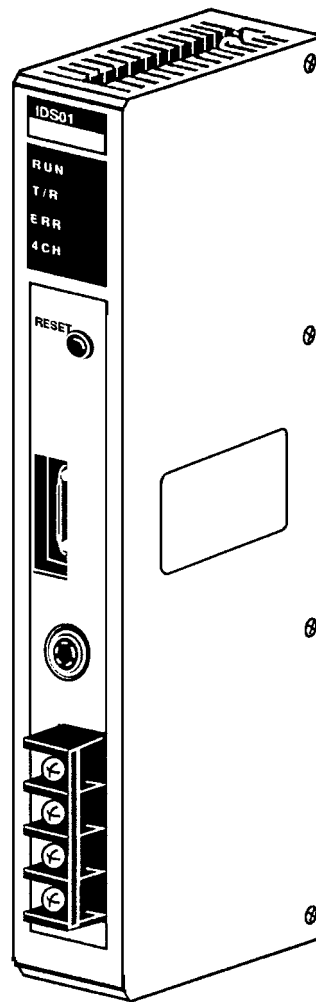# C500-IDS01-V1/IDS02

ID Sensor

Revised May 1990

Written and Produced for OMRON by:
Brent Winchester
Koji Suzuta
DATEC Inc.

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 warnings in this manual. Always heed the information provided with them.

DANGER! Indicates information that, if not heeded, could result in loss of life or serious injury.

Caution Indicates information that, if not heeded, could result in minor injury or damage to the product.

OMRON Product References

All OMRON products are capitalized in this manual. The word "Unit" is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation "Ch," which appears in some displays and on some OMRON products, means "word" and is abbreviated "Wd" in documentation.

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... Indicates lists of one sort or another, such as procedures, precautions, etc.

TABLE OF CONTENTS

About this Manual:

This manual explains the installation and operation of the C500-IDS01-V1 and C500-IDS02 ID Sensors, which are non-contact information detection systems with long-range detection capabilities. Through a Read/Write Head, the systems read information from or write information to a Data Carrier mounted to a moving workpiece.

Before operating the ID Sensor, thoroughly familiarize yourself with both the Unit and this manual.

This manual is organized as follows:

Section 1 describes the features, components, configuration, and installation of both models.

Section 2 contains information on operation, including switch settings, bit allocation, and communication commands, and introduces the user program.

Section 3 describes programming and includes example programs that illustrate data transfer between the Unit and the CPU; monitoring functions and timing considerations are also covered in this section.

Section 4 contains information on maintenance and troubleshooting.

Appendixes A, B, and *C,* a *Glossary*, and an *Index* are also provided.

SECTION 1
System Description and Installation

This section describes the features, components, configuration, and installation of the C500-IDS01-V1/IDS02 ID Sensor systems.

1–1   System Description

The ID Sensor system is a versatile non-contact identification system. A basic ID Sensor system comprises an ID Sensor Unit, a Read/Write (R/W) Head, and a Data Carrier.

The ID Sensor Unit mounts to the OMRON C500, C1000H, or C2000H building-block type Programmable Controllers (PC). The Data Carrier mounts to a moving workpiece or workpiece carrier. The R/W Head, connected by cable to the ID Sensor Unit, must be positioned at a point within communication range of the Data Carrier's travel path. Responding to commands from the user program in the PC, the ID Sensor reads from or writes to the Data Carrier through a R/W Head via electromagnetic induction. The operations of the ID Sensor Unit can be monitored and checked with the Handheld Programming Console (C200H-PRO27-E).

Figure F1–1 illustrates the C500-IDS01-V1 ID Sensor system.

C500-IDS01-V1 ID Sensor System

F1–1   C500-IDS01-V1 ID Sensor System

ID Sensor Unit
C500-IDS01-V1

Handheld Programming Console
C200H-PRO27-E

R/W Head
V600-H06

Data Carrier
V600-D2KR01
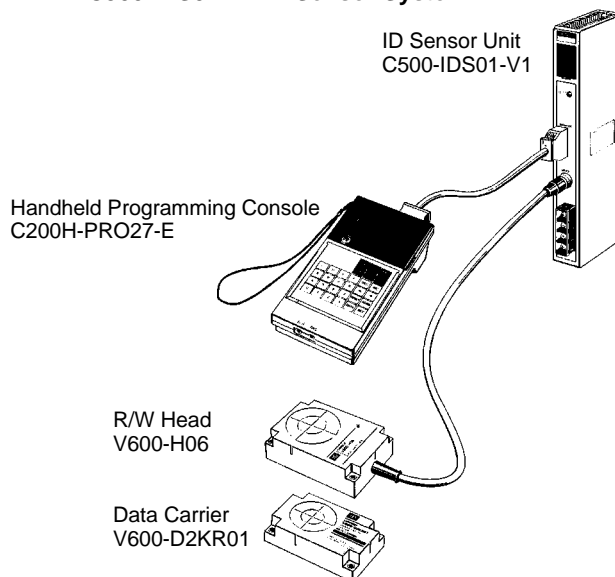
Long-range ID Sensor System

When the R/W Head must be located more than 10 meters from the ID Sensor Unit, the C500-IDS02, a special long-range ID Sensor system is required. The long-range system includes an ID Adapter Unit that amplifies the signal between the R/W Head and ID Sensor Unit. An ID Adapter Unit can only be connected to an ID Sensor Unit that is designed for that particular Adapter model.

Figure F1–2 illustrates the C500-IDS02 long-range ID Sensor system.

F1–2 C500-IDS02 ID Sensor System

ID Sensor Unit
C500-IDS02

Handheld Programming Console
C200H-PRO27-E

R/W Head
V600-H06

Data Carrier
V600-D2KR01

ID Adapter
C500-IDA02
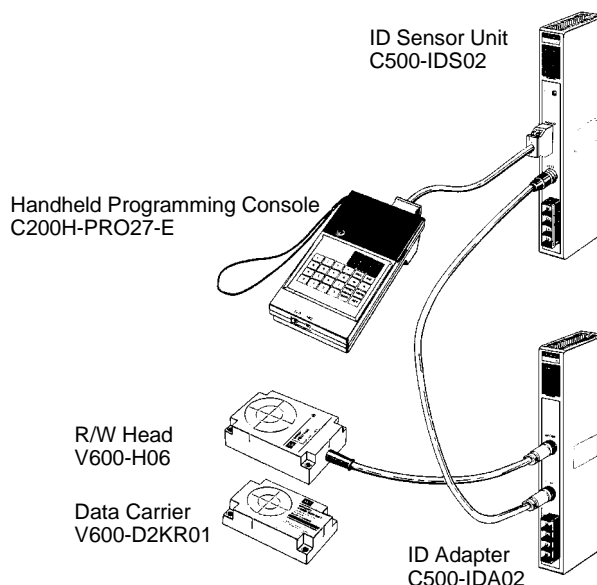
1–2 Features

The ID Sensor system has the following features:

Intelligent I/O Read/Write Capability

Up to 251 words of data can be transferred between the PC and the ID Sensor Unit using Intelligent I/O Write (WRIT(87)) and Intelligent I/O Read (READ(88)) instructions, thus enabling high-speed data transfer.

Six Dedicated Commands

Data is transferred between the ID Sensor Unit and the Data Carrier with the following six dedicated commands:

Read
Write
Auto Read
Auto Write
Clear-all
Auto Read/Write Abort

Up to 502 bytes of data can be read from or written to the Data Carrier at one time. Clear-all clears all data in the Data Carrier's memory (2K bytes). These commands are compatible with both the V600 and V620 ID Controllers.

Monitoring with the Handheld Programming Console

The Handheld Programming Console can be used to monitor data transfer as well as errors that have occurred during operation. A keyboard sheet for the Handheld Programming Console is included with the ID Sensor Unit.

Storage of Error Information

Error information is stored in the internal memory of the ID Sensor Unit. A built-in capacitor stores the information for 15 days (at 25%C).

Compatibility

The R/W Head and Data Carrier, for the C500-IDS01-V1 and C500-IDS02 are compatible with the V600 ID Controller.

The C500-IDA02 ID Adapter for the C500-IDS02 is compatible with the V600 ID Controller.

If an incompatible R/W Head, Data Carrier, or Adapter is connected to an ID Sensor Unit, a connection error will occur, preventing operation of the Unit.

1–3   Components and Indicators

Figure F1–3 shows the front panel of the C500-IDS01-V1 ID Sensor Unit.

Front Panel
C500-IDS01-V1 ID Sensor Unit

F1–3   C500-IDS01-V1/IDS21 ID Sensor Units

— Indicators

— DIP switch
(Behind indicator panel; see note 1)

— RESET   switch
(see note 2)

— Handheld Programming Console connector

— R/W Head connector

— 24 VDC Power Supply terminals

— Unused
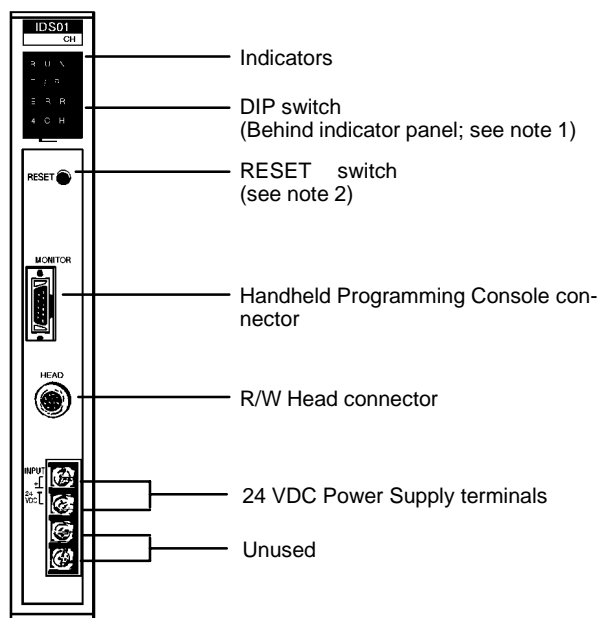
1, 2, 3...   1.   To gain access to the DIP switches, remove the indicator panel with a standard screwdriver.

2.   Do not press RESET when the T/R indicator is lit. Refer to *p NO TAG note 2* before using the RESET switch.

Figure F1–4 shows the front panel of the C500-IDS02 ID Sensor Unit.

Front Panel
C500-IDS02 ID Sensor Unit

F1–4   C500-IDS02 ID Sensor Unit
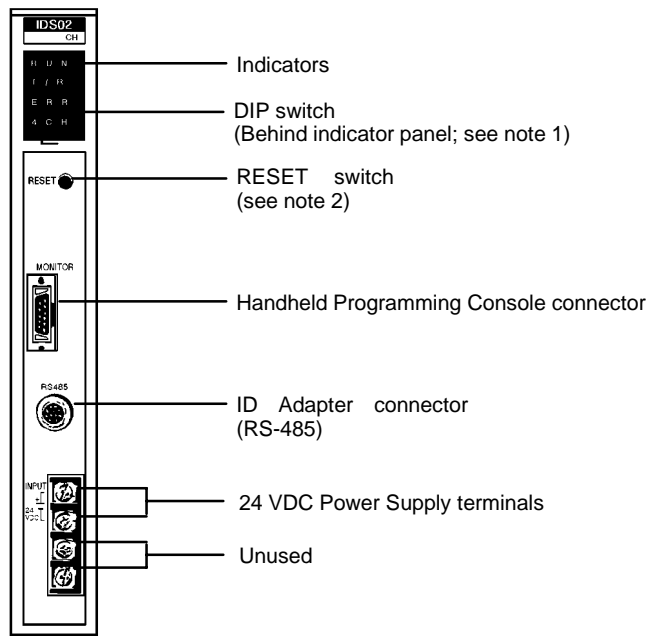
Note 1. To gain access to the DIP switches, remove the indicator panel with a standard screwdriver.

2. Do not press RESET when the T/R indicator is lit. Refer to *p NO TAG note 2* before using the RESET switch.

Indicators

Table T1–1 shows the functions of the ID Sensor Unit indicators.

T1–1 ID Sensor Unit Indicators

Indicator	Function
RUN	Lit while the ID Sensor is operating
	Unlit when an error occurs in the ID Sensor Unit
T/R	Lit during data communication
ERROR	Lit when an error occurs in the ID Sensor Unit
4 CH (see p V)	Lit when the ID Sensor Unit is set to 4 words
	Unlit when the ID Sensor Unit is set to 2 words

Figure F1–5 shows the front panel of the C500-IDA02 ID Adapter.

5

**Front Panel
ID Adapter**

F1−5   Front Panel C500-IDA02/IDA22 ID Adapter

Power indicator
(Lit when power is applied)

R/W Head connector

ID Sensor Unit connector (RS-485)

24 VDC Power Supply terminals

Unused
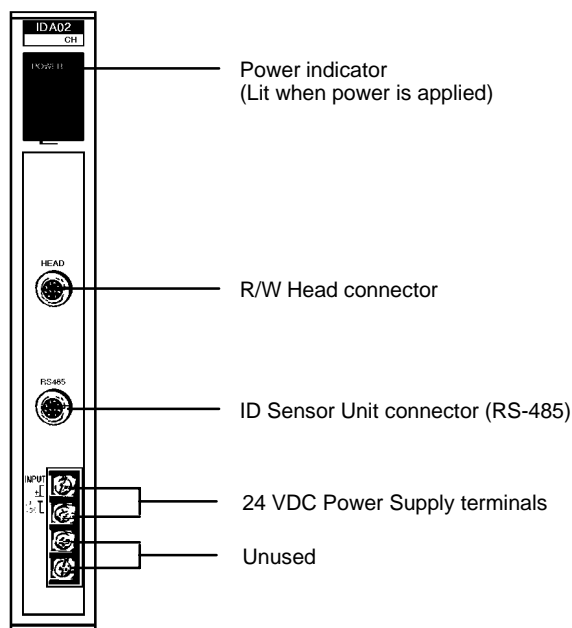
1−4   System Configurations

Figure F1−6 illustrates a typical system configuration of the
C500-IDS01-V1ID Sensor. The system consists of an ID Sensor Unit
mounted to a Programmable Controller (PC), a R/W Head connected to the
ID Sensor Unit, and a Data Carrier mounted on a moving workpiece or work-
piece carrier. Only one R/W Head can be connected to an ID Sensor Unit.

To monitor data and error information, connect a Handheld Programming
Console to the ID Sensor. The data is displayed on the screen of the Pro-
gramming Console. Refer to *Section 3−3 Monitoring.*

F1−6   C500-IDS01-V1 System Configuration
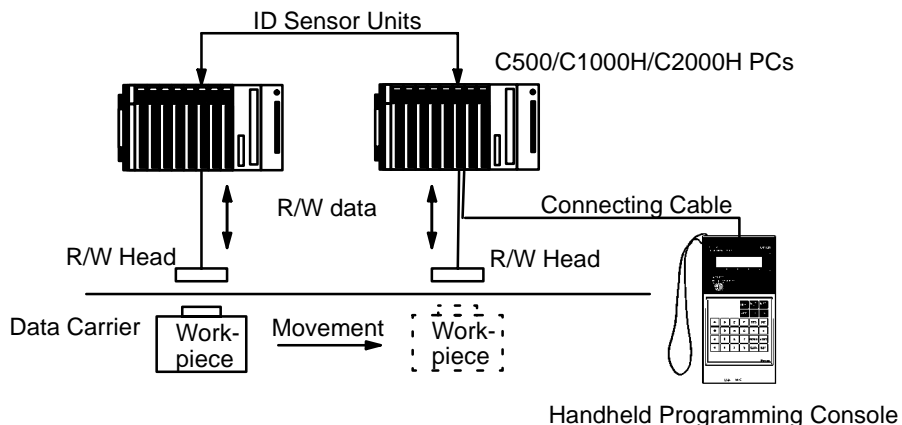
If the R/W Head must be located more than 10 meters from the ID Sensor
Unit, a long-range ID Sensor system that includes an ID Adapter is required.

The ID Adapter amplifies the signal between the R/W Head and ID Sensor Unit.

Figure F1–7 illustrates the C500-IDS02 ID Sensor system.

F1–7   C500-IDS02 System Configuration
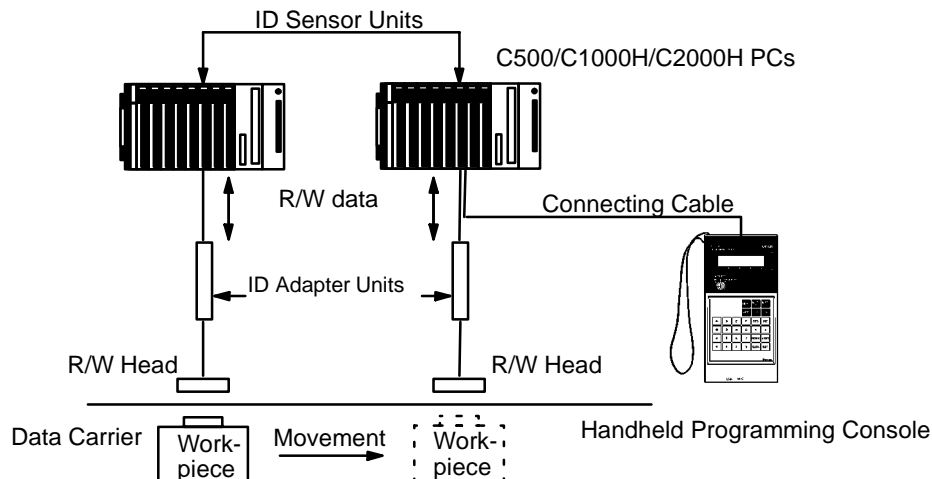
1–5   Installation

This section contains information on the installation of system components. Before carrying out any of the procedures outlined in this section, make sure that they apply to your model of ID Sensor.

1–5–1   Installing the R/W Head and Data Carrier

To ensure correct communication between the ID Sensor Unit and the Data Carrier, install the R/W Head and Data Carrier according to the guidelines in this section. Pay particular attention to the center displacement and the distance between the Data Carrier and the R/W Head, as these parameters differ depending on whether the R/W Head is detecting a stationary or moving Data Carrier. The speed of the Data Carrier also affects the amount of data that can be transmitted; high speeds reduce the amount of time the Data Carrier is within range of the R/W Head, thus reducing the amount of data that can be transmitted.

The Data Carrier can be mounted directly to a moving workpiece or workpiece carrier moving along a production line. However, special care is required when embedding the Data Carrier or R/W Head in a metallic object; follow the guidelines that begin on page 9 of this section.

Refer to *Appendix B Specifications* for exact dimensions of the R/W Head and Data Carrier.

Stationary Data Carrier

1, 2, 3...   1.   Distance between Data Carrier and R/W Head: 10 to 35 mm

Maintain a distance of 10 to 35 mm between the R/W Head and a stationary Data Carrier, regardless of whether data is to be read from or written to the Data Carrier.

7

F1–8   Distance between Data Carrier and R/W Head
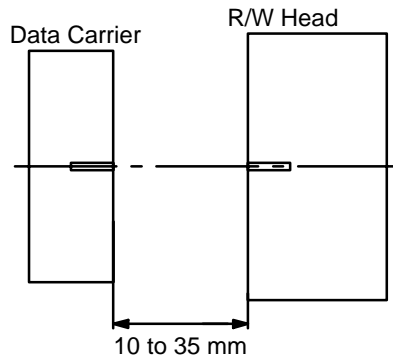
2.   Center Displacement: +10 mm

Permissible center displacement refers to the amount the centers of the Data
Carrier and R/W Head can be misaligned, yet detection still occurs. When the
Data Carrier and R\W Head are 10 to 35 mm apart, the R/W Head can detect
the Data Carrier 10 mm before and 10 mm after their centers are aligned.

F1–9   Center Displacement
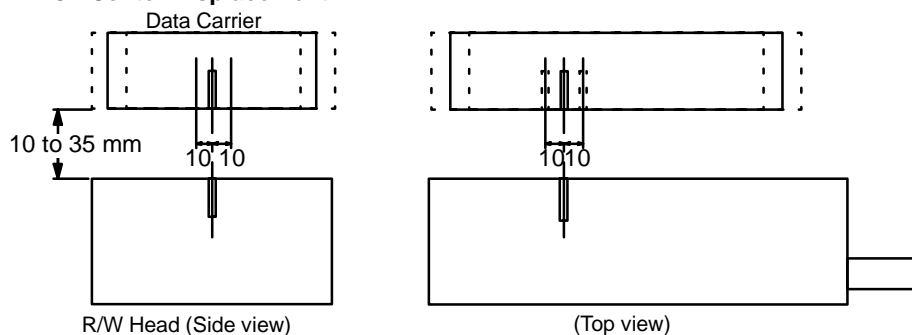
Moving Data Carrier (Auto Read/Auto Write)

1, 2, 3...   1.   Distance between Data Carrier and R/W Head: 20 to 35 mm

Maintain a distance of 20 to 35 mm between the R/W Head and a moving
Data Carrier. The speed of the Data Carrier must be appropriate to the
amount of data to be read or written. See Table T1–2.
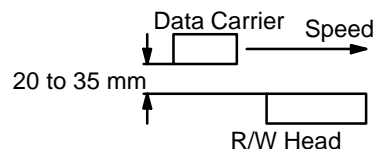
2.   Speed of travel

The appropriate speed for the Data Carrier differs according to: (a) the quan-
tity of data (the number of bytes) to be transferred; and (b) whether the data
is to be read from or written to the Data Carrier. The following graph illus-
trates how the quantity of data that can be transferred increases as the
speed of the Data Carrier is decreased. Using the graph in Table T1–2 and
the monitoring functions described in *Section 3–3 Monitoring*, adjust the
speed of the Data Carrier so that it is within the appropriate speed range.

T1–2 Relationship between Speed of Data Carrier and Quantity of Data (Auto Read/Auto Write)
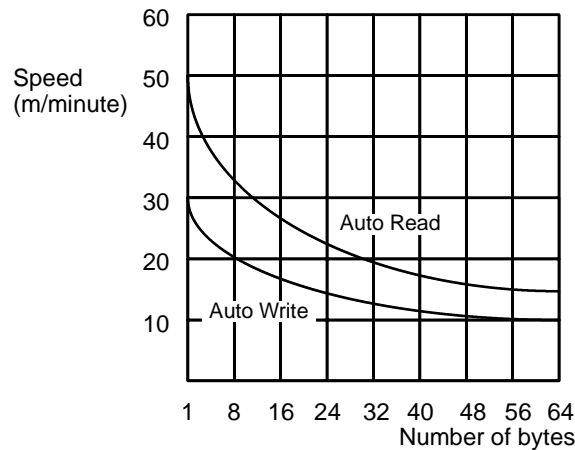
The data in this graph is based on the assumption that communication between the Data Carrier and R/W Head is performed normally, without error (if the Data Carrier passes the R/W Head without being detected, a Data Carrier communication error will occur).

Installing Data Carriers and R/W Heads Side by Side or Face to Face

When two or more Data Carriers or R/W Heads are in close proximity, mutual interference between the Data Carriers or R/W Heads may occur, causing a malfunction. Provide the following distances between one Data Carrier or R/W Head and another:

F1–10 Minimum Distances between Adjacent Data Carriers and R/W Heads
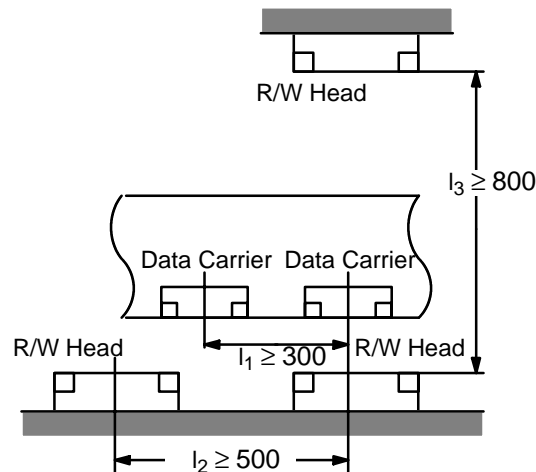
l_1 = distance between Data Carriers installed side by side ≥ 300 mm

l_2 = distance between R/W Heads installed side by side ≥ 500 mm

l_3 = distance between R/W Heads installed face to face ≥ 800 mm

Embedding a R/W Head or Data Carrier in a Metallic Object

Care must be taken when embedding a Data Carrier or R/W Head in a metallic object. To ensure proper operation, maintain the minimum distances shown in the following figures between the sides of the Data Carrier or R/W Head and the surrounding metal.

When embedding the R/W Head in a metallic object, make sure a minimum of 30 mm separates all four sides of the R/W Head from the metallic object.

9

F1−11 Embedded R/W Head
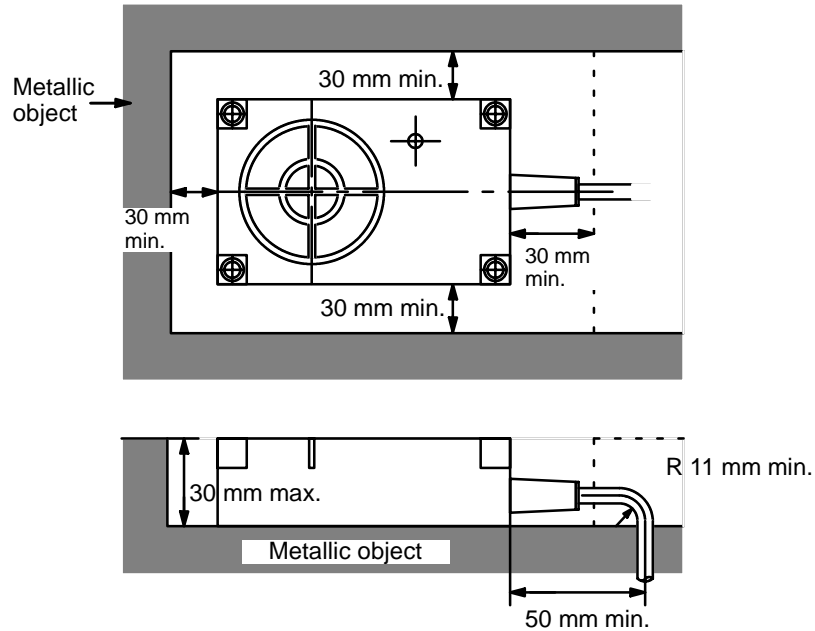
Unlike the R/W Head, the Data Carrier does not require separation from the metallic object on all sides in order to operate properly. However, the front face of the Data Carrier must not be below the surface of the metallic object.

F1−12 Embedded Data Carrier
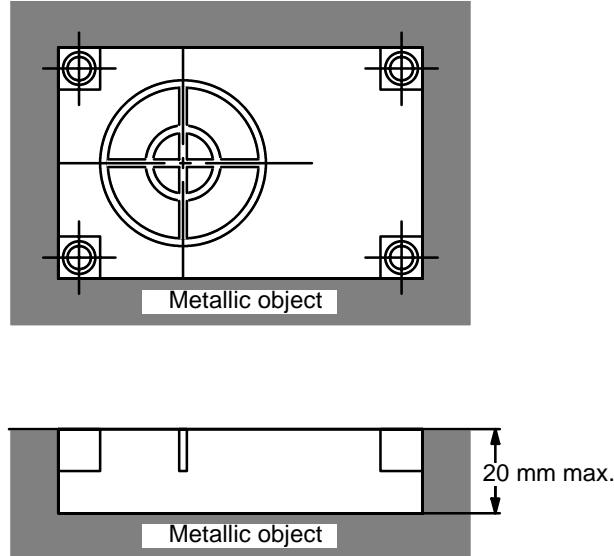
1−5−2 System Connection

ID Sensor Units can be mounted to any slot of a C500, C1000H, or C200H building-block type Programmable Controller. This section explains connections and wiring of all ID Sensor system components.

Refer to Figures F1−1 and F1−2 for connection diagrams.

Connecting the C500-IDS01-V1 ID Sensor

1, 2, 3... 1. Before connecting and wiring the ID Sensor Unit, turn OFF the power to the PC.

2. Connect the R/W Head to the ID Sensor Unit connector marked "HEAD" . (To disconnect the cable, pull while grasping the outer ring of the cable.)

3. Connect a 24 VDC power supply (250 mA min.) to the 24 VDC terminals of the ID Sensor Unit. If the power supply is not connected, the Unit will not be able to communicate with the R/W Head, and an error will occur. Solderless terminals are recommended for the power supply connection. When connecting the power supply to the terminals of the ID Sensor Unit, make certain that the correct polarity is observed.

Connecting the C500-IDS02 ID Sensor

1, 2, 3... 1. Before connecting and wiring the ID Sensor Unit, turn OFF the power to the PC.

2. To connect the ID Adapter to the ID Sensor Unit, first assemble a cable of the appropriate length; use the connectors supplied as accessories. (Refer to *Preparing the RS-485 Cable* on page 11.) Connect one end of the cable to the RS-485 connector of the ID Sensor Unit; turn the outer ring clockwise until it clicks. Connect the other end to the RS-485 connector of the ID Adapter Unit in the same manner. Note that although the connectors on both ends of the RS-485 cable appear identical, the connector at the ID Adapter end of the cable is insulated from the shield.

3. Connect the cable of the R/W Head to the HEAD connector of the C500-IDA02 ID Adapter Unit. (To disconnect the cable, pull while grasping the outer ring of the cable; do not pull at an angle.)

4. Connect a 24 VDC power supply (250 mA min.) to the 24 VDC terminals of the ID Sensor Unit. Without this power supply the Unit will not be able to communicate with the ID Adapter, and an error will occur. Connect a 24 VDC power supply (450 mA min.) to the 24 VDC terminals of the ID Adapter. If no power supply is connected, the ID Adapter will not operate, and an error will occur. Solderless terminals are recommended for connecting the power supply. When connecting the power supply, make certain that the correct polarity is observed.

Connecting the Handheld Programming Console

Refer to *Section 3–3 Monitoring* and Figure F1–1 for information on connecting the Handheld Programming Console.

Preparing the RS-485 Cable

Before assembly

The ID Sensor Unit and the ID Adapter communicate through the RS-485 interface. To connect the ID Adapter to the ID Sensor Unit, first prepare a cable of a length suitable to your needs (maximum length 200 m); use the connectors supplied as accessories. Note that at the ID Adapter end of the RS-485 cable, the connector must be insulated from the shield.

Pin letters and signal assignments

Use the connectors supplied for the ID Sensor Unit and ID Adapter. Using twisted-pair cable, connect the pins to the corresponding letters of each connector (pin letters appear on the face of the connector). Be sure to maintain identical pin letter and signal assignments for both connectors . Figure F1–13 shows pin letters and signal assignments.

F1–13 RS-485 Cable; Pin Letters and Signal Assignments

Pin letter	Signal	Shielded twisted-pair cable	Pin letter	Signal
A			A	
B			B	
C	SD1+		C	SD1+
D	SD1–		D	SD1–
E	SD2+		E	SD2+
F	SD2–		F	SD2–
G	SD3+		G	SD3+
H	SD3–		H	SD3–
J	SD4+		J	SD4+
K	SD4–		K	SD4–
L	SD5+		L	SD5+
M	SD5–		M	SD5–
Connector housing	FG	Shield		
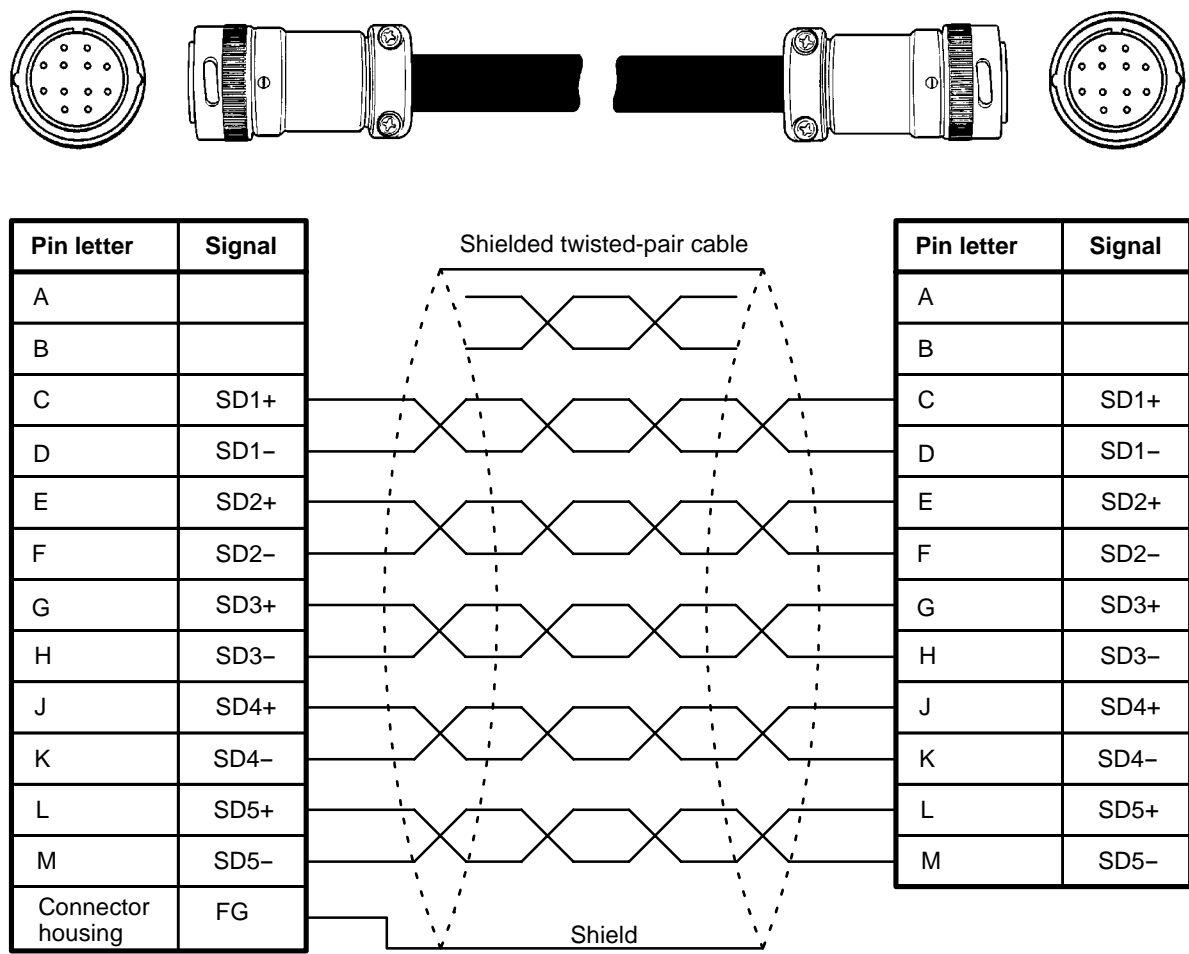
Note   Confirm all pin letters before completing assembly.

Preparing the ID Sensor Unit end of the RS-485 cable

The numbered steps that follow refer to the numbered steps in Figure F1–14.

1, 2, 3...   1.   Cut the cable to the appropriate length.

2.   Remove a 15 mm length of the rubber sheath from the end of the cable by cutting the sheath with a razor. Be careful not to damage the shielded cable underneath.

3.   Cut and remove 10 mm of the shield with scissors.

4.   Remove 5 mm of the insulation from the end of each conductor with a stripper.

5.   Fold the shielded cable back over the rubber sheath.

6.   Wind aluminum foil tape over the folded part of the shielded cable.

F1–14 Preparing the ID Sensor End of the RS-485 Cable

(1)

(2) ← 15 mm →

(3) 5 mm

(4) 5 mm

(5)

(6) ——————— Aluminum foil tape
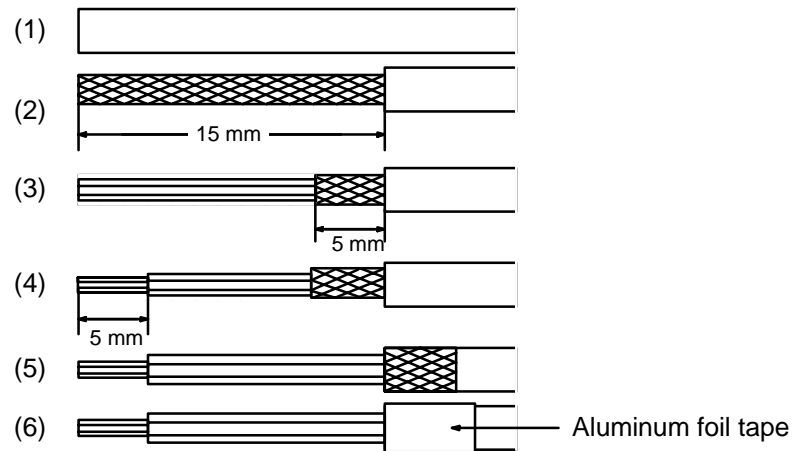
Preparing the ID Adapter End of the RS-485 Cable (insulated shield)

The numbered steps that follow refer to the numbered steps in Figure F1–15.

1, 2, 3...   1.   Confirm that the cable is the appropriate length.

2.   Remove a 15 mm length of the rubber sheath from the end of the cable by cutting the sheath with a razor. Be careful not to cut deeper than necessary.

3.   With scissors, cut and remove the entire length of exposed shield.

4.   Remove 5 mm of the insulation from the end of each conductor with a stripper.

5.   Wind vinyl insulating tape over the folded part of the shielded cable.

F1–15 Preparing the ID Adapter End of the RS-485 Cable

(1)

(2) ← 15 mm →

(3)

(4) 5 mm

(5) ——————— Vinyl insulating tape
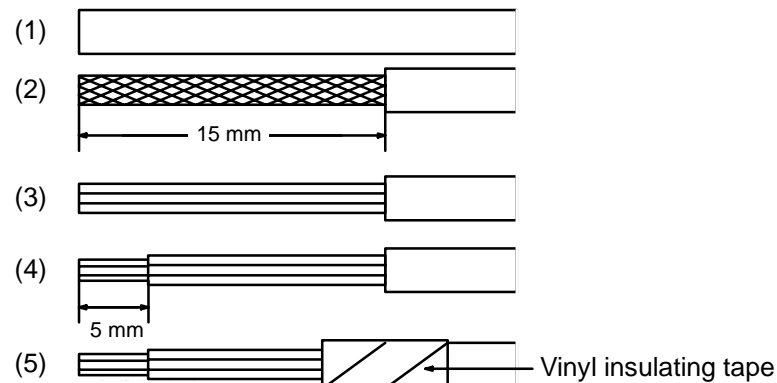
Disassembling the connectors

Refer to Figure F1–16.

1, 2, 3...   1.   Loosen the 2 setscrews with a small standard screwdriver.

2.   Remove part A from part B by inserting the connector into the Unit, and turning part B counterclockwise.

3.   Loosen the 2 clamp screws with a Phillips screwdriver.

13

F1–16 Disassembling the Connector

Setscrew

Clamp screws

Part A   Part B
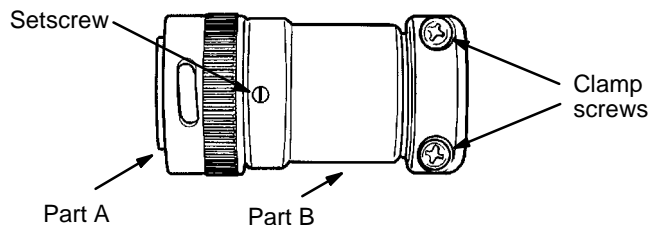
Soldering the twisted-pair wire

Refer to Figure F1–17.

1, 2, 3...   1.   Slide a 10-mm length of heat-shrink tubing (type F, inside diameter 1.5 mm) over each wire, leaving the exposed wire uncovered.

2.   Tin each wire and connector terminal.

3.   Solder each wire to its mating pin as shown, leaving 1 mm of exposed wire.

4.   Slide the heat-shrink tubing over the exposed wire and soldered joints as shown. Shrink the tubing with a heat gun.

5.   Wind insulating vinyl tape over the unused twisted-pair wire.

F1–17 Soldering the Twisted-Pair Wire to the RS-485 Connector

Soldering iron

Twisted-pair wire

1 mm

Connector

Heat-shrink tubing
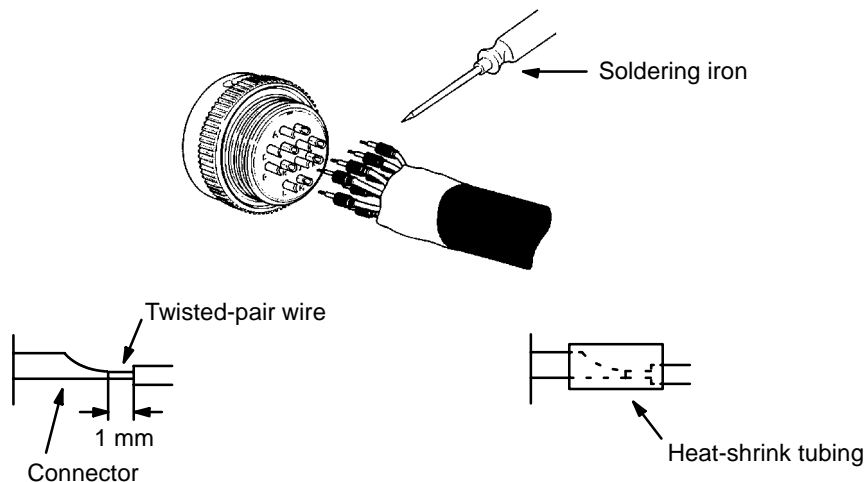
Assembling the connectors   Refer to Figure F1–18.

1, 2, 3...   1.   Assemble the connector by inserting connector part A into the Unit and threading part B clockwise onto part A.

2.   Tighten the 2 setscrews with a small standard screwdriver.

3.   Fix the cable by tightening the 2 clamp screws with a Phillips screwdriver.

F1–18 Assembled Connector

Setscrew

Part A   Part B   Clamp
                           screws
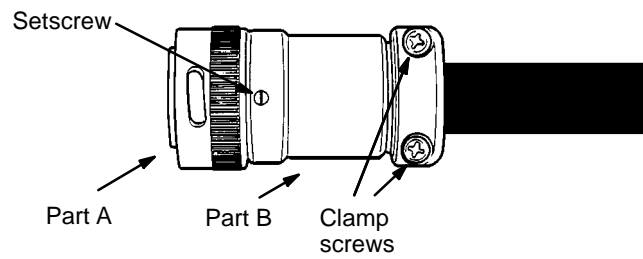
The Next Step   Once you have completed assembly and installation of the ID Sensor sys-
                           tem, turn to Section 2 for details on setup and operation.

SECTION 2
Operation

This section contains specific information on preparation and operation of the ID Sensor system. Study this section to obtain a good understanding of the operating structure of the ID Sensor system.

Presented first is information on DIP switch setting for two- and four-word operation, including bit allocation, flag operation, and data processing for both settings. Explanations follow for communication commands, and write protection. Example programs that illustrate basic programming for the transfer of data between the ID Sensor Unit and the CPU are also provided.

Refer to *Section 3 Programming* for specific programming instructions, and for information on timing considerations and monitoring.

2–1 DIP Switch Setting

The DIP switch provided on the ID Sensor Units is used for setting operation parameters.

Do not attempt to set the DIP switch of the ID Sensor Unit while power is being applied to the ID Sensor Unit. Turn OFF the power to the PC whenever you change the DIP switch settings.

DIP switch settings are registered upon application of power to the PC.

Note that no DIP switch is provided on the ID Adapter.

To gain access to the DIP switch, remove the indicator panel on the front of the ID Sensor Unit with a standard screwdriver.

F2–1 ID Sensor Unit DIP Switch
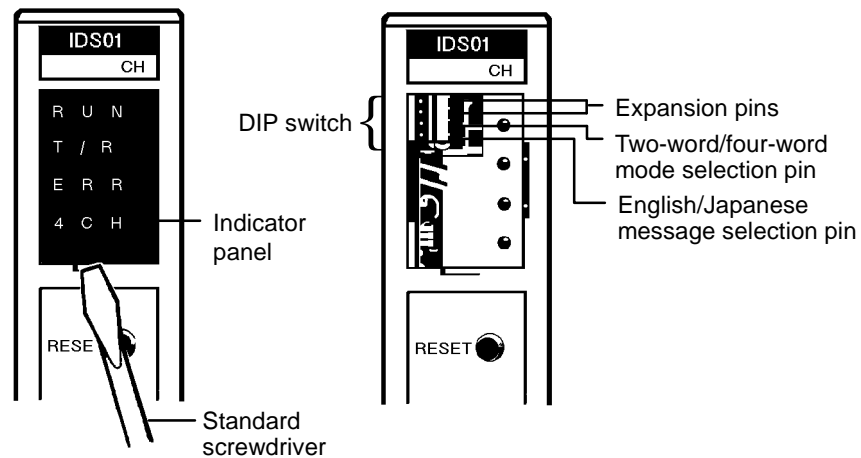
Table T2–1 shows DIP switch settings. Note that OFF is to the right; ON is to the left.

T2–1 DIP Switch Settings

Pin	Function		Pin Setting
1	Number of words	2	Set to OFF when WRIT(87) and READ(88) instructions are available.
		4	Set to ON when the ID Sensor Unit is mounted to a Remote I/O Slave Rack or is mounted to a PC that is not provided with the READ(88) and WRIT(87) instructions.
2	Language of message display		Set to OFF to display messages in Japanese.
			Set to ON to display messages in English.
3 and 4	Reserved for expansion		Set these pins to OFF.

To replace the indicator panel, engage the bottom tab of the panel in the slot.
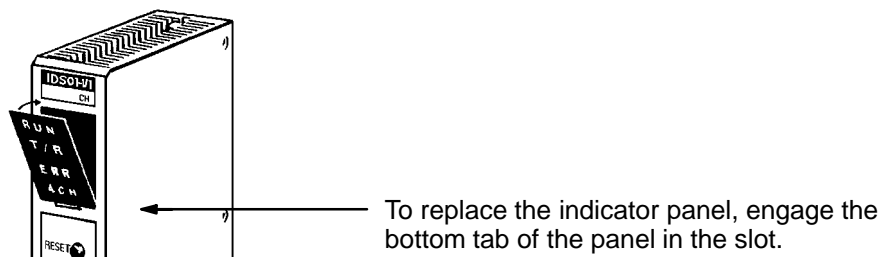
2–1–1   Two-Word/Four-Word Mode Selection

The ID Sensor Unit can be mounted to any slot of a C500, C1000H, or C2000H building-block type Programmable Controller. However, the number of words the Unit is to be set to, and the programming method (instructions to be used), differ according to: a) the PC model to which the Unit is mounted; and b) whether the ID Sensor Unit is mounted to a Remote I/O Slave Rack. Table T2–2 shows this relationship.

T2–2   Relationship between Programmable Controller Model, Instructions, and Number of Words

Programmable Controller	Unit Mounting Position	Instructions	Number of words
Models with WRIT(87) and READ(88) instructions	CPU Backplane, Expansion I/O Backplane	WRIT(87) and READ(88)	2
	Remote I/O Slave Rack	MOV, etc.	4
Models without WRIT(87) and READ(88) instructions	CPU Backplane, Expansion I/O Backplane, Remote I/O Slave Rack		

Note   1. WRIT(87): Intelligent I/O Write Instruction
READ(88): Intelligent I/O Read Instruction
WRIT(87) and READ(88) transfer up to 251 words of data between the ID Sensor Unit and the CPU of the PC; MOV transfers one word of data at a time.
(The Intelligent I/O Read/Write instructions are in fact capable of transferring 255 words, but as four words are used for communication codes, in practice only 251 words are available for data transfer.)
The PC performs I/O refresh each time WRIT(87) and READ(88) are executed. However, when MOV is executed, I/O refresh is performed according to the scanning operation of the CPU.

2. WRIT(87) and READ(88) are available with all C1000H and C2000H PCs, and to C500 PCs provided with either of the following CPUs:

• C500-CPU11-V1

• 3G2C3-CPU11-EV1

3. Use the ID Sensor Unit's built-in DIP switch to select two- or four-word mode. When mounting other I/O Units on the PC, make sure the words assigned to the ID Sensor Unit have not also been assigned to other I/O Units.

**Bit Allocation
(Two-Word Operation)**

Table T2–3 shows bit allocations when the DIP switch of the ID Sensor Unit is set to two-word mode.

T2–3 Bit Allocation When ID Sensor Unit is Set to Two-Word Mode

Bit	Word	
	n	n+1
	Output	Input
00	(PC busy)	(ID busy)
01	(PC write end)	(ID read in progress)
02	(PC read end)	(ID write end)
03	Command processing end flag reset	Command error
04	System reset	Programming Console MONITOR mode
05	–––	Auto Read/Write Abort end
06	–––	ID unit error
07	–––	–––
08	–––	Data Carrier read/write in progress
09	–––	Command processing end
10	–––	Data Carrier missing error
11	–––	Write protect error
12	–––	Data Carrier communication error
13	–––	Data Carrier address over
14	–––	Data verify error
15	–––	R/W Head disconnect error

Note 1. When the WRIT(87) and READ(88) instructions are used (when the ID Sensor Unit is mounted to the CPU Backplane or Expansion I/O Backplane of a PC having the WRIT(87) and READ(88) instructions), set pin 1 of the ID Sensor Unit's built-in DIP switch to the OFF position for two-word mode. (Refer to *Section 2–1 DIP Switch Setting.*)

2. The bits enclosed in parentheses operate automatically when the WRIT(87) and READ(88) instructions are executed. These bits are read-only; do not use for other purposes.

3. To output data to word n with an instruction such as MOV, turn OFF the PC busy, PC write end, and Data Carrier read end flags.

4. The ID read-in-progress flag verifies that data written in common memory by WRIT(87) is being read by the ID Sensor Unit.

5. The ID read-in-progress flag can be used to verify that data has been correctly written to the common memory of the ID Sensor Unit.

6. The status of word n+1 bits 10 through 15 do not change while being monitored by the Programming Console.

7. If an error occurs, the corresponding error flag and the command processing end flag simultaneously turn ON. The error flag and command processing end flag are turned OFF when the ID Sensor Unit receives a new command or when the command processing end flag reset (word n bit 03) turns ON.

8. Delay command transfer for 1 ms after the system reset flag (word n bit 04) has been turned OFF.

**Flag Functions
(Two-Word Operation)**

Table T2–4 shows the function of each flag when the ID Sensor Unit is set to two-word mode.

T2–4 Function of Each Flag when ID Sensor Unit Is Set to Two-Word Mode

Word	Bit	Flag name	Function
n	00	(PC busy)	These flags operate automatically when the WRIT(87) and READ(88) instructions are executed.
	01	(PC write end)	They are read-only and must not be used for other purposes.
	02	(PC read end)	Turn OFF these bits when data is to be sent via word n by MOV, etc.
	03	Command processing end flag reset	When this flag turns ON and then turns OFF, the command processing end flag (bit 09 of word n+1) is turned OFF. Program so that this bit operates after a command has been processed.
	04	System reset	When this flag turns ON and then turns OFF, the ID Sensor Unit is started from the initial state.
	05 to 15	–––	Unused. Bits 05 to 15 are reserved for functional expansion. Do not use them as IRs.
n+1	00	(ID busy)	These flags operate automatically when the WRIT(87) and READ(88) instructions are executed.
	01	(ID read in progress)	They are read-only and must not be used for other purposes.
	02	(ID write end)	
	03	Command error	This flag turns ON when the ID Sensor Unit cannot process the command sent from the PC when: (1) the command is undefined, or, (2) the command does not include a terminator.
	04	Programming Console MONITOR mode	This flag turns ON when the Programming Console connected to the ID Sensor Unit is in the MONITOR mode.
	05	Auto Read/Write Abort end	This flag turns ON when the ID Sensor Unit has received the Auto Read/Write Abort command from the PC and has completed the command.
	06	ID Unit error	This flag turns ON if an error has occurred in the ID Sensor Unit (watchdog timer) or when the RESET switch is pressed.
	07	–––	Unused. Bit 07 is reserved for functional expansion. Do not use it as a work bit.
	08	Data Carrier read/write in progress	This flag turns ON while the ID Sensor Unit is reading from or writing to the Data Carrier.
	09	Command processing end	This flag turns ON when the ID Sensor Unit has processed the command received from the PC. Note that this flag turns ON regardless of whether the command execution has ended normally or abnormally.
	10	Data Carrier missing error	This flag turns ON when the Data Carrier is undetected by the ID Sensor Unit after the ID Sensor Unit has received Read, Write, or Clear-all instructions from the PC. This flag also turns ON when no 24 VDC power is supplied to the C500-IDS01-V1.
	11	Write protect error	This flag turns ON when an attempt is made to write data to a write-protected area of the ID Sensor Unit's memory.
	12	Data Carrier communication error	This flag turns ON if an error has occurred during data communication between the ID Sensor Unit and Data Carrier.
	13	Data Carrier address over	This flag turns ON when the ID Sensor Unit attempts to access a memory address of the Data Carrier beyond the Data Carrier's memory capacity.
	14	Data verify error	When the ID Sensor Unit reads/writes data to/from the Data Carrier, the Unit reads the read/written data to compare it against the data it has read or written first. If the data read last does not match the data the ID Sensor Unit read or wrote first, an error occurs and this flag turns ON.
	15	R/W Head disconnect error	This flag turns ON when the R/W Head is not connected to the Unit, or when no 24 VDC power is supplied to the C500-IDS02 or C500-IDA02.

**Flag Operation
(Two-Word Operation)**

Figure F2–2 is a diagram of flag operation when the ID Sensor is set to two-word mode.

WRIT(87) is executed when a given condition is satisfied, and when the ID busy flag and ID read-in-progress flag are both 0. The instruction is processed as NOP (no operation) when either flag turns ON.

After the instruction has been executed, the PC write end flag is temporarily turns ON and the equal flag of the PC turns ON. The equal flag of the PC indicates the instruction has been completed.

Successful data transfer between the Data Carrier and the ID Sensor Unit is indicated when the command processing end flag (word n+1 bit 09) turns ON.

The command processing end flag is not cleared automatically. It is cleared by the command processing end flag reset flag (word n bit 03). Therefore, the operation of the command processing end flag reset flag must be programmed to clear the command processing end flag.

WRIT(87) must not be executed while the command processing end flag turns ON.

READ(88) is automatically executed when a given condition is satisfied, the ID busy flag is 0, and when the ID write end flag turns ON. When the Read command or Auto Read command has been executed, the ID busy flag is automatically turned OFF and the ID write end flag is automatically turned ON.

After READ(88) has been executed, the PC read end flag temporarily turns ON and the equal flag of the PC turns ON. Therefore, the equal flag indicates a completed instruction.

F2–2   Flag Operation when ID Sensor Unit Is Set to Two-Word Mode
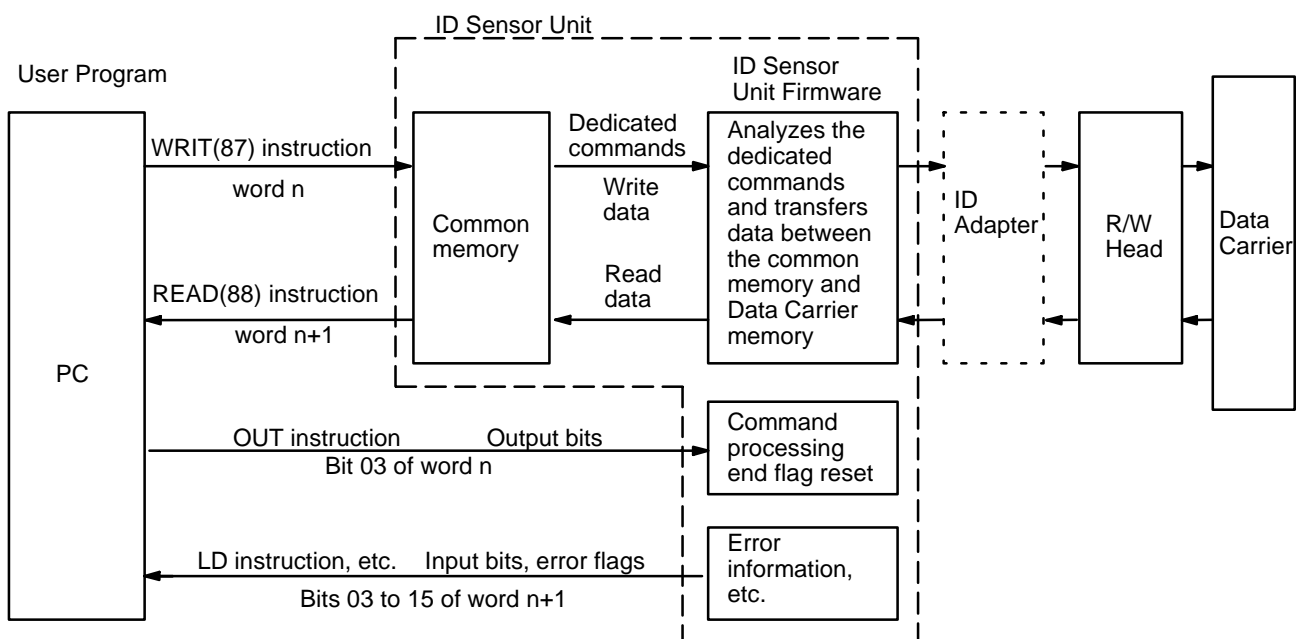
Data Processing (Two-Word Operation) Figure F2–3 shows the relationship between the data processing operations of the PC, the ID Sensor Unit, and the user program.

F2–3 Data Processing when ID Sensor Unit Is Set to Two-Word Mode.
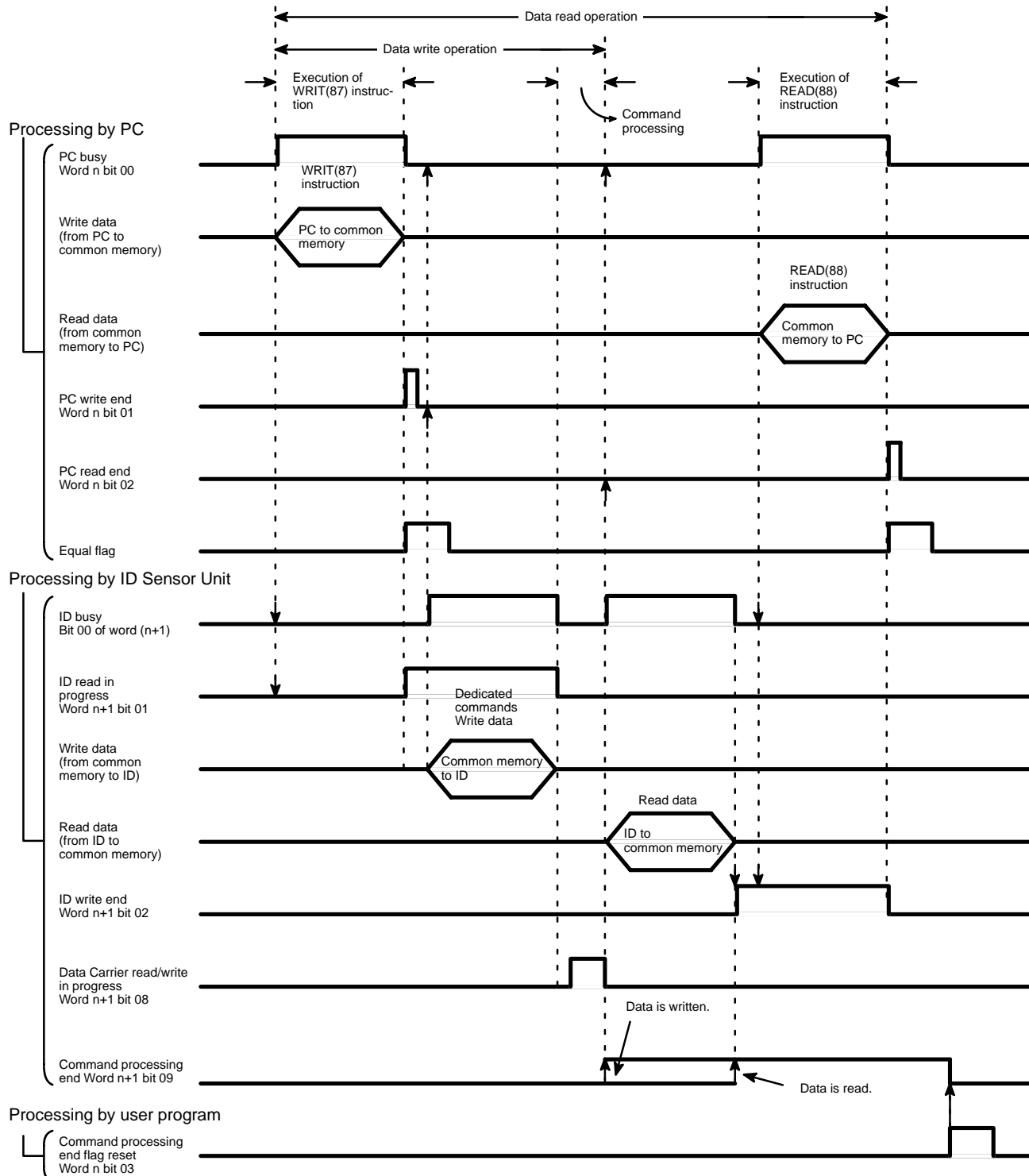
Bit Allocation (Four-Word Operation)

Table T2–5 shows bit allocation when the DIP switch of the ID Sensor Unit is set to four-word mode. Refer to *Section T2–5 DIP Switch Setting*.

T2–5 Bit Allocation when ID Sensor Unit Is Set to Four-Word Mode

Bit	Word					
	n	**n+1**		**n+2**	**n+3**	
	Output	Output		Input	Input	
00	Write data	00	PC busy	Read data	00	ID busy
01		01	PC write end		01	ID read in progress
02		02	PC read end		02	ID write end
03		03	Command processing end flag reset		03	Command error
04		04	System reset		04	Programming Console MONITOR mode
05		–––			05	Auto Read/Write Abort end
06					06	ID Unit error
07					07	–––
08					08	Data Carrier read/write in progress
09					09	Command processing end
10					10	Data Carrier missing error
11					11	Write protect error
12					12	Data Carrier communication error
13					13	Data Carrier address over
14					14	Data verify error
15					15	R/W Head disconnect error

Note 1. When the WRIT(87) and READ(88) instructions cannot be used (when the ID Sensor Unit is mounted on a PC that is not provided with WRIT(87) and READ(88), or on a Remote I/O Slave Rack), set pin 1 of the DIP switch on the ID Sensor Unit to ON. Leave pin 2 in the OFF position. In this mode, the ID Sensor Unit is set to four-word mode. The status of word n+3 bits 10 through 15 does not change while those bits are being monitored by the Programming Console. (Refer to *Section 2–1 DIP Switch Setting; Section 3–3 Monitoring*.)

2. If an error occurs, the corresponding error flag turns ON simultaneously with the command processing end flag. The error and command processing end flags are turned OFF when the ID Sensor Unit has received a new command or the command processing end flag reset (word n bit 03) has been turned ON.

3. Delay command transfer for one minute after the system reset flag (word n bit 04) has turned OFF.

Flag Functions (Four-Word Operation)

Tables T2–6 and T2–7 show the function of each flag when the ID Sensor Unit is set to four-word mode.

T2–6 Function of Each Flag when ID Sensor Unit Is Set to Four-Word Mode (words n, n+1, n+2)

Bit No.		Flag	Function
Word	**Bit**		
n	00 to 15	Write data	This is the data written from the PC to the common memory of the ID Sensor Unit by the MOV command of the PC.
n+1	00	PC busy	Program this flag to turn ON when the PC starts reading/writing data to/from the common memory, and to turn OFF when the PC has completely read/written the data. While this flag turns ON, the ID Sensor Unit cannot access the common memory.
	01	PC write end	Program this flag to turn ON (see note) after the PC has written data to the common memory (by executing MOV, etc; see note). When this flag turns ON, the ID read-in-progress flag (word n+3 bit 01) is automatically turned ON.
	02	PC read end	Program this flag to turn ON (see note) after the PC has read data from the common memory (by executing MOV, etc; see note). When this flag turns ON, the ID write-in-progress flag (word n+3 bit 02) is automatically turned ON.
	03	Command processing end flag reset	When this flag turns ON and then turns OFF, the command processing end flag (bit 09 of word n+1) is also cleared. Program so that this flag turns ON and then turns OFF after a command has been executed.
	04	System reset	When this flag turns ON and then turns OFF, the ID Sensor Unit is restarted from the initial state.
	05 to 15	–––	Unused. Bits 05 to 15 are reserved for functional expansion. Do not use them as work bits.
	00 to 15	Read data	The PC reads this data from the common memory by executing MOV.

Note When the ID Sensor Unit is mounted to a Remote I/O Slave Rack, the PC does not complete writing/reading data until the I/O response time of the Unit has elapsed (refer to *Section 3–4 Timing Considerations*). Therefore, the PC write end and PC read end flags must be programmed to remain at 1 during this period.
These flags may remain at 1 until immediately before the PC begins writing/reading the next piece of data.

T2–7 Function of Each Flag when ID Sensor Unit Is Set to Four-Word Mode (word n+3)

| Bit No.		Flag	Function
Word	Bit		
n+3	00	ID busy	When the ID Sensor Unit starts writing/reading data to/from the common memory, this flag turns ON; when the Unit has finished writing/reading the data, it is turned OFF. While this flag is 1, the PC cannot access the common memory.
	01	ID read in progress	This flag turns ON when the PC write end flag (word n+1 bit 01) turns ON, enabling the ID Sensor Unit to read data from the common memory. When the ID Sensor Unit has finished reading the data, the flag is turned OFF.
	02	ID write end	This flag turns ON when the ID Sensor Unit has finished writing data to the common memory; it is turned OFF when the PC read end flag (bit 02 of word n+1) turns ON.
	03	Command error	This flag turns ON if the ID Sensor Unit cannot process the command sent from the PC when: (1) the command is undefined or; (2) the command does not include a terminator.
	04	Programming Console MONITOR mode	This flag turns ON when the Programming Console connected to the ID Sensor Unit is in the MONITOR mode.
	05	Auto Read/Write Abort end	This flag turns ON when the ID Sensor Unit has received the Auto Read/Write Abort command from the PC and has finished processing the command.
	06	ID Unit error	This flag turns ON if an error has occurred in the ID Sensor Unit (watchdog timer) or when the RESET switch has been pressed.
	07	–––	Reserved for functional expansion. Do not use it as a work bit.
	08	Data Carrier read/write in progress	This flag turns ON while the ID Sensor Unit is reading/writing data from/to the Data Carrier.
	09	Command processing end	This flag turns ON when the ID Sensor Unit has processed the command received from the PC. Note that this flag turns ON regardless of whether the command execution has ended normally or abnormally.
	10	Data Carrier missing error	This flag turns ON when the Data Carrier is not detected by the ID Sensor Unit after the ID Sensor Unit has received the Read, Write, or Clear-all command from the PC. It also turns ON when 24 VDC power is not being applied to the Unit.
	11	Write protect error	This flag turns ON when an attempt is made to write data to a write-protected area of the ID Sensor Unit's memory.
	12	Data Carrier communication error	This flag turns ON if an error has occurred during data communication between the ID Sensor Unit and Data Carrier.
	13	Data Carrier address over	This flag turns ON when the ID Sensor Unit attempts to access a memory address of the Data Carrier beyond the Data Carrier's memory capacity.
	14	Data verify error	When the ID Sensor Unit reads/writes data from/to the Data Carrier, the unit reads the read/written data to compare it against the data which the Data Carrier has read or written first. If the data read last does not match the data the ID Sensor Unit read or wrote first, an error occurs and this flag turns ON.
	15	R/W Head disconnect error	This flag turns ON when the R/W Head is not connected to the ID Sensor Unit, or when no 24 VDC power is supplied to the C500-IDS02 or C500-IDA02.

Flag Operation (Four-Word Operation)

F2–4   Flag Operation when ID Sensor Unit Is Set to Four-Word Mode
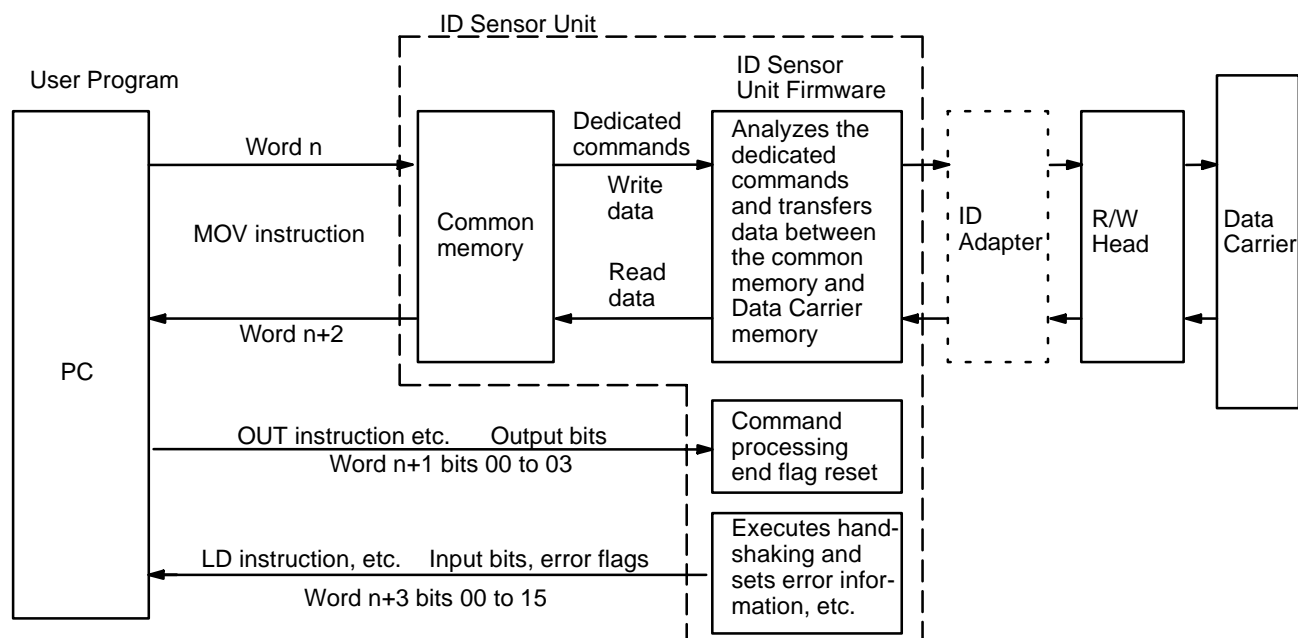
Data Processing (Four-Word Operation) Figure F2–5 shows the relationship between the data processing operations of the ID Sensor Unit and the user program when the ID Sensor has been set to four-word mode.

F2–5 Data Processing when ID Sensor Unit Is Set to Four-Word Mode.
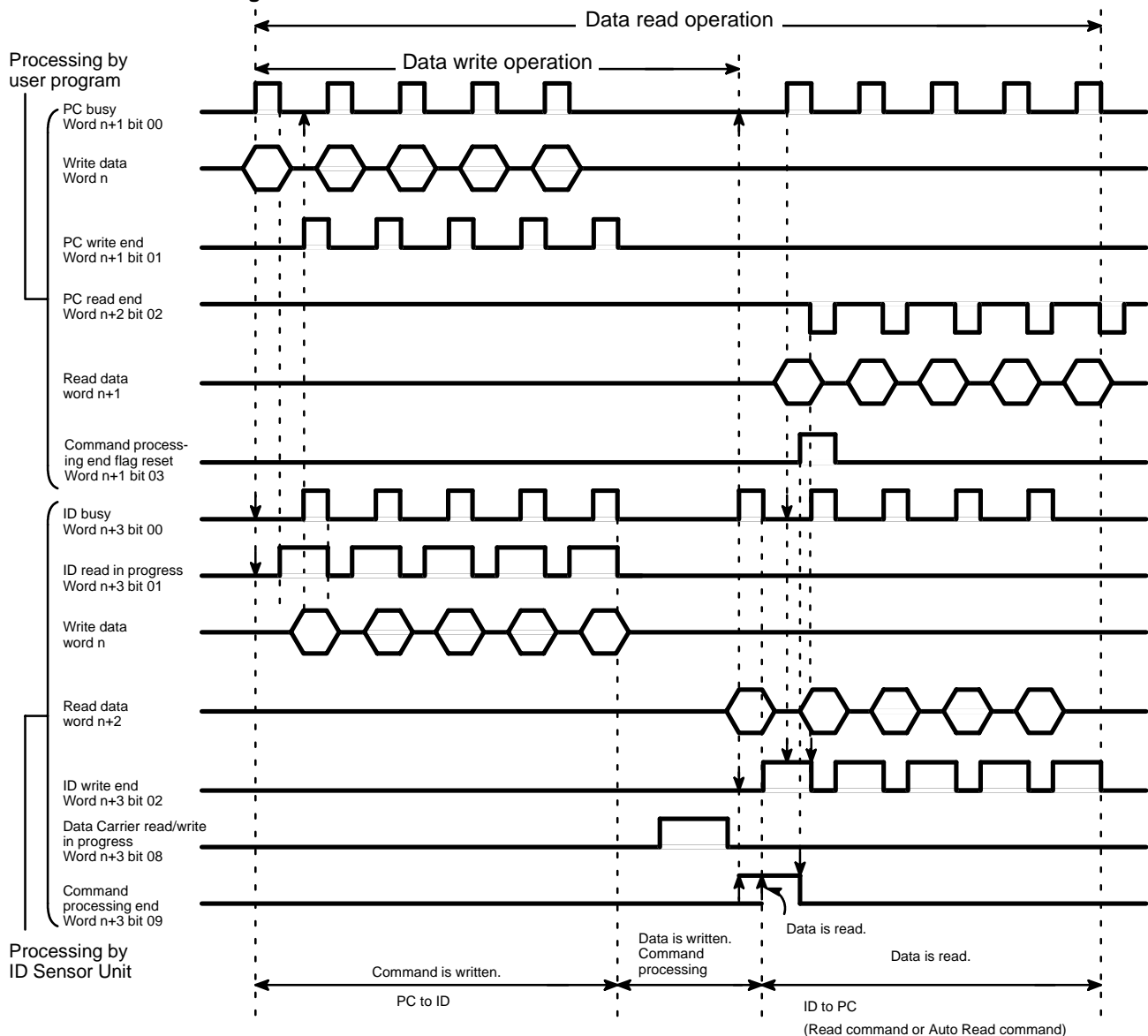
Timing of Data Transfer When the ID Sensor Unit is mounted to the CPU Backplane or Expansion I/O Backplane of a PC, the contents of the following flags and data are transferred in 1 scan by a differentiation instruction (transfer of the contents of a flag or data only during the scan immediately following a change in those contents):

• PC busy flag (word n+1 bit 00)

• Write data (word n bits 00 to 15)

• PC write end flag (word n+1 bit 01)

• PC read end flag (word n+1 bit 02)

• Read data (word n+2 bits 00 to 15)

However, if the ID Sensor Unit is mounted to a Remote I/O Slave Rack, transfer is delayed by the I/O response time of the Remote I/O Slave Rack.

Therefore, prolong the output of these flags and the data in the program for the duration of the response period. (Refer to *Section 3–4 Timing Considerations.)*

2–2   The User Program

The ID Sensor Unit will not operate unless it is programmed to do so by the PC. The Unit communicates with the Data Carrier through the Read/Write Head by means of the commands provided by the user program of the PC.

The user program of the PC consists of two modules: one issues commands to the ID Sensor Unit, and the other sends/receives data. Develop the program by using instructions such as Intelligent I/O Write (WRIT(87)), Intelligent I/O Read (READ(88)), and MOV.

Figure F2–6 shows the basic operation outline of the two modules of the program.

F2–6   User Program Operation Outline
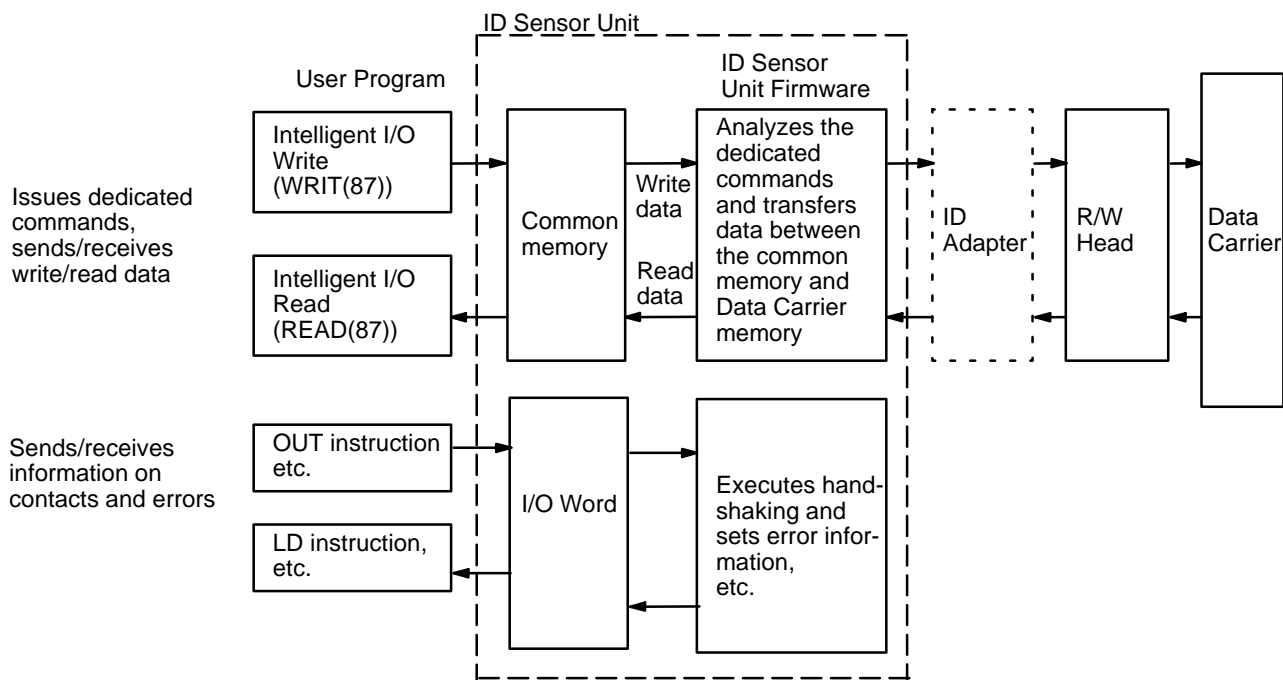
Note   If your PC is not provided with Intelligent I/O Write/Read instructions, transfer data between the PC and ID Sensor Unit by using MOV on a word-by-word basis.

Relationship between CPU Operation Status and ID Sensor Unit   As the ID Sensor Unit is controlled by the program contained in the CPU of the PC, when the CPU is reset, the ID Sensor Unit is also reset.

The ID Sensor Unit executes commands even when the CPU is in the PROGRAM mode.

Communication with the CPU   The ID Sensor Unit reads data from and writes data to the Data Carrier in accordance with the commands sent from the CPU.

Writing Data to the Data Carrier from the CPU   The CPU, via the Write, Auto Write, and Clear-all commands, directs the ID Sensor Unit to write data to the Data Carrier. Figure F2–7 shows the steps involved in writing data to the Data Carrier.

F2–7 Writing Data to the Data Carrier from the CPU
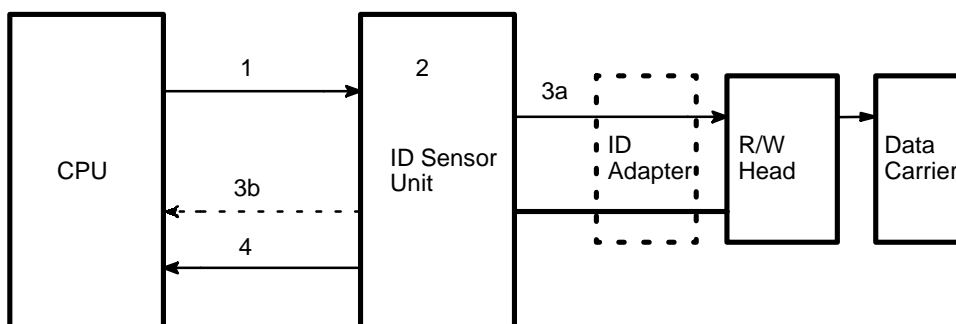
1, 2, 3...
1. The CPU of the PC issues the Write, Auto Write, or Clear-all command by using WRIT(87) or MOV.
2. The ID Sensor Unit analyzes the command received from the PC.
3. If the command is correct, the ID Sensor Unit writes the required data to the Data Carrier.
   If the command is illegal, the ID Sensor Unit turns ON the command processing end and command error flags of the PC (refer to p 20 and p 24 *Bit Allocation*).
4. When the ID Sensor Unit has completed writing data to the Data Carrier, the Unit turns ON the command processing end flag of the PC.

If communication with the Data Carrier cannot be established, or if an error occurs during communication, the ID Sensor Unit stops data communication with the Data Carrier and turns ON the command processing and Data Carrier communication error flags of the PC.

Steps 1 to 4 compose one write operation.

Reading Data from the Data Carrier to the CPU
The CPU, via the Read and Auto Read commands, directs the ID Sensor Unit to read data from the Data Carrier. Figure F2–8 shows the steps involved in reading data from the Data Carrier.

F2–8 Reading Data from the Data Carrier to the CPU
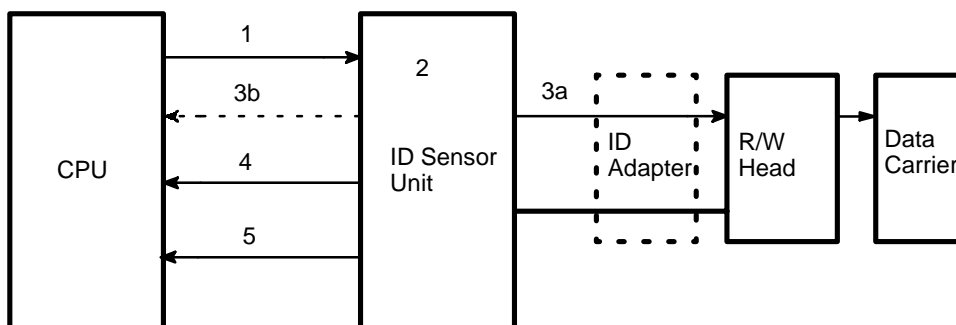
1, 2, 3...
1. The CPU of the PC issues the Read or Auto Read command to the ID Sensor Unit by using WRIT(87) or MOV.
2. The ID Sensor Unit analyzes the command it has received from the PC.
3. If the command is correct, the ID Sensor Unit reads the required data from the Data Carrier.
   If the command is illegal, the ID Sensor Unit turns ON the command processing end and command error flags of the PC (refer to p 20 and p 24 *Bit Allocation*).
4. When the ID Sensor Unit has completed reading data from the Data Carrier, the Unit turns ON the command processing end flag of the PC.

If communication with the Data Carrier cannot be established, or if an error occurs during communication, the ID Sensor Unit stops data communication with the Data Carrier and turns ON the command processing end and Data Carrier communication error flags of the PC.

5.   Next, the PC executes READ(88) or MOV to retrieve the data from the ID Sensor Unit.

Steps 1 to 5 compose one read operation.

2–2–1   Program Examples

The following figures provide examples of programs; refer to these figures before developing your program. Further examples are presented in *Section 3 Programming*.

Writing Data

F2–9   Program Examples: Writing Data

PC (user program)
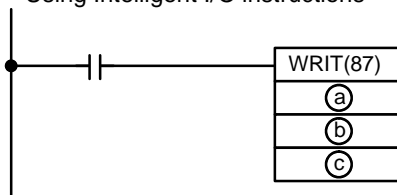
Using Intelligent I/O instructions

```
        ┌─────────┐
───┤├───│ WRIT(87)│
        │    ⓐ    │
        │    ⓑ    │
        │    ©    │
        └─────────┘
```

Using MOV
(when Intelligent I/O instructions are not available)

```
        ┌─────────┐
───┤├───│   MOV   │
        │    ⓓ    │
        │    ©    │
        └─────────┘
```
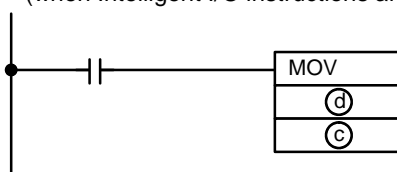
ⓐ : number of words to be transferred
ⓑ : first destination word number
© : first word number of ID Sensor Unit
ⓓ : source word number of transfer data

PC (source memory)
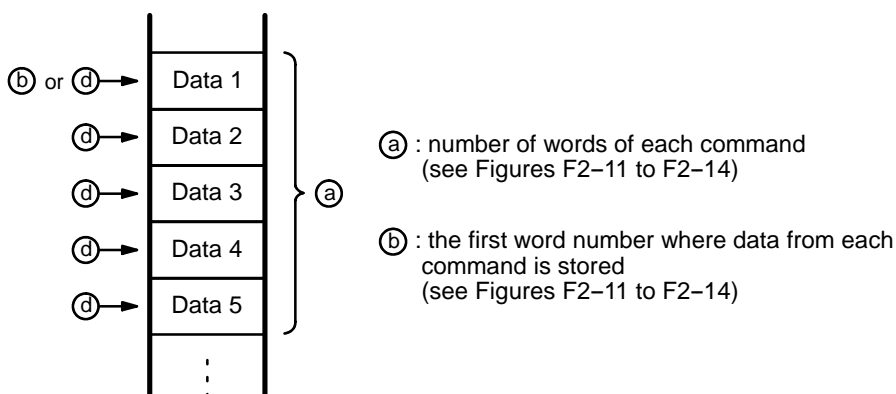
ⓐ : number of words of each command
    (see Figures F2–11 to F2–14)

ⓑ : the first word number where data from each command is stored
    (see Figures F2–11 to F2–14)

When the Intelligent I/O Write (WRIT(87)) instruction is used, up to 251 words of data can be transferred to the ID Sensor Unit at one time. However,

31

if this instruction is not available and MOV is used instead, data from only one word can be transferred at a time.

Reading Data

F2–10 Program Examples: Reading Data

PC (user program)
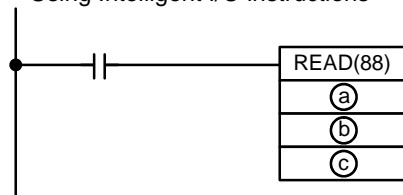
Using Intelligent I/O instructions

```
┌─────────────┐
│  READ(88)   │
│     ⓐ      │
│     ⓑ      │
│     ⓒ      │
└─────────────┘
```

Using MOV
(when Intelligent I/O instructions are not available)

```
┌─────────────┐
│    MOV      │
│     ⓓ      │
│     ⓔ      │
└─────────────┘
```
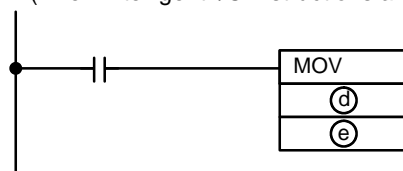
ⓐ : number of words to be transferred
ⓑ : first word number of ID Sensor Unit + 1
ⓒ : first destination word number
ⓓ : first word number of ID Sensor Unit + 2
ⓔ : destination word number

PC (destination memory)

ⓒ or ⓔ →	Data 1
ⓔ →	Data 2
ⓔ →	Data 3
ⓔ →	Data 4
ⓔ →	Data 5

ⓐ (spanning Data 1 through Data 5)
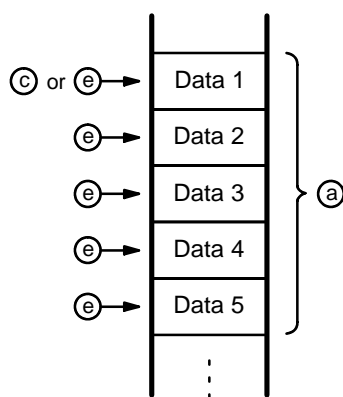
When the Intelligent I/O Read (READ(88)) instruction is used, up to 251 words of data can be transferred to the PC at one time. However, if this instruction is not provided and MOV is used instead, data from only one word can be transferred at a time.

2–2–2   Communication Commands

The ID Sensor Unit is provided with six dedicated commands for communicating with the Data Carrier through the Read/Write Head. Table T2–8 outlines these commands.

T2–8 Communication Commands

Command name	Mnemonic	ASCII code	Function
Write	WT	57 54	Writes data to the internal memory of the Data Carrier. Up to 502 bytes (251 words) of data can be written at a time.
Read	RD	52 44	Reads data from the internal memory of the Data Carrier. Up to 502 bytes (251 words) of data can be read at a time.
Auto Write	AW	41 57	Waits until the Data Carrier approaches the Read/Write Head and then writes data to the internal memory of the Data Carrier as it comes within detection range of the Read/Write Head. Up to 502 bytes (251 words) of data can be written at a time.
Auto Read	AR	41 52	Waits until the Data Carrier approaches the Read/Write Head and then reads data from the internal memory of the Data Carrier as it comes within detection range of the Read/Write Head. Up to 502 bytes (251 words) of data can be read at a time.
Clear-all (see Note)	CA	43 41	Clears the contents of the Data Carrier's internal memory; however, the contents of addresses 0000 and 0001 are not cleared as these addresses store the date of production of the Data Carrier.
Auto Read/Write Abort	AA	41 41	Aborts Auto Read and Auto Write. When this command is executed, the ID Sensor Unit is initialized and waits for the next command.

Note The Clear-all command clears all data after address 0002, regardless of write protection.

To write data to the Data Carrier, use the WRIT(87) or MOV instructions of the PC to issue the Write or Auto Write command and Clear-all command to the ID Sensor Unit.

To read data from the Data Carrier, use the WRIT(87) or MOV instructions of the PC to issue the Read or Auto Read command to the ID Sensor Unit. As soon as the ID Sensor Unit has read data from the Data Carrier, execute the READ(88) instruction of the PC to read the data into the PC.

Write Command This command writes data to the internal memory of the Data Carrier. Up to 502 bytes (251 words) of data can be written at a time.

F2–11 Write Command

15 ◄————► 00

W	**T**

- - - This is OP (operation) code indicating that the command is Write.

5	7	5	4

- - - This is OP code represented in ASCII code.

Specifies the type of data to be written, which can be ASCII characters or hexadecimal numbers. Code A (41) specifies ASCII characters, while H (48) specifies hexadecimal numbers.

A/H		1

- - - This code selects a Read/Write Head and is always fixed to 1.

41/48		3	1

- - - ASCII code

- - - Specifies the first address of the Data Carrier memory to which data is to be written. Addresses 0002 through 07FF (0002 through 2047 decimal) can be specified in hexadecimal.

Write data

- 502 bytes max. = 251 words

- ASCII character data: 502 characters

- Hexadecimal number (0 through F): 1,004

*	↻

- - - Terminator

2	A	0	D

- - - ASCII code

Read Command   The Read command reads data from the internal memory of the Data Carrier. Up to 502 bytes (251 words) of data can be read at a time.

F2–12 Read Command

```
          15  ◄──────►  00
```

R	**D**	- - - This is OP code indicating that the command is Read.
5 2	4 4	- - - This is OP code represented in ASCII code.
A/H	1	- - - This code selects a Read/Write Head and is always fixed to 1.
41/48	3 1	- - - ASCII code
		- - - Specifies the first address of the Data Carrier memory to which data is to be read. Addresses 0000 through 07FF (0000 through 2047 decimal) can be specified in hexadecimal.
		- - - Specifies the number of bytes, which can range from 0001 through 01F6 (0001 through 0502 in decimal) to be read in hexadecimal code.
*	↻	- - - Terminator
2 A	0 D	- - - ASCII code

This field specifies whether the data to be read from the Data Carrier is ASCII characters or hexadecimal code. When ASCII characters are to be read, this field contains code A (41 in ASCII code); when hexadecimal code is to be read, it contains code H (48 in ASCII code).

Auto Write Command

This command does not execute until the Data Carrier approaches the Read/Write Head. When the Data Carrier comes within detection range of the Read/Write Head, this command writes data to the internal memory of the Data Carrier. Up to 502 bytes (251 words) of data can be written at a time.

F2–13 Auto Write Command

15 ◄──────► 00

| A | W | - - - This is OP code indicating that the command is Auto Write. |

| 4 | 1 | 5 | 7 | - - - This is OP code represented in ASCII code. |

Specifies the - - - type of data to be written, which can be ASCII characters or hexadecimal numbers. Code A (41) specifies ASCII characters, while H (48) specifies hexadecimal numbers.

| A/H | 1 | - - - This code selects a Read/Write Head and is always fixed to 1. |

| 41/48 | 3 | 1 | - - - ASCII code |

- - - Specifies the first address of the Data Carrier memory to which data is to be written. Addresses 0002 through 07FF (0002 through 2047 decimal) can be specified in hexadecimal.

Write data

- 502 bytes max. = 251 words

- ASCII character data: 502 characters

- Hexadecimal number (0 through F): 1,004

| * | ↻ | - - - Terminator |

| 2 | A | 0 | D | - - - ASCII code |

Auto Read Command

This command does not execute until the Data Carrier approaches the Read/Write Head. When the Data Carrier comes within detection range of the R/W Head, this command reads data from the internal memory of the Data Carrier. Up to 502 bytes (251 words) of data can be read at a time.

F2–14 Auto Read Command

15 ←——→ 00

A	**R**	- - - This is OP code indicating that the command is Auto Read.

4	1	5	2	- - - This is OP code represented in ASCII code.

This field specifies - - - whether the data to be read from the Data Carrier is ASCII characters or hexadecimal code. When ASCII characters are to be read, this field contains code A (41 in ASCII code); when hexadecimal code is to be read, it contains code H (48 in ASCII code).

A/H	1	- - - This code selects a Read/Write Head and is always fixed to 1.

41/48	3	1	- - - ASCII code

- - - Specifies the first address of the Data Carrier memory from which data is to be read. Addresses 0000 through 07FF (0000 through 2047 decimal) can be specified in hexadecimal.

- - - Specifies the number of bytes, which can range from 0001 through 01F6 (0001 through 0502 in decimal) to be read in hexadecimal code.

*	↻	- - - Terminator

2	A	0	D	- - - ASCII code

Clear-all Command

This command clears the Data Carrier's internal memory. However, the contents of addresses 0000 and 0001 are not cleared as these addresses store the date of production of the Data Carrier.

F2–15 Clear-all Command

15 ←——→ 00

C	**A**	- - - This is OP code indicating that the command is Clear-all.

4	3	4	1	- - - This is OP code represented in ASCII code.

Blank - - - (no specification)

	1	- - - This code selects a Read/Write Head and is always fixed to 1.

0	0	3	1	- - - ASCII code

*	↻	- - - Terminator

2	A	0	D	- - - ASCII code
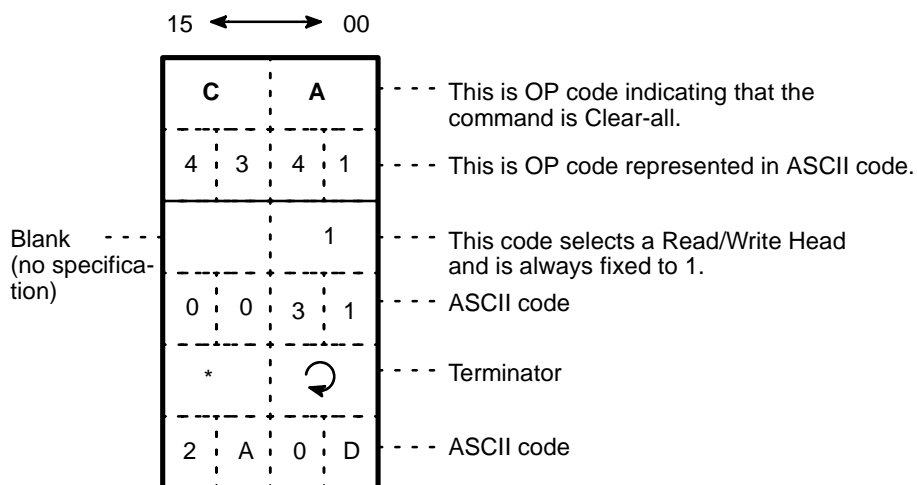
Auto Read/Write Abort

This command aborts Auto Read and Auto Write. When this command is executed, the ID Sensor Unit is initialized and waits for the next command.

37

F2–16 Auto Read/Write Abort
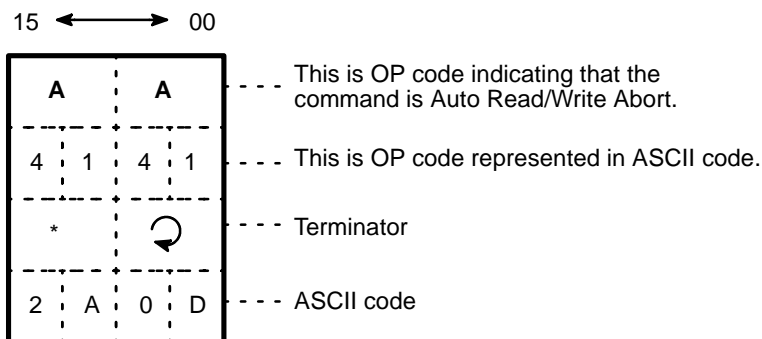
This command is regarded as an undefined command when it is received by the ID Sensor Unit while the Unit is waiting for a command input.

2–2–3 Write Protection

Data written to the Data Carrier can be write-protected. First write the data to the desired area of the Data Carrier's memory by using Write, then write-protect the area using the following procedures.

Addresses 0002 to 0005 of the Data Carrier's memory are used to enable or clear the write protect function. Set these addresses as shown in Table T2–9.

Enabling Write Protection

T2–9 Enabling Write Protection

Bit	7	6	5	4	3	2	1	0
Address 0002	Write protect	$X16^3$			$X16^2$			
Address 0003	$X16^1$				$X16^0$			
Address 0004	$X16^3$				$X16^2$			
Address 0005	$X16^1$				$X16^0$			

Write protect beginning address

Setting range: 0006 through 07FF

Write protect end address
Setting range: 0006 through FFFF

(When 0800 is set to FFFF, 07FF is assumed.)

To clear the write protect function, clear all address bits from 0002 through 0005.

Bit 7 of address 0002	1	Enables write protect function
	0	Clears write protect function

Example 1
Clearing Write Protection

T2–10 Clearing Write Protection

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

Note To disable or clear the write protect function, clear all address bits from 0002 through 0007.
If the only 0 bit is the 7th bit of address 0002, the function is ignored.

Example 2
Write-protecting Addresses 0015 through 0120

T2–11 Write-protecting Addresses 0015 through 0120

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

Result Data Carrier's memory
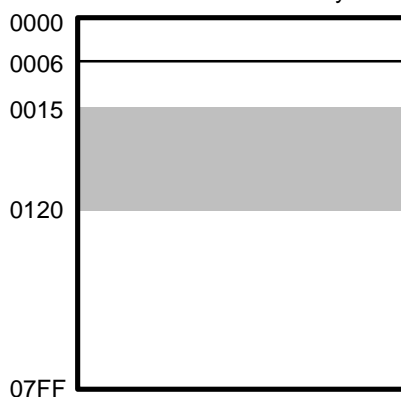
Write-protected area

Data can be written to addresses 0006 through 0014, and 0121 through 07FF.

Example 3
Write-protecting Addresses 0700 through 0350

T2–12 Write-protecting Addresses 0700 through 0350

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

Result
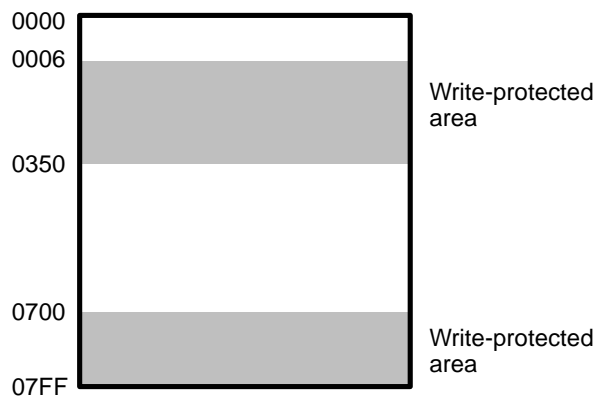
Addresses 0006 through 0350, and 0700 through 07FF are write-protected. Data can be written to addresses 0351 through 06FF.

Example 4
Write-protecting Address 02BE Only

T2–13 Write-protecting Address 02BE Only

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

Result

0000

0006

02BE

Write-protected
area

07FF

Only address 02BE is
write-protected.
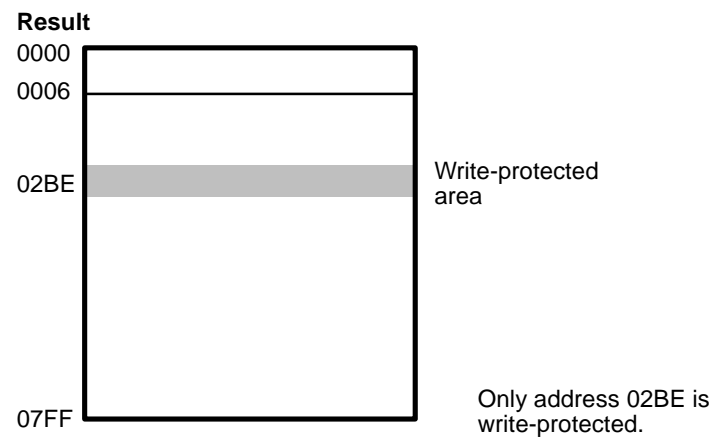
Example 5
Write-protecting Addresses 0600 through 07FF

T2–14 Write-protecting Addresses 0600 through 07FF

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

Result

0000

0006

Write-protected
area

0600

07FF

Addresses 0600 through 07FF
are write-protected. When ad-
dress 0800 is set to FFFF as an
end address, 07FF is assumed.
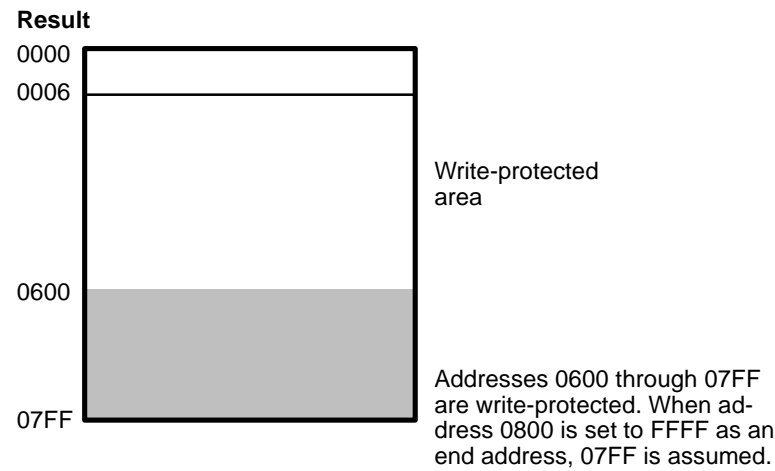
2–2–4   Registration of Date of Production of Data Carrier

The life of the Data Carrier is approximately 8 years. Develop a program that monitors the age of the Data Carrier and notifies the user to replace it before it becomes unusable.

Using the CPU's user program or a Host Computer, execute Read in order to read the date of production and monitor the life of the Data Carrier.

The first 2 bytes (addresses 0000 and 0001) of the Data Carrier's internal memory are reserved to store the date of production, which is registered at the factory before shipment.

No data can be written to these two bytes; an attempt to do so will result in a write protect error.

Figure F2–17 shows the format in which the date of production is registered; Figure F2–18 gives examples of dates registered.

F2–17 Registration of Data Carrier's Date of Production

Bit	7	6	5	4	3	2	1	0
Address 0000	Higher digit of month				Lower digit of month			
Address 0001	Higher digit of year				Lower digit of year			

Note Only the last 2 digits of the year are registered.

F2–18 Examples of Registration of Data Carrier's Date of Production

(1) March, 1988

Bit	7	6	5	4	3	2	1	0
Address 0000	0				3			
Address 0001	8				8			

(2) December, 1990

Bit	7	6	5	4	3	2	1	0
Address 0000	1				2			
Address 0001	9				0			

This section provides example programs that illustrate data transfer between the ID Sensor Unit and the CPU of the PC. Six communication commands (Write, Auto Write, Read, Auto Read, Clear-all, and Auto Read/Write Abort) can be used.

Section 3–1 illustrates program examples for an ID Sensor Unit set to two-word mode; Section 3–2 illustrates program examples for an ID Sensor Unit set to four-word mode.

.Refer to *Section 2–2 The User Program* for basic information on developing a user program.

3–1 Program Examples (Two-Word Mode)

Note that the following conditions apply to the example programs in this section:

1, 2, 3...   1. All example programs are for the C1000H Programmable Controller.
2. The ID Sensor Unit is set to two words, words 000 and 001. Therefore, it is assumed that the WRIT(87) and READ(88) instructions are used. If these instructions are not provided with your PC, transfer data on a word by word basis via MOV.
3. Data sent from the ID Sensor Unit to the PC is stored in the DM area of the PC.

Note that the number of words used for each command must be the same as the number of words used for the WRIT(87) instruction.

3–1–1 Writing to the Data Carrier

This subsection includes program examples of the Write, Auto Write, and Clear-all commands.

Program Example 1: The Write Command

The Intelligent I/O Write (WRIT(87)) instruction is used to execute the Write command, Auto Write command, or Clear-all command. When programming, make sure WRIT(87) is executed only once each time a command is executed.

The following program examples are for one transfer operation of 251 words of data. When transferring more than 251 words of data (to execute the transfer operation more than once), refer to *Section 3–4 Timing Considerations*.

F3–1   Using "Write" to write 5 Bytes of ASCII Code Data (31 to 35) to the Data Carrier

Command data in the CPU

Data to be written
to Data Carrier

15 ←——→ 00

Address 7 ←——→ 0

DM 1000	57	54

- - - WT (Write)

DM 1001	41	31

- - - A1 (Hexadecimal, Head 1)

DM 1002	00	06

- - - First write address
of Data Carrier

DM 1003	31	32
DM 1004	33	34

Data to be written to Data Carrier:
31 through 35 (5 bytes)

DM 1005	35	2A
DM 1006	0D	00

If the number of bytes to be written to the Data
Carrier is odd, shift codes 2A and 0D forward
one byte and write 00 into the last 8 bits.

0006	31
0007	32
0008	33
0009	34
000A	35

WRIT(87)
is
executed. →

ID
Sensor
Unit's
internal
memory

Write
command
is
executed. →

Data cannot be written to
write-protected areas.

Operation

When the execution command is turned ON, the PC first verifies that the command processing end flag (00109) has been turned OFF. It then executes WRIT(87), which transfers seven words of data (the contents of DM 1000 to DM 1006) to the ID Sensor Unit. After WRIT(87) has been executed, the equal flag (25506) is automatically turned ON.

The ID Sensor Unit analyzes the type of command it has received, the address of the Data Carrier, and the data to be written to the Data Carrier. The ID Sensor Unit then executes the Write command to access the Data Carrier.

After the command has been completed, the command processing end flag (00109) turns ON. This flag does not turn OFF automatically; therefore, turn ON and then turn OFF the command processing end flag reset bit (00003) to turn OFF the command processing end flag.

Program Example 2: The Auto Write Command

F3–2   Using "Auto Write" to Write 3 Bytes of ASCII Code Data (41 to 43) to the Data Carrier

```
  00109
──┤├───────────────────────────────────( 00003 )   Command processing end flag reset
Command processing end flag

Execution command
──┤├─────────────────────[ DIFU (13) 15000 ]   Command transfer start

  15000    13001
──┤├────┬───┤/├──────────────────────────( 13000 )   Command transfer in progress
        │             00109
──┤├────┘         ──┤/├──┬──┌──────────┐
  13000                  │  │ WRIT(87) │   Command transfer
                         │  │  #0006   │
                         │  │ DM 1100  │
                         │  │  000     │
                         │  └──────────┘
                    25506 │
                  ──┤├────┘──────────────( 13001 )   Command transfer end
                  Equal flag
```

Command data in the CPU

Data to be written
to Data Carrier

15 ←——→ 00

Address 7 ←——→ 0

DM1100	41	57	- - - AW (Auto Write)
DM1101	41	31	- - - A1 (Hexadecimal, Head 1)
DM1102	00	0B	- - - First write address of Data Carrier
DM1103	41	42	- - Data to be written to Data Carrier: 41 through 43 (3 bytes)
DM1104	43	2A	
DM1105	0D	00	If the number of bytes to be written to the Data Carrier is odd, shift codes 2A and 0D forward one byte and write 00 into the last 8 bits.

WRIT(87) is executed. → ID Sensor Unit's internal memory

Auto Write command is executed. →

000B	41
000C	42
000D	43

Data cannot be written to write-protected areas.

Operation

When the execution command is turned ON, the PC checks that the command processing end flag (00109) has been turned OFF. It then executes WRIT(87), which transfers six words of data (the contents of DM 1100 to DM 1105) to the ID Sensor Unit. After WRIT(87) has been executed, the equal flag (25506) is automatically turned ON.

The ID Sensor Unit analyzes the type of the command it has received, the address of the Data Carrier, and the data to be written to the Data Carrier. The ID Sensor Unit then executes the Auto Write command to access the Data Carrier.

After the command has been completed, the command processing end flag (00109) turns ON. This flag does not turn OFF automatically; turn ON and then turn OFF the command processing end flag reset bit (00003) to turn OFF the command processing end flag.

Program Example 3: The Clear-all Command

F3–3   Using "Clear-all" to Clear All Memory Areas of the Data Carrier

Command data in the CPU

Data Carrier memory contents after Clear-all execution

15 ←——→ 00

Address 7 ←——→ 0

DM1200	43	41	- - - CA (Clear-all)
DM1201	00	31	- - - 1
DM1202	2A	0D	- - - If the number of bytes to be cleared is odd, shift codes 2A and 0D forward one byte and write 00 into the last 8 bits.

Address	
0002	00
0003	00
⋮	⋮
07FE	00
07FF	00

WRIT(87) is executed. → ID Sensor Unit's internal memory Clear-all command is executed. →

Addresses 0000 and 0001 of the Data Carrier's memory are reserved for registering the Data Carrier's date of production; they cannot be cleared.

Operation
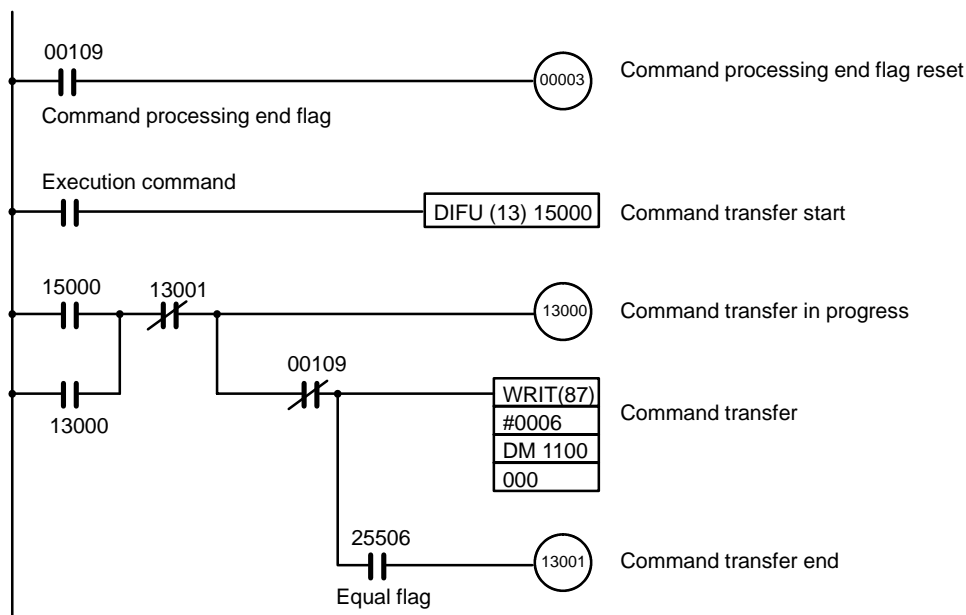
When the execution command is turned ON, the PC checks that the command processing end flag (00109) has been turned OFF. It then executes WRIT(87), which transfers three words (the data contained in DM 1200 to DM 1202) to the ID Sensor Unit. After WRIT(87) has been executed, the equal flag (25506) automatically turns ON.
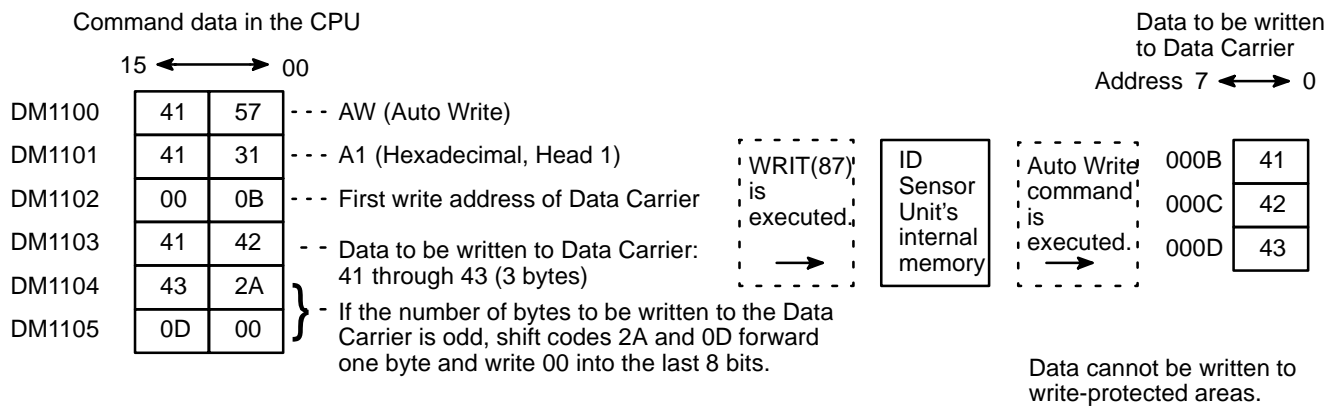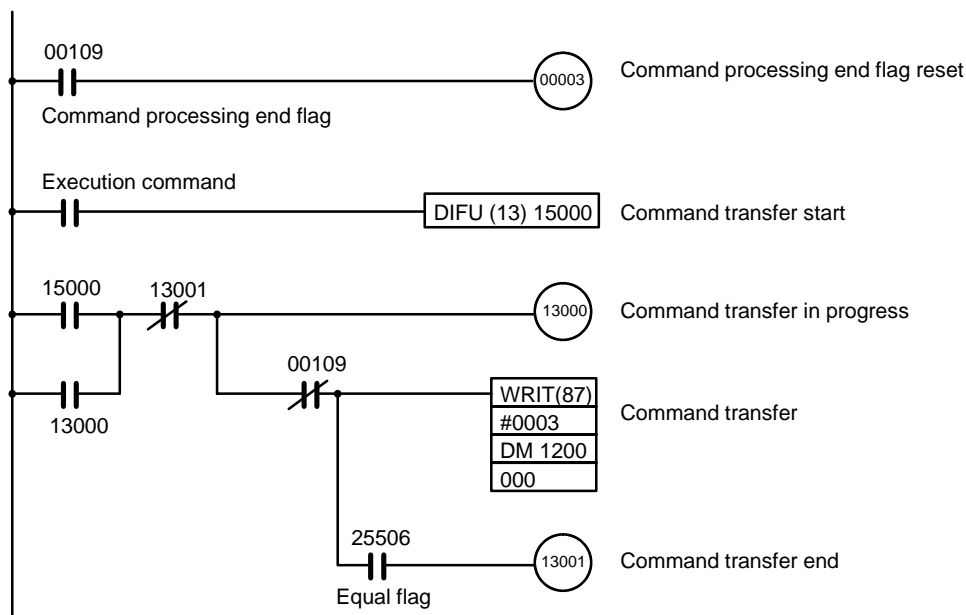
The ID Sensor Unit analyzes the type of the command it has received, and then issues the Clear-all command to the Data Carrier.

After the command has been completed, the command processing end flag (00109) turns ON. This flag does not turn OFF automatically; turn ON and then OFF the command processing end flag reset bit (00003) to turn OFF the command processing end flag.

3–1–2   Reading from the Data Carrier

To execute the Read and Auto Read commands, the Intelligent I/O Write (WRIT(87)) and Intelligent I/O Read (READ(88)) instructions must be executed. WRIT(87) is used to transfer commands; while READ(88) is used to read data to the PC.

Execute WRIT(87) only once each time a command is executed.

The following program examples are for one transfer operation (transferring 251 words of data). To transfer more than 251 words of data (to execute the transfer operation more than once), refer to *Section 3–4 Timing Considerations*.

Example 4: The Read Command

F3–4 Using "Read" to Transfer 4 Bytes of Data from Data Carrier to PC from Address 0100
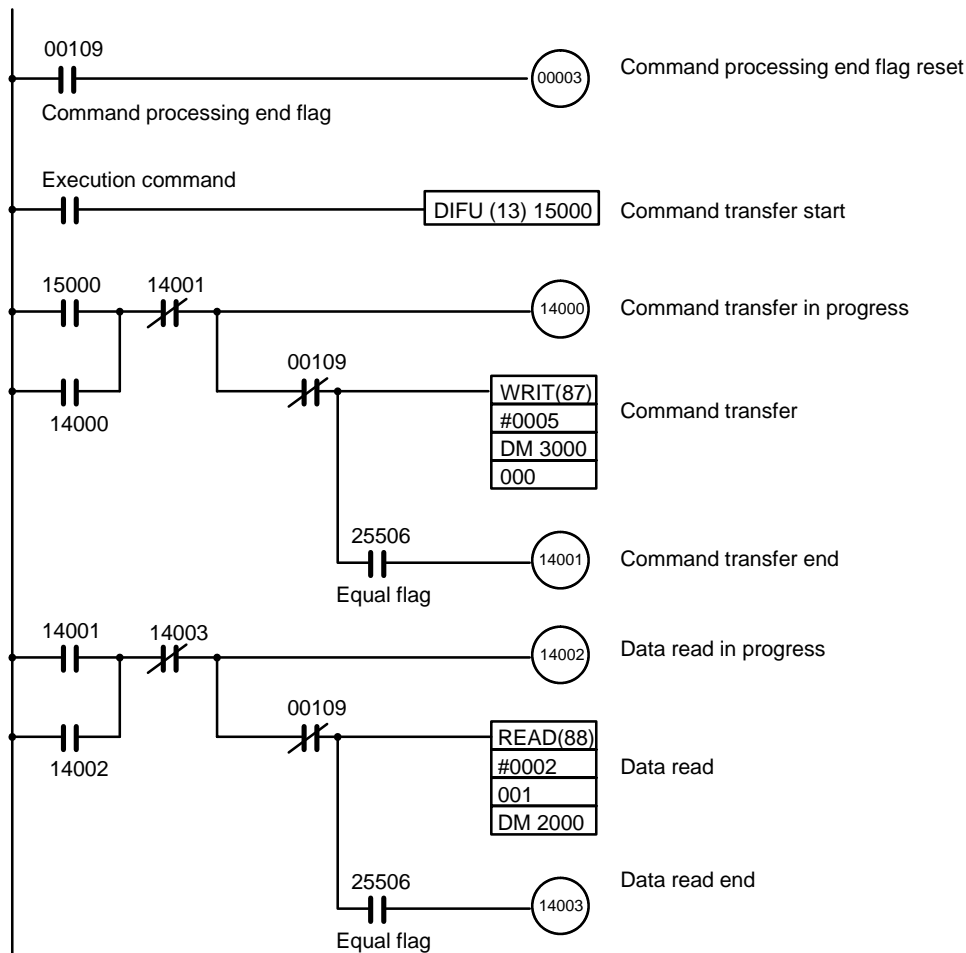
```
00109                                                    ( 00003 )   Command processing end flag reset
─┤├─────────────────────────────────────────────────
Command processing end flag


Execution command
─┤├─────────────────────────────[ DIFU (13) 15000 ]   Command transfer start


15000    14001                                           ( 14000 )   Command transfer in progress
─┤├──────┤╱├──┬──────────────────────────────────
       │                        00109
─┤├────┤              ────────┤╱├──┬──[ WRIT(87)  ]   Command transfer
14000                                │  [ #0005     ]
                                     │  [ DM 3000   ]
                                     │  [ 000       ]

                          25506
                        ──┤├──────────────────────( 14001 )   Command transfer end
                        Equal flag


14001    14003                                           ( 14002 )   Data read in progress
─┤├──────┤╱├──┬──────────────────────────────────
       │                        00109
─┤├────┤              ────────┤╱├──┬──[ READ(88)  ]   Data read
14002                                │  [ #0002     ]
                                     │  [ 001       ]
                                     │  [ DM 2000   ]

                          25506
                        ──┤├──────────────────────( 14003 )   Data read end
                        Equal flag
```

●The Read command specifies that 4 bytes of data are to be read. Therefore, READ(88) reads 2 words of data (one word equals 2 bytes).

Command data of PC

	15 ◄─► 00	
DM 3000	52 ¦ 44	RD
DM 3001	41 ¦ 31	A1
DM 3002	01 ¦ 00	Address of first byte to be read from Data Carrier
DM 3003	00 ¦ 04	Number of bytes to be read
DM 3004	2A ¦ 0D	*

WRIT(87) is executed.

Data of Data Carrier

Address 7 ◄─► 0	
0100	31
0101	32
0102	33
0103	34

Data is read to PC

	15 ◄─► 00	
DM 2000	31	32
DM 2001	33	34

READ(88) is executed.

ID Sensor Unit's internal memory

Read command is executed.

If the number of bytes to be read is odd, the last 8 bits of data are undefined.

*If the number of bytes to be read is odd, round the number up and divide by 2.

Operation When the execution command is turned ON, the PC first checks that the command processing end flag (00109) has been turned OFF. It then ex-

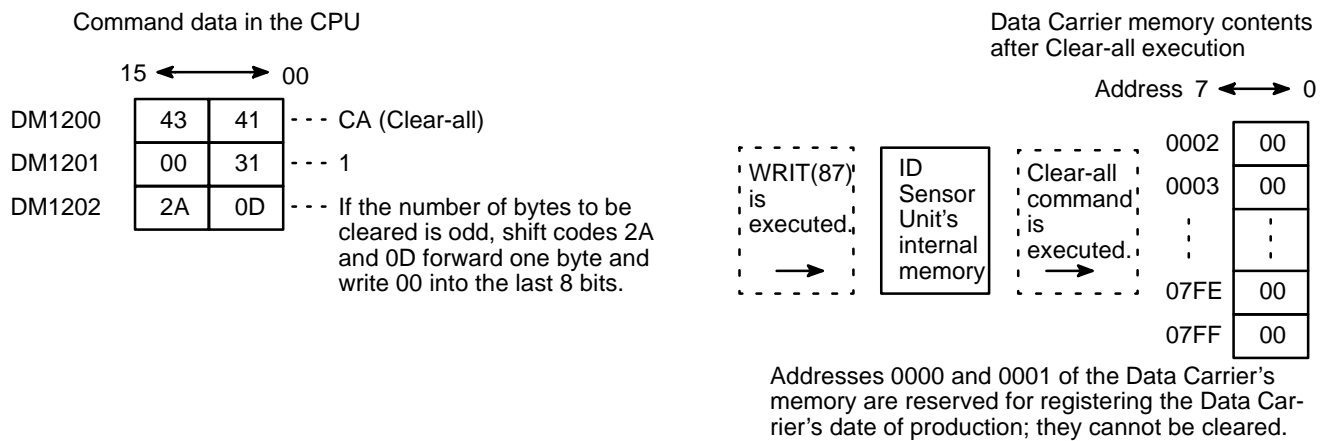ecutes WRIT(87), which writes the data contained in DM 3000 to DM 3004 to the internal memory of the ID Sensor Unit.

The ID Sensor Unit analyzes the type of the command it has received, the address of the Data Carrier, and the number of bytes to be read. The ID Sensor Unit then issues the Read command to the Data Carrier.

After the data read from the Data Carrier has been written to the common memory of the ID Sensor Unit, the command processing end flag (00109) is turned ON, enabling the PC to read the data from the common memory. In this example, the data is read by READ(88) as soon as the command transfer end flag (14001) has been turned ON.

After WRIT(87) and READ(88) have been completed, the equal flag (25506) of the PC automatically turns ON. This flag is does not automatically turn OFF; turn ON and then turn OFF the command processing end flag reset bit (00003) to turn OFF the command processing end flag.

If errors have occurred in the ID Sensor Unit during execution of the Read command, the command processing end flag (00109) and the error flags (00103, 00106, 00110 to 00115) are turned ON, but READ(88) is not executed.

Example 5: The Auto Read Command

F3–5 Using "Auto Read" to Transfer 7 Bytes of Data from Data Carrier to PC from Address 0004
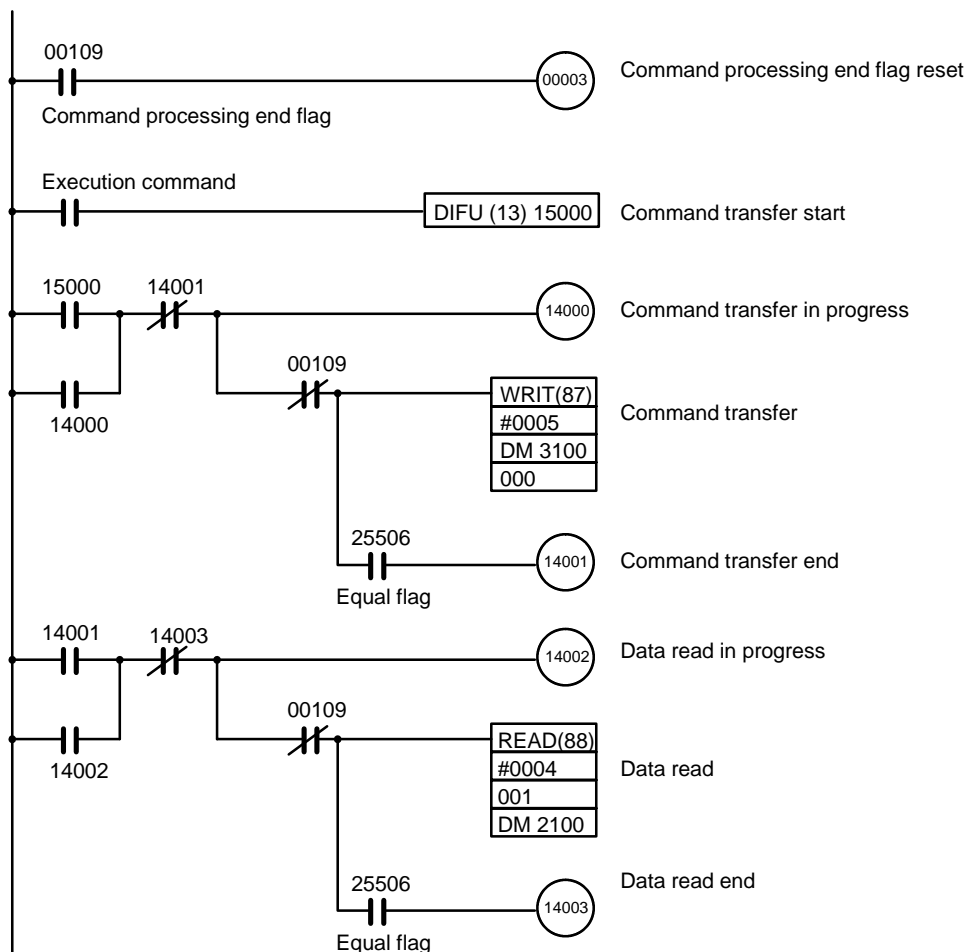
• The Read command specifies that 7 bytes of data are to be read. Therefore, READ(88) reads 4 words of data (one word equals 2 bytes).

Command data of PC

	15 ←→ 00	
DM 3100	41 52	AR
DM 3101	41 31	A1
DM 3102	01 04	Address of first byte to be read from Data Carrier
DM 3103	00 07	Number of bytes to be read
DM 3104	2A 0D	*

WRIT(87) is executed.

Data of Data Carrier

Data is read to PC

	15 ←→ 00	
DM 2100	35 36	READ(88)
DM 2101	37 38	is executed.
DM 2102	39 3A	
DM 2103	3B xx	

ID Sensor Unit's internal memory

Auto Read command is executed.

Address 7 ←→ 0	
0104	35
0105	36
0106	37
0107	38
0108	39
	3A
0109	3B
010	
A	

If the number of bytes to be read is odd, the last 8 bits of data are undefined.

*If the number of bytes to be read is odd, round the number up and divide by 2.

Operation

When the execution command is turned ON, the PC first checks that the command processing end flag (00109) has been turned OFF. It then executes WRIT(87), which writes the data contained in DM 3100 to DM 3104 to the internal memory of the ID Sensor Unit.

The ID Sensor Unit analyzes the type of command it has received, the address of the Data Carrier, and the number of bytes to be read. The ID Sensor Unit then issues the Auto Read command to the Data Carrier.

After the data read from the Data Carrier has been written to the common memory of the ID Sensor Unit, the command processing end flag (00109) is turned ON, enabling the PC to read the data from the common memory. In this example, the data is read by READ(88) as soon as the command transfer end flag (14001) has been turned ON.

After WRIT(87) and READ(88) have been completed, the equal flag (25506) of the PC is automatically turned ON. This flag does not turn OFF automatically; turn ON and then turn OFF the command processing end flag reset bit (00003) to turn OFF the command processing end flag.
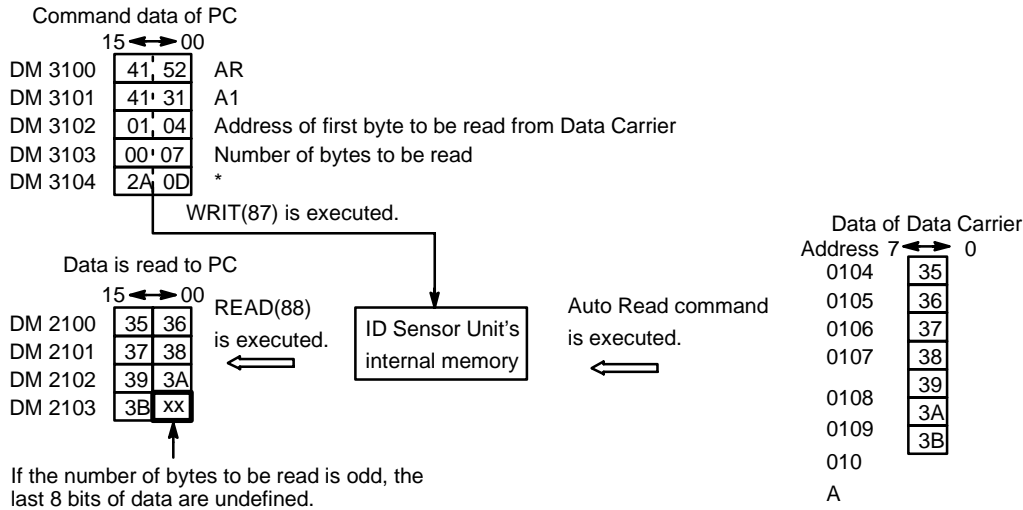
If errors have occurred in the ID Sensor Unit during execution of the Auto Read command, the command processing end flag (00109) and the error flags (00103, 00106, 00110 to 00115) are turned ON, but READ(88) is not executed.

3–2   Program Examples (Four-Word Mode)

This section gives program examples for data transmission between the ID Sensor Unit and PC when the ID Sensor Unit is set to four-word mode. This is the case when the ID Sensor Unit is mounted to a PC not equipped with Intelligent I/O Read Write instructions, or when the ID Sensor Unit is mounted to a Remote I/O Slave Rack. Refer to *Section 2-1-1 Two-Word/Four-Word Selection*.

Commands for data transmission between the ID Sensor Unit and the Data Carrier are performed automatically.

Note that all the example programs in this section are executed under the following conditions:

1, 2, 3...   1.   Program examples apply to the C1000H Programmable Controller.

2.   The ID Sensor Unit is set to four words (words 000, 001, 002, and 003).

3.   Data sent from the ID Sensor Unit to the PC is stored in the DM area of the PC.

3–2–1   Writing to the Data Carrier

When the ID Sensor Unit is mounted to a Remote I/O Slave Rack, commands and data must be maintained during the time required for Remote I/O transfer. Calculate the Remote I/O transfer time using the following formula:
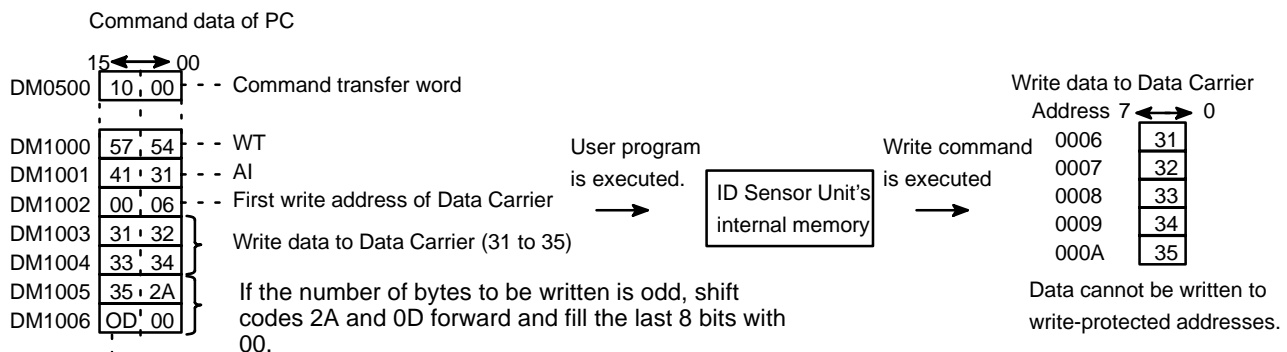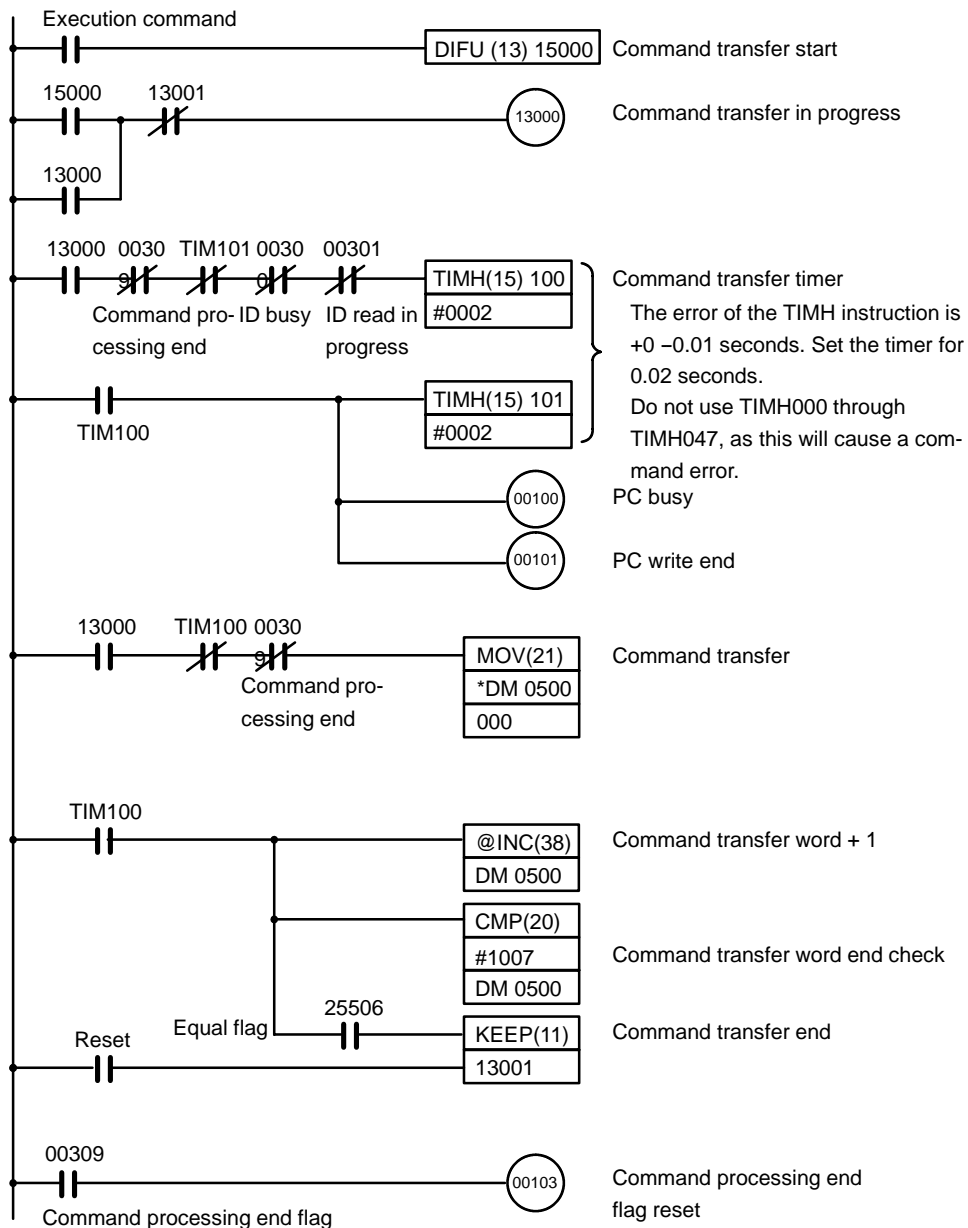
Remote I/O transfer time = 1.4 + (0.2 x (the number of words allocated to the Remote I/O Slave Rack))

For example, if only one Unit is mounted to the Remote I/O Slave Rack, the calculation would be as follows:

Example: 1.4 + (0.2 x 4) = 2.2 ms

In this case, the data should be maintained for a minimum of 3 ms.

F3–6   Using MOV to Write 5 bytes of ASCII Code Data (31 to 35) to the Data Carrier.

Execution command

DIFU (13) 15000 — Command transfer start

15000 13001 — 13000 — Command transfer in progress

13000

13000 0030 TIM101 0030 00301

TIMH(15) 100
#0002

Command transfer timer
The error of the TIMH instruction is +0 –0.01 seconds. Set the timer for 0.02 seconds.
Do not use TIMH000 through TIMH047, as this will cause a command error.

Command pro-cessing end   ID busy   ID read in progress

TIM100

TIMH(15) 101
#0002

00100 — PC busy

00101 — PC write end

13000 TIM100 0030

MOV(21)
*DM 0500
000

Command transfer

Command pro-cessing end

TIM100

@INC(38)
DM 0500

Command transfer word + 1

CMP(20)
#1007
DM 0500

Command transfer word end check

Reset   Equal flag   25506

KEEP(11)
13001

Command transfer end

00309

00103 — Command processing end flag reset

Command processing end flag

Command data of PC

15 ◄——► 00

DM0500 | 10 , 00 | - - Command transfer word

DM1000 | 57 , 54 | - - WT
DM1001 | 41 , 31 | - - AI
DM1002 | 00 , 06 | - - First write address of Data Carrier
DM1003 | 31 , 32 | } Write data to Data Carrier (31 to 35)
DM1004 | 33 , 34 |
DM1005 | 35 , 2A | } If the number of bytes to be written is odd, shift
DM1006 | 0D , 00 | codes 2A and 0D forward and fill the last 8 bits with 00.

User program is executed. → ID Sensor Unit's internal memory → Write command is executed

Write data to Data Carrier
Address 7 ◄——► 0

0006 | 31
0007 | 32
0008 | 33
0009 | 34
000A | 35

Data cannot be written to write-protected addresses.

Operation

When the execution command is turned ON, the PC first checks that the command processing flag (00309), the ID busy flag (00300), and the ID read-in-progress flag (00301) have been turned OFF. It then executes the command transfer timer.

Use TIM000 through TIM511 or TIMH048 through TIMH 511 for the command transfer timer. Using TIMH000 to TIMH047 will cause a command error.

Make sure that the command processing end flag (00309) is OFF, then write 7 words of data (DM1000 to DM1006), via MOV, to the ID Sensor Unit.

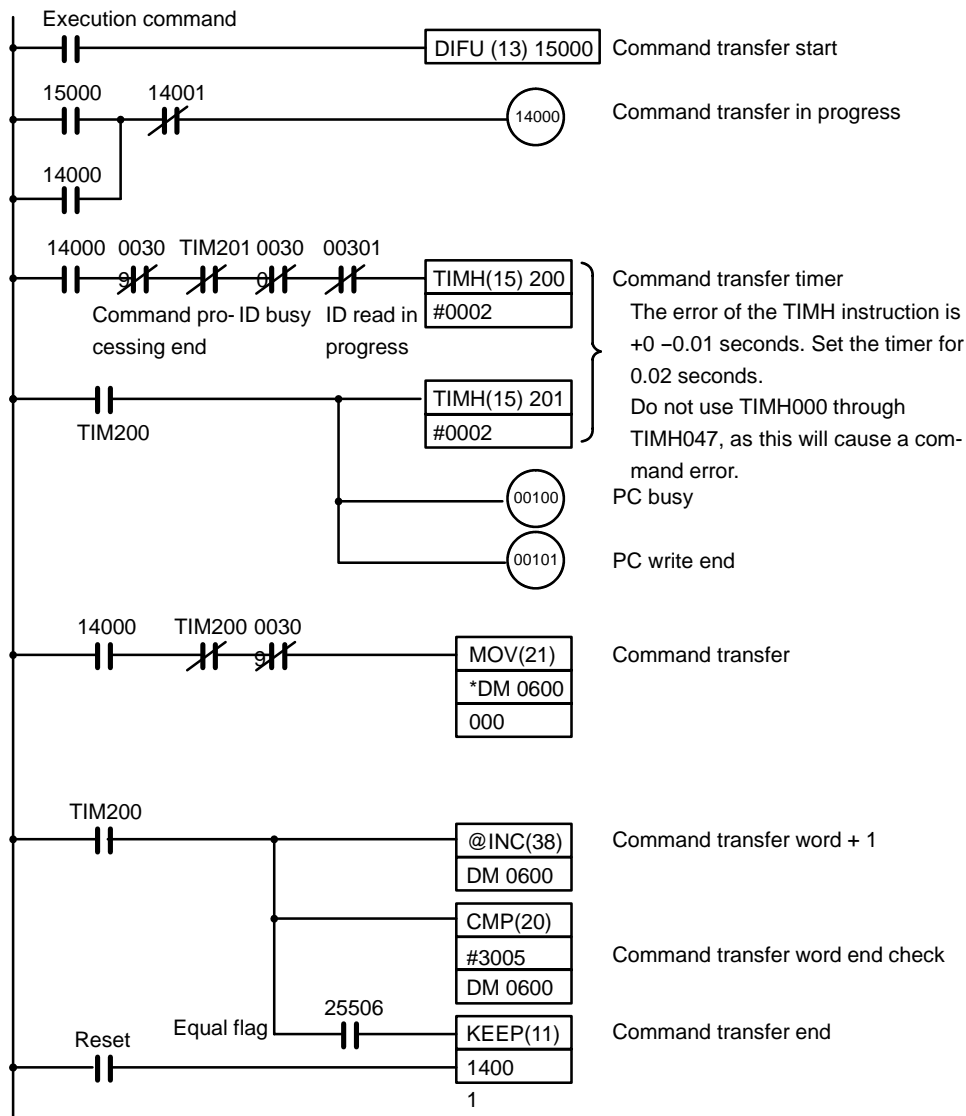Command transfer ends when the command transfer word transfers the end word.

The ID Sensor Unit analyzes the type of command it has received, the address of the Data Carrier, and the number of bytes to be written. The ID Sensor Unit then issues the Write command to the Data Carrier.

When command processing ends, the command processing end flag (00309) is turned ON. This flag (00309) does not turn OFF automatically; turn ON and then turn OFF the command processing end flag reset bit (00103) to turn OFF the command processing end flag.
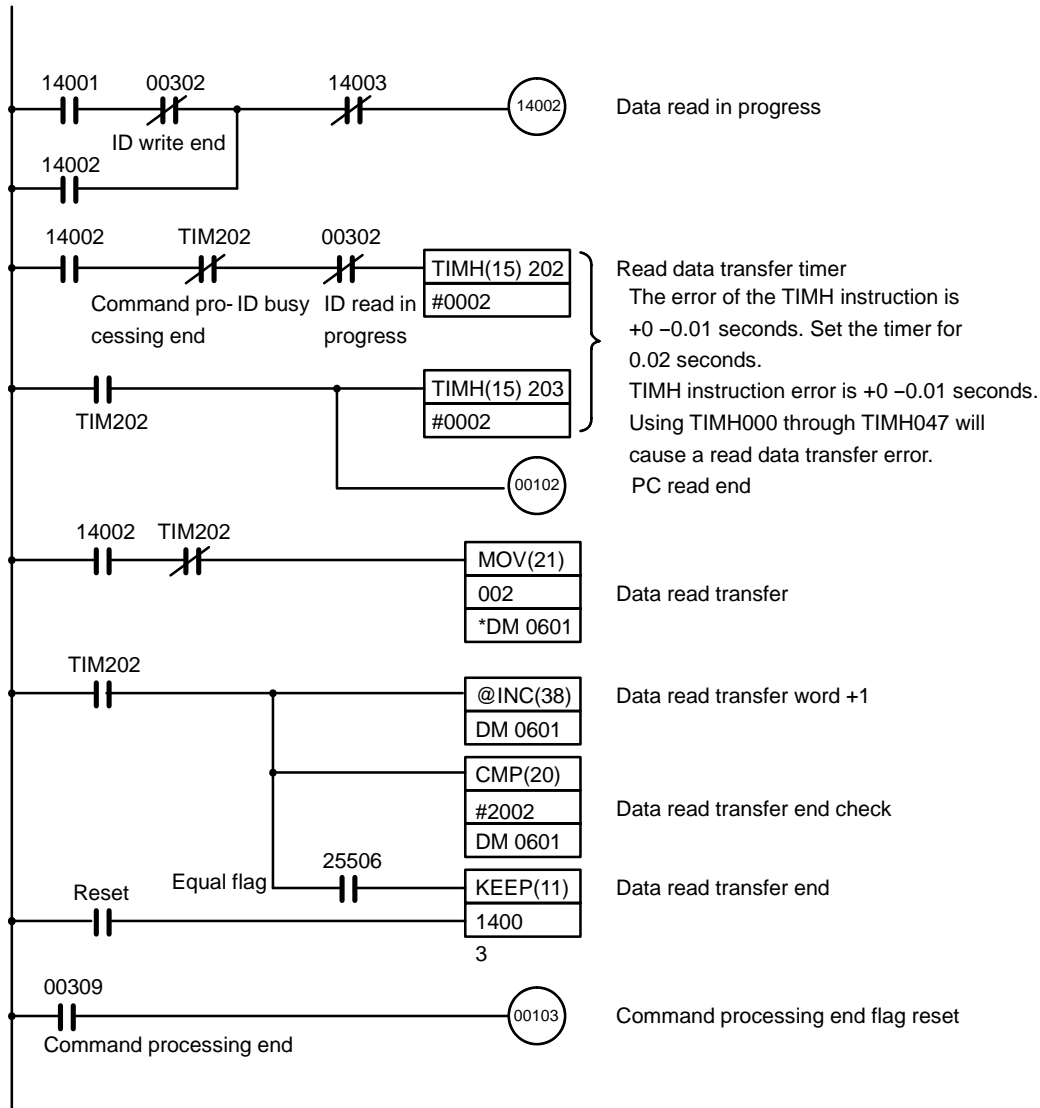
3–2–2 Reading from the Data Carrier

When the ID Sensor Unit is mounted to a Remote I/O Slave Rack, commands and data must be maintained during the time required for Remote I/O transfer. Calculate the Remote I/O transfer time using the formula shown in *Section 3-2-1 Writing to the Data Carrier.*

F3–7   Using MOV to Read 4 Bytes of Data from Data Carrier Address 0100 to PC

Execution command

DIFU (13) 15000 — Command transfer start

14000 — Command transfer in progress

TIMH(15) 200 #0002 — Command transfer timer

Command pro- ID busy   ID read in
cessing end   progress

The error of the TIMH instruction is +0 −0.01 seconds. Set the timer for 0.02 seconds.
Do not use TIMH000 through TIMH047, as this will cause a command error.

TIMH(15) 201 #0002

TIM200

00100 — PC busy

00101 — PC write end

MOV(21) *DM 0600 000 — Command transfer

@INC(38) DM 0600 — Command transfer word + 1

CMP(20) #3005 DM 0600 — Command transfer word end check

Equal flag   25506

KEEP(11) 1400 1 — Command transfer end

Reset

(Continued from previous page)

```
 14001    00302      14003
──┤├──────┤╱├────┬────┤╱├──────────────( 14002 )      Data read in progress
            ID write end
 14002                │
──┤├──────────────────┘
```

```
 14002     TIM202    00302    ┌─────────────┐
──┤├────────┤╱├───────┤╱├─────┤ TIMH(15) 202│        Read data transfer timer
  Command pro- ID busy  ID read in │   #0002    │          The error of the TIMH instruction is
  cessing end         progress └─────────────┘          +0 −0.01 seconds. Set the timer for
                                                          0.02 seconds.
           ┌──────────────────┬─┤ TIMH(15) 203│          TIMH instruction error is +0 −0.01 seconds.
  ──┤├──────                   │ │   #0002    │          Using TIMH000 through TIMH047 will
    TIM202                      │ └─────────────┘          cause a read data transfer error.
                               └──────────( 00102 )       PC read end
```

```
 14002    TIM202              ┌─────────┐
──┤├───────┤╱├────────────────┤ MOV(21) │
                              │   002   │        Data read transfer
                              │ *DM 0601│
                              └─────────┘
```

```
 TIM202                       ┌─────────┐
──┤├──────────────────┬───────┤ @INC(38)│        Data read transfer word +1
                      │       │ DM 0601 │
                      │       └─────────┘
                      │       ┌─────────┐
                      ├───────┤ CMP(20) │
                      │       │  #2002  │        Data read transfer end check
                      │       │ DM 0601 │
                      │       └─────────┘
          Equal flag  25506   ┌─────────┐
  Reset  ┌──────────────┤├────┤ KEEP(11)│        Data read transfer end
──┤├─────┘                    │  1400   │
                              │    3    │
                              └─────────┘
```

```
 00309
──┤├──────────────────────────────────────( 00103 )    Command processing end flag reset
 Command processing end
```

Command data of PC

```
      15◄──►00
DM0600 │30 , 00│ - - Command transfer word
DM0601 │20 ' 00│ - - Data read transfer word
         ⋮
DM3000 │52 , 44│ - - RD
DM3001 │41 ' 31│ - - AI
DM3002 │01 , 00│ - - Start read address of Data Carrier
DM3003 │00 ' 04│ - - Number of bytes read
DM3004 │2A , 0D│ - - - *
```

- The read command specifies that 4 bytes of data are to be read. Therefore, READ(88) reads 2 words of data (one word equals 2 bytes).
- If the number of bytes to be read is odd, round the number up and divide by 2.

User program command transfer is executed

Write data to Data Carrier

```
Address 7 ◄──► 0
   0100   │ 31 │
   0101   │ 32 │
   0102   │ 33 │
   0103   │ 34 │
```

Data is read to PC

```
   15◄──►00
DM2000 │31│32│
DM2001 │33│34│
```

User program read data transfer is executed ◄── ID Sensor Unit's internal memory ◄── Read command is executed.

If the number of bytes to be read is odd, the last 8 bits of data are undefined.

*If the number of bytes to be read is odd, round the number up and divide by 2.

55

Operation

When the execution command is turned ON, the PC first checks whether the command processing end flag (00309), the ID busy flag (00300), and the ID read-in-progress flag (00301) are turned OFF. It then starts the command transfer timer.

Use TIM000 through TIM511 or TIMH048 through TIMH511 for the command transfer timer. Using TIMH000 through TIMH047 will cause a command error.

Make sure that command processing end flag is OFF, then write 5 words of data (DM 3000 to DM 3004) via MOV to the ID Sensor Unit.

The command transfer is complete when the command transfer word transfers the end word.

The ID Sensor Unit analyzes the type of command it has received, the address of the Data Carrier, and the number of bytes to be read. The ID Sensor Unit then issues the read command to the Data Carrier.

After the read data has been written to common memory in the ID Sensor Unit, the ID write end flag (00302) is turned ON, and the data of the PC can be read. The read data transfer timer is then executed.

Use TIM000 through TIM511 or TIMH048 through TIMH511 for the read data transfer timer. Using TIMH000 through TIMH047 will cause a read data transfer error.

Using MOV, transfer 2 words of data from the ID Sensor Unit to DM2000 to DM2001. When the read data transfer word transfers the end word, transfer of the read data is complete.

When the command processing ends, the command processing end flag (00309) is turned ON. Because this flag (00309) does not turn OFF automatically, turn ON and then turn OFF the command processing end flag reset bit (00103) to turn OFF the command processing end flag.

If errors occur in the ID Sensor Unit during execution of the read command, the command processing end flag (00309) and the error flags (00303, 00306, 00310 to 00315) are turned ON, but the ID write flag (00302) is not turned ON.

3–3 Monitoring

This section explains the use of the Handheld Programming Console to monitor data communication between the ID Sensor and the Data Carrier, and to monitor errors.

Except where otherwise noted, the operations covered in this section can only be performed while the Handheld Programming Console is in MONITOR mode.

3–3–1 Connecting the Handheld Programming Console

Use the C200H-PRO27 Handheld Programming Console to monitor the operations of the ID Sensor Unit. Before connecting the Programming Console to the ID Sensor Unit, turn OFF the power to the PC.

Use the optional C200H-CN222 (2 m) or C200H-CN422 (4 m) connecting cable to connect the Handheld Programming Console to the ID Sensor Unit. Connect the cable to the connector labeled "MONITOR" on the front panel of the ID Sensor Unit.

Refer to Figures F1–1 and F1–2 for connection examples.

Attaching the Keyboard Sheet

Attach the keyboard sheet (provided with the ID Sensor Unit as an accessory) as shown in Figure F3–8.

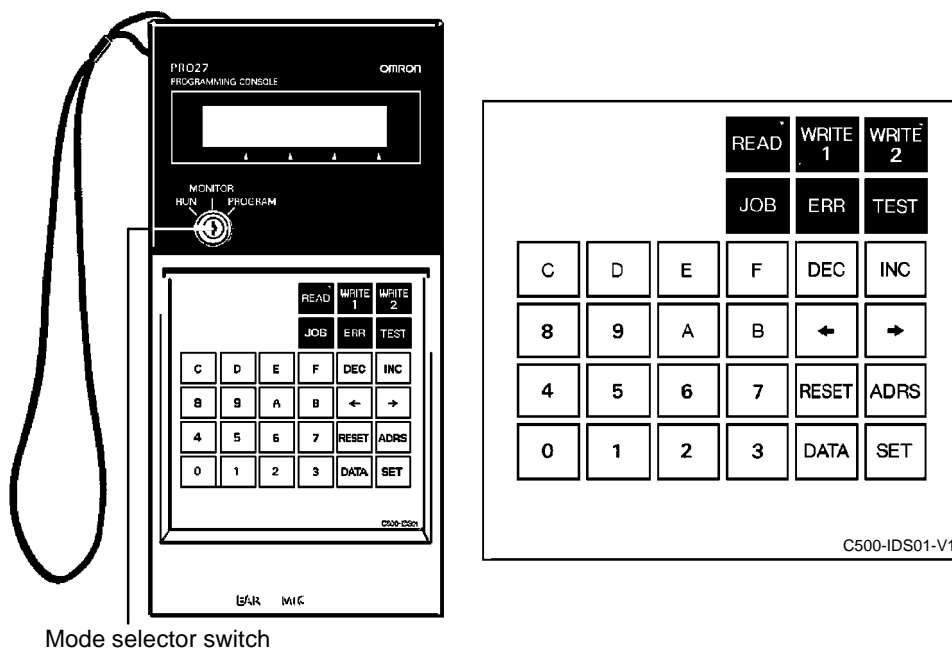**F3–8   Attaching the Keyboard Sheet**
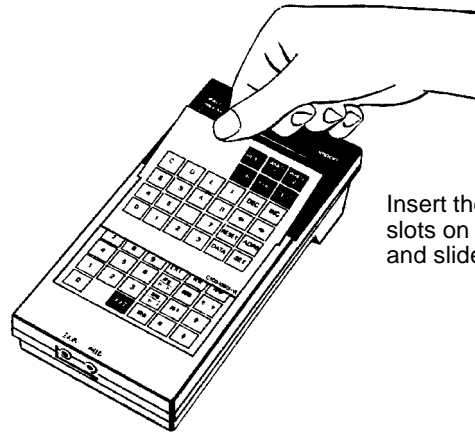
Insert the keyboard sheet into the slots on both sides of the keyboard, and slide into place.

3–3–2   Mode Setting

The Handheld Programming Console can be operated in three modes; the functions and applications of these modes are outlined in Table T3–1. Use the Mode selector switch on the Handheld Programming Console to select the mode (refer to Figure F3–9).

Note that these modes apply only to the ID Sensor Unit; they do not apply to the CPU.

F3–9   Handheld Programming Console Key Layout

Mode selector switch

T3–1 Programming Console Modes; Functions and Applications

Mode	Function		Application
RUN	In this mode, the CPU transfers data to and from the Data Carrier according to the program in the CPU. It is a normal operating mode only; no key input is possible.		Set the ID Sensor to RUN mode for normal operation.
MONITOR	In this mode, use Read, Write, Continuous Write, and Step Write to monitor data communication between the ID Sensor Unit and the Data Carrier.	The ID Sensor Unit reads/writes data directly from/to the Data Carrier.	An easy operation test such as Read, Step Write or Continuous Write can be performed when installing the ID Sensor.
	In this mode, the ID Sensor Unit operates only via commands input from the Handheld Programming Console; commands from the CPU are ignored.	The ID Sensor Unit repeatedly executes Read, Write, Auto Read, or Auto Write. If an error occurs, the corresponding error code is displayed on the Programming Console. (Refer to *Section 3–3–10 Error Codes.*)	Use this mode to test (TEST) and adjust the speed of the Data Carrier and the distance from the Read/Write Head.
		Any communication error that has occurred in RUN mode is displayed on the Programming Console.	If an error occurs, use MONITOR mode to determine the cause (Refer to *Section 3–3–9 Error Log Display.*)
PROGRAM	Not used.		–––

RUN Mode

In this mode, the CPU transfers data to and from the Data Carrier according to the program in the CPU. It is a normal operating mode; data cannot be input.

The following message appears on the Handheld Programming Console display.

```
<RUN>
```

PROGRAM Mode

This mode is not used, as the ID Sensor Unit cannot be programmed. When the mode selector on the Programming Console is set to the PROGRAM position, the following message is displayed.

```
<PROGRAM>
<MODE ERROR>
```

MONITOR Mode

When the selector is set to the MONITOR position, the following message is displayed, indicating that the operation of the ID Sensor Unit can be monitored.

```
<MONITOR>          BZ
```

Note 1. The CPU program is not executed in this mode. MONITOR mode is used specifically for monitoring operation of the ID Sensor Unit.

2. After monitoring the ID Sensor Unit, be sure to set the Handheld Programming Console to RUN to resume normal operation.
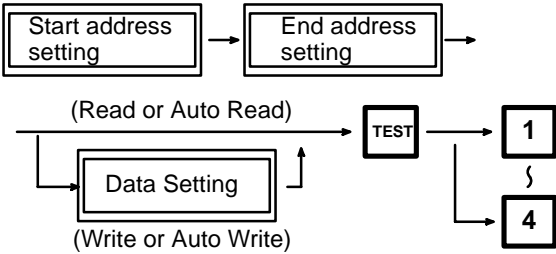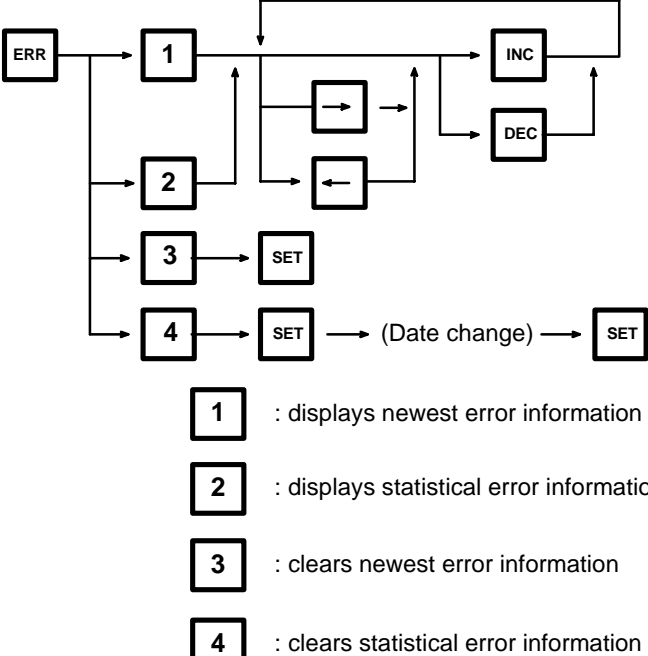
MONITOR Mode Functions and Operation

Table T3–2 gives a brief explanation of the commands used for monitoring and their functions. Each command is explained in more detail later in this section.

Note that these commands can only be used when the Programming Console is in MONITOR mode.

T3–2 MONITOR Modes and Operation

Monitor command	Function	Key sequence
JOB	Sets a Read/Write Head word number (fixed to 1) and address page number.	
Start address/end address setting	---	
DATA setting	---	
READ	Reads 1 byte of data from a specified address of the Data Carrier.	
Step Write (WRITE 1)	Writes 1 byte of data to a specified address of the Data Carrier.	
Continuous Write (WRITE 2)	Writes several bytes of identical data to a specified address range of the Data Carrier.	

Monitor command	Function	Key sequence
Monitor test (TEST)	Use this command to repeatedly execute Read, Write, Auto Read, or Auto Write in a specified address range of the Data Carrier and monitor error messages that occur as a result of command execution. The specified address range is accessed at one-second intervals.	Start address setting → End address setting → (Read or Auto Read) → TEST → 1 ∫ 4 Data Setting (Write or Auto Write)
Error log display	Use this command to display errors that occurred while the ID Sensor was in RUN mode. Error messages and corresponding codes are displayed, and errors are classified as either "newest error" or "statistical error".	ERR → 1 → INC / DEC → → / ← 2 3 → SET 4 → SET → (Date change) → SET 1 : displays newest error information 2 : displays statistical error information 3 : clears newest error information 4 : clears statistical error information

Initial Display

When the mode selector is in the MONITOR mode, the following message is displayed:

```
<MONITOR>        BZ
```
— Indicates that the buzzer is enabled.

Press the "B" key to alternately enable or disable the buzzer.

Note When the Programming Console is in MONITOR mode and the buzzer is enabled, only the following keys are functional:
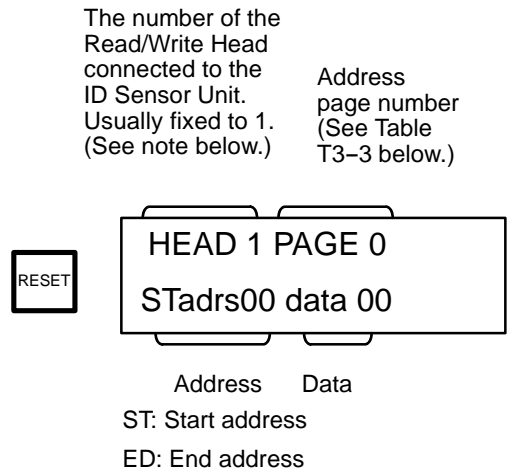
RESET   DATA   ADRS   JOB   B

RESET Display

Press the RESET key to return the screen to RESET status. Press the RESET key either after a monitoring operation has been completed, or during a monitoring operation to abort that operation.

The following message is displayed when the RESET key is pressed:

The number of the
Read/Write Head
connected to the
ID Sensor Unit.
Usually fixed to 1.
(See note below.)

Address
page number
(See Table
T3–3 below.)

```
        ┌──────────┐ ┌────────┐
┌─────┐ │  HEAD 1 PAGE 0        │
│RESET│ │                      │
└─────┘ │  STadrs00 data 00    │
        └──────────┘ └────────┘
```

Address   Data

ST: Start address
ED: End address

Note The number "1" need not be changed or reset, unless otherwise instructed or necessary.

3–3–3 The JOB Function

Use the JOB operation when the current address page number must be changed.

The JOB operation can also be used to set a Read/Write Head word number and address page number. However, since the Read/Write Head word number is already fixed to 1, no word number has to be set.

Address Page Numbers The 2K bytes of addresses in the Data Carrier are divided into eight pages, from 0 through 7, with 256 bytes assigned to each page.

T3–3 Address Page Numbers

	Address Page Number							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Address range	000 through 0FF	100 through 1FF	200 through 2FF	300 through 3FF	400 through 4FF	500 through 5FF	600 through 6FF	700 through 7FF

Setting Address Page Numbers There are two methods for setting address page numbers: with the INC and DEC keys or with the DATA key (see Figures F3–10 and F3–11).

F3–10 Setting Address Page Numbers (INC/DEC keys)
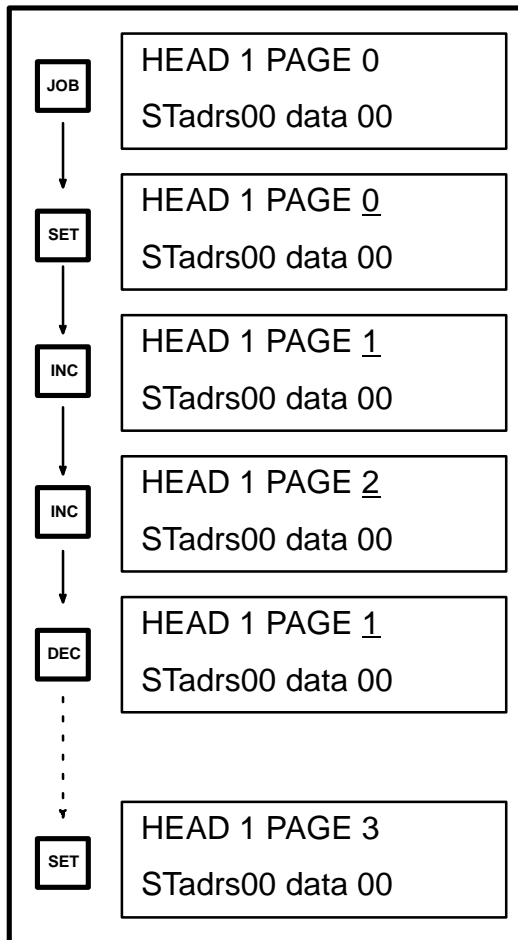
JOB	HEAD 1 PAGE 0 STadrs00 data 00	Press the JOB key while the initial message or reset message is displayed.
SET	HEAD 1 PAGE <u>0</u> STadrs00 data 00	A R/W Head number can now be set; as the word number is already fixed, press the SET key to continue.
INC	HEAD 1 PAGE <u>1</u> STadrs00 data 00	The address page number is increased by one each time the INC key is pressed.
INC	HEAD 1 PAGE <u>2</u> STadrs00 data 00	
DEC	HEAD 1 PAGE <u>1</u> STadrs00 data 00	The address page number is decreased by one each time the DEC key is pressed.
SET	HEAD 1 PAGE 3 STadrs00 data 00	After the address page number has been selected, press the SET key. The address page number must be within the range of 0 through 7. If any other value is set, an error will occur and the error message "ADDRESS E" will be displayed upon execution of a subsequent command.

F3–11 Inputting Address Page Numbers (DATA key)
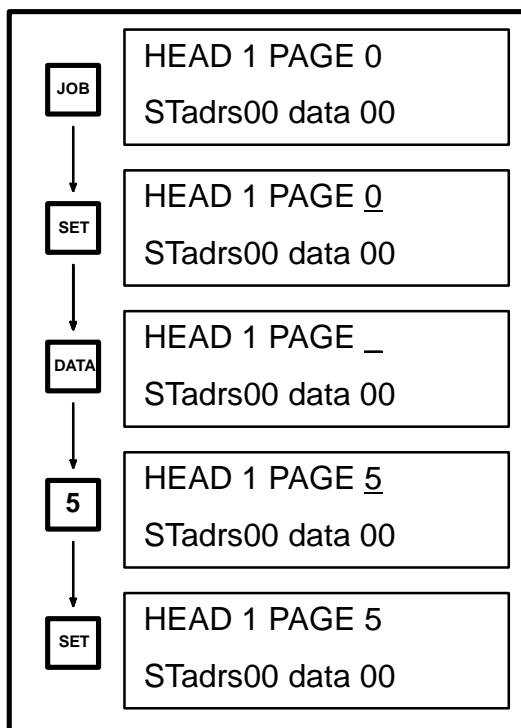
JOB	HEAD 1 PAGE 0 STadrs00 data 00	Press the JOB key while the initial message or reset message is displayed.

SET	HEAD 1 PAGE 0 STadrs00 data 00	A R/W Head word number can now be set; as the word number is already fixed, press the SET key to continue.

DATA	HEAD 1 PAGE _ STadrs00 data 00	Press the DATA key; an address page number can now be input.

5	HEAD 1 PAGE 5 STadrs00 data 00	Set the address page number to the desired value (within the range 0 through 7) by pressing the corresponding numeric key. In this example, the address page number is set to 5.

SET	HEAD 1 PAGE 5 STadrs00 data 00	Press the SET key to complete the procedure. If a value exceeding 7 is set, an error will occur, and the error message "ADDRESS E" will be displayed when a subsequent command is executed.

3–3–4   Address/Data Setting

Before executing the Read (READ), Step Write (WRITE 1), Continuous Write (WRITE 2), or Test (TEST) commands, you must specify the Data Carrier address to be accessed and the data (1 byte) to be written to that address. This section explains the procedure for specifying the data, selecting the addresses, and setting the addresses and data. The data and addresses that must be set before the execution of each command are shown in Table T3–4.

Once the data is set in the specified address range, it will be retained until the data is set again. Therefore, the same address can be accessed as many times as required by pressing the command key.

T3–5   Setting Start Address, End Address, and Data

Command	Address		Data
	Start address	**End address**	
READ	*	–––	–––
WRITE 1 (Step Write)	*	–––	*
WRITE 2 (Continuous Write)	*	*	*
TEST 1 (Read)	*	*	–––
TEST 2 (Write)	*	*	*
TEST 3 (Auto Read)	*	*	–––
TEST 4 (Auto Write)	*	*	*

Note   1.   Items marked * must be set.

2.   Set an end address whose value is equal to or greater than that of the specified start address.

Selecting Start and End Addresses

First, select a start or end address. Refer to the diagram below in selecting either the start address or the end address of a specific page. Once selected, the desired values can be input.

| | HEAD 1 PAGE 1
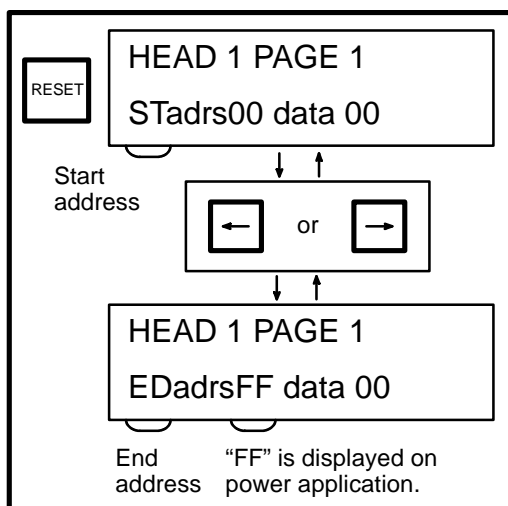
STadrs00 data 00 | Press the RESET button to display the reset screen, as shown on the left. |

RESET

Start
address

← or →

Pressing the left or right arrow key alternately displays the current start and end addresses.

| HEAD 1 PAGE 1

EDadrsFF data 00 |

End
address

"FF" is displayed on
power application.

Note This operation displays only the current addresses; it cannot be used to change an address.

Setting Addresses

First select either a start address (STadrs) or end address (EDadrs) as described under the previous heading *Selecting Start and End Addresses.* Then enter the desired value for the start address or end address. The values can be input either directly (Figure F3–12) or by using the INC/DEC keys (Figure F3–13).

F3–12 Setting Addresses (Direct Input)

ADRS

| HEAD 1 PAGE 1

STadrs_ data 00 |
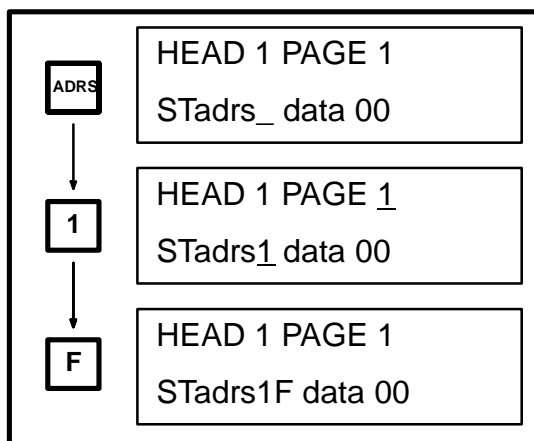
Change the current address (start or end address) by first pressing the ADRS key and then entering the desired value. In this example, the start address is changed to 1F.

1

| HEAD 1 PAGE 1

STadrs1 data 00 |

Enter the value (from 0 through F) of the leftmost digit of the address. In this example, the higher digit is 1.

F

| HEAD 1 PAGE 1

STadrs1F data 00 |

Enter the value (from 0 through F) of the rightmost digit of the address. In this example, the lower digit is F.

The address can also be input or changed using the INC or DEC keys, as shown in Figure F3–13.

F3–13 Setting Addresses (INC/DEC)

INC

| HEAD 1 PAGE 1

STadrs20 data 00 |
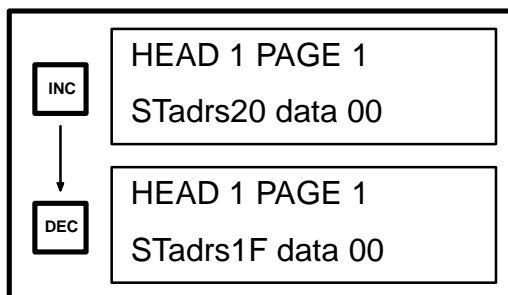
The address is incremented each time the INC key is pressed. Note that the address is set in hexadecimal.

DEC

| HEAD 1 PAGE 1

STadrs1F data 00 |

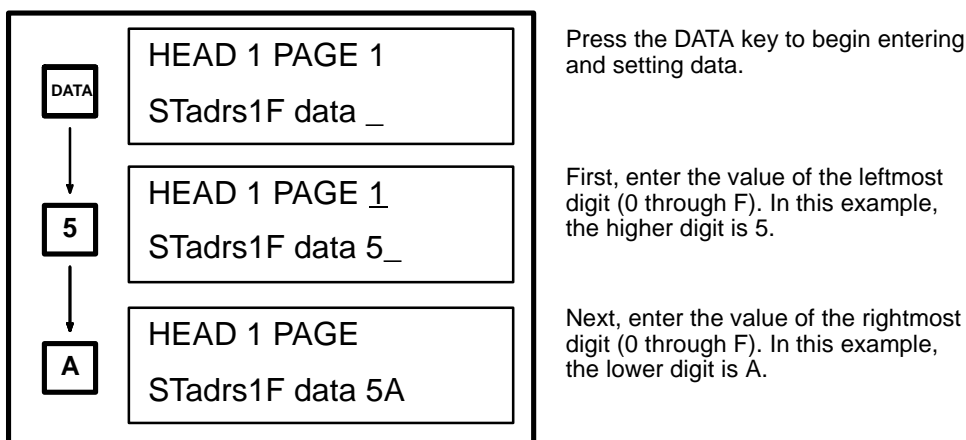The address is decremented each time the DEC key is pressed.

When setting the address, be sure that the end address is equal to or greater than the start address. If a value input for the end address is less than that of the start address, the buzzer will sound and the input will not be accepted.

When the last value is input, the entire address is automatically set; it is not necessary to press the SET key.

Data Setting

After the address to be accessed has been set, input and set the data. Refer to Figure F3–14.

F3–14 Data Setting

| DATA | HEAD 1 PAGE 1
STadrs1F data _ | Press the DATA key to begin entering and setting data. |

First, enter the value of the leftmost digit (0 through F). In this example, the higher digit is 5.

HEAD 1 PAGE 1
STadrs1F data 5_

Next, enter the value of the rightmost digit (0 through F). In this example, the lower digit is A.

HEAD 1 PAGE
STadrs1F data 5A

After the lower digit has been entered, the data is automatically set; it is not necessary to press the SET key.

If you have entered the wrong data, or you want to change the data, press the DATA key and repeat the procedure.

If the Read command is subsequently used to read data to the same data area, the set data will be changed to the value read by the Read command.

3–3–5   READ

This operation reads 1 byte of data from a specified address in the Data Carrier. Refer to Figure F3–15.

Before performing this operation, select the address and data you want to read. Refer to *Section 3-3-4 Address/Data Setting* for details*.*

F3–15 READ
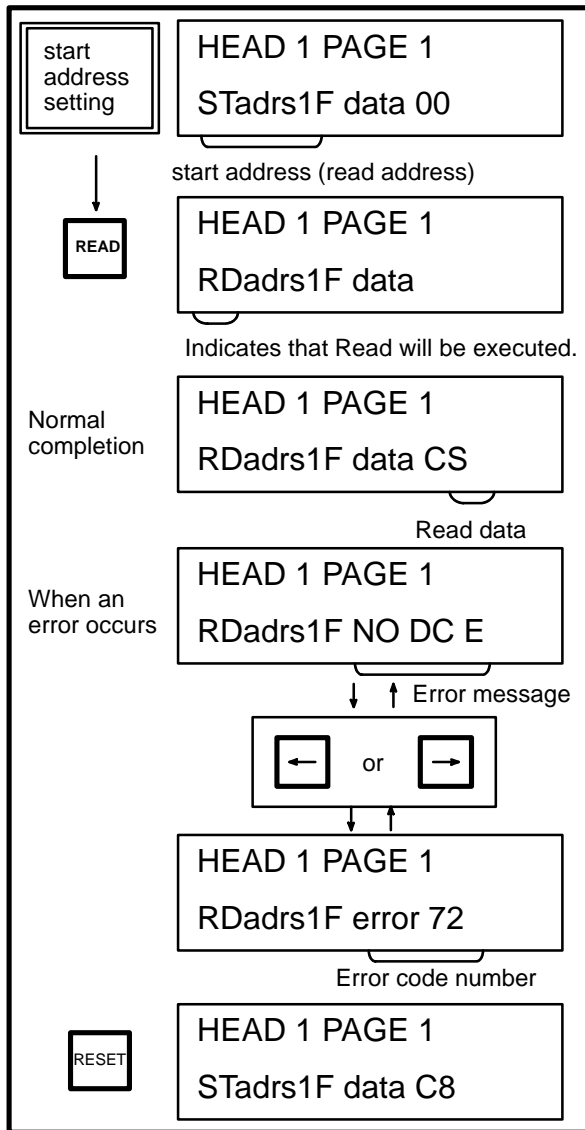
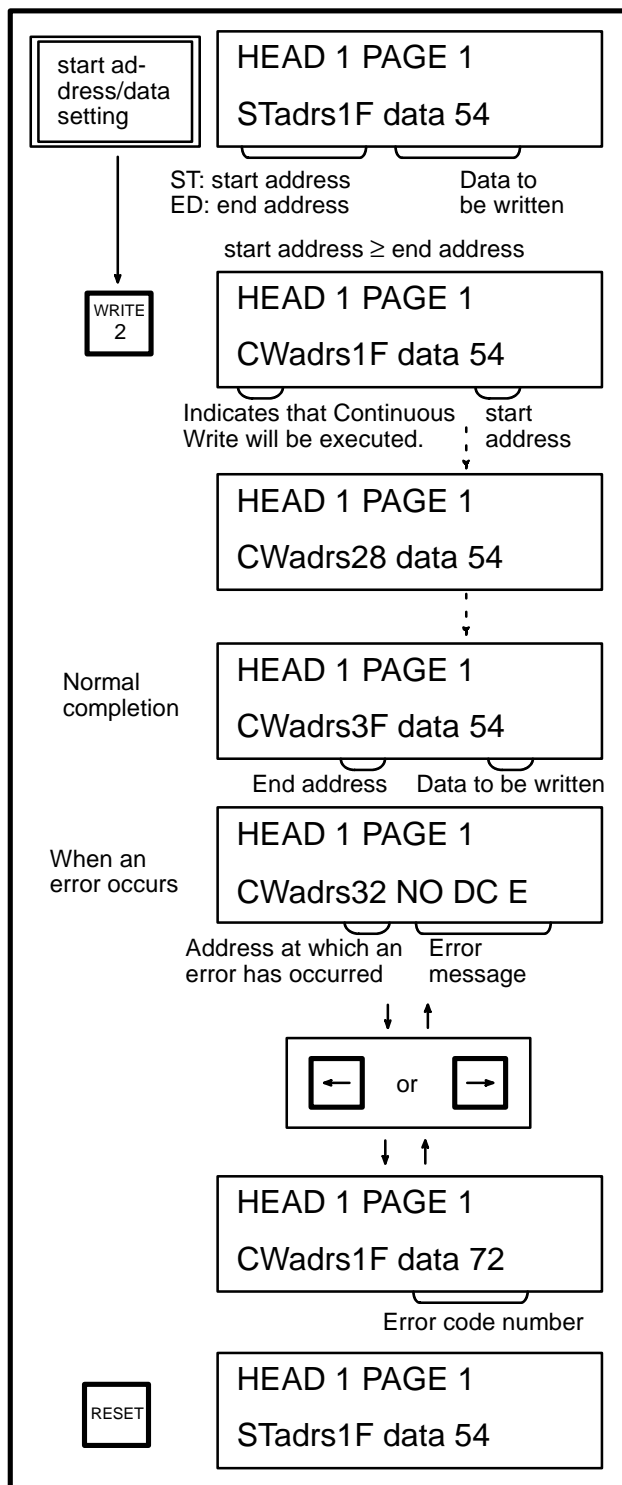|	
start address setting	**HEAD 1 PAGE 1** **STadrs1F data 00** start address (read address)	Set the start address from which the data is to be read.
↓ READ	**HEAD 1 PAGE 1** **RDadrs1F data** Indicates that Read will be executed.	Press the READ key; the data in the specified start address will be read.
Normal completion	**HEAD 1 PAGE 1** **RDadrs1F data CS** Read data	When the read operation has been completed, the read data is displayed.
When an error occurs	**HEAD 1 PAGE 1** **RDadrs1F NO DC E** ↓ ↑ Error message	If an error has occurred during the READ operation, the buzzer will sound for 2 seconds, and an error message will be displayed (refer to *Section 3–3–10 Error Codes*).
	← or →	Pressing the left or right arrow key will toggle the display between the error message and the corresponding error code.
	HEAD 1 PAGE 1 **RDadrs1F error 72** Error code number	
RESET	**HEAD 1 PAGE 1** **STadrs1F data C8**	To perform another operation or to abort the READ operation, press the RESET key. The display will return to the reset display. In this example, the display indicates the reset status. Another operation can now be performed.

3–3–6   Step Write (WRITE 1)

This operation writes 1 byte of specified data to a specified address in the Data Carrier. Refer to Figure F3–16 .

Before performing this operation, select the address and the data you want to write. Refer to *Section 3-3-4 Address/Data Setting* for details.

F3–16 Step Write (WRITE 1)

start address/data setting	HEAD 1 PAGE 1 STadrs1F data 83

start address (write address)   Data to be written
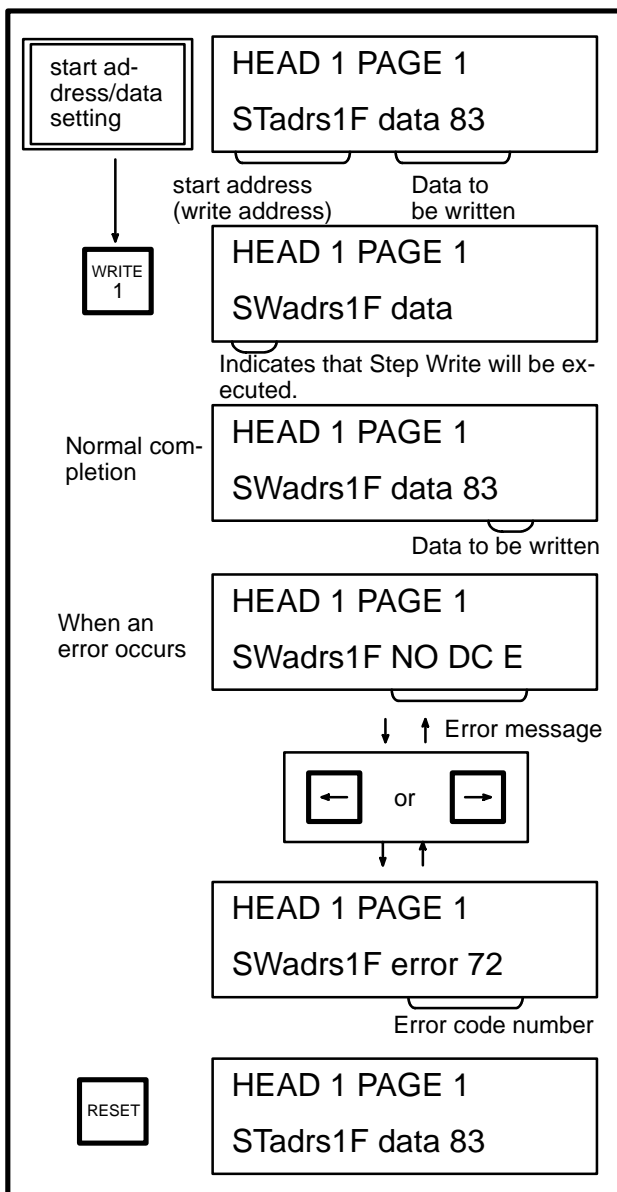
Set the data to be written and the address in the Data Carrier the data is to be written to.

WRITE 1	HEAD 1 PAGE 1 SWadrs1F data

Indicates that Step Write will be executed.

Press the WRITE 1 key to write the data to the start address and begin the Step Write operation.

Normal completion	HEAD 1 PAGE 1 SWadrs1F data 83

Data to be written

If the data is written correctly, it is displayed as shown in the example.

When an error occurs	HEAD 1 PAGE 1 SWadrs1F NO DC E

↓ ↑ Error message

If an error occurs during the operation, the buzzer sounds for 2 seconds, and an error message is displayed (Refer to *Section 3–3–10 Error Codes*).

← or →

Pressing the left or right arrow key will toggle the display between the error message and the corresponding error code.

↓ ↑

HEAD 1 PAGE 1

SWadrs1F error 72

Error code number

RESET	HEAD 1 PAGE 1 STadrs1F data 83

To perform another operation, or to abort the Step Write operation, press the RESET key. The display will return to the reset status. In this example, the display indicates the reset status. Another operation can now be performed.
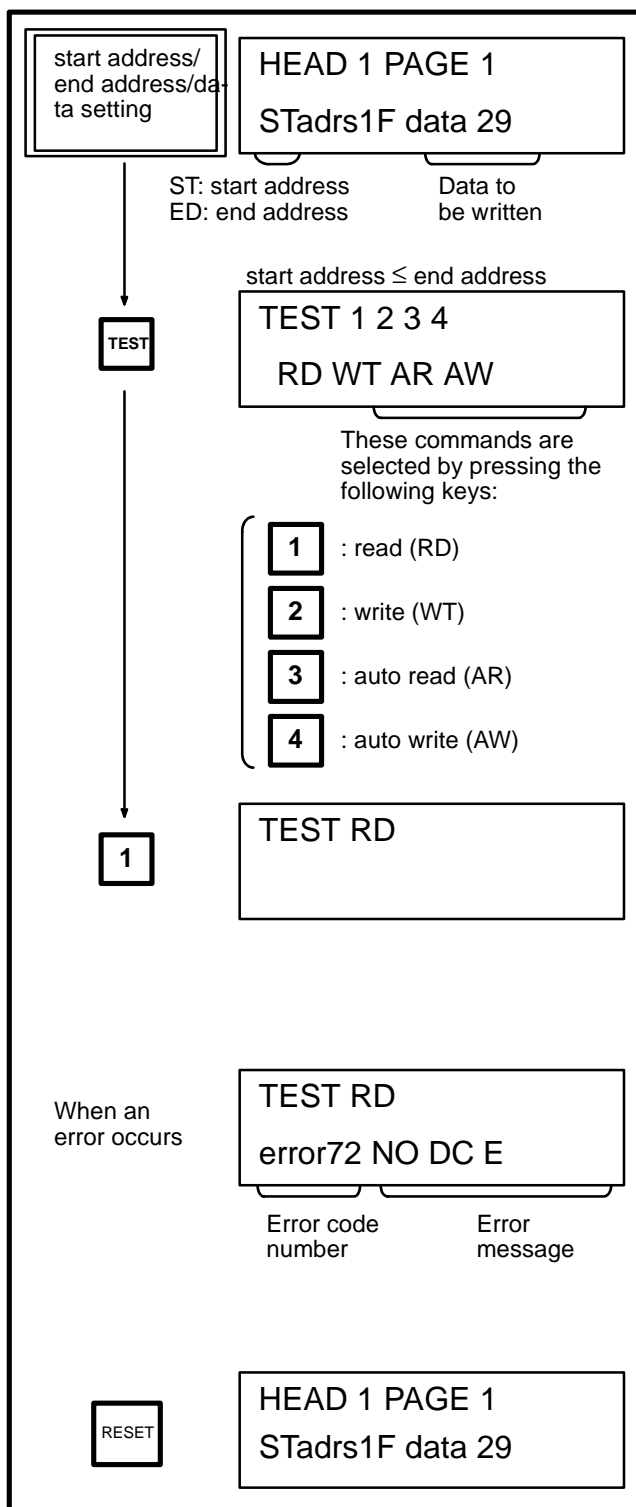
3–3–7   Continuous Write (WRITE 2)

This operation continuously writes several bytes of the same data to a specified address range in the Data Carrier. Refer to Figure F3–17.

Before performing this operation, select the address and the data you want to write. Refer to *Section 3-3-4 Address/Data Setting* for details.

F3–17 Continuous Write (WRITE 2)

start address/data setting → HEAD 1 PAGE 1 / STadrs1F data 54	Select the start and addresses, as well as the data to be written.

ST: start address   Data to
ED: end address   be written

start address ≥ end address

| WRITE 2 | HEAD 1 PAGE 1 / CWadrs1F data 54 | Press the WRITE 2 key. "CW" is displayed in the lower left corner of the Programming Console display, indicating that Continuous Write is being executed. The data is written to the addresses in the range specified. |

Indicates that Continuous   start
Write will be executed.   address

HEAD 1 PAGE 1
CWadrs28 data 54

Normal completion — HEAD 1 PAGE 1 / CWadrs3F data 54

  When the data is written correctly to all addresses and the Continuous Write operation is completed, the written data appears as shown in the example.

End address   Data to be written

When an error occurs — HEAD 1 PAGE 1 / CWadrs32 NO DC E

  If an error occurs during the Continuous Write operation, the buzzer sounds for 2 seconds, and an error message is displayed. (Refer to *Section 3–3–10 Error Codes.*)

Address at which an   Error
error has occurred   message

← or →

  Pressing the left or right arrow key will toggle the display between the error message and the corresponding error code.

HEAD 1 PAGE 1
CWadrs1F data 72

Error code number

RESET — HEAD 1 PAGE 1 / STadrs1F data 54

  To perform another operation or abort the Continuous Write operation, press the RESET key, and the display will return to reset status. In this example, the display indicates the reset status. Another operation can now be performed.

3–3–8   **Monitor Test (TEST)**

This operation repeatedly executes (at 1-second intervals) either the Read, Write, Auto Read, or Auto Write command in specified addresses of the Data Carrier. Any command errors that occur are displayed. Use this operation to

test and adjust the distance of the Data Carrier from the Read/Write Head, and the travel speed of the Data Carrier. Refer to Figure F3–18.

Before performing this operation, select the address and the data you want to read or write. Refer to *Section 3-3-4 Address/Data Setting* for details.

F3–18 Monitor Test (TEST)

start address/ end address/data setting	**HEAD 1 PAGE 1** **STadrs1F data 29**

ST: start address   Data to
ED: end address   be written

start address ≤ end address

TEST	**TEST 1 2 3 4** **RD WT AR AW**

These commands are selected by pressing the following keys:

1	: read (RD)
2	: write (WT)
3	: auto read (AR)
4	: auto write (AW)

1	**TEST RD**

When an error occurs

TEST RD **error72 NO DC E**

Error code   Error
number   message

RESET	**HEAD 1 PAGE 1** **STadrs1F data 29**

First, select the address to be accessed and the data to be written or read. When executing Write or Auto Write, remember to set the data to be written as well as the address.

Press the TEST key. Execute a command from the command menu (displayed on the screen) by pressing the number that corresponds to the command you want to execute.

In this example, the READ command is selected.

From the start address to the end address of the Data Carrier, the READ command is executed on a step-by-step basis. In one-second intervals, data is read and checked for errors. If an error occurs while a command is being executed, the corresponding error number and message are displayed. (Refer to *Section 3–3–10 Error Codes*). The error message and code disappear automatically if the next command is executed correctly.

While the TEST operation is being performed, the T/R LED indicator on the ID Sensor Unit blinks.

To begin another command or to abort the TEST operation, press the RESET key and the display will return to the reset status.

3–3–9   Error Log Display (ERR)

This operation displays errors that have occurred while the ID Sensor Unit was in the RUN mode and the user program was being executed. The errors are displayed in two formats: newest error information and statistical error information.

"Newest error" is a list of the 30 most recent errors; "statistical error" displays the number of times an error has occurred since a predetermined starting date. The MCBF (Mean Cycle Between Failures: total number of commands/ total number of errors) is also displayed. To change the date from which errors are to be monitored (registration date), execute the statistical error clearing operation (key 4) as shown in Figure F3–19.

F3–19 Error Log Display (ERR)
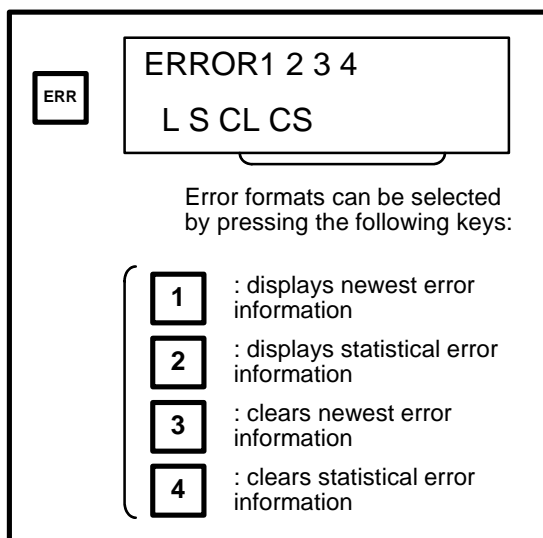
Press the ERR key to display the newest error information or statistical error information.

Use keys 1 through 4 to display or clear desired error information.

The error information storage area of the ID Sensor Unit is undefined upon delivery. Before using the ID Sensor Unit, press key 3 to clear newest error information, and key 4 to clear statistical error information.

Error information is backed up by a capacitor for up to 15 days (at 25%C). If the ID Sensor Unit is left OFF for more than 15 days, the error information becomes undefined and the error information must be cleared again.

Clearing Newest Error Information (Key 3)

F3–20 Clearing Newest Error Information

ERR

ERROR1 2 3 4

L S CL CS

3

CLEAR LAT. ERRORS

CLEAR L?PUSH SET

"L" = "Newest"

SET

HEAD 1 PAGE 1

STadrs1F data 29
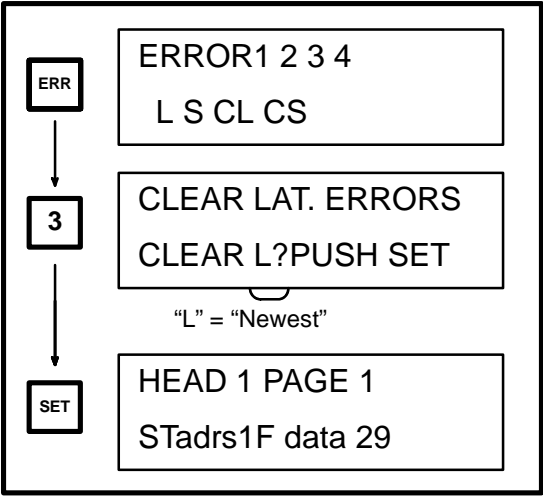
When the ERR key is pressed, the menu shown at left is displayed. Press key 3 to choose the newest error clearing operation.

The message "CLEAR L?" is displayed, asking for confirmation that the information is to be cleared. Press RESET to preserve the error information. Press SET to clear the information.

When the information has been cleared, the display returns to the RESET status.

Clearing Statistical Error Information (Key 4)

F3–21 Clearing Statistical Error Information
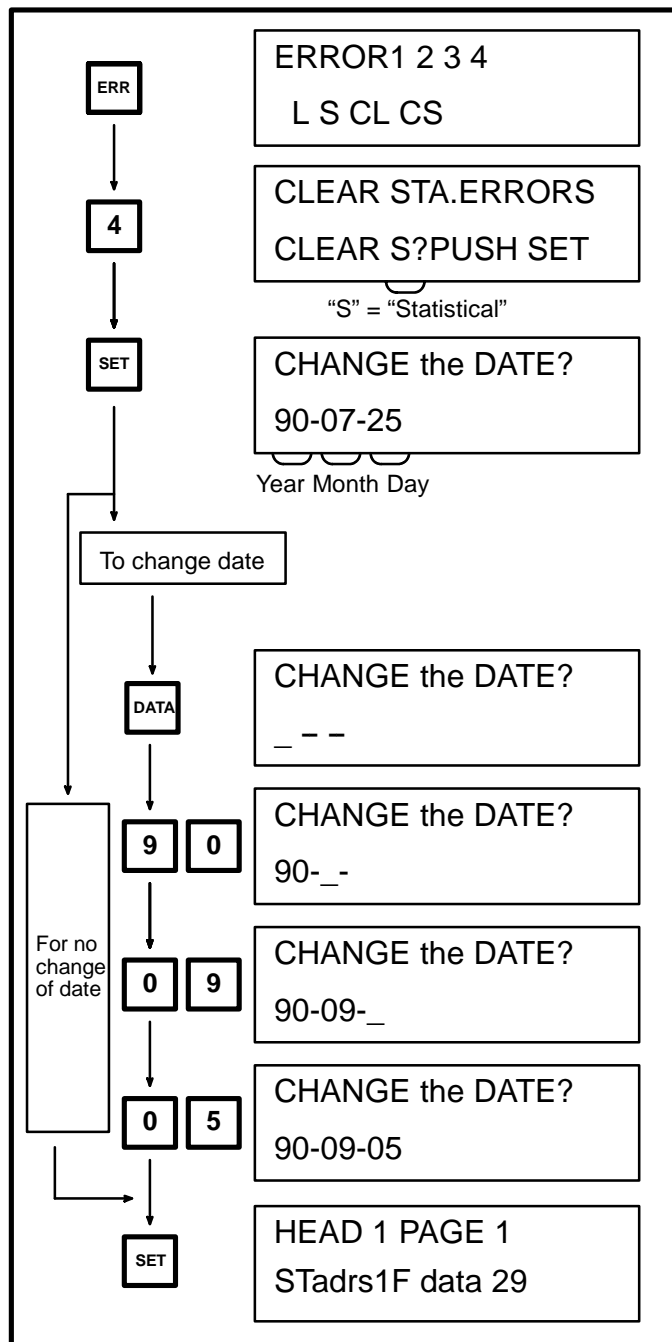
Flow	Display	Description
ERR	ERROR1 2 3 4 L S CL CS	Press key 4 to clear the statistical error information and set a new registration date.
↓ **4**	CLEAR STA.ERRORS CLEAR S?PUSH SET "S" = "Statistical"	The message "CLEAR S?" is displayed, asking for confirmation that the statistical error information is to be cleared.
↓ **SET**	CHANGE the DATE? 90-07-25 Year Month Day	Press the RESET key to retain the information. Press the SET key to clear the information and set a new date from which statistical error information is to be collected. When the error information has been cleared, the previous registration date is displayed, followed by the message, "CHANGE the DATE?"
To change date		
↓ **DATA**	CHANGE the DATE? _ _ _	Press the DATA key to begin entering the date.
↓ **9** **0**	CHANGE the DATE? 90-_-	Enter the last 2 digits of the year. In this example, the year is turns ON990.
For no change of date ↓ **0** **9**	CHANGE the DATE? 90-09-_	Next, enter the month as a 2-digit number (01 for January; 09 for September). In this example, the month is set to September.
↓ **0** **5**	CHANGE the DATE? 90-09-05	Now input the day as a 2-digit number. Be sure to input the prefix 0 when entering a single-digit day (i.e. 01, 02). In this example, the day is set to the 5th.
↓ **SET**	HEAD 1 PAGE 1 STadrs1F data 29	Press the SET key to set the date. The display will return to the reset status.

If the month is set to 00 or greater than 12, or if the day is set to 00 or greater than 31, all the previously set values will be cleared and the date must be re-entered.

Newest Error Information (Key 1)

F3–22 Newest Error Information Key

| ERR | ERROR1 2 3 4
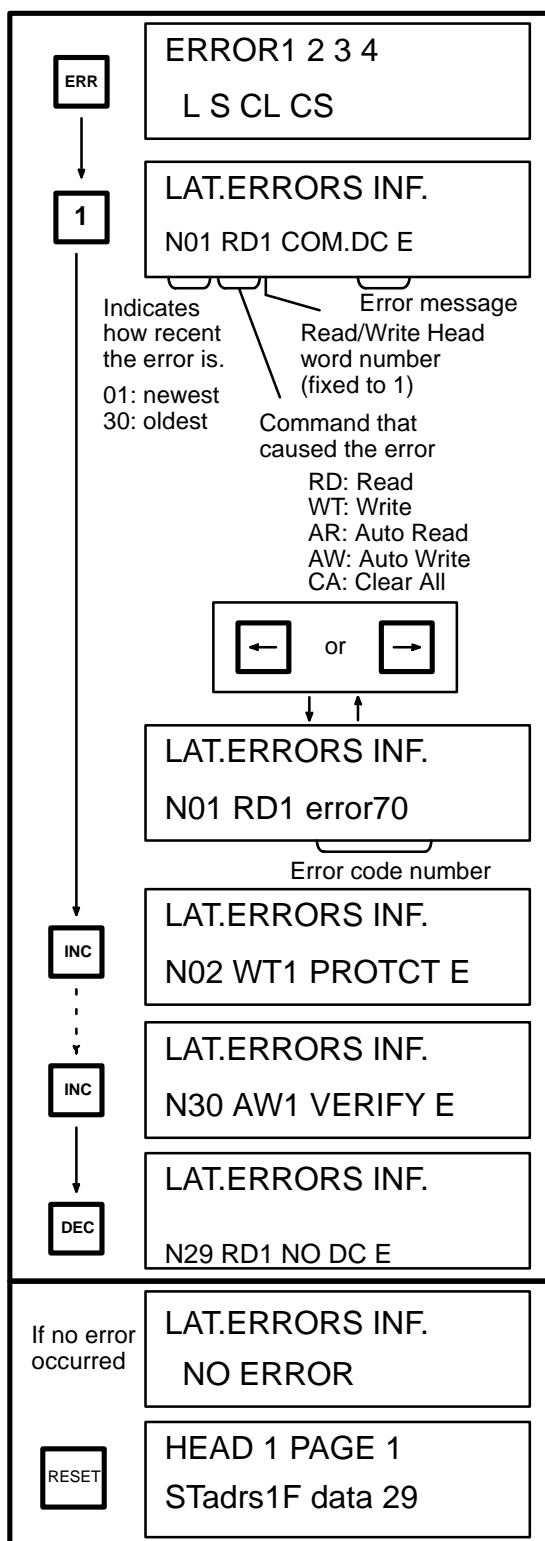
 L S CL CS | Press key 1 to display the command that caused the error and the corresponding error message. |

| 1 | LAT.ERRORS INF.

N01 RD1 COM.DC E | Up to 30 errors can be displayed sequentially by using the INC key. |

Indicates how recent the error is.

01: newest
30: oldest

Error message

Read/Write Head word number (fixed to 1)

Command that caused the error

    RD: Read
    WT: Write
    AR: Auto Read
    AW: Auto Write
    CA: Clear All

| ← or → |

Press either the left or right arrow key to alternately display the error code number and error message.

| LAT.ERRORS INF.

N01 RD1 error70 |

Error code number

| INC | LAT.ERRORS INF.

N02 WT1 PROTCT E |

Each time the INC key is pressed, the previous error is displayed.

If an error code is being displayed, press INC to display the error message associated with that code.

| INC | LAT.ERRORS INF.

N30 AW1 VERIFY E |

| DEC | LAT.ERRORS INF.

N29 RD1 NO DC E |

Each time the DEC key is pressed, new errors are displayed in the order in which they occurred.

| If no error occurred | LAT.ERRORS INF.

 NO ERROR |

If no errors have occurred, "NO ERROR" is displayed.

| RESET | HEAD 1 PAGE 1

STadrs1F data 29 |

To start another operation or abort the operation, press the RESET key and the display will return to reset status.

Statistical Error Information (Key 2)

F3–23 Statistical Error Information
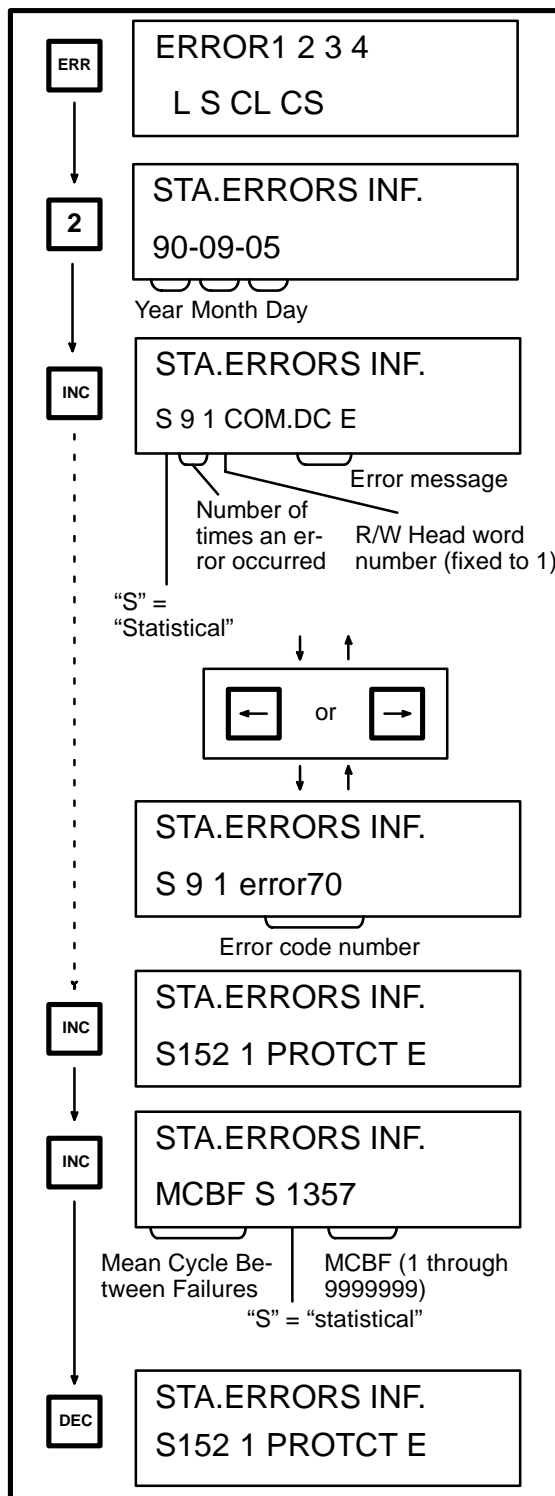
ERR → ERROR1 2 3 4 L S CL CS	Press key 2 to display the statistical error information.
2 → STA.ERRORS INF. 90-09-05 Year Month Day	The date is displayed first. This date was previously registered by the user as the date from which errors were to be monitored.
INC → STA.ERRORS INF. S 9 1 COM.DC E	Press the INC key to display the number of times an error has occurred, the error message, and the R/W Head word number.

Error message

Number of times an error occurred   R/W Head word number (fixed to 1)

"S" = "Statistical"

Up to 999 errors can be displayed. If 1000 errors have occurred, the 1000th error is displayed as 999.

← or →

Press the left or right arrow key to alternately display the error code number and error message.

STA.ERRORS INF.
 S 9 1 error70

Error code number

If an error code is being displayed, as in the example shown at left, press the INC key again to display the error message for the same error. Press the INC key once more to display the next error code and message.

INC → STA.ERRORS INF.
 S152 1 PROTCT E

INC → STA.ERRORS INF.
 MCBF S 1357

Mean Cycle Between Failures   MCBF (1 through 9999999)

"S" = "statistical"

After all messages have been displayed, press the INC key to display the MCBF. The MCBF value is calculated using the following expression:

$$\text{MCBF value} = \frac{\text{Total number of commands}}{\text{Total number of errors}}$$

(The MCBF is rounded off.)

If the MCBF value is 9999999 or more, "9999999" will be displayed.

DEC → STA.ERRORS INF.
 S152 1 PROTCT E

Press the DEC key to display the previous screen.

| If an error did not occur | STA.ERRORS INF.

NO ERROR | If no errors have occurred, this message will be displayed. |

| RESET | HEAD 1 PAGE 1

STadrs1F data 29 | To start another operation or abort the Error Log operation, press the RESET key and the display will return to reset status. |
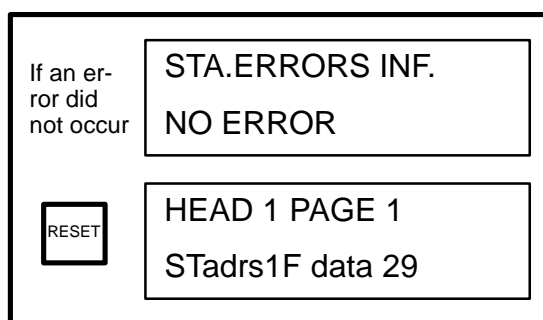
3–3–10 Error Codes

T3–6 Error Codes

Error code number	Error name	Error message
70	Data Carrier communication error	COM. DC E
71	Data verification error	VERIFY E
72	No Data Carrier error	NO DC E
7A	Data Carrier address over	ADRS E
7C	Read/Write Head disconnect error	R/W H E
7D	Write protect error	PROTCT E

3–4   Timing Considerations

This section covers timing considerations such as the time required for processing and turnaround time, which is the time required by the PC to retrieve a command and complete the reading/writing of data from/to the Data Carrier.

Use the tables and graphs that follow to calculate the amount of time required for executing commands involving data communications between the ID Sensor Unit and Data Carrier.

3–4–1   Command Processing Time

Command Processing Time is the time required for data communication between the CPU, ID Sensor, and Data Carrier. Table T3–7 and Figure F3–24 show the processing times required for the communication of various quantities of data.

T3–7 ID Sensor Command Processing Time

Command	Bytes									
	1	4	8	16	32	64	128	256	502	2K
Read/Write (including Auto Read/Write) (ms)	110	115	125	145	220	370	660	1240	2400	–––
Clear-all (ms)	–––	–––	–––	–––	–––	–––	–––	–––	–––	9505

The following graphs show the relationship between the quantity of data to be processed and the time required for processing a command.

F3–24 Command Processing Time Graph

Processing time (ms)

Quantity of data (bytes)
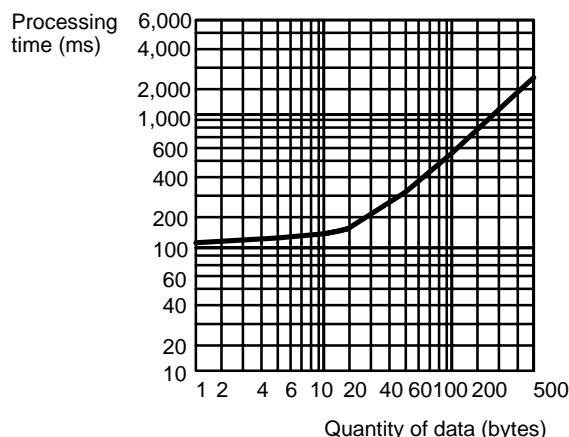
3–4–2   Turnaround Time

urnaround time (TAT) is the elapsed time from the retrieval of a command by the PC until the data has been read from or written to the Data Carrier. Turnaround time can be calculated as follows:

TAT = Coefficient x PC scan time + Command processing time (+ Remote I/O communication time, if applicable)

Coefficient: Differs according to the number of bytes to be read/written and the I/O refresh time.

PC scan time: The time required by the CPU to scan the program, refresh the I/O area, etc. Determine this value by referring to *Table T3–1 PC Scan Time Coefficients*.

Command processing time: The time required to process the communication between the ID Sensor Unit and the Data Carrier. Determine this value by referring to *Section 3–4–1 Command Processing Time*.

Remote I/O communication time: additional time required if the ID Sensor Unit is mounted to a Remote I/O Slave Rack. If the ID Sensor Unit is not mounted to a Remote I/O Slave Rack, this time is zero.

The timing charts and program examples presented in this section assume the following conditions:

1, 2, 3...   1.   The ID Sensor Unit is set for two-word operation (words 000 and 001; refer to *Section 2-1 DIP Switch Setting)* and the Intelligent I/O Read/ Write instructions are being used.
2.   Data sent from the ID Sensor Unit to the PC is stored in the DM area of the PC.

If Intelligent I/O Read/Write instructions are not provided with your PC, the ID Sensor Unit must be set for four-word operation. Transfer data on a word-by-word basis by executing MOV.

Note that MOV can be executed only once during each scan. Therefore, when using MOV, the number of scans must equal the number of words to be transferred.

T3–1   PC Scan Time Coefficients

No. of intelligent instructions	1	2	3	4	5
No. of bytes	1 to 502	503 to 1,004	1,005 to 1,506	1,507 to 2,008	2,009 to 2,042
Write Auto Write Read Auto Read	min 3 to max 5	min 6 to max 9	min 9 to max 13	min 12 to max 17	min 15 to max 21
Clear-all	3 to 5*	–––	–––	–––	–––

*The Clear-all command can clear up to 2,046 bytes when the Intelligent I/O Instruction is executed once.

Note The data in this table applies to the program examples given on the following pages.

3–4–3   Program Examples and Timing Diagrams

The following program examples and timing diagrams illustrate the relationship between commands, number of bytes transferred, and scan time.

Write and Auto Write Commands

(1) To Write 502 Bytes of Data

F3–25 Writing 502 Bytes of Data
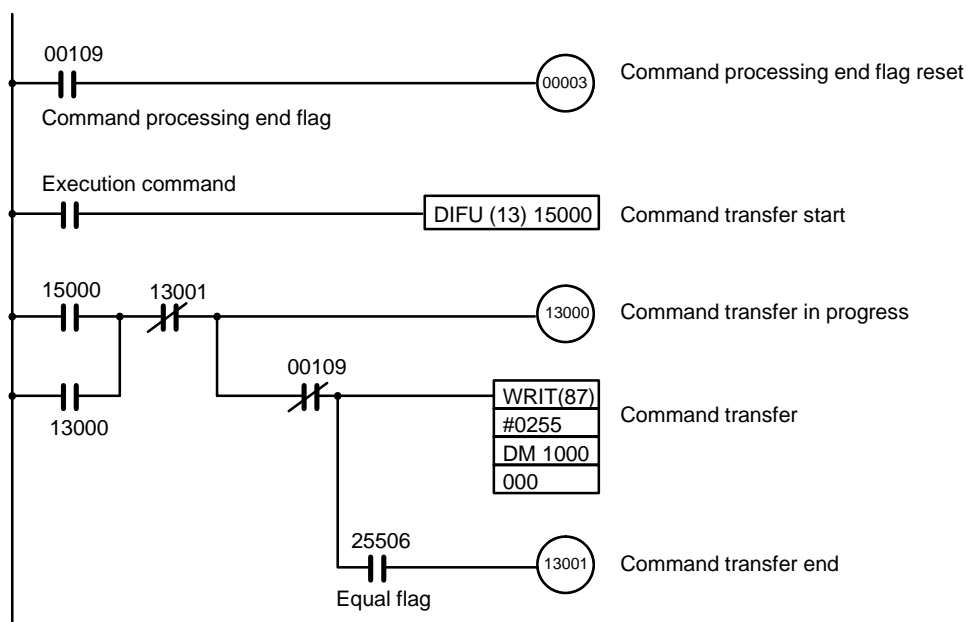
Minimum Scan Time

F3–26 Minimum Scan Time; Write and Auto Write
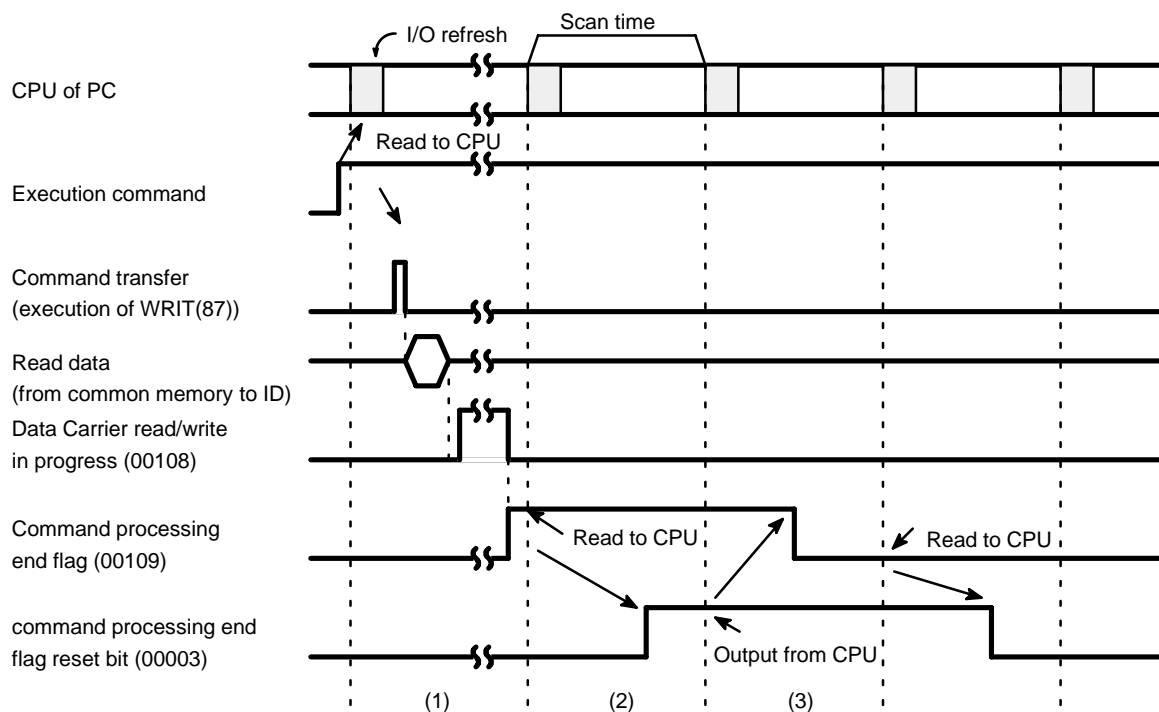
Maximum Scan Time
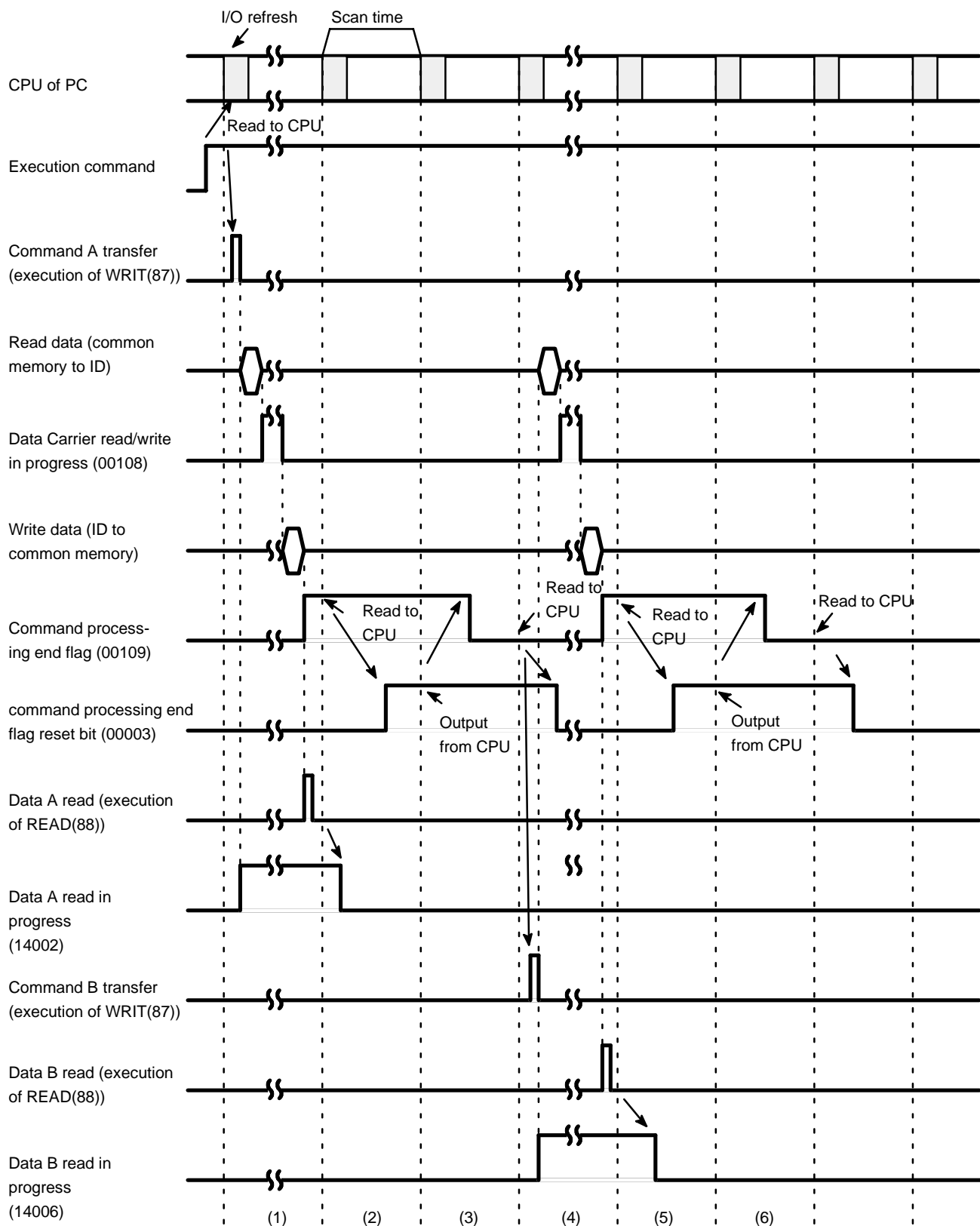
F3–27 Maximum Scan Time; Write and Auto Write
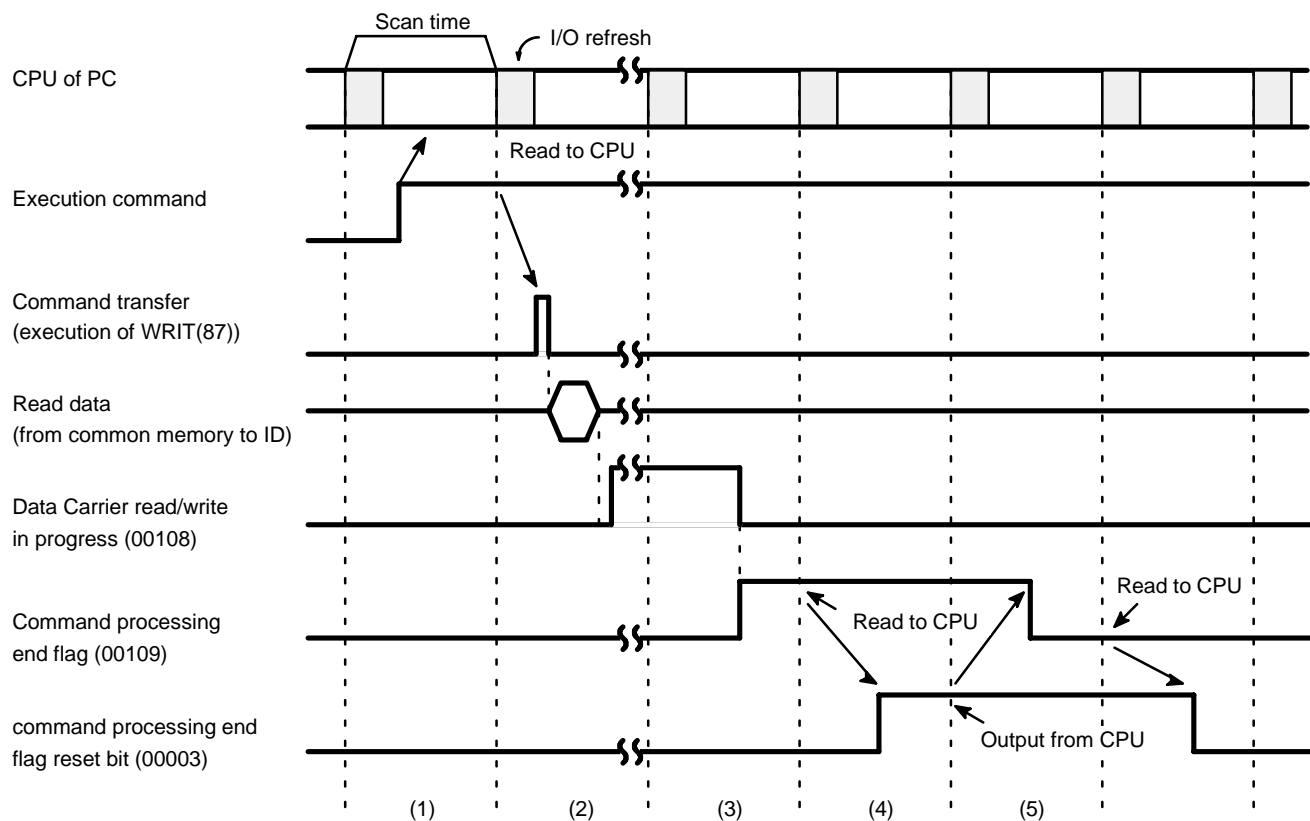
Note The processing time of the Write command varies according to the quantity of data to be written. Therefore, TAT varies according to what point during a scan the command processing end flag (00109) is set to ON.
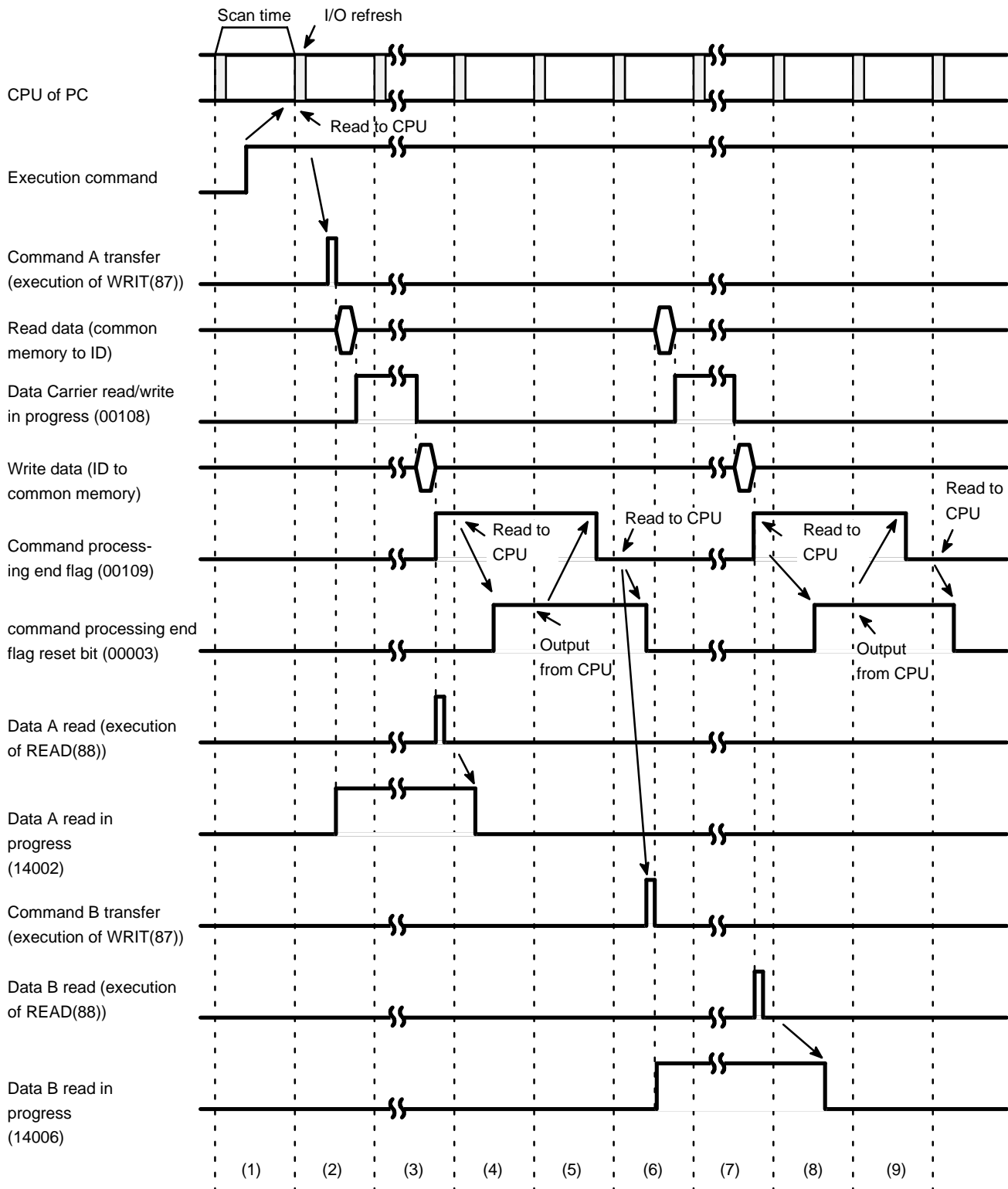
F3–28 Writing 1,004 Bytes of Data

Ladder	Description
(command processing end flag) ── 00109 ──┤├──●── DIFU (13) 15001	Command processing end
└──────(00003)	Command processing end flag reset
Execution command ──┤├────── DIFU (13) 15000	Command A transfer start
15000 ──┤├──●── 13001 ──┤╱├──●──(13000)	Command A transfer in progress
13000 ──┤├────── 00109 ──┤╱├──●── WRIT(87) / #025 / DM 1000 / 000	Command A transfer
25506 ──┤├──(13001) Equal flag	Command A transfer end
13001 ──┤├──●── 13003 ──┤╱├──●──(13002)	Command A processing in progress
13002 ──┤├──●── 13004 ──┤├── 1500 ──┤├── KEEP(11) / 13003	Command A processing end (command B transfer start)
13002 ──┤╱├── 13003 ──┤├──●── 13005 ──┤╱├──●──(13104)	Command B transfer in progress
13004 ──┤├────── 00109 ──┤╱├──●── WRIT(87) / #025 / DM 1255 / 000	Command B transfer
25506 ──┤├──(13005) Equal flag	Command B transfer end
13005 ──┤├──●── 13007 ──┤╱├──●──(13006)	Command B processing in progress
13006 ──┤├── Reset ──┤├── 1500 ──┤├── KEEP(11) / 13007	Command B processing end

Minimum Scan Time

F3–29 Minimum Scan Time
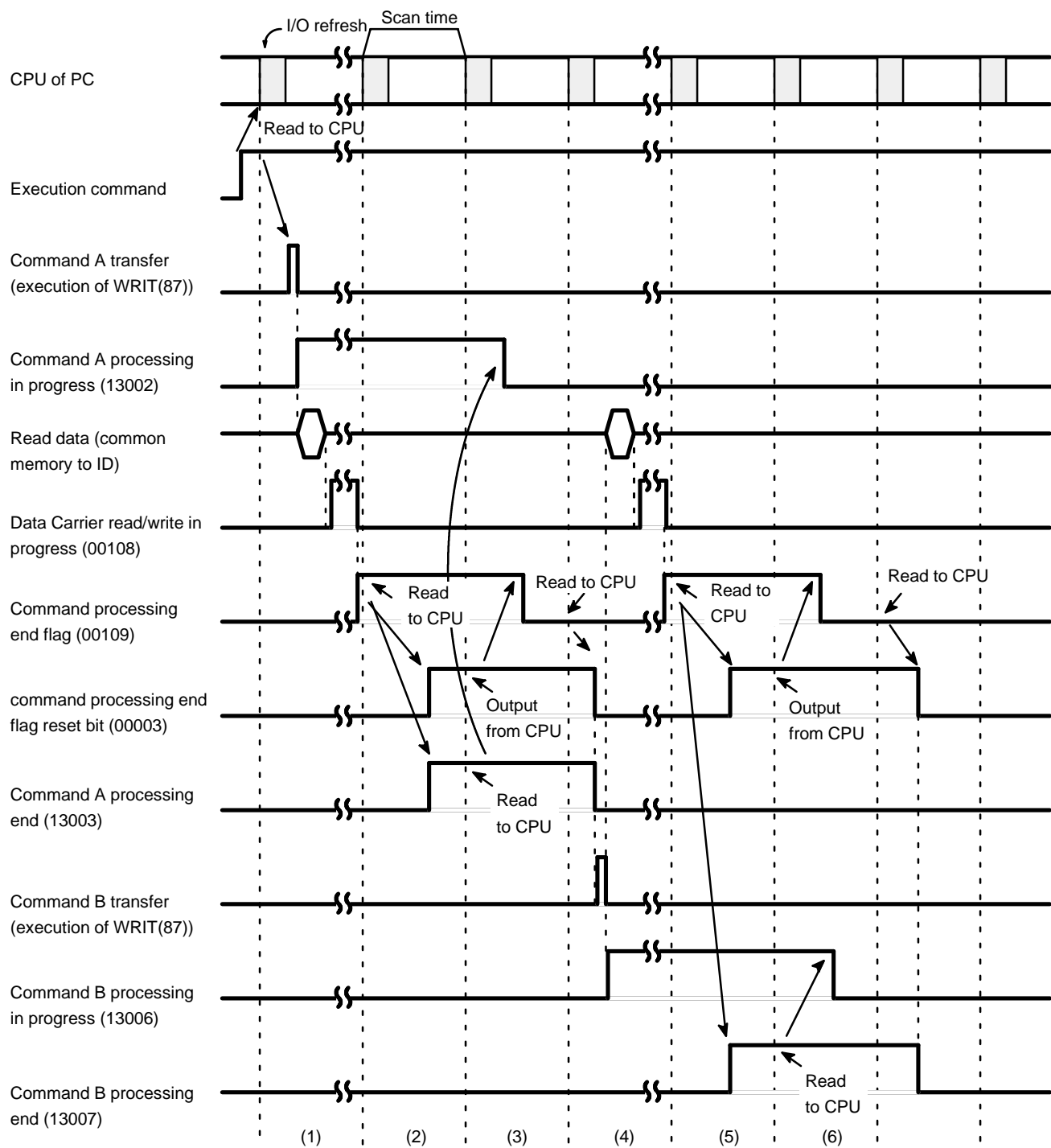
Maximum Scan Time

F3–30 Maximum Scan Time
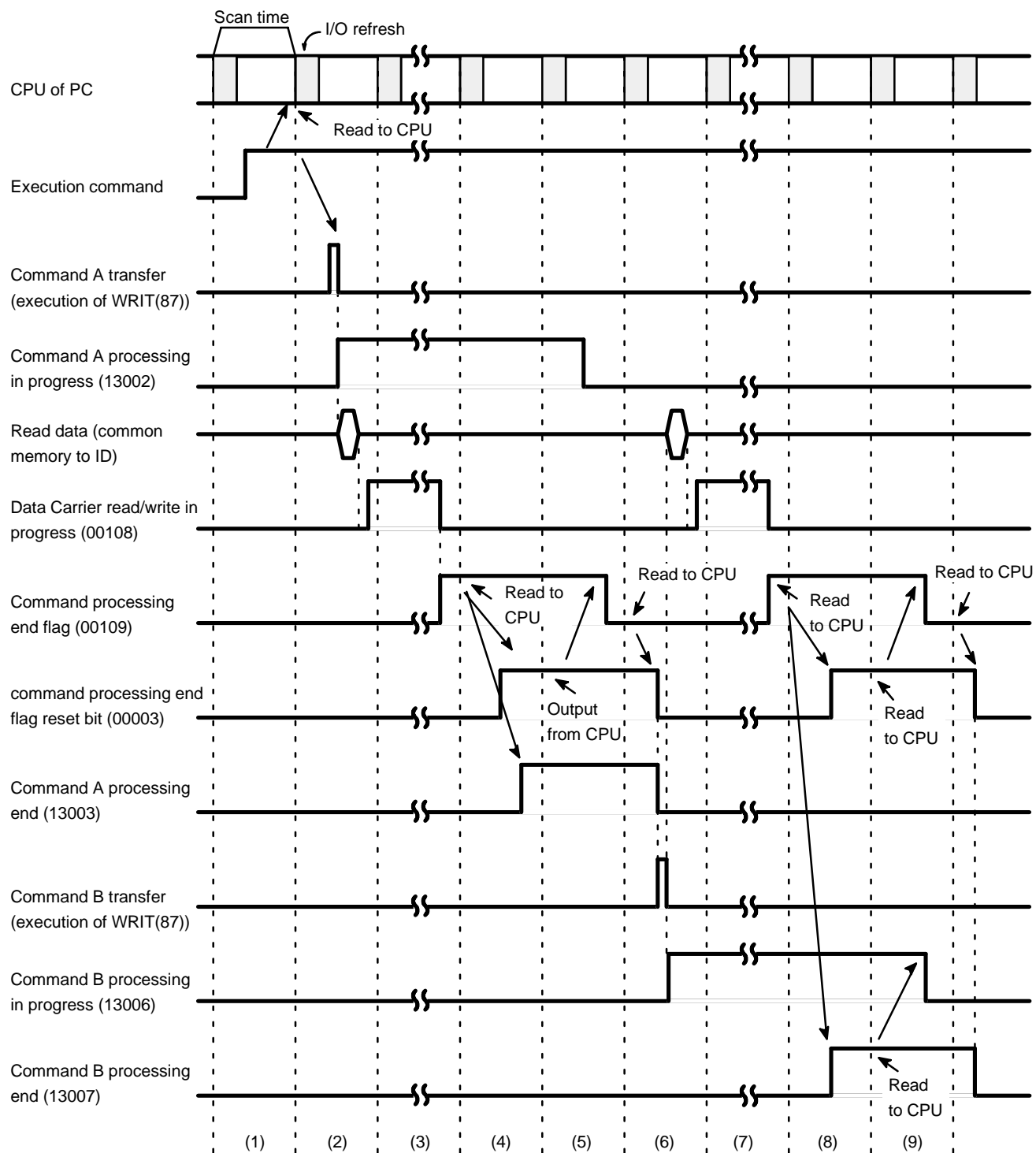
Scan time

I/O refresh

CPU of PC

Read to CPU

Execution command

Command A transfer
(execution of WRIT(87))

Command A processing
in progress (13002)

Read data (common
memory to ID)

Data Carrier read/write in
progress (00108)

Command processing
end flag (00109)

Read to CPU

Read to CPU

Read to
CPU

Read
to CPU

command processing end
flag reset bit (00003)

Output
from CPU

Read
to CPU

Command A processing
end (13003)

Command B transfer
(execution of WRIT(87))

Command B processing
in progress (13006)

Command B processing
end (13007)

Read
to CPU

(1)   (2)   (3)   (4)   (5)   (6)   (7)   (8)   (9)

Note The processing time of the Write command varies according to the quantity
of data to be written. Therefore, TAT varies according to what point during a
scan the command processing end flag (00109) is set to ON.

Read and Auto Read Commands

F3–31 Reading 502 Bytes of Data

```
    00109
     ┤├──────────────────────────────────────( 00003 )   Command processing end flag reset
Command processing end flag

Execution command
     ┤├──────────────────────────[ DIFU (13) 15000 ]   Command transfer start

    15000    14001
     ┤├────┬──┤/├────┬───────────────────────( 14000 )   Command transfer in progress
          │        │        00109
     ┤├───┘        └────────┤/├────┬──[ WRIT(87) ]   Command transfer
    14000                         │  [ #0005    ]
                                  │  [ DM 3000  ]
                                  │  [ 000      ]
                       25506      │
                        ┤├────────┴──( 14001 )   Command transfer end
                      Equal flag

    14001    14003
     ┤├────┬──┤/├────┬───────────────────────( 14002 )   Data read in progress
          │        │
     ┤├───┘        └────────────────[ READ(88) ]   Data read
    14002                            [ #0255    ]
                                     [ 001      ]
                                     [ DM 2000  ]
                       25506
                        ┤├───────────( 14003 )   Data read end
                      Equal flag
```

82

Minimum Scan Time

F3–32 Minimum Scan Time
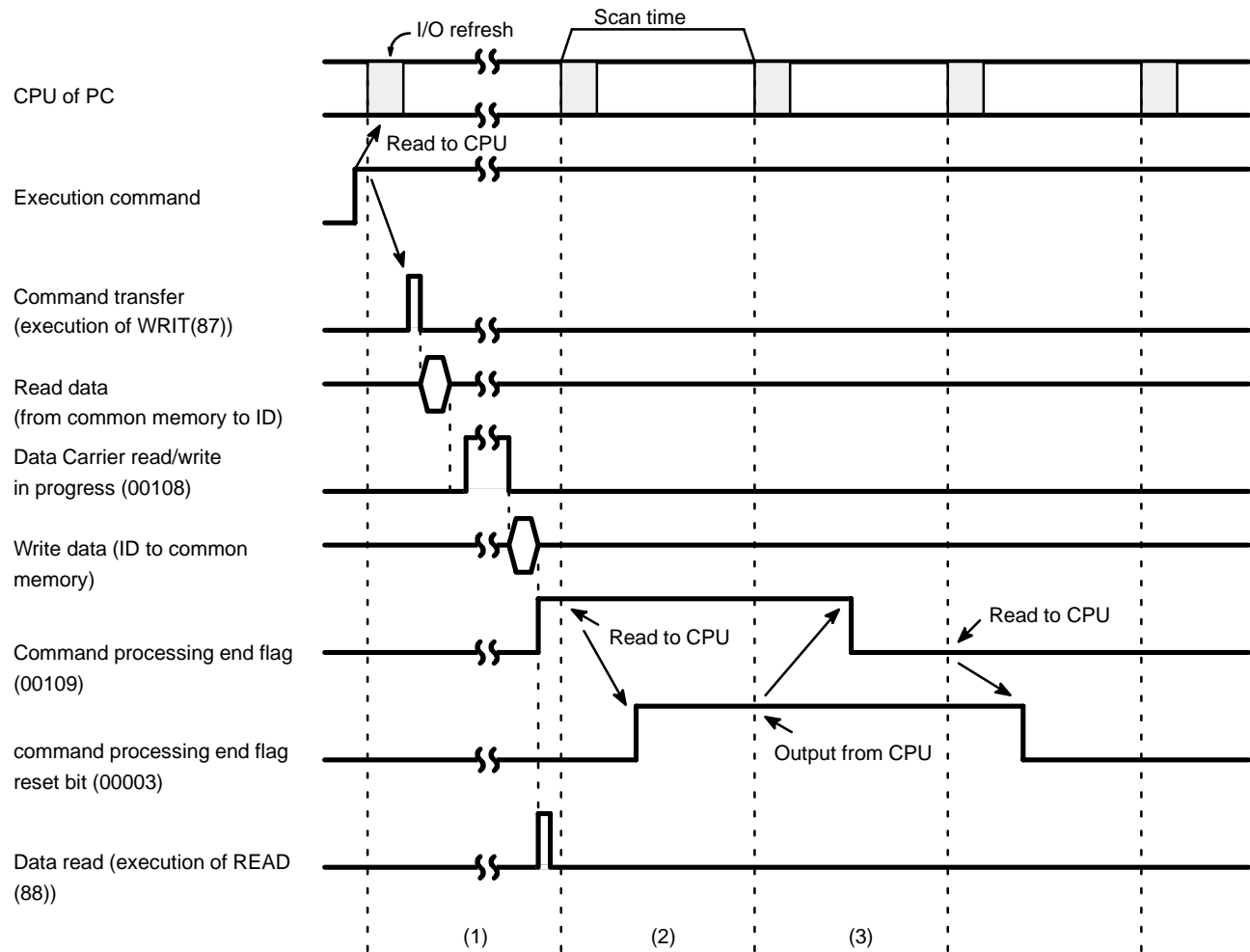
Maximum Scan Time

F3–33 Maximum Scan Time
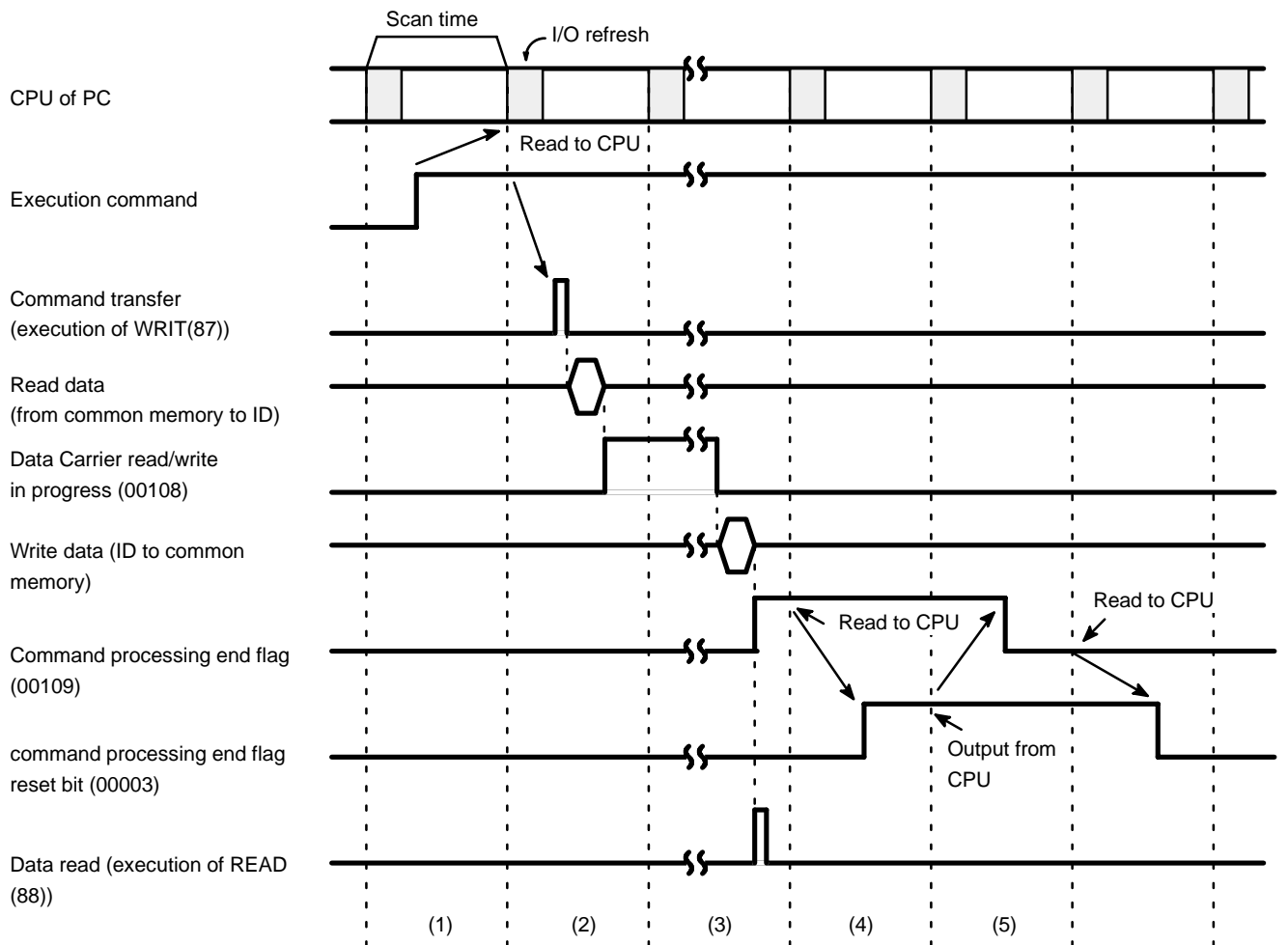
Note The processing time of the Read command varies according to the quantity of data to be written. Therefore, TAT varies according to what point during a scan the command processing end flag (00109) is set to ON.

F3–34 Reading 1,004 Bytes of Data

Ladder element	Description
0010 / 9 ⊣⊢ (command processing end flag) → (00003)	Command processing end flag reset
Execution command ⊣⊢ → DIFU (13) 15000	Command transfer start
15000 ⊣⊢ 14001 ⊣/⊢ → (14000)	Command A transfer in progress
14000 ⊣⊢	
0010 / 9 ⊣/⊢ → WRIT(87) / #000 / DM 1000 / 000	Command A transfer
2550 / 6 ⊣⊢ Equal flag → (14001)	Command A transfer end
14001 ⊣⊢ 14003 ⊣/⊢ → (14002)	Data A read in progress
14002 ⊣⊢	
READ(88) / #025 / 501 / DM 2000	Data A read
2550 / 6 ⊣⊢ Equal flag → (14003)	Data A read end (command B transfer start)
14003 ⊣⊢ 14005 ⊣/⊢ → (14004)	Command B transfer in progress
14004 ⊣⊢	
0010 / 9 ⊣/⊢ → WRIT(87) / #000 / DM 1005 / 000	Command B transfer
2550 / 6 ⊣⊢ Equal flag → (14005)	Command B transfer end
14005 ⊣⊢ 14007 ⊣/⊢ → (14006)	Data B read in progress
14006 ⊣⊢	
READ(88) / #025 / 501 / DM 1255	Data B read
2550 / 6 ⊣⊢ Equal flag → (14007)	Data B read end

85

Minimum Scan Time

F3–35 Minimum Scan Time

Maximum Scan Time

F3–36 Maximum Scan Time

Note The processing time of the Read command varies according to the quantity of data to be written. Therefore, TAT varies according to what point during a scan the command processing end flag (00109) is set to ON.

SECTION 4
Troubleshooting

This section contains information that can help you to determine the cause(s) of any problems you may encounter in the operation of your ID Sensor system. Refer to this section any time you experience a malfunction.

Also included is a checklist of preventive maintenance measures, which you should follow on a monthly basis to ensure long service from your ID Sensor system.

4–1 Periodic Maintenance

Go over the following checklist monthly to ensure trouble-free operation of the ID Sensor system.

T4–1 Monthly Checklist

Condition	Checklist Item	Standard
Environmental	Is the ambient temperature (panel temperature) appropriate?	0% to 55%C
	Is the humidity appropriate?	35 to 85%, without condensation
	Is there dust on the surface of the Unit?	Dust-free
Mounting	Is the ID Sensor Unit securely mounted?	Must not be loose
	Is the cable securely connected?	The cable connector must not be loose
	Are there cracks or noticeable weak areas in the cable?	Appearance must be normal, free of cracks or exposed wires

4–2 What To Do If a Malfunction Occurs

Table T4-2 shows causes and corrective actions for particular malfunctions. Refer to this table if you experience trouble with the ID Sensor system.

T4–2 Malfunction Checklist

Error	Cause	Corrective Action
All indicators remain unlit.	Power is not applied to the PC.	Apply power to the PC. If the indicators continue to remain unlit, make sure the PC is properly connected to the power supply.
	The ID Sensor Unit is not mounted securely.	Completely remove the ID Sensor Unit from the PC (see note 1) and remount it, making sure the connecting terminals are secure.
ERROR indicator lights.	The RESET switch is ON.	Press the RESET switch (see note 2). If the ERROR indicator does not go off, the switch is defective; replace the Unit.
	A WDT (watchdog timer) error has occurred in the ID Sensor Unit.	Press the RESET switch (see note 2).
	CPU ERROR indicator is lit.	Locate the cause of the error in the PC and correct it.

Note 1. Before removing the ID Sensor Unit from the PC, make sure the power to the PC is OFF.

2. Do not press the RESET switch while the T/R indicator is lit or while the Intelligent I/O Read Instruction (READ(88)) is being executed; otherwise, the Read/complete flag will turn ON and will not turn OFF, preventing data transfer. If this occurs, turn the system OFF and then ON again. If the RESET switch is pressed while READ(88) is being executed, or if the operation mode of the PC is changed from RUN/MONITOR to PROGRAM while READ(88) is being executed, word n+1 bit 02 (ID write end flag) will remain ON. To turn this flag OFF, either turn the power supply to the PC to OFF and then ON, or turn OFF word n bit 02 (PC read end flag) or word n bit 04 (system reset flag) by performing a forced reset operation with the Programming Console.

Replacing the Unit   Before replacing the ID Sensor Unit, be sure to turn OFF the power to the PC. Remove the Unit and replace it with a new Unit, making sure it is securely mounted. Check the new Unit thoroughly before operation.

When returning a defective Unit to OMRON, include a detailed explanation of the problem.

Spare Parts To minimize downtime of the system, it is advisable to keep at least one spare Unit on hand.

4–3   Diagnostic Flow Charts

If an error occurs, determine the conditions under which it occurs: intermittent or continuing; on-line or off-line.

Use the following flowcharts in Figures F4-1 and F4-2 to determine the cause of an error.

F4–1 Basic Assurance Test (BAT)
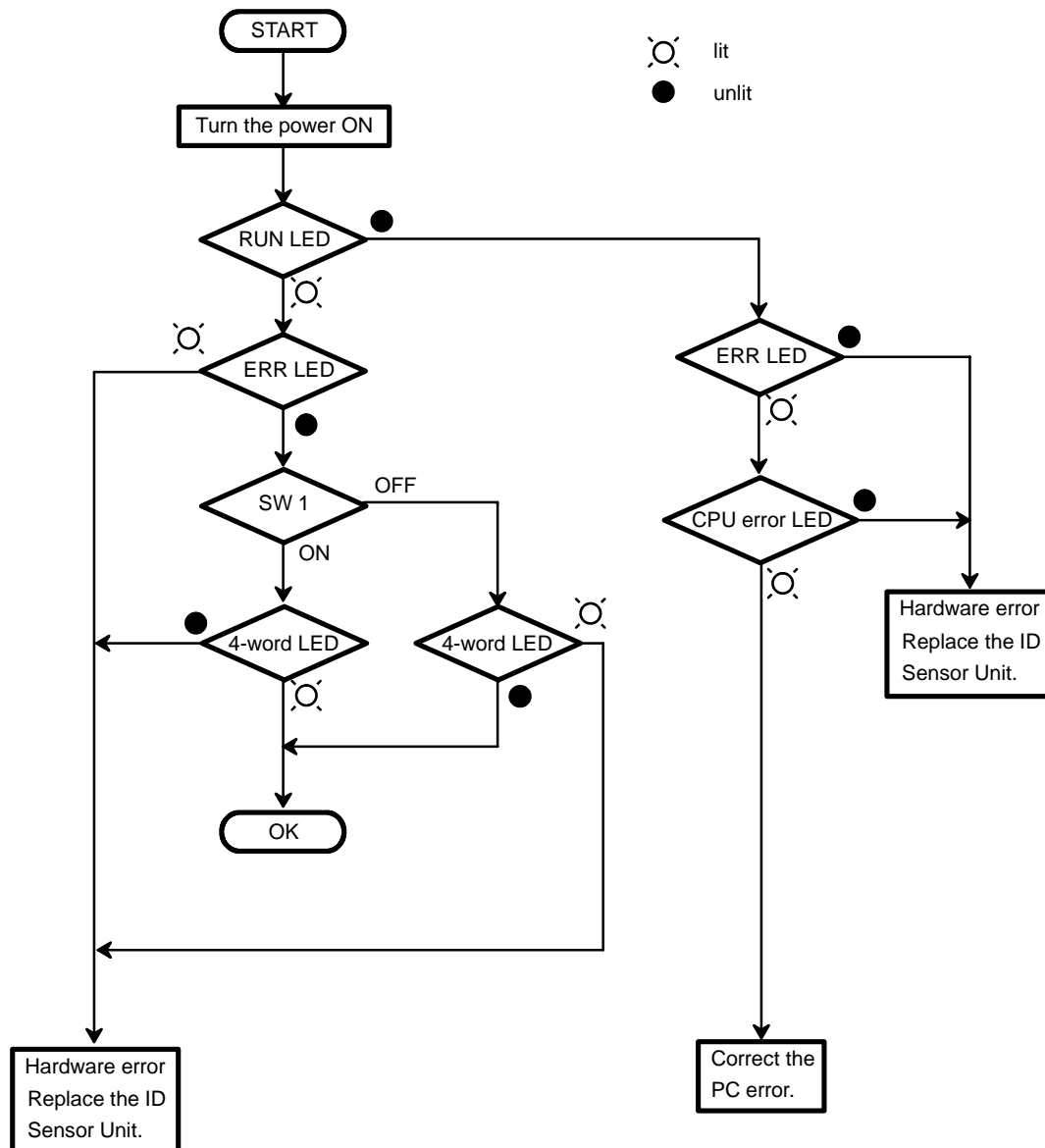
F4–2 Flowchart for Testing with the Programming

```
                              ┌──────────────┐
                              │    START     │
                              └──────┬───────┘
                              ┌──────┴───────┐
                              │ Connect the Pro-│
                              │ gramming Console │
                              └──────┬───────┘
                              ┌──────┴───────┐
                              │ Turn the power ON │
                              └──────┬───────┘
                          ①─────────┤
```

| <RUN> | <PROGRAM> MODE ERROR | <MONITOR> BZ | - - - - - -
 - - - - - - |

- Programming Console in MONITOR mode?
  - No → Set the Programming Console to MONITOR mode. → Return to ①
  - Yes

- Execute "TEST AW"
  - COM. DC E
    - Yes → Workpiece moving too fast? Refer to *Section 1-5 Installation.*
      - No
      - Yes → Adjust speed of workpiece
    - No → VERIFY E
      - Yes → Return to ①
      - No

- Hardware error Replace the ID Sensor Unit

- Is distance between R/W Head and Data Carrier adequate? Refer to *Section 1-5 Installation.*
  - Yes → 24 VDC connection OK?
    - Yes
    - No → Connect 24 VDC
  - No → Adjust the distance

- ADRS E
  - Yes
  - No → R/W H E
    - Yes → Is R/W Head defective?
      - No
      - Yes → Replace R/W Head
    - No → PROTCT E
      - Yes
      - No → OK

- Data Carrier defective?
  - No
  - Yes → Replace Data Carrier.

- Hardware error Replace the ID Sensor Unit.

Appendix A
Standard Models

Name	Model Number
ID Sensor Unit	C500-IDS01-V1
ID Sensor Unit (long-distance type)	C500-IDS02
Read/Write Head	V600-H06
Data Carrier	V600-D2KR01
ID Adapter (for IDS02)	C500-IDA02
Handheld Programming Console	C200H-PRO27-E
Connecting Cable (2 m) (See note)	C200H-CN222
Connecting Cable (4 m) (See note)	C200H-CN422

Note The cable connects the Handheld Programming Console to the ID Sensor Unit.

Appendix B
Specifications

Dimensions ID Sensor Unit C500-IDS01-V1/IDS02ID Adapter C500-IDA02(millimeters)

All Units have the dimensions shown in the following figures.

IDS01

250

34.5

73
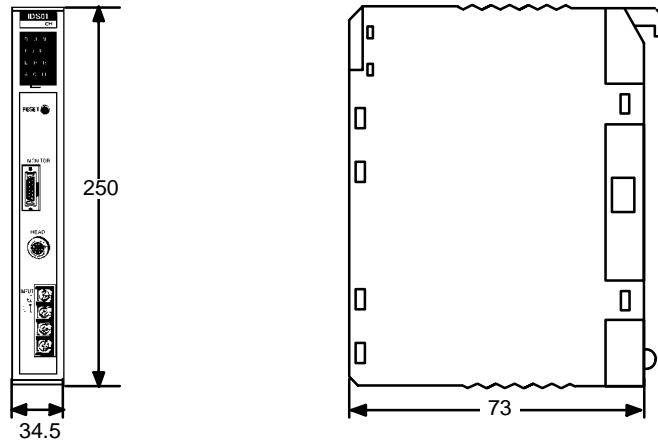
Mounted Dimensions(millimeters)

Connection cables

Backplane

115

Approx. 170
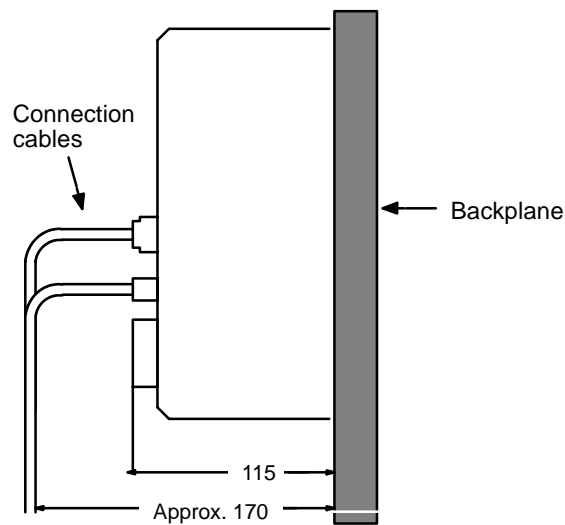
Note Before mounting the ID Sensor Unit, verify the depth of the control panel.

Data Carrier V600-D2KR01(millimeters)
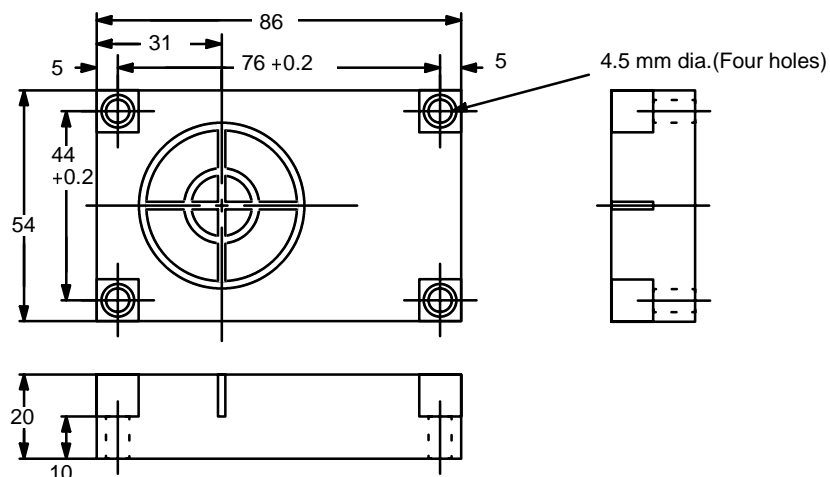
Read/Write Head V600-H06(millimeters)
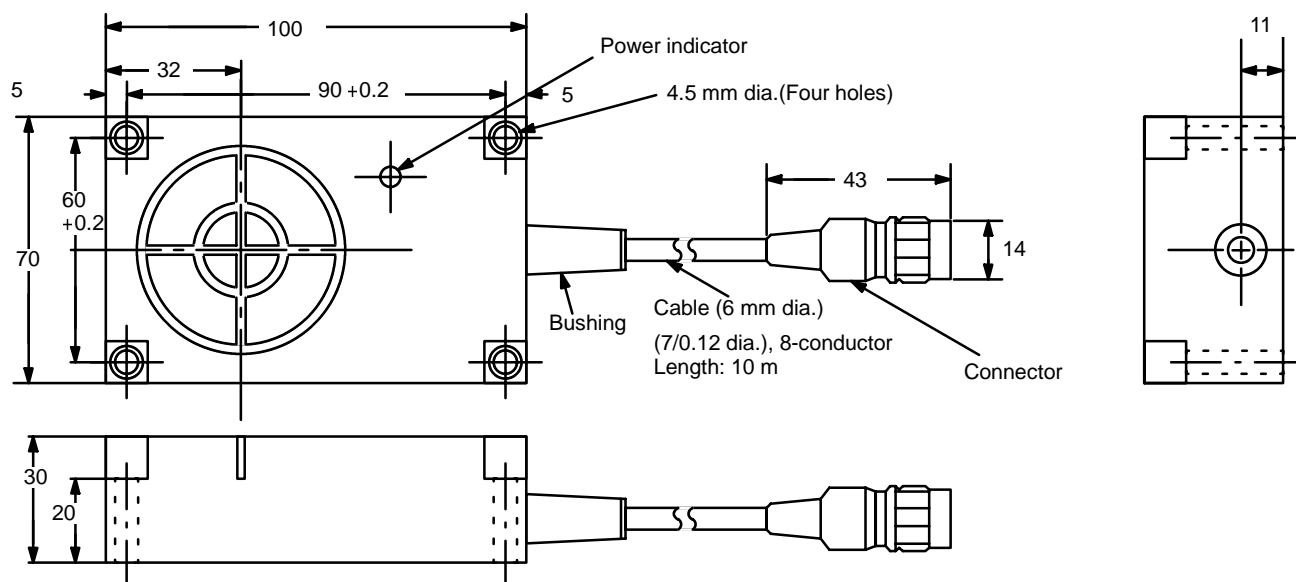
ID Sensor Unit Specifications

Ratings   All ratings conform to those of C-series Programmable Controllers.

Characteristics

Item	Specifications
Communication Control Procedure	Interactive
Number of Read/Write Heads connected	One per ID Sensor Unit
Data Carrier	2K bytes RAM (with built-in battery)
Data Carrier memory format	8-bit
Commands	Read, Write, Auto Read, Auto Write, Clear-all, and Auto Read/Write Abort
Data transferable per instruction	Up to 251 words (502 bytes) can be transferred with WRIT(87) and READ(88) (see note 1).

Diagnostic functions	• CPU watchdog timer
	• Communication errors
	  Six communication errors identify causes of errors that have occurred during communication between the Data Carrier and the ID Sensor Unit. (i.e. Data Carrier missing, communication error)
	• Error log
	  The error log function allows communication errors to be displayed in statistical form or in order of occurrence. Errors are retained by the backup capacitor.

Monitoring functions	The following monitoring functions are available when the ID Sensor Unit is connected to a Handheld Programming Console. (Use the keyboard sheet provided with the ID Sensor Unit.) (Cable length: 4 m max.) Read (1 byte) Step Write (1 byte) Continuous Write Test Error Log
Memory backup	Error information is backed up by a capacitor for 15 days (at 25%C; see note 2).
Number of words required	2 words when using WRIT(87) and READ(88); 4 words when using MOV (DIP switch-selectable)
Internal current consumption	400 mA max. at 5 VDC.
External current supply	250 mA max. at 24 VDC (to drive R/W Head)
Dimensions	34.5(W)x250(H)x93(D) mm
Weight	700 grams max.

Note 1. WRIT(87) and READ(88) are actually capable of transferring 255 words, but, as 4 words are used for command codes, in practice only 251 words are available for data transfer.

2. The error information stored in the memory of the ID Sensor Unit is retained by a built-in backup capacitor for 15 days at an ambient temperature of 25%C. As shown in the following diagram, the duration of the backup shortens as the temperature rises.

Backup period (days)

15

10

5

2

0

25 30 40 50 60

Ambient temperature (%C)
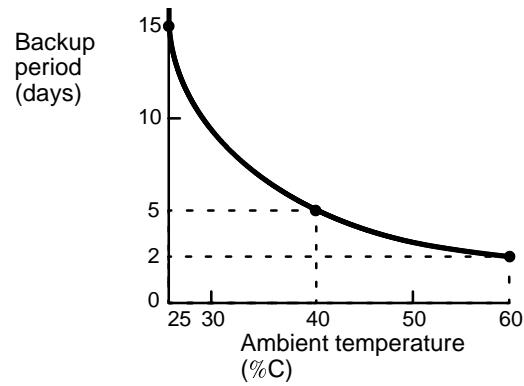
Internal Circuit Block for ID Sensor Units
C500-IDS01-V1

PC CPU

I/O Bus

Interface circuit

Common memory (see note 1)

I/O word data (see note 2)

I/O

LED indicators Switches

CPU

System memory

Work memory

Communication interface for R/W Head

Handheld Programming Console connector

R/W Head connector

C500-IDS02

PC CPU

I/O Bus

Interface circuit

Common memory (see note 1)

I/O word data (see note 2)

I/O

LED indicators Switches

CPU

System memory

Work memory

Communication interface for RS-485

Handheld Programming Console connector

ID Adapter connector for RS-485

Note 1. The common memory is read from and written to by the WRIT(87) and READ(88) instructions.

2. I/O word data is read from and written to by MOV, etc.

Internal Circuit Block for ID Adapter Units C500-IDA02
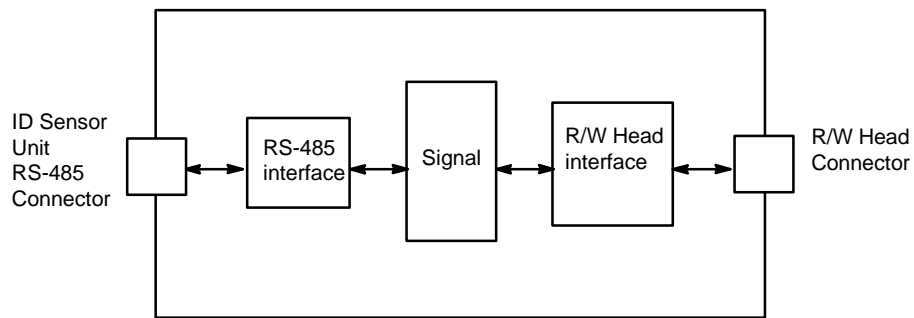
C500-IDS0-V1/IDS02
ID Sensor Specifications
Data Carrier

Item	Specifications		
Model	V600-D2KR01		
Type of memory and capacity	S-RAM, 2K bytes		
Memory format	8 bits/address configuration		
Memory backup	Backed up by a built-in lithium battery (not user-replaceable) Backup period: 8 years (at -25% to 70%C) Replace Data Carrier within 8 years of date of production.		
Date of production	Registered when Data Carrier is shipped.		
Read/write distance (stationary)	10 to 35 mm (at +10 mm max. center displacement)		
Read/write distance (moving)	20 to 35 mm		
Maximum speed of travel	Number of bytes transferred	1 byte	32 bytes
	When Auto Read is executed	50 m/minute	15 m/minute
	When Auto Write is executed	30 m/minute	10 m/minute
Vibration	Mechanical durability: 10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, for 2 hours each		
Shock	Mechanical durability: 1,000 m/s^2 (approx. 100 G) in X, Y, and Z directions, 10 times each		
Ambient temperature	-25% to 70%C		
Ambient humidity	35 to 95% RH		
Environmental resistance	IEC Standard IP67		
Dimensions	86(W)x54(H)x20(D) mm		
Weight	170 grams max.		

Read/Write Head

Item	Specifications
Model	V600-H06
Insulation resistance	50 MW (at 500 VDC) between cable terminals and housing
Dielectric strength	500 VAC 50/60 Hz for 1 minute between cable terminals and housing
Vibration	Mechanical durability: 10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, for 2 hours each
Shock	Mechanical durability: 1,000 m/s^2 (approx. 100 G) in X, Y, and Z directions, 10 times each
Ambient operating temperature	-25% to 70%C
Humidity	35 to 95% RH
Environmental resistance	IEC Standard IP67
Dimensions	100(W)x70(H)x30(D) mm
Cable length	10 m
Weight	350 grams max. (Read/Write Head only) 1 kilogram max. (including cable)

ID Adapter Specifications

Ratings   All ratings conform to those of all C-series Programmable Controllers.

Characteristics

Item	Specifications
Number of words occupied	No I/O word is occupied
Power for external supply	24 VDC 450 mA max.
Internal current consumption	5 VDC is not consumed
Dimensions	34.5(W)x250(H)x93(D) mm
Weight	550 grams max.

Appendix C
ASCII Conversions

This appendix gives data conversions for ASCII characters. The decimal, binary and hexadecimal equivalents are given.

Extended ASCII to Binary and Hexadecimal

The following table gives the conversions for the standard ASCII character set to both binary and hexadecimal. In the Programmable Controller, all ASCII data is stored in it's hexadecimal equivalent.

Bits 0 to 3		Bits 4 to 7											
BIN		0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
	HEX	2	3	4	5	6	7	A	B	C	D	E	F
0000	0	Space	0	@	P	`	p		0	@	P	`	p
0001	1	!	1	A	Q	a	q	!	1	A	Q	a	q
0010	2	"	2	B	R	b	r	"	2	B	R	b	r
0011	3	#	3	C	S	c	s	#	3	C	S	c	s
0100	4	$	4	D	T	d	t	$	4	D	T	d	t
0101	5	%	5	E	U	e	u	%	5	E	U	e	u
0110	6	&	6	F	V	f	v	&	6	F	V	f	v
0111	7	'	7	G	W	g	w	'	7	G	W	g	w
1000	8	(	8	H	X	h	x	(	8	H	X	h	x
1001	9	)	9	I	Y	i	y	)	9	I	Y	i	y
1010	A	*	:	J	Z	j	z	*	:	J	Z	j	z
1011	B	+	;	K	[	k	{	+	;	K	[	k	{
1100	C	,	<	L	\	l	|	,	<	L	\	l	|
1101	D	-	=	M	]	m	}	-	=	M	]	m	}
1110	E	.	>	N	^	n	«	.	>	N	^	n	
1111	F	/	?	O	_	o	~	/	?	O	_	o	~

ASCII to Decimal

The following table gives the decimal equivalents of the range of English language ASCII characters. The Programmable Controller stores ASCII data in hexadecimal form. Care should be taken when inputting ASCII data in equivalent forms.

ASCII	Decimal	ASCII	Decimal	ASCII	Decimal	ASCII	Decimal	ASCII	Decimal	ASCII	Decimal
Space	32	0	48	@	64	P	80	'	96	p	112
!	33	1	49	A	65	Q	81	a	97	q	113
"	34	2	50	B	66	R	82	b	98	r	114
#	35	3	51	C	67	S	83	c	99	s	115
$	36	4	52	D	68	T	84	d	100	t	116
%	37	5	53	E	69	U	85	e	101	u	117
&	38	6	54	F	70	V	86	f	102	v	118
'	39	7	55	G	71	W	87	g	103	w	119
(	40	8	56	H	72	X	88	h	104	x	120
)	41	9	57	I	73	Y	89	i	105	y	121
*	42	:	58	J	74	Z	90	j	106	z	122
+	43	;	59	K	75	[	91	k	107	{	123
,	44	<	60	L	76	\	92	l	108	|	124
-	45	=	61	M	77	]	93	m	109	}	125
.	46	>	62	N	78	^	94	n	110	«	126
/	47	?	63	O	79	_	95	o	111	~	127

Glossary

ASCII code [A(merican) S(tandard) C(ode for) I(nformation) I(nterchange)] A standard computer code used to facilitate the interchange of information among various types of data-processing equipment.

Backplane A base to which Units are mounted to form a Rack. Backplanes provide a series of connectors for these Units along with wiring to connect them to the CPU and Power Supply. Backplanes also provide connectors used for connection to other Backplanes. In some Systems, different Backplanes are used for different Racks; in other Systems, Racks differ only by the Units mounted to them.

backup A copy of existing data which is valuable if the original data is accidentally erased.

bit The smallest piece of information that can be represented on a computer. A bit has the value of either zero or one, corresponding to the electrical signals ON and OFF. A bit is one binary digit.

central processing unit A device that is capable of storing a program and data, and executing the set of instructions contained in the program. In a PC System, the central processing unit executes the program, processes I/O signals, communicates with external devices, etc.

center displacement In this manual, center displacement refers to the degree of misalignment of the center points of the Data Carrier and the Read/Write Head at which data communication is still possible.

CPU An acronym for central processing unit.

CPU Backplane A Backplane used to create a CPU Rack.

CPU Rack Part of a Rack PC, the CPU Rack contains the CPU, a Power Supply, and other Units.

Expansion I/O Unit An I/O Unit for a Package-type PC that provides more I/O points to the PC.

flag A bit that is turned ON and OFF automatically by the system in order to provide status information.

hexadecimal A number system used to represent numbers in base 16 with digits 0,1,2...9,A,B...F.

Intelligent I/O Unit	A Unit, such as an ASCII Unit or Ladder Program I/O Unit, that is equipped with its own CPU and can be programmed.
I/O devices	The devices which are connected to the terminals on I/O Units, Special I/O Units, or Intelligent I/O Units. I/O devices may be part of the Control System if they function to help control other devices, or they may be part of the controlled system if they interact directly with it.
I/O Unit	The most basic type of Unit mounted to a Backplane. I/O Units include Input Units and Output Units, each of which is available in a range of specifications. I/O Units do not include Special I/O Units, Link Units, etc.
PC	An acronym for Programmable Controller.
Power Supply	A Unit that mounts to a Backplane in a Rack PC. It provides power at the voltage required by the other Units on the Rack.
Programmable Controller	A small, computer-like device that can control peripheral equipment, such as an electric door or quality control devices, based on programming and peripheral input devices. Any process that can be controlled using electrical signals can be controlled by a PC. PCs can be used independently or networked together into a system to control more complex operations.
register/registered	Storing text and graphics in the RAM/ROM card from a personal computer or the ASCII Unit. Graphics that have been written to the RAM/ROM card are referred to as registered messages.
Remote I/O Slave Rack	A Backplane to which is mounted a Remote I/O Slave Unit. This Rack can be located a considerable distance from the CPU Rack, with the only connection being a cable connecting the Slave to a Remote I/O Master Unit mounted on the CPU Rack or on an Expansion I/O Rack.
Remote I/O Slave Unit	A Remote I/O Unit that is accessed through a Remote I/O Master Unit.
Remote I/O Unit	A Unit that extends the distance an Expansion I/O Rack can be from the CPU.
RS–485 interface	An industry standard connector for serial communications.
scan time	The time the PC requires to perform internal operations such as resetting the watchdog timer, reading the program, receiving input data, sending output data, and executing instructions. Scan time is monitored by the watchdog timer within the PC. If scan time takes longer than specified, an error message may be generated, or the CPU may stop. Scan times differ according to

the configuration of the system.

Special I/O Unit A dedicated Unit that is designed for a specific purpose. Special I/O Units include Position Control Units, High-speed Counters, Analog I/O Units, etc.

system configuration The arrangement in which Units in a System are connected. This term refers to the arrangement and wiring of all the devices needed to compose the System. In OMRON terminology, "system configuration" describes the arrangement and connection of the Units comprising a Control System that includes one or more PCs.

Unit In OMRON PC terminology, the word Unit is capitalized to indicate any product sold for a PC System. Though most of the names of these products include the word Unit, this is not always so; for example, a Remote Terminal is referred to as a Unit. Context generally makes the meaning of this word clear.

word In digital circuits, a group of bits. Usually a word consists of four, eight, or sixteen bits. In C-series PCs, a word consists of sixteen bits. Words can be used to store data, or they can be used for I/O.

work bits Bits in the IR area that are not being used for input or output. These bits can be used in the program in any way desired.

write protection Write protection is a means of ensuring that specified information written to the Data Carrier cannot be altered or erased.

Index

OMRON Sales Offices

BRASIL

OMRON ELECTRÔNICA DO BRASIL LTDA.
Rua Acrus, 220–Jd. Aeroporto CEP 04612–São Paulo
Tel: (11)542–1611/Fax: (11)241–0736
Tlx: 1154121 OMRO BR

CANADA

OMRON CANADA INC.
350 Middlefield Road, Scarborough, Ontario M1S 5B1
Tel: (416)298–9988/Fax: (416)293–1816/Tlx: 065–25360

Montreal

OMRON CANADA INC. (Regional Office)
227 Place, Frontenac, Pointe Claire, Quebec H9R 4Z7
Tel: (514)694–6361

U.S.A.

OMRON ELECTRONICS INC.
1 East Commerce Drive, Schaumburg, IL 60173
Tel: (708)843–7900/Fax: (708)843–8568
Tlx: 910–291–0426 OMRONELEC SHBU

Atlanta

3300 N.E. Expressway, Suite 3W Atlanta, GA 30341
Tel: (404)451–2370/Fax: (404)451–7504

Boston

175 Andover Street, Danvers, MA, 01923
Tel: (617)774–6501/Fax: (617)774–310

Cincinnati

4350 Glendale–Miford Road Suite 110 Cincinnati, OH 45242
Tel: (513)733–8334/Fax: (513)733–8363

Los Angeles

2050 S. Santa Cruz st. Suite 110 Anaheim, CA 92805
Tel: (714)978–6008/Fax: (714)978–0192

Philadelphia

487 Devon Park Drive, Suite 214, Wayne, PA 19087
Tel: (215)964–9376/Fax: (215)964–8379

San Francisco

20045 Stevens Creek Blvd. Suite 1B, Cupertino, CA 95014
Tel: (408)255–9231/Fax: (408)996–3854
Tlx: (910)338–0503

AUSTRALIA

OMRON ELECTRONICS PTY. LTD.
Private Bag No. 12, Frenchs Forest Post Office
Frenchs Forest, NSW 2086
Tel: (02)975–1511/Fax: (02)975–1518

HONG KONG

OMRON ELECTRONICS ASIA LTD.
Unit 1510–12, Silvercord Tower 1
30, Canton Road, Tsimshatsui, Kowloon
Tel: 7233827/Fax: 7231475/Tlx: 41092 OMRON HX

INDONESIA

P.T. INTERPANCA WIRA DINAMIKA
JI. Pinangsia Timur No. 48
Jakarta 11110 Indonesia
Tel: 6900601 (4 lines)/Fax: 6499080/Tlx: 42951–IA

JAPAN

OMRON Corporation
FA Division H.Q.
13F Gotenyama Mori Bldg.
4–7–35, Kitashinagawa, Shinagawa–ku,
Tokyo 140 Japan
Tel: (03)5488–3183/Fax: (03)5488–3271

KOREA

OMRON KOREA CO., LTD.
Room No. 802, New Seoul Bldg., #618–3 Sin Sa–Dong,
Kang Nam–Gu Seoul
Tel: (822)512–0871/Fax: (822)511–9279

MALAYSIA

PRECICON SDN BHD
9th Fl., West Wing, Wesma Tractors, 7 Jalan SS16/1,
Subang Jaya, 47500 Petaling Jaya Selangor Darul Eh-
san
Tel: 7334450/Fax: 7335303/Tlx: MA36227

NEW ZEALAND

CONTROLTECH SYSTEMS LTD.
6A Rakino Way, Mt. Wellington, Auckland
Tel: 60–9650/Fax: 60–9572/Tlx: 21570

PAKISTAN

KARIKO
7, Scotch Corner, Upper Mall Lahore
Tel: 372536/370748/Tlx: 4944 CTOLH PK

PHILIPPINES

P.I. INDUSTRIAL SUPPLY CO., INC.
682–684 Rizal Avenue, Manila
Tel: 49–86–20/Tlx: 63299 PIELSU PN

SINGAPORE

OMRON SINGAPORE (PTE.)LTD.
5 Little Road #08–01, Cemtex Industrial Bldg, 1953
Tel: 2830006/Fax: 2850682/Tlx: RS23403

TAIWAN

OMRON TAIWAN ELECTRONICS INC.
MAIN OFFICE
6F. Home Young Bldg, No. 363, Fu-Shing N. Rd.
Taipei, Taiwan, R.O.C.
Tel: 2–716–3745/Fax: 2–712–6712

THAILAND

OMRON–TRISAK CO., LTD.
No. 248 Rachadaphisek Rd. Huay Kwang Bangkok
Tel: 2224380/Fax: 2761966/Tlx: 87133 TRITRAD TH

OMRON Sales Offices (Continued)

────────── **EUROPE** ──────────

AUSTRIA

OMRON ELECTRONICS Ges.m.b.H.
Camillo Sitte Gasse 6–8, A–1152 Wien
Tel: (0222)9276060/Fax: (0222)9276067/Tlx: 134230

BELGIUM

OMRON ELECTERONICS N.V./S.A.
Stationsstraat 24, B–1720 Groot–Bijgaarden
Tel: (02)4662480/Fax: (02)4660687/Tlx: 62150

DENMARK

OMRON ELECTRONICS A/S
Grønrisvej
DK-2450 Copenhagen SV
Tel: 45-36-442111/Fax: 45-36-442188

FINLAND

OMRON ELECTRONICS OY
Metsanpo jankuja 5
SF–02130 ESPOO
Tel: 001–358–0–460511/Fax: 001–358–0–460136

FRANCE

OMRON ELECTRONICS S.a.r.l.
19, rue du Bois Galon,
BP 33
94121 Fontenay–Sous–Bois, Cédex
Tel: (1)48761212/Fax: (1)48760930/Tlx: 264931

GREECE

KALAMARAKIS & SAPOUNAS, S.A.
10, Great Kydonion Street, GR–111 44 Athens
Tel: (01)2235511.12/Tlx: 216736

ITALY

OMRON ELECTRONICS S.r.l.
Viale Certosa 49, 20149 Milano
Tel: (02)32681/Fax: (02)325154

NETHERLANDS

OMRON ELECTRONICS B.V.
Jan Rebelstraat 4, NL–1069 CB, Amsterdam–Osdorp
Tel: (020)196363/Fax: (020)198292

NORWAY

OMRON ELECTRONICS NORWAY A/S
Ole Deviks vei 4
P.O. Box 109 Bryn, N–0611 OSLO 6
Norway
Tel: +47(2)65 75 00/Fax: +47(2)65 83 00

PORTUGAL

OMRON ELECTRONICS LDA
Av. Miguel Bombarda 70–2e 1000 LISBON
Tel: (351)1771170/Fax: (351)1770976

SPAIN

OMRON ELECTRONICS S.A.
c/Arturo Soria 95/99, E–28027 Madrid
Tel: (91)4070211/Fax: (91)4070883
Tlx: 49190 OMRES E

SWEDEN

OMRON ELECTRONICS A.B.
Musseronvagen 1C, P.O. Box 1223, S–14125 Huddinge
Tel: (08)7460040/Fax: (08)7743095/Tlx: 17484

SWITZERLAND

OMRON ELECTRONICS AG
Gewerbestrasse 7, 6330 Cham
Tel: (042)416441/Fax: (042)416445/Tlx: 862118

U.K.

IMO PRECISION CONTROLS LTD
1000 North Circular Road, Staples Corner GB–London
NW2 7JP
Tel: (081)4526444/Fax: (081)4502274/Tlx: 28514

W. GERMANY

OMRON ELECTRONICS G.m.b.H.
Oberrather Strasse, 6, D–4000 Düsseldorf 30
Tel: (0211)65020/Fax: (0211)6502107 or (0211)6502149
Tlx: 8581890

────────── **MIDDLE EAST & AFRICA** ──────────

BAHRAIN

EBRAHIM AL–SHAKAR & SONS
Manama 304
Tel: 254418/Tlx: 8588 ESSCO–BN

IRAN

IRAN BARGH ELECTRICAL CO., LTD.
P.O. Box 11365 – 3517 Tehran 15718
Tel: 213261/Tlx: 213636 TPBA IR

KENYA

SWITCHGEAR & CONTROLS, LTD.
P.O. Box 42503, Nairobi
Tel: 540381/Tlx: 25522

KUWAIT

AMMAR & PARTNERS ELECTRICAL CO
P.O. Box 1871, 13019 Safat
Tel: 817322/Fax: 4841818/Tlx: 44486 APPECO

MOROCCO

MEST COMPOSANTS ELEC.
4, Rue De Provins Casablanca
Tel: 246390/Tlx: 26902 MEST M

SAUDI ARABIA

TAYSEER AL SHEIKH CORPN
P.O. Box 19865, Jeddah 21445
Tel: 2–6717285/Fax: 2–6721910
Tlx: 606292 TAYSCO SJ

TUNISIA

AXAFRICE
8, Avenue du Quebec, 1001 Tunis
Tel: 1–255938/Tlx: 14932

TURKEY

TEKNIK MALZEME SATIS VE TICARET A.S.
Hayriye Caddesi 16, 80060 Galatasaray, Istanbul
Tel: 1–1499340/Fax: 1–1430258/Tlx: 1831258

U.A.E.

DEIRA GENERAL MARKETING
P.O. Box 11370, Dubai
Tel: 224554/Tlx: 48557 DEGAMEM

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

Cat. No. W180−E1−1

Revision code

The following table outlines the changes made to the manual during each revision. Page numbers refer to previous version.

Revision code	Date	Revised content
1	May,1990	Original production
	Dec,1990	Converted to the current format based on the information contained in the original manual. No changes to content were made.