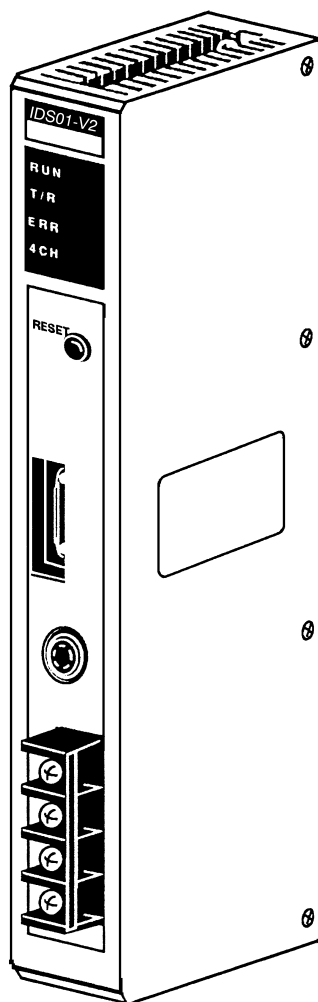




C500-IDS01-V2/IDS02-V1 C500-IDS21/IDS22 ID Sensor

Operation Guide

Revised September 1999



Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.


ERRORS AND OMISSIONS


The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.


Notice:

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

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

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

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

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

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, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PC” means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

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

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

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

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No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

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About this Manual:

This manual describes the installation and operation of two contactless information detection systems: the C500-IDS01-V2/IDS02-V1 Electromagnetic Inductor ID Sensors and the C500-IDS21/IDS22 Microwave ID Sensors. Both systems are designed to read information from or write information to a Data Carrier mounted to a moving workpiece, and both have long-range detection and high-speed data transfer capabilities. Refer to the appropriate R/W Head and Data Carrier Operation Manuals for the specifications and operation of the R/W Head and Data Carrier. The table below shows a list of manuals available for the V600/V620 FA ID System.

Name	Catalog no.
Handheld ID Controller Operation Guide	Z43
V600 FA ID System Serial Interface Operation Manual	Z44
V600 FA ID System Parallel Interface Operation Manual	Z45
FA ID System V620 ID System with Serial Interface System Manual	Z68
FA ID System V620 ID System with Parallel Interface System Manual	Z69
V600/620 FA ID System Operation Manual	Z83
V600 FA ID System R/W Heads and SRAM Data Carriers Operation Manual	Z95
V600 FA ID System R/W Heads and EEPROM Data Carriers Operation Manual	Z96
V600 FA ID System R/W Heads and SRAM Data Carriers Supplement	Z98
V600 FA ID System R/W Heads and EEPROM Data Carriers Supplement	Z99

Before operating an ID Sensor system, 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 systems. This section also notes some of the differences between the two systems.

Section 2 contains information on operation, including switch settings, bit allocation, communication commands, and basic programming concepts.

Section 3 includes example programs that illustrate data transfer between the Unit and the CPU; mounting functions and timing considerations are also covered.

Section 4 contains information on maintenance and troubleshooting.

Appendices A, B, and C, a Glossary, and an Index are also included.



WARNING

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

PRECAUTIONS

This section provides general precautions for using the C500-IDS□□ ID Sensors and related devices.

The information contained in this section is important for the safe and reliable application of C500-IDS□□ ID Sensors. You must read this section and understand the information contained before attempting to set up or operate a PC system.

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1 Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of installing control devices.
- Personnel in charge of designing control systems.
- Personnel in charge of managing control systems and facilities.

2 General Precautions


The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.


Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.


This manual provides information for operating the ID Sensor system. Be sure to read this manual before attempting to use the ID Sensor systems and keep this manual close at hand for reference during operation.


Since the V620 ID Sensor system uses microwaves of 2,450 MHz, permission is required from the local electrical communications regulatory board before installing the system.


 **WARNING** It is extremely important that ID Sensor systems be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying ID Sensor systems to the above-mentioned applications.


3 Safety Precautions

 **WARNING** Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.




 **WARNING** Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.

 **WARNING** Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.

 **WARNING** Do not throw the Data Carrier into fire or heat the Data Carrier to a temperature exceeding 100°C. Doing so may cause ignition or burning of the built-in lithium battery.

 **WARNING** Do not short the battery terminals or charge, disassemble, heat, or incinerate the battery. Doing any of these may result in leakage, rupture, heat generation, or ignition of the battery.


4 Operating Environment Precautions


-  **Caution** Do not operate the ID Sensor system in the following locations:
- Locations subject to direct sunlight.
 - Locations subject to temperatures or humidity outside the range specified in the specifications.
 - Locations subject to condensation as the result of severe changes in temperature.
 - Locations subject to corrosive or flammable gases.
 - Locations subject to dust (especially iron dust) or salts.
 - Locations subject to exposure to water, oil, or chemicals.
 - Locations subject to shock or vibration.
-  **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations:
- Locations subject to static electricity or other forms of noise.
 - Locations subject to strong electromagnetic fields.
 - Locations subject to possible exposure to radioactivity.
 - Locations close to power supplies.
-  **Caution** The operating environment of the ID Sensor system can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the ID Sensor system. Be sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

5 Application Precautions

Observe the following precautions when using the ID Sensor system.

- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.
- Interlock circuits, limit circuits, and similar safety measures in external circuits (i.e., not in the Programmable Controller) must be provided by the customer.

-  **WARNING** Always heed these precautions. Failure to abide by the following precautions could lead to serious or possibly fatal injury.
- Always connect to a ground of 100 Ω or less when installing the ID Sensor systems. Not connecting to a ground of 100 Ω or less may result in electric shock.
 - Always turn OFF the power supply to the PC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
 - Mounting or dismounting I/O Units, CPU Units, Memory Cassettes, or any other Units.
 - Assembling the Units.
 - Setting DIP switches or rotary switches.
 - Connecting cables or wiring the system.
 - Connecting or disconnecting the connectors.

 **Caution** Failure to abide by the following precautions could lead to faulty operation of the PC or the system, or could damage the PC or PC Units. Always heed these precautions.

- Always use the power supply voltages specified in the operation manuals. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Do not apply voltages to the Input Units in excess of the rated input voltage. Excess voltages may result in burning.
- Do not apply voltages or connect loads to the Output Units in excess of the maximum switching capacity. Excess voltage or loads may result in burning.
- Disconnect the functional ground terminal when performing withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in the relevant manuals. Incorrect tightening torque may result in malfunction.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Be sure that the terminal blocks, Memory Units, expansion cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Check switch settings, the contents of the DM Area, and other preparations before starting operation. Starting operation without the proper settings or data may result in an unexpected operation.
- Check the user program for proper execution before actually running it on the system. Not checking the program may result in an unexpected operation.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
 - Changing the operating mode of the PC.
 - Force-setting/force-resetting any bit in memory.
 - Changing the present value of any word or any set value in memory.
- Resume operation only after transferring to the new CPU Unit the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.
- Do not place objects on top of the cables or other wiring lines. Doing so may break the cables.
- When replacing parts, be sure to confirm that the rating of a new part is correct. Not doing so may result in malfunction or burning.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.
- Install the Units properly as specified in the operation manuals. Improper installation of the Units may result in malfunction.

SECTION 1

System Description and Installation

This section describes the features, components, configuration, and installation of two ID Sensor systems: the C500-IDS01-V2/IDS02-V1 Electromagnetic Induction ID Sensor systems and the C500-IDS21/IDS22 Microwave ID Sensor systems. Although similar in appearance and in most aspects described in this manual, the Microwave ID Sensor systems are capable of transmitting data to the Data Carrier over a greater distance than is possible with the Electromagnetic Induction ID Sensor systems.

The C500-IDS01-V2/IDS02-V1 ID Sensor read and write data through a Read/Write (R/W) Head; the C500-IDS21/IDS22 Sensors read and write data through a Read/Write (R/W) Antenna. Throughout this manual, the term R/W Head also refers to a R/W Antenna, unless otherwise indicated. Refer to the V600/620 FA ID System Operation Manual for the specifications and installation conditions of the Data Carrier, R/W Head, and R/W Antenna.

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1-1 System Description

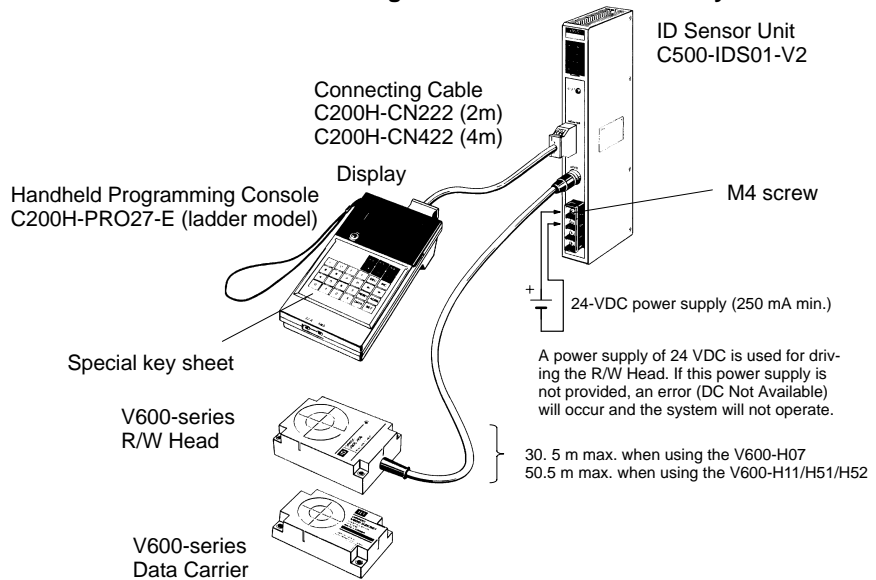
The ID Sensor system is a versatile contactless identification system. A basic ID Sensor system comprises an ID Sensor Unit, a R/W Head or R/W Antenna, and a Data Carrier. The ID Sensor Unit connects to a single V600-series R/W Head.

The ID Sensor Unit mounts to the OMRON C/CV-series 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), or through a R/W Antenna (via microwave). 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-V2 Electromagnetic Induction ID Sensor system; Figure F1-2 illustrates the C500-IDS21 Microwave ID Sensor Unit system.

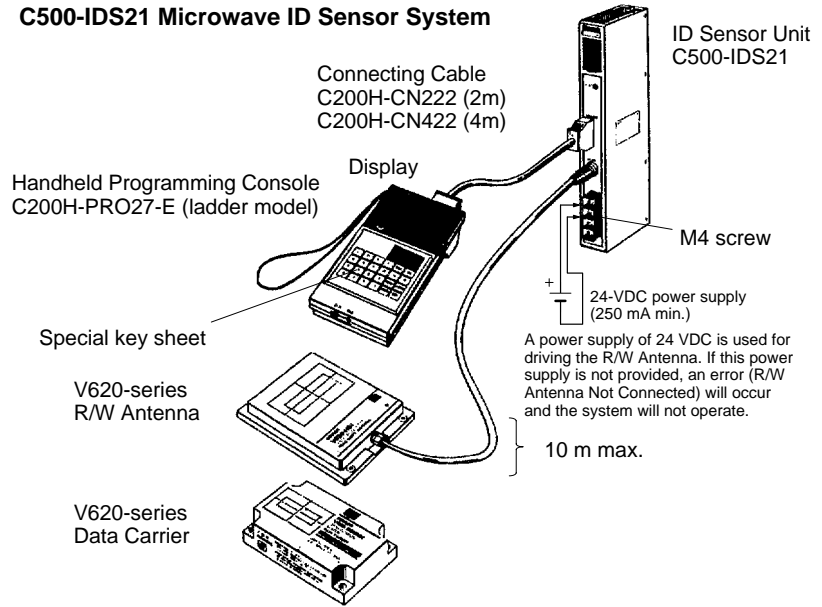
C500-IDS01-V2 Electromagnetic Induction ID Sensor System

F1-1 C500-IDS01-V2 Electromagnetic Induction ID Sensor System



C500-IDS21 Microwave ID Sensor System

F1-2 C500-IDS21 Microwave ID Sensor System



Long-range ID Sensor System

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

Figure F1-3 illustrates the C500-IDS02-V1 Electromagnetic Induction ID Sensor long-range system; Figure F1-4 illustrates the C500-IDS22 Microwave ID Sensor long-range system.

Seven Dedicated Commands Data is transferred between the ID Sensor Unit and the Data Carrier with the following seven dedicated commands:

- Read
- Write
- Auto Read
- Auto Write
- Clear-all
- Auto Read/Write Abort
- Data management (C500-IDS01-V2/C500-IDS02-V1 only)

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 key 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-V2 and C500-IDS02-V1 are compatible with the V600 Electromagnetic Induction ID Controller. The R/W Antenna and Data Carrier for the C500-IDS21 and C500-IDS22 are compatible with the V620 Microwave ID Controller. The C500-IDA02 ID Adapter for the C500-IDS02-V1 is compatible with the V600 Electromagnetic Induction ID Controller. The C500-IDA02 ID Adapter for the C500-IDS02-V1 is compatible with the V620 Microwave 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.

	ID Sensor Unit		Electromagnetic induction			Microwave	
	ID Sensor	ID Adapter	V600-H□□ R/W Head	V600-D□□ R□□ Data Carrier (with built-in battery)	V600-D□□ P□□ Data Carrier (with no built-in battery)	V620-H□□ R/W Antenna	V620-D□□ R□□ Data Carrier (with built-in battery)
Electromagnetic induction	C500-IDS01-V2	---	Yes	Yes	Yes	No	No
	C500-IDS02-V1	C500-IDA02	Yes	Yes	Yes	No	No
	C500-IDS01-V1	---	Yes	Yes	No	No	No
	C500-IDS02	C500-IDA02	Yes	Yes	No	No	No
Microwave	C500-IDS21	---	No	No	No	V620-H01/-H02	V620-D8KR01
	C500-IDS22	C500-IDA22	No	No	No	V620-H01/-H02	V620-D8KR01

Note Refer to the list of applicable manuals in the *About this Manual* section.

Differences between C500-IDS01-V1/C500-IDS02 and C500-IDS01-V2/C500-IDS02-V1

The C500-IDS01-V2 and C500-IDS02-V1, which are updated versions of the C500-IDS01-V1/IDS02, have the following three new features in addition to all the capabilities that the C500-IDS01-V2 and C500-IDS02-V1 possess. The C500-IDS01-V2 and C500-IDS02-V1 are compatible with the C500-IDS01-V1/IDS02.

- 1, 2, 3... 1. Connecting to Data Carrier Incorporating EEPROM
The C500-IDS01-V2 and C500-IDS02-V1 read data from and write data to the V600-D□□P□□ containing an EEPROM. To read data, the user can select the communications distance priority mode or communications

speed priority mode with local communications mode switch 3. Neither of these modes are, however, available when the ID Sensor Unit is connected to the SRAM Data Carrier.

2. New Commands

The C500-IDS01-V2 and C500-IDS02-V1 incorporate data management commands, with which it is possible to check the reliability of the Data Carrier's data. The details of the commands are as follows:

Function	Command	Meaning
Checking of data	MD-K	By adding a check code to the Data Carrier's data, it is possible to detect a data error due to the battery of the Data Carrier that incorporates SRAM, or excessive overwriting operations of the Data Carrier that incorporates EEPROM. Use the MD-K command to calculate and write the check code to the Data Carrier. Use the MD-C command to collate the check code. The MD-K command and MD-C command must be always used together.
	MD-C	
Checking of the number of overwriting operations	MD-L	Check the life of the Data Carrier's EEPROM by counting the number of overwriting operations. The Data Carrier's EEPROM allows a total of 100,000 overwriting operations.
	MD-S	If the maximum number of overwriting operations is written onto the DC in advance, the number of overwriting operations will be decremented every time overwriting is performed on the DC and the remaining number of overwriting operations of the EEPROM DC can be detected. This command is applicable to models with the lot number **55 (shipped in May 1995) and later.

3. Hexadecimal Page Number Display

The page number is displayed in hexadecimal, in which case the rightmost two digits of the address are displayed as the page number.

In the following example, the user has access to address 0A00 or 1000.

C500-IDS01-V2/IDS02-V1

**C500-IDS01-V1/IDS02
C500-IDS21/IDS22**

HEAD 1 PAGE 0A STadrs00 data 00

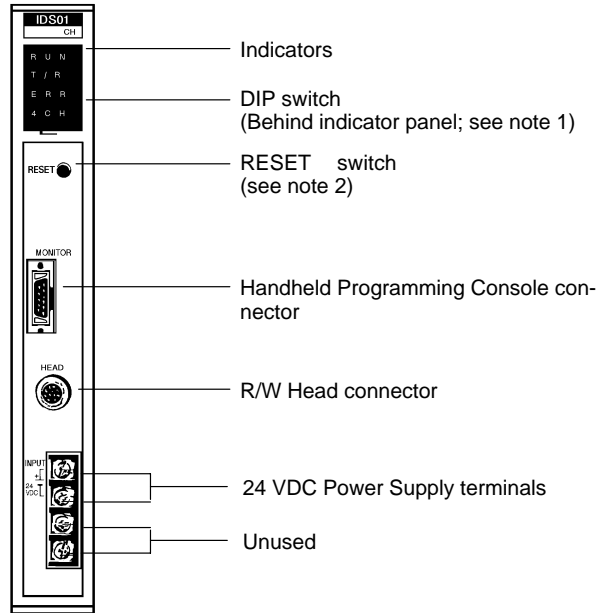
ANT. 1 PAGE 10 STadrs00 data 00

1-3 Components and Indicators

Figure F1-5 the front panel of the C500-IDS01-V2 ID Sensor Unit; it is identical in appearance to the C500-IDS21 ID Sensor Unit.

Front Panel C500-IDS01-V2/IDS21 ID Sensor Unit

F1-5 C500-IDS01-V2/IDS21 ID Sensor Units

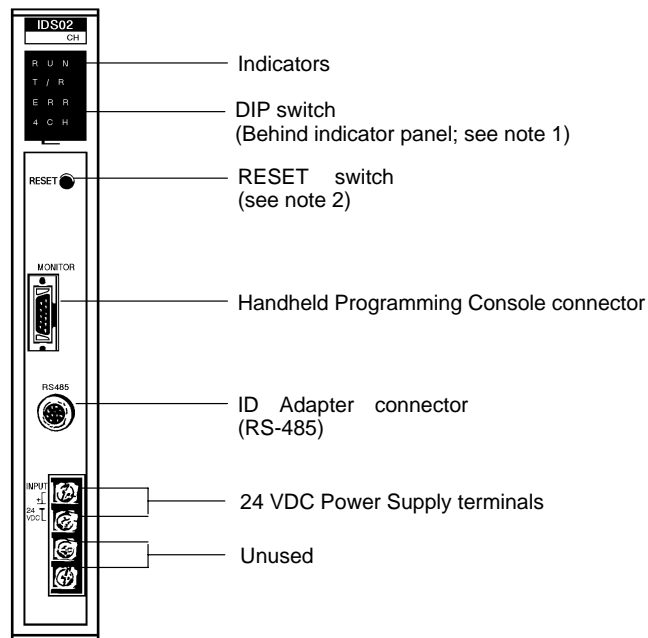


- Note**
1. To gain access to the DIP switches, remove the indicator panel with a standard screwdriver.
 2. Do not press RESET when the T/R indicator is lit. Refer to *p110, note 2* before using the RESET switch.

Figure F1-6 shows the front panel of the C500-IDS02-V1 ID Sensor Unit; it is identical in appearance to the C500-IDS22 ID Sensor Unit.

Front Panel C500-IDS02-V1/IDS22 ID Sensor Unit

F1-6 C500-IDS02-V1/IDS22 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 *p110 note2* before using the RESET switch.

Indicators

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

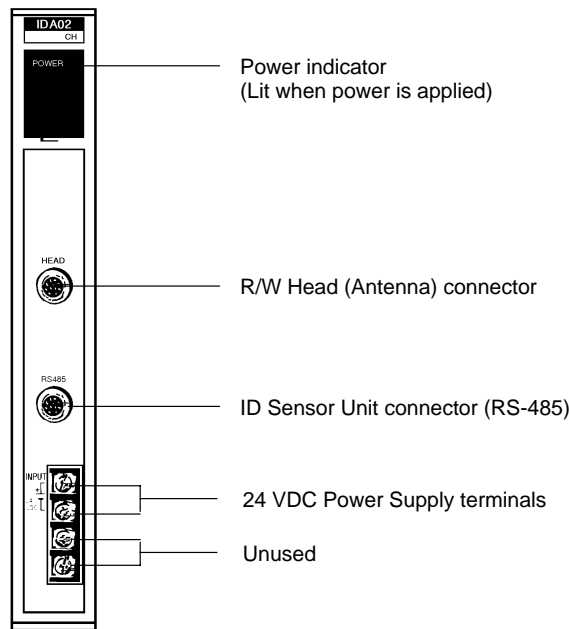
T1–1 ID Sensor Unit Indicators

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 page 17)	Lit when the ID Sensor Unit is set to 4 words
	Unlit when the ID Sensor Unit is set to 2 words

Figure F1–7 shows the front panel of the C500-IDA02 ID Adapter; it is identical in appearance to the C500-IDA22 ID Adapter.

Front Panel C500-IDA02/IDA22 ID Adapter

F1–7 Front Panel C500-IDA02/IDA22 ID Adapter

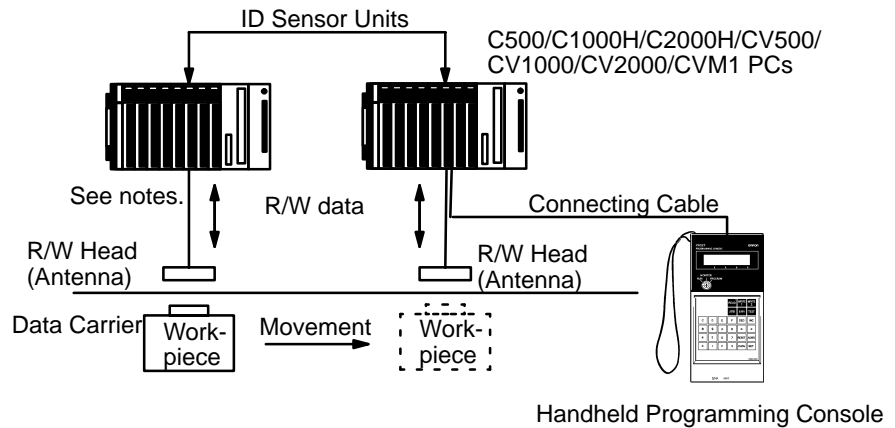


1-4 System Configurations

Figure F1–8 illustrates a typical system configuration of the C500-IDS01-V2 Electromagnetic Induction ID Sensor system and the C500-IDS21 Microwave ID Sensor system. Both systems 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 workpiece 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 Programming Console. Refer to *Section 3-3 Monitoring*.

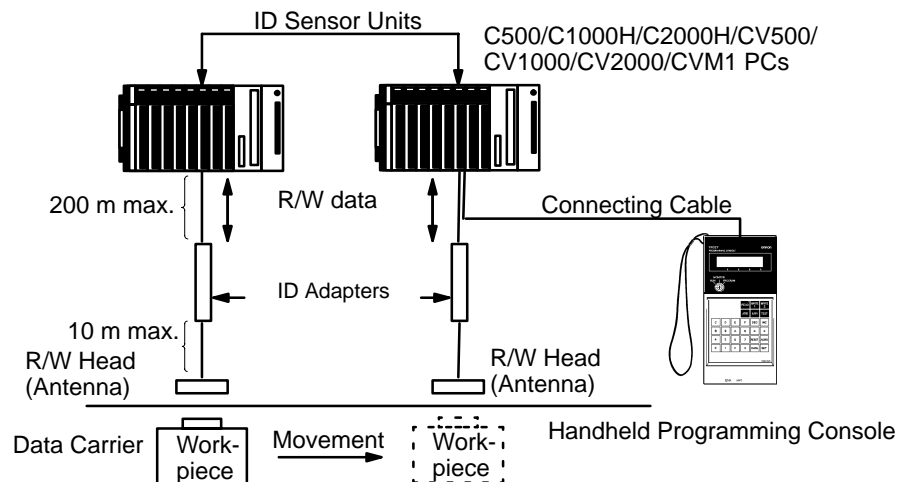
F1-8 C500-IDS01-V2/IDS21 System Configuration



- Note**
1. With the C500-IDS01-V2, the maximum cable length is 30.5 m when using the V600-H07 and 50.5 m when using the V600-H11/H51/H52.
 2. With the C500-IDS21, the maximum cable length is 10 m max.

Figure F1-9 illustrates the C500-IDS02-V1 Electromagnetic Induction ID Sensor and C500-IDS22 Microwave ID Sensor systems.

F1-9 C500-IDS02-V1/IDS22 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.

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 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 through F1-4 connection diagrams.

Connecting the C500-IDS01-V2 and C500-IDS21

- 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” or “ANTENNA”. (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 or Antenna, 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-V1 and C500-IDS22

- 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 10) 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 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; connect the cable of the R/W Antenna to the ANTENNA connector of the C500-IDA22 ID Adapter. (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 to F1–4 information on connecting the Handheld Programming Console.

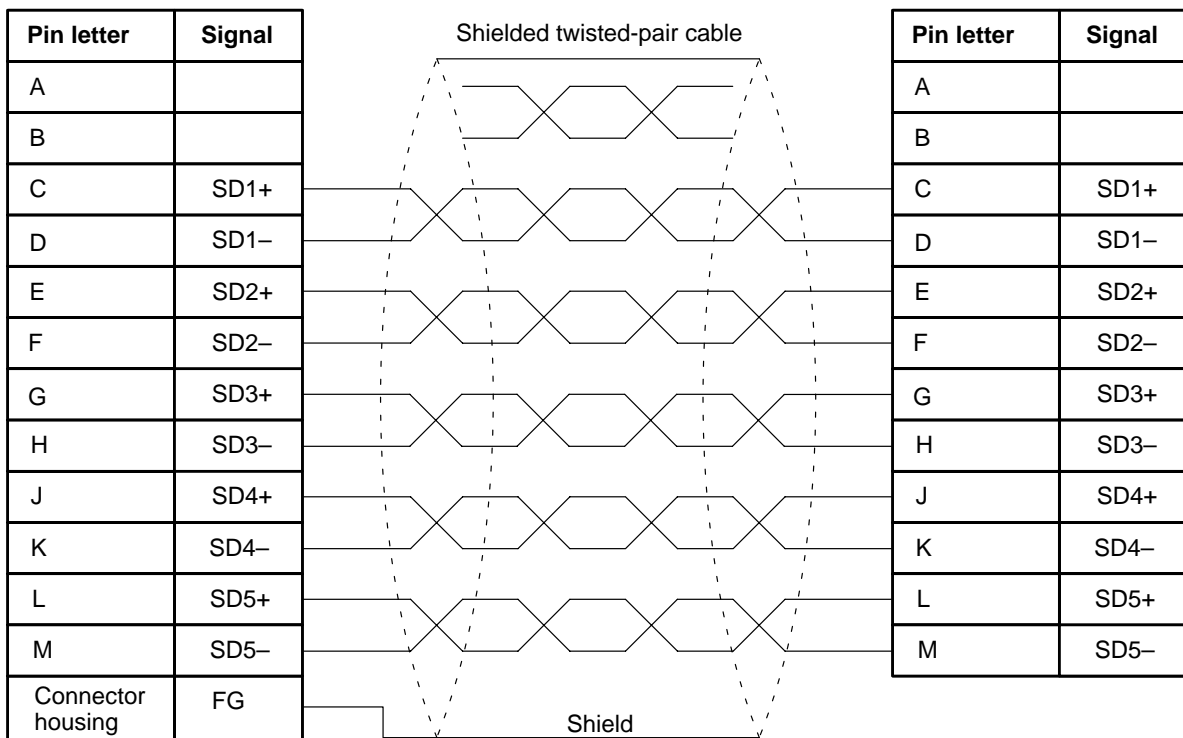
Preparing the RS-485 Cable**Before Assembly**

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 Assignment

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 F1-10 shows pin letters and signal assignments.

F1-10 RS-485 Cable; Pin Letters and Signal Assignments



Note Confirm all pin letters before completing assembly.

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

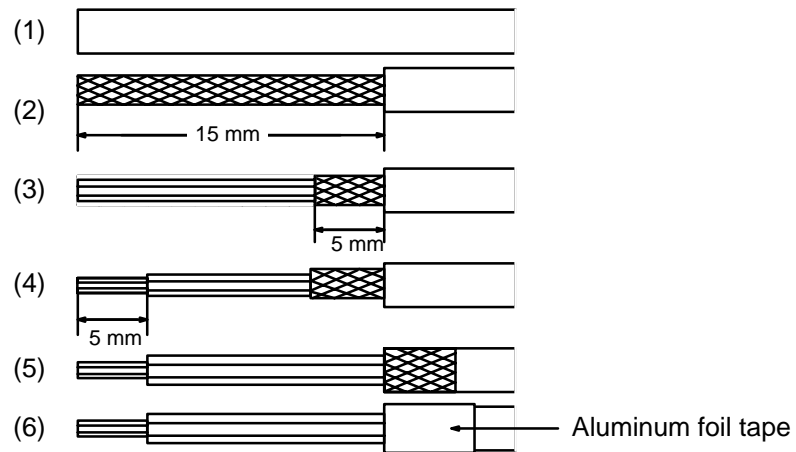
1, 2, 3...

The numbered steps that follow refer to the numbered steps in Figure F1-11.

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.

F1-11 Preparing the ID Sensor End of the RS-485 Cable

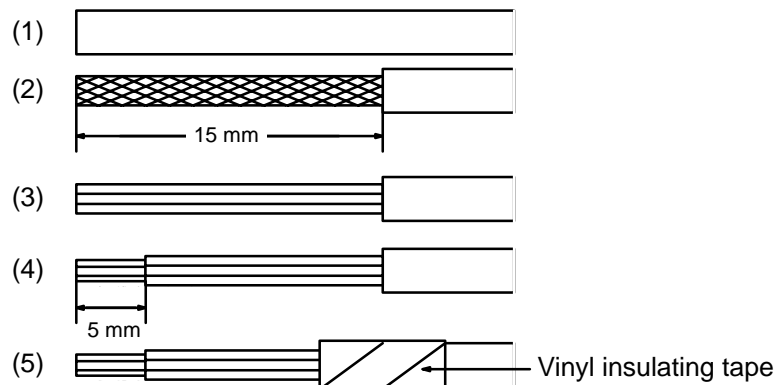


Preparing the ID Adapter End of the RS-485 Cable (insulated shield) 1, 2, 3...

The numbered steps that follow refer to the numbered steps in Figure F1-12.

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.

F1-12 Preparing the ID Adapter End of the RS-485 Cable



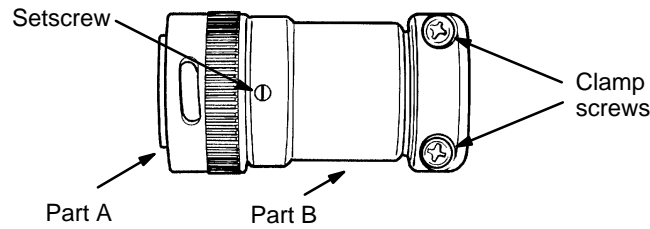
Disassembling the Connectors

1, 2, 3... Refer to Figure F1-13.

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.

- Loosen the 2 clamp screws with a Phillips screwdriver.

F1-13 Disassembling the Connector



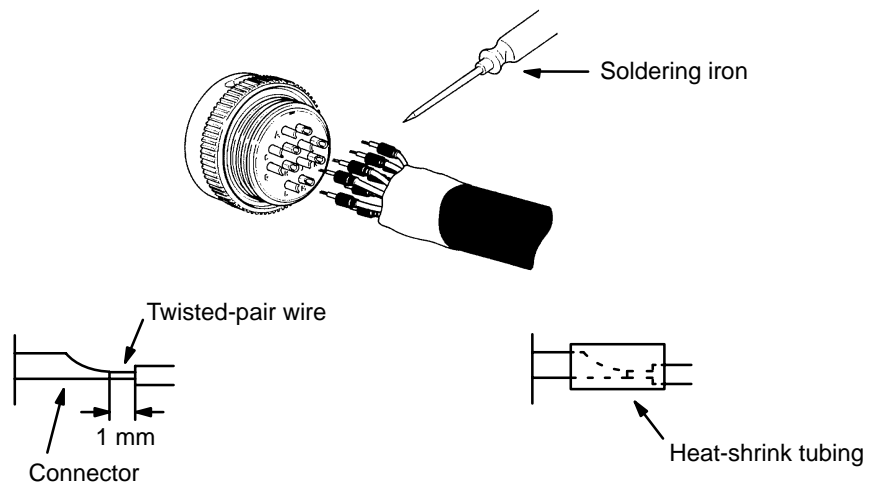
Soldering the Twisted-pair Wire

1, 2, 3...

Refer to Figure F1-14.

- Slide a 10-mm length of heat-shrink tubing (type F, inside diameter 1.5 mm) over each wire, leaving the exposed wire uncovered.
- Tin each wire and connector terminal.
- Solder each wire to its mating pin as shown, leaving 1 mm of exposed wire.
- Slide the heat-shrink tubing over the exposed wire and soldered joints as shown. Shrink the tubing with a heat gun.
- Wind insulating vinyl tape over the unused twisted-pair wire.

F1-14 Soldering the Twisted-Pair Wire to the RS-485 Connector



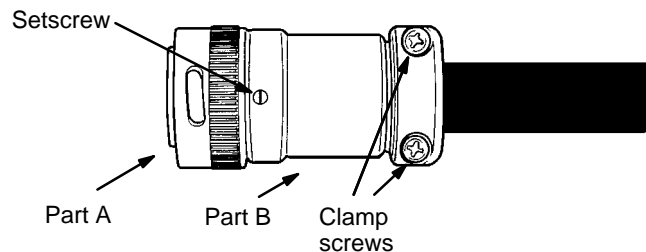
Assembling the Connectors

1, 2, 3...

Refer to Figure F1-15.

- Assemble the connector by inserting connector part A into the Unit and threading part B clockwise onto part A.
- Tighten the 2 setscrews with a small standard screwdriver.
- Fix the cable by tightening the 2 clamp screws with a Phillips screwdriver.

F1-15 Assembled Connector



The Next Step

Once you have completed assembly and installation of the ID Sensor system, turn to Section 2 for details on setup and operation.

1-5-2 Maximum Distance Between ID Sensor Unit and R/W Head

R/W Head	C500				C200	
	IDS01-V1	IDS01-V2	IDS02	IDS02-V1	IDS01	IDS01-V1
V600-H52 (V600-D23P52) (V600-D23P54)	---	50.5 m	---	10 m	---	50.5 m
V600-H51 (V600-D23P61)	---	50.5 m	---	10 m	---	50.5 m
V600-H11 (V600-D23P72) (V600-D23P61) (V600-D2KR16)	---	50.5 m	---	10 m	---	50.5 m
V600-H07 (V600-D23P71) (V600-D23P72)	30.5 m for lots manufactured in or after 1991 and 10 m for lots manufactured before 1991.	30.5 m	10 m	10 m	30.5 m for lots manufactured in or after 1992 and 10 m for lots manufactured before 1992.	30.5 m
V600-H06	10 m	30.5 m	10 m	10 m	10 m	30.5 m

Note With the C500-IDS02 (V1), the maximum cable length between the IDS02 (V1) and IDA02 is 200 m max. The length shown above is a distance between the IDA02 and the R/W Head.

1-5-3 Maximum Distance Between ID Sensor Unit and R/W Antenna

R/W Antenna	C500		C200H-IDS21
	IDS21	IDS22	
V620-H01 (microwave)	10 m	10 m	10 m

Note With the C500-IDS22, the maximum cable length between the IDS22 and IDA22 is 200 m max. This length shown above is a distance between the IDA22 and the R/W Head.

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	16
2-1-1	Two-Word/Four-Word Mode Selection	17
2-2	The User Program	27
2-2-1	Program Examples	29
2-2-2	Communication Commands	31
2-2-3	Data Carrier Memory	42
2-2-4	Write Protection Function	43
2-2-5	Write Protection Examples	44
2-2-6	Data Carrier's Production Date	48
2-2-7	Detection of Data Carrier's Life	49

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

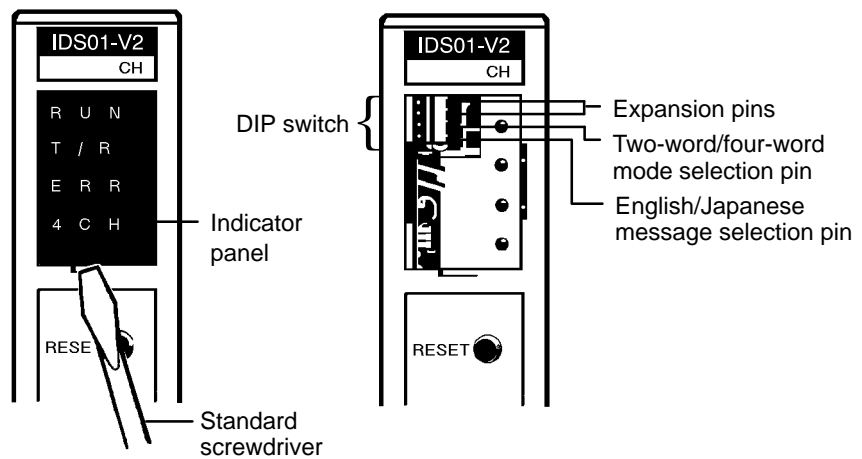


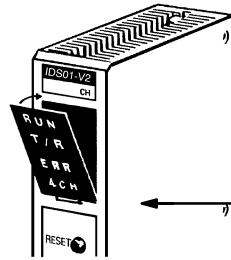
Table T2-1 shows DIP switch settings. Note that OFF is to the right; ON is to the left.

T2-1 DIP Switch Settings

Pin	Function	Pin Setting	
1	Number of words	2	Set to OFF when WRIT(87/191) and READ(88/190) 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(88/190) and WRIT(87/191) instructions.
2	Language of message display		Set to OFF to display messages in Japanese.
			Set to ON to display messages in English.
3	Local communications mode (see note 1)		Set to OFF for communications distance priority mode
			Set to ON for communications speed priority mode
4	Reserved for expansion	Set this pin to OFF.	

Note The user can select the communications distance priority mode or communications speed priority mode with pin 2 of the DIP switch when the C500-IDS01-V2 or C500-IDS02-V1 accesses the EEPROM Data Carrier. Neither of these modes are, however, available when the ID Sensor Unit accesses the SRAM Data Carrier or when the C500-IDS21/IDS22 accesses any Data Carrier, in which case turn pin 2 OFF. Refer to the V600 FA ID Sys-

tem R/W Heads and EEPROM Data Carriers Operation Manual for the communications distance and speed of the EEPROM Data Carrier.



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, C2000H, CV500, CV1000, CV2000, or CVM1 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(87/191) and READ(88/190) instructions	CPU Backplane, Expansion I/O Backplane	WRIT(87/191) and READ(88/190)	2
	Remote I/O Slave Rack	WRIT(87/191) or READ(88/190) cannot be used.	4
Models without WRIT(87/191) and READ(88/190) instructions	CPU Backplane, Expansion I/O Backplane, Remote I/O Slave Rack		

- Note**
- WRIT(87/191): Intelligent I/O Write Instruction
 READ(88/190): Intelligent I/O Read Instruction
 WRIT(87/191) and READ(88/190) transfer up to 255 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(87/191) and READ(88/190) are executed. However, when MOV is executed, I/O refresh is performed according to the scanning operation of the CPU.
 - WRIT(87/191) and READ(88/190) are available provided with either of the following series of CPUs:

Instruction	C500/C1000H/C2000H	CV500/1000/2000/CVM1
WRIT(87/191)	WRIT87	WRIT191
READ(88/190)	READ88	READ190

- 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	---	Data Carrier warning
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. Bit 15 is the "R/W Head disconnect error" for the C500-IDS01-V2/IDS02-V1, and the "R/W Antenna disconnect error" for the C500-IDS21/IDS22.
 2. When the WRIT(87/191) and READ(88/190) 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(87/191) and READ(88/190) instructions), set pin 1 of the ID Sensor Unit's DIP switch to the OFF position for two-word mode. (Refer to *Section 2-1 DIP Switch Setting*.)
 3. The bits enclosed in parentheses operate automatically when the WRIT(87/191) and READ(88/190) instructions are executed. These bits are read-only; do not use for any other purpose.
 4. The status of word n+1 bits 10 through 15 do not change while being monitored by the Programming Console.
 5. 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.
 6. 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(87/191) and READ(88/190) 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(87/191) and READ(88/190) 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	Data Carrier warning	This flag turns ON when the Data Carrier's battery is almost dead. This flag also turns ON when the MD-C command detects a data check error, when the MD-L command detects that the number of overwriting operations reaches 100,000, or when the MD-S command detects that the number of overwriting operations reaches the end of its service life set by the user.
	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-V2.
	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 error	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 24 VDC power is not supplied to the C500-IDS02-V1/IDS22 or IDA02/22.	
	R/W Ant. disconnect error		

Note When the system is reset, word n+1 changes to “FFF9.”

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(87/191) 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.

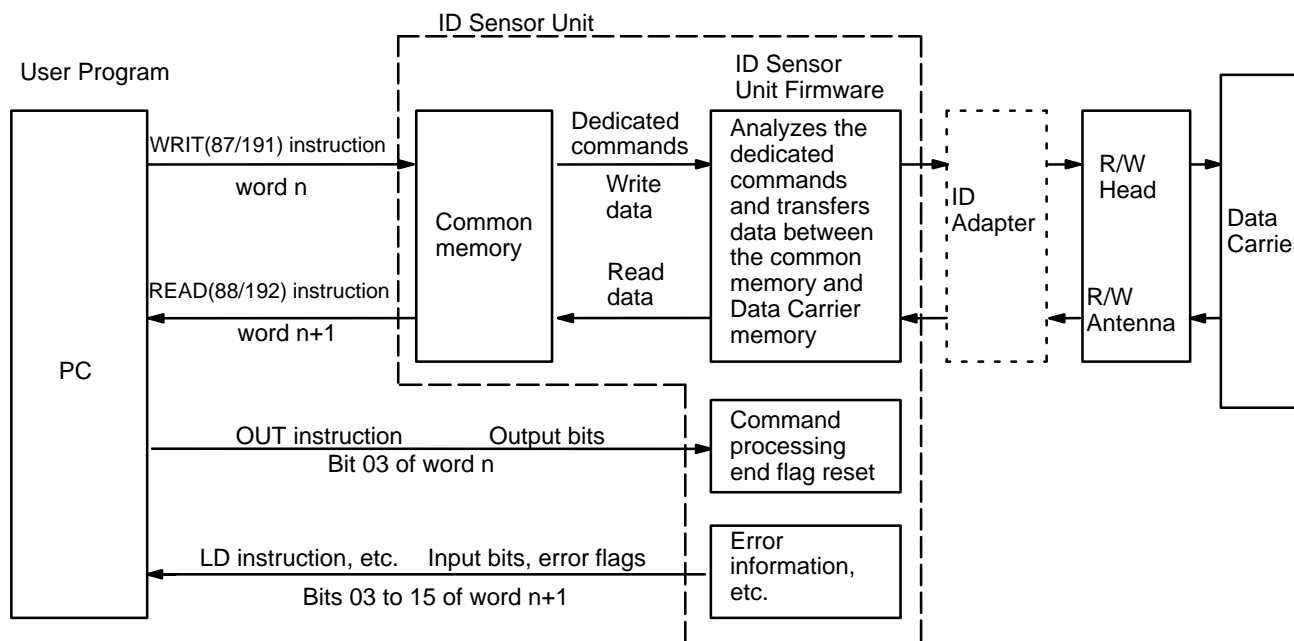
The command processing end flag is not cleared automatically. It is cleared by the command processing end flag reset flag (word n bit 03). Therefore, the operation of the command processing end flag reset flag must be programmed to clear the command processing end flag.

WRIT(87/191) must not be executed while the command processing end flag turns ON.

READ(88/190) 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(88/190) 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.

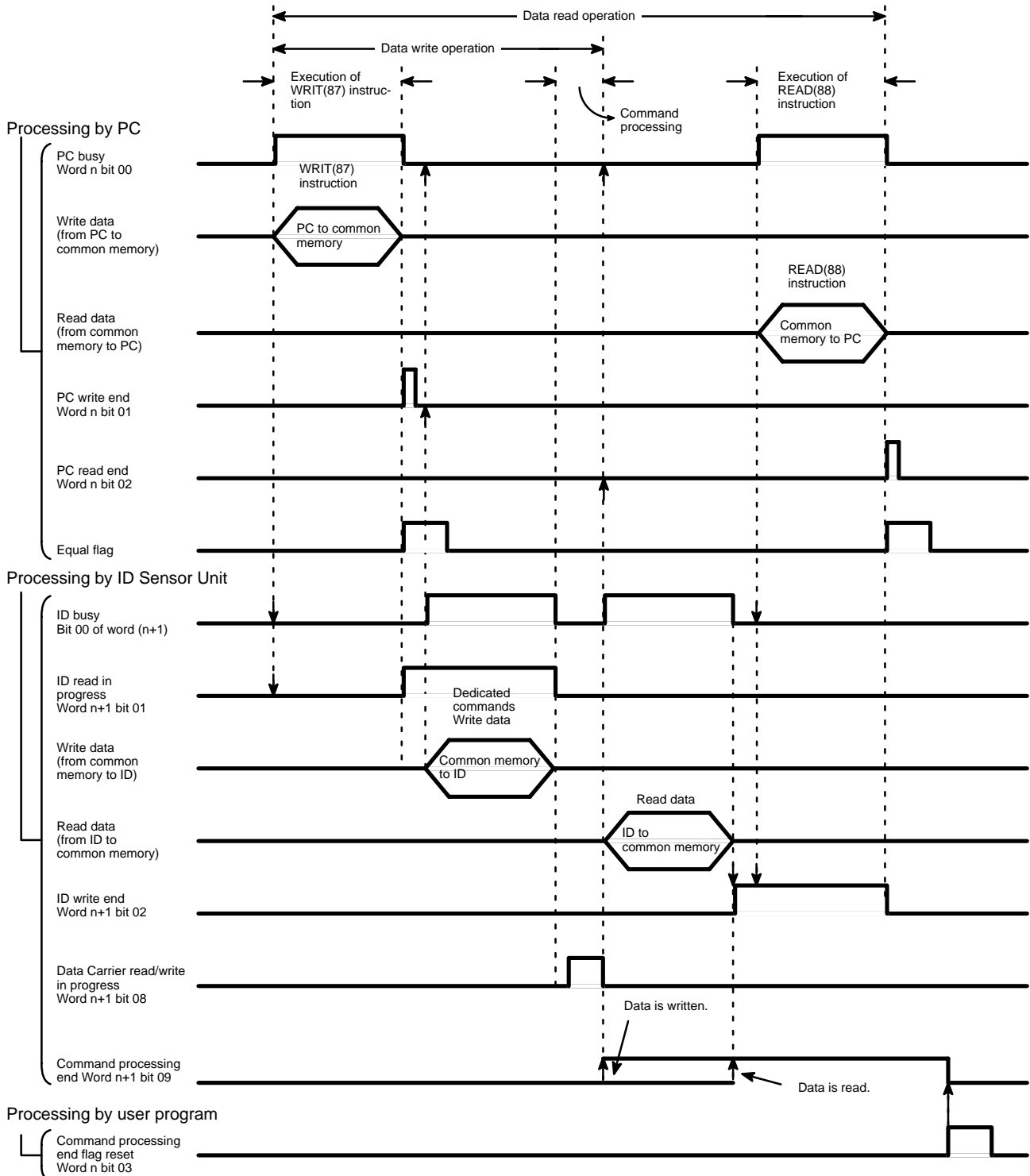
F2–2 Flag Operation when ID Sensor Unit Is Set to Two-Word Mode



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	Data Carrier warning
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 (see note 1) R/W Ant. disconnect error (see note 1)

- Note**
1. Bit 15 is the “R/W Head disconnect error” for the C500-IDS01-V2/IDS02-V1, and the “R/W Antenna disconnect error” for the C500-IDS21/IDS22.
 2. When the WRIT(87/191) and READ(88/190) instructions cannot be used (when the ID Sensor Unit is mounted on a PC that is not provided with WRIT(87/191) and READ(88/190), 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*.)
 3. 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.
 4. 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.

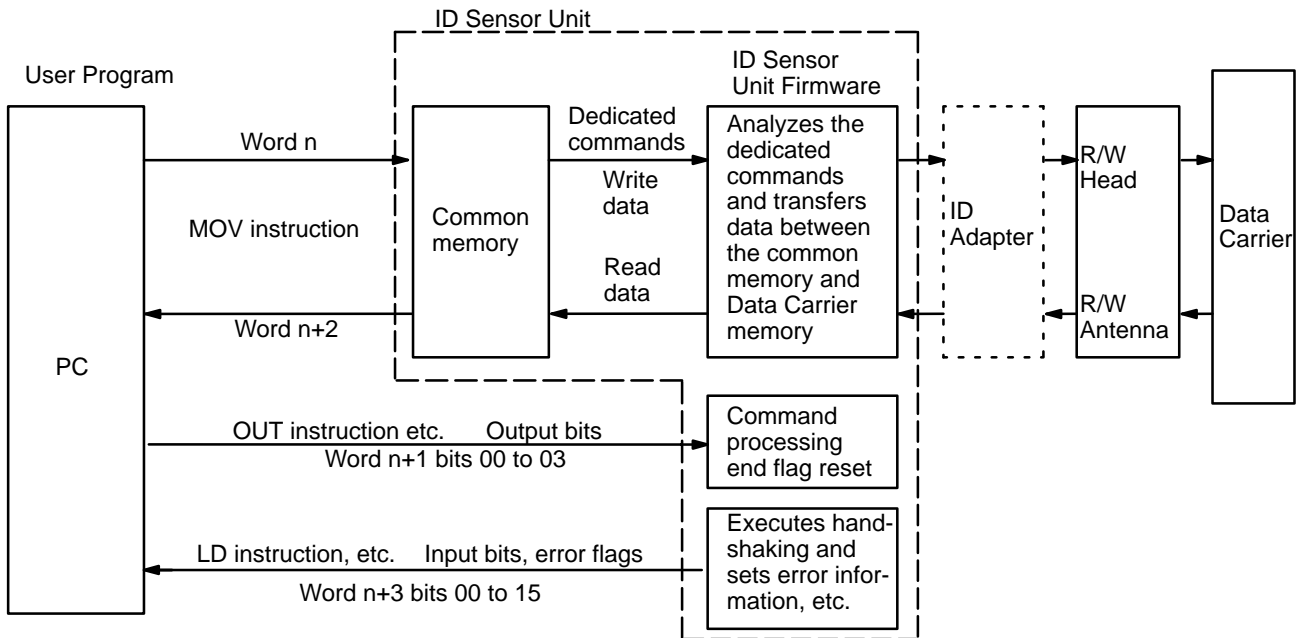
These flags may remain at 1 until immediately before the PC begins writing/reading the next piece of data.

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	Data Carrier warning	This flag turns ON when the Data Carrier's battery is almost dead. This flag also turns ON when the MD-C command detects a data check error or the MD-L command detects that the number of overwriting operations is 100,000.
	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 R/W Ant. 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-V1/IDS21/IDS22 or IDA02/IDA22.	

Flag Operation (Four-Word Operation)

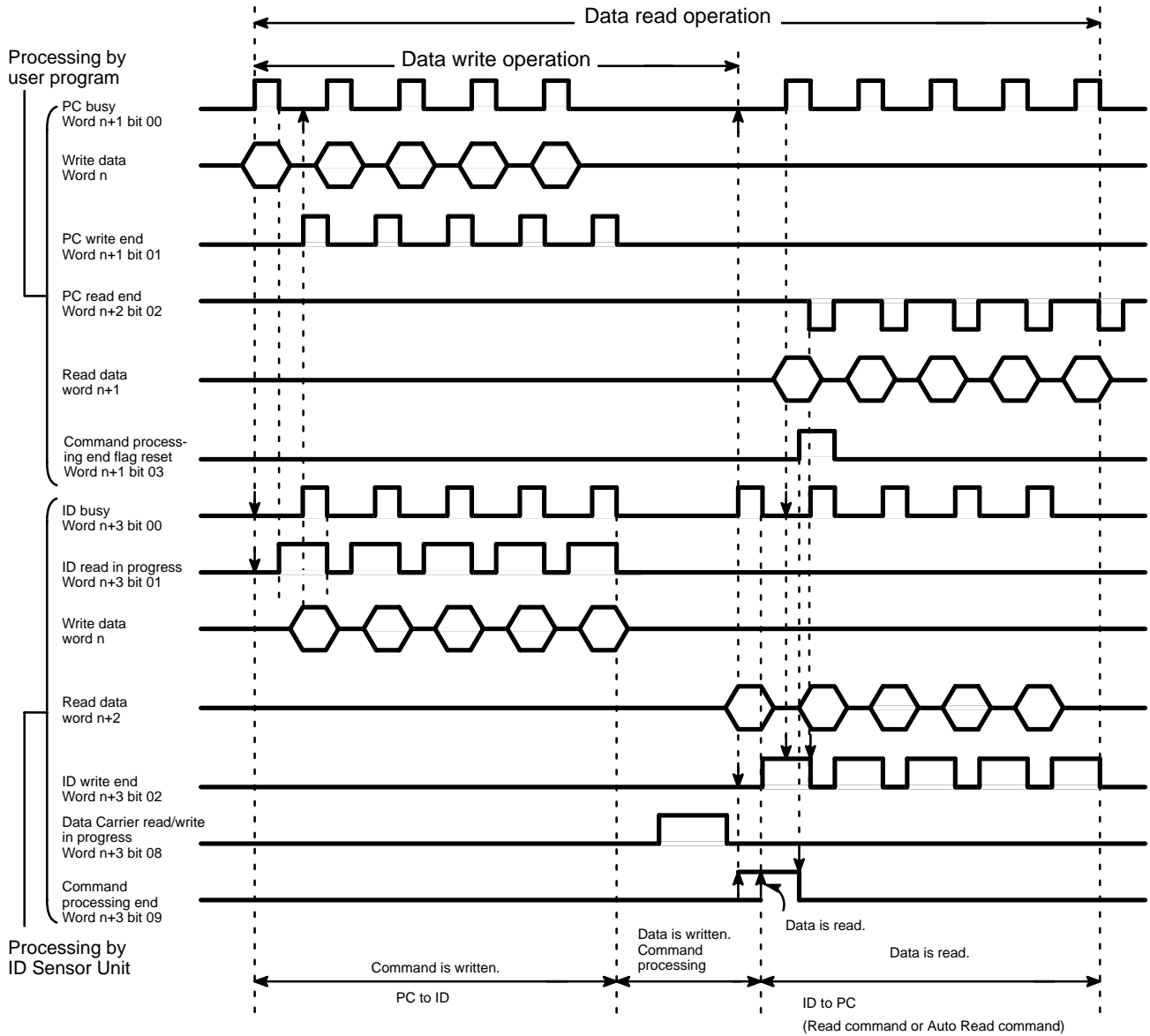
F2-4 Flag Operation when ID Sensor Unit Is Set to Four-Word Mode



**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*.)

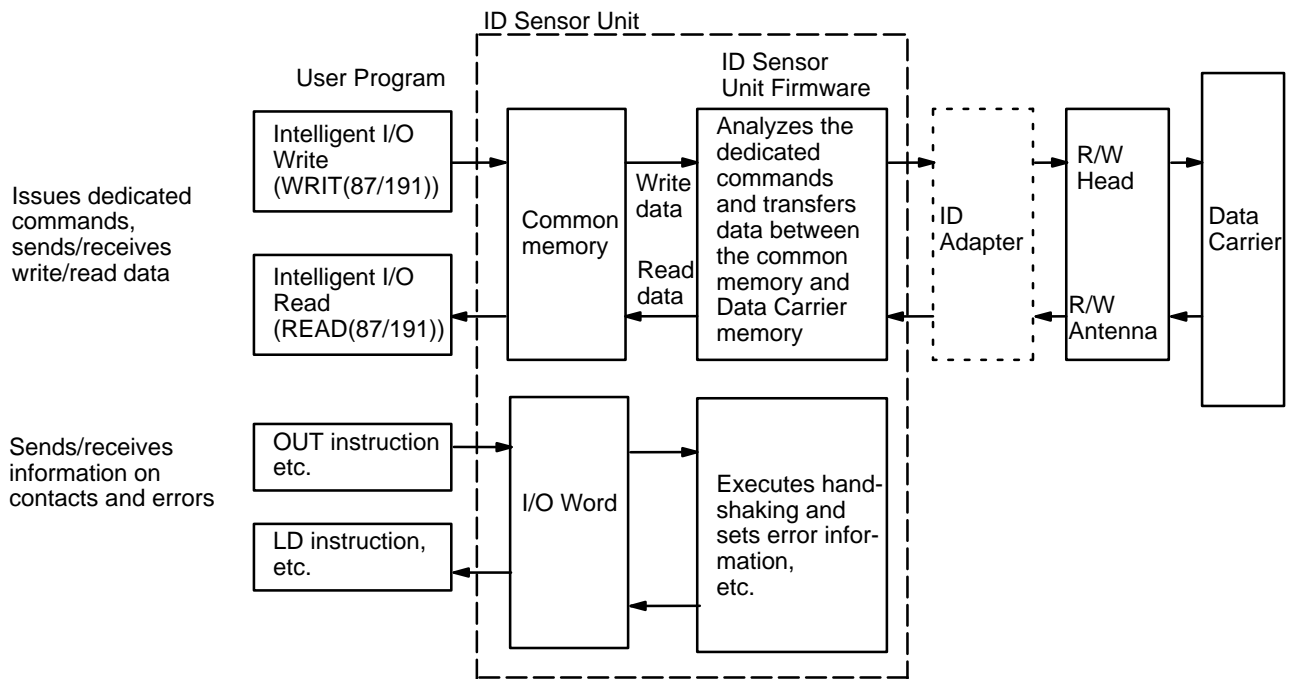
2-2 The User Program

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(87/191)), Intelligent I/O Read (READ(88/190)), 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.

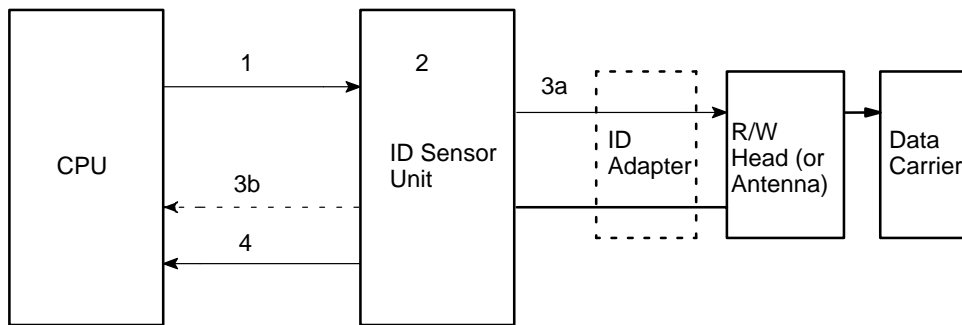
Communication with the CPU

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(87/191) 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 18 and p 22 *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.

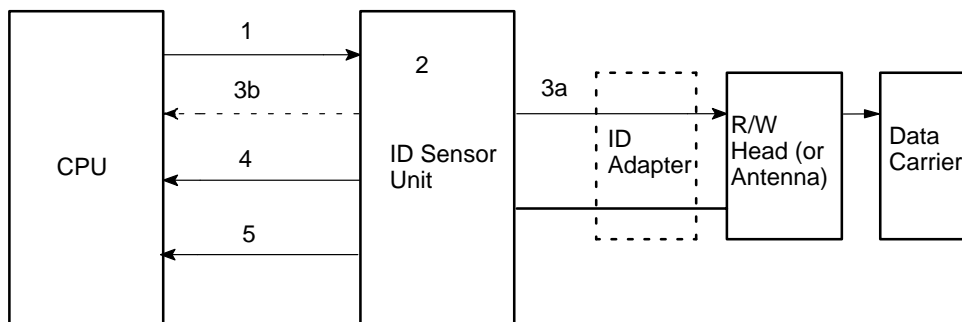
If communication with the Data Carrier cannot be established, or if an error occurs during communication, the ID Sensor Unit stops data communication with the Data Carrier and turns ON the command processing and Data Carrier communication error flags of the PC.

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(87/191) 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 18 and p 22 *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(88/190) or MOV to retrieve the data from the ID Sensor Unit.

Steps 1 to 5 compose one read operation.

2-2-1 Program Examples

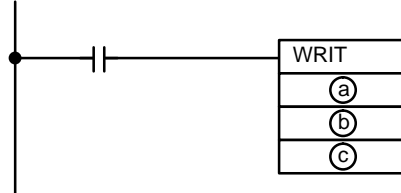
The following figures provide examples of programs; refer to these figures before developing your program. Further examples are presented in *Section 3 Programming*.

Writing Data

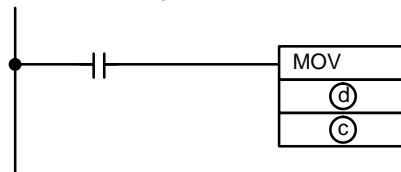
F2-9 Program Examples: Writing Data

PC (user program)

Using Intelligent I/O instructions

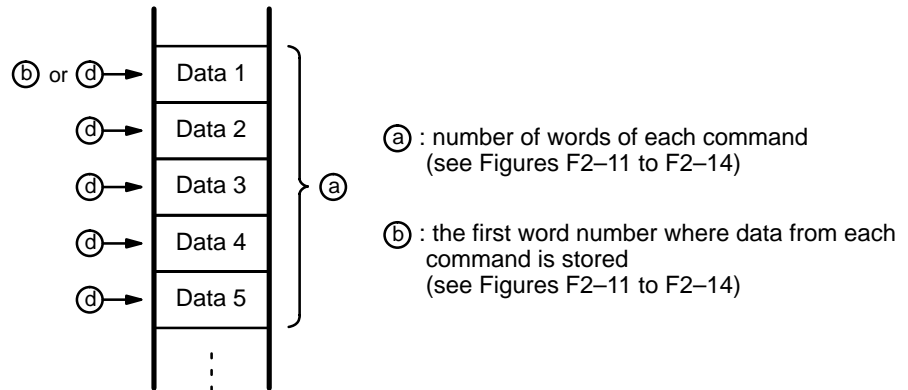


Using MOV
(when Intelligent I/O instructions are not available)



- (a) : number of words to be transferred
- (b) : first destination word number
- (c) : first word number of ID Sensor Unit
- (d) : source word number of transfer data

PC (source memory)



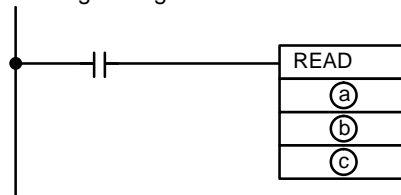
When the Intelligent I/O Write (WRIT(87/191)) instruction is used, up to 255 words of data can be transferred to the ID Sensor Unit at one time. However, if this instruction is not available and MOV is used instead, data from only one word can be transferred at a time.

Reading Data

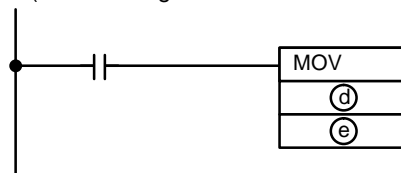
F2-10 Program Examples: Reading Data

PC (user program)

Using Intelligent I/O instructions

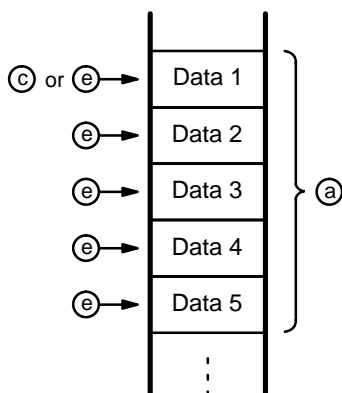


Using MOV
 (when Intelligent I/O instructions are not available)



- (a) : number of words to be transferred
- (b) : first word number of ID Sensor Unit + 1
- (c) : first destination word number
- (d) : first word number of ID Sensor Unit + 2
- (e) : destination word number

PC (destination memory)



When the Intelligent I/O Read (READ(88/190)) instruction is used, up to 255 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 seven 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
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.
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.
Auto Read	AR	41 52	Waits until the Data Carrier approaches the Read/Write Head (or Antenna) and then reads data from the internal memory of the Data Carrier as it comes within detection range of the Read/Write Head (or Antenna). 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 (or Antenna) and then writes data to the internal memory of the Data Carrier as it comes within detection range of the Read/Write Head (or Antenna). Up to 502 bytes (251 words) of data can be written 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.
Data management commands (IDS01-V2/IDS02-V1)	MD	4D 44	Check Data Carrier memory. There are three data management commands (i.e., the MD-K command, MD-C command, and MD-L command). The MD-K command and MD-C command check the reliability of the Data Carrier's data. The MD-L or MD-S command check the number of overwriting operations of the Data Carrier.

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

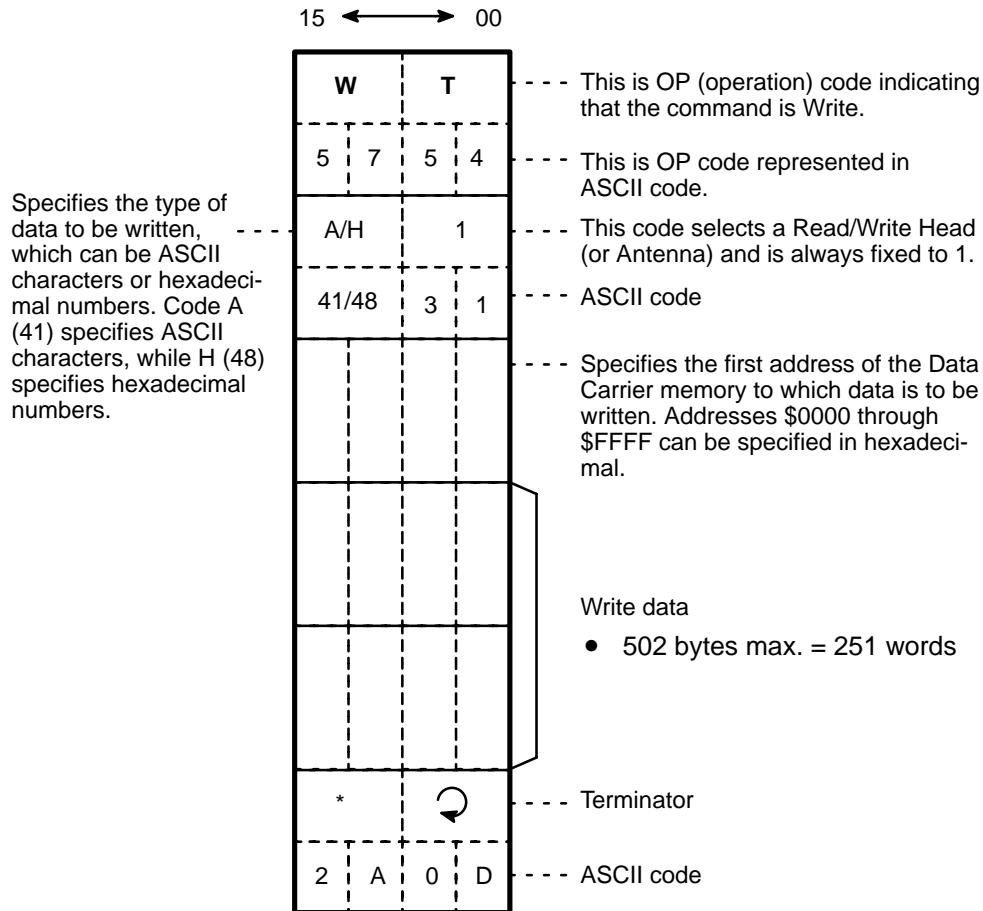
To write data to the Data Carrier, use the WRIT(87/191) or MOV instructions of the PC to issue the Write or Auto Write command and Clear-all command to the ID Sensor Unit.

To read data from the Data Carrier, use the WRIT(87/191) 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.

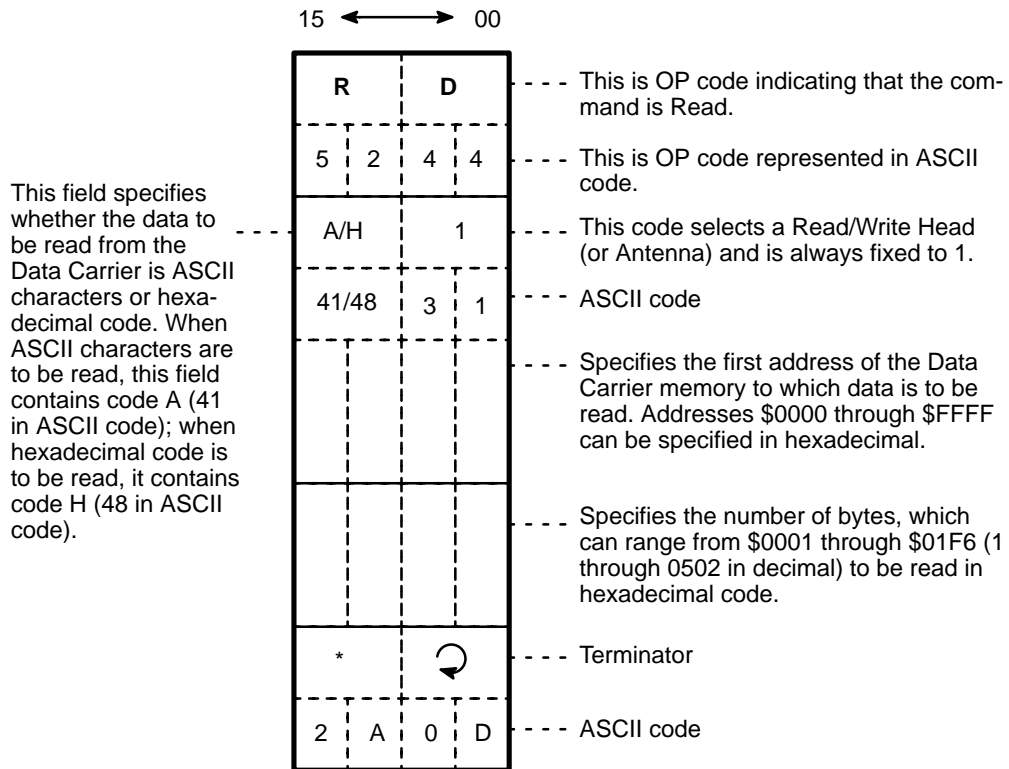
F2-11 Write Command



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.

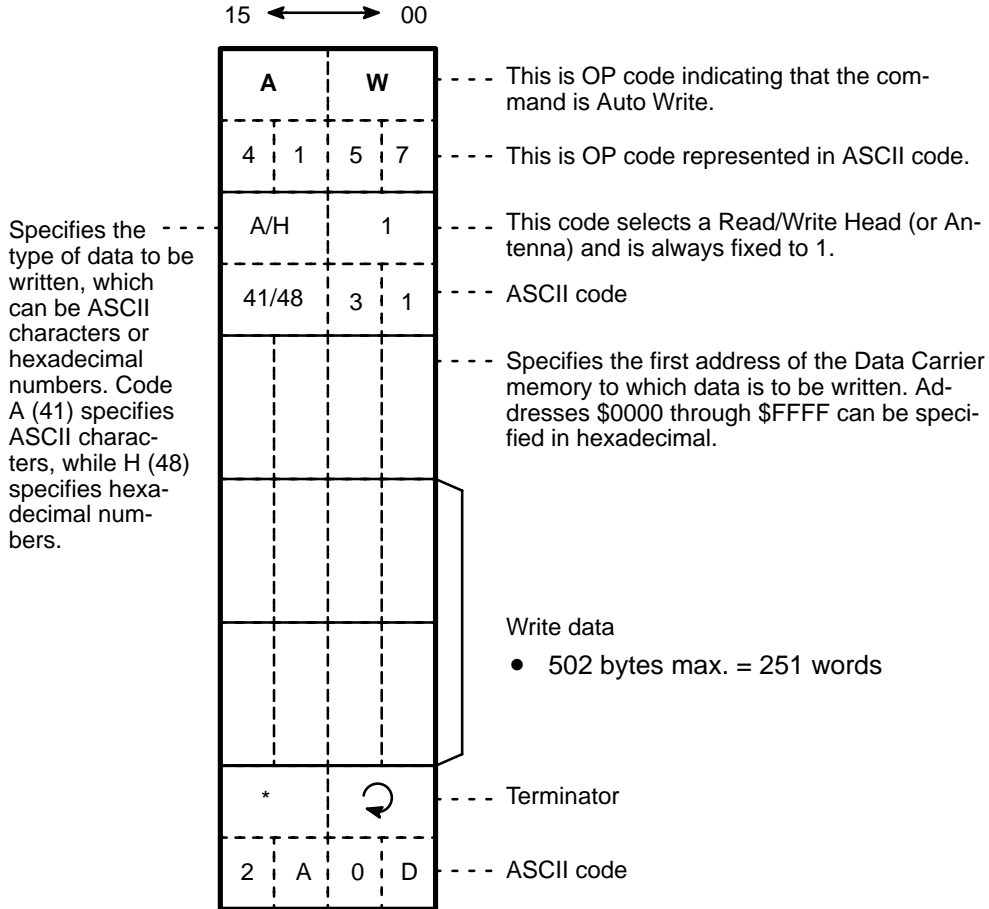
F2-12 Read Command



Auto Write Command

This command does not execute until the Data Carrier approaches the Read/Write Head (or Antenna). When the Data Carrier comes within detection range of the Read/Write Head (or Antenna), 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.

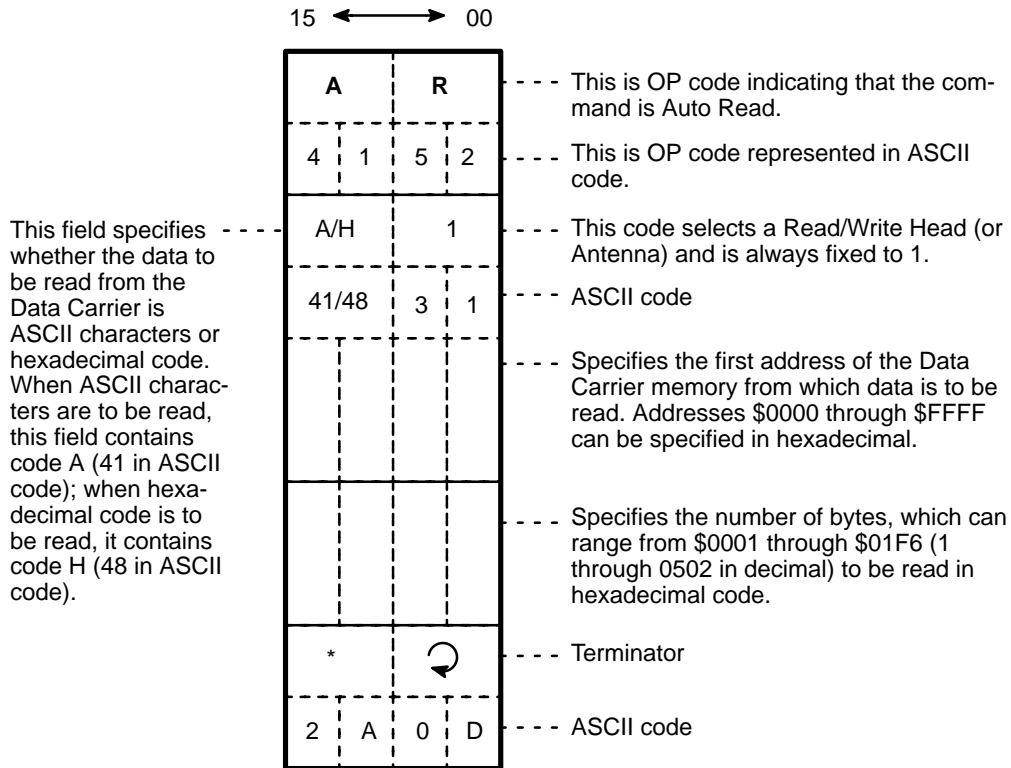
F2-13 Auto Write Command



Auto Read Command

This command does not execute until the Data Carrier approaches the Read/Write Head (or Antenna). 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.

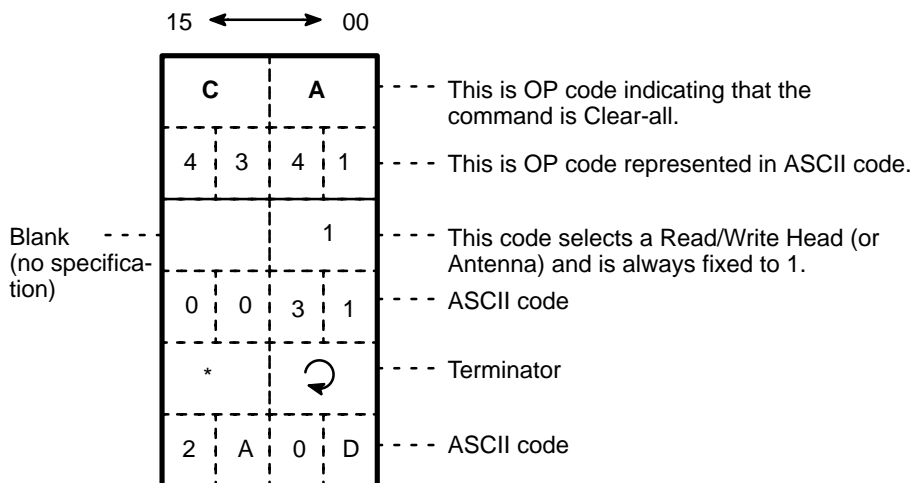
F2-14 Auto Read Command



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. The number of command data words is fixed to 3.

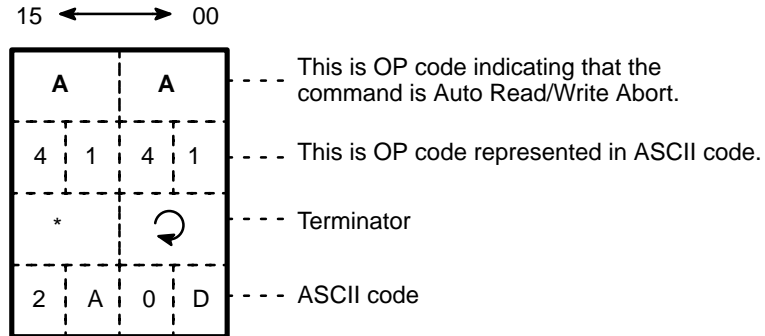
F2-15 Clear-all Command



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. The number of command data words is fixed to 2.

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.

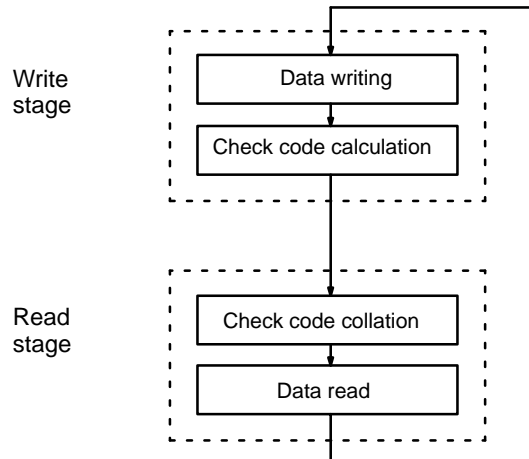
Data Management (IDS01-V2/IDS02-V1 only)

1, 2, 3... 1. Data Check

By adding a check code to the Data Carrier data, it is possible to detect a data error due to the battery of the SRAM Data Carrier or excessive overwriting operations of the EEPROM Data Carrier. Use the MD-K command to calculate and write the check code to the Data Carrier. Use the MD-C command to collate the check code.

Usage:

After data is written to the Data Carrier, use the MD-K command to calculate and add the check code to the data. To check whether or not the Data Carrier's data is corrupted, use the MD-C command before reading the data and collate the check code of the data.

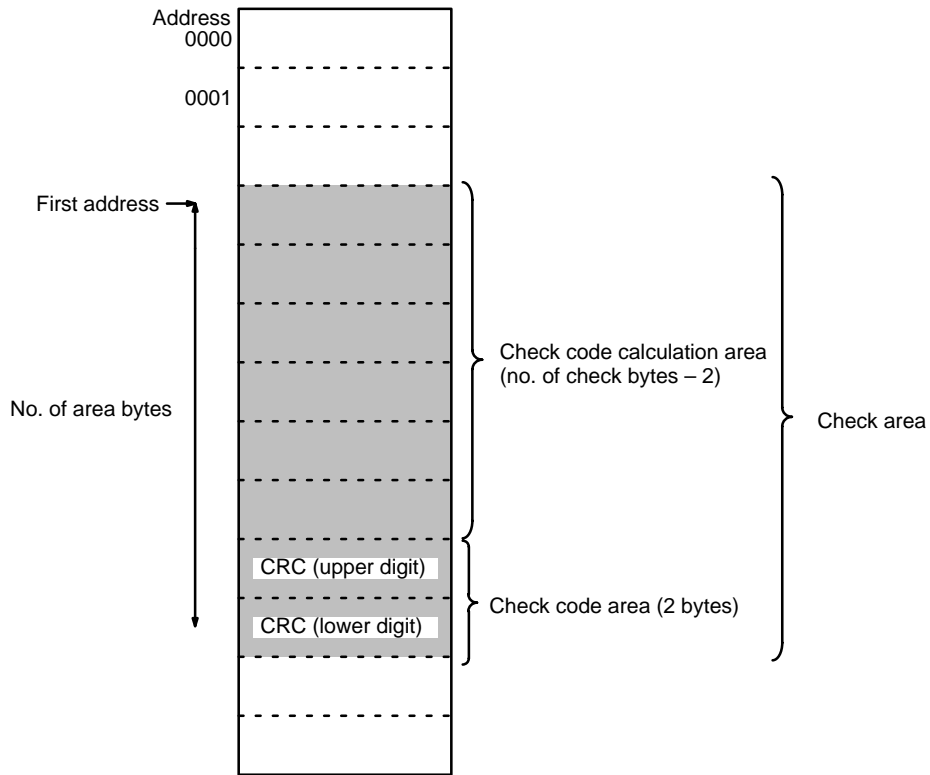


Command:

It is possible to calculate, write, or collate the CRC code (see note) in the check area designated by the command. The CRC code is calculated by using the generating function $X^{16} + X^{12} + X^5 + 1$.

Note CRC stands for cyclic redundancy check. The cyclic redundancy check is an error detecting method.

If data collation is designated using processing code C, the CRC of the data in the calculation objective area is calculated and the result is compared with the data in the check code area. If they do not coincide, the Data Carrier warning flag will be turned ON.



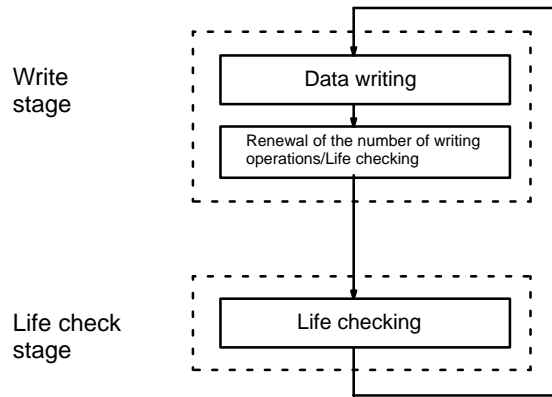
Note The last two bytes of a check area are for the check code area, to which nothing must be written.

2. Management of Overwriting Operations 1

By counting the number of writing operations, it is possible to detect if the DC with EEPROM has been overwritten 100,000 times.

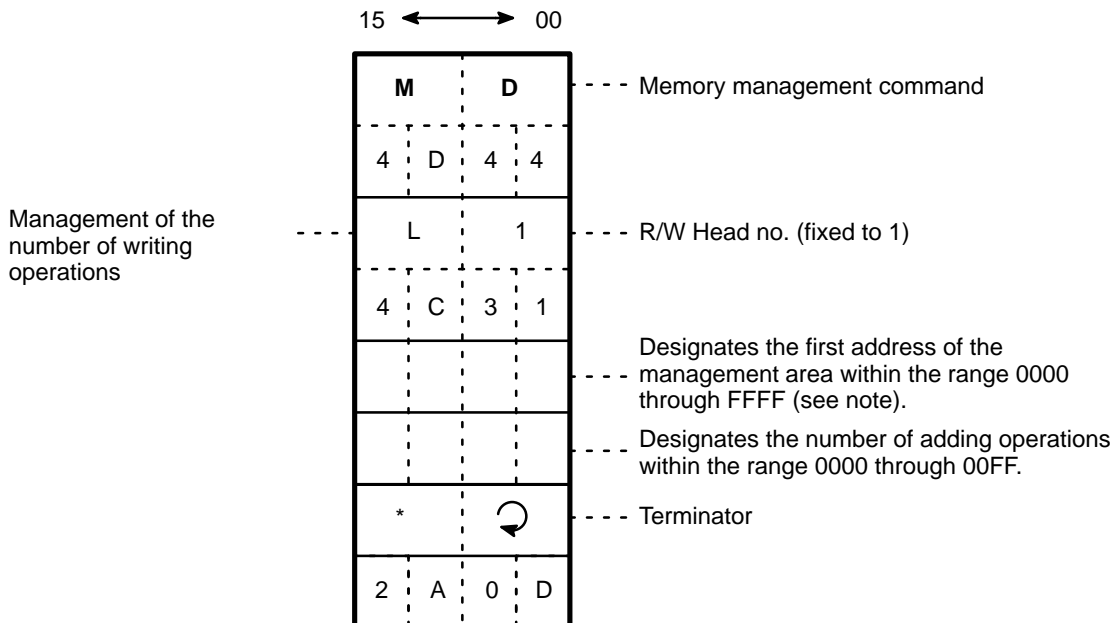
Usage:

After writing data to the most frequently used address, renew the number of overwriting operations in order to check the life of the EEPROM. It is possible to overwrite data to each address 100,000 times. Therefore, it is necessary to count the number of overwriting operations of the most frequently used address. It is also possible to check the life of the EEPROM without renewing the number of overwriting operations.



Command:

Add an appropriate number [up to 255 (00FF)] to the data of the address designated by the user in order to judge if the address has been overwritten 100,000 times. If 0 (0000) is added, only the life of the address will be checked. The number of command data words is fixed to 5.

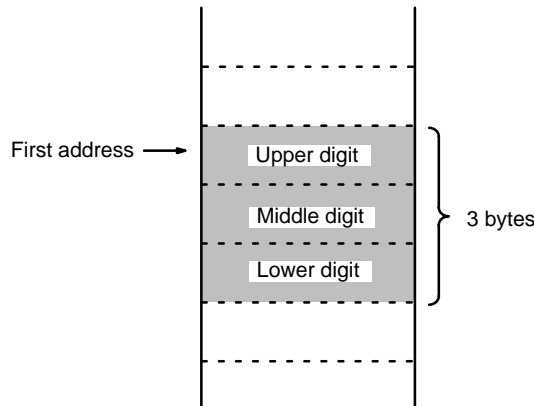


Note Designate the first address on the EEPROM DC so that the terminator will be □□□0 to □□□5 or □□□8 to □□□D, otherwise an address error will result.

When the command is executed and the address is found to have been overwritten 100,000 times, the Data Carrier warning flag will be turned ON.

Command Processing:

Overwriting operation management area consists three bytes from the first address, to which the appropriate number [up to 255 (00FF)] that the user designates is added. If the result is larger than 100,000, the Data Carrier warning flag will be turned ON. If the area has been overwritten 100,000 times, the value in the overwriting operation management area will not be renewed.

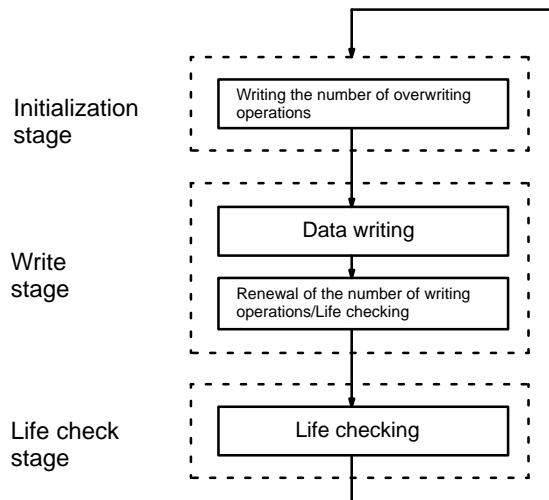


3. Management of Overwriting Operations 2

By counting the number of writing operations, it is possible to detect if the DC with EEPROM has been overwritten for the number of operations set by the user.

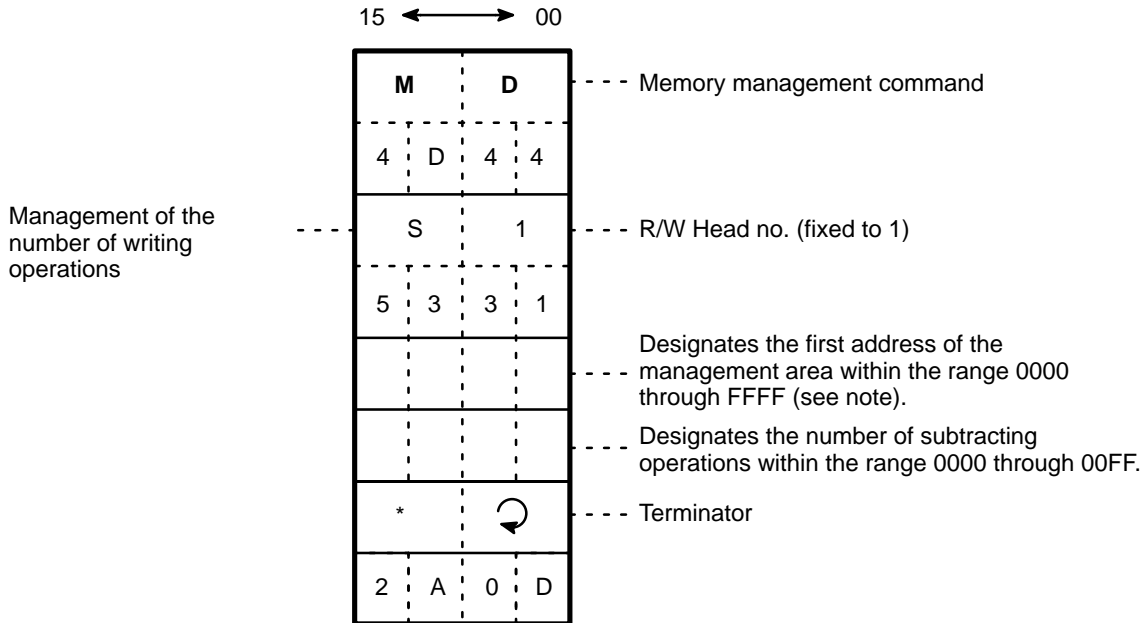
Usage:

Using the write command, write in advance the number of desired overwriting operations onto the overwriting operation management area of the DC. After writing data to the most frequently used address, renew the number of overwriting operations in order to check the life of the EEPROM. The number of overwriting operations is determined for each address by the DC specifications. Therefore, it is necessary to count the number of overwriting operations of the most frequently used address. It is also possible to check the life of the EEPROM without renewing the number of overwriting operations.



Command:

Subtracts an appropriate number [up to 255 (00FF)] from the data of the address designated by the user in order to judge if the address has been overwritten for the number of operations set by the user. If 0 (0000) is subtracted, only the life of the address will be checked. The number of command data words is fixed to 5.

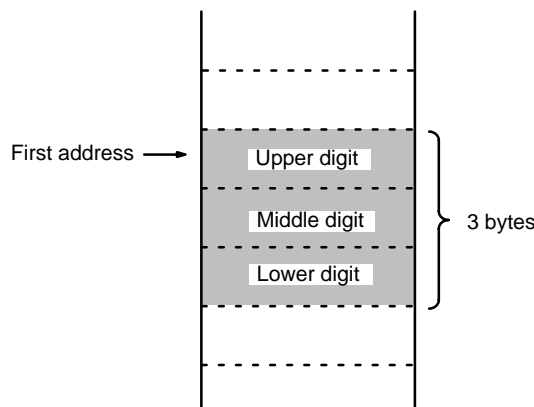


Note Designate the first address on the EEPROM DC so that the terminator will be □□□0 to □□□5 or □□□8 to □□□D, otherwise an address error will result.

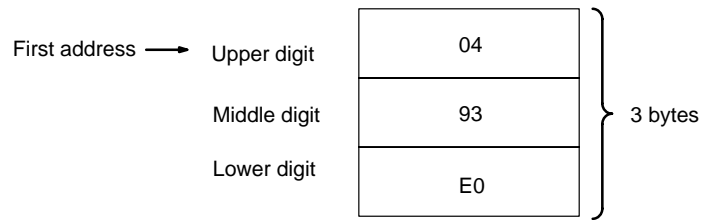
When the command is executed and the address is found to have been overwritten for the number of operations set by the user, the Data Carrier warning flag will be turned ON.

Command Processing:

Overwriting operation management area consists of three bytes from the first address, from which the appropriate number is subtracted. If the value set in this area is smaller than 0, the Data Carrier warning flag will be turned ON. If the data in the management area is already 0, the value in the overwriting operation management area will not be renewed.



When using a DC with the number of overwriting operations set to 300,000, make the settings as shown below.

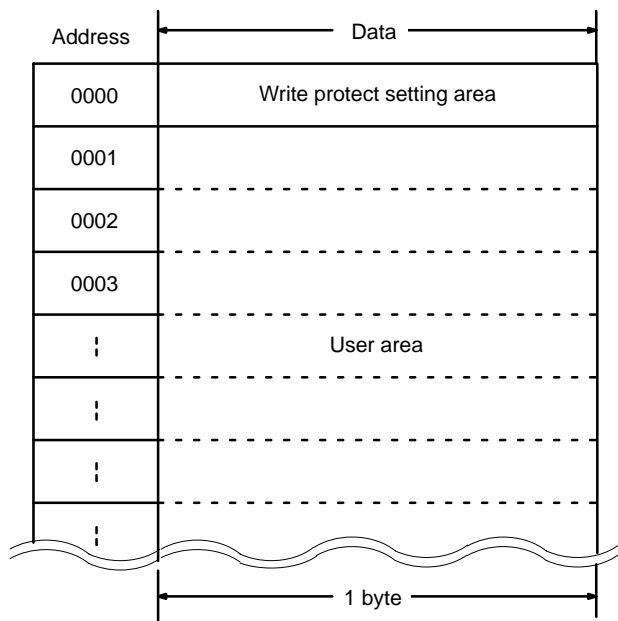


2-2-3 Data Carrier Memory

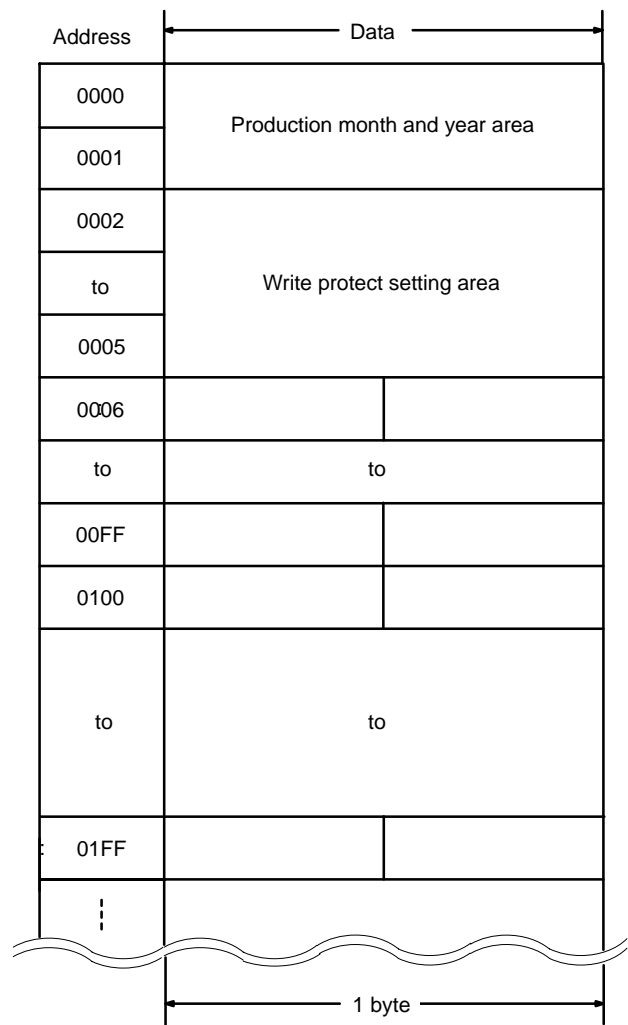
The ID Sensor Unit has a memory access space of 64k bytes (0000 to FFFF), the accessible space of which for the Data Carrier is decided according to the memory capacity of the Data Carrier. The production year and month area, the write protection area of the ID Sensor Unit, and the processing methods of the areas vary with the memory capacity of the Data Carrier, the details of which are explained below.

Data Carrier Memory Map

Data Carrier With a Memory Capacity of 256 Bytes Maximum



Data Carrier With a Memory Capacity of More Than 256 Bytes



2-2-4 Write Protection Function

The write protection function protects the data kept in the Data Carrier from being purged by mistake. We recommend the user to write-protect any important data items after the user writes them to the Data Carrier. The write protection method is explained below.

Data Carrier with Memory up to 256 Bytes

1, 2, 3... 1. Write Protection Method

By writing write protection end address data to address 0000 of the Data Carrier, the area between address 0001 and the end address that has been designated will be write-protected. Whether or not to execute write protection is specified by the leftmost bit of address 0000.

Address	Bit							
	7	6	5	4	3	2	1	0
0000	Yes/No	End address						

Write protection execution bit (the leftmost bit of address 0000).

- 1: Write protection (yes)
- 2: Write protection (no)

End address available range

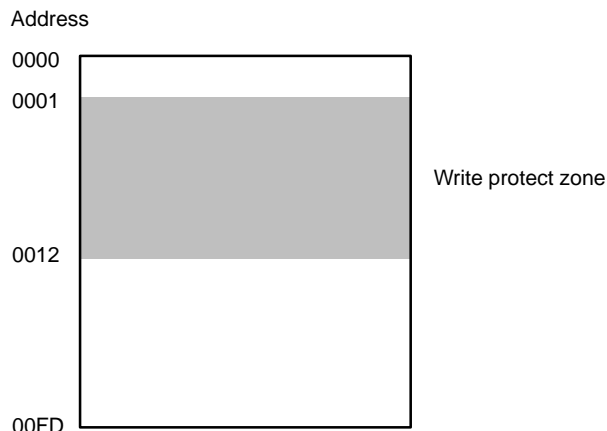
00, 01 to 7F

Addresses between addresses 80 to FD cannot be the end address. If the end address is set to 00, addresses 01 to FD will be write-protected. Addresses FE and FF are reserved for the system and the user cannot use these addresses.

2. Write Protection Example (DC with 254-byte Memory)

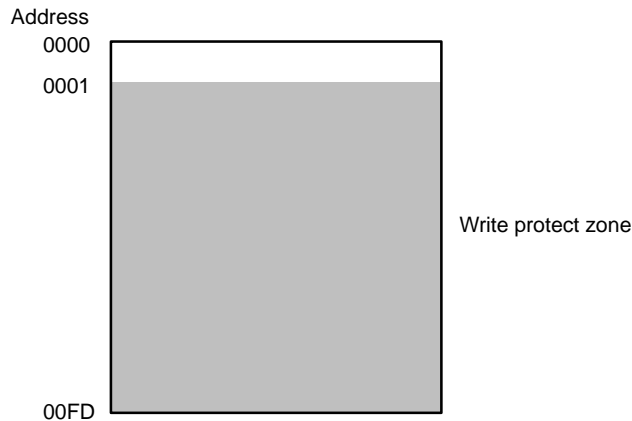
- a. In the following example, addresses 0001 to 0012 are write-protected.

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



- b. If the end address is 00, all areas except address 0000 will be write-protected. In the following example, the end address is set to 00.

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



- 3. How to Cancel Write Protection
To cancel write protection, set the leftmost bit of address 0000 to 0. When write protection is cancelled, the data in address 0000 will be null and void.

- Note**
- a) Address 0000 is never write-protected.
 - b) Write protection is effective from address 0001 through the succeeding addresses. This means that the user must write any data to be write-protected to address 0001 and the succeeding addresses.

2-2-5 Write Protection Examples

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 \$7FFF

Write protect end address
Setting range: \$0006 through \$FFFF
(When \$0800 is set to FFFF, \$7FFF 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

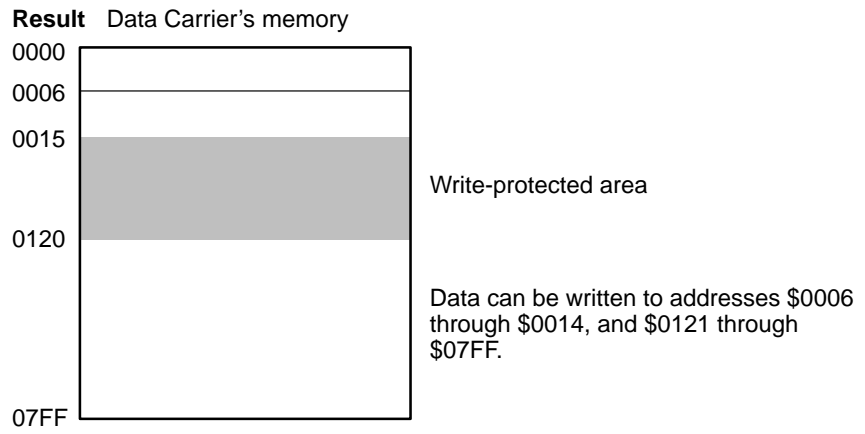
Bit	7	6	5	4	3	2	1	0
Address 0002	0	0	0	0	0	0	0	0
	0				0			
Address 0003	0	0	0	0	0	0	0	0
	0				0			
Address 0004	0	0	0	0	0	0	0	0
	0				0			
Address 0005	0	0	0	0	0	0	0	0
	0				0			

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

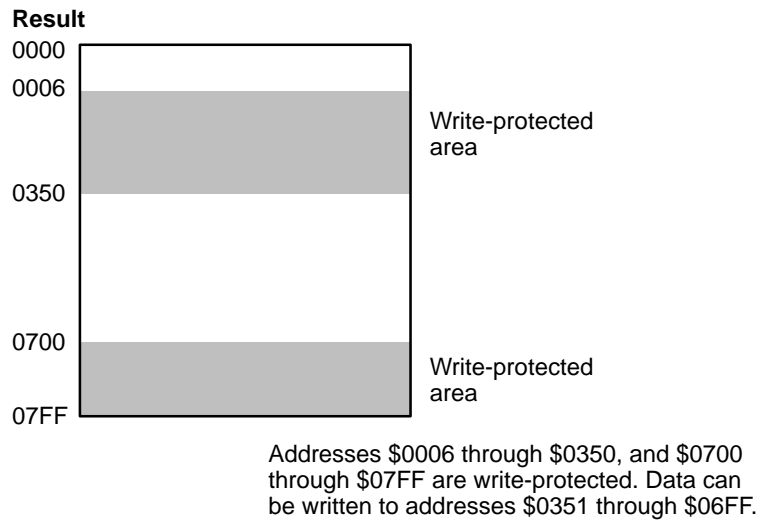
Bit	7	6	5	4	3	2	1	0
Address 0002	1	0	0	0	0	0	0	0
	8				0			
Address 0003	0	0	0	1	0	1	0	1
	1				5			
Address 0004	0	0	0	0	0	0	0	1
	0				1			
Address 0005	0	0	1	0	0	0	0	0
	2				0			



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			

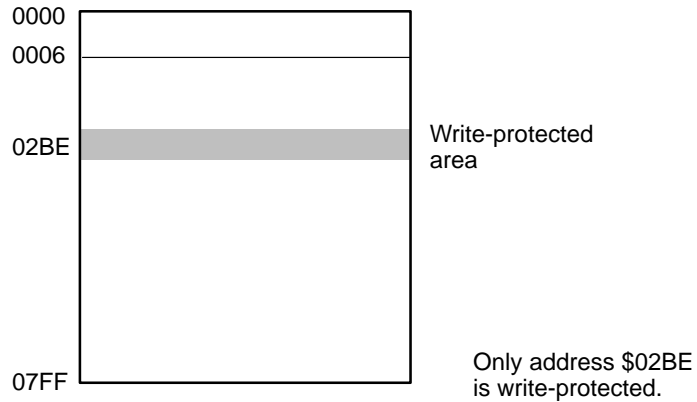


Example 4
Write-protecting Address 02BE Only

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			

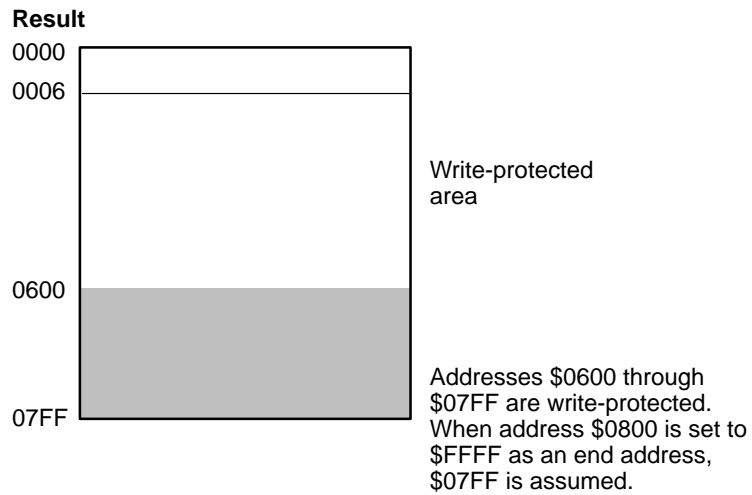
Result



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			



2-2-6 Data Carrier’s Production Date

The life of the Data Carrier is approximately 5 years for model V620-D2KR01, and 8 years for model V600-D2K01. 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			

2-2-7 Detection of Data Carrier's Life

The detecting method of the Data Carrier's life varies with the kind of memory (SRAM or EEPROM) incorporated by the Data Carrier. In the case of the Data Carrier with SRAM, the life of the built-in battery will be checked. In the case of the Data Carrier with EEPROM, the number of overwriting operations (possible up to 100,000 times or desired number of operations) will be checked.

Data Carrier With SRAM (Built-in Battery)

- 1, 2, 3... 1. Battery Voltage Check

The voltage of the Data Carrier's built-in battery can be checked only if the user reads the two-byte data in addresses 0000 to 0001. The Data Carrier is not designed so that the voltage is automatically checked, because at the time of battery check, a certain amount of current flows into the internal circuitry of the Data Carrier, which in turn consumes the electricity of the battery. We recommend the user to make a program so that the voltage of the battery can be checked once a day.

Battery Low Check Execution Command


- a. Read command
- b. Auto read command


When the voltage of the battery is low, the DC Warning Flag (word n+1 bit 7) will be turned ON.

2. Data Carrier's Life After Generation of Battery Low Signal
 Replace the Data Carrier with a new one as soon as possible when the Data Carrier's battery low signal is turned ON, even though the Data Carrier can be used for approximately one month after its battery low signal is turned ON.

Data Carrier With EEPROM (With No Battery)

By counting the number of overwriting operations, it is possible to check the life of the Data Carrier's EEPROM. The Data Carrier's EEPROM allows a total of 100,000 or desired number of overwriting operations.

 **WARNING** Do not throw the Data Carrier into fire or heat the Data Carrier to a temperature exceeding 100°C. Doing so may cause ignition or burning of the built-in lithium battery.

 **WARNING** Do not short the battery terminals or charge, disassemble, heat, or incinerate the battery. Doing any of these may result in leakage, rupture, heat generation, or ignition of the battery.

Note The Data Carrier with SRAM incorporates thionyl chloride lithium battery. The internal resistance of the thionyl chloride lithium battery will rise if the battery is not used for several month, in which case, the Data Carrier will generate a battery low signal if a battery check is carried out (even if the battery is not low). When using the Data Carrier that has not been used for a month, carry out some trial operations for approximately 10 minutes in order to re-activate the battery. The trial operation will not significantly shorten the life of the battery.

SECTION 3

Programming

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.

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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

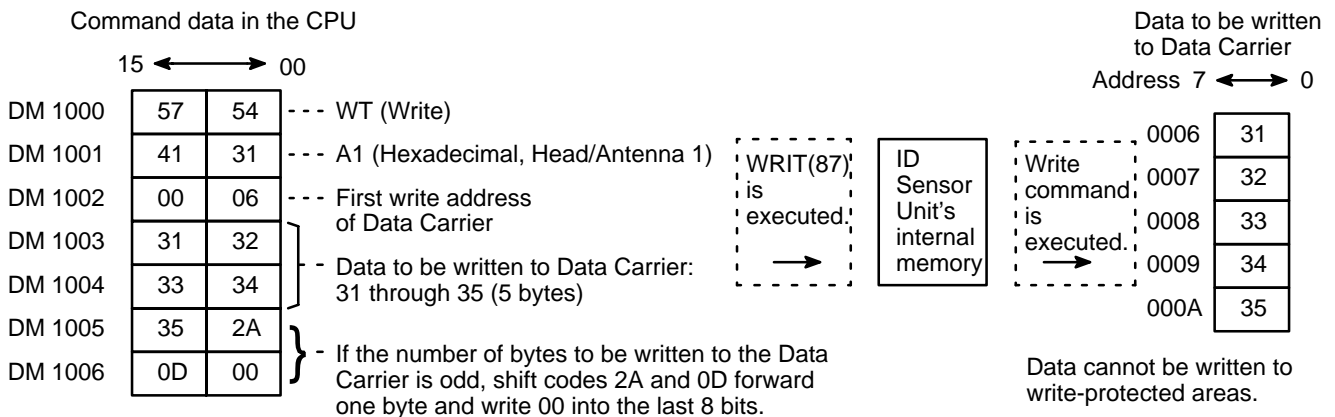
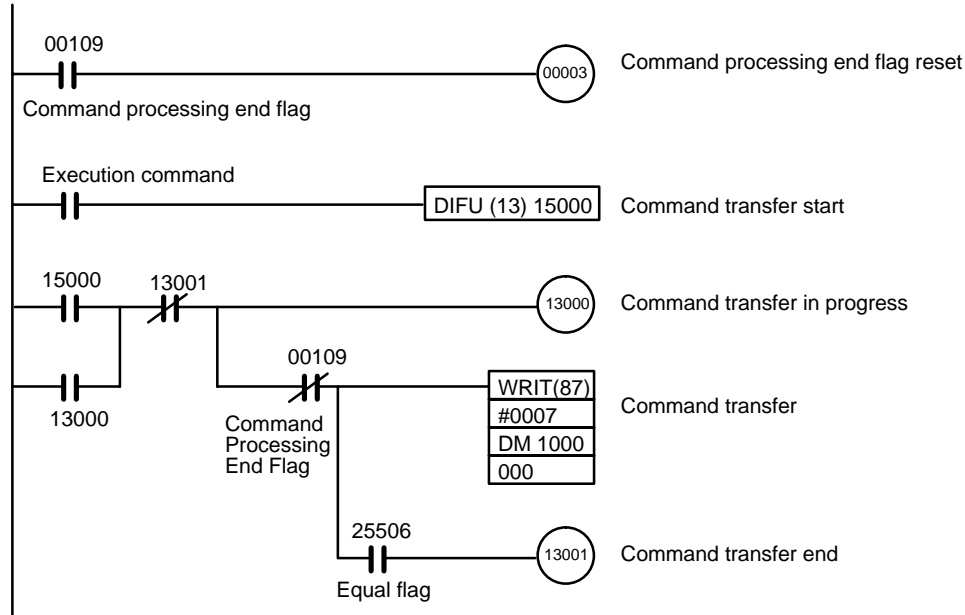
This subsection includes program examples of the Write, Auto Write, and Clear-all commands.

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



Operation

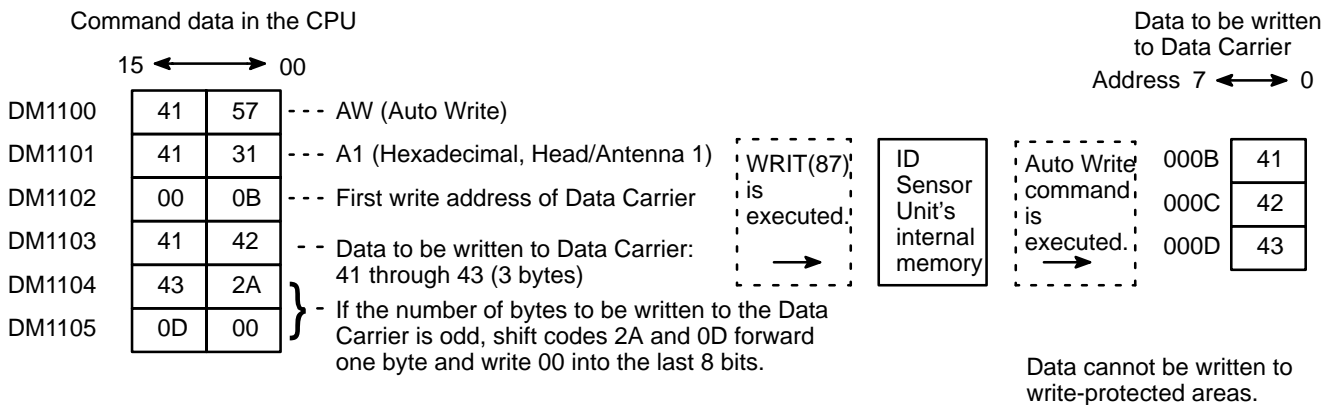
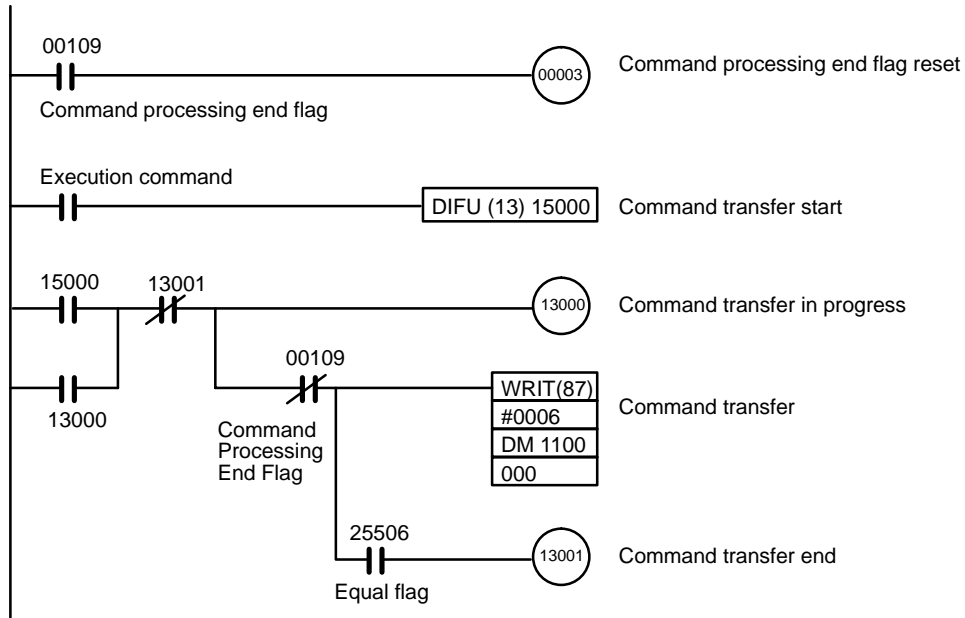
When the execution command is turned ON, the PC first verifies that the command processing end flag (00109) has been turned OFF. It then executes WRIT(87), which transfers seven words of data (the contents of DM 1000 to DM 1006) to the ID Sensor Unit. After WRIT(87) has been executed, the equal flag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



Operation

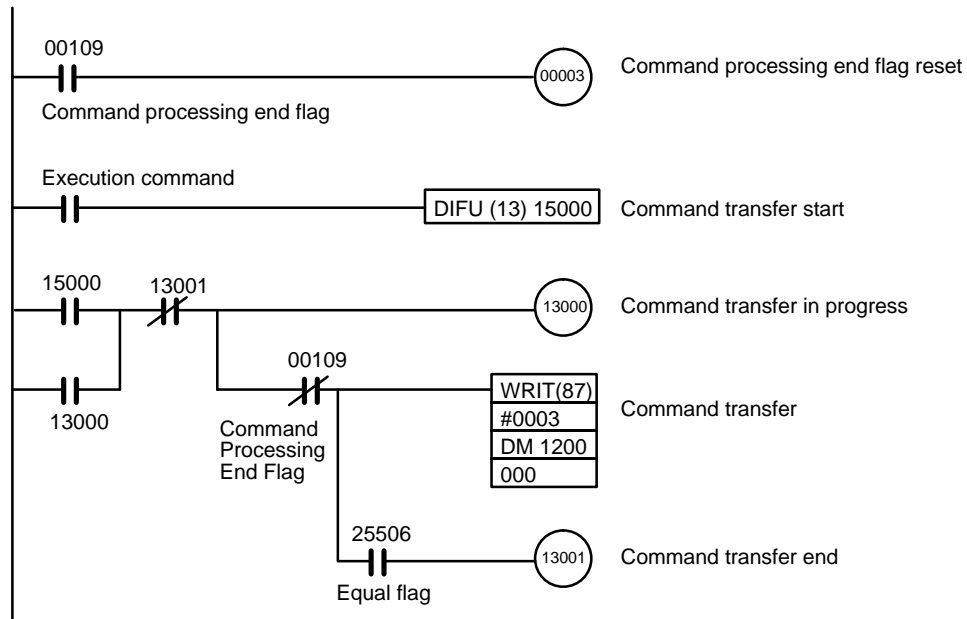
When the execution command is turned ON, the PC checks that the command processing end flag (00109) has been turned OFF. It then executes WRIT(87), which transfers six words of data (the contents of DM 1100 to DM 1105) to the ID Sensor Unit. After WRIT(87) has been executed, the equal flag (25506) is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

	15 ←	→	00	
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.	

Data Carrier memory contents after Clear-all execution

	Address 7 ←	→	0
	0002	00	
	0003	00	
	⋮	⋮	
	07FE	00	
	07FF	00	

Diagram showing the flow of data from the CPU to the ID Sensor Unit's internal memory. The WRIT(87) command is executed, and the Clear-all command is then executed, clearing the memory contents from address 0002 to 07FF.

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

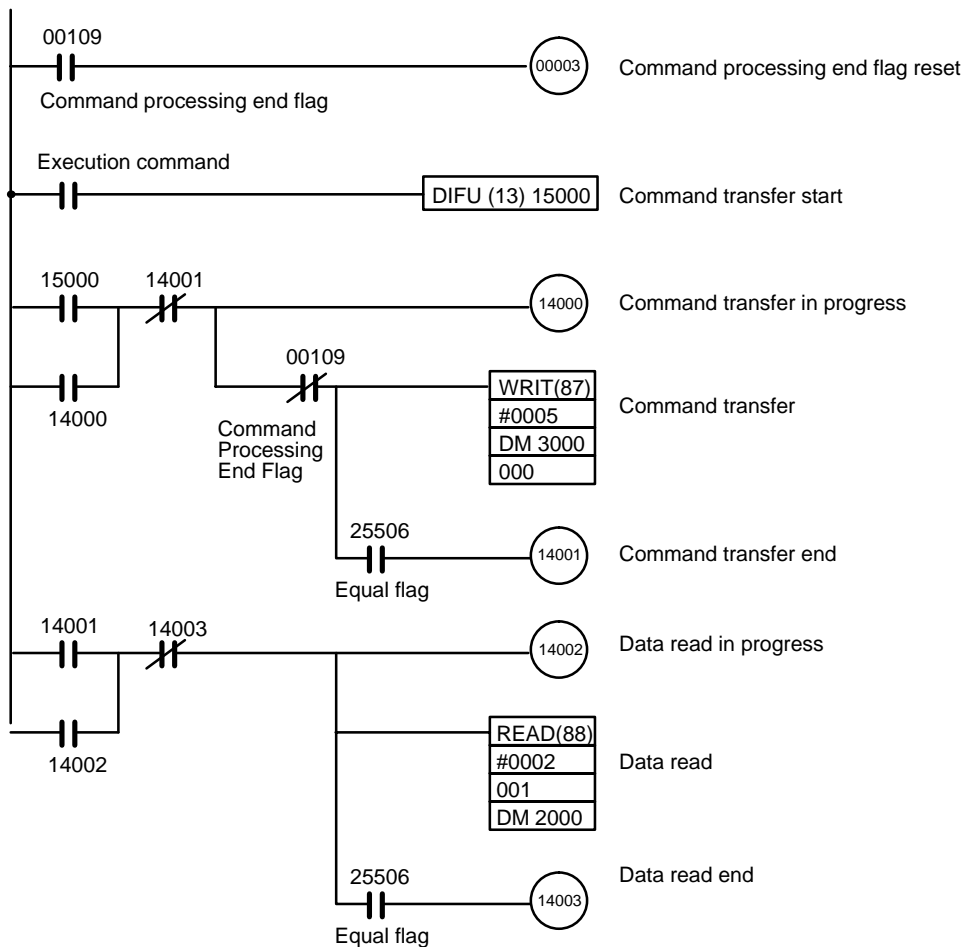
To execute the Read and Auto Read commands, the Intelligent I/O Write (WRIT(87)) and Intelligent I/O Read (READ(88)) instructions must be executed. WRIT(87) is used to transfer commands; while READ(88) is used to read data to the PC.

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

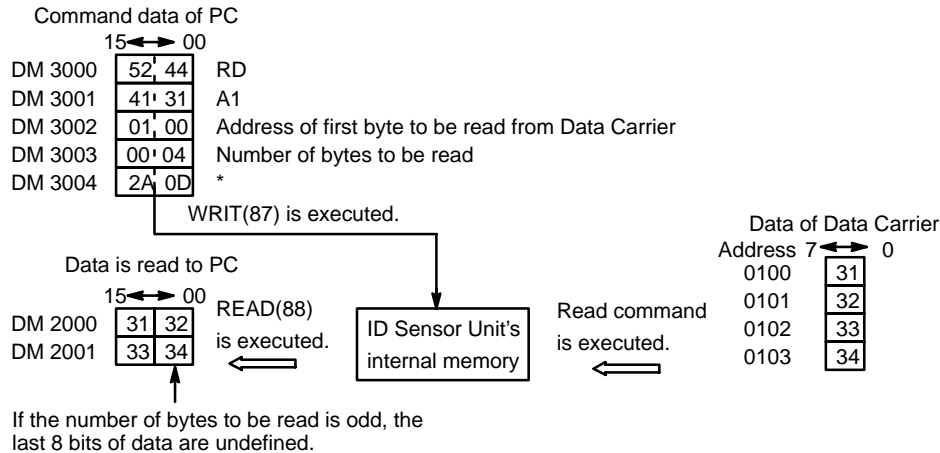
The following program examples are for one transfer operation (transferring 251 words of data). To transfer more than 251 words of data (to execute the transfer operation more than once), refer to *Section 3-4 Timing Considerations*.

Example 4: The Read Command

F3-4 Using "Read" to Transfer 4 Bytes of Data from Data Carrier to PC from Address 0100



- 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).



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 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.

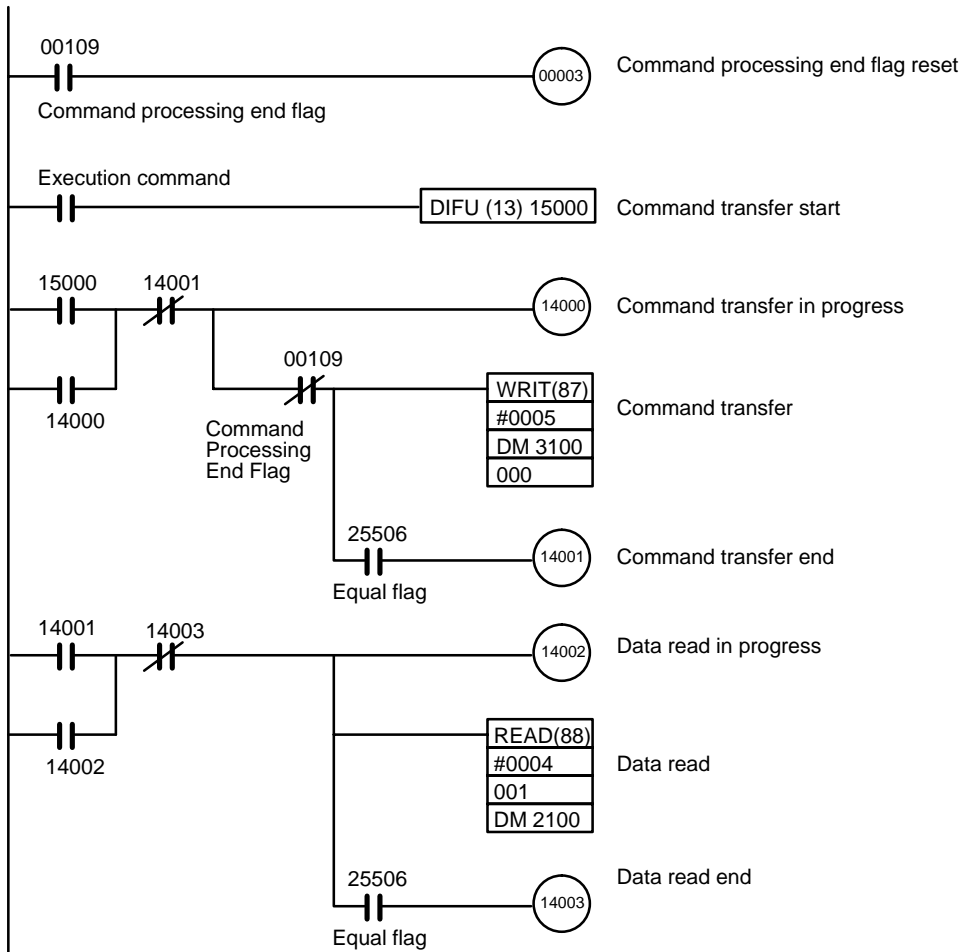
After WRIT(87) and READ(88) have been completed, the equal flag (25506) of the PC automatically turns ON. This flag is does not automatically turn OFF; turn ON and then turn OFF the command processing end flag reset bit (00003) to turn OFF the command processing end flag.

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.

Note If WRIT(87) is executed again before the data has been completely read by READ(88), the previous data will be read. If the Peripheral Device used for activating the address chatters or is subjected to vibration, WRIT(87) may be executed twice. To prevent this, take the necessary precautions so that the Peripheral Device does not chatter or vibrate. Otherwise, alter the program so that the PC will not accept WRIT(87) until the data has completely read by READ(88).

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.

	15 ↔ 00	
DM 2100	35' 36	
DM 2101	37' 38	
DM 2102	39' 3A	
DM 2103	3B' xx	

Data is read to PC

READ(88) is executed.

ID Sensor Unit's internal memory

Auto Read command is executed.

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

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.

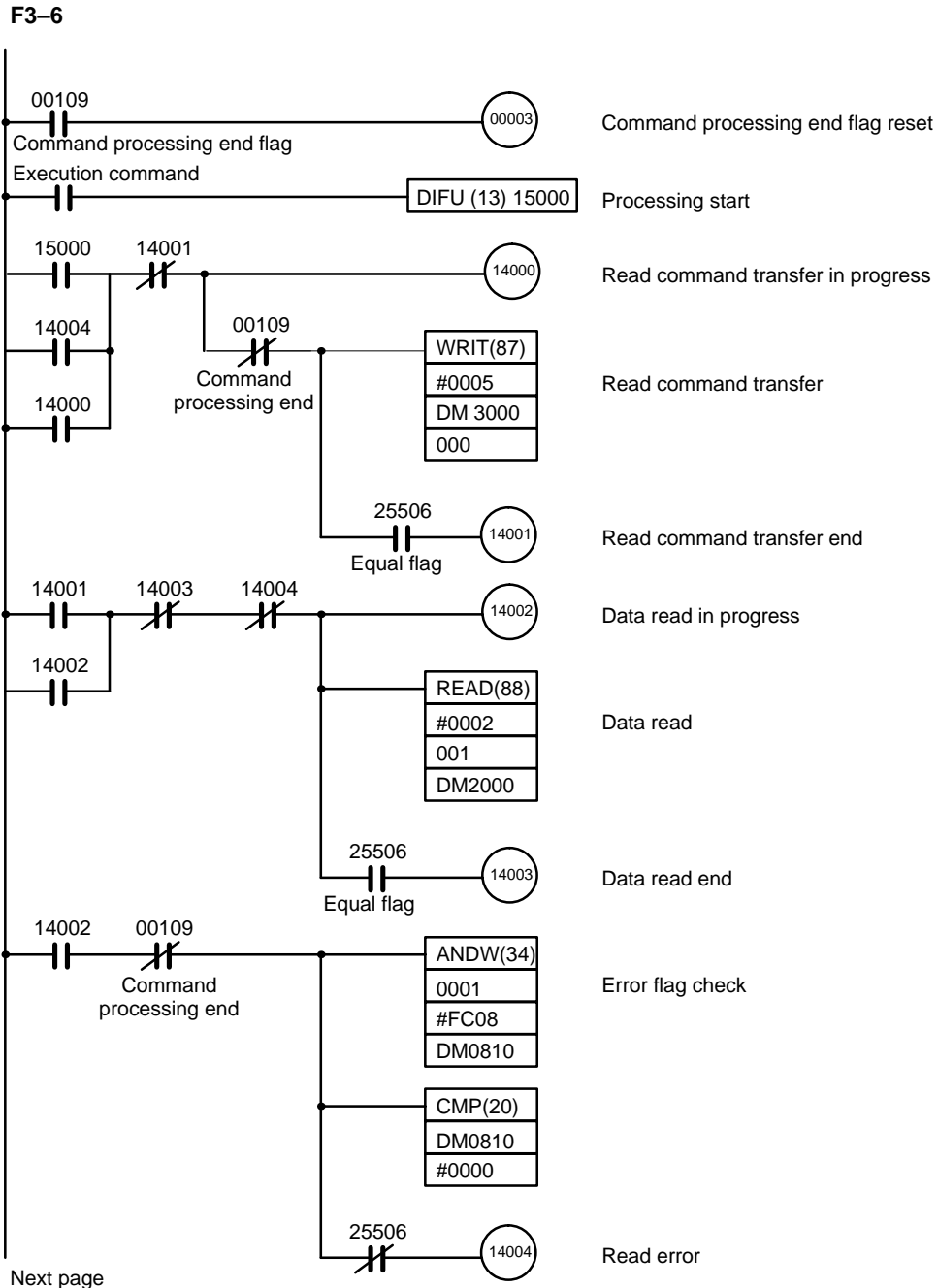
After the data read from the Data Carrier has been written to the common memory of the ID Sensor Unit, the command processing end flag (00109) is turned ON, enabling the PC to read the data from the common memory. In this example, the data is read by READ(88) as soon as the command transfer end flag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

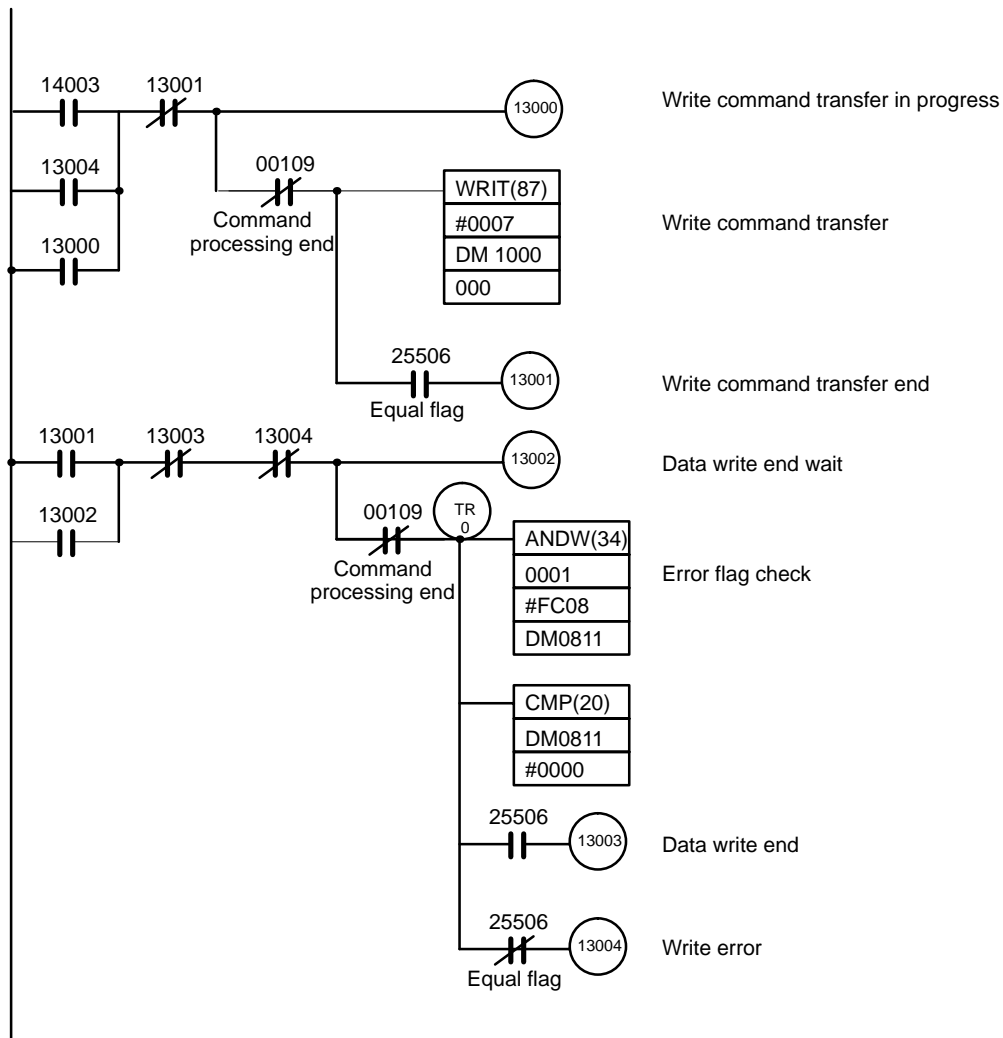
After WRIT(87) and READ(88) have been completed, the equal flag (25506) of the PC is automatically turned ON. This flag does not turn OFF automatically; turn ON and then turn OFF the command processing end flag reset bit (00003) to turn OFF the command processing end flag.

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.

3-1-3 Combination of Read and Write Operations

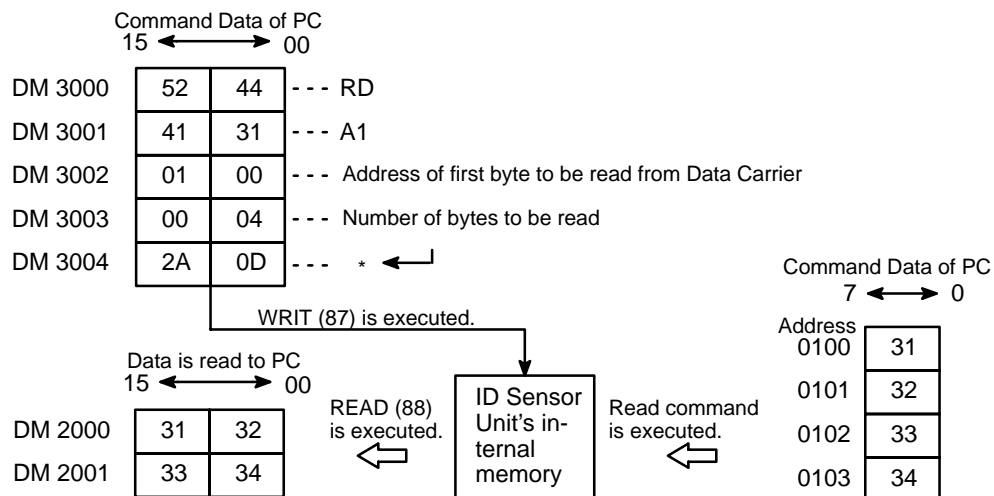
In the following example, after the PC reads 4 bytes of data from address 0100 of the Data Carrier, 5 bytes of data (ASCII data 31 to 35) are written to the Data Carrier.

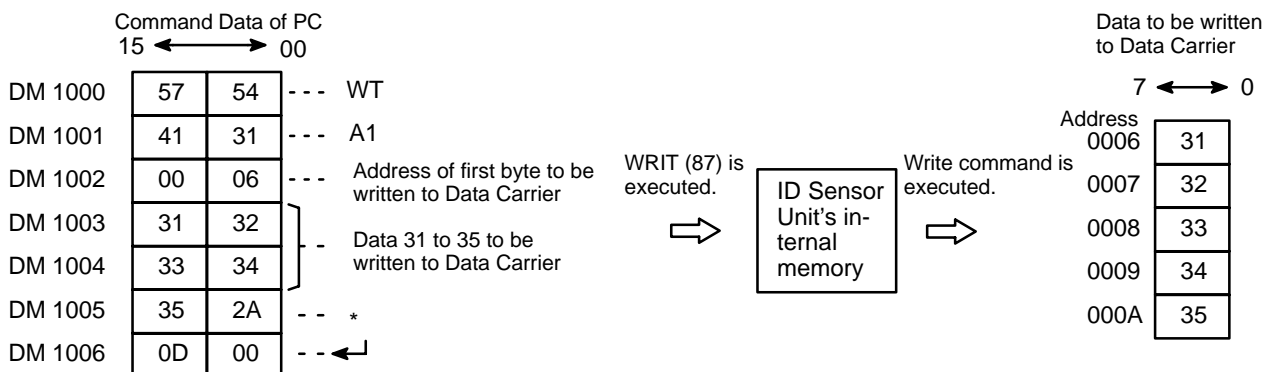




The Read command specifies that 4 bytes of data are to be read. Therefore, READ(88) reads 2 words of data (one word equals 2 bytes).

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





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 3000 to DM 3004 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 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, and the data read transfer end flag (14003) is turned ON.

The command end processing flag (00109) 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 Read command, the command processing end flag (00109) and the error flags (00103, 00106, 00110 to 00115) are turned ON, and the execution of WRIT(88) is repeated until the Read command has been executed without errors.

When the data read transfer end flag (14003) 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 1000 to DM 1006 to the internal memory of the ID Sensor Unit.

After WRIT(87) has been completed, the equal flag (25506) of the PC is automatically turned ON.

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 Write command to the Data Carrier.

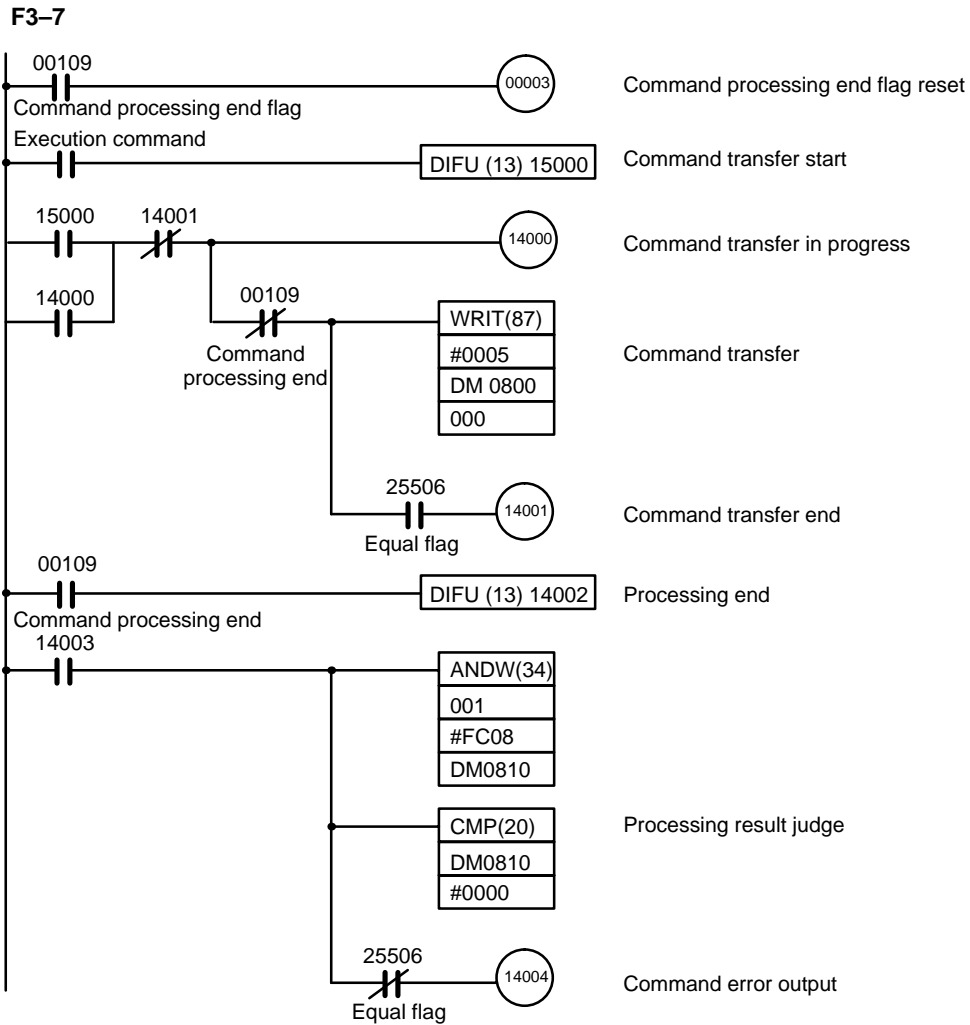
After the processing of the Write command has been completed, the command end processing flag (00109) of the PC is turned ON.

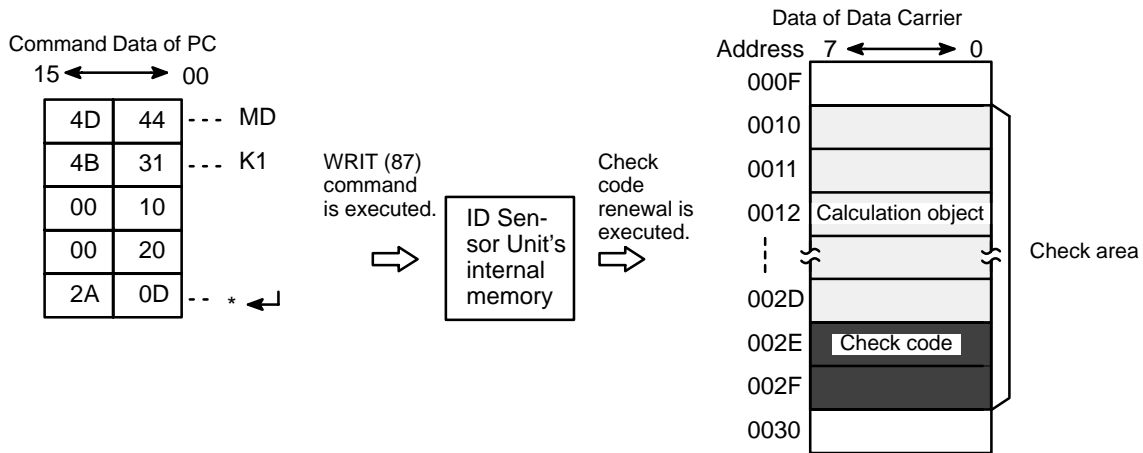
If all error flags (00103, 00110 to 00115) are OFF, the command processing end flag (13993) is turned ON and all the processing operations terminate.

The command end processing flag (00109) 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, and the execution of WRIT(88) is repeated until the Read command has been executed without errors.

3-1-4 Calculate and Write Operations for Check Code





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 0800 to DM 0804 to the internal memory of the ID Sensor Unit.

After WRIT(87) has been completed, the equal flag (25506) of the PC is automatically turned ON.

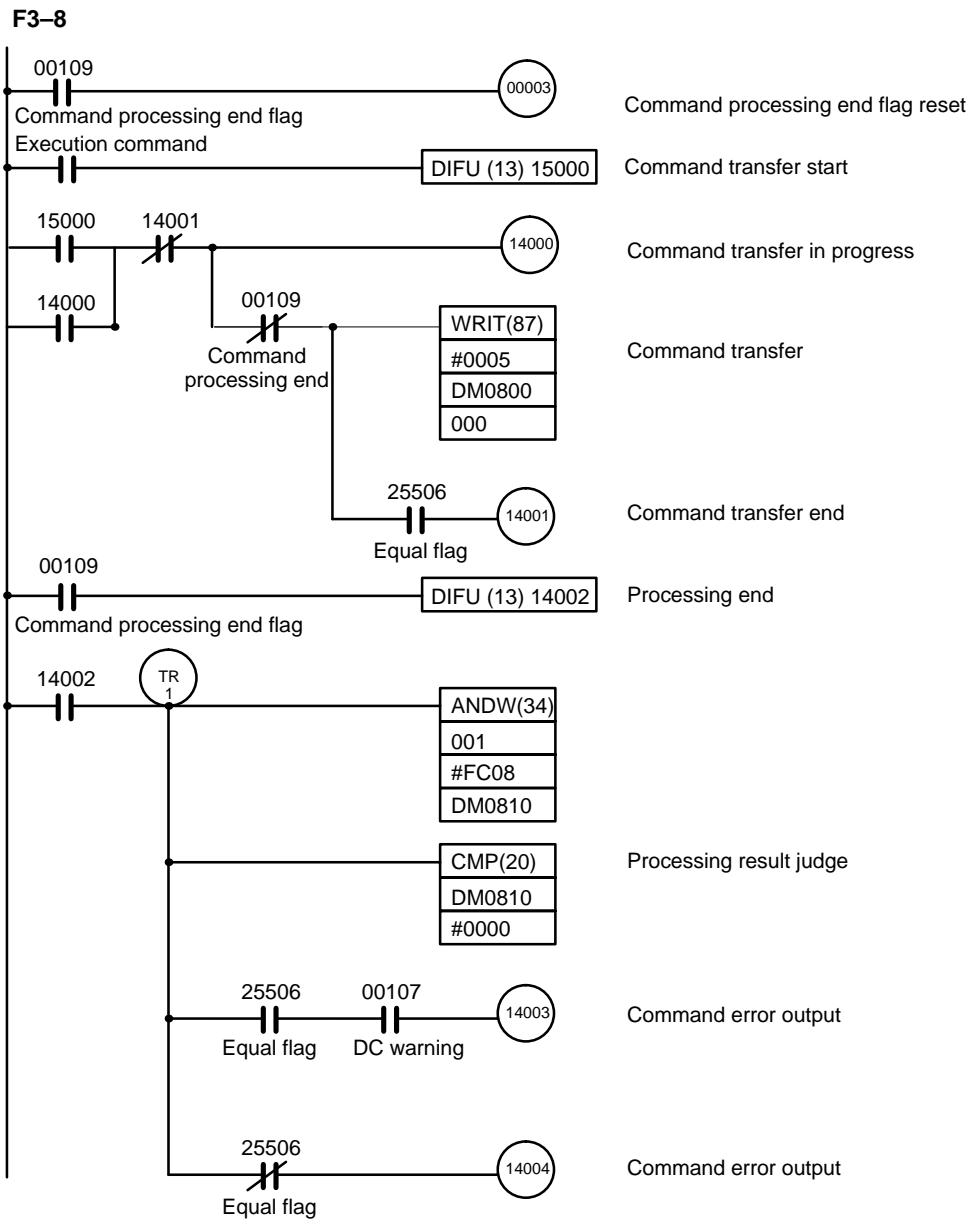
The ID Sensor Unit analyzes the type of command it has received, the address of the Data Carrier, and the number of bytes to be read. The ID Sensor Unit then issues the Read command to the Data Carrier.

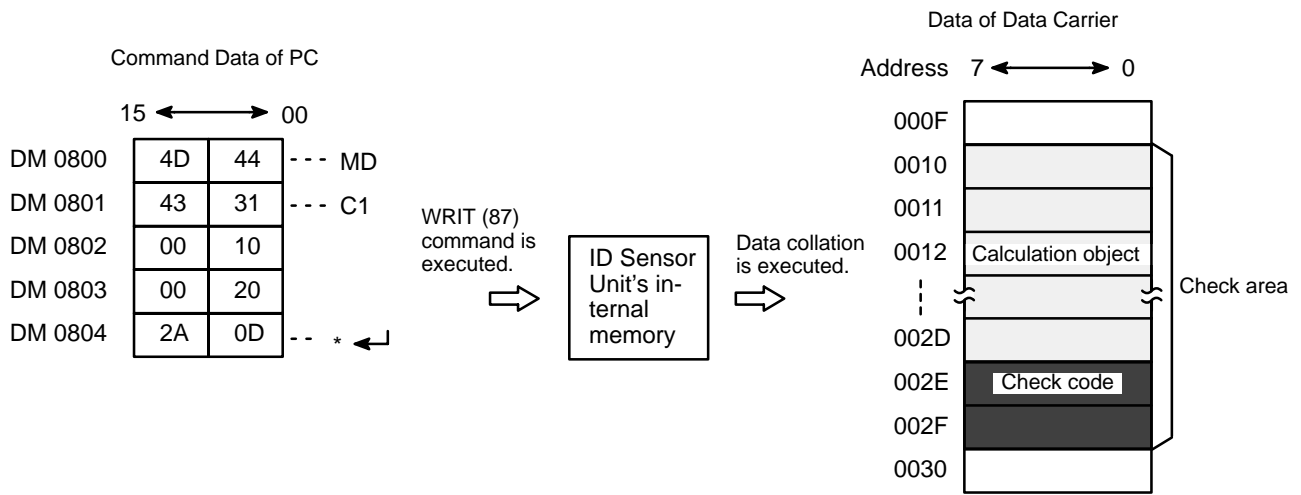
After the command has been processed, the command processing end flag (00109) is turned ON.

If there has been an error during the command processing, the command processing error flag (14004) is turned ON.

The command end processing flag (00109) does not turn OFF automatically; turn ON and turn OFF the command processing end flag reset bit (00003) to turn OFF the command processing end flag.

3-1-5 Collate Operation for Check Code





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 0800 to DM 0804 to the internal memory of the ID Sensor Unit.

After WRIT(87) has been completed, the equal flag (25506) of the PC is automatically turned ON.

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.

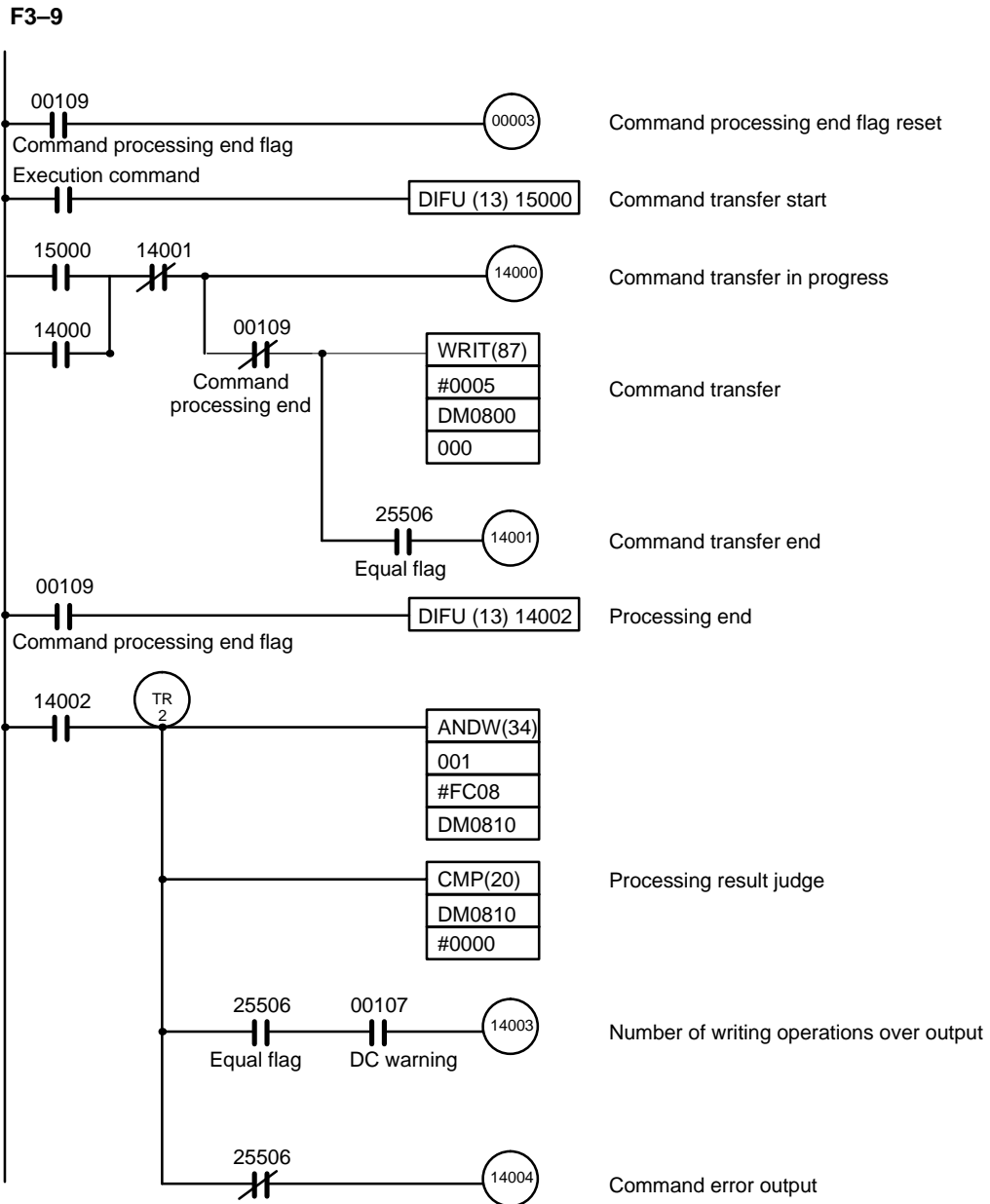
After the command has been processed, the command processing end flag (00109) is turned ON.

If there has been an error during the command processing, the command processing error flag (14004) is turned ON. If the command has been processed without any error and the Data Carrier warning flag (00107) is turned ON, the data read end flag (14003) is turned ON.

The command end processing flag (00109) 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.

3-1-6 Number of Overwrite Operations Check

In the following example, the number of overwriting operations on the Data Carrier is checked.



Command Data of PC when using MD-L Command

	15 ← → 00		
DM 0800	4D	44	--- MD
DM 0801	4C	31	--- L1
DM 0802	00	80	
DM 0803	00	10	
DM 0804	2A	0D	-- * ←

WRIT (87) command is executed.

ID Sensor Unit's internal memory

Number of writing operations check is executed.

Data of Data Carrier
Address 7 ← → 0

007F	Number of writing operations area
0080	
0081	
0082	
0083	
0084	

Command Data of PC when using MD-S Command

	15 ← → 00		
DM 0800	4D	44	--- MD
DM 0801	4C	31	--- L1
DM 0802	00	80	
DM 0803	00	01	
DM 0804	2A	0D	-- * ←

Note When using the MD-S command, write in advance the number of overwriting operations onto the number of writing operations area using the write command. It will be "0493E0" for a DC with the number of overwriting operations set for 300,000 operations.

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 0800 to DM 0804 to the internal memory of the ID Sensor Unit.

After WRIT(87) has been completed, the equal flag (25506) of the PC is automatically turned ON.

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 command has been processed, the command processing end flag (00109) is turned ON.

If there has been an error during the command processing, the command processing error flag (14004) is turned ON. If the command has been processed without any error and the Data Carrier warning flag (00107) is turned ON, the data read end flag (14003) is turned ON.

The command end processing flag (00109) 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.

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:

Hold time = PC's scan time x 2 + Remote I/O transfer time x 2

Remote I/O transfer time = 1.4 + (0.2 x (the number of words allocated to the Remote I/O Slave Rack))

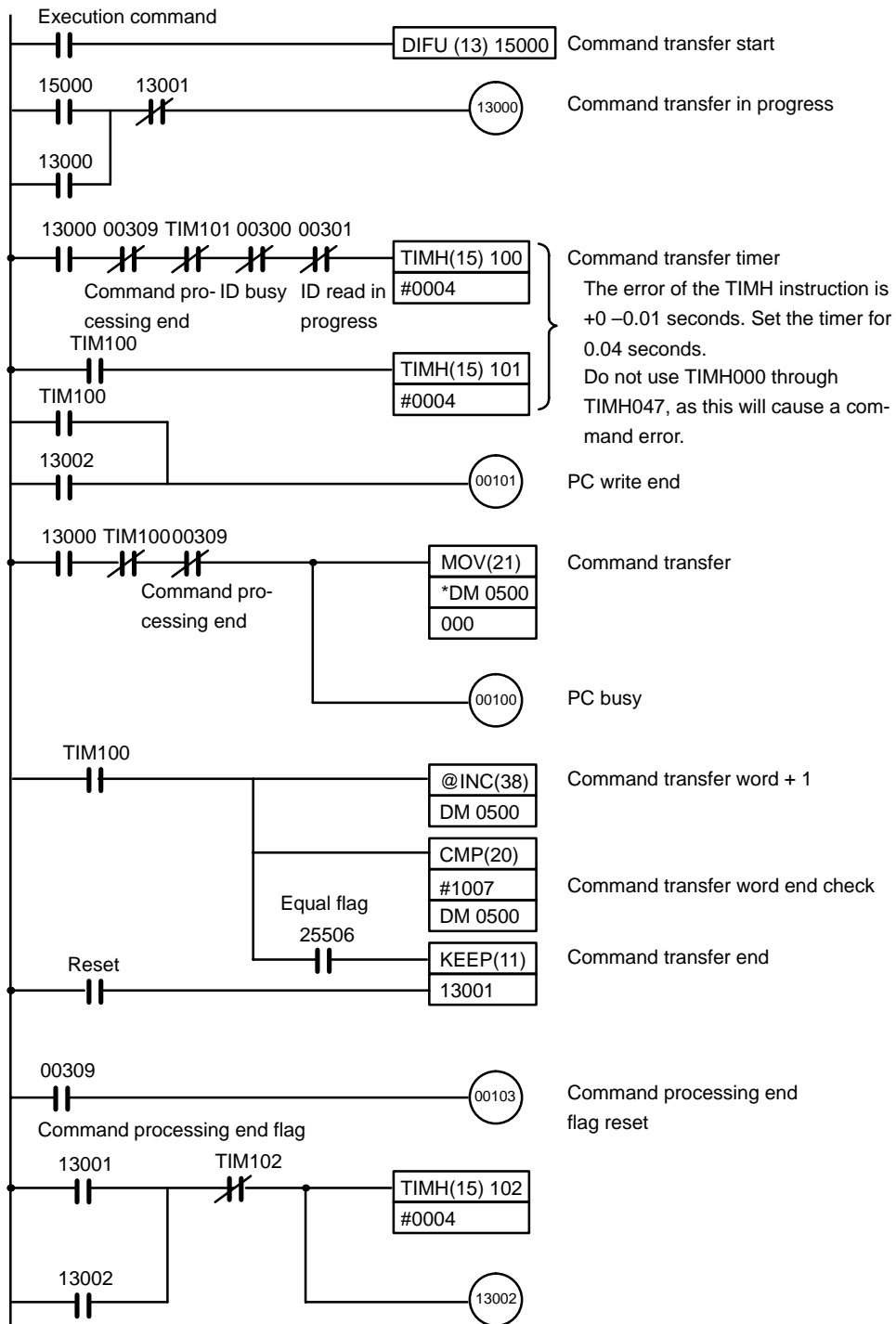
For example, if only one Unit is mounted to the Remote I/O Slave Rack, the calculation would be as follows:

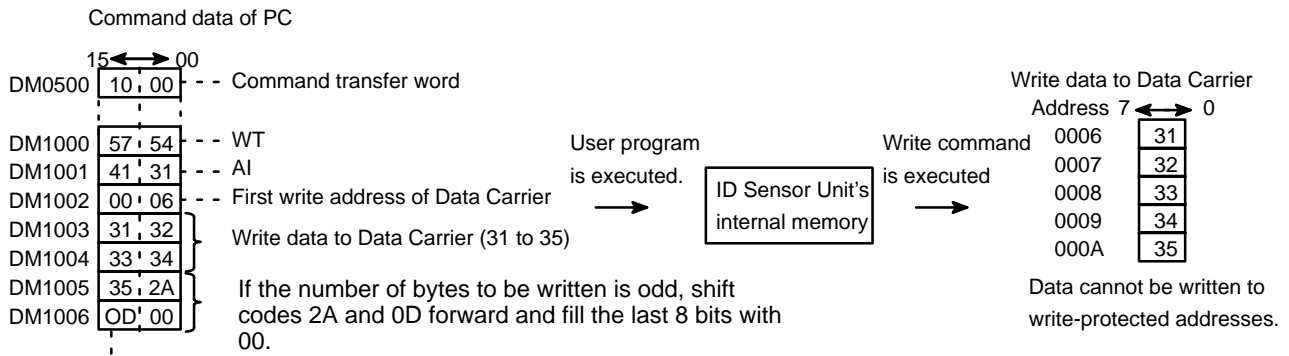
Example: $1.4 + (0.2 \times 4) = 2.2$ ms

PC'S scan time = 10 ms

Hold time - $10 \text{ ms} \times 2 + 2.2 \text{ ms} \times 2 = 24.4$ ms

F3-10 Using MOV to Write 5 bytes of ASCII Code Data (31 to 35) to the Data Carrier.





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 TIMH511 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.

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:

$$\text{Hold time} = \text{PC's scan time} \times 2 + \text{Remote I/O transfer time} \times 2$$

$$\text{Remote I/O transfer time} = 1.4 + (0.2 \times (\text{the number of words allocated to the Remote I/O Slave Rack}))$$

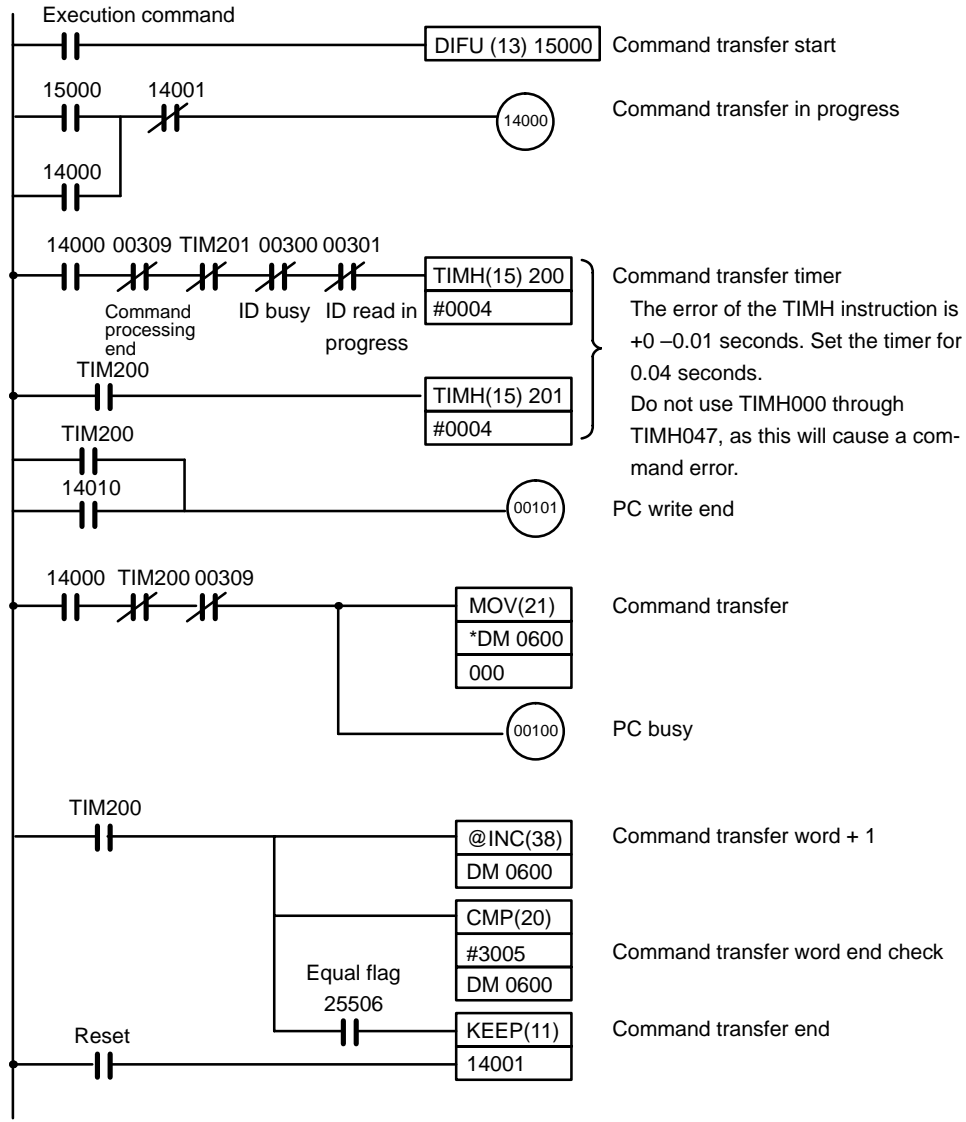
For example, if only one Unit is mounted to the Remote I/O Slave Rack, the calculation would be as follows:

$$\text{Example: } 1.4 + (0.2 \times 4) = 2.2 \text{ ms}$$

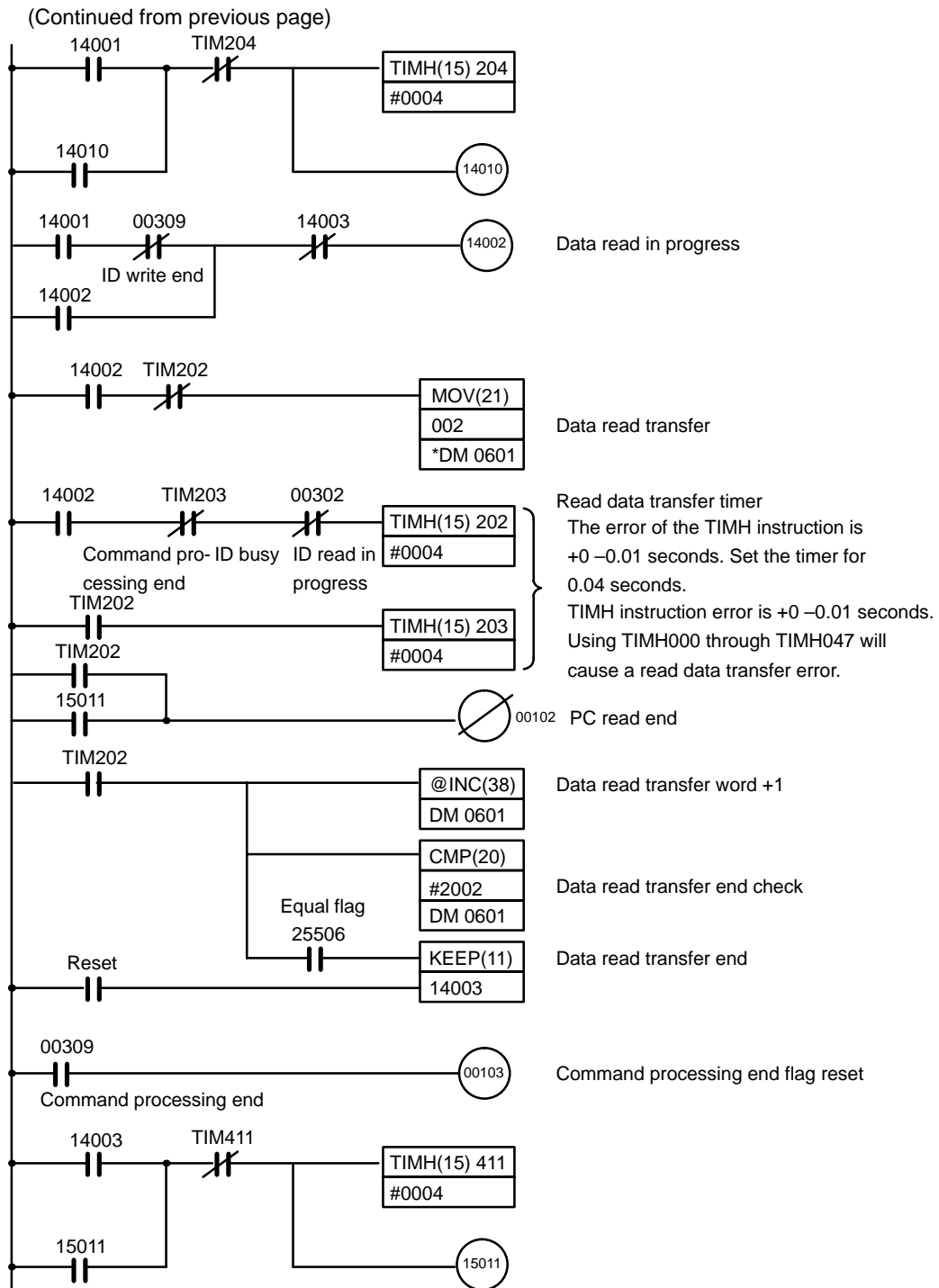
$$\text{PC'S scan time} = 10 \text{ ms}$$

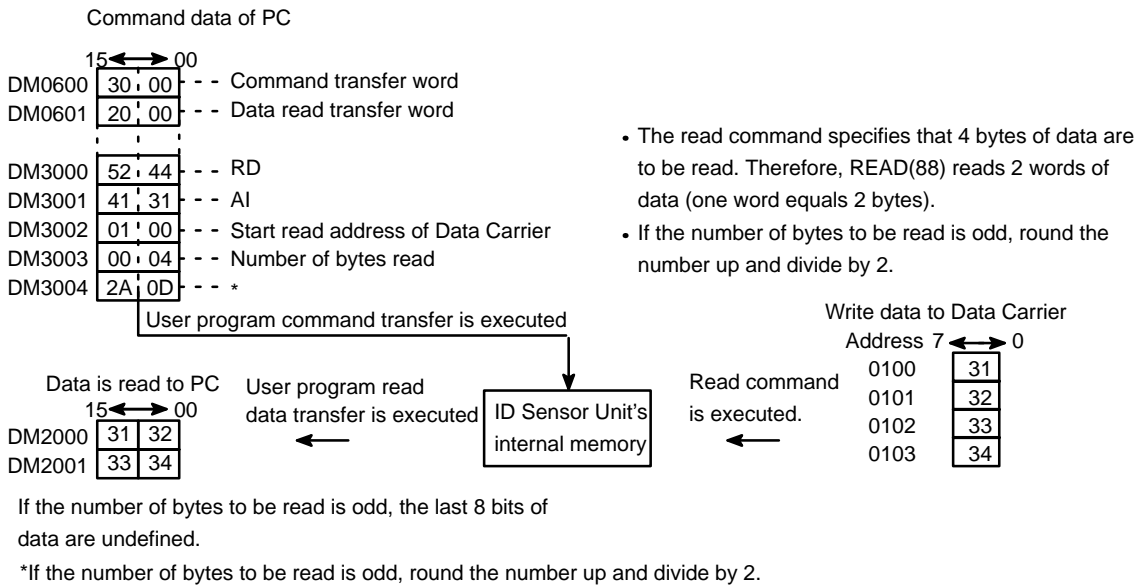
$$\text{Hold time} = 10 \text{ ms} \times 2 + 2.2 \text{ ms} \times 2 = 24.4 \text{ ms}$$

F3-11 Using MOV to Read 4 Bytes of Data from Data Carrier Address 0100 to PC



Next page





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 (00309) 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-E 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.

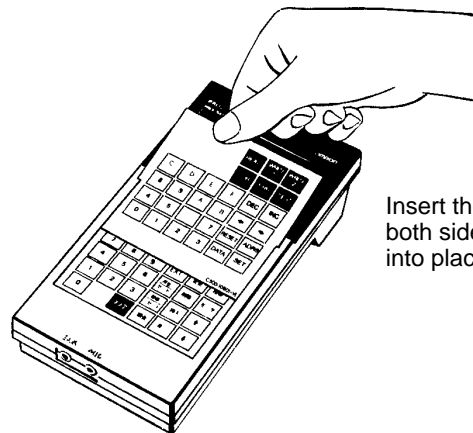
Use the optional C200H-CN222 (2 m) or C200H-CN422 (4 m) connecting cable to connect the Handheld Programming Console to the ID Sensor Unit. Connect the cable to the connector labeled "MONITOR" on the front panel of the ID Sensor Unit.

Refer to Figures F1-1 and F1-4 connection examples.

Attaching the Key Sheet

Attach the key sheet (provided with the ID Sensor Unit as an accessory) as shown in Figure F3-12.

F3-12 Attaching the Key Sheet



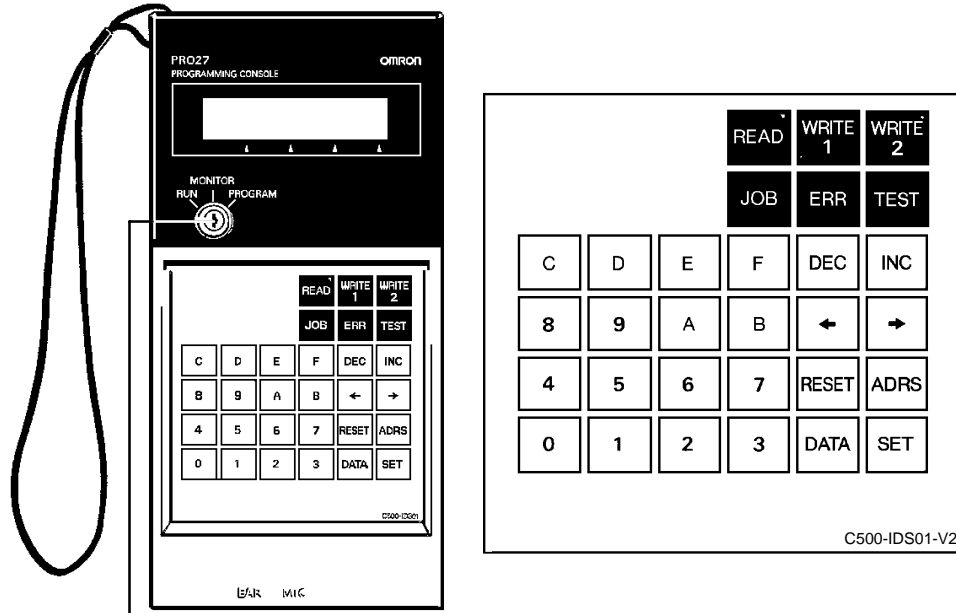
Insert the key sheet into the slots on both sides of the key pad, and slide into place.

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 F3-13).

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

F3-13 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. 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 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.
		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 (or Antenna).
		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

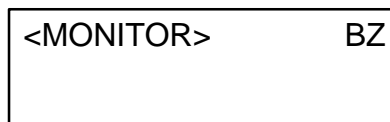
Monitor command	Function	Key sequence
JOB	Sets a Read/Write Head word number (fixed to 1) and address page number.	<pre> graph TD JOB[JOB] --> SET1[SET] SET1 --> INC[INC] SET1 --> DEC[DEC] SET1 --> DATA[DATA] INC --> DEC DEC --> INC INC --> SET2[SET] DEC --> SET2 DATA --> O0[0] O0 --> O1[0] O0O1["(IDS01-V2/IDS02-V1)"] O0O1 --> SET3[SET] O0O1 --> O7[7] O7 --> OF[F] O7OF["(IDS21/IDS22)"] O7OF --> SET4[SET] O0O1 --> O0_2[0] O0_2 --> SET5[SET] O1_2[1] --> O2[2] O2 --> O7_2[7] O1_2O2O7_2 --> SET6[SET] </pre>

Monitor command	Function	Key sequence
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 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.	

Monitor command	Function	Key sequence
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".	<p>1 : displays newest error information</p> <p>2 : displays statistical error information</p> <p>3 : clears newest error information</p> <p>4 : clears statistical error information</p>

Initial Display

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



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 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:

C500-IDS01-V2/02-V1

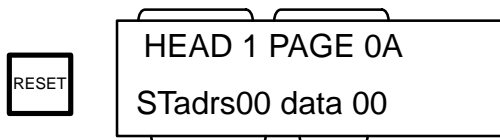
The number of the Read/Write Head connected to the ID Sensor Unit. Usually fixed to 1. (See note below.)

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

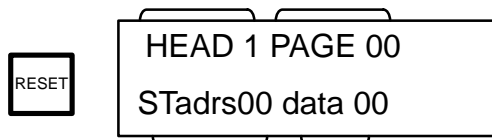
C500-IDS21/22

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

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



Address Data
ST: Start address
ED: End address



Address Data
ST: Start address
ED: End address

- Note**
1. The C500H-IDS01-V2 or C500-IDS02-V1 indicates “HEAD 1” while the C500H-IDS21 or C500-IDS22 indicates “ANT.1”. Throughout this section, “HEAD 1” is displayed on the screen, but “ANT.1” will be displayed when the C500-IDS21 or C500-IDS22 is used.
 2. The address page number must be set in hexadecimal on the C500H-IDS01-V2 or C500-IDS02-V1 and decimal on the C500H-IDS21 or C500-IDS22.

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 (or Antenna) word number and address page number. However, since the Read/Write Head (or Antenna) 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.

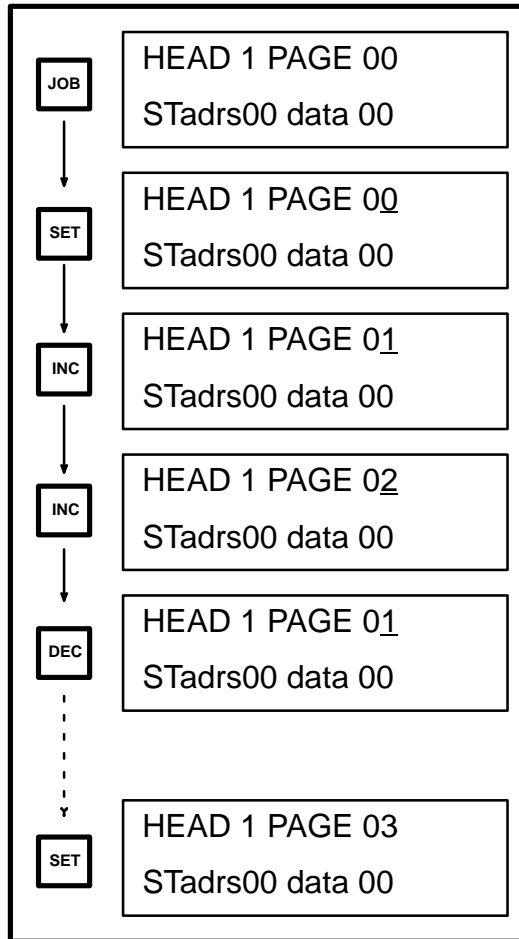
T3-3 Address Page Numbers

Address Page Number								
Address range	0	1	2	3	4	5	6	7
	000 through 0FF	100 through 1FF	200 through 2FF	300 through 3FF	400 through 4FF	500 through 5FF	600 through 6FF	700 through 7FF
	8	9	A	B	C	D	E	F
	800 through 8FF	900 through 9FF	A00 through AFF	B00 through BFF	C00 through CFF	D00 through DFF	E00 through EFF	F00 through FFF
	10	11	12	13	14	15	16	17
	1000 through 10FF	1100 through 11FF	1200 through 12FF	1300 through 13FF	1400 through 14FF	1500 through 15FF	1600 through 16FF	1700 through 17FF

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 F3-14 and F3-15).

F3-14 Setting Address Page Numbers (INC/DEC keys)



Press the JOB key while the initial message or reset message is displayed.

A R/W Head (Antenna) number can now be set; as the word number is already fixed, press the SET key to continue.

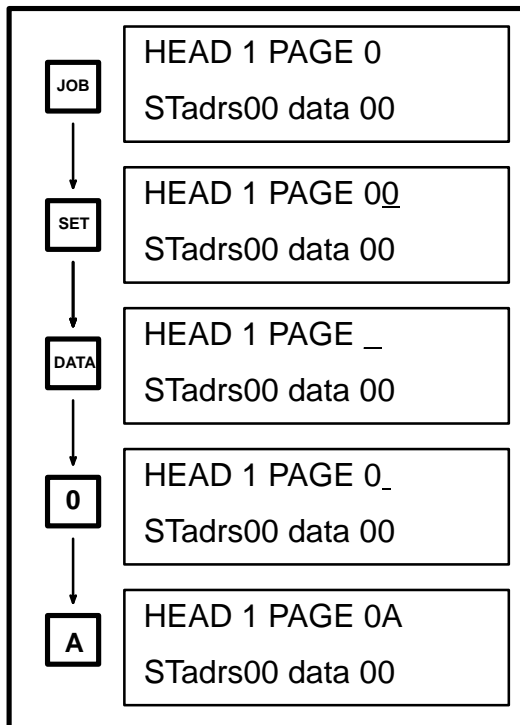
The address page number is increased by one each time the INC key is pressed.

The address page number is decreased by one each time the DEC key is pressed.

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.

F3-15 Inputting Address Page Numbers (DATA key)

C500-IDS01-V2/C500-IDS02-V1



Press the JOB key while the initial message or reset message is displayed.

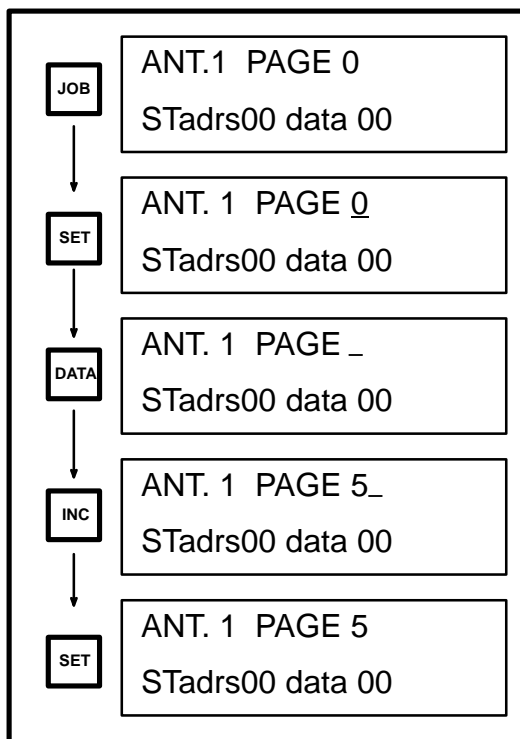
A R/W Head (Antenna) word number can now be set; as the word number is already fixed, press the SET key to continue.

Press the DATA key; an address page number can now be input.

Set the address page number to the desired value (within the range 0 through F) by pressing the corresponding numeric key.

Set the lower digit of the address page number to the desired value (within the range 0 through F) by pressing the corresponding numeric key. In this example, the address page number is set to 0A.

C500-IDS21/22



Press the JOB key while the initial message or reset message is displayed.

A R/W Head (Antenna) number can now be set; as the word number is already fixed, press the SET key to continue.

The address page number is decreased by one each time the DEC key is pressed.

Set the address page number to the desired value (within the range 0 through 9).

In this example, the address page number is set to 5.

Press the SET key to complete the procedure.

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.

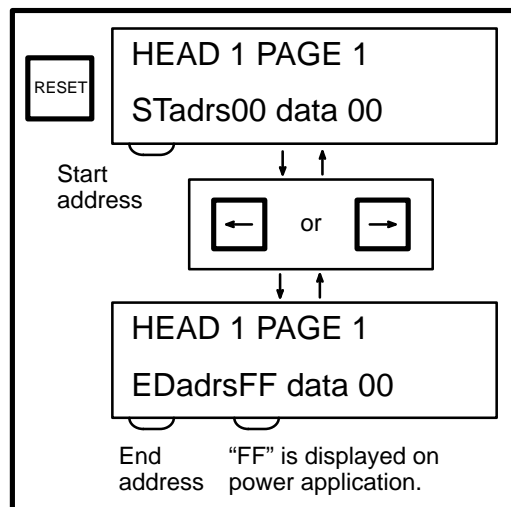
T3-5 Setting Start Address, End Address, and Data

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.



Press the RESET button to display the reset screen, as shown on the left.

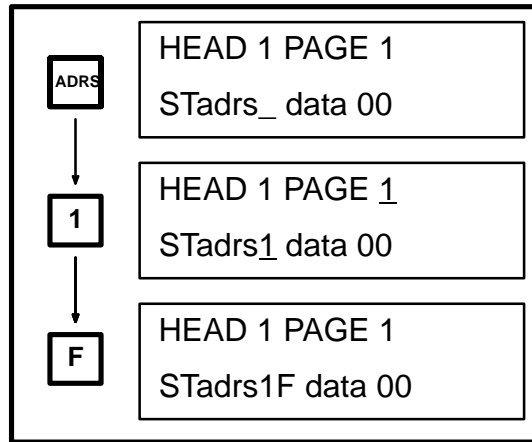
Pressing the left or right arrow key alternately displays the current start and end addresses.

- Note**
1. This operation displays only the current addresses; it cannot be used to change an address.
 2. Models C500-IDS01-V2/IDS02-V1 indicate "HEAD 1" while Models C500-IDS21/IDS22 indicate "ANT. 1".

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 F3-16) or by using the INC/DEC keys (Figure F3-17).

F3-16 Setting Addresses (Direct Input)



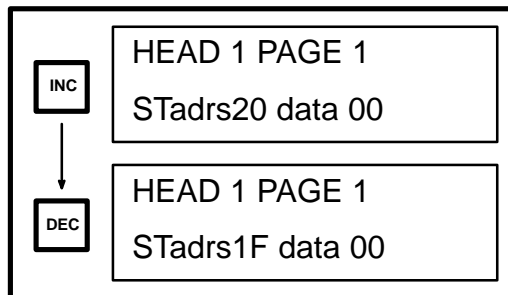
Change the current address (start or end address) by first pressing the ADRS key and then entering the desired value. In this example, the start address is changed to 1F.

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

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 F3-17.

F3-17 Setting Addresses (INC/DEC)



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

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

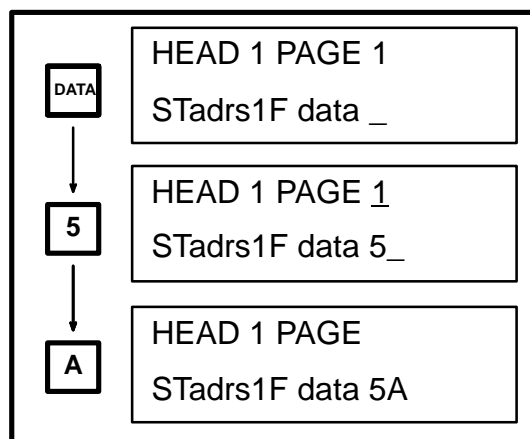
When setting the address, be sure that the end address is equal to or greater than the start address. If a value input for the end address is less than that of the start address, the buzzer will sound and the input will not be accepted.

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 F3-18.

F3-18 Data Setting



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.

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

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.

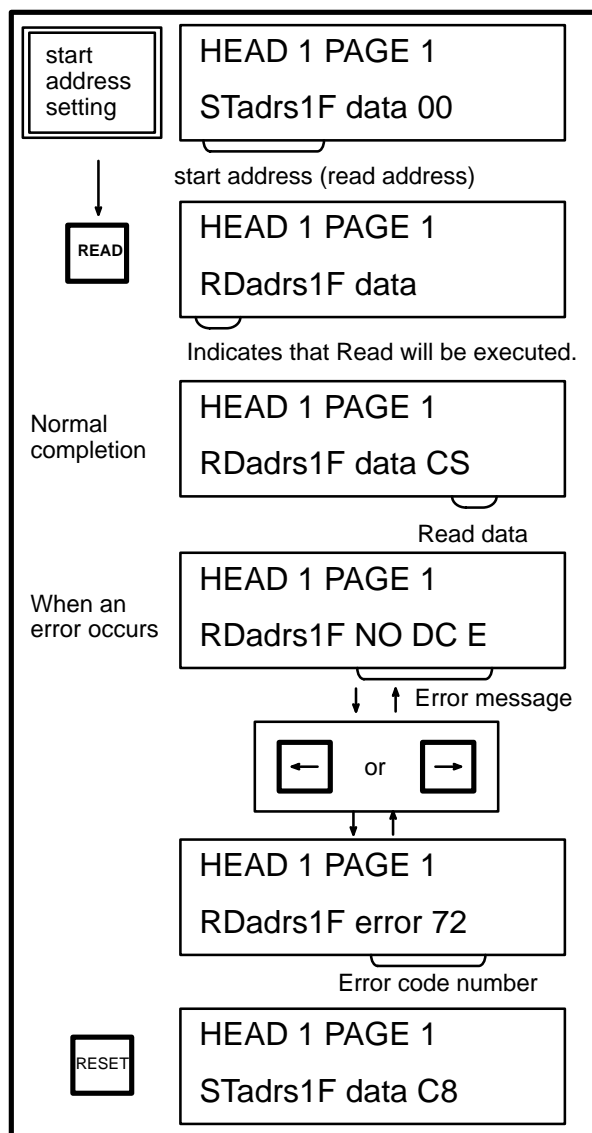
If the Read command is subsequently used to read data to the same data area, the set data will be changed to the value read by the Read command.

3-3-5 READ

This operation reads 1 byte of data from a specified address in the Data Carrier. Refer to Figure F3-19.

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

F3-19 READ



Set the start address from which the data is to be read.

Press the READ key; the data in the specified start address will be read.

When the read operation has been completed, the read data is displayed.

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*).

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

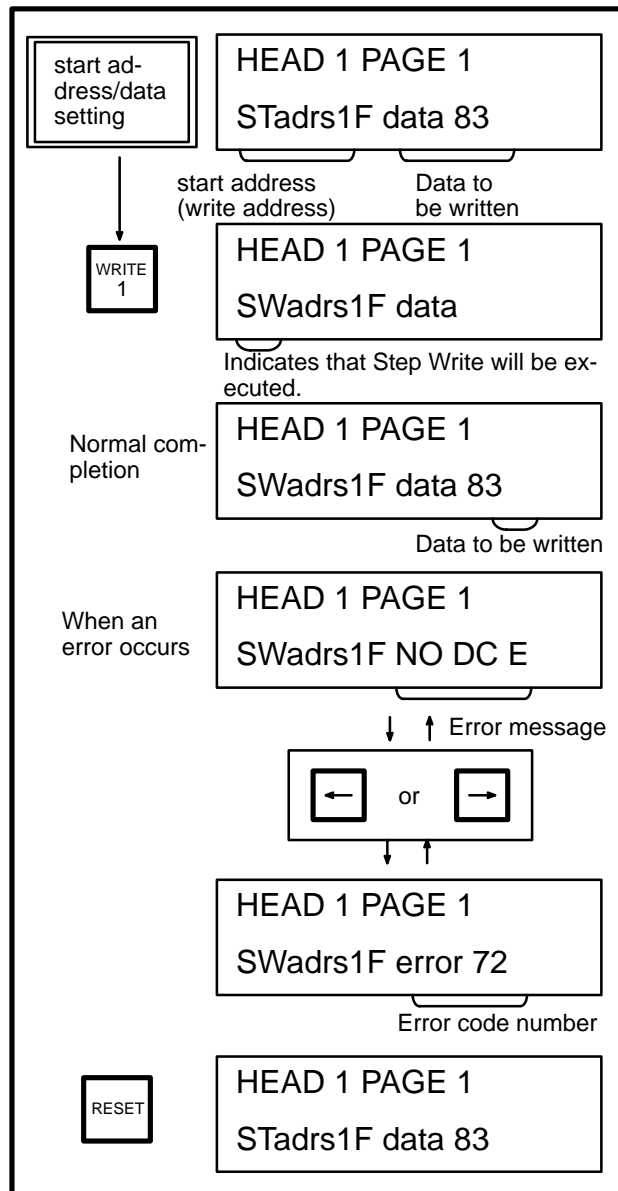
To perform another operation or to abort the READ operation, press the RESET key. The display will return to the reset display. In this example, the display indicates the reset status. Another operation can now be performed.

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 F3-20.

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.

F3-20 Step Write (WRITE 1)



Set the data to be written and the address in the Data Carrier the data is to be written to.

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

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

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*).

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

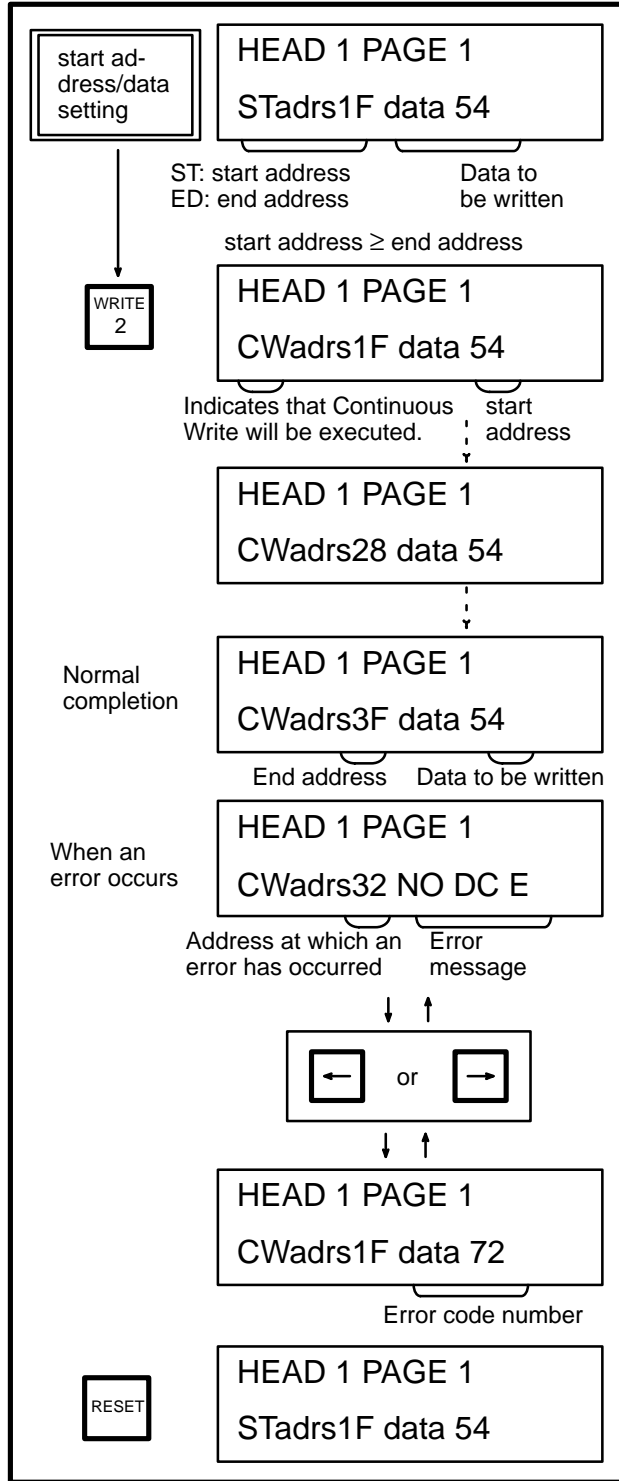
To perform another operation, or to abort the Step Write operation, press the RESET key. The display will return to the reset status. In this example, the display indicates the reset status. Another operation can now be performed.

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 F3-21.

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.

F3-21 Continuous Write (WRITE 2)



Select the start and end addresses, as well as the data to be written.

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.

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.

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.)

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

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.

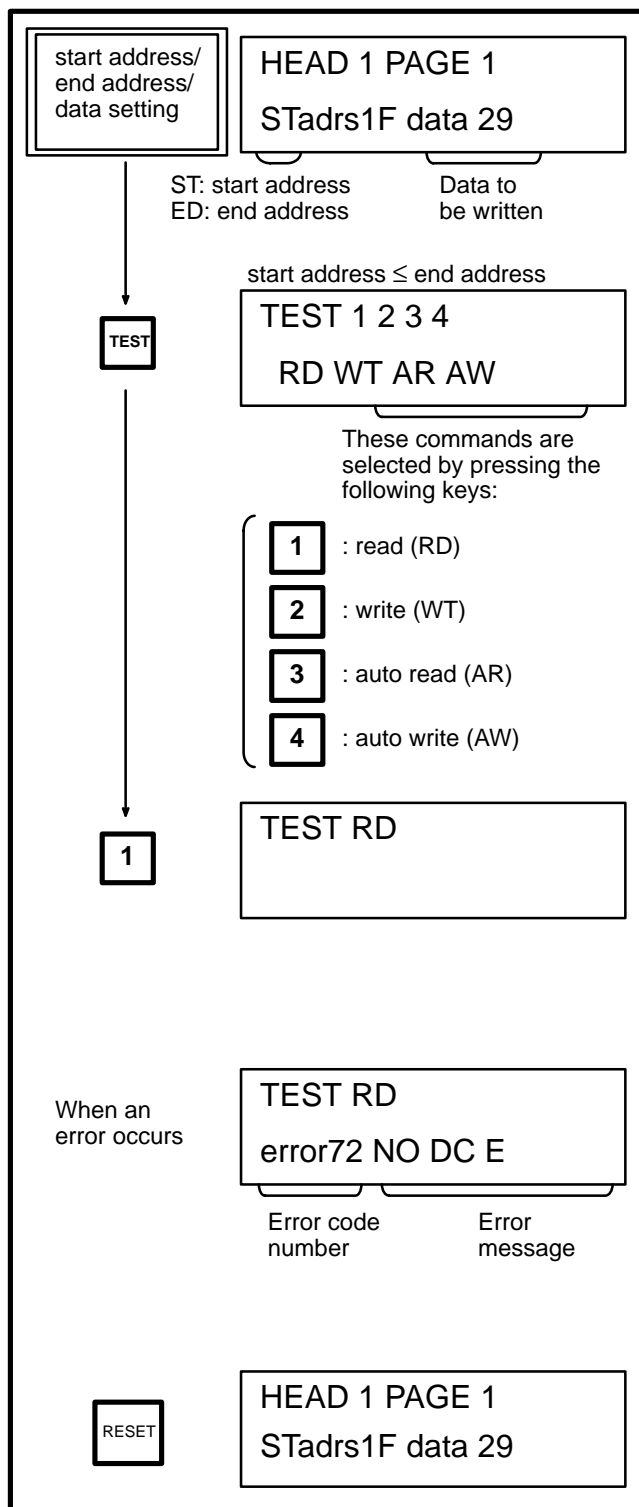
3-3-8 Monitor Test (TEST)

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 F3-22.

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.

F3-22 Monitor Test (TEST)



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.

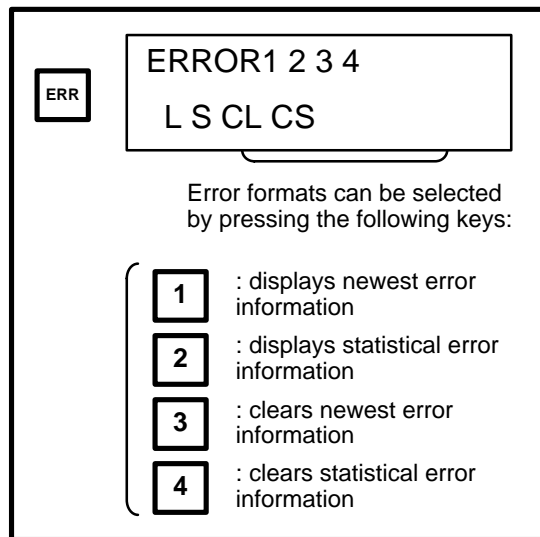
To begin another command or to abort the TEST operation, press the RESET key and the display will return to the reset status.

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 F3–23.

F3–23 Error Log Display (ERR)



Press the ERR key to display the newest error information or statistical error information.

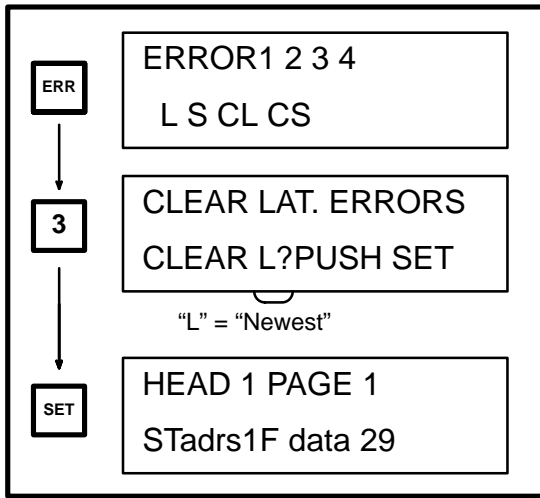
Use keys 1 through 4 to display or clear desired error information.

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)

F3-24 Clearing Newest Error Information



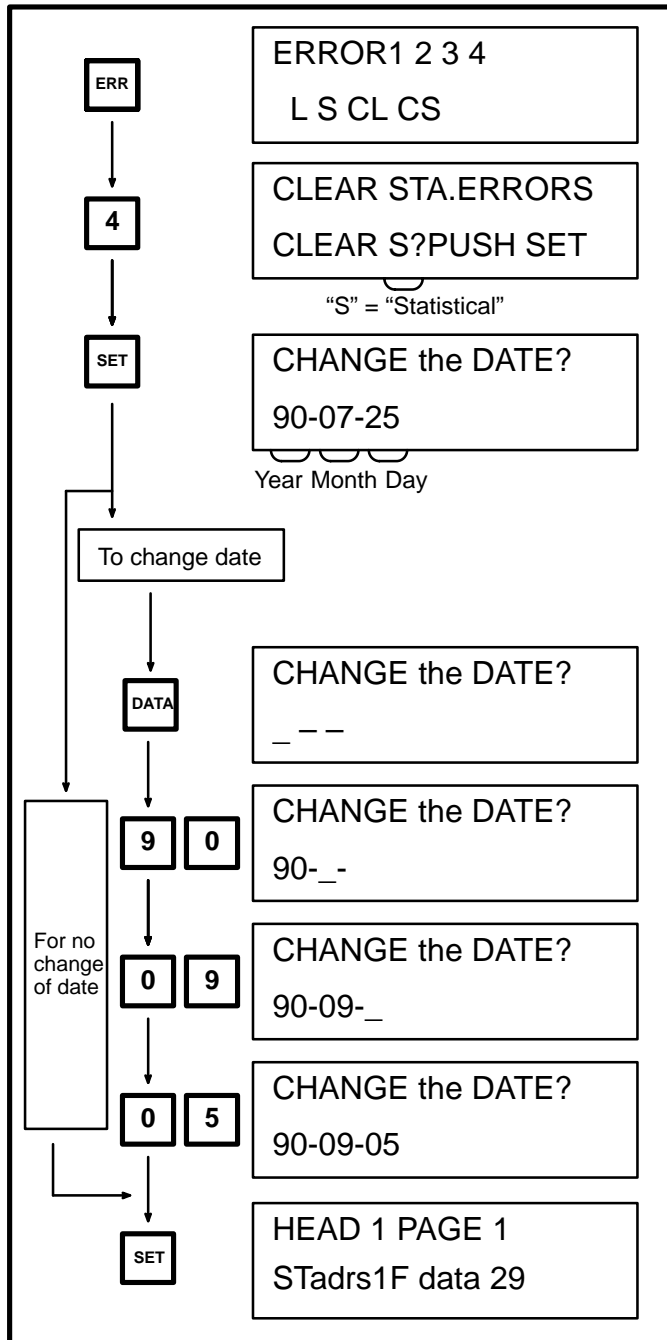
When the ERR key is pressed, the menu shown at left is displayed. Press key 3 to choose the newest error clearing operation.

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)

F3-25 Clearing Statistical Error Information



Press key 4 to clear the statistical error information and set a new registration date.

The message "CLEAR S?" is displayed, asking for confirmation that the statistical error information is to be cleared.

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?"

Press the DATA key to begin entering the date.

Enter the last 2 digits of the year. In this example, the year is turns ON990.

Next, enter the month as a 2-digit number (01 for January; 09 for September). In this example, the month is set to September.

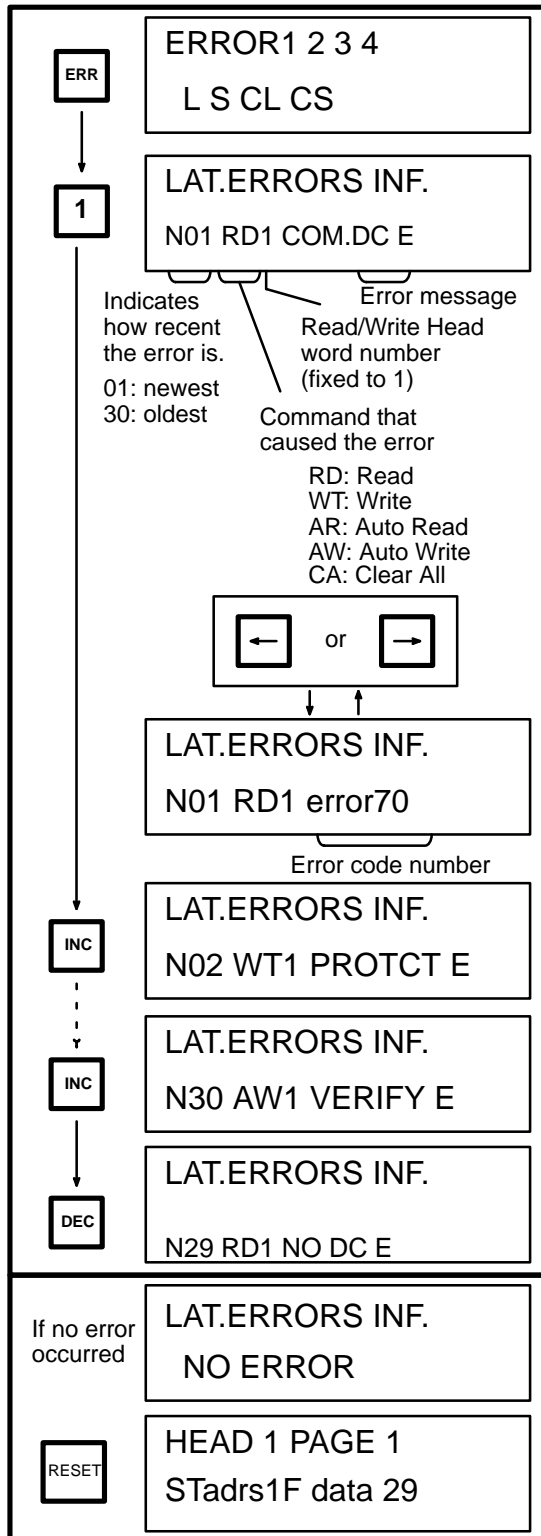
Now input the day as a 2-digit number. Be sure to input the prefix 0 when entering a single-digit day (i.e. 01, 02). In this example, the day is set to the 5th.

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)

F3-26 Newest Error Information Key



Press key 1 to display the command that caused the error and the corresponding error message.

Up to 30 errors can be displayed sequentially by using the INC key.

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

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.

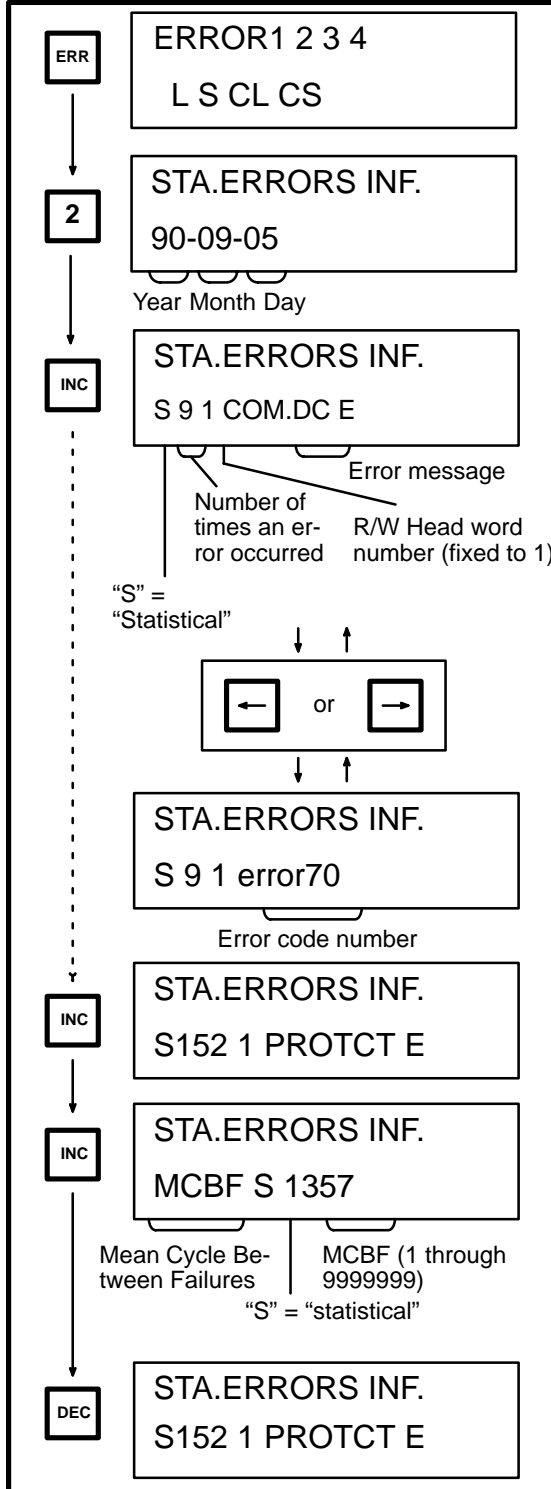
Each time the DEC key is pressed, new errors are displayed in the order in which they occurred.

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

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)

F3-27 Statistical Error Information



Press key 2 to display the statistical error information.

The date is displayed first. This date was previously registered by the user as the date from which errors were to be monitored.

Press the INC key to display the number of times an error has occurred, the error message, and the R/W Head word number.

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

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

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.

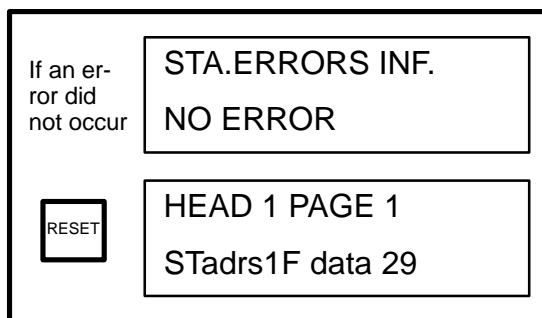
After all messages have been displayed, press the INC key to display the MCBF. The MCBF value is calculated using the following expression:

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

(The MCBF is rounded off.)

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

Press the DEC key to display the previous screen.



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

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 error	ADRS E
7C	Read/Write Head disconnect error	R/W H E
7D	Write protect error	PROTCT E

Note Models C500-IDS01-V2/IDS02-V1 indicate "R/W H E".
Models C500-IDS21/IDS22 indicate "R/W A 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, T3-8 and Figure F3-28 show the processing times required for the communication of various quantities of data.

T3-7 C500-IDS01-V2/IDS02-V1

Data Carrier	IDS mode	Command	Byte										
			1	4	8	16	32	64	128	256	502	2K	8K
V600-D□□R-□□ (battery built-in type)	---	Read	54	59	66	82	111	172	293	536	1000	---	---
		Write (clear all)	96	109	127	162	232	374	709	1220	2305	9123	36218
V600-D□□P□□ (with no battery)	Communications distance priority mode	Read	72	86	104	141	213	357	646	1224	---	---	---
		Write	185	212	249	322	468	760	1345	2515	---	---	---
	Communications speed priority mode	Read	85	91	99	113	144	205	326	567	---	---	---
		Write	197	219	250	309	428	667	1145	2098	---	---	---

Note 1. The IDS mode is set with pin 3 of the DIP switch.

2. The time required for each command processing of the Data Carrier with a built-in battery is not influenced by the IDS mode.
3. 3.2k and 8k bytes allow the execution of only the clear all command.

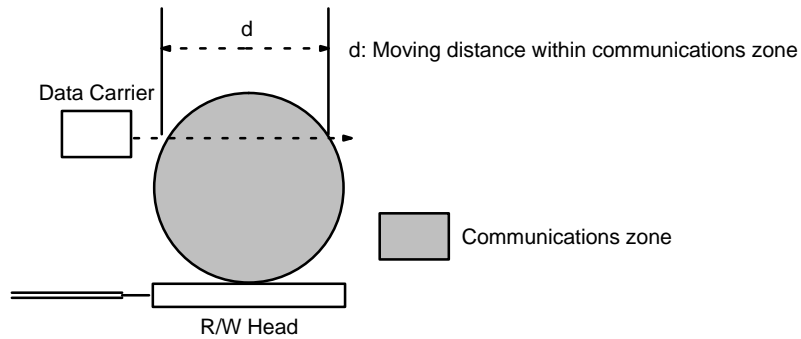
T3-8 C500-IDS21/IDS22

Command	Byte									
	1	4	8	16	32	64	128	256	502	2K
Read/Write command (including auto command)	90	95	105	120	200	355	665	1285	2530	---
Clear all command	---	---	---	---	---	---	---	---	---	9875

Data Carrier Moving Speed Use the following formula to obtain the moving speed of the Data Carrier.

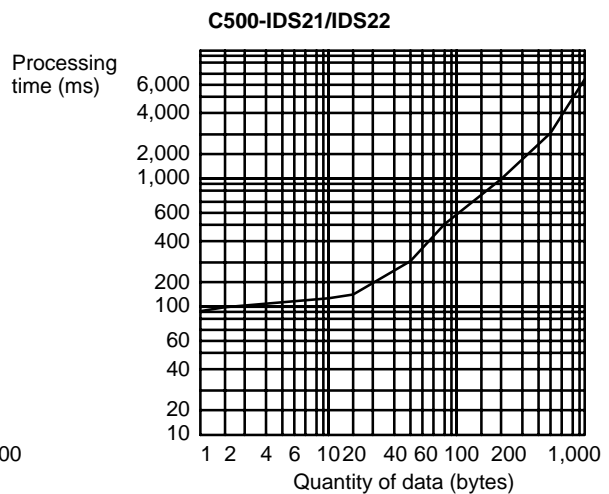
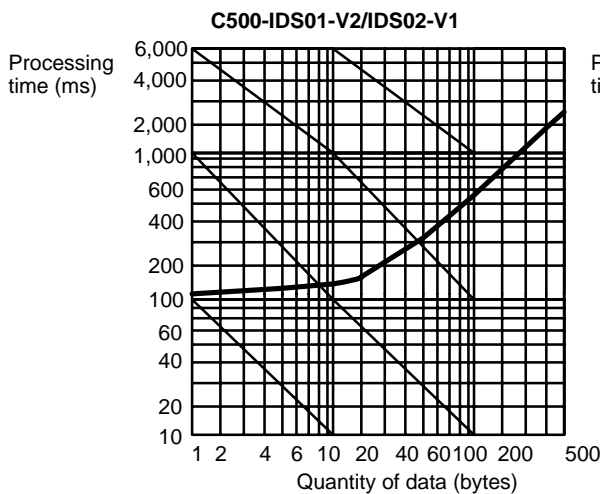
$$\text{Moving speed} = \frac{\text{Moving distance in the communications zone}}{\text{Command processing time}}$$

Refer to the above table for the processing time of each command. The Data Carrier's moving distance in the communications zone varies with the combination of the R/W Head and Data Carrier. Refer to the applicable R/W Head and Data Carrier Operation Manual.



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

F3-28 Command Processing Time Graph



3-4-2 Turnaround Time

Turnaround 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:

$$\text{TAT} = \text{Coefficient} \times \text{PC scan time} + \text{Command processing time} (+ \text{Remote I/O communication time, if applicable})$$

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.

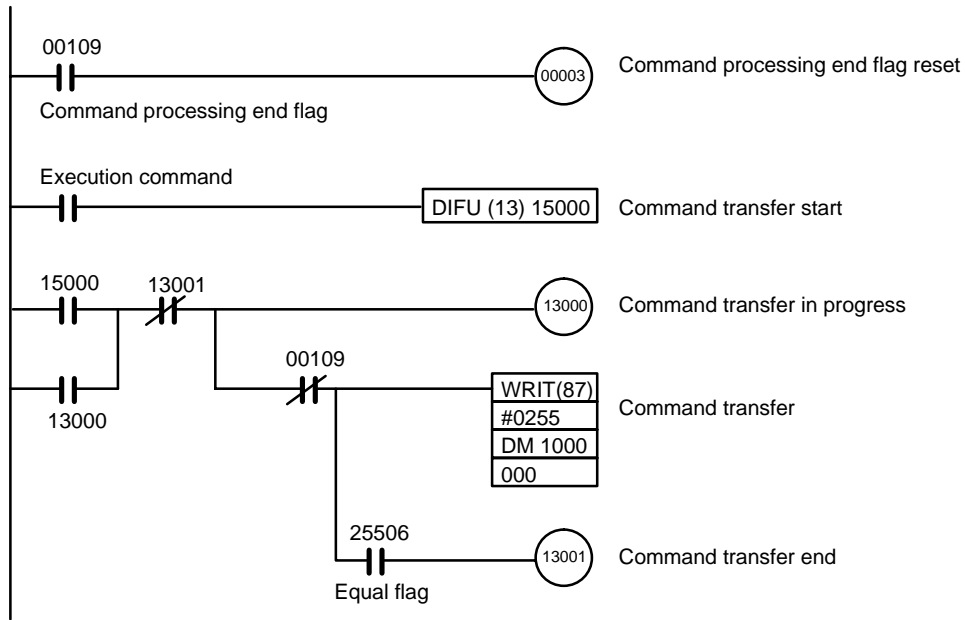
3-4-3 Program Examples and Timing Diagrams

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

Write and Auto Write Commands

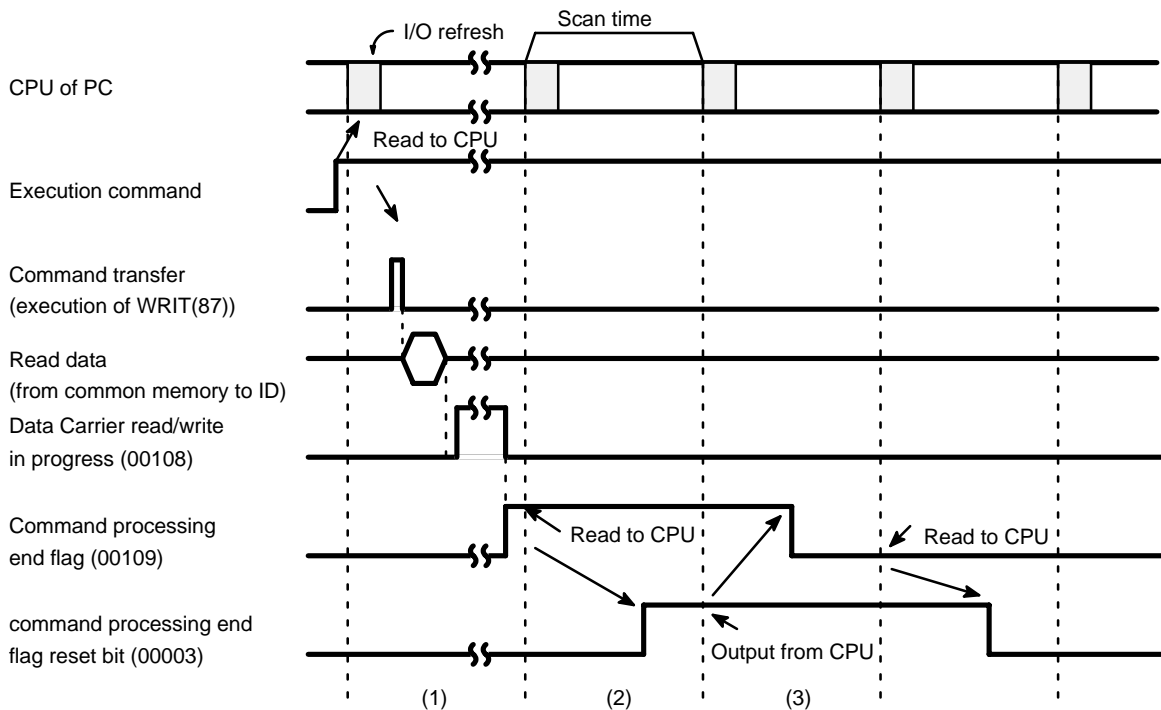
(1) To Write 502 Bytes of Data

F3-29 Writing 502 Bytes of Data



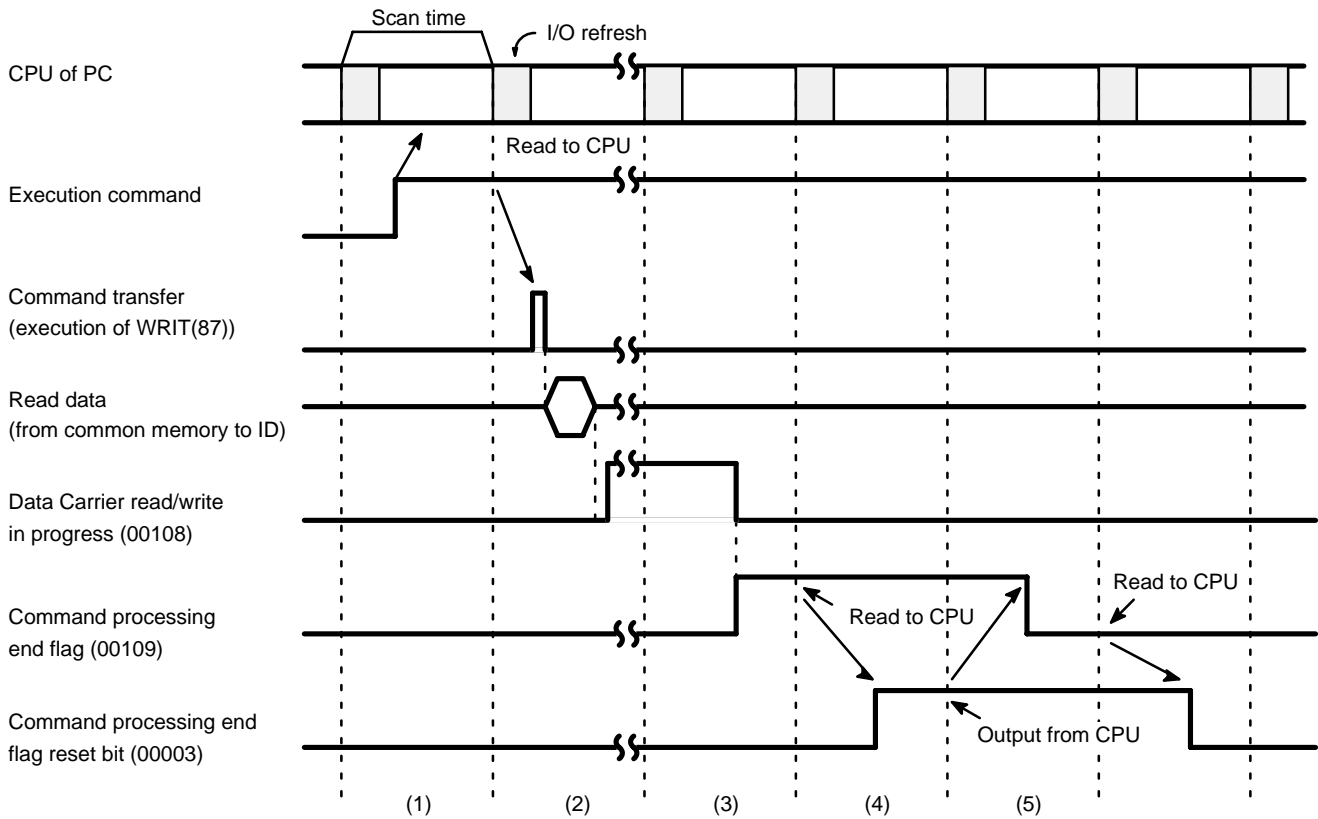
Minimum Scan Time

F3-30 Minimum Scan Time; Write and Auto Write



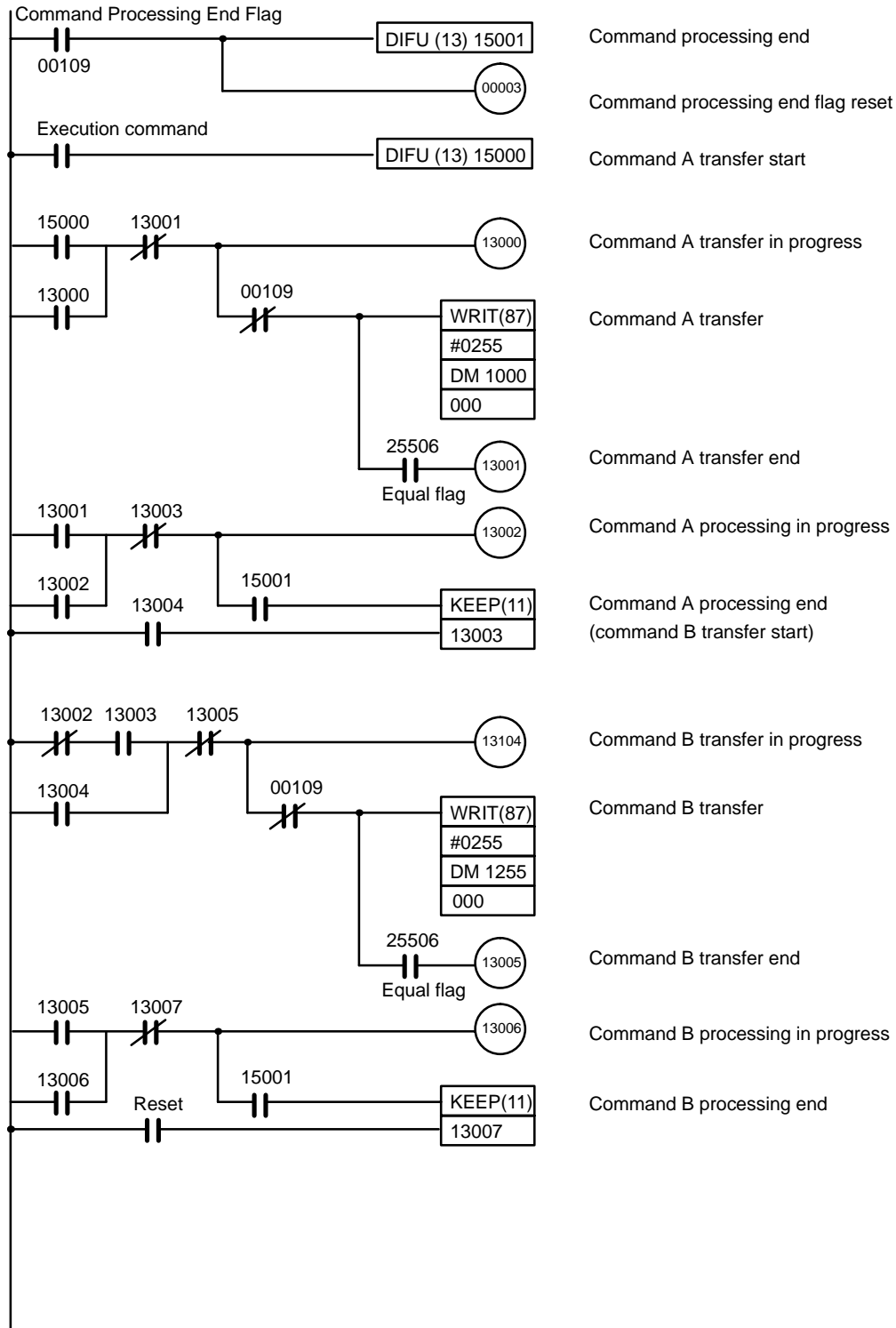
Maximum Scan Time

F3-31 Maximum Scan Time; Write and Auto Write



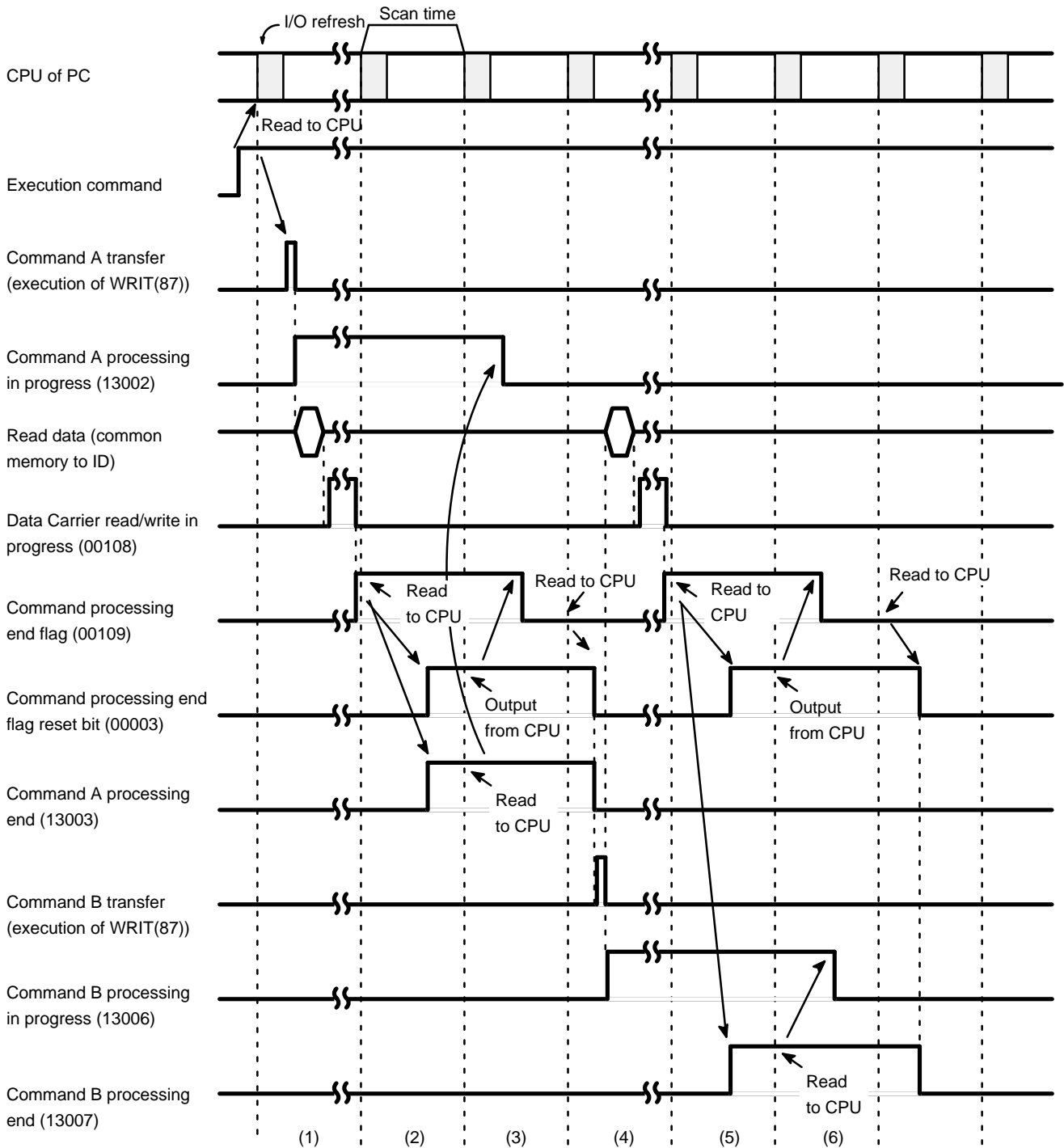
Note The processing time of the Write command varies according to the quantity of data to be written. Therefore, TAT varies according to what point during a scan the command processing end flag (00109) is set to ON.

F3-32 Writing 1,004 Bytes of Data



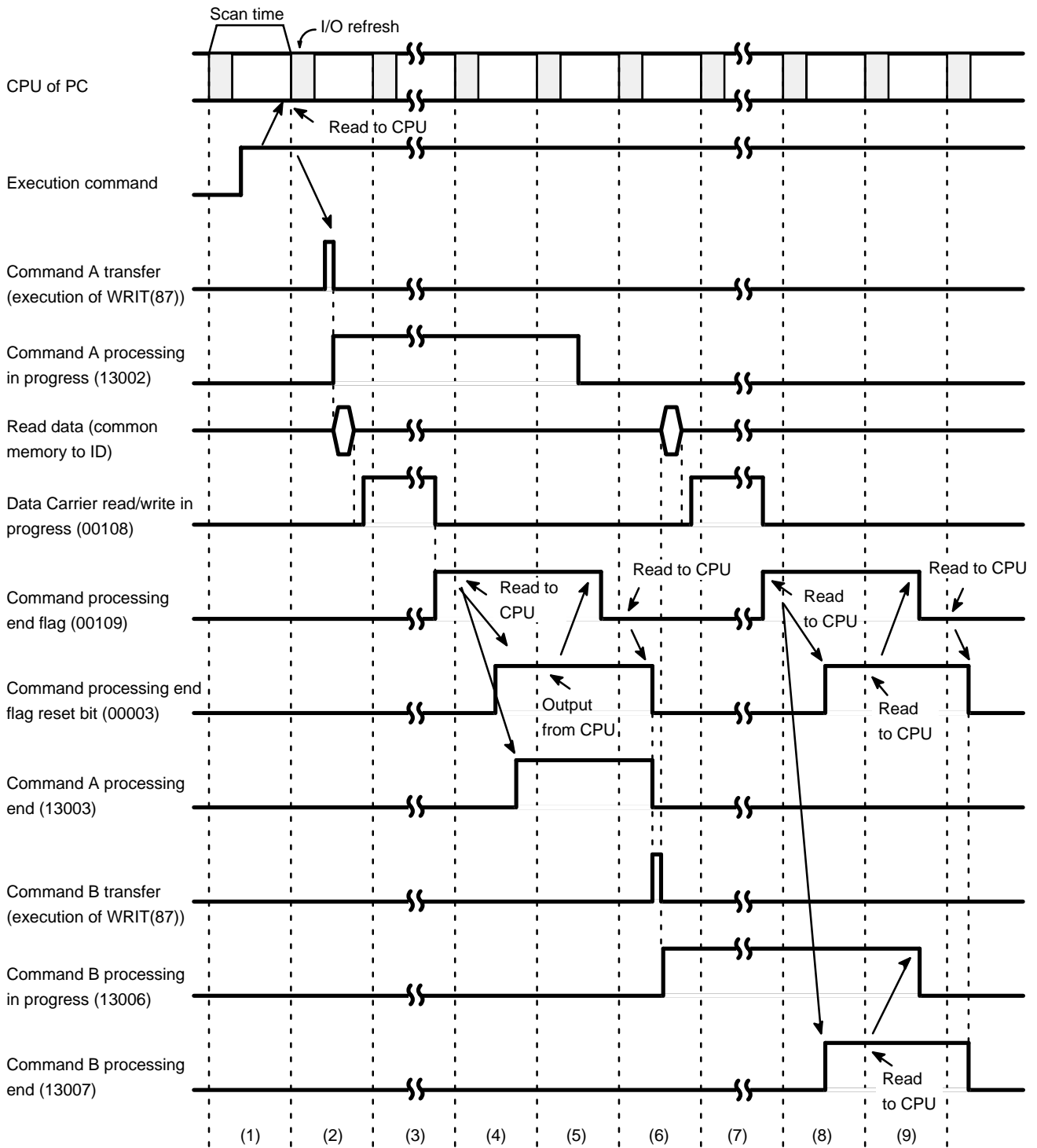
Minimum Scan Time

F3-33 Minimum Scan Time



Maximum Scan Time

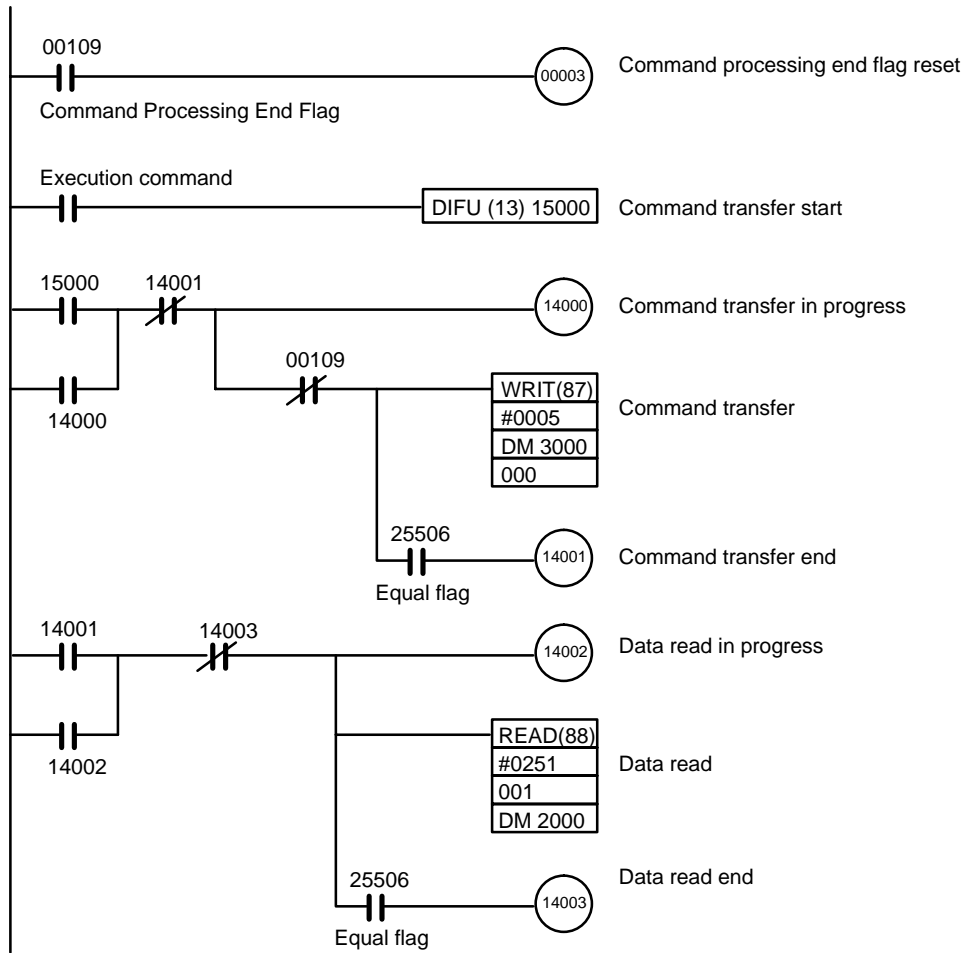
F3-34 Maximum Scan Time



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.

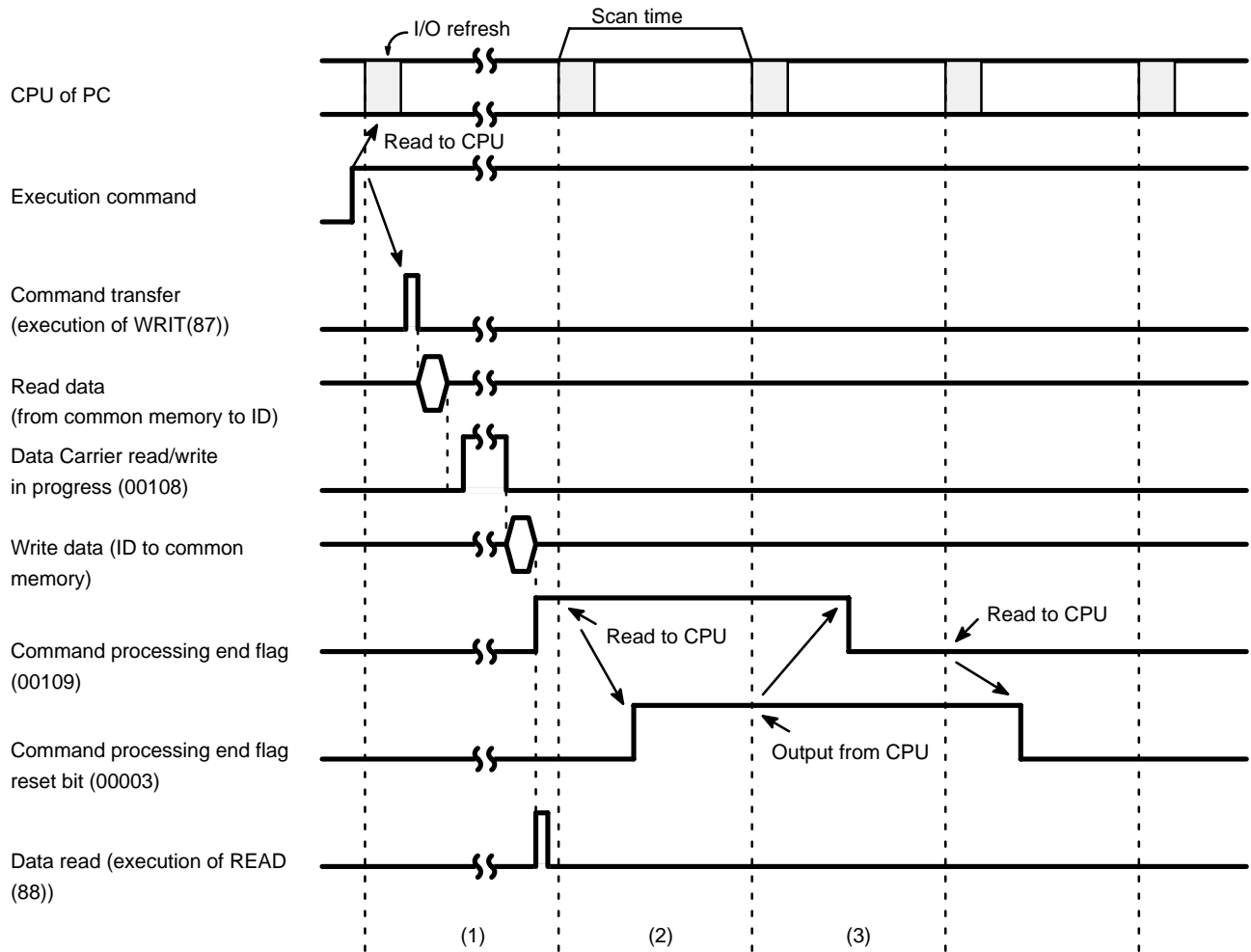
Read and Auto Read Commands

F3-35 Reading 502 Bytes of Data



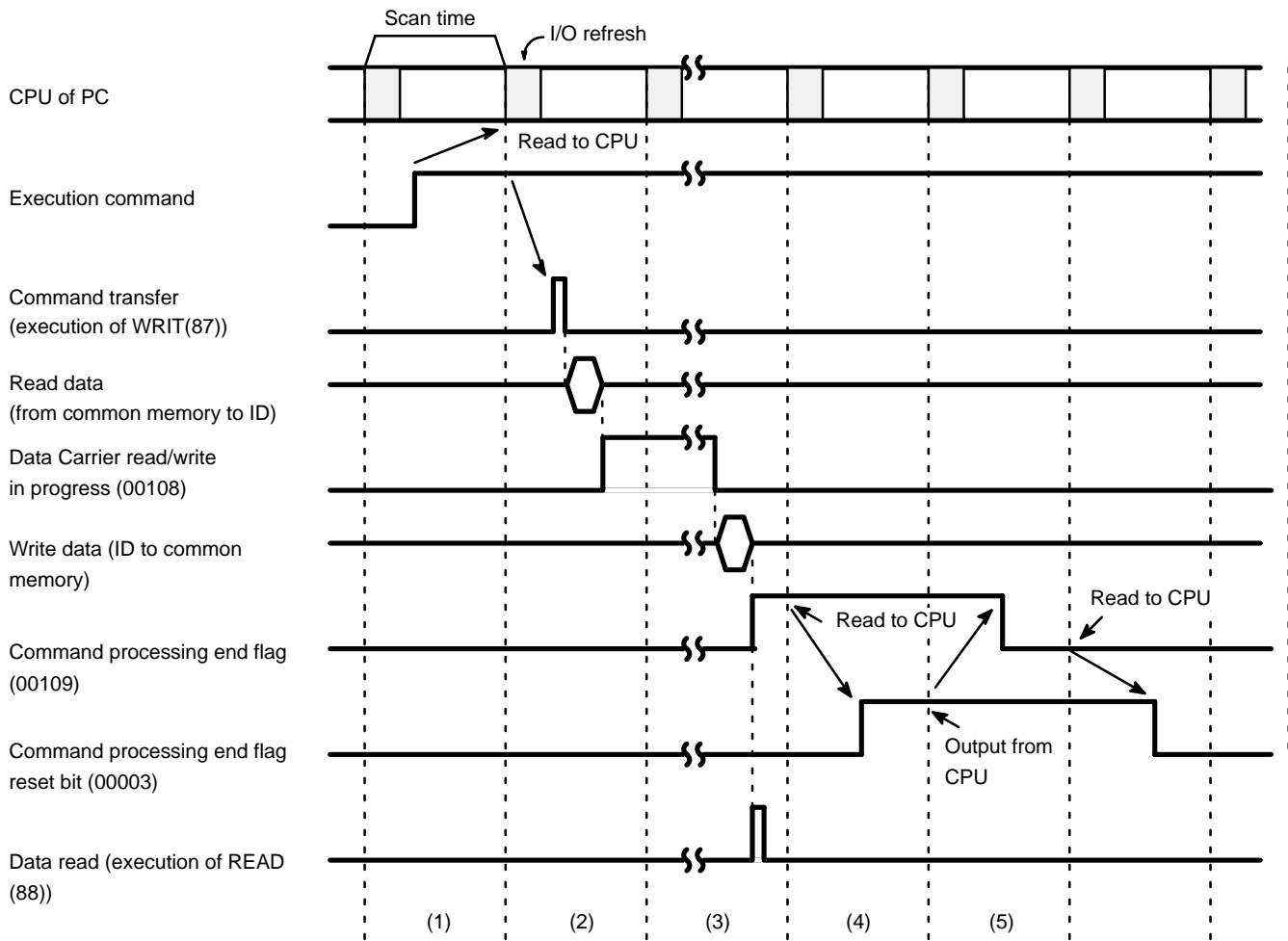
Minimum Scan Time

F3-36 Minimum Scan Time



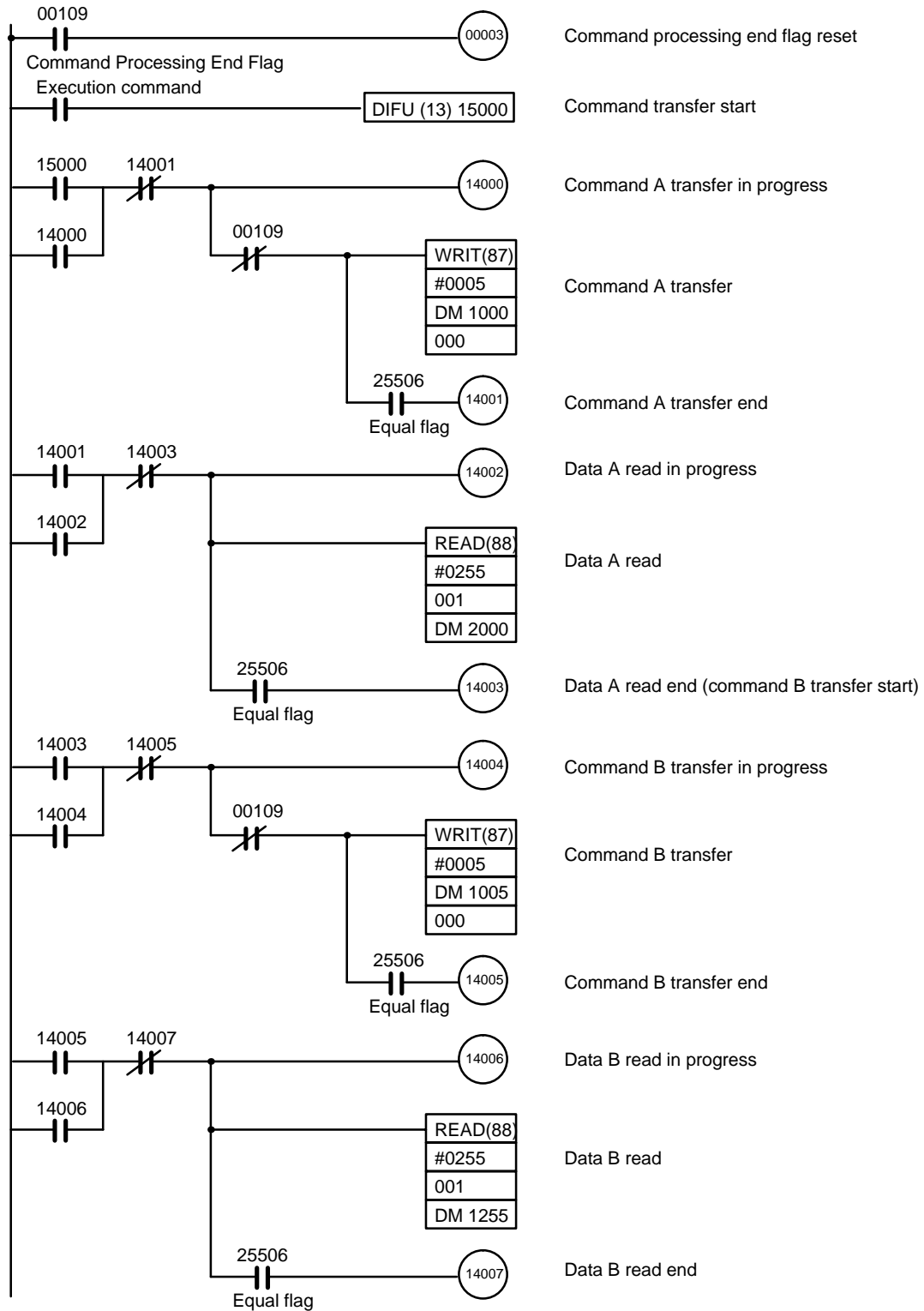
Maximum Scan Time

F3-37 Maximum Scan Time



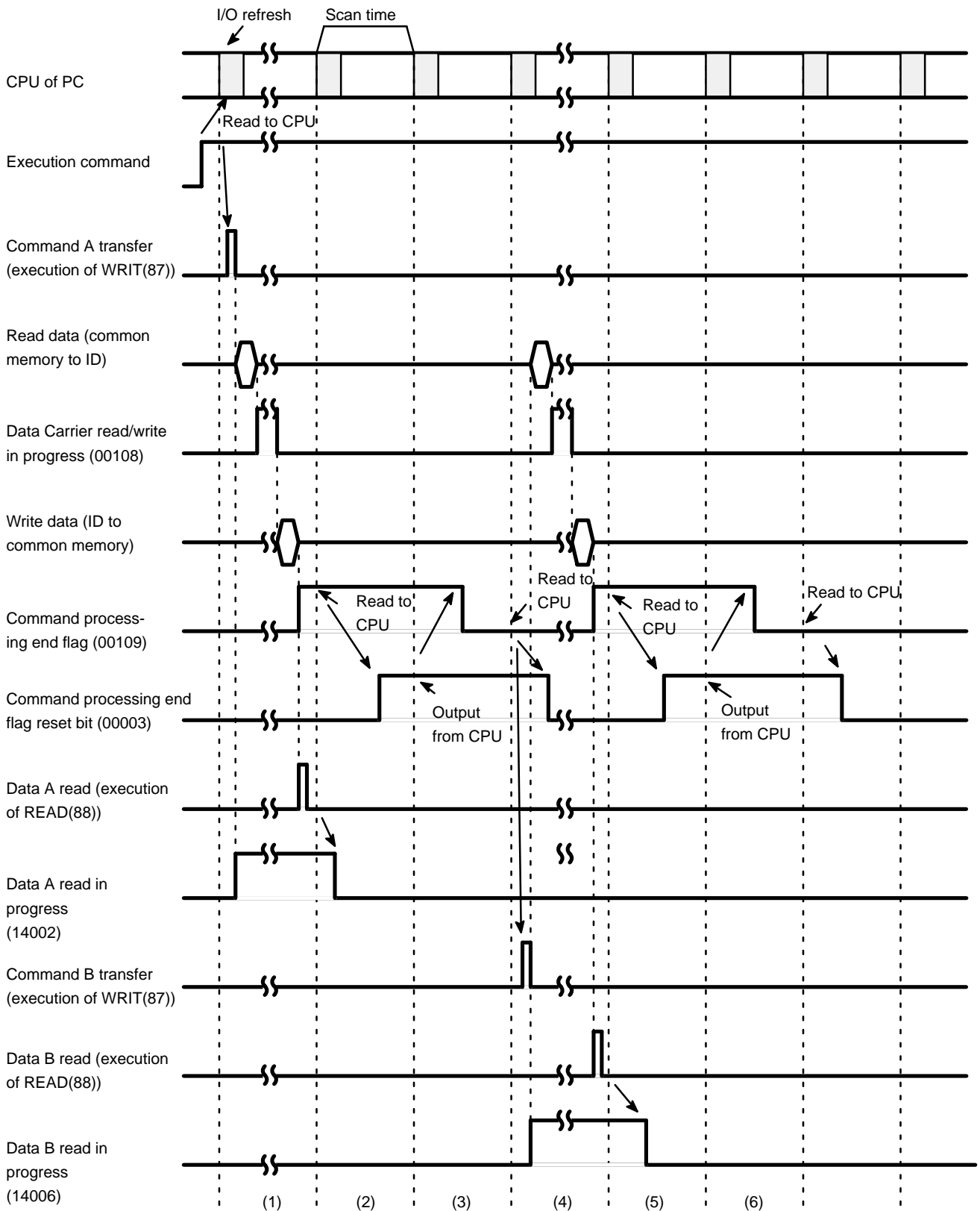
Note The processing time of the Read command varies according to the quantity of data to be written. Therefore, TAT varies according to what point during a scan the command processing end flag (00109) is set to ON.

F3-38 Reading 1,004 Bytes of Data



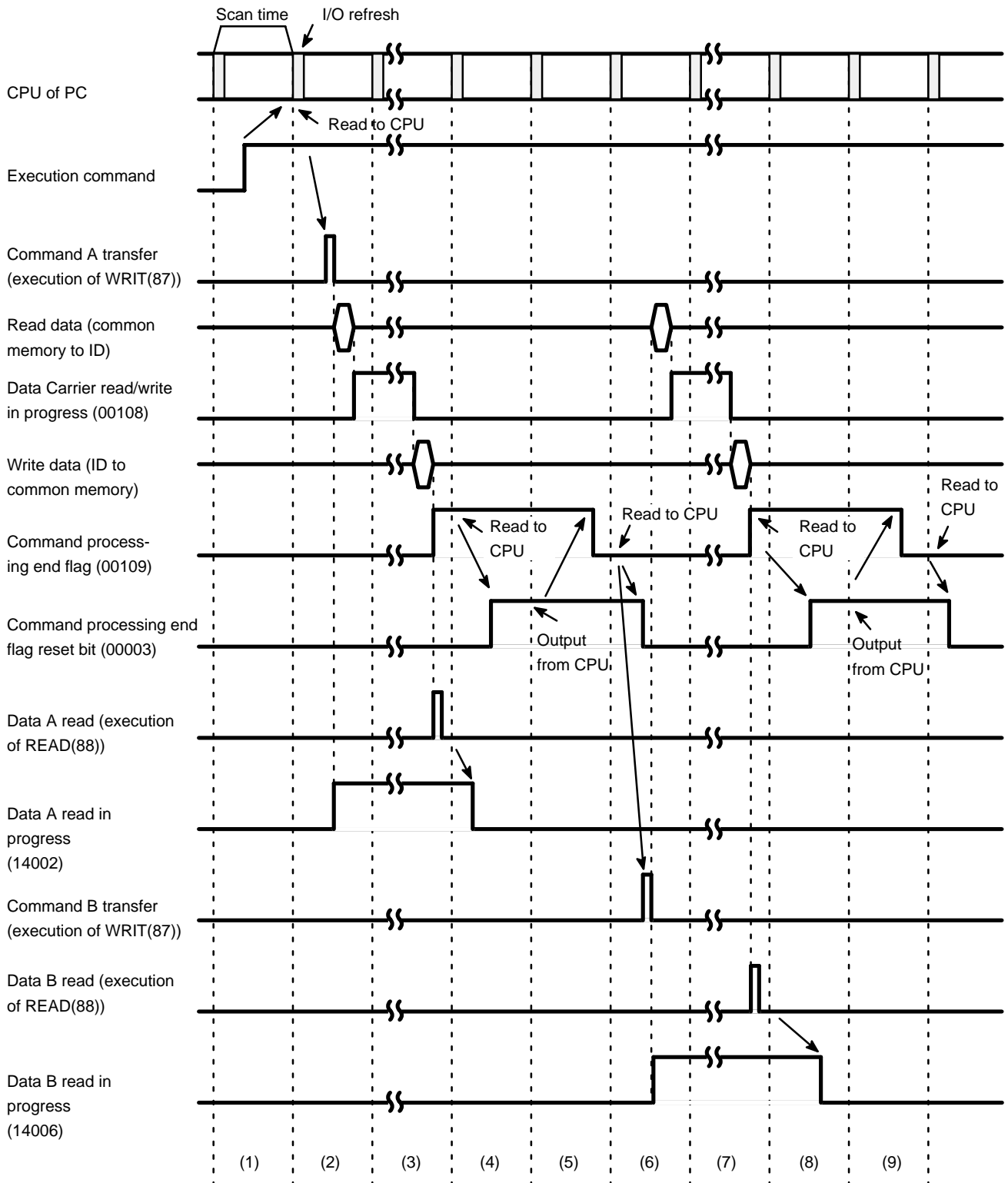
Minimum Scan Time

F3-39 Minimum Scan Time



Maximum Scan Time

F3-40 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	110
4-2	What To Do If a Malfunction Occurs	110
4-3	Diagnostic Flow Charts	111

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(88/190)) 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(88/190) is being executed, or if the operation mode of the PC is changed from RUN/MONITOR to PROGRAM while READ(88/190) 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

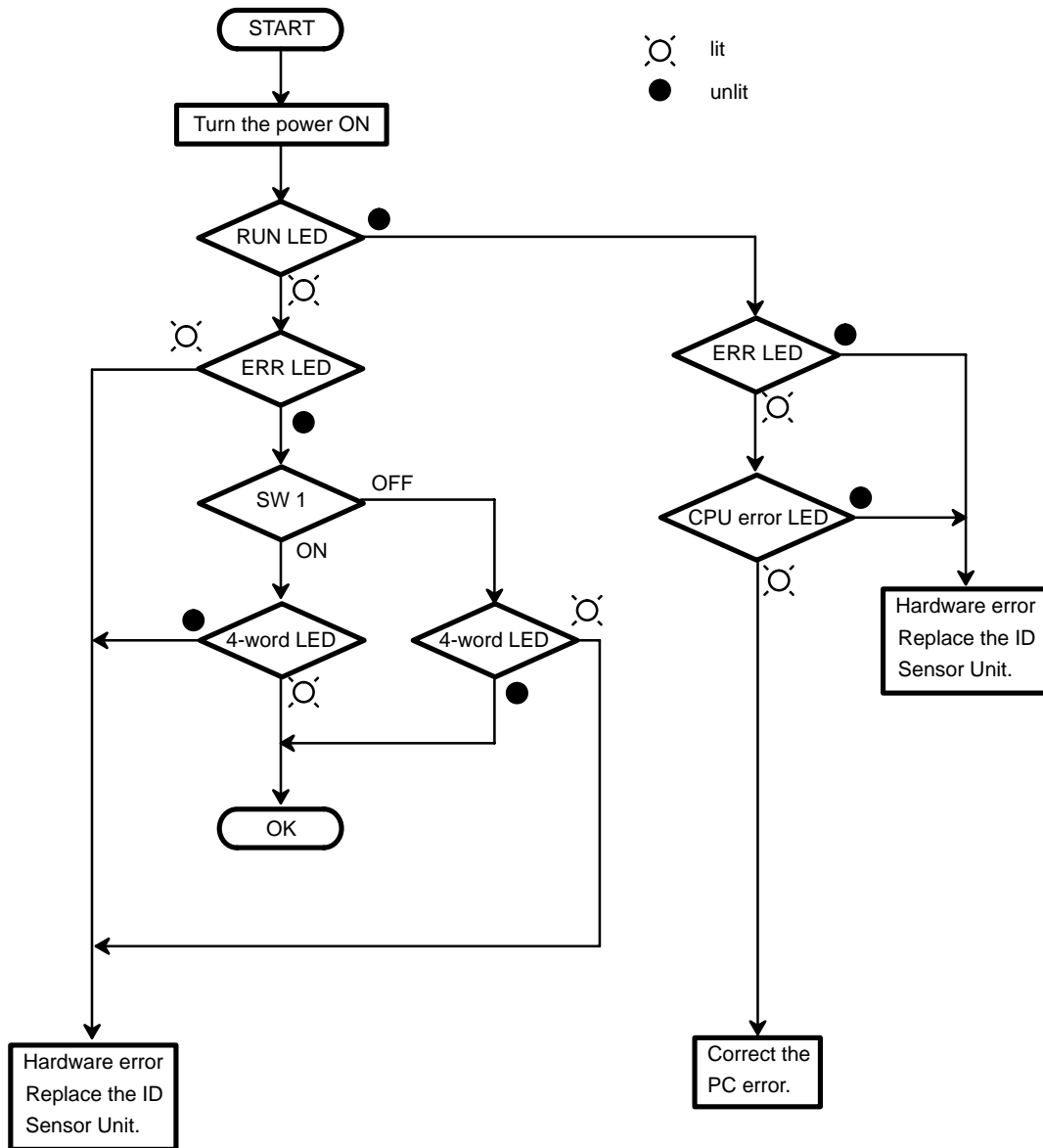
To minimize downtime of the system, it is advisable to keep at least one spare Unit on hand.

4-3 Diagnostic Flow Charts

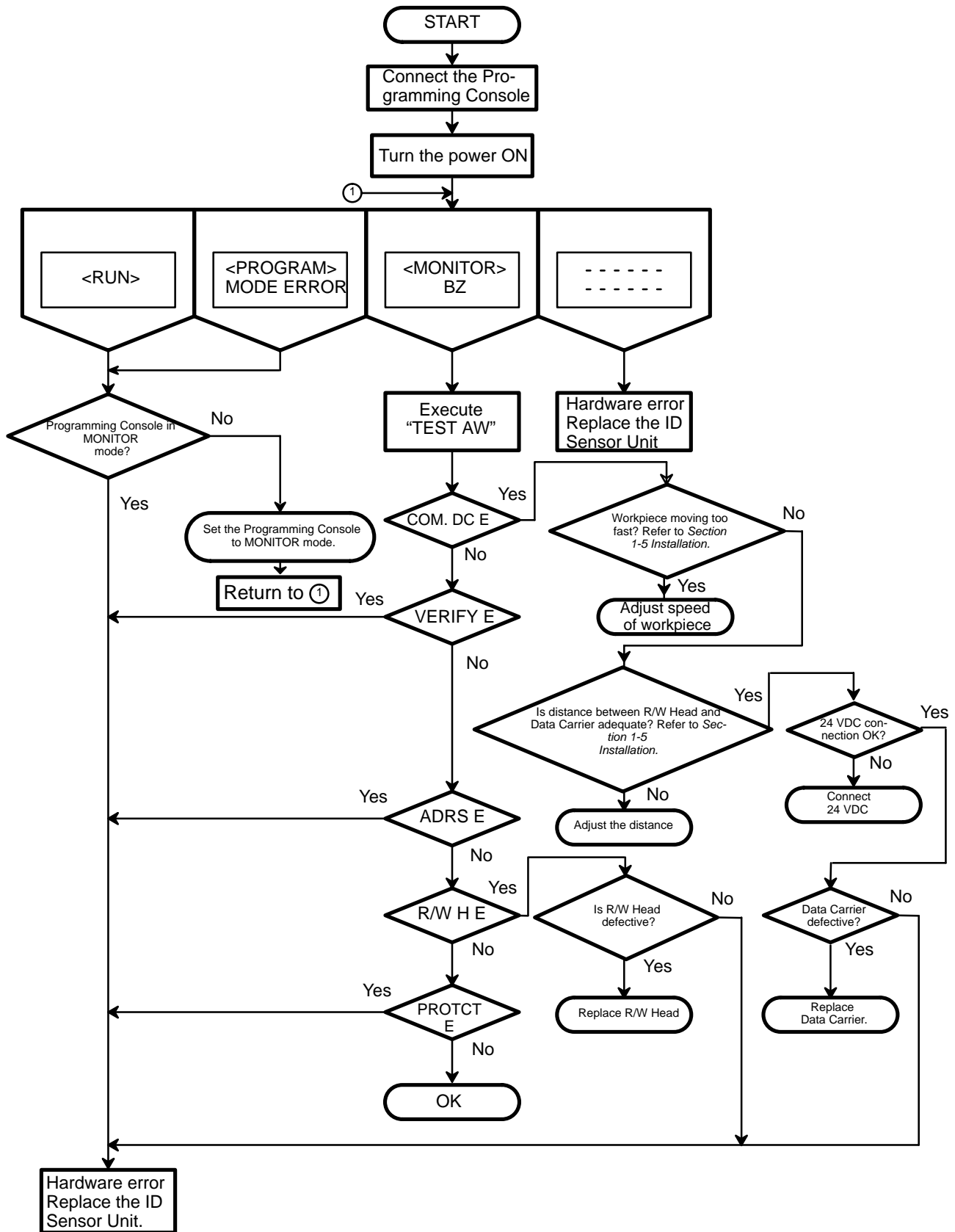
If an error occurs, determine the conditions under which it occurs: intermittent or continuing; on-line or off-line.

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

F4-1 Basic Assurance Test (BAT)



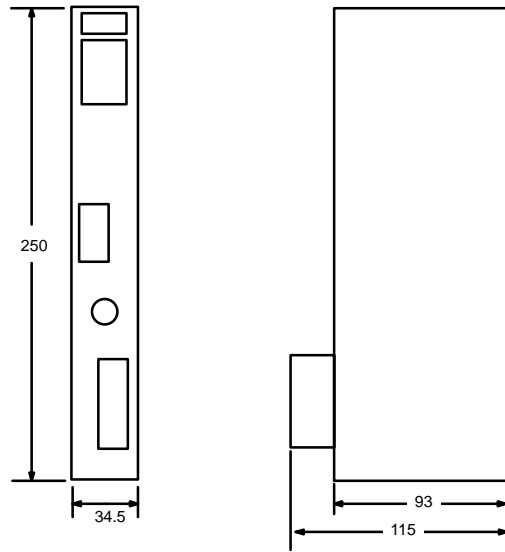
F4-2 Flowchart for Testing with the Programming



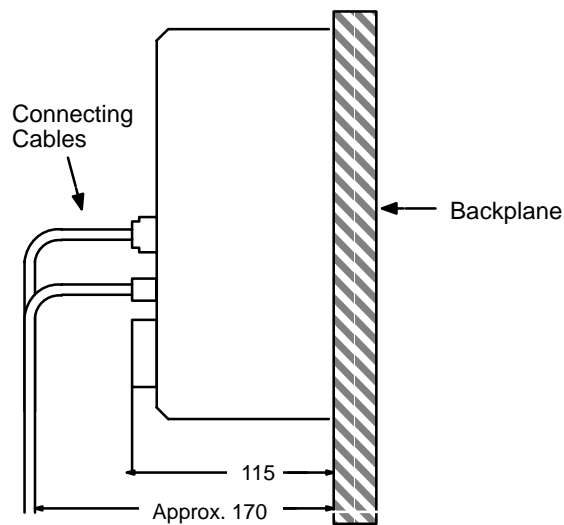
Appendix A Specifications

Dimensions ID Sensor Unit
C500-IDS01-V2/IDS02-V1/
IDS21/IDS22 ID Adapter
C500- IDA02/IDA22
(millimeters)

All Units have the dimensions shown in the following figures.



Mounted Dimensions (millimeters)



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

ID Sensor Unit Specifications

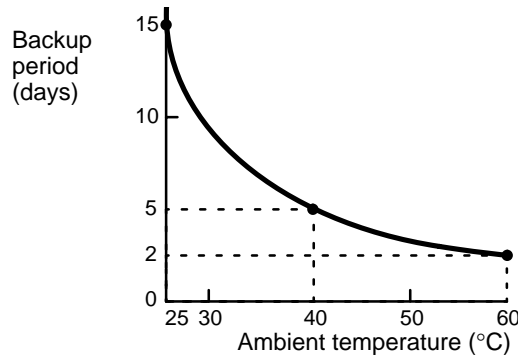
Ratings

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

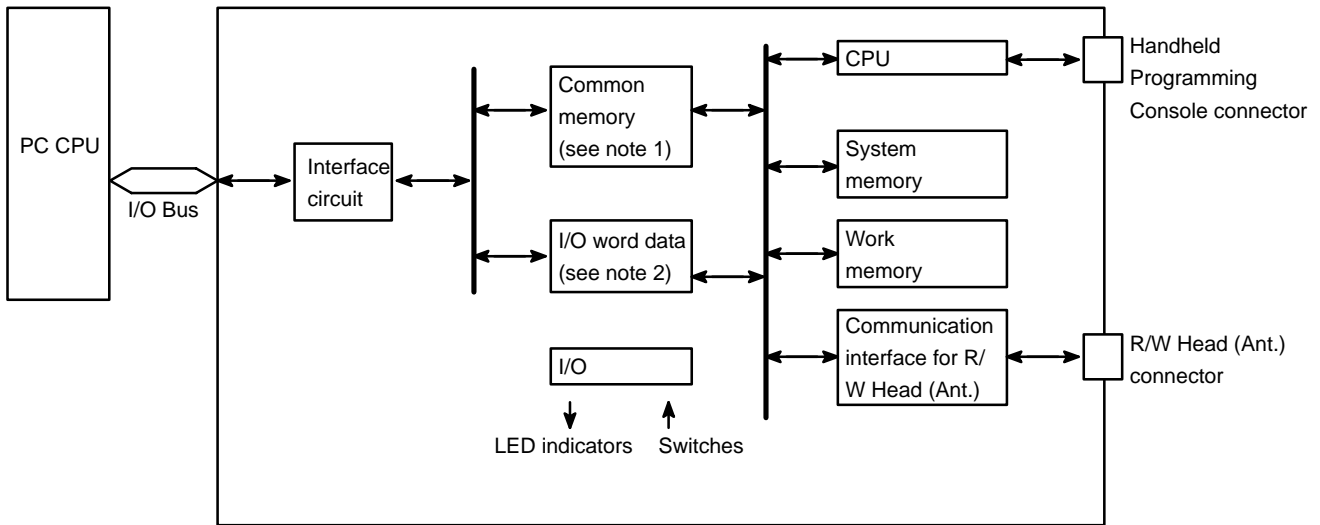
Characteristics

Item	Specifications
Communication Control Procedure	Interactive
Number of Read/Write Heads (Antennas) connected	One per ID Sensor Unit
Data Carrier	C500-IDS01-V2/IDS02-V1: V600-series Data Carrier C500-IDS21/IDS22: V620-series Data Carrier
Commands	Read, Write, Auto Read, Auto Write, Clear-all, and Auto Read/Write Abort, and Data Management (C500-IDS01-V2/C500-IDS02-V1 only)
Data transferable per instruction	Up to 251 words (502 bytes) can be transferred with WRIT(87/191) and READ(88/190) (see note 1).
Diagnostic functions	<ul style="list-style-type: none"> • CPU watchdog timer • Communication errors Seven 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	<p>The following monitoring functions are available when the ID Sensor Unit is connected to a Handheld Programming Console. (Use the key sheet provided with the ID Sensor Unit.) (Cable length: 4 m max.)</p> <ul style="list-style-type: none"> 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(87/191) and READ(88/190) 4 words when not using WRIT(87/191) or READ(88/190)
Internal current consumption	400 mA max. at 5 VDC.
External current supply	250 mA min. at 24 V DC±10% (to drive R/W Head or R/W Antenna)
Dimensions	34.5 (W) x 250 (H) x 93 (D) mm
Weight	700 g max.

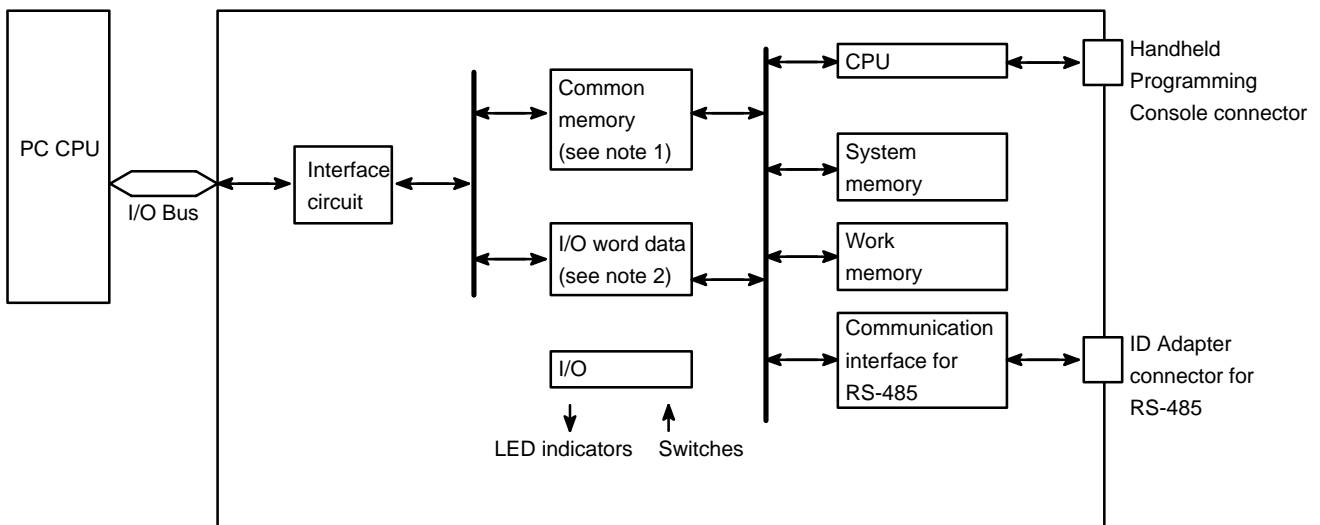
- Note**
1. WRIT(87/191) and READ(88/190) are actually capable of transferring 255 words, but, as 4 words are used for command codes, in practice only 251 words are available for data transfer.
 2. The error information stored in the memory of the ID Sensor Unit is retained by a built-in backup capacitor 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.



**Internal Circuit Block for ID Sensor Units
C500-IDS01-V2/IDS21**

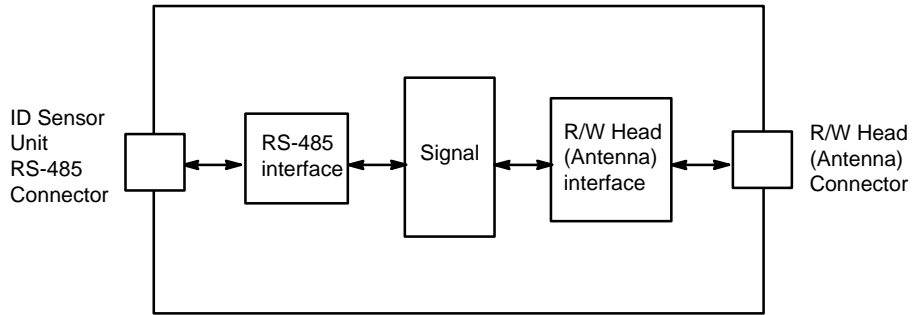


C500-IDS02-V1/IDS22



- Note**
1. The common memory is read from and written to by the WRIT(87/191) and READ(88/190) instructions.
 2. I/O word data is read from and written to by MOV, etc.

Internal Circuit Block for ID Adapters C500-IDA02/IDA22



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 V DC±10% 450 mA min.
Internal current consumption	5 VDC is not consumed
Dimensions	34.5 (W) x 250 (H) x 93 (D) mm
Weight	550 g max.

Appendix B Standard Models

Name	Model Number
Electromagnetic Induction ID Sensor Unit	C500-IDS01-V2
Electromagnetic Induction ID Sensor Unit (long-distance type)	C500-IDS02-V1
Microwave ID Sensor Unit	C500-IDS21
Microwave ID Sensor Unit (long-distance type)	C500-IDS22
ID Adapter (for IDS02-V1)	C500-IDA02
ID Adapter (for IDS22)	C500-IDA22
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 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 its hexadecimal equivalent.

Bits 0 to 3		Bits 4 to 7											
BIN	HEX	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
		2	3	4	5	6	7	A	B	C	D	E	F
0000	0	Space	0	@	P	^	P		-	9	≡	⊗	⊖
0001	1	!	1	A	Q	a	q	⊖	7	≡	⊗	⊖	⊖
0010	2	"	2	B	R	b	r	7	イ	7	×	⊖	⊖
0011	3	#	3	C	S	c	s	∟	ウ	7	≡	⊗	⊗
0100	4	\$	4	D	T	d	t	∟	エ	ト	7	⊖	⊖
0101	5	%	5	E	U	e	u	*	オ	ナ	∟	⊖	⊖
0110	6	&	6	F	V	f	v	7	カ	ニ	≡	⊖	Σ
0111	7	'	7	G	W	g	w	7	キ	ヌ	∟	⊖	π
1000	8	(	8	H	X	h	x	イ	ク	ネ	∟	7	⊗
1001	9	)	9	I	Y	i	y	⊖	ケ	ノ	⊖	∟	⊖
1010	A	*	:	J	Z	j	z	≡	コ	ハ	∟	∟	≡
1011	B	+	:	K	[	k	[	オ	ケ	ヒ	⊖	⊗	≡
1100	C	,	<	L	¥	l	l	⊖	シ	フ	∟	⊖	≡
1101	D	-	=	M	∟	m	∟	∟	ズ	ハ	∟	⊖	∟
1110	E	.	>	N	^	n	←	≡	セ	ホ	∟	∟	
1111	F	/	?	O	_	o	+	∟	ソ	マ	≡	⊖	+

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.

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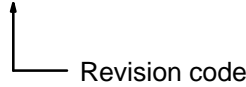
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Revision History

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

Cat. No. W126-E1-5



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

Revision code	Date	Revised content
1	Feb. 1989	Original production. Reference material used was 29-130B.
2	April 1990	Revised and expanded to include long-distance ID Sensor Units C500-IDS02/IDS22. Reference materials used were 29-130B and W126-E1-1.
3	November 1992	The material from W180 has been incorporated into the guide. Layout changes have been made throughout the guide. Pages 58, 60, 66, 95: The program examples were altered. Page 59: A note has been added to the bottom of the page. Page 122: The ASCII Code List has been replaced.
4	June 1993	C500-IDS01-V1 changed to C500-IDS01-V2, and C500-IDS02 changed to IDS02-V1. Changes related to CV-series CPU additions made. Where applicable, WRIT(87) and READ(88) changed to WRIT(87/191) and READ(88/190) respectively. Page 2: Sentence added to the first paragraph. PC models corrected to "C/CV-series" models. Pages 3, 4: F1-3 and F1-4 replaced with new figures. Page 4: Dedicated commands increased to seven. Table and note added to the bottom of the page. Additional section outlining differences between ID Sensor Unit models added. Page 22: Table rewritten and note added. Page 23: Table, Notes 1 and 2 rewritten. Page 24: Bit 07 Input defined, Notes 2 and 3 rewritten, and Notes 5 and 6 deleted. Page 26: Corrected: Word n, Bits 00, 01, 02; Word n+1, Bits 00, 01, 02, 07, and 13. Pages 29, 31: Word n+3 Input 07 corrected. Pages 37, 38: 251 words corrected to 255 words within the text. Page 38: Data management command added to table. Pages 39 to 42: Addresses corrected in the diagram. Page 44: Sections on data management and Data Carrier memory added. Page 47: Section on Data Carrier life added. Pages 51 to 56: "Command Processing End Flag" added to program example diagrams. Page 57: Two-word mode program examples added. 3-2-1 <i>Writing to the Data Carrier</i> description has been rewritten. Page 59: Information added to the bottom of the page. Page 67: C500-IDS21/22 illustration added and notes rewritten. Address page numbers increased for the table. Page 69: C500-IDS21/22 example added. Page 81: Error name corrected for 7A in the table. Page 82: Command processing time tables corrected and information added. Page 99: Top figure changed. Page 102: Data Carrier, Commands, and Number of words required corrected in the table.
5	September 1999	Added PLP section in front of Section 1. Pages 2, 3, and 4: Updated the illustrations. Page 5: Added MD-S command to the table. Pages 8 and 9: Added distances to the R/W Head. Page 14: Added tables showing distances to the ID Sensor. Page 19: Added a description about the MD-S command to Word n+1 Bit 07. Page 20: Added a note to the end of the table. Page 31: Added MD-S command to the description about data management commands. Page 37: Added a description about Data Carrier warning flag to the end of the illustration. Page 40: Added descriptions about Management of Overwriting Operations 2. Page 49: Added warnings about handling of the Data Carrier. Page 56: Changed the ladder program. Page 58: Changed the ladder program. Page 68: Added descriptions about the MD-S command. Pages 69, 71, and 72: Changed the ladder program. Pages 112 and 114: Changed from "24 VDC" to "24 V DC±10%" for external supply.