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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



SYSMAC
Programmable Controllers

C200H
(CPU01-E/03-E/11-E)

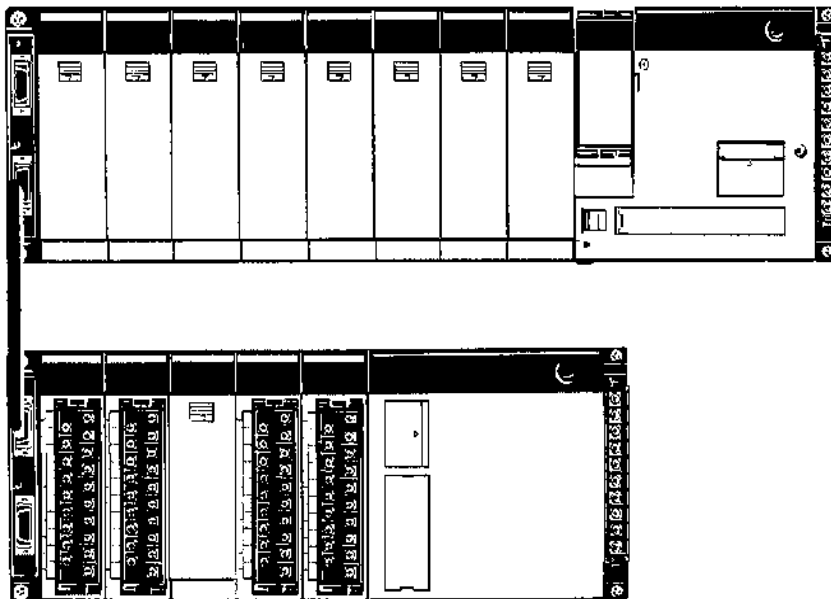
OPERATION MANUAL

OMRON

C200H Programmable Controllers (CPU01-E/03-E/11-E)

Operation Manual


Revised June 2003





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:

The OMRON C200H PCs offer a simple but effective way to automate processing. Manufacturing, assembly, packaging, and many other processes can be automated to save time and money.

This manual describes the characteristics and abilities of the PCs, as well as programming operations and instructions and other aspects of operation and preparation. Before attempting to operate the PC, thoroughly familiarize yourself with the information contained herein. Hardware information is provided in detail in the *C200H PCs (CPU01-E/03-E/11-E) Installation Guide*. A table of other manuals that can be used in conjunction with this manual is provided at the end of *Section 1 Introduction*.

Section 1 Introduction explains the background and some of the basic terms used in ladder-diagram programming. It also provides an overview of the process of programming and operating a PC and explains basic terminology used with OMRON PCs. Descriptions of Peripheral Devices used with the C200H PCs and a table of other manuals available to use with this manual for special PC applications are also provided.

Section 2 Hardware Considerations explains basic aspects of the overall PC configuration and describes the indicators that are referred to in other sections of this manual.

Section 3 Memory Areas takes a look at the way memory is divided and allocated and explains the information provided there to aid in programming. It explains how I/O is managed in memory and how bits in memory correspond to specific I/O points. It also provides information on System DM, a special area in C200H PCs that provides the user with flexible control of PC operating parameters.

Section 4 Writing and Entering Programs explains the basics of ladder-diagram programming, looking at the elements that make up the parts of a ladder-diagram program and explaining how execution of this program is controlled. It also explains how to convert ladder diagrams into mnemonic code so that the programs can be entered using a Programming Console.

Section 5 Instruction Set describes all of the instructions used in programming.

Section 6 Program Execution Timing explains the scanning process used to execute the program and tells how to coordinate inputs and outputs so that they occur at the proper times.

Section 7 Program Debugging and Execution explains the Programming Console procedures used to input and debug the program and to monitor and control operation.

Finally, **Section 8 Troubleshooting** provides information on error indications and other means of reducing down-time. Information in this section is also useful when debugging programs.

The **Appendices** provide tables of standard OMRON products available for the C200H PCs, reference tables of instructions and Programming Console operations, coding sheet to help in programming and parameter input, and other information helpful in PC operation.



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 Programmable Controller (PC) and related devices.

The information contained in this section is important for the safe and reliable application of the Programmable Controller. 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 FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA systems and facilities.


2 General Precautions

The user must operate the product according to the performance specifications described in the relevant 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 programming and operating the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.


 **WARNING** It is extremely important that a PC and all PC Units 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 a PC system to the above-mentioned applications.

3 Safety Precautions

 **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 attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

 **WARNING** Provide safety measures in external circuits (i.e., not in the Programmable Controller), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the PC or another external factor affecting the PC operation. Not doing so may result in serious accidents.


- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.
- The PC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system.

- The PC outputs may remain ON or OFF due to deposition or burning of the output relays or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24-VDC output (service power supply to the PC) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.


4 Operating Environment Precautions

 **Caution** Do not operate the control 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 PC 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 PC 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 PC system.

 **WARNING** Always heed these precautions. Failure to abide by the following precautions could lead to serious or possibly fatal injury.

- Always ground the system to 100 Ω or less when installing the Units. 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 Power Supply Units, I/O Units, CPU Units, Memory Units, 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.

- 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.
- Always use the power supply voltages specified in this manual. 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 this manual. Incorrect tightening torque may result in malfunction.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Wire correctly. Incorrect wiring may result in burning.
- Mount Units only after checking terminal blocks and connectors completely.
- 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 the user program for proper execution before actually running it on the Unit. 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.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.

- 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.

SECTION 1

Introduction

This section gives a brief overview of the history of Programmable Controllers and explains terms commonly used in ladder-diagram programming. It also provides an overview of the process of programming and operating a PC and explains basic terminology used with OMRON PCs. Descriptions of peripheral devices used with the C200H, and a table of other manuals available to use with this manual for special PC applications, are also provided.

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1-1 Overview

A PC (Programmable Controller) is basically a CPU (Central Processing Unit) containing a program and connected to input and output (I/O) devices. The program controls the PC so that when an input signal from an input device turns ON, the appropriate response is made. The response normally involves turning ON an output signal to some sort of output device. The input devices could be photoelectric sensors, pushbuttons on control panels, limit switches, or any other device that can produce a signal that can be input into the PC. The output devices could be solenoids, switches activating indicator lamps, relays turning on motors, or any other devices that can be activated by signals output from the PC.

For example, a sensor detecting a passing product turns ON an input to the PC. The PC responds by turning ON an output that activates a pusher that pushes the product onto another conveyor for further processing. Another sensor, positioned higher than the first, turns ON a different input to indicate that the product is too tall. The PC responds by turning on another pusher positioned before the pusher mentioned above to push the too-tall product into a rejection box.

Although this example involves only two inputs and two outputs, it is typical of the type of control operation that PCs can achieve. Actually even this example is much more complex than it may at first appear because of the timing that would be required, i.e., "How does the PC know when to activate each pusher?" Much more complicated operations, however, are also possible. The problem is how to get the desired control signals from available inputs at appropriate times.

To achieve proper control, the C200H uses a form of PC logic called ladder-diagram programming. This manual is written to explain ladder-diagram programming and to prepare the reader to program and operate the C200H.

1-2 The Origins of PC Logic

PCs historically originate in relay-based control systems. And although the integrated circuits and internal logic of the PC have taken the place of the discrete relays, timers, counters, and other such devices, actual PC operation proceeds as if those discrete devices were still in place. PC control, however, also provides computer capabilities and accuracy to achieve a great deal more flexibility and reliability than is possible with relays.

The symbols and other control concepts used to describe PC operation also come from relay-based control and form the basis of the ladder-diagram programming method. Most of the terms used to describe these symbols and concepts, however, have come in from computer terminology.

Relay vs. PC Terminology

The terminology used throughout this manual is somewhat different from relay terminology, but the concepts are the same.

The following table shows the relationship between relay terms and the PC terms used for OMRON PCs.

Relay term	PC equivalent
contact	input or condition
coil	output or work bit
NO relay	normally open condition
NC relay	normally closed condition

Actually there is not a total equivalence between these terms. The term condition is only used to describe ladder diagram programs in general and is specifically equivalent to one of certain set of basic instructions. The terms input and output are not used in programming per se, except in reference to I/O bits that are assigned to input and output signals coming into and leaving the PC. Normally open conditions and normally closed conditions are explained in *4-3 Basic Ladder Diagrams*.

1-3 PC Terminology

Although also provided in the *Glossary* at the back of this manual, the following terms are crucial to understanding PC operation and are thus explained here.

PC

Because the C200H is a Rack PC, there is no one product that is a C200H PC. That is why we talk about the configuration of the PC, because a PC is a configuration of smaller Units.

To have a functional PC, you would need to have a CPU Rack with at least one Unit mounted to it that provides I/O points. When we refer to the PC, however, we are generally talking about the CPU and all of the Units directly controlled by it through the program. This does not include the I/O devices connected to PC inputs and outputs.

If you are not familiar with the terms used above to describe a PC, refer to *Section 2 Hardware Considerations* for explanations.

Inputs and Outputs

A device connected to the PC that sends a signal to the PC is called an **input device**; the signal it sends is called an **input signal**. A signal enters the PC through terminals or through pins on a connector on a Unit. The place where a signal enters the PC is called an **input point**. This input point is allocated a location in memory that reflects its status, i.e., either ON or OFF. This memory location is called an **input bit**. The CPU, in its normal processing cycle, monitors the status of all input points and turns ON or OFF corresponding input bits accordingly.

There are also **output bits** in memory that are allocated to **output points** on Units through which **output signals** are sent to **output devices**, i.e., an output bit is turned ON to send a signal to an output device through an output point. The CPU periodically turns output points ON or OFF according to the status of the output bits.

These terms are used when describing different aspects of PC operation. When programming, one is concerned with what information is held in memory, and so I/O bits are referred to. When talking about the Units that connect the PC to the controlled system and the places on these Units where signals enter and leave the PC, I/O points are referred to. When wiring these I/O points, the physical counterparts of the I/O points, either terminals or connector pins, are referred to. When talking about the signals that enter or leave the PC, one refers to input signals and output signals, or sometimes just inputs and outputs. It all depends on what aspect of PC operation is being talked about.

Controlled System and Control System

The Control System includes the PC and all I/O devices it uses to control an external system. A sensor that provides information to achieve control is an input device that is clearly part of the Control System. The controlled system is the external system that is being controlled by the PC program through these I/O devices. I/O devices can sometimes be considered part of the controlled system, e.g., a motor used to drive a conveyor belt.

1-4 OMRON Product Terminology

OMRON products are divided into several functional groups that have generic names. *Appendix A Standard Models* list products according to these groups. The term **Unit** is used to refer to all of the OMRON PC products. Although a Unit is any one of the building blocks that goes together to form a C200H PC, its meaning is generally, but not always, limited in context to refer to the Units that are mounted to a Rack. Most, but not all, of these products have names that end with the word Unit.

The largest group of OMRON products is the **I/O Units**. These include all of the Rack-mounting Units that provide non-dedicated input or output points for general use. I/O Units come with a variety of point connections and specifications.

Special I/O Units are dedicated Units that are designed to meet specific needs. These include Position Control Units, High-speed Counter Units, and Analog I/O Units.

Link Units are used to create Link Systems that link more than one PC or link a single PC to remote I/O points. Link Units include Remote I/O Units, PC Link Units, Host Link Units, SYSMAC NET Link Units, and SYSMAC LINK Units. SYSMAC NET Link and SYSMAC LINK Units can be used with the CPU11-E only.

Other product groups include **Programming Devices**, **Peripheral Devices**, and **DIN Rail Products**.

1-5 Overview of PC Operation

The following are the basic steps involved in programming and operating a C200H. Assuming you have already purchased one or more of these PCs, you must have a reasonable idea of the required information for steps one and two, which are discussed briefly below. This manual is written to explain steps three through six, eight, and nine. The relevant sections of this manual that provide more information are listed with each of these steps.

- 1, 2, 3...**
1. Determine what the controlled system must do, in what order, and at what times.
 2. Determine what Racks and what Units will be required. Refer to the *C200H Installation Guide*. If a Link System is required, refer to the appropriate *System Manual*.
 3. On paper, assign all input and output devices to I/O points on Units and determine which I/O bits will be allocated to each. If the PC includes Special I/O Units or Link Systems, refer to the individual *Operation Manuals* or *System Manuals* for details on I/O bit allocation. (*Section 3 Memory Areas*)
 4. Using relay ladder symbols, write a program that represents the sequence of required operations and their inter-relationships. Be sure to also program appropriate responses for all possible emergency situations. (*Section 4 Writing and Inputting the Program*, *Section 5 Instruction Set*, *Section 6 Program Execution Timing*)
 5. Input the program and all required operating parameters into the PC. (*Section 4-6 Inputting, Modifying, and Checking the Program*.)
 6. Debug the program, first to eliminate any syntax errors, and then to find execution errors. (*Section 4-6 Inputting, Modifying, and Checking the Program*, *Section 7 Program Monitoring and Execution*, and *Section 8 Troubleshooting*)
 7. Wire the PC to the controlled system. This step can actually be started as soon as step 3 has been completed. Refer to the *C200H Installation*

Guide and to Operation Manuals and System Manuals for details on individual Units.

8. Test the program in an actual control situation and carry out fine tuning as required. (*Section 7 Program Monitoring and Execution and Section 8 Troubleshooting*)
9. Record two copies of the finished program on masters and store them safely in different locations. (*Section 4-6 Inputting, Modifying, and Checking the Program*)

Control System Design

Designing the Control System is the first step in automating any process. A PC can be programmed and operated only after the overall Control System is fully understood. Designing the Control System requires, first of all, a thorough understanding of the system that is to be controlled. The first step in designing a Control System is thus determining the requirements of the controlled system.

Input/Output Requirements

The first thing that must be assessed is the number of input and output points that the controlled system will require. This is done by identifying each device that is to send an input signal to the PC or which is to receive an output signal from the PC. Keep in mind that the number of I/O points available depends on the configuration of the PC. Refer to *3-3 IR Area* for details on I/O capacity and the allocation of I/O bits to I/O points.

Sequence, Timing, and Relationships

Next, determine the sequence in which control operations are to occur and the relative timing of the operations. Identify the physical relationships between the I/O devices as well as the kinds of responses that should occur between them.

For instance, a photoelectric switch might be functionally tied to a motor by way of a counter within the PC. When the PC receives an input from a start switch, it could start the motor. The PC could then stop the motor when the counter has received a specified number of input signals from the photoelectric switch.

Each of the related tasks must be similarly determined, from the beginning of the control operation to the end.

Unit Requirements

The actual Units that will be mounted or connected to PC Racks must be determined according to the requirements of the I/O devices. Actual hardware specifications, such as voltage and current levels, as well as functional considerations, such as those that require Special I/O Units or Link Systems will need to be considered. In many cases, Special I/O Units, Intelligent I/O Units, or Link Systems can greatly reduce the programming burden. Details on these Units and Link Systems are available in appropriate *Operation Manuals* and *System Manuals*.

Once the entire Control System has been designed, the task of programming, debugging, and operation as described in the remaining sections of this manual can begin.

1-6 Peripheral Devices

The following peripheral devices can be used in programming, either to input/debug/monitor the PC program or to interface the PC to external devices to output the program or memory area data. Model numbers for all devices listed below are provided in *Appendix A Standard Models*. OMRON product names have been placed in bold when introduced in the following descriptions.

Programming Console

A Programming Console is the simplest form of programming device for OMRON PCs. Although a **Programming Console Adapter** is sometimes required, all Programming Consoles are connected directly to the CPU without requiring a separate interface. The Programming Console also functions as an interface to transfer programs to a standard cassette tape recorder.

Various types of Programming Console are available, including both CPU-mounting and Hand-held models. Programming Console operations are described later in this manual.

Graphic Programming Console: GPC

The GPC allows you to perform all the operations of the Programming Console as well as many additional ones. PC programs can be written on-screen in ladder-diagram form as well as in mnemonic form. As the program is written, it is displayed on a liquid crystal display, making confirmation and modification quick and easy. Syntax checks may also be performed on the programs before they are downloaded to the PC. Many other functions are available, depending on the Memory Pack used with the GPC.

A **Peripheral Interface Unit** is required to interface the GPC to the PC.

The GPC also functions as an interface to copy programs directly to a standard cassette tape recorder. A **PROM Writer**, **Floppy Disk Interface Unit**, or **Printer Interface Unit** can be directly mounted to the GPC to output programs directly to an EPROM chip, floppy disk drive, or printing device, respectively.

Ladder Support Software: LSS

LSS is designed to run on IBM AT/XT compatibles to enable all of the operations available on the GPC.

A **Peripheral Interface Unit** or **Host Link Unit** is required to interface a computer running LSS to the PC. Using an Optical Host Link Unit also enables the use of optical fiber cable to connect the FIT to the PC. Wired Host Link Units are available when desired. (Although FIT does not have optical connectors, conversion to optical fiber cable is possible by using converting **Link Adapters**.)

Factory Intelligent Terminal: FIT

The FIT is an OMRON computer with specially designed software that allows you to perform all of the operations that are available with the GPC or LSS. Programs can also be output directly to an EPROM chip, floppy disk drive, or printing device without any additional interface. The FIT has an EPROM writer and two 3.5" floppy disk drives built in.

A **Peripheral Interface Unit** or **Host Link Unit** is required to interface the FIT to the PC. Using an Optical Host Link Unit also enables the use of optical fiber cable to connect the FIT to the PC. Wired Host Link Units are available when desired. (Although FIT does not have optical connectors, conversion to optical fiber cable is possible by using converting **Link Adapters**.)

PROM Writer

Other than its applications described above, the PROM Writer can be mounted to the PC's CPU to write programs to EPROM chips.

Floppy Disk Interface Unit

Other than its applications described above, the Floppy Disk Interface Unit can be mounted to the PC's CPU to interface a floppy disk drive and write programs onto floppy disks.

Printer Interface Unit

Other than its applications described above, the Printer Interface Unit can be mounted to the PC's CPU to interface a printer or X-Y plotter to print out programs in either mnemonic or ladder-diagram form.

1-7 Available Manuals

The following table lists other manuals that may be required to program and/or operate the C200H. *Operation Manuals* and/or *Operation Guides* are also provided with individual Units and are required for wiring and other specifications.

Name	Cat. No.	Contents
GPC Operation Manual	W84	Programming procedures for the GPC (Graphics Programming Console)
FIT Operation Manual	W150	Programming procedures for using the FIT (Factory Intelligent Terminal)
LSS Operation Manual	W237	Programming procedures for using LSS (Ladder Support Software)
SSS Operation Manual: Basic SSS Operation Manual: C series PCs	W247 W248	Programming procedures for using SSS (SYSMAC Support Software)
Data Access Console Operation Guide	W173	Data area monitoring and data modification procedures for the Data Access Console
Printer Interface Unit Operation Guide	W107	Procedures for interfacing a PC to a printer
PROM Writer Operation Guide	W155	Procedures for writing programs to EPROM chips
Floppy Disk Interface Unit Operation Guide	W119	Procedures for interfacing a PC to a floppy disk drive
Wired Remote I/O System Manual (SYSMAC BUS)	W120	Information on building a Wired Remote I/O System to enable remote I/O capability
Optical Remote I/O System Manual (SYSMAC BUS)	W136	Information on building an Optical Remote I/O System to enable remote I/O capability
PC Link System Manual	W135	Information on building a PC Link System to automatically transfer data between PCs
Host Link System Manual (SYSMAC WAY)	W143	Information on building a Host Link System to manage PCs from a 'host' computer
SYSMAC NET Link Unit Operation Manual	W114	Information on building a SYSMAC NET Link System and thus create an optical LAN integrating PCs with computers and other peripheral devices
SYSMAC LINK System Manual	W174	Information on building a SYSMAC LINK System to enable automatic data transfer, programming, and programmed data transfer between the PCs in the System
High-speed Counter Unit Operation Manual	CT001V1/CT002: W141 CT021: W311	Information on High-speed Counter Unit
Position Control Unit Operation Manuals	NC111: W137 NC112: W128 NC211: W166	Information on Position Control Unit
Analog I/O Units Operation Guide	W127	Information on the C200H-AD001, C200H-DA001 Analog I/O Units
Analog Input Unit Operation Manual	W229	Information on the C200H-AD002 Analog Input Unit
Temperature Sensor Unit Operation Guide	W124	Information on Temperature Sensor Unit
ASCII Unit Operation Manual	W165	Information on ASCII Unit
ID Sensor Unit Operation Guide	W153	Information on ID Sensor Unit
Voice Unit Operation Manual	W172	Information on Voice Unit
Fuzzy Logic Unit Operation Manual	W208	Information on Fuzzy Logic Unit
Fuzzy Support Software Operation Manual	W210	Information on the Fuzzy Support Software which supports the Fuzzy Logic Units
Temperature Control Unit Operation Manual	W225	Information on Temperature Control Unit

Name	Cat. No.	Contents
Heat/Cool Temperature Control Unit Operation Manual	W240	Information on Heating and Cooling Temperature Control Unit
PID Control Unit Operation Manual	W241	Information on PID Control Unit
Cam Positioner Unit Operation Manual	W224	Information on Cam Positioner Unit

1-8 LSS Capabilities

The LSS is a complete programming and control package designed for C-series PCs. It provides not only programming capabilities, but also advanced debugging, monitoring, and program/data management. The following tables provide only a brief introduction to the capabilities of the LSS. For further information and actual operating procedures, please refer to the *Ladder Support Software Operation Manual*.

1-8-1 Offline Operations

Group	Description	
General Programming	General programming operations feature function keys to easily read, write, and store programs.	
PROGRAMMING	SAVE PROGRAM	Writes all or part of the user program to a data disk.
	RETRIEVE PROGRAM	Retrieves all or part of the user program from on a data disk.
	CHANGE DISPLAY	Switches the display between four display modes: Ladder, Ladder with Comments, Mnemonic 1 (function key and numeric key input mode) and Mnemonic 2 (alphanumeric key input mode).
	SEARCH INSTRUCTION	Searches for instructions including specified operands.
	I/O COMMENT	Creates, reads, modifies, and searches for I/O comments.
	BLOCK COMMENT	Creates, edits, and searches for block comments for output instructions.
	LINE COMMENT	Creates, searches for, and edits line comments.
	CUT AND PASTE	Edits programs by copying, moving, or deleting instruction blocks.
	EDIT I/O COMMENT	Displays 32 I/O comments at once to write, edit, and search.
	RETRIEVE COMMENTS	Retrieves comments from programs stored on a data disk.
	MEMORY USAGE	Displays the used capacity of user program memory, comments, and internal memory.
	CLEAR MEMORY	Clears the user program memory.
	CHECK PROGRAM	Checks whether the user program contains syntax errors. The check can be performed in three levels.

Group	Description	
DM (data memory)	DM operations are used to edit DM data in hexadecimal or ASCII form. There are also features for copying, filling and printing DM data, as well as data disk save and retrieve operations.	
I/O TABLE	I/O TABLE is used to edit, check, and print I/O tables. It also provides data disk save and retrieve operations.	
UTILITY	DATA AREA LISTS	Displays lists of such items as used areas and cross-references (i.e., instructions that use specified operands).
	CHANGE ADDRESSES	Globally changes bit and word addresses in the user program.
	PRINT LISTS	Prints lists, ladder diagrams, and mnemonics.
	EPROM FUNCTIONS	Writes, reads, and compares the user program between the PROM Writer and system work disk.
	C500 → C2000H	Converts the program format from C500 to C2000H
	NETWORK DATA LINKS	Creates a data link table.
	CREATE LIBRARY FILE	Formats a floppy disk or hard disk for use with the LSS.
UTILITY (continued)	TIME CHART MONITOR	Accesses the time chart monitor displays produced online.
	SET INSTRUCTIONS	Used to assign instructions to function codes in instructions tables and to save/retrieve instructions tables to/from data disk files.
	RETRIEVE/SAVE INSTR	Used to save and retrieve expansion instruction sets to and from data disk files.
	PC SETUP	Used to set the PC operating parameters in the PC Setup and to save and retrieve PC Setups to and from data disk files.

1-8-2 Online Operations

Group	Function name	Description
ON-LINE	MONITOR DATA	Used to monitor up to 20 bits/words during program execution. The status of bits and contents of words being monitored can also be controlled.
	TRANSFER PROGRAM	Transfers and compares the user program between the LSS and PC.
	ON-LINE EDIT	Edits the PC program during MONITOR mode execution.
	READ CYCLE TIME	Reads and displays the cycle time of the PC.
	CLEAR DATA AREAS	Clears the PC data areas such as HR, CNT, AR, and DM (to zero).
	MEMORY USAGE	Displays the used capacity of program memory area, comments, and internal memory.
	Operations are also available to change display modes and search for instructions and comments.	
DM	DM area operations are available to transfer and compare DM data between the PC, LSS, and data disks, and to monitor DM contents in the PC.	
I/O TABLE	I/O TABLE operations are used to write, transfer, and compare I/O tables between the PC and LSS.	
UTILITY	FILE MEMORY	Displays file memory lists; transfers file memory contents between PC and LSS; clears file memory; transfers file memory contents between PC and File Memory Unit; saves or retrieves file memory contents to or from floppy disk; and edits file memory data.
	XFER DATA LINK TBL	Transfers and compares data link tables between the PC and computer.
	CLOCK	Used to read and set the internal clock in the PC.
	TRANSFER INSTR	Used to transfer the expansion instruction set from the PC to the LSS.
	TRANSFER PC SETUP	Used to transfer the PC Setup between the PC and the LSS

1-8-3 Offline and Online Operations

Group	Description
SYSTEM SETUP	The SYSTEM SETUP provides settings for the operating environment of the LSS, including the PC that's being communicated with (including network and interface settings) and disk drive, comment, printer, PROM Writer, and monitor settings. It also provides settings for transfer of I/O table and data link tables to UM.
FILE MANAGEMENT	FILE MANAGEMENT operations include basic file management features so that files can be manipulated directly from the LSS. It also provides a feature for merging program files.

SECTION 2

Hardware Considerations

This section provides information on hardware aspects of the C200H that are relevant to programming and software operation. These include indicators on the CPU Unit and basic PC configuration. This information is covered in detail in the *C200H Installation Guide*.

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