DENSO

RF Tag Handy Scanner

SP1-QUBi

User's Manual

Contents

Preface

Thank you for using the DENSO WAVE RF Tag Handy Scanner.

Please read this manual thoroughly prior to operation to ensure full use of the product's functionality, and store safely in a convenient location for quick reference even after reading.

Made for iPhone, Made for iPad, and Made for iPod means that an accessory has been designed to connect specifically to the iPhone, iPad, or iPod, and has been certified by the developer to meet Apple performance standards. Apple is not responsible for the operation of this device or its compliance with safety and regulatory standards.

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About This Manual

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- Every attempt has been made to ensure that the content of this manual is thorough and up to date, however, we kindly ask you to report any questionable descriptions, mistakes or omissions, if any, to DENSO WAVE INCORPORATED.

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- DENSO WAVE will not bear any responsibility for data which customers have recorded and are received by DENSO WAVE for repair and analysis.

■ Related Manuals

- DENSO SP1 SDK for Android Manual
- DENSO SP1 SDK for iOS Manual
- DENSO SP1 SDK for Xamarin Manual

Customer Registration and Inquiries

Customer Registration

To allow us to provide our customers with comprehensive service and support, we request that all customers complete a Member Registration Form. Registered members will be offered the following privileges.

- The latest upgrade information
- Free exhibition and event information for new products
- Free web-information service "QBdirect"

QBdirect Service Contents

Information searching service (FAQ)	Offers detailed information on each product.
Download service	The latest OS systems for the SP1 Series, repair software, and sample programs can be downloaded.
E-mail inquiries	Product related queries can be sent in by e-mail.

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

How to Register

Access the URL below and follow the instructions provided.
https://www.denso-wave.com/

Inquiries

For inquires relating to products, please access our website https://www.denso-wave.com .
Technical inquiries can be made at our exclusive website for registered users (QBdirect).

SAFETY PRECAUTIONS

Be sure to observe all these safety precautions.

■ Please READ through these instructions carefully. They will enable you to use the scanner correctly.

■ Always keep this manual nearby for speedy reference.

Safety precautions description in this document.

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

Warning levels

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

Meaning of Symbols

A triangle (⚠) with a picture inside alerts you to a warning of danger. Here you see the warning for electrical shock.

A diagonal line through a circle (⊘) warns you of something you should not do; it may or may not have a picture inside. Here you see a screwdriver inside the circle, meaning that you should not disassemble.

A black circle (●) with a picture inside alerts you to something you MUST do. This example shows that you MUST unplug the power cord.

⚠️ DANGER

Handling the battery

Incorrect handling the batteries may result in electrical shock, overheating, smoke generation, combustion, blowout, or leakage of battery fluid. Please read the following items prior to use.

🚫	• Never disassemble or modify the battery.
🚫	• Do not stick a needle into the battery, hammer at it, or tread on it. • Avoid dropping or throwing the battery or letting it undergo any shock or impact. • Do not use significantly damaged or deformed batteries. Do not use batteries when they are subject to the impact, for example, a drop impact. • Never connect the battery (+) and (-) terminals with a metal object such as a piece of wire. • Do not carry or store the battery together with ballpoint pens, necklaces, coins, hairpins, or anything else metallic. • Never place the battery into or soak it in water or seawater.
🚫	• Never burn or heat up the battery. • Never use, leave, or charge the battery in the vicinity of high-temperature locations (60 °C or higher) such as a fire, stove, or under a scorching sun. • Do not use or store the battery in places exceeding the service or storage temperature.
🚫	• Never charge the battery near a fire or in strong sunlight. Raised battery temperature may result in leakage of battery fluid, blowout, or combustion. • Never charge or use the battery where any inflammable gases may be emitted. • Never apply solder directly to the battery. • Do not use batteries other than the specified ones.
❗	• If the battery fluid leaked from the battery gets into the eyes, wash thoroughly with clean water such as tap water without rubbing and obtain medical treatment immediately. Failure to do so will result in eye injuries. • During use, charging, or storage of the battery, if odors come from the battery, the battery is overheated, discolored, deformed, or anything unusual is found, unload the battery from the scanner or charger. Do not use the battery.
🔌	• If the battery does not finish recharging within the specified time, stop recharging.

⚠ WARNING

⚠

To System Designers:
- When introducing the scanner in those systems that could affect human lives (e.g., medicines management system), develop applications carefully through redundancy and safety design which avoids the feasibility of affecting human lives even if a data error occurs.

Handling the scanner

Incorrect handling of the scanner could cause electric shock, impaired vision, skin problems, injury, burns and generation of heat and smoke from the scanner. Be sure to observe the following to use the device correctly.

🚫	• Never disassemble or modify the scanner.
🚫	• Do not let the battery undergo any shock or impact or throw it at something hard. • When the scanner is subject to the strong impact, for example, a drop impact, check the case for any damage and the battery for damage and leakage. • Never use a damaged case. • Never use a damaged or leaked battery. • Do not insert any foreign materials into the battery. • Do not get the scanner wet or put it in water or seawater. • Never put the scanner in a microwave oven or high-pressure container. • Never put the scanner in places where there are excessively high temperatures, such as inside closed-up automobiles, or in places exposed to direct sunlight. • Avoid using the scanner in extremely humid or dusty areas, or where there are drastic temperature changes. • Never stare into the reading window.
❗	• If battery fluid leaks from the battery and it gets into your eyes, wash thoroughly with clean water such as tap water without rubbing and obtain medical treatment immediately. Failure to do so will result in eye injuries. • If smoke, abnormal odor or noise comes from the scanner, immediately turn off the power and remove the battery from the scanner case.

⚠ WARNING

Handling the battery

Incorrect handling the batteries may result in electrical shock, overheating, smoke generation, combustion, blowout, or leakage of battery fluid. Please read the following items prior to use.

🚫	• The battery is exclusively for the scanner. Do not use the battery for purposes other than charging the scanner. • Never put the battery in a microwave oven or high-pressure container.
❗	• Use the specified charger or charging cable. • If abnormal odor, heat, discoloration, deformation or any other abnormal conditions are noticed when the battery is in use, being charged, or is in storage, remove it from the scanner or charger and avoid further use.

⚠ CAUTION

Handling the scanner
Incorrect handling of the scanner could cause generation of heat and smoke from the scanner, and malfunction. Be sure to observe the following to use the device correctly.

⚠	• When using the hand strap or neck strap, exercise due care to avoid getting them caught in other objects or entangled in rotating machinery. Failure to do so could result in accident or injury.
🚫	• Do not move your ear close to the speaker while the Buzzer is beeping. Doing so could lead to hearing difficulty. • Do not operate the scanner in environments where static electricity can build into significant charges. Doing so could result in malfunction or mechanical failure. • Avoid dropping the battery cartridge or letting it undergo any strong shock or impact. Doing so could result in malfunction or mechanical failure. • Do not use the scanner near a wireless transmitter such as a ham radio. Doing so could result in malfunction or mechanical failure. • Do not touch the scanner with oily hands or gloves containing oil such as machine oil and grease. Doing so may cause the deformation and discoloration of a device. • Do not attach a wet scanner or rechargeable battery cartridge to CU • Do not use excessive force when inserting or removing the battery cartridge. Doing so could result in malfunction or mechanical failure. • Keep magnetic cards such as a cash card or a credit card away from the beeper of this product. Failure to do so

Usage environment restrictions

● Do not use the scanner where it may be exposed to fire, high temperatures, or direct sunlight.

Failure to observe this may result in damage, overheating, explosion, or fire.

When the scanner is stored in a high-temperature, high-humidity environment of 50° to 60°C, leave to sit in a location at room temperature and normal humidity for at least 1 day prior to use.

Failure to observe this may cause a reading failure or damage the scanner.

● Do not use the scanner in places with extreme temperature variations.

Failure to observe this may lead to the scanner malfunction due to condensation.

Leave the scanner for a short while prior to use when moved from a cold to a warm environment.

● Do not use the scanner in places where it may be exposed to strong impact or significant static electricity.
● Do not use the scanner in places where a strong magnetic field is generated.

Failure to observe this may lead to the scanner malfunction due to magnetic force.

Keep the scanner away from radio waves and metallic objects.

Wireless communication may not be possible in the following locations.

● In the vicinity of other RFID devices

Failure to observe this may lead to scanner malfunction.
● In the vicinity of the following devices operating on a 2.4 GHz waveband
・Industrial, scientific, or medical equipment such as microwave ovens
・Wireless LAN devices
・Logistics systems in places such as plants or warehouses
・Wireless devices such as personal radio stations

Communication may not be possible due to radio wave interference.

● In the vicinity of household appliances emitting radio waves such as computers or televisions

Communication may not be possible due to electromagnetic noise.

● In the vicinity of metallic objects, in places with high levels of metallic dust, or in places surrounded by metallic walls

Communication may not be possible due to the presence of metallic objects.

Components Required

This product communicates with iOS terminal such as iPhone, and Android™ terminal using Bluetooth® interface. Since batteries are not included, please prepare either of the following specified batteries.

- Thin-type battery (with thin battery cover)
- Large capacity battery (with large capacity battery cover)
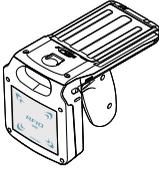
RF Tag Handy Scanner
SP1-QUBi
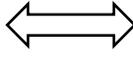
Bluetooth®
Communication

Host terminal

Optional items

Host terminal	BHT-1800 series, etc.	
Thin-type battery (with thin battery cover)	BT-SP1LA-C	Prepare either of these batteries
Large capacity battery (with large capacity battery cover)	BT-SP1L-C	
Communication unit	CU-SP1A	
Charger	CH-SP1L4	4 slots charger
AC adapter	AD3-02 series	For CU and CH
USB Direct Cable	CBSP-US2000/4	
Thin-type battery	BT-180LA	2900mAh
Large capacity battery	BT-SP1L	5800mAh
Attachment	EA-SP1-AS	For Smart Device
Attachment	EA-SP1-A1800	For BHT-1800
Charging Cable	CBBHT-US500/C18-4A	For BHT-1800

Bluetooth® Wireless Communication Link

The scanner SP1-QUBi uses Bluetooth® wireless networking technology.

Item	Specifications
Standard	Bluetooth® Specification Ver. 2.1+EDR
Radio output	Class 2 (maximum 2.5 mW)
Profile(s) supported	SPP (Serial Port Profile), iAP2
Communications range (reference value*1)	Max. 10 m, with no obstructions

*1 This value is for wireless networking between the scanner and the host terminal. The communications range varies with the equipment used and the operating environment.

Wireless networking requires a stable radio environment. Not all operating environments provide this. In particular, note that

- Using the scanner in close proximity to other wireless LAN equipment operating in the same frequency band (2.4 GHz) risks radio interference that can reduce throughput or even entirely block wireless networking.

- Microwave ovens, industrial heating equipment, high-frequency medical equipment, and other equipment using the 2.4 GHz band can sometimes block wireless networking.

- Electromagnetic noise from computers, refrigerators, and other home appliances can sometimes block wireless networking.

- The following environments can sometimes block wireless networking.
  - Metal objects or particles in the vicinity
  - Metal walls around the area
  - Excessive vibration

- The communications range of 10 m given above is merely a reference value assuming a clear line of sight. Reliable wireless networking is by no means guaranteed at 10 m for all combinations of equipment used and operating environments. Some combinations might even work for greater distances, but be sure to confirm that the scanner link operates properly before introducing the link operation.

NOTE: To System Designers:

- Before developing applications, make sure that the intended environment is free of the interference factors above and thus actually capable of supporting link operation.

- When introducing the scanner into an environment where equipment using radio waves in the 2.4 GHz band operates or when introducing such equipment after the introduction of the scanner, be sure to confirm that the scanner radio link operates properly with all equipment being in operation beforehand.

- If the environment of the radio communications system is changed after the introduction (e.g., newly installed household appliances and movement/addition of shelves or objects), then confirm that the radio link operates properly again before the actual use.

Proper Care of the Scanner

Make sure to turn OFF the scanner before cleaning.

■Scanner and battery terminal dirt

Periodically wipe any dirt from the terminals of the scanner and battery with a cotton swab or similar soft object.

Be sure not to scratch or deform the terminals while cleaning.

Never use organic solvents such as thinner or alcohol, as this may cause terminal plating to be peeled off.

■Housing dirt

Wipe any dirt from the housing with a dry, soft cloth.

If excessively dirty, wipe with a soft cloth that has been soaked in soapy water (always use a neutral detergent) and wrung out thoroughly.

Never use organic solvents such as thinner or alcohol, as this may cause the housing to be marred or paint to be peeled off.

■Code reading window dirt

Any dirt or dust adhering to the clear plate of the code reading window will adversely affect reading performance.

When using in dusty areas, check regularly whether any dust has accumulated on the clear plate of the code reading window,

and if so, first blow the dust away with an airbrush, and then gently wipe the plate with a cotton swab or similar soft object.

If sand or hard particles have accumulated, rubbing the plate will result in scratches. Blow the particles away with an airbrush

or wipe with a soft brush.

Chapter 1 Names and Functions

Strap hole
Use this hole when attaching a hand strap.

Code reading window
A window to read two-dimensional code such as QR Code, and barcode

Battery cover

Battery cover lock

Beep sound emitting hole

Trigger switch
Push this switch when reading RF tag or code.

RF tag antenna
Communicates with RF tag.
Do not apply the metallic object such as metallic name tape or cover it with your hand.

Bluetooth® antenna
Do not apply the metallic object such as metallic name tape or cover it with your hand because an antenna is incorporated.

Status indicator
Illuminates in blue when reading is completed.

Charging terminals
Charge the scanner with CU or a dedicated charger.

Power button

Pairing indicator
Shows the Bluetooth® connecting status.

Mode button

Power indicator
Shows the battery level and the charging status.

Pairing button
Push this button when connecting/disconnecting Bluetooth®.

1.1 Description on each operating part

Button	Operation	Description
Power button ⏻	Powers ON/OFF	To power ON, press the button for one second or more when the power is OFF. To power OFF, press the button for three seconds or more when the power is ON.
	Checks battery power level.	Press this button swiftly (for less than one second), and the power indicator turns on in the color according to the battery level.
Pairing button PAIR	Enables Bluetooth®	Press this button for one second or more to enable the pairing. Then, the pairing indicator blinks in blue.
	Disconnects Bluetooth®	Press this button for one second or more while being connected, and then the connection is broken up.
	Disables Bluetooth®	Press this button for three seconds or more when the pairing is enabled, and then the paring will be disabled
Mode button MODE	Switches the pairing mode	Press this button for three seconds or more to switch the pairing mode (master mode/slave mode) of the Bluetooth® function.
	Checks the paring mode	Press this button swiftly (for less than one second), and the status indicator turns on in the color according to the current pairing mode. Blue: Slave mode Red: Master mode
Trigger switch	Reads RF tag/code	Press this switch when reading RF tag or codes.
*	Resets to the factory default.	Press the mode button and the paring button at the same time and press the power button for three seconds or more simultaneously when the power is OFF. Then, the status will be reset to the factory default and the power will be OFF automatically.

*: Mode button, paring button, and power button

1.2 Description on each indicator

Indicator	Status	Description
Status indicator	Red, illuminating	While communicating with RF tag
	Blue, illuminating	RF tag/code reading is completed.
	Red, blinking (High speed, 3 times)	RF tag communication error (*1)
	Red, blinking (Middle speed, 3 times)	Data transfer error (*2)
	Red, blinking (Middle speed, continuously)	Device error (*2)
	Red blinking (Low speed, continuously)	Full buffer (*3)
	Blue, illuminating (for 1 second)	Current pairing mode: Slave mode
	Red, illuminating (for 1 second)	Current pairing mode: Master mode
	Violet, illuminating	While using in a low temperature environment (below 0°C),
Pairing indicator	Blue, blinking (Low speed)	Pairing available status
	Blue, blinking (High speed)	Pairing is completed. (iOS terminal only)
	Blue, illuminating (Continuously)	Connection is completed.
Power indicator	Green, illuminating (for 1 second)	Battery power level: 40% or more
	Orange, illuminating (for 1 second)	Battery power level: 39% to 10%
	Red, illuminating (for 1 second)	Battery power level: Less than 10%
	Orange, blinking (Continuously)	Battery level warning: 39% to 10%
	Red, blinking (Continuously)	Battery level warning: Less than 10%
	Green, illuminating (Only while charging)	Charging is completed.
	Red, illuminating (Only while charging)	While charging
	Red, blinking (Only while charging)	Charging error
Status indicator and Power indicator	Blue, blinking (at the same time)	Software updating (*4)

*1: Confirm RF tag, peripheral environment, and applications at the host side.

*2: If these errors still occur after powering on the scanner again, there may be something wrong with the device. Contact a system administrator.

*3: Only when in the batch mode. Transfer data by the application at the host side.

*4: Do not remove the battery until complete.

1.3 Description on each buzzer

Function	Status	Description
Power	4times (ON 70ms、OFF 70ms)	Power On
	5times (ON 100ms、OFF 100ms)、	Detection of the battery deterioration
	3min interval, 5times (ON 100ms、OFF 100ms)、	Battery power level: Less than 10%
	High freq, 1time (ON 480ms)	Power Off
Barcode and RFID	Short time, 1time (ON 80ms)	Code reading is completed.
	Short time, 1time (ON 80ms)	RF tag reading is completed.
	Low freq, short time, 5times (ON 70ms、OFF 70ms)	RF tag communication error
	High freq, short time, 5times (ON 70ms、OFF 70ms)	Data transfer error
	High freq, short time, 5times (ON 70ms、OFF 70ms)	Device error
	Log freq, short time, 2times (ON 70ms、OFF 70ms)	Switch the master mode to the slave mode
	Low freq, short time, 3times (ON 70ms、OFF 70ms)	Switch the slave mode to the master mode
Bluetooth®	High freq, short time, 3times (60ms、60ms)	Bluetooth® ON/Completed connection
	High freq, long time, 1time (480ms)	Bluetooth® failed to connec/disconnect

2.1 Loading the Batteries

When you purchase the scanner, a battery is not installed. Install it in the following procedure.

1 Press down and slide the battery cover lock ① in the direction indicated by the arrow. Remove the battery cover. ②
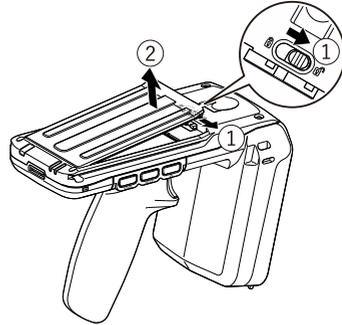
2 Confirm the direction of a battery and an electrode. Insert the battery in the arrow ① direction and completely install it ②.

3 Retract a strap for removing a battery to the position shown in the figure.
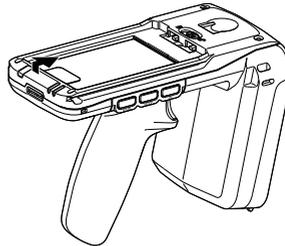
4 Close the battery cover ① so as not to involve the strap. Press down and slide the battery cover lock ② in the direction indicated by the arrow to lock the cover.

5 When replacing batteries, open the battery cover and pull out the battery using the strap.

Before replacing batteries, be sure to power off the scanner.
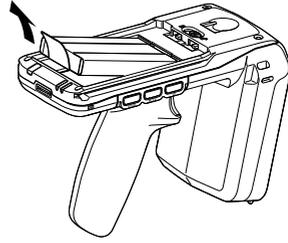
Notice on installing the battery.

・ Remove the battery from the scanner and store it if not using the scanner for an extended period of time.

・ When using the scanner, be sure to attach the battery cover.

2.2 Battery Charging

When you purchase the scanner, a battery has not been fully charged. You need to charge the battery using the dedicated Charging Cradle. Be sure to power off the scanner before charging.

Charging the scanner

1 Connect the output plug of the AC adapter into the DC input connector of the CU.

Connect the AC adapter to a wall socket

AC adapter   **DC input connector**
AD3-02 (FSP050-DBAE1)
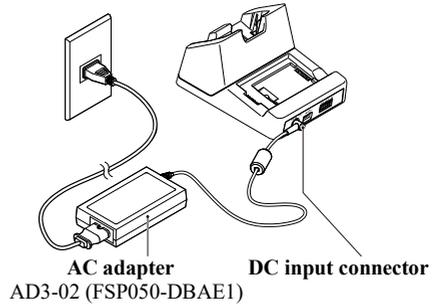
2 Set the scanner on the CU.
Take care not to involve a hand strap between the scanner and the CU.
Push the scanner to the CU securely.
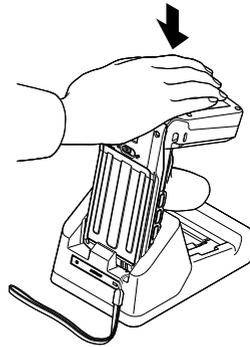
3 The power indicator of the scanner turns red and charging starts. When the charging finishes, the power indicator turns green.

When removing, pick up the scanner with the CU held with one hand.

Power indicator
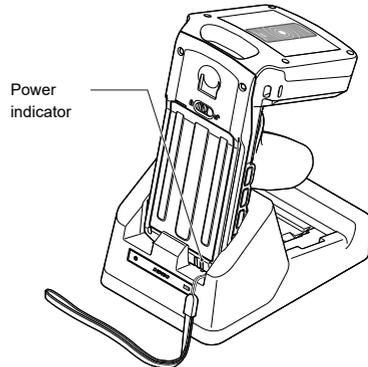
●**Charging time**
・It takes approximately for 3.5 hours for BT-180LA thin-type battery and 7 hours for BT-SP1L large capacity battery to charge a battery to full. This charging time is a standard time when the temperature is at 25°C and it may vary according to the condition of operation.

Power indicator on the scanner
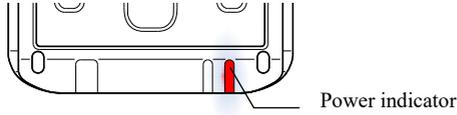
Power indicator

Power indicator	Status
Red, solid	Charging
Green, solid	Charging completed
Red, blink	Charging error (Charging will stop)
No light	Charger is not correctly connected

Charging the spare battery

1 Set a spare battery to this cradle.
Check the direction of electrode and push the battery in the CU securely.

"Spare battery charge indicator" of CU turns red and starts charging.
When "spare battery charging indicator" turns green, charging is completed.

Remove the spare battery from the CU.

Spare battery charging indicator
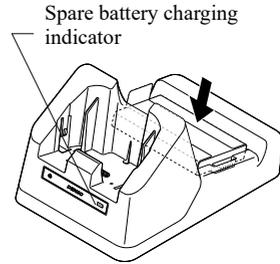
●Charging time
・It takes approximately for 4 hours for BT-180LA thin-type battery and 8 hours for BT-SP1L large capacity battery to charge a battery to full. This charging time is a standard time when the temperature is at 25°C and it may vary according to the condition of operation.

Spare battery charging indicator
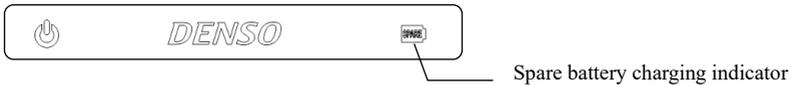
Power indicator	Status
Red, solid	Charging
Green, solid	Charging completed
Red, blink	Charging error (Charging will stop)
No light	Battery is not correctly connected

Use of USB Direct Cable

Connect the Direct Cable to a power adaptor such as a USB charger or a USB port in a host computer.

It may take long to charge to full depending on the power supply capacity of the host computer.

1 Fasten the USB Direct Cable to the lower end of the scanner.

Take care so as not to get a strap entangled in the cable when attaching or removing a direct cable.
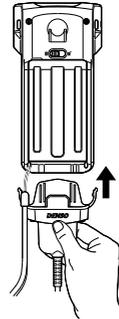
2 When removing, do not pull a cable.
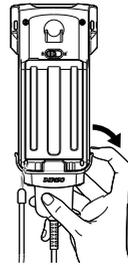
Make sure that the power adaptor has the specified output rating listed below.
Use a USB charger with the specified output rating.
Use a USB charger that is compliant or compatible with the USB-IF standard, Battery Charging Specification Rev 1.2.Failure to follow instruction may cause smoke and or fire.

Power adapter output rating

Specifications	Voltage 5 +/- 0.25 (V) DC
	Current Min 2.0 A

Notice of Charging

●Charging temperature

・Charging the battery at room temperature (18°C to 25°C) is recommended in order to deliver optimal performance. Please note that battery charging stops when ambient temperature drops below 0°C or exceeds 40°C.

●If the power indicator of the scanner blinks red, this indicates the circumstances described below. Please take any appropriate action.

・A battery is not installed.

    Install a battery.

・Inappropriate contact of electrode

    Wipe off dirt around an electrode and charge the battery again.

・Abnormal temperature of battery is detected.

    Charge the battery under an environment at the appropriate temperature (0°C to 40°C).

    Avoid peripheral heated objects and direct sunlight.

    Unless there is any heated object peripherally, stop charging and replace batteries.

    A battery may be heated during the use. In this case, leave the battery for a while and then charge it again.

・A battery has not yet been fully charged even after the specified charging time.

    Recharge it with a spare battery charging slot of CU.

・Due to battery damage and battery life

    Replace a battery with a new one.

・Due to a battery stored for a long time with very low battery level

    Recharge it with a spare battery charging slot of CU.

●Remove the battery from the scanner or the cradle then store in a cool and dry place if not using the scanner for an extended period of time.

●When storing a battery for long periods, please consider the followings.

    ・Do not store a battery immediately after fully charging.
    ・Do not store a depleted (too depleted to turn on the scanner) battery.

    Storing a battery for long periods under the above status may deteriorate the performance and life of the battery.

    During long-term storage, storing the battery at less than 40% of the power level is recommended.

During long-tern storage, charge the battery fully once a year in order to maintain the battery performance. When fully charging, allow the battery to discharge down to the recommended level before restoring.

2.3 Powering ON/OFF

Turning the scanner on

Press and hold the power button of the scanner for one second or more.
The beeper sounds, the power indicator turns on (indicating the battery level), and the scanner powers on.
For the battery level, see "Battery Power Level Indicator".

Turning the scanner off

Press and hold the power button of the scanner for three seconds or more.
The beeper sounds, the power indicator turns on (indicating the battery level), and then the scanner powers off.
For the battery level, see "Battery Power Level Indicator".

2.4 Connecting the Host Terminal

This product communicates with iOS terminal such as iPhone, and Android™ terminal using Bluetooth® interface.

About the paring mode

Pairing mode has master mode and slave mode. It is set as the slave mode at the factory default.

Mode	Operation
Master mode	Tries to connect to the host terminal that is connected last after the power ON. If it cannot be connected within the specified time, the Bluetooth® function will be disabled.
Slave mode	Waits for the connection from the host terminal when Bluetooth® function is enabled. If it cannot be connected within the specified time, the Bluetooth® function will be disabled.

It is set at the master mode if it is connected to the host terminal even once. If you would like to connect to another host terminal, switch to the slave mode by pushing the mode button for three seconds or more.

To check the pairing mode, press the mode button swiftly (for less than one second). Then the status indicator turns on in the color according to the current pairing mode.
    Blue: Slave mode
    Red: Master mode

Paring

Implement the pairing in the slave mode as described below.

1 Enable the Bluetooth® function of the host terminal to enable the detection.

For details, refer to the User's Manual of the host terminal.

2 Power on the scanner, and the pairing indicator will blink in blue and the Bluetooth® function will be enabled a little later. If it is not enabled, press the pairing button for one second or more to enable the pairing.

3 Select this scanner from the device list of the host terminal to implement pairing.

As for iOS terminal, the pairing indicator blinks in the fast cycle.

The device name of a scanner is displayed as "SP1-XXXXXX". XXXXXX is the serial number of the scanner and the serial number is indicated in the rating plate.

4 Connect this product by implementing the user application of the host terminal.

Then, the pairing indicator illuminates in blue.

Paring by using the target setting application

[STEP1] Set host target

SP1 Power on. Then, Reading the QR code on the back side of SP1 from the connection target setting application installed on the host terminal, and register the host terminal information.

[STEP2] Bluetooth enable

Press paring button for one second or more to enable the pairing. Then, the pairing indicator blinks in blue. Connecting to the host terminal, the pairing indicator illuminate continuously.

2.5 Scanning Codes

Follow the procedure below to scan codes.

(1)   Move the code reading window close to the code, and then either start from the user application or press the trigger switch. Light for scanning is irradiated.
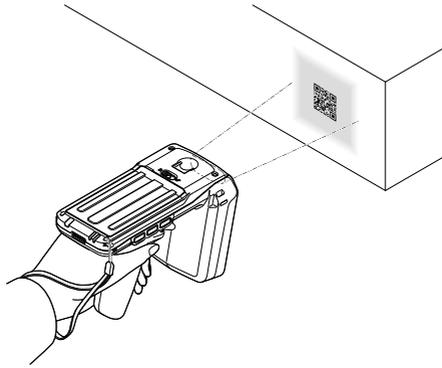
(2)   When the scanning is successfully completed, the status indicator will illuminate in blue and the beeper will be sounded.

Notice on code scanning

・Readable area specified by the light irradiation area is a target area, but does not guarantee the scanning of codes in the light irradiation area.

・Readable area is narrower than the light irradiation area. When the scanning distance is 10 cm, the readable area is approximately 6 X 4 cm.

・Only one code can be contained in the readable area. If there is more than one code in the readable area, a scanner may not be able to scan codes or may continue alternate code scanning. If the multi-line barcode scanning is permitted and if the split QR Code scanning is configured as the batch edit mode, however, more than one code can be scanned all at once.

・A code can be scanned in all direction, but scan it at the position where it is securely within the reading area including the margin.

・A part of light reflected on the label may become extremely strong according to an angle between the irradiated light of a scanner or room light, and the label, which may cause the specular reflection and disable the code scanning. In this case, adjust the angle and/or distance between the label and the scanner.

When codes cannot be scanned successfully

Cause		Measure
Specular reflection	When the light is focused on the printed surface of the code from directly above, the scanner may not read the code due to specular reflection.	Adjust an angle between the code printed surface and the scanner, and try again.
Distance from code	Scanning may be unsuccessful if it is too close to or too far from the reading window of the scanner, even when the code is within the read area.	Move the scanner slowly toward or away from the code and try again.
Code surface curvature	Scanning may be unsuccessful if the code surface is curved.	Scan the barcode at the center of the barcode reading window.
Code surface dirt	Scanning may be unsuccessful if its surface is dirty.	Wipe the dirt from the code and try again.
Code reading window dirt	Scanning may be unsuccessful if the code reading window is dirty.	Blow any dust away with an airbrush, and then gently wipe the reading window with a cotton swab or similar soft object.
Direct sunlight, ambient light	Code scanning may be adversely affected by direct sunlight or the brightness of the surrounding light.	Perform code scanning away from direct sunlight. Try adjusting the brightness of the surrounding light when scanning indoors.
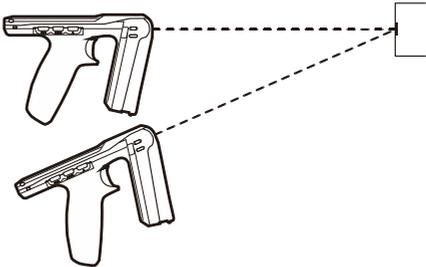
2.6 Reading/Writing RF Tags

Read or write RF tags in accordance with the procedures described below.

(1)　Point the RF tag antenna toward the RF tag, and then either start from the host user application or press the trigger switch. The status indicator illuminates in red and the radio wave is emitted to the RF tag.

RF tag

A part of RF tag antenna
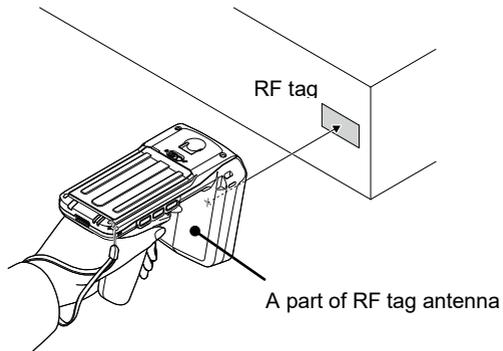
(2)　When the reading/writing is successfully completed, the status indicator will illuminate in blue and the beeper will be sounded.

Notice on RF tag reading/writing

・Radio wave is used when reading/writing RF tag. Therefore, the peripheral metallic objects and devices using radio wave (e.g. mobile phone, ham radio, and microwave oven) may deteriorate the reading performance of the scanner. When using the scanner, keep the above mentioned items as far away as possible.

・When two or more RFID devices are used closely in a row, the scanner may have difficulty in reading or cannot read codes due to interference. Keep each device away in the sufficient distance.

・Inconsistency of resonance frequency caused by an object with RF tag may make it difficult to read the tag. Select RF tag with less inconsistent frequency and confirm the operation in advance.

・If the scanner is continuously used for reading/writing RF tag, the RF tag antenna may be heated. Do not touch the heated RF tag antenna. Doing so for a long time may cause low-temperature burn.
If the scanner is used for reading/writing RF tag for a long time continuously, it may operate slowly or cannot read the tag smoothly due to the protection from heating of internal parts. This may not cause a problem. If the sufficient reading performance is required, however, stop emitting the radio wave, and retry the operation a little later.

・If the scanner is used under the circumstances at the high temperature for a long time continuously, it may operate slowly or cannot read the tag smoothly due to the protection from heating of internal parts. This may not cause a problem. If the sufficient reading performance is required, however, stop emitting the radio wave, and retry the operation a little later. To take the reading performance fully into account, use the scanner under the circumstances at the normal temperature.

・If the scanner is used under the circumstances at the low temperature (below 0°C), use the large capacity battery (BT-SP1L).

・If the scanner is used under the circumstances at the especially low temperature (below -10 °C. e.g. in the refrigerated warehouse), power the scanner ON at the normal temperature in advance and then take it there. Powering ON the scanner at the low temperature may interrupt the operation.

・If the scanner is used under the circumstances at the low temperature, it may operate slowly or cannot read the tag smoothly due to the characteristics of a battery. The operable time may also be extremely reduced. Confirm the operating condition in advance to use the scanner at the low temperature.

・If the communication with the host terminal is disconnected during the RF tag reading, the scanner continues the RF tag reading as the batch mode and accumulates data in SP1. Accumulated data will disappear when the battery level is specially low. Immediately reconnect to the host terminal and pick up data. Never remove a battery during the batch mode.

・If the scanner is charged during RF tag reading/writing, communication with the RF tag will be interrupted. If the charging is discontinued, communication with the RF tag will resume.

When an RF tag cannot be read/written correctly

Cause		Measure
Effect of metal	When an RF tag is placed on a metal plate, it may not be read/written.	Keep an RF tag 15 cm or more away from a metal plate.
Effect of electromagnetic noise	If you use the scanner near electric appliances which generate electromagnetic noise, including an inverter fluorescent light, microwave oven, and electromagnetic cooking device, etc., it may not be able to read and write RF tags.	Do not use the scanner near electric appliances which generate electromagnetic noise, including an inverter fluorescent light, microwave oven, and electromagnetic cooking device, etc.
Radio interference	If there is any other RFID device near the scanner, it may not be able to read/write RF tags. If the scanner is used near other radio devices such as a personal radio station or an amateur radio station, it may not be able to read/write RF tags.	Do not use the scanner near other RFID devices. Do not use the scanner near other radio devices such as a personal radio station or an amateur radio station.
Distance from an RF tag	If the distance from an RF tag is too close or too far, the scanner may not be able to read/write it. The writable distance may be shorter than the readable distance.	The readable and writable distances vary according to the RF tag type. Slowly move the scanner toward and away from an RF tag to find the readable and writable distances.

2.7 Battery Power level Indicator

The battery power level can be checked with the power indicator by pressing the power button swiftly. The battery power is displayed in 3 levels.

Level: 40% or more: Illuminating in green

39% to 10 %: Illuminating in orange

Less than 10%: Illuminating in red

The battery power level indicator shows only a rough estimate of battery power and does not show an accurate remaining power level. Therefore, please charge the battery early.

If the power indicator blinks in orange, it indicates that the battery power level become low and recommends the immediate charging. Please read Safety Precautions for the handling of the battery to ensure the proper battery use.

Battery service life

The battery is a consumable part. And it should be replaced upon the earlier of one year or after being charged approximately 300 times. The performance of the battery's lithium-ion battery will deteriorate gradually with repeated charging and discharging, even during normal use. When the battery operation time becomes shorter even after charging for the specified length of time, replace the battery with a new one. Generally, a battery will soon deteriorate under the circumstances at the high temperature. Continuous use of a scanner and repeated scanning of RF tags for a long time at the high temperature may decline the battery service life earlier than usual. In this case, replace the battery with a new one.

2.8 Attaching the Host Terminal

2.8.1 Attachment for BHT-1800
  Install the attachment for BHT-1800 series in the following procedure.

1 Prepare the attachment for BHT-1800 series (separately sold).

Attachment locking area
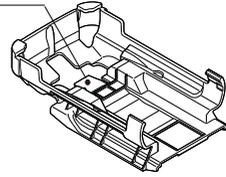
2 Slide the attachment all the way to the end in the arrow direction along the rails on both sides of the scanner. Check that the attachment is locked.
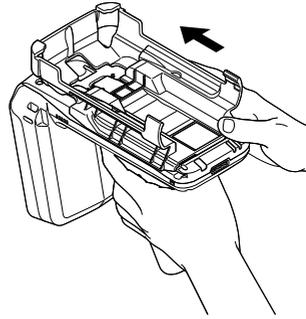
3 Insert the end of BHT-1800 as shown on the right to install.
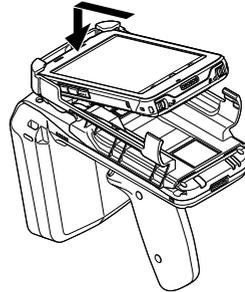
4 When removing, lift the rear end of the terminal as shown on the right.
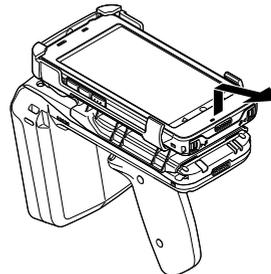
5	When removing the attachment from the scanner, push the attachment as shown on the right, remove it's locked area, and slide it.

Note: Do not remove the attachment with your finger caught in the locked area. Doing so could damage the device.
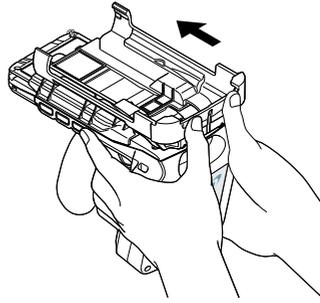
Cautions on installing the BHT-1800

● Do not drop or swing a scanner with the attachment installed, or let it undergo any strong impact.
● The malfunction of the host terminal and devices, and defective data having been dropped or subject to impact are not guaranteed.
● When attaching or removing the attachment, be sure to remove the strap.

2.8.2 Universal Attachment
    Install the device such as the smartphone in the following procedure.

1	Prepare the attachment for universal device (separately sold).

Attachment locking area
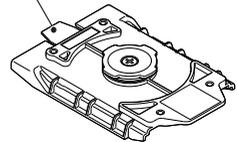
2	Slide the attachment all the way to the end in the arrow direction along the rails on both sides of the scanner. Check that the attachment is locked.
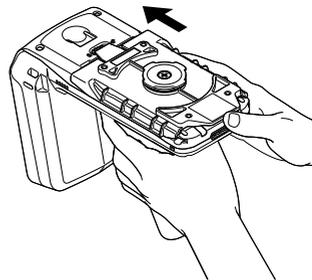
3 Attach the adaptor supported by QUAD LOCK® (separately sold) as shown on the right to install.
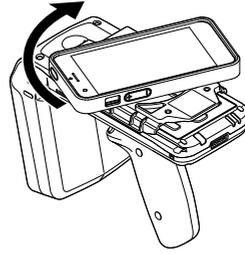
4 When removing, follow the procedure shown on the right.
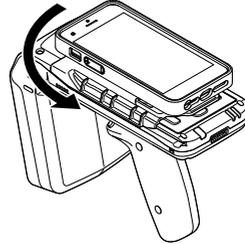
5 When removing the attachment from the scanner, push the attachment as shown on the right, remove it's locked area, and slide it.

Note: Do not remove the attachment with your finger caught in the locked area. Doing so could damage the device.
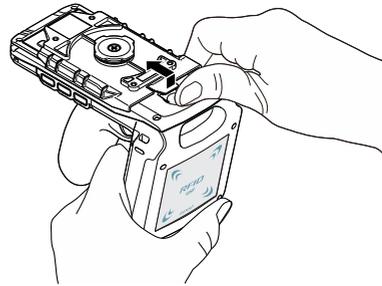
Cautions on installing the universal attachment

- Do not drop or swing a scanner with the attachment installed, or let it undergo any strong impact.
- The malfunction of the host terminal and devices, and defective data having been dropped or subject to impact are not guaranteed.
- When attaching or removing the attachment, be sure to remove the strap.

---

86 mm

40 mm
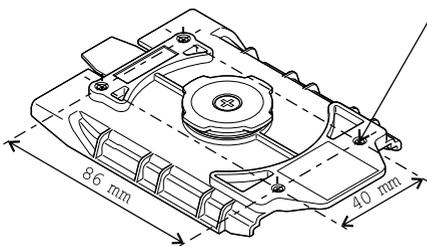
4×M3×5

Specification for the screw installation hole
  Nominal diameter and pitch: M3×0.5 mm
  Depth of thread: 5 mm
  Maximum tightening torque: 1.5 Nm

* Prepare screws in advance after checking the installing condition.

  Tighten screws with the appropriate torque. Make sure that there is no looseness before using the device.

Troubleshooting Guide

Problem   The scanner does not power on.

・Make sure that the battery is properly inserted into the scanner.

・Check the battery power level and charge the battery if necessary.

・Wipe any dirt from the battery and scanner terminals.

Problem   The scanner cannot be charged.

・Make sure that the dedicated Cradle is used.

・Make sure that the battery is properly inserted into the scanner.

・Make sure that the scanner has been properly placed on the Cradle.
　The power indicator of scanner will turn red when properly placed on the Cradle.

・Wipe any dirt from the battery and scanner terminals.

・If the battery in use is an old one that has been repeatedly charged 300 times or more, or if more than one year has elapsed, replace it with a new one.

Problem   The scanner unexpectedly powers OFF.

・Make sure that the battery has been fully charged. If not, charge the battery.

・The scanner may be set to auto power OFF. If so, the scanner will automatically power OFF when it is not used for the specified period of time.
　The auto power OFF setting can only be changed with the user program.

If the scanner cannot be turned ON even after taking all the above measures, there is a possibility that the Cradle is broken. Notify the system administrator.
Refer to the User's Manual for appropriate measures if an error message is displayed on the scanner during the operation.

Chapter 3 Parameters and Defaults

The parameters in the table below can be set with application software.

Please refer to " DENSO SP1 SDK for Android API Reference Manual" for setting contents and setting method.

(1) Common parameters

Descripiton	Parameter
Power save	Normal
sound the buzzer when power-on	Buzzer on
Confirm battery charge remaining by push power button	Enabled
Buzzer volume	LOUD
Buzzer tone	HIGH
Buzzer duration	MIDDLE (80ms)
Auto power off	Enabled
Auto power off time duration	60min
Bluetooth wait settings when disconnected	Enabled
Disconnect by hold down pairing button	Wait host
Sound the buzzer when reading RFID or Barcode	Enabled
Light the LED when reading RFID or Barcode	Enabled

(2) Barcode parameter

Descripiton	Parameter
Trigger mode	Auto-off Mode
Light mode	Auto
Marker mode	Normal
Re-read prevention time	1s
Decoding level	4
Revesed reflectance reading	Disabled
Point scaning mode	Normal
Reverse mode	Disabled
Mirror reflection	Disabled
ITF minimum number of digits	4
STF minimum number of digits	3
CODABAR minimum number of digits	4

(3) RFID parameter

Descripiton	Parameter
RF Trigger mode	Continuous mode 1
Read power dBm	30dBm
Write power dBm	30dBm
Channel	All channels enabled
Q param	4
Session flag	S0
Session init	Disabled
Polarization	Both vertical and horizontal
Power save	Disabled
Double reading	Disabled
Write verify	No verify
Link profile (*1)	Link profile 4 (*2)

*1: Link profile

Link profile	
1	Tari : 25us, Tag response : Miller-4, Link Frequency : 250kHz
2	Tari : 25us, Tag response : Miller-4, Link Frequency : 300kHz
4	Tari : 12.5us, Tag response : Miller-2, Link Frequency : 400kHz
5	Tari : 12.5us, Tag response : FM0, Link Frequency : 400kHz

*2: Link profile 2 for EU and India model

Appendix 1. Specifications

Item			SP1-QUBi
Scanning spec.	RFID	RF tag	ISO/IEC 1800-63 Type C (EPC global Class 1 Gen2) compatible
		Frequency	See Appendix 1. Specifications(2)
		RF Power	See Appendix 1. Specifications(2)
		Modulation	PR-ASK
		Scanning speed(*1)	700 tags per second MAX.
		Scanning distance(*1)	Aprrox. 8m MAX.
		Output adjustment	10 – 30dBm
	Code scanner	Readable codes	QR Code (Model 1 and Model 2), MicroQR, rMQR(*2), SQRC(*3), PDF417, MicroPDF417, MaxiCode, Data Matrix, and EAN.UCC Composite symbol EAN-13/8, UPC-A/E, UPC/EAN with add-on, Interleaved 2 of 5 (ITF), Standard 2 of 5 (STF), Code 39, Codabar (NW-7), Code 93, Code 128, GS1-128 (EAN-128), and GS1 DataBar (RSS)
		Skew angle	360°
		Scanning resolution	0.167 mm (6.6 mils) min. for two-dimensional codes 0.125 mm (4.9 mils) min. for barcodes
		Elevation angle (skew)	±50°
		Tilt angle (pitch)	±50°
		Light source	LED (red)
		Reading confirmation	Blue LED, and beeper
Interface	Bluetooth®		Bluetooth® Specification Ver. 2.1+EDR compatible
	Profile(s) supported		SPP (Serial Port Profile), iAP2
Input power	Main power		Li-ion battery(BT-180LA, BT-SP1L)
Internal memory			80,000 RF tags

(∗1) Function settings may be subject to restrictions in some countries..
(∗2) The firmware and Software Development Kit(SDK) versions of SP1-QUBi that can read rMQR are as shown below:
    SP1-QUBi firmware version: Ver. 1.16 or later.
    DENSO SP1 SDK for Xamarin Version: Ver. 1.1.0 or later.
(∗3) To use SQRC outside Japan, contact your Denso Wave representative.

Item		SP1-QUBi
Operating time (*4)		4 hours(BT-180LA), 8hours(BT-SP1L)
Environmental conditions	Operating temperature range	-20° to 40°C(∗5)
	Charging temperature range	0° to 40°C(18° to 25°C recommended)
	Operating humidity range	5% to 95% RH (∗6)
	Storage temperature range	-20° to 60°C
	Storage humidity range	5% to 95% PH (∗6)
	Drop resistance (∗7)	30 drops from 1.2m onto concrete(5times on each of 6faces), 1.5m
	Protection rating	IP54
	Tumble (∗7)	1000 drops (0.5m)
Dimensions (W) × (D) × (H)		90 × 174 × 128 mm
Weight		Approx. 400 g (with BT-180LA), Approx. 450 g (with BT-SP1L)

(∗4) These operating times are reference values measured under room temperature and other conditions set by our company. Actual operating times depend on working conditions. Conditions set by our company: Power Save Mode 2, RF Tag Continuous Read Mode 1, LOW beeper level.
(∗5) When the product is used at ambient temperatures of -10°C or below, turn on the product and operate briefly at normal room temperature before taking the product to the worksite; do not turn off.
Due to battery characteristics, operations may be subject to certain limitations, such as significantly decreased operating time, under low temperature conditions (0°C or lower). If ambient temperatures are very low, check for normal function before using the product..
(∗6) Sharp temperature change, dewing or freezing not allowed, wet-bulb temperature 30°C max.
(∗7) This is a test value obtained under room temperature conditions. It is not a guaranteed value.

Appendix 1. Specifications(2)

RFID characteristics

Country	Freq. in MHz	RF power	Remarks
Europian Union	865 - 868	2W ERP or less	Link profile4,5 : 0.5W ERP or less
Uinted States of America	902 - 928	4W EIRP or less	
Canada	902 - 928	4W EIRP or less	
Australia	920 - 926	4W EIRP or less	
Israel	915 - 917	2W EIRP or less	
Taiwan	922 - 928	4W EIRP or less	
Thailand	920 - 925	4W EIRP or less	
Hong Kong	920 - 925	4W EIRP or less	
Singapore	920 - 925	2W ERP or less	
Indonesia	920 - 925	0.4W EIRP or less	
Vietnam	918 - 923	0.5W ERP or less	
Malaysia	919 - 923	2W ERP or less	
Philippines	918 - 920	4W EIRP or less	
India	865 - 867	2W ERP or less	Link profile4,5 : 0.5W ERP or less
China	920.5 – 924.5	2W ERP or less	
New Zealand	920 - 926	4W EIRP or less	

[1] RF tag specifications

Item		Specifications
Communication System		ISO/IEC 18000-63 Conforming to (GS1 Gen2)
Interogater to RF tag	Modulation system	PR-ASK 80-100%
	Encoding system	Pulse interval [PIE]
	Communication speed	40 kbps
RF tag to Interogater	Modulation system	Backscatter ASK
	Encoding system	Mirror Subcarrier or FM0
	Communication speed	62.5 to 400 kbps

Cautions on RFID Communication Notes

1. Communication may become "unstable" or "impossible" even if the RF tag satisfies the above specifications.

   Therefore, operation should be checked thoroughly by using actual tag.

2. Do not touch the antenna area by hand during communication to avoid interfering radio waves.

3. The communication performance may decline at places near metals.

[2] RF tag performance

The reading performance is a value when the measurement is implemented under the following condition.

Temperature: 25 ± 5 ℃

RF tag to be used: DENSO WAVE specified tag

Reading: AD-229r6 manufactured by AVERY DENNISON

Writing: AD-227m5 manufactured by AVERY DENNISON

Operation mode: Reading within 5 seconds at the Auto-OFF mode, Link Profile=1

Ambient environment:

・Only objects and operators exist within a range of a meter.

・Wireless devices such as mobile phones do not exist within a range of a meter.

・There is no radio reflection from the peripheral objects.

[3] RF tag reading distance
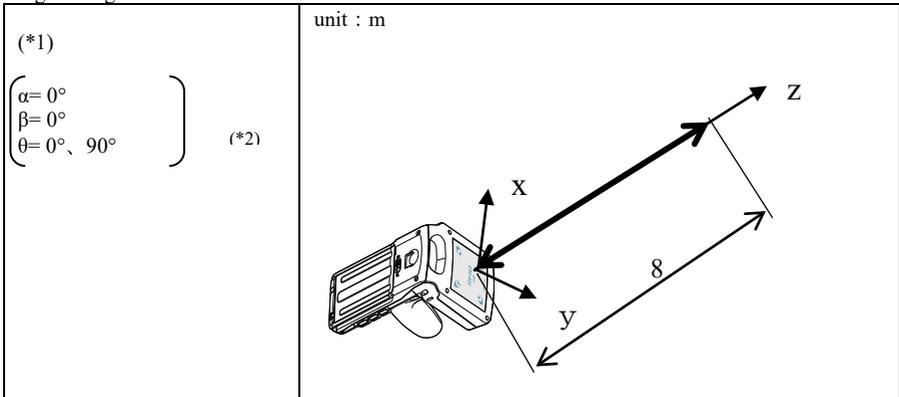
*1: This is not a guaranteed value but a reference value measured by using DENSO WAVE specified tag (AVERY DENNISON AD-229r6).

It is applicable when the center of RF tag exists within the range where arrows indicate in the figure.

*2: Define α, β, θ as follows.

Elevation angle α	
Tilt angle β	
Skew angle θ	
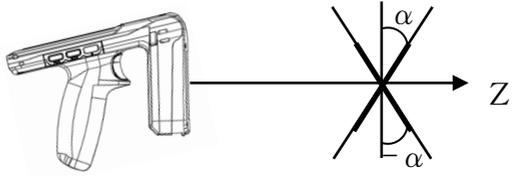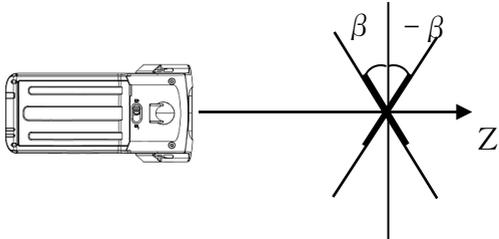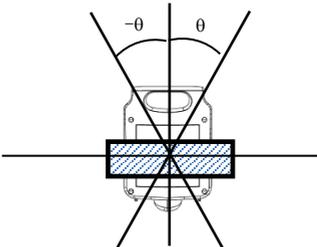
*3: Communication when writing in the RF tag
   When controlling the RF tag for writing, the RF tag communication range tends to be narrow in comparison with the case when reading RF tag. Available writing range becomes approximately a quarter to a half of the available reading range.

[4] Others
(1) Data writing in RF tag may be impossible depending on the RF tag type and the ambient environment.
(2) Communication distance decreases when antenna surface crosses tag surface at right angles.
(3) Communication distance is affected by the position of the scanner in hand and holding method of the scanner.
.

Appendix 2. Bluetooth® Glossary

The table below lists Bluetooth® communication terms used in this manual.

Bluetooth® Address (Bluetooth® Device Address) (BD_ADDR)	Bluetooth® Device Address. Each Bluetooth® device is allocated a unique 48-bit device address defined by the Bluetooth® SIG.
Local Name	Bluetooth® Device Name. This is a user-friendly name for the Bluetooth® device to identify itself.
Bluetooth® Wireless Link	Wireless communications line connecting the master and slave devices. When the Bluetooth® wireless link is established, data can be sent to and from the master and slave devices.
Master	Master device that initiates and requests operations and controls slave devices.
Slave	Slave device that is network-controlled by the master device in Bluetooth® wireless communication.

Appendix 3. CU-SP1A Specifications

(1) Hardware

Input voltage	12V DC
Dimensions	110 x 158 x 84 mm
Weight	Approx. 295g
Current Consumption	2.5A（at 12V DC）
Operating　temperature	0～40℃
Storage temprature	-10～60℃

84

110

158

unit[mm]
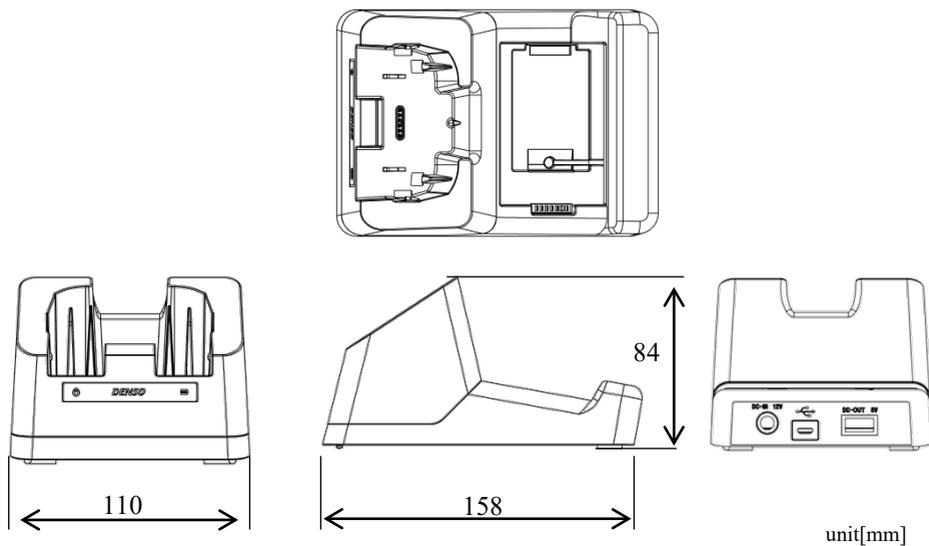
(2) Charging time

Charging SP1	BT-180LA　approx. 3.5 hours
	BT-SP1L　approx. 7 hours
Charging spare battery	BT-180LA　approx. 4 hours
	BT-SP1L　approx. 8 hours

　　The charging time is only for reference at an ambient temperature 25 ℃.

(3) DC output connector

　USB A port : 5 V、1.5 A MAX.

RF Tag Handy Scanner

SP1-QUBi

User's Manual

3rd Edition, January 2024

DENSO WAVE INCORPORATED