

Cat. No. W135-E1-3

**SYSMAC**  
**C200H-LK401/C500-LK009-V1**  
**PC Link**

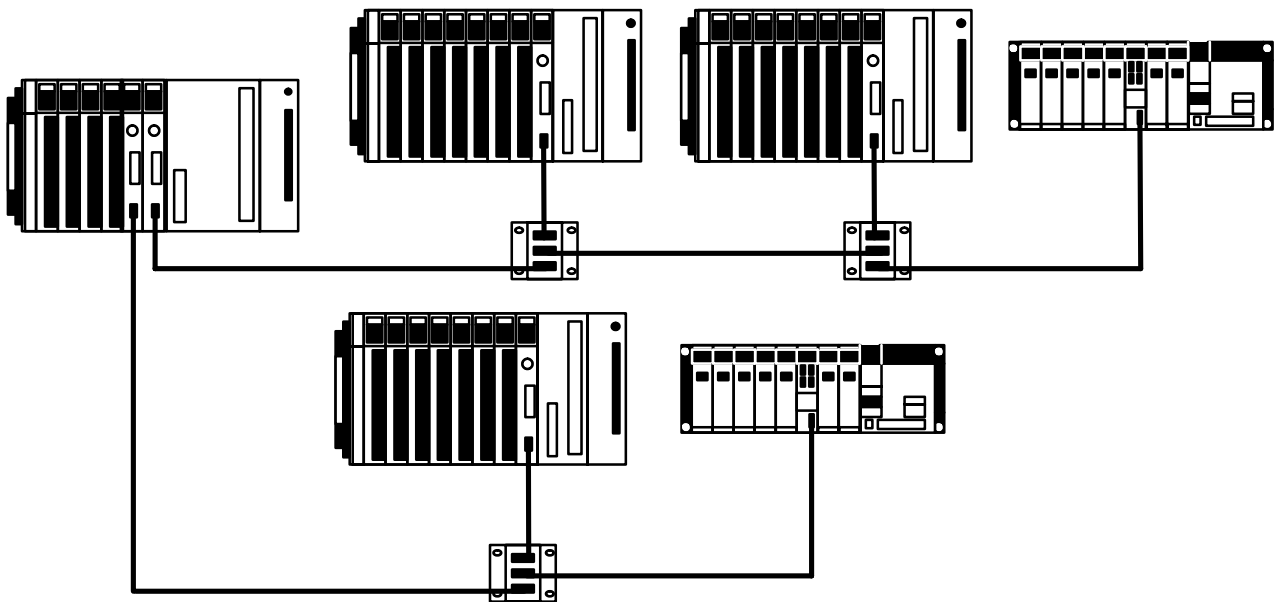
**SYSTEM MANUAL**

**OMRON**

# PC Link

## System Manual

*Revised March 2000*








## 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

<b>PRECAUTIONS</b> .....	<b>xi</b>
1 Intended Audience .....	xii
2 General Precautions .....	xii
3 Safety Precautions .....	xii
4 Operating Environment Precautions .....	xiii
5 Application Precautions .....	xiii
<b>SECTION 1</b>	
<b>Introduction</b> .....	<b>1</b>
1-1 PC Link Systems .....	2
1-2 Operating Levels and Polling .....	2
<b>SECTION 2</b>	
<b>System Design</b> .....	<b>5</b>
2-1 System Configuration .....	6
2-2 Using Link Adaptors .....	10
<b>SECTION 3</b>	
<b>Data Exchange and Operations</b> .....	<b>11</b>
3-1 LR Area Data .....	12
3-2 LR Area Allocations .....	13
3-3 LR Area Division Tables .....	17
3-4 Data Exchange .....	21
<b>SECTION 4</b>	
<b>Unit Components and Switch Settings</b> .....	<b>23</b>
4-1 C200H PC Link Units .....	24
4-2 C500 PC Link Units .....	28
4-3 Switch Setting Example .....	33
<b>SECTION 5</b>	
<b>System Installation</b> .....	<b>37</b>
5-1 Mounting and Connections .....	38
5-2 Dimensions .....	42
<b>SECTION 6</b>	
<b>Programming Considerations</b> .....	<b>45</b>
6-1 Response Times .....	46
6-2 Reducing Response Time (C200H, C200HS, C200HX/HG/HE(-Z)) .....	51
6-3 Programming Examples .....	52
<b>SECTION 7</b>	
<b>Error Processing</b> .....	<b>59</b>
7-1 SR Area Flags .....	60
7-2 Error Examples .....	62
7-3 Error Tables .....	65
<b>SECTION 8</b>	
<b>Inspection and Maintenance</b> .....	<b>69</b>
<b>Appendix</b>	
A Standard Models .....	71
B Specifications .....	73
<b>Glossary</b> .....	<b>75</b>
<b>Index</b> .....	<b>81</b>
<b>Revision History</b> .....	<b>83</b>

# PRECAUTIONS

This section provides general precautions for using the Programmable Controller (PC) and related devices.

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

1 Intended Audience .....	xii
2 General Precautions .....	xii
3 Safety Precautions .....	xii
4 Operating Environment Precautions .....	xiii
5 Application Precautions .....	xiii

## 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 operation manuals.


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


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


This manual provides information for programming and operating OMRON PCs. Be sure to read this manual before attempting to use the software and keep this manual close at hand for reference during operation.

 **WARNING** It is extremely important that a PC and all PC Units be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying a PC System to the abovementioned applications.

## 3 Safety Precautions




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

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

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





## 4 Operating Environment Precautions

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

## 5 Application Precautions

Observe the following precautions when using the PC system.

-  **WARNING** Always heed these precautions. Failure to abide by the following precautions could lead to serious or possibly fatal injury.
- Always ground the system to 100  $\Omega$  or less when installing the Units. Not connecting to a ground of 100  $\Omega$  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 PC or the system, or could damage the PC or PC Units. Always heed these precautions.
- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.

- Always use the power supply voltages specified in this manual. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Do not apply voltages to the Input Units in excess of the rated input voltage. Excess voltages may result in burning.
- Do not apply voltages or connect loads to the Output Units in excess of the maximum switching capacity. Excess voltage or loads may result in burning.
- Disconnect the functional ground terminal when performing withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in this manual. Incorrect tightening torque may result in malfunction.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Wire correctly. Incorrect wiring may result in burning.
- Mount Units only after checking terminal blocks and connectors completely.
- Be sure that the terminal blocks, Memory Units, expansion cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
  - Changing the operating mode of the PC.
  - Force-setting/force-resetting any bit in memory.
  - Changing the present value of any word or any set value in memory.
- Resume operation only after transferring to the new CPU Unit the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.
- Do not place objects on top of the cables or other wiring lines. Doing so may break the cables.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- When replacing parts, be sure to confirm that the rating of a new part is correct. Not doing so may result in malfunction or burning.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.

**SECTION 1**  
**Introduction**

1-1 PC Link Systems ..... 2

1-2 Operating Levels and Polling ..... 2

## 1-1 PC Link Systems

A PC Link System is established to interconnect two or more C-series PCs through PC Link Units to allow data transfer through the LR area of each PC. PC Link Subsystems can be established within the PC Link System, creating different levels of operation. Each PC in the PC Link System automatically exchanges data with all the PCs in the same Subsystem. Any PC in two Subsystems (i.e., any PC to which two PC Link Units are mounted) can be used as a "transfer PC" to transfer data between two PC Link Subsystems.

The data communications provided by PC Link Systems allow use of the inputs and outputs on all of the PCs in the System in the program of any PC. PC Link Systems do not establish hierarchies of control between PCs. i.e., all control actions must be written in the programs of individual PCs.

<b>Compared with I/O Links</b>	PC Link Systems exchange data differently to I/O Links in Optical Remote I/O Systems in three main ways. First, an I/O Link requires the use of I/O points, reducing the number of I/O points available to connect to I/O devices. Second, the number of bits transferred between PCs in a PC Link System is limited only by the size of the LR area and the number of PCs in the PC Link System; an I/O Link in a Remote Optical System can handle only one or two words. Third, I/O Links use programmed input and output operations to transfer data, whereas PC Link Systems use an automatic polling method.
<b>Effective I/O Utilization</b>	PC Link Systems access only the LR area of the PC for data exchange and do not require the use of any of the PCs I/O points.
<b>Simplified System Setup</b>	Settings on the PC Link Units allow for data exchange little or no programming required.
<b>Subsystem Data Exchange</b>	Two PC Link Subsystems operating at different levels can exchange data via the LR area of a PC operating in both Subsystems.
<b>LK009-V1 Improvements</b>	The C500-LK009-V1 differs from the 3G2A5-LK009 in insulation of the transmission section from the internal circuits to improve anti-noise performance. This increased performance reduces noise interfere originating in ground differences, cable inductance, etc. The C500-LK009-V1 can also be used together with the C200H-LK401. This is not possible with the 3G2A5-LK009.
<b>LK003-E PC Link Units</b>	Although not covered in detail in this manual, the LK003-E PC Link Unit can be used in PC Link Systems together with the LK009-V1 PC Link Unit. If the LK003-E is used, the PC Link System must be single-level and all LK009-V1 PC Link Units in the System must be set to LK003-E mode. The LK003-E (or an LK009-V1 in LK003-E mode) can be used only on C500 PCs and cannot be used in the same PC Link System as a C200H-LK401 PC Link Unit.

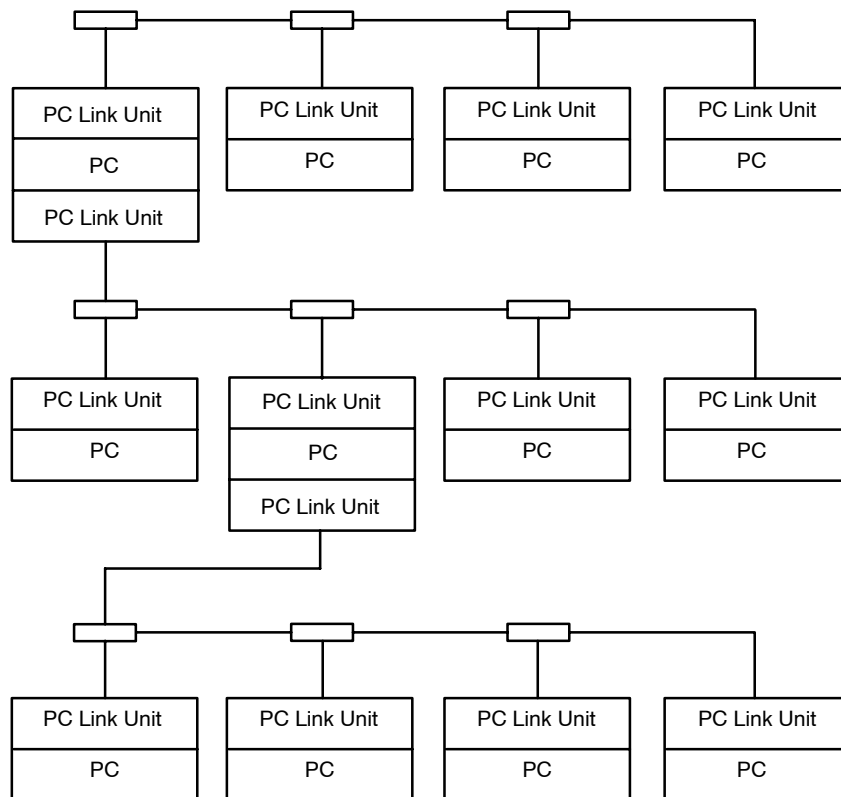
## 1-2 Operating Levels and Polling

All PC Link Units are assigned **unit numbers** which determine what part of the LR area each is to be allocated. Whenever two or more PCs are connected in a PC Link System, one of the PC Link Units must be set as the polling unit (i.e., as Unit #0) and all other PC Link Units must be set as polled units (i.e., as any Unit other than #0). The polling unit of each PC Link Subsystem does not control the other PCs, which are each controlled independently by their own CPUs.

A maximum of two PC Link Units can be mounted to the same PC. If two PC Link Units are mounted to one PC anywhere in the System, the System is multilevel, and all Units must be set for a Multilevel System (see 4-2-2 *Switch Settings*). In a Multilevel System, operating levels must be set to create PC Link Subsystems. Each Subsystem will have its own polling unit.

Up to four Subsystems are possible. There will always be one more Subsystem than there are PCs to which two PC Link Units are mounted. Only operating levels 0 and 1 are set, as it is necessary only to differentiate between two PC Link Units on the same PC. All of the PC Link Unit in the same Subsystem must be set to the same level.

A PC Link System with three Subsystems is shown below. Any one of the PC Link Units in any Subsystem may be designated as the polling unit. All other Units would be polled units. The small boxes shown connecting the PC Link Units are Link Adapters, which are used to connect PC Link Units when more than two are used in a Subsystem. See following sections for details on System design and Link Adapters. (The 3G2A5-LK003-E PC Link Unit cannot be used in Multilevel Systems.)



**SECTION 2**  
**System Design**

2-1 System Configuration ..... 6

2-2 Using Link Adaptors ..... 10

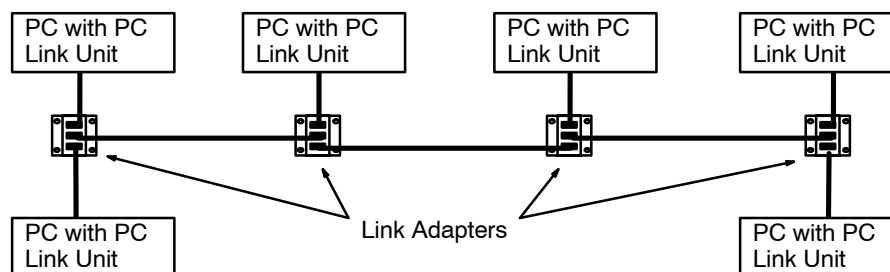
## 2-1 System Configuration

**PC Link Units** are mounted to the PC Racks and connected to each other. Each PC Link Unit contains a buffer through which data is transferred to and from the other PC Link Units connected to it. The C500-LK009-V1 can be used with C500, C1000H, and C2000H PCs, but not with a C200H, C200HS, or C200HX/HG/HE(-Z) PC. The C200H-LK401 can be used with C200H, C200HS, and C200HX/HG/HE(-Z) PCs.

**Link Adapters** are used in any System other than one containing only two PC Link Units connected with wire cable. They serve as branching points to enable connecting more than two PC Link Units, which provide only one connector each allowing only two PC Link Units to be connected directly, or they serve as conversion points to change between wire and optical fiber cables. The 3G2A9-AL001 Link Adapter is used as the Branching Link Adapter (see Example 3, below), and combinations of the 3G2A9-AL004 and 3G2A9-AL002 Link Adapters are used to convert to and from optical fiber cable. Refer to the *Link Adapter Installation Guide* for Link Adapter specifications and details.

### Multilink Systems

Each PC Link Unit has only one connector, making it impossible to connect more than two PC Link Units directly. Many more PCs can become part of the same PC Link System however, if Branching Link Adapters are used to connect through. A PC Link System including six PCs is illustrated below to show this. This arrangement also protects PC Link communications from shutting down completely for failures in the line, i.e., if communications are broken off on a branch line, data transfer will continue to PCs still connected though PC Link Units to the polling unit.



### Multilevel Systems

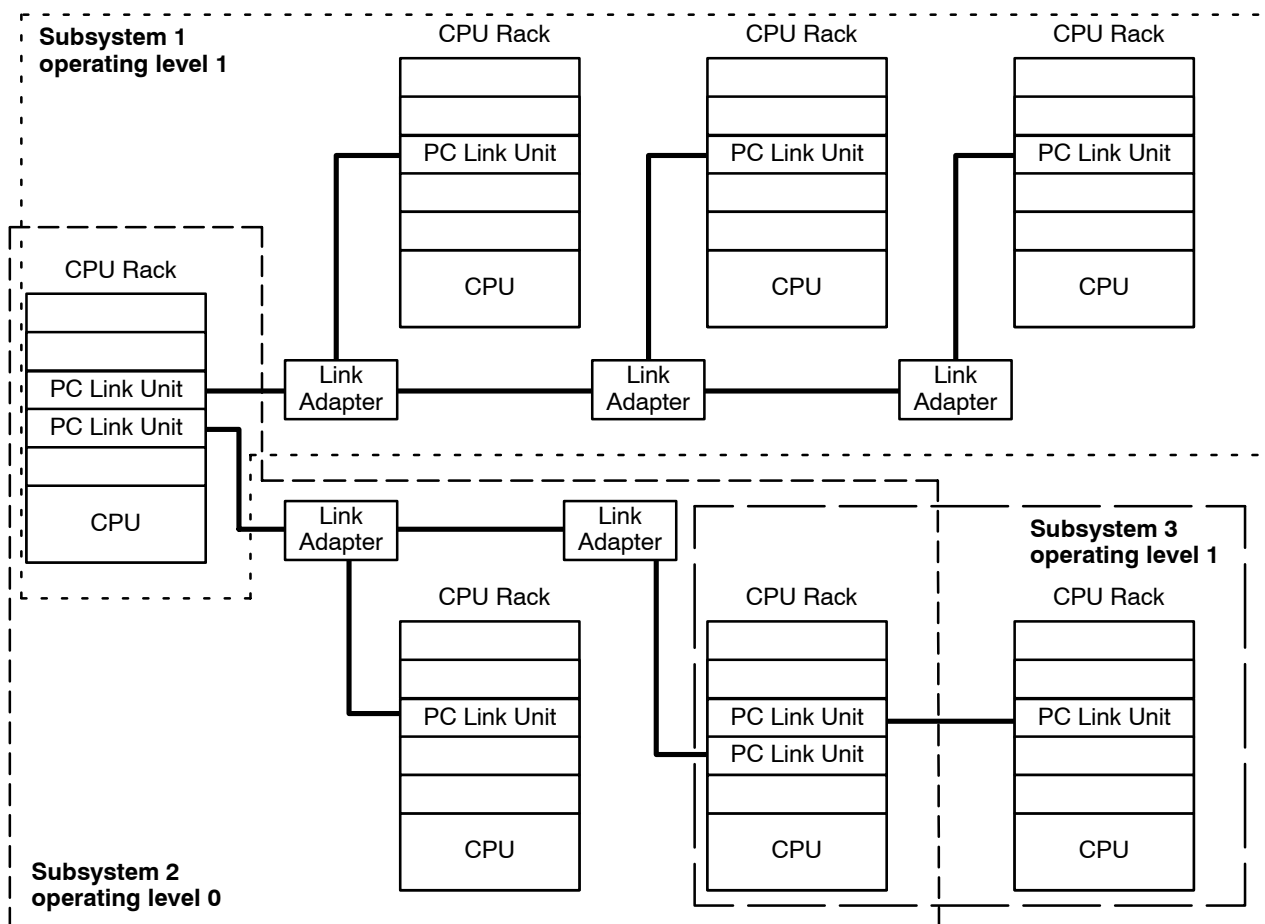
Up to two PC Link Units can be mounted to one PC. Any PC with two PC Link Units mounted to it or any PC part of a PC Link System that contains such a PC is in a **Multilevel PC Link System**. If any one PC in the PC Link System has two PC Link Units mounted to it, the entire System is multilevel.

Each group of PCs connected by PC Link Units and sharing parts of the LR area are part of the same **PC Link Subsystem**. If a PC has two PC Link Units mounted to it, it is part of two PC Link Subsystems, with each Subsystem extending from a PC with two PC Link Units to either the end PC or the next PC with two PC Link Units (see diagram below).

Each Subsystem will have its own polling unit. Each Subsystem is also assigned an **operating level** to differentiate the two Subsystems to which one PC belongs. These operating levels do not imply a hierarchy or in anyway affect operation of the Subsystems except to determine which LR words are allocated to which Subsystem (see next subsection for details).

The following example conceptually shows a Multilevel PC Link System with three Subsystems. Although Subsystems 1 and 3 are assigned the same operating level, they are not related in any special way.

Note that a Link Adapter is not used in Subsystem 3. As explained above, it does not require any because it contains only two PCs.



### Transfer PCs

A PC that has two PC Link Units mounted to it is called a transfer PC. This is because it can be used to transfer data between the two PC Link Subsystems to which it belongs.

Although all the PCs in the same Subsystem automatically have data written into their LR areas from the PCs in the same Subsystem, this is not the case with PCs in different Subsystems. A PC that belongs to two Subsystems can, however, transfer data between Subsystems by reading it from any part of the LR words it shares with one of the Subsystems and writing the data to the words allocated it in the other Subsystem. This transfer operation is programmed by the user in the normal user program.

### Transmission Distance

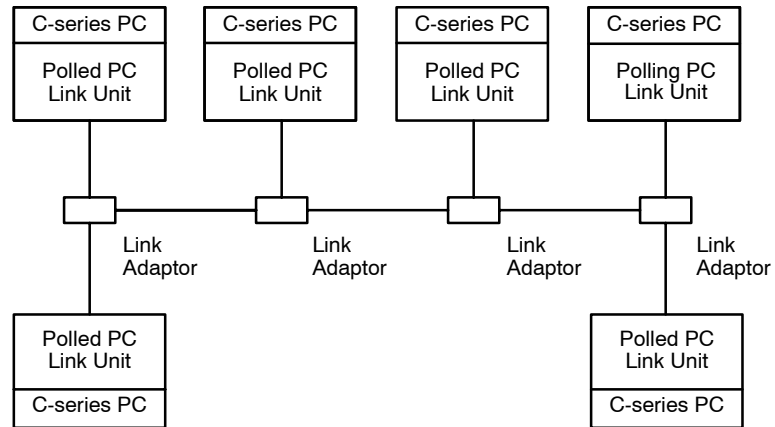
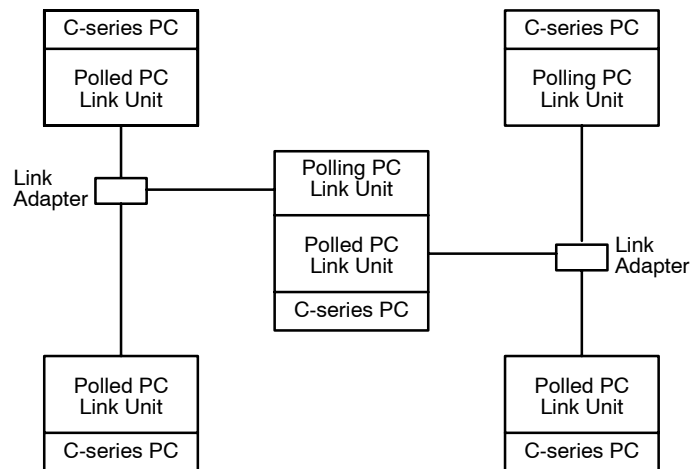
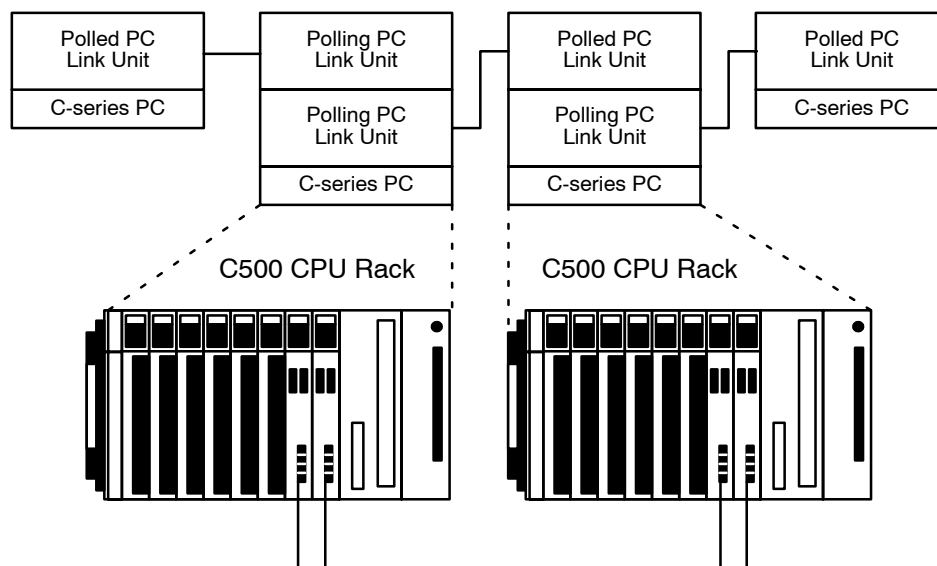
The total length of wire cable (e.g., RS-485 or RS-422) must not exceed 500 m. Individual branch lines from Link Adapters to PC Link Units must not exceed 10 m. Greater transmission distances can be achieved by using optical links between PC Link Units (see Section 2 Link Adapters).

### Examples

The following examples demonstrate some of the ways that PCs can be connected in PC Link Systems. Example 3 also provides the appearance two of the CPU Racks in the System.

An example of a PC Link System designed using optical links is provided in *2-2 Using Link Adapters*.



**Example 1  
Single-level System****Example 2  
Two-level System****Example 3  
Three-level System**

**System Limitations**

The maximum number of PCs that may be used in a PC Link System is limited by the number of LR words available. This is determined by the number of levels, the specific PCs employed, and the mode settings on the PC Link Units.

A PC Link Unit must be assigned a number no greater than one less than the maximum number of allowable PCs to be acknowledge as part of the System. A PC Link Unit assigned a number greater than this limit will not be acknowledged. The maximum number of Units available in a specific PC Link System is described in the following tables.

Only the PC Link Unit combinations shown below are possible. Note particularly that the LK003-E (or LK009-V1 in LK003-E mode) can only be used with other LK003-E PC Link Units (or LK009-V1 in LK003-E mode).

**Polling Unit: C200H-LK401 PC Link Unit on C200H, C200HS, or C200HX/HG/HE(-Z) PC**

	Polled units			
	LK401 on C200H, C200HS, or C200HX/HG/HE(-Z)	LK009-V1 on C500	LK009-V1 on C1000H or C2000H	Max. total
<b>Multilevel</b>	16	8	16	16
<b>Single-level</b>	32	8	32	32

**Polling Unit: C500-LK009-V1 PC Link Unit on C1000H or C2000H PC**

	Polled units			
	LK009-V1 on C1000H or C2000H	LK009-V1 on C500	LK401 on C200H, C200HS, or C200HX/HG/HE(-Z)	Max. total
<b>Multilevel</b>	16	8	16	16
<b>Single-level</b>	32	8	32	32

**Polling Unit: C500-LK009-V1 PC Link Unit on C500 PC**

	Polled units				
	LK009-V1 on C1000H or C2000H	LK009-V1 on C500	LK003-E on C500	LK401 on C200H, C200HS, or C200HX/HG/HE(-Z)	Max. total
<b>Multilevel</b>	8	8	Not possible	8	8
<b>Single-level</b>	8	8	Not possible.	8	8
<b>LK003-E mode</b>	Not possible	8	8	Not possible.	8

**Polling Unit: 3G2A5-LK003-E PC Link Unit on C500 PC**

	Polled units		
	LK009-V1 on C500 in LK003-E mode	LK003-E on C500	Max. total
<b>Single-level</b>	8	8	8

## 2-2 Using Link Adaptors

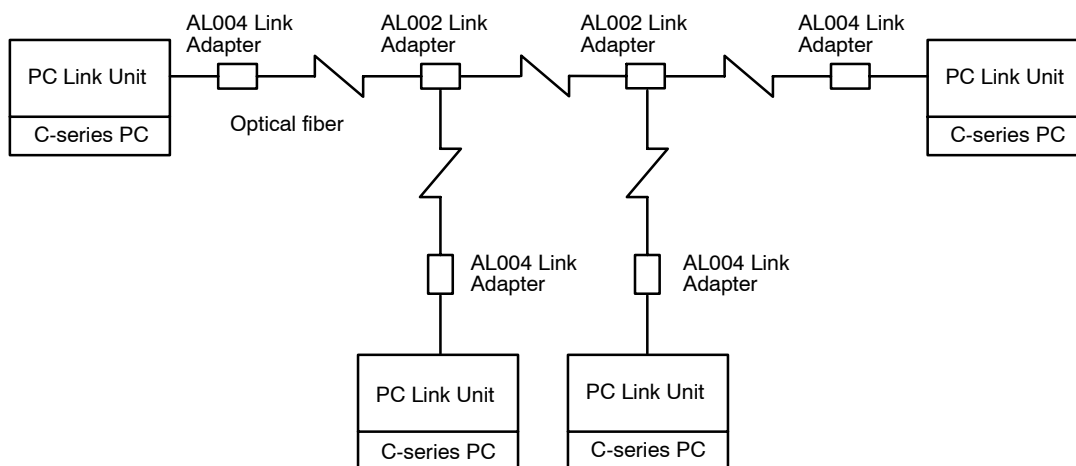
In a PC Link System, Link Adaptors are used whenever more than two PC Link Units are connected in any one PC Link Subsystem. They are also used to enable optical links between PC Link Units to provide greater transmission distance and greater noise resistance. When using Link Adaptors, refer to the *Link Adaptor Installation Guide*.

### Optical Cable in PC Link Systems

A PC Link System can be set up to take advantage of optical communications by using combinations of Branching and Converting Link Adaptors. As shown below, each PC Link Unit is connected to a Converting Link Adapter that converts to optical communications. Optical fiber cable is then used to form the main line and branch lines that connect each PC Link Unit-Converting Link Adapter pair.

The straight lines in the following diagram represent wire cables; those with zig-zags in them, optical fiber cable.

In the following example, any of the PC Link Units may be set as the polling unit.



### Handling Optical Fiber Cable

Although special characteristics of optical fibers call for care in connecting optical devices, laying optical fiber cable basically does not differ from laying wire cable. All OMRON PCF and the 3G5A2-PF101 APF (length: 1 m) cable come with connectors attached. Connectors for all other APF cables must be assembled by the customer. As using Optical Fiber cable requires the use of Link Adaptors, refer to the *Link Adaptor Installation Guide* for more detailed information.

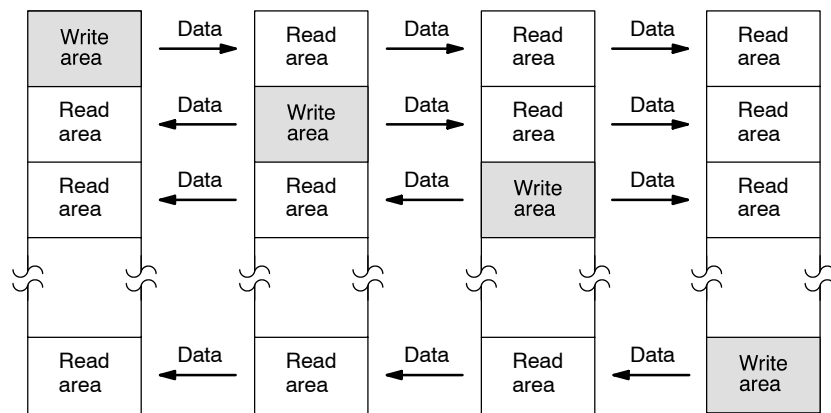
**SECTION 3**  
**Data Exchange and Operations**

3-1	LR Area Data .....	12
3-2	LR Area Allocations .....	13
3-3	LR Area Division Tables .....	17
3-4	Data Exchange .....	21

### 3-1 LR Area Data

PC Link Systems employ the LR area in the exchange of data. The content of the LR areas in all PCs in the same PC Link Subsystem (or Single-level System) is kept consistent. To achieve this, the LR area is divided among all of the PCs in the Subsystem according to switch settings, and each PC writes data only to the part of the LR area allocated to it. When a PC writes to its LR area, the data is updated in the LR areas of all the other PCs in the PC Link Subsystem during the next polling cycle. The other PCs can then read this data and use it to coordinate activities with the PC that has written the data. Each PC thus writes data to its **write words** and reads data from the words written to by all of the other PC Link Units in the same Subsystem. Any action that affects the contents of the LR area is reflected in the LR area in all PCs. The data transfer is shown below in a Single-level System. Arrows indicate data flow within the PC Link System.

"Write area" is the area written by that Unit. "Read area" is an area read by that Unit (i.e., written by another Unit). All unused portions of the LR area may be used as work bits in programming.



What determines what part of the LR area is allocated to which PC is the unit number assigned to each PC Link Unit. These numbers in turn determine which PC Link Units are **polling units** and which are **polled units**.

When PC Link Unit 0 is set for the total number of LR bits used, and each of the PC Link Units is assigned a unit number, the LR area is divided and assigned to each PC Link Unit automatically.

In a Multilevel System, all PCs have their LR areas divided in half, with one half being assigned to each of two Subsystems. This is true regardless of whether or not the PC is actually in two Subsystems, i.e., if only one PC Link Unit is mounted to a PC in a Multilevel System, one half of the LR area is not used by the PC Link System.

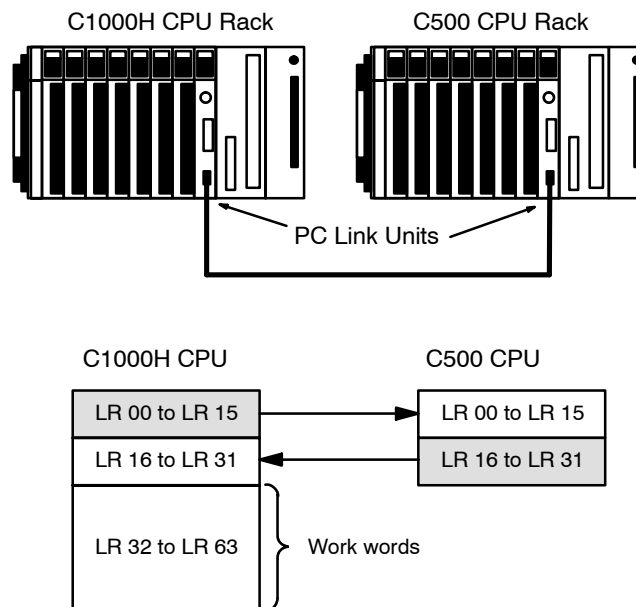
Each PC in two Subsystems (i.e., with two PC Link Units mounted to it) thus contains all the LR area data from both Subsystems and has a write data area in assigned to each. Any PC with only one PC Link Unit contains only the LR area data for the Subsystem it is in. The LR area of any PC with two PC Link Units (i.e., the data-transfer PCs) can thus be used to transfer data between two Subsystems by programming the data-transfer PC to move data between its section of the first half and its section of the last half of its LR area. See Section 6 Application Examples for specific LR area allocation examples for both Single-level and Multilevel Systems.

## 3-2 LR Area Allocations

To enable data transfer between PCs in a PC Link System, part of the LR area is allocated as the write area for each PC in the System. Which and how many LR words are allocated to each PC are determined by switch settings, which are described in *4-2-2 Switch Settings*. This section describes the method for allocating words assuming that each PC is allocated the maximum number of words possible.

### LR Area Allocation in Mixed-PC Systems

If a System contains PCs that have different sizes of LR areas, only the words that are common to both areas are used in actual PC Link communications. In the following example, the LR areas of each PC are illustrated below it. Words labeled “**work words**” are not used by the PC Link System and are available for use in programming if required. As shown, the rest of the LR area is divided with the smaller LR area of the other PC to form the write words for each.

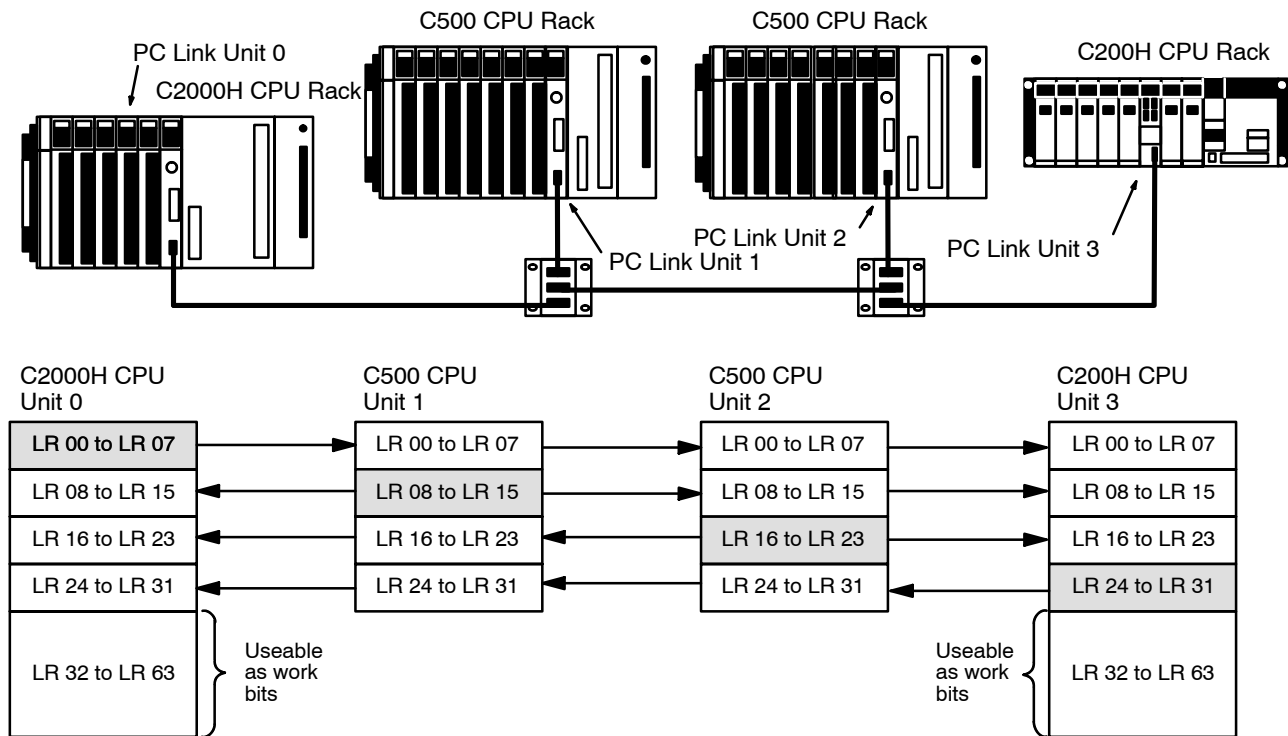


### Single-level System

The following example combines one C2000H PC, two C500 PCs, and a C200H PC in a Single-level System using 128 LR bits per PC. The PC Link Unit on the C2000H PC at the left end of the System has been designated as the polling unit. The C500 PCs, providing the smallest LR areas, limit the number of bits that can be transferred via the PC Link Units. Because the C500 PC has only 32 words, only words 00 through 31 may be used in the C2000H PCs (Units #0 and #2). The C2000H and C200H LR words that are not used (32 to 63) may be used as work bits in programming. The LR word allocations for each PC Link Unit are given below it. The shaded area is the section of the LR area written to by the PC Link Unit. The arrows indicate data flow.

In this example, data written to words LR 8 through 15 by the PC to which PC Link Unit 2 is mounted is automatically transmitted to words LR 8 through 15 in the other PCs. While the PCs for PC Link Units #0, #1, and #3 are able to read this data freely, they cannot write in this area. All of the other PCs also

are assigned the word shaded below them which they write and can be written by the other PCs.



**Note** The C200H could be replaced by the C200HS and C200HX/HG/HE(-Z) without any changes in this example.

### LR Area Allocations in Multilevel Systems

In a Multilevel PC Link System, only half of the LR area in each PC is used for communications in any one PC Link Subsystem. The first half of the words (from word 00) is used by the Subsystem assigned operating level 0; the second half, by the Subsystem assigned operating level 1. This is true regardless of whether or not a PC is actually in two Subsystems. In the example on the next page, the two C500s do not use LR words 16 through 31 because they are not in a Subsystem in operating level 1. If another PC Link Unit was later added to either PC, these words would be available for use by it. The number of words used by a Subsystem is thus half of the number of words provided by the PC with the smallest LR area.

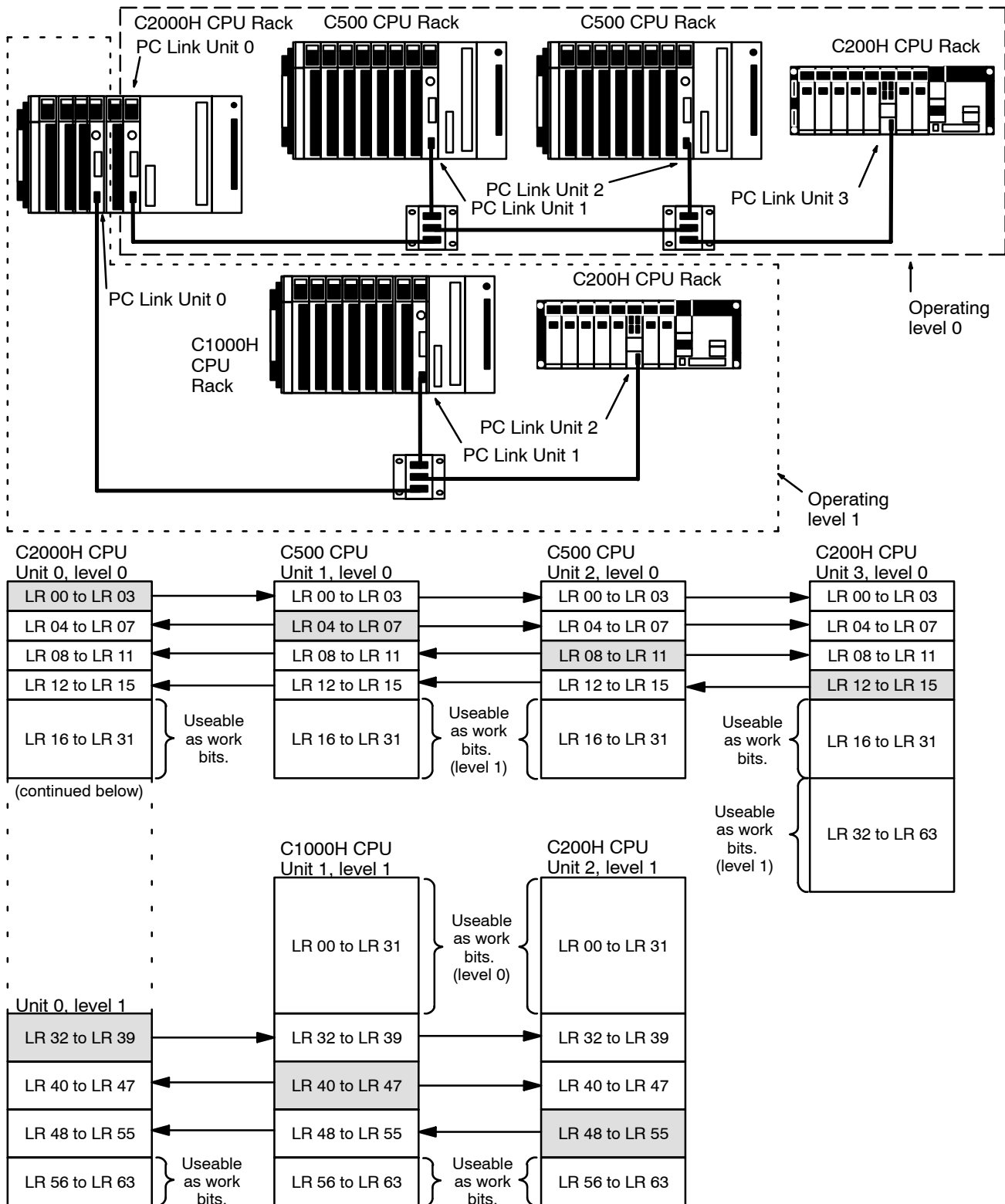
Once the words used in a Subsystem are determined, the process is the same as for any other PC Link System: words common to all of the PCs in a Subsystem are divided evenly among the PC Link Units, with unit numbers determining which words are allocated to which Unit. Again, the Unit assigned number 0 in each Subsystem is the polling unit for that Subsystem.

Below are provided the system configuration, unit numbers, operating levels, and word allocations for each PC Link Unit in a Multilevel System. The vertical bars represent the LR area in each PC. Arrows indicate data flow from the words written to by each PC. Write words for each PC have been shaded.

In the Subsystem assigned operating level 1, LR words 56 through 63 are not used for PC Link communications because switch settings are available only for 2, 4, 8, or 16 PC Link Units per Subsystem. If a fourth PC was added to this Subsystem, it would be assigned these words.

Although not used by the PC Link System, words labeled "not used" may be used as work words in programming to manipulate data within the CPU.

In the example below, the C2000H PC would be a transfer PC and could be used to transfer data between the two Subsystems, e.g., to write to LR word12 by the C200H PC in operating level 0 to LR word 32, one of its write words in operating level 1. Any PC in level 1 could then access this data directly from LR word 32 in its own LR area.



**Note** The C200H could be replaced by the C200HS and C200HX/HG/HE(-Z) without any changes in this example.

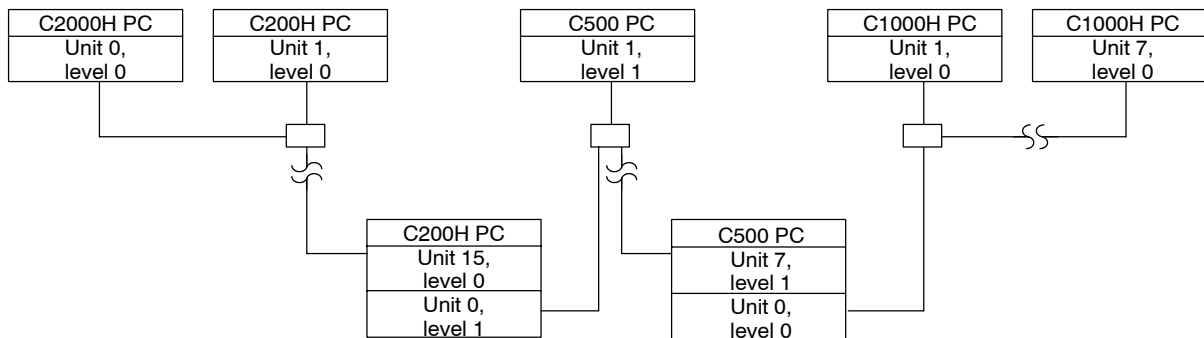


### System with Three Subsystems

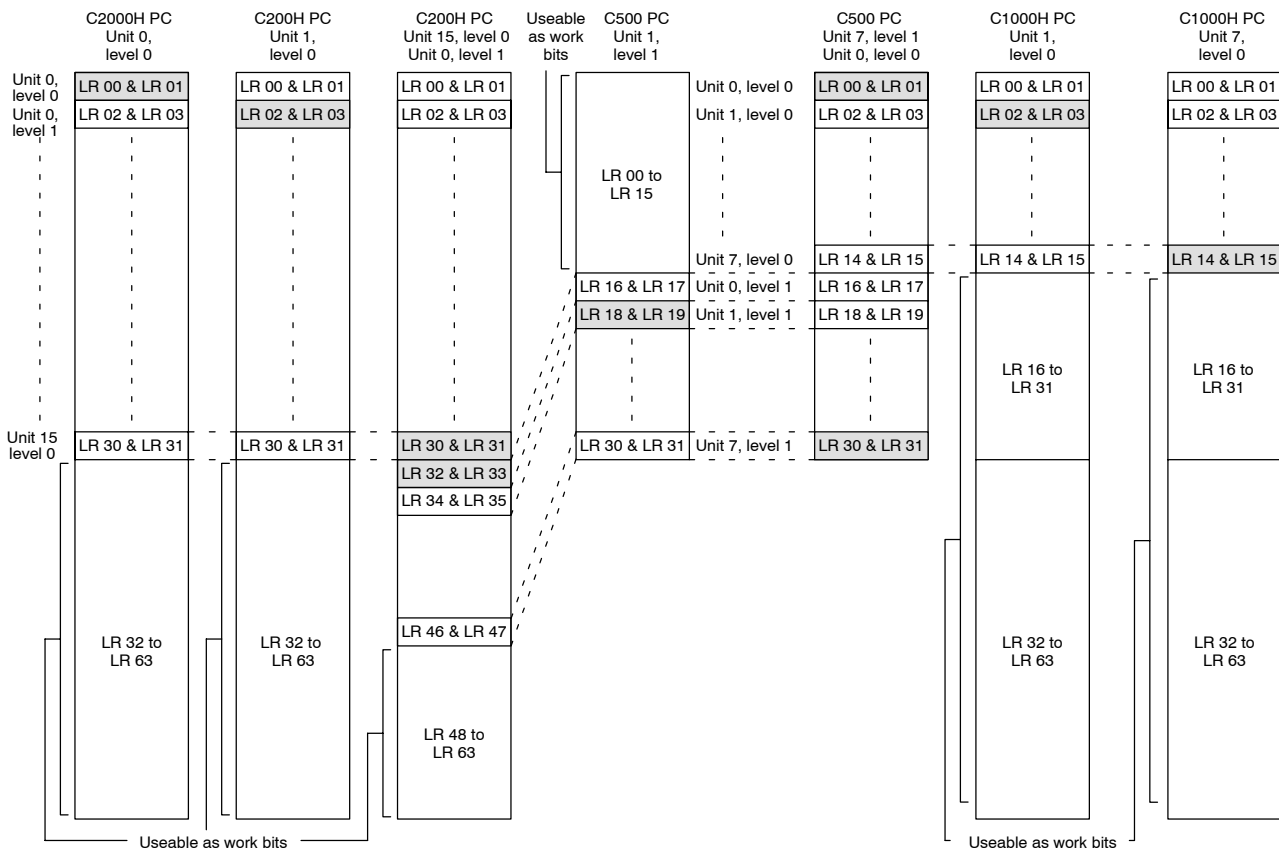
The following example combines a C2000H PC, fourteen C500 PCs, and fifteen C200H PCs in a Multilevel System with three Subsystems. Not all PCs are shown below; missing Units are indicated by dotted lines. The PC Link Unit farthest to the left in each Subsystem has been designated as the polling unit. The C500 PCs, providing the smallest LR area in their Subsystems, limit the number of bits that can be transferred via the PC Link Units. The LR word allocations for each PC Link Unit are given below it. The shaded area is the section(s) of the LR area written to by the PC Link Unit(s).

In this example, data written to LR 03 by the PC with PC Link Unit 1 of the leftmost Subsystem (level 0) is automatically transmitted to LR 03 in the other PCs of that Subsystem. To make the data available to the middle Subsystem (level 1), it is necessary for the transfer PC to transfer the data from LR 03 to LR 32 or LR 33 (the level 1 write words for that PC). To do this, the PC must be programmed with MOV LR 03 to LR 32 or LR 33. The data is then automatically transmitted to LR 16 or LR 17 in the other PCs of the middle Subsystem. To make the data available to the rightmost Subsystem (level 0), it is necessary for the transfer PC to transfer the data from LR 16 or LR 17 to LR 00 or LR 01. Again, the MOV instruction is utilized.

Because this is a Multilevel System, only half of the available LR words may be used by each Subsystem: the first half by the level 0 Subsystems, the second half by the level 1 Subsystem. The unused LR words in each PC may be used as work bits in programming.



**Note** The C200H could be replaced by the C200HS and C200HX/HG/HE(-Z) without any changes in this example.



### 3-3 LR Area Division Tables

The PC Link Unit has the ability to transfer from 2 to 32 words (32 to 512 bits) of data between PCs. The LR area is divided according to the number of PC Link Units and the number of Subsystems in the System. Refer to the appropriate table for your System. Any unused portion of the LR area may be used as work bits. The number of LR bits transferred per Unit and Single-level/Multilevel designation are made on switches on the PC Link Units.

#### Single-level Systems

C200H, C200HS, C200HX/HG/HE(-Z), C1000H, or C2000H PCs

No. of PC Link Units		17 to 32	9 to 16	5 to 8	3 or 4	2
LR Wd	LR bits/Unit	32	64	128	256	512
0 and 1		Unit #0	Unit #0	Unit #0	Unit #0	Unit #0
2 and 3		Unit #1				
4 and 5		Unit #2				
6 and 7		Unit #3				
8 and 9		Unit #4	Unit #2	Unit #1		
10 and 11		Unit #5				
12 and 13		Unit #6				
14 and 15		Unit #7				
16 and 17		Unit #8	Unit #4	Unit #2	Unit #1	
18 and 19		Unit #9				
20 and 21		Unit #10				
22 and 23		Unit #11				
24 and 25		Unit #12	Unit #6	Unit #3		
26 and 27		Unit #13				
28 and 29		Unit #14				
		Unit #7				

30 and 31	Unit #15				
32 and 33	Unit #16	Unit #8	Unit #4	Unit #2	Unit #1
34 and 35	Unit #17				
36 and 37	Unit #18	Unit #9	Unit #5	Unit #3	Unit #1
38 and 39	Unit #19				
40 and 41	Unit #20	Unit #10	Unit #6	Unit #3	Unit #1
42 and 43	Unit #21				
44 and 45	Unit #22	Unit #11	Unit #7	Unit #3	Unit #1
46 and 47	Unit #23				
48 and 49	Unit #24	Unit #12	Unit #7	Unit #3	Unit #1
50 and 51	Unit #25				
52 and 53	Unit #26	Unit #13	Unit #7	Unit #3	Unit #1
54 and 55	Unit #27				
56 and 57	Unit #28	Unit #14	Unit #7	Unit #3	Unit #1
58 and 59	Unit #29				
60 and 61	Unit #30	Unit #15	Unit #7	Unit #3	Unit #1
62 and 63	Unit #31				

**C500 PCs**

If the LK003-E is used or LK-009-E(-V1) is used in LK003 mode, the right-most three columns of the following table can be applied.

No. of PC Link Units		5 to 8	5 to 8	3 or 4	2
LR Wd	LR bits/Unit	32	64	128	256
0 and 1		Unit #0	Unit #0	Unit #0	Unit #0
2 and 3		Unit #1			
4 and 5		Unit #2			
6 and 7		Unit #3			
8 and 9		Unit #4	Unit #2	Unit #1	
10 and 11		Unit #5			
12 and 13		Unit #6			
14 and 15		Unit #7	Unit #3		
16 and 17		Usable as work bits.	Unit #4	Unit #2	Unit #1
18 and 19			Unit #5		
20 and 21				Unit #6	
22 and 23					
24 and 25					
26 and 27					
28 and 29			Unit #7		
30 and 31					

**Multilevel Systems**

In a System with more than two Subsystems, the same data applies to any Subsystems designated level 0 and those Subsystems designated level 1.

**C200H, C200HS, C200HX/HG/HE(-Z), C1000H, or C2000H PCs****Level 0**

No. of PC Link Units		9 to 16	5 to 8	3 or 4	2		
LR Wd	LR bits/Unit	32	64	128	256		
0 and 1		Unit #0	Unit #0	Unit #0	Unit #0		
2 and 3		Unit #1					
4 and 5		Unit #2					
6 and 7		Unit #3					
8 and 9		Unit #4	Unit #2	Unit #1		Unit #0	
10 and 11		Unit #5					
12 and 13		Unit #6					
14 and 15		Unit #7					
16 and 17		Unit #8	Unit #4	Unit #2	Unit #1		
18 and 19		Unit #9					
20 and 21		Unit #10	Unit #5				Unit #3
22 and 23		Unit #11					
24 and 25		Unit #12	Unit #6				
26 and 27		Unit #13					
28 and 29		Unit #14	Unit #7				
30 and 31		Unit #15					

## Level 1

No. of PC Link Units		9 to 16	5 to 8	3 or 4	2
LR Wd	LR bits/Unit	32	64	128	256
32 and 33		Unit #0	Unit #0	Unit #0	Unit #0
34 and 35		Unit #1			
36 and 37		Unit #2	Unit #1		
38 and 39		Unit #3			
40 and 41		Unit #4	Unit #2	Unit #1	
42 and 43		Unit #5			
44 and 45		Unit #6	Unit #3		
46 and 47		Unit #7			
48 and 49		Unit #8	Unit #4	Unit #2	Unit #1
50 and 51		Unit #9			
52 and 53		Unit #10	Unit #5		
54 and 55		Unit #11			
56 and 57		Unit #12	Unit #6	Unit #3	
58 and 59		Unit #13			
60 and 61		Unit #14	Unit #7		
62 and 63		Unit #15			

## C500 PCs

## Level 0

No. of PC Link Units		5 to 8	3 or 4	2
LR Wd	LR bits/Unit	32	64	128
0 and 1		Unit #0	Unit #0	Unit #0
2 and 3		Unit #1		
4 and 5		Unit #2	Unit #1	
6 and 7		Unit #3		
8 and 9		Unit #4	Unit #2	Unit #1
10 and 11		Unit #5		
12 and 13		Unit #6	Unit #3	
14 and 15		Unit #7		

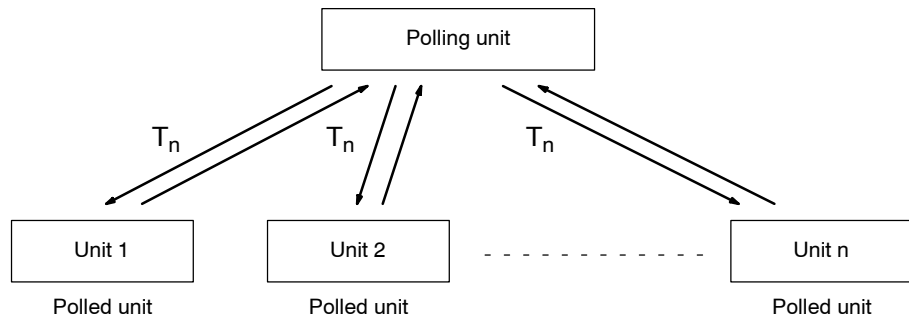
## Level 1

No. of PC Link Units		5 to 8	3 or 4	2
LR Wd	LR bits/Unit	32	64	128
16 and 17		Unit #0	Unit #0	Unit #0
18 and 19		Unit #1		
20 and 21		Unit #2	Unit #1	
22 and 23		Unit #3		
24 and 25		Unit #4	Unit #2	Unit #1
26 and 27		Unit #5		
28 and 29		Unit #6	Unit #3	
30 and 31		Unit #7		

### 3-4 Data Exchange

System control in a PC Link System is decentralized; the polling unit merely handles communications among the PC Link Units. A link is established between the polling unit and a polled unit when the polled unit confirms a section of the LR area allocated to it as a write area.

The polling unit polls each PC Link Unit in the System or Subsystem in turn, sending the most recent LR data for the other PCs in the System and receiving the most recent LR data from the PC Link Unit being polled. Data is held in a PC Link Unit in a buffer that is updated by the PC during the PC Link servicing portion of the PC's scan. When Units are polled, the RUN and Error flag statuses for each Unit in the System are also updated. In the following diagram  $T_n$  is the transmission time per PC (see below).



$$\text{Total polling time} = T_n \times \text{number of PC Link Units} + 10 \text{ ms}$$

If an error occurs during transfer, communication is broken either partially or completely (see 7-1 *SR Area Flags* for details), preventing LR data from being updated, although the most recent data is normally preserved, even for power failures.

#### Maximum and Minimum Polling Time

The maximum time required per PC scan for PC Link Unit transmissions depends on the number of PC Link Units in the System and the number of LR bits transferred per PC, i.e., the maximum time is the time required to service all PCs and update all LR words in each. The equation for this is given below. The final 10 ms is required for processing at the end of transmission.

#### Maximum transmission time =

$$\text{transmission time per PC Link Unit} \times \text{number of PC Link Units} + 10 \text{ ms}$$

The minimum transmission time is the transmission time for one PC Link Unit plus the post-transfer processing time:

#### Minimum transmission time =

$$\text{transmission time for one PC Link Unit} + 10 \text{ ms}$$

#### Transmission Time per PC Link Unit

Number of LR bits	32	64	128	256	512
Transmission time	2.2 ms	2.5 ms	2.8 ms	3.8 ms	5.8 ms

#### Induction Sequence

After 256 cycles of PC Link Unit polling, an induction sequence is executed if any PC Link Units have not been established in communications. This sequence is executed for each non-active PC Link Unit to established communications and requires 15 ms per PC Link Unit.

**PC Data Areas**

PC Link Units utilize data areas in the PCs for both communication and operation monitoring. These data areas are enumerated in the table below.

	<b>C2000H, C1000H, C200H, C200HS, or C200HX/HG/HE(-Z)</b>	<b>C500</b>
<b>LR Area</b>	LR 0000 to LR 6315 (1,024 bits)	LR 0000 to LR 3115 (512 bits)
<b>Error flags</b>	24708 to 24715 24808 to 24815 24908 to 24915 25008 to 25015	5808 to 5815 6208 to 6215
<b>PC RUN flags</b>	24700 to 24707 24800 to 24807 24900 to 24907 25000 to 25007	5800 to 5807 6200 to 6207

More detailed information about each of the areas is provided in *Section 7 Error Processing*.

## **SECTION 4**

### **Unit Components and Switch Settings**

4-1	C200H PC Link Units . . . . .	24
4-1-1	Nomenclature, Switches, and Indicators . . . . .	24
4-1-2	Switch Settings . . . . .	25
4-2	C500 PC Link Units . . . . .	28
4-2-1	Nomenclature, Switches, and Indicators . . . . .	28
4-2-2	Switch Settings . . . . .	29
4-3	Switch Setting Example . . . . .	33

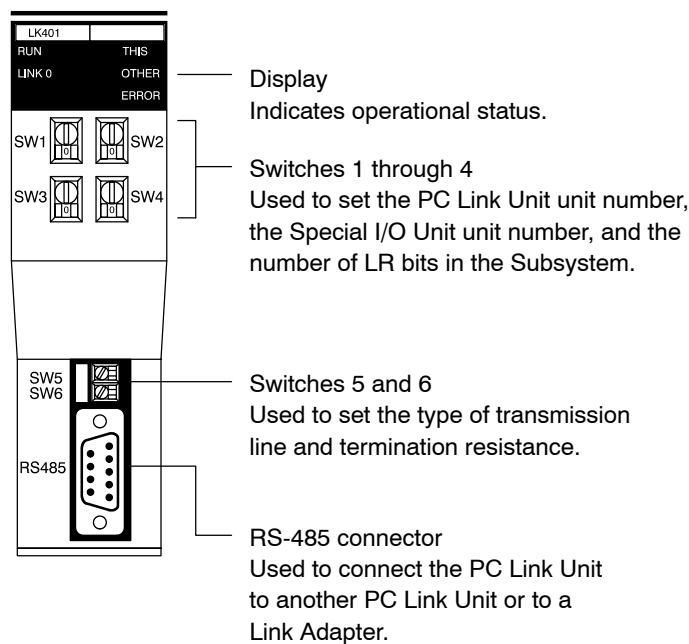


## 4-1 C200H PC Link Units

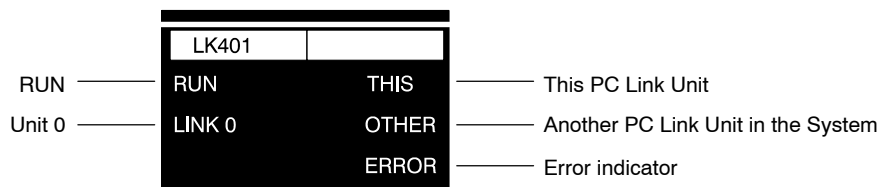
### 4-1-1 Nomenclature, Switches, and Indicators

The basic names and functions of PC Link Unit components are given below.

#### Front Panel



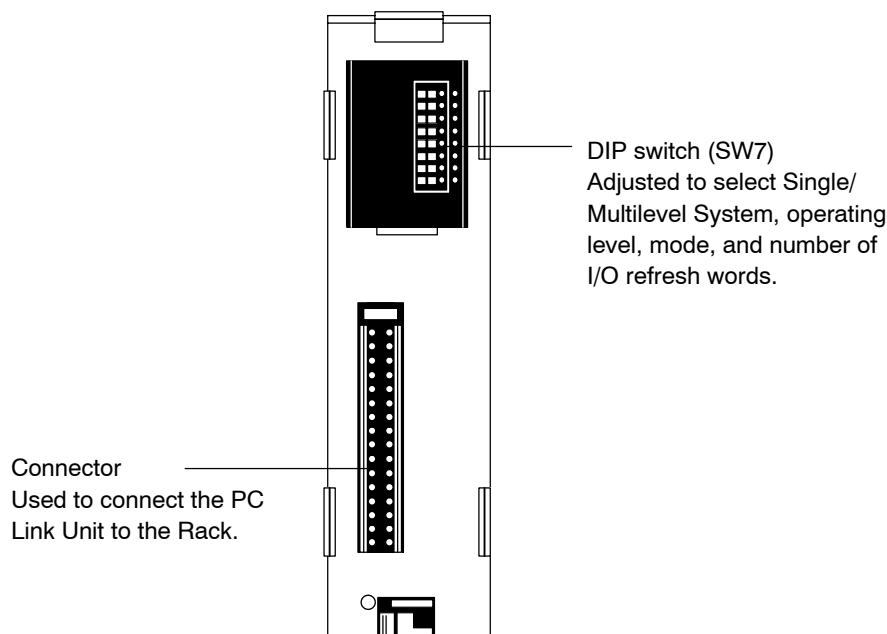
#### Display



The LEDs indicate the following :

LED	Function/Meaning
RUN	Lit when PC Link Units are operating.
LINK 0	Lit when PC Link Unit #0 (polling unit) is operating properly. Not lit when an error has occurred.
THIS	Lit when this PC Link Unit is operating properly. Not lit when an error has occurred.
OTHER	Lit when other PC Link Units are operating properly. Not lit when an error has occurred.
ERROR	Light when a unit number is set incorrectly; flashes when an error has occurred on the links between #0 or others and this PC Link Unit. Not lit during normal operation.
All LEDs not lit.	All LEDs will go out when an error occurs in the PC.

## Back Panel



### 4-1-2 Switch Settings

Switch settings determine how the PC Link Units will work together and how the LR area will be allocated to data communications. All switches should be set before mounting a PC Link Unit to the PC.

**Note** Errors in switch settings, which are not always detected by the System, can cause incorrect data communications. Set and check all switch settings carefully.

#### Front-panel Switches

The switches on the front panel are numbered from 1 through 4. They are set using a regular screwdriver. Turn the switch until the desired number appears in the window. Be careful not to damage the slots on the switches. Do not leave a switch mid-way between settings.

#### Switches 1 and 2: PC Link Unit Number

Switches 1 and 2 determine the PC Link Unit number. Switch 1 is the tens digit; switch 2, the ones digit. The number of the Unit thus can be read directly by considering the digits in the windows of switch 1 and switch 2 as a single number. Each PC Link Unit in every Subsystem must be given its own unit number. This number will determine the LR words allocated to the Unit. The Unit assigned number 0 is the polling unit. All other Units are polled units. Do not use the same unit number more than once in any one Subsystem. Do not set a number higher than one less than the maximum number of PC Link Units allowed in the System (see 2-1 *System Configuration* for specific limits). Errors in setting unit number are sometimes not detected by the System, leading to incorrect data in the LR area. Set unit numbers carefully.

#### Switch 3: Special I/O Unit Number

The C200H-LK401 PC Link Unit is considered a Special I/O Unit for the C200H, C200HS, or C200HX/HG/HE(-Z) PC and must be assigned a unit number as such. Set a number between 0 and 9. The unit number assigned to the PC Link Unit must not be used for any other Special I/O Unit controlled by the same PC. IR and DM words allocated to the unit number assigned are not used by the PC Link Unit, and may therefore be used as work bits in programming.

**Switch 4:  
Number of LR Bits**

This setting is necessary only on the polling unit (Unit 0). This setting determines the number of LR bits that will be transferred via the LR area for each PC Link Unit.

Setting	No. of LR bits Single-level	PC Link Units Single-level	No. of LR bits Multilevel	PC Link Units Multilevel
0	32	32	32	16
1	64	16	64	8
2	128	8	128	4
3	256	4	256	2
4	512	2		
5	Setting unavailable			
6				
7				
8				
9				

As there is a maximum number of LR bits available for use in the LR area and since the number of available bits must be split equally among the PC Link Units of the System, as the number of bits required by a particular Unit increases, the maximum number of PC Link Units in the Subsystem must decrease. As the number of Units required in the Subsystem increases, the number of LR bits assigned to each PC Link Unit must decrease.

**Switch 5:  
Transmission Line Selector**

Set switch 5 to the right if only wire cable is used in the System, and to the left if optical links are used between Link Adapters.

**Switch 6:  
Termination Resistance**

Set switch 6 to the left to connect (turn ON) termination resistance (220  $\Omega$ ), and to the right to disconnect (turn OFF) termination resistance. The termination resistance must be turned ON in the first and last PC Link Units in each Subsystem.

**Switch 7:  
Back-panel DIP Switch**

Pins 5 through 7 are not used and must be set to OFF. The rest of the pins are set as described below.

**Pins 1 and 2:  
I/O Refresh Bits**

This setting determines the number of LR bits refreshed during each PC scan. The number set here must be equal to or greater than the number of LR bits transferred per PC set on switch 4.

Reducing the number of bits refreshed will shorten the PC scan time, but it will increase the transmission time in the PC Link System. These relationships are shown in the following tables along with pin settings.

Pin 1	Pin 2	No. of refresh bits	Increase in scan time
OFF	OFF	512	8.9 ms
OFF	ON	256	5.7 ms
ON	OFF	128	3.6 ms
ON	ON	64	2.8 ms

The following table shows the number of scans of delay in communication produced by various numbers of refresh bits and LR bits. The delays given are for Single-level Systems. Delays in Multilevel Systems would be half of those shown below.

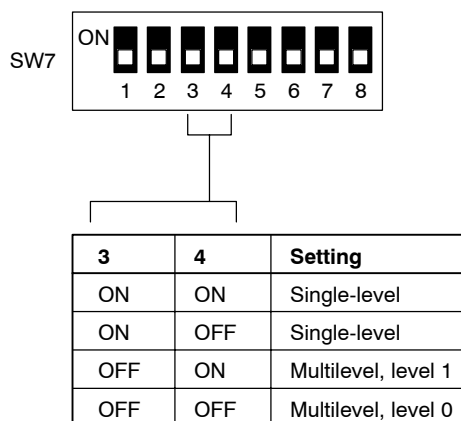
<div>No. of re- fresh bits</div> <div>No. of LR bits</div>	64	128	256	512
32	16	8	4	4
64	16	8	4	4
128	--	8	4	4
256	--	--	4	2
512	--	--	--	2

**Note** The IORF (97) instruction can be used in programming to refresh LR bits at particular points in a programming if current LR data is required. Refer to the *Operation Manual* for your CPU Unit for details.

#### Pins 3 and 4: Levels

When mounting two PC Link Units to the same PC in a Multilevel System, set one PC Link Unit for operating level 0 and the other for operating level 1. Set all PC Link Units in each Subsystem to the same operating level. If all PCs in the System have only one PC Link Unit mounted to them, set all Units for a Single-level System. There is no difference in the first two settings. Operating Level flags, AR 2411 and AR 2412, can be used to check operating levels.

**Note** An error indication will not be made even if two PC Link Units with the same Subsystem are mounted to the same PC; set and check the pins with care.



#### Pins 8: Double Allocation Setting

Pin 8 on switch 7 can be turned on to allocate twice the normal number of words to any polled unit. This is not possible for a polling unit, which will be allocated the normal number of words regardless of the setting of pin 8.

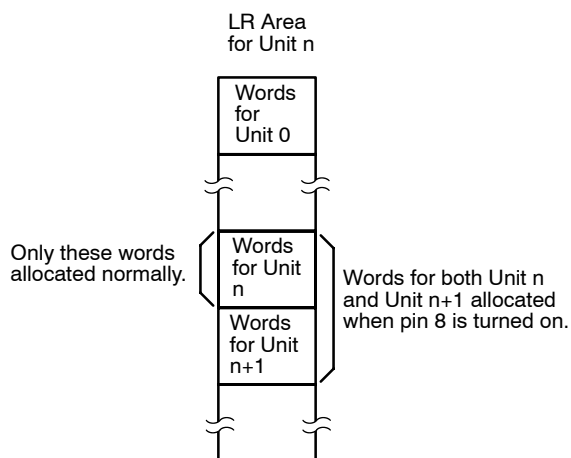
If pin 8 is left off, the PC Link Unit will be allocated the number of words indicated by setting of switch 4. The actual words will be determined by the unit number.

If pin 8 is turned on, the PC Link Unit will be allocated the words both for its unit number and for the next larger unit number, i.e., it will be allocated twice the number of words set on switch 4. If pin 8 is set for double allocation, do not use the next larger number for any other PC Link Unit.

**Note** LR area data will not be accurate if the next larger unit number is set on another PC Link Unit and no error indication will be made.

When a PC Link Unit is set for double allocation, the RUN and Error Flags for both the assigned unit number and those for the next larger unit number will operate according to the status of the PC Link Unit.

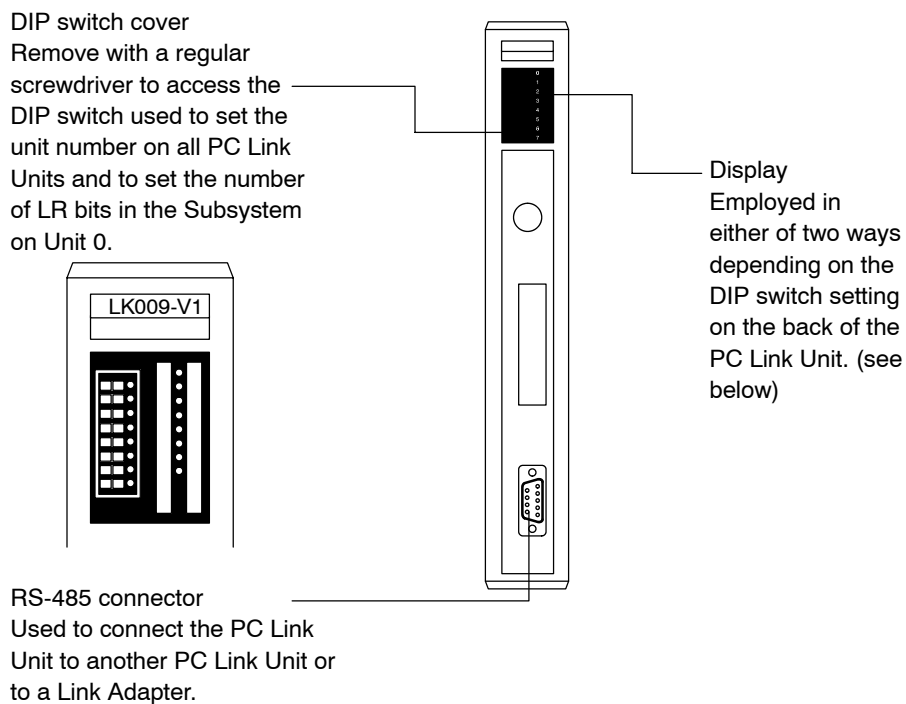
Pin 8, SW7	Allocation
OFF	Normal
ON	Double



## 4-2 C500 PC Link Units

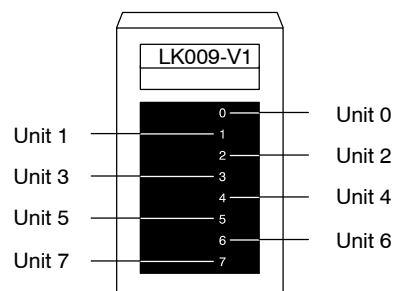
### 4-2-1 Nomenclature, Switches, and Indicators

The basic names and functions of PC Link Unit components are given below.

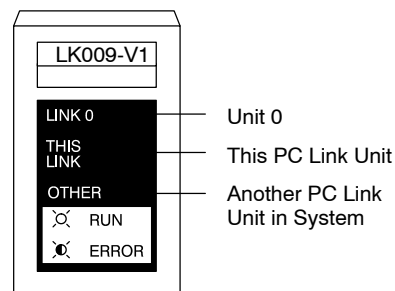


## Display Patterns

## Display Pattern A



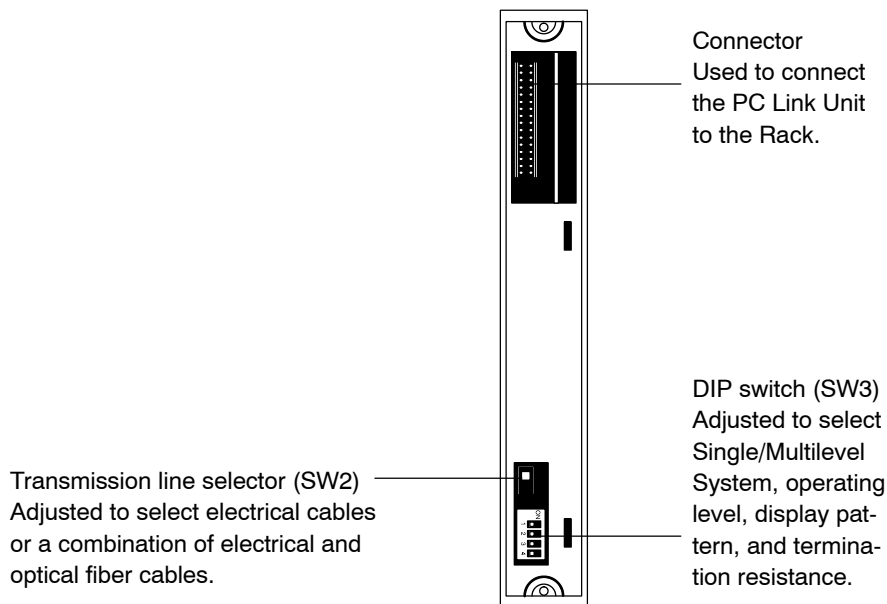
## Display Pattern B



The LED's indicate the following for either display pattern:

LED status	Meaning
Lit	The specified PC Link Unit is operating properly.
Blinking	An error has occurred in the specified PC Link Unit after its link to the System is established.
Unlit	The specified PC Link Unit is not linked to the System.

## Back Panel



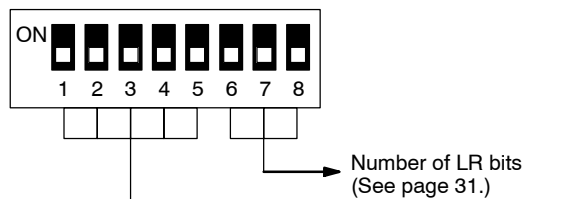
## 4-2-2 Switch Settings

Switch settings determine how the PC Link Units will work together and how the LR area will be allocated to data communications. All switches should be set before mounting a PC Link Unit to the PC.

**Note** Errors in switch settings, which are not always detected by the System, can cause incorrect data communications. Set and check all switch settings carefully.

**Front-panel DIP Switch:  
Unit Number**

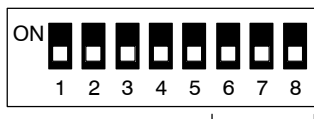
Each PC Link Unit must be given a unit number. This number will determine the LR words allocated to it. The Unit assigned number 0 is the polling unit. All other Units are polled units. Do not use the same unit number more than once in any one Subsystem. Do not set a number higher than one less than the maximum number of PC Link Units allowed in the System. Remove the DIP switch cover with a screwdriver and adjust the DIP switch according to the following tables. Confirm that all switches have been properly set and that the PC power is off before mounting the PC Link Unit to the PC. Example DIP switch settings are presented at the end of this section.



1	2	3	4	5	Unit no.
OFF	OFF	OFF	OFF	OFF	0
OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	ON	OFF	2
OFF	OFF	OFF	ON	ON	3
OFF	OFF	ON	OFF	OFF	4
OFF	OFF	ON	OFF	ON	5
OFF	OFF	ON	ON	OFF	6
OFF	OFF	ON	ON	ON	7
OFF	ON	OFF	OFF	OFF	8
OFF	ON	OFF	OFF	ON	9
OFF	ON	OFF	ON	OFF	10
OFF	ON	OFF	ON	ON	11
OFF	ON	ON	OFF	OFF	12
OFF	ON	ON	OFF	ON	13
OFF	ON	ON	ON	OFF	14
OFF	ON	ON	ON	ON	15
ON	OFF	OFF	OFF	OFF	16
ON	OFF	OFF	OFF	ON	17
ON	OFF	OFF	ON	OFF	18
ON	OFF	OFF	ON	ON	19
ON	OFF	ON	OFF	OFF	20
ON	OFF	ON	OFF	ON	21
ON	OFF	ON	ON	OFF	22
ON	OFF	ON	ON	ON	23
ON	ON	OFF	OFF	OFF	24
ON	ON	OFF	OFF	ON	25
ON	ON	OFF	ON	OFF	26
ON	ON	OFF	ON	ON	27
ON	ON	ON	OFF	OFF	28
ON	ON	ON	OFF	ON	29
ON	ON	ON	ON	OFF	30
ON	ON	ON	ON	ON	31

**Number of LR Bits**

The following setting is necessary only on the polling unit (Unit 0). This setting determines the number of LR bits that will be transferred via the LR area for each PC Link Unit.



On C1000H, or C2000H PC

On C500 PC

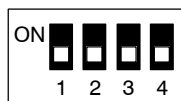
Number of LR Bits/Maximum PC Link Units per Subsystem

6	7	8	Single-level	Multilevel
OFF	OFF	OFF	32/32	32/16
OFF	OFF	ON	64/16	64/8
OFF	ON	OFF	128/8	128/4
OFF	ON	ON	256/4	256/2
ON	OFF	OFF	512/2	Setting unavailable
ON	OFF	ON		
ON	ON	OFF		
ON	ON	ON		

6	7	8	LK003 mode	Single-level	Multilevel
OFF	OFF	OFF	256/2	32/8	32/8
OFF	OFF	ON	128/4	64/8	64/4
OFF	ON	OFF	64/8	128/4	128/2
OFF	ON	ON	Setting unavailable		
ON	OFF	OFF			
ON	OFF	ON			
ON	ON	OFF			
ON	ON	ON			

**Back-panel DIP Switch**

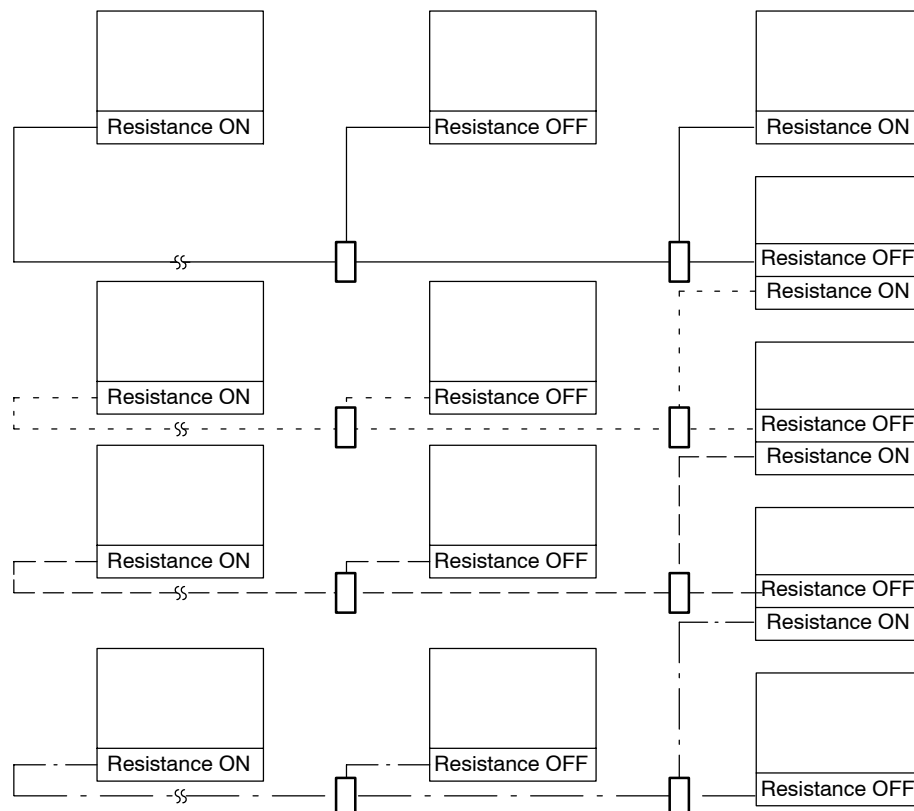
The back-panel DIP switch is a 4-pin switch, as shown below. Set each of the pins as described.





**Pin 1: Termination Resistance**

To operate properly, the PC Link Unit at each end of the main line of each Subsystem must have the termination resistance switch turned ON, and all PC Link Units that branch off the main line must be turned OFF. An example is provided below. Each large box represents one or two PC Link Units mounted to a C-series PC; each small box; a Link Adapter. The different lines represent different Subsystems.

**Pin 2: Display Pattern**

If eight PC Link Units or fewer are employed in one Subsystem, adjust the display selector for pattern A by setting this switch OFF. If more than eight PC Link Units are employed in one level, adjust the display selector for pattern B by setting this switch to ON.

**Pins 3 and 4: Levels and Modes**

When mounting two PC Link Units to the same PC in a Multilevel System, set one PC Link Unit for operating level 0 and the other for operating level 1. Set all other PC Link Units in each Subsystem to the same operating level. In a Single-level System (i.e., a System that has no PC with two PC Link Units mounted to it), designate the mode. Pin combinations are as shown below.

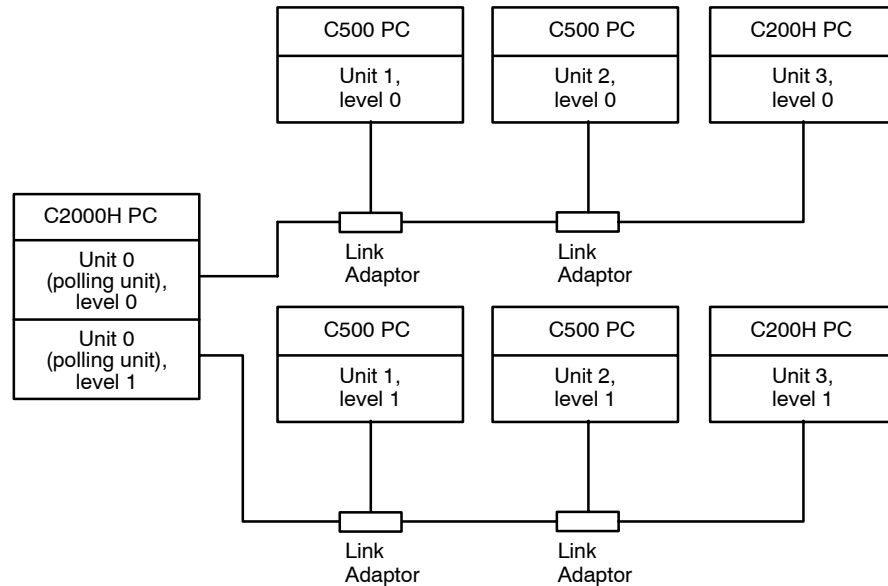
3	4	Setting
ON	ON	Single-level, LK009 mode
ON	OFF	Single-level, LK003 mode
OFF	ON	Multilevel, level 1
OFF	OFF	Multilevel, level 0

**Switch 2: Transmission Line Selector**

Set this selector to the top position if optical fiber cable is used to connect Link Adapters. Set it to the bottom position if only electrical cable is used in the System.

## 4-3 Switch Setting Example

Switch settings for the following System are given below for level 0. The settings for all PC Link Units in level 1 would be the same, except for the level setting (pins 3 and 4 on the back-panel DIP switches). These are the normal settings, but not the only ones possible. The System is multilevel with two Subsystems, contains eight PC Link Units in each Subsystem, and combines C2000H, C500, and C200H PCs.

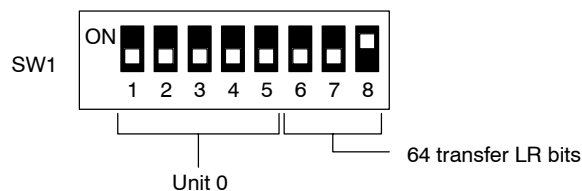


**Note** The C200H could be replaced by the C200HS and C200HX/HG/HE(-Z) without any changes in this example.

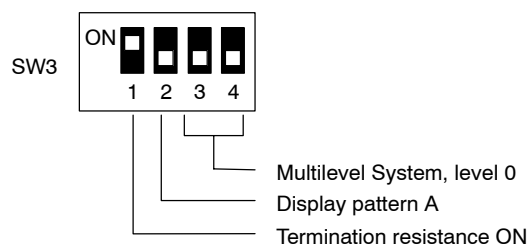
### Unit 0, Level 0 C500-LK009-V1

The transmission line selector is set to the bottom position (no optical links). The DIP switches are set as follows:

Front-panel DIP Switch



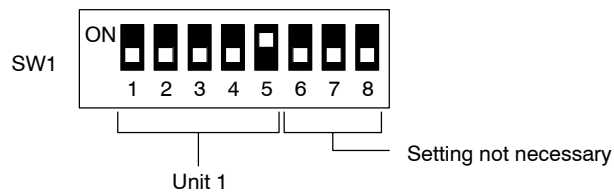
Back-panel DIP Switch



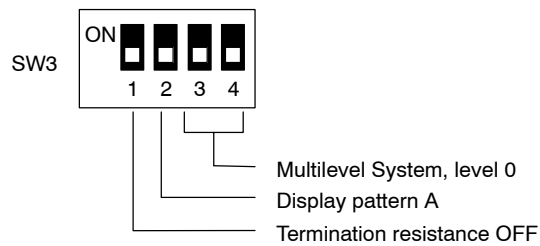
**Unit 1, Level 0**  
**C500-LK009-V1**

The transmission line selector is set to the bottom position (no optical links).  
The DIP switches are set as follows:

## Front-panel DIP Switch

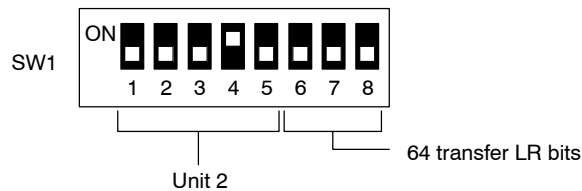


## Back-panel DIP Switch

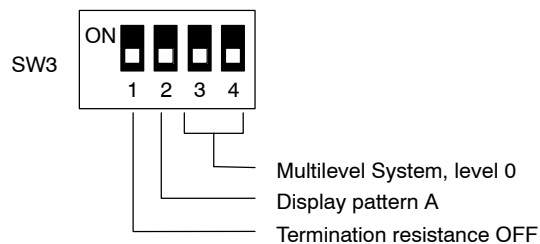
**Unit 2, Level 0**  
**C500-LK009-V1**

The transmission line selector is set to the bottom position (no optical links).  
The DIP switches are set as follows:

## Front-panel DIP Switch



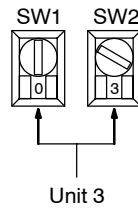
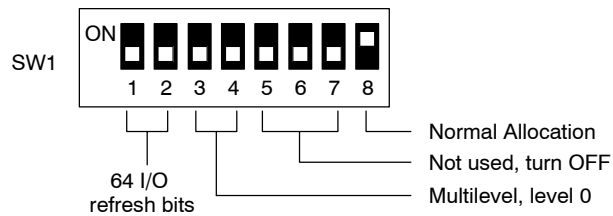
## Back-panel DIP Switch



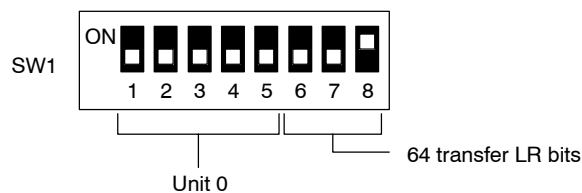
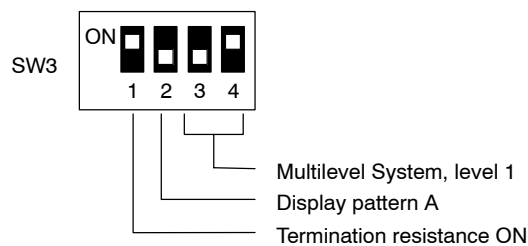
## Switches 1 and 2

**Unit 3, Level 0**  
**C200H-LK401**

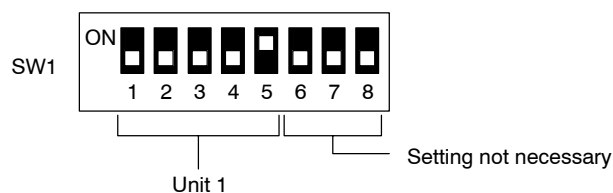
Switch 3 is set to any number not used by another Special I/O Unit. Switch 4 does not need to be set. Switch 5 is set to the right to designate no optical links in the System. Switch 6, the termination resistance, is turned ON (to the left). The other switches are set as shown below.

**DIP Switch****Unit 0, Level 1**  
**C500-LK009-V1**

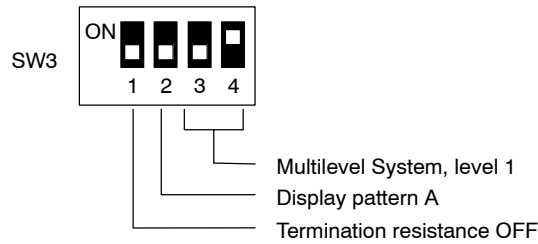
The transmission line selector is set to the bottom position (no optical links). The DIP switches are set as follows:

**Front-panel DIP Switch****Back-panel DIP Switch****Unit 1, Level 1**  
**C500-LK009-V1**

The transmission line selector is set to the bottom position (no optical links). The DIP switches are set as follows:

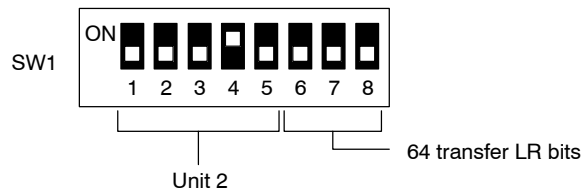
**Front-panel DIP Switch**

## Back-panel DIP Switch

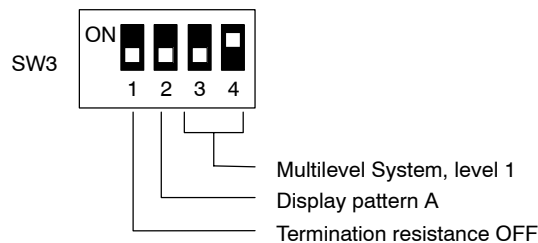
Unit 2, Level 1  
C500-LK009-V1

The transmission line selector is set to the bottom position (no optical links).  
The DIP switches are set as follows:

## Front-panel DIP Switch



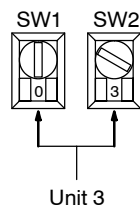
## Back-panel DIP Switch



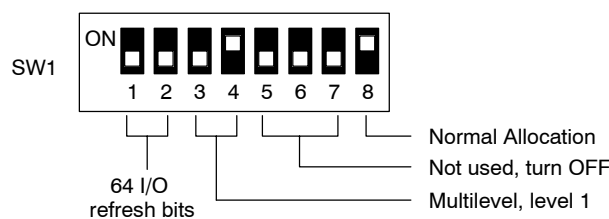
## Switches 1 and 2

Unit 3, Level 1  
C200H-LK401

Switch 3 is set to any number not used by another Special I/O Unit. Switch 4 does not need to be set. Switch 5 is set to the right to designate no optical links in the System. Switch 6, the termination resistance, is turned ON (to the left). The other switches are set as shown below.



## DIP Switch



**SECTION 5**  
**System Installation**

5-1 Mounting and Connections ..... 38

5-1-1 Mounting Location ..... 38

5-1-2 Connections ..... 38

5-2 Dimensions ..... 42

## 5-1 Mounting and Connections

### 5-1-1 Mounting Location

<b>C2000H Simplex System</b>	The PC Link Unit may be mounted to any of the slots on the C2000H CPU Rack.
<b>C2000H Duplex System</b>	The PC Link Unit may be mounted to any of the six slots on the Power Supply side (right side) of the I/O Rack connected to the CPU Rack.
<b>C500 or C1000H System</b>	On C500-BC082 or C500-BC052 Racks, the PC Link Unit may be mounted to any of the five slots on the CPU side (right side) of the CPU Rack.  On C500-BC081 or C500-BC051 Racks, the PC Link Unit may be mounted to any of the three slots on the CPU side (right side) of the CPU Rack.
<b>C200H, C200HS, or C200HX/HG/HE(-Z) System</b>	The PC Link Unit can be mounted to any slot on the CPU Rack or an Expansion I/O Rack connected under the CPU Rack except for the two rightmost slots on the CPU Rack (those closest to the CPU). The PC Link Unit cannot be mounted to a Slave Rack (a Rack that contains a Remote I/O Slave Unit) or to an Expansion I/O Rack controlled through a Slave Rack.

### 5-1-2 Connections

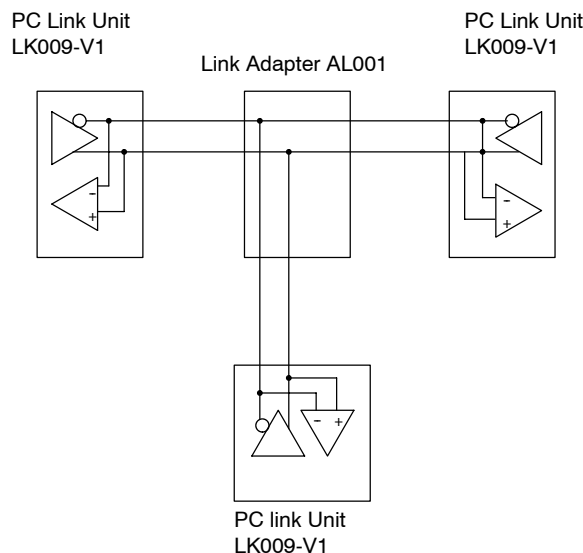
Although connections made directly to the PC Link Units are generally shielded twisted pair cable, the PC Link System can also contain optical links between the Link Adapters (see 2-2 *Using Link Adapters* for details). The System is thus either all electrical cable or a combination of electrical and optical fiber cable.

Connectors are provided with the PC Link Units and the Link Adapters. All cable must be purchased separately. Shielded twisted pair cable is recommended.

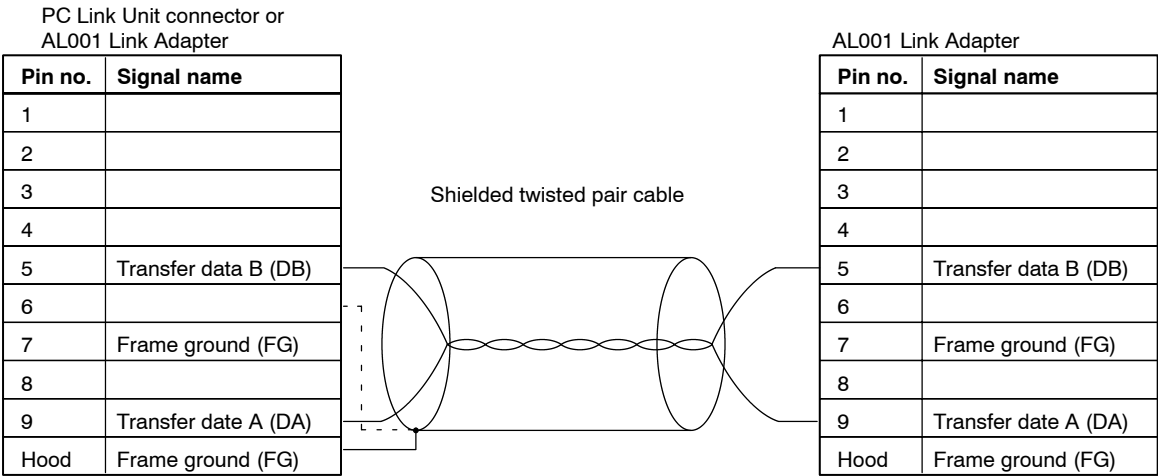
Note that RS-485 interfaces (connectors) are used for the PC Link Units, but RS-422 interfaces (connectors) are used for Link Adapters.

#### Electrical Cable Only

When only electrical cables are used, wiring is 2-conductor half duplex and should be shielded twisted pair cable.

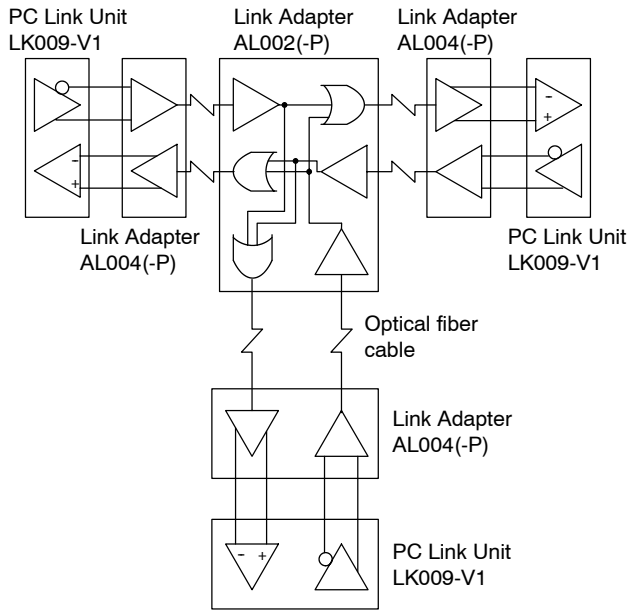


Pin connections for Systems not using optical links are shown below. Twist DB and DA together. The shield wire is connected only at one end of each cable to prevent current flow. For cables connecting a PC Link Unit to a Link Adapter, connect the shield wire to FG at the PC Link Unit connector (either the connector hood, if it is metal, or pin #7 can be used). For cables connecting two Link Adapters, connect the shield wire to pin #7 at either Link Adapter connector, but not at both. Connector pin numbers and connector assembly are described in following subsections.



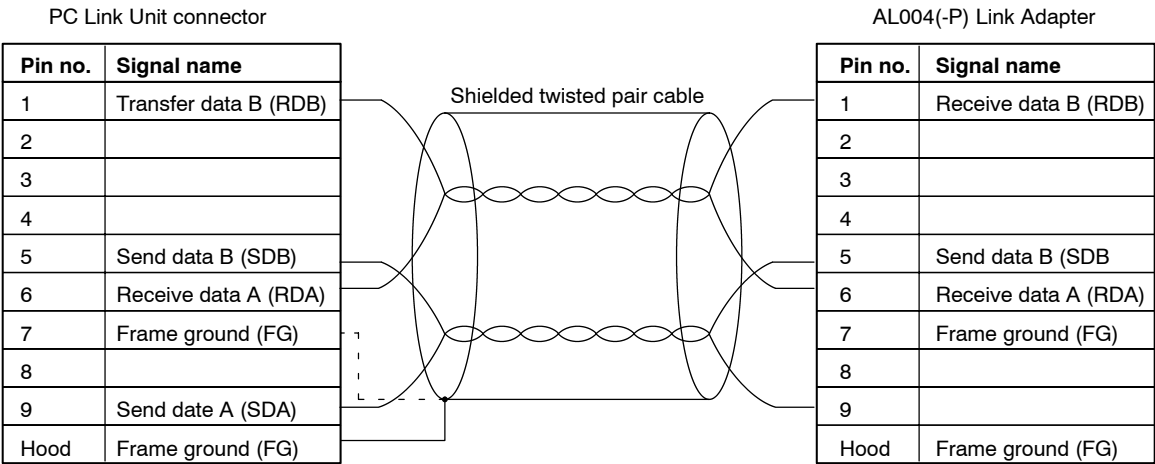
Electrical and Optical Fiber Cable

Optical fiber cable is extremely effective in eliminating malfunctions caused by noise sources near the connecting cables or by differences in the PC ground impedances. It also increases the total cable length allowable in the System. When optical fiber cable is used together with electrical cables, wiring is 4-conductor simplex. Wire cable sections should be kept as short as possible, preferably less than 10 meters each.





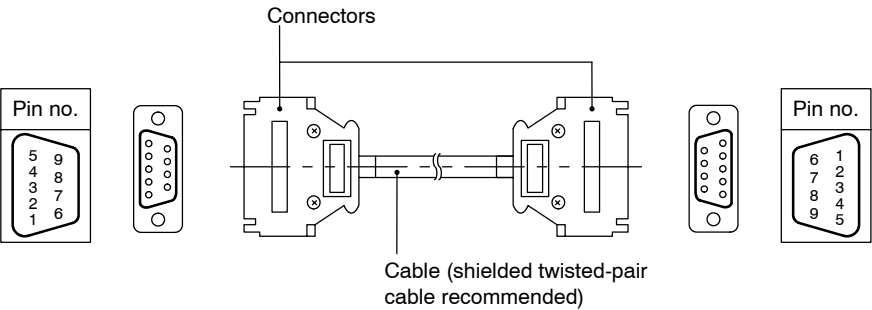
Pin connections for Systems using optical links are shown below. Twist SDB with SDA; RDA with RDB. The shield wire is connected only at one end of each cable to prevent current flow. For cables connecting a PC Link Unit to a Link Adapter, connect the shield wire to FG at the PC Link Unit connector (either the connector hood, if it is metal, or pin #7 can be used). Connector pin numbers and connector assembly are described in following subsections. See Section 2 Link Adapters for information on optical fiber cables.



Connector Pin Numbers

Connector pin numbers and cable-connector layout are shown below. Connector assembly is described in a following subsection.

Connector	XM2A-0901
Housing	XM2S-0911
Maker	OMRON



Cable Lengths

Keep the length of the connecting cable between a Link Adapter and a branched PC Link Unit to within 10 m. In Systems employing optical fiber cable between Link Adapter, the lengths of electrical cable should be made as short as possible to take full advantage of the properties of the optical links. If only electrical cable is used, the total length of all the cables on both main and branch lines must not exceed 500 m.

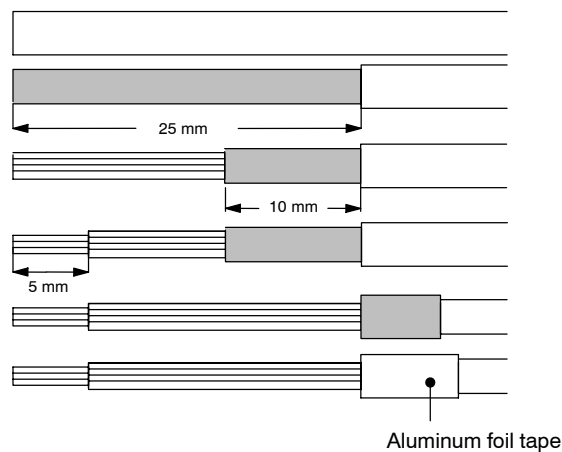
**Wiring Cables**

Use the following procedure to wire connectors.

**Preparing to Connect Shield Wire to FG**

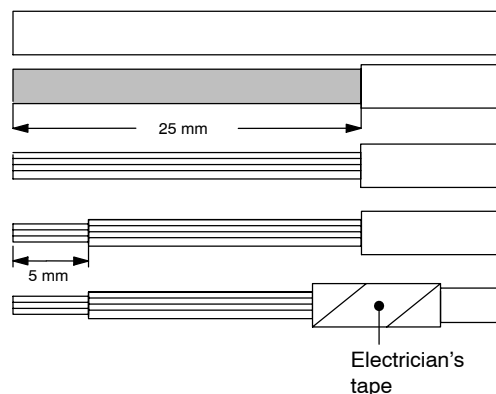
Refer to the following diagrams as necessary.

- 1, 2, 3...**
1. Cut the cable to the required length.
  2. Being careful not to damage the braiding underneath, use a razor blade to cut away 25 mm of sheath.
  3. Using scissors, cut away all but 10 mm of the exposed shield wire braiding.
  4. Using wire strippers, remove the covering from the last 5 mm of all wires.
  5. Fold the braiding back over the end of the sheath.
  6. Wrap aluminum foil tape 1 1/2 turns over top of the braiding on top of the sheath.

**Preparing for No Shield Wire Connection to FG**

Refer to the following diagrams as necessary.

- 1, 2, 3...**
1. Cut the cable to the required length.
  2. Being careful not to damage the braiding underneath, use a razor blade to cut away 25 mm of sheath.
  3. Using scissors, cut away all of the exposed shield wire braiding.
  4. Using wire strippers, remove the covering from the last 5 mm of all wires.
  5. Wrap electrician's tape over top of the end of the cut sheath.



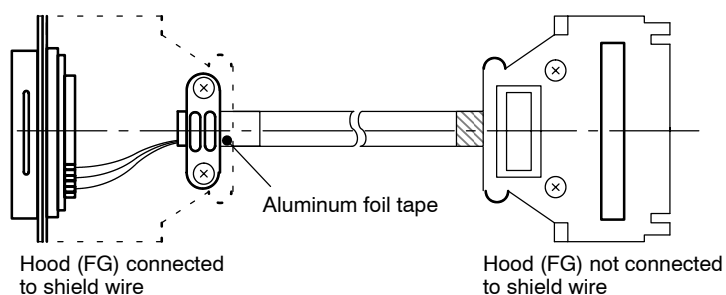
**Soldering**

Observe the following when soldering wires onto the connector.

- 1, 2, 3...** 1. Place heat-shrinking tubes onto all wires far enough from the end so as to not interfere with soldering.
2. Presolder all wires and connector terminals.
3. Solder all wires, inserting 4 mm of the exposed 5 mm of wire into the connector terminal.
4. Move the heat-shrinking tubes onto the soldered area and shrink them into place.

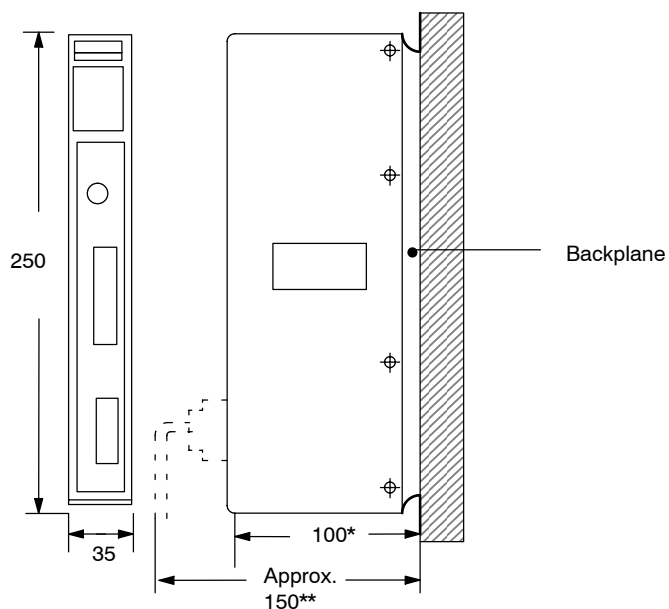
**Hood Assembly**

Assemble the connector hood as shown the following diagram. See the connection diagrams above to confirm whether one end is or is not to be connected to the shield wire.

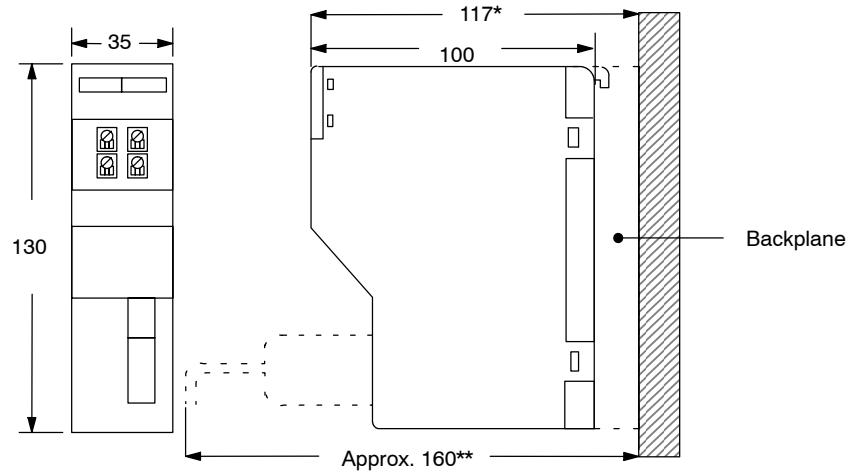
**5-2 Dimensions**

C500-LK009-V1

Unit: mm



C500-LK401



\*PC Link Unit and Base

\*\*Including RS-485 Connector

**SECTION 6**  
**Programming Considerations**

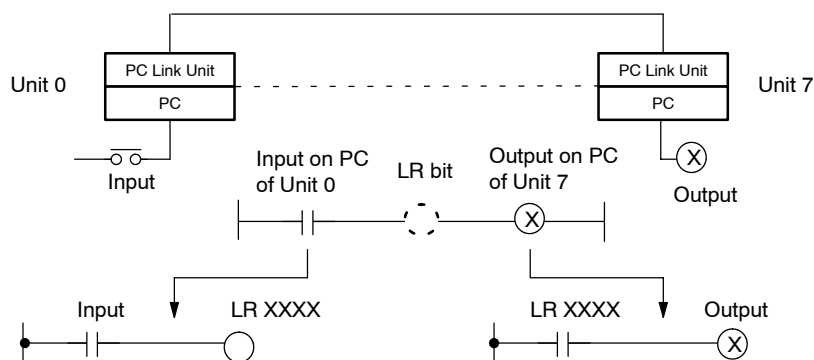
6-1	Response Times .....	46
6-2	Reducing Response Time (C200H, C200HS, C200HX/HG/HE(-Z)) .....	51
6-3	Programming Examples .....	52

## 6-1 Response Times

The processing that determines and the methods for calculating maximum and minimum response times from input to output are provided in this subsection. The following System and I/O program steps will be used in all examples below. This System contains eight PC Link Units.

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 processing occurs during the PC scan, particular that inputs will not produce programmed-actions until the program has been execution.

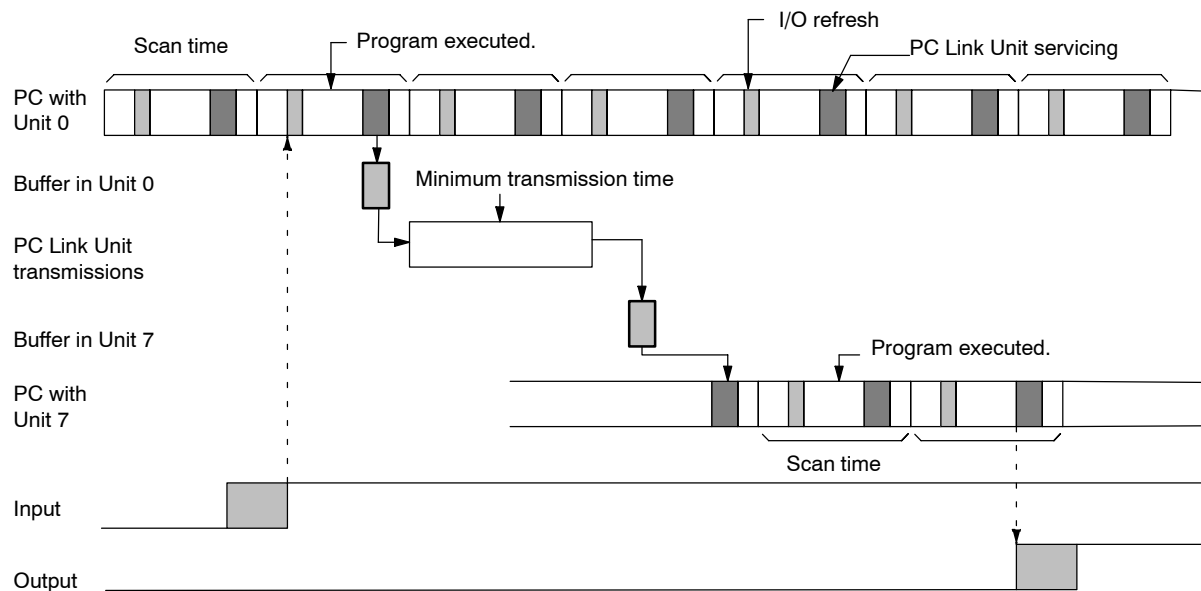


**Note** Noise may increase I/O delays.

### C500 PCs

#### Minimum Response Time

The following illustrates the data flow that will produce the minimum response time, i.e., the time that results when all signals and data transmissions are processed as soon as they occur.



The equation for minimum I/O response time is thus as follows:

Response time = input ON delay + scan time of PC of Unit 0 + minimum transmission time + scan time of PC of Unit 7 + output ON delay

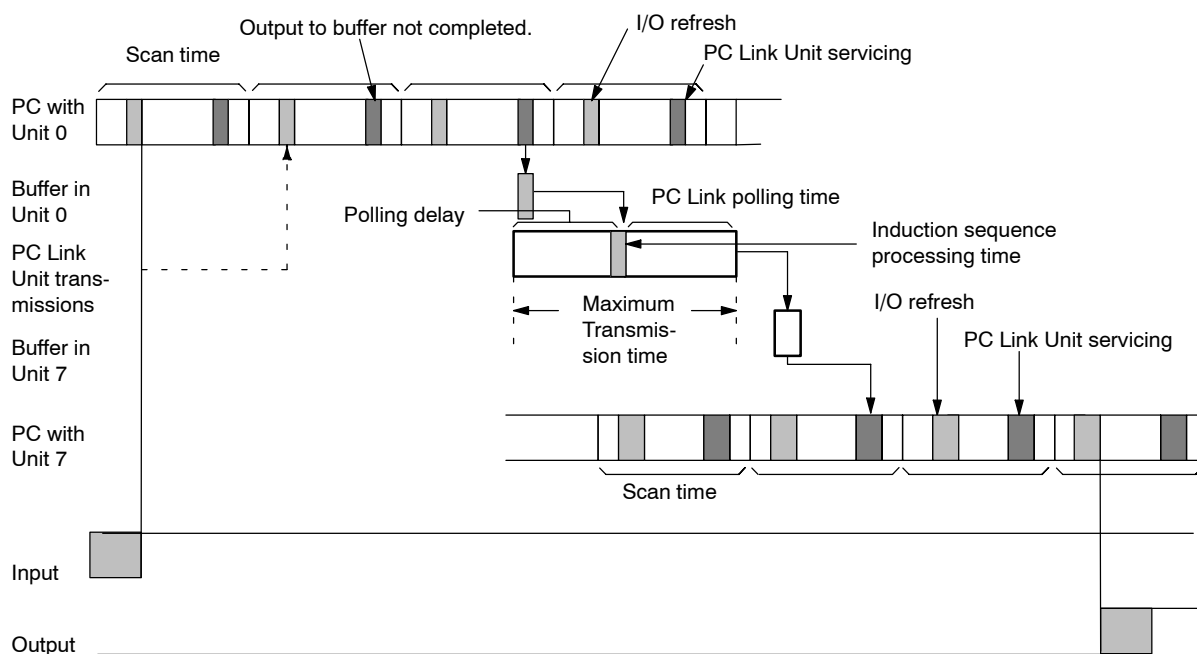
Inserting the following values into this equation produces a minimum I/O response time of 99 ms.

Input ON delay	1.5 ms
Output ON delay	15 ms
Scan time of PC of Unit 0	20 ms
Scan time of PC of Unit 7	50 ms
Minimum transmission time	12.5 ms (for 8 Units transferring 64 bits each)

### Maximum Response Time

The following diagram illustrates the data flow that will produce the maximum response time. Delays occur because signals or data is received just after they would be processed, because processing cannot be finished at one time, or because data is sent during processing. In all cases, processing must wait until the next scan/polling cycle.

First output to the buffer in the polling unit is delayed because all of the data could not be loaded into the buffer at once. The polling delay is the result of the LR data in its PC being updated immediately after the previous data was sent to the buffer in the PC Link Unit, causing a delay until the next polling cycle. One more polling cycle is then required before the data reaches the buffer in PC Link Unit 7.



The equation for maximum I/O response time is as follows:

$$\text{Response time} = \text{input ON delay} + (\text{scan time of PC of Unit 0} \times 3) + (\text{PC Link polling time} \times 2 + \text{induction sequence processing time}) + (\text{scan time of PC of Unit 7} \times 2) + \text{output ON delay}$$

Inserting the same values plus the following values into this equation produces a maximum I/O response time of 236.5 ms.

PC Link polling time: 30 ms

Induction sequence processing time: 0 ms

## C1000H and C2000H PCs

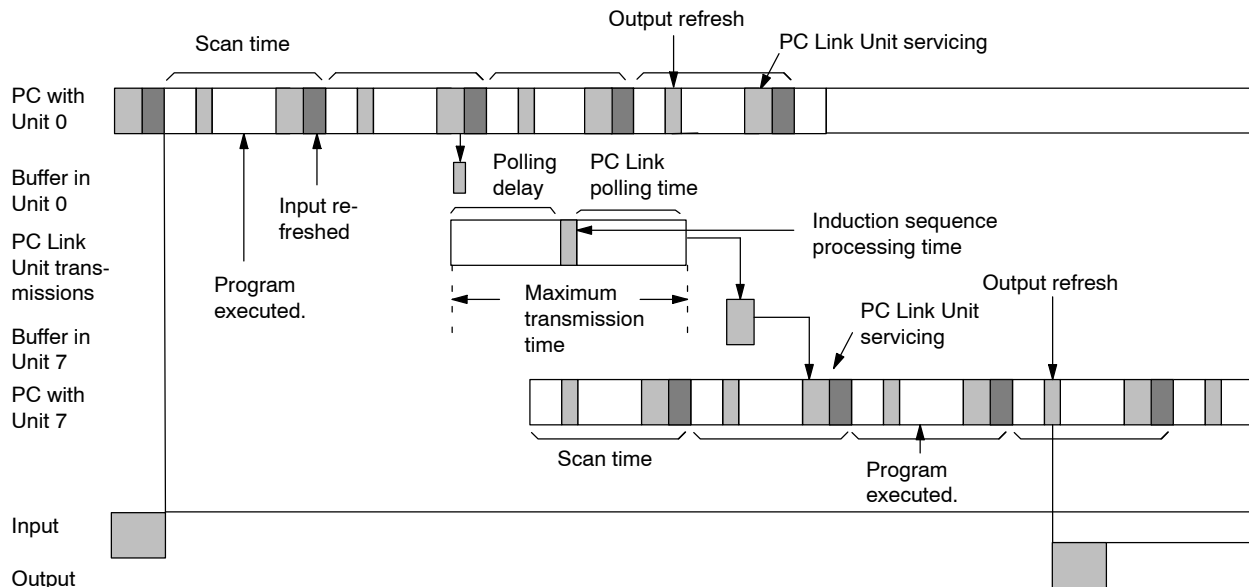
### Minimum Response Time

Although the scan for C1000H and C2000H PCs is slightly different from that for the C500 PC, the data flow that produces the minimum response time between input and output and the equation for computing it are the same as those shown for C500 PCs. Using the minimum transmission time of 12.5 ms in the equation produces a minimum I/O response time of 99 ms.

### Maximum Response Time

The following diagram illustrates the data flow that will produce the maximum response time for a Single-level PC Link System. Delays occur because signals or data is received just after they would be processed or because data is sent during processing. In either case, processing must wait until the next scan/polling cycle.

The polling delay is the result of the LR data in its PC being updated immediately after the previous was sent to the buffer in the PC Link Unit, cause a delay until the next polling cycle. One more polling cycle is then required before the data reaches the buffer in PC Link Unit 7.



The equation for maximum I/O response time is thus as follows:

$$\text{Response time} = \text{input ON delay} + (\text{scan time of PC of Unit 0} \times 2) + (\text{PC Link polling time} \times 2 + \text{induction sequence processing time}) + (\text{scan time of PC of Unit 7} \times 2) + \text{output ON delay}$$

Inserting the same values plus the following values into this equation and again using the minimum transmission time produces a maximum I/O response time of 336.5 ms.



PC Link polling time: 30 ms

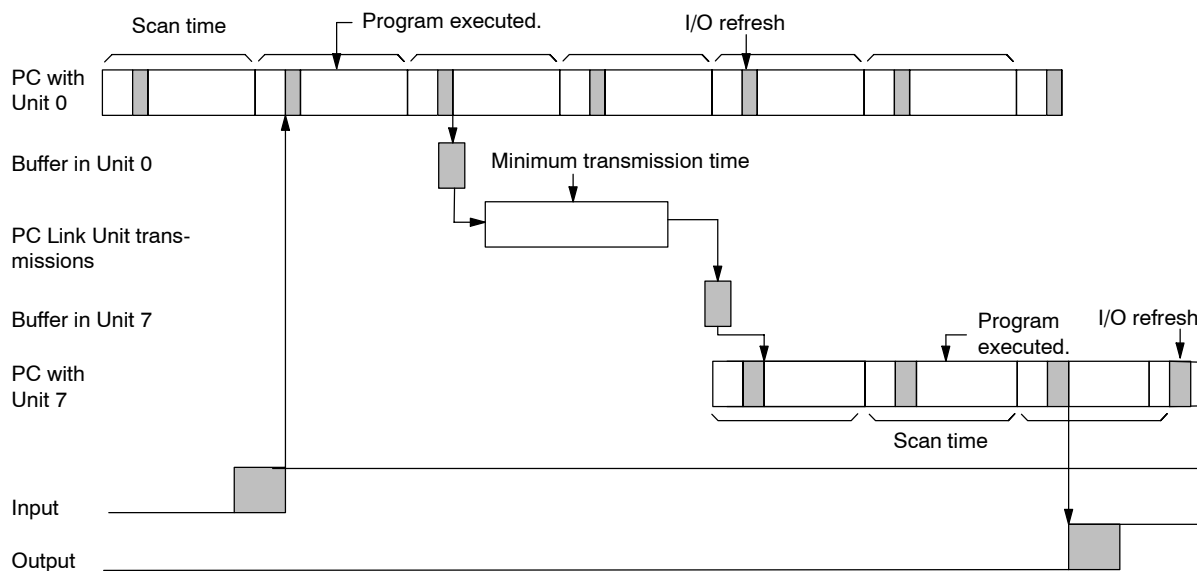
Induction sequence processing time: 120 ms

In a Multilevel PC Link System, the time required for the output may be delayed one more scan at both Unit 0 and Unit 7. This is because PC Link servicing is split into two parts in the PC scan, only one of which may be serviced during any one scan depending on the time required for program execution. Refer to the *C1000H/C2000H Operation Manual* for details.

### **C200H, C200HS, and C200HX/HG/HE(-Z) PCs**

#### **Minimum Response Time**

The following illustrates the data flow that will produce the minimum response time, i.e., the time that results when all signals and data transmissions are processed as soon as they occur.



The equation for minimum I/O response time is thus as follows:

$$\text{Response time} = \text{input ON delay} + \text{scan time of PC of Unit 0} + \text{minimum transmission time} + (\text{scan time of PC of Unit 7} \times 2) + \text{output ON delay}$$

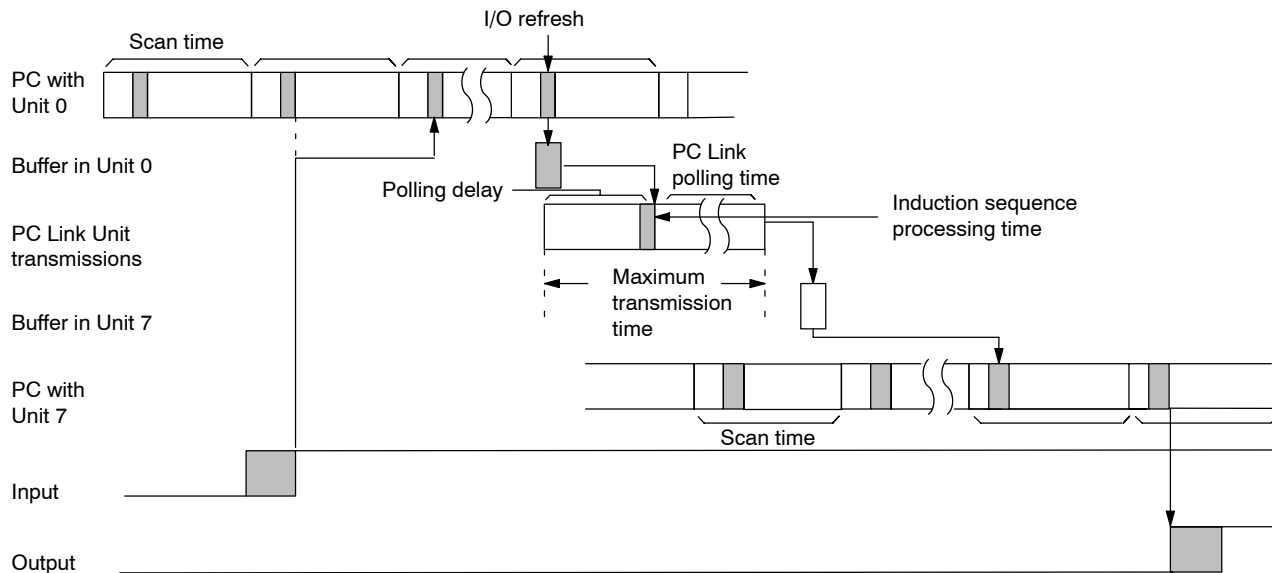
Inserting the following values into this equation produces a minimum I/O response time of 149.3 ms.

Input ON delay	1.5 ms
Output ON delay	15 ms
Scan time for PC of Unit 0	20 ms
Scan time for PC of Unit 7	50 ms

**Maximum Response Time**

The following diagram illustrates the data flow that will produce the maximum response time. Delays occur because signals or data is received just after they would be processed or because data is sent during processing. In either case, processing must wait until the next scan/polling cycle.

First output to the buffer in the polling unit is delayed by the setting of the number of LR bits to be refreshed each scan. A similar delay is present when the LR data reaches Unit 7. The polling delay is the result of the LR data in its PC being updated immediately after the previous was sent to the buffer in the PC Link Unit, cause a delay until the next polling cycle. One more polling cycle is then required before the data reaches the buffer in PC Link Unit 7.



The equation for maximum I/O response time is thus as follows:

Response time = input ON delay + [scan time of PC of Unit 0 x (number of LR transfer bits ÷ I/O refresh bits)] + alpha + (PC Link polling time + induction sequence processing time) + {scan time of PC of Unit 7 x [(number of LR transfer bits ÷ I/O refresh bits) x 2 + 1]} + beta + output ON delay

If scan time of PC of Unit 0 > PC Link polling time, alpha = scan time of PC of Unit 0. If scan time of PC of Unit 0 < PC Link polling time, alpha = PC Link polling time.

If scan time of PC of Unit 7 > PC Link polling time, beta = scan time of PC of Unit 7. If scan time of PC of Unit 7 < PC Link polling time, beta = PC Link polling time.

Inserting the following values into this equation produces a maximum I/O response time of 661.3 ms.

I/O refresh bits for Unit 0	256
I/O refresh bits for Unit 7	256

## 6-2 Reducing Response Time (C200H, C200HS, C200HX/HG/HE(-Z))

IORF(97) can be used in programming to shorten the I/O response time greater than is possible by setting a high number of refresh bits. (Remember, increasing the number of refresh bits set on the back-panel LED shortens response time, but increases the scan time of the PC.) The following calculations for the maximum scan time use the same example System configuration as that used in 6-1 *Response Times*. In programming the PCs for PC Link Units #0 and #7, IORF(97) is executed during every PC scan for the PC Link Units. The basic equation for the maximum I/O response time is as follows:

$$\text{Response time} = \text{input ON delay} + [\text{scan time of PC of Unit 0} \times (\text{number of LR transfer bits} \div \text{number of I/O refresh bits} \div 2)] + \alpha + \text{PC Link scan time} + \text{invitation sequence processing time} + \{\text{scan time of PC of Unit 7} \times [(\text{number of LR transfer bits} \div \text{number of I/O refresh bits} \div 2) \times 2 + 1]\} + \beta + \text{output ON delay}$$

If scan time of PC of Unit 0 > PC Link scan time,  $\alpha$  = scan time of PC of Unit 0. If scan time of PC of Unit 0 < PC Link scan time,  $\alpha$  = PC Link scan time.

If scan time of PC of Unit 7 > PC Link scan time,  $\beta$  = scan time of PC of Unit 7. If scan time of PC of Unit 7 < PC Link scan time,  $\beta$  = PC Link scan time.

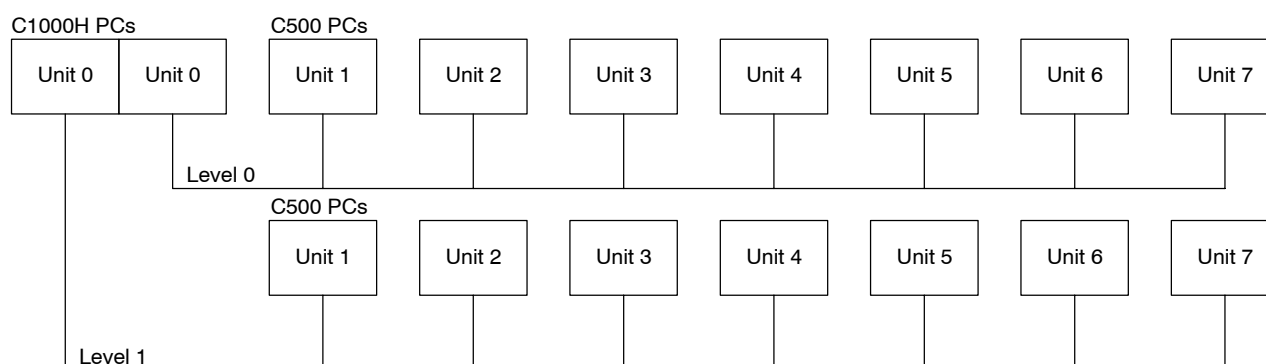
The required data from the example System configuration is as follows:

Input ON delay	1.5 ms
Output ON delay	15 ms
Scan time of PC of Unit 0	20 ms + 5.7 ms = 25.7 (required for IORF execution)
Scan time of PC of Unit 7	50 ms + 5.7 ms = 55.7 (required for IORF execution)
Number of PC Link Units	8
Number of LR bits	1,024
Number of refresh bits for Unit 0	256
Number of refresh bits for Unit 7	256
PC Link scan time	32.4 ms
Invitation sequence processing time	0 ms

Placing these values into the equation produces a maximum I/O response time of 466.9 ms, approximately 200 ms shorter than that obtained for the same I/O example in 6-1 *Response Times*.

## 6-3 Programming Examples

This example explains the programming required to start the entire Control System shown below only after all “preparation-completed flags” are turned ON for both Subsystems. Using the following programming, any PC that is not in RUN mode will be ignored and operations will continue for the other PCs. The program is designed to start the System only if none of the PCs is already running. The Control System consists of 15 PCs and 16 C500-LK009-V1 PC Link Units using 32 transfer bits each. Both polling units are mounted to a C1000H PC. All other PC Link Units are mounted to C500 PCs in two Subsystems each consisting of seven PC Link Units.



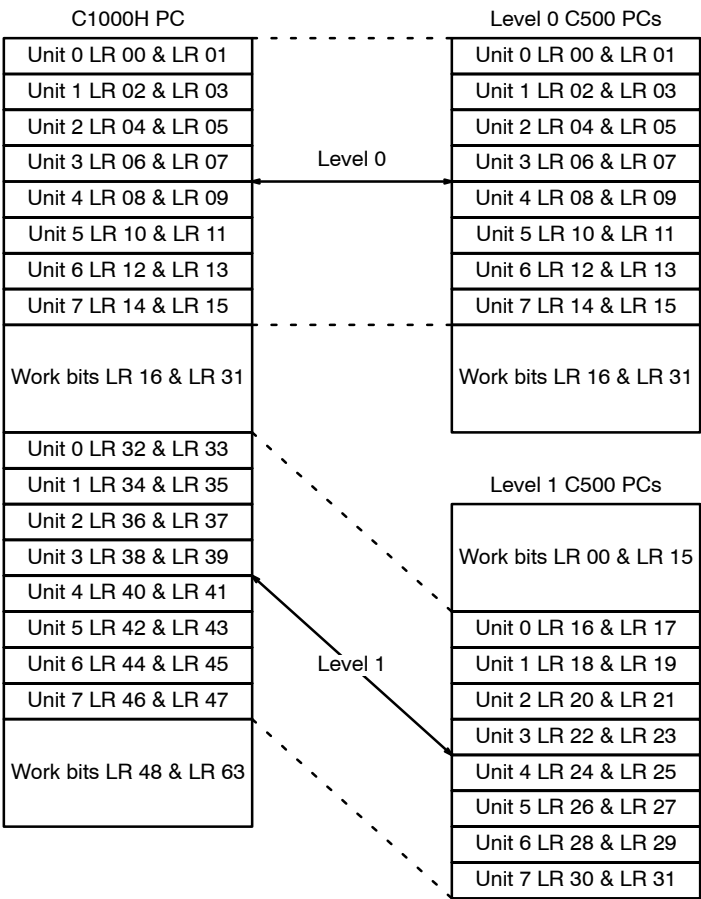
### C1000H Write Bits

<b>LR 0000</b>	Level 0 START command bit
<b>LR 3200</b>	Level 1 START command bit
<b>LR 0001</b>	Preparation-completed flag for Units #0, level 0 and level 1

### C500 Write Bits

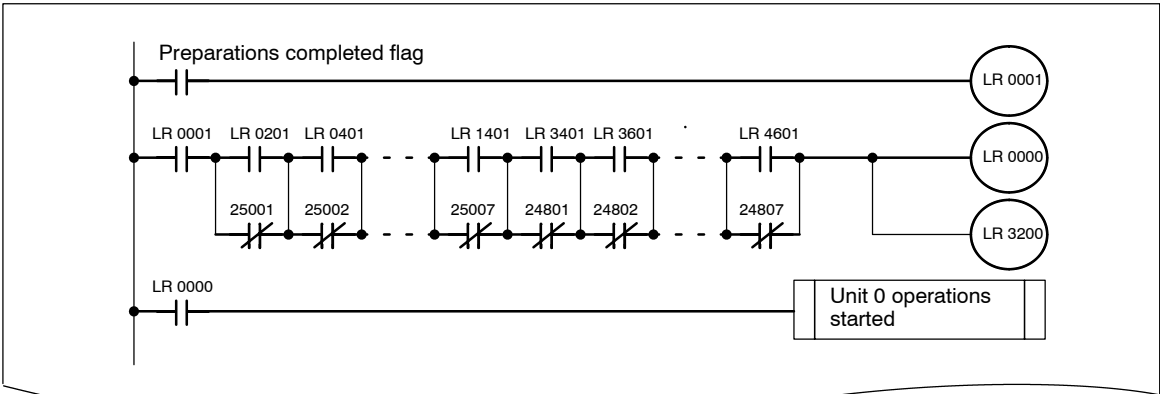
<b>LR 0201</b>	Preparation-completed flag for Unit #1, level 0
<b>LR 0401</b>	Preparation-completed flag for Unit #2, level 0
<b>LR 0601</b>	Preparation-completed flag for Unit #3, level 0
<b>LR 0801</b>	Preparation-completed flag for Unit #4, level 0
<b>LR 1001</b>	Preparation-completed flag for Unit #5, level 0
<b>LR 1201</b>	Preparation-completed flag for Unit #6, level 0
<b>LR 1401</b>	Preparation-completed flag for Unit #7, level 0
<b>LR 1801</b>	Preparation-completed flag for Unit #1, level 1
<b>LR 2001</b>	Preparation-completed flag for Unit #2, level 1
<b>LR 2201</b>	Preparation-completed flag for Unit #3, level 1
<b>LR 2401</b>	Preparation-completed flag for Unit #4, level 1
<b>LR 2601</b>	Preparation-completed flag for Unit #5, level 1
<b>LR 2801</b>	Preparation-completed flag for Unit #6, level 1
<b>LR 3001</b>	Preparation-completed flag for Unit #7, level 1

LR Area Allocations

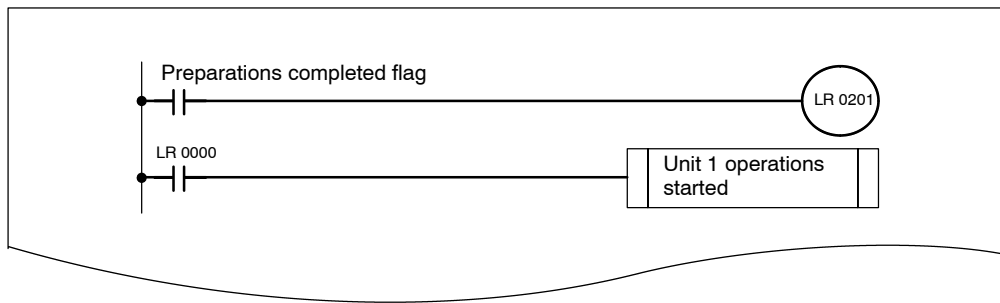


**Program** PC RUN flags (24800 through 24807 and 25000 through 25007) are used in programming the PC with Units #0. They are ON when the PC is operational.

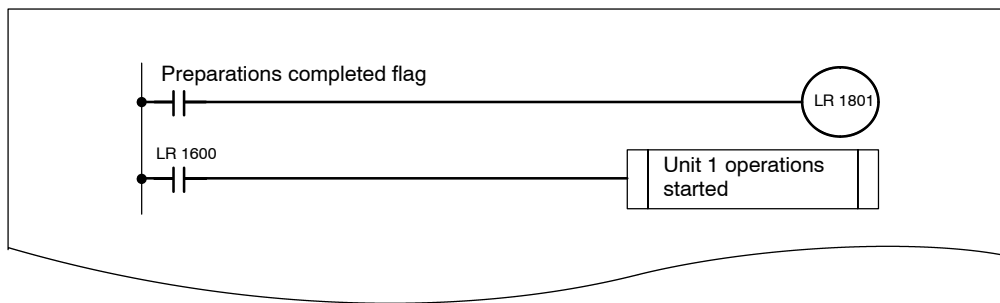
Units #0 (Levels 0 and 1)



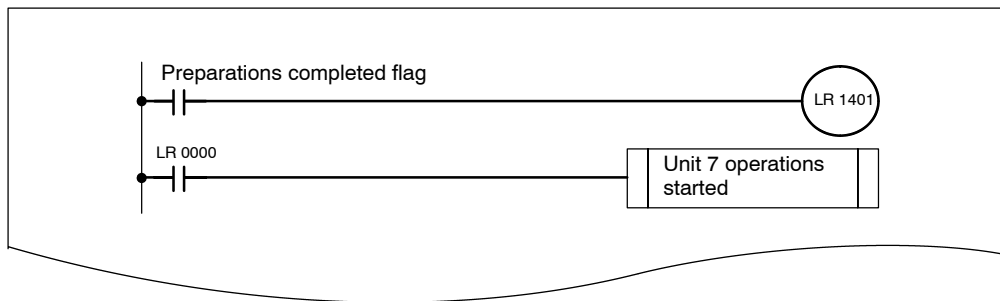
### Unit 1, Level 0



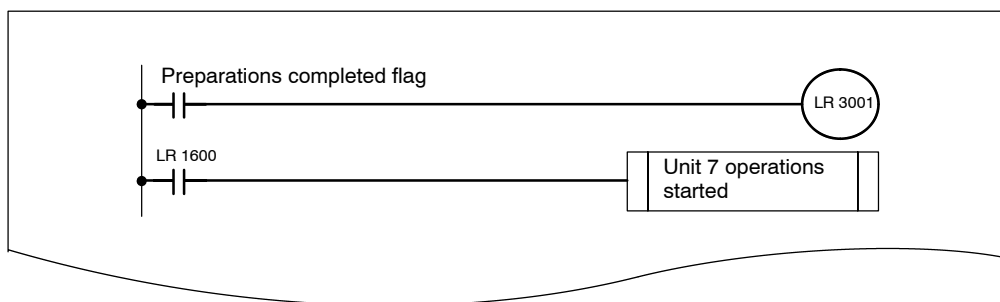
### Unit 1, Level 1



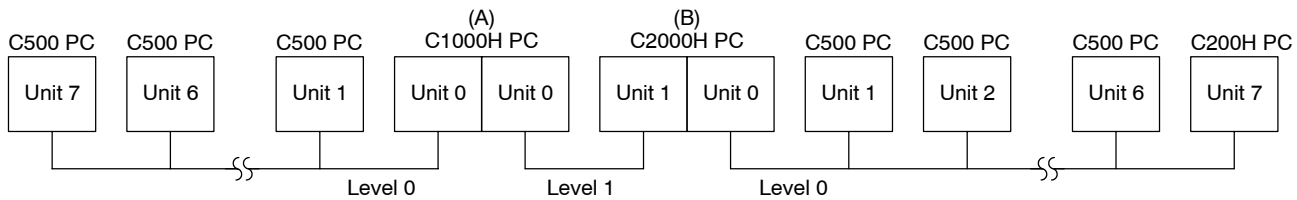
### Unit 7, Level 0



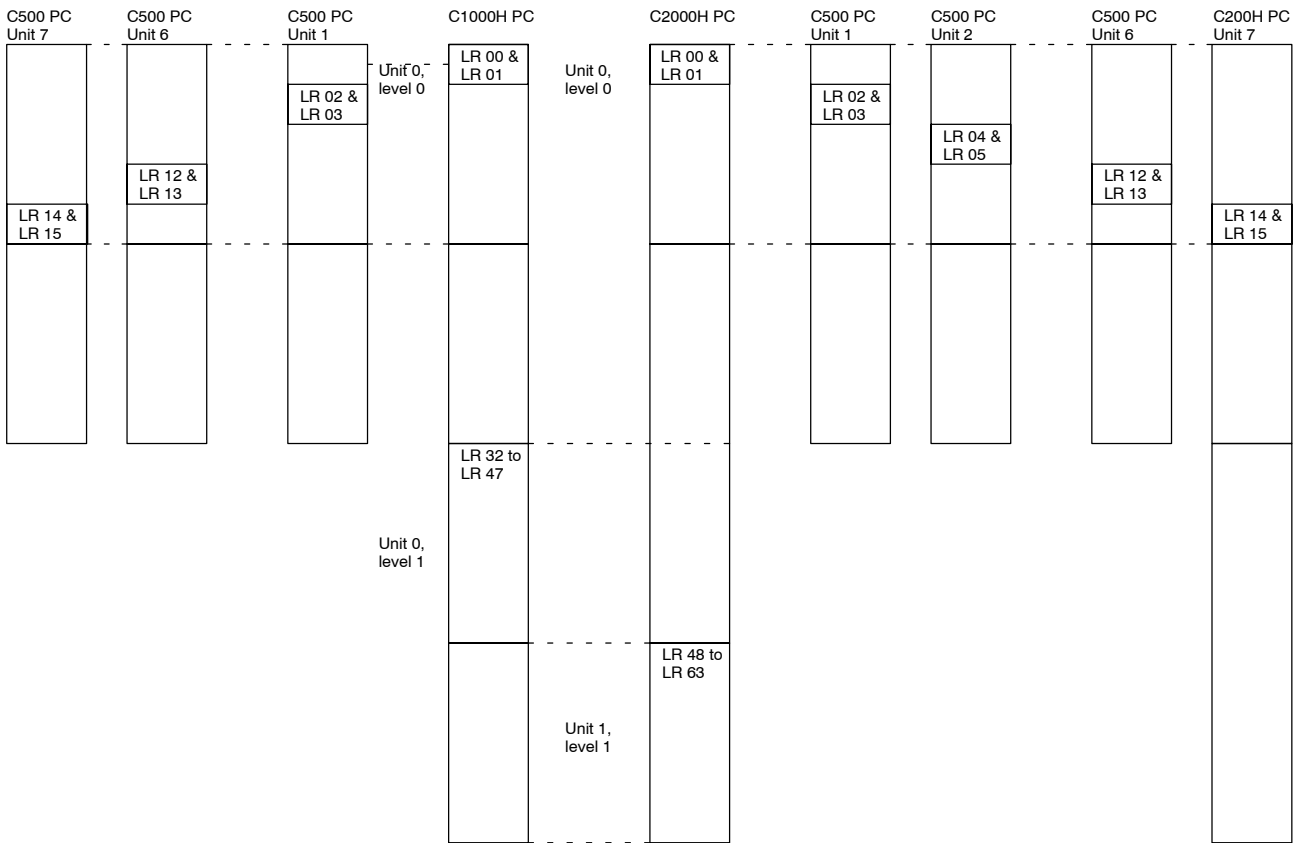
### Unit 7, Level 1



**System Configuration 2** This example is for a System with three Subsystems consisting of a C1000H PC, a C2000H PC, thirteen C500 PCs, and a C200H PC as shown below. Programming on the following pages shows the necessary steps for transferring data through the transfer PCs. Not all PCs in the System are described.



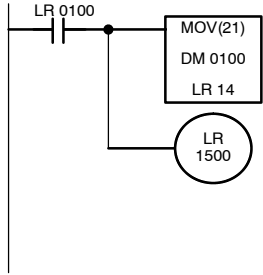
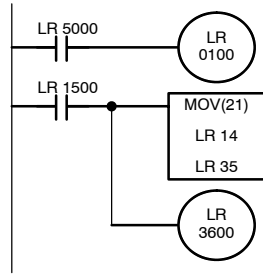
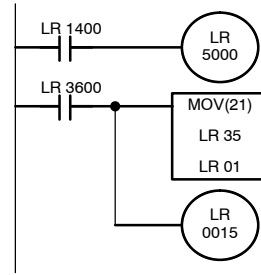
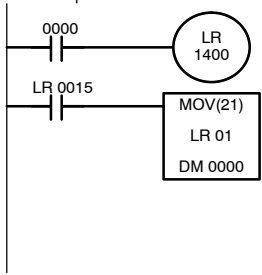
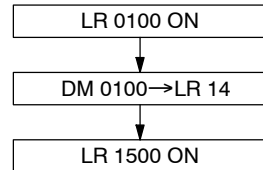
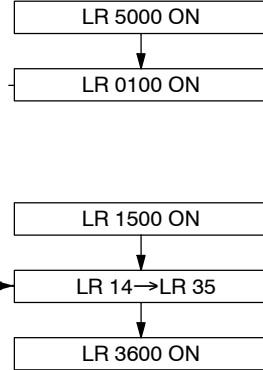


**LR Area Allocations** All words below are shown with the Unit that writes to them.



**Note** The C200H could be replaced by the C200HS and C200HX/HG/HE(-Z) without any changes in this example.

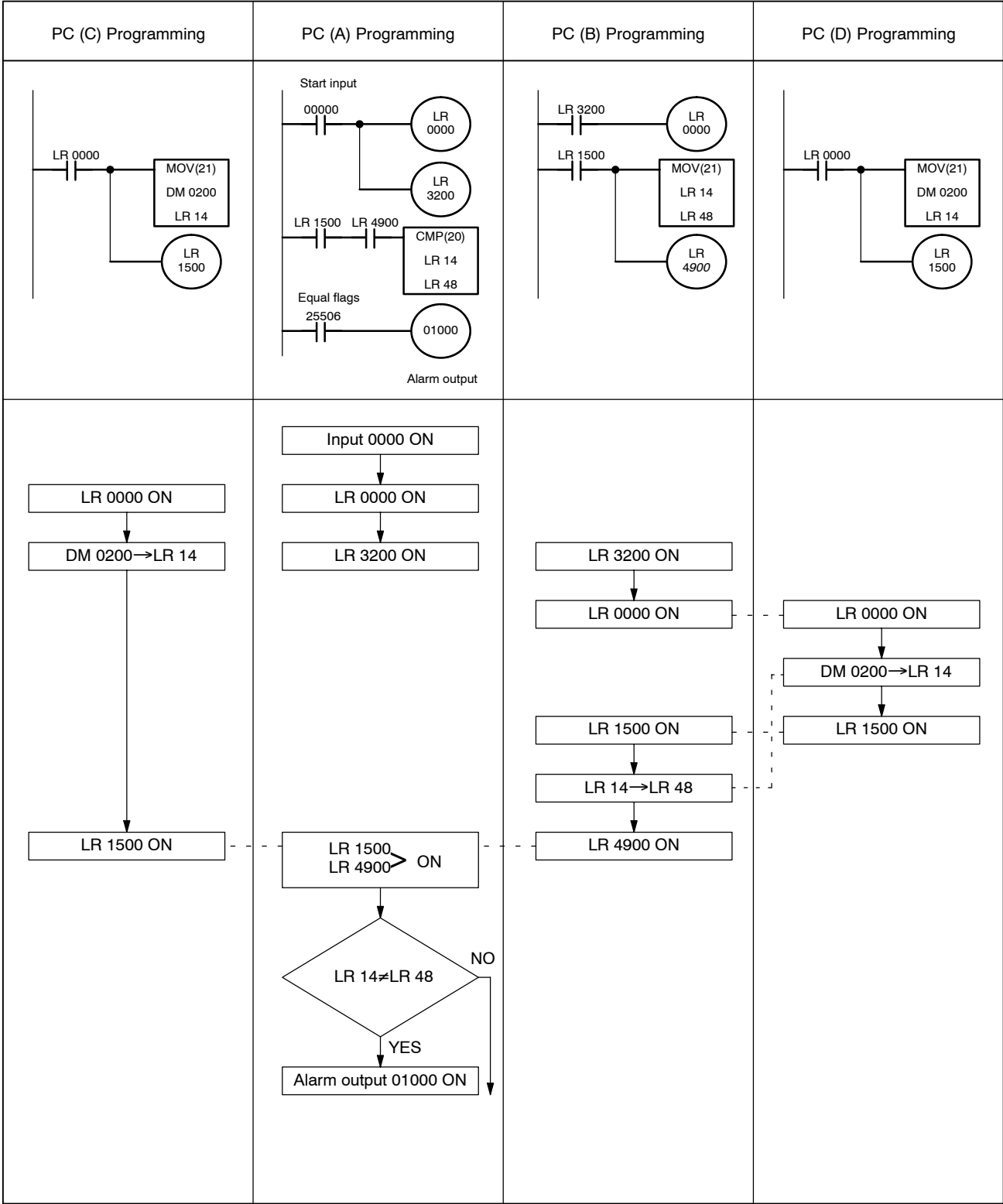
Programming Example 1

Using the above System, the following programming, which is started by turning ON input 0000 in PC (D), will move the contents of DM 0100 from PC (C) to DM 0000 in PC (D). In the table below, the process starts at the right when PC (D) sends a START signal is sent to PC (B). This signal is transferred across the PCs to PC (C) (at the extreme left in the table below) and then the transfer of data is instigated from PC (C) to PC (D) (right to left in the table below.)

PC (C) Programming	PC (A) Programming	PC (B) Programming	PC (D) Programming
 <p>Contents of DM 0100 is transferred to LR 14 and the Completed flag, LR 1500 (defined by the programmer), is turned ON when LR 0100 (written by PC(A)) turns ON.</p>	 <p>A START signal is sent to PC (C) when LR 5000 (written by PC (B)) turns ON. When transfer of DM 0100 data has been completed at PC (C), the contents of LR 14 is transferred to LR 35 and the Completed flag, LR 3600, is turned ON.</p>	 <p>A START signal is sent to PC (A) when LR 1400 (written by PC (D)) turns ON. When transfer of LR 14 data to LR 35 has been completed at PC (A), the contents of LR 35 is transferred to LR 01 and the Completed flag, LR 0015, is turned ON.</p>	 <p>A START signal is sent to PC (B) when input 0000 turns ON. When transfer of LR 35 data to LR 01 has been completed at PC (B), the contents of LR 01 is transferred to DM 0000.</p>
			



**Programming Example 2** Using the above System, the following programming, which is started by start input 0000 in PC (A), will compare the contents of DM 0200 in PCs (C) and (D) and output an alarm signal if the contents differ.



## SECTION 7

### Error Processing

The PC Link Units provide various means of monitoring systems operation and resolving errors when they occur. These include LED indications, PC RUN and Error Flags, and, for C200H, C200HS, and C200HX/HG/HE(-Z) systems, Special I/O Unit Error Flags and Restart Bits.

7-1	SR Area Flags .....	60
7-2	Error Examples .....	62
7-3	Error Tables .....	65

## 7-1 SR Area Flags

### PC RUN and Error Flags

PC RUN Flags can be read to determine the operational status of each PC to which a PC Link Unit is mounted. All PCs are operational when their PC RUN Flag is ON.

If there is a transfer error or a power failure for any PC Link Unit, the Error Flag for that Unit will turn ON, and an error message will be sent. When the error is removed (the power comes on or transfer preparation is completed) the Error Flag will go OFF. An error in Unit 0 stops all data transfer, but an error in another Unit only stops that Unit's communication. LR bit status is maintained whenever communication stops for one or more Units. Error Flags will not turn ON for FALS(07) instructions; use the PC RUN Flags. The following tables show the unit number for Single-level Systems (top line) and the unit number followed by the level for Multilevel Systems (bottom line).

### C200H, C200HS, C200HX/HG/HE(-Z), C1000H, and C2000H PCs

	Bit 8								Bit 7								Bit 0
SR	#31	#30	#29	#28	#27	#26	#25	#24	#31	#30	#29	#28	#27	#26	#25	#24	
247	#15,1	#14,1	#13,1	#12,1	#11,1	#10,1	#9,1	#8,1	#15,1	#14,1	#13,1	#12,1	#11,1	#10,1	#9,1	#8,1	
SR	#23	#22	#21	#20	#19	#18	#17	#16	#23	#22	#21	#20	#19	#18	#17	#16	
248	#7,1	#6,1	#5,1	#4,1	#3,1	#2,1	#1,1	#0,1	#7,1	#6,1	#5,1	#4,1	#3,1	#2,1	#1,1	#0,1	
SR	#15	#14	#13	#12	#11	#10	#9	#8	#15	#14	#13	#12	#11	#10	#9	#8	
249	#15,0	#14,0	#13,0	#12,0	#11,0	#10,0	#9,0	#8,0	#15,0	#14,0	#13,0	#12,0	#11,0	#10,0	#9,0	#8,0	
SR	#7	#6	#5	#4	#3	#2	#1	#0	#7	#6	#5	#4	#3	#2	#1	#0	
250	#7,0	#6,0	#5,0	#4,0	#3,0	#2,0	#1,0	#0,0	#7,0	#6,0	#5,0	#4,0	#3,0	#2,0	#1,0	#0,0	
Error Flags									PC RUN Flags								

### C500 PCs

	Bit 8								Bit 7								Bit 0
SR	#7,1	#6,1	#5,1	#4,1	#3,1	#2,1	#1,1	#0,1	#7,1	#6,1	#5,1	#4,1	#3,1	#2,1	#1,1	#0,1	
58																	
SR	#7	#6	#5	#4	#3	#2	#1	#0	#7	#6	#5	#4	#3	#2	#1	#0	
62	#7,0	#6,0	#5,0	#4,0	#3,0	#2,0	#1,0	#0,0	#7,0	#6,0	#5,0	#4,0	#3,0	#2,0	#1,0	#0,0	
Error Flags									PC RUN Flags								

### Level Flags

AR area flags that indicate the type of System and level of the Subsystem of the PC Link Unit mounted to the PC are also provided for C200H, C200HS, C200HX/HG/HE(-Z), C1000H, and C2000H PCs. AR bit 2411 will be ON if a level 1 PC Link Unit in a Multilevel System is mounted to the PC.

AR bit 2412 will be ON if a level 0 PC Link Unit in a Multilevel System or a PC Link Unit in a Single-level System is mounted to the PC.

**Special I/O Unit Restart Bits and Error Flags  
(C200H, C200HS,  
C200HX/HG/HE(-Z))**

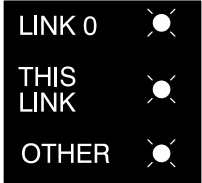
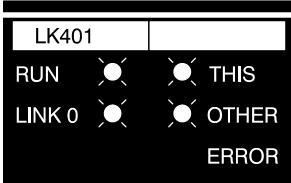

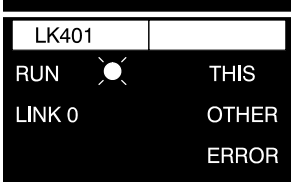
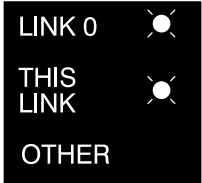
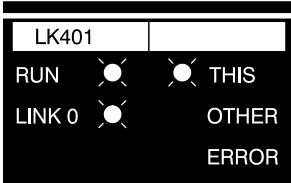

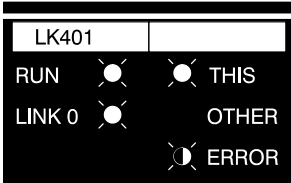
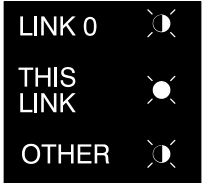
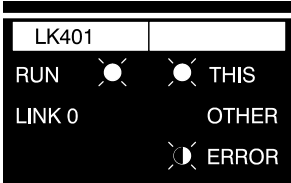
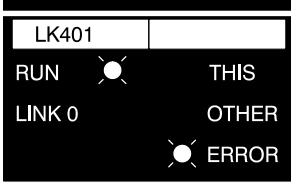
Because the C200H-LK401 is treated as a Special I/O Unit, Special I/O Unit Restart Bits and Error Flags are effective for it. An Error Flag turns ON when the same Special I/O Unit unit number is assigned to more than one Unit or when an error has occurred in the refresh cycle between the PC and the Special I/O Unit with the designated unit number. **This unit number is different than and set independently from the PC Link Unit's unit number.** When an error occurs in any Special I/O Unit, SR bit 25415 will also turn ON. Restart Bits can be used to restart a Special I/O Unit to clear an error or to change switch settings by turning the flag bit OFF, and then back ON, either through programming or through the Programming Console. The restart operation starts the PC Link Unit from the same initial step as if the power were just turned on, and will turn ON the Error Flag for that Unit at the PC of other Special I/O Units. If the PC Link Unit still does not function properly, turn off the power to the PC, then turn it on again. Error Flags and Restart Bit are refreshed every PC scan.

Word	Bit	Function
AR 00	0	Error Flag for Special I/O Unit #0
	1	Error Flag for Special I/O Unit #1
	2	Error Flag for Special I/O Unit #2
	3	Error Flag for Special I/O Unit #3
	4	Error Flag for Special I/O Unit #4
	5	Error Flag for Special I/O Unit #5
	6	Error Flag for Special I/O Unit #6
	7	Error Flag for Special I/O Unit #7
	8	Error Flag for Special I/O Unit #8
	09	Error Flag for Special I/O Unit #9
AR 01	0	Restart Bit for Special I/O Unit #0
	1	Restart Bit for Special I/O Unit #1
	2	Restart Bit for Special I/O Unit #2
	3	Restart Bit for Special I/O Unit #3
	4	Restart Bit for Special I/O Unit #4
	5	Restart Bit for Special I/O Unit #5
	6	Restart Bit for Special I/O Unit #6
	7	Restart Bit for Special I/O Unit #7
	8	Restart Bit for Special I/O Unit #8
	09	Restart Bit for Special I/O Unit #9

## 7-2 Error Examples

Error conditions are indicated by the LEDs as described below.

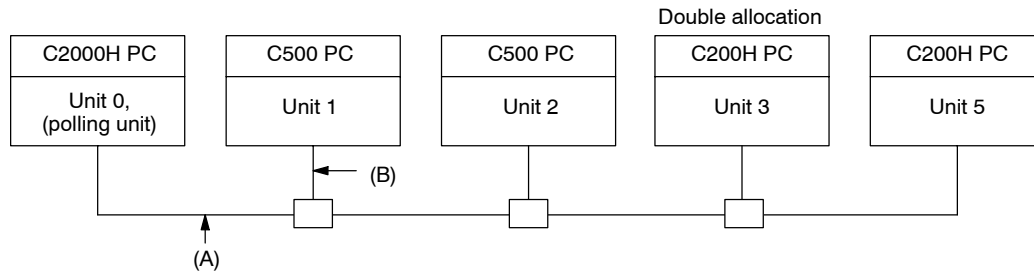
**Note** Some errors in switch settings (e.g., setting the same unit number for more than on PC Link Unit) will not result in an error display, but will cause LR area data to be in error.

LK009	LK401	MEANING
		Indicates all PC Link Units in this operating level are exchanging data normally.
		Indicates data exchange is not occurring with any other PC Link Unit.
		Only possible on the polling unit: indicates that none of the PC Link Units are capable of data exchange.
		Indicates an error exists in another PC Link Unit that is not the polling unit.
		Indicates an error exists between this Unit and the polling unit.
		Indicates setting of PC Link Unit numbers is wrong.

**Note:** Open circles indicate lit LEDs. Half-back circles indicate flashing LEDs.

## System Configuration

This example will describe error indications on all PC Link Units using the following System configuration. Transmission line breaks will be described at two different points, A and B. Unit 3 has been set for double allocation, and thus is allocated the LR bits and flags from both Unit 3 and Unit 4.

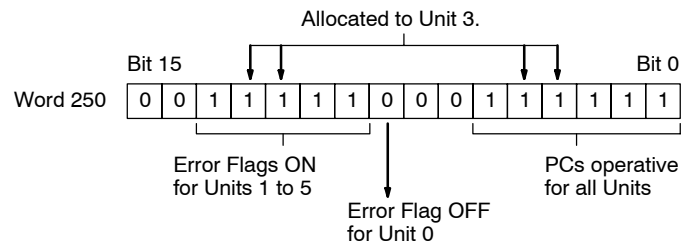
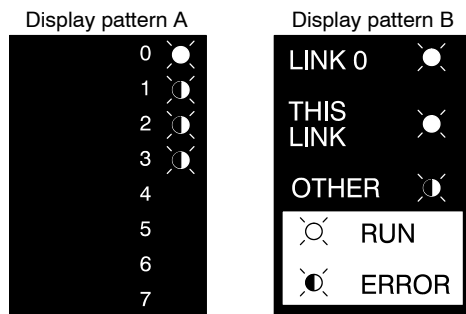


**Note** The C200H could be replaced by the C200HS and C200HX/HG/HE(-Z) without any changes in this example.

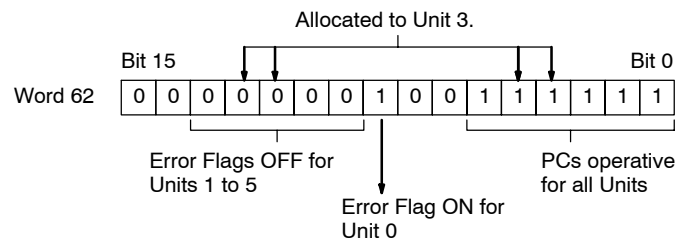
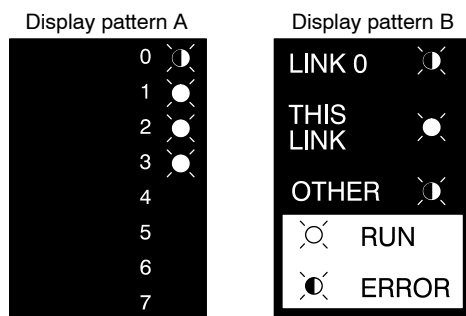
## Break at Point A

Because Unit 0 receives no response from Units 1, 2, 3, and 5 it indicates an error for all of them. Because Units 1, 2, 3, and 5 receive no polling signal from Unit 0, they each indicate an error for it. LED indications are shown below, as well as the conditions of the PC RUN and Error Flags in the SR area.

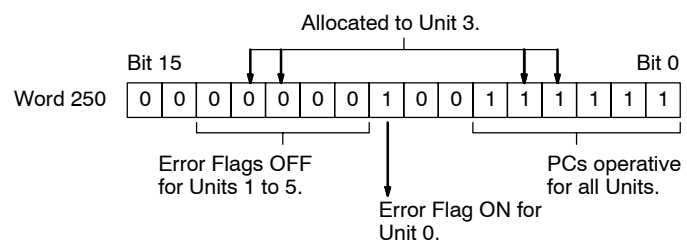
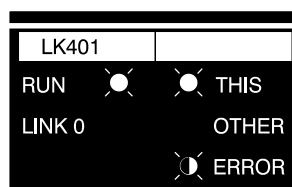
## Unit 0 (C2000H PC)



## Units 1 and 2 (C500 PC)

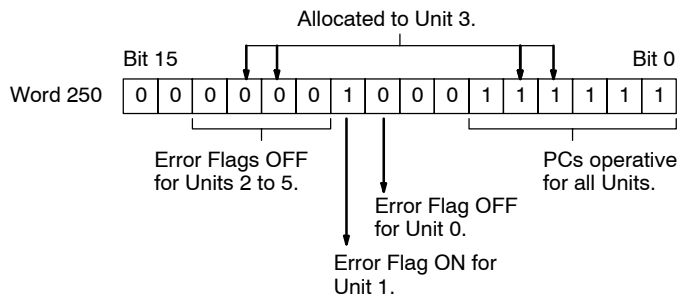
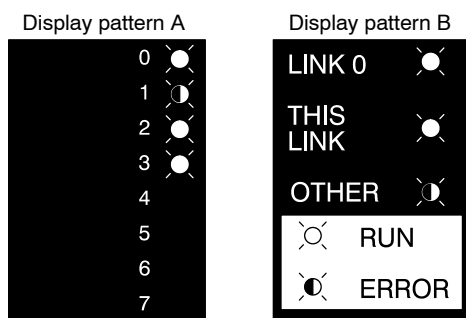
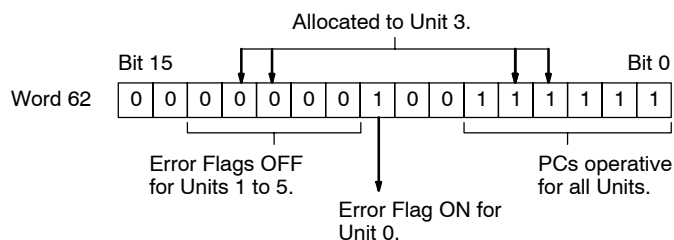
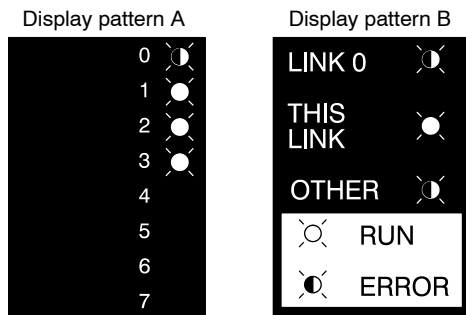
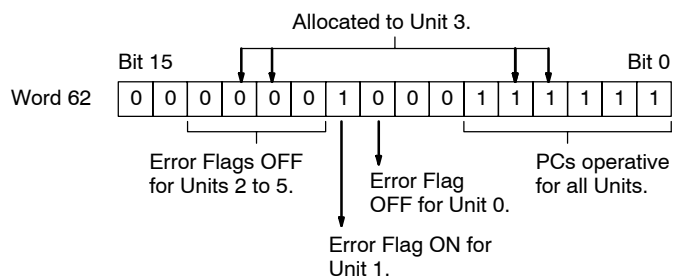
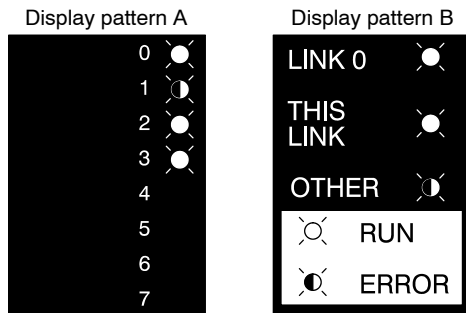


## Units 3 and 5 (C200H PC)

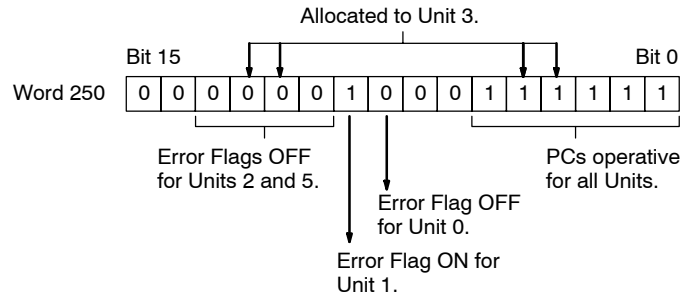
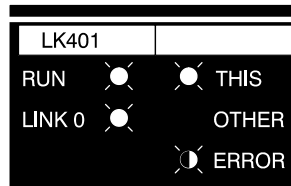


**Break at Point B**

Because Unit 0 receives no response from Unit 1 only, it indicates an error for it, and normal conditions for Units 2 and 3. Since Unit 1 receives no polling signal from Unit 0, it indicates an error for Unit 0. Units 2, 3, and 5 receive signals from each other and indicate normal conditions other than an error for Unit 1. LED indications are shown below, as well as the conditions of the PC RUN and Error Flags in the SR area.

**Unit 0 (C2000H PC)****Unit 1 (C500 PC)****Unit 2 (C500 PC)**

## Units 3 and 5 (C200H PC)



**Note** The C200H could be replaced by the C200HS and C200HX/HG/HE(-Z) without any changes in this example.

## 7-3 Error Tables

### C500, C1000H, and C2000H PCs

Error Condition	Unit #0 PC CPU error	Unit #0 down (line broken or watchdog timer error)	Unit #1 cable problem (missing or broken)	Unit #0 cable problem (missing or broken)	Unit #n cable problem (missing or broken)	Error in data reception from Unit #n	Unit #n down (line broken or watchdog timer error)	Unit #n PC CPU error
Unit #0	At startup	Link not established			---			
	During operation	PC RUN Flag OFF for Unit #0.	All LEDs not lit (link broken).	All Error Flags OFF but that for #0. All LEDs but LINK 0 flashing.	Error Flags for Unit #n ON. LED for Unit #n flashing (link with Unit #n broken).			PC RUN Flag for Unit #n OFF (pre- vious data retained).
Units other than #0 and #n	At startup	Link not established			---			
	During operation	PC RUN Flag OFF for Unit #0.	Error Flags for Unit #0 ON. LED for Unit #0 flashing (link broken).	Error Flags for Unit #n ON. LED for Unit #n flashing (previous data re- tained for Unit #n).	Error Flags for "this" Unit ON. "THIS LINK" LED flashing (previous data re- tained for Unit #n).	Error Flags for Unit #n ON. LED for Unit #n flashing (previous data re- tained for Unit #n).	PC RUN Flag for Unit #n OFF (pre- vious data retained).	
Unit #n	At startup	Link not established			---			
	During operation	PC RUN Flag OFF for Unit #0 (previous data re- tained for Unit #0)	Error Flags for Unit #0 ON. LED for Unit #0 flashing (link broken).	Error Flags for Unit #0 ON. LED for Unit #0 flashing (previous data re- tained for Unit #0).	---	All LEDs not lit.	Frozen	



## C200H, C200HS, and C200HX/HG/HE(-Z) PCs

<div>Error</div> <div>Condition</div>	Unit #0 PC CPU error	Unit #0 Special I/O Unit error	Unit #1 cable problem (missing or broken)	Unit #0 cable problem (missing or broken)	Unit #n cable problem (missing or broken)	Error in data reception from Unit #n	Unit #n PC CPU error	Unit #n Special I/O Unit error
Unit #0	At startup	Link not established			---			
	During operation	All LEDs not lit (link broken).	SR bit 25415 ON; RUN LED not lit (link broken).	All Error Flags OFF but that for #0. "OTHER" LED not lit; ERROR LED flashing. (error for all polled Units).	Error Flags for Unit #n ON. OTHER LED not lit; ERROR LED flashing (link with Unit #n broken).			
Units other than #0 and #n	At startup	Link not established			---			
	During operation	Error Flags for Unit #0 ON. LED not lit; ERROR LED flashing (link broken).			Error Flags for Unit #n ON.OTHER LED not lit; ERROR LED flashing.	Error Flags for "this" Unit ON; "THIS LINK" LED not lit; ERROR LED flashing (link with "this" Unit broken).	Error Flags for Unit #n ON; "OTHER" LED not lit; ERROR LED flashing.	
Unit #n	At startup	Link not established			---			
	During operation	Error Flags for Unit #0 ON. "LINK 0" and "OTHER" LEDs not lit; ERROR LED flashing.			Error Flags for Unit #n ON; "LINK 0" LED not lit; ERROR LED flashing.	---	All LEDs not lit.	"RUN" LED not lit(link with Unit #n broken).

## General Errors

Error	Possible cause	Correction
LED does not light	PC power OFF	Turn power ON.
	PC Link Unit loose.	Tighten mounting screws.
	Unit no./number of transfer points settings not matched properly.	Reset Unit no. and/or number of transfer points.
LED does not light properly	PC Link Unit display pattern setting wrong.	Readjust display pattern setting.
	Poor cable connections.	Check cables, screws and connectors.
Data not being transferred properly	Mode selector not adjusted properly.	Check mode selector setting.
	Same unit no. set for two different Units.	Check unit no. settings.

**Error List for Special I/O Units (C200H, C200HS, C200HX/HG/HE(-Z))**

Because the C200H-LK401 is treated as a Special I/O Unit, the following errors, Error Flags, and Restart Bits are used with it.

Error	Causes and status	Correction
Waiting for Special I/O Unit start-up.	Special I/O Unit has a hardware malfunction. PC will not begin operation.	Replace the abnormal Special I/O Unit with a new Unit. (Abnormal Unit displays only \$s when I/O table is read.)
Too many Special I/O Units.	Same unit number has been assigned to more than one Special I/O Unit. PC will not begin operation. SR bit 25415 is ON.	Set unit numbers so that each is used only once. (Unit numbers can be accessed by reading the I/O table.)
Error in Special I/O Unit.	Refreshing was not normally executed between CPU and the Special I/O Unit. Only the abnormal Unit will stop operation. SR bit 25415 is ON.	Obtain abnormal unit number by reading AR 0000 to AR 0009, remove the cause of the error, and then restart by turning on and then off the appropriate Restart Bit (AR 0100 to AR 0109). If the Unit does not recover normal operation after restarting, replace it with a new one.

**Error Flags (C200H, C200HS, C200HX/HG/HE(-Z))**

The following Error Flags will turn ON when the same unit number is assigned to more than one Special I/O Unit, or when the refreshing operation between the PC and the Special I/O Unit is not normally executed.

Bit	Unit number
AR0000	0
AR0001	1
AR0002	2
AR0003	3
AR0004	4
AR0005	5
AR0006	6
AR0007	7
AR0008	8
AR0009	9

**Restart Bits (C200H, C200HS, C200HX/HG/HE(-Z))**

The following Restart Bits are turned on, and then back off again to restart Special I/O Units. It is not necessary to turn off Unit power when its Restart Bit is used.

Bit	Unit number
AR0100	0
AR0101	1
AR0102	2
AR0103	3
AR0104	4
AR0105	5
AR0106	6
AR0107	7
AR0108	8
AR0109	9

## **SECTION 8**

### **Inspection and Maintenance**

PC Link Units should be inspected regularly at the same time as the PCs to which they are attached. The following three areas should be given special attention.

Item	Description
Ambient conditions	Temperature: 0° to 55°C
	Humidity: 35% to 85%
	Dust-free
Proper attachment	PC Link Unit attached firmly?
	Connectors and cables firm?
	No breaking cables?
Others	If Link Adapters* are used, is power supply stable and within appropriate limits?
	If optical fiber cable is used, is it kinked (limit: 15-mm-radius bends)?

If there is a problem, follow the following steps.

- 1, 2, 3...**
1. Always turn the power off before attaching or removing a PC Link Unit.
  2. If there is a poor connection, dip a soft, clean cotton cloth in industrial-grade alcohol and wipe the connectors with it. Then remove any threads left by the cloth, and reattach the PC Link Unit.
  3. It is best to keep an extra PC Link Unit on hand to use as a replacement if one stops operating.
  4. If a PC Link Unit does not operate properly, replace it with a new one, and test the new one immediately.
  5. When returning an old PC Link Unit for repair, include a description of the exact problems and symptoms.
  6. The PC Link Unit is designed so that parts replacement is unnecessary. However, it may be necessary to replace a fuse in a Link Adapter if used (3G2A9-AL002-E or 3G2A9-AL004-E). The 3G2A9-AL002-E requires a 0.1-A, 250-V fuse, and the 3G2A9-AL004-E, a 0.3-A, 250-V fuse.

# Appendix A

## Standard Models

This chart shows the standard models of the products that are available for use with PC Link Units.

Product	Specifications	Model number
PC Link Unit	For use with C500, C500F, C1000H, C2000, and C2000H PCs. Multilevel System possible. Includes one RS485 connector and connector cover.	C500-LK009-V1
	For use with C200H, C200HS, and C200HX/HG/HE(-Z) PCs. Multilevel System possible.	C200H-LK401
	Includes one RS485 connector and connector cover.	
Link Adapter	Optical (APF/PCF) (3 connectors)	3G2A9-AL002-PE
	Optical (APF/PCF), RS-422, RS-232C (1 connector each)	3G2A9-AL001-PE
	Optical (APF/PCF), (AGF) (1 connector each)	3G2A9-AL005-PE
	Optical (APF/PCF) (1 connector), (AGF) (2 connectors)	3G2A9-AL006-PE
	RS-422 (3 connectors)	3G2A9-AL001
	Optical (PCF) (3 connectors)	3G2A9-AL002-E
	Optical (PCF), RS-422, RS-232 (1 connector each)	3G2A9-AL001-E
	Optical (PCF), optical (AGF) (1 connector each)	3G2A9-AL005-E
	Optical (PCF) (1 connector), (AGF) (2 connectors)	3G2A9-AL006-E

### Cables and Connectors

Cable to connect PC Link Units to each other or to Link Adapters must be purchased by the user. OMRON does not supply it. The following cable is recommended. The Connector is produced by OMRON.

<b>Cable</b>	CO-HC-ESV-3P x 7/0.2
<b>Connector</b>	XM2A-0901
<b>Housing</b>	XM2S-0911
<b>Maker</b>	OMRON

### All Plastic Optical Fiber Cable

Model numbers with the suffix -P can be connected to up to 20 m of APF cable.

Product	Specifications	Model number
Plastic optical fiber cable	Cable only (w/o connector) Order in multiples of 5 m from 5 to 100 m, or in lengths of 200 m or 500 m	B500-PF002
Optical connector A	W/2 optical connectors (brown) For plastic optical fiber cable 10 m long or shorter	3G5A2-CO001
Optical connector B	W/2 optical connectors (black) For plastic optical fiber cable 8 to 20 m long	3G5A2-CO002
Plastic optical fiber set	1 m cable with connector A attached to both ends	3G5A2-PF101
Optical connector puller	Purchase separately	---

**Plastic-clad Optical Fiber Cable**

Model numbers with the suffix -P can be connected to up to 200 m of PCF cable.

Product	Description		Model number
Optical fiber cable (indoor)	.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
Optical fiber cable (indoor/ outdoor)	10 to 500 m, w/ connector (order in multiples of 1 m)	Operating temperature -10° to 70° C	3G5A2-OF002
	510 to 800 m, w/ connector (order in multiples of 1 m)	Operating temperature 0° to 55°C (Do not expose to direct sunlight.)	

**Note:** Because optical fiber cable cannot be spliced as easily as ordinary cables when cut or extended, be sure to order an adequate length. The cable length does not include connectors.

## Appendix B

### Specifications

Item	Specification					
Communication method	2-conductor, half duplex or 4-conductor, half duplex (if optical links are included.)					
Sync	HDLC					
Transmission speed	128 kbps					
Transmission method	Broad scanning					
Transmission distance	500 m (total cable length in System without optical links, including branch lines)					
Possible no. of PC Link Units per System	<b>PC of polling unit</b>	<b>Single-level</b>			<b>Multilevel</b>	
	C200H, C200HS, C200HX/HG/HE(-Z), C1000H, or C2000H	32			16	
	C500 or C500F	8			8	
Transmission LR bits	No. of PC Link Units PC of polling unit	2	3-4	5-8	9-16	17-32
	C200H, C200HS, C200HX/HG/HE(-Z), C1000H, or C2000H	512	256	128	64	32
	C500 or C500F	256	128	64	---	---
Transmission time	35 ms max. (for 128 bits with 8 PC Link Units)					
Diagnostic functions	CPU watchdog timer, CRC transmission error check					
Interface	RS-485					
Cable used	Shielded twisted pair (C0-HC-ESV-3P x 7/0.2)					
---	<b>C500-LK009-V1</b>	<b>C200H-LK401</b>				
Current consumption	0.9 A max. at 5 VDC	0.25 A max. at 5 VDC				
Weight	800 g max.	400 g max.				

# Glossary

<b>Backplane</b>	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.
<b>basic Link System</b>	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.
<b>branch line</b>	A communications line leading from a Link Adapter to any but the terminators in a Link System.
<b>Branching Link Adapter</b>	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.
<b>buffer</b>	A temporary storage space for data in a computerized device.
<b>building-block PC</b>	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.
<b>combined Link System</b>	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.
<b>common data areas</b>	LR data areas in separate PCs whose contents are kept the same. Each PC writes data to certain LR area words, and then transfers this data to the same LR area words in the other PCs that have a PC Link Unit connected in series with it. Common data areas are created in PC Link Systems
<b>Control System</b>	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.
<b>controlled system</b>	The devices that are being controlled by a PC System.
<b>Converting Link Adapter</b>	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.
<b>CPU</b>	An acronym for central processing unit. In a PC System, the CPU executes the program, processes I/O signals, communicates with external devices, etc.
<b>CPU Backplane</b>	A Backplane used to create a CPU Rack.
<b>CPU Rack</b>	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.



---

## Glossary

---

<b>data area</b>	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.
<b>distributed control</b>	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.
<b>electrical noise</b>	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.
<b>Expansion I/O Backplane</b>	A Backplane used to create an Expansion I/O Rack.
<b>Expansion I/O Rack</b>	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.
<b>I/O capacity</b>	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.
<b>I/O Control Unit</b>	A Unit mounted to the CPU Rack in certain PCs to monitor and control I/O points on Expansion I/O Units.
<b>I/O devices</b>	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.
<b>I/O Interface Unit</b>	A Unit mounted to an Expansion I/O Rack in certain PCs to interface the Expansion I/O Rack to the CPU Rack.
<b>I/O point</b>	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.
<b>I/O Unit</b>	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.
<b>interface</b>	An interface is the conceptual boundary between systems or devices and usually involves changes in the way the communicated data is represented. Interface devices such as NSBs in Net Link Systems perform operations such as changing the coding, format, or speed of the data.
<b>Link Adapter</b>	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.
<b>link</b>	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).

---

## Glossary

---

<b>linkable slot</b>	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.
<b>Link System</b>	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.
<b>Link Unit</b>	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.
<b>main line</b>	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.
<b>Multilevel PC Link System</b>	A PC Link System in which at least one PC has two PC Link Units mounted to it.
<b>Multilink PC Link System</b>	A PC Link System in which more than two PCs share a common data area.
<b>noise interference</b>	Disturbances in signals caused by electrical noise.
<b>optical cable link</b>	In a Wired Remote I/O System, an optical cable connecting two Converting Link Adapters. Specified because the System otherwise uses wire communications.
<b>optical communications</b>	A communications method in which signals are sent over optical fiber cable to prevent noise interference and increase transmission distance.
<b>optical fiber cable</b>	Cable made from light conducting filaments used to transmit signals.
<b>PC</b>	An acronym for Programmable Controller.
<b>PC Link Subsystem</b>	All of the PCs that share the same part of the LR are in a PC Link System. PC Link Subsystems exist within a PC Link System when one or more of the PCs in the System has two PC Link Units mounted to it. If Subsystems exist, the System is considered a Multilevel PC Link System.
<b>PC Link System</b>	A System in which PCs are connected through PC Link Units to enable them to share common data areas, i.e., each of the PCs writes to certain words in the LR area and receives the data of the words written by all other PC Link Units connected in series with it.
<b>PC Link Unit</b>	The Unit used to connect PCs in a PC Link System.
<b>PC System</b>	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.
<b>peripheral device</b>	Devices connected to a PC System to aid in system operation. Peripheral devices include printers, programming devices, external storage media, etc.
<b>polled unit</b>	Any of the Units in a PC Link system that share common data areas except for the Polling Unit.

---

## Glossary

---

<b>polling</b>	A method in which one element in a system monitors changes in the contents of certain data words to maintain accurate records of the contents. In a PC Link System, polling is performed by the polling unit to maintain common data areas among PCs.
<b>polling unit</b>	The PC Link Unit in a PC Link System that handles data transmissions to maintain common data areas within the PCs. In a PC Link System, the polling unit always shares common data areas with the polled units.
<b>printed circuit board</b>	A board onto which electrical circuits are printed for mounting into a computer or electrical device.
<b>Programmable Controller</b>	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 Programmable 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.
<b>programming device</b>	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.
<b>Rack</b>	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.
<b>read word</b>	A word in the LR area that contains data transferred from another PC in a PC Link System. A read word cannot be written to by the PC.
<b>relay-based control</b>	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.
<b>series</b>	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.
<b>Single-level PC Link System</b>	A PC Link System in which there is no PC with more than one PC Link Unit.
<b>Single-link PC Link System</b>	A PC Link System that connects only two PCs to each other.
<b>slot</b>	A position on a Rack (Backplane) to which a Unit can be mounted.
<b>Special I/O Unit</b>	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.
<b>switching capacity</b>	The voltage/current that a relay can switch on and off.
<b>system configuration</b>	The arrangement in which Units in a System are connected.

---

## Glossary

---

<b>transfer PC</b>	A PC that belongs to two PC Link Subsystems (i.e., has two PC Link Units mounted to it). A transfer PC can be used to transfer data between the two PC Link Subsystems to which it belongs.
<b>transmission distance</b>	The distance that a signal can be transmitted.
<b>Unit</b>	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.
<b>unit number</b>	A number assigned to some Link Units and Special I/O Units to assign words and sometimes other operating parameters to it.
<b>wire communications</b>	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.
<b>work word</b>	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.
<b>write word</b>	A word written in the LR area by a PC in a PC Link System. The data of the write words is transferred to the rest of the PCs that share common data areas, i.e., the write words for one PC are read words for the rest of the PCs in the PC Link System.

# Index

## Numbers

3G2A5-LK009-E, 2

## A–B

application examples, 51

applications, precautions, xiii

Branching Link Adapter, PC Link System, 10

## C

C500-LK003-E PC Link Unit, 2

cable connections procedure, 40

cable lengths, 40

connections, 38

wiring connectors, 41

connector hood, assembly, 41

connector layout, 40

connector pin numbers, 39

control actions in PC Link Systems, 2

Converting Link Adapter, PC Link System, 10

## D

data area allocation, Multilevel PC Link System, 14

data configuration, 42

data-transfer PCs, 12

dimensions, 42

DIP switch

LK009, 29

LK401, 25

DIP switch cover, LK009, 28

Display

LK009, 28

LK401, 24

display patterns, 29

setting (LK009), 32

## E

Error Flag, 60

error tables

C200H, C200HS, and C200HX/HG/HE(-Z) PCs, 65

C500, C500H, C1000H, C2000, and C2000H PCs, 65

errors

example LED indications, 61, 62

general, 66

processing, 55

## I

I/O refresh bits (LK401), 26

indicators, 24, 28

inspection and maintenance, 67

installation, precautions, xiii

instructions, IORF(97), 51

## L

LED indications

LK009, 29

LK401, 24

Level Flag, 60

limitations in number of PCs, 9

Link Adapter, PC Link System, 10

Link Adapters, 3, 10

termination resistance, 10

LR area

allocation example for, multilevel system, 13

allocation in Multilevel PC Link System, 14

allocation of different size areas in PC Link System, 13

allocation tables for, 22

use of, 12

using unallocated bits in, 12

## M

mode, 32

models numbers, 73

mounting location, 33

Multilevel PC Link System, 6

multilevel system, example, 8

multilevel systems, 3

example, 8

## N–O

operating environment, precautions, xiii

operating level

PC Link System, 6

word allocation in PC Link System, 14

Operating Level flags (LK401), 27

operating level, setting  
    LK009, 32  
    LK401, 26  
operating levels, 3  
operation, 17  
optical fiber cable, PC Link System, 10  
optical links, 7, 10

## **P**

PC Link Subsystem, 6  
PC Link System  
    diagram  
        Link Adapters, 6  
        LR area allocation, 12, 13, 14  
        Multilevel System, 7, 14  
        System using optical cable, 10  
    Multilevel System, 6  
    transferring data, 7  
PC RUN Flag, 59  
PCs  
    applicable, 6  
    system limitations for, 9  
Polling Unit, Multilevel PC Link System, 6  
polling unit, 2  
precautions  
    applications, xiii  
    general, xi  
    operating environment, xiii  
    safety, xii  
programming examples  
    simultaneous startup, 16  
    transferring data between Subsystems, 52  
protection, System, PC Link System, 6

## **R**

response time, 21  
response time calculations  
    C1000H, C2000, and C2000H PCs, 46  
    C200H PCs, 48  
    C500 PCs, 46  
RS-485 connector  
    LK009, 28  
    LK401, 24  
RS-485 interfaces, 38

## **S**

safety precautions. *See* precautions  
scan time, PC, 26

shield wire connections, 38  
shutdown, System, preventing, PC Link System, 6  
single-level system example, 8  
Special I/O Unit Error Flags, 67  
Special I/O Unit error list, 66  
Special I/O Unit number, setting (LK401), 25  
Special I/O Unit Restart Bits, 67  
Special I/O Unit Restart Bits and Error Flags, 60  
specifications, 70  
standard Omron products for PC Link Systems, 71  
Subsystems, PC Link, 2, 3  
switch settings, 10  
    example, 27  
    LK009, 25, 29  
    LK401, 32  
switches, 24, 28  
system configuration, 6

## **T**

termination resistance  
    LK009, 31  
    setting on LK401, 26  
transfer PC, 7  
transferring data, 12  
    transfer PCs in PC Link System, 7  
transmission delay (LK401), 26  
transmission distance, 7  
Transmission line selector, LK009, 29  
transmission line selector, setting  
    LK009, 32  
    LK401, 26  
transmission time, 21  
troubleshooting, 59

## **U**

unit number, word allocation in PC Link System, 13, 14  
unit numbers  
    determining, 9  
    setting, LK009, 28

## **W**

wiring *See* connections, 38  
work words, PC Link System, 14

## Revision History

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

Cat. No. W135-E1-3



The following table outlines the changes made to the manual during each revision. Page references are to the previous version of the manual.

Revision code	Date	Revised content
1	---	Original production
2	July 1990	Complete reorganization and rewrite Correction to switch 5 setting on p. 24 Connector model added to <i>Appendix A</i> .
2A	July 1994	Address change.
2B	May 1996	Section of precautions added before section 1 and adjustments made to signal words for precautions. <b>Page ix:</b> Introduction to <i>About this Manual</i> rewritten. <b>Page 42:</b> Connector Pin Numbers section rewritten. <b>Page 71:</b> Cables and Connectors table corrected.
3	March 2000	"Restart Flag" globally corrected to "Restart Bit." C200HS and C200HX/HG/HE(-Z) PCs added.



## OMRON ELECTRONICS LLC

1 Commerce Drive  
Schaumburg, IL 60173  
847.843.7900  
For US technical support or  
other inquiries: 800.556.6766

## OMRON CANADA, INC.

885 Milner Avenue  
Toronto, Ontario M1B 5V8  
416.286.6465

## OMRON ON-LINE

Global - <http://www.omron.com>  
USA - <http://www.omron.com/oei>  
Canada - <http://www.omron.ca>

### UNITED STATES

To locate a Regional Sales Office, local Distributor or  
to obtain product information, call: 847.843.7900

### CANADA REGIONAL SALES OFFICES

<b>Ontario</b>	Toronto	416.286.6465
	Kitchener	519.896.1144
	Kingston	613.376.3968
<b>Quebec</b>	Montreal	514.636.6676
<b>British Columbia</b>	Vancouver	604.522.8855
<b>Alberta</b>	Edmonton	403.440.0818
	Calgary	403.257.3095

### BRAZIL SALES OFFICE

**Sao Paulo** 55.11.5564.6488

### ARGENTINA SALES OFFICE

**Cono Sur** 54.114.787.1129

### MEXICO SALES OFFICES

<b>Florida</b> 954.227.2121	<b>Ciudad Juarez</b> 656.623.7083
<b>Mexico, D.F.</b> 555.534.1195	<b>Monterrey, N.L.</b> 818.377.4281