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Cat.No. Z127–E1–1

V600 RFID System

R/W Heads and SRAM Data Carriers

OPERATION MANUAL

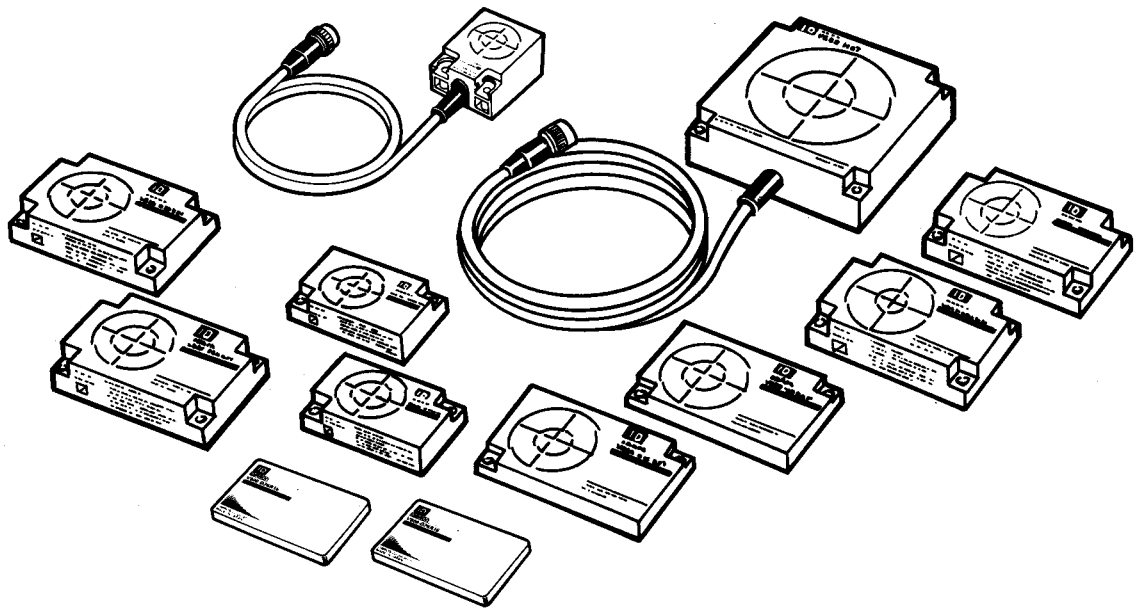
OMRON

V600 RFID System

R/W Heads and SRAM Data Carriers

Operation Manual

Produced August 1998



Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠Caution Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Product Application

You must allow sufficient leeway against product ratings and functionality, and provide safety measures, such as fail-safe measures, whenever applying the products described in this manual in any of the following situations. Always consult with your OMRON representative whenever applying the products in any of these situations.

- Applications under any conditions or any environments not described in this manual.
- Applications for nuclear power control, railways, aviation, automobiles, furnaces, medical equipment, amusement equipment, safety equipment, etc.
- Applications that can affect human life or property or that particularly require safety.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

TABLE OF CONTENTS

About this Manual:

This manual describes the installation and operation of the V600-series Read/Write Heads and battery-powered SRAM Data Carriers, and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install and operate the Read/Write Heads and Data Carriers. Keep this manual in a convenient location where it can continue to be used for reference and guidance.

Section 1 provides general information on features and system configuration.

Section 2 provides specifications for the Read/Write Heads and Data Carriers.

Section 3 provides communications specifications.

Section 4 explains how to install the Read/Write Heads and Data Carriers.

Section 5 provides information on specific chemicals that affect the Read/Write Heads and Data Carriers.

Appendix A provides information on accessories that can be purchased separately.

Appendix B provides information on discontinued models and their replacements.

Appendix C provides information on particular models to be used in England.

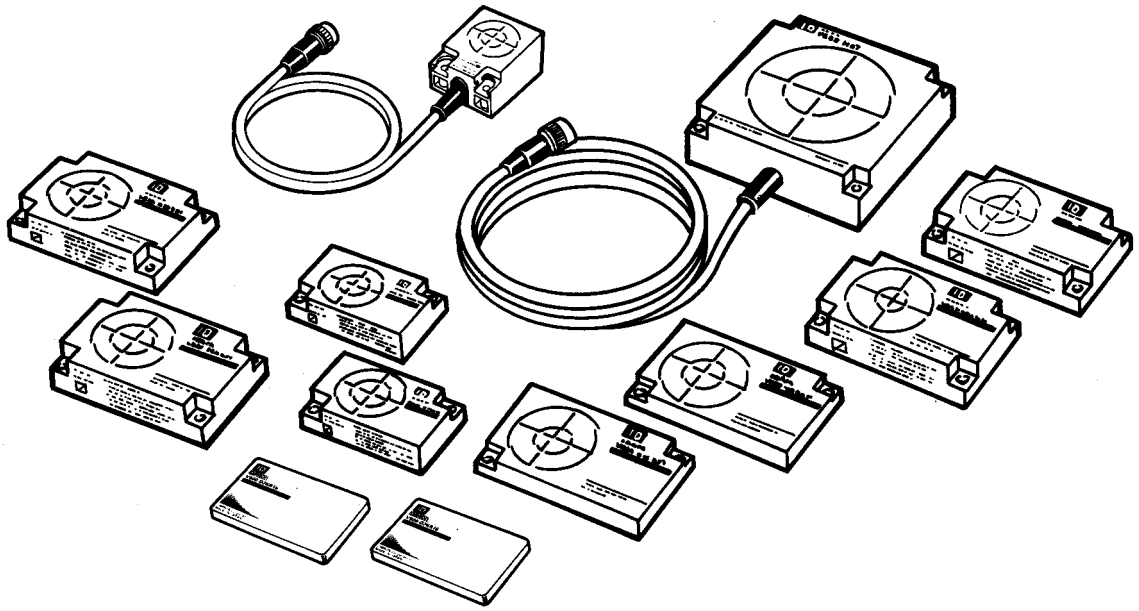
⚠WARNING Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

SECTION 1
Features and System Configuration

This section provides a general introduction to the V600 RFID System, including the V600-series Read/Write (R/W) Heads and Data Carriers. The V600 RFID System utilizes non-contact data transfer in which data is transmitted electromagnetically without physical contact between the devices.

1-1 Features

The V600 RFID System offers powerful support to the automation of large-scale distributed control systems and multi-model small-scale production systems by means of contactless data communication.



Contactless Data Transfer

Data is transmitted between the Data Carrier (DC) and Read/Write (R/W) Head electromagnetically in both directions, without physical contact between the two devices.

SRAM Memory

SRAM (static random access memory) is used for the DC's memory. There is no limit to the number of times that the memory can be accessed for reading or writing data. The memory is powered by a long-life lithium battery.

CRC Error Detection

A 16-bit CRC (Cyclic Redundancy Check) has been added to detect data transmission errors in both directions between the ID Controller and R/W Head, and the R/W Head and DC. This feature also helps to ensure superior transmission reliability even in environments where noise tends to occur.

8K-byte Memory

The DCs have an 8K-byte memory. In addition to essential identification data, information on models and test results can be entered on-site.

Long Battery Life

The battery will last eight years in temperatures ranging from –25°C to 70°C (–18°F to 158°F).

Battery Status Checking

The projected battery service life can be easily checked by means of a command from the ID Controller, which simplifies battery maintenance.

Superior Durability and High Reliability

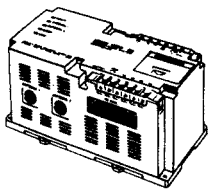
The R/W Head and DC offer superior resistance to environmental factors such as vibration, oil, water, and so on.

1-2 System Configuration

A V600 RFID System is made up of ID Controllers, R/W Heads, and DCs. A system can be assembled to suit almost any situation with different arrangements of these components.

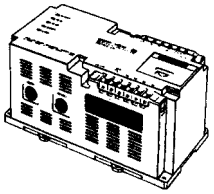
ID Controllers and ID Sensor Units

V600-CA1A/CA2A



100 to 240 VAC
Host: RS-232C/RS-422

V600-CA8A/CA9A

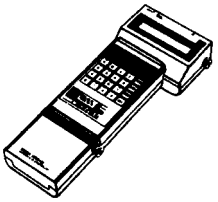


100 to 240 VAC
Host: Parallel PNP/NPN

V600-CF1A

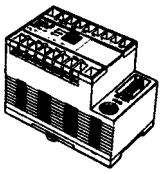
100 to 240 VAC
Host: RS-232C

V600-CB-S



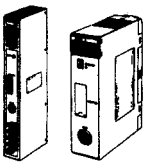
Hand-held Model

V600-CD1D-V2



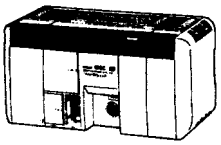
24 VDC
Host: RS-232C

C500-IDS01-V2
C200H-IDS01-V1



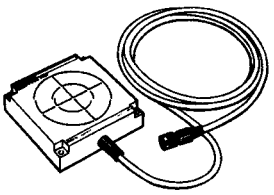
PLC, ID Sensor Units

IDSC-C1DR-A
IDSC-C1DT-A

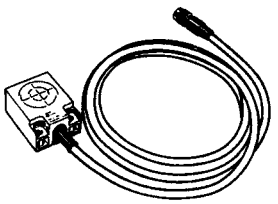


ID Controllers

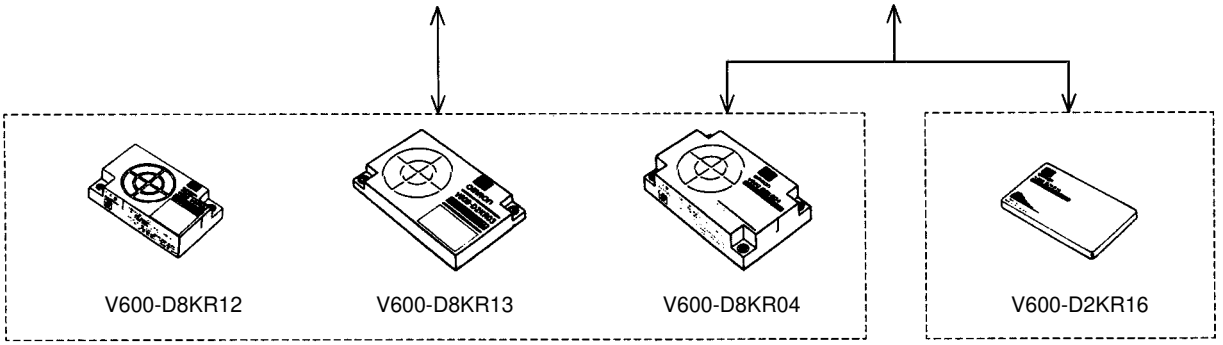
R/W Heads and Data Carriers



V600-H07



V600-H11



Note Refer to Appendix B for details on the availability of V600-H12 and V600-D8KR11.

SECTION 2
Specifications

This section provides Read/Write (R/W) Head and Data Carrier (DC) specifications.

2-1 R/W Heads

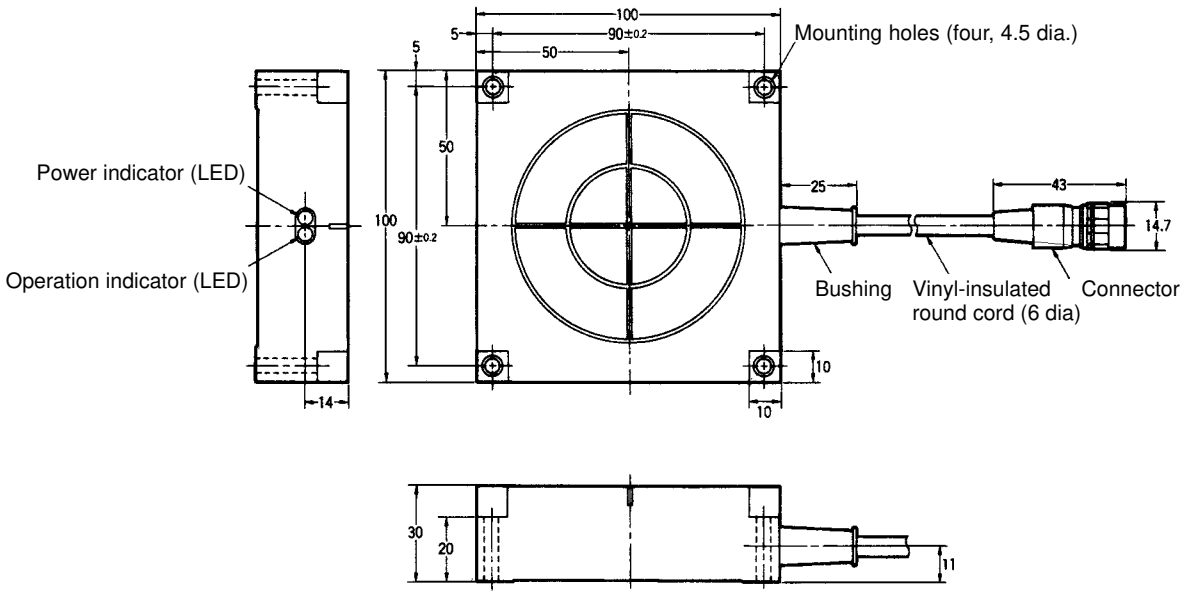
2-1-1 Specifications and Outer Dimensions

V600-H07/V600-H11

Item	Model	
	V600-H07	V600-H11
Operating frequency	530 kHz	
Operating temperature	–25°C to 70°C	–10°C to 60°C
Storage temperature	–40°C to 85°C	–25°C to 75°C
Operating humidity	35% to 95% RH	
Insulation resistance	50 MΩ min. between cable terminals and case (at 500 VDC)	
Dielectric strength	1,000 VAC 50/60 Hz for 1 minute between cable terminals and case.	
Degree of protection (See note.)	Meets or exceeds IEC60529 IP67 and JEM IP67G standards.	
Vibration resistance	10 to 500 Hz, 1.0 mm in each direction; acceleration: 150 m/s^2 (about 15 G); one sweep in each of three axis directions, three sweeps in 11 minutes	
Shock resistance	500 m/s^2 (about 50 G) three times each in X, Y, Z directions, total 18 times	
Error detection	16-bit CRC (Cyclic Redundancy Check) is used in both directions of transmission.	
LED indicators	Power supply: green; communications: orange	
Cable length	Standard lengths of 0.5, 2, 5, and 10 m.	
Max. cable length	30.5 m	50.5 m
Weight (approximate)	1 kg (with 10 m cable)	650 g (with 10 m cable)

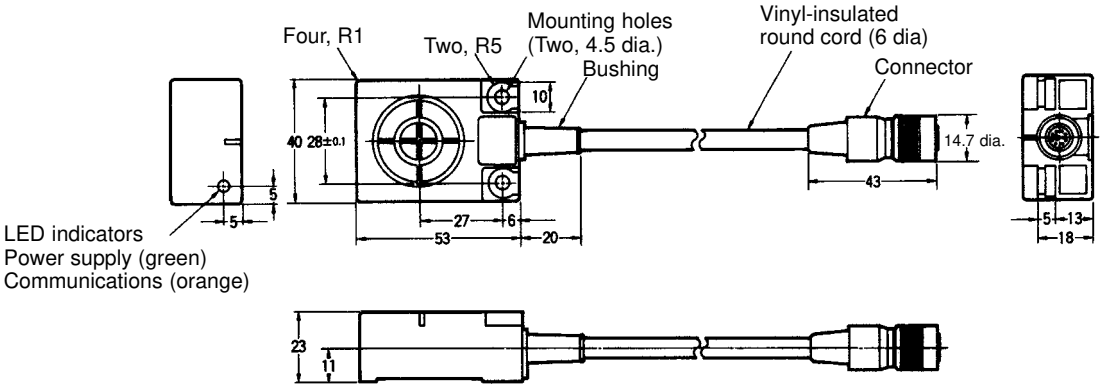
Note The connectors are not waterproof.

V600-H07



Case material	ABS resin
Fill resin	Epoxy resin
Cable	PVC (oil-resistant)

V600-H11



Case material	ABS resin
Fill resin	Epoxy resin
Cable	PVC (oil-resistant)

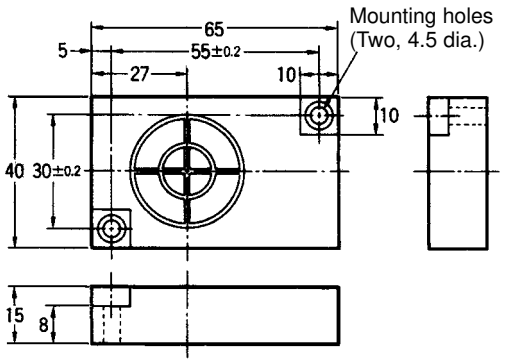
2-2 Data Carriers

2-2-1 Specifications and Outer Dimensions

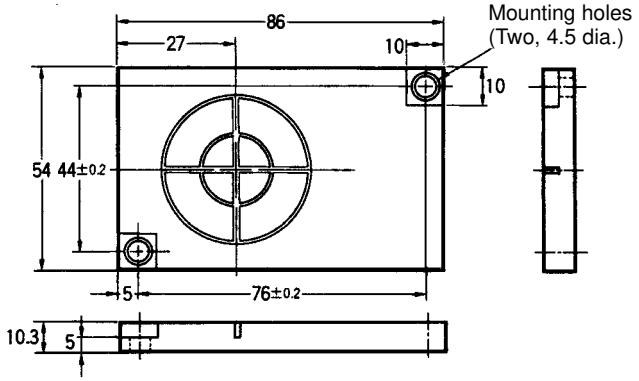
V600-D8KR12/13/04

Item	Model		
	V600-D8KR12	V600-D8KR13	V600-D8KR04
Memory capacity	8K bytes		
Memory type	SRAM (static random access memory)		
Battery service life	Refer to the graphs in *2-3 Data Carrier Battery Service Life*.		
Number of data read/write conversions	No limit (up to the extent of the battery service life)		
Error detection	16-bit CRC error detection is used in both directions of transmission.		
Operating temperature	Data retention: –40°C to 70°C; read/write: –25°C to 70°C		
Storage temperature	–40°C to 70°C		
Operating humidity	35% to 95% RH		
Degree of protection	Meets or exceeds IEC60529 IP67 standards and JEM IP67G standards.		
Vibration resistance	10 to 500 Hz, 1.0 mm in each direction; acceleration: 150 m/s^2 (about 15 G); one sweep in each of three axis directions, three sweeps in 11 minutes		
Shock resistance	1,000 m/s^2 (about 100 G) three times each in X, Y, Z directions, total 18 times		
Weight (approximate)	70 g	70 g	160 g

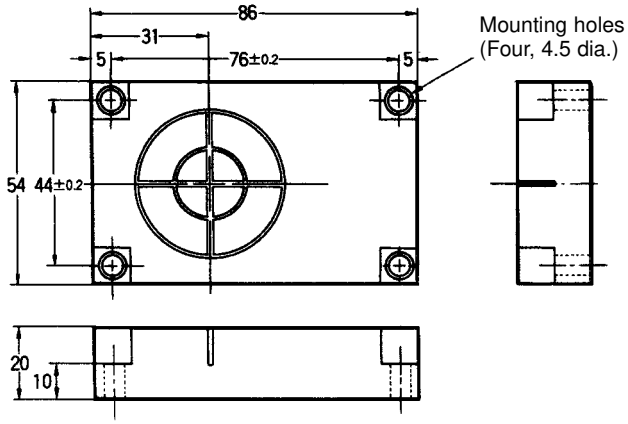
V600-D8KR12



V600-D8KR13



V600-D8KR04



Case material	ABS resin
Fill resin	Epoxy resin

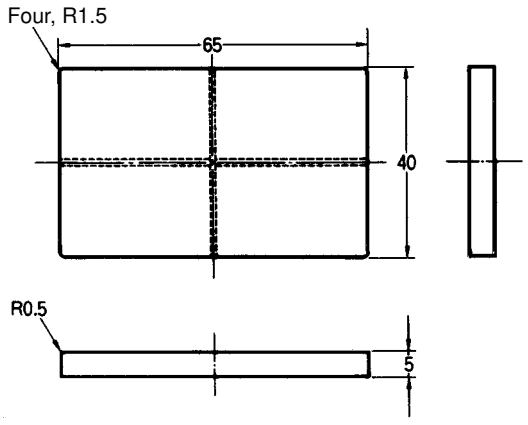
⚠ WARNING The SRAM-type Data Carrier has a built-in lithium battery which can combust or explode if mishandled. Do not disassemble the Data Carrier, or subject it to high pressure or high temperatures (of 100°C or more), or dispose of it by incineration.

V600-D2KR16

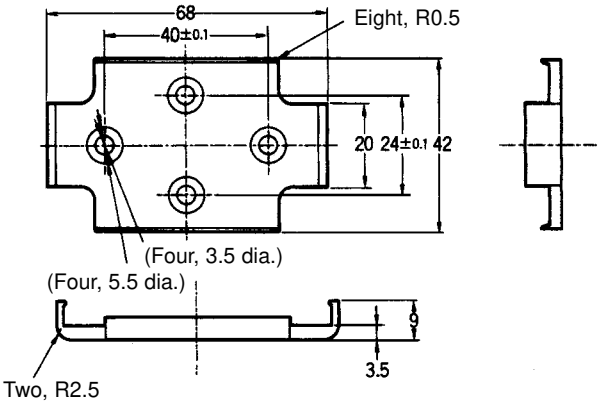
Item	V600-D2KR16
Memory capacity	2K bytes
Memory type	SRAM (static random access memory)
Battery service life (See note 1.)	2 years (replaceable battery)
Number of data read/write conversions	No limit (unrelated to battery service life)
Error detection	16-bit CRC error detection is used in both directions of transmission.
Operating temperature	Data retention: –15°C to 70°C; read/write: 0°C to 50°C
Storage temperature	–15°C to 70°C
Operating humidity	35% to 85% RH
Degree of protection (See note 2.)	IEC60529 IP50 standards
Vibration resistance	10 to 150 Hz, 1.5 mm in each direction; acceleration: 100 m/s^2 (about 10 G); for 30 min. each in X, Y, Z directions.
Shock resistance	300 m/s^2 (about 30 G) three times each in X, Y, Z directions, total 18 times
Weight (approximate)	15 g

Note
1. This is the battery service life when the battery is used in an environment with an ambient temperature below 25°C. For the relationship between temperature and battery service life, refer to *2-3 Data Carrier Battery Service Life*.
2. When the accessory battery replacement cover seal is in place.

V600-D2KR16



Special-purpose Holder (V600-A81)

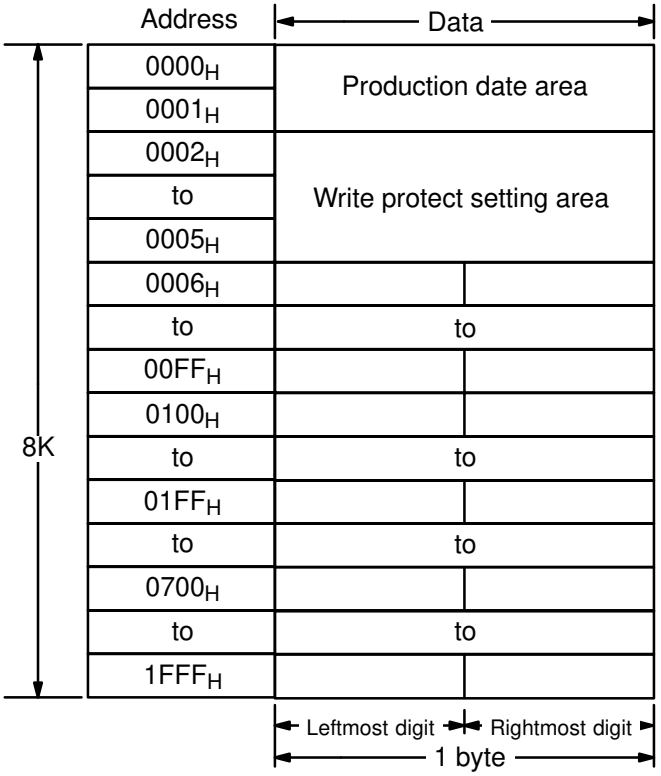


Case material: ABS resin

⚠ WARNING The SRAM-type Data Carrier has a built-in lithium battery which can combust or explode if mishandled. Do not disassemble the Data Carrier, or subject it to high pressure or high temperatures (of 100°C or more), or dispose of it by incineration.

2-2-2 Memory Map

The Data Carrier (DC) has a memory area of up to 8K bytes. Each address of the memory area specifies one byte. A single byte of data can be written to one address.



Production Date Area (Written by Maker)

Address	Bit							
	7	6	5	4	3	2	1	0
0000_H	Month (10s digit)				Month (1s digit)			
0001_H	Year (10s digit)				Year (1s digit)			

Note
1. Address 0000 contains the month of production (March→"03," October→"10").
2. Address 0001 contains the lower two digits of the year (1997→"97").
3. This area is read only.

The memory is SRAM, so there is no limit on the number of times that data can be read or overwritten.

The memory capacity is 8 KB, and the available addresses are 0000_H to $1FFF_H$.

The memory contents are preserved by a long-life lithium battery.

2-2-3 Write Protect Function

The write protect function protects important data stored in the memory of the Data Carrier, such as product number and model, from being overwritten inadvertently. With this function, the data in a specified memory area can be protected. It is recommended that important data be write-protected as follows:

Setting the Write Protect Function

The write protect function is set in the four bytes of addresses 0002_H through 0005_H of the Data Carrier's memory. The status of the leftmost bit of address 0002_H determines whether or not the write protect function is in effect.

When Executing the Write Protect Function

Address	Bit							
	7	6	5	4	3	2	1	0
0002_H	YES/ NO	Leftmost two digits of beginning address						
0003_H	Rightmost two digits of beginning address							
0004_H	Leftmost two digits of ending address							
0005_H	Rightmost two digits of ending address							

The region specified by the beginning and ending addresses will be protected when the write protect control bit (leftmost bit of address 0002_H) is ON, as shown in the following table.

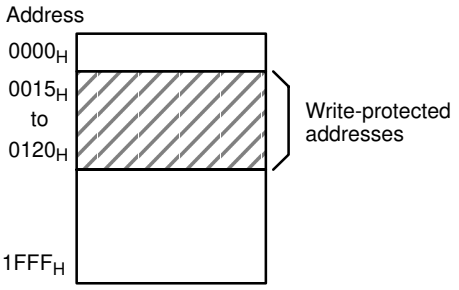
Leftmost bit of 0002_H	Write Protect Function
ON	Data is write-protected.
OFF	Data is not write-protected.

Area that can be set:
Beginning address: 0006_H to $1FFF_H$
Ending address: 0006_H to $1FFF_H$

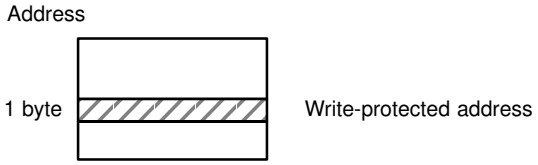
Examples

1, 2, 3... 1. The following settings would write-protect addresses 0015_H through 0120_H (i.e., the beginning address to the ending addresses):

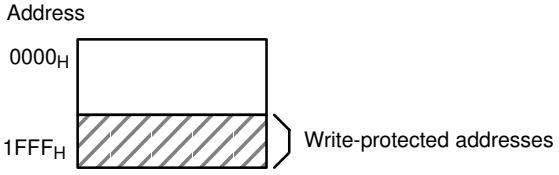
Address	Bit							
	7	6	5	4	3	2	1	0
0002_H	1	0	0	0	0	0	0	0
	8				0			
0003_H	0	0	0	1	0	1	0	1
	1				5			
0004_H	0	0	0	0	0	0	0	1
	0				1			
0005_H	0	0	1	0	0	0	0	0
	2				0			



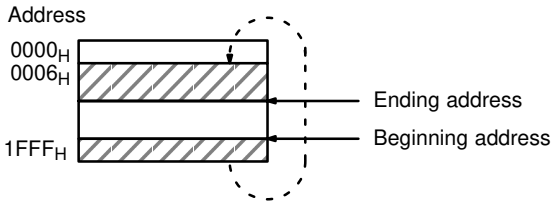
2. To write-protect only 1 byte, set the same address as the start and ending addresses (beginning address = ending address).



3. If the ending address exceeds the last address of the Data Carrier memory (ending address > $1FFF_H$), the addresses up to $1FFF_H$ will be write-protected:.



4. If the beginning address is greater than the ending address (beginning address > ending address), the write-protected area will wrap through 0006_H, so that addresses from 0006_H through the ending address,and from the beginning address through $1FFF_H$ will be write-protected.



Canceling Write Protection

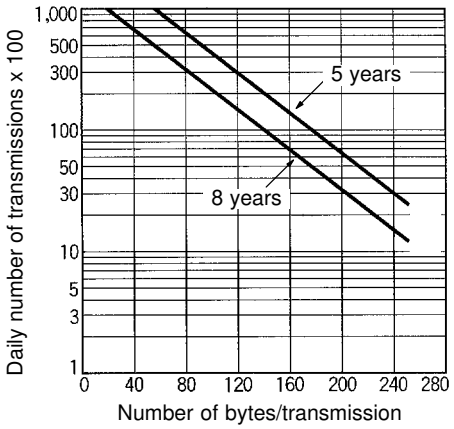
To cancel write protection, turn OFF the leftmost bit of address 0002_H. The write protection will be cancelled, and the beginning and ending addresses that are set for 0002_H to 0005_H will be ignored.

2-3 Data Carrier Battery Service Life

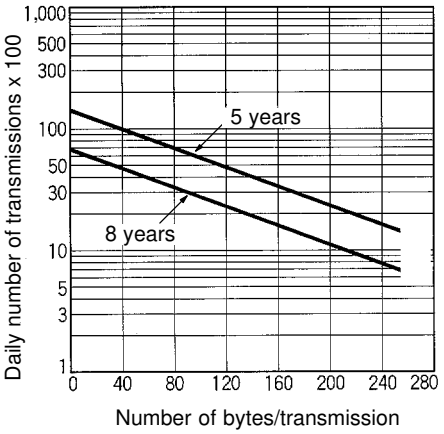
2-3-1 Battery Service Life Factors

The Data Carrier has a built-in lithium battery that provides power. The service life of the battery depends on the number and size of data transmissions. The graphs below show the relationship between daily number and size of transmissions and battery service life. (The illustrations shown here are representative examples.)

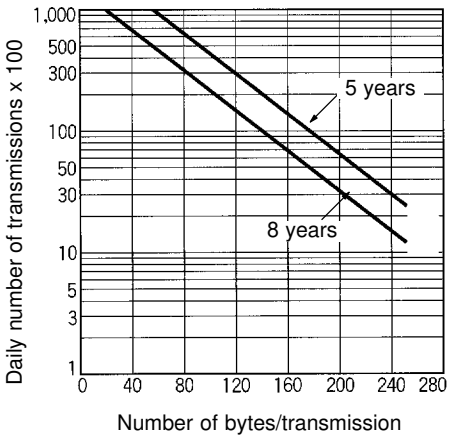
V600-D8KR12



V600-D8KR13



V600-D8KR04



The preceding graphs show the lowest possible lifetimes for DCs in the temperature range –10°C to 55°C (14°F to 131°F). Normally, batteries will last longer at lower ambient temperatures.

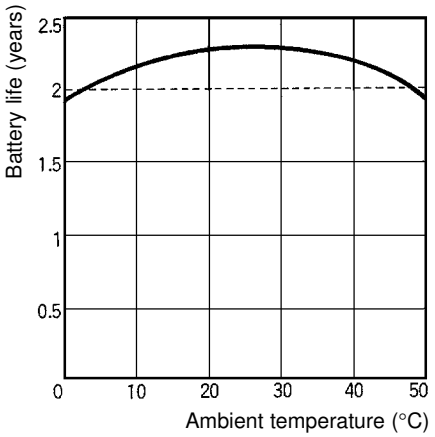
With a V600-D8KR04 DC at 55°C (131°F), for example, 200 bytes of data can be accessed 3,000 times a day for 8 years or 6,500 times a day for 5 years.

With a V600-D8KR12 DC at 55°C (131°F), 40 bytes of data can be accessed 2,000 times a day for 8 years or 4,500 times a day for 5 years.

V600-D2KR16

The battery used for the V600-D2KR16 has a service life of 2 years at an ambient temperature of 25°C, regardless of the number of access times or R/W bytes.

Battery Service Life vs. Temperature



The above graph shows the relationship between the service life of a built-in battery and ambient temperature (after the insulation sheet is removed). The table below shows the life expectancy of a battery that is stored separately (without being installed in the DC).

Temperature	Battery consumption rate (%) per year
20	1
30	2
40	4
50	8
60	16
70	32

If the DC is kept at a temperature of 70°C without removing the insulation sheet, the battery will last for 1.36 years (2 years x (1 – 0.32)). Furthermore, if the DC is kept for one year at a temperature of 70°C without removing the insulation sheet, the battery will last for an additional period of approximately 1.4 years if used at an ambient temperature of 25°C. The life of the battery will be shorter if used at an ambient temperature of 0° or 50°C.

Note

1. The data in the V600-D2KR16 will be lost at the time of battery replacement. Be sure to make a backup of the data before replacing the battery.
2. After replacing the battery, be sure to affix the battery cover seal. IP50 is not guaranteed if the battery cover seal is not affixed.

2-3-2 Battery Service Life Expectancy Check

Checking Whether the Battery is Low

Models With Built-in Battery (Except V600-D2KR16)

1, 2, 3... 1. Data Carrier battery checks are not performed automatically, only during times of special access.
When a battery check is performed, a small current is passed through the DC's internal circuitry. Too much power would be consumed if a battery check was performed automatically every time DC memory was accessed. Incorporate a routine once-a-day check when creating the system program.

2. Access for checking whether the battery is low is only enabled when the two bytes of data from address 0000_H to 0001_H are read.

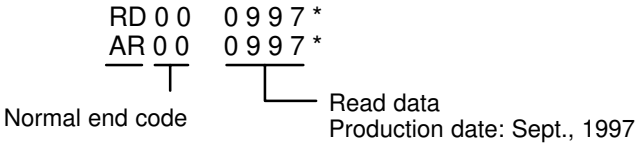
   Use one of the following commands to check the battery status. (The *CR* at the end of each command means carriage return.)

   a) Read command: RD H/A 1 0000 02∗*CR*

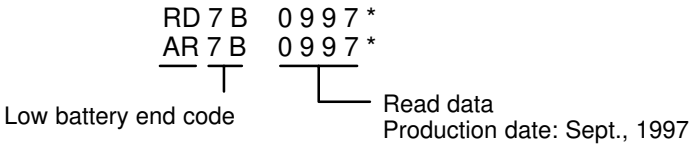
   b) Auto Read command: AR H/A 1 0000 02∗*CR*

   c) Polling Auto Read command: PR H/A 1 0000 02∗*CR*

3. If the end code of the response is 00, the battery is operating normally. If the end code is 7B, the battery is low. The following are responses to Read and Auto Read commands sent to a DC with a good battery:



   The following are responses to Read and Auto Read commands sent to a DC with a low battery:



Note With the V600-D2KR16 (replaceable-battery model), read/write commands are executed without regard to addresses.

Service Life of Data Carriers After the Battery-low Code is Generated

Under ordinary operating conditions the DC can be used for about one month after a low battery end code is received. However, it is recommended that the DC be replaced with a new one as soon as possible.

The V600-D2KR16 (replaceable-battery model) can be used for approximately two weeks under normal operating conditions, but it is recommended that the battery be replaced with a new one as soon as possible.

Note The DC (except for the V600-D2KR16, SRAM memory model) contains a thionyl chloride-type lithium battery. One characteristic of this type of battery is its tendency to develop a higher internal resistance when it is not used. If the battery isn't used for several months, the internal resistance can increase enough to cause a low battery response, even if the battery is good.

Consequently, after several months of disuse it is recommended to transmit data to/from the DC for about 10 minutes to "warm up" the battery and decrease its internal resistance. This operation will have almost no effect on the useful life of the battery.

SECTION 3
Communications Specifications

This section provides specifications for communications.

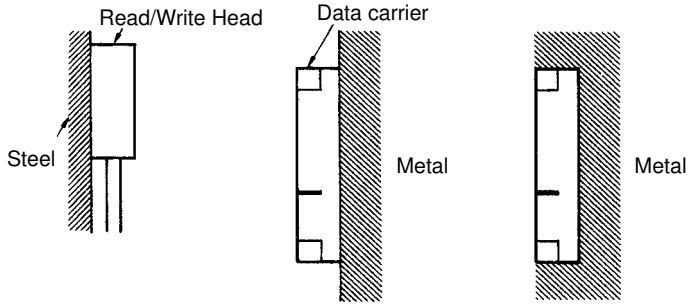
3-1 Transmission Range

3-1-1 Transmission Range Specifications (Certified Performance)

R/W Head	Setting conditions		Transmission range (unit: mm, axis slip: ±10 mm)			
			V600-D8KR12	V600-D8KR13	V600-D8KR04	V600-D2KR16
V600-H07	Stationary	Flush-mounted within metal	10 to 50	10 to 30	See page 28.	---
		Surface-mounted on metal	10 to 60	10 to 35	10 to 100	---
	Moving	Flush-mounted within metal	25 to 50	20 to 30	See page 28.	---
		Surface-mounted on metal	25 to 60	20 to 35	50 to 100	---
V600-H11	Stationary	Flush-mounted within metal	5 to 40	10 to 30	See page 28.	2 to 15
		Surface-mounted on metal	5 to 45	10 to 30	10 to 65	2 to 15
	Moving	Flush-mounted within metal	25 to 40	15 to 30	See page 28.	6 to 15
		Surface-mounted on metal	25 to 45	15 to 30	30 to 65	10 to 15

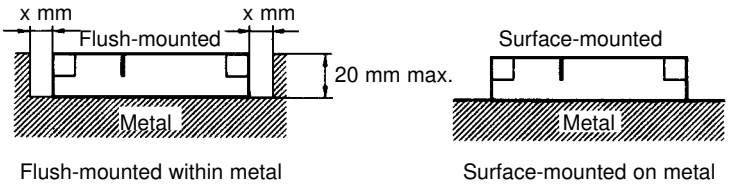
Note
1. These specifications are the certified performance when taking into consideration variations in ambient temperatures and products.
2. The read range and the write range are the same.
3. The Data Carrier and Read/Write Head installation conditions are as follows:

1) V600-D8KR12, V600-D8KR13 Data Carriers

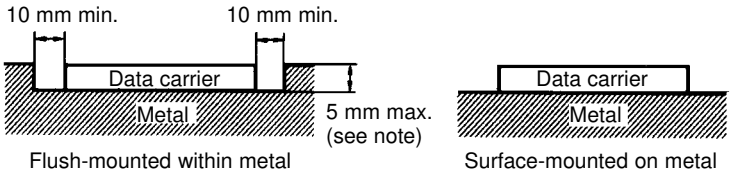


2) V600-D8KR04 Data Carriers

For flush-mounting within metal, the read/write distance changes depending on distance *x* from the metal.



3) V600-D2KR16 Data Carriers

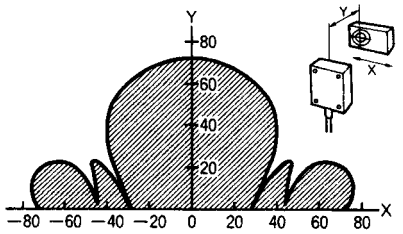


For details regarding R/W Head and DC installation, refer to *Section 4 Installation*.

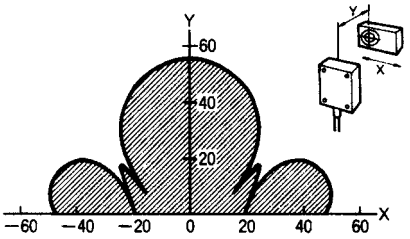
3-1-2 Transmission Areas

The following diagrams show representative examples of the communications areas. All measurement units are shown in mm.

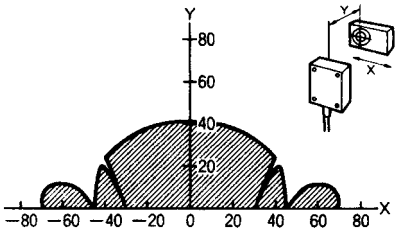
V600-D8KR12 and V600-H07



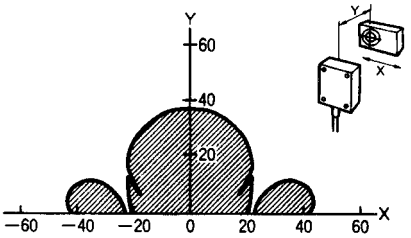
V600-D8KR12 and V600-H11



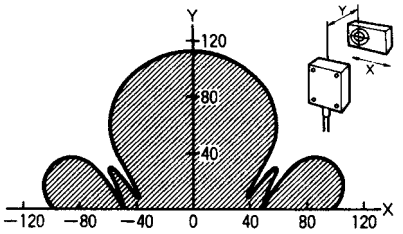
V600-D8KR13 and V600-H07



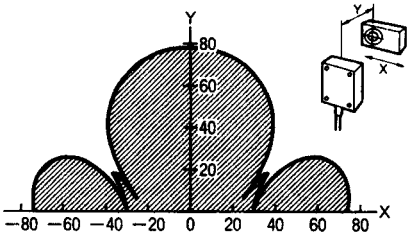
V600-D8KR13 and V600-H11



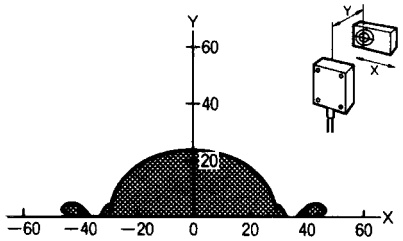
V600-D8KR04 and V600-H07



V600-D8KR04 and V600-H11



V600-D2KR16 and V600-H11



Note The mounting method is surface-mounted on metal in all cases.

3-2 Transmission Time

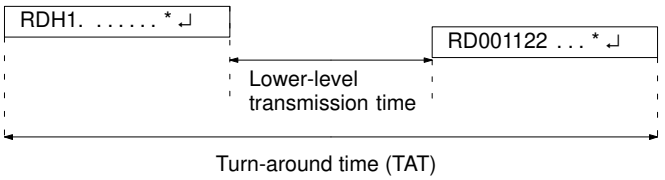
Transmission Time

Transmission times are the same for all models of R/W Heads and DCs covered in this manual, although transmission times are different for DCs that contain batteries. The term “transmission time” is used to indicate both the turn-around time (TAT) and the lower level transmission time between the R/W Head and DC.

The TAT is the total time required from the transmission of a command from a host device (such as a host computer) until the reception of a response at the host device.

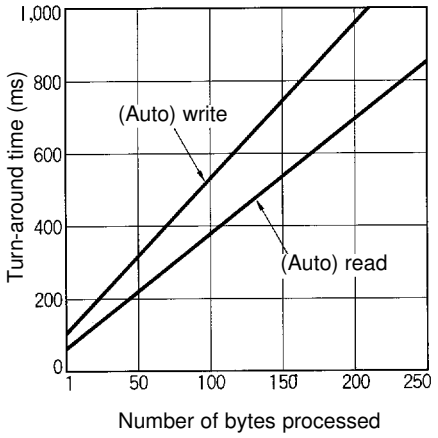
The lower-level transmission time is the time required for transmission of data between the R/W Head and DC.

The following diagram shows the TAT and lower-level transmission time for the READ command.



TAT (Reference)

The following diagrams show the TAT and lower-level transmission time for V600-CA1A, V600-CA2A, V600-CD1D-V2, and V600-CF1A Serial Interface ID Controllers. (The TAT for Parallel Interface ID Controllers and ID Sensor Units varies with the host's software.)



Calculation Method (Reference) (Unit: ms)

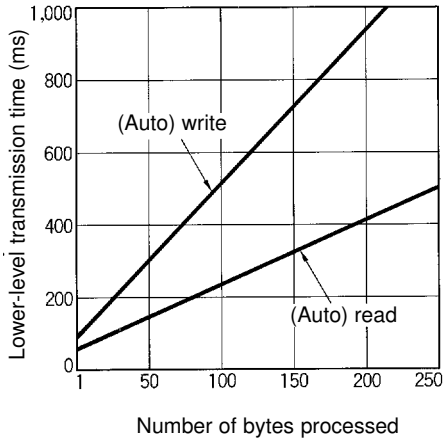
Read/Write	TAT
Read	T = 2.9N + 69.8
Write	T = 5.3N + 105.6

N: Number of bytes processed

Note

1. The value given for the TAT data assumes that the communications settings for the V600-CA1A ID Controller are as follows:
   Baud rate: 9600 bps; data length: 8 bits; stop bits: 1; parity: odd.
2. The number of bytes is the number for ASCII code. (For details, refer to the *RFID System Operation Manual (Z83)*.

Transmission Time With the Data Carrier (Reference)



Calculation Method (Reference) (Unit: ms)

Read/Write	Lower-level transmission time
Read	T = 1.8N + 48.4
Write	T = 4.2N + 86.5

N: Number of bytes processed

3-3 Data Carrier Speed

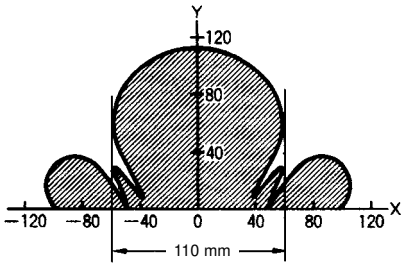
The number of bytes that can be processed using the Auto Read and Auto Write commands depends on the speed of the DC. The relationship between the number of bytes and DC speed in m/minute can be determined from the following equation.

$$\text{Max. DC Speed} = \frac{\text{Distance travelled in the transmission range (m)}}{\text{Lower-level transmission time (min)}}$$

- The "distance travelled in the transmission range (m)" is the maximum width of the transmission range (in the X direction). Refer to the diagrams in *3-1 Transmission Range*.
- The "lower-level transmission time (min)" is the time required for transmission between the DC and the R/W Head. For details regarding this calculation, refer to *3-2 Transmission Time*.

Calculation Example

In this example diagram, the V600-D8KR04 and V600-H07 are combined and four bytes are read.



This diagram shows the following:

Distance travelled in transmission range, Y (transmission distance) = 110 mm
Lower-level transmission time, T = 1.8 x 4 + 48.4 = 55.6 ms.

Accordingly, the DC speed in this case will be as follows:

$$\text{Max. DC Speed} = \frac{\text{Distance travelled in the transmission range (m)}}{\text{Lower-level transmission time (min)}} = \frac{110\ (\text{mm})}{55.6\ (\text{ms})}$$

$$= 118.7\ \text{m/min}$$

Note

1. The distance travelled in the transmission time will vary depending on the read/write distance and the shaft slippage. Refer to the diagrams in *3-1 Transmission Range*.
2. The DC speed is the standard value. Before using the equipment, run a test to determine the speed under the actual operating conditions.
3. The DC speed data above do not take into account possible transmission errors in host or lower-level communications.
4. When the V600-CA8A/CA9A is used, the speed will vary depending on the software at the host device.

SECTION 4
Installation

This section describes the recommended installation methods for the R/W Heads and Data Carriers (DCs), and provides details on the battery's service life expectancy and methods to check the battery's condition.

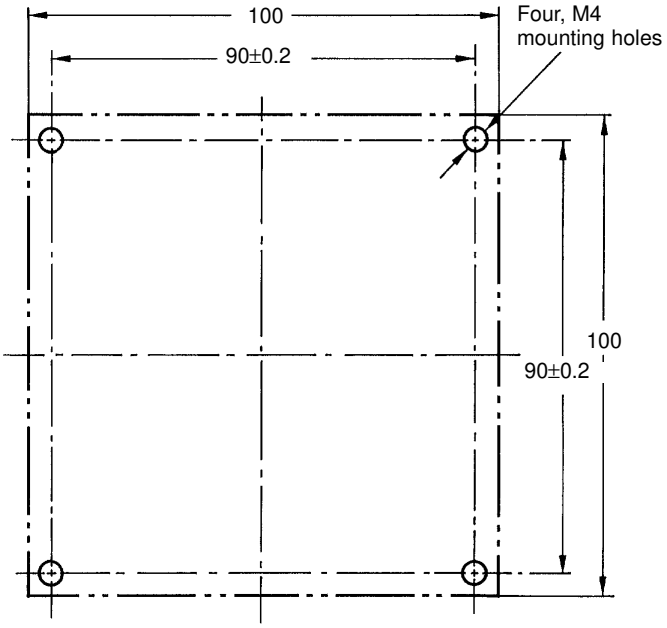
4-1 R/W Head Installation

4-1-1 Installation Method

V600-H07 R/W Head

Use M4 screws and spring washers (in four places) for R/W Head installation. Tighten the screws to a torque of 0.7 to 1.2 N•m (approximately 7 to 12 kgf•cm).

There are no restrictions on the mounting direction or the direction of access to the DC, but if the R/W Head is to be installed near a device such as a conveyance belt, make sure there is no danger of the R/W Head being accidentally struck.



Mounting Bracket Dimensions (V600-H07 Only)