

4.3.4 Connection Confirmation (USB-HID)

To use USB-HID, you need to connect to a PC running Microsoft Windows 10.

Confirm the USB-HID Connection

1. Connect the scan engine to the PC.
2. Right-click the Microsoft Windows icon and select **Device Manager**.
3. Expand **Human Interface Devices**. All USB-HID devices connected to the PC are listed.



4. Make sure “USB Input Device” appears in the list of devices.

4.3.5 NumLock Control and CapsLock Control

You can configure the behavior of NumLock and CapsLock when you send data.

NumLock Control and CapsLock Control Commands

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

*1 When NumLock is ON, only use the numeric keypad.
*2 Use this command when CapsLock is set to always ON. When you start transmitting data, send this command to toggle the CapsLock status. When you are finished transmitting data, toggle the CapsLock status again.
*3 CapsLock status is configured to display the original string. Use this command to return to the original CapsLock status when data transmission is complete.

4.3.6 Data Output Speed (USB-HID)

You can adjust data output speed in USB-HID by configuring the transmit interval time. Shorter times create faster output.

Note: Output speed also depends on the host system. Errors may occur if the host system cannot support the data output speed.

After you configure the data output speed, you need to reboot the scan engine to set the command.

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 Settings:

- To set the transmit interval to 1 ms (fastest), use this command:

  [E9MQ1

- To set the transmit interval to 10 ms, use this command:

  [E9MQ1Q0

4.3.7 Inter Character Delay (USB-HID)

Inter character delay adds a configurable delay after each transmitted character. This delay can be helpful if the host does not support flow control and is not capable of handling the received data.

Inter Character Delay Commands (USB-HID)

Command	Delay	Default
LA	No delay	✓
LB	1	
LC	2	
LD	3	
LE	4	
LF	5	
LG	6	
LH	7	
LI	8	
LJ	9	
LK	10	

4.3.8 Keyboard Language

You can set the keyboard language used on the host PC.

Note: Character arrangement on the keyboard depends on the country or language. If the setting is incorrect, the output results will also be incorrect.

Keyboard Language Commands

Command	Description	Code Page	Default
KE	USA	Windows 1252	✓
KV	UK	Windows 1252	
KG	German	Windows 1252	
KI	French	Windows 1252	
[BAO	French (Mac)	-	
OW	Italian	Windows 1252	
KJ	Spanish	Windows 1252	
PH	Portuguese	Windows 1252	
PL	Swiss French	Windows 1252	
PK	Swiss German	Windows 1252	
PI	Dutch	Windows 1252	
PJ	Belgian	Windows 1252	
PD	Swedish	Windows 1252	
PG	Finnish	Windows 1252	
KK	Danish	Windows 1252	
PE	Norwegian	Windows 1252	
WF	Czech	Windows 1250	
[BAY	Hungarian	Windows 1250	

Keyboard Language Commands (*continued*)

Command	Description	Code Page	Default
[BPJ	Turkish	Windows 1254	
[EF4	Russian English	Windows 1251	
[EF5	Russian Cyrillic	Windows 1251	
[BAZ	Brazilian	Windows 1252	
[E76	Chinese	Windows 1252	
[E77	Korean	Windows 1252	
[E78	Taiwanese	Windows 1252	
PM	Japanese	Shift-JIS	

4.3.9 Troubleshooting USB-HID

Use this table to find possible solutions to common USB-HID problems.

USB-HID Troubleshooting

Problem	Possible Solution
Output is not correct Characters are out of order	• Make sure the keyboard language and output destination application settings are correct. • If the host processing speed is not fast enough, add 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.
Multi-byte character is not output	Try the Windows WIME application with USB-COM. For more information, see **“COM to HID Output (WIME)” on page 30**. 
Line break is doubled	Configure 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 the device manager Scan engine unexpectedly restarts Error beep sounds and there is no output after reading a barcode	• Make sure the USB cable is properly connected. • Make sure that the connected USB port is operating properly. • Make sure that the USB port power supply is providing enough power. Laptops or hubs may not be able to supply sufficient power. • Remove the scan engine from the USB port, and then re-connect the scan engine. • Connect the scan engine to a different port.

4.4 Data Buffer Mode Common Setting

The data buffer mode setting is common to all interfaces. This setting lets you specify whether to read an object during data output.

When data buffer mode is enabled, the scan engine can perform other operations, such as barcode scanning while outputting decoded data. However, reading performance may decrease

during the data output. When buffer mode is disabled, the scan engine stops other operations until it finishes outputting decoded data.

Data Buffer Mode Commands

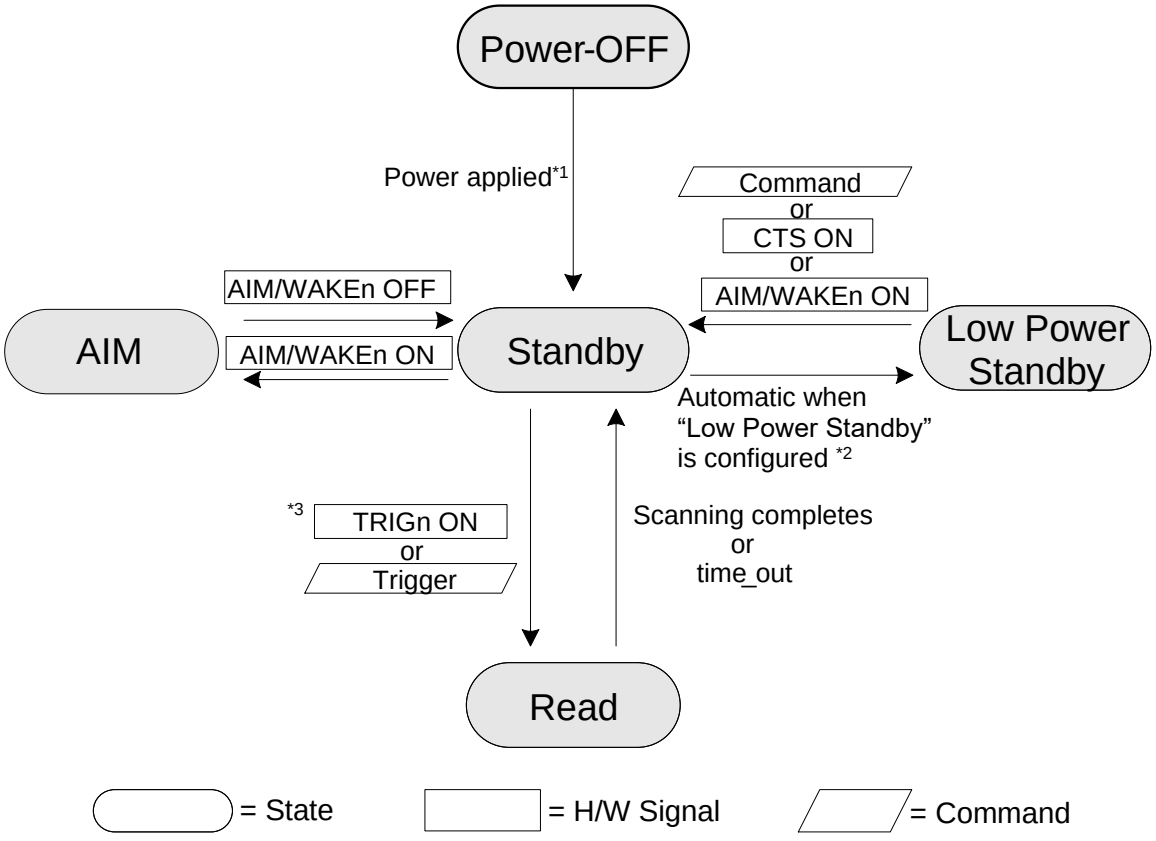
Command	Description	Default
[D80	Data buffer disable	
[D81	Data buffer enable *	✓

5 Power Management and Timing

These power management and timing configurations are available:

- Power Mode Transition
- Current Consumption
- Low Power
- Recovery from Low Power Mode
- Power ON/OFF Timing
- Read Timing

5.1 Power Mode Transition



*1 These options are available to reduce start-up time: Fast Boot and Normal Boot.
*2 When Low Power Standby is enabled, the scan engine automatically enters the Low Power state after power on.
*3 The Hardware Trigger (or Z Trigger) command moves from the Low Power state to the Read state.

Figure **22***: Power Mode Transition*

Power Mode Descriptions

Status	Description
Read	The scan engine is reading a barcode. Both the white LED and the green aiming light are on.
Standby	The scan engine is ready to read a barcode.
Low Power	The scan engine is in a low power consumption state. You can configure the amount of time the scan engine remains in standby mode before it changes to low power mode. For more information, see **"Low Power" on page 41**.
AIM	When the AIM signal is ON, the green aiming light is on.

5.2 Current Consumption

Before integrating the scan engine, make sure you are familiar with the current consumption specifications.

5.2.1 Absolute Maximum Ratings

Note: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute maximum rated conditions for extended periods of time may affect device reliability.

Item	Symbol	Rated Value	Unit
Power Supply Voltage	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	I_{PK}	-	-	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	-	I_{OP}	-	-	300	450	mA
Standby Current	Standby	0 ms	I_{STB}	-	-	26		mA
	Low Power	18 ms	I_{LOW}	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	-	I_{OP}	-	-	210	320	mA
Standby Current	Standby	0 ms	I_{STB}	-	-	23		mA
	Low Power	18 ms	I_{LOW}	Configured	-	10		mA

*1 Recovery time is time until ready to scan.

USB

[V_{CC} = 3.3V] (IF:UART, T_A = 25°C)

Item	State	Recovery Time*1	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Current	Read	-	I_{OP}	-	-	300	450	mA
Standby Current	Standby	0 ms	I_{STB}	-	-	46		mA
	Low Power	18 ms	I_{LOW}	Configured	-	28		mA
Low Power Current	Suspend	18 ms	I_{SUS}	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	-	I_{OP}	-	-	210	320	mA
Standby Current	Standby	0 ms	I_{STB}	-	-	32		mA
	Low Power	18 ms	I_{LOW}	Configured	-	20		mA
Low Power Current	Suspend	18 ms	I_{SUS}	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	-	I_{OP}	-	-	300	450	mA
Standby Current	Standby	0 ms	I_{STB}	-	-	26		mA
Low Power Current	Low Power	41 ms	I_{LOW}	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	-	I_{OP}	-	-	210	320	mA
Standby Current	Standby	0 ms	I_{STB}	-	-	20		mA
Low Power Current	Low Power	41 ms	I_{LOW}	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	-	I_{OP}	-	-	300	450	mA
Standby Current*2	Standby	0 ms	I_{STB}	-	-	28		mA
Low Power Current *2	Low Power	43 ms	I_{LOW}	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	-	I_{OP}	-	-	210	320	mA
Low Power Current	Standby	0 ms	I_{STB}	-	-	20		mA
Low Power Current*2	Low Power	43 ms	I_{LOW}	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 the USB as virtual COM (USB-COM), use this 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 the scan engine is in standby mode. When the scan engine shifts from standby mode to low power mode, all scan engine settings are retained.

5.3.1 Enable/Disable Low Power Mode

When you enable low power mode, you can configure the transition time. Transition time is the amount of time the scan engine remains in standby mode before it changes to low power mode. The default setting for transition time is 5 seconds.

Low Power Mode Enable/Disable Commands

Command	Description	Default
[XSC	Disable low power mode	✓
[EB8	Enable low power mode	

5.3.2 Transition Time

The transition time (t_1) indicates that the scan engine is in “standby mode.” After the transition time, the scan enters low power mode, and the POWERDWN signal becomes high.

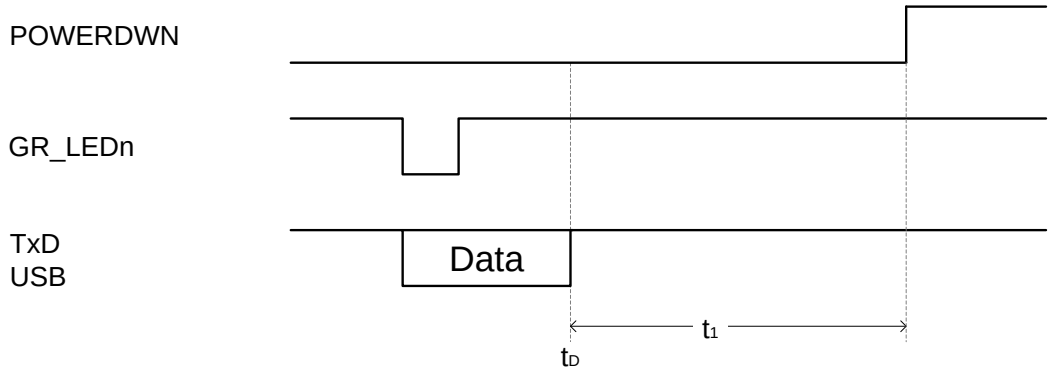


Figure **23***: Transition Time*

Low Power Transition Time Commands

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

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

Example Setting:

To enable “low power mode” and set the transition time so that the scan engine changes to low power mode from standby mode after 3 seconds, use this command:

<Esc>[EB8[EBAQ0Q0Q0Q3<CR>

Note: You should set this command when you set the Factory Default Settings. For more information, see **“How to Permanently Change the Factory Default Settings” on page 11**.

5.3.3 USB Low Power Mode Transition Condition

For the USB interface, the scan engine shifts 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. The USB bus may be moved to SUSPEND mode when successful USB communication (like reading data or command data) is not performed for a certain period of time. The USB host device manages this mode.

5.3.4 USB Selective Suspend

The USB selective suspend feature lets the hub driver suspend an individual port without affecting other ports on the hub. This feature helps conserve battery power. You can set selective suspend for USB-COM (using the USB as a virtual COM) and USB-HID (using the USB for key code input) communications.

Set Selective Suspend for USB-COM

1. Install the Opticon USB Code Reader driver Version 3.0.0.0 or later.
2. Enable USB Selective Suspend.

Set Selective Suspend for USB-HID

1. Connect the scan engine to a PC running Microsoft Windows 10. The native Microsoft HID class driver performs the HID connection.
2. To enable USB Selective Suspend, modify the registry that controls the HID class driver. For more information, go to the [Microsoft] MSDN HID USB peripherals webpage.

5.3.5 USB Low Power Mode Communication Sequence

The scan engine detects when the host shifts to SUSPEND mode and transitions to low power mode. The next diagram describes the scan engine and USB host device communication sequence.

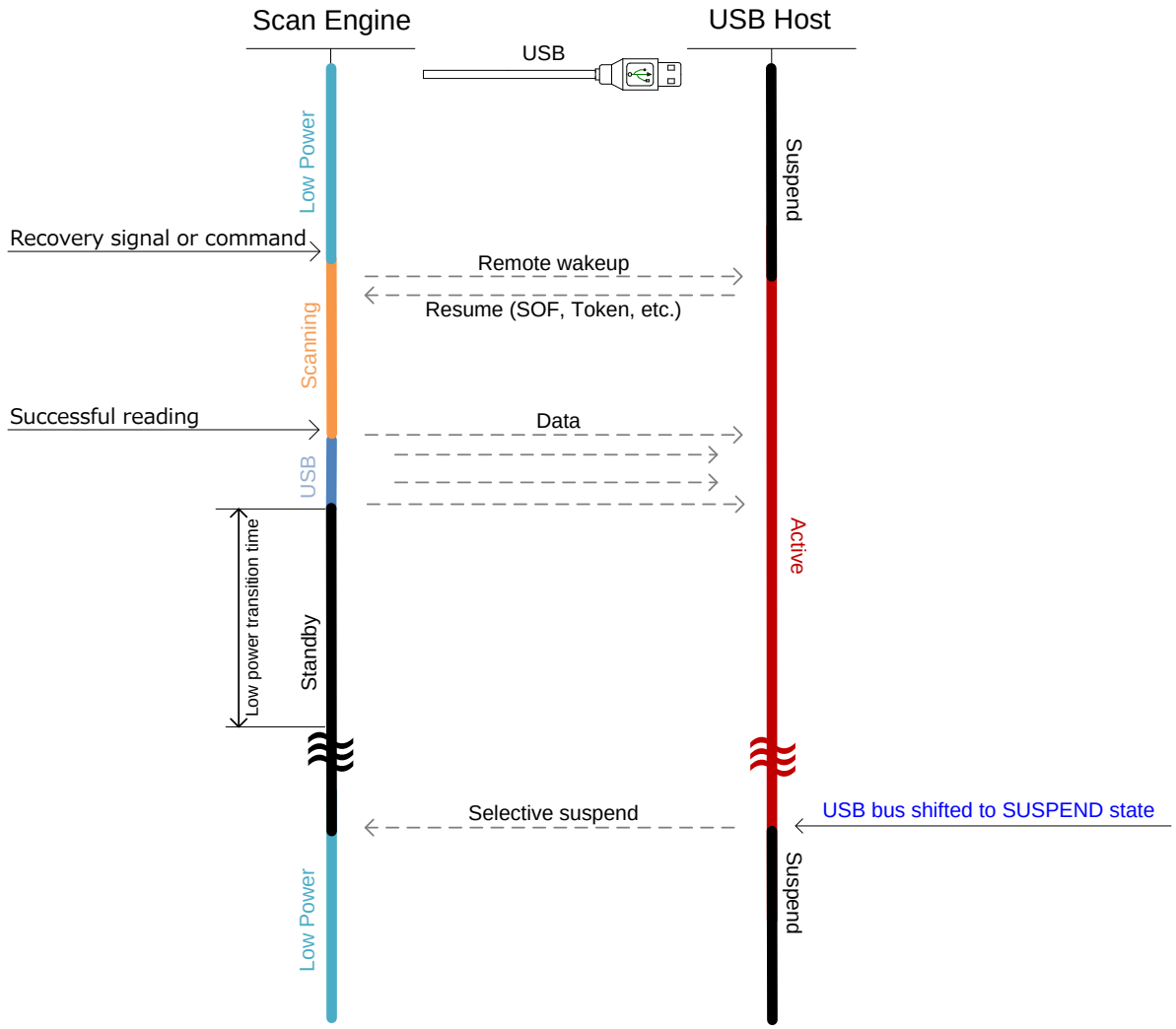


Figure **24***: USB Low Power Mode Communication Sequence*

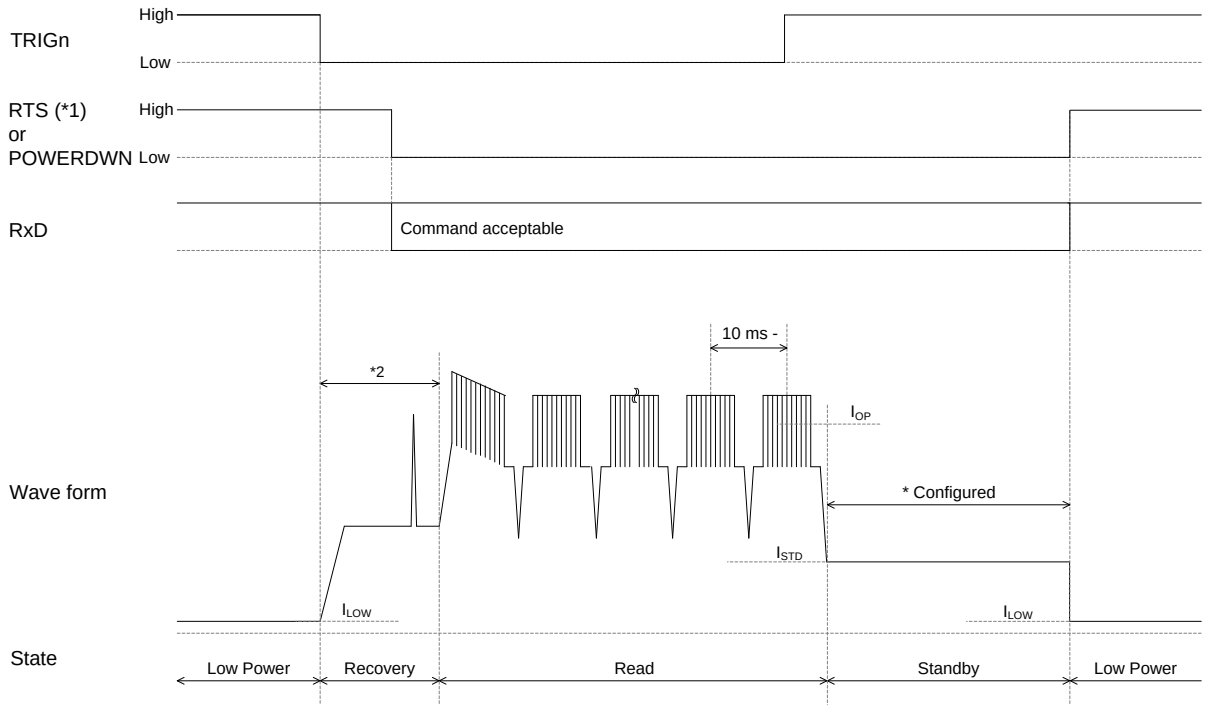
5.4 How to Recover from Low Power Mode

To recover from low power mode, you need to consider conditions such as the signal to use and timing. For more information, see **"Low Power" on page 41**.

5.4.1 Recover from Low Power Mode by Signal (UART)

You can use a signal (TRIGn, CTS, and AIM/WAKEn) to recover from low power mode.

If you need to send additional commands, they will be accepted when the RTS or POWERDOWN signal becomes low.



*1 Cannot be used when Handshaking is set to MODEM, because the RTS signal is “High.”
*2 MDI-4x00 and MDI-4x50 have different recovery times: MDI-4x00 = 18 ms, MDI-4x50 = 41 ms.

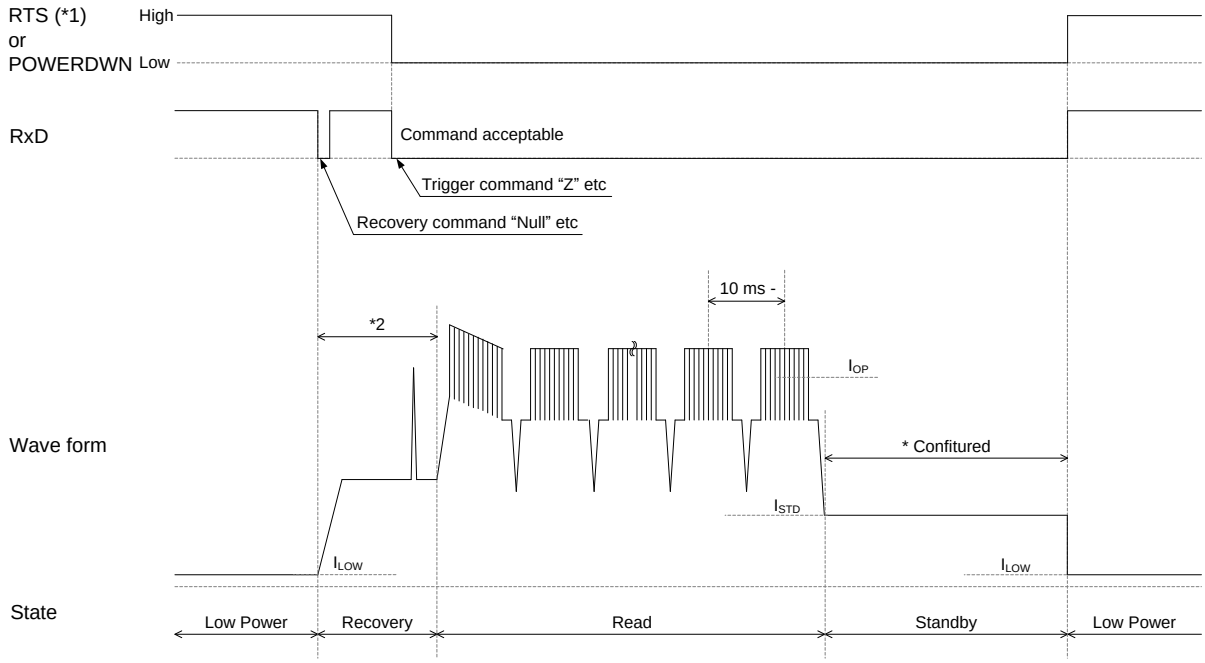
Figure **25***: Recovery Example Using TRIGn Signal*

5.4.2 Recover from Low Power Mode by Command (UART)

You can use a command to recover from low power mode.

Recover from Low Power Mode by Command

1. To start the recovery process, send dummy data, such as a NULL character.
2. Wait until the RTS or POWERDWN signal becomes low. (This should happen within 30 ms.)
3. To start reading, send the trigger command “Z”.
4. If you need to send additional commands, confirm that the RTS or POWERDOWN signal is low.



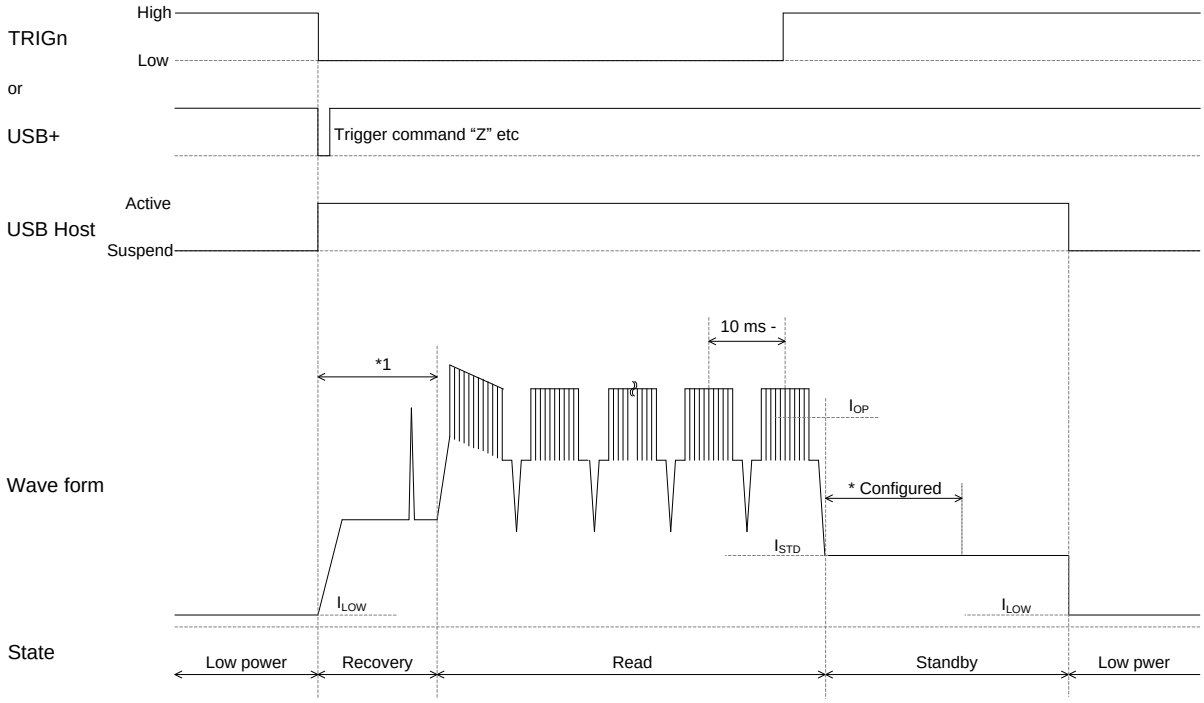
*1 Cannot be used when Handshaking is set to MODEM, because the RTS signal is “High.”
*2 The MDI-4x00 and MDI-4x50 have different in recovery times: MDI-4x00 = 18 ms, MDI-4x50 = 41 ms.

Figure ***26****: Recovery Example Using Commands*

5.4.3 Recover from Low Power Mode (USB)

You can use a signal (TRIGn, CTS, and AIM/WAKEn) or a command to recover from low power mode. Recovery starts when the host starts sending a command through USB. Approximately 43 ms after the command is sent, the scan engine becomes active and is ready to read barcodes.

Note: USB always accepts the command and changes to Active mode when it sends the command.



*1 MDI-4x00 and MDI-4x50 have different recovery times: MDI-4x00 = 18 ms, MDI-4x50 = 43 ms.

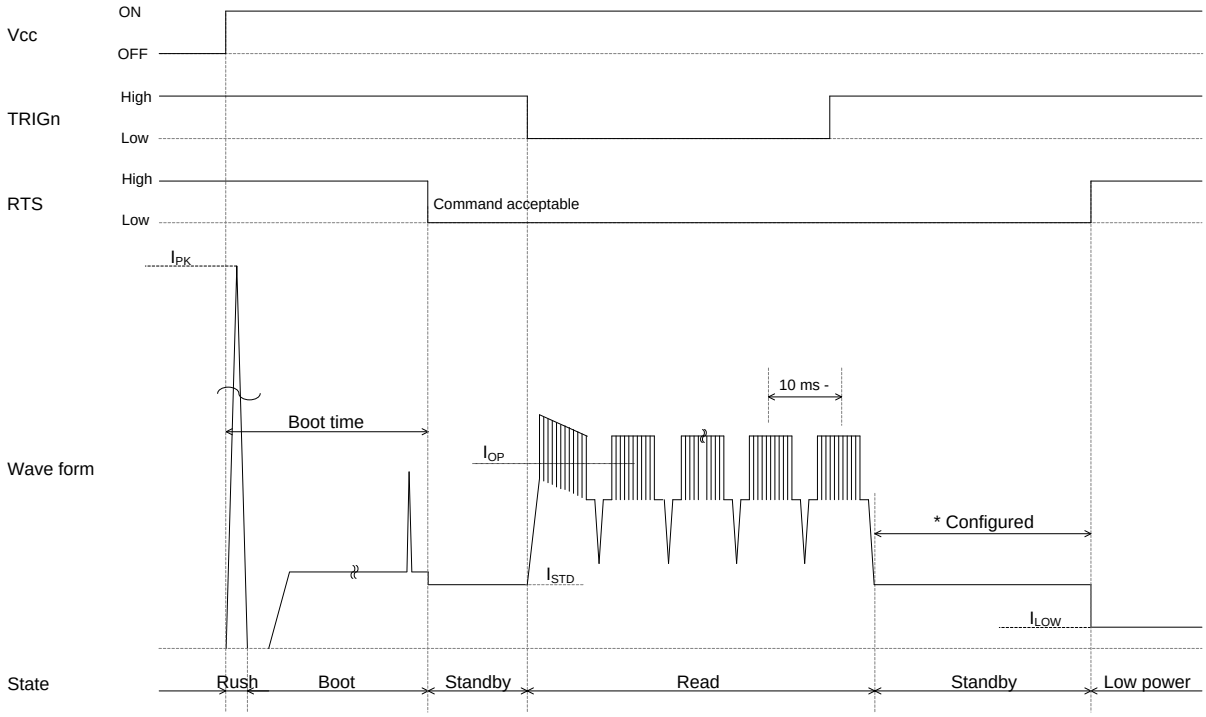
*Figure **27**: Recovery Example from Low Power Mode (USB)*

5.5 Power ON /OFF Timing

The power on/off timing of the scan engine is described below.

5.5.1 Power-On Timing

Power-on timing indicates the time from power on until barcodes are readable.



*1 Cannot be used when Handshaking is set to MODEM, because the RTS signal is “High.”

Figure **28***: Power-On Timing*

Startup Time Modes (IF:UART/USB V_{CC} = 3.3V/5.0V TA = 25°C)

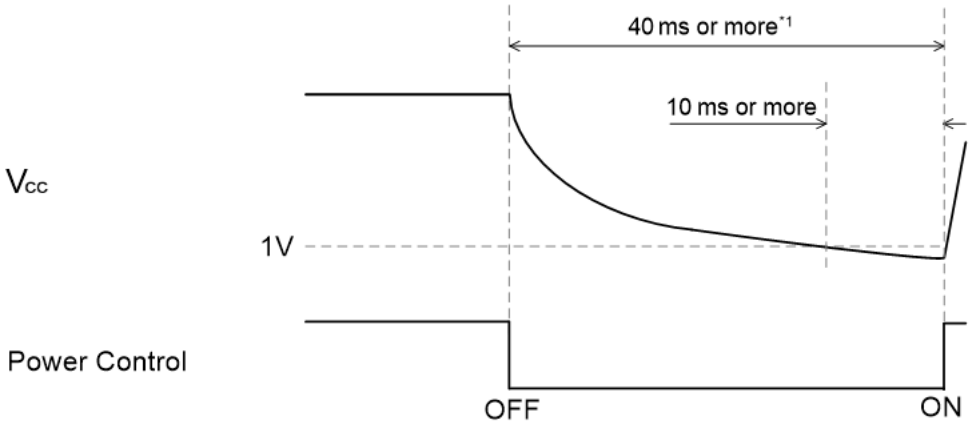
Mode	Condition	Min.	Typ.	Max.	Unit
Normal Boot		-	510	-	ms
Fast Boot Mode	Configured*		425	-	ms

* For more information, see **“Fast Boot Mode” on page 12**.

5.5.2 Power-Off Timing

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

When power to the scan engine is turned off (V_{CC} of 1V or less), you need to wait at least 10 ms before turning on the power again.



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

Figure **29***: Power-Off Timing*

When saving scan engine configurations, settings are stored in the scan engine:

- when the Z2 command is sent.
- after 1D or 2D menu barcodes are processed.

Writing these settings to flash memory 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 "ACK/NAK for serial command" is enabled, the scan engine sends an ACK after saving the configuration data.

5.6 Read Timing

This diagram illustrates the read timing of the scan engine.

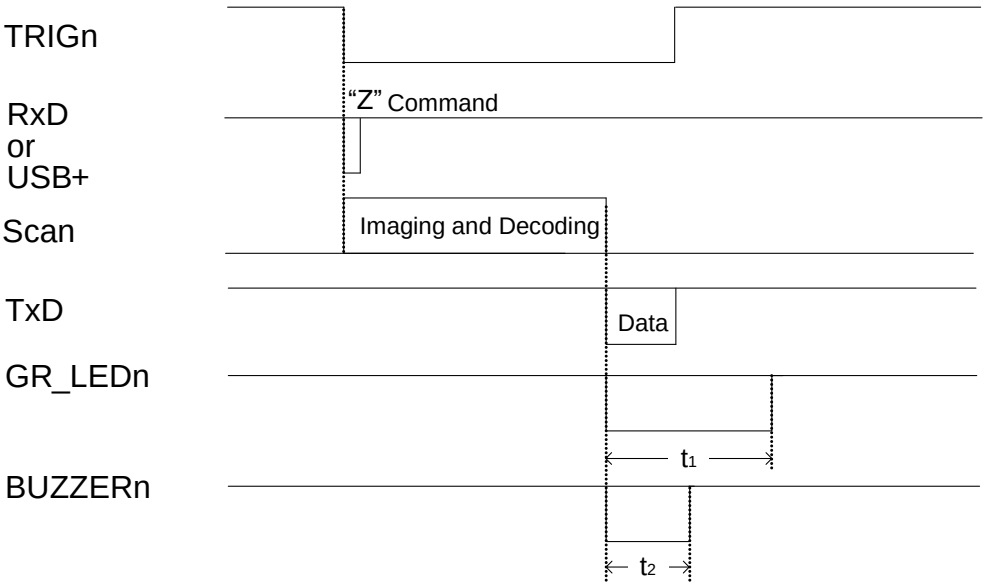


Figure **30***: Read Timing*

Read Timing Symbol Descriptions

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

*1 You can configure the GR_LEDn signal period. For more information, see **"Good Read LED" on page 99**.
*2 You can configure the BUZZERn signal period. For more information, see **"Buzzer" on page 97**.

5.6.1 Read Time

Read time sets the amount of time for one readout operation. The operation starts when 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 Time Setting Commands

Command	Description	Notes
Y0	Trigger signal synchronization or "Z" "Y" command control	✓
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	
YL	Read time infinite	
YM	Read time 10 times	

* When auto trigger is enabled and read time is set to "Y0," the read time is automatically set by image processing.

5.6.2 Trigger Signal Control

By default, the TRIGn signal determines the read time. When the TRIGn signal is low, the scan engine reads a barcode.

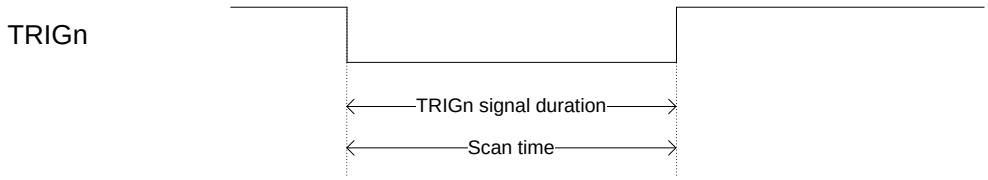


Figure **31***: Trigger Signal Control*

When read time is set, you can also set the start time. For more information, see the previous section, **"Read Time" on page 49**.

Read Time Start Time Commands

Command	Description	Default
+O	Start from TRIGn signal end	✓
+P	Start from TRIGn signal start	

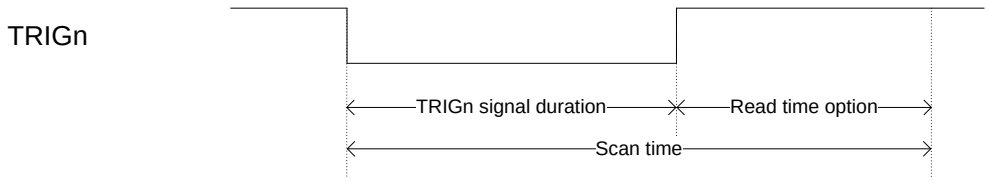


Figure **32***: Start from TRIGn Signal End*

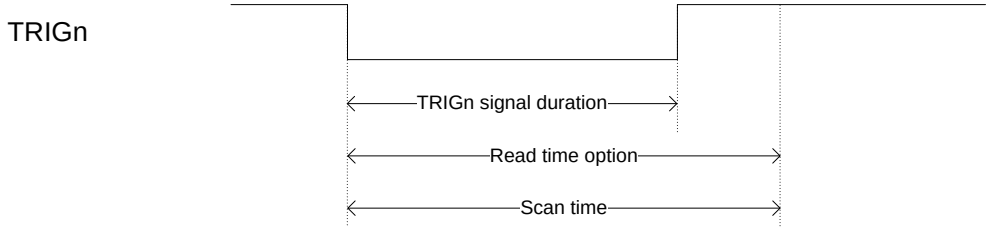


Figure **33***: Start from TRIGn Signal Start*

5.6.3 Command Trigger Control

To read a command, start reading by sending the “Z” command and stop reading by sending the “Y” command.

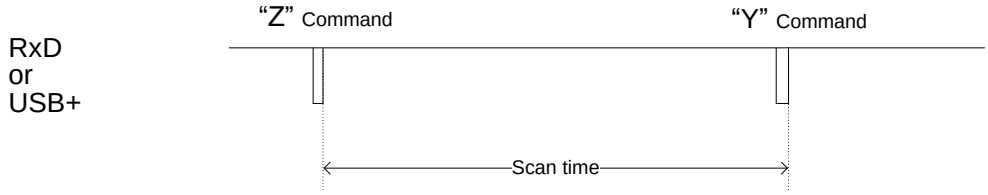


Figure **34***: Command Trigger Control*

The scan engine stops reading a barcode when the read time elapses. You can also stop the scan engine from reading a barcode by sending the “Y” command.

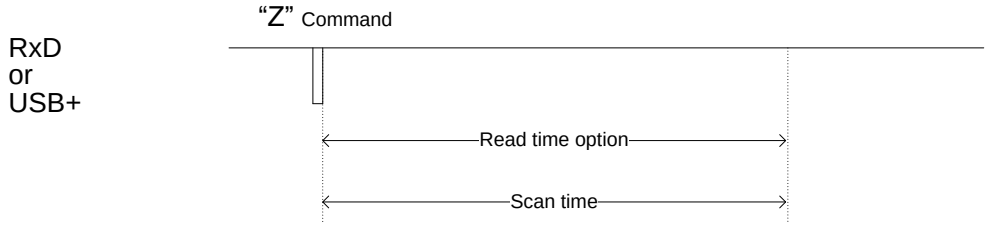


Figure **35***: Command Trigger Control with Effective Read Time*

5.6.4 Trigger Delay

Set the Trigger Delay to start reading after a specified period of time.

Trigger Delay Commands

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

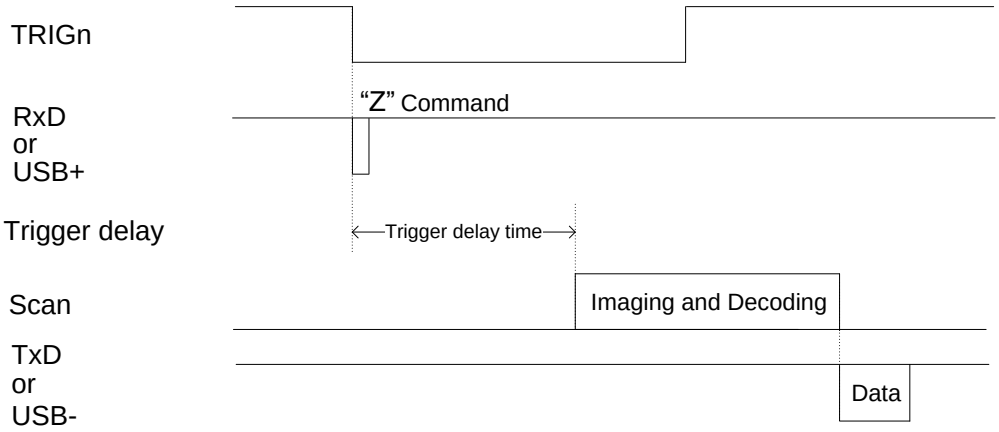


Figure **36***: Trigger Delay Timing*

6 Barcode Options

Barcode options for the scan engine let you configure the enabled code types, code specific options, and the number of characters to read. These settings do not affect reading 1D menu barcodes.

Note: For best reading performance, only enable the barcodes you need.

6.1 How to Set Readable Barcodes

The next tables show the supported symbologies and their configuration commands. These options are available for the Enable/Disable command:

- Single: Only the specified symbology is enabled. All other symbologies are disabled.
- Multiple: The specified symbology is enabled in addition to the symbologies that are already enabled.
- Disable: The specified symbology is disabled. All symbologies that are already enabled remain enabled.

1D Barcodes

Symbology	Enable/Disable Command			Default					
	Single	Multiple	Disable	Enable	Mini Length	Positive Negative Image	ST/SP Transmission	Check Digit	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 2of 5	J7	R7	[X4K	✓	5		-	×	
Interleaved 2of 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		-	×	

* For more information about how to convert Code 128 to GS1 128, see **"GS1 Conversion" on page 55**.

6.1.1 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		

6.1.2 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		✓	

* For more information about how to convert GS1, see **"GS1 Conversion" on page 55**.

6.1.3 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 -B CC-A UPC -B CC-B			✓	

* For more information about how to convert GS1, see **"GS1 Conversion" on page 55**.
* When composite EAN or composite UPC is enabled, EAN or UPC only cannot be read.

6.1.4 2D Barcodes

Symbologies	Enable/Disable Command			Default	
	Single	Multiple	Disable	Enable	Suffix
PDF417	[BC3	[BCF	[BCR	✓	USB-HID " ENTER" USB-COM UART " CR"
Micro PDF417	[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	✓	
Aztec Code	[BC5	[BCH	[BCT	✓	
Aztec Runes	[BF4	[BF2	[BF3		
Chinese-sensible code	[D4K	[D4L	[D4M		
Maxi Code	[BC2	[BCE	[BCQ		

* For more information about how to convert GS1 QR and GS1 Data Matrix, see **"GS1 Conversion" on page 55**.

6.1.5 Other Options for Barcodes

Symbologies	Single	Multiple	Disable	Notes
All barcodes (1D, 2D)	A0		B0	Excluding add-on
All 1D barcodes	[BCA	[BCM	[BCY	Including add-on
All 2D barcodes	[BCB	[BCN	[BCZ	*1, *2

*1 PDF417, Codablock F, QR Code, Data Matrix (ECC 200), Maxi Code, Micro PDF417, Aztec Code, Composite code, Aztec Runes, Micro QR, and Chinese-sensible code.

*2 When "ALL 2D barcodes" is enabled, a link flag is enabled and only UPC/EAN cannot be read.

6.1.6 OCR Barcodes

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
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		

* ICAO travel documents can be read regardless of the image direction because the format is fixed.

To free edit the standard OCR font and read barcodes, see **"Optical Character Recognition" on page 59**. For advanced settings, see the "Data Edit Programing Manual."

6.2 Setting Code Common Options

6.2.1 GS1 Conversion

The GS1 organization has defined fields (such as a serial number, production date, and price) that may be encoded in a barcode. These fields are identified by an application identifier (AI) followed by the data for that field. For example, the number 11 followed by 200213 is a production date (11) of 2002, February 13 (200201 in the format YYMMDD).

The data for an AI does not always have a fixed length. In these cases, a Group Separator (GS) or 0x1D is added after the variable data field. The GS character is not printable, but the MDI-4100 has several options to convert the GS character to a printable character. By default, GS characters are not transmitted, but you can enable sending these characters with or without conversion.

Additionally, the GS1 organization has defined a function 1 character (FNC1). Each GS1-128 barcode starts with this character. Like the GS character, FNC1 is not printable. FNC1 is also not an ASCII character. By default, this character is not output. But, you can output it as the sequence]C1, which is the AIM identifier for GS1-128.

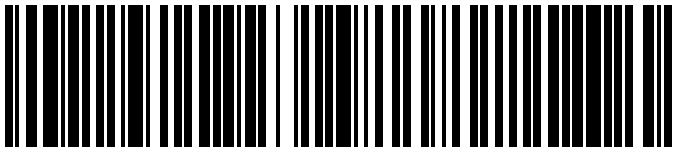
Example of the structure of a GS1-128 barcode:

FNC1	AI	AI Data (Fixed)	AI	AI Data (Variable)	GS	...	AI	AI Data

Note: If the last field contains variable length AI data, the GS character is omitted.

Example with actual data:

FNC1	01	95012345678903	3103	000123
Start	Global trade item	14-character data Trade item is 14 digit long	AI	6-character data



(01)95012345678903(3103)000123

Except for the fact that other GS1 barcodes (such as GS1 Databar) do not start with a FNC1 character, the structure is the same.

GS1 Conversion Commands

GS1 Conversion Supported Symbologies	Command	Command Description	Initial Setting
GS1-128 GS1 DataBar GS1 DataBar Composite GS1 Data Matrix GS1 QR Code	[X/0	Disable GS1 conversion	✓
	[X/2	Enable GS1 conversion 2	
	[X/4	Enable GS1 conversion 4	

Disable GS1 conversion: Both the FNC1 character and the GS character are not transmitted. The previous example would produce this output:
019501234567890331030000123

Enable GS1 conversion 2: Braces are put around the AI identifiers, similar to human-readable text under a barcode. The previous example would produce this output:
(01)95012345678903(3103)000123

Enable GS1 Conversion 4: Converts the FNC1 character as the AIM identifier and transmits the GS characters. If the interface is set to USB-HID, the GS characters are transmitted as <CTRL>]:
]C1019501234567890331030000123

You can create more complex conversions of GS1 barcodes with Opticon's "UniversalConfig" program by completely defining how the various application identifiers and data are output.

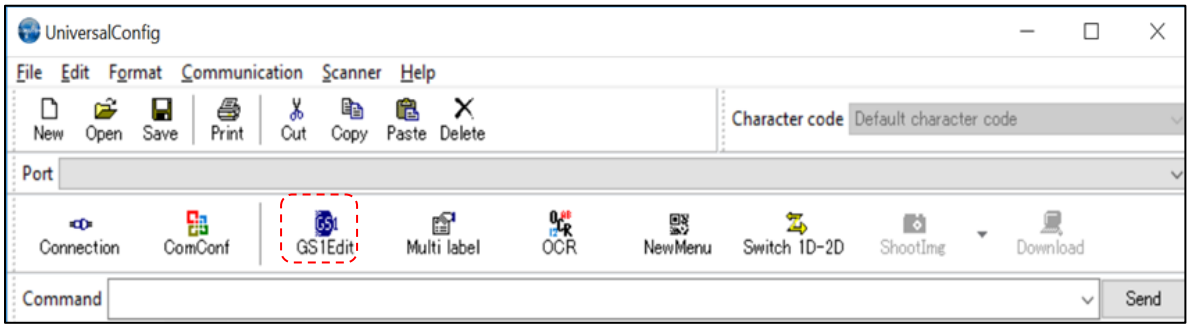


Figure **37***: GS1 Edit Feature in Opticon's "UniversalConfig"*

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

Barcodes are typically printed in black on a white background and are called normal or positive barcodes. But, sometimes they are printed in white on a black background, which are called negative barcodes.

Positive Image of Code 128 Negative Image of Code 128

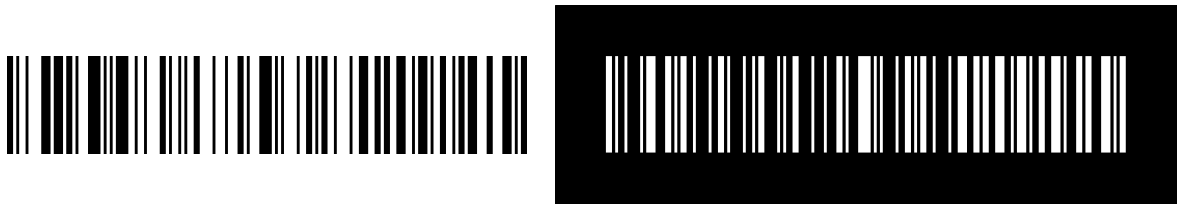


Figure **38***: Positive and Negative Barcode Images*

1D Positive and Negative Barcode Commands

Command		Description	Default
[DLA	Q0	Decode positive barcodes only.	✓
	Q1	Decode negative barcodes only.	
	Q2	Decode positive barcodes and negative barcodes.	

* For best reading performance, only enable the barcodes you need.

6.2.3 Quiet Zone (1D Code Common)

The quiet zone is the blank margin on either side of a barcode that tells the scan engine where the barcode starts and stops. You can configure the scan engine to decode barcodes that have smaller start or end margins than specified for the symbology.

Note: Only use smaller margin checks when necessary. This option may increase the possibility of partial and ghost reads.

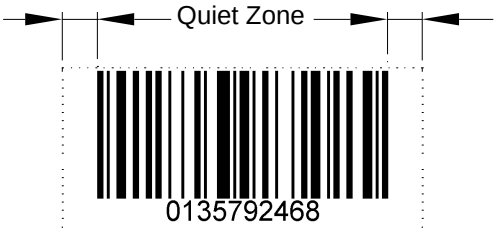


Figure **39***: Quiet Zone*

Margin Check Commands

Command	Description	Default
YN	No margin check	
YO	Margin check 1/7 nominal	
YP	Margin check 2/7 nominal	
YQ	Margin check 3/7 nominal	
YR	Margin check 4/7 nominal	
YS	Margin check 5/7 nominal	
YT	Margin check 6/7 nominal	
YU	Margin check nominal	✓

6.2.4 Redundancy (1D Code Common)

When redundancy is enabled, a 1D code must be scanned and decoded multiple times with the same result before it is considered correctly decoded. The redundancy count is the number of times the 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. With high-quality printed barcodes, the default redundancy setting is adequate.

Note: This setting only affects reading 1D barcodes.

Redundancy Commands

Command	Description	Default
X0	Read 1 time, redundancy = 0	
X1	Read 2 times, redundancy = 1	
X2	Read 3 times, redundancy = 2	✓
X3	Read 4 times, redundancy = 3	
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

When you scan one of these UPC/EAN barcodes, the scan engine searches for a valid UPC/EAN add-on code for a specified length of time:

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

The behavior of the scan engine depends on whether it finds a valid add-on code:

- If a valid add-on code is found, the scan engine immediately sends the data.
- If there is no add-on code, the scan engine sends the data without the add-on.
- If the add-on code is not valid, the scan engine ignores the code.

You can configure the length of time that the scan engine searches for a valid UPC/EAN add-on code.

Add-On Waiting Time Commands

Command	Description	Initial Setting
XA	Add-on waiting time disabled	
XB	Add-on waiting time: 0.25 seconds	
XC	Add-on waiting time: 0.50 seconds	✓
XD	Add-on waiting time: 0.75 seconds	

6.2.6 ECI Protocol Output

Lets you determine whether to output data for ECI (Extended Channel Interpretation) protocol. ECI is an embedded piece of information in a barcode that tells the scan engine details about the references used to encode the data in the symbol. The scan engine uses this information to automatically select matching options to decode the symbol. ECI protocol is supported in these 2D barcodes: QR Code, Data Matrix, Aztec Code, and Maxi Code.

The ECI protocol output is indicated with a backslash, a 6-digit number, and two backslashes.

If you do not want to output data for ECI protocol, change the AIM ID from ECI protocol implemented to ECI protocol not implemented, delete the 6-digit number, and replace the two backslashes with one backslash.

Output example:

```
Output data for ECI protocol:        ]Q2\000001test\\test
Do not output data for ECI protocol: ]Q1test\test
*Backslash: '\'
```

ECI Protocol Output Commands

Command	Description	Default
[DLE	Do not output ECI protocol	✓
[DLF	Output ECI protocol	

6.2.7 Optical Character Recognition

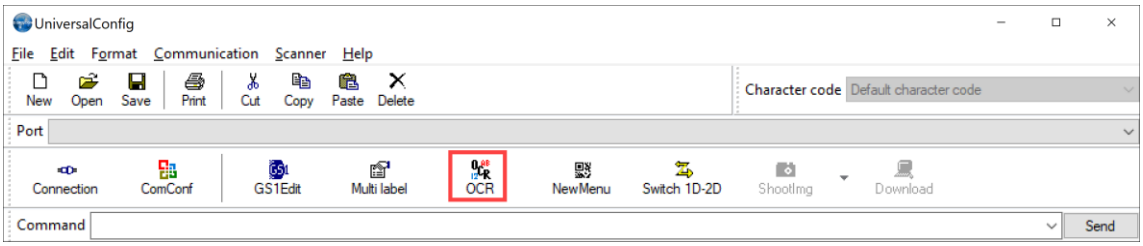
You can configure the scan engine to use Optical Character Recognition (OCR) to identify a specific pattern of characters in a barcode.

You can set up to 2 rows of characters containing up to 40 digits. For each digit, you can specify one of these types of characters:

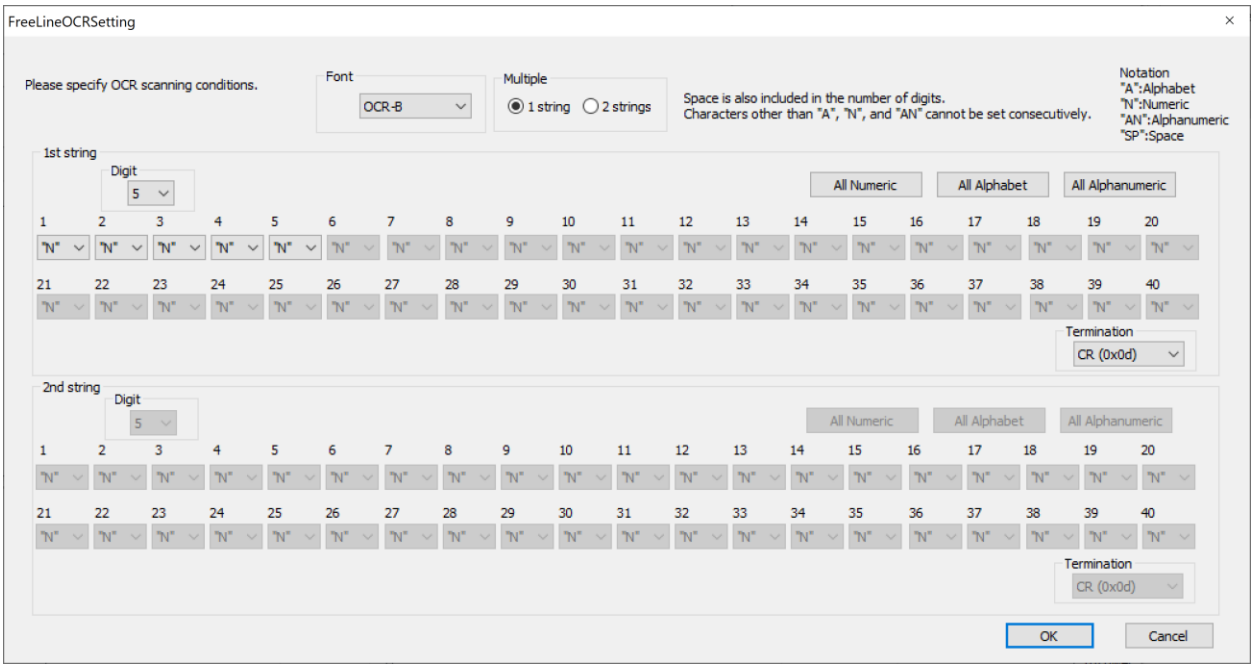
- "A": alphabetic character (letter)
- "N": numeric character (number)
- "AN": alphanumeric character (letter or number)
- "SP": space
- One of these symbols: !"#$%&'()*+,-./:;⇔?@[\]^_`{|}~
  Those are ASCII 33 ~ 47, 58 ~ 46, 91 ~ 96 and 123~126

Configure OCR

1. Start the Opticon UniversalConfig application and click **OCR**.



2. Configure the appropriate OCR settings, and click **OK**.



3. Scan the configuration barcode.

Note: For advanced settings, see the “Data Edit Programing Manual”. To configure settings that cannot be set, contact your local Opticon Representative.

6.3 How to Set Code-Specific Options

6.3.1 UPC

UPC (which technically refers to UPC-A) is a barcode developed in the 1970s by the United States Uniform Code Council Inc. UPC is mainly used in the distribution industry to scan trade items at the point of sale.

6.3.1.1 UPC-A Settings

UPC-A settings include a character set, number of digits, and a check digit (CD) method.

UPC-A Settings

Setting	Options
Character set	Numeric (0 - 9)
Number of digits	12 digits (11 digits plus a 1-digit CD) fixed length
CD method	Modulus 10/Wait 3

UPC-A Transfer Data Format

Digit	Description
Leading "0"	Yes
Data	11 digits
CD	1 digit

* To make the format compatible with JAN/EAN-13, set Data to 13 digits, which transfers a leading “0” and CD. For more information, see “

UPC-A CD Transfer/Front “0” Transfer” on page **62**.

6.3.1.2 UPC-A Add-On 2 Digits/5 Digits

UPC-A Add-On 2 Digits/5 Digits is a UPC-A barcode with an additional 2-digit or 5-digit barcode to the right of the main barcode. When add-on digits are enabled, the add-on code must be within the reading range for the barcode to be successfully read. If the add-on code is not within the reading range, after an add-on waiting time the scan engine reads the barcode as UPC or EAN.

Note: Reading response decreases when add-on digits are enabled and only UPC or EAN barcodes are read.

UPC-A Add-On 2 Digits Transfer Data Format

Digit	Description
Leading "0"	Yes
Data	11 digits
CD	1 digit
Add-On	2 digits

UPC-A Add-On 5 Digits Transfer Data Format

Digit	Description
Leading "0"	Yes
Data	11 digits
CD	1 digit
Add-On	5 digits

6.3.1.3 UPC-A CD Transfer/Front "0" Transfer

Lets you determine whether to transmit a leading "0" and a check digit (CD). Because the 13-digit transfer data format transfers a leading "0" and a CD, the format is compatible with JAN/EAN-13.

6.3.1.4 UPC-E Settings

UPC-E settings include a character set, number of digits, and a check digit (CD) method.

UPC-E Settings

Setting	Options
Character set	Numeric (0 - 9)
Number of digits	7 digits (6 digits plus a 1-digit CD) fixed length
CD method	Modulus 10/Wait 3

UPC-E Transfer Data Format

Digit	Description
Leading "0"	Yes
Data	6 digits
CD	1 digit

6.3.1.5 UPC-E Add-On 2 Digits/5 Digits

UPC-E Add-On 2 Digits/5 Digits is a UPC-E barcode with an additional 2-digit or 5-digit barcode to the right of the main barcode.

UPC-E Add-On 2 Digits Transfer Data Format

Digit	Description
Leading "0"	Yes
Data	6 digits
CD	1 digit
Add-On	2 digits

UPC-E Add-On 5 Digits Transfer Data Format

Digit	Description
Leading "0"	Yes
Data	6 digits
CD	1 digit
Add-On	5 digits

6.3.1.6 UPC-E CD Transfer/Front "0" Transfer

Lets you transmit a leading "0" and a check digit (CD). Because the 8-digit transfer data format transfers a leading "0" and CD, the format is compatible with JAN/EAN-8.

6.3.1.7 UPC-A/UPC-E Format and Transfer Commands

Use these commands to format and transfer UPC-A/UPC-E data.

UPC-A/UPC-E Format and Transfer Commands

Code	Setting	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 digits	
		R3	Enable UPC, add-on 5 digits	
		[X4D	Disable UPC, add-on 5 digits	✓
UPC-E	UPC-E leading zero CD transmission	E6	UPC-E, leading zero, transmit CD, 8 transfer digits	
		E7	UPC-E, no leading zero, transmit CD, 7 transfer digits 7	✓
		E8	UPC-E, leading zero, do not transmit CD, 7 transfer digits	
		E9	UPC-E, no leading zero, do not transmit CD, 6 transfer digits	
	UPC-A, E conversion	6Q	Transmit UPC-E	✓
		6P	Transmit as UPC-A	

* You can also transfer the setting to UPC-A format.

6.3.2 EAN/JAN

The European Article Numbering (EAN) system (also known as International Article Number) and the Japanese Article Numbering (JAN) system are members of the UPC barcode family.

EAN-13 is used world-wide to automatically identify retail products. In the USA, retail scanning systems have been required to read EAN-13 since 2005.

The EAN and JAN symbologies are identical, except that JAN uses a country code in the range of 490 to 499, which indicates that the manufacturer was registered in Japan.

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

EAN/JAN-13 Settings

Setting	Options
Character set	Numeric (0 - 9)
Number of digits	13 digits (12 digits plus a 1-digit CD) fixed length

EAN/JAN-13 Transfer Data Format

Digit	Description
Data	12 digits
Check Digit (CD)	1 digit

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

EAN/JAN-13 Add-On 2 Digits/5 Digits is an EAN/JAN-13 barcode with an additional 2-digit or 5-digit barcode to the right of the main barcode. When add-on digits are enabled, the add-on code must be within the reading range for the barcode to be successfully read. If the add-on code is not within the reading range, after an add-on waiting time the scan engine reads the barcode as UPC or EAN.

Note: Reading response decreases when add-on digits are enabled and only UPC or EAN barcodes are read.

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

Digit	Description
Data	12 digits
CD	1 digit
Add-On	2 digits

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

Digit	Description
Data	12 digits
CD	1 digit
Add-On	5 digits

EAN/JAN-13 CD Transfer

Lets you configure the EAN/JAN-13 CD.

EAN-13 Forced Add-On

You can enable EAN-13 Forced Add-On so that EAN-13 barcodes with specific leading 3-digits (378/379/529/414/419/434/439/977/978) are not read.

Note: An EAN-13 barcode that has leading 3-digits does not have add-on digits.

ISBN Conversion

When ISBN conversion is enabled, EAN-13 data with a leading “978” or “979” is converted. To re-calculate the CD, ISBN conversion removes the leading 3 digits and outputs the remaining 10 digits. If the CD is 10, ISBN conversion outputs “X.”

ISBN Conversion Examples:

- ISBN conversion of EAN-13 “9791230671184” removes “979” and outputs “1230671184.”
- ISBN conversion of EAN-13 “9780123782830” removes “978”, changes the CD to “X” and outputs “012378283X.”

ISSN Conversion

When ISSN conversion is enabled, EAN-13 data with a leading “977” is converted. To re-calculate the CD, ISSN conversion removes the leading 3 digits and outputs 8 digits.

ISMN Conversion

When ISMN conversion is enabled, EAN-13 data with a leading “9790” is converted. 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 data with a leading “9790” is converted to ISBN format.

ISMN Conversion Example:

ISMN conversion of EAN-13 “9790230671187” outputs “M230671187.”

EAN/JAN-8 Settings

Setting	Options
Character set	Numeric (0 - 9)
Number of digits	8 digits (7 digits plus a 1-digit CD) fixed length

EAN/JAN-8 Transfer Data Format

Digit	Description
Data	7 digits
CD	1 digit

6.3.2.2 EAN/JAN-8 Add-On 2 Digits/5 Digits

EAN/JAN-8 Add-On 2 Digits/5 Digits is an EAN/JAN-8 barcode with an additional 2-digit or 5-digit barcode to the right of the main barcode. When add-on digits are enabled, the add-on code must be within the reading range for the barcode to be successfully read. If the add-on code is not within the reading range, after an add-on waiting time the scan engine reads the barcode as UPC or EAN.

Note: Reading response decreases when add-on digits are enabled and only UPC or EAN barcodes are read.

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

Digit	Description
Data	7 digits
CD	1 digit
Add-On	2 digits

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

Digit	Description
Data	7 digits
CD	1 digit
Add-On	5 digits

EAN/JAN-8 CD Transfer

Lets you configure the EAN/JAN-8 check digit (CD).

EAN/JAN-13 Optional Settings

Symbology	Setting	Command	Description	Default
EAN/JAN-13	CD Transmission	6K	Transmit EAN/JAN -13 CD	✓
		6J	Not transmit EAN/JAN-13 CD	
	Add-on 2 digits	JH	Enable single 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	Enable single 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 start at 378/379/529; Enable EAN forced add-on	
		-H	When EAN-13 start at 378/379/529; Disable EAN forced add-on	✓
		-C	When EAN-13 start at 434/439/414/419/977/978; Enable EAN forced add-on	
		-D	When EAN-13 start 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

Setting	Command	Description	Default
CD Transmission	6I	Transmit EAN/JAN-8 CD	✓
	6H	Do not transmit EAN/JAN-8 CD	
Add-on 2 digits	JB	Enable single 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	Enable single 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 Italian Pharmaceutical

Code 39 is a barcode developed by Intermec and has been standardized as ISO/IEC 16388. Code 39 is mainly used in the Industrial field.

Code 39 Settings

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

Code 39 Transfer Data Format

Digit	Description
Start code	“*”
Data	Variable length
Check Digit (CD)	Yes
Stop code	“*”

Calculate Code 39 CD

Lets you configure the CD.

Transfer Code 39 CD

Lets you configure the transfer CD.

Transfer Code 39 Start/Stop Code

Lets you configure the transfer Start/Stop code.

Code 39 Conversion Settings

Setting	Description
Standard Code 39	Send data character as is.
Full ASCII Code 39	Converts the correct combination of the data character to Full ASCII and transmits the data character. If an incorrect combination is found, the data character is not transmitted.
Full ASCII Code 39, if possible	Converts the specified combination of the data character to Full ASCII and transmits the data character. If the combination is incorrect, the data character is transmitted without converting, as is.
Italian Pharmaceutical	Converts Code 39 data to Italian Pharmaceutical format. Italian Pharmaceutical format is fixed length with 8 digits of numeric data followed by a mandatory 1-digit CD. If the data is not correctly converted to Italian Pharmaceutical format, the data is not sent.
Italian Pharmaceutical, if possible	Converts Code 39 data to Italian Pharmaceutical format. If the data is not correctly converted to Italian Pharmaceutical format, the data is sent as standard Code 39.

Code 39 Optional Settings

Setting	Command	Description	Default
CD	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	
Italian Pharmaceutical	D6	Italian Pharmaceutical only	
	D7	Italian Pharmaceutical, if possible	
	DA	Do not transmit leading A for Italian Pharmaceutical	✓
	DB	Transmit leading A for Italian Pharmaceutical	
Concatenation	+M	Disable concatenation	✓
	+L	Enable concatenation	

6.3.4 Codabar

Codabar is a relatively early stage barcode developed by Monarch Marking Company in 1972.

Codabar Settings

Setting	Options
Character set	Numeric (0 - 9) Symbol (- $:/, +)
Start/stop code	A, B, C, or D
Digits	Variable length
Check Digit (CD)	Typically, not used.

Codabar Transfer Data Format

Digit	Description
Start code	1 digit
Data	Variable length
CD	Yes
Stop code	1 digit

Codabar (NW-7) Read Mode

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

Codabar CD

In Codabar, Modulus 16 is generally used.

Codabar CD Transfer

Lets you configure the transfer CD.

Start/Stop Code Transfer

Lets you configure the transfer start/stop code. You can also convert the code and transfer the code when the start/stop code is transferred.

Codabar Optional Settings

Setting	Command	Description	Default
CD	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 (ITF) is a continuous two-width barcode symbology standardized by ISO/IEC 16390. ITF encodes digits and is used commercially on 135 mm film, for ITF-14 (GS1 implementation) barcodes, and on some product cartons (although, the products inside are labeled with UPC or EAN barcodes).

Interleaved 2 of 5 Settings

Setting	Options
Character set	Numeric (0 - 9)
Start/stop code	Hidden character
Digits	Variable length (even number)
Check Digit (CD) method	Modulus 10/Wait 3

Interleaved 2 of 5 Transfer Data Format

Digit	Description
Data	Variable length
CD	Yes

Interleaved 2 of 5 CD Method

Lets you configure the CD. This setting also configures the CD for Interleaved 2 of 5, Industrial 2 of 5, S-Code, and Matrix 2 of 5.

Interleaved 2 of 5 CD Transmit

Lets you configure the transfer CD. This setting also configures the transfer CD for Interleaved 2 of 5, Industrial 2 of 5, S-Code, and Matrix 2 of 5.

Industrial 2 of 5 Space Check

Industrial 2 of 5 can be configured to include an inter-character gap or space (which is the multiple width of a narrow bar) between characters. Use Industrial 2 of 5 Space Check to check for this space.

Interleaved 2 of 5 and Industrial 2 of 5 Optional Settings

Setting	Command	Description	Default
CD	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 is a high-density linear barcode symbology developed by Computer Identix Inc. in the USA in 1981. Code 128 is used for alphanumeric or numeric barcodes and can encode all 128 ASCII characters.

Code128 Settings

Setting	Options
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
Check Digit (CD) method	Modulus 103

Code 128 Transfer Data Format

Digit	Description
Data	Variable length

GS1 Conversion

Disable/Enable GS1-128 GS1 conversion is configurable. For more information, see **"GS1 Conversion" on page 55**.

Code 128 Concatenation

When concatenation is enabled, scanned data is added to the end of the data buffered in the scan engine, and then all of the data in the buffer is sent. You can concatenate a maximum of 400 characters.

The read time is updated each time the scan engine scans a barcode label. If the barcode is not read within the read time, the buffered data is discarded. For more information, see **"Read Time" on page 49**.

If the Code128 barcode contains an FNC2 character as the leading digit, you cannot enable concatenation. To concatenate data, you need to omit the leading FNC2 character.

Code 128 Optional Settings

Setting	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

Setting	Command	Description	Default
CD	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

Setting	Command	Description	Default
CD	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

Setting	Command	Description	Default
CD transmission	4O	Do not transmit CD	
	4N	Transmit CD	✓
Space insertion	DO	Disable space insertion	✓
	DN	Enable space insertion	
X conversion	DP	Conversion A -> X disabled	✓
	DQ	Conversion A -> X enabled	

6.3.10 Telepen

Setting	Command	Description	Default
Conversion output mode	D2	Numeric mode	✓
	D3	ASCII mode	

6.3.11 Code 11

Setting	Command	Description	Default
CD	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

Setting	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 known as Reduced Space Symbology (RSS-14), is a family of barcode symbologies that includes:

- Symbologies intended for retail point of sale:
  - GS1 DataBar Omnidirectional
  - GS1 DataBar Stacked Omnidirectional
  - GS1 DataBar Expanded
  - GS1 DataBar Expanded Stacked
- Symbologies not intended for retail point of sale:
  - GS1 DataBar Truncated
  - GS1 DataBar Limited
  - GS1 DataBar Stacked

GS1 Databar bar codes encode a GTIN-12 or GTIN-13 in a 14-digit data structure. To make the GTIN-12 or GTIN-13 a 14-digit data structure, leading zeros are filled to the left of the GTIN.

GS1 DataBar Omnidirectional Settings

Setting	Options
Character set	Numeric (0 - 9)
Digits	Application identifier “01” and 14 digits
Check sum*	Modulus 79
CD	Modulus 10/Wait 3

* Check sum is always checked, but not sent.

GS1 DataBar Limited Settings

Setting	Options
Character set	Numeric (0 - 9)
Digits	Application identifier “01” and 14 digits
Check sum*	Modulus 89
CD	Modulus 10/Wait 3

* Check sum is always checked, but not sent.

GS1 DataBar Expanded Settings

Setting	Options
Character set	Capital/small character alphabet, numbers, 20 types of symbols, function character (FNC1)
Digits	74 digits (numeric) and 41 digits (alphabet)
Check sum*	Modulus 211

* Check sum is always checked, but not sent.

GS1 DataBar Omnidirectional and GS1 DataBar Limited Transfer Data Format

Digit	Description
AI	“01”
Data	13 digits
CD	1 digit

GS1 DataBar Expanded Transfer Data Format

Digit	Description
Data	1 to 74 digits

GS1 Conversion

You can configure GS1 conversion for GS1 DataBar. For more information, see **“GS1 Conversion” on page 55**.

6.3.14 GS1 Composite

The GS1 Composite barcode symbology contains a linear barcode component with a special 2D Composite Component (CC) barcode symbol printed on top. The linear component encodes the item’s primary identification. The adjacent 2D component encodes supplementary data.

GS1 Composite Settings

Setting	Options
Character set	ASCII value 0 - 127 (ISO 646) ASCII value 128 - 255 (ISO 8859, Alphabet No.1, Extend ASCII) When using ECI protocol, many other character sets are available. For more information, see “ECI Protocol Output” on page 59.
Composite	CC-A is a revised version of Micro PDF417. CC-B is normal Micro PDF417. CC-C is normal PDF417.
Maximum digits	CC-A: 56 character CC-B: 338 character CC-C: 2361 character
Symbol size	1D part: refer to GS1 DataBar and UPC/EAN Composite part: CC-A and CC-B are same as Micro PDF417. CC-C is same as PDF417
Error correction	1D part: error detection only Composite par: Reed Solomon error correction
Link flags	GS1 DataBar and GS1 128 composite have link flags. UPC/EAN composite does not have link flags.

CC-A Transfer Data Format

Digit	Description
1D data	1 to 74 digits
Composite data	1 to 56 digits

CC-B Transfer Data Format

Digit	Description
1D data	1 to 74 digits
Composite data	1 to 338 digits

CC-C Transfer Data Format

Digit	Description
1D data	1 to 74 digits
Composite data	1 to 2361 digits

GS1 Conversion

Disable/Enable GS1 conversion of Composite GS1 DataBar by setting. For more information, see “GS1 Conversion” on page 55.

6.3.15 PDF417

PDF417 is a stack linear barcode developed by Symbol Technology Inc. and is used for international logistics, ID cards, and parts labels. PDF417 is standardized in ISO/IEC 15438:2006.


PDF417 sample


Micro PDF417 sample

PDF417 Settings

Setting	Options
Character set	ASCII value 0 to 127 (ISO 646) ASCII value 128 to 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 (Micro PDF417)	Text compression: 250 characters Byte compression: 150 characters Numeric compression: 366 characters
Symbol size (PDF417)	Number of lines: 3 to 90 Number of rows: 1 to 30
Symbol size (Micro PDF417)	Number of lines: 4 to 44 Number of rows: 1 to 4
Error correction (PDF417)	Error correction level 8. For error detection, only.
Error correction (Micro PDF417)	Number of code words for error correction is fixed by the symbol and cannot be changed.

PDF417 Transfer Data Format

Digit	Description
Data	Variable length

Note: To enable Micro PDF417, see **“2D Barcodes” on page 54**.

6.3.16 QR Code

QR Code (shortened from Quick Response Code) is a matrix type 2D barcode developed by DENSO WAVE INC. QR Code became popular in a wide range of fields due to its fast readability and relatively large storage capacity. QR Code is standardized in ISO/IEC 18004:2000.

QR Code

QR Code Settings

Setting	Options
Character set	1) Numeric data (Numbers 0 to 9) 2) Alphanumeric data (Numbers 0 to 9, Capital letter A to Z, 9 special characters: space, $, %, *, +, -, ., /, :) 3) 8-bit byte data (Latin character based on JIS X 0201, character set of 8 bit code for Katakana character.) 4) Chinese character (Character specified by the shift-coded expression of JIS X 0208)
Maximum digits	Alphanumeric data: 4296 characters 8-bit data: 2953 character Numeric data: 7089 characters Chinese character data: 1817 characters
Symbol size	Minimum: 21 x 21 module Maximum: 177 x 177 module
Error correction	Read Solomon error correction level 4 L:7% M:15% Q:25% H:30%
Negative barcode, mirror printing	Negative and mirror printed QR Code are readable.
Concatenated code	Outputs after reading all concatenated codes.

GS1 Conversion

Disable/Enable GS1 QR Code conversion by setting. For more information, see **“GS1 Conversion” on page 55**.

ECI Protocol Output

Disable/Enable output of QR Code ECI protocol data by setting.

Micro QR

QR Code Settings

Setting	Options
Character set	1) Numeric data (numbers 0-9) 2) Alphanumeric data (numbers 0-9, capital characters A-Z, 9 special characters: space, $, %, *, +, -, ., /, :) 3) 8 bit byte data (Latin character based on JIS X 0201, character set of 8 bit code for Katakana character.) 4) Chinese character (Character specified by the shift-coded expression of JIS X 0208)
Maximum digits	Alphanumeric data: 21 character 8 bit data: 15 character Numeric data: 35 character Chinese character data: 9 character
Symbol size error correction	Version M1: 11 x 11 module – Error detection only Version M2: 13 x 13 module – Read Solomon error correction 2 steps(L, M) Version M3: 15 x 15 module – Read Solomon error correction 2 steps(L, M) Version M4: 17 x 17 module – Read Solomon error correction 3 steps (L, M, Q)
Negative barcode, mirror printing	Negative and mirror printed QR Code are readable

QR Code Transfer Data Format

Digit	Description
Data	Variable length

6.3.17 Data Matrix

Data Matrix is a matrix type 2D barcode developed by Idymatrix Corporation that can be characterized by black and white dots arranged in a square or rectangular pattern. The most popular application for Data Matrix is marking small items, because it can encode fifty characters in a symbol that is readable at 2 to 3 mm^2 and because it can be read with only a 20% contrast ratio. Data Matrix is standardized in ISO/IEC 16022.

Data Matrix

RectangleMatrixCode

Data Matrix Settings

Setting	Options
Character set	ASCII value 0 to 127 (ISO 646) ASCII value 128 to 255 (ISO 8859-1, Alphabet No.1, Expand ASCII) When using ECI protocol, many other character sets are available. For more information, see “ECI Protocol Output” on page 59.
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 barcode, mirror printing	Negative and mirror printed Data Matrix are readable.

Data Matrix Transfer Data Format

Digit	Description
Data	Variable length

GS1 Conversion

Disable/Enable GS1 Data Matrix conversion by setting. For more information, see “GS1 Conversion” on page 55.

ECI Protocol Output

Disable/Enable output of Data Matrix ECI protocol data by setting.

6.3.18 Aztec Code

Aztec Code is a 2D matrix barcode developed by Welch Allyn Company. Because Aztec Code does not require a quiet zone, it can potentially use less space than other matrix barcodes. Aztec Code is mainly used for transportation tickets.

Aztec code

Aztec Code Settings

Setting	Options
Character set	ASCII value 0 to 127 (ISO 646) ASCII value 128 to 255 (ISO 8859-1, Alphabet No.1, Expand ASCII) When using ECI protocol, many other character sets are available. For more information, see “ **ECI Protocol** Output” **on page 59**.
Maximum number of digits	Alphanumeric data: 3067 characters Numeric data: 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.

Aztec Code Transfer Data Format

Digit	Description
Data	Variable length

ECI Protocol Output

You can disable or enable output of Aztec Code data using ECI protocol. For more information, see “

ECI Protocol Output**" on page 59**.

6.4 How to Set the Number of Characters to Read

When you scan barcode labels that have a fixed-length, configure the scan engine to only scan the number of characters in the barcode. When properly configured, the scan engine rejects barcodes that are not the specified length. This feature helps ensure the accuracy of scanned data.

The scan engine only checks the length of the barcode data. Options like transmit start/stop character and check digit (CD) are not included. Setting the number of characters to read does not affect fixed-length codes, like 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 barcode type and only affects the specified barcode 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)
"Command List: Fixed Length ON/Minimum/Maximum Length" on page 83.	Qa	Qb	Qc	Qd		

Configuration Examples

Command	Description
<Esc>[DC1Q6<CR>	Set Code 39 length to 6 digits
<Esc>[DC1Q6[DC1Q1Q2<CR>	Set Code 39 length to 6 digits and 12 digits
<Esc>[DC1Q6[DC4Q1Q2<CR>	Set Code 39 length to 6 digits and Interleaved 2 of 5 to 12 digits
<Esc>[DC1<CR>	Clear fixed length for Code 39
<Esc>[DB4Q4<CR>	Set minimum length for Interleaved 2 of 5 to 4 digits
<Esc>[DB4<CR>	Clear minimum length for Interleaved 2 of 5
<Esc>[DA1Q1Q2<CR>	Set maximum length for Code 39 to 12 digits
<Esc>[DA1<CR>	Clear maximum length for Code 39
<Esc>[DALQ2Q0[DAJQ1Q2Q5<CR>	Set maximum length for PDF417 to 20 digits and QR Code to 125 digits

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

To set the length for each barcode, enter a command followed by a value. When you reset the settings, the current length for the barcode becomes the default.

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
Maxi Code	[DCK	[DBK	[DAK
Aztec Code	[DCI	[DBI	[DAI
Micro PDF417	[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 Data String Options

You can change the letter case (uppercase/lowercase) in the transmitted data string, as well as add special characters before or after the data.

7.1 How to Change Uppercase and Lowercase Letters

You can convert the decoded data to all lowercase or all uppercase letters. You can also switch the case being used. That is, change lowercase characters to uppercase and vice versa. This feature may be helpful if the host requires a specific case.

Case Conversion Commands

Command	Description	Example: AbCd	Default
YZ	No case conversion	AbCd	✓
YW	Convert to upper case	ABCD	
YX	Convert to lower case	abcd	
YY	Exchange case	aBcD	

7.2 How to Add Characters

You can add special characters that provide additional information to the beginning or end of a barcode. The output format depends on whether you add a prefix/suffix or a preamble/postamble.

Prefix/Suffix

You can add a prefix or suffix of up to 4 digits to the data string. For each barcode symbology, you can specify characters to add before or after the data. By default, the prefix is empty and the suffix for all barcodes is the “CR” character.

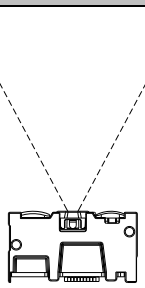
Note: If the number of configured prefix/suffix characters exceeds the maximum of 4 digits, the configuration is ignored.

Note: You cannot add a prefix or suffix if you are using Optical Character Recognition Data Edit Reading. For more information, see **“Optical Character Recognition” on page 59** and **“OCR Barcodes” on page 54**.

Preamble/Postamble

You can add a preamble or postamble of up to 8 digits to the data string. For all barcode symbologies, you can specify characters to add before or after the data. By default, the preamble and postamble are empty.

Preamble	Prefix for each code	Decoded Data	Suffix for each code*	Postamble
8 digits max	4 digits max		4 digits max	8 digits max



*By default, <CR> is added to suffix. To clear the default suffix, use the “RZ” command.

Figure **40***: Prefix/Suffix and Preamble/Postamble*

7.2.1 How to Set the Prefix/Suffix

When you set the prefix/suffix, the prefix/suffix commands clear the current values, including the default suffix “CR” and configure new settings.

For all barcodes, the default suffix is:

- HID: “Enter”
- COM: “CR”
- UART: “CR”

To set the Prefix/Suffix

1. Send a prefix/suffix command from **“Prefix/Suffix Commands” on page 85**.
2. Send a value command from **“Prefix/Suffix Value Commands” on page 86**.

Example prefix/suffix setting:

To set “C39:” as the prefix and “CR” and “LF” as the suffix for Code 39, send this command:

<Esc>M40CQ3Q96AO41M1J<CR>

Note: You can also set the prefix/suffix with a menu or 2D menu barcode.

7.2.2 Prefix/Suffix Commands

The prefix/suffix commands clear the current values, including the default suffix “CR” and configure new settings.

Prefix/Suffix Commands for all Barcodes

Barcode	Prefix Command	Suffix Command
All barcodes prefix/suffix	RY	RZ
Common prefix/Common suffix	MZ	PS

* By default, “CR” is added to the prefix or suffix for all barcodes. To clear “CR”, send the “RZ” command only.

Barcode Prefix and Suffix Commands

Barcode	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	*$	*%
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
Aztec	[BF0	[BF1
Chinese Sensible Code	[D4N	[D4O

Barcode Prefix and Suffix Commands (*continued*)

Barcode	Prefix Command	Suffix Command
QR Code	MK	PW
Maxi Code	ML	PX
PDF417	OC	PY
Micro PDF417	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

7.2.3 Prefix/Suffix Value Commands

Prefix/Suffix Value Commands

Setting	Description
ASCII	Includes all 128 ASCII characters.
Code identification	The code identification is transmitted in OPTICON ID, ISO15424 standard, or AIM-ID.
Code length	The number of characters after the output format that are configured with options specified in **“How to Set Code-Specific Options” on page 60**.
Code coordinate	The code coordinate is transmitted as the pixel coordinate of the image sensor.
Scan time	The time from when the trigger is activated until the data output starts.

7.2.3.1 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				

7.2.3.2 Code Identification (ID)

To add the Code Identification (ID), send a Code ID command with the command to set a prefix/suffix.

Code ID Commands

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

Use one of these code identification methods:

- OPTICON Code ID. For more information, see **"Code ID Table" on page 101**.
- AIM/ISO Code ID. For more information, see **"Code Option AIM/ISO15424 Code ID Prefix/Suffix Value" on page 102**.

The code identifier is transmitted in ISO 15424 format:

]cM

where:

-] is ASCII decimal value 93
- c is a code character
- M is modifier character

Example Code ID command:

To add "<OPTICON Code ID>" to the all codes prefix, send this command:

<Esc>RY$2<CR>

7.2.3.3 Code Length

To add the code length, send a code length command with the command to set a prefix/suffix. For 1D barcodes, the code length is transmitted as 2 digits (excluding prefix and suffix characters). For 2D barcodes, the code length is transmitted as 6 digits. You can also send the length as 6 digits for both 1D and 2D barcodes. These direct input characters are counted as 1 of the 4 digits in the prefix and suffix.

Code Length Commands

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

Example Code Length command:

To set the prefix for all codes to <Code length (1D/2D: 2/6 digit)>, send this command:

<ESC>RY$3<CR>

7.2.3.4 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 Coordinate Commands

Command	Description	Default
[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

where:

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

The range of the coordinates is:

- X: 0 to 639
- Y: 0 to 479

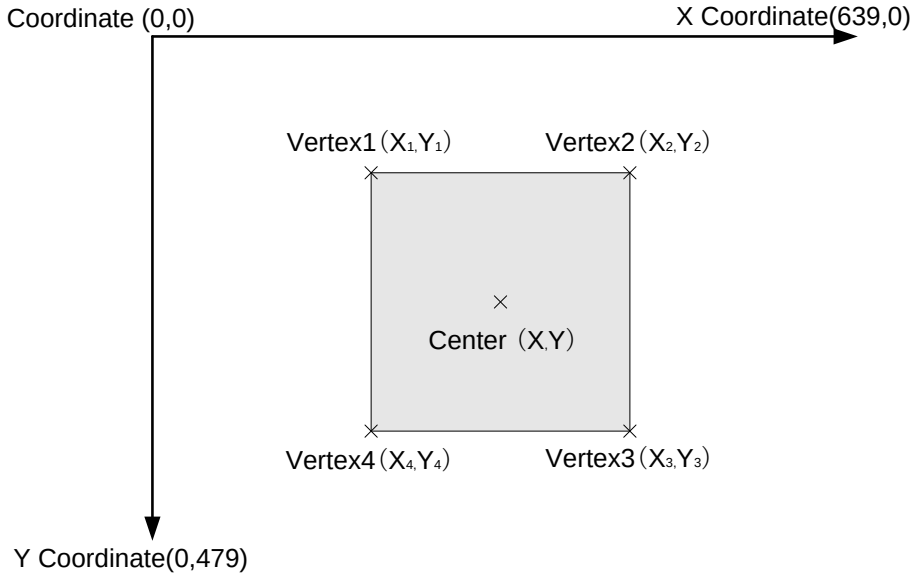


Figure **41***: Code Coordinates*

7.2.3.5 Scan Time

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

Scan Time Command

Command	Description
[EDG	Scan time

Scan time output format:

Tms

where:

- T is flexible length.
- ms is maximum string length, which is 4.

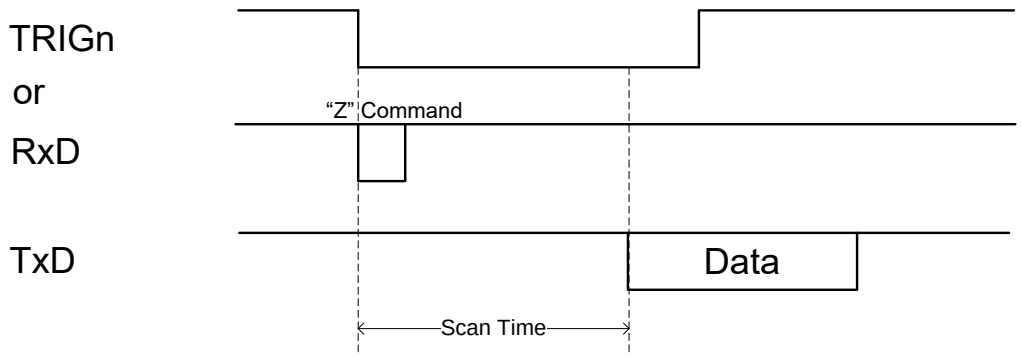


Figure **42***: Scan Time*

8 Read Options

You can configure read options, such as read modes, trigger settings, illumination and aiming, batch reading, and data editing.

8.1 Read Modes

Barcode reading starts when the trigger signal (TRIGn) is pulled low, when the trigger command ("Z") is received, or when an object is detected and the scan engine is in auto trigger mode.

8.1.1 Single and Multiple Read Modes

You can configure single read and multiple read modes for the scan engine.

Read Mode Commands

Read Mode	Command	Description	Default
Single Read	S0	Single read in a single trigger press.	✓
Multiple Read 1	[D3P	Multiple reads in a single trigger press: the scan engine saves the data in memory and does not read the same data.	
Multiple Read 2	S1	Multiple reads in a single trigger press: the scan engine reads the same data.	

Single Read Mode

In single read mode, the scan engine starts reading after a trigger press and continues reading until a barcode is successfully decoded or until the read time expires. For more information, see **"Central Reading" on page 91**.

Multiple Read Mode 1 (Does Not Read the Same Data)

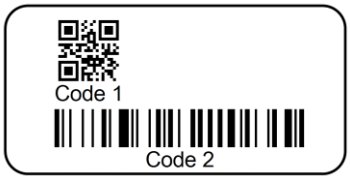
In this multiple read mode, the scan engine starts reading after a trigger press and keeps reading (even after a barcode is successfully decoded) until the read time expires. To prevent a

barcode from being read twice, the scan engine saves the barcode data in memory (up to 20 barcodes). When subsequent barcodes are read, the scan engine compares the data with the data in memory and ignores the data if it has been previously read. This read mode can be helpful to prevent reading the same barcode twice.

Note: Because the maximum number of barcodes that the scan engine can keep in memory is 20, after 20 different barcodes are read, the same barcode can be read again.

Example of Multiple Read Mode 1:

The scan engine will read both Code 1 and Code 2 with a single trigger press.



Multiple Read Mode 2 (Reads Duplicate Data)

Just like Multiple Read Mode 1, the scan engine starts reading after a trigger press and keeps reading (even after a barcode is successfully decoded) until the read time expires. In Multiple Read Mode 2, the scan engine reads the same barcode in a single trigger press if one of these conditions are met:

- The duplicate barcodes are separated by at least one other barcode.
- The Double Read Reset Time has passed. For more information, see **"Double Read Reset Time" on page 94**.

Example of Multiple Read Mode 2:

The barcode 0001 is read twice, because the duplicate barcodes are separated by at least one other barcode.

8.1.2 Central Reading

To help you read barcodes that are positioned close to each other, enable Central Reading. When Central Reading is enabled, the scan engine only reads the barcode in the center position of the reading area.

Central Reading Commands

Command	Description	Default
[D00	Enable central reading: only read barcodes in the center position of the aiming LED	
[D0Z	Disable central reading: read all barcodes in the reading area	✓

Figure **43***: Readable Positions in Central Reading*

Figure **44***: Unreadable Positions in Central Reading*

8.2 Manual Trigger/Trigger Repeat

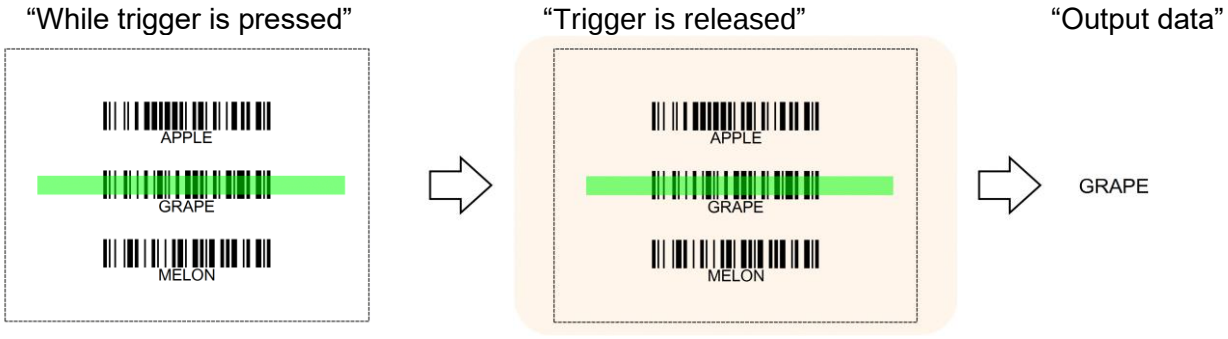
By default, the scan engine is in manual trigger mode. In manual trigger mode, you can enable the Trigger Repeat function. Trigger Repeat helps properly aim the scan engine before scanning a barcode. This function helps improve reading performance when reading barcodes that are tightly packed together.

The Trigger Repeat behavior depends on Read Time and Central Reading. For more information, see **"Read Time" on page 49** and the previous section, **"Central Reading" on page 91**.

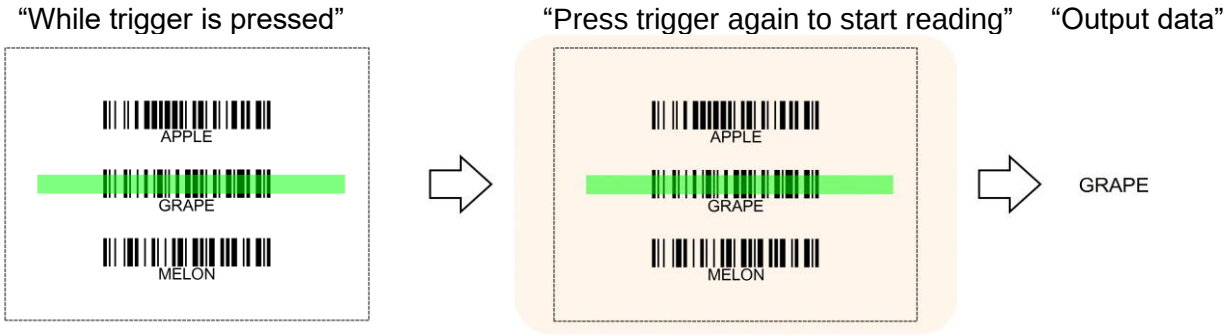
Trigger Repeat Commands

Command	Description	Default
/K	Disable trigger repeat	✓
/M	Enable trigger repeat	

Example for Trigger Repeat Synchronized with Read Time:



Example for Trigger Repeat with Read Time set to 1 second or more:



8.3 Auto Trigger

When auto trigger is enabled, the scan engine automatically detects and reads barcodes.

8.3.1 Auto Trigger Modes

You can configure these two auto trigger modes:

- Presentation auto trigger mode: Use this mode when the scan engine is in a fixed position and barcodes are presented to the scan engine.
- Handheld auto trigger mode: Use this mode when the scan engine is not in a fixed position.

Auto Trigger Mode Commands

Command	Description	Default
+F	Disable auto trigger mode	✓
+I	Enable auto trigger mode	

Presentation and Handheld Auto Trigger Mode Commands

Command	Description	Default
[DL5	Presentation auto trigger mode	✓
[DL6	Handheld auto trigger mode	

8.3.2 Auto Trigger Sensitivity

You can configure the sensitivity of the scan engine to detect barcodes. Sensitivity is affected by environmental conditions, so you need to adjust this setting accordingly.

Auto Trigger Sensitivity Commands

Command	Description	Default
[XMF	High sensitivity	
[XMH	Normal sensitivity	✓
[XMJ	Low sensitivity	

8.3.3 Double Read Reset Time

When auto trigger mode is enabled, you can set the time interval in which the same barcode can be read again. When a barcode with different data is read, this command is reset.

Double Read Reset Time Commands

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

* When this command is set to 0 seconds, the same barcode will not be read.

8.3.4 Read Time Adjustment

Lets you configure when to end auto trigger scanning.

Auto Trigger Read Time Adjustment Commands

Command	Description	Default
[EFH	Long time	
[EFI	Normal time	✓
[EFJ	Short time	

* When the read time is set to “Y0,” the read time is automatically set by image processing. For more information, see **“Read Time” on page 49**.

8.3.5 Auto Trigger Sleep Mode

If the scan engine does not detect a barcode after a specified period of time, the scan engine transitions to sleep mode. At specified time intervals, the scan engine tries to detect a barcode. If a barcode is detected or if the trigger is pulled, the scan engine exits sleep mode. To disable sleep mode transition, set this command to 0 seconds.

Auto Trigger Sleep Mode 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

Lets you determine which mode to use to detect a barcode.

- Green aiming detection: A barcode is detected when it falls within the green aiming light. Use this mode to scan barcodes indoors. In brighter environments, the scan engine may have difficulty detecting barcodes using this mode.
- Warm white illumination detection: A barcode is detected when it falls within the range of the warm white light. Use this mode to scan barcodes in dark environments.
- No illumination detection: A barcode is detected without any illumination from the scan engine. This mode uses the least amount of power, but the effectiveness to detect barcodes may also be reduced. Use this mode to scan barcodes in well-lit areas.

Detection Mode Commands

Command	Description	Default
[DDG	Green aiming detection	✓
[DDH	Warm white illumination detection	
[DDI	No illumination detection	

8.4 Illumination and Aiming

You can enable or disable warm white illumination and green LED aiming.

8.4.1 Reading LED Illumination

You can enable or disable LED illumination, select an illumination method, and set illumination brightness. Configuring these settings can be helpful to reduce specular reflection and increase barcode scanning performance.

LED Illumination Mode Commands

Command	Description	Default
[D39	Enable: Improves reading performance, in general.	
[D3A	Disable: Improves reading performance for barcodes displayed on LCD screens.	
[D3B	Automatic switching: Alternates the floodlight between ON and OFF. The scan engine memorizes the illumination in which a barcode was read successfully and uses this mode to scan the next barcode. Use this mode in environments where specular reflection is likely to occur.	
[D3Q	Prevent specular reflection: Disables illumination only when specular reflection occurs.	✓

LED Illumination Brightness Commands

Command	Description	Default
[DDB	Standard brightness	✓
[DDC	Low brightness	

8.4.2 External LED Illumination

You can enable external LED illumination to improve barcode reading performance. When external LED illumination is enabled, the scan engine provides an output signal on pin-3. To activate and save the new configuration, you need to send the Z2 command.

LED Output Mode (Pin3) Commands

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

8.4.3 LED Aiming

You can enable or disable the green aiming LED, as well as configure the brightness.

LED Aiming Commands

Command	Description	Default
[D3D	Enable LED aiming	✓
[D3E	Disable LED aiming	

LED Aiming Brightness Commands

Command	Description	Default
[DDD	High brightness	✓
[DDE	Standard brightness	
[DDF	Low brightness	

8.5 Batch Reading

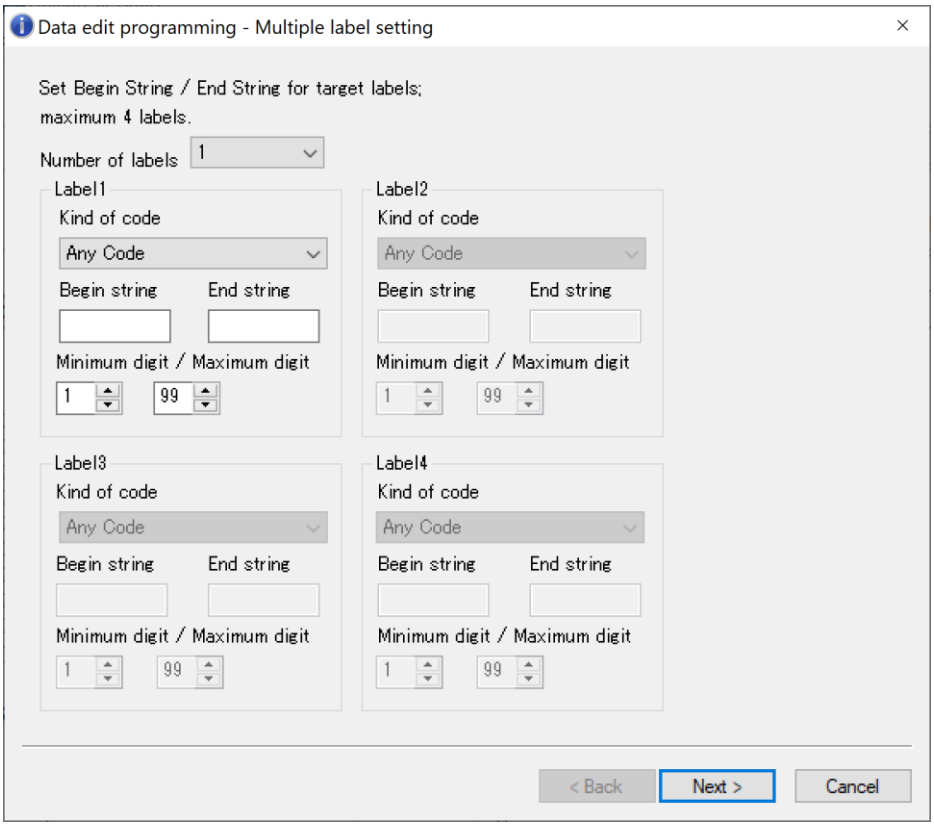
You can configure batch reading for fixed format barcodes.

Note: The data edit/extract reading function is supported by the scan engine but is not available in “UniversalConfig2.0”. For help, contact your local Opticon Representative.

Configure Batch Reading

1. Start the Opticon UniversalConfig application and click **Multi label**.

2. Follow the instructions to configure batch reading settings for up to 4 barcodes. To configure additional settings, contact your local Opticon Representative.



9 Indicator Options

You can configure options for the Buzzer and Good Read LED.

9.1 Buzzer

The scan engine provides feedback through these buzzer indicators:

- Good read
- Startup
- Read timeout
- Intermediate

The BUZZERn signal controls the buzzer tone and sound pressure with the pulse-width modulation (PWM) signal.

9.1.1 Buzzer Volume

Buzzer volume settings are applied to all buzzers.

Buzzer Volume Commands

Command	Buzzer Loudness	Default
T0	Maximum	✓
T1	Loud	
T2	Normal	
T3	Minimum	

9.1.2 Good Read Buzzer

The good read buzzer sounds when a barcode is successfully read. You can enable or disable the buzzer, as well as configure the duration and tone of the buzzer.

Good Read Buzzer Commands

Command	Description	Default
W8	Enable buzzer	✓
W0	Disable buzzer	

Good Read Buzzer Duration Commands

Command	Description	Default
W7	Buzzer duration: 50 ms	✓
[EFW	Buzzer duration: 75 ms	
W4	Buzzer duration: 100 ms	
W5	Buzzer duration: 200 ms	
W6	Buzzer duration: 400 ms	

Good Read Buzzer Tone Commands

Command	Description	Default
W1	Medium frequency buzzer (3000 Hz)	3000 Hz
W2	2-step buzzer tone (high to low)	
W3	2-step buzzer tone (low to high)	

Good Read Buzzer Tone Frequency Commands

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

9.1.3 Startup Buzzer

The startup buzzer beeps when the scan engine is powered on.

To activate and save the new configuration, you need to use the Z2 command (save settings in non-volatile memory).

Startup Buzzer Commands

Command	Description	Default
GD	Disable startup buzzer	✓
GC	Enable startup buzzer	

9.1.4 Read Timeout Buzzer

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

Read Timeout Buzzer Commands

Command	Description	Default
[EAP	Disable read timeout buzzer	✓
[EAQ	Enable read timeout buzzer	

9.1.5 Intermediate Buzzer

If a barcode is decoded but does not yet meet the conditions to output data, an intermediate buzzer sounds.

For example, if the buffer is configured to read five barcodes, the intermediate buzzer sounds after the 1st, 2nd, 3rd and 4th barcodes are decoded to confirm that each barcode has been read. When the 5th and last barcode is decoded, a good read buzzer sounds and the data is output. When the good read buzzer is disabled, this setting is also disabled.

Intermediate Buzzer Commands

Command		Description	Default
[EBY	Q0	Disable intermediate buzzer	
	Q1	Enable intermediate buzzer	✓

* Intermediate buzzer frequency: 5000 Hz (5 KHz), duration: 10 ms

9.1.6 Idle Level of BUZZERn pin

You can configure the idle level of the BUZZERn pin to minimize power consumption when the buzzer is not active. For example, when a PNP transistor is used to drive the buzzer, the transistor is “open” when the BUZZERn signal is low, so the idle level should be low.

To automatically maximize power, use a Custom Command Line command to make this setting the default. For more information, see **“How to Permanently Change the Factory Default Settings” on page 11**.

To activate and save the new configuration, you need to use the Z2 command (save settings in non-volatile memory).

BUZZERn Idle Level Commands

Command	Description	Default
[BAW	Idle level low (Active high)	
[BAX	Idle level high (Active low)	✓

9.2 Good Read LED

When an LED is connected to the GR_LEDn pin, the GR_LEDn signal controls the good read LED.

Note: Because the scan engine can only supply a limited output current through the GR_LEDn pin, use a transistor to amplify the current.

9.2.1 Good Read LED Duration

The good read LED lights up after a barcode is successfully decoded. You can configure how long the good read LED stays on or disabled the LED.

Good Read LED Commands

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

9.2.2 Inverted Good Read LED

In Good Read LED inverted mode, the GR_LEDn signal is inverted.

Inverted Good Read LED Commands

Command	Description	Default
[E6Y	Good Read LED normal mode	✓
[E6Z	Good Read LED inverted mode	

9.3 Good Read Aiming

When a barcode is successfully read, the green good read aiming light turns on, briefly. You can configure the frequency and duration of this light.

Good Read Aiming Commands

Command				Function	Description	Default
[EF3	Qa	Qb	Qc			
	a			Settings	0: Indicator frequency 1: First indicator duration after reading	
		b		Numeric setting 10b + c	Indicator frequency: 0 to 99 times Indicator duration: 0 to 99 x 10 ms	Indicator frequency: 0 times Indicator duration: 100 ms
			c			

Example Good Read Aiming Settings:

- To turn on the lights 2 times after 100 ms (default), send this command:

  [EF3Q0Q0Q2

- To set the first indicator duration after reading to 500 ms, and then turn on the lights 2 times after 100 ms, send this command:

  [EF3Q1Q5Q0

9.4 General Indicator Timing

The buzzer and good read LED share common settings. Specifically, both indicators can be activated after decoding a barcode and before or after transmitting the data.

Indicator Timing Commands

Command	Description	Default
VY	Before data transmission*	✓
VZ	After data transmission	

* Both indicators are activated soon after the barcode is decoded.

10 Appendix

This appendix contains reference data.

10.1 Code ID Table

These tables list the Code IDs that can be added to the prefix or suffix.

10.1.1 Opticon Code ID Prefix/Suffix Value

Code	Code ID	Code	Code ID
UPC-A	C	Code 11	b
UPC-A +2	F	Code 128	T
UPC-A +5	G	GS1-128	
UPC-E	D	GS1 DataBar	y
UPC-E +2	H	CC-A	m
UPC-E +5	I	CC-B	n
EAN-13	B	CC-C	l
EAN-13 +2	L	Korean Postal Authority	c
EAN-13 +5	M	Intelligent mail	0
EAN-8	A	Postal-TNT, KIX	1
EAN-8 +2	J	Japanese postal code	2
EAN-8 +5	K	Postnet	3
Code 39	V	Australia postal code	4
Code 39 Full ASCII	W	US Planet	6
Italian Pharmaceutical	Y	UK Postal (Royal mail)	7
Codabar	R	4-state Mailmark barcode	8
Codabar ABC	S	Codablock F	E
Codabar CX	f	Data Matrix	t
Industrial 2of5	O	Aztec	o
Interleaved 2of5	N	Aztec Runes	
S-Code	g	Chinese Sensible Code	e
Matrix 2of5	Q	QR Code	u
Chinese Post	w	Micro QR Code	j
Code 93	U	Maxi Code	v
IATA	P	PDF417	r
MSI/Plessey	Z	Micro PDF417	s
Telepen	d	ICAO Travel Documents (OCR)	9
UK/Plessey	a	ISBN and Other OCR Font B	z

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

AIM/ISO15424 Code ID

Symbology	Code ID
UPC-A	]E0
UPC-A +2	]E3
UPC-A +5	]E3
UPC-E	]E0
UPC-E +2	]E3
UPC-E +5	]E3
EAN-13	]E0
EAN-13 +2	]E3
EAN-13 +5	]E3
EAN-8	]E4
EAN-8 +2	]E7
EAN-8 +5	]E7
Code 39	]A*
Code 39 Full ASCII	]A*
Tri-Optic	]X0
Code 39 It. Pharmaceutical	]X0
Codabar	]F*
Codabar ABC	]F*
Codabar CX	]X0
Industrial 2 of 5	]S0
Interleaved 2 of 5	]I*
S-Code	]X0
Matrix 2 of 5	]X0
Chinese Post	]X0
IATA	]R*
MSI/Plessey	]M*
	]X0

Symbology	Code ID
Telepen	]B*
UK/Plessey	]P0
Code 128	]C0
GS1-128	]C1
Code 93	]G0
Code 11	]H*
	]X0
Korean Postal Authority	]X0
Intelligent Mail Barcode	]X0
POSTNET	]X0
GS1 DataBar	]e0
CC-A	]e1
CC-B	]e1
CC-C	]e1
GS1 DataBar with CC-A	]e0
GS1 DataBar with CC-B	]e0
GS1 DataBar with CC-C	]e0
Codablock F	]o*
DataMatrix	]d*
Aztec	]z*
	]X0
QR Code	]Q*
Micro QR Code	]Q*
Maxi Code	]U*
PDF417	]L0
Micro PDF417	]L0
OCR	]X0

Note: Commands noted with an asterisk (*) are described differently depending on the code type. For more information, see one of the next corresponding tables.

Code 39 Option AIM/ISO15424 Code ID: A*

Code Option	]AIM-ID
Normal Code 39 (D5) Do not check CD (C1) Transmit CD (D9)	]A0
Normal Code 39 (D5) Check CD (C0) Transmit CD (D9)	]A1
Normal Code 39 (D5) Do not check CD (C1) Do not transmit CD (D8)	]A2
Normal Code 39 (D5) Check CD (C0) Do not transmit CD (D8)	]A3

Code Option	]AIM-ID
Full ASCII Code 39 (D4) or Full ASCII Code 39 if pos. (+K) Not check CD (C1) Transmit CD (D9)	]A4
Full ASCII Code 39(D4) or Full ASCII Code 39 if pos. (+K) Check CD (C0) Transmit CD (D9)	]A5
Full ASCII Code 39(D4) or Full ASCII Code 39 if pos. (+K) Do not check CD (C1) Do not transmit CD (D8)	]A6
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*

Code Option	]AIM-ID
Codabar normal mode (HA) Do not check CD (H7) Transmit CD (H8)	]F0
Codabar ABC (H4) or (H3) Do not check CD (H7) Transmit CD (H8)	]F1
Codabar normal mode (HA) Check CD (H6) Transmit CD (H8)	]F2
Codabar ABC (H4) or (H3) Check CD (H6) Transmit CD (H8)	]F3

Code Option	]AIM-ID
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) Do not transmit CD (H9)	]F5
Codabar normal mode (HA) Check CD (H6) Do not transmit CD (H9)	]F6
Codabar ABC (H4) or (H3) Check CD (H6) Do not transmit CD (H9)	]F7

Interleaved 2of5 Option AIM/ISO15424 Code ID: I*

Code Option	]AIM-ID	Code Option	]AIM-ID
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

IATA Option AIM/ISO15424 Code ID: R*

Code Option	]AIM-ID	Code Option	]AIM-ID
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

Code Option	]AIM-ID	Code Option	]AIM-ID
Check 1CD = MOD 10 (4B):		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
(4B) + Transmit CD1 (4E) or	]M0		
(4B) + Do not transmit CD (4G) or	]M1		
(4B) + Transmit CD1 and CD2 (4F)	]X0		
Check 2CD's = MOD 10/MOD 10 (4C): (4C) + Transmit CD1 (4E) or (4C) + Do 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*

Code Option	]AIM-ID	Code Option	]AIM-ID
Telepen (numeric or ASCII only):		Telepen (numeric followed by ASCII):	
ASCII mode (D3)	]B0	ASCII mode (D3)	]B0
Numeric mode (D2)	]B1	Numeric mode (D2)	]B2
Telepen (ASCII followed by numeric)			
(not supported):			
ASCII mode (D3)	]B0		

Code 11 Option AIM/ISO15424 Code ID: H*/X0

Code Option	]AIM-ID	Code Option	]AIM-ID
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)	
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)	]H3

Codablock F Option AIM/ISO15424 Code ID: O*

Code Option	]AIM-ID	Code Option	]AIM-ID
FNC1 not used	]O4	FNC1 in 1st position	]O5

DataMatrix Options AIM/ISO15424 Code ID: d*

Code Option	]AIM-ID	Code Option	]AIM-ID
ECC200	]d1	ECC200, supporting ECI protocol	]d4
ECC200, FNC1 IN 1st or 5th position	]d2	ECC200, FNC1 in 1st or 5th position and supporting ECI protocol	]d5
ECC200, FNC1 IN 2nd or 6th position	]d3	ECC200,FNC1 in 2nd or 6th position and supporting ECI protocol	]d6

Aztec Options AIM/ISO15424 Code ID: z*

Code Option	]AIM-ID	Code Option	]AIM-ID
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	]z6	Structured append header included, FNC1 following an initial letter or pair of digits, ECI protocol implemented	]zB
Structured append header included and FNC1 preceding 1st message character	]z7		

QR Code Option AIM/ISO15424 Code ID: Q*

Code Option	]AIM-ID	Code Option	]AIM-ID
Model 1	]Q0	Model 2, ECI protocol implemented	]Q4
Model 2, ECI protocol not implemented	]Q1	FNC1 in first position	
Model 2, ECI protocol implemented	]Q2	Model 2, ECI protocol not implemented	]Q5
Model 2, ECI protocol not implemented	]Q3	FNC1 in second position	
Model 2, ECI protocol not implemented, FNC1 in first position		Model 2, ECI protocol implemented	]Q6
		FNC1 in second position	

Maxi Code Option AIM/ISO15424 Code ID: U*

Code Option	]AIM-ID	Code Option	]AIM-ID
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

10.2.1 Common Specification Overview

Control Section Specifications

Specification	Value	Notes
CPU	CPU ARM Cortex-A7	CoreMax. 800MHz
LPDDR2 RAM	1G bits	DDRCLK400MHz
Flash ROM	1G bits Flash Memory	

Interface Section Specifications

Specification	Value	Notes
UART	300 bps to 115200 bps	Default: 9600bps
USB	Full Speed 12Mbps (HID/COM)	

Optical Section Specifications

Specification	Value	Notes
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°	

Power Specifications

Specification	Value	Notes
Range of Operating Voltage	3.3/5.0 V (3.0～5.5V)	
Current Consumption	MDI-4x00: See **"Current Consumption of the MDI-4x00" on page 39.** MDI-4x50: See **"Current Consumption of the MDI-4x50" on page 40.**	Ambient temperature: 25°C

Environmental Specifications

Specification		Value	Notes
Temperature	Operating	-20 to 60 °C	AC adapter 0 to 40°C
	Storage	-40 to 70 °C	
Humidity	Operating	5 to 90% (non-condensing, no frost)	
	Storage	5 to 90% (non-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 Model (SR) Reading Specifications

Specification	Value
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
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)

Note: OPTOELECTRONICS test chart.

Standard Model (SR) Reading Depth of Field

Resolution mm (mil)	Symbology	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″)	51mm (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 Specifications

Specification	Value
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
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 100% moving at 1 m/s (DOC: 130 mm)

Note: OPTOELECTRONICS test chart.

High-Density Model (HD) Reading Depth of Field

(T_A = 25°C)

Resolution mm (mil)	Symbology	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 Characteristic

Specification	Value
Minimum Resolution	Code 39: 0.051 mm QR Code: 0.084 mm Data Matrix: 0.084 mm
Barcode width	Possible to read: Width 40 mm Code 39 Resolution 0.2 mm (DOF: 75 mm)

Note: OPTOELECTRONICS test chart.

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

(T_A = 25°C)

Resolution mm (mil)	Symbology	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.

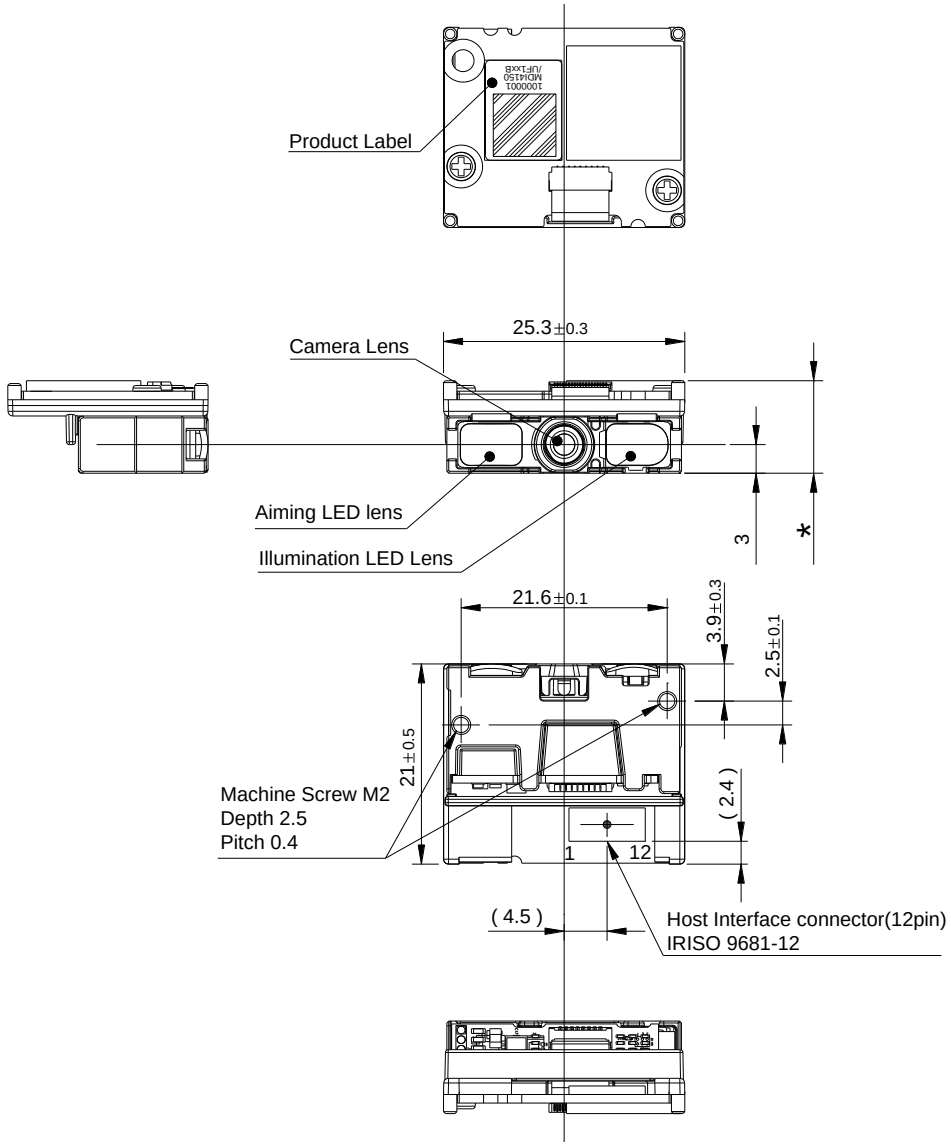
The depth of field is a determined while using the OPTOELECTRONICS test chart PCS 0.9, without specular reflection and at room temperature and room humidity.

10.2.3 MDI-4xx0 Detailed View

MDI-4100 and MDI-4150 Dimensions

Dimensions: W: 25.3 mm × D: 21.0 mm × H: 9.7 mm

Weight: Approx. 5.5 g



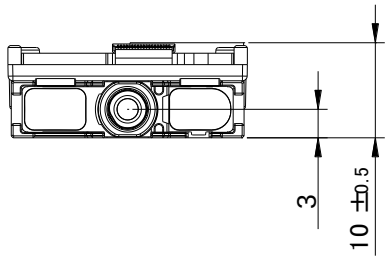
* Height of the MDI-4100 and the MDI-4150

Figure ***45****: MDI-4100 and MDI-4150 Mechanical Drawing*

MDI-4100 and MDI-4150 Circuit Board

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

MDI-4100



MDI-4150

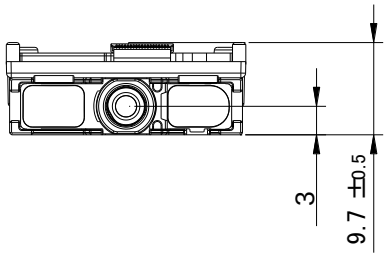


Figure **46***: MDI-4100 and MDI-4150 Circuit Board*

MDI-4000 and MDI-4050 Detailed View

Camera:	Approx. 13.6 mm (D) × 24.6 mm (W) × 6 mm (H)
Decoder Board:	Approx. 20.8 mm (D) × 25.1 mm (W) × 3.2 mm (H)
Weight:	Approx. 5.5g

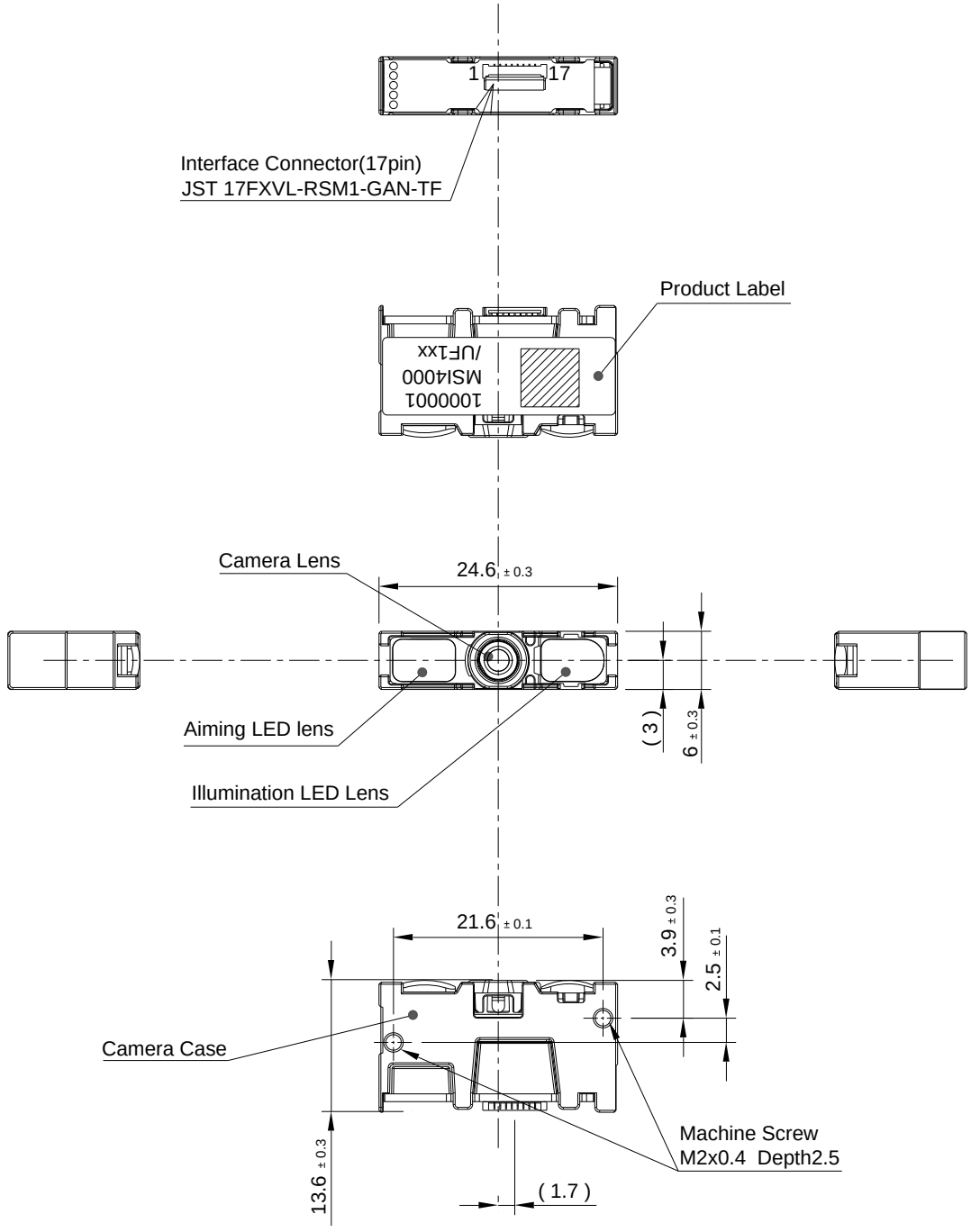
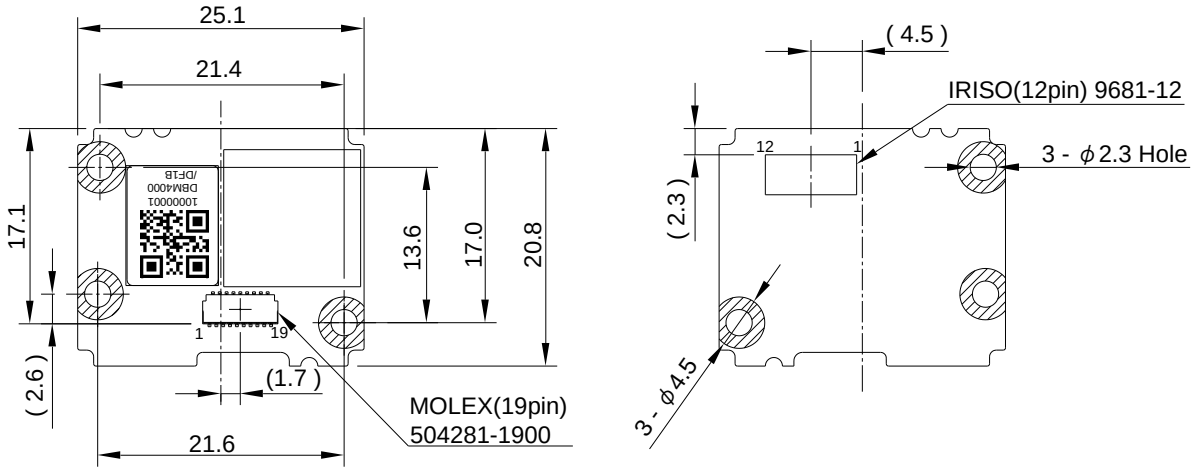


Figure ***47****: MDI-4000 and MDI-4050 Mechanical Drawing*

DBM-4000 and DBM-4050 Decoder Board



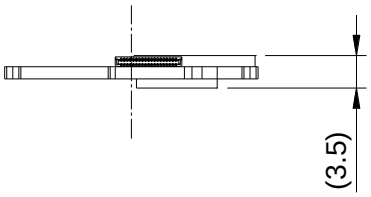
* Height of the DBM-4000 and the DBM-4050.

Figure **48***: DBM-4000 and DBM-4050 Decoder Board*

DBM-4000 and DBM-4050 Circuit Board

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

DBM-4000



DBM-4050

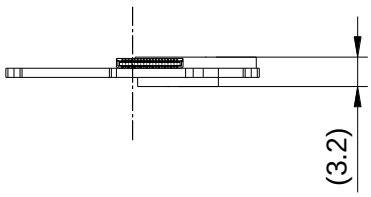


Figure **49***: DBM-4000 and DBM-4050 Circuit Board*

FPC Cable

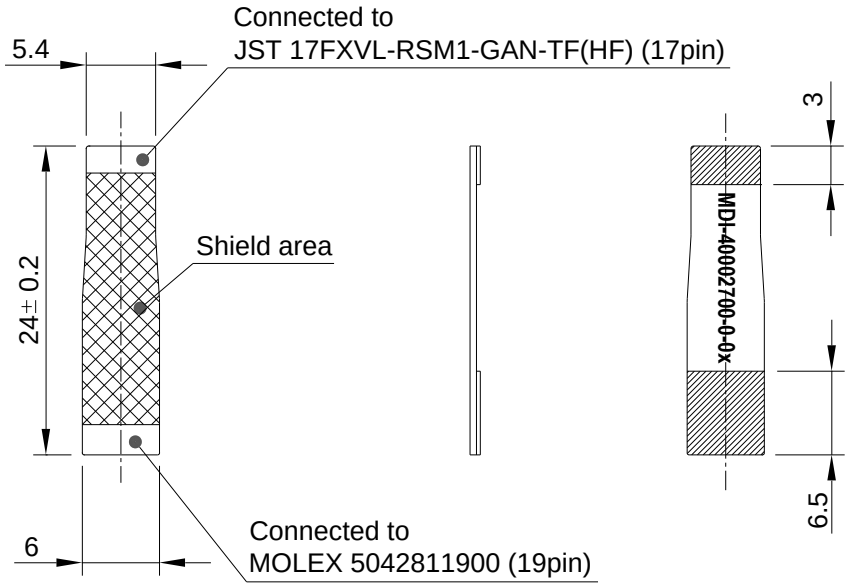


Figure **50***: FPC Cable*

10.3 Sample Barcodes

10.3.1 1D Barcodes

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

Code 39 Italian Pharmaceutical

Code 39 Full ASCII

Tri-Optic

Codabar

Codabar

Codabar ABC

Codabar CX

Industrial 2 of 5/Interleaved 2 of 5

Industrial 2 of 5

Interleaved 2 of 5

S-Code

Code 128

Code 93

IATA

MSI/Plessey

UK/Plessey

Telepen

Code11

Matrix 2 of 5

10.3.2 Postal Code

Chinese Post Matrix 2 of 5

Korean Postal Authority

Intelligent Mail Barcode

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

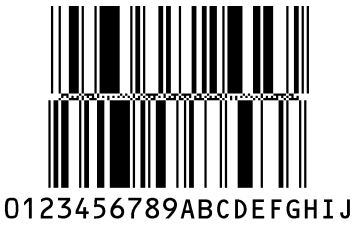
GS1 DataBar Stacked

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

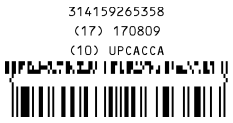
EAN-13 CC-B

EAN-8 CC-A

EAN-8 CC-B

Composite UPC

UPC-A CC-A



UPC-A CC-B

UPC-E CC-A

UPC-E CC-B

10.3.5 2D Barcodes

PDF417

Micro PDF417

Codablock F

QR Code

Micro QR

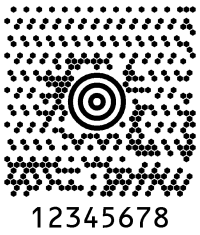
Data Matrix(ECC 200)

Aztec Code

Aztec Runes

Chinese-sensible code

Maxi Code



OCR Font (Machine Readable Travel Document)

ICAO Travel Documents

Machine readable Passports

```
P<JPNABCDEFG<<HIJKLMN<OPQRSTU<VWXYZ<<<<<<<<<

L898902C<3JPN4209247M1609271234567890<<<<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<<<<<<<<<<
D23145890 7UTO7408122F1204159<<<<<<<6
```

OCR Font (Free OCR Edit)

OCR-A

OCR-A Free Edit

Enable

4567890

0123456789012

DEFGHIJ

23456CDEFGH

OCR-B

OCR-A Free Edit

Enable

345678

89012345678

FGHIJKLMN

56789012ABCD

Free Edit

Disable