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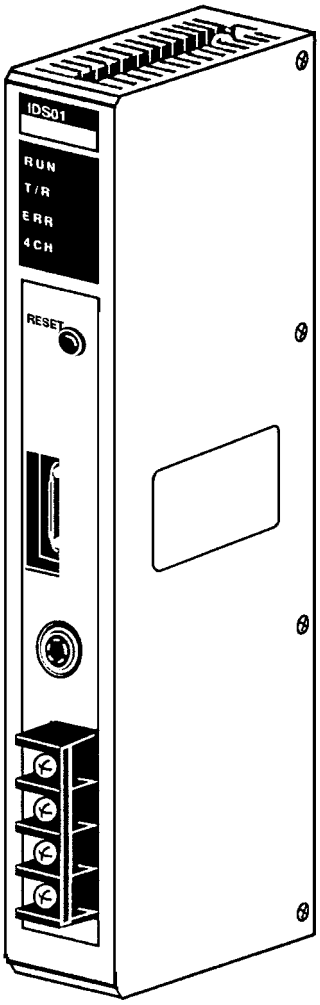
C500-IDS01-V1/IDS02

ID Sensor

Revised May 1990



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

Notice:

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

The following conventions are used to indicate and classify warnings in this manual. Always heed the information provided with them.

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

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

OMRON Product References

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

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

Visual Aids

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

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

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

TABLE OF CONTENTS

About this Manual:

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

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

This manual is organized as follows:

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

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

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

Section 4 contains information on maintenance and troubleshooting.

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

SECTION 1
System Description and Installation

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

1–1 System Description

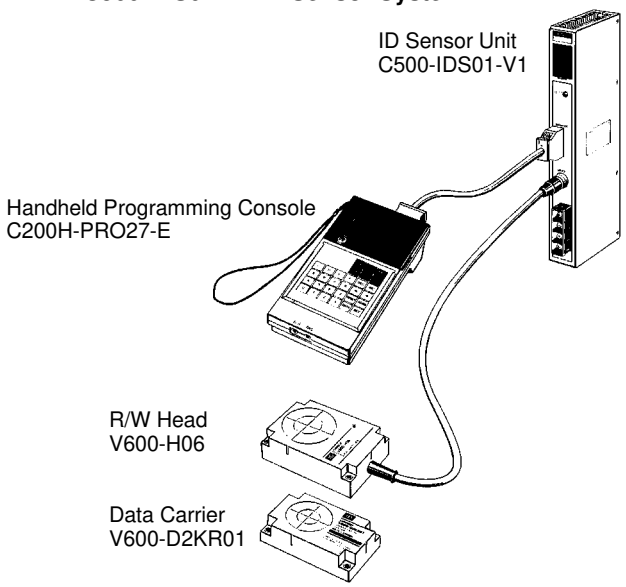
The ID Sensor system is a versatile non-contact identification system. A basic ID Sensor system comprises an ID Sensor Unit, a Read/Write (R/W) Head, and a Data Carrier.

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

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

C500-IDS01-V1 ID Sensor System

F1–1 C500-IDS01-V1 ID Sensor System

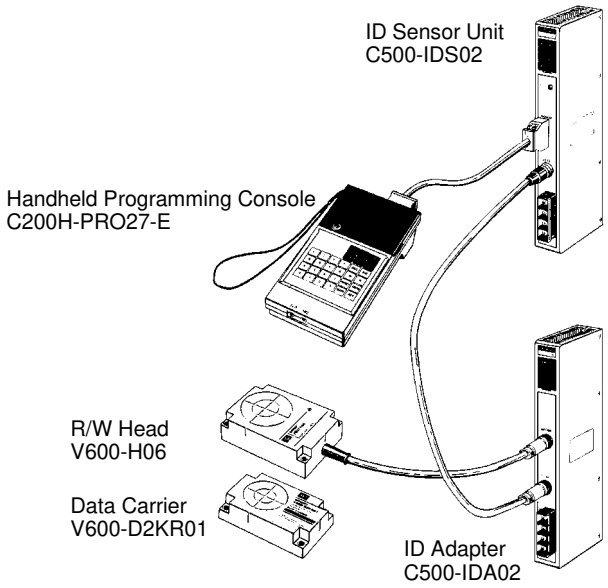


Long-range ID Sensor System

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

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

F1–2 C500-IDS02 ID Sensor System



1–2 Features

The ID Sensor system has the following features:

Intelligent I/O Read/Write Capability

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

Six Dedicated Commands

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

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

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

Monitoring with the Handheld Programming Console

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

Storage of Error Information

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

Compatibility

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

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

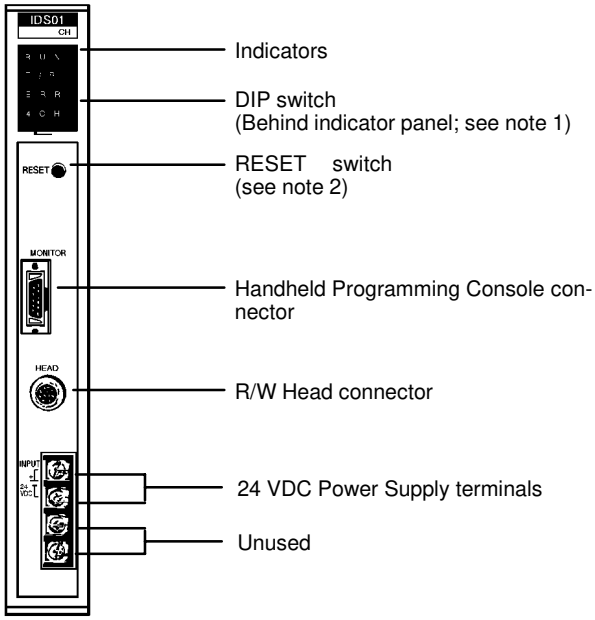
If an incompatible R/W Head, Data Carrier, or Adapter is connected to an ID Sensor Unit, a connection error will occur, preventing operation of the Unit.

1–3 Components and Indicators

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

Front Panel
C500-IDS01-V1 ID Sensor Unit

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



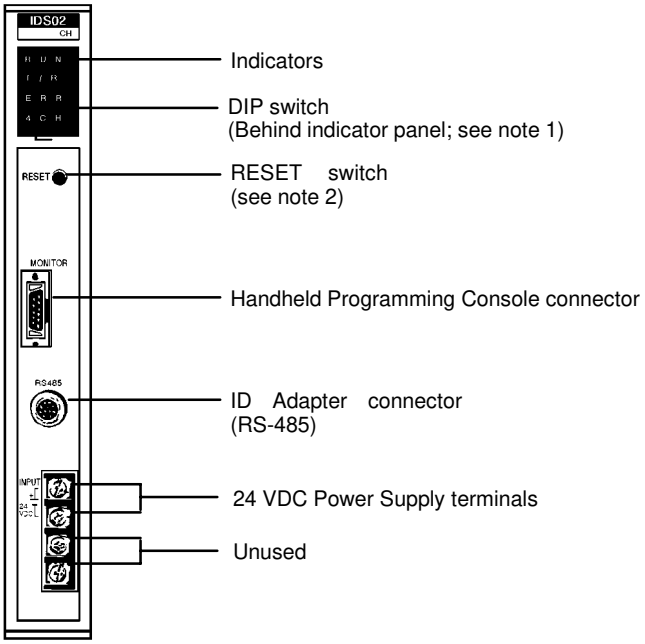
1, 2, 3... 1. To gain access to the DIP switches, remove the indicator panel with a standard screwdriver.

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

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

Front Panel
C500-IDS02 ID Sensor Unit

F1–4 C500-IDS02 ID Sensor Unit



Note
1. To gain access to the DIP switches, remove the indicator panel with a standard screwdriver.
2. Do not press RESET when the T/R indicator is lit. Refer to *p NO TAG note 2* before using the RESET switch.

Indicators

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

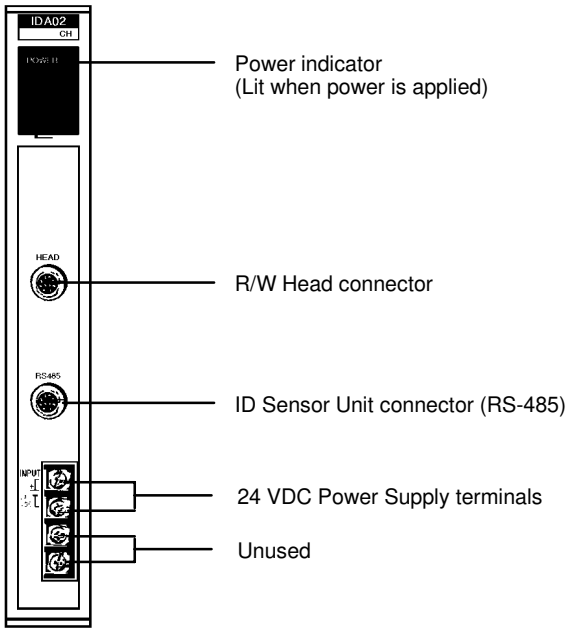
T1–1 ID Sensor Unit Indicators

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

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

Front Panel ID Adapter

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

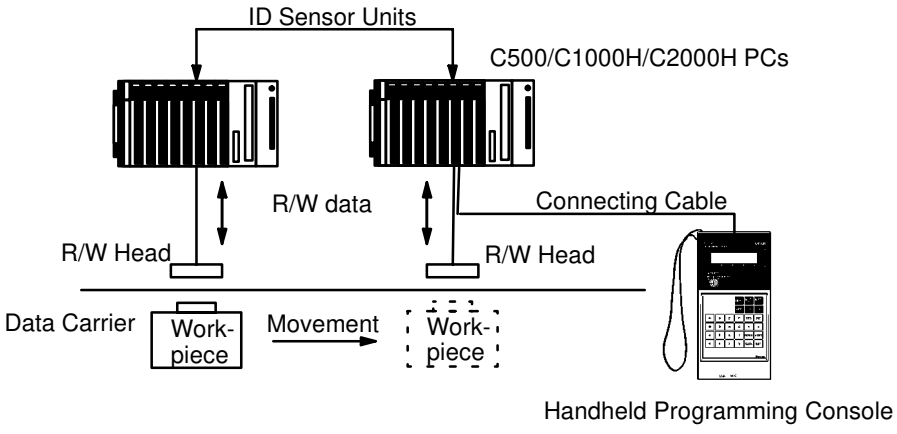


1–4 System Configurations

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

F1–6 C500-IDS01-V1 System Configuration

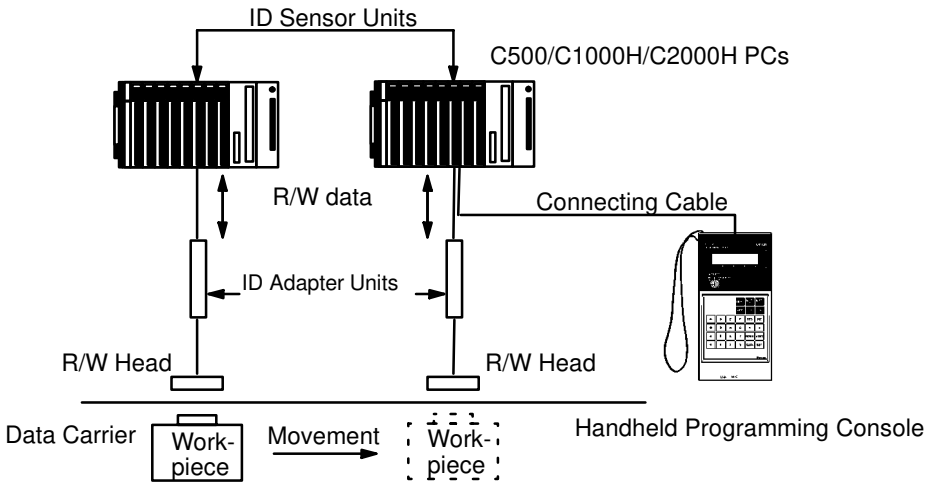


If the R/W Head must be located more than 10 meters from the ID Sensor Unit, a long-range ID Sensor system that includes an ID Adapter is required.

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

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

F1–7 C500-IDS02 System Configuration



1–5 Installation

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

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

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

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

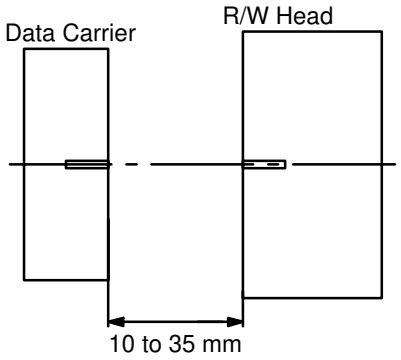
Refer to *Appendix B Specifications* for exact dimensions of the R/W Head and Data Carrier.

Stationary Data Carrier

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

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

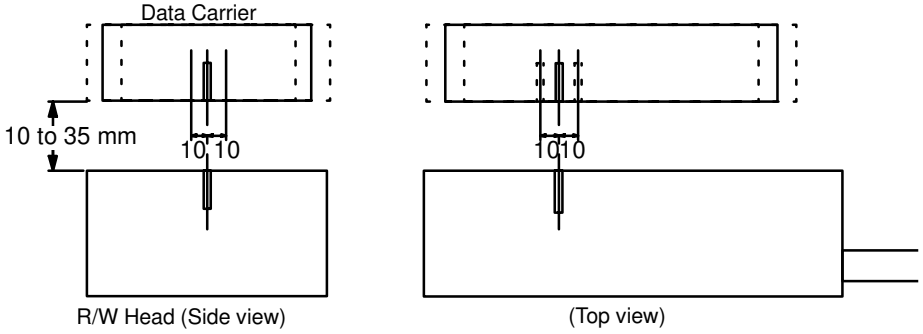
F1–8 Distance between Data Carrier and R/W Head



2. Center Displacement: +10 mm

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

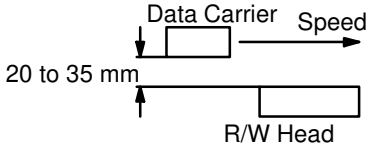
F1–9 Center Displacement



Moving Data Carrier (Auto Read/Auto Write)

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

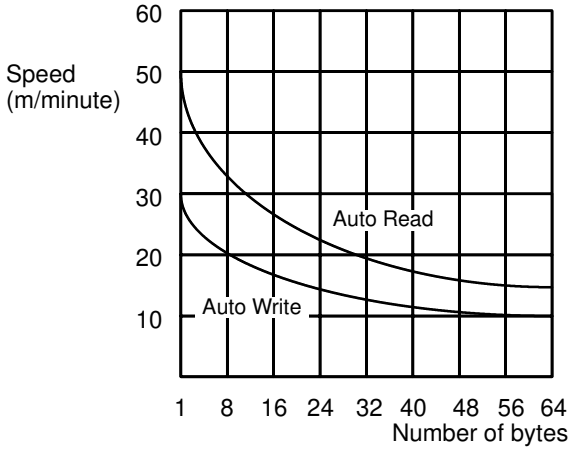
Maintain a distance of 20 to 35 mm between the R/W Head and a moving Data Carrier. The speed of the Data Carrier must be appropriate to the amount of data to be read or written. See Table T1–2.



2. Speed of travel

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

T1–2 Relationship between Speed of Data Carrier and Quantity of Data (Auto Read/Auto Write)

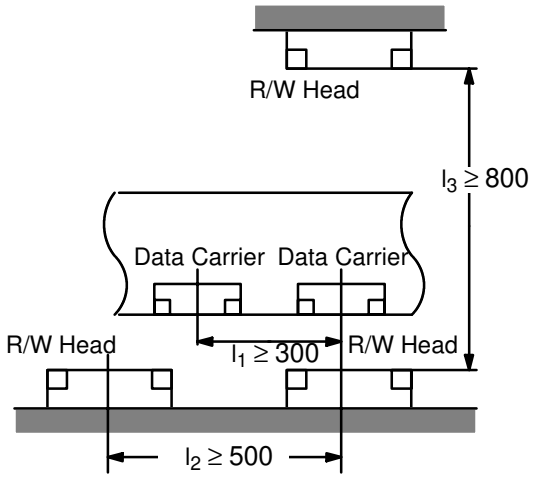


The data in this graph is based on the assumption that communication between the Data Carrier and R/W Head is performed normally, without error (if the Data Carrier passes the R/W Head without being detected, a Data Carrier communication error will occur).

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

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

F1–10 Minimum Distances between Adjacent Data Carriers and R/W Heads



l_1 = distance between Data Carriers installed side by side ≥ 300 mm

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

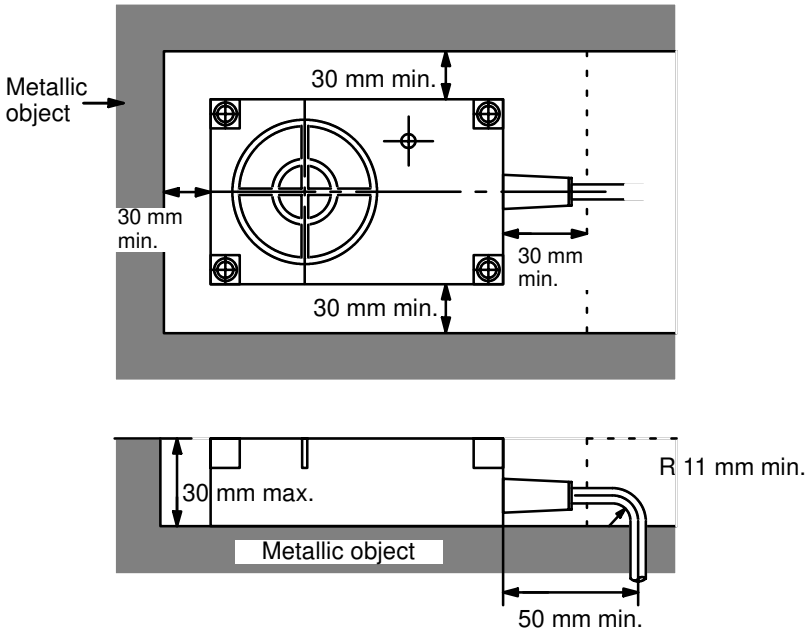
l_3 = distance between R/W Heads installed face to face ≥ 800 mm

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

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

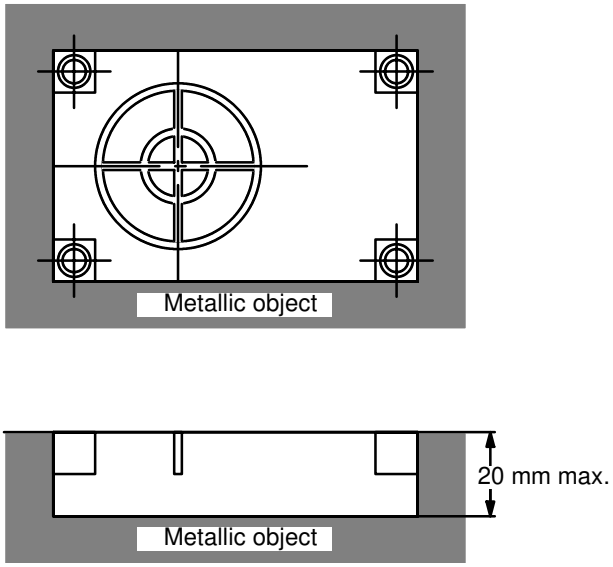
When embedding the R/W Head in a metallic object, make sure a minimum of 30 mm separates all four sides of the R/W Head from the metallic object.

F1–11 Embedded R/W Head



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

F1–12 Embedded Data Carrier



1–5–2 System Connection

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

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

Connecting the C500-IDS01-V1 ID Sensor

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

2. Connect the R/W Head to the ID Sensor Unit connector marked “HEAD” . (To disconnect the cable, pull while grasping the outer ring of the cable.)
3. Connect a 24 VDC power supply (250 mA min.) to the 24 VDC terminals of the ID Sensor Unit. If the power supply is not connected, the Unit will not be able to communicate with the R/W Head, and an error will occur. Solderless terminals are recommended for the power supply connection. When connecting the power supply to the terminals of the ID Sensor Unit, make certain that the correct polarity is observed.

Connecting the C500-IDS02 ID Sensor

1, 2, 3...

1. Before connecting and wiring the ID Sensor Unit, turn OFF the power to the PC.
2. To connect the ID Adapter to the ID Sensor Unit, first assemble a cable of the appropriate length; use the connectors supplied as accessories. (Refer to *Preparing the RS-485 Cable* on page 11.) Connect one end of the cable to the RS-485 connector of the ID Sensor Unit; turn the outer ring clockwise until it clicks. Connect the other end to the RS-485 connector of the ID Adapter Unit in the same manner. Note that although the connectors on both ends of the RS-485 cable appear identical, the connector at the ID Adapter end of the cable is insulated from the shield.
3. Connect the cable of the R/W Head to the HEAD connector of the C500-IDA02 ID Adapter Unit. (To disconnect the cable, pull while grasping the outer ring of the cable; do not pull at an angle.)
4. Connect a 24 VDC power supply (250 mA min.) to the 24 VDC terminals of the ID Sensor Unit. Without this power supply the Unit will not be able to communicate with the ID Adapter, and an error will occur. Connect a 24 VDC power supply (450 mA min.) to the 24 VDC terminals of the ID Adapter. If no power supply is connected, the ID Adapter will not operate, and an error will occur. Solderless terminals are recommended for connecting the power supply. When connecting the power supply, make certain that the correct polarity is observed.

Connecting the Handheld Programming Console

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

Preparing the RS-485 Cable

Before assembly

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

Pin letters and signal assignments

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

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

Pin letter	Signal
A	
B	
C	SD1+
D	SD1–
E	SD2+
F	SD2–
G	SD3+
H	SD3–
J	SD4+
K	SD4–
L	SD5+
M	SD5–
Connector housing	FG

Shielded twisted-pair cable

Shield

Pin letter	Signal
A	
B	
C	SD1+
D	SD1–
E	SD2+
F	SD2–
G	SD3+
H	SD3–
J	SD4+
K	SD4–
L	SD5+
M	SD5–

Note Confirm all pin letters before completing assembly.

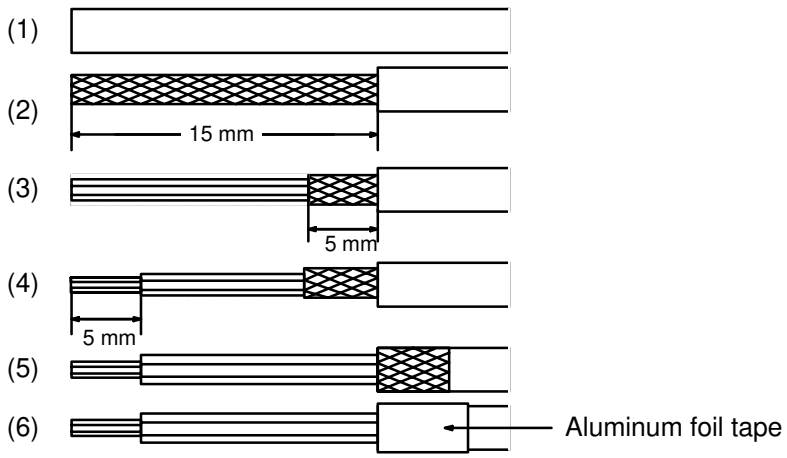
Preparing the ID Sensor Unit end of the RS-485 cable

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

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

2. Remove a 15 mm length of the rubber sheath from the end of the cable by cutting the sheath with a razor. Be careful not to damage the shielded cable underneath.
3. Cut and remove 10 mm of the shield with scissors.
4. Remove 5 mm of the insulation from the end of each conductor with a stripper.
5. Fold the shielded cable back over the rubber sheath.
6. Wind aluminum foil tape over the folded part of the shielded cable.

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

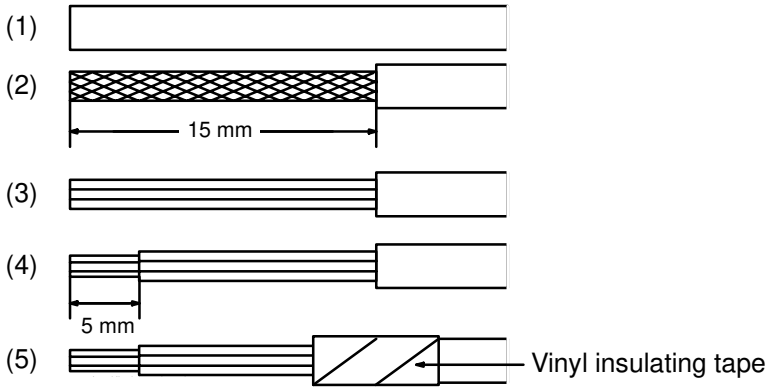


Preparing the ID Adapter End of the RS-485 Cable (insulated shield)

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

1, 2, 3... 1. Confirm that the cable is the appropriate length.
2. Remove a 15 mm length of the rubber sheath from the end of the cable by cutting the sheath with a razor. Be careful not to cut deeper than necessary.
3. With scissors, cut and remove the entire length of exposed shield.
4. Remove 5 mm of the insulation from the end of each conductor with a stripper.
5. Wind vinyl insulating tape over the folded part of the shielded cable.

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

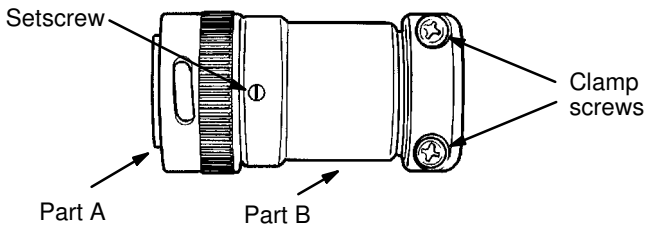


Disassembling the connectors

Refer to Figure F1–16.

1, 2, 3... 1. Loosen the 2 setscrews with a small standard screwdriver.
2. Remove part A from part B by inserting the connector into the Unit, and turning part B counterclockwise.
3. Loosen the 2 clamp screws with a Phillips screwdriver.

F1–16 Disassembling the Connector

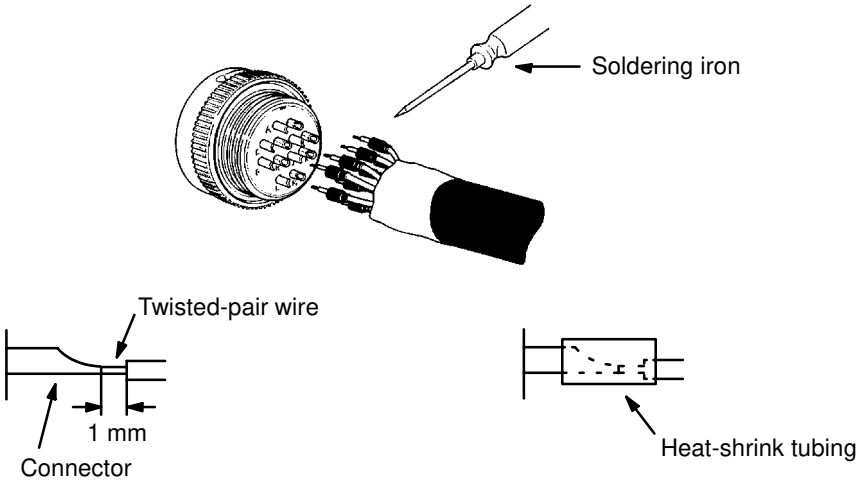


Soldering the twisted-pair wire

Refer to Figure F1–17.

1, 2, 3... 1. Slide a 10-mm length of heat-shrink tubing (type F, inside diameter 1.5 mm) over each wire, leaving the exposed wire uncovered.
2. Tin each wire and connector terminal.
3. Solder each wire to its mating pin as shown, leaving 1 mm of exposed wire.
4. Slide the heat-shrink tubing over the exposed wire and soldered joints as shown. Shrink the tubing with a heat gun.
5. Wind insulating vinyl tape over the unused twisted-pair wire.

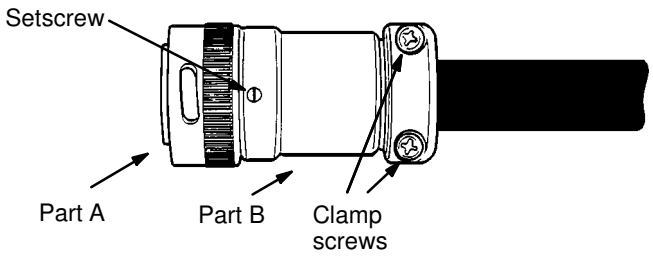
F1–17 Soldering the Twisted-Pair Wire to the RS-485 Connector



Assembling the connectors Refer to Figure F1–18.

1, 2, 3... 1. Assemble the connector by inserting connector part A into the Unit and threading part B clockwise onto part A.
2. Tighten the 2 setscrews with a small standard screwdriver.
3. Fix the cable by tightening the 2 clamp screws with a Phillips screwdriver.

F1–18 Assembled Connector



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.

SECTION 2
Operation

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

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

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

2–1 DIP Switch Setting

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

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

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

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

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

F2–1 ID Sensor Unit DIP Switch

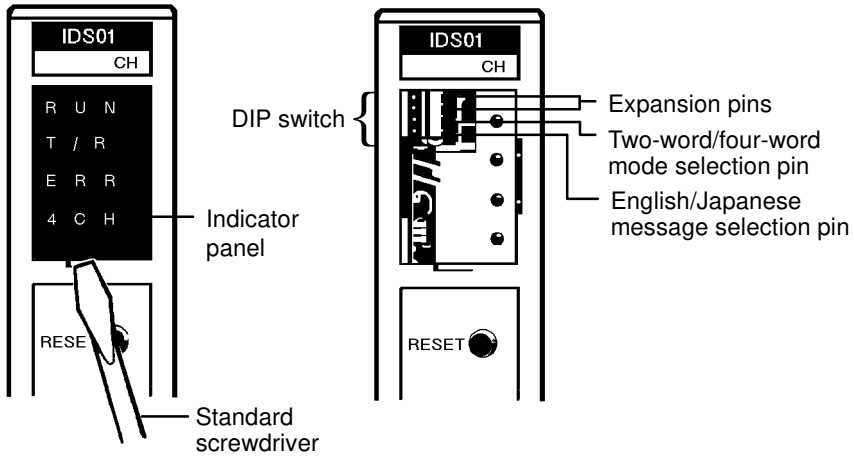
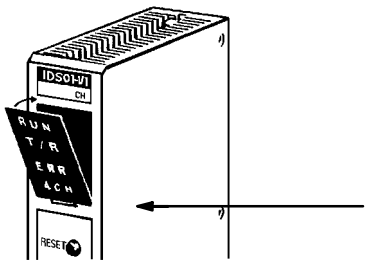


Table T2–1 shows DIP switch settings. Note that OFF is to the right; ON is to the left.

T2–1 DIP Switch Settings

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



To replace the indicator panel, engage the bottom tab of the panel in the slot.

2–1–1 Two-Word/Four-Word Mode Selection

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

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

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

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

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

- C500-CPU11-V1
- 3G2C3-CPU11-EV1

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

Bit Allocation (Two-Word Operation)

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

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

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

Note

1. When the WRIT(87) and READ(88) instructions are used (when the ID Sensor Unit is mounted to the CPU Backplane or Expansion I/O Backplane of a PC having the WRIT(87) and READ(88) instructions), set pin 1 of the ID Sensor Unit's built-in DIP switch to the OFF position for two-word mode. (Refer to *Section 2–1 DIP Switch Setting*.)
2. The bits enclosed in parentheses operate automatically when the WRIT(87) and READ(88) instructions are executed. These bits are read-only; do not use for other purposes.
3. To output data to word n with an instruction such as MOV, turn OFF the PC busy, PC write end, and Data Carrier read end flags.
4. The ID read-in-progress flag verifies that data written in common memory by WRIT(87) is being read by the ID Sensor Unit.
5. The ID read-in-progress flag can be used to verify that data has been correctly written to the common memory of the ID Sensor Unit.
6. The status of word n+1 bits 10 through 15 do not change while being monitored by the Programming Console.
7. If an error occurs, the corresponding error flag and the command processing end flag simultaneously turn ON. The error flag and command processing end flag are turned OFF when the ID Sensor Unit receives a new command or when the command processing end flag reset (word n bit 03) turns ON.
8. Delay command transfer for 1 ms after the system reset flag (word n bit 04) has been turned OFF.

Flag Functions (Two-Word Operation)

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