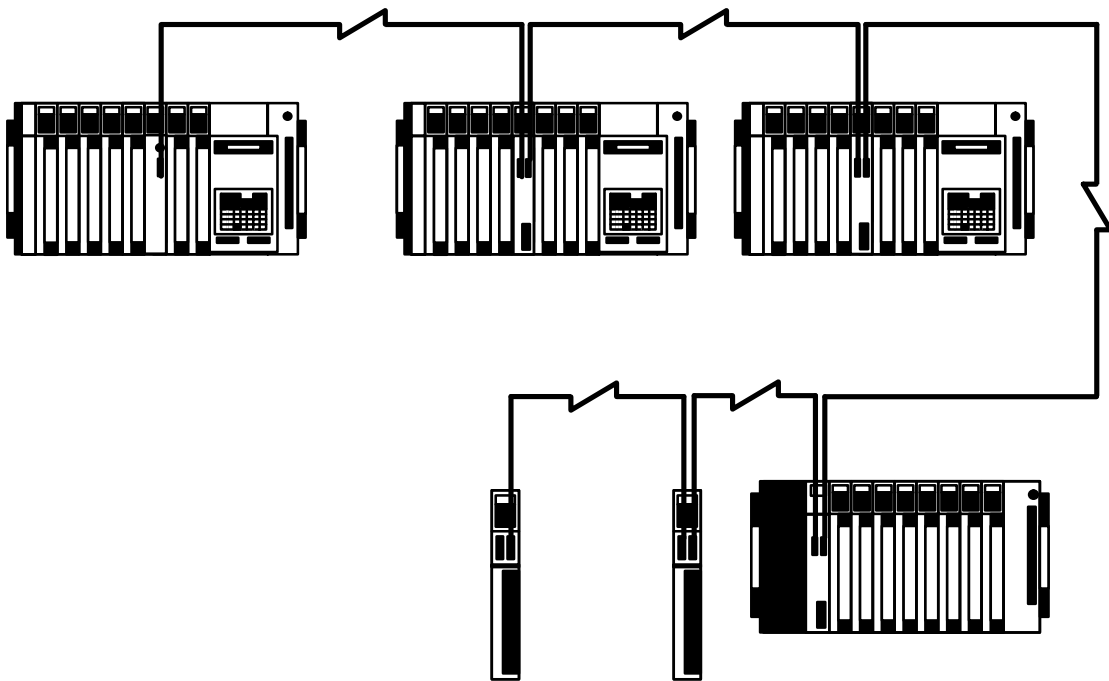




Optical Remote I/O

System Manual

Revised December 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.

© OMRON, 1990

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form, or by any means, mechanical, electronic, photocopying, recording, or otherwise, without the prior written permission of OMRON.

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.

TABLE OF CONTENTS

PRECAUTIONS	
1 Intended Audience	
2 General Precautions	
3 Safety Precautions	
4 Operating Environment Precautions	
5 Application Precautions	
SECTION 1	
Introduction	
1-1 Remote I/O Systems	
1-2 Optical Remote I/O Systems	
SECTION 2	
System Design	
2-1 Basic System	
2-2 Multilevel Systems	
2-3 C20, P-type, and K-type Systems	
2-4 C120 Systems	
2-5 C500 Systems	
2-6 C1000H and C2000H Systems	
2-7 C200H System	
2-8 Combined Systems	
2-9 Connection Precautions	
SECTION 3	
Operations	
3-1 Block Diagrams	
3-2 I/O Link Unit Operation	
3-3 Unit Number and I/O Word Allocation	
3-4 I/O Word Allocation Examples	
SECTION 4	
Unit Components and Switch Settings	
4-1 Remote I/O Units	
4-2 I/O Link Units	
4-3 Optical I/O Units	
4-4 Switch Settings	
SECTION 5	
System Installation	
5-1 Dimensions	
5-2 Optical Fiber Cable	
5-3 Wiring	
SECTION 6	
I/O Response Times	
6-1 Introduction	
6-2 C500 Systems	
6-3 C1000H and C2000H Systems	
6-4 C200H Systems	

TABLE OF CONTENTS

SECTION 7

Error Processing

- 7-1 Self-diagnosis
- 7-2 SR and AR Area Flags
- 7-3 Locating Transfer Errors

Appendices

- A Standard Models
- B Specifications
- C Power Supply Wiring Precautions
- D Using the C200H-RM001-PV1 with CS1-series PCs

Glossary

Index

Revision History

About this Manual:

Basic OMRON PC Systems can be expanded to include Optical Remote I/O Systems. These flexible, distributed control systems which use optical fiber cable to provide rapid data transmission over long distances, free from external noise.

This manual has been prepared to explain how to incorporate Optical Remote I/O Systems into C120, C200H, C500, C1000H, and C2000H PC Systems. It provides the necessary information, such as system configuration, settings, and I/O word allocation, for connecting Remote I/O Master Units, Remote I/O Slave Units, I/O Link Units, and/or Optical I/O Units.

Before attempting to install or operate an Optical Remote I/O System, be sure to thoroughly familiarize yourself with the information contained herein.

Section 1 introduces Optical Remote I/O Systems and describes their advantages and characteristics.

Section 2 describes the components that go together to construct an Optical Remote I/O System and the factors required to design a System.

Section 3 describes the LR area used in data transfer between the PCs, the method used to allocate it to the PCs, and the polling process used to actually transfer data.

Section 4 provides details on Optical Remote I/O Systems and the main Units used to build these Systems. Parts of the Units, switch setting, and examples of switch settings are provided.

Section 5 provides details on Unit dimensions and optical fiber cable.

Section 6 offers details on response times.

Section 7 describes error indications and error processing. Both indicator lights and dedicated error-related flags are provided.

Appendix A provides a list of the basic specifications and complete model numbers of products used in Optical Remote I/O Systems.

Appendix B provides technical specifications.



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 Optical Remote I/O System and related devices.

The information contained in this section is important for the safe and reliable application of the Optical Remote I/O System. You must read this section and understand the information contained before attempting to set up or operate the Optical Remote I/O System.

- 1 Intended Audience
- 2 General Precautions
- 3 Safety Precautions
- 4 Operating Environment Precautions
- 5 Application Precautions

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 System. Be sure to read this manual before attempting to use the System and keep this manual close at hand for reference during operation.

-  **WARNING** It is extremely important that the Optical Remote I/O System 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 the Optical Remote I/O 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.
-  **Caution** Tighten the screws on the terminal block of the AC Power Supply Unit to the torque specified in the operation manual. The loose screws may result in burning or malfunction.
-  **Caution** Execute online edit only after confirming that no adverse effects will be caused by extending the cycle time. Otherwise, the input signals may not be readable.
-  **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, in order 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.


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 Optical Remote I/O 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 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 Optical Remote I/O 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 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 Optical Remote I/O 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.
- 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.
- 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

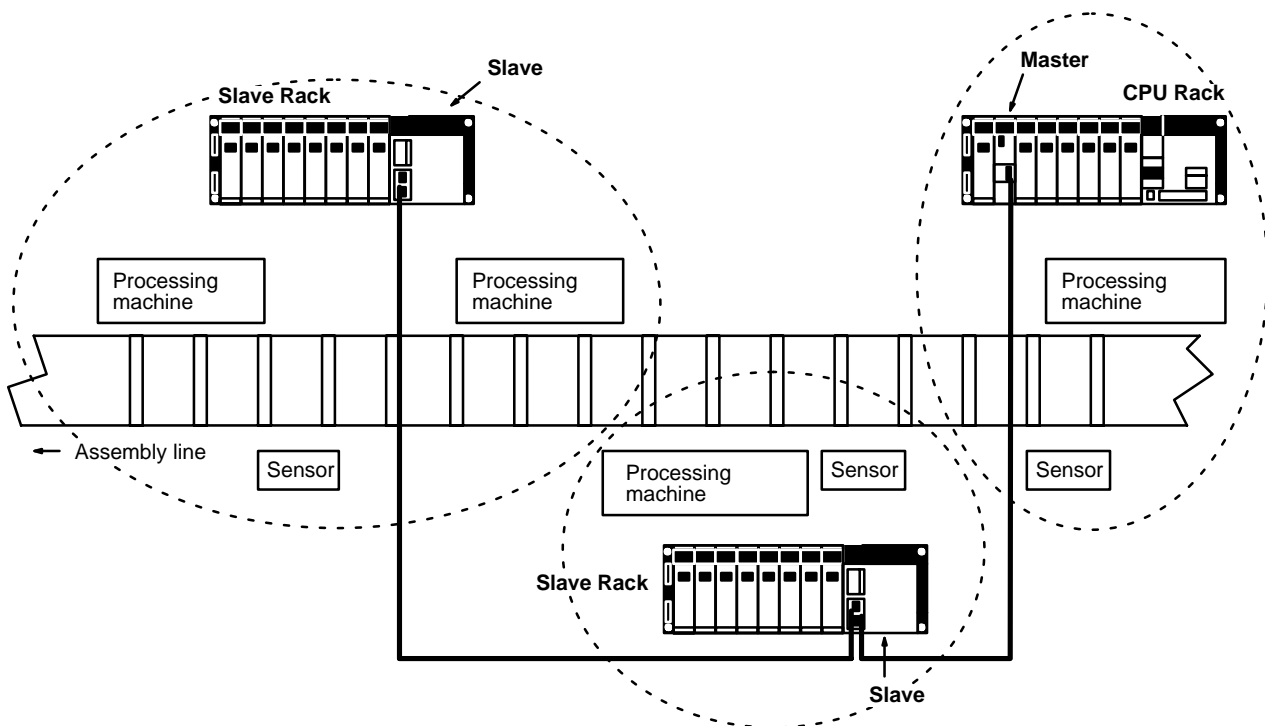
1-1 Remote I/O Systems
1-2 Optical Remote I/O Systems

1-1 Remote I/O Systems

Assembly lines are often extremely long, making it difficult if not impossible to wire all I/O devices directly from CPU Racks or Expansion I/O Racks. A Remote I/O System can be used to solve this problem. In a Remote I/O System, a Rack can be located farther from the CPU Rack than is possible with Expansion I/O Racks connected directly to the CPU Rack.

By locating a Rack farther from the CPU Rack, a Remote I/O System eliminates the time and mess in wiring (or changing wiring) to many devices that are separated from the CPU Rack. Although all I/O points must ultimately be wired individually, the question is one of distance: Do you want to wire dozens of terminals all the way across a factory complex or do you want to run a single cable for most of the distance and then wire individual terminals locally?

The following diagram illustrates how a simple Remote I/O System would be set up. Slave Racks, described below, are controlled by the CPU through the Master. The dotted circles show the devices that would be controlled through the Units on each Rack.



Wiring distance could also be reduced by placing an independent CPU Rack near every location that required control, but in doing so, each PC would have to be programmed independently and the activities of all the PC programs would need to be coordinated, a very difficult job. Here too, a Remote I/O System simplifies the task by allowing a single CPU, and thus a single program, to integrate control of the entire process. A Remote I/O System thus has these two advantages: Racks can be located a greater distance from the CPU Rack and coordinating control actions is simplified because all control is exerted by one program.

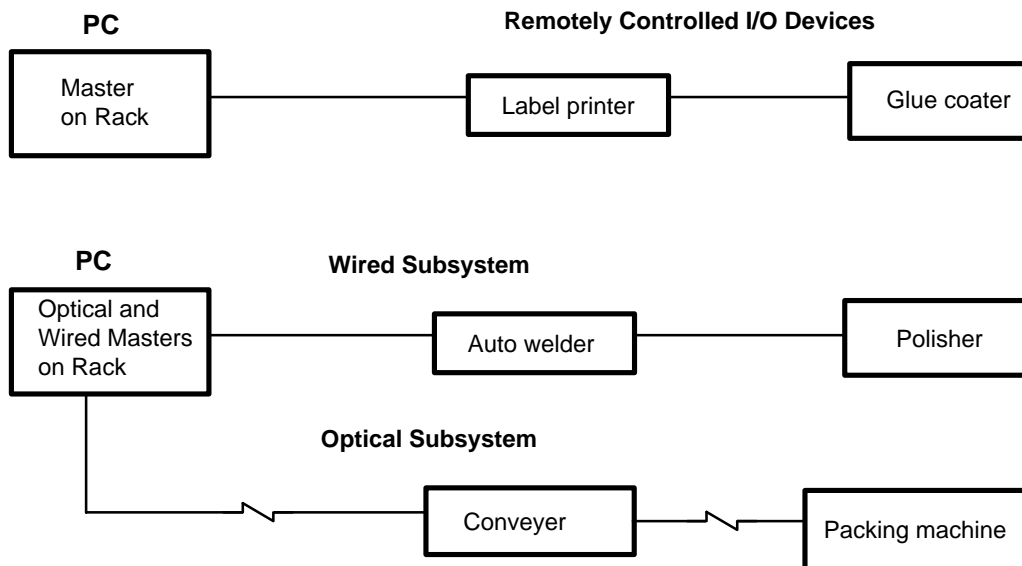
A third advantage of Remote I/O Systems is reduced noise interference. This is the result of the single cable that replaces the otherwise numerous wires that would be required all the way from the CPU and Expansion I/O Racks to the I/O devices.

A Remote I/O System directly involves only one PC and the program in it. Through it, a large number of I/O points can be controlled a greater distance from

the PC. This is achieved by mounting a **Remote I/O Master Unit** to the CPU Rack to control I/O points located possibly many kilometers away. Each Master serves as a 'switching point' for controlling all of the I/O points accessed through it. These I/O points are accessed through the Master, not controlled by it. All I/O control comes from the program in the CPU.

More than one Master can be mounted to a single PC, with each Master forming the starting point of a **Remote I/O Subsystem**, i.e., a Remote I/O Subsystem includes one Master plus all of the **Remote I/O Units** controlled through it.

The Remote I/O Units that can be included in each Subsystem depend on the specifications of the Master. Masters are available either with optical or wire specifications. **Optical Remote I/O Systems** transfer data through **optical fiber cables** to enable the greatest transmission distance and the greatest resistance to electrical noise. **Wired Remote I/O Systems** use wire cables which don't offer as great a distance as Optical Subsystems, but do greatly reduce the burden of wiring remote I/O and afford greater resistance to noise than independently wired I/O points. Both types of Master can be mounted to the same PC to meet specific distance and noise-resistance requirements.



All Remote I/O Systems consist of at least one Remote I/O Master Unit connected in series to one or more Units accessed through it. One of these Units that is common to most Remote I/O Systems is a Remote I/O Slave Unit.

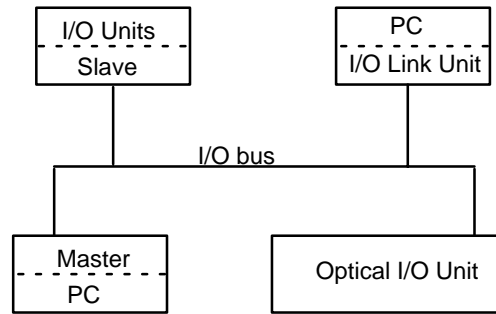
A Master is mounted to the CPU Rack or an Expansion I/O Rack; a Slave is mounted to a Backplane to form what is called a **Slave Rack**. To a Slave Rack is mounted the same other Units as those mounted to the CPU or Expansion I/O Rack, with only a few exceptions (e.g., Link Units other than Slaves cannot be mounted to Slave Racks). The advantage of a Slave Rack is that it can be located a considerable distance from the CPU Rack with the only connection required being a cable running from the Master to the Slave. The actual distance a Slave Rack can be removed from the Master, as well as the other Units used to configure a Remote I/O System, depends on the type of Remote I/O System being used. Collectively, all of the Units connected in a Remote I/O System are referred to as **Remote I/O Units**.

This manual describes Optical Remote I/O Systems. Wired Remote I/O Units are described in the *Wired Remote I/O System Manual*.

1-2 Optical Remote I/O Systems

Optical Remote I/O Systems are flexible, distributed control systems which can be customized as necessary by adding or eliminating various Units. They are easy to design and adjust and have a very short downtime even in the unlikely event of system failure.

Optical Remote I/O Systems consist of one or more Remote I/O Master Units together with one or more of the following Units: I/O Link Units, I/O Slave Unit, and Optical I/O Units.



An **I/O Link Unit** mounted to a CPU Rack or an independent **I/O Link Rack** is used to create an I/O Link between two CPUs. An I/O Link allows one CPU to directly input and/or output one or two words of data from and to another CPU. This enables coordination of CPU activities. Although this is an exception to the basic 'one-program' concept of Remote I/O Systems, it can be very effective when one part of an operation requires a separate program but also requires integration with another PC. With the smaller (e.g., P-type and K-type) PCs, I/O Links are also the only way to connect to a Remote I/O System.

An I/O Link can also be set up as the only element of an Optical Remote I/O System, i.e., without any Optical I/O Units or Slave Racks. Such a System would be like a PC Link System on a very limited scale, but it would employ I/O bits in the IR area and not the LR area.

An Optical I/O Unit is used when it is necessary to control only a few I/O points in one location. It is not mounted to a Rack; rather, it is located by itself in series with the rest of the Units in the System. In this respect, an Optical I/O Unit is the Optical System equivalent of a Remote Terminal. Unlike a Remote Terminal, however, an Optical I/O Unit has fixed I/O terminals, not replaceable relays. In appearance, it looks much like an I/O Unit or Special I/O Unit.

A Remote I/O Subsystem consists of a single Remote I/O Master Unit and all Remote I/O Units controlled through it.

In this manual, the term "Remote I/O Subsystem" always refers to an Optical System unless specifically designated as a Wired System. For convenience, Remote I/O Master Units and Remote I/O Slave Units are referred to respectively as simply "Masters" and "Slaves". These terms, as well, always refer to Optical Units unless otherwise specified. The term "Slave Rack" is used to refer to a Backplane with a Slave mounted to it. "PC" always means Programmable Controller.

C500 Masters and C500 Slaves are used for the C500, C1000H, and C2000H. C500 Masters and C500 Slaves can also be used for the C120, although a C120 Master and C120 Slave are available

An Optical Remote I/O System provides a number of advantages, as indicated in the following table.

Features of Optical Remote I/O Systems

Advantages of Optical Remote I/O Systems

Reduced wiring burden and easier wiring changes
Greater transmission distance from CPU Rack
Coordination of control facilitated by use of a single program
I/O Links enable direct transfer of data between PCs
Rapid data transmission
High responsiveness and fidelity
Free from the adverse effects of external noise

Optical fiber cable is used for communication lines. As a result, wiring is significantly simplified and the system can be easily expanded as necessary.

Either All-plastic Fiber (APF), Plastic-clad Fiber (PCF), or Quartz Crystal (AGF) can be used for the optical fiber cables in an Optical Remote I/O System. APF cable is especially instrumental in simplifying wiring and reducing cost.

Terminology

A variety of basic Systems and Subsystems can be constructed and combined in many ways to meet a wide range of control requirements. Throughout this manual, particular terms are used to refer to these basic systems, and they are defined as follows.

A Control System is the extended system, including all external devices such as stepping motors, mechatronic modules, and control components (solenoids, sensors, switches, etc.).

A PC System is a system which includes a Programmable Controller (PC) and all it controls up to, but not including, any external devices.

A Remote I/O System includes all the Optical and Wired Remote I/O subsystems under the control of a single PC. These systems can perform distributed control actions, such as remote operation of several large machines, by executing a program in the memory of a single PC's CPU.

Model numbers have been shortened. For example, a C200H-RT001 Remote I/O Slave Unit is called simply a "C200H Slave." See *Appendix A* for a complete list of all products covered in this manual, along with their model numbers.

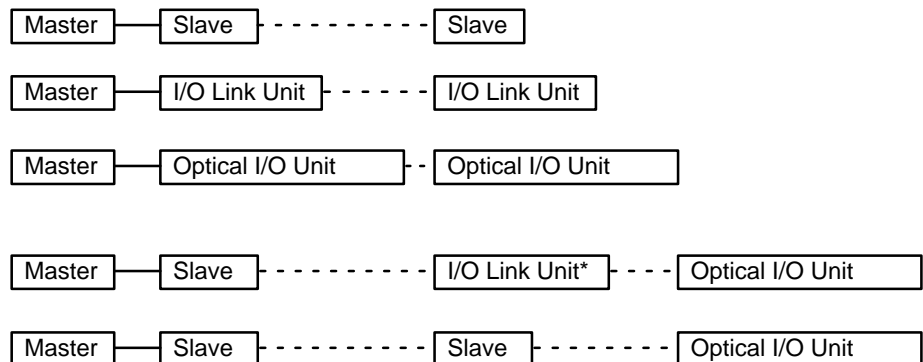
SECTION 2

System Design

2-1	Basic System
2-2	Multilevel Systems
2-3	C20, P-type, and K-type Systems
2-4	C120 Systems
2-5	C500 Systems
2-6	C1000H and C2000H Systems
2-7	C200H System
2-8	Combined Systems
2-9	Connection Precautions

2-1 Basic System

Some basic Systems of Remote I/O Units (i.e., Masters and Slaves), I/O Link Units, and Optical I/O Units are shown in the following table.



Caution I/O Link Units cannot be connected to Slaves in C200H Systems.

Unit Connection

One Master is always necessary to connect Slaves, I/O Link Units, and Optical I/O Units. Slaves, I/O Link Units, and Optical I/O Units can be used in combination. Connect all Slaves, I/O Link Units, and Optical I/O Units in series starting from the Master. The only condition that must be met in regard to the order of connecting Remote I/O Units is that the Master be on one end of the System and I/O Link Units cannot be connected after C200H Slaves.

There are three types of Master: One for the C120, one for the C500 (which is also used for the C120, C1000H, and C2000H), and one for the C200H. Two type of Slaves are available: One for the C500, C1000H, and C2000H, and one for the C200H. There are no Masters or Slaves available for the C20, P-type PCs, or K-type PCs.

The I/O Link Unit also comes in three types: the C20 I/O Link Unit for the C20, K-type PCs, and P-type PCs, the C120 I/O Link Unit for the C120, and the C500 I/O Link Unit for the C500, C1000H, and C2000H. There is no I/O Link Unit for the C200H.

Mounting Units

C500 Slaves are mounted to the I/O Interface Unit's position on the Slave Rack and connected in series to the Master. C200H Slaves are mounted to the right side of a Backplane where the Power Supply normally goes. A Power Supply is normally built into the Slave.

C200H and C500 Masters can be mounted to any slot on the CPU Rack or Expansion I/O Rack. C120 Masters are mounted to C120-SIO27 Remote I/O Rack only.

The C500 I/O Link Unit is mounted to any slot on a C500, C1000H, or C200H CPU Rack or Expansion I/O Rack and the C120 I/O Link Unit is mounted to the C120-SIO23 I/O Link Rack. The C20 I/O Link Unit is free-standing and is connected via a Connecting Cable to the C20, K-type, or P-type CPU or Expansion I/O Unit.

Connecting Wired Subsystems

Wired Subsystems and Optical Subsystems can be connected together in the same PC System as described in 2-2 *Multilevel Systems*. Any Wired Units used (e.g., Wired Slaves or Remote Terminals) must be counted against the total number of Units connectable in any System, as shown below.

Maximum Number of Connectable Remote I/O Units

Item	C120/C500	C1000H/ C2000H	C200H*
Masters per PC	4	8	2
Slaves per Master	2	8	–
Slaves per PC	8	16	5
Total Slaves, I/O Link Units, and Optical I/O Units per Master	32	64 (Repeater Unit required for more than 32 Units.)	
Connection words per Master	16 words	32 words	

*In C200H Systems, the maximum number of connectable Units and words is the same regardless of whether one or two Masters are used.



Caution In C1000H and C2000H Systems, the CPU determines the number of connected Slaves from the assigned Unit numbers, as shown in the following table. It is thus important to always set Unit numbers in order starting from #0 so that the number of Units that can be used in the System is not limited.

Largest Unit No. Set	Number of Units Connected
0 or 1	2
2 or 3	4
4 or 5	6
6 or 7	8

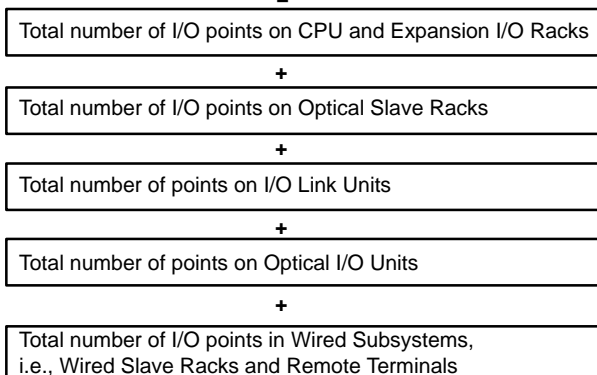
Total I/O Points

The total number of I/O points in the System must not exceed the number of I/O points provided by the CPU to which the Master is mounted.

The number of I/O points in a C1000H System can be increased up to 2,048, and the number of points in a C200H System can be increased to 1,680, by including Remote I/O Units and the necessary related Units. The total number of I/O points available from the CPU Rack or Expansion I/O Racks, however, is 1,024.

CPU	Maximum Number of I/O Points
C2000H	2,048
C1000H	1,024 (expandable up to 2,048 points)
C500	512
C200H	336 (expandable to 1,680 points)
C120	256

Total number of I/O points in System



2-2 Multilevel Systems

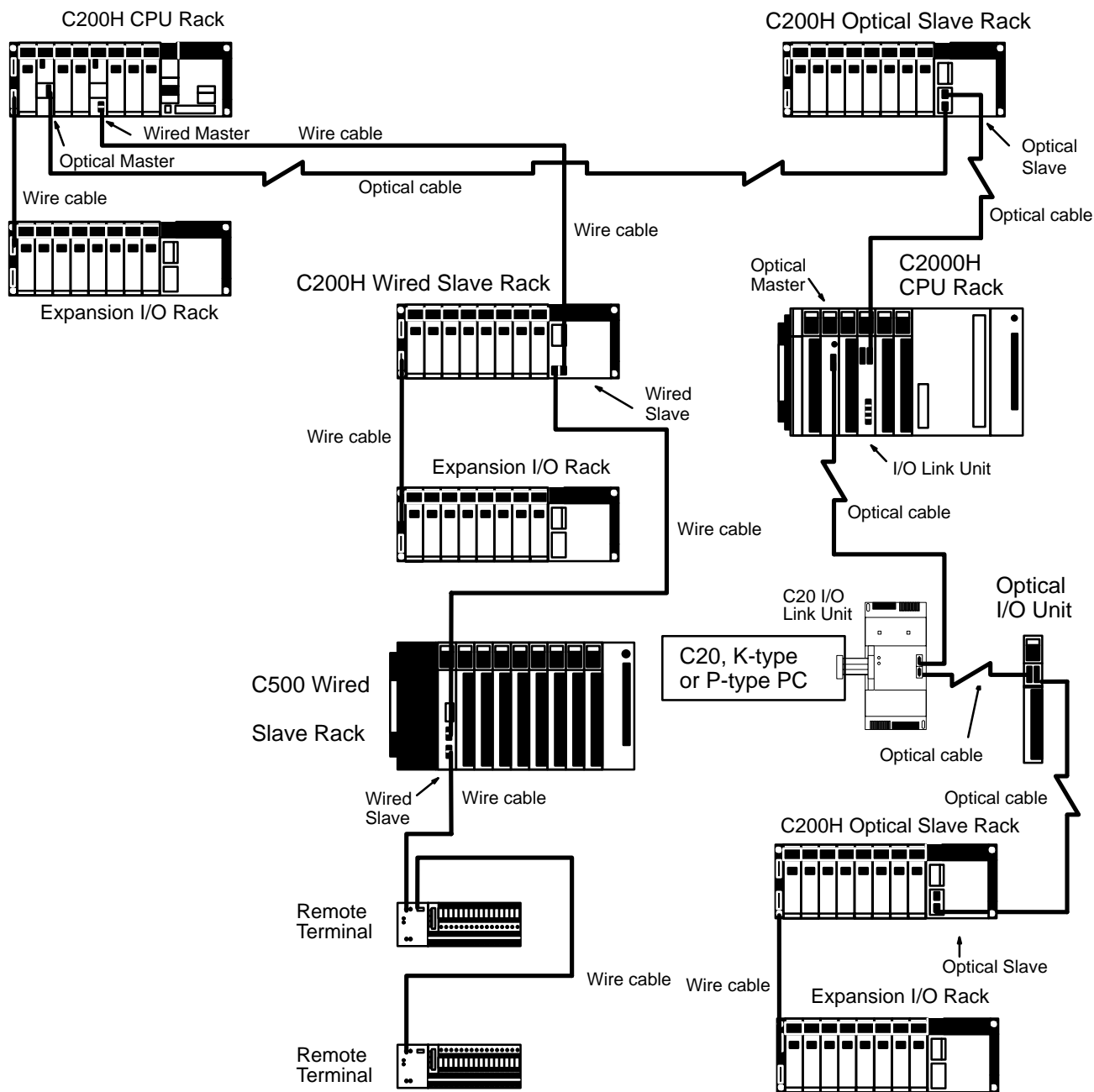
There is no reason that a Remote I/O System must remain restricted to one Master or to either wired or optical communications. PCs support multiple Masters, some of which can be Wired and some of which can be Optical.

If there is more than one Master mounted under the control of a single CPU, each Master forms the beginning of a **Remote I/O Subsystem**. Although the number of Subsystems supported by each PC is limited, each Subsystem can be considered independently from the others as long as the total capacity of the PC is not exceeded. It is important to note that although both Wired and Optical Masters can be controlled by the same CPU, Optical and Wired Remote I/O Units cannot be combined in the same Subsystem, i.e., Optical Masters can be connected only to Optical Slaves, Optical I/O Units, and I/O Link Units; Wired Masters can be connected only to Wired Slaves, Remote Terminals, and I/O Terminals.

In the example on the next page, two CPU Racks are used. The one in the upper left corner controls two Remote I/O Subsystems, one Wired and one Optical. The Optical System contains an I/O Link to the other CPU Rack (at the right), which has one Remote I/O Subsystem controlled by it.

The Optical I/O Unit, Slave Rack, and Expansion I/O Rack beneath the CPU Rack at the right are controlled through the Optical Master on this CPU Rack. This Optical Master also connects the CPU to the C20 I/O Link Unit.

Another aspect of Remote I/O Systems demonstrated by this diagram is the presence of Expansion I/O Racks, both connected to a CPU Rack and to Slave Racks. Although normally not shown in system diagrams for Link Systems, Expansion I/O Racks can be used to increase the number of I/O Units mountable at any one location.



2-3 C20, P-type, and K-type Systems

The C20, P-type PCs, and K-type PCs can be connected to Remote I/O System only through the C20 I/O Link Unit. They can thus send data to and receive data from the PC that controls the Remote I/O System, but they cannot control their own Remote I/O System. These PCs are therefore included in some of the other system configurations, but none are provided for them here.

2-4 C120 Systems

Up to four Masters can be connected to any one PC and up to two Slaves can be connected to any one Master. In C120 System, either C120 Masters or C500 Masters can be used. Which Master is used makes no difference to the operation of the Remote I/O System. The C120 Master 3G2A6-RM001-(P)E is mounted to the upper slot of the Remote I/O Rack 3G2C4-SI027-E (100 VAC).

The C500 Master C500-RM001-(P)V1 is mounted to a C500 Expansion I/O Rack (connected to the C120 CPU). Slaves can be mounted only to the C500 Expansion I/O Rack, and they must be mounted to the leftmost slot of the Rack.

The C120 provides 256 I/O points. This means that the total number of points used for I/O Units, I/O Link Units, and Optical I/O Units must be 256 or less. If, for example, 256 points are controlled by one Master connected to a C120, no more Masters can be employed for that C120, and no more I/O points can be added to the Remote I/O System.

Refer to 5-2 *Optical Fiber Cable* for maximum cable lengths.

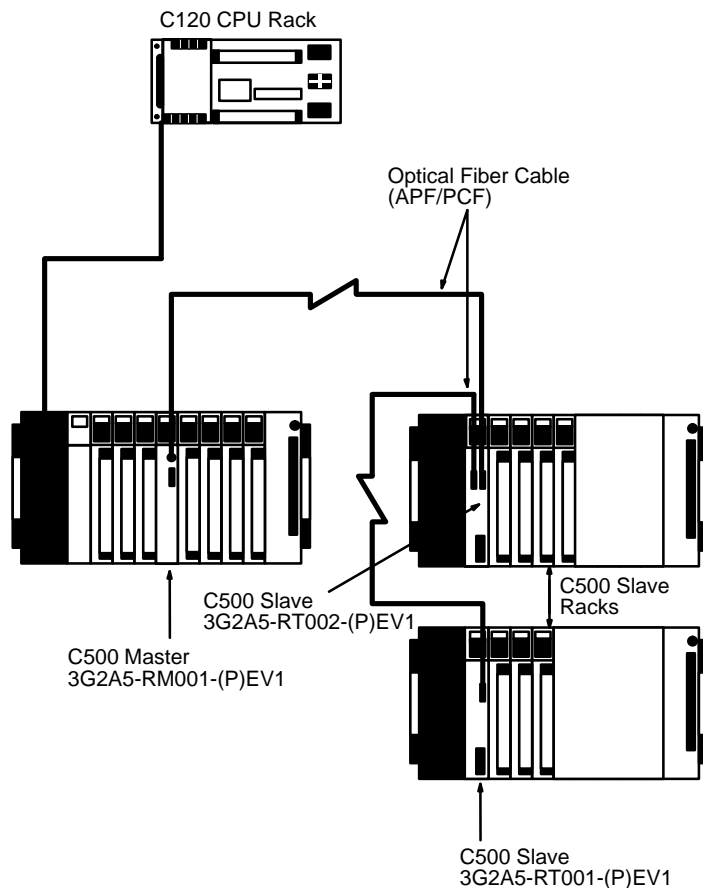
Example 1

The three Systems in this example show the different ways the basic Optical Remote I/O Units can be arranged. The first System uses only Slaves, as would be done if a more I/O points were required in each location than could be provided by Optical I/O Units or if future expandability was necessary. The second System uses only Optical I/O Units to provide minimal I/O points at each location. The third System incorporates both Slaves and Optical I/O Units, as would be necessary in many Systems to provide the specific number of points needed at different types of control locations.

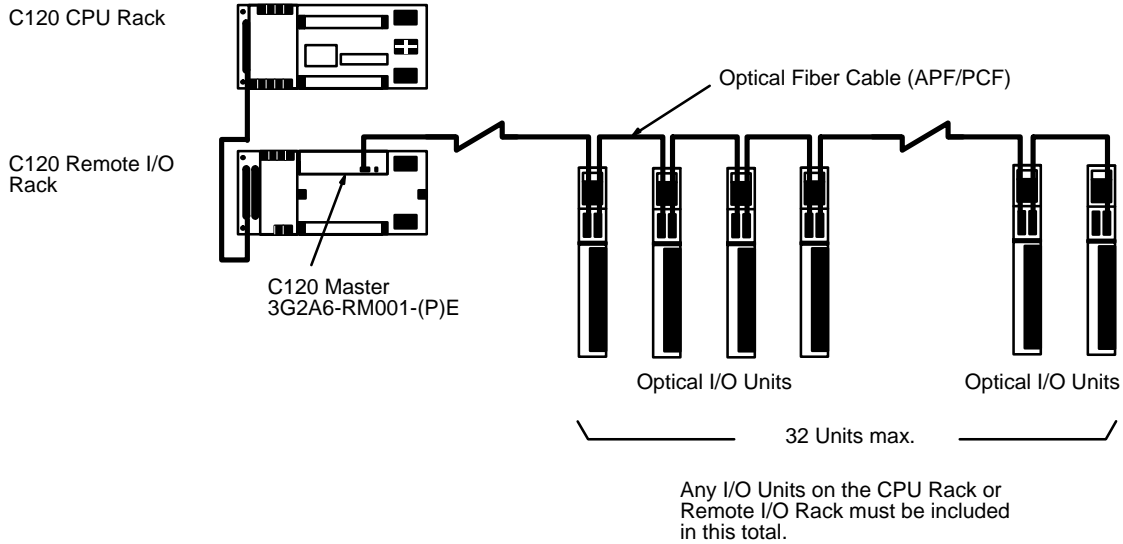
Here, the first System uses a C500 Master on a C500 Expansion I/O Rack; the other two Systems, a C120 Master on a C120 Remote I/O Rack. Either of these Systems could be changed to use the other type of Master without affecting Remote I/O System Operation. The difference would be the number of I/O points that could be provided from the Rack containing the Master.

For limitations in Unit connections, refer to Maximum Number of Connectable Remote I/O Units under 2-1 *Basic System*.

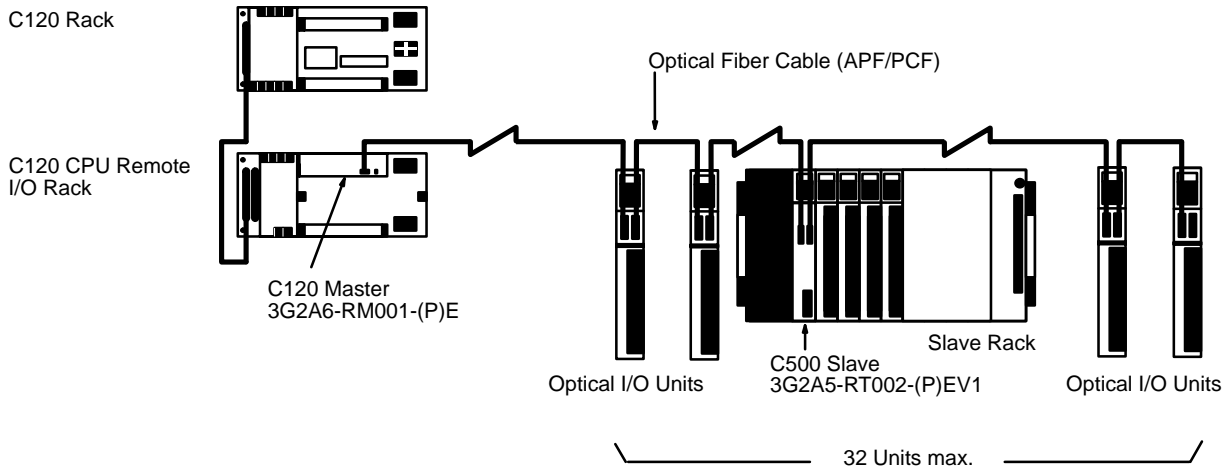
Master and Slaves



Optical I/O Units

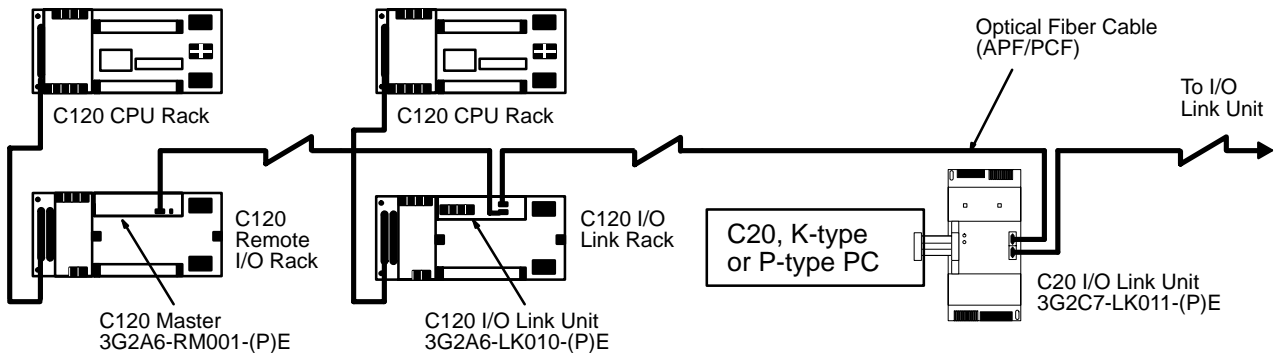


Slaves and Optical I/O Units



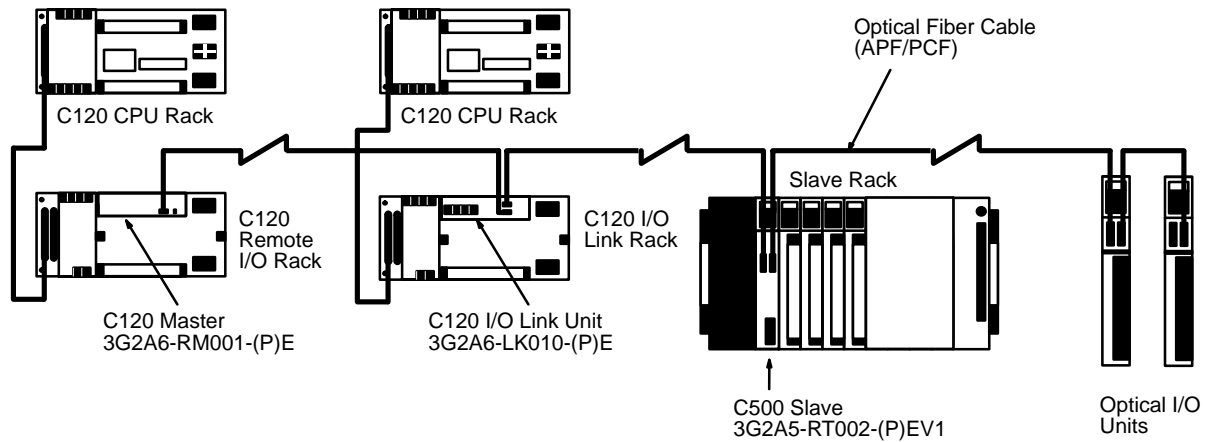
Example 2 I/O Link Units

Not only the C20 and C120 I/O Link Units but also the C500 I/O Link Unit can be connected to the System. A maximum of 256 points on I/O Link Units can be connected when all of these I/O Link Units are set to 16 points, i.e., 16 I/O Link Units per Master. (The C20 I/O Link Unit has no setting for the number of I/O points and is thus limited to 32 points.)



Example 3 I/O Link Units, Slaves, and Optical I/O Units

Any combination of I/O Link Units, Slaves, and Optical I/O Units may be connected.



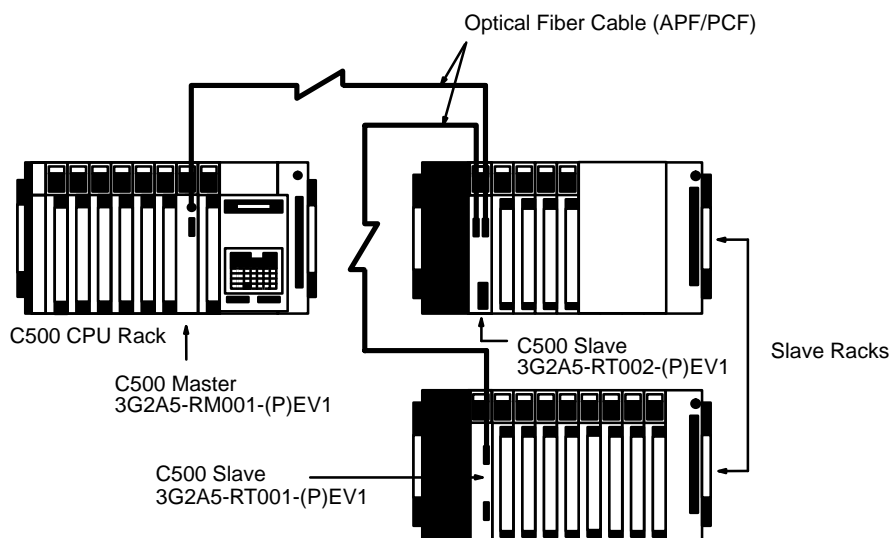
2-5 C500 Systems

Up to four Masters can be mounted on the same PC.

C500 PCs provide 512 I/O points. This means that the total number of points used for I/O Units, I/O Link Units, and Optical I/O Units must be 512 or less. If, for example, 512 points are controlled by one Master connected to a C500, no more Masters or I/O points can be employed for that C500.

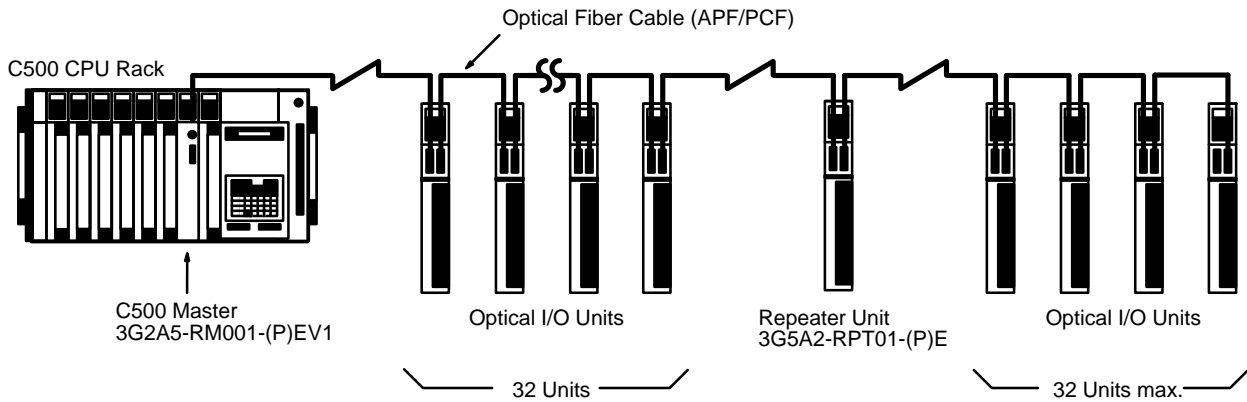
Refer to 5-2 *Optical Fiber Cable* for maximum cable lengths. For limitations in Unit connections, refer to Maximum Number of Connectable Remote I/O Units under 2-1 *Basic System*.

Example 1 Master and Slaves



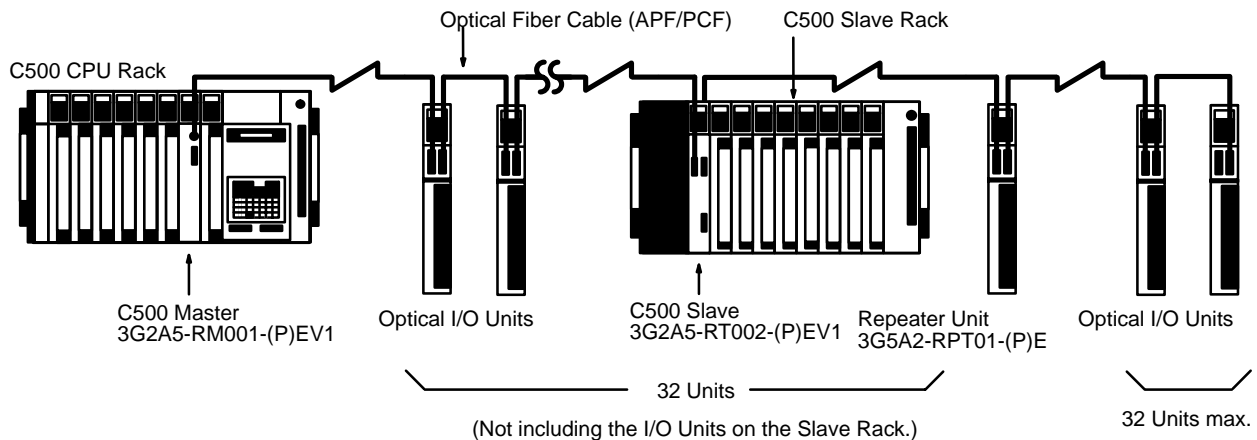
Example 2 Optical I/O Units

Up to 64 Optical I/O Units can be connected to one Master on a C500. If more than 32 Units are connected to the same Master, a Repeater Unit must be installed after the first 32 Units.



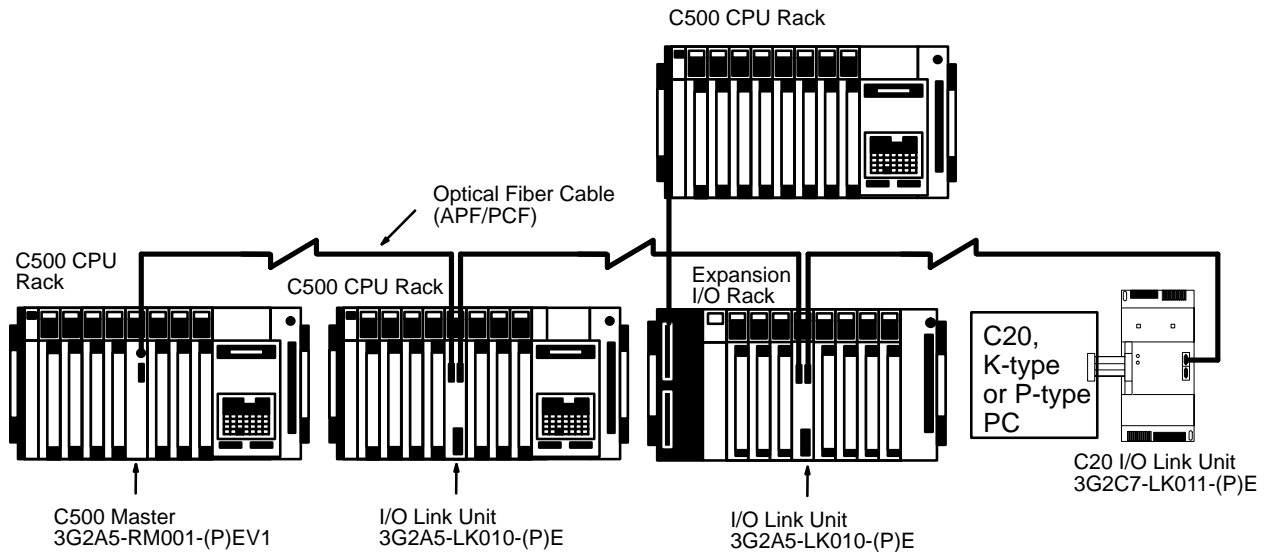
Example 3 Slaves and Optical I/O Units

Up to 64 Units, consisting of Optical I/O Units and up to two Slaves, can be connected to one Master on a C500. If more than 32 Units are connected to the same Master, a Repeater Unit must be installed after the first 32 Units. The Slave's I/O Units are not counted in the 32, but the I/O points must be counted in the total I/O points.



Example 4 I/O Link Units

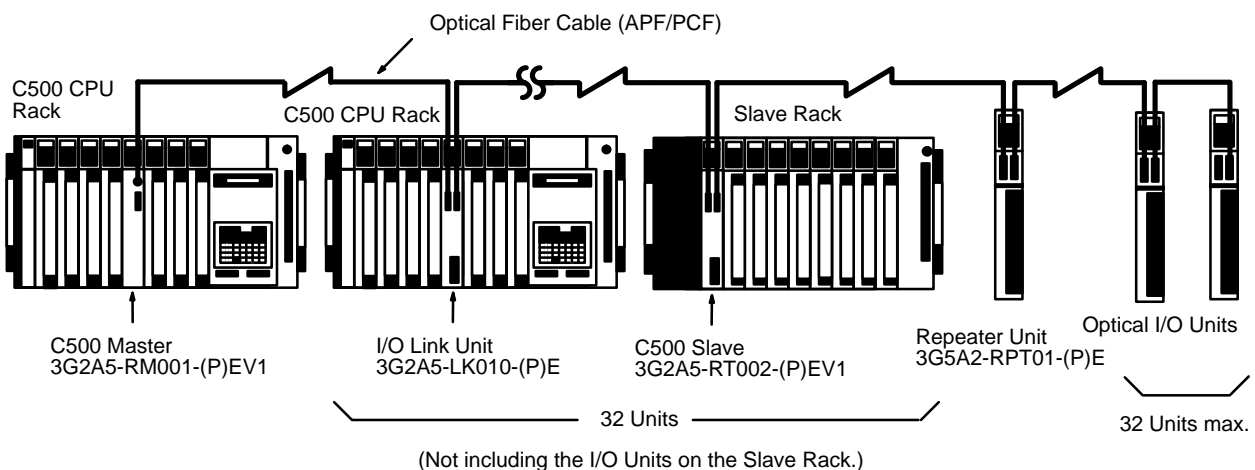
A maximum of 512 I/O points on I/O Units can be connected per Master, i.e., when the I/O Link Units are all set for 16 points each, up to 32 Units can be connected to one Master on a C500. This would mean, however, that all I/O points provided by the PC would be occupied and that no other I/O Units could be connected. (The C20 I/O Link Unit has no setting for the number of I/O points and is thus limited to 32 points.)



Example 5 I/O Link Units, Slaves, and Optical I/O Units

Up to two Slaves can be connected to one Master. Each I/O Link Unit requires 16 or 32 points (depending on the setting) and each Optical I/O Unit requires eight points. These may be used in any combination of I/O which does not exceed the total number of I/O points provided by the PC to which the Master is connected.

If more than 32 Units are connected to the same Master, a Repeater Unit must be installed after the first 32 Units. The Slave's I/O Units are not counted in the 32 Units, but the I/O points must be included in the total number of I/O points.



2-6 C1000H and C2000H Systems

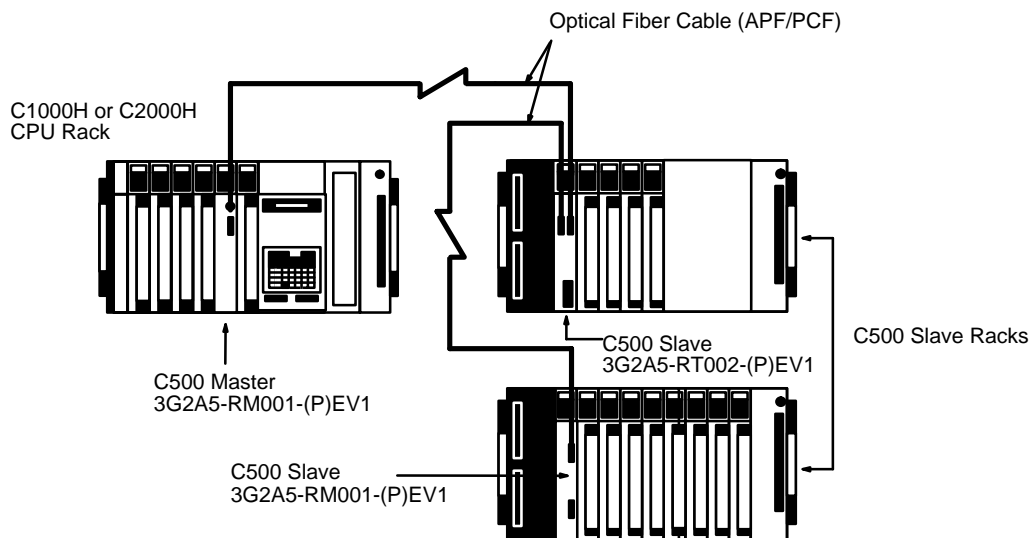
Up to eight Masters can be connected to the same PC.

The C1000H and C2000H provide 2,048 I/O points. This means that the total number of points used for I/O Units, I/O Link Units, and Optical I/O Units must be 2,048 or less. If, for example, 2,048 points are controlled by five or more Masters on a C1000H or C2000H, no more Masters or I/O points can be employed on that C1000H or C2000H. (The number of I/O points for the I/O Units on a C1000H's CPU Rack or Expansion I/O Racks, however, must be kept to within 1,204.) The number of words in any one Remote I/O Subsystem must also be kept to within 32.

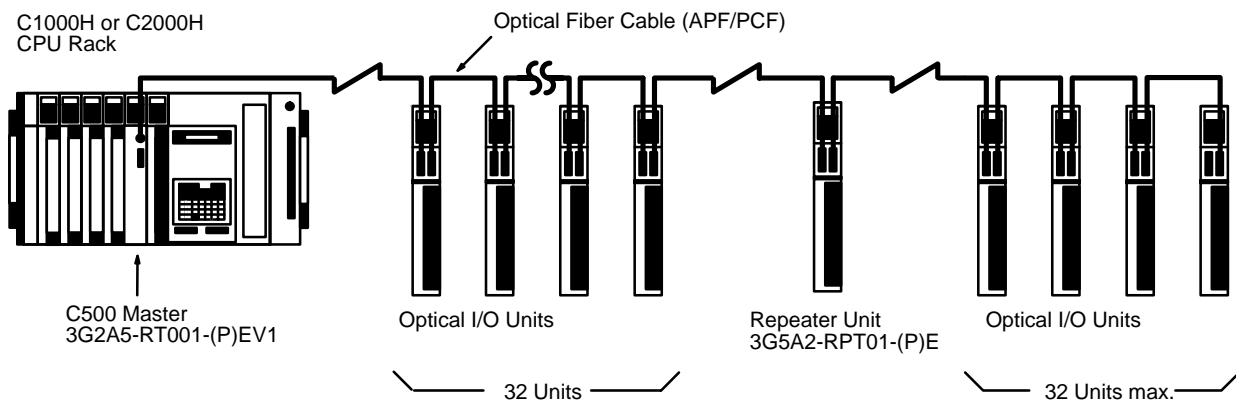
For maximum cable lengths, refer to 5-2 *Optical Fiber Cable*. For limitations in Unit connections, refer to Maximum Number of Connectable Remote I/O Units under 2-1 *Basic System*.

Example 1 Master and Slaves

Up to two Slaves can be connected to one Master.

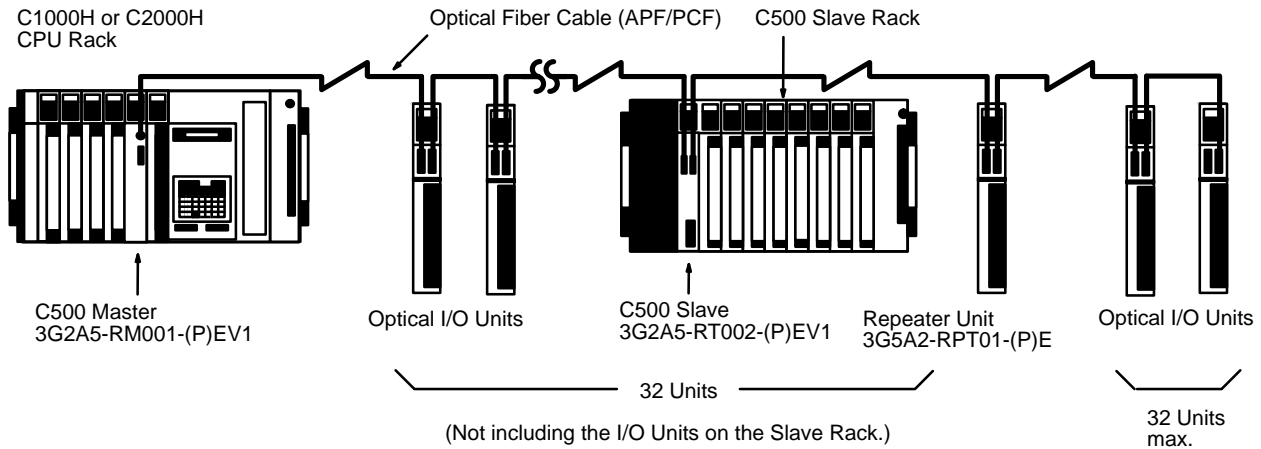


Example 2 Optical I/O Units



Up to 64 Optical I/O Units can be connected to one Master on a C1000H or C2000H. If more than 32 Units are connected to the same Master on a PC, a Repeater Unit must be installed after the first 32 Units.

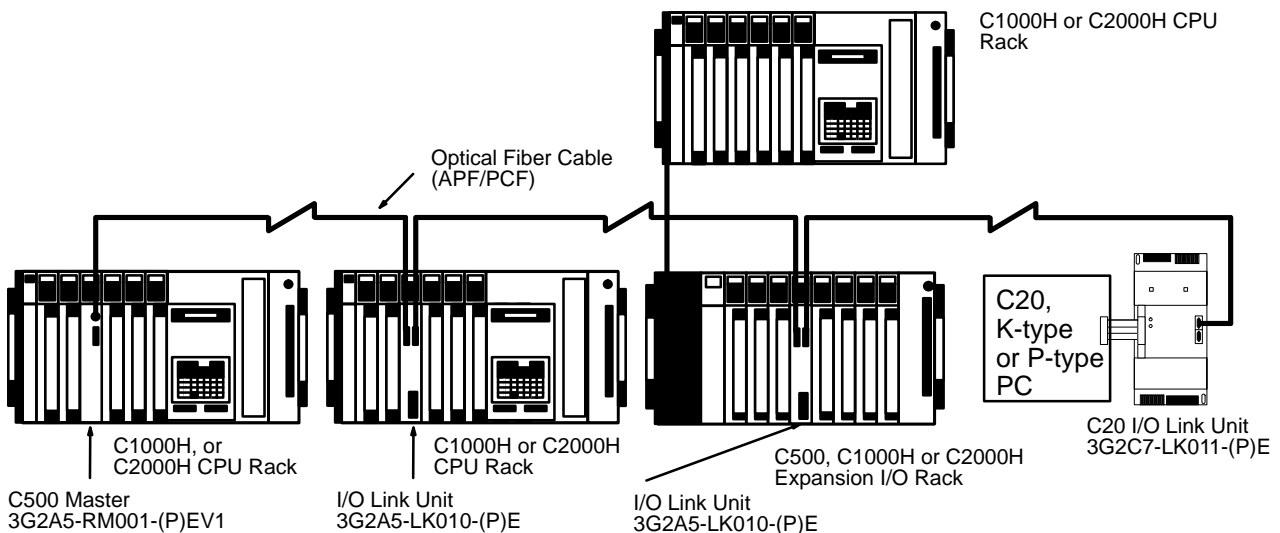
Example 3 Slaves and Optical I/O Units



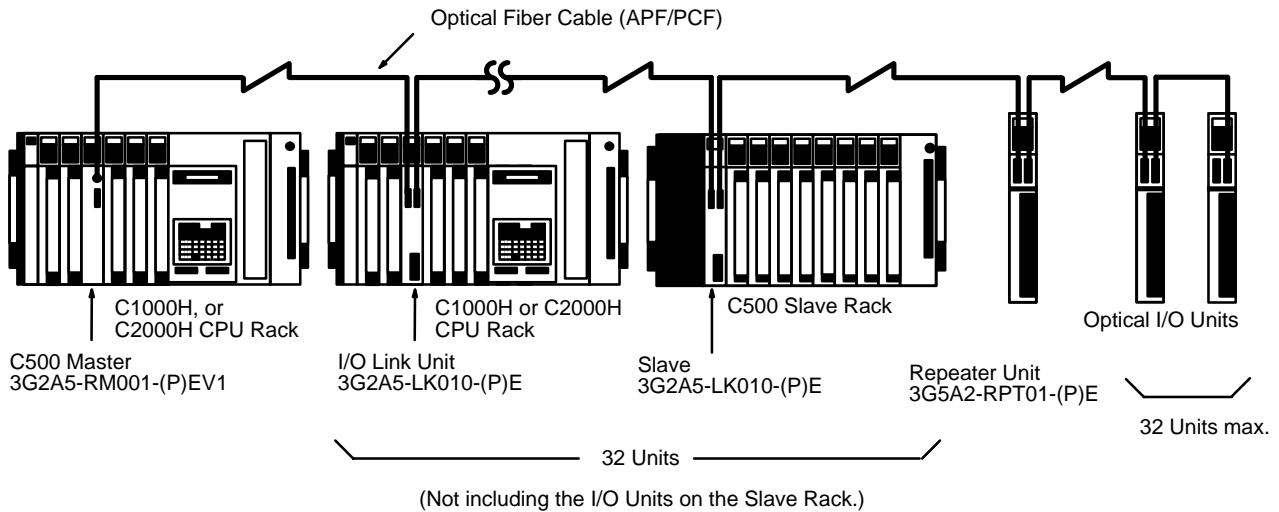
Up to 64 Units, consisting of Optical I/O Units and up to two Slaves, can be connected to one Master on a C1000H or C2000H. If more than 32 Units are connected to the same Master, a Repeater Unit must be installed after the first 32 Units. The Slave's I/O Units are not counted in the 32, but the I/O points must be counted in the I/O point total.

Example 4 I/O Link Units

A maximum of 512 I/O points on I/O Link Units can be connected per master, i.e., when the I/O Link Units are all set for 16 points each, up to 32 Units can be connected to one Master on a C1000H or C2000H. (The C20 I/O Link Unit has no setting for the number of I/O points and is thus limited to 32 points.)



Example 5 I/O Link Units, Slaves, and Optical I/O Units



Up to two Slaves can be connected to one Master. Each I/O Link Unit requires 16 or 32 points (depending on the setting) and each Optical I/O Unit requires eight points. These may be used in any combination desired that does not exceed the total number of I/O points provided by the CPU to which the Master is connected.

If more than 32 Units are connected to the same Master, a Repeater Unit must be installed after the first 32 Units. The Slave's I/O Units are not counted in the 32, but the I/O points must be counted in the I/O point total.

2-7 C200H System

A maximum of two Masters, either optical or wired, may be connected in one C200H PC System. Masters may be mounted directly to the CPU Rack or to Expansion I/O Racks. Any slots may be used except for the two rightmost slots of the CPU Rack. Using the two rightmost slots will prevent mounting devices directly to the CPU.

Regardless of the number of Masters, a maximum of five Slave Racks, either Optical or Wired, can be attached. Only I/O Units or Special I/O Units can be mounted to Slave Racks. A maximum of 64 Optical I/O Units can be connected, with a Repeater Unit installed after the first 32 Units. The number of words in any one Remote I/O Subsystem must be kept to within 32.

There is a limit to the number of Special I/O Units which can be mounted to Slave Racks. The following table gives the maximum total of Units possible from groups A, B, C, or D when no Special I/O Units are mounted to any other Racks. These totals assume that only those Units in one of these groups are used.

A	B	C	D
High-speed Counter Units Analog I/O Units NC111 and NC 112 Position Control Units ASCII Units	Multipoint I/O Units	Temperature Sensor Units	NC211 Position Control Units
4 Units total	8 Units total	6 Units total	2 Units total

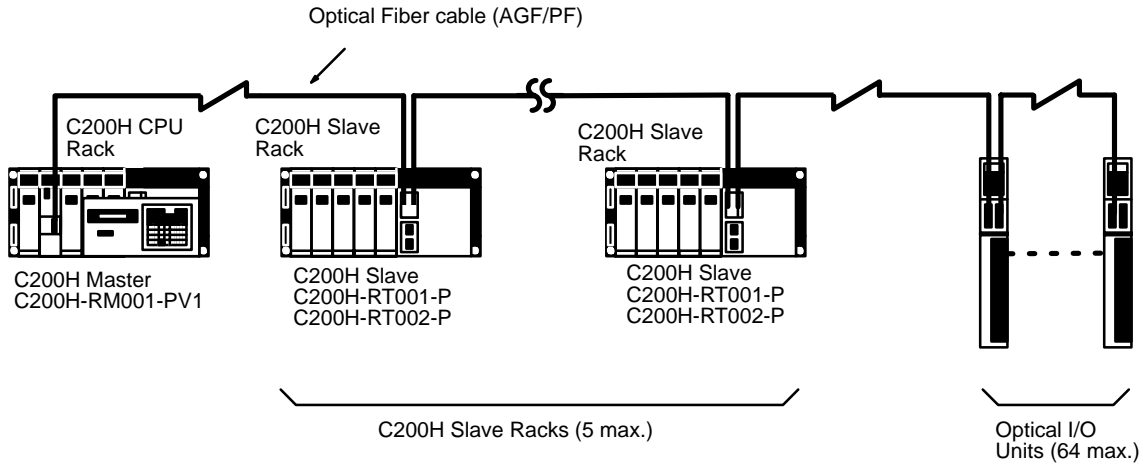
When combining Units from more than one of these three groups, both of the following equations must be satisfied:

$$3A + B + 2C + 6D \leq 12$$

$$A + B + C + D \leq 8$$

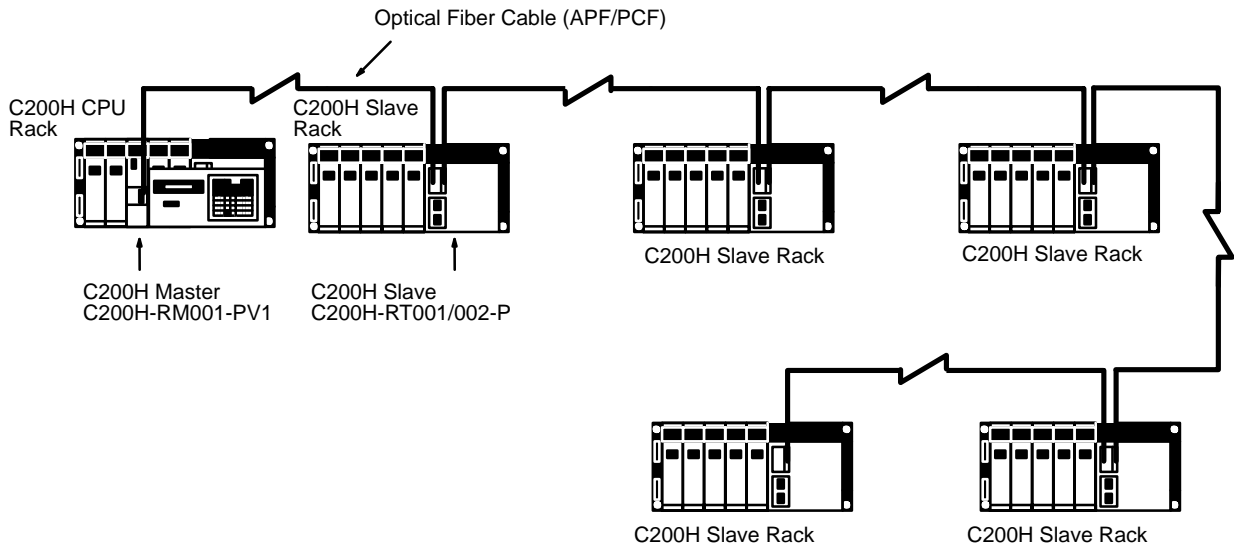
If the number of Special I/O Units controlled by the PC is ten, then no additional Special I/O Units may be mounted to any Rack.

Example 1 Basic C200H System

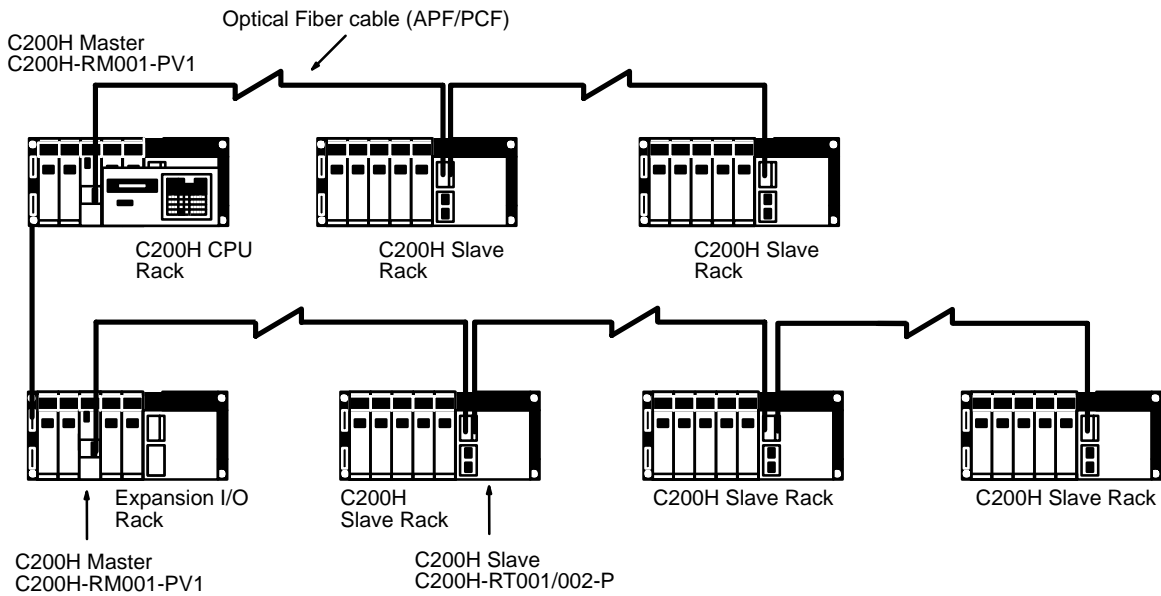


Example 2 Slaves Only

One Master



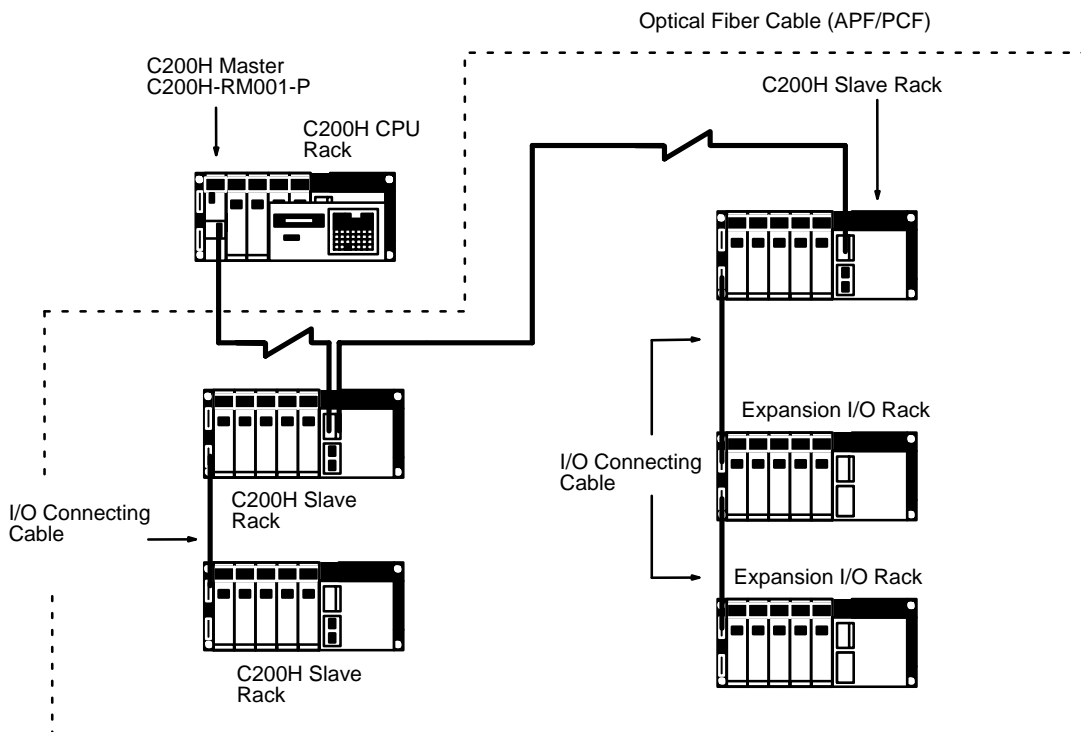
Two Masters



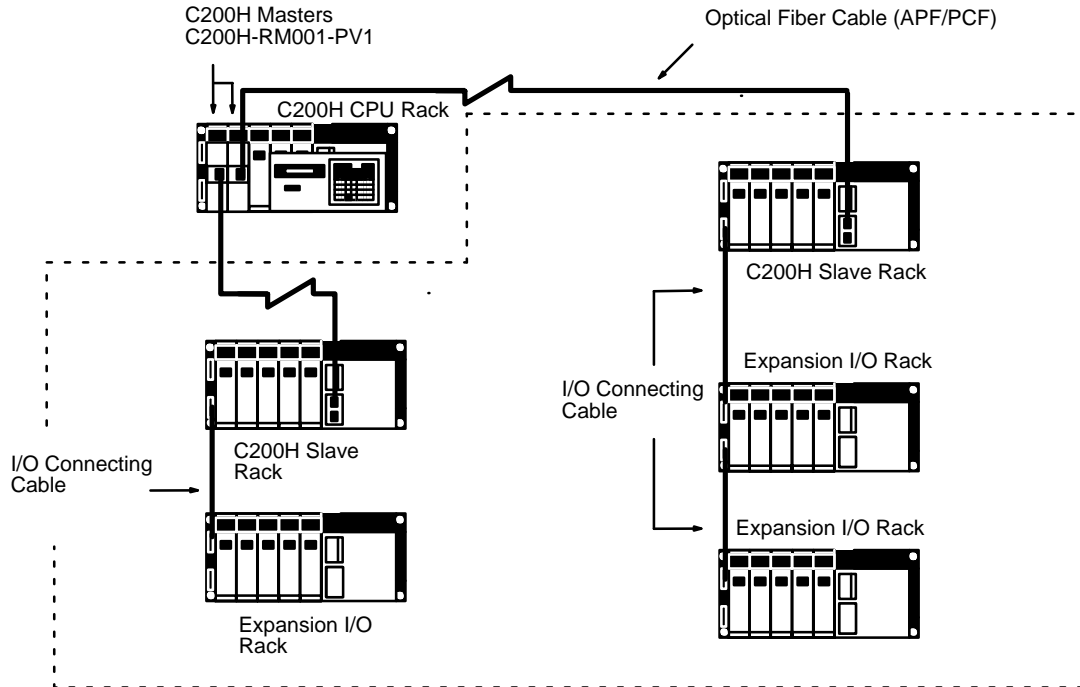
Example 3 Slaves with Expansion I/O Racks

I/O Connecting Cable can be used to connect up to two Expansion I/O Racks to a Slave Rack. (The I/O Connecting Cable must be 2 m or less in length.) In any one C200H System, however, only a total of 5 Slaves and Slave-connected Expansion I/O Racks can be connected.

One Master

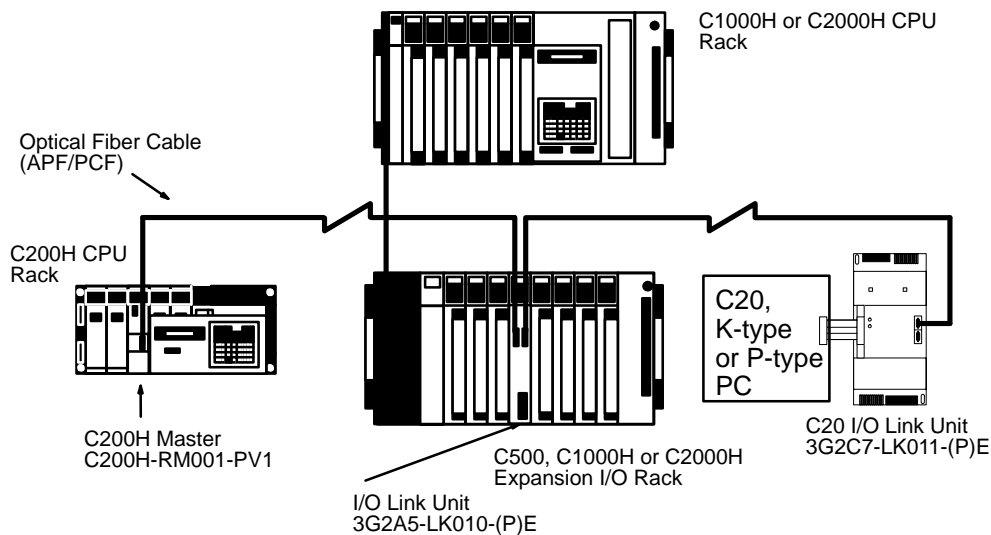


Two Masters



Example 4 I/O Link Units

A maximum of 512 I/O points on I/O Link Units can be connected per master, i.e., when the I/O Link Units are all set for 16 points each, up to 32 Units can be connected to one Master on a C200H. (The C20 I/O Link Unit has no setting for the number of I/O points and is thus limited to 32 points.)



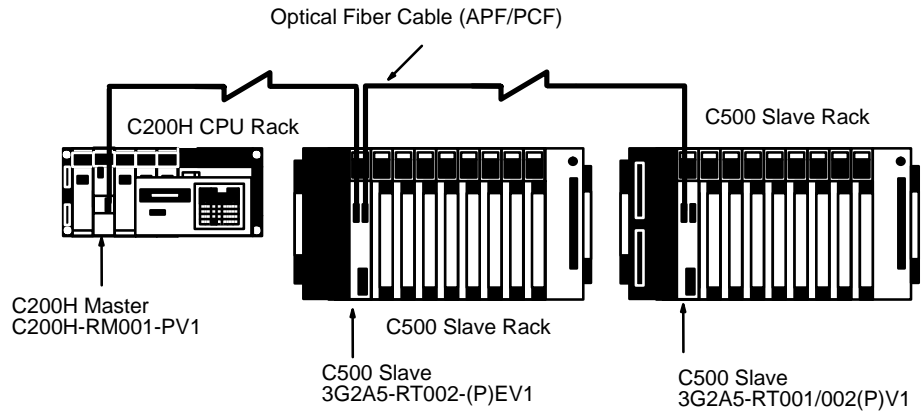
2-8 Combined Systems

Example 1 Connecting Other Units to C200H Masters

C500 Slaves

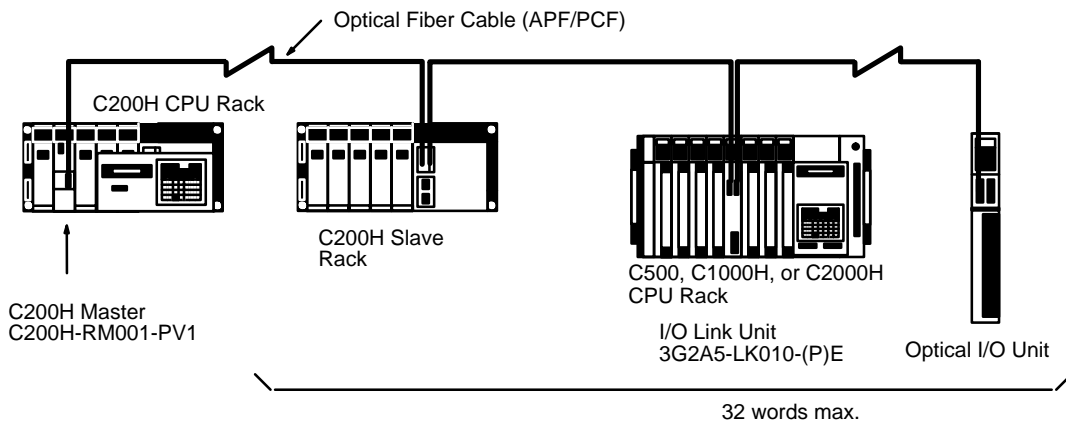
Up to two C500 Slaves, either optical or wired, can be connected to the C200H PC (regardless of the number of C200H Masters). C500 Slaves and C200H Slaves can also be used in combination; however, a maximum of five Slaves can be attached, with each C500 Slave counted as two Slaves. Any Wired Slaves must be counted in the total. Here, Special I/O Units can be mounted to C500

Slave Racks as always, although a maximum of 20 words can be allocated on each C500 slave Rack. Words for Units on C500 Slave Racks are automatically allocated from the left as is normal in C500 Systems.



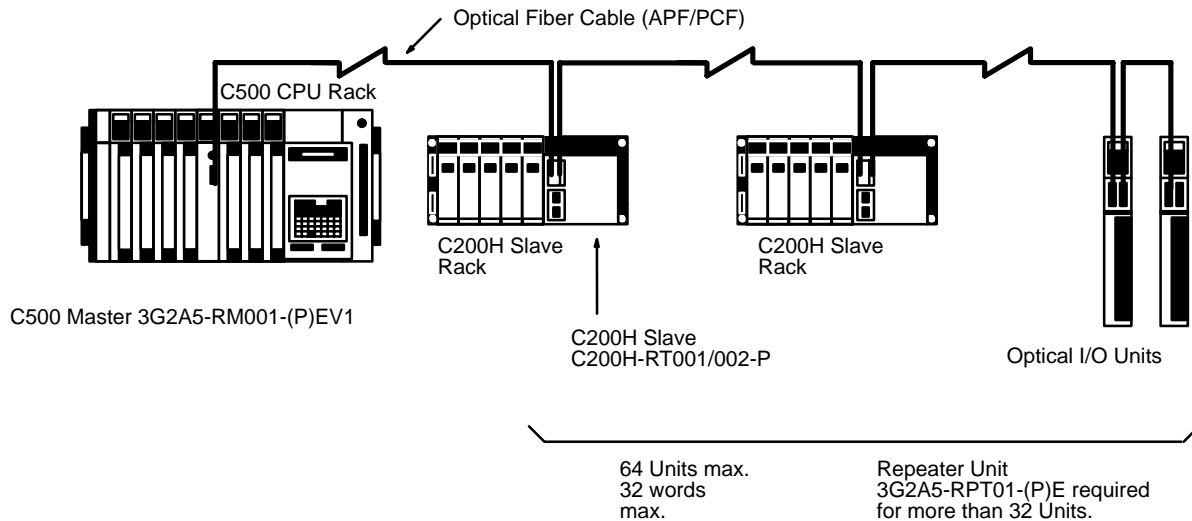
Connecting through I/O Link Units

The C200H PC can be connected to C120, C500, C1000H, and C2000H PCs through I/O Link Units. I/O Link Unit bits are allocated between IR 200 and IR 231. Words are allocated into this area according to I/O Link Unit settings for 1 word (16 points) or 2 (32 points).



Example 2 Connecting C200H Slaves to Other Masters

C200H Slaves can be connected to C120 or C500 Masters. Connection conditions are the same as those for C500 Slaves, i.e., words for I/O Units on C200H Slaves are automatically allocated. Here, however, Special I/O Units cannot be mounted, and C200H I/O Units are handled as one word per Unit.



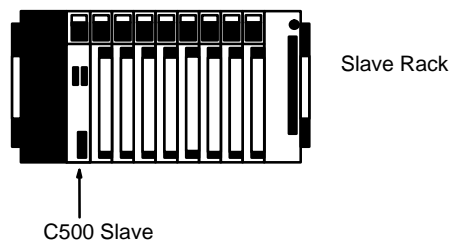
Note If a Unit with the blown-fuse detection function and alarm detection circuit (C200H-OD411/213/214/OA221) is used on a C200H Slave Rack that is connected to a PC other than a C200H/C200HS, all 16 I/O points will be regarded as outputs. Therefore, you will not be able to read the flags for blown-fuse detection function and alarm detection circuit from the ladder program.

2-9 Connection Precautions

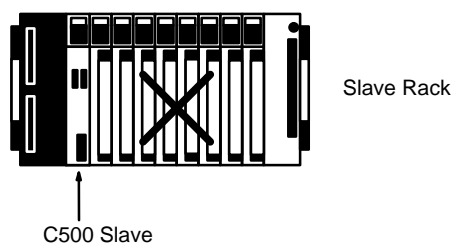
For limitations in Unit connections, refer to Maximum Number of Connectable Remote I/O Units under 2-1 Basic System.

Slaves

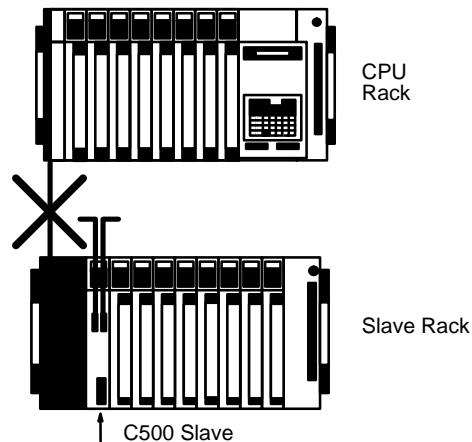
Install Slaves on the leftmost slot of the Rack in all but C200H Systems. In C200H Systems, Slaves contain the power supply and are mounted to the right of the Backplane, not to a slot.



A Master cannot be mounted to a Slave Rack or to any Expansion I/O Rack connected to a Slave Rack.



A Slave Rack cannot be connected directly to a CPU Rack, i.e., it must be connected through the Slave to the Master.



When connecting an Expansion I/O Rack in a C500, C1000H, C2000H, or C120 System, it must not be connected to a Slave Rack. Expansion I/O Racks may be connected to Slave Racks in C200H Systems.

Link Adapters

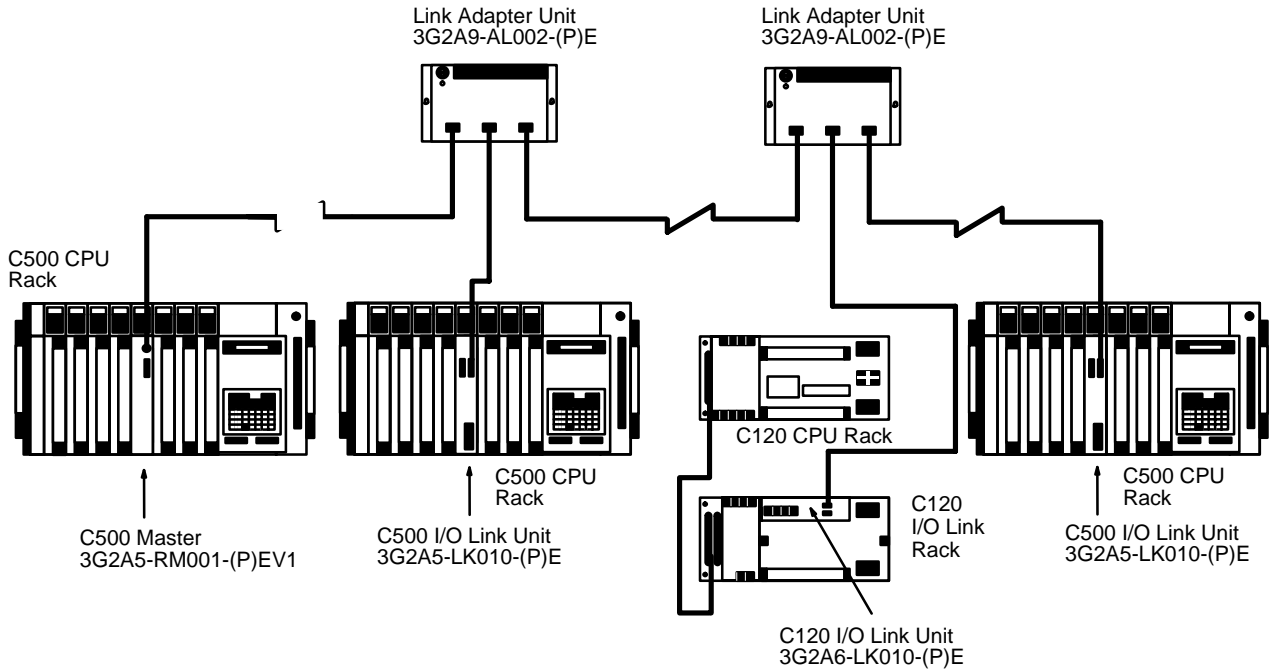
When the Units are connected in series, a disconnected line or a power failure in any one of them stops data transfer down the line past that point. This problem can be avoided by using Link Adapters. If a power failure occurs in a Unit connected to a branch line of a Link Adapter, the Unit is bypassed and signals continue to be transmitted to other Units down the line. For details on this and other uses of Link Adapters, refer to the *Link Adapter Operation Manual*.

If a Remote I/O System is connected in series, the entire System will stop operating if any one link in the System is broken. To prevent this, Branching Link Adapters can be used with the Slave Racks, Optical I/O Units, and I/O Link Units in the System so that actual series connections go through the Link Adapters on a main line.

In a branched System, the Master and the last Unit in the System are on the main line that runs through the Link Adapters; the rest of the Units in the System are on branch lines. Because connections do not run through any Unit linked in the System, the rest of the System will continue operating regardless of the status of any one Unit.

Although beyond the scope of this Manual, there are measures that can be taken to shut down the PC System for failures in any one part of it even when Link Adapters are used.

A Remote I/O System connected through Link Adapters is shown below.



SECTION 3

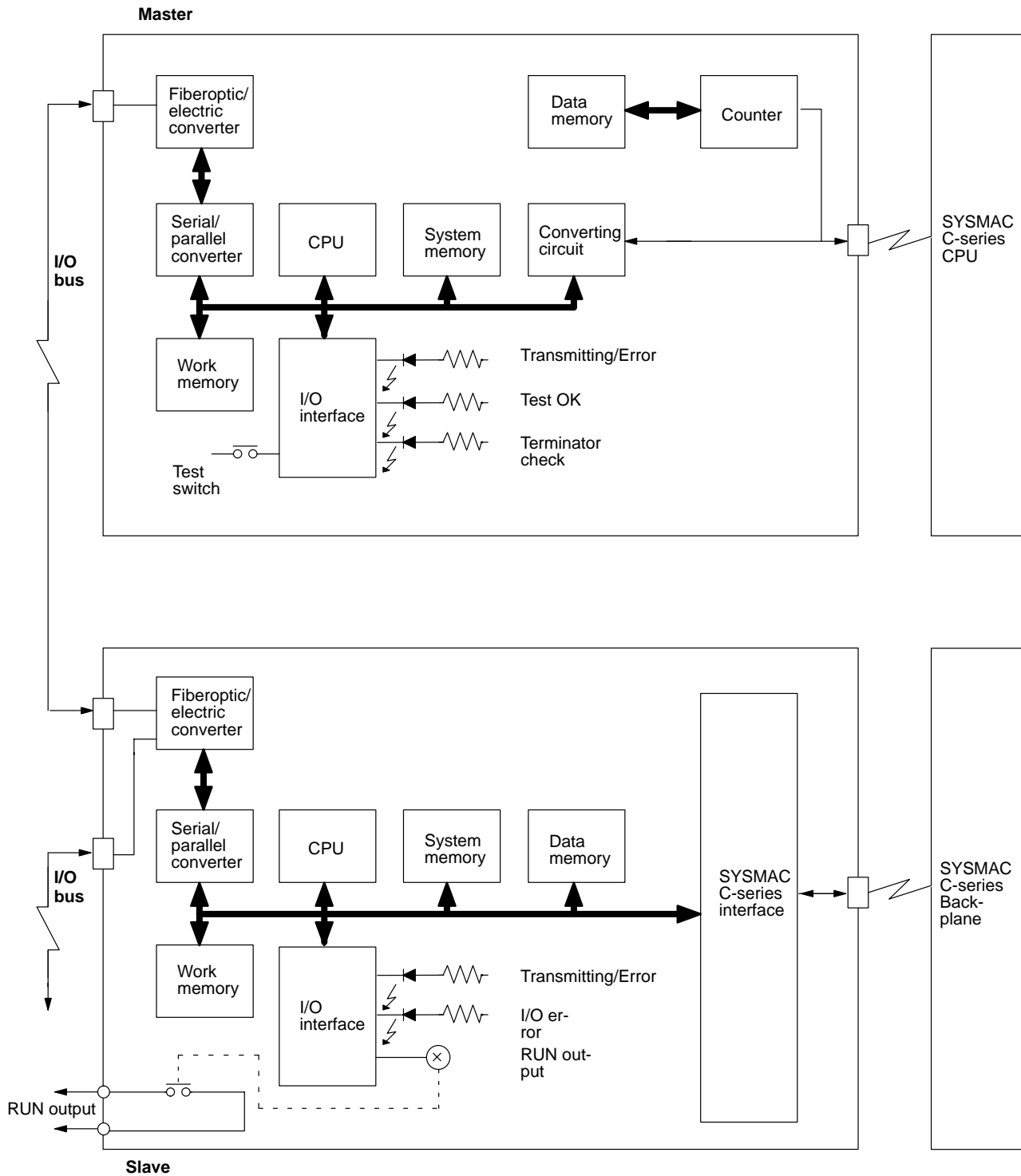
Operations

3-1	Block Diagrams
3-2	I/O Link Unit Operation
3-3	Unit Number and I/O Word Allocation
3-4	I/O Word Allocation Examples

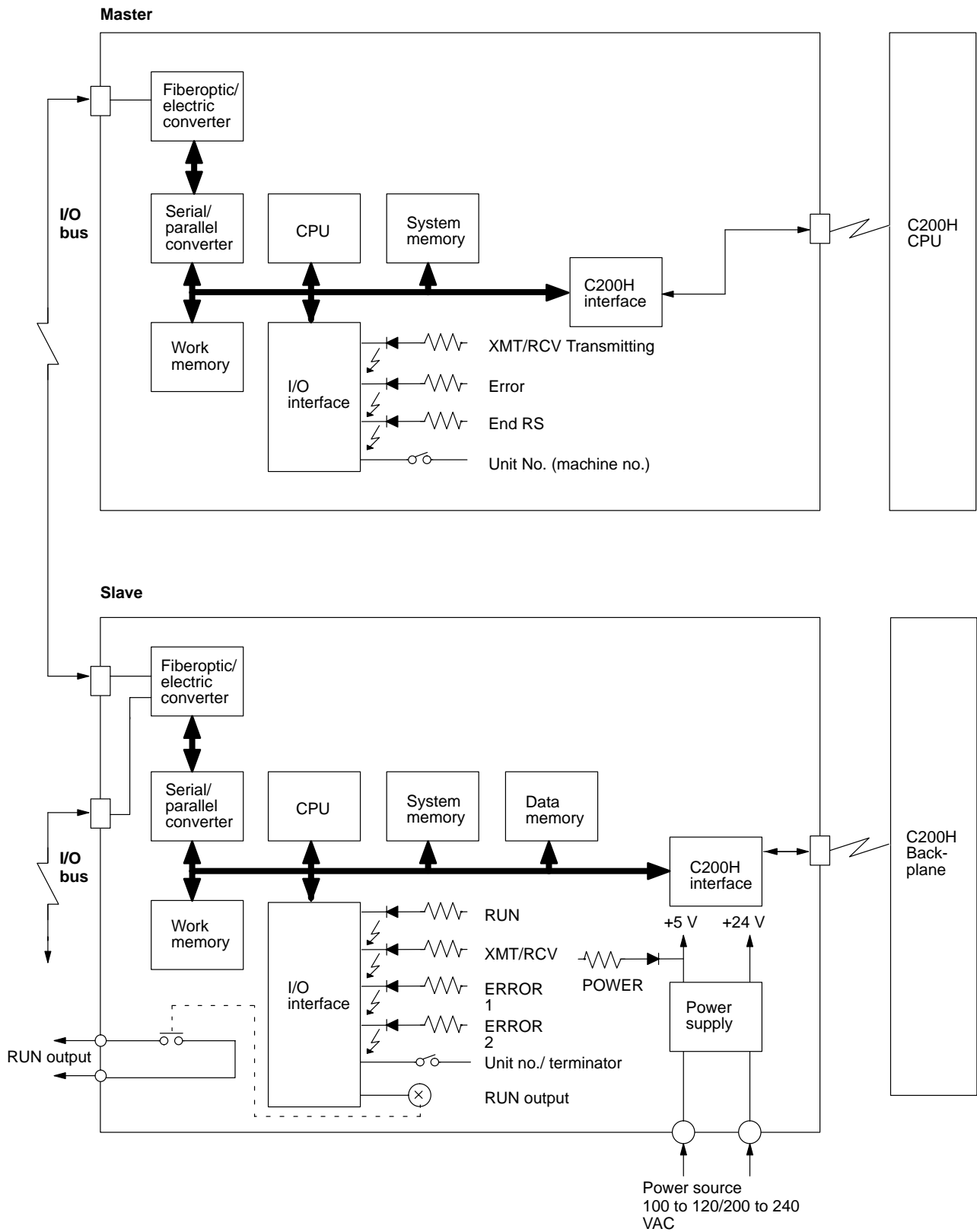
3-1 Block Diagrams

The following block diagrams show the basic functional blocks for Units available in Optical Remote I/O Systems.

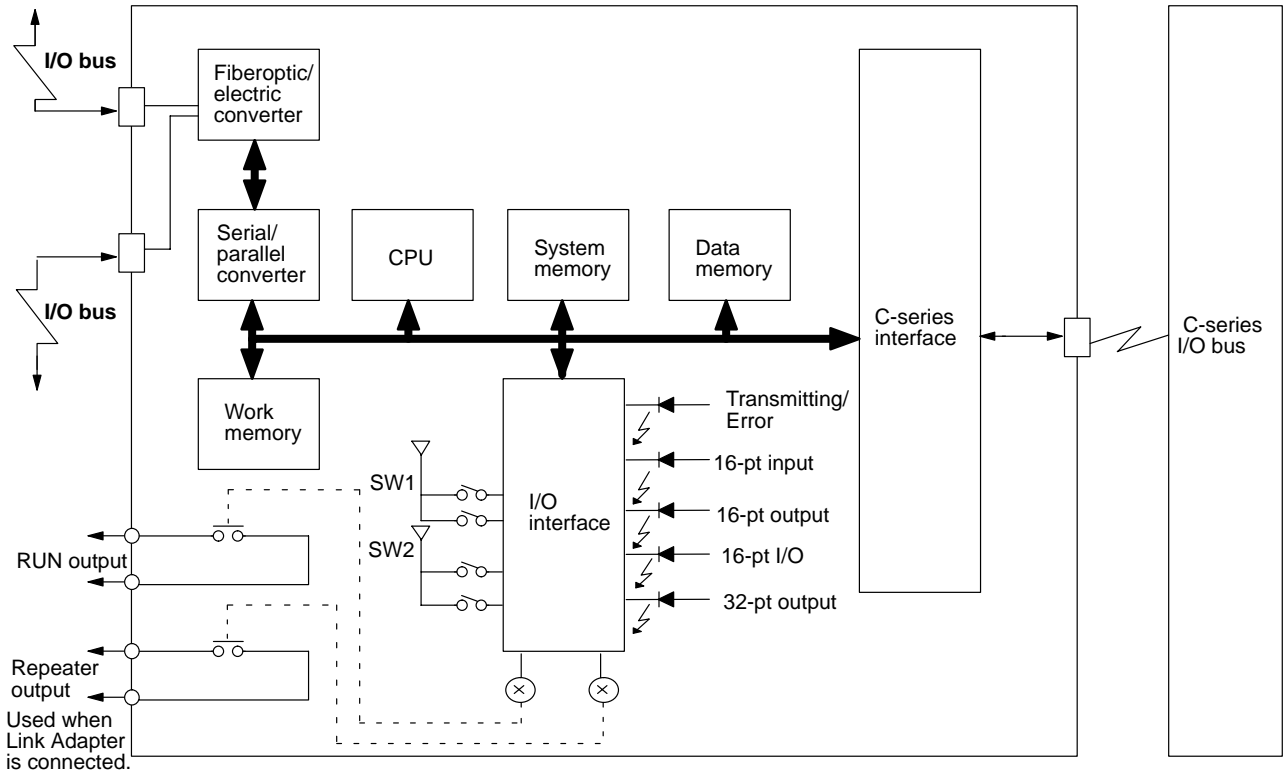
C120 and C500 Master and Slave



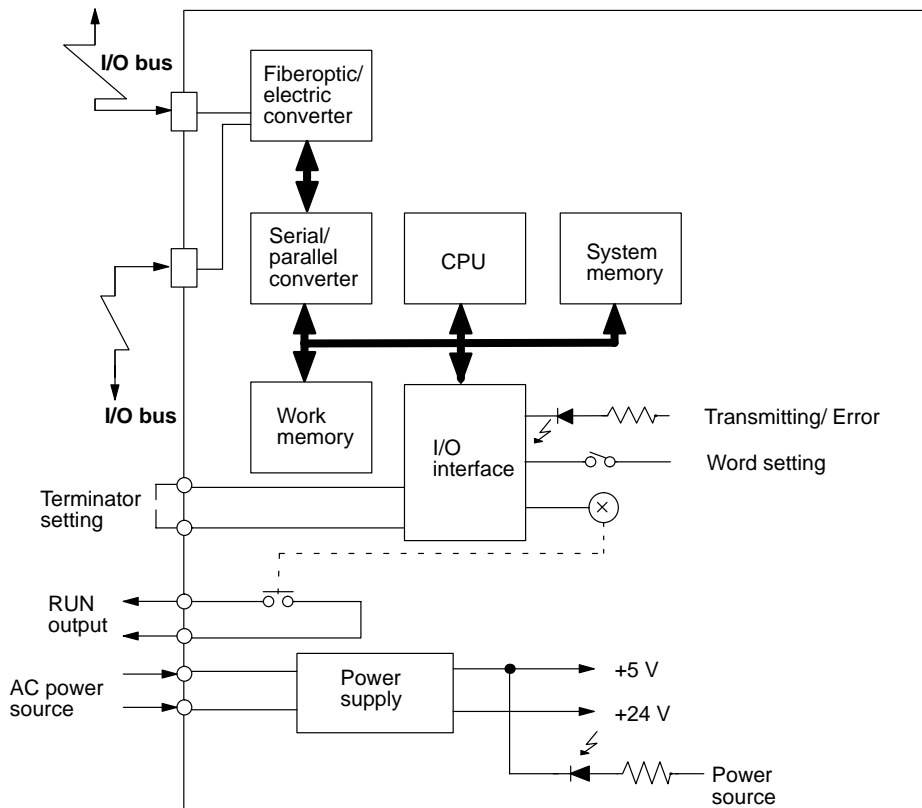
C200H Master and Slave



I/O Link Unit



Optical I/O Unit

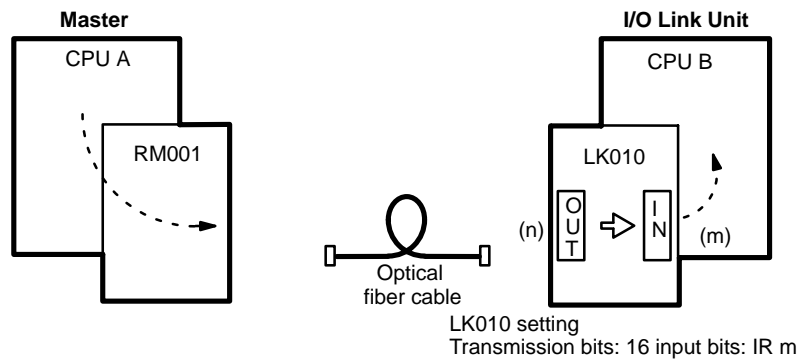


3-2 I/O Link Unit Operation

Of the three I/O Link Units, the C120 and C500 I/O Link Units can be set for operation via 16 input points, 16 outputs, 16 input and 16 output points, or 32 output points. The C20 I/O Link Units has no setting for the number of I/O points, and always operates via 16 input and 16 output points.

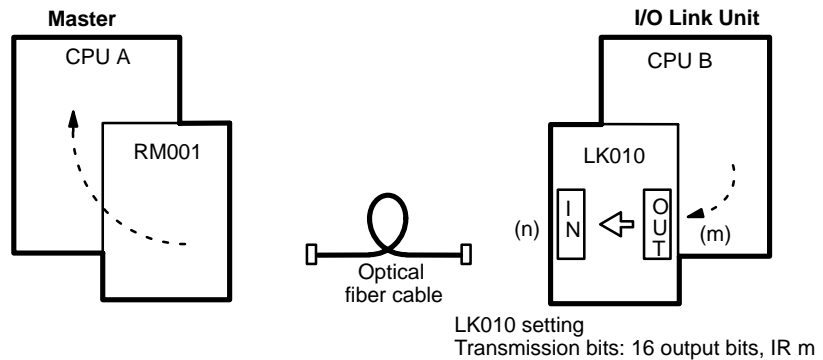
(1) 16 Input Bits

In the System shown below, CPU B sees 16 input bits. The I/O word allocations are determined by mounting location. CPU A sees 16 output bits. The word allocations are determined by the settings on the I/O Link Unit. The respective input and output words are treated as ordinary I/O words, and data is transferred from CPU A to CPU B. “n” is the word set on the I/O Link Unit, i.e., that allocated it by the PC with the Master (CPU A). “m” is the word allocated to the I/O Link Unit by the PC to which it is mounted (CPU B).



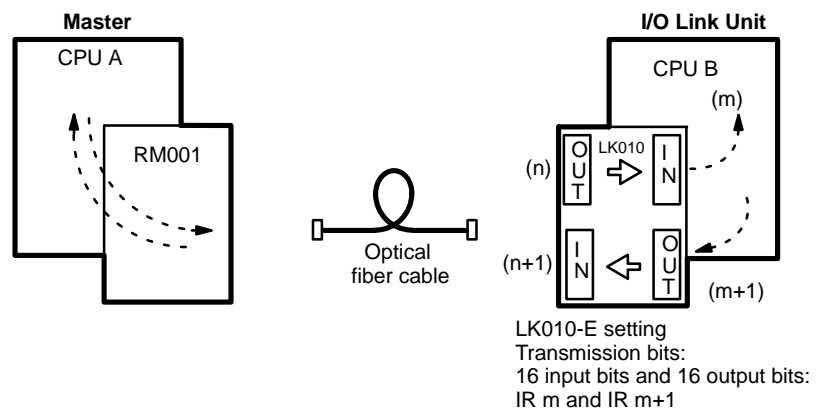
(2) 16 Output Bits

As shown, the situation just explained is exactly reversed.



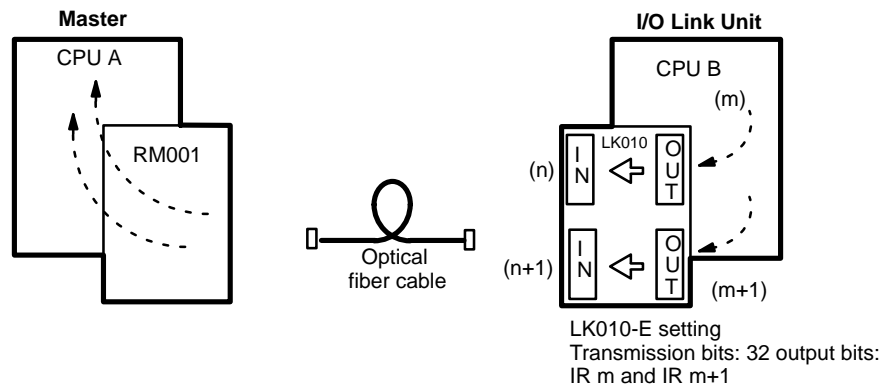
(3) 16 Input and 16 Output Bits

As shown, the two previously described situations are combined into one.



(4) 32 Output Bits

Again, the situation is the same as 16 output bits, except that four words are used instead of two.



3-3 Unit Number and I/O Word Allocation

Allocation of I/O words for C20 I/O Link Units for C20, K-type PCs, and P-type PCs is covered in the *Operation Manuals* for these PCs and is not duplicated here. The remote I/O words allocated for the PC of the Master to which an C20 I/O Link Unit is connected are described below.

Basic Allocation

Word allocations on Racks in Remote I/O Systems follow basically the same pattern as the PC to which the Master is mounted, i.e., by the mounting order of and by the number of words required for each Unit mounted for C120, C500, C1000H, and C2000H Systems and by fixed slot words in C200H Systems.

In either case, allocations start from the lowest word starting on the left side of the CPU Rack. When a Master is reached on a Rack, allocation jumps to the leftmost Unit mounted on the first Slave Rack connected to the Master, and then to the second Slave Rack, etc, until the terminator is reached. Then allocations return to the Unit following the Master and continue across the CPU Rack and Expansion I/O Racks until all the Units on all Racks have been allocated. Details on and examples of allocation are provided below.

Words for Units not mounted to Racks (i.e., Optical I/O Units and I/O Link Units) are not determined as described, but according to switch settings on the Units, as described below. I

I/O Link Units are allocated words both by the CPU to which they are directly connected and by the CPU to which they are connected via the Remote I/O System. When programming operations involving I/O Link Units, be sure you are using the words allocated by the CPU for which the program is being written.

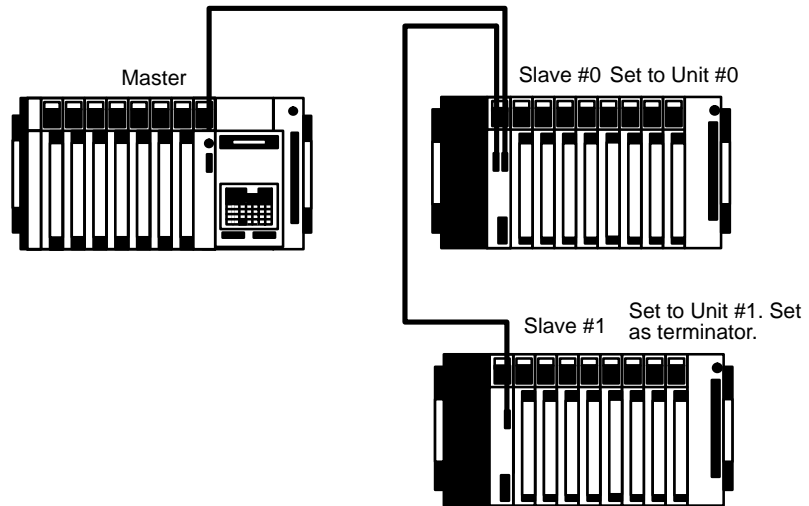
Terminator

There must be one terminator set for each Master, and it must be the Unit at the opposite end of the I/O bus from the Master. The terminator may be a Slave, an I/O Link Unit, or an Optical I/O Unit. The Master checks for a terminator immediately upon power application. If the terminator is properly set, the other Units connected to the I/O bus are acknowledged. All following operation is based on this initial check. Therefore, if a Unit is not attached properly or if the power to a Unit is not on when this check is performed, that Unit will be ignored during actual operation.

Slave Unit Number and Terminator Settings

Because more than one Slave can be attached to each Master, unit number settings are necessary to distinguish the Slaves. unit numbers 0 through 7 can be set for C1000H, and C2000H Slaves; Unit numbers 0 through 4, for C200H Slaves; and unit numbers 0 and 1 for C120 and C500 Slaves. The same unit number cannot be used on more than one Slave under the same Master. Setting undefined unit numbers will prevent Slave operation. Set the Slave connected to

the Master as Unit #0, the Slave connected to Unit #0 as Unit #1, and so on. Setting unit numbers and a terminator is necessary for every Master, even when only one Slave is connected. Refer to 4-4 *Switch Settings* for details.



I/O Units can be mounted to any slot on Slave Racks, just as in any other Rack. Word numbers are assigned in the order the I/O Units are mounted. In C200H Systems, words are allocated according to Slave unit numbers as shown in the following table.

Unit Number	Words
0	50 to 59
1	60 to 69
2	70 to 79
3	80 to 89
4	90 to 99

If an Expansion I/O Rack is connected to C200H Slave Racks with I/O Connecting Cable, the Expansion I/O Rack is automatically allocated the words for the next unit number. This number cannot be set for another Slave in the System.

I/O Unit Words on C500 Slaves in C200H Systems

I/O Units mounted on C500 Slave Racks connected to C200H Masters are allocated words as follows, according to the unit numbers of the C500 Slave .

Unit Number	Words
0	50 to 69
1	60 to 79
2	70 to 89
3	80 to 99

Note that consecutive unit numbers cannot be assigned to C500 Slaves because of overlapping word allocations.

I/O Units on C200H Slave Racks are automatically allocated words just like other I/O Units, except that Special I/O Units are allocated special bits. All I/O Units mounted on C500 Slave Racks also will be automatically allocated words as usual, except that only 20 words can be used.

C200H Slaves Connected in Other PC Systems

Connection conditions for C200H Slaves in other PC Systems (e.g., C500 or C1000H) are the same as those for C500 Slaves. DIP switch settings for these C200H Slaves must specify that they are not connected to C200H Masters. (See 4-4 *Switch Settings*.) Here, all I/O Units, including Special I/O Units, are automatically allocated words as usual, i.e., special bits are not allocated.

An Expansion I/O Rack cannot be connected to a C500 Slave Rack via I/O Connecting Cable. Unlike C200H Slaves, C500 Slaves do not have switches for setting output OFF/output hold during transmission error. All data is cleared from C500 Slaves during transmission errors.

I/O Link Unit Word Settings

I/O Link Unit word settings determine which I/O words will be occupied by the Unit. C120 and C500 I/O Link Units can be set to occupy 16 or 32 points. C20 I/O Link Units always occupy 32 points. On C-series PCs there are 16 bits to a word, so the I/O Link Unit will occupy either one or two words. Words 0 through 31 are available. The actual words allocated in C200H, C1000H, and C2000H Systems will vary from the switch settings as described below. When setting words, be sure not to set word numbers for one Unit which have already been set for another Unit.

I/O Units mounted to Slave Racks are automatically assigned words according to their mounting location. Words for all I/O Link Units must be set using their DIP switches. For more details on settings, refer to *4-4 Switch Settings*.

I/O Link Unit Words in C200H Systems

Although other PCs can be attached to the C200H through I/O Link Units, word allocations for these Units are the same as those for Optical I/O Units, i.e., words 200 through 231. The actual words allocated the I/O Link Units will be 200 greater than the values set on the Units' switches.

Optical I/O Unit Word Settings

Use the DIP switches on Optical I/O Units to set their I/O words. Do not combine their input and output words into a single 16-point word. In other words, the two 8-point sections composing a single 16-point word must be either both input or both output in all but C200H Systems. The actual Optical I/O Unit words in C200H systems will be 200 greater than the values set on the Units' switches. For more details on settings, refer to *4-4 Switch Settings*.

Word Multipliers of C1000H and C2000H

The maximum number of bits a Master can transmit is 512 (32 words x 16 bits/word). Words 0 to 31 can therefore be set for I/O Link Units and Optical I/O Units. However, since the C1000H, and C2000H PCs can handle up to 2,048 bits (128 words x 16 bits/word), the Units cannot be assigned to words 32 to 127 of these PCs without some identification other than the normal word settings. It is therefore necessary to assign numbers to the Masters to which I/O Link Units and Optical I/O Units are connected and identify the words with these numbers as well as the word settings.

These additionally assigned numbers, which can be from 0 through 3, are called "word multipliers." The following equation illustrates the relationship between word multipliers and word allocations.

$$\text{I/O word allocation} = (32 \text{ words} \times \text{word multiplier}) + (\text{word set on Unit})$$

For example, suppose word 28 is set on an I/O Link Unit and word multiplier 2 is assigned to the Master of that I/O Link Unit. The I/O word of the I/O Link Unit, viewed from the PC, is computed as follows:

$$32 \text{ words} \times 2 + 28 \text{ words} = \text{word } 92$$

A word multiplier does not have to be assigned to a Master to which only Slaves are connected because word numbers will be automatically assigned by "free location" to any I/O Units connected to the Slaves

The I/O words assigned to Optical I/O Units, Slaves, or I/O Link Units connected to the Master with the lowest word multiplier must not be the same as the I/O words assigned to the last I/O Unit.

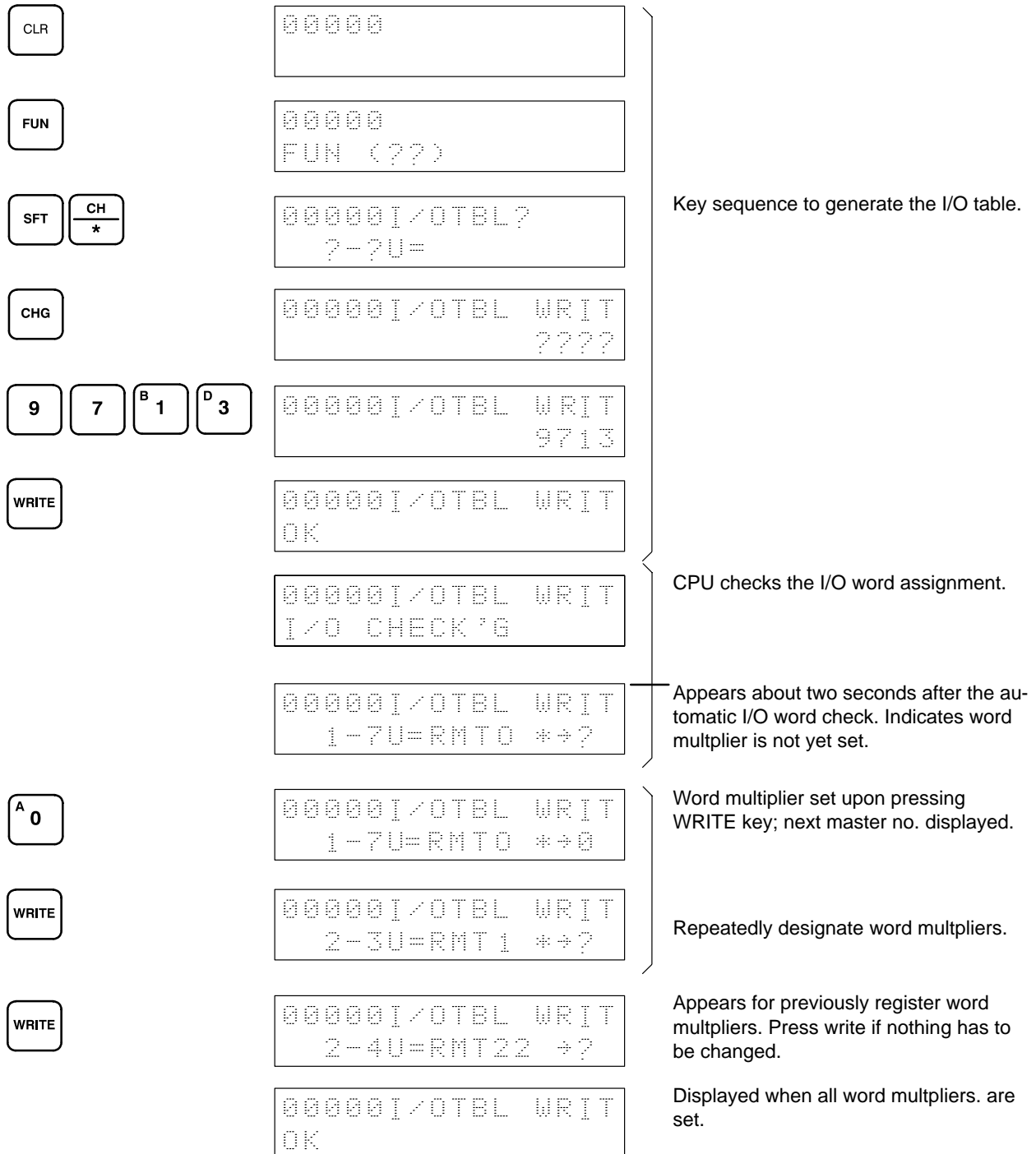
The same word multiplier can be assigned to more than one Master. In this case, however, the same word must not be set on the Units on a Master having the same word multiplier as another Master.

Setting Word Multipliers

Set the word multipliers in a C1000H or C2000H System using the Programming Console as shown below. Before setting word multipliers, set the mode selector

switch to the PROGRAM position. Refer to your PC's *Operation Manual* for details.

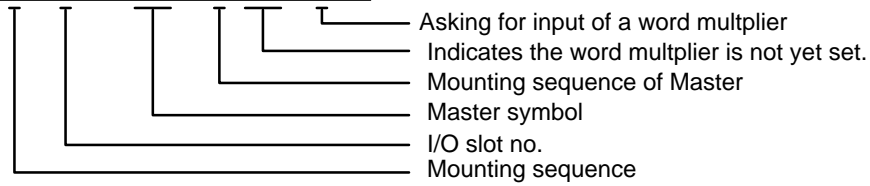
Note If a Unit with the blown-fuse detection function and alarm detection circuit (C200H-OD411/213/214/OA221) is used on a C200H Slave Rack that is connected to a PC other than a C200H/C200HS, all 16 I/O points will be regarded as outputs. Therefore, you will not be able to read the flags for blown-fuse detection function and alarm detection circuit from the ladder program.



Word multipliers must be assigned only to the Masters to which I/O Link Units or Optical I/O Units are connected. This message is not displayed for Masters to which only Slaves are connected.

```

00000I/O TBL WRIT
1-7U=RMT0 *+?
    
```

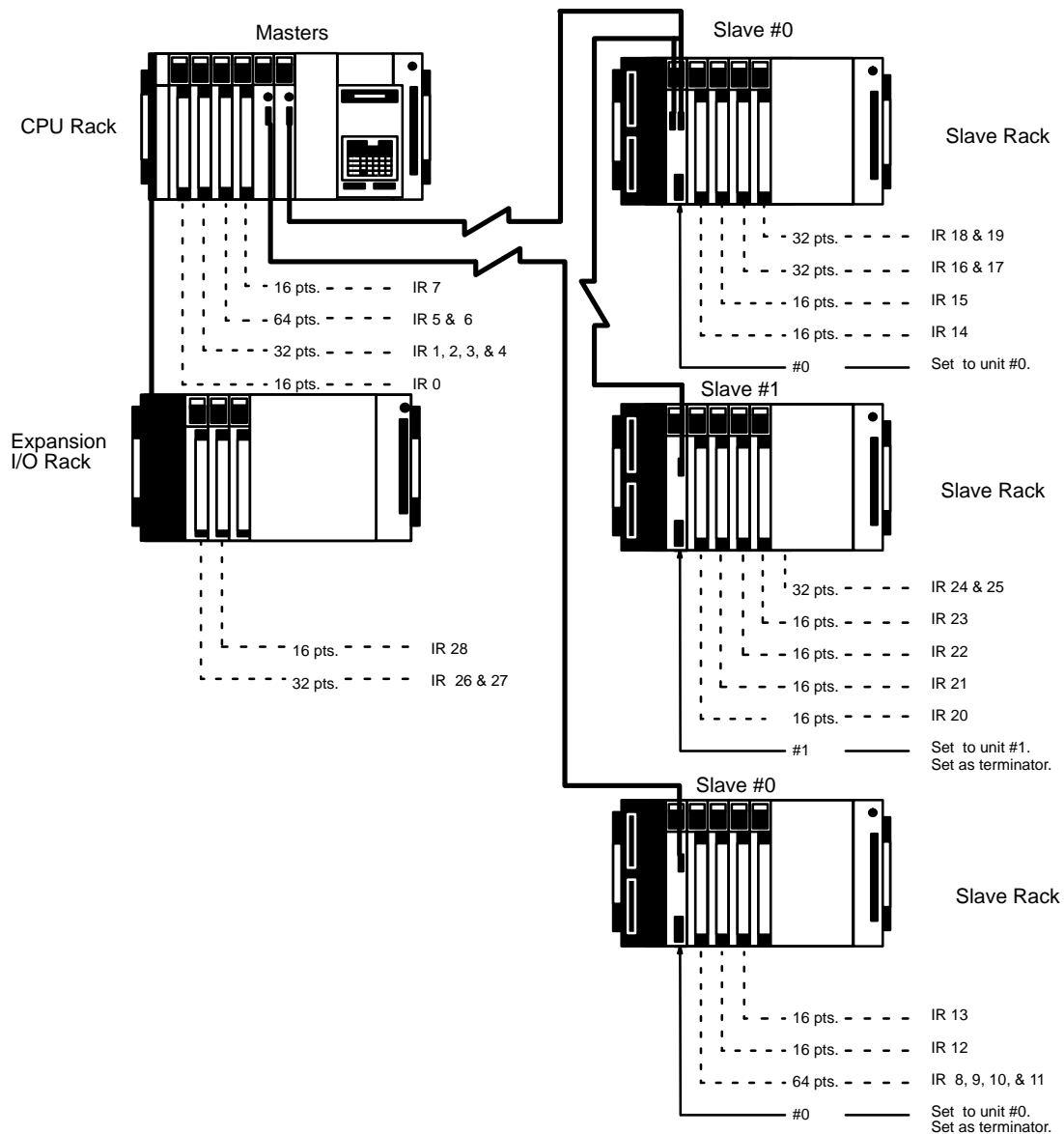


3-4 I/O Word Allocation Examples

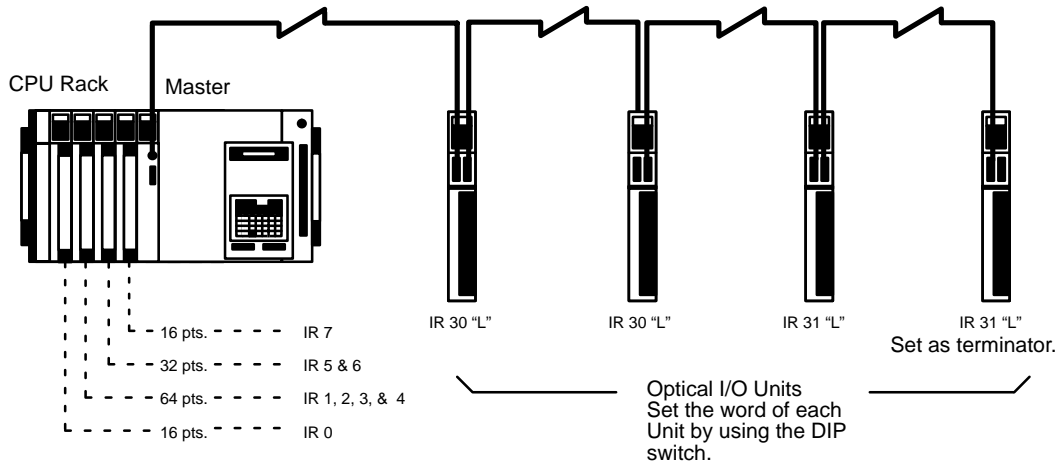
The following examples detail word allocations in the IR area.

Example 1 C500 with Slaves

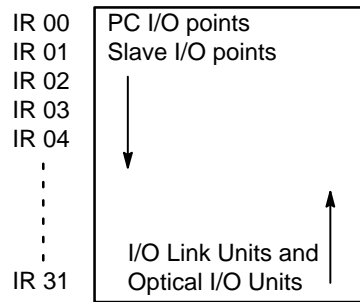
With two Slaves connected to one Master, the Slaves are set to unit numbers 0 and 1. The order does not matter. The last Unit must be set as the terminator. If only one Slave is connected, set it as Unit number 0 and set it as the terminator.



Example 2 C500 with Optical I/O Units

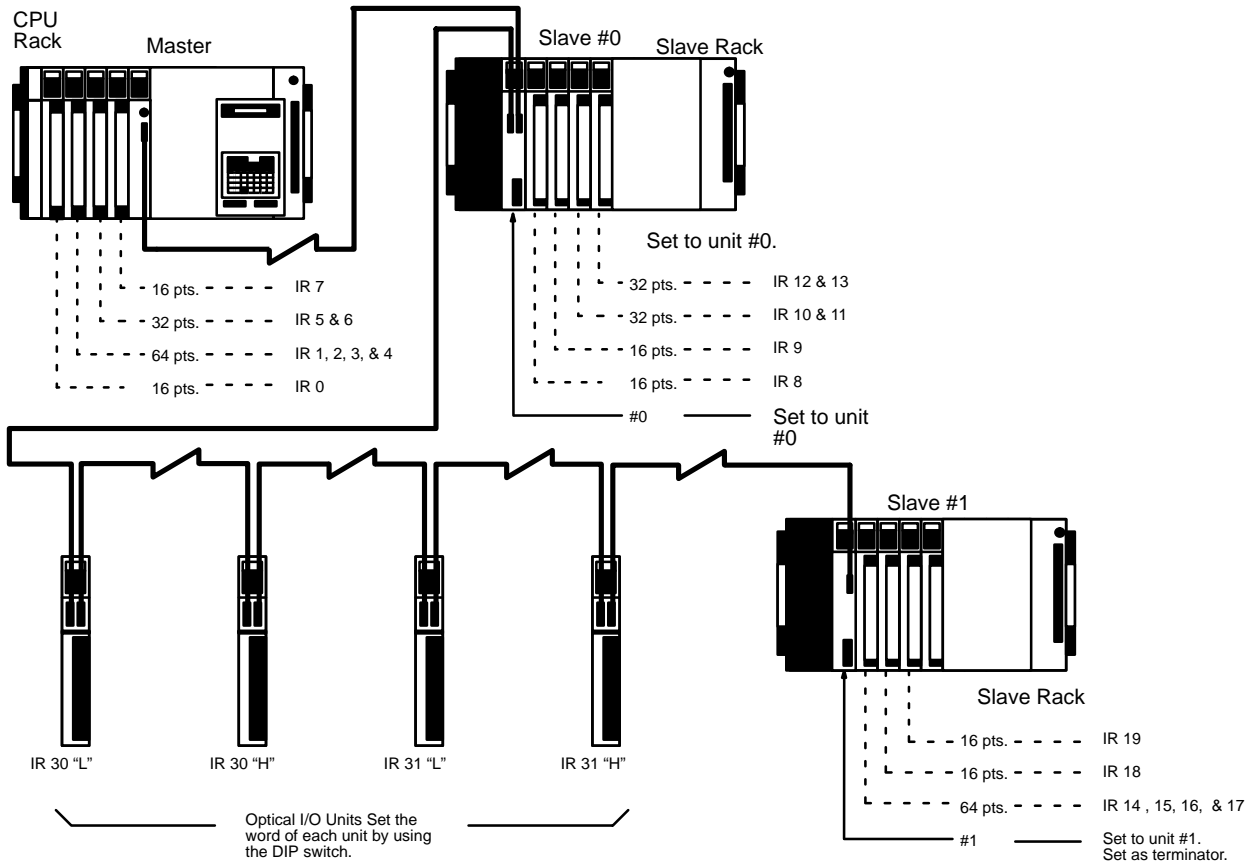


Because the I/O Units are assigned words starting at the lower end (word 00), duplication can be avoided by starting the Optical I/O Unit words in reverse order beginning with IR 31.



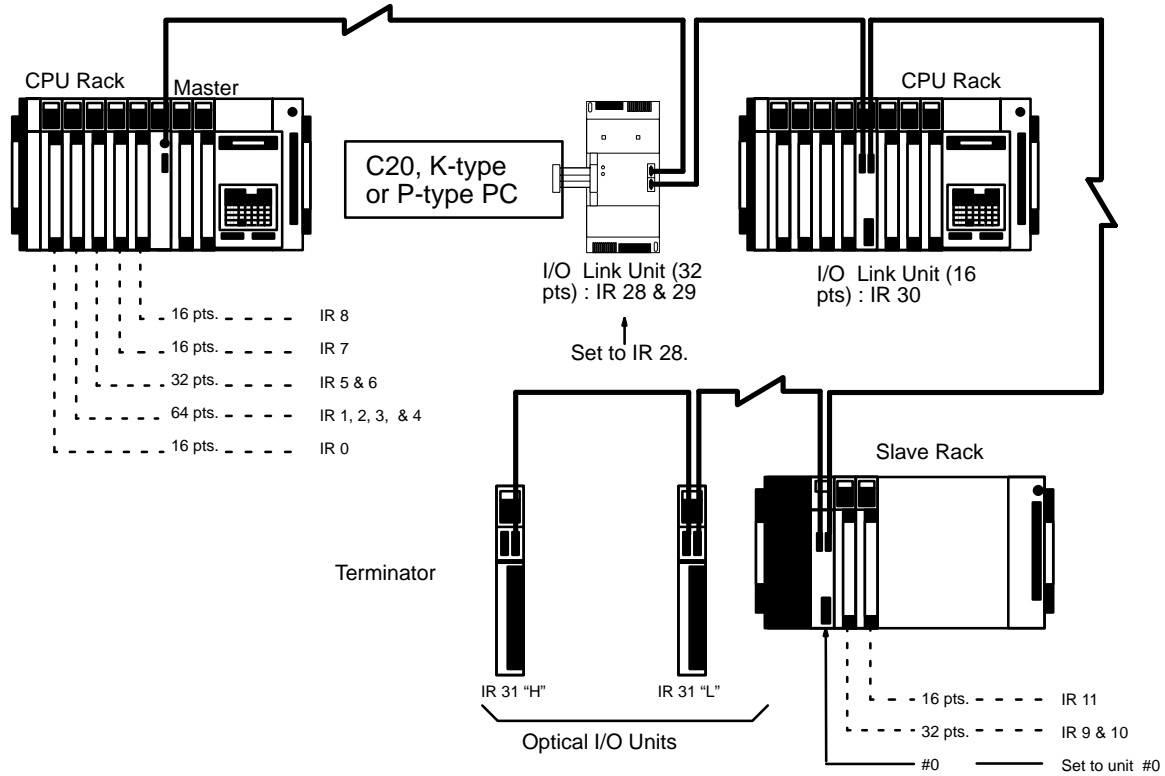
Be sure that words set for Optical I/O Units or I/O Link Units do not overlap with words being used for other I/O data. Do not combine input and output words into one 16-point word. Two 8-point words (i.e., Optical I/O Units) composing one 16-point word must both be either input or output.

Example 3 C500 with Slaves and Optical I/O Units



Because the I/O Units are assigned words starting at the lower end (word 00), duplication can be avoided by starting the Optical I/O Unit words from the upper end.

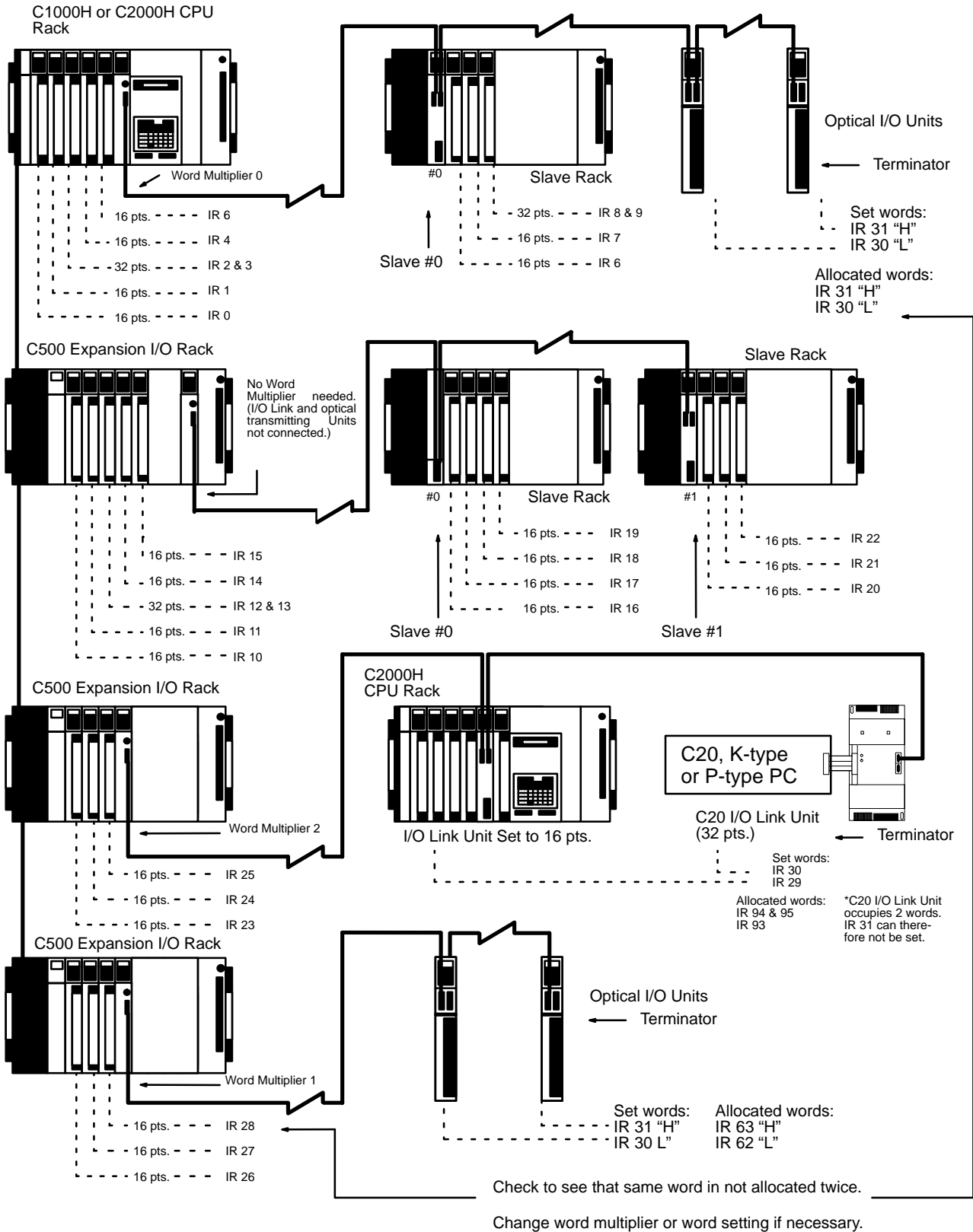
Example 4 C500 with Slaves, I/O Link Units, and Optical I/O Units



Because the I/O Units are assigned words starting at the lower end (word 00), duplication can be avoided by starting the Optical I/O Unit words and I/O Link Unit words from the upper end.

Do not use words being used for other I/O data. Do not combine input and output words into one 16-point word. Two 8-point words (i.e., Optical I/O Units) composing one 16-point word must both be either input or output.

Example 5 C1000H or C2000H with Slaves, I/O Link Units, and Optical I/O Units

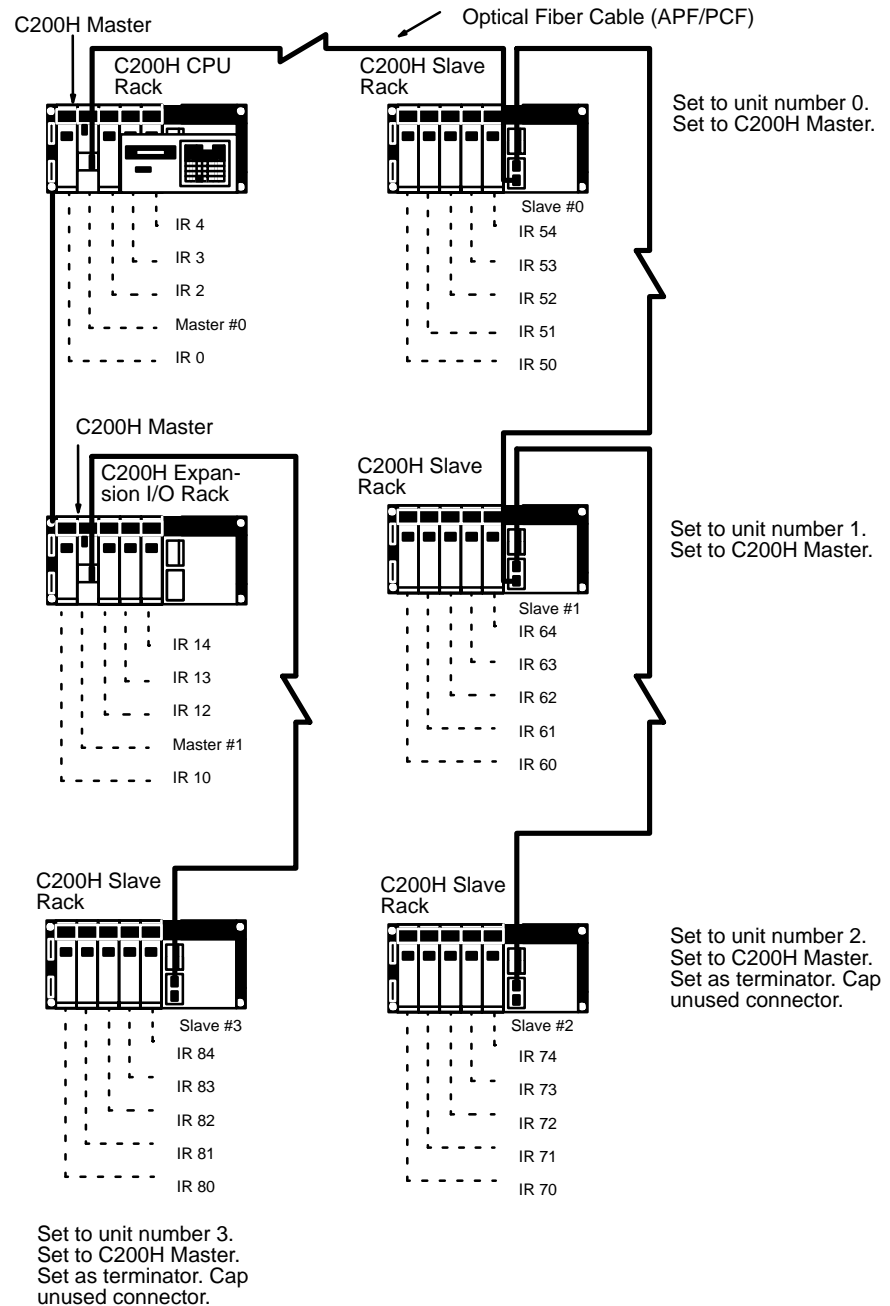


Because the I/O Units are assigned words starting at the lower end (word 00), duplication can be avoided by starting the Optical I/O Unit words and I/O Link Unit words from the upper end.

Do not use words being used for other I/O data. Do not combine input and output words into one 16-point word. Two 8-point words (i.e., Optical I/O Units) composing one 16-point word must both be either input or output.

Example 6 C200H System with C200H Slaves

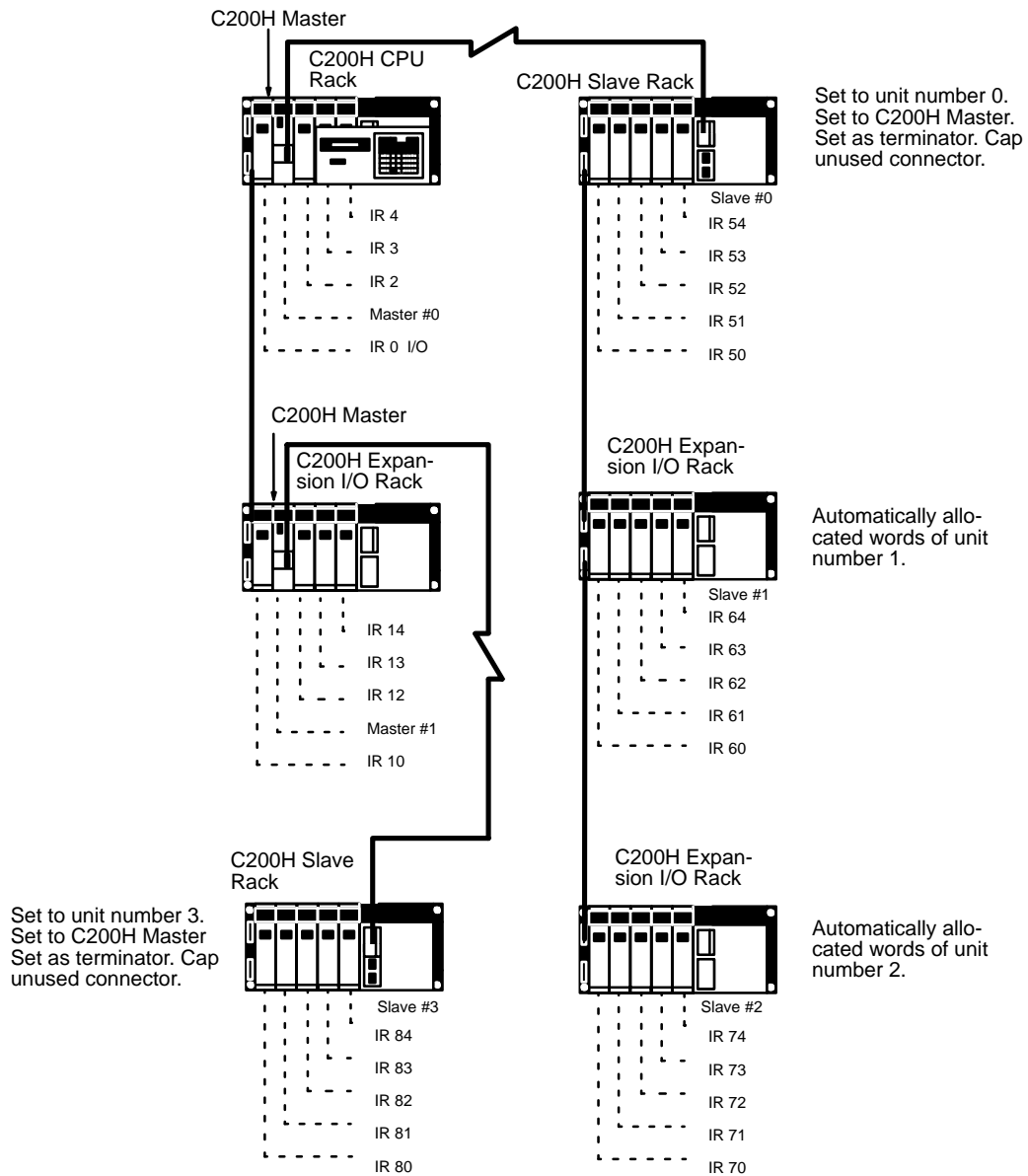
Although up to five C200H Slaves can be attached, this example shows only four. Words 100 through 199 are allocated for Special I/O Units (High-speed Counter Units and Position Control Units) on the Slave Racks.



Example 7 C200H System with C200H Slaves Connected to Expansion I/O Racks

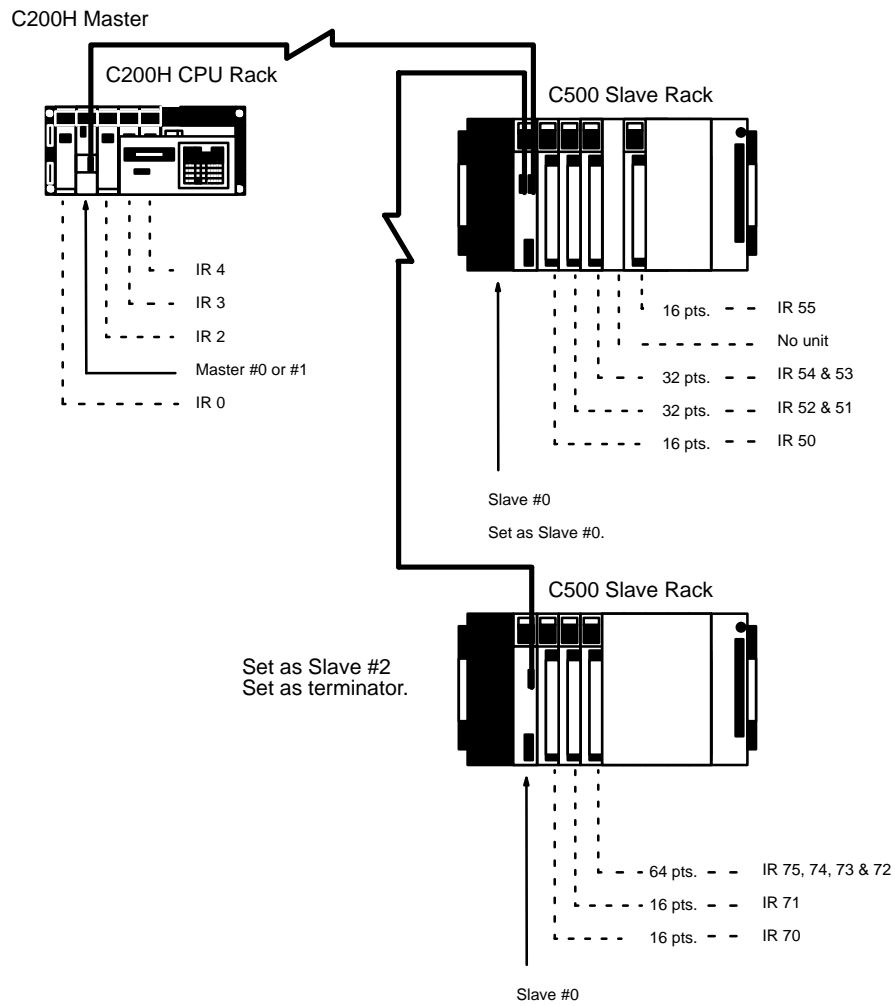
Although up to five C200H Slaves can be attached, this example shows only four, i.e., two actual Slaves and two Expansion I/O Racks connected to Slaves (which are also counted as Slaves). Words 100 through 199 are allocated for Special I/O Units (High-speed Counter Units and Position Control Units) on the

Slave Racks. Expansion I/O Units are automatically allocated the words for the next unit numbers after the one set for the Slave to which they are attached.

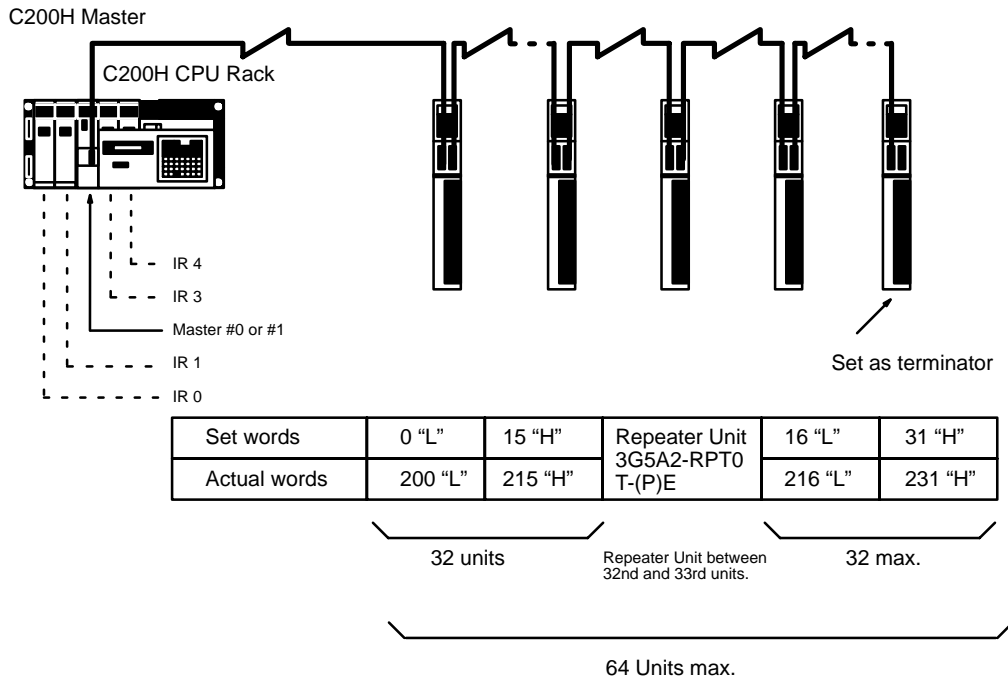


Example 8 C200H System with C500 Slaves

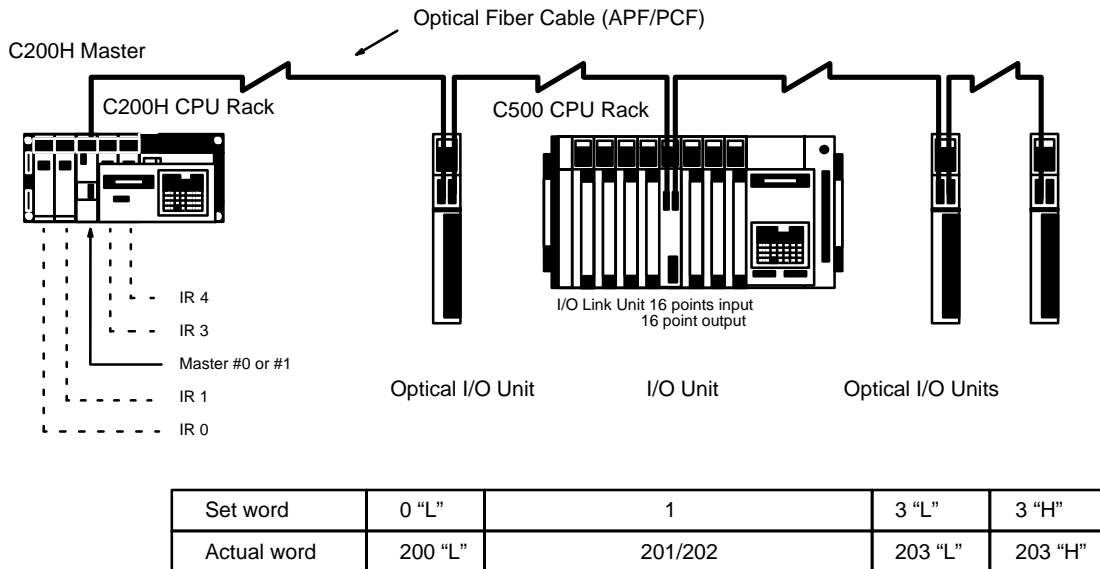
This example shows the maximum number of C500 Slaves that can be used in a C200H System.



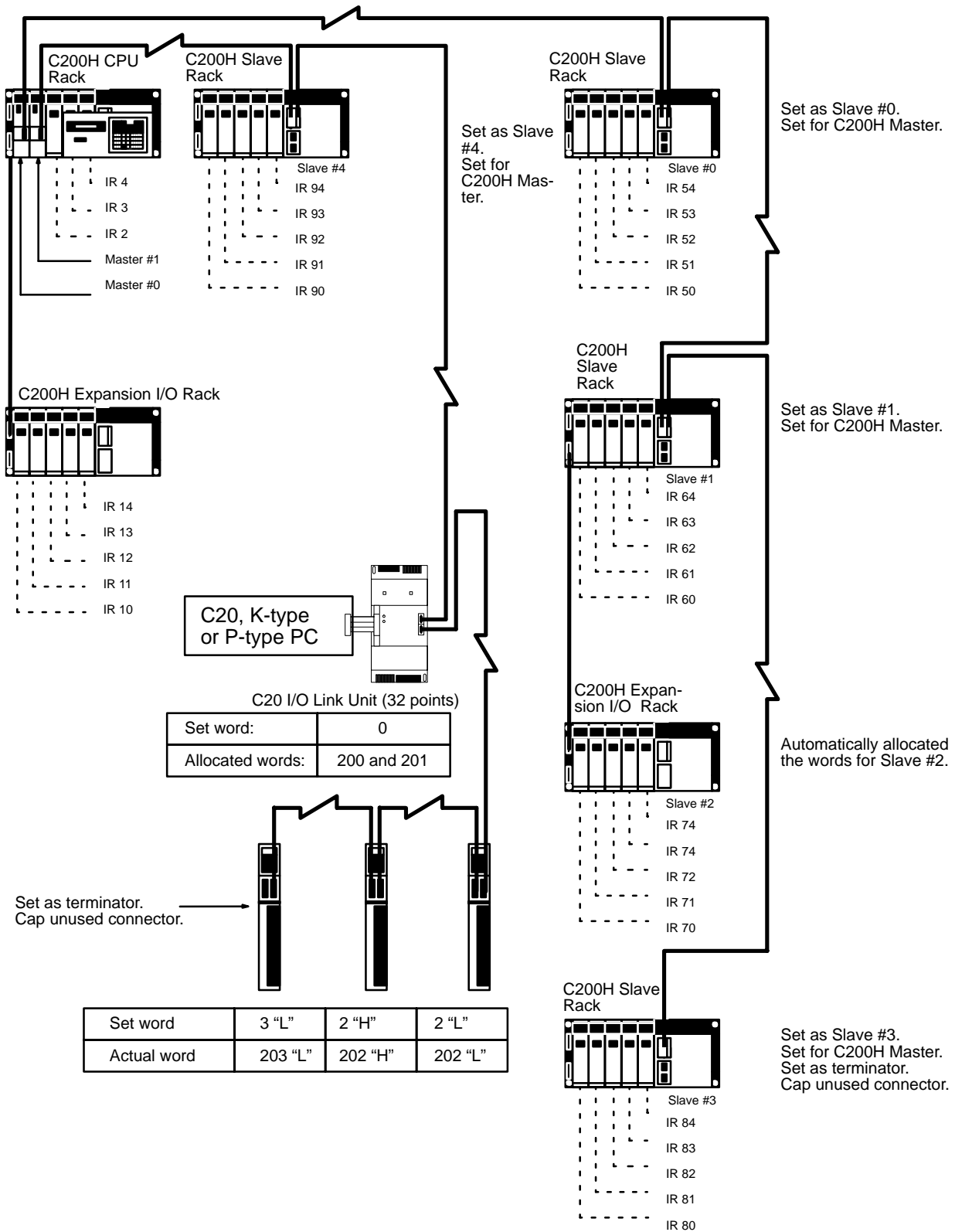
Example 9 C200H System with Optical I/O Units



Example 10 C200H System with I/O Link Unit Connection to Other PCs

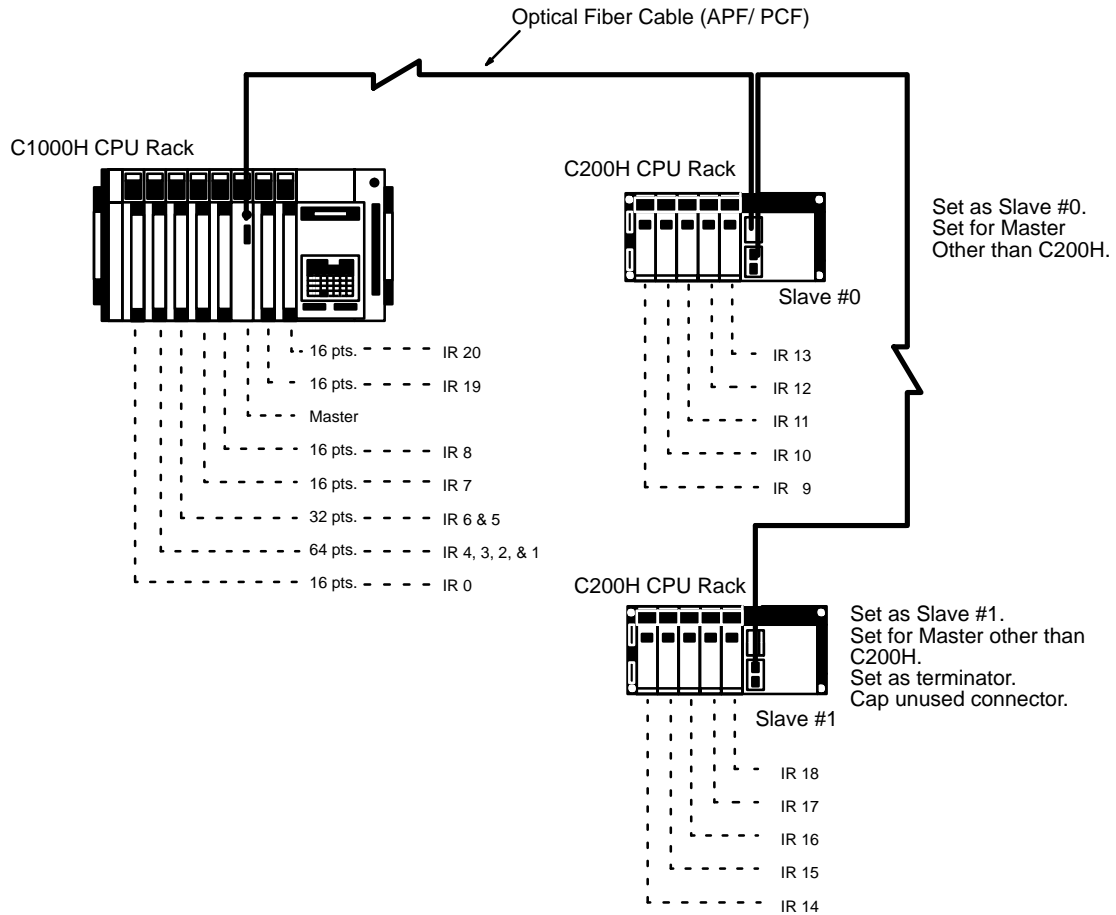


Example 11 C200H System with I/O Link Unit Connection to Other PC and Optical I/O Units



Example 12 C200H Slaves Connected to Other PCs

Masters other than the C200H do not have unit number settings. Words for all Slaves attached to them are allocated automatically in the order they are mounted.



Note If a Unit with the blown-fuse detection function and alarm detection circuit (C200H-OD411/213/214/OA221) is used on a C200H Slave Rack that is connected to a PC other than a C200H/C200HS, all 16 I/O points will be regarded as outputs. Therefore, you will not be able to read the flags for blown-fuse detection function and alarm detection circuit from the ladder program.

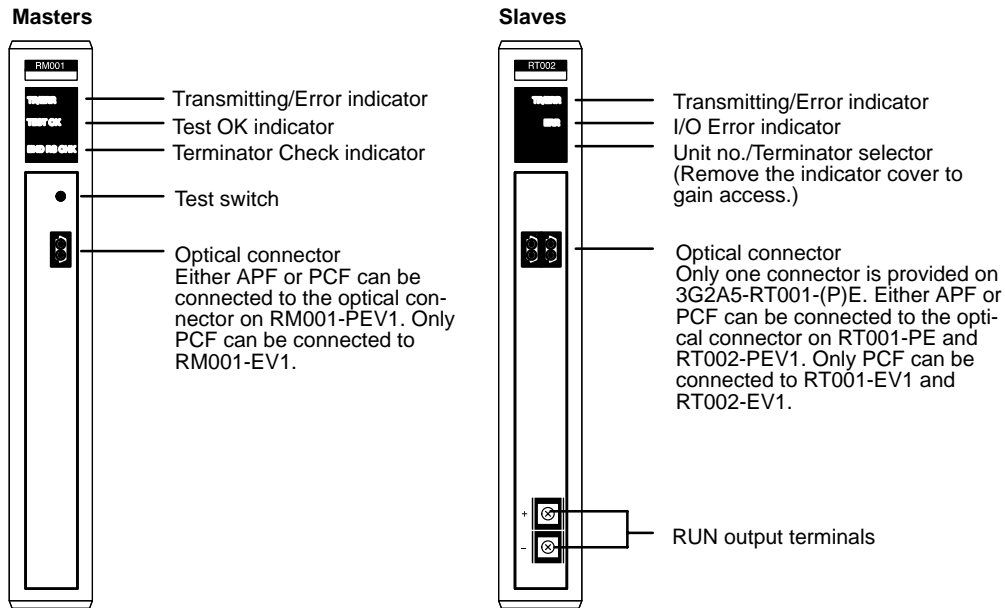
SECTION 4

Unit Components and Switch Settings

4-1	Remote I/O Units
4-2	I/O Link Units
4-3	Optical I/O Units
4-4	Switch Settings

4-1 Remote I/O Units

C120, C500, C1000H, and C2000H Systems



Indicators

Unit	Indicator	Function
Master/Slave	Transmitting Error	Flashes during transmission. Lights during an error.
Master	Test OK	When performing a transmission test: – Lights to indicate normal transmission. – Remains unlit to indicate an error. Testing is repeated as long as the switch is activated; the LED will go out at any point an error occurs.
	Terminator Check	Lights to indicate activation and then goes out to indicate that the terminator has been located.
Slave	I/O Error	Lights to indicate an error in the I/O Bus at the Slave Unit or a mis-recognition at the PC.

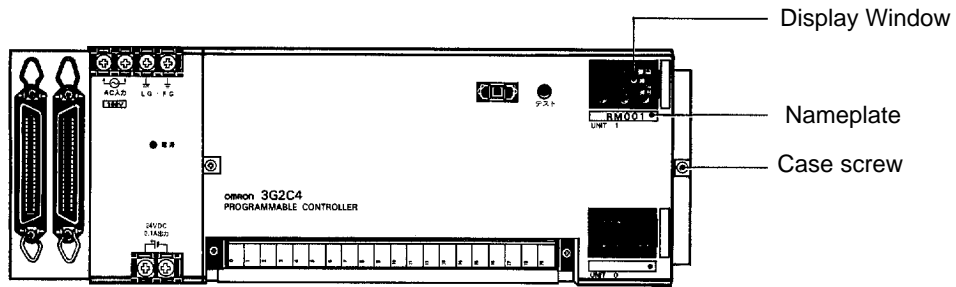
Switches and RUN Output Terminals

Unit	Indicator	Function
Master	Test Switch	Tests the transmission connections with the PC in PROGRAM mode. The testing is repeated as long as the switch is act vated.
Slave	Unit No./Terminator selector	Pins 1 and 2 set the unit number. Pin 4 sets the terminator. Pin 3 is not used.
	RUN output	RUN signal (Stays on during normal run or monitor time; goes off during programming or an error.)

Model 3G2A6-RM001-(P)E for C120

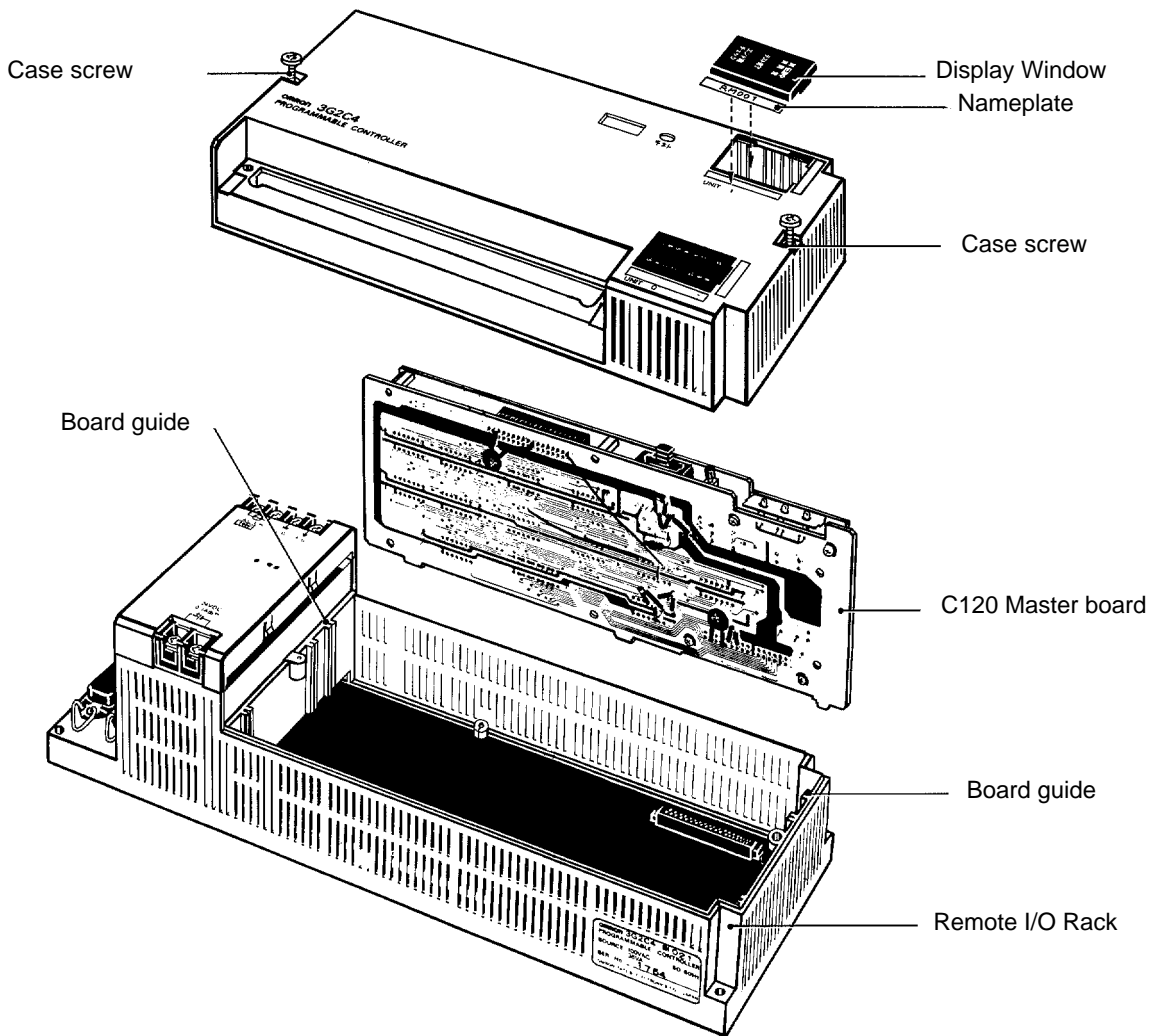
The 3G2A6-RM001-(P)E Remote I/O Master Unit is not housed in a case. The housing for this Unit, called a "Remote I/O Rack," must be specified separately when ordering. The name and function of each part of this C120 Master are the same as those of the C500 Master.

Remote I/O Rack

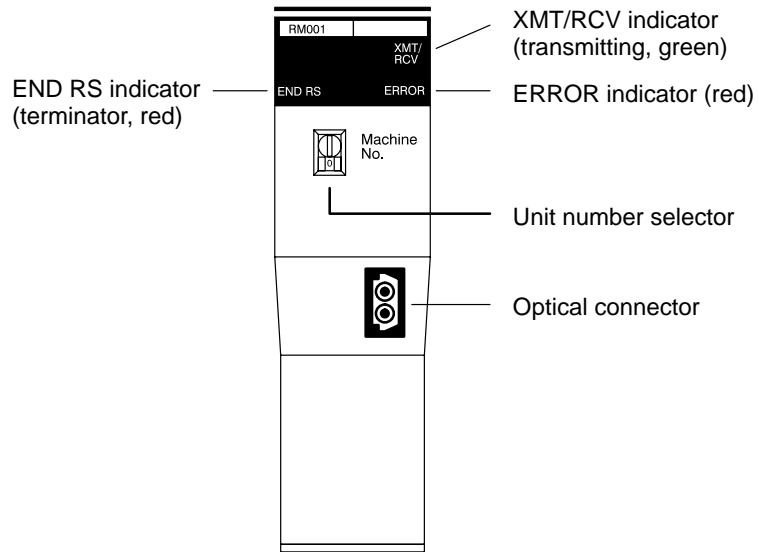


3G2C4-SI027-E (100 VAC)

Unit and Housing Assembly



C200H Remote I/O Master Unit C200H-RM001-PV1



Indicators

Unit	Indicator	Function
XMT/RCV (Transmitting)	Unit #0 or #1	Flashes if there is one or more Optical I/O Units or Slaves undergoing normal transmission. Not lit if all Optical I/O Units and Slaves have errors or if an error occurs in the CPU refresh cycle.
	Unit #2 or #3	Not lit if even one of the Optical I/O Units or Slaves in the transmission has an error or if an error occurs in the CPU refresh cycle.

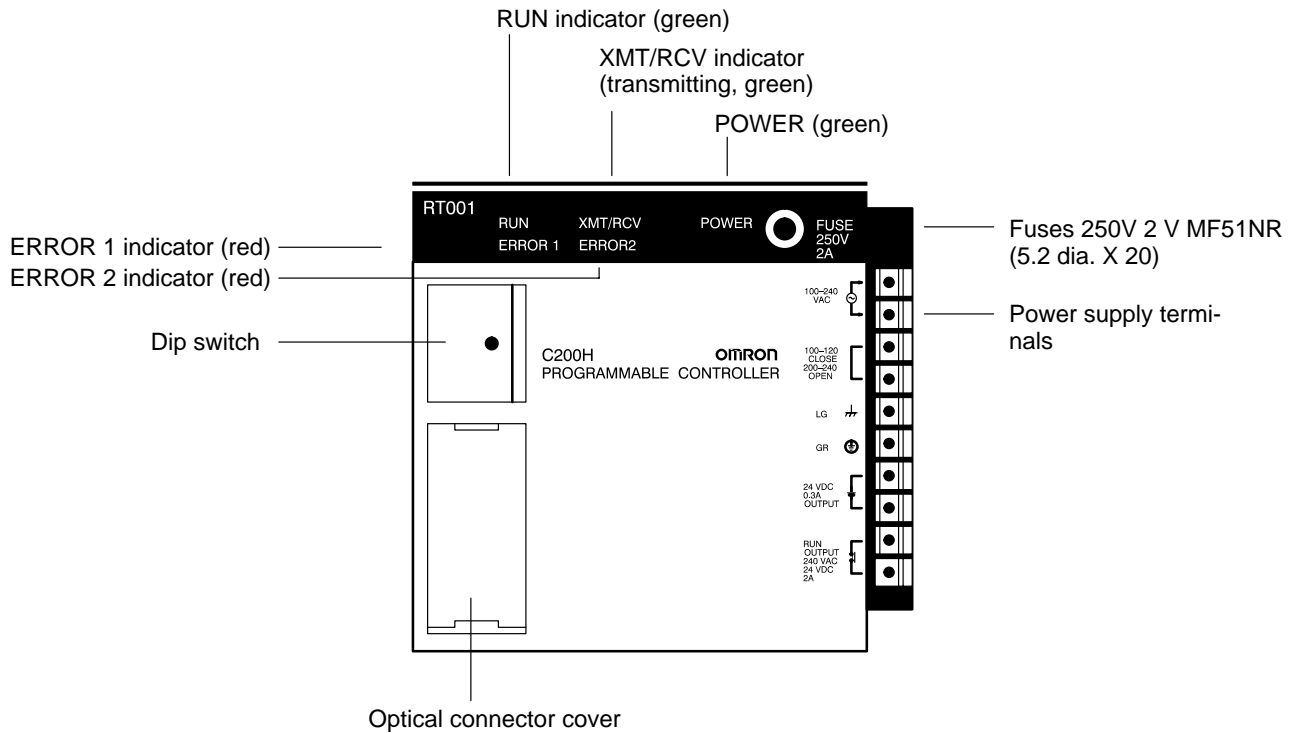
Indicator	Function
ERROR (Transmission error)	Lights if even one of the Optical I/O Units or Slaves in the transmission has an error or if an error occurs in the CPU refresh cycle.
END RS (Terminator check)	Not lit if all of the Optical I/O Units or Slaves in the transmission are normal. Is lit and remains so at the start of operation until a terminator has been located.

Switches

Name	Function
Unit No.	Used to set the unit number (machine number) of the Master (set to 1 or 3 for #1 or set to 0 or 2 for #2.) The system will not operate if two Masters are given the same unit number or if undefined values are set. Unit numbers are used for AR error flags (AR0014 and AR0015) and restart flags (AR0114 and AR0115). Either unit number can be set when only one Master is used.

Note If numbers 0 or 1 are used to set the unit number (#0 and #1, respectively), transmission will continue even when transmission errors occur. If numbers 2 or 3 are used (#0 and #1, respectively), all transmissions to Slaves will be stopped for transmission errors.

C200H Slave Unit (C200H-RT001-P Shown Here)



Note The optical connector is accessed by removing the cover. (Use a screwdriver to open the cover if necessary.) Either APF or PCF cable can be connected. (Refer to 5-2 *Optical Fiber Cable*.)

Always cap the unused connector if the Slave is the terminator.

C200H Slave Indicators

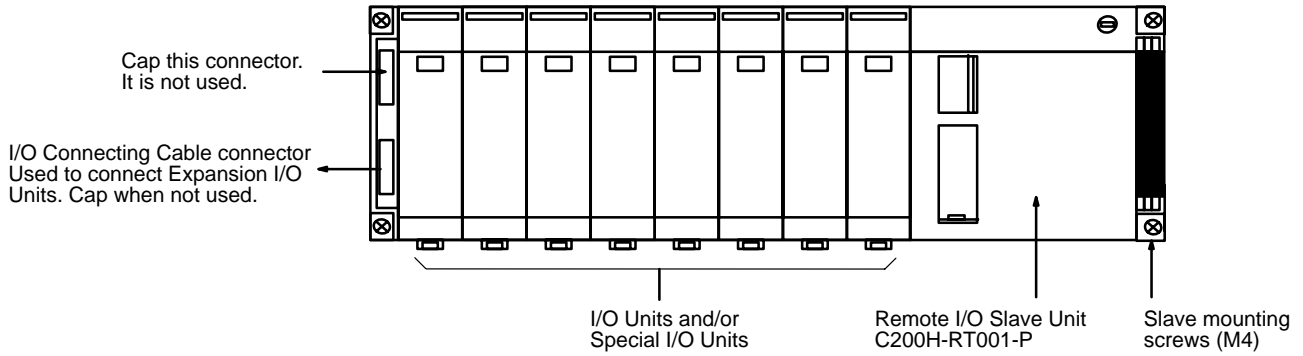
The operating conditions of C200 Slaves can be discerned from their indicators, as shown in the following table.

XMT/RCV	ERROR 1	ERROR 2	RUN	Condition	Function
Not lit.	Not lit.	Not lit.	Not lit.	System not operating.	Indicates that system check by Master is not finished or that power is not being supplied.
Flashing.	Not lit.	Not lit.	---	Normal trans.	Indicates normal transmission with Master.
Not lit.	Lit.	Not lit.	Not lit.	Trans. error	Indicates error in transmission with Master.
---	Lit.	Lit.	Not lit.	I/O bus error	Indicates error in I/O bus connected to I/O Unit on Slave.
Flashing.	Flashing.	Lit.	---	I/O verification error	Indicates that configuration of I/O Units on Slave has changed.
Flashing.	Lit.	Lit.	Not lit.	I/O setting error	Indicate that Slave Input and Output Units have been reversed.
Flashing.	Lit.	Flashing.	---	I/O Rack not verified	Indicates that an I/O Expansion Rack connected to the Slave via I/O Connecting Cable has not been verified by the PC's CPU.

Note “---” in the above table indicates that the stated condition can occur with the indicator either lit or not lit. See *Section 7 Error Processing* for corrective measures.

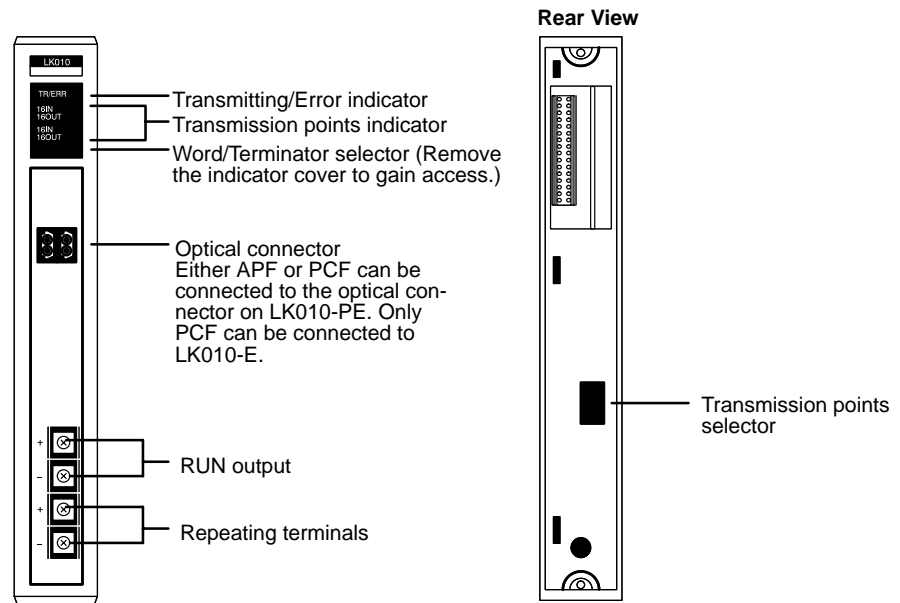
C200H Slave Rack

The same Backplanes are used as for CPU Racks and Expansion I/O Racks. See *Appendix A* for details.



4-2 I/O Link Units

C500 I/O Link Unit



Indicators

Indicator	Function
Transmitting	Blinks during transmission
Error	Lights during an error
16 IN 16 OUT 16 IN • 16 OUT 32 OUT	Appropriate LED lights to indicate the setting of the Transmission Points selector on the back.

Switches

Switch	Function
Word/Terminator selector	Set the number of words of the I/O Link Unit and whether or not it is the terminator.
Transmission Points selector	Set the number of transmission points of the I/O Link Unit.

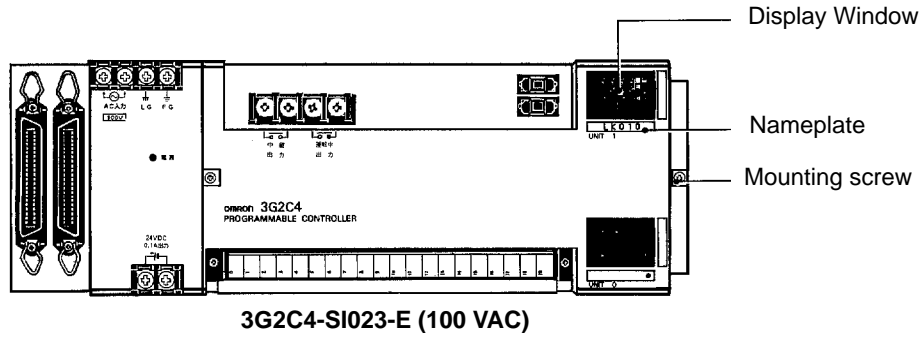
Terminals

Terminal	Function
RUN output	RUN signal (Stays on during normal run or monitor time; goes off during programming or an error.)
Power ON output	Power ON signal (Stays on while the power of the I/O Link Unit to the PC is on).

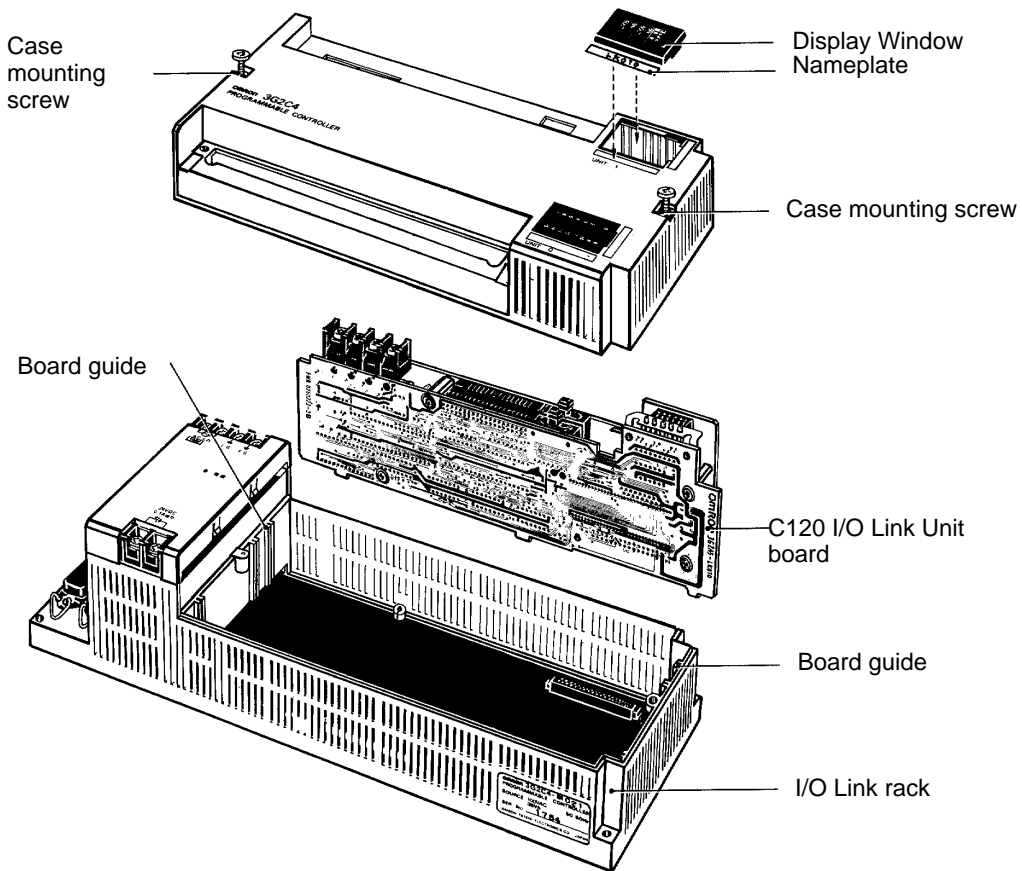
C120 I/O Link Unit

The 3G2A6-LK010-(P)E I/O Link Unit is not housed in a case. The housing of this Unit, called an "I/O Link Rack," must be specified separately when ordering. The name and function of each part of this C120 I/O Link Unit are the same as those of the C500 Link Unit.

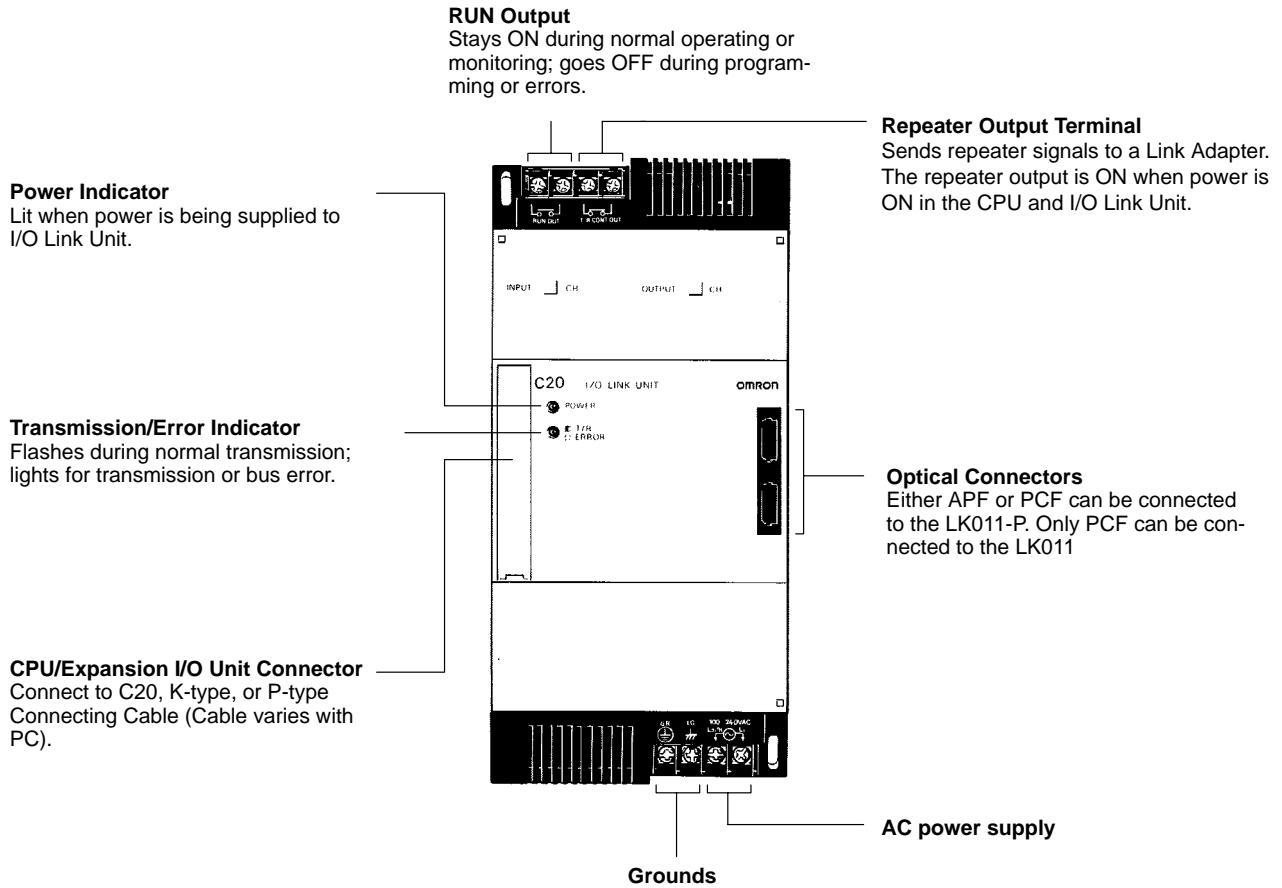
I/O Link Rack



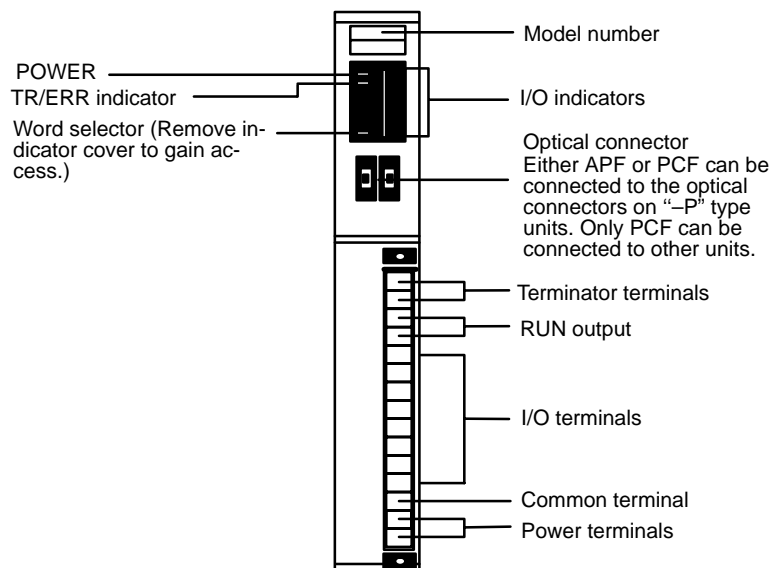
Unit and Housing Assembly



C20 Link Unit



4-3 Optical I/O Units



Indicators

Indicator	Function
POWER	Lights when the power is on.
TR/ERR	Blinks during transmission. Lights during error.
0 to 7	Indicate the ON/OFF status of I/O points.

Switch

Switch	Function
Word selector	Set to the Optical I/O Unit's word.

Terminals

Terminal	Function
Terminator setting	Short for terminator (the Unit at the end).
I/O Terminals, common	Terminals for I/O wiring (refer to each Unit's specifications).
Power input terminals	Power supply terminals (refer to each Unit's specifications).

4-4 Switch Settings

Switch Setting Order

Set the Units using the following procedure:

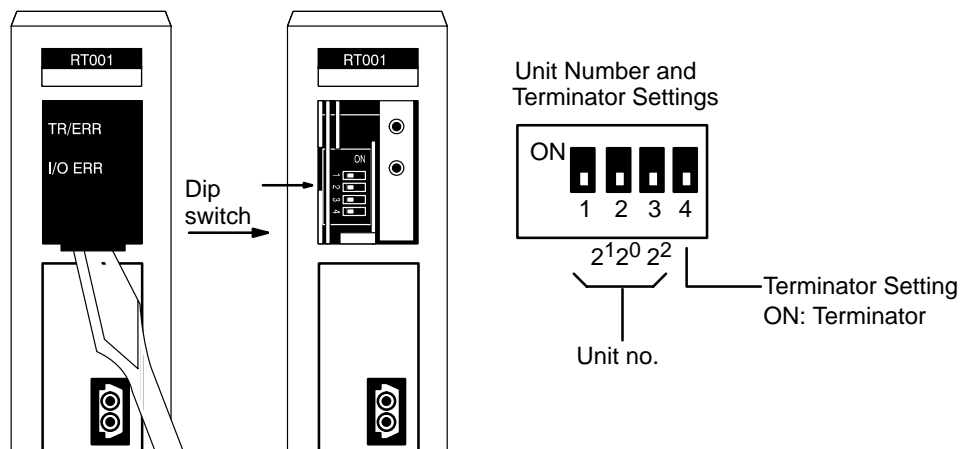
- 1, 2, 3...
 1. Turn off the power, set the unit numbers of the Slaves and check the last I/O word being used by the PC. For a C1000H or C2000H System, always set Slave unit numbers in order starting from number 0.
 2. Set the Optical I/O Unit and the I/O Link Unit words so that no words are used twice. Also, do not set more than the available number of words. This will result in an I/O error.
 3. Connect the optical fiber cables starting from the Master and working out to the terminator. It does not matter which connector is used for the line from the Master.
 4. Set the terminator for the last Unit for each Master. Check to confirm that no intermediate Units have been accidentally set as terminators.
 5. Apply power to the System in any convenient order.
 6. After the terminator check indicator on the Master goes out, enter the I/O table through the Programming Console if required for your PC. If a terminator is not found, CPU WAIT'G will be displayed on the Programming Console. Once the I/O table has been entered, it is not necessary to re-enter it each time power is turned on, unless there is a change.
 7. After entering the I/O table, specify word multipliers for Masters if you are using a C1000H or C2000H System.

Note

1. Once the I/O table has been generated, it is retained in the memory even while power is turned off.
2. If the System does not operate properly after following the above steps, refer to *Section 7 Error Processing*.

C120, C500, C1000H, and C2000H Slaves

Be sure to set DIP switches with the power off. Remove the indicator panel, as shown, and set the switch according to the following chart. Although the 3G2A6-RT001-(P)V1 is a special terminator unit (i.e., it has only one connector), it must still be set as the terminator.



Unit no.	Pin 1	Pin 2	Pin 3
#0	OFF	OFF	OFF
#1	OFF	ON	OFF
#2	ON	OFF	OFF
#3	ON	ON	OFF
#4	OFF	OFF	ON
#5	OFF	ON	ON
#6	ON	OFF	ON
#7	ON	ON	ON

C200H Master

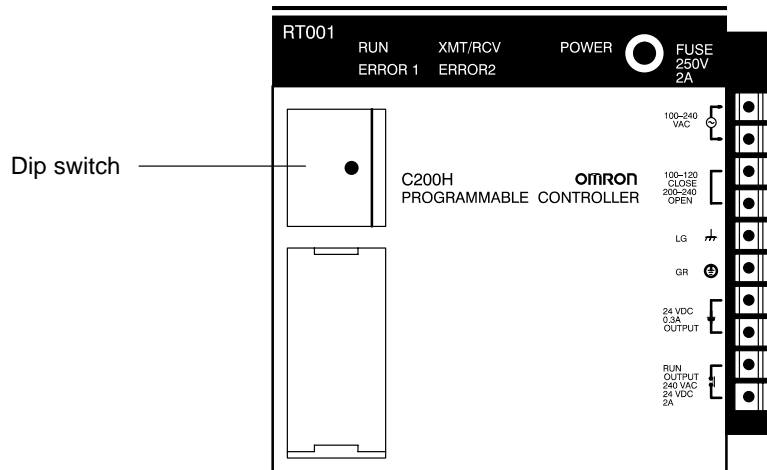
C200H-RM001-P



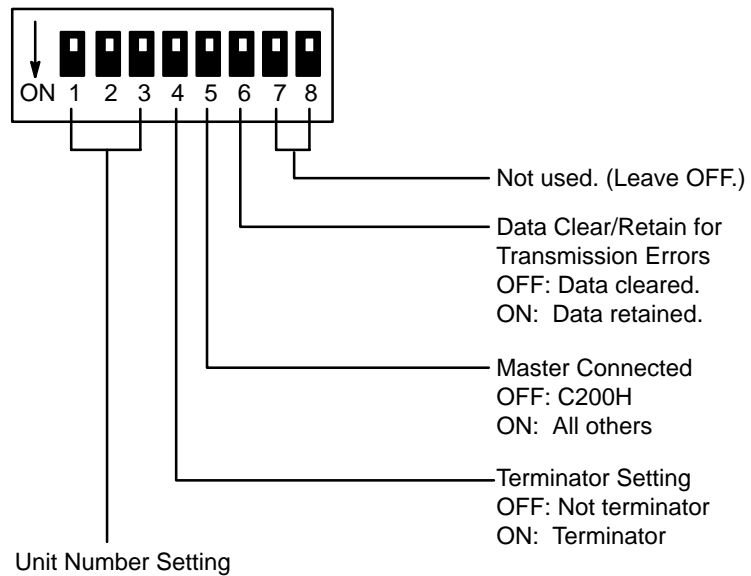
The unit number is set to distinguish between Masters. The order of Master unit numbers is not important. Always turn off the power supply to the PC before setting, and use a screwdriver to set the number. Do not set the same unit number for more than one Master. Do not set values other than 0 through 3.

C200H Slave

C200H-RT001-P

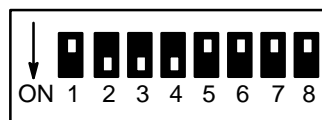


Always turn off the power supply to the PC and to the Slave before setting. All DIP switch positions are OFF when the Unit is delivered.



Unit number	Pin 1	Pin 2	Pin 3	Models
#0	OFF	OFF	OFF	C120, C500
#1	OFF	OFF	ON	
#2	OFF	ON	OFF	C120, C500, C200H
#3	OFF	ON	ON	
#4	ON	OFF	OFF	C120, C500, C200H, C1000H, C2000H
#5	ON	OFF	ON	
#6	ON	ON	OFF	
#7	ON	ON	ON	

Setting Example

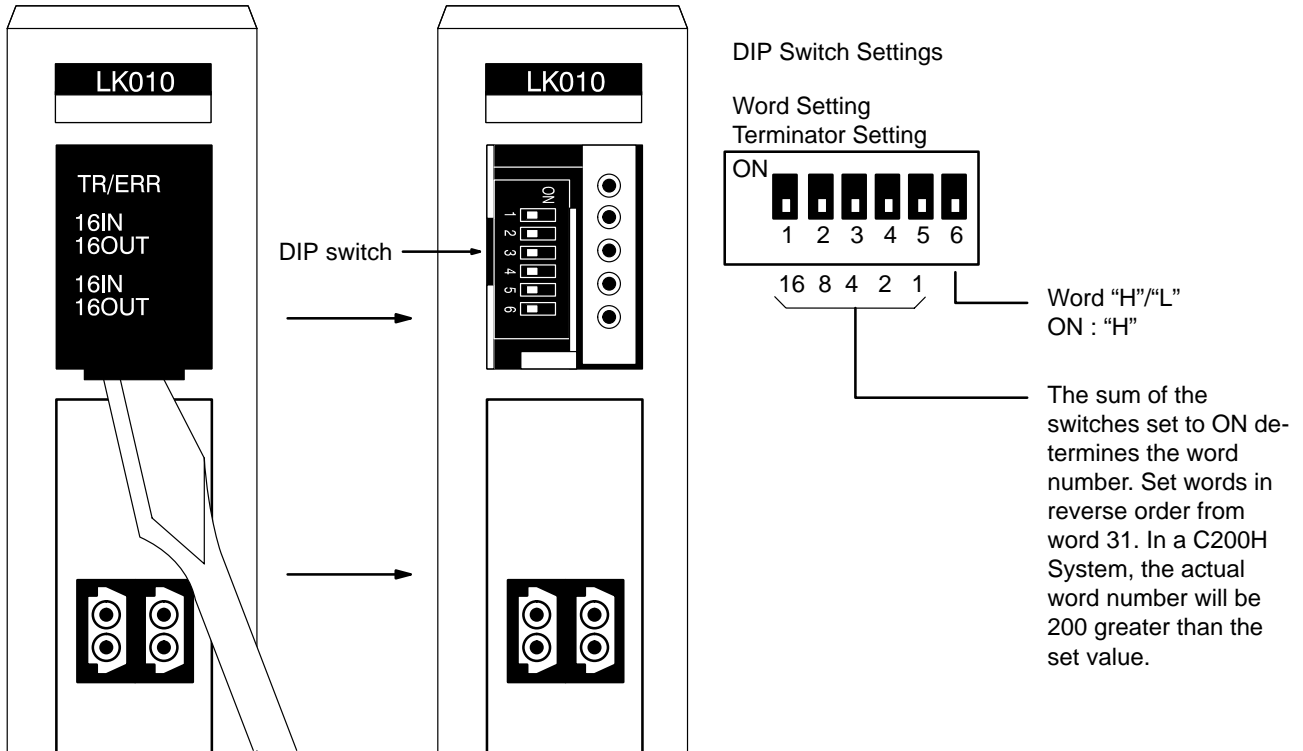


Unit number: 3
 Set as terminator.
 Master: C200H
 Data cleared for transmission errors.

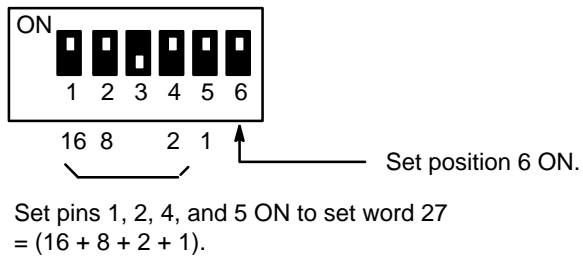
I/O Link Units

Be sure to set DIP switches with the power off. Remove the indicator panel, as shown, and set the switches according to the following chart. Be sure to replace the cover when finished. The appearance of the switch is the same for all Link Units. The position of the switch for C500 I/O Links is shown below. It is located behind the indicator cover on the C120 I/O Link Unit too. On the C20 I/O Link Unit, the switch is located behind the cover on the side of the Unit.

Word and Terminator Setting

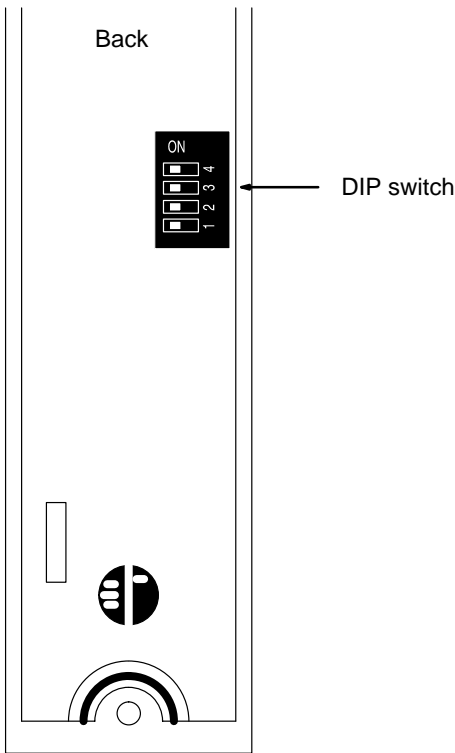


Example: Setting IR 27 and terminator (Actually IR 227 in C200H System)



Transmission Points Setting

Set the switch on the rear panel as shown in the following chart. This switch does not exist on the C20 I/O Link Unit.

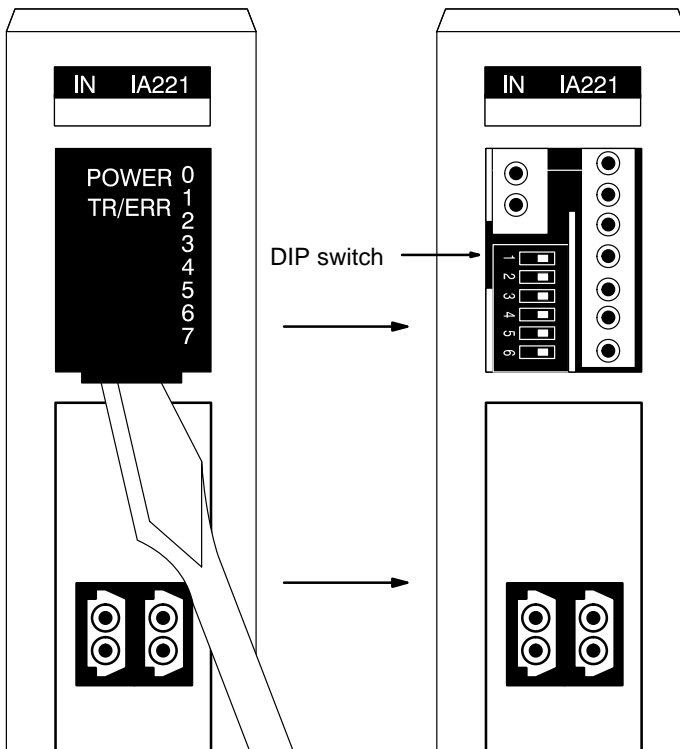


Switch	Operation
<p>ON 1 2 3 4</p>	<p>ON 1 2 3 4</p> <p>16-point input 1 to 4: OFF</p>
<p>ON 1 2 3 4</p>	<p>ON 1 2 3 4</p> <p>16-point output 4: ON 1 to 3: OFF</p>
<p>ON 1 2 3 4</p>	<p>ON 1 2 3 4</p> <p>16-point input 16-point output 2 & 3: ON 1 & 4: OFF</p>
<p>ON 1 2 3 4</p>	<p>ON 1 2 3 4</p> <p>32-point output 2 to 4: ON 1: OFF</p>

Optical I/O Units

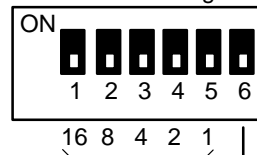
Be sure to set DIP switches with the power off. Remove the indicator panel, as shown, and set the switch according to the following chart.

Word and Terminator Setting



DIP Switch Settings

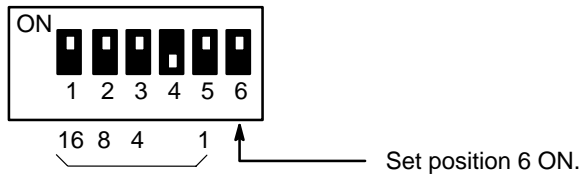
**Word Setting
Terminator Setting**



Terminator setting
ON: Terminator

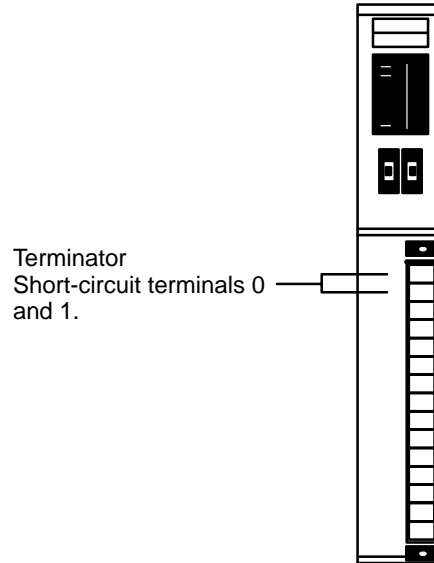
The sum of the switches set to ON determines the word number. Set words in reverse order from word 31. In a C200H System, the actual word number will be 200 greater than the set value.

Example: Setting Word 29 "H" and terminator (Actually word 229 in C200H System)



Set pins 1, 2, 3, and 5 ON to set word 29
= (16 + 8 + 4 + 1).

Terminator



SECTION 5

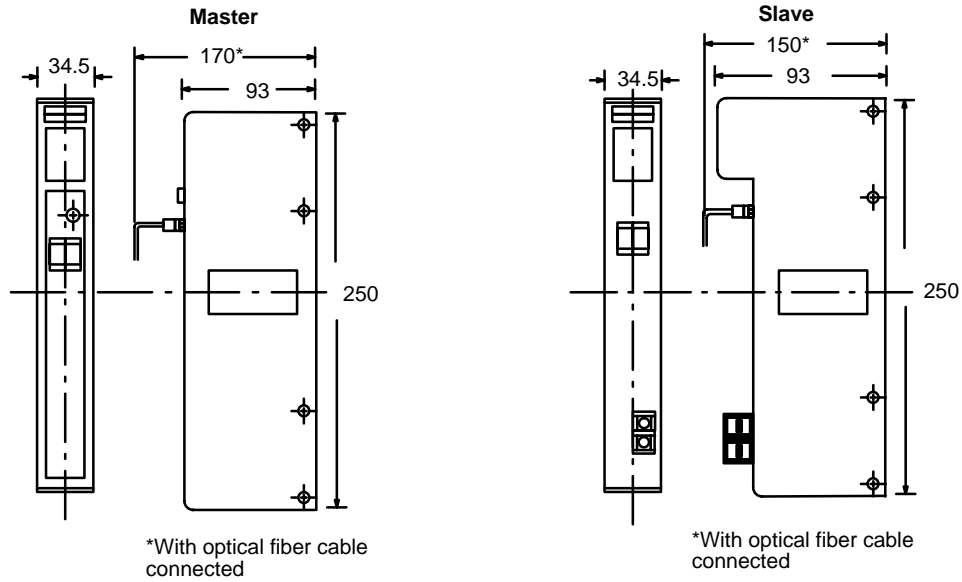
System Installation

5-1	Dimensions	
5-1-1	Masters and Slaves	
5-1-2	I/O Link Units	
5-1-3	Optical I/O Units	
5-1-4	CPU, Slave, and Expansion I/O Racks	
5-2	Optical Fiber Cable	
5-3	Wiring	
5-3-1	C200H Slave Terminals	
5-3-2	C20 I/O Link Unit Terminals	

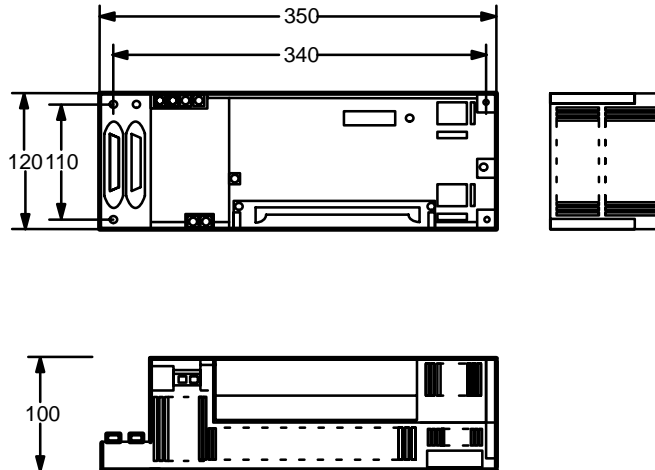
5-1 Dimensions

5-1-1 Masters and Slaves

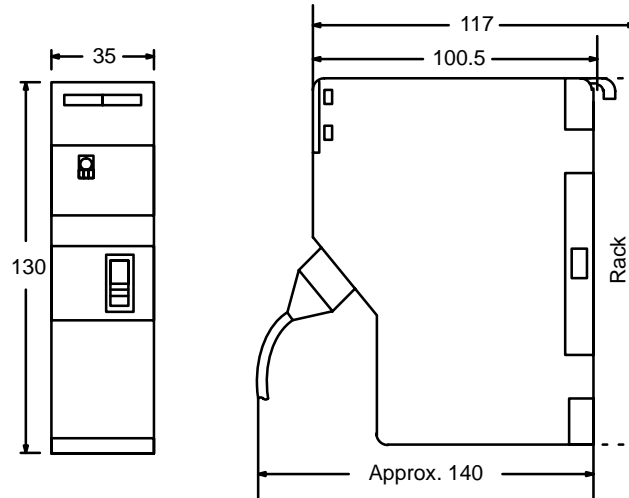
C120 and C500 (Unit: mm)



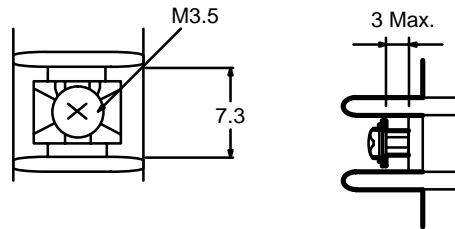
Remote I/O Rack for C120 (Unit: mm)



C200H Master (Unit: mm)

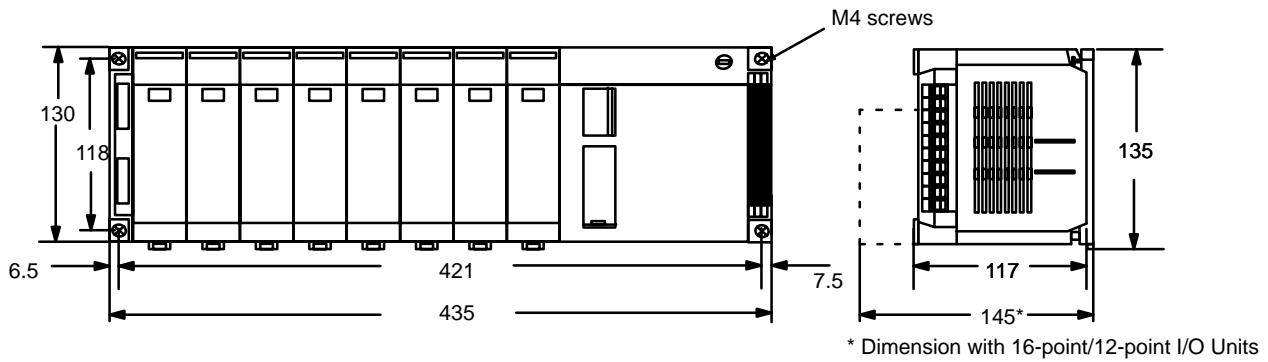


Terminal Dimensions (Unit: mm)

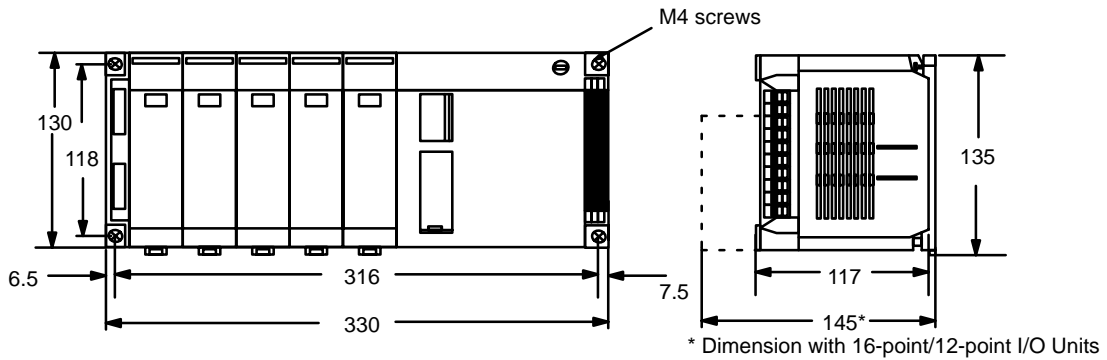


C200H Slave Racks (Unit: mm)

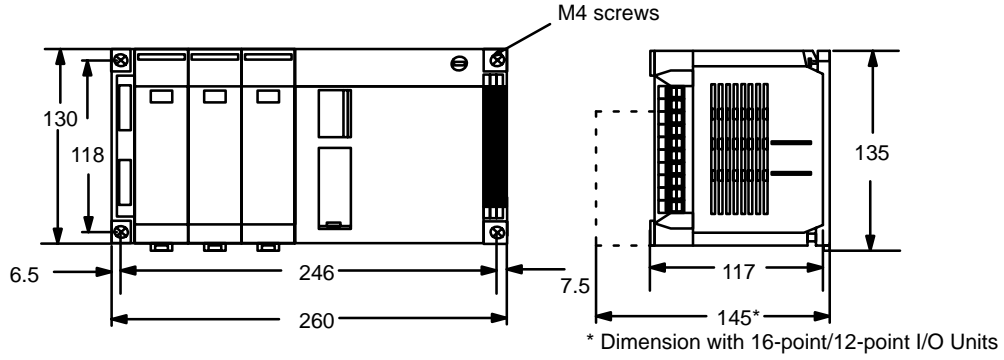
8-slot Rack



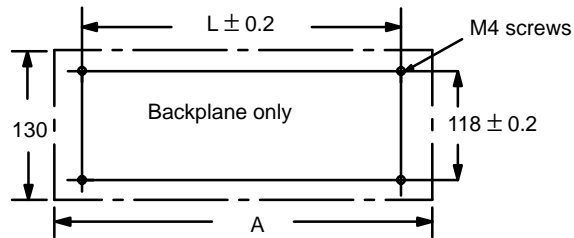
5-slot Rack



3-slot Rack



Mounting Dimensions (Unit: mm)



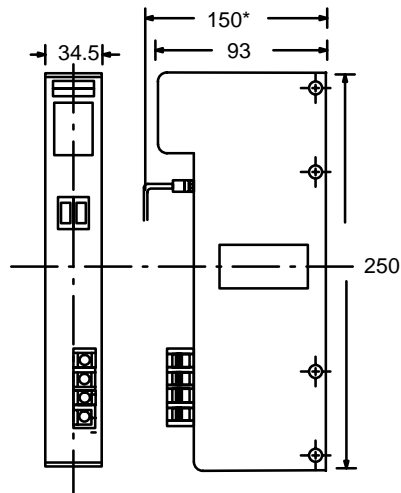
Backplane

Backplane	Type	L	A
C200H-BC031	3-slot	246	260
C200H-BC051	5-slot	316	330
C200H-BC081	8-slot	421	435

5-1-2 I/O Link Units

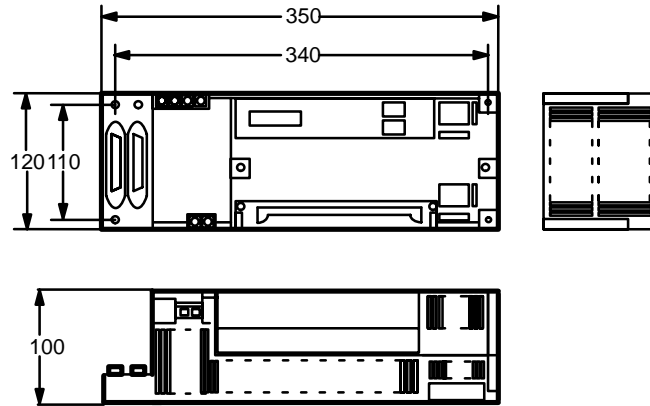
C500 I/O Link Unit (Unit: mm)

3G2A5-LK010-(P)E



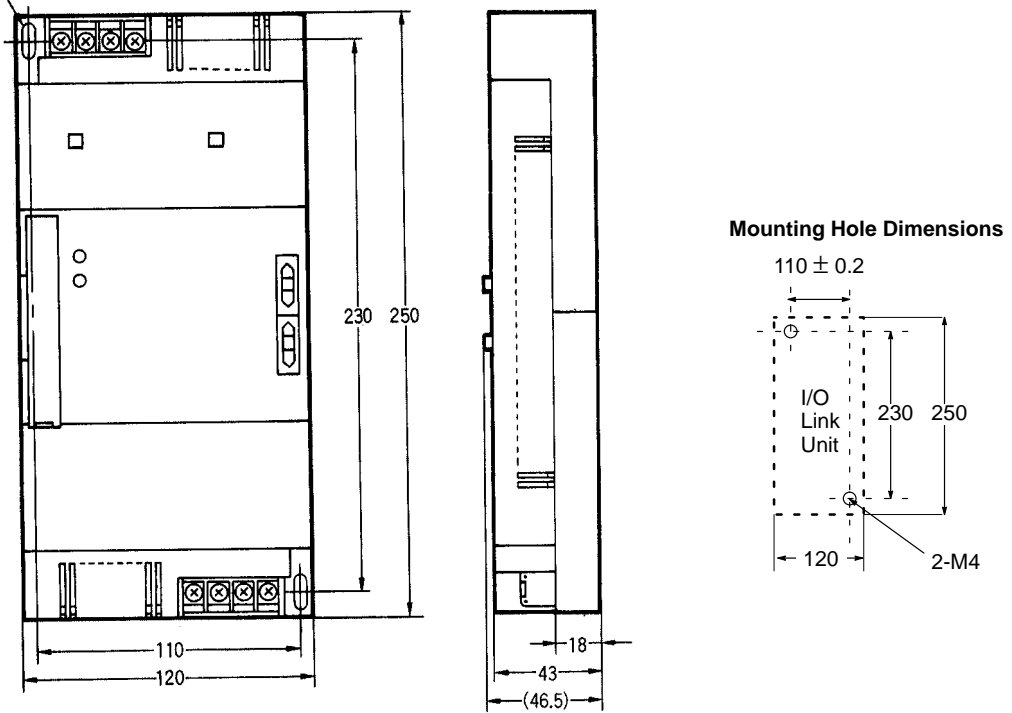
*With optical fiber cable connected

C120 I/O Link Rack (Unit: mm)



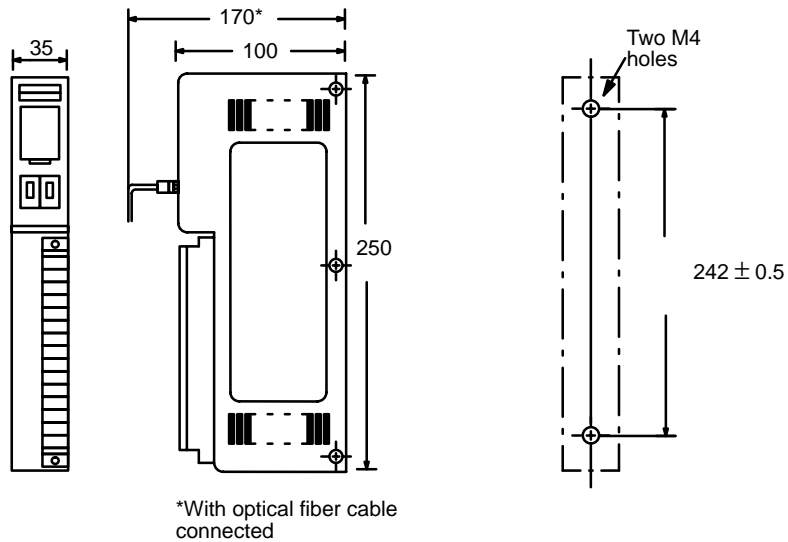
C20 I/O Link Unit

Two M4 holes

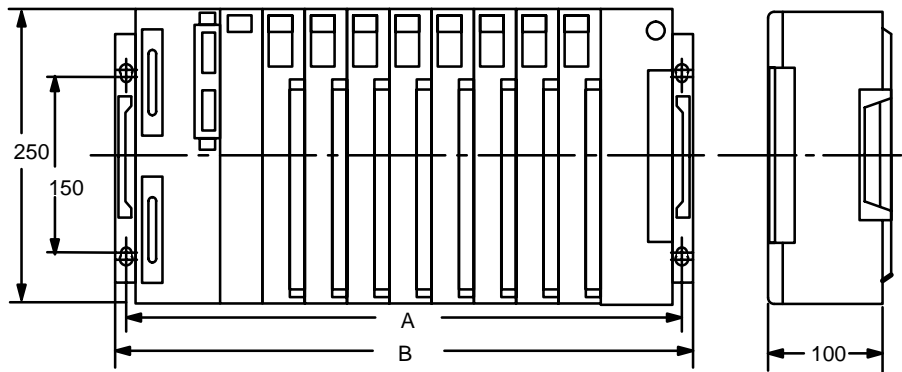


5-1-3 Optical I/O Units

(Unit: mm)



5-1-4 CPU, Slave, and Expansion I/O Racks



The figure above illustrates an 8-slot Rack. The 5-slot and 3-slot Racks are similar except that the length varies with the number of slots. Lengths, in millimeters, for all three models are given in the table below.

Backplane	Type	A	B
3G2A5-BC081	8-slot	465	480
C500-BL061	6-slot	290	305
3G2A5-BC051	5-slot	360	375
C500-BL041	4-slot	220	235
C500-BL031	3-slot	185	200

5-2 Optical Fiber Cable

Plastic-clad Optical Fiber (PCF) and All-plastic Optical Fiber (APF) cable can be used for the communication lines of the Optical Remote I/O System. APF cable has the following features and functions. Use of APF cable is recommended if the transmission distance is 20 m or less. Quartz crystal cable can also be used by incorporating Link Adapters into the System to transmit up to 3 km. Refer to the *Link Adapter Operation Manual* for details.

Features and Functions

Low Cable Cost

All-plastic optical fiber and optical connectors are less expensive than other optical fibers, reducing cable cost.

Easy Processing and Installation

Because the user can attach connectors to the plastic optical fiber cables, cables can be laid first and then the connectors can be attached, allowing optimum adjustment of cable length to eliminate wasted cable. This ease of handling also ensures quick recovery in the event of cable breakage.

Transmission Distance Extendible to 200 m

PCF cable can also be connected to APF Units to extend the transmission distance to up to 200 m.

Cable	Unit	
	For all-plastic optical fiber	For plastic-clad optical fiber
Plastic optical fiber (APF)	20 m max.	Cannot be connected
Plastic-clad optical fiber (PCF)	200 m max.	800 m max.

Note The above transmission distances can be extended by using a Link Adapter. For details, refer to the Link Adapter manual.

Using APF Units

The model names of APF Units are the same as those of corresponding PCF Units, except for the suffix “-P” added to APF Units. APF Units are identical to corresponding PCF Units in appearance, including the shape of the optical connectors. APF cable cannot be connected to PCF Units; PCF cable must be used to connect an APF Unit to a PCF Unit. Refer to Plastic Optical Fiber Cable Specifications for APF cable assembly and handling.

A complete list of Optical Fiber Units is available in *Appendix A Standard Models*.

Types of Cable

The following three optical fiber cables can be used in an Optical Remote I/O System as listed below. Operating conditions are different for each of these cables.

Fiber	All-plastic (APF)	Plastic-clad (PCF)
Application	For short-distance transmission and indoor use	For medium-distance transmission
Applicable Units	Those with suffix “-P”	All. Distance differs with Unit
Transmission distance (max.)	20 m	“-P” Units 200m Non“-P” Units 800m
Remarks	Available from OMRON User must assemble connectors	Available from OMRON W/connectors

Refer to cable specifications for handling instructions.

Notes on Handling Optical Fiber Cable

Be sure to attach the protective cap to the unused optical connector of the Unit specified as the terminator. This cap is supplied as an accessory to protect the module from external light interference. Although the optical fiber cable is designed to provide sufficient mechanical strength, never allow heavy objects to fall onto it.

When installing the optical fiber cable with connectors, secure, on a stable block, the portion of the cable immediately before the connector so that the weight of the cable is not pulling on the connector.

Always hold on to the connector when attaching or removing the cable; do not pull or push directly on the cable.

The optical connector can be connected in one direction only. When connecting, be sure to insert the connector up to the locking position.

Be careful not to soil the edges of the optical connectors. Attach the protective caps the connectors whenever the connectors are not in use. When the connec-

tors have become dirty, lightly wipe them with clean tissue paper or cotton (moisten with ethyl alcohol if necessary to remove dirt). Do not, however, use any organic solvents other than ethyl alcohol.

The minimum bending radius is 25 mm for APF cable; 15 mm for PCF cable. Never use the cable bent at a small radius.

The total length of all cables in the system must not exceed 10 km.

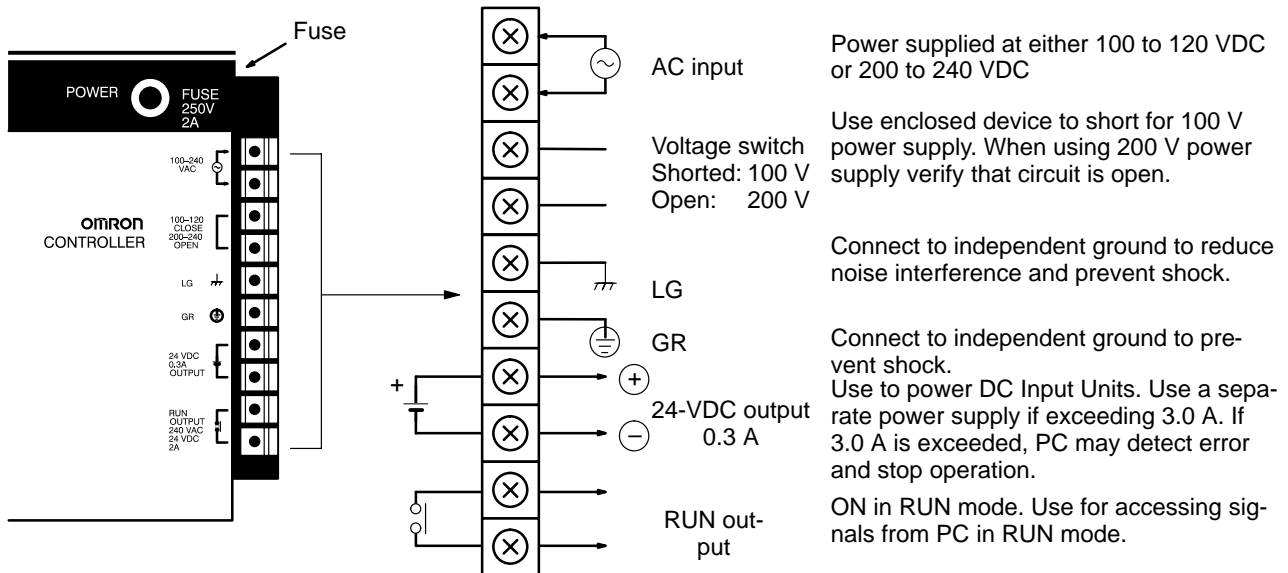
3G5A2-PF002 All-Plastic Fiber Cable requires either Optical Connector A (when the cable length is 10 m or less) or Optical Connector B (when the cable length ranges from 8 to 20 m) per transmission line. These connectors are supplied in pairs. The optical connectors for APF Cable must be assembled by the user.

Notes on Ordering and Assembling APF Cables

5-3 Wiring

5-3-1 C200H Slave Terminals

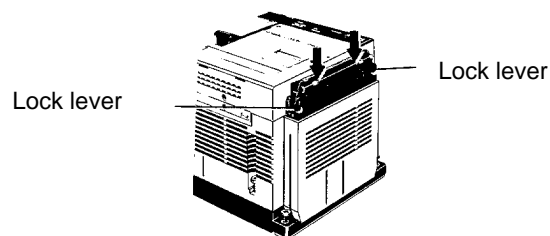
C200H-RT001-P



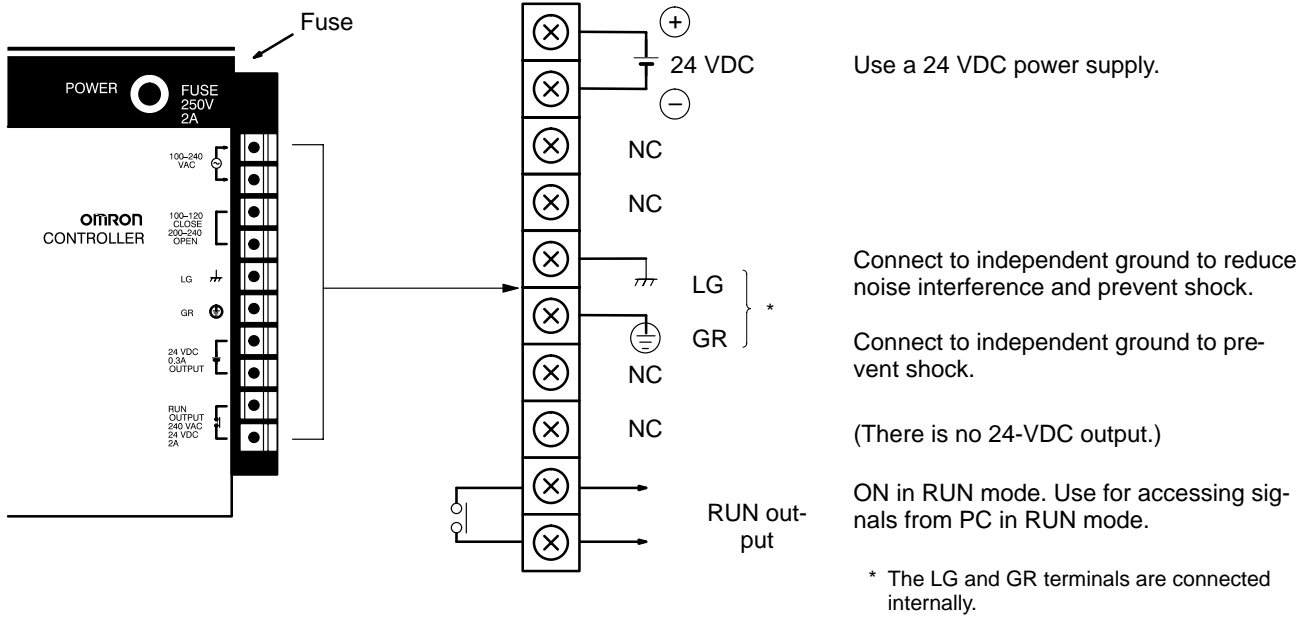
Note Be sure to use a wire of at least 1.25 mm² in thickness. Use M3.5 screws for tightening crimp terminals. Use round crimp terminals for wiring. Do not connect bare stranded wires directly to terminal blocks.

Caution Tighten the terminal block screws of the AC Power Supply to a torque of 0.8 N•m. Loose screws may result in burning or malfunction.

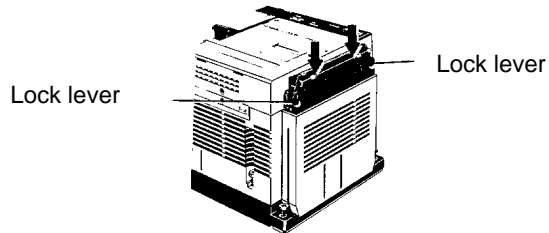
Note Make sure that the 2-piece connector on the terminal block, shown below, clicks into place when attaching it, indicating that the lock lever is in place.



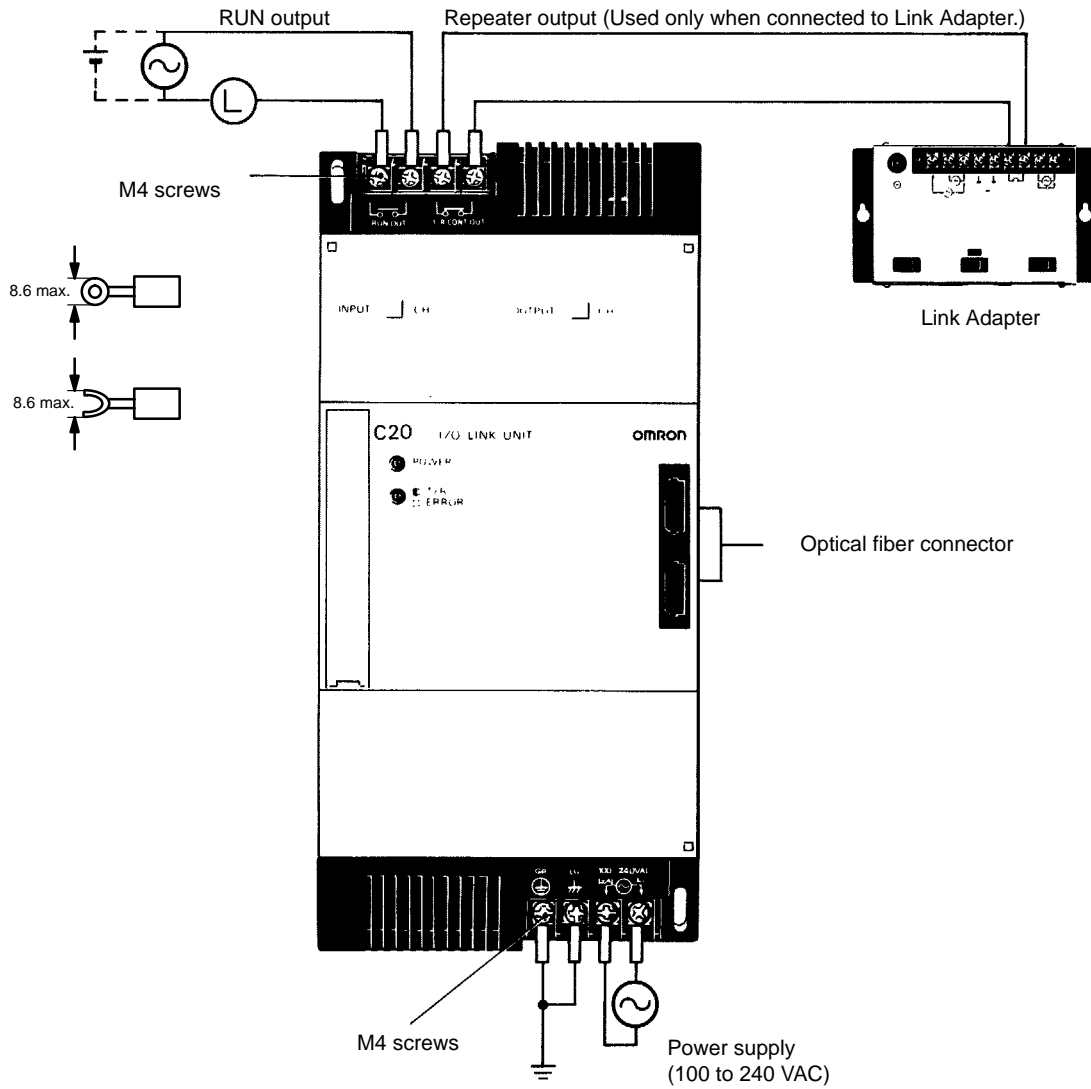
C200H-RT002-P



- Note**
1. Be sure to use a wire of at least 1.25 mm² in thickness. Use M3.5 screws for tightening crimp terminals. Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminal blocks. Tighten the terminal block screws to a torque of 0.8 N•m.
 2. Make sure that the 2-piece connector on the terminal block, shown below, clicks into place when attaching it, indicating that the lock lever is in place.



5-3-2 C20 I/O Link Unit Terminals



SECTION 6

I/O Response Times

6-1	Introduction
6-2	C500 Systems
6-3	C1000H and C2000H Systems
6-4	C200H Systems

6-1 Introduction

The time required to produce a programmed output to an input within a Remote I/O System varies with the scan time of the PC, the transmission time of the Remote I/O System, and the timing of the input.


The processing that determines and the methods for calculating maximum and minimum response times from input to output are provided in this subsection. Calculations assume that both the input and the output are located on Slave Racks in a Remote I/O System.

Although more precise equations are possible if required, equations used for the following calculations do not consider fractions of a scan.

In looking at the following timing charts, it is important to remember the sequence in which processing occurs during the PC scan, particular that inputs will not produce programmed actions until the program has been executed.



When calculating the response times involving inputs and outputs from another CPU connected by an I/O Link Unit, the scan time of the controlling CPU and the scan time of the PC to which the I/O Link Unit is mounted must both be considered.

 **Caution** Noise may increase I/O delays.

6-2 C500 Systems

With C500 Remote I/O Systems, both the scan time of the PC and the transmission time required by the Remote I/O System need to be considered in computing the I/O response times.

Remote I/O Transmission Times

The remote I/O transmission time is computed as follows:

$$\begin{aligned} T_{RM} &= \text{Total Slave transmission time for one Master} \\ &= \Sigma T_{RT} + T_{TT} \end{aligned}$$

$$\begin{aligned} T_{RT} &= \text{Transmission time for each Slave} \\ &= 1.4 \text{ ms} + (0.2 \text{ ms} \times n) \end{aligned}$$

Where n = number of I/O words on the Slave Rack

$$\begin{aligned} T_{TT} &= \text{Optical I/O Unit transmission time} \\ &= 0.2 \text{ ms} \times m \end{aligned}$$

Where m = number of Optical I/O Units

Minimum I/O Response Times

The minimum response time occurs when all signals are processed as soon as they are received, meaning only one scan is required to execute the program before the output is made.

$$\text{Time} = \text{Input ON delay} + \text{scan time} + T_{RM} + \text{output ON delay}$$

Maximum I/O Response Times

The maximum response time occurs when the input just misses both the first remote I/O transmission and the program execution portion of the scan, meaning that processing must wait for the next transmission and then the next scan.

$$\text{Time} = \text{Input ON delay} + \text{scan time} \times 2 + T_{RM} \times 2 + T_{RT} + \text{output ON delay}$$

Example Computations

Calculations would be as shown below for input and output ON delays of 10 ms and a scan time of 20 ms. This example uses only one Slave Rack connected to

a Master and four words allocated on the Slave Rack. Because there is only one Slave, T_{RM} and T_{RT} are the same.

$$T_{RT} = 1.4 + (0.2 \times 4) = 2.2 \text{ ms}$$

$$T_{RM} = 2.2 \text{ ms}$$

Minimum I/O Response Time

$$\begin{aligned} \text{Time} &= 10 \text{ ms} + 20 \text{ ms} + 2.2 \text{ ms} + 10 \text{ ms} \\ &= 42.2 \text{ ms} \end{aligned}$$

Maximum I/O Response Time

$$\begin{aligned} \text{Time} &= 10 \text{ ms} + (20 \text{ ms} \times 2) + (2.2 \text{ ms} \times 2) + 2.2 \text{ ms} + 10 \text{ ms} \\ &= 66.6 \text{ ms} \end{aligned}$$

Transmission Time for Remote I/O Errors

The above computations assume that there is no remote I/O error (including power interruptions). If an error occurs for a Slave, the response time would be increased by 20 ms for each Slave connected to the same Master as the Slave where the error occurred. If an error occurs for a Optical I/O Unit, the overall delay time would be increased by 5 ms for each Optical I/O Unit connected to the same Master as the Optical I/O Unit where the error occurred.

6-3 C1000H and C2000H Systems

With C1000H and C2000H Remote I/O Systems, both the scan time of the PC and the transmission time required by the Remote I/O System need to be considered in computing the I/O response times.

Remote I/O Transmission Times

The remote I/O transmission time is computed as follows:

$$\begin{aligned} T_{RM} &= \text{Total Slave transmission time for one Master} \\ &= \Sigma T_{RT} + T_{TT} \end{aligned}$$

$$\begin{aligned} T_{RT} &= \text{Transmission time for each Slave} \\ &= 1.4 \text{ ms} + (0.2 \text{ ms} \times n) \end{aligned}$$

Where n = number of I/O words on the Slave Rack

$$\begin{aligned} T_{TT} &= \text{Optical I/O Unit transmission time} \\ &= 0.2 \text{ ms} \times m \end{aligned}$$

Where m = number of Optical I/O Units

Minimum I/O Response Times

The minimum response time occurs when all signals are processed as soon as they are received. Because remote I/O processing is handled in parallel with program execution, two scans are required so that the program is executed.

$$\text{Time} = \text{Input ON delay} + \text{scan time} \times 2 + T_{RM} + \text{output ON delay}$$

Maximum I/O Response Times

The maximum response time occurs when the input just misses both the first remote I/O transmission and the program execution portion of the scan, meaning that processing must wait for the next transmission and then the next (i.e., the third) scan.

$$\text{Time} = \text{Input ON delay} + \text{scan time} \times 3 + T_{RM} \times 2 + T_{RT} + \text{output ON delay}$$

Example Computations

Calculations would be as shown below for input and output ON delays of 10 ms and a scan time of 20 ms. This example uses a C1000H system with only one Slave Rack connected to a Master and four words allocated on the Slave Rack. Because there is only one Slave, T_{RM} and T_{RT} are the same.

$$T_{RT} = 1.4 + (0.2 \times 4) = 2.2 \text{ ms}$$

$$T_{RM} = 2.2 \text{ ms}$$

Minimum I/O Response Time

$$\begin{aligned} \text{Time} &= 10 \text{ ms} + 20 \text{ ms} \times 2 + 2.2 \text{ ms} + 10 \text{ ms} \\ &= 62.2 \text{ ms} \end{aligned}$$

Maximum I/O Response Time

$$\begin{aligned} \text{Time} &= 10 \text{ ms} + (20 \text{ ms} \times 3) + (2.2 \text{ ms} \times 2) + 2.2 \text{ ms} + 10 \text{ ms} \\ &= 86.6 \text{ ms} \end{aligned}$$

Transmission Time for Remote I/O Errors

The above computations assume that there is no remote I/O error (including power interruptions). If an error occurs for a Slave, the response time would be increased by 20 ms for each Slave connected to the same Master as the Slave where the error occurred. If an error occurs for an Optical I/O Unit, the overall delay time would be increased by 5 ms for each Optical I/O Unit connected to the same Master as the Optical I/O Unit where the error occurred.

6-4 C200H Systems

With C200H Remote I/O Systems, only the scan time of the PC needs to be considered in computing the I/O response times as long as the remote I/O transmission time is negligible and smaller than the scan time. The scan time, however, is increased by the presence of the Remote I/O System.

Scan Time

The scan time for Remote I/O Systems is increased by the following amount for each Master (approx.):

$$1.3 \text{ ms} + 100 \mu\text{s} \times (\text{number of 8-pt. Units controlled through the Master} + (\text{number of 16-pt. Units controlled through Master} \times 2)) + \alpha$$

Where,

$$\alpha = 200 \mu\text{s} \times \text{number of words used by Special I/O Units}$$

A more detailed explanation of scan time operation and calculations is available in the *PC Operation Manual*.

Minimum I/O Response Times

The minimum response time occurs when all signals are processed as soon as they are received. Here, three scans are required so that the program is executed.

$$\text{Time} = \text{Input ON delay} + \text{scan time} \times 3 + \text{output ON delay}$$

Maximum I/O Response Times

The maximum response time occurs when the input just misses the program execution portion of the scan, meaning that processing must wait for the next transmission and then the next (i.e., the fourth) scan.

$$\text{Time} = \text{Input ON delay} + \text{scan time} \times 4 + \text{output ON delay}$$

Example Computations

Calculations would be as shown below for input and output ON delays of 10 ms and a scan time of 20 ms. This example uses only one Slave Rack connected to a Master and four words allocated on the Slave Rack.

Minimum I/O Response Time

$$\begin{aligned} \text{Time} &= 10 \text{ ms} + 20 \text{ ms} \times 3 + 10 \text{ ms} \\ &= 80 \text{ ms} \end{aligned}$$

Maximum I/O Response Time

$$\begin{aligned} \text{Time} &= 10 \text{ ms} + 20 \text{ ms} \times 4 + 10 \text{ ms} \\ &= 100 \text{ ms} \end{aligned}$$

SECTION 7

Error Processing

- 7-1 Self-diagnosis
- 7-1-1 C120, C500, C1000H, and C2000H Systems
- 7-1-2 C200H Systems
- 7-2 SR and AR Area Flags
- 7-3 Locating Transfer Errors

7-1 Self-diagnosis

C-series Systems have self-diagnostic features to aid in the event of an error. These features are divided into hardware diagnosis and system diagnosis. In either case, the error message or FAL number is read through the Programming Console. Some errors are also monitored by SR bits and can be programmed for indication by an external alarm. The SR bits can also be programmed to stop PC operation in the event of specific errors. Refer to the Troubleshooting Charts on the following pages.

7-1-1 C120, C500, C1000H, and C2000H Systems

The following tables are in pairs. The first one of each pair classifies the errors according to Programming Console displays and CPU LEDs. The second one of each pair provides details on possible causes and corrections according to Remote I/O Unit LEDs.

Errors Before Operation

Programming Console Display	CPU Waiting	
Error	Waiting for remote power	
Error code	---	
SR bits	For Transfer error in I/O bus.	6112 ON (other than C1000H, C2000H) 25312 ON (C1000H, C2000H)
CPU LEDs	Power: lit Run: not lit	

LEDs on Master			Slave LEDs		Optical I/O Unit LEDs		I/O Link Unit LEDs	Cause	Correction
Trans/Error	Test OK	Terminator check	Trans/Error	I/O error	Power	Trans/Error	Trans/Error		
flash	--	lit	--	--	--	--	--	Remote I/O Unit power OFF I/O bus line break	Apply power to the Unit
lit	--	--	--	--	--	--	--	No terminator	Check settings beginning with terminator and check word settings.
lit	--	--	--	lit	--	--	--	Transfer error in I/O bus	
flash	--	--	not lit	not lit	lit	not lit	not lit	Remote I/O bus error	Check Remote I/O Units.
not lit	not lit	not lit	--	--	--	--	--	Remote I/O Unit error	Replace Master.
flash	--	--	--	--	lit	--	--	Slave unit number error	Correct Slave unit number setting.

Non-fatal Errors

Programming Console Display	Remote I/O err	
Error	Remote I/O errors	
Error code	B0 to B3 (other than C1000H, C2000H) B0 to B7 (C1000H, C2000H)	
SR bits	For all Remote I/O errors	6112 ON (other than C1000H, C2000H) 25312 ON (C1000H, C2000H)
CPU LEDs	Power: lit Alarm: lit	

LEDs on Master			Slave LEDs		Optical I/O Unit LEDs		I/O Link Unit LEDs	Cause	Correction
Trans/Error	Test OK	Terminator check	Trans/Error	I/O error	Power	Trans/Error	Trans/Error		
lit	--	--	lit	--	lit	lit	lit	Transfer error in I/O bus I/O bus line break	Refer to 7-2 SR and AR Area Flags to locate the error. The System will automatically be restored upon correcting the error.
lit	--	--	not lit	not lit	--	not lit	not lit	Remote power OFF or CPU error	

LEDs on Master			Slave LEDs		Optical I/O Unit LEDs		I/O Link Unit LEDs	Cause	Correction
Trans/Error	Test OK	Terminator check	Trans/Error	I/O error	Power	Trans/Error	Trans/Error		
lit	--	--	--	lit	--	--	--	Remote I/O bus error	Check Slave Racks.
not lit	not lit	not lit	--	--	--	--	--	master error	Replace Master.

Programming Console Display	I/O VER ERR
Error	I/O verification error
Error code	E7
SR bits	For all I/O verification errors 6110 ON (other than C1000H, C2000H) 25310 ON (C1000H, C2000H)
CPU LEDs	Power: lit Alarm: lit

LEDs on Master			Slave LEDs		Optical I/O Unit LEDs		I/O Link Unit LEDs	Cause	Correction
Trans/Error	Test OK	Terminator check	Trans/Error	I/O error	Power	Trans/Error	Trans/Error		
--	--	--	--	--	--	--	--	Slave Rack Unit loose or an I/O Unit has been added. Non-remote I/O word and Optical I/O Unit word settings overlap.	Verify I/O Table with the Programming Console and correct I/O settings.

Fatal Errors

Programming Console Display	I/O SET ERR
Error	I/O Setting error
Error code	E0
SR bits	None
CPU LEDs	Power: lit Run: not lit Error: lit

LEDs on Master			Slave LEDs		Optical I/O Unit LEDs		I/O Link Unit LEDs	Cause	Correction
Trans/Error	Test OK	Terminator check	Trans/Error	I/O error	Power	Trans/Error	Trans/Error		
--	--	--	--	lit	--	--	--	Remote I/O Input and Output Units have been reversed.	Verify I/O Table with the Programming Console and correct I/O Units or I/O Table.
--	--	--	--	--	--	--	--	Optical I/O Unit input and output words combined.	

Note If the same Unit number is assigned to more than one Slave or the same data word is set for I/O points of several Optical I/O Units, data contention occurs on the I/O bus, causing transmission errors. Transmission errors are also caused by external light interference if protective caps are not attached to unused connectors.

7-1-2 C200H Systems

Lighting and flashing of the Master XMT/RCV LED depends on the unit number settings of the Master. For Masters #0 and #1, if any of the Masters involved in

transmission has an error, the LED will flash. If all such Units have errors, the LED will go out. For Masters #2 and #3, all transmission will stop and the LED will go out if even one Unit has an error.

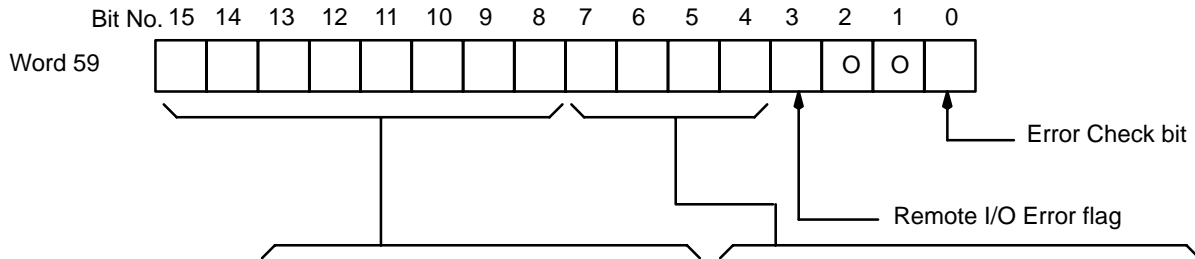
I/O verification errors and I/O setting errors occur when an I/O table is used or when the power supply to a Slave is turned off and I/O Unit settings are changed during CPU operation.

Condition		C200H Master LEDs			C200H Slave LEDs				Cause	Correction
		XMT/RCV	Error	END RS	XMT/RCV	Error 1	Error 2	RUN		
Prior to system operation	Master not detected	not lit	not lit	not lit	---	---	---	---	CPU doesn't detect the Master. Master not mount properly or CPU error.	Check mounting of Master; turn power back ON. If error cannot be cleared, replace Master.
	Remote I/O errors	not lit	not lit	lit	---	---	---	---	Optical Remote I/O Unit power OFF or I/O bus line broken. Terminator not set.	Turn on power to the Slaves and connected Units. Check optical fiber cables. Set the Unit farthest removed from Master as the terminator.
		not lit	lit	lit	---	lit	lit	not lit	Slave I/O bus error.	Replace faulty unit.
					---	---	---	not lit	Transmission error in I/O bus.	Check optical fiber cables.
	Too many I/O points	not lit	lit	not lit	not lit	---	---	not lit	Same word multiplier used for more than one Master.	Check word multipliers and correct any that are redundant
		flash	not lit	not lit	flash	---	---	not lit	Same unit number assigned more than once.	Check AR02 through AR06 for the redundant unit numbers and correct them.
Remote I/O System operation failure	Slave not confirmed	flash	not lit	not lit	not lit	not lit	not lit	not lit	Slave not verified.	Check Slave unit numbers and turn power back ON. Then, turn CPU power supply back ON or restart Master.
	Expansion I/O Rack not confirmed				flash	lit	flash	---	Expansion I/O Unit connected via I/O connecting cable not recognized by CPU.	Check I/O Connecting Cable connections. Check I/O Expansion Rack words and the system configuration. If an I/O table is being used, reference it on the Programming Console, and restore the system configuration or recreate the I/O table.
Remote I/O error (after starting system)	Remote I/O System operation failure	flash/lit	lit	not lit	not lit	not lit	not lit	not lit	I/O bus line break or CPU error.	Check optical fiber cable. If the cause is removed, recovery will be automatic. Otherwise replace unit.
	Transmission Error				not lit	lit	not lit	not lit	I/O bus transmission line break or error.	
	I/O bus error				flash	lit	lit	not lit	Slave I/O bus error.	Check all Slaves and Slave Racks. Replace faulty units.
	I/O verification error				flash	flash	lit	---	I/O Unit on Slave Rack removed or added.	Reference the I/O table on the Programming Console, and reset I/O or recreate the I/O table.
	I/O setting error				flash	lit	lit	not lit	Input and Output Units reversed on Slave Rack.	Reference the I/O on the Programming Console, and restore the I/O Unit word allocations
	Transmission error				not lit	lit	not lit	not lit	Transmission line shorted.	Check optical fiber cables.

7-2 SR and AR Area Flags

The following tables show how to monitor errors using SR and/or AR bits.

SR Bits in C120 or C500

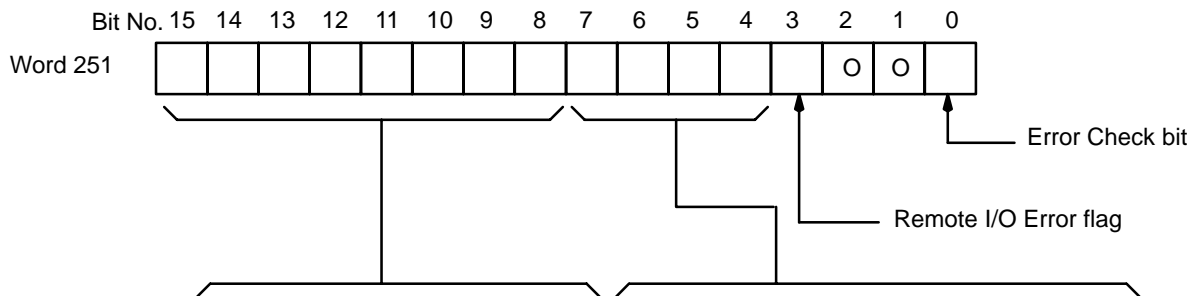


Error Location	Bits 8 to 15	Definition	Bits 4 to 7	Definition
Remote I/O Unit	B0 to B3	Indicates the Master by mounting location. B0 is the leftmost Master on the Rack.	8	Indicates a failure in the Master.
			0	Indicates a failure in Slave #0.
			1	Indicates a failure in Slave #1.
Optical I/O Unit	00 to 31	Refers to the Optical I/O Unit word number.	0	Indicates an even word.
			1	Indicates an odd word.
I/O Link Unit	00 to 31	Refers to the I/O Link Unit word number.	0, 1	Indicates a failure in the I/O Link Unit.

The Error Check bit can be turned ON and OFF to read errors when they have occurred in more than one Unit.

The Remote I/O Error flag indicates that an error has occurred in one of the Remote I/O Units.

SR Bits in C1000H and C2000H



Error Location	Bits 8 to 15	Definition	Bits 4 to 7	Definition
Remote I/O Unit	B0 to B7	The codes (Remote Nos.) on the right are assigned to Masters on CPU or Expansion I/O Rack from the lowest word.	0 to 7	Indicates unit number of Slave with error. (#0 to #7)
			8	Indicates a failure in Master.
Optical I/O Unit	00 to 31	Indicates word allocated to Optical I/O Unit.	0, 2, 4, 6	Indicates "L" word. 0 Multiplier 0 2 Multiplier 1 4 Multiplier 2 6 Multiplier 3
			1, 3, 5, 7	Indicates "H" word. 1 Multiplier 0 3 Multiplier 1 5 Multiplier 2 7 Multiplier 3
I/O Link Unit	00 to 31	Indicates word allocated to I/O Link Unit.	0, 1	Multiplier 0
			2, 3	Multiplier 1
			4, 5	Multiplier 2
			6, 7	Multiplier 3

The Error Check bit can be turned ON and OFF to read errors when they have occurred in more than one Unit.

The Remote I/O Error flag indicates that an error has occurred in one of the Remote I/O Units.

Note The number of the word to which an Optical I/O Unit or I/O Link Unit is actually assigned is calculated using the following formula.

$$\text{Word no.} = (\text{Word no. listed in the above table}) + (\text{Word multiplier listed in the above table} \times 32)$$

SR and AR Bits in C200H

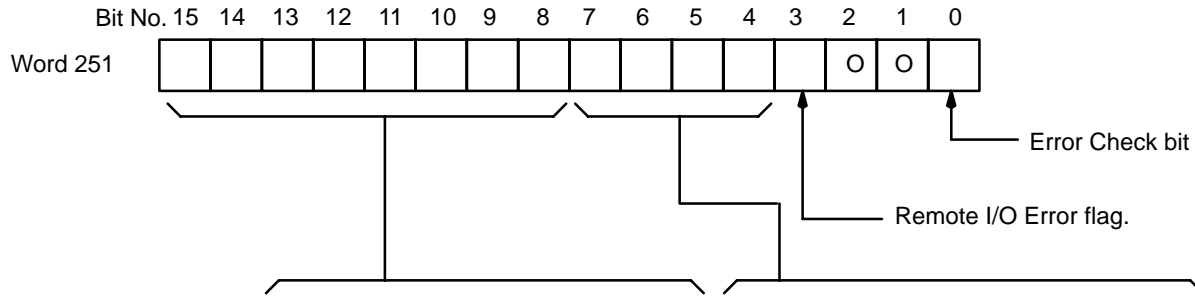
AR 0014 and AR 0015	Unit number of Master with error
AR 02	Unit number of Slave with error at beginning of operations
AR 03 through AR 06	Optical I/O Unit word numbers with errors at beginning of operations
SR 251	Unit numbers and word numbers of all Remote I/O Units with errors after beginning of operations

C200H Error Numbers and Restart Flags

Bit No.	Function
AR 0014	ON for error in Master #1.
AR 0015	ON for error in Master #0.
AR 0114	Restart bit for Master #1.
AR 0115	Restart bit for Master #0.

To restart after removing the cause of an error, turn the Restart bit ON and then OFF again.

SR Word 251 Contents



Error Location	Bits 8 to 15	Definition	Bits 4 to 7	Definition
Remote I/O Unit	B0 to B1	Indicates the unit number of the Master.	0 to 4	Indicates the Unit number of the Slave.
Optical I/O Unit	00 to 31	Indicates word no. of Optical I/O Unit.	0	Indicates "L" word.
			1	Indicates "H" word.
I/O Link Unit	00 to 31	Indicates words no. set on I/O Link Unit.	0, 1	Either indicate the I/O Link Unit.

The Error Check bit can be turned ON and OFF to read errors when they have occurred in more than one Unit. The Remote I/O Error flag indicates that an error has occurred in one of the Remote I/O Units.

Slaves numbered 0 through 4 are allocated 10 words each in order from 50 through 99, i.e., 50 through 59, 60 through 69, etc.

Optical I/O Unit and I/O Link Unit word numbers are 200 greater than the number actually set.

Unit Numbers and Word Numbers with Errors at Beginning of Operations

Slaves

The following Error flags go ON for duplication in Slave unit numbers or transmission errors at the beginning of operations.

Flag	Slave unit number
AR 0200	0
AR 0201	1
AR 0202	2
AR 0203	3
AR 0204	4

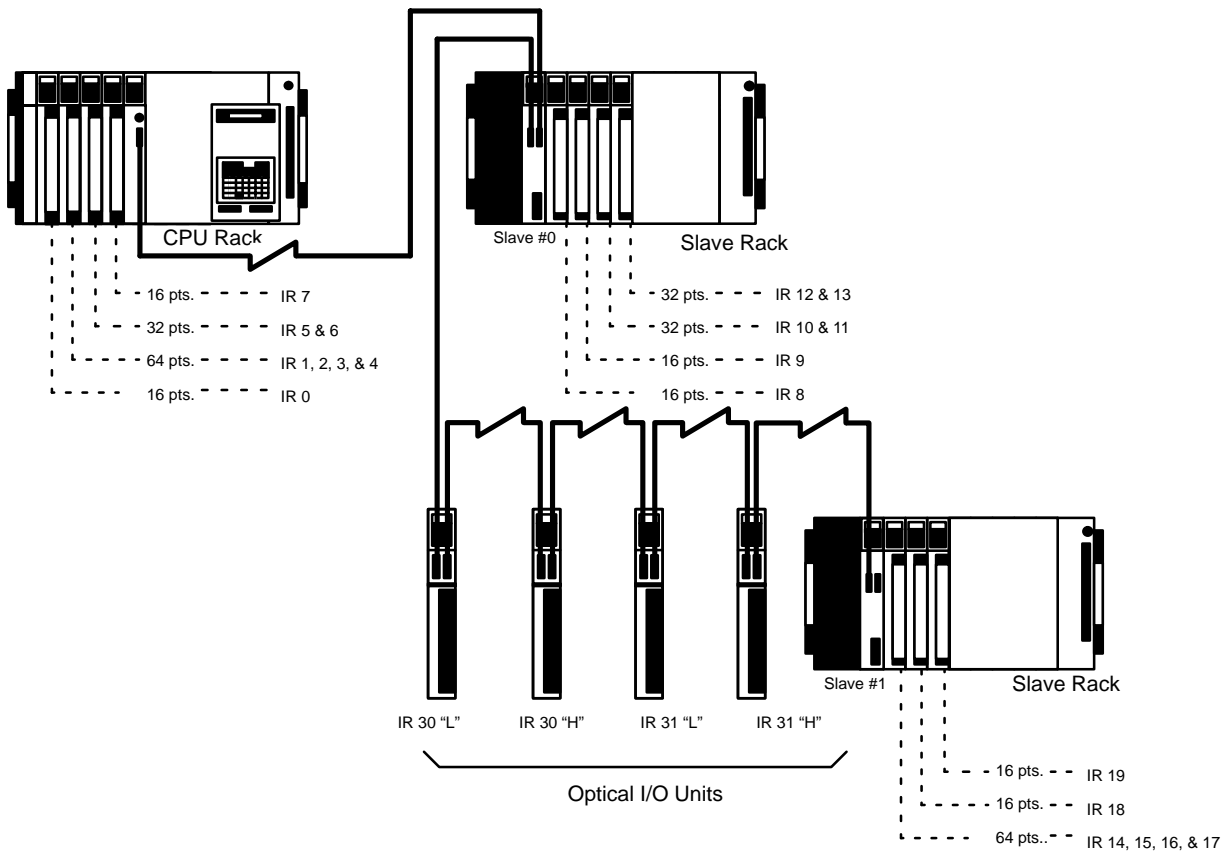
Optical I/O Units

The following error flags for Optical I/O Units go ON for word duplication in words set for Optical I/O Units.

Word	Bit	Unit	Word	Bit	Unit
AR 03	AR 0300	0 "L"	AR 05	AR 0500	16 "L"
	AR 0301	0 "H"		AR 0501	16 "H"
	AR 0302	1 "L"		AR 0502	17 "L"
	AR 0303	1 "H"		AR 0503	17 "H"
	AR 0304	2 "L"		AR 0504	18 "L"
	AR 0305	2 "H"		AR 0505	18 "H"
	AR 0306	3 "L"		AR 0506	19 "L"
	AR 0307	3 "H"		AR 0507	19 "H"
	AR 0308	4 "L"		AR 0508	20 "L"
	AR 0309	4 "H"		AR 0509	20 "H"
	AR 0310	5 "L"		AR 0510	21 "L"
	AR 0311	5 "H"		AR 0511	21 "H"
	AR 0312	6 "L"		AR 0512	22 "L"
	AR 0313	6 "H"		AR 0513	22 "H"
	AR 0314	7 "L"		AR 0514	23 "L"
AR 0315	7 "H"	AR 0515	23 "H"		
AR 04	AR 0400	8 "L"	AR 06	AR 0600	24 "L"
	AR 0401	8 "H"		AR 0601	24 "H"
	AR 0402	9 "L"		AR 0602	25 "L"
	AR 0403	9 "H"		AR 0603	25 "H"
	AR 0404	10 "L"		AR 0604	26 "L"
	AR 0405	10 "H"		AR 0605	26 "H"
	AR 0406	11 "L"		AR 0606	27 "L"
	AR 0407	11 "H"		AR 0607	27 "H"
	AR 0408	12 "L"		AR 0608	28 "L"
	AR 0409	12 "H"		AR 0609	28 "H"
	AR 0410	13 "L"		AR 0610	29 "L"
	AR 0411	13 "H"		AR 0611	29 "H"
	AR 0412	14 "L"		AR 0612	30 "L"
	AR 0413	14 "H"		AR 0613	30 "H"
	AR 0414	15 "L"		AR 0614	31 "L"
AR 0415	15 "H"	AR 0615	31 "H"		

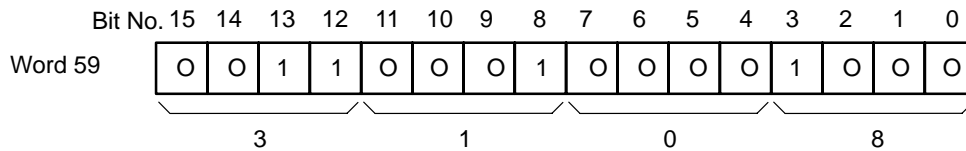
Using Flags to Locate Errors

C120, C500



Locating the Error

In the System depicted above, let's assume an error has occurred in IR 31 "L" of the Optical I/O Unit. Word 59 shows the following data.

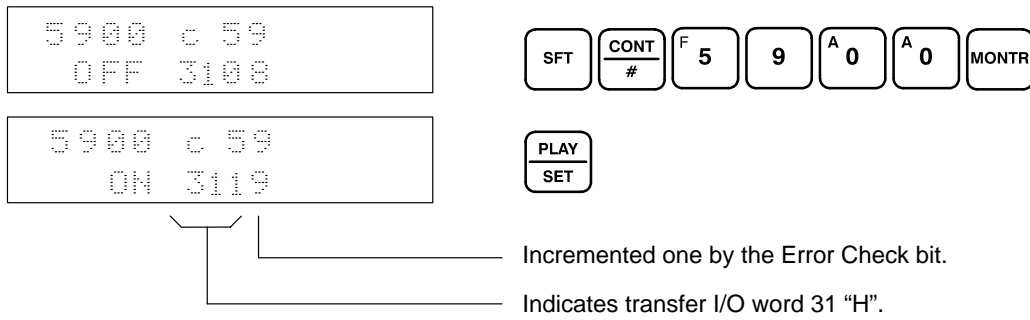


Monitoring word 59 with the Programming Console reveals the following data.

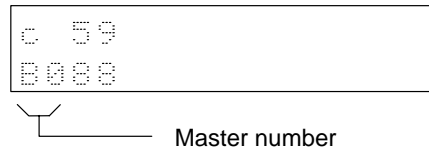


└┬┘ Indicates a remote I/O error.
└┬┘ Indicates transfer I/O word 031 "L".

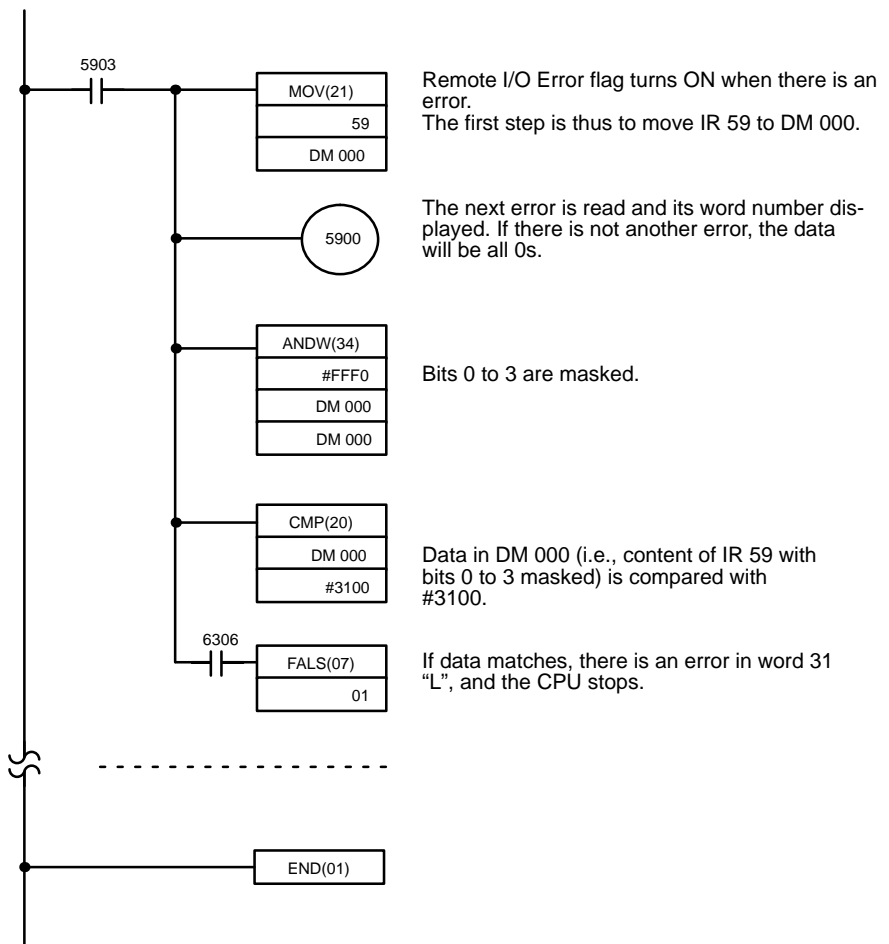
To check for other errors, monitor 5900 and force-set the System. This causes the next error word to be displayed.



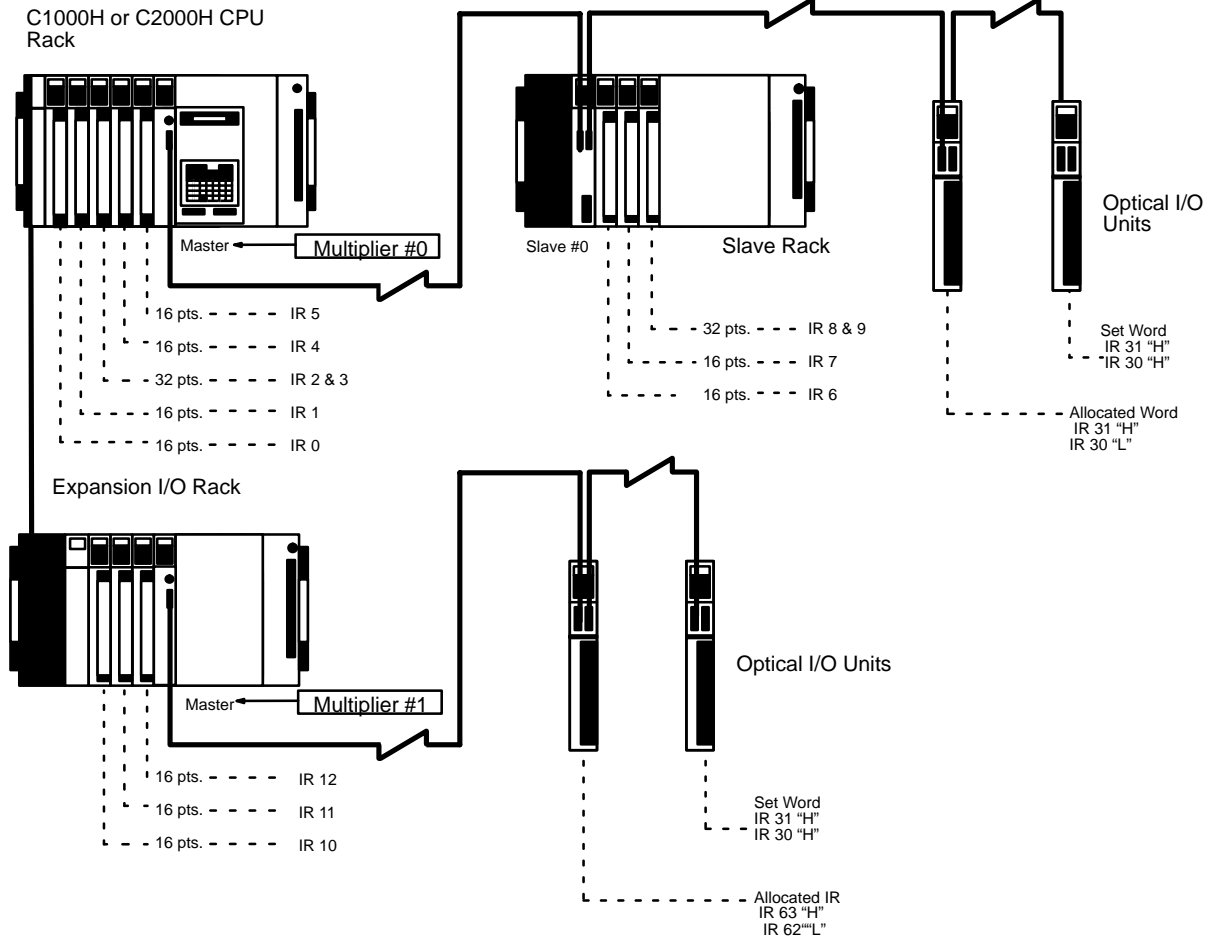
To read the next error, reset the Error Check bit, then set it again. If the leftmost Master has an error, the following message is displayed. Errors in the Remote I/O Units cannot be read is there is an error in the Master.



This is an example program to stop PC operation if an error occurs in the Unit assigned to word 31 "L."

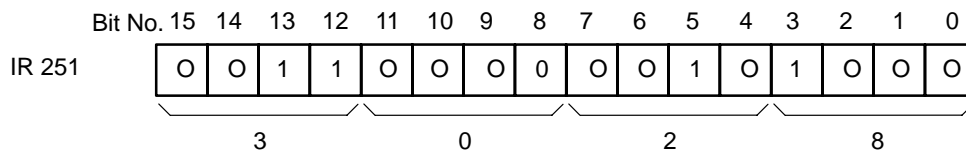


C1000H, C2000H

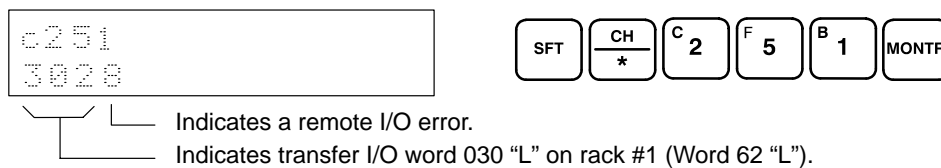


Locating the Error

In the System depicted above, let's assume an error has occurred in IR 62 "L" of the Optical I/O Unit (IR 30 "L" of Master with a word multiplier of 1). IR 251 shows the following data.

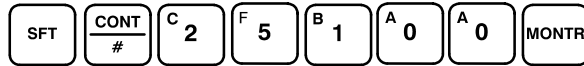


Monitoring IR 251 with the Programming Console reveals the following data.



To check for other errors, monitor 25100 and force-set the System. This causes the next error IR to be displayed.

```
25100 c251
^ OFF 3020
```



```
25100 C251
■ ON 3139
```



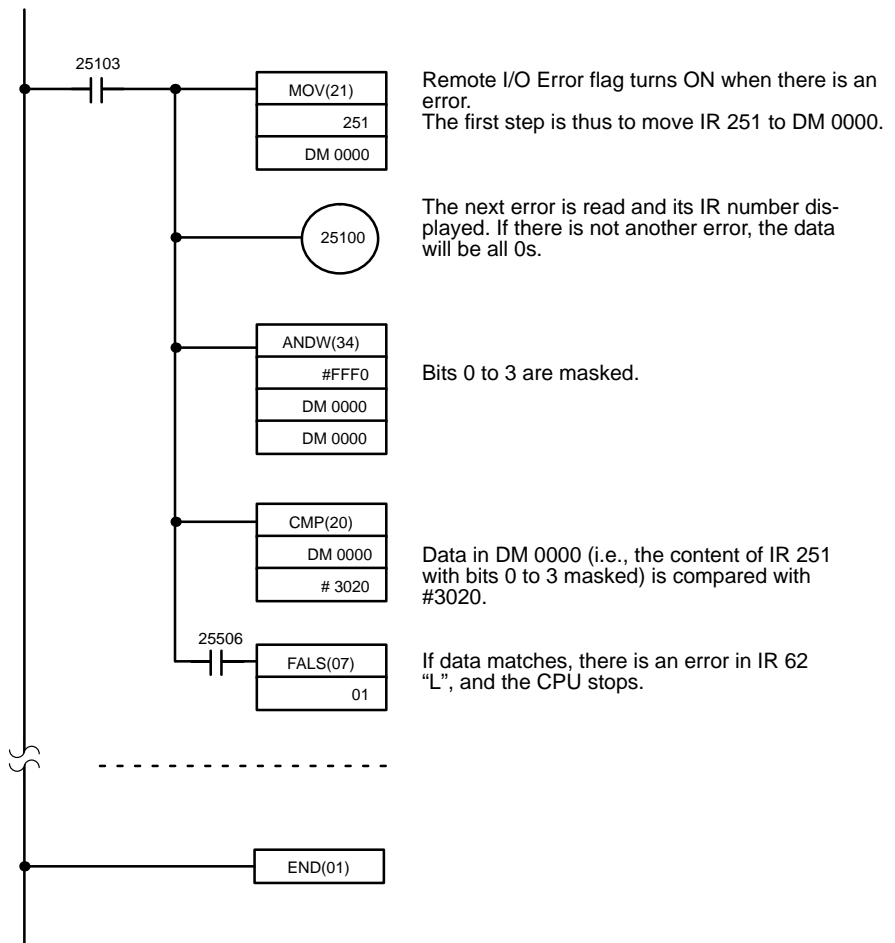
Incremented one by the Error Check bit.
Indicates transfer I/O IR 31 "H" of Master with a word multiplier of 1 (Wd 63 "H").

To read the next error, reset the Error Check bit and then set it. If the leftmost Master has an error, the following is displayed. Errors in the Remote I/O Units cannot be read if there is an error in the Master.

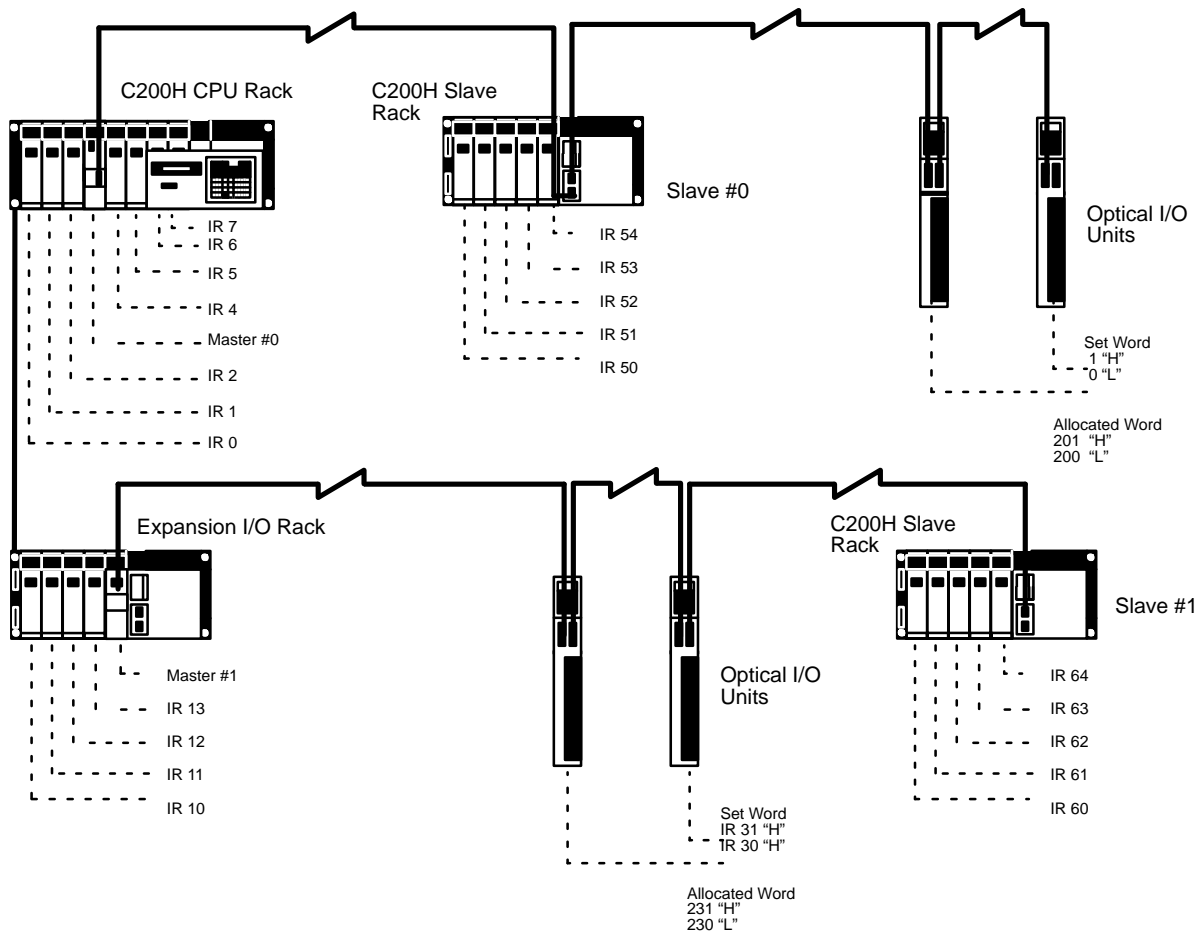
```
c251
B100
```

Master number

This is an example program to stop PC operation if an error occurs in the Unit assigned to IR 62 "L" (IR 30 "L" of Master with a word multiplier of 1).

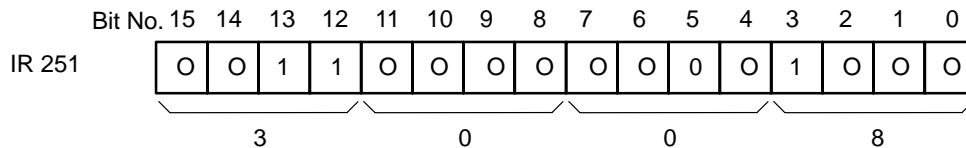


C200H

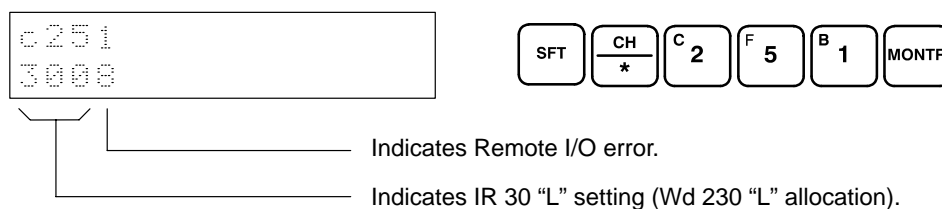


Locating the Error

In the System depicted above, let's assume an error has occurred in IR 230 "L" of the Optical I/O Unit. IR 251 shows the following data:



Monitoring IR 251 with the Programming Console reveals the following data.



To check for other errors, monitor 25100 and force-set the System. This causes the next error word to be displayed.

```
25100 c251
^ OFF 3008
```



```
25100 C251
■ ON 3119
```



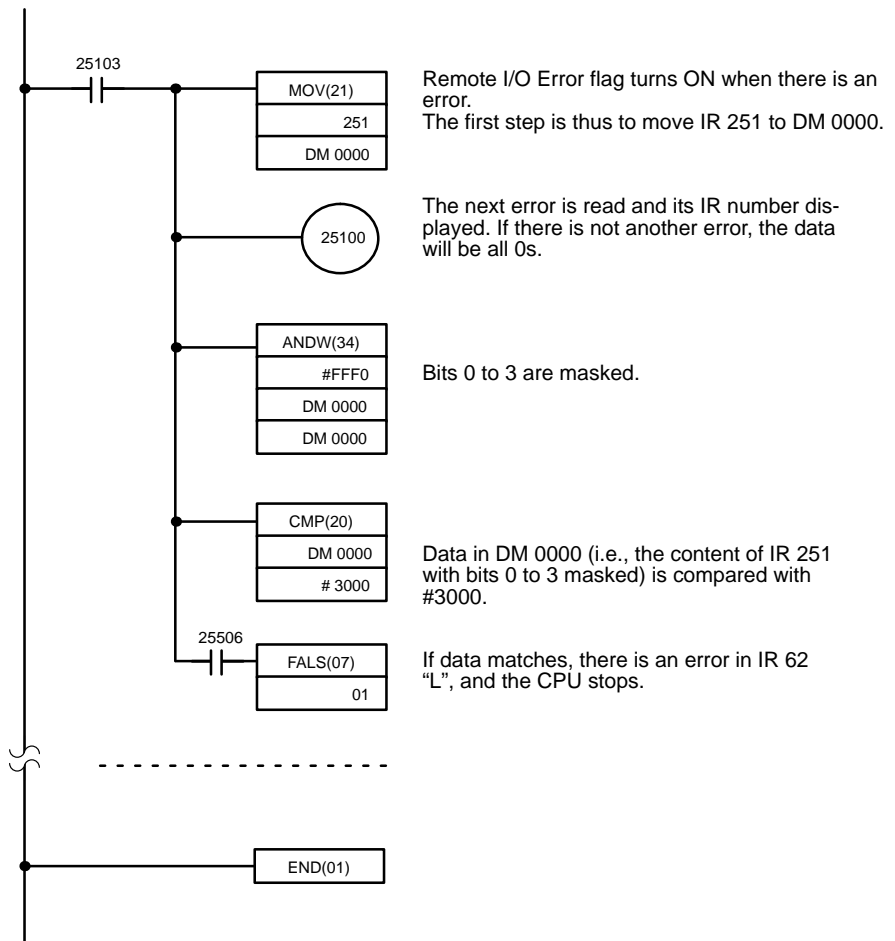
Incremented one by the Error Check bit.
Indicates word 31 "H" setting (Wd 231 "H" allocation).

To read the next error, reset the Error check bit and then set it. If the leftmost Master has an error, the following is displayed. Errors in the Remote Units cannot be read if there is an error in the Master.

```
c251
B118
```

Indicates Remote I/O error.
Indicates IR 30 "L" setting (Wd 230 "L" allocation).

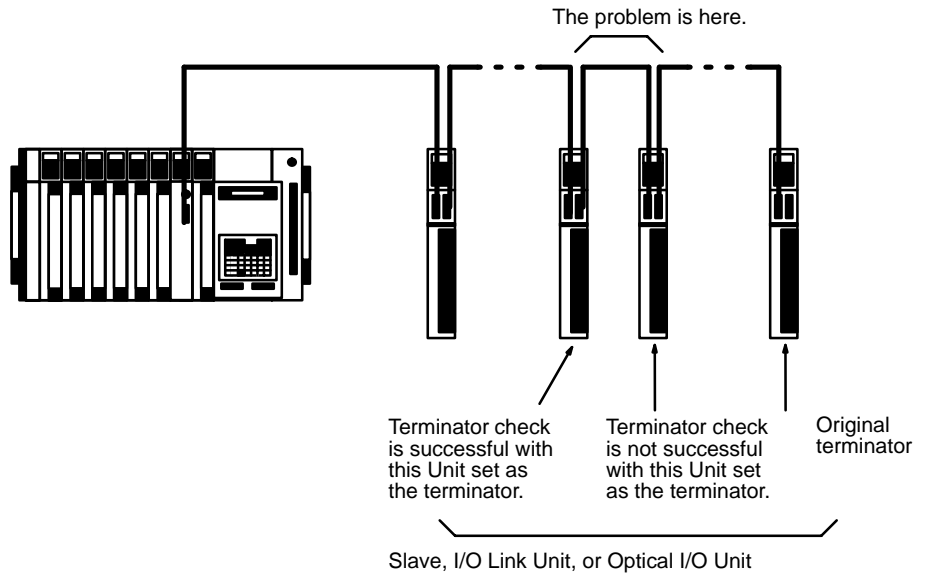
This is an example program to stop PC operation if an error occurs in the Unit assigned to IR 230 "L" (IR 30 "L" setting of 1).



7-3 Locating Transfer Errors

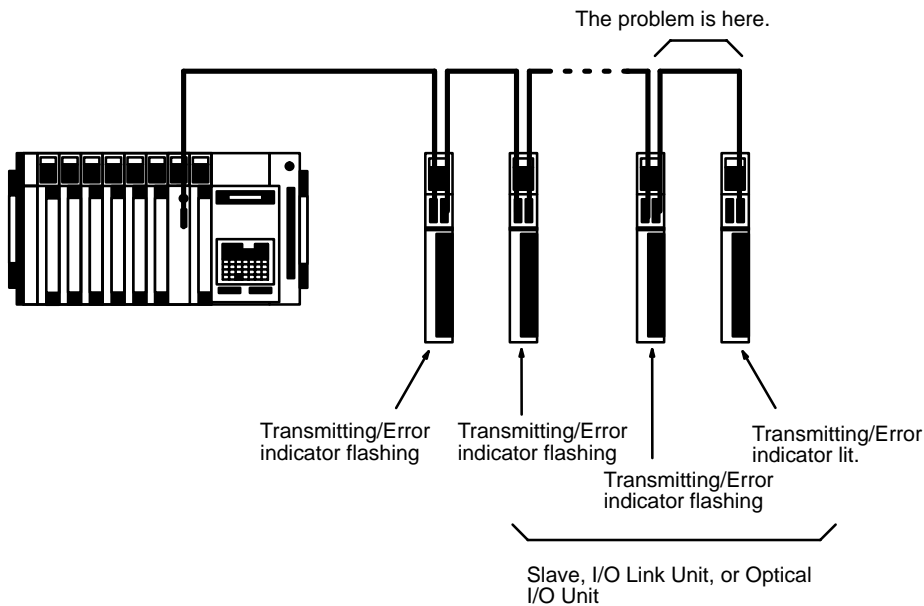
Before Terminator Acknowledgment

The Transmitting/Error indicator may indicate an error before the Terminator Check indicator goes off. If it does, the line may be disconnected or the power to one of the Units in the line may be off. To locate the problem, set the Unit just before the end as the terminator and test the System again. Continue moving the terminator up one Unit at a time until the Master is able to acknowledge a terminator. This will let you know what section of the line the problem is in. Check the power supply and data transfer line connections for that section and test the System again.



After Terminator Acknowledgment

Check the Transmitting/Error indicator of each Unit in the line to determine where the error has occurred. The problem can then be corrected by repairing the transfer line between the last Unit with the Transmitting/Error indicator flashing, indicating normal transmission, and the first Unit with the Transmitting/Error indicator lit, indicating an error.



Appendix A

Standard Models

Remote I/O Units, I/O Link Units, and Optical I/O Units are available as either APF or PCF units. The model names of APF Units are the same as those of corresponding PCF Units except for the suffix “-P” added to APF Units. APF Units are identical to corresponding PCF Units in appearance, including the shape of the optical connectors. These types differ from each in the optical fiber cable they can use and the transmission distances they allow. A complete description of these differences can be found in *5-2 Optical fiber Cable* under the heading Transmission Distances.

When connecting these two types of Units to each other, be sure to use plastic-clad optical fiber cable (PCF).

Masters and Slaves

Name	Specifications		Model number
Master	For C500, C1000H, C2000H	APF/PCF	3G2A5-RM001-PEV1
		PCF	3G2A5-RM001-EV1
	For C120	APF/PCF	3G2A6-RM001-PE
		PCF	3G2A6-RM001-E
	For C200H	APF/PCF	C200H-RM001-PV1
C120 Remote I/O Rack	For mounting Remote I/O 100 VAC Master		3G2C4-SI027-E
Slave	For C500, C1000H, C2000H	w/1 optical connector (APF/PCF)	3G2A5-RT001-PEV1
		w/2 optical connectors (APF/PCF)	3G2A5-RT002-PEV1
		w/1 optical connector (PCF)	3G2A5-RT001-EV1
		w/2 optical connector (PCF)	3G2A5-RT002-EV1
	For C200H	Internal power supply APF/PCF	100 to 120 or 200 to 240 VAC
		24 VDC	C200H-RT002-P
C500 Slave Backplane	For C500, C1000H, C2000H Slave Racks		C500-BL061 C500-BL041 C500-BL031
C200H Backplane	For CPU, Expansion I/O, or Slave Rack	10-slot	C200H-BC101-V2
		8-slot	C200H-BC081-V2
		5-slot	C200H-BC051-V2
		3-slot	C200H-BC031-V2
C200H I/O Power Supply	Voltage switchable between 100 to 120 and 200 to 240 VAC		C200H-PS221
	24 VDC		C200H-PS211

C200H I/O Connecting Cable

Length: 30 cm	C200H-CN311
Length: 70 cm	C200H-CN711
Length: 2 m	C200H-CN221
Length: 5 m	C200H-CN521
Length: 10 m	C200H-CN131

I/O Link Units

Unit	Specifications		Model number
I/O Link Unit	For C500, C1000H, C2000H PCs	APF/PCF	3G2A5-LK010-PE
		PCF	3G2A5-LK010-E
C120 I/O Link Rack	For mounting I/O Link Unit	100 VAC	3G2C4-SI023-E
C20 I/O Link Unit	For P-type and K-type PC	70 cm	C20P-CN711
Connecting Cable	For C20	5 cm	3G2C7-CN501
		32 cm	3G2C7-CN311
		70 cm	3G2C7-CN711

Optical I/O Units

Unit		Specifications			Model number
Optical I/O Unit (APF/PCF)	No-voltage contact input	No-voltage contact 10 mA	8 pts.	100 VAC power supply	3G5A2-ID001-PE
	AC/DC input	12 to 24 VAC/DC 10 mA	8 pts.		3G5A2-IM211-PE
	AC input	100 VAC 10 mA	8 pts.		3G5A2-IA121-PE
	Relay contact output	250 VAC/24 VDC 2 A	8 pts.	100/200 VAC power supply	3G5A2-OC221-PE
	Transistor output	12 to 48 VDC 0.3 A	8 pts.		3G5A2-OD411-PE
	Triac output	100/200 VAC 1 A	8 pts.		3G5A2-OA222-PE
Optical I/O Unit (PCF)	No-voltage contact input	No-voltage contact 10 mA	8 pts.	100 VAC power supply	3G5A2-ID001-E
	AC/DC input	12 to 24 VAC/DC 10 mA	8 pts.		3G5A2-IM211-E
	AC input	100 VAC 10 mA	8 pts.		3G5A2-IA121-E
		200 VAC 10 mA	8 pts.	3G5A2-IA221-E	
	Relay contact output	250 VAC/24 VDC 2 A	8 pts.	100/200 VAC power supply	3G5A2-OC221-E
	Transistor output	12 to 48 VDC 0.3 A	8 pts.		3G5A2-OD411-E
	Triac output	100/200 VAC 1 A	8 pts.		3G5A2-OA222-E

Link Adapters and Repeater Units

Name	Specifications	Model number	
Link Adapter	Optical (APF/PCF), 3 connectors	3G2A9-AL002-PE	
	Optical (APF/PCF), RS-422, RS-232C 1 connector each	3G2A9-AL004-PE	
	RS-422, 3 connectors	3G2A9-AL001	
	Optical (PCF), 3 connectors	3G2A9-AL002-E	
	Optical (PCF), RS-422, RS-232C 1 connector each	3G2A9-AL004-E	
Repeater Unit	For more than 32 Remote I/O Slaves in an Optical Remote I/O System	APF/PCF	3G5A2-RPT01-PE
		PCF	3G5A2-RPT01-E

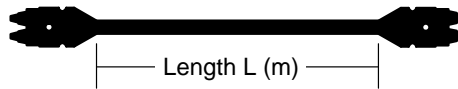
All Plastic Optical Fiber Cable (APF)

Name	Specifications	Model number
Plastic fiber optical cable	Cable only (w/o optical connector). Order in units of 5 m for cables 5 to 100 m long. For longer cables, order in units of 200 or 500 m.	3G5A2-PF002
Optical connector A	With 2 optical connectors (brown) For plastic optical fiber cable 10 m long or shorter	3G5A2-CO001
Optical connector B	With 2 optical connectors (black) For plastic optical fiber cable 8 to 20 m long	3G5A2-CO002
Plastic optical fiber set	1 m cable with optical connector A attached on both ends	3G5A2-PF101

Plastic-Clad Optical Fiber Cable (PCF)

Name	Specification		Model number
Cable for indoor use	0.1 m w/connector	Operating temperature: -10° to 70°C	3G5A2-OF011
	1 m w/connector		3G5A2-OF101
	2 m w/connector		3G5A2-OF201
	3 m w/connector		3G5A2-OF301
	5 m w/connector		3G5A2-OF501
	10 m w/connector		3G5A2-OF111
	20 m w/connector		3G5A2-OF211
	30 m w/connector		3G5A2-OF311
	40 m w/connector		3G5A2-OF411
	50 m w/connector		3G5A2-OF511
Cable for both indoor and outdoor use	10 to 500 m, w/connector (specify cable length in units of 1 m when ordering)	Operating temperature: -10° to 70°C	3G5A2-OF002
	510 to 800 m, w/connector (specify cable length in units of 1 m when ordering)	Operating temperature: 0° to 55°C (must not be exposed to sunlight)	

- Note**
- Optical cable cannot be connected as easily as ordinary wire for breaks or extensions; carefully determine lengths when placing your order.
 - Fiber length L (m)



Appendix B Specifications

Ratings

Conforms to the SYSMAC C-series PCs.

Common Characteristics

Transmission	Time-sharing, multiplexing cyclic system
Communication	Half-duplex
Transmission speed	187.5 kbps
Transmission delay	16 ms/128 bits.

Transmission Distances

Unit	For all-plastic optical fiber	For plastic-clad optical fiber
Plastic optical fiber (APF)	20 m max.	Cannot be connected
Plastic-clad optical fiber (PCF)	200 m max.	800 m max.

C120, C500, C1000H, and C2000H Remote I/O Master and Slave Units

Item	Master	Slave
Transmission points	512 pts. max. (including Special I/O Units)	512 max. (including Special I/O Units)
RUN output	None	Contact output (closed during operation) Contact capacity: 2 A 250 VAC (cosine of phase angle = 1) 2 A 24 VDC
Internal power supply	5 VDC 750 mA max.	5 VDC, 550 mA max.
Weight	500 g max.	500 g max.

C200H Remote I/O Master Units

Transmission words	Slave Racks: 50 words Optical I/O Units and I/O Link Units: 32 words
Internal power supply	5 VDC, 200 mA max.
Weight	350 g max.

C200H Remote I/O Slave Units

Slave	C200H-RT001-P	C200H-RT002-P
Power supply	100 to 120/200 to 240 VDC (switchable) 50/60 Hz	24 VDC
Allowable voltage variation	85 to 132/170 to 264 VDC	20.4 to 26.4 VDC
24-VDC output terminal	24 VDC +10%/-20%, 0.3 A max.	(not applicable)
Power consumption	100 VA max.	80 W max.
Weight	1.3 kg max.	1.3 kg max.
RUN output	Contact output: 1a contact Contact capacity: 250 VAC, 2 A (cosine of phase angle=1) 0.5A (cosine of phase angle=0.4) 24 VDC, 2 A	
Power output	5 VDC, 3 A (2.7 A actually supplied to I/O Units)	
Transmission bits	10 words per Slave	

C120 and C500 I/O Link Units

Transmission bits		32 bits (max.) Switch-selectable settings 16 input 16 output 16 input, 16 output 32 output
External outputs	RUN output	SPST-NO output (Model G6B) Contact capacity: 2 A (max.)
	Repeater output	SPST-NO output (Model G6B), for repeater signal
Internal power supply		5 V, 600 mA max
Weight		500 g max.

C20 I/O Link Units

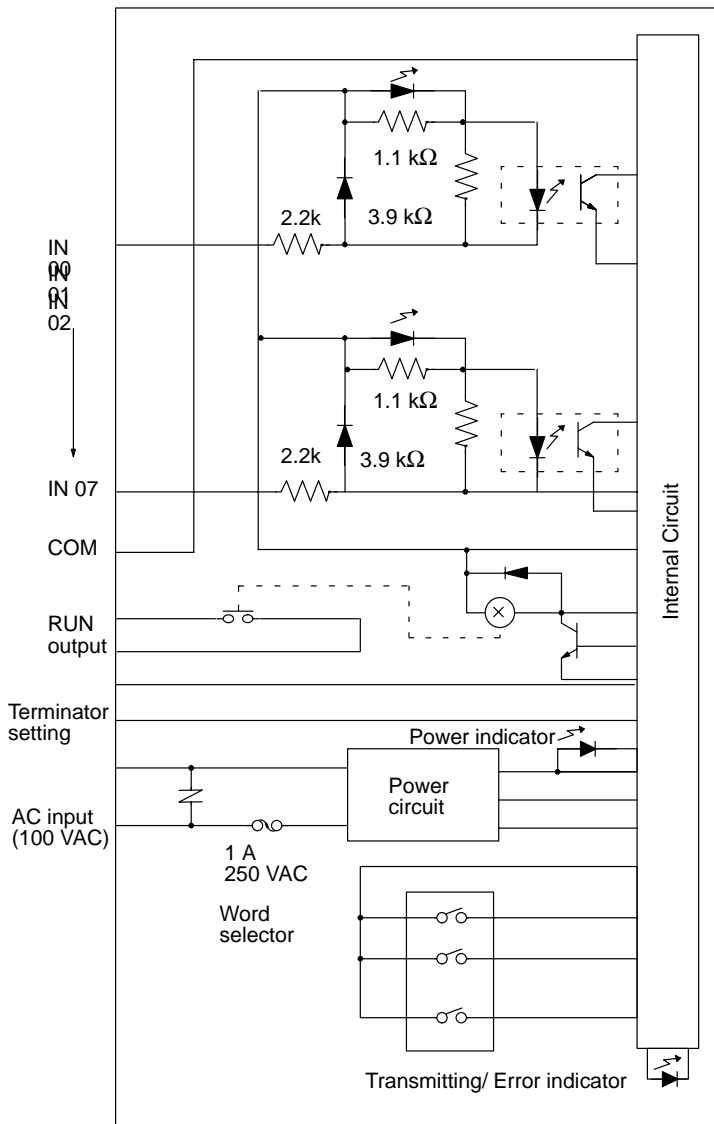
Transmission bits		32 bits 16 input, 16 output
External outputs	RUN output	SPST-NO output (Model G6B) Contact capacity: 2 A (max.)
	Repeater output	SPST-NO output (Model G6B), for repeater signal
Supply voltage		100 to 120/200 to 240 VAC 50/60 Hz
Operating voltage range		85 to 132/ 170 to 264 VAC
Power consumption		15 VA max.
Insulation resistance		10 M Ω min. (at 500 VDC) between AC terminals and housing
Dielectric strength		2,000 VAC 50/60 Hz for 1 minute (between AC terminals and housing)
Noise immunity		1,000 V p-p, pulse width: 100 ns to 1 μ s, rise time: 1 ns
Vibration		10 to 35 Hz, 2 mm double amplitude, in X, Y, and Z directions, 2 hours each
Shock		98 m/s ² in X, Y, and Z directions, 3 times each
Ambient temperature		Operating: 0° to 55°C; Storage: -20° to 65°C
Environment		No corrosive gas
Humidity		35% to 85% (without condensation)
Grounding		Less than 100 Ω
Structure		IEC IP-30 (mounted in a panel)
Weight		1 kg max.
Dimensions		120 (W) x 250 (H) x 43 (D)

Optical I/O Units

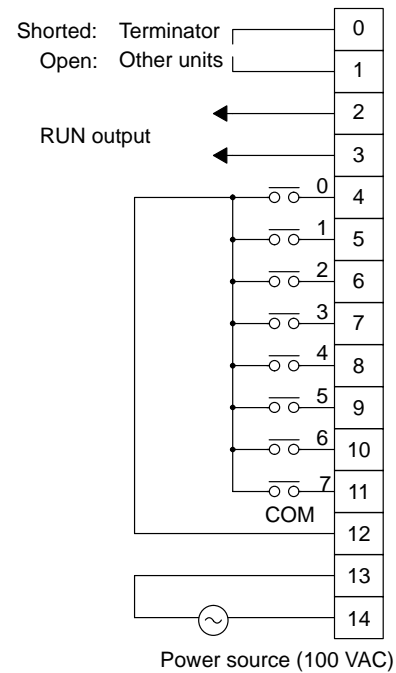
Transmission bits		8 bits (max.)
RUN output		Contact output, SPST-NO (Model G6B) (closed during operation) Contact capacity: 250 VAC 2 A (cosine of phase angle=1) (C200H: 0.5 A (cosine of phase angle = 0.4)) 24 VDC, 2 A
Power supply voltage		Refer to each Unit's specifications.
Weight		

No-voltage Contact Optical Input Units

Item	3G5A2-ID001-(P)E
Input voltage	No-voltage contacts
Input impedance	---
Input current	10 mA typical.
ON delay time	10 ms max.
OFF delay time	15 ms max.
No. of circuits	8 pts. (per common)
ON voltage	---
OFF voltage	---
Power supply voltage	100 VAC 50/60 Hz
Power consumption	25 VA max.
Weight	580 g max.



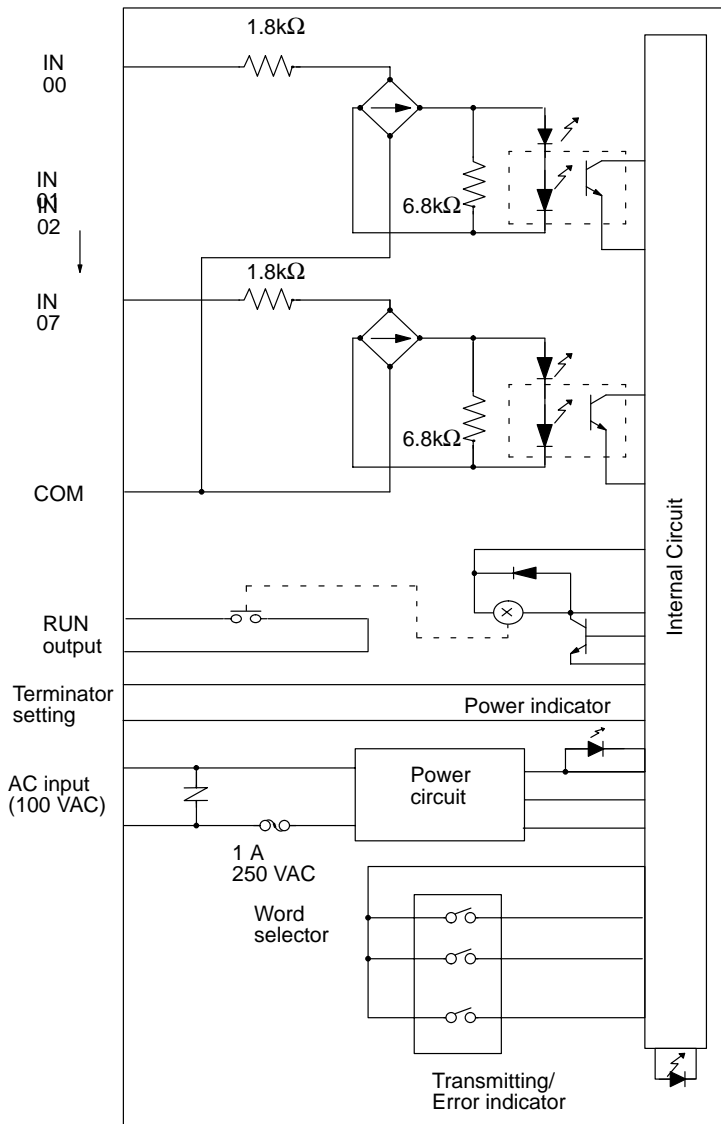
Circuit Configuration



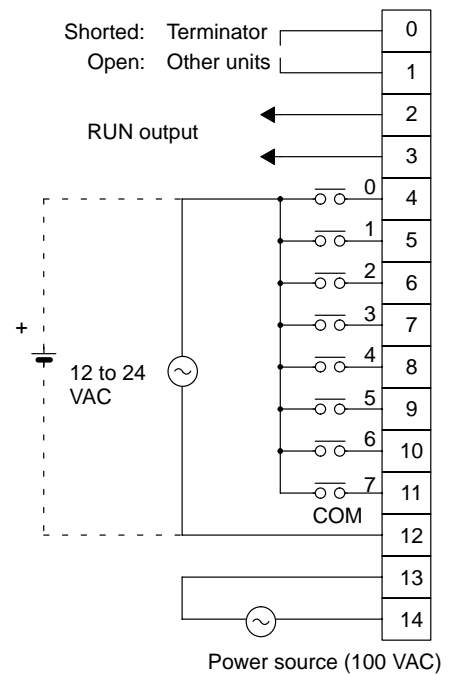
Terminal Connections

AC/DC Optical Input Units

Item	3G5A2-IM211-(P)E
Input voltage	12 to 24 VAC/DC +10%/-15%
Input impedance	1.8 kΩ
Input current	10 mA typical (at 24 VDC)
ON delay time	10 ms max.
OFF delay time	15 ms max.
No. of circuits	8 pts. (per common)
ON voltage	10.2 VDC min.
OFF voltage	3.0 VDC max.
Power supply voltage	100 VAC 50/60 Hz
Power consumption	20 VA max.
Weight	580 g max.



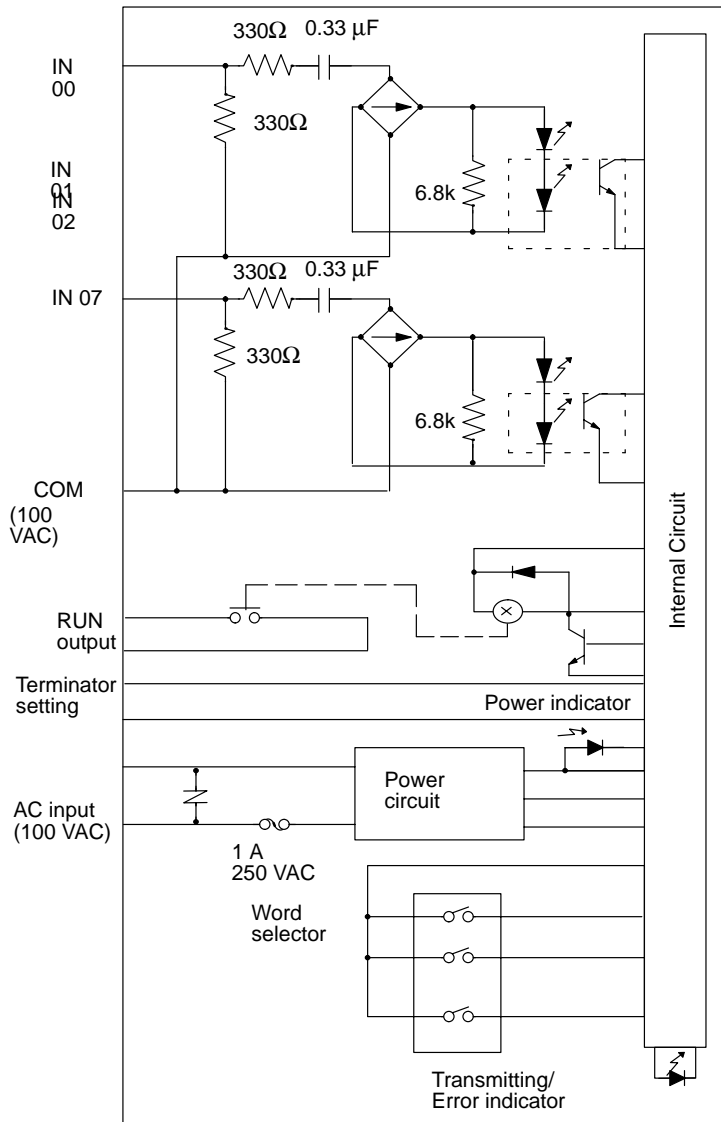
Circuit Configuration



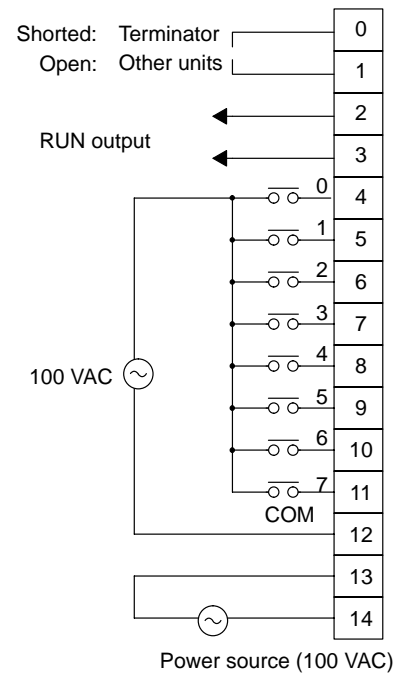
Terminal Connections

AC Optical Input Units

Item	3G5A2-IA121-(P)E
Input voltage	100 VAC +10%/-15% 50/60 Hz
Input impedance	9.7 kΩ (50 Hz) 8 kΩ (60 Hz)
Input current	10 mA typical (at 100 VAC)
ON delay time	10 ms max.
OFF delay time	15 ms max.
No. of circuits	8 pts. (per common)
ON voltage	60 VAC min.
OFF voltage	20 VAC max.
Power supply voltage	100 VAC 50/60 Hz
Power consumption	20 VA max.
Weight	580 g max.



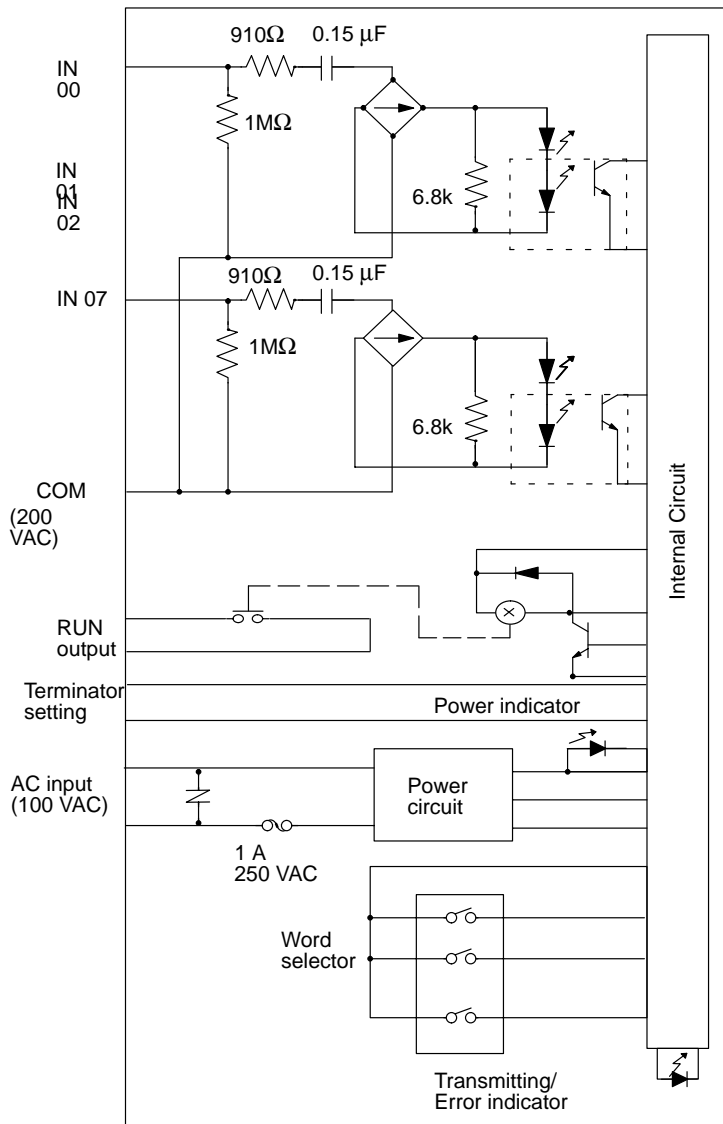
Circuit Configuration



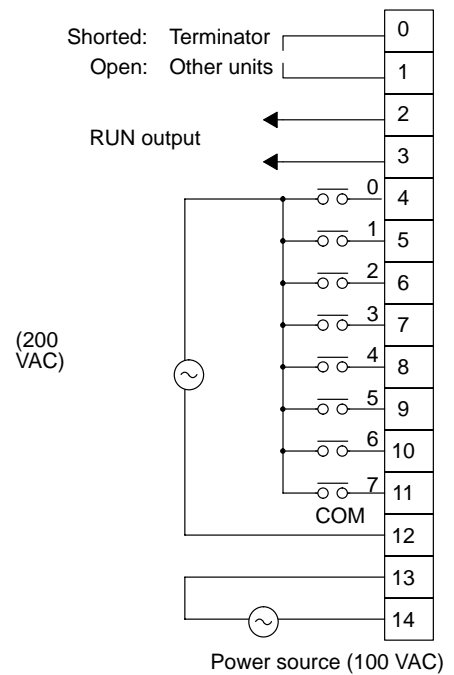
Terminal Connections

AC Optical Input Units

Item	3G5A2-IA221-(P)E
Input voltage	200 VAC +10%/-15% 50/60 Hz
Input impedance	22 kΩ (50 Hz) 18 kΩ (60 Hz)
Input current	10 mA typical (at 100 VAC)
ON delay time	10 ms max.
OFF delay time	15 ms max.
No. of circuits	8 pts. (per common)
ON voltage	120 VAC min.
OFF voltage	40 VAC max.
Power supply voltage	100 VAC 50/60 Hz
Power consumption	20 VA max.
Weight	600 g max.



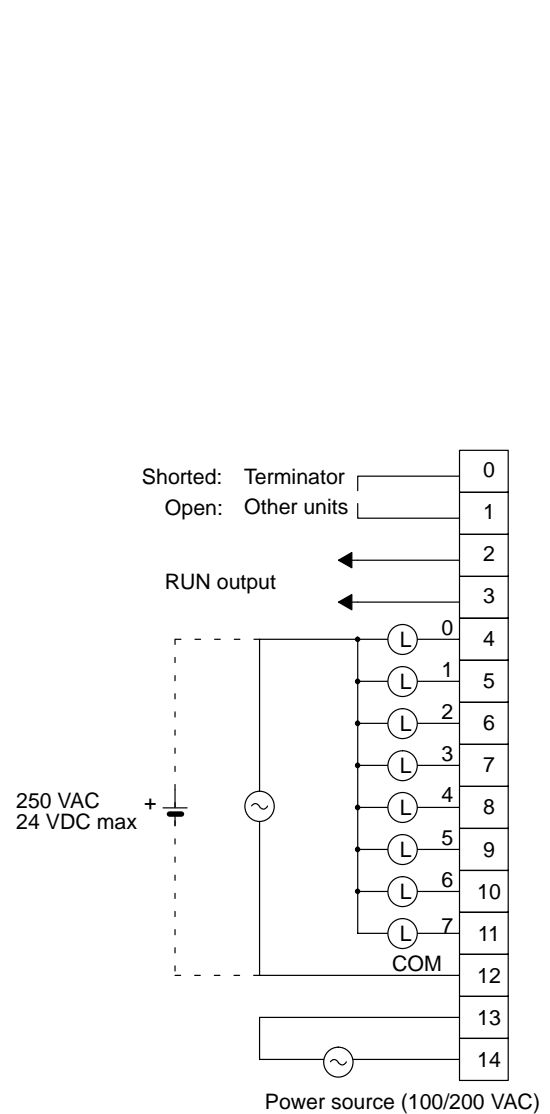
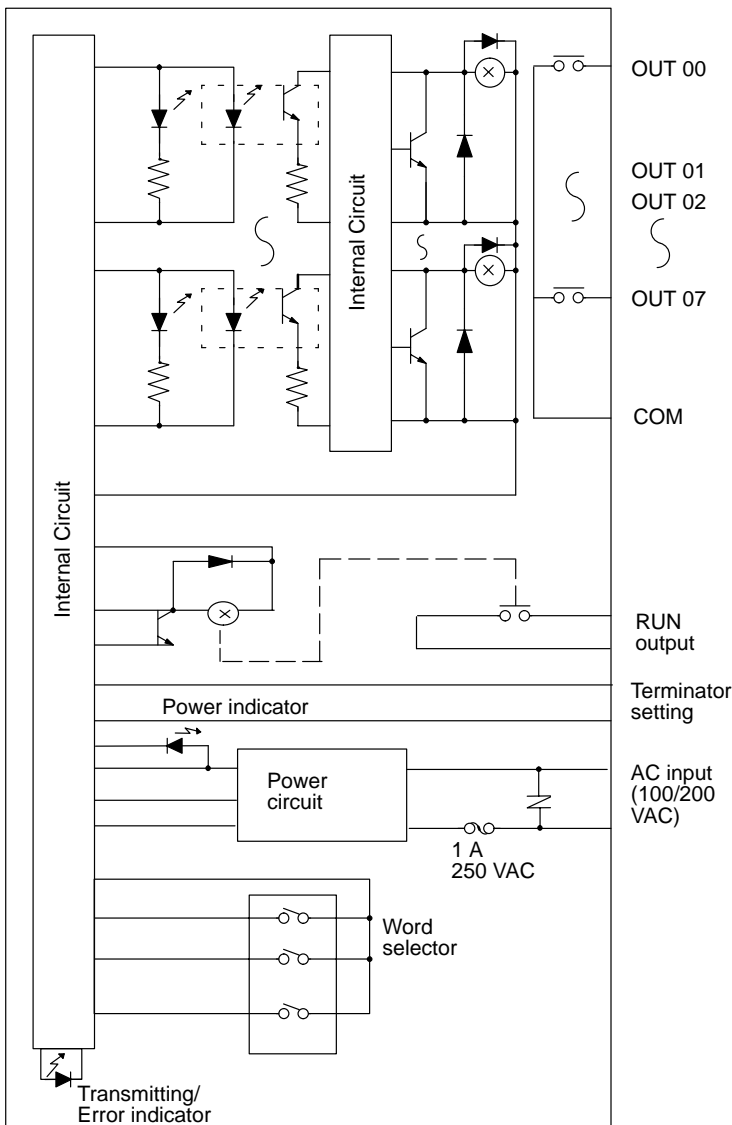
Circuit Configuration



Terminal Connections

Contact Optical Output Units

Item	3G5A2-OC221-(P)E
Max. switching capacity	Resistive: 2 A 250 VAC (cosine of phase angle = 1) 2 A 24 VDC Inductive: 0.5 A 250 VAC (cosine of phase angle = 0.4)
Min. switching capacity	100 mA 5 VDC
ON delay time	15 ms max.
OFF delay time	15 ms max.
No. of circuits	8 pts. (per common)
Service life	Electrical: 300,000 operations (resistive load) 100,000 operations (inductive load) Mechanical: 50,000,000 operations
Power supply voltage	100/200 VAC 50/60 Hz
Power consumption	20 VA max.
Weight	600 g max.

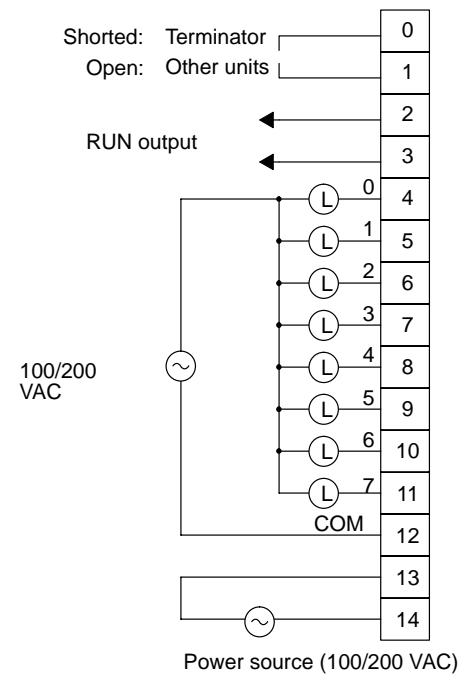
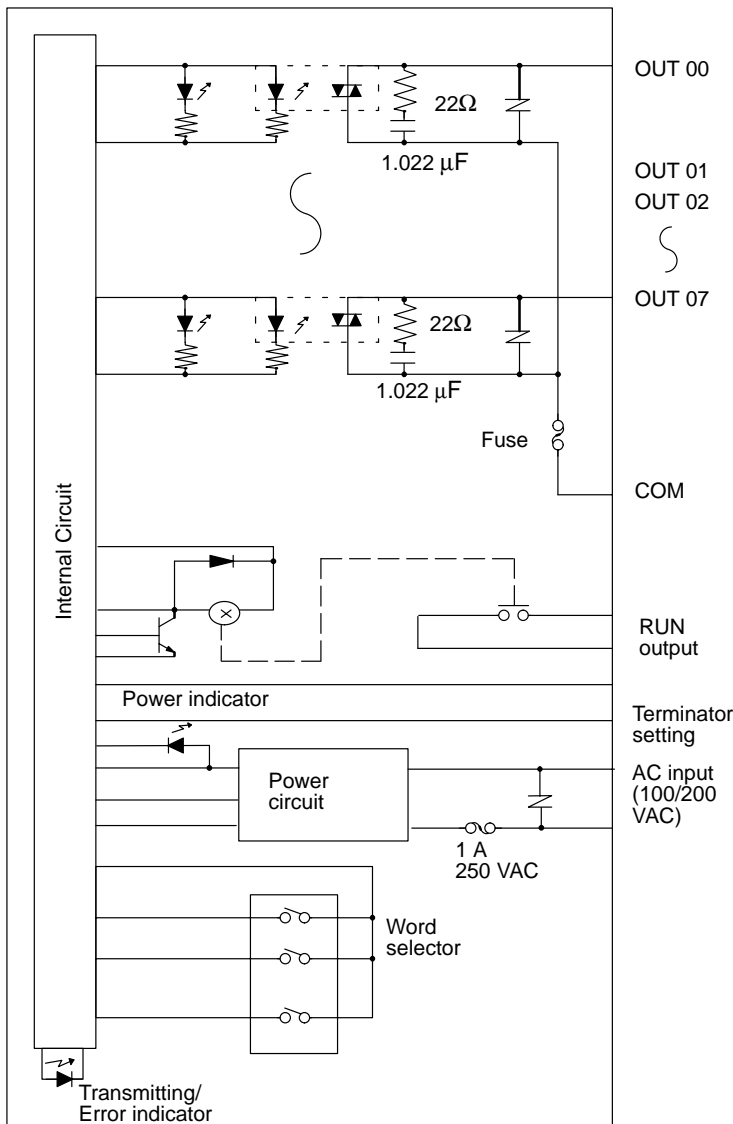


Circuit Configuration

Terminal Connections

Triac Optical Output Units

Item	3G5A2-OA222-(P)E
Max. switching capacity	100/200 VAC +10%/-15%, 1 A 50/60 Hz
Min. switching capacity	10 mA, 100 VAC
Leakage current	3 mA max. (at 100 VAC)
Saturation voltage	1.2 V max.
ON delay time	1 ms max.
OFF delay time	Max. 1/2 of load frequency
No. of circuits	8 pts. (per common)
Fuse capacity	250 V, 5 A
Power supply voltage	100/200 VAC 50/60 Hz
Power consumption	20 VA max.
Weight	600 g max.

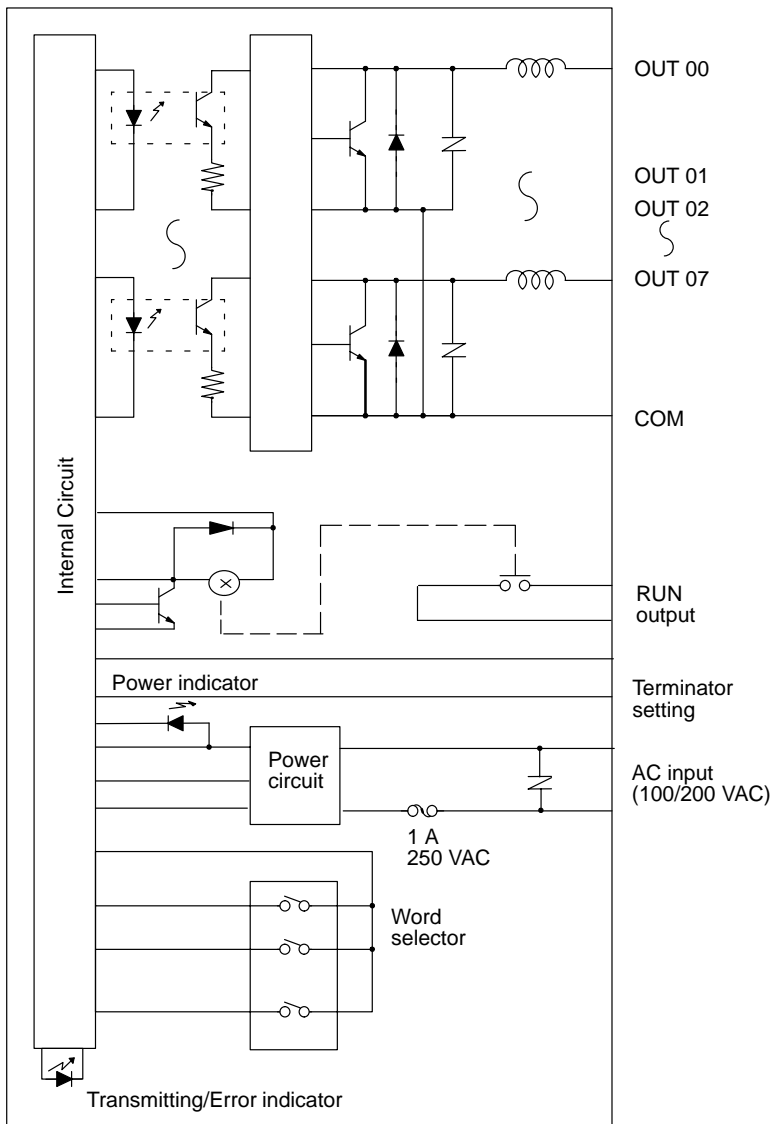


Circuit Configuration

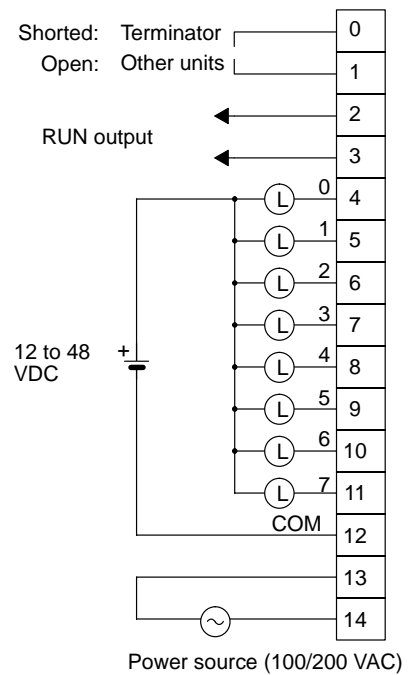
Terminal Connections

Transistor Output Units

Item	3G5A2-OD411-(P)E
Max. switching capacity	12 to 48 VDC +10%/-15%, 0.3 A
Min. switching capacity	---
Leakage current	100 μ A max.
Saturation voltage	1.5 V max.
ON delay time	0.2 ms max.
OFF delay time	0.3 ms max.
No. of circuits	8 pts. (per common)
Fuse capacity	Fuse not provided.
Power supply voltage	100/200 VAC 50/60 Hz
Power consumption	20 VA max.
Weight	600 g max.



Circuit Configuration



Terminal Connections

Appendix C

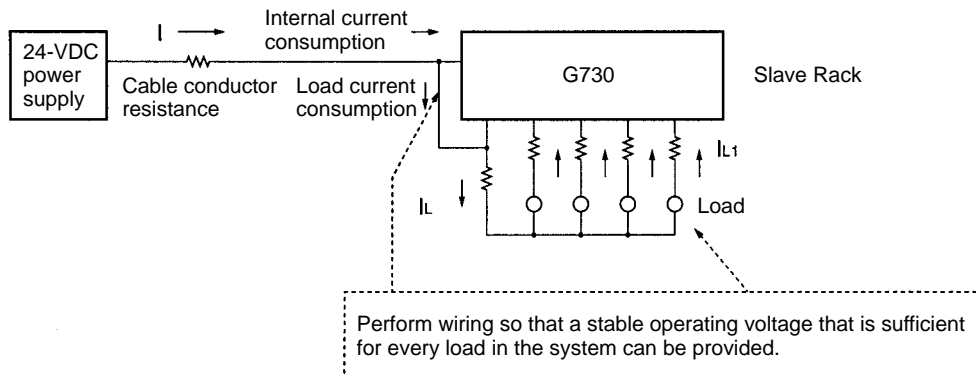
Power Supply Wiring Precautions

Voltage Drop

If the wiring distance for the power supply to a Slave Rack in a SYSMAC BUS Remote I/O System is too long, there will be a voltage drop that may result in the power supply becoming insufficient for the Slave Rack load. Design the system so that a stable power supply can be provided for all Slave Racks.

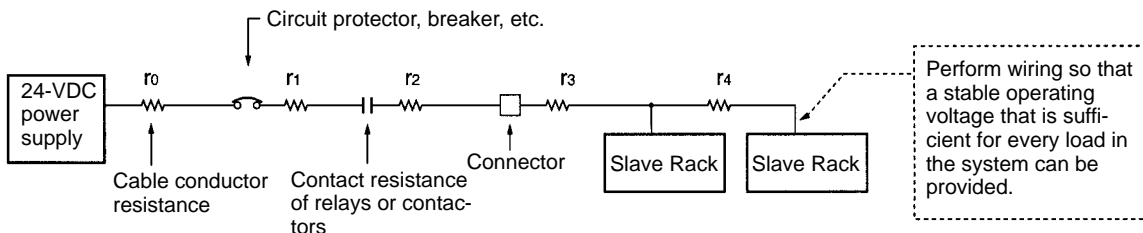
Slave Rack Power Supply

Cable conductor resistance and line current will cause voltage drops in the cables used for supplying power to Slave Racks. In the kind of system shown below, the current consumption for the Slave Rack load, as well as its internal current consumption, will add to the line current and further contribute to a voltage drop. Use cable sizes and wiring distances so that final voltages for all Slave Racks will stay within the allowable voltage variation ranges.



Resistance of Other Devices

In systems where devices such as circuit protectors, contactors, connectors, and fuses are used between Racks, the internal and contact resistances of the devices will also contribute to voltage drop (in addition to the voltage drop caused by cable conductor resistance). Allow for these resistances when designing the system.

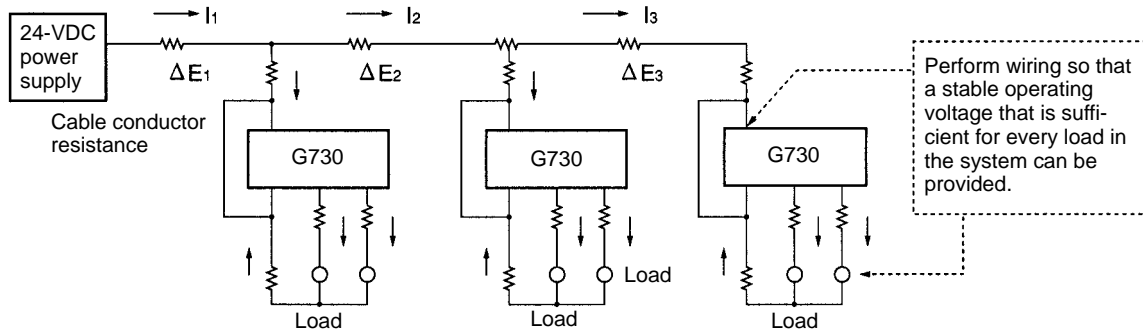


Note The conductor resistance and allowable current of cables will vary with their cross-sectional area, material, structure, and the ambient temperature. Select cables for the system after confirming the cable specifications in the relevant catalogs.

Power Supply Arrangement

Supplying Power for I/O Altogether

When designing systems where power is supplied for all I/O from the same power supply, it is necessary to consider the power consumption for each load and each Rack's internal power consumption. Use cable sizes so that voltages for all loads and Racks in the system will stay within the allowable voltage variation ranges.



Arranging I/O Power Supply

When deciding whether to supply power for I/O from just one point or several points, observe the points below.

Several Power Supplies

When using more than one power supply, the power supplies can be placed at various points in the system (rather than grouping all the power supplies together) to reduce line current, and consequently, the voltage drop.

One Power Supply

When using only one power supply, observe the following points to limit voltage drop and thereby keep the voltage within the allowable range:

- Use sufficiently thick cables.
- Raise the output voltage of the power supply.
- Make the wiring distances as short as possible.

Power Failures

It is necessary to decide how the system should operate in the event of a power failure. Choose one of the following:

- A system where all operation is stopped if one power supply fails.
- A system where operation can be continued in the event of a power failure in one power supply, by the provision of several power supplies at various points in the system.

Cost

When designing a system, also consider factors that will affect the overall cost, such as the number of power supplies, the thickness and length of cables, and wiring costs.

Appendix D

Using the C200H-RM001-PV1 with CS1-series PCs

Memory Allocation

When using the C200H-RM001-PV1 Master Unit with a CS1-series PC, there are differences in memory allocation for the following areas (details given in *Data Configuration* below):

- SYSMAC BUS Area
- Optical I/O Unit and I/O Terminal Area.

Data Configuration

SYSMAC BUS Area (Slave Rack Allocation)

The SYSMAC BUS Area contains 50 words with addresses ranging from CIO 3000 to CIO 3049. Each C200H Slave Rack is allocated 10 words based on the Rack's rack number (No. 0 to 4). From these 10 words, one word (16 bits) is allocated to each slot in the Slave Rack from left (i.e., from the slot furthest away from the Slave) to right. Allocations are fixed by slot, i.e., if there is no Unit in a slot, the word normally allocated to that slot will not be used.

- Note**
1. The words are allocated according to rack numbers even when two Master Units are being used.
 2. If C500 Slaves (C500-RT201) are used, they are allocated twice the number of words allocated to C200H Slaves (20 words). Any two non-consecutive numbers between 0 and 3 can be set as rack numbers in this case.

Rack number	Allocated words	
	CS1	C200H/HX/HG/HE/HS
0	CIO 3000 to CIO 3009	IR 050 to IR 059
1	CIO 3010 to CIO 3019	IR 060 to IR 069
2	CIO 3020 to CIO 3029	IR 070 to IR 079
3	CIO 3030 to CIO 3039	IR 080 to IR 089
4	CIO 3040 to CIO 3049	IR 090 to IR 099

Optical I/O Unit and I/O Terminal Area (Allocation for Slaves other than Slave Racks)

The Optical I/O Unit and I/O Terminal Area contains 32 words with addresses ranging from CIO 3100 to CIO 3131. Each Slave is allocated 1 word based on its unit number setting (0 to 31) except for Optical I/O Units, which are allocated 2 words each.

- Note** The words are allocated according to unit numbers even when two Master Units are being used.

Unit number	Allocated words	
	CS1	C200H/HX/HG/HE/HS
0	CIO 3100	IR 200
1	CIO 3101	IR 201
to	to	to
31	CIO 3131	IR 231

- Note** When there are two Masters mounted to the CPU Rack, make settings so that the same words are not allocated to two different Slaves.

Related Flags in Auxiliary Area (AR Area and SR Area)

CS1		Description	Corresponding flag in C200H/HX/HG/HE/HS
Name	Address		
SYSMAC BUS Error Flag (Non-fatal error)	A40205	ON when an error occurs in a data transfer in the SYSMAC BUS system. The number of the Master involved is indicated with bits A40500 and A40501.	SR 25312
SYSMAC BUS Master Error Flags	A40500 to A40501	When a transmission error occurs in the SYSMAC BUS system, the flag for the affected Master Unit will be turned ON. A40500: Flag for Master Unit #0 A40501: Flag for Master Unit #1	SR 25104 to SR 25115
Slave Number of SYSMAC Bus Error After Startup	A42504 to A42506	When there is an error in a Slave Rack, these bits contain the Slave's unit number.	AR 0200 to AR 0204 (Slave Rack Error Flags) Each flag corresponds to a rack number (0 to 4)
	A42504 only	When there is an error in an Optical I/O Unit (excluding Slave Racks), the status of A42504 (0 or 1) indicates whether the unit is high or low.	SR 25103 (Remote I/O Error Flag) The status of the flags in AR 03 to AR 06 indicate whether the unit is high or low.
	A42508 to A42515	When there is an error in a Slave Rack, this byte contains the 2-digit hexadecimal unit number of the Master to which the Slave is connected. (0xB0 for Master Unit 0, 0xB1 for Master Unit 1)	AR 0015: Flag for Master Unit #0 AR 0014: Flag for Master Unit #1
		When there is an error in an Optical I/O Unit, this byte contains the 2-digit hexadecimal unit number (00 to 1F, or 0 to 31 decimal).	AR 03 to AR 06 Each flag corresponds to a unit number and letter (L or H).
SYSMAC BUS Slave Number Refresh Bit	A50900	Turn this bit ON to refresh the error information in A425 (unit number of Slave where error occurred after startup).	SR 25100

CIO Area Allocation

The CIO Area is not used.

DM Area Allocation

The DM Area is not used.

Settings and Operation

Initial Settings (Hardware Settings)

- Mount a Master to a CS1 CPU Rack, a C200H Expansion I/O Rack, or a CS1 Expansion Rack. (Do not mount to a SYSMAC BUS Slave Rack.) In a basic system, up to two Masters can be mounted. There are no restrictions on the mounting position.
- Using the unit number selector on the front side of the Master, set the Master unit number and specify whether to continue or stop operation in the event of a transmission error.
- For each Slave Rack, set the rack number, set whether to clear or retain data during transmission errors, and set the type of Master connected.
- Set the unit number for each Remote I/O Unit.
- Wire the system using 2-core cable or optical fiber as required.
- Set the terminators.
- Connect the Programming Device to the PC.
- Turn ON power for the Slave Racks and the Remote I/O Units.
- Turn ON power for the PC.
- Create I/O tables.

Ladder Program

No settings required.

Glossary

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. Backplanes also provide connectors used to connect them 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.
basic Link System	A control system that includes only one of the following systems: Remote I/O System, PC Link System, Host Link System, or Net Link System.
branch line	A communications line leading from a Link Adapter to any but the terminators in a Link System.
Branching Link Adapter	A Link Adapter used to branch connections to Units in a Link System. Used either to prevent the entire System from shutting down for an interruption at only one point in the System or to enable connecting more than two Units in one System when each Unit supports only one connector.
building-block PC	A PC that is constructed from individual components, or "building blocks." With building-block PCs, there is no one Unit that is independently identifiable as a PC. The PC is rather a functional assembly of components.
combined Link System	A control system that includes more than one of the following systems: Remote I/O System, PC Link System, Host Link System, or Net Link System.
Control System	All of the hardware and software components used to control other devices. A Control System includes the PC System, the PC programs, and all I/O devices that are used to control or obtain feedback from the controlled system.
controlled system	The devices that are being controlled by a PC System.
Converting Link Adapter	A Link Adapter used to convert between different types of optical fiber cable, different types of wire cable, or between optical fiber cable and wire cable. Such conversion is necessary to connect Units that use different forms of communication.
CPU	An acronym for central processing unit. In a PC System, the CPU executes the program, processes I/O signals, communicates with external devices, etc.
CPU Backplane	A Backplane used to create a CPU Rack.
CPU Rack	Part of a building-block PC, the CPU Rack contains the CPU, a Power Supply, and other Units. With most PCs, the CPU Rack is the only Rack that provides linkable slots.
data area	An area in the PC's memory that is designed to hold a specific type of data, e.g., the LR area is designed for to hold common data in a PC Link System.
distributed control	A automation concept in which control of each portion of an automated system is located near the devices actually being control, i.e., control is decentralized and 'distributed' over the system. Distributed control is a concept basic to PC Systems.
electrical noise	Electrical 'static' that can disturb electronic communications. The 'snow' that can appear on a TV screen is an example of the effects of electrical noise.

Expansion I/O Backplane	A Backplane used to create an Expansion I/O Rack.
Expansion I/O Rack	Part of a building-block PC, an Expansion I/O Rack is connected to either a CPU Rack or Slave Rack to increase the number of slots available for mounting Units.
I/O Block	Either an Input Block or an Output Block. It provides mounting positions for replaceable relays.
I/O capacity	The number of inputs and outputs that a PC is able to handle. This number ranges from around one-hundred for smaller PCs to two-thousand for the largest ones.
I/O Control Unit	A Unit mounted to the CPU Rack in certain PCs to monitor and control I/O points on Expansion I/O Units.
I/O devices	The devices to which terminals on I/O Units, Special I/O Units, or Intelligent I/O Units are connected. I/O devices may be either part of the Control System, if they function to help control other devices, or they may be part of the controlled system.
I/O Interface Unit	A Unit mounted to an Expansion I/O Rack in certain PCs to interface the Expansion I/O Rack to the CPU Rack.
I/O Link	Created in an Optical Remote I/O System to enable input/output of one or two IR words directly between PCs. The words are input/output between the PC controlling the Master and a PC connected to the Remote I/O System through an I/O Link Unit or an I/O Link Rack.
I/O Link Rack	A Rack used with certain PCs (e.g., C120) to mount an I/O Link Unit.
I/O Link Unit	A Unit used with certain PCs to create an I/O Link in an Optical Remote I/O System.
I/O point	The place at which an input signal enters the PC System or an output signal leaves the PC System. In physical terms, an I/O point corresponds to terminals or connector pins on a Unit; in terms of programming, an I/O point corresponds to an I/O bit in the IR area.
I/O Terminal	A Remote I/O Unit connected in a Wired Remote I/O Subsystem to provide up to sixteen I/O points at one location. I/O Terminals provide fixed transistor inputs or outputs.
I/O Unit	The most basic type of Unit mounted to a backplane to create a Rack. 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.
Input Block	A Unit used in combination with a Modular Remote Terminal. An Input Block provides mounting positions for replaceable relays. Each relay can be selected according to specific input requirements.
Input Remote Terminal	A Remote Terminal that provides input points.
Link Adapter	A Unit used to connect communications lines, either to branch the lines or to convert between different types of cable. There are two types of Link Adapter: Branching Link Adapters and Converting Link Adapters.
link	A hardware or software connection formed between two Units. "Link" can refer either to a part of the physical connection between two Units (e.g., optical links in

	Wired Remote I/O Systems) or a software connection created to data existing at another location (Network Data Links).
linkable slot	A slot on either a CPU or Expansion I/O Backplane to which a Link Unit can be mounted. Backplanes differ in the slots to which Link Units can be mounted.
Link System	A system that includes one or more of the following systems: Remote I/O System, PC Link System, Host Link System, or Net Link System.
Link Unit	Any of the Units used to connect a PC to a Link System. These are Remote I/O Units, I/O Link Units, PC Link Units, Host Link Units, and Net Link Units.
main line	In a Link System connected through Branching Link Adapters, the communications cable that runs from the Unit at each end of the System through the Link Adapters.
Master	Short for Remote I/O Master Unit.
noise interference	Disturbances in signals caused by electrical noise.
Optical Slave Rack	A Slave Rack connected through an Optical Remote I/O Slave Unit.
Optical I/O Unit	A Unit that is connected in an Optical Remote I/O System to provide 8 I/O points. Optical I/O Units are not mounted to a Rack.
optical cable link	In a Wired Remote I/O System, an optical cable connecting two Converting Link Adapters. Specified because the System otherwise uses wire communications.
optical communications	A communications method in which signals are sent over optical fiber cable to prevent noise interference and increase transmission distance.
optical fiber cable	Cable made from light conducting filaments used to transmit signals.
Output Block	A Unit used in combination with a Modular Remote Terminal. An Output Block provides mounting positions for replaceable relays. Each relay can be selected according to specific output requirements.
Output Remote Terminal	A Remote Terminal that provides output points.
PC	An acronym for Programmable Controller.
PC System	With building-block PCs, all of the Racks and independent Units connected directly to them up to, but not including the I/O devices. The limits of the PC System on the upper end is the PC and the program in its CPU and on the lower end, I/O Units, Special I/O Units, Optical I/O Units, Remote Terminals, etc.
peripheral device	Devices connected to a PC System to aid in system operation. Peripheral devices include printers, programming devices, external storage media, etc.
printed circuit board	A board onto which electrical circuits are printed for mounting into a computer or electrical device.
Programmable Controller	A computerized device that can accept inputs from external devices and generate outputs to external devices according to a program held in memory. Programmable Controllers are used to automate control of external devices. Although single-unit Programmable Controllers are available, building-block Programmable Controllers are constructed from separate components. Such Pro-

	grammable Controllers are formed only when enough of these separate components are assembled to form a functional assembly, i.e., there is no one individual Unit called a PC.
programming device	A peripheral device used to input a program into a PC or to alter or monitor a program already held in the PC. There are dedicated programming devices, such as Programming Consoles, and there are non-dedicated devices, such as a host computer.
Rack	An assembly of various Units on a Backplane that forms a functional unit in a building-block PC System. Racks include CPU Racks, Expansion I/O Racks, I/O Racks, and Slave Racks.
relay-based control	The forerunner of PCs. In relay-based control, groups of relays are wired to each other to form control circuits. In a PC, these are replaced by programmable circuits.
Remote I/O Master Unit	The Unit in a Remote I/O System through which signals are sent to all other Remote I/O Units. The Remote I/O Master Unit is mounted either to a CPU Rack or an Expansion I/O Rack connected to the CPU Rack. Remote I/O Master Unit is generally abbreviated to simply "Master."
Remote I/O Slave Unit	A Unit mounted to a Backplane to form a Slave Rack. Remote I/O Slave Unit is generally abbreviated to simply "Slave."
Remote I/O Subsystem	A Master and all of the Remote I/O Units connected in series to it. A Remote I/O Subsystem exists when more than one Master is mounted to a PC. If Subsystems exist, the System is considered a Multilevel Remote I/O System.
Remote I/O System	A system in which remote I/O points are controlled through a Master mounted to a CPU Rack or an Expansion I/O Rack connected to the CPU Rack.
Remote I/O Unit	Any of the Units in a Remote I/O System. Remote I/O Units include Masters, Slaves, Optical I/O Units, I/O Link Units, and Remote Terminals.
Remote Terminal	A Remote I/O Unit connected in a Wired Remote I/O Subsystem to provide up to sixteen I/O points at one location. Remote Terminals feature replaceable relays that can be individually changed to meet specific I/O requirements.
series	A wiring method in which Units are wired consecutively in a string. In Link Systems wired through Link Adapters, the Units are still functionally wired in series, even though Units are placed on branch lines.
Slave	Short for Remote I/O Slave Unit.
Slave Rack	A Rack containing a Remote I/O Slave Unit and controlled through a Remote I/O Master Unit. Slave Racks are generally located away from the CPU Rack.
slot	A position on a Rack (Backplane) to which a Unit can be mounted.
Special I/O Unit	A dedicated Unit that is designed for a specific purpose. Special I/O Units include Position Control Units, High-speed Counter Units, Analog I/O Units, etc.
switching capacity	The voltage/current that a relay can switch on and off.
system configuration	The arrangement in which Units in a System are connected.
transmission distance	The distance that a signal can be transmitted.

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 end with the word Unit, not all do, e.g., a Remote Terminal is referred to in a collective sense as a Unit. Context generally makes any limitations of this word clear.
unit number	A number assigned to some Link Units and Special I/O Units to assign words and sometimes other operating parameters to it.
wire communications	A communications method in which signals are sent over wire cable. Although noise resistance and transmission distance can sometimes be a problem with wire communications, they are still the cheapest and the most common, and perfectly adequate for many applications.
Wired Slave Rack	A Slave Rack connected through a Wired Remote I/O Slave Unit.
work word	A word that can be used for data calculation or other manipulation in programming, e.g., LR words not used in a PC Link or Net Link System.

Index

A

Abbreviations, model numbers,
applications, precautions,

B

block diagrams
I/O Link Units,
Optical I/O Units,
Remote I/O Master Units,
Remote I/O Master Units (C200H),
Remote I/O Slave Units,
Remote I/O Slave Units (C200H),

C

C1000H, and C2000H Systems
configuration,
response time,
C120 Systems, configuration,
C20 Systems, configuration,
C200H Remote I/O Slave Racks,
C200H Systems
configuration,
I/O Link Unit words in,
response time,
word allocation in,
C500 Systems
configuration,
response time,
cable
optical fiber, transmission distance,
types of optical fiber,
CPU WAIT'G,

D

delay time, in C500 Remote I/O Systems, ,
dimensions
C500 CPU Racks,
Expansion I/O Racks, ,
I/O Link Units,
Optical I/O Units,
Remote I/O Master Units,
Remote I/O Master Units (C200H),
Remote I/O Racks,
Remote I/O Slave Units,
Slave Racks, C200H,

E

error processing,
errors
AR area flags,
Error Check bit, , ,
error numbers and restart flags (C200H),
locating
in C1000H, or C2000H Systems,
in C120 or C500 Systems,
in C200H Systems,
transfer errors,
monitoring
using SR and AR bits in C200H, ,
using SR bits in C1000H, and C2000H,
using SR bits in C120 or C500,
Remote I/O Error flag, , ,
SR area flags,
word duplication flags,
Example, C200H Basic System Configuration,

I

I/O Link Rack, dimensions,
I/O Link Racks,
for C120,
unit and housing assembly,
I/O Link Unit
definition,
dimensions,
power supply terminals (C20),
I/O Link Units
block diagram,
channel settings,
dimensions,
indicators,
nomenclature,
operation, ,
switch settings for,
switches,
terminals,
transmission points setting for,
word allocation,
words in C200H Systems,
I/O points, maximum per System,
I/O word allocation
for C1000H, and C2000H Systems,
for C200H Slaves connected to other PCs,
for C200H System with C200H Slaves,
for C200H System with C200H Slaves and Expansion I/O
Racks,
for C200H System with C500 Slaves,
for C200H System with I/O Link Unit Connection to other
PC,
for C200H System with Optical Transmitting I/O Units,
for C500 Master with Optical Transmitting I/O Units,

for C500 Master with Slaves,
for C500 Master, Slaves, I/O Link Units, I/O Units,
for C500 Master, Slaves, Optical I/O Units,
for complex C200H System configuration,
for Optical I/O Units,
setting order,

indicators

I/O Link Units,
Optical I/O Units, ,
Remote I/O Master Units,
Remote I/O Master Units (C200H),
Remote I/O Slave Units,
Remote I/O Slave Units (C200H),

installation, precautions,

L

Link Adapter,
branching,

Link Adapters, ,

N

noise interference, reduction by Remote I/O System,

nomenclature, Optical I/O Units,

O

operating environment, precautions,

optical fiber cable,
handling of,
ordering and assembling APF cable,
transmission distance,
types and functions of,

Optical I/O Units

assigning word numbers for,
block diagram,
dimensions,
error flags for word duplication,
indicators,
maximum number of for C200H,
nomenclature,
switch setting for,
switches,
terminals,
terminator settings for,
unit components,
word settings for,

Optical Remote I/O System

advantages,
branchline,
mainline,
overview,
using Link Adaptors,

Optical Remote I/O Systems, definitions of types,

P

power supply, terminals
C20 I/O Link Unit,
C200H Slaves,

precautions,
applications,
general,
operating environment,
safety,

programming, simplification by Remote I/O System,

Programming Console
displays, CPU WAIT'G,
entering I/O table through,

protection, against complete system failure,

R

rack numbers, ,

Remote I/O Master Units

block diagram, ,
dimensions, ,
indicators, ,
switch settings (C200H),
switches,
switches and RUN output terminals,
unit components, ,
Unit numbers (C200H),

Remote I/O Racks,

dimensions,
unit and housing assembly,

Remote I/O Slave Units

allocating word numbers for,
block diagram, ,
C200H Slaves in other PC Systems,
dimensions,
indicators, ,
mounting to rack,
switch settings, ,
switch settings (C200H),
switches and RUN output terminals,
terminals (C200H),
unit components, ,
Unit numbers,

Remote I/O Subsystem,

Remote I/O System

Multilevel System,
overview,

response time

C1000H, and C2000H Systems,
C200H Systems,
C500 Systems,

S

safety precautions. *See* precautions

self-diagnosis,

Slave Racks, C200H,

Special I/O Units
 and word allocation in C200H Systems,
 in C200H Systems,

specifications,

switch settings
 I/O Link Units,
 Optical I/O Units,
 Remote I/O Master Units (C200H),
 Remote I/O Slave Units,
 Remote I/O Slave Units (C200H),

switches
 I/O Link Units,
 Optical I/O Units,
 Remote I/O Master Units,
 Remote I/O Master Units (C200H),
 Remote I/O Slave Units,

system configuration
 basic,
 C1000H, and C2000H Systems,
 I/O Link Units, Slaves, Optical I/O Units,
 Link Units,
 Master and Slaves,
 Optical I/O Units,
 Slaves and Optical I/O Units,
 C120 Systems,
 I/O Link Units,
 I/O Link Units, Slaves, Optical I/O Units,
 Masters and Slaves,
 Optical I/O Units,
 Slaves and Optical I/O Units,
 C20 Systems,
 C200H Systems,
 basic configuration,
 C200H Slaves and different type Masters,
 connecting to other PCs,
 I/O Link Units,
 one Master and several Slaves,
 Slaves with Expansion I/O Racks, ,
 two Masters and several Slaves,

C500 Systems,
 I/O Link Units,
 I/O Link Units, Slaves Optical I/O Units,
 Master and Slaves,
 Optical I/O Units,
 Slaves and Optical I/O Units,
 Unit connection,

system design,

T

terminals
 I/O Link Units,
 Optical I/O Units,

terminators, , , ,
 I/O Link Units,
 Optical I/O Units,
 Remote I/O Slave Units,
 settings,

troubleshooting, charts
 C200H Systems,
 most PC Systems,

U

unit components
 I/O Link Units,
 Optical I/O Units,
 Remote I/O Master Units,
 Remote I/O Master Units (C200H),
 Remote I/O Slave Units,
 Remote I/O Slave Units (C200H),

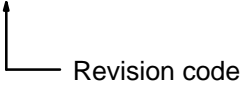
Unit numbers, ,

W

word allocation
 for Remote I/O Slave Units,
 in C200H Systems,

Revision History

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

Cat. No. W136-E1-3
 Revision code

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
2	August 1989	Complete reorganization and rewrite. C200H Slave Backplanes added. Name of Optical Transmitting I/O Units changed to Optical I/O Units. I/O response times added. C20 I/O Link Unit added.
3	December 1999	<i>Precautions, Appendix C, and Appendix D</i> added. Page 9: Slaves per Master for C1000H/C2000H corrected to 8 from 2 for the top table. Page 24: Note added after second diagram on page. Page 35: Note added after <i>Setting Word Multipliers</i> . Page 47: Note added after diagram. Page 73: Information on wiring and installation added after diagram. Page 74: Note added to diagram. Information on wiring added after diagram. Page 101: Changes made to model numbers for C200H Master and C200H Backplanes. Page 102: Some information on I/O Link Units, Optical I/O Units, and Link Adapters removed. Page 103: Information on Quartz Cable removed. Page 107: "10G" changed to "98 m/s ² " in table. Page 105: "For plastic-clad optical fiber" column has been deleted from the Transmission Distances table.