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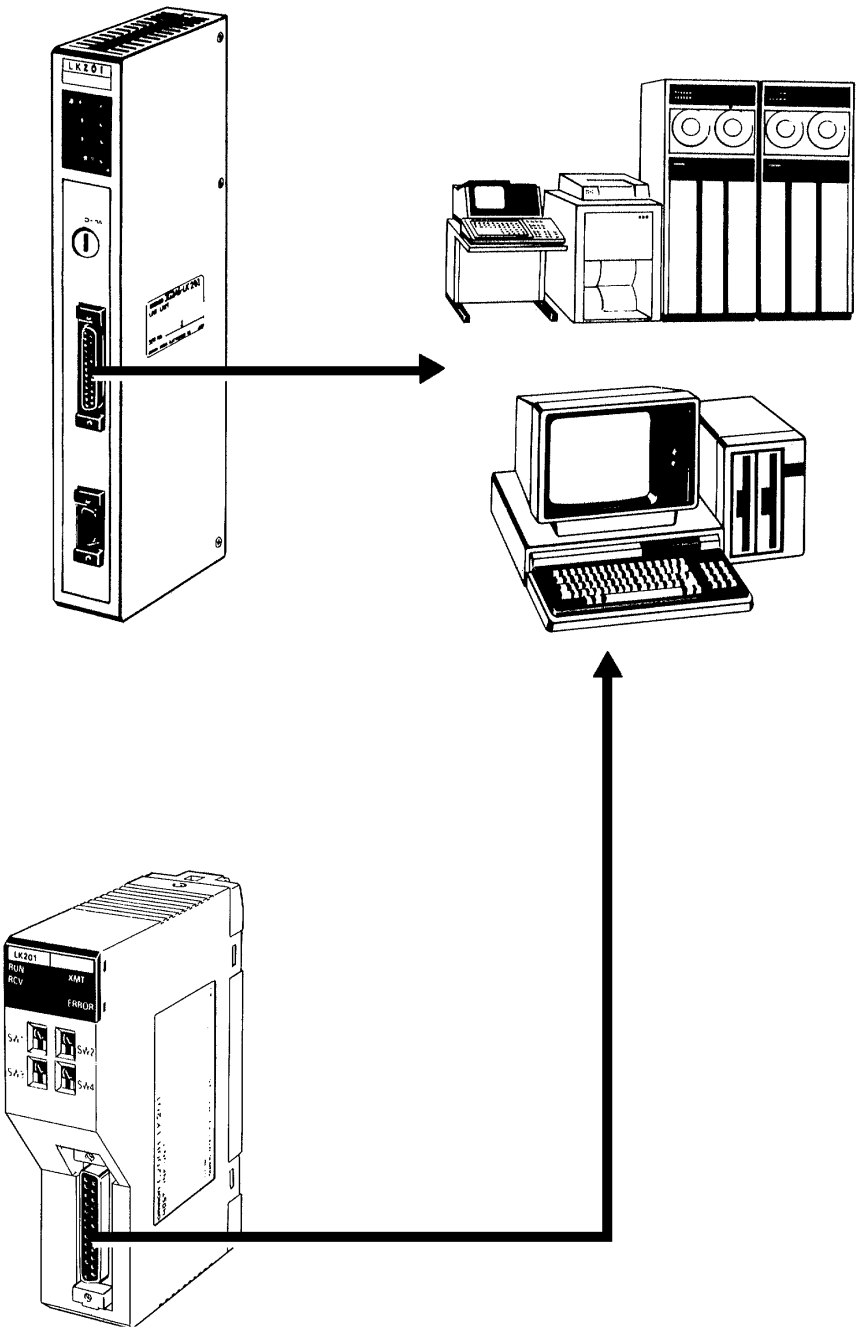
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SYSMAC WAY
Host Link Units

For Use With C-series Rack PCs

Revised August 1996



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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 the product.

⚠ DANGER! Indicates information that, if not heeded, is likely to result in loss of life or serious injury.

⚠ WARNING Indicates information that, if not heeded, could possibly result in loss of life or serious injury.

⚠ Caution Indicates information that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

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 “PLC” means Programmable Controller (Programmable Logic Controller) and is not used as an abbreviation for anything else.

Visual Aids

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

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

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

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About this Manual:

This manual describes the functions, characteristics, and operating procedures of the Host Link Units for the C-series building block PCs (Programmable Controllers), i.e., the C120, C200H, C200HS, C200HX, C200HG, C200HE, C500, C1000H, and C2000H Units.

Section 1 gives a brief overview of the applicable Units and how to connect them into a PC system, including the settings for the host computer. It also gives details on various interface connections and how to prepare cables for RS-422 and RS-232C connectors.

Section 2 gives the characteristics of the different Host Link Units which are grouped according to their model numbers. The information includes their external appearance, the names of the switches and the functions, the PC operating modes for the various settings, flags, and I/O response times.

Section 3 gives the basics necessary for effective programming. It starts with the full set of instructions and the command levels at which they operate. Communications protocols are outlined, and the methods for calculating the Frame Checksum (FCS) values is explained.

Section 4 provides the commands and responses for the complete set of instructions covered in this manual. It also includes a table of error response codes and communications examples using some of the instructions.

Section 5 details ways of detecting, preventing, and remedying errors that occur in the Host Link systems.

Appendix A provides information on the standard Host Link Unit and Link Adapter models that are discussed in this manual and gives details for accessories that can be used with the Host Link Units, such as connector cables and optical fiber interfaces.

Appendix B gives specifications for the Host Link Units and Link Adapters.

Appendix C provides data conversions between ASCII characters and their hex, binary, and decimal equivalents. It should be noted that the PC always stores ASCII data in its hexadecimal equivalent.

Appendix D lists the data equivalent for hex, binary, BCD, and decimal up to 32_{dec}.

The ***Glossary*** gives a comprehensive list of expressions commonly used when dealing with Host Link Units and Programmable Controllers.

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

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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.

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1 Intended Audience

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

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

2 General Precautions

The user must operate the product according to the performance specifications described in the 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 Never attempt to disassemble any Units while power is being supplied. Doing so may result in serious electrical shock or electrocution.

⚠ WARNING Never touch any of the terminals while power is being supplied. Doing so may result in serious electrical shock or electrocution.

4 Operating Environment Precautions

Do not operate the control system in the following places.

- Where the PC is exposed to direct sunlight.
- Where the ambient temperature is below 0°C or over 55°C.
- Where the PC may be affected by condensation due to radical temperature changes.
- Where the ambient humidity is below 10% or over 90%.
- Where there is any corrosive or inflammable gas.
- Where there is excessive dust, saline air, or metal powder.
- Where the PC is affected by vibration or shock.
- Where any water, oil, or chemical may splash on the PC.

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⚠ 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.

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

- Always ground the system to 100 Ω or less when installing the system to protect against electrical shock.
- Always turn off the power supply to the PC before attempting any of the following. Performing any of the following with the power supply turned on may lead to electrical shock:
  - Mounting or removing any Units (e.g., I/O Units, CPU Unit, etc.) or memory cassettes.
  - Assembling any devices or racks.
  - Connecting or disconnecting any cables or wiring.

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

- Use the Units only with the power supplies and voltages specified in the operation manuals. Other power supplies and voltages may damage the Units.
- Take measures to stabilize the power supply to conform to the rated supply if it is not stable.
- Provide circuit breakers and other safety measures to provide protection against shorts in external wiring.
- Do not apply voltages exceeding the rated input voltage to Input Units. The Input Units may be destroyed.
- Do not apply voltages exceeding the maximum switching capacity to Output Units. The Output Units may be destroyed.
- Always disconnect the LG terminal when performing withstand voltage tests.
- Install all Units according to instructions in the operation manuals. Improper installation may cause faulty operation.
- Provide proper shielding when installing in the following locations:
  - Locations subject to static electricity or other sources of noise.
  - Locations subject to strong electromagnetic fields.
  - Locations subject to possible exposure to radiation.
  - Locations near to power supply lines.
- Be sure to tighten Backplane screws, terminal screws, and cable connector screws securely.
- Do not attempt to take any Units apart, to repair any Units, or to modify any Units in any way.

⚠ Caution The following precautions are necessary to ensure the general safety of the system. Always heed these precautions.

- Provide double safety mechanisms to handle incorrect signals that can be generated by broken signal lines or momentary power interruptions.
- Provide external interlock circuits, limit circuits, and other safety circuits in addition to any provided within the PC to ensure safety.

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SECTION 1
Introduction

This document is designed to introduce the reader to the principles of operation of **Host Link Units**, their characteristics, and methods of interfacing them into PC networks. *1-1 Applicable Units* lists the PCs that are applicable for each Unit and the type of connections which can be used.

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1-1 Applicable Units

A Host Link Unit allows a host computer to monitor the operating status and data areas of the PCs and to control the communications between the PCs and the controlled system.

One Host Link Unit is required for each PC, and up to 32 PCs can be connected to a single host computer. The Host Link Units described in this manual are referred to as “Rack-mounting” or “CPU mounting.” A Rack-mounting Host Link Unit is mounted to an I/O slot of the CPU or Expansion I/O Rack of the building block PC. A CPU-mounting Host Link Unit is mounted directly to the PC’s CPU.

Different types of Host Link Units, e.g., Rack-mounting and CPU-mounting, can be combined so that the same PC can be connected to more than one Host Link Unit. An example of a system using some of these combinations is provided in *1-2 System Configuration*, along with other example configurations. Most of these systems also employ Link Adapters, which are usually used in a system to branch between Host Link Units, host computers, etc., or to interface wire cables with optical fiber cables, or to perform both of these functions.

The following table gives the mounting method, types of connectors, and applicable PCs for each of the Host Link Units dealt with in this manual.

Host Link Unit	Mounting Type	Applicable PCs	Connection*
C200H-LK101-PV1	Rack-mounting	C200H, C200HS, C200HX, C200HG, and C200HE	APF/PCF/H-PCF
C200H-LK201-V1	Rack-mounting	C200H, C200HS, C200HX, C200HG, and C200HE	RS-232C
C200H-LK202-V1	Rack-mounting	C200H, C200HS, C200HX, C200HG, and C200HE	RS-422
3G2A5-LK101-PEV1	Rack-mounting	C500, C1000H, and C2000H	APF/PCF/H-PCF
C500-LK103-P**	Rack-mounting	C500, C1000H, and C2000H	APF/PCF/H-PCF
3G2A5-LK101-EV1	Rack-mounting	C500, C1000H, and C2000H	PCF/H-PCF
3G2A5-LK201-EV1	Rack-mounting	C500, C1000H, and C2000H	RS-232C/RS-422
C500-LK103**	Rack-mounting	C500, C1000H, and C2000H	PCF/H-PCF
C500-LK203**	Rack-mounting	C500, C1000H, and C2000H	RS-232C/RS-422
3G2A6-LK101-PEV1	CPU-mounting	C200H, C120, C500, C1000H, and C2000H	APF/PCF/H-PCF
3G2A6-LK101-EV1	CPU-mounting	C200H, C120, C500, C1000H, and C2000H	PCF/H-PCF
3G2A6-LK201-EV1	CPU-mounting	C200H, C120, C500, C1000H, and C2000H	RS-232C
3G2A6-LK202-EV1	CPU-mounting	C200H, C120, C500, C1000H, and C2000H	RS-422

* APF: All-plastic optical fiber cable/PCF: Plastic-clad optical fiber cable/H-PCF: Hard-clad plastic optical fiber cable/RS-422: RS-422 cable/RS-232C: RS-232C cable

** The C500-LK103(-P) and C500-LK203 can be used with the C500 PC only when the 3G2C3-CPU11-EV1 is used.

1-2 System Configuration

The following examples illustrate possible applications of Host Link Units in wired or optical systems, or both.

Some systems will comprise just one Host Link Unit connected to a single host computer. This is known as a “single-link” system. Others systems might comprise many Host Link Units connected to a host computer. This configuration is known as a “multiple-link” system. Although most systems will require only one host computer, if both Rack-mounting and CPU-mounting Host Link Units are used together, two host computers can be connected to the same PC, independent of each other. The PC can then execute commands sent from either host computer.

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Up to two of the C500-LK103, C500-LK103-P, and C500-LK203 Rack-mounting Host Link Units can also be connected, in any combination (including two of the same Units), to any to a single C1000H, or C2000H PC, allowing up to three host computers to be connected to these PCs. Control from three host computers is also available with C200H/HS/HX/HG/HE PCs, where a second Rack-mounting Host Link Unit can be added on a C200H Expansion I/O Rack. All other PCs are limited to two Host Link Units. SYSMAC NET Link Units can be combined with the C500-LK103(-P) and C500-LK203 Rack-mounting Host Link Units when a C1000H or C2000H PC is used. When combining with a SYSMAC NET Link Unit, however, only one Rack-mounting Host Link Unit can be used instead of two.

In all but the third configuration example, Link Adapters are used to branch between system devices, or to convert between different types of cables, or to perform both of these functions. The first part of the Link Adapter model numbers (3G2A9-) in the examples has been omitted.

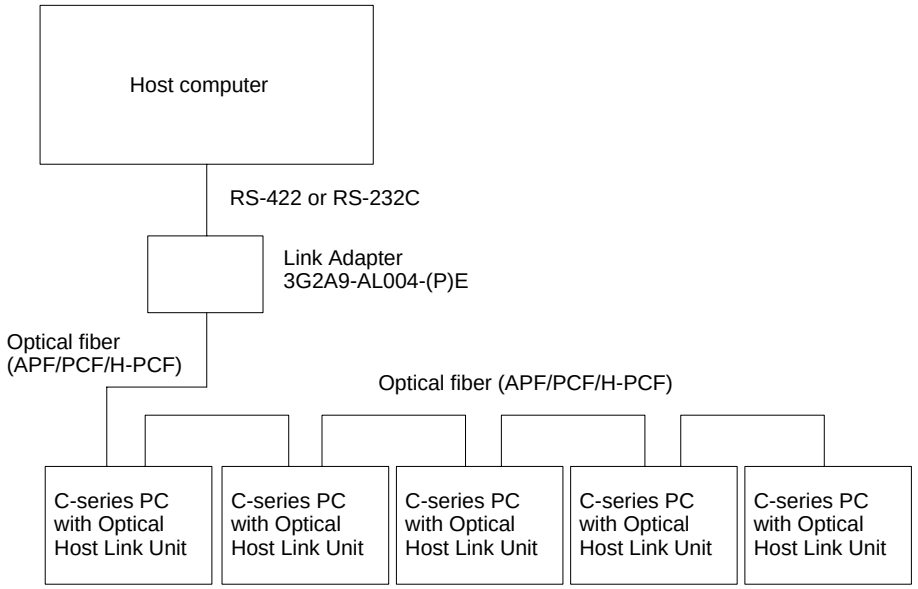
1-2-1 Connections

System components can be connected using RS-232C or RS-422 cables, or both, any of three types of optical fiber cable, or a combination of wired and optical sections. In any system, the maximum length of RS-232C cable is 15 m. The total length of all RS-422 cable must be no longer than 10 m. RS-232C and RS-422 cables which are used to connect the Host Link Unit to the host computer are not available from OMRON and must be purchased from an alternative source.

Maximum lengths for optical fiber cables are determined by the type of cable and the particular models employed. Models which finish with “-P” in the code number can be set at a length of 20 m for APF cable and 200 m for PCF cable. Models without the “-P” coding can be set at a maximum length of 800m with PCF cable.

1-2-2 System Examples

Example 1 Serial Multiple-link System with Optical Fiber Cable

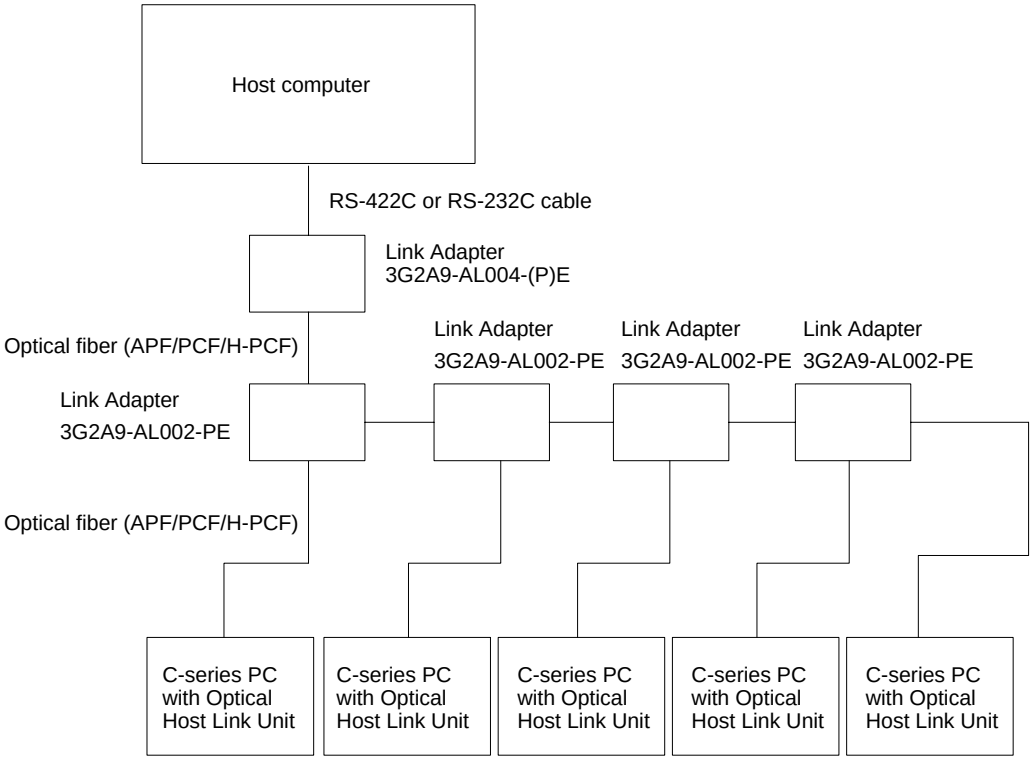


As shown above, more than one Host Link Unit can be connected in series using optical fiber. If, however, any failure (due to power failure, disconnection, etc.)

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occurs in one of the Units, the series connection will cause all subsequent Host Link Units to cease to operate. This can be prevented by using Link Adapters such as the 3G2A9-AL002-PE Link Adapter shown in the following example. These Link Adapters bypass any Host Link Unit not connected properly so that the rest of the system can operate normally.

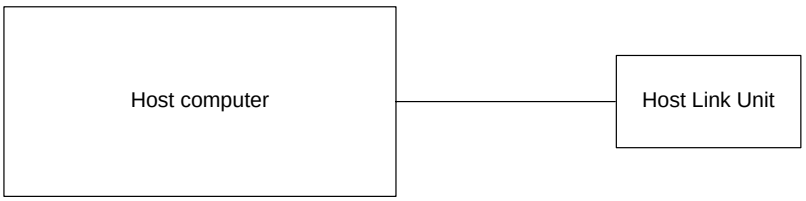
Example 2 Parallel Multiple-link System with Optical Fiber Cable



Even if a power failure occurs in a Host Link Unit connected to a branch line of a Link Adapter, signals are still transmitted to the other Host Link Units.

Example 3 Single-link System with RS-232C Cable

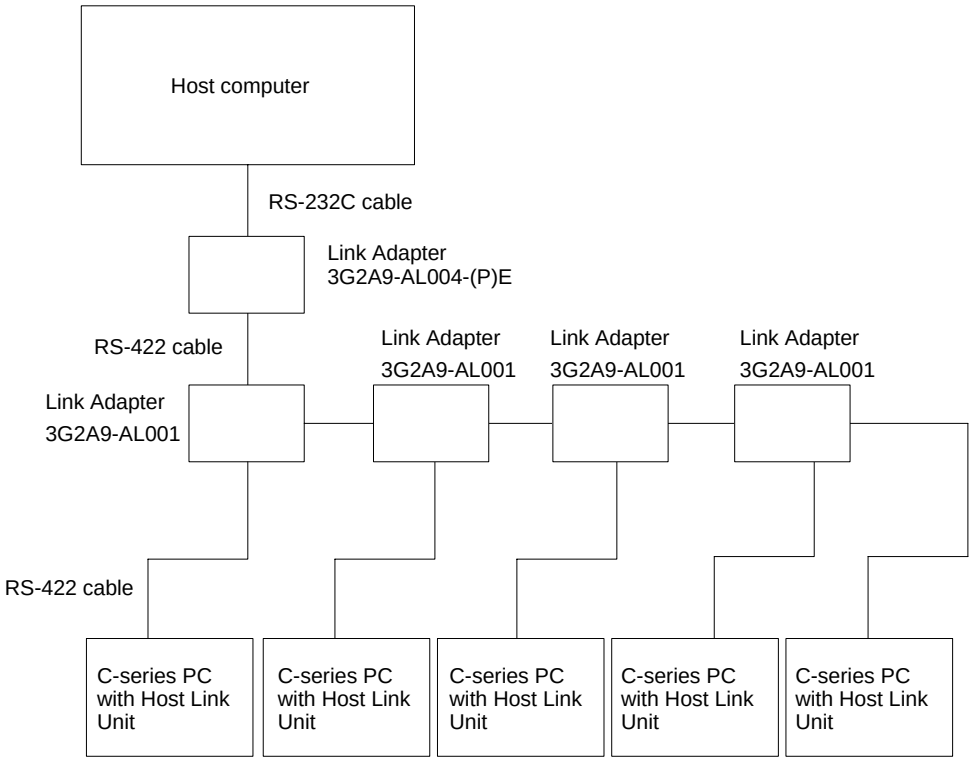
In a system where a RS-232C cable connects a Host Link Unit directly to a host computer, only one Host Link Unit can be connected to that host computer, i.e., it has a single-link. The following Host Link Units can be used in this type of system: 3G2A5-LK201-EV1, C200H-LK201-V1, C500-LK203, and 3G2A6-LK201-EV1. It should be noted that the PC onto which the Host Link Unit is mounted could have another Host Link Unit connected directly or indirectly connected to another host computer.



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Example 4 Multiple-link System with RS-232C and RS-422 Cable

By using RS-422 cable, more than one Host Link Unit can be connected to the same host computer to make a multiple-link system.

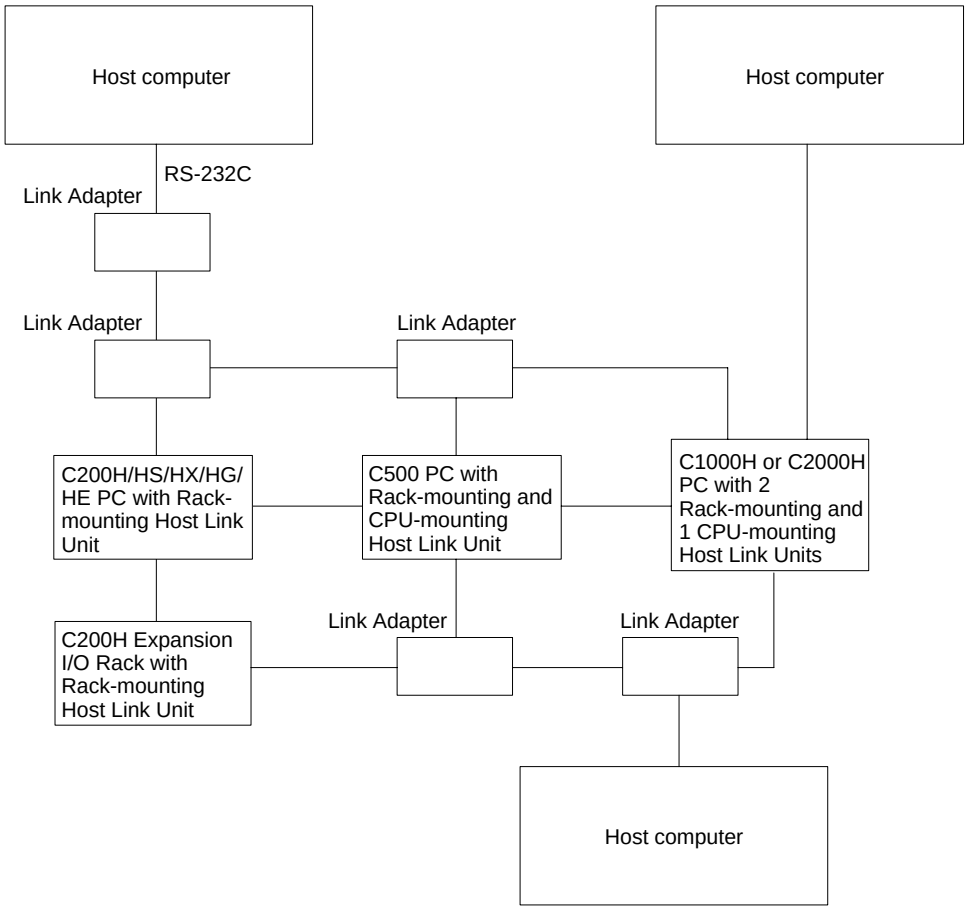


Example 5 Multiple-link Multiple-level System

In this example, Rack-mounting and CPU-mounting Host Link Units are combined to control a C500 PC from two host computers. A CPU-mounting Host Link Unit is also combined with two Rack-mounting Host Link Units (C500-LK103(-P) or C500-LK203, or both) on another PC, a C1000H or C2000H, to control this PC from all three host computers. Furthermore, two C200H Rack-mounting Host Link Units (C200H-LK101-PV1 or C200H-LK202-V1, or both) are combined to control a C200H/HS/HX/HG/HE PC from a third host computer.

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All lines connecting to host computers would have to be RS-232C cable. All other lines could be RS-422 cable or optical fiber cable, depending on the particular Host Link Units and Link Adapters used. Note that the host computer on the upper right is considered to be in a single-link system with the Host Link Unit directly beneath it, despite the fact that other Host Link Units connect the same PC to other host computers.



1-3 Mounting Host Link Units

The I/O slots onto which the Host Link Units can be mounted are as follows:

PC		I/O slot
C200H/C200HS/C200HX/C200HG/C200HE		Any* slot of the CPU or Expansion I/O Racks
C500, C1000H	with 3G2A5-BC081, 3G2A5-BC051, or C500-BC031 Backplane	Any of the three slots on the right hand side of the CPU Rack
	with C500-BC082, C500-BC052, C500-BC091, or C500-BC061 Backplane	Any of the five slots on the right hand side of the CPU Rack
C2000H simplex system with 3G2C5-BC061 Backplane		Any of the slots on the CPU Rack
C2000H duplex system with 3G2C5-BI082 Backplane		Any of the six slots on the Expansion I/O Rack

* If mounted to either of the rightmost slots of the CPU Rack, other peripheral devices, such as the Programming Console, cannot be mounted.

Note Host Link Unit switches must be set before mounting.

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1-4 Host Computer Settings

To establish correct data communications with the Host Link Unit, the communications conditions listed below must match on both the host computer and the Host Link Unit. For the actual setting of these conditions, refer to the host computer manual.

Transmission Speed

The transmission speed of the Host Link Unit must match that of the host computer. See *Section 2 Host Link Unit Characteristics* for the setting procedure.

Single-character Data Format

Set the host computer to the following 11-bit data format (7-bit ASCII):

Number of start bits:	1
Data Length:	7 bits
Even (vertical) parity:	1 bit
Number of stop bits:	2

For the C200H-LK101-PV1, C200H-LK202-V1, C500-LK103(-P), and C500-LK203 Host Link Units, the following 11-bit format can also be set (8-bit JIS). Make sure that the host computer and Host Link Unit formats match.

Number of start bits:	1
Data length:	8 bits
Parity (odd or even):	1 bit
Number of stop bits:	1

1-5 Types of Interfaces

The system must be properly interfaced to enable error-free communications. Use the following information to correctly interface your system.

1-5-1 Optical Interface

In an optical fiber system, the maximum transmission distance varies depending on the type of optical fiber cable, which in turn depends on the Host Link Unit model. Refer to the table under in *Appendix C* for optical fiber cable lengths. Optical fiber cable connectors must be assembled by the user.

The products listed in the following table can be used to interface the C500-LK203, 3G2A5-LK201-EV1, C200H-LK201-V1, or the 3G2A6-LK201-EV1 Host Link Unit to a host computer.

Product	Model Number	Quantity Required	Miscellaneous
Optical Interface	Z3RN-A-5	2	RS-232C - optical converter interface
Optical Fiber Cable	Z3F2-4D□M*	1	---
AC Adapter	Z3GP-01	1 or 2	For supplying power to optical interface

* When ordering, replace the "□" with the desired cable length: 1, 5, 10, 20, 30, 50, 100, 200, 400, or 500 m, e.g., Z3F2-4D30M to order a 30 m cable.

Note

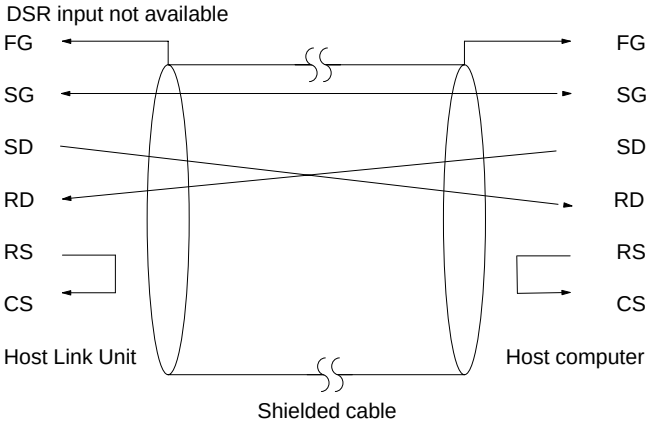
1. The optical interface must be provided with a 5 V power supply.
2. To supply 5 V to a Z3RN-A-5 Optical Interface connected on the host computer side of a Host Link Unit (only with C500-LK203 or C200H-LK201-V1 models), set the 5 V supply switch on the back of the Host Link Unit to ON (up). The normal setting is OFF.
3. When using a 3G2A5-LK201-EV1 or the 3G2A6-LK201-EV1 Host Link Unit, use the AC adapters to supply 5 V to the Optical Interface on both the Host Link Unit side and the host computer side.

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1-5-2 RS-232C Interface

(For all but C500-LK203 and insulated types.) When using an optical fiber cable or RS-422 cable, several Host Link Units can be connected to one host computer. When RS-232C cables are used, however, the connection must be made on a one-to-one basis, or a Link Adapter must be used to convert to RS-422 cable or optical fiber cable as shown in *Examples 1 and 2* in *1-2-2 System Examples* (see also *Link Adapters Installation Guide*). The table below gives the proper connections for a RS-232C interface.

Signal*	Symbol	Pin No.
Frame ground	FG	1
Signal ground	SG	7
Send data	SD	2
Receive data	RD	3
Request to send	RS	4
Clear to send	CS	5
Equipment Ready	ER	20
Send signal element timing 1***	ST1	24
Send signal element timing 2***	ST2	15
Receive timing***	RT	17
5-V power supply**	5V	14

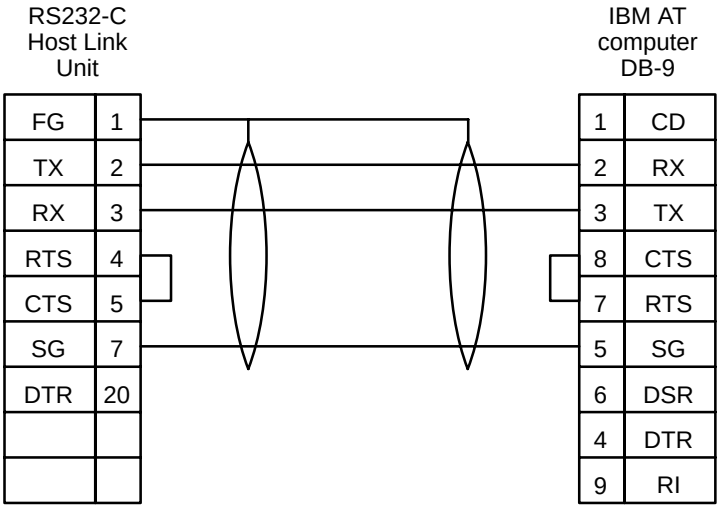


* Viewed from the Host Link Unit.
** For Optical Interfaces used with the C500-LK203 Host Link Unit.
***For synchronous timing (not available with C200H-LK201-V1Host Link Unit).

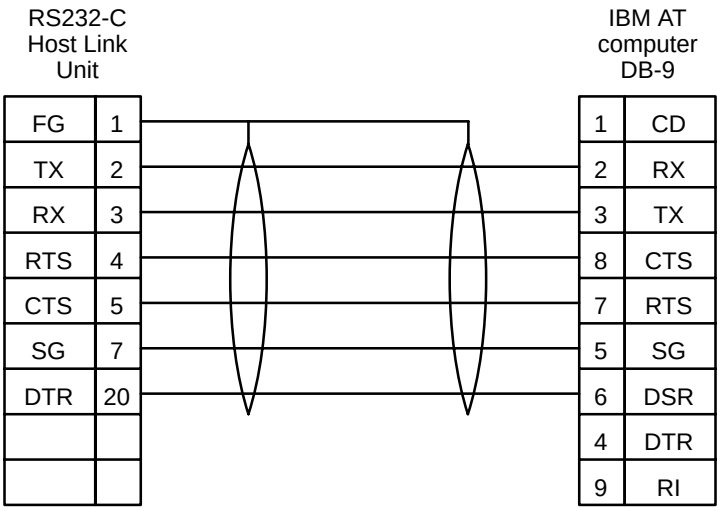
The maximum cable length is 15 m. Ground the FG terminals of both the PC and the host computer at a point that has a resistance of less than 100 Ω.

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Interfacing to IBM AT via AL004 Link Adapter



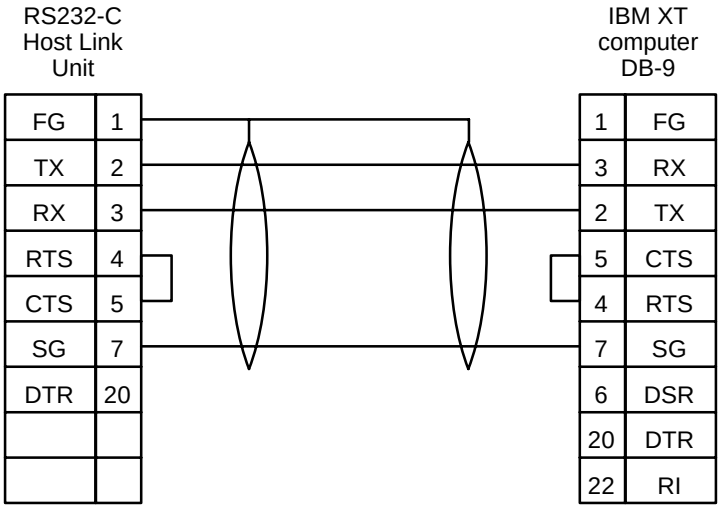
Two-wire system, no handshaking.



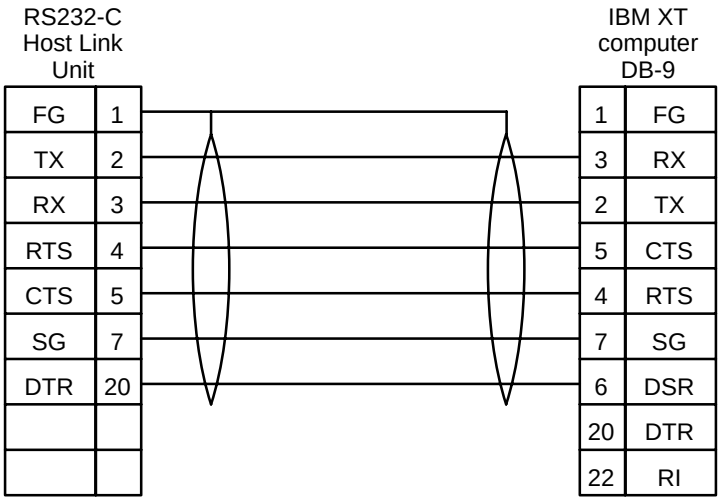
Full handshake configuration.

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Interfacing to IBM XT via AL004 Link Adapter



Two-wire system, no handshaking.



Full handshake configuration.

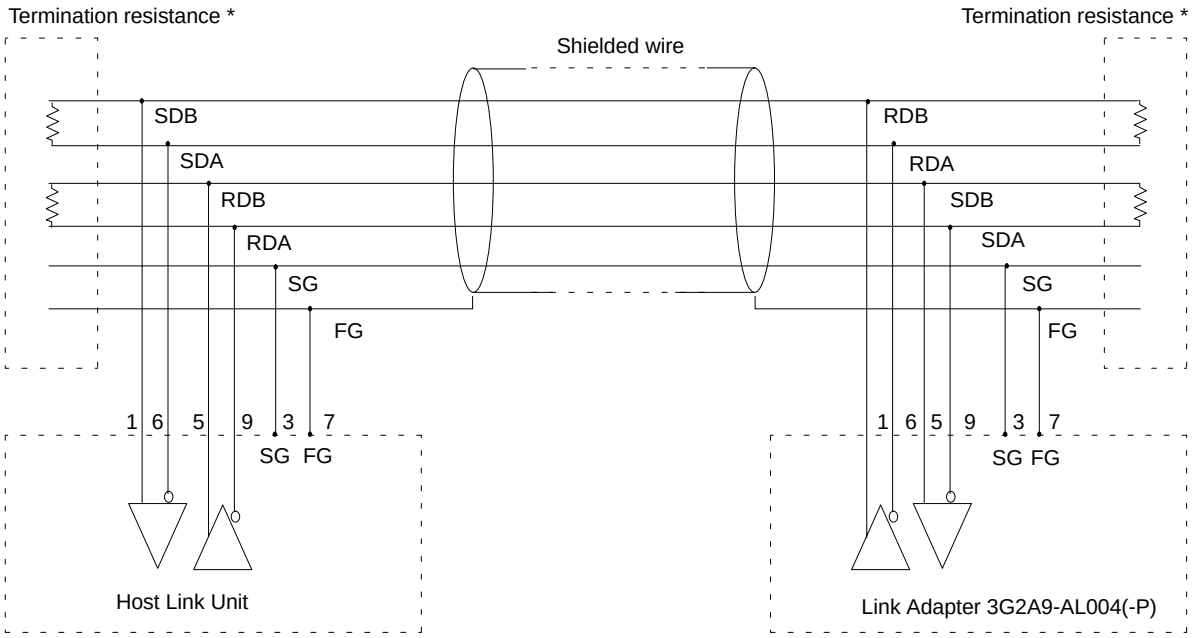
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1-5-3 RS-422 Interface

(For all but C500-LK203 and insulated types) The following table details the pin connections for a RS-422 interface.

Signal*	Symbol	Pin No.
Send data A	SDA	9
Send data B	SDB	5
Receive data A	RDA	6
Receive data B	RDB	1
Signal ground	SG	3
Frame ground	FG	7

* Viewed from the Host Link Unit.

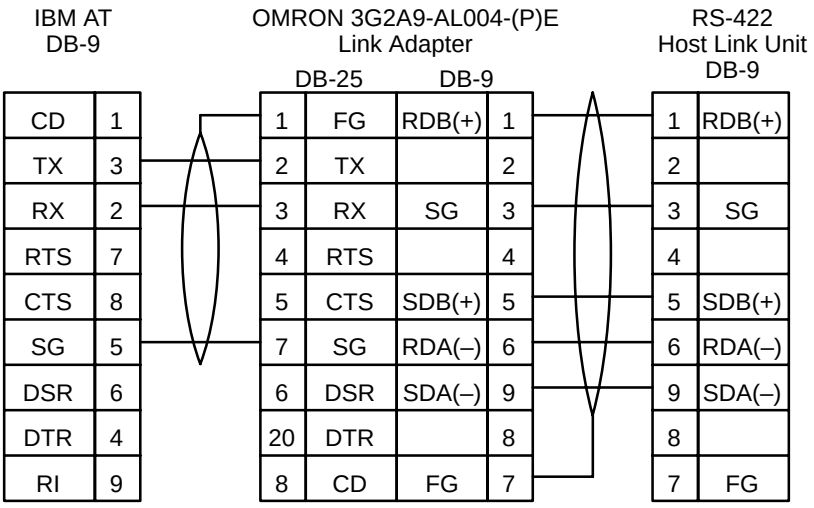


* The total termination resistance must be 100 Ω min.
The built-in resistance is 220 Ω.

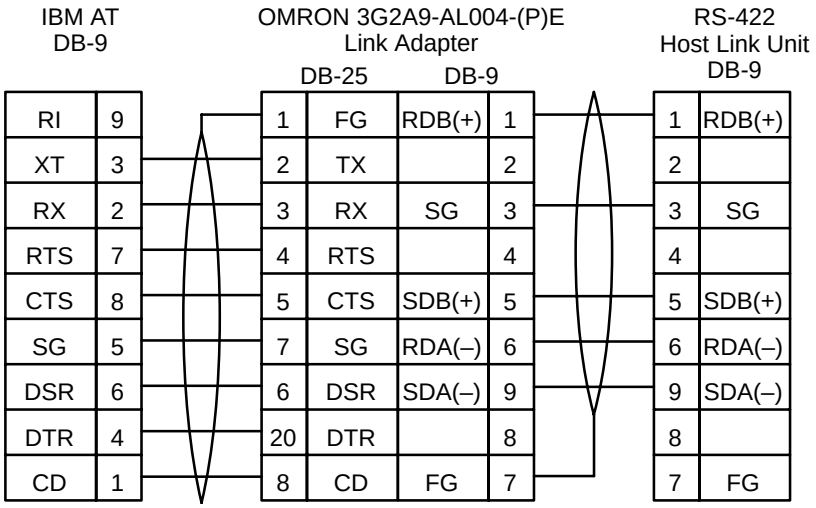
The maximum cable length is 500 m. Ground the FG terminals on both the PC and the host computer to a point where the resistance is less than 100 Ω. For more information, refer to the PC or host computer manuals.

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Interfacing to IBM AT via AL004 Link Adapter



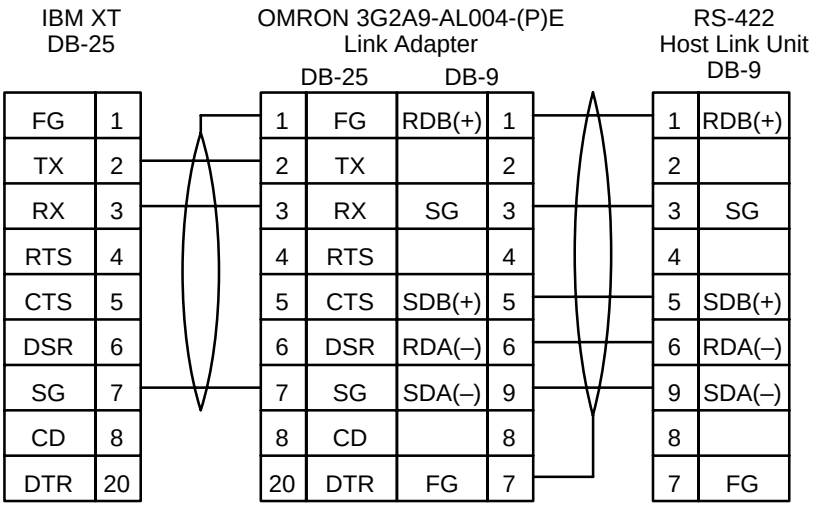
Two-wire system, no hand-shaking.



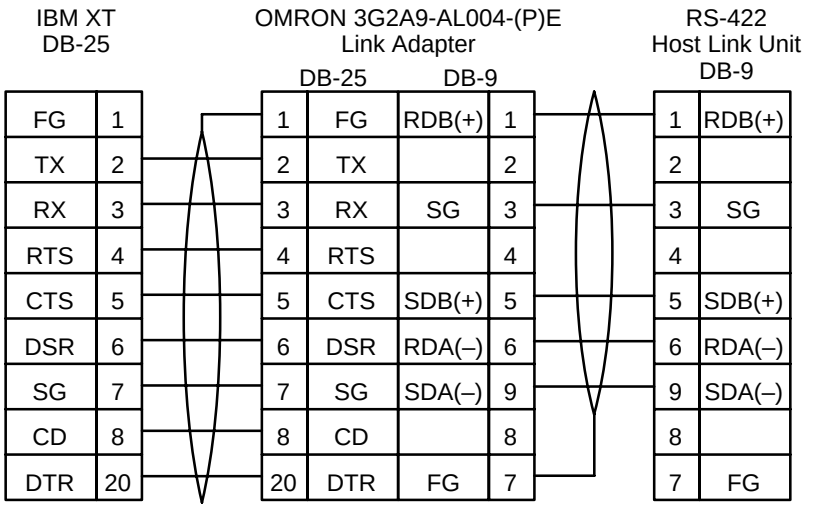
Full handshake configuration.

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Interfacing to IBM XT via AL004 Link Adapter



Two-wire system, no hand-shaking.



Full handshake configuration.

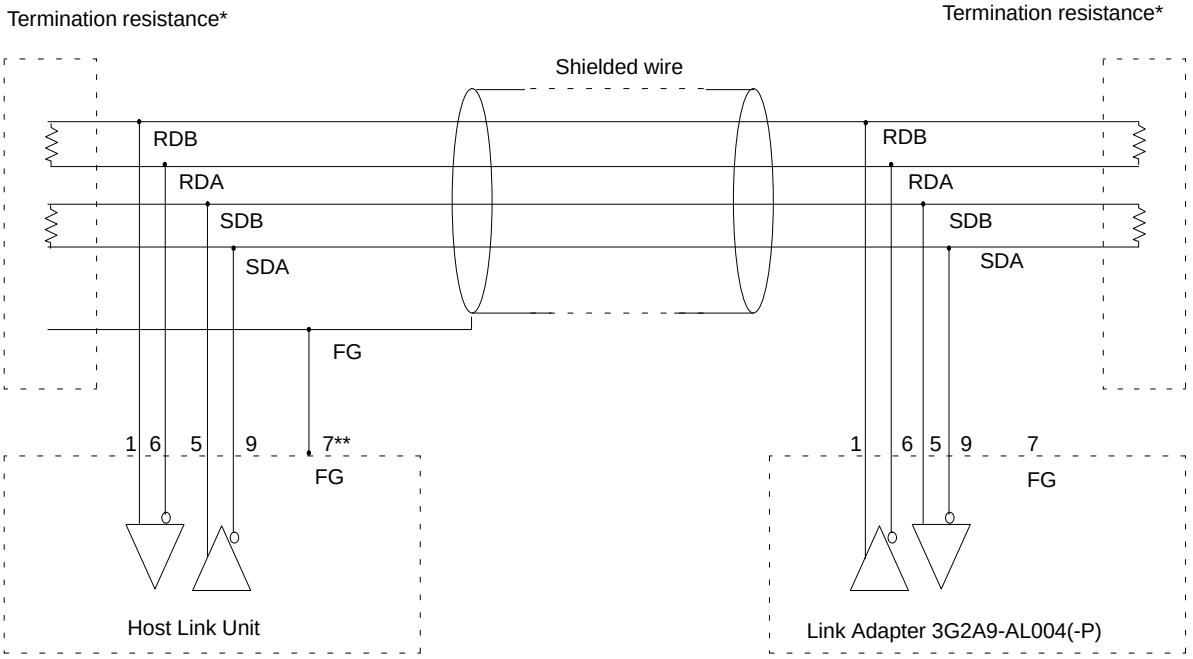
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RS-422 Interface (For Insulated C500-LK203)

The table below lists the connections for interfacing a RS-422 cable to an insulated C500-LK203 Host Link Unit.

Signal*	Symbol	Pin No.
Send data A	SDA	9
Send data B	SDB	5
Receive data A	RDA	6
Receive data B	RDB	1
Frame ground	FG	7
Frame ground**	FG	Hood fitting

* Viewed from the Host Link Unit.
** In order to prevent current flow in the shield wire, make a connection to only one end of it. Either pin 7 or the hood fitting can be used to connect the shield wire to the frame ground.



* The total termination resistance must be 100 Ω min. The built-in resistance is 220 Ω.

** In order to prevent current flow in the shield wire, make a connection to only one end of it. Either pin 7 or the hood fitting can be used to connect the shield wire to the frame ground.

The maximum cable length is 500 m. Ground the FG terminals of both the PC and the host computer to a point with a resistance of less than 100 Ω. For details, refer to the PC or host computer manuals.

C500-LK203 Noise Tolerance The RS-422 interface on the C500-LK203 Host Link Unit is insulated to improve its tolerance to electrical noise. Although the increased tolerance provides better performance under normal operating conditions, the operation ca be affected in very noisy environments. For this reason the optical C500-LK103(-P) is recommended in situations where noise might be a problem.

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FG Connections for Insulated C500-LK203 Host Link Units

In systems which use only the insulated C500-LK203 Host Link Units, connect the frame ground to the shield wire at the connections to the Host Link Units and at either end of the connections between Link Adapters. In systems using the insulated C500-LK203 with other types of Host Link Units, connect the frame ground to the shield wire at connections to the C500-LK203 Host Link Units and at both ends of all connections between Link Adapters and between the other Host Link Units and Link Adapters.

Multiple-link Connections

When connecting a multiple-link system with RS-422 cable, use shielded twisted pair cables for the Host Link Unit. The total cable length of the entire system must not exceed 500 m. The length of each branch line should be kept to less than 10 m.

The optical Host Link Units can be used to achieve greater distances in the overall system (see *Example 2* in *1-2 System Configuration*). If they are connected in series, however, signals are not transmitted to any Unit that is not supplied with power, or any other Units beyond it. To avoid any problems with this, signals can also be distributed through Link Adapter 3G2A9-AL002-PE. To connect the Host Link Units to the host computer, Link Adapter 3G2A9-AL004-(P)E is necessary to be able to interface the optical fiber cables and the RS-232C and RS-422 cables.

1-6 Wiring RS-232C and RS-422 Cable Connectors

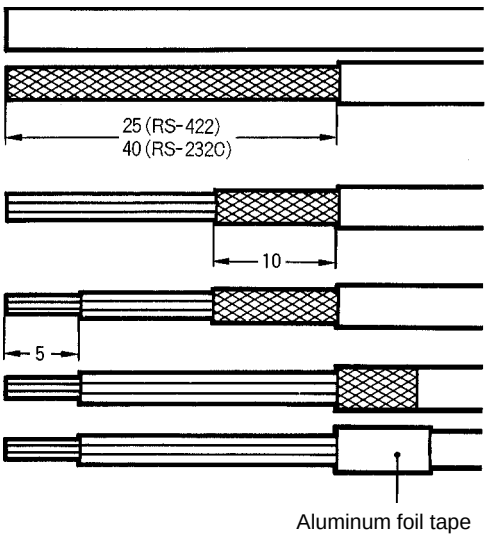
The following procedures should be followed when wiring RS-232C and RS-422 connectors.

1-6-1 Preparation for Connecting Shielded Cable to FG

The procedures listed below correspond to the following diagrams.

1, 2, 3...

1. Cut the cable to the required length.
2. Use a razor blade to cut away the sheath (being careful not to damage the braiding underneath): 25 mm for RS-422 cable; 40 mm for RS-232C cable.
3. Use scissors to cut away all but 10 mm of the exposed braiding.
4. Use wire strippers to remove the insulation from the last 5 mm of each wire.
5. Move the boot to cut the edge of the sheath and fold the braiding back over the end of it.
6. Wrap aluminum foil tape over the top of the braiding on top of the boot for one and a half turns.



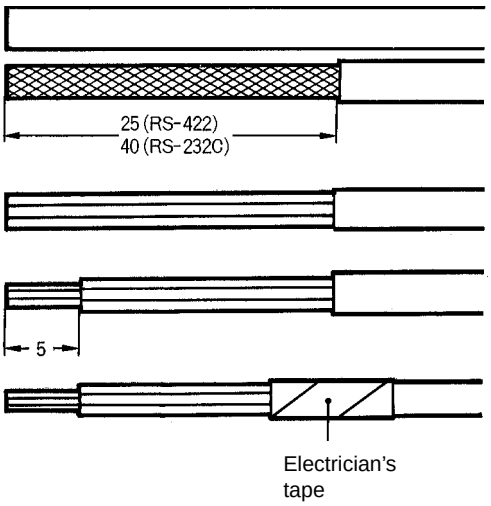
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1-6-2 Preparation for Connecting Unshielded Cable to FG

The procedures outlined in the list below correspond to the following diagrams.

1, 2, 3...

1. Cut the cable to the required length.
2. Use a razor blade to cut away the sheath: 25 mm for RS-422 cable; 40 mm for RS-232C cable.
3. Use scissors to cut away the exposed braiding.
4. Use wire strippers to remove the insulation from the last 5 mm of all wires.
5. Wrap insulating tape over the top and end of the the cut sheath.

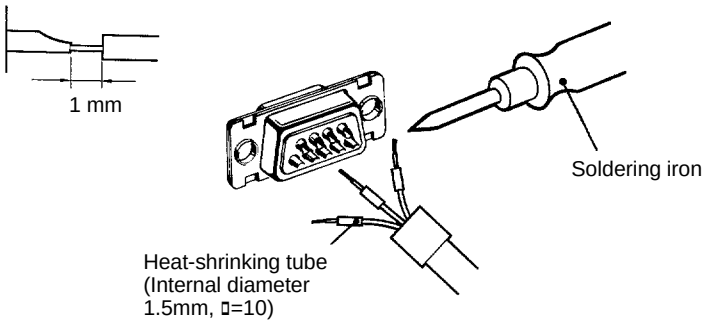


Soldering

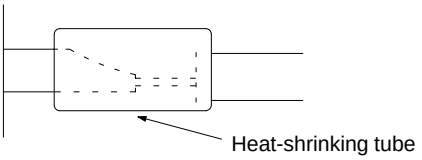
Observe the following when soldering the prepared wires onto the connectors.

1, 2, 3...

1. Place heat-shrinking tubes over all wires, far enough away from the end so as not to interfere with the soldering.
2. Pre-solder all wires and connector terminals.
3. Solder wires, inserting 4 mm of the exposed 5 mm of wire into the connector terminal.



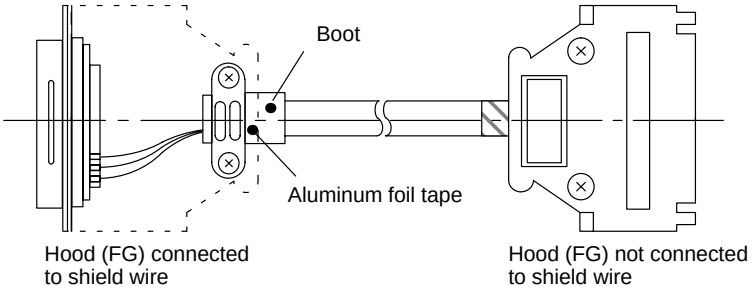
4. Move the heat-shrinking tubes onto the soldered area and shrink them into place.



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Hood Assembly

Assemble the hood as shown in the following diagram.

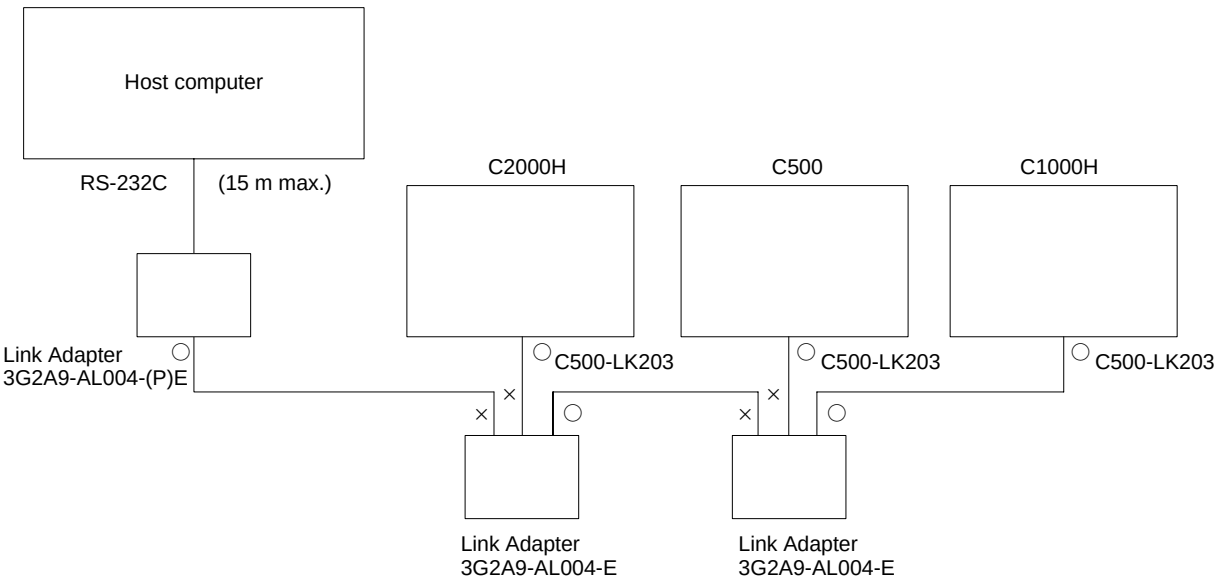


1-6-3 FG Connection to the Cable's Shield Wire (RS-422 Interface)

Connection of C500-LK203 Host Link Units

When connecting a Host Link Unit and a Link Adapter, connect the cable's shield wire to the Host Link Unit's FG. Do not connect the shield wire to the Link Adapter's FG.

When connecting two Link Adapters, connect the cable's shield wire to either Link Adapter's FG.



Note Just one end of the shield wire is connected to FG to prevent current from flowing in the shield wire.

○: Connect the shield wire to FG.

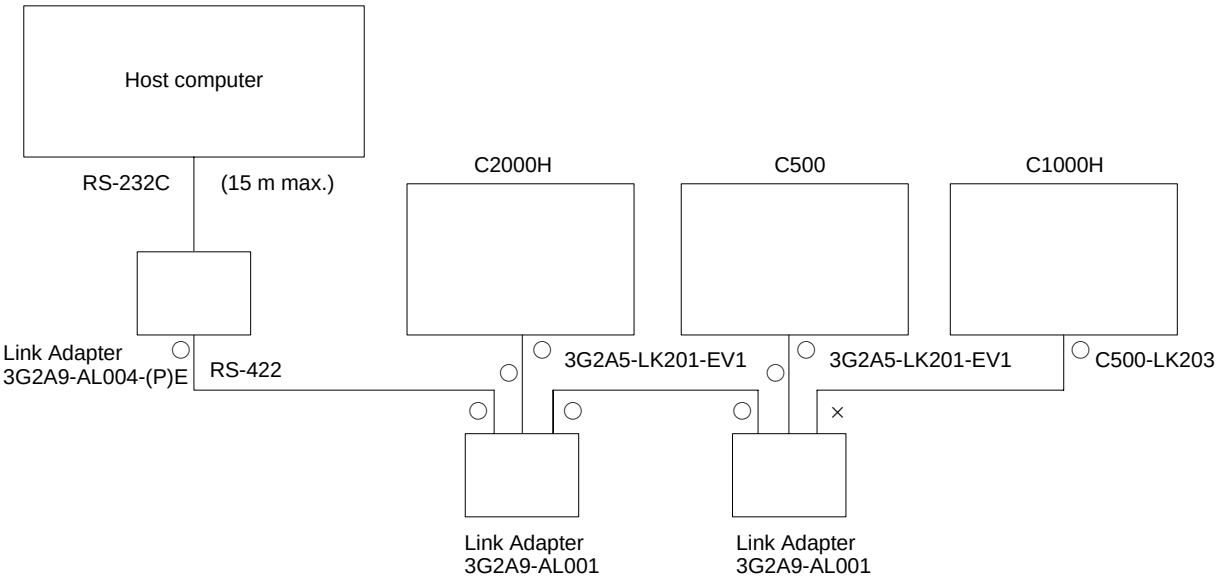
×: Do not connect the shield wire to FG.

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Connection of C500-LK203 with other Host Link Units

When connecting a C500-LK203 and a Link Adapter, connect the cable's shield wire to the C500-LK203 Host Link Unit's FG. Do not connect the shield wire to the Link Adapter's FG.

When connecting a Host Link Unit (other than a C500-LK203) and a Link Adapter, connect the both ends of the cable's shield wire to the FGs. Also connect both ends to the FG's when connecting two Link Adapters.



Note Just one end of the shield wire is connected to FG to prevent current from flowing in the shield wire.

○: Connect the shield wire to FG.

×: Do not connect the shield wire to FG.

1-6-4 Wiring

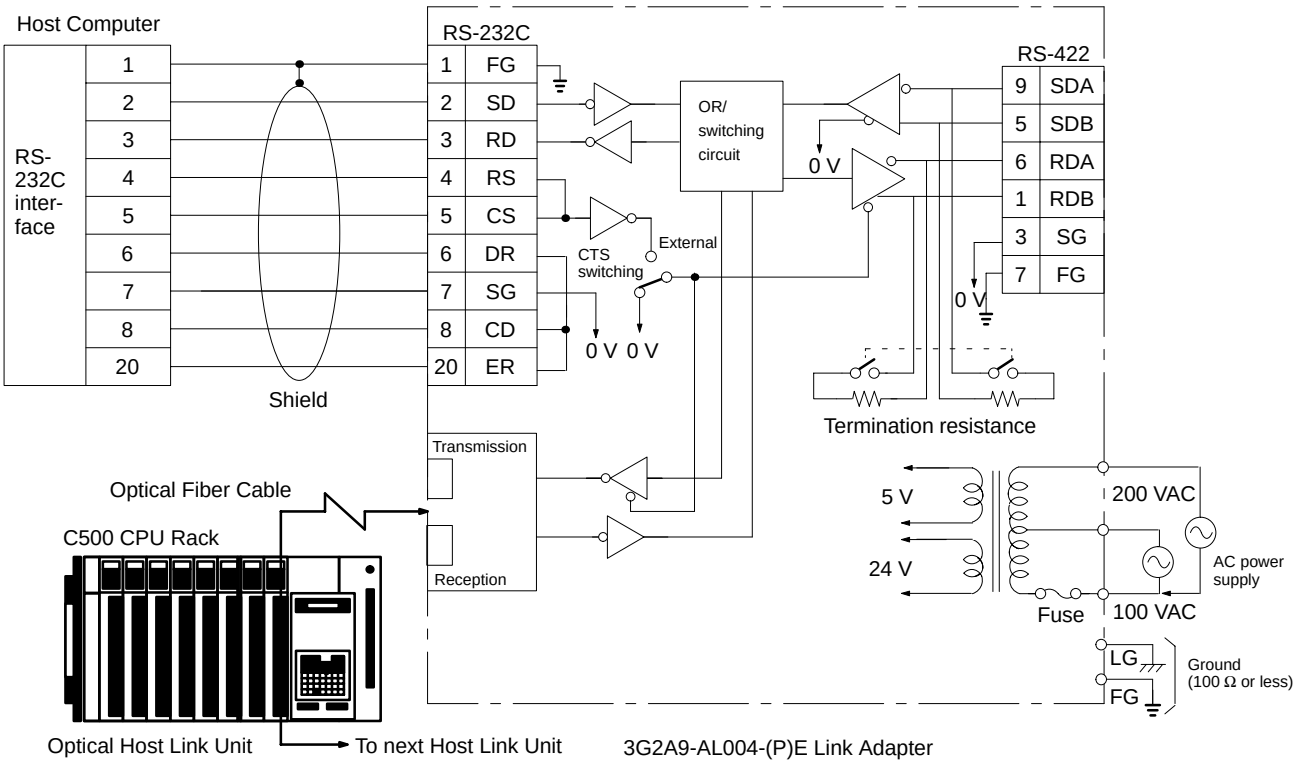
Connection of Optical Host Link Units

Optical Host Link Units (C200H-LK101-PV1, 3G2A5-LK101-(P)EV1, C500-LK103(-P), and 3G2A6-LK101-(P)EV1) are connected sequentially with Optical Fiber Cable. Consequently, Units cannot transmit if they follow a Unit that is turned off. Branches can be made in the Optical Fiber Cable with a 3G2A9-AL002-(P)E Link Adapter.

When connecting a host computer, a 3G2A9-AL004-(P)E Link Adapter is required to convert Optical Fiber Cable to RS-232C or RS-422.

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Wiring Example



Switch Settings

CTS (CS) Switching (Link Adapter Settings)

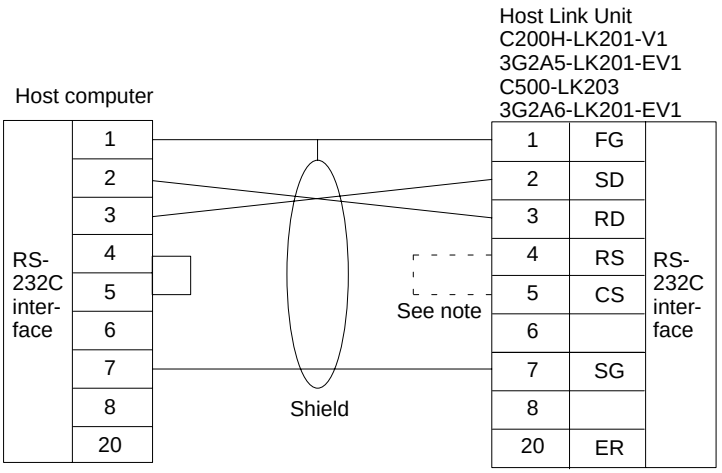
Set to “0 V” when the CTS (Clear-To-Send) signal will usually be ON. Set to “External” when the signal is received externally. This switch is normally set to “0 V.”

Note Always cap unused Optical Connectors. If the connectors are not capped, ambient light interference can enter the Optical Connectors and cause transmission errors.

1:1 Connection of Host Computer and Host Link Unit

The following diagram shows a 1:1 connection of a host computer and a Host Link Unit (C200H-LK202-V1, 3G2A5-LK201-EV1, C500-LK203, or 3G2A6-LK202-EV1).

Wiring Example



Note It is not necessary to connect the RS and CS signals if the CTS switch on the back of the Host Link Unit is set to 0 V.

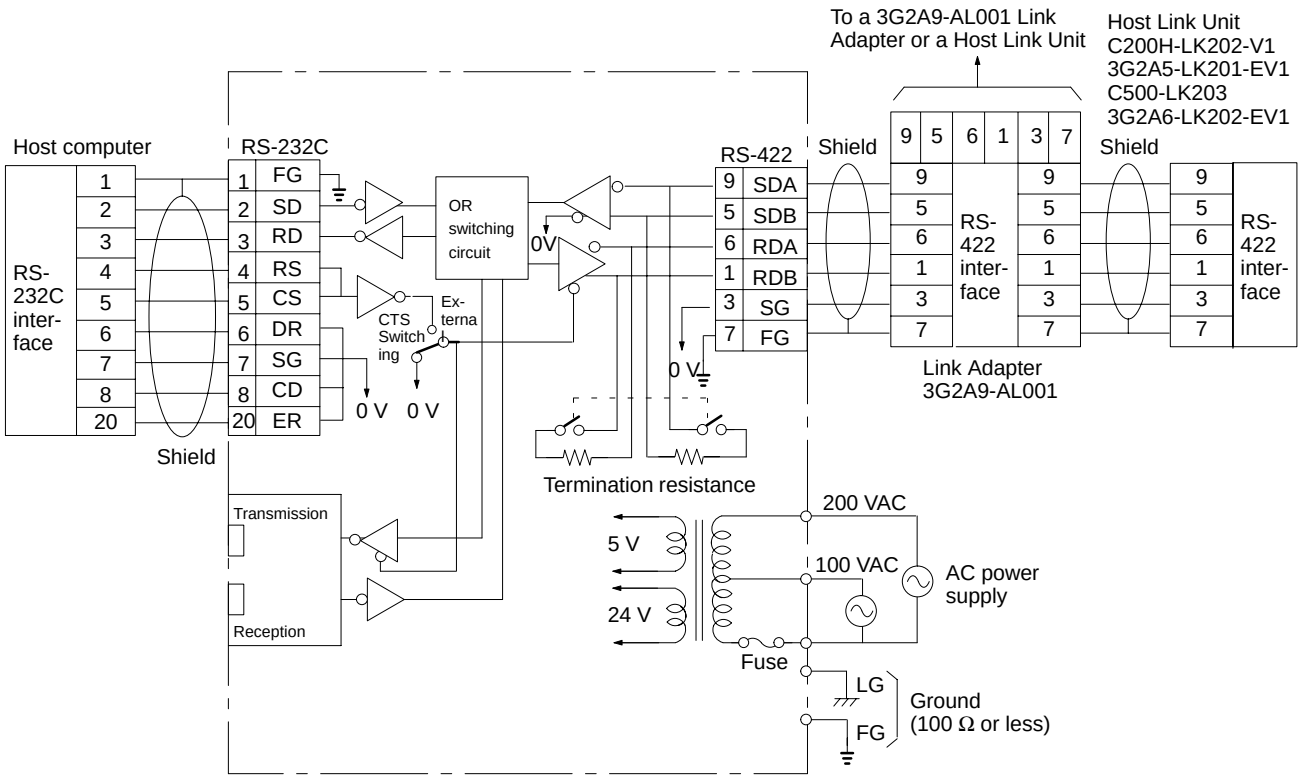
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Set the I/O port switch on the back of 3G2A5-LK201-EV1/C500-LK203 Host Link Units to “RS-232C.”

1:N Connection of Host Computer and Host Link Unit

Set to 0 V when the CTS (Clear-To-Send) signal will usually be ON. Set to External when the signal is received externally. This switch is normally set to 0 V.

Wiring Example



Note Set the I/O port switch on the back of 3G2A5-LK201-EV1/C500-LK203 Host Link Units to “RS-422.”

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SECTION 2
Host Link Unit Characteristics

This section provides the switch location and setting details for each group of Host Link Units. The Units are grouped according the operating characteristics. C200H Units are dealt with first, followed by C500 and 3G2A5 models, and 3G2A6 models are included at the end of the section.

For each grouping, labelled pictures of the different models show the positions and names of the switches and connections. The functions of the switches are then explained. The effects of the Host Link Units and other peripheral devices on the operating mode of the PC System are discussed, followed by a section on the I/O Response Times.

The systems and PCs that apply to each Host Link Unit are given in the table at the beginning of *Section 1*.

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2-1 C200H Host Link Units

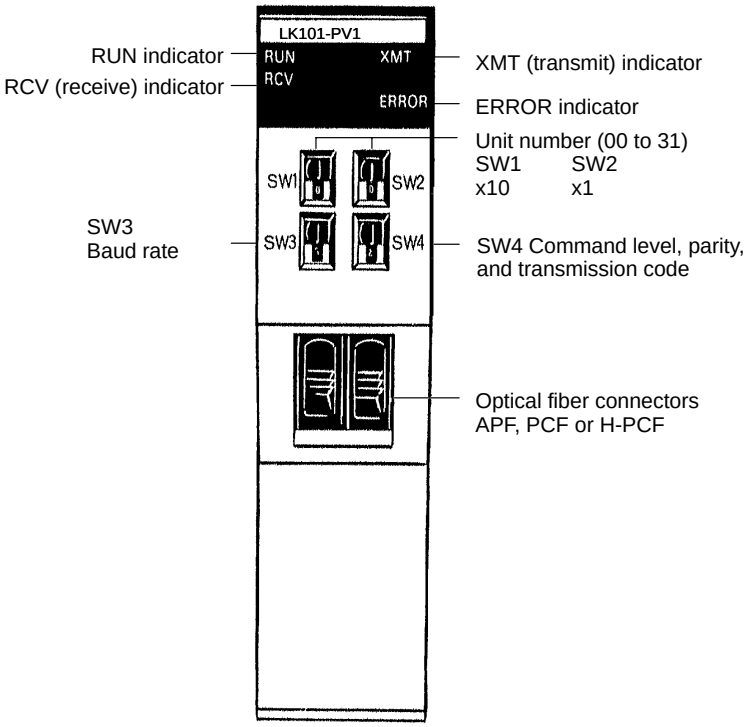
2-1-1 Nomenclature and External Appearance

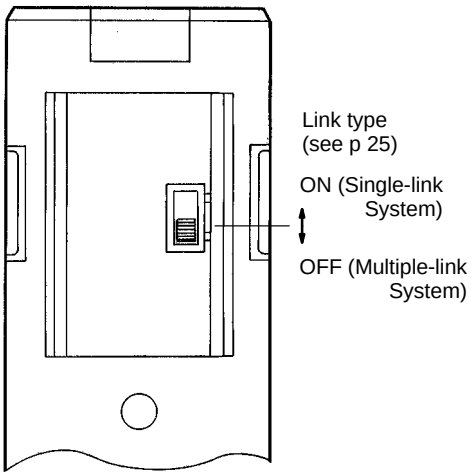
The following figures give details of switch types, selectors, and connectors for your Host Link Unit. It will be necessary to refer to these diagrams from time to time as you read further in the manual, particularly when reading the section on *2-1-2 Switch Settings*.

Front Panels

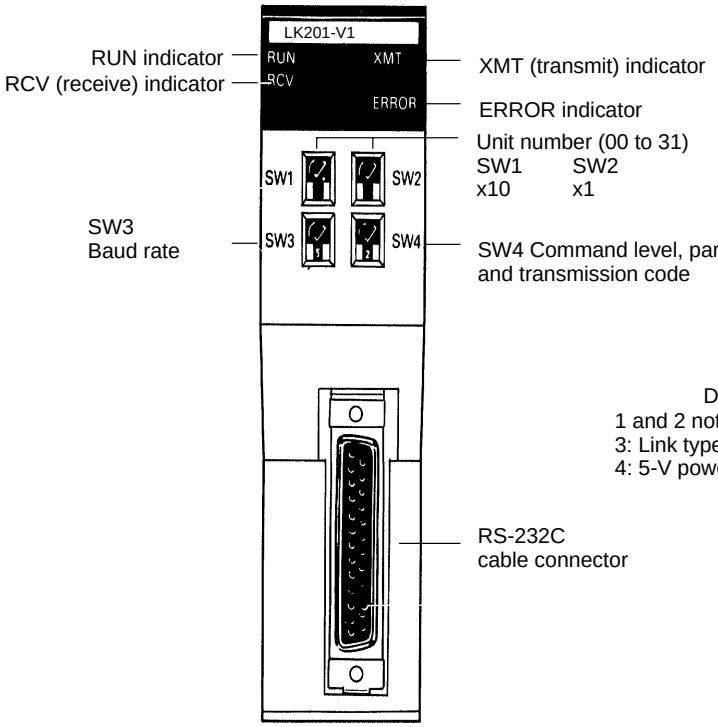
Rear Panels

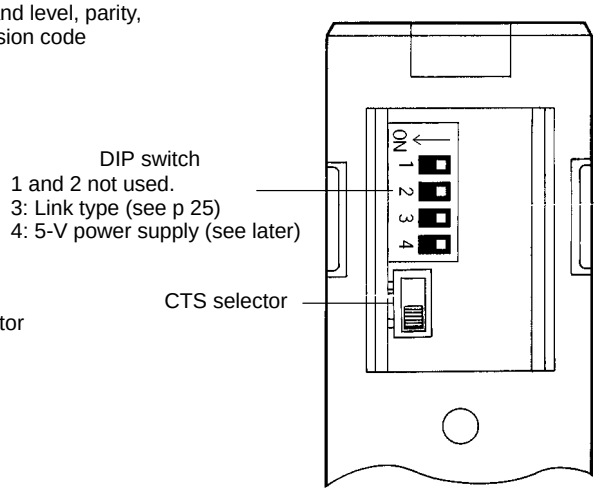
C200H-LK101-PV1





C200H-LK201-V1

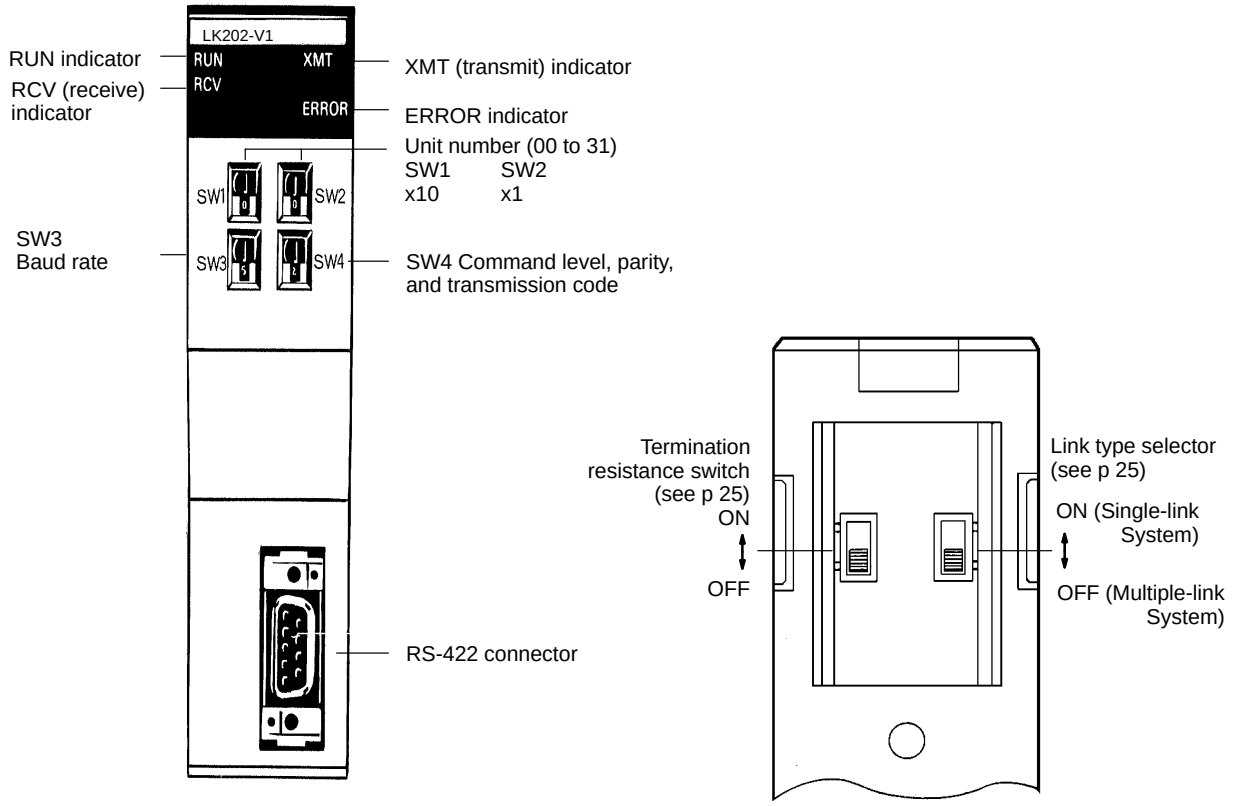




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Front Panel **Rear Panel**

C200H-LK202-V1



2-1-2 Switch Settings

The following information provides details on correct settings for the range of Host Link Units covered by this manual. Pay particular attention to the RUN/STOP and MONITOR/NORMAL switches on the C1000H-style cards.

SW1 and SW2

These switches are used to set the Unit number. The same unit number must not be specified for more than one Unit.

SW3: Baud Rate

The baud rate of the Host Link Unit, as determined by the following switch settings, must match that of the host computer.

SW3	Baud rate
0	300 bps
1	600 bps
2	1,200 bps
3	2,400 bps
4	4,800 bps
5	9,600 bps
6	19,200 bps
7	Do not set
8	
9	

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SW4: Command Level, Parity and Transmission Code

SW4	Command Level*	Parity	Transmission Code
0	1	Even	ASCII 7 bit, 2 stop bits
1	1,2		
2	1,2,3**		
3	Do not set		
4	1	Odd	
5	1,2		
6	1,2,3		
7	Do not set		
8	1	Even	JIS 8 bit, 1 stop bit
9	1,2		
A	1,2,3		
B	Do not set		
C	1	Odd	
D	1,2		
E	1,2,3		
F	Do not set		

* See descriptions of Command Levels at the end of this sub-section.

** Use this setting when using LSS (Ladder Support Software)

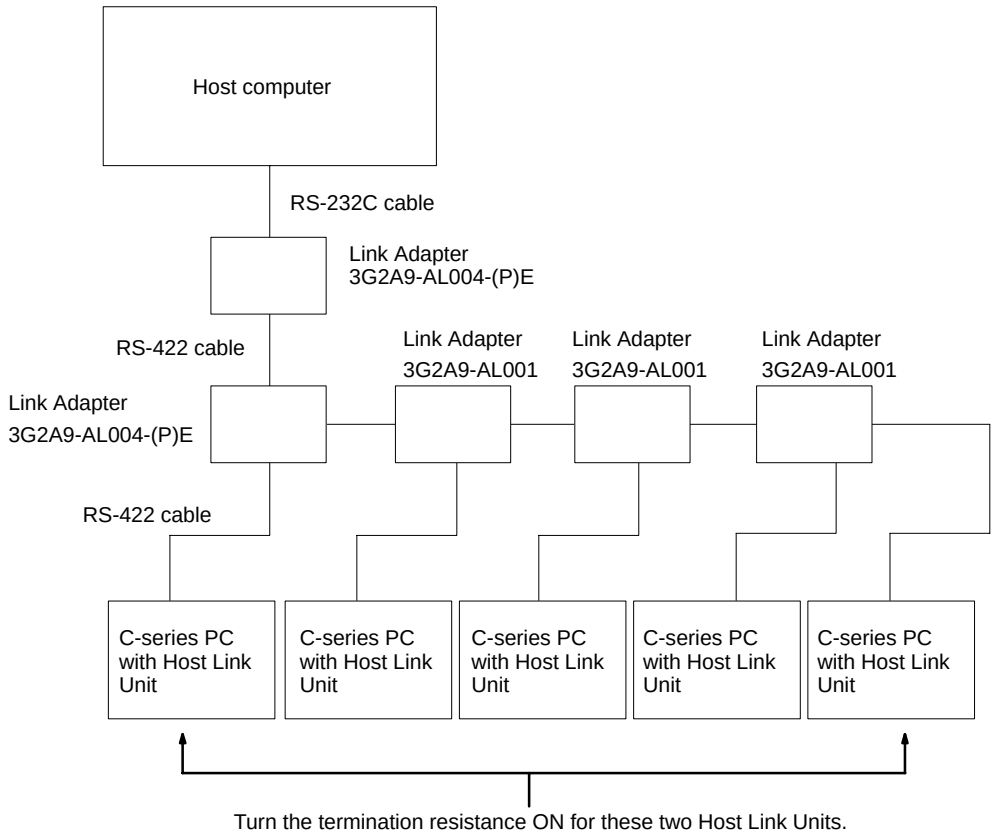
Mode Selection

C200H Units are automatically set to HOST mode. See *2-1-4 PC Operating Mode* for further details.

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Termination Resistance

When using a RS-422 cable (C200H-LK202-V1 Host Link Units) throughout a system, the Host Link Unit at each end of the cable system (as detailed in the following diagram) must have the termination resistances connected by turning ON the switch on the back of the panel. When this switch is set to ON, a built-in termination resistance of 220 Ω is connected. When set to OFF, the termination resistance is disconnected.



CTS Selector

For RS-232C models (C200H-LK201-V1), the selector is set to 0 V, the clear-to-send (CTS) signal is continuously ON. When the selector is set to external, the Unit will respond to externally generated CTS signals. This is normally set to CTS always ON, i.e., the switch is set to ON.

5-V Power Supply Switch

When using a Z3RN-A-5 Optical Interface with an RS-232C Host Link Unit, the 5 V power supply switch should be set to ON; otherwise it should be set to OFF. On the C200H-LK201-V1, pin 4 on the back-panel DIP switch functions as the 5 V power supply switch.

Link Type Selector

Pin 3 on the back-panel DIP switch of the C200H-LK201-V1 (RS-232C connection), and the Link Type Selector on the rear of the C200H-LK101-PV1 (optical fiber connection) provide the same functions as described below.

OFF (Single-link):
If set to OFF, the Host Link Unit is connected to the host computer on a one-to-one basis (see *Example 3* and *Example 5* under *1-2 System Configuration*. The Unit number and Frame Checksum (FCS) settings are not required. The normal setting is ON (see below).

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ON (Multiple-link):
If set to ON, up to 32 Host Link Units can be connected to one host computer. The unit number and FCS must be specified, even if only one Host Link Unit is connected to the host computer. When using Ladder Support Software, LSS, the switch must be set to ON.

Command Levels

1, 2, 3...

1. Enables data areas to be read and, when the CPU has been correctly set via the SC (Status Write) command, data can also be written.
2. Enables program transfers and reading or writing of I/O tables.
3. I/O READs can be performed and I/O tables can be registered. The Command Level should be set to *"1, 2, 3"* for running LSS software, program transfers, etc. Other levels may be used for Systems Control Software, monitoring, Data Acquisition Software, etc.

Note Commands valid for each level are listed in *3-1 Command Levels.*

2-1-3 Indicators

Indicator	Function
RUN	ON when the Unit is operating. Depending on the settings of switches 1 to 4, this indicator will blink when an error occurs. (See notes.)
RCV	ON when the Host Link Unit is receiving data.
XMT	ON when the Host Link Unit is transmitting data.
ERROR	Goes ON when a transfer error is detected (See note 1.); goes OFF when a new command is received normally. Goes ON when an error is detected in communications with the CPU. The RUN indicator will blink in this case. (See note 2.)

Note

1. Transfer errors include parity, framing, overrun, and FCS errors.
2. Operation of the Unit is stopped when the RUN indicator is OFF or blinking. Restart the Unit after setting switches 1 to 4 correctly.
3. Refer to *5-4 Troubleshooting* for details on correcting the following problems.
   - The RUN indicator does not light.
   - The Host Link Unit's RCV indicator does not light when data is transmitted from the host computer.
   - The RCV indicator lights, but the XMT indicator does not.
   - The ERROR indicator lights.
   - The XMT indicator lights, but the host computer does not receive the data.

2-1-4 PC Operating Modes

The operating mode of the PC depends on the Memory Unit's Initial Mode setting, the RUN/STOP on the any CPU-mounted Host Link Unit, and the status of any peripheral device connected to the PC. Refer to the following table for details.

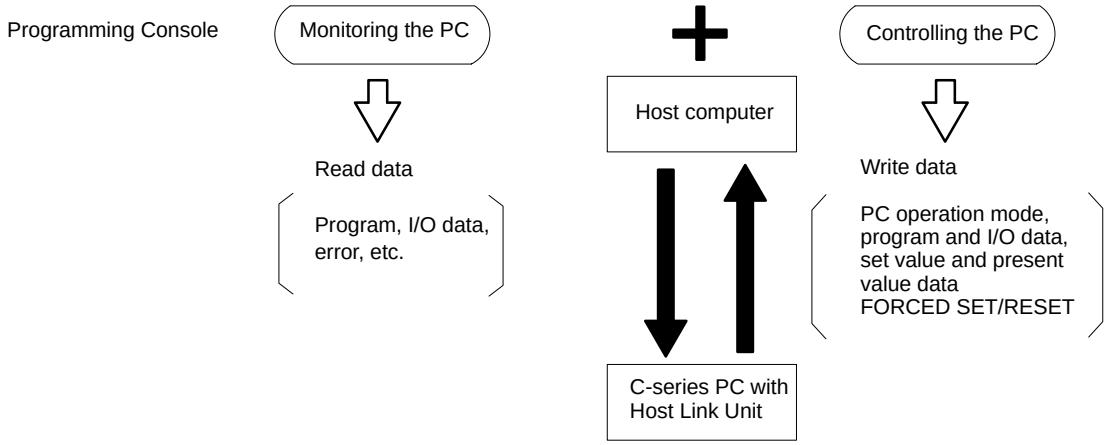
PC Mode on Applying Power with the Host Link Unit Mounted

System configuration and Host Link Unit setting		Memory Unit Initial Mode setting	
		Normal (OFF)	Run (ON)
With no CPU-mounted device		RUN	RUN
With CPU-mounting Host Link Unit	RUN	RUN	
	STOP	PROGRAM	
With CPU-mounting peripheral device		PROGRAM	
With Programming Console		The mode is determined by the mode selector on the Console, i.e., RUN, MONITOR or PROGRAM.	

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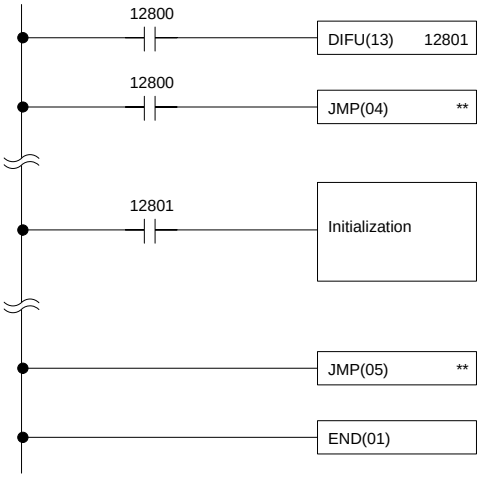
Data Flow

The diagram below shows the flow of data between the system using C200H Host Link Units, and a Programming Console. As can be seen, the Programming Console can be used for monitoring, or for writing to the PC System.



Controlling PC Start-up

PROGRAM mode cannot be achieved manually when C200H Rack-mounting Host Link Units are used without a Programming Console or other peripheral device. Programming can be implemented, however, to prevent the PC from automatically starting when the power is applied. This allows greater control and the Unit can be started later with a command from the host computer. The following is an example of a programmed start-up for a C1000H PC.



Appropriate initialization codes must be programmed between JMP(04) and JME(05). IR area bit 12800 can then be turned on to start PC operation from the host computer. The PC must be set in MONITOR mode for this to be possible. To initialize the PC when starting operation, use DIFU with the Always ON Flag; the Reset Flag cannot be used. Refer to your PC's operation manual for specific bits. The PC's operating mode can then be changed from the host computer after operation has begun. When programming in this fashion, note the following conditions:

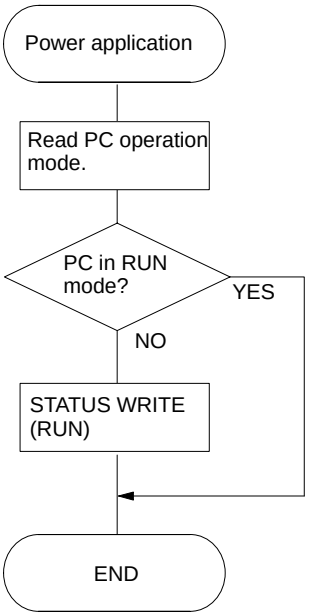
1, 2, 3...

1. Before turning on the IR area bit 12800, set the C200H Host Link Units to MONITOR mode using the host computer.
2. JMP command numbers must be between 01 and 99 for C200H/HS, C1000H, and C2000H PCs.

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Sending a RUN Start Command to the PC

The following flowchart shows the computer decision making processes for ensuring that the PC is in RUN mode after start-up.



2-1-5 Restart Bits and Error Flags

Host Link Units use some of the Special Relay (SR) area and Auxiliary Relay (AR) area bits of the PC to restart the communications control program of the Host Link Unit and to indicate the occurrence of communications errors between the Unit and the computer. The word (Wd) addresses and bit numbers of these bits are as follows:

	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SR Wd 252			RM* #0 connection error flag				CM* restart bit	CM* error flag	RM* #1 connec-tion error flag	RM* #1 HC** error flag						
SR Wd 253					RM* #0 HC** error flag											
AR Wd 00			RM* #0 CPU** error flag	RM* #1 CPU** error flag												
AR Wd 24	CM* restart bit	RM* #0 connection error flag	RM* #1 connection error flag													
AR Wd 267			RM* #1 Transmis-sion ready (C200HS/ HX/HG/HE only)								RM* #0 Transmis-sion ready (C200HS/ HX/HG/HE only)					

* RM: Rack-mounting Host Link Unit
CM: CPU-mounting Host Link Unit
** HC: Error between the Host Link Unit and the host computer
CPU: Error between the Host Link Unit and the CPU of the PC

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Host Link Unit Restart Bit

When this bit is turned ON, the Host Link Unit is reset to its initial conditions, as if the power had just been applied.

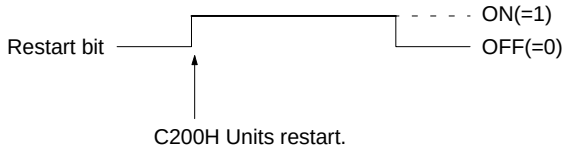
⚠ Caution Do not turn this bit ON in the user program; doing so could cause the memory to be lost.

Host Link Unit Error Flag

This flag turns ON if a transmission error occurs between the PC and the Host Link Unit. It turns ON the error indicator on the front of the Unit.

Note

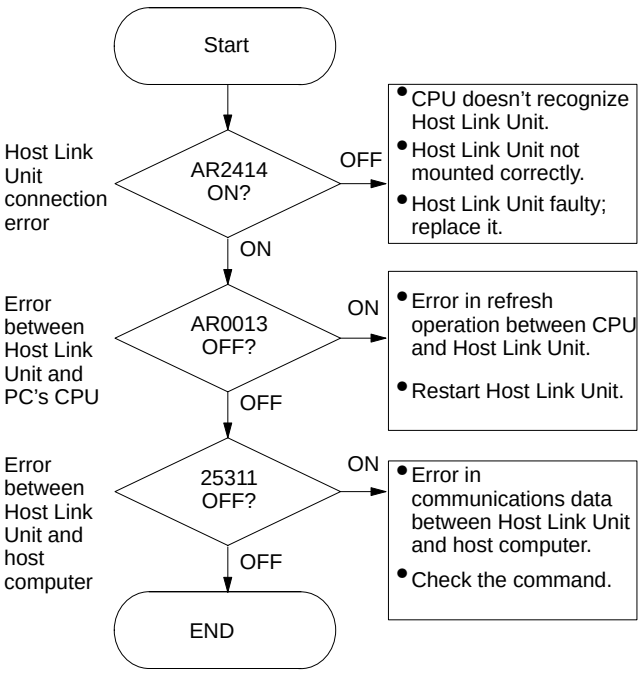
1. When the Host Link Unit Restart bit is turned ON, the Host Link Unit Error Flag is turned OFF.
2. Set the Host Link Unit to LOCAL mode before force setting or force resetting an error flag.
3. With all but C200H Rack-mounting Host Link Units, communications between the Host Link Unit and the host computer will not be resumed until the Restart bit is turned OFF. The initialization process is repeated as long as the Restart bit is ON.



4. If the error condition does not clear, disconnect and then reconnect the power to the PC.

Error Location

The following example for a Rack-mounting Host Link Unit with an assigned operating level 0, indicates the process flow used in locating errors.



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2-1-6 I/O Response Time

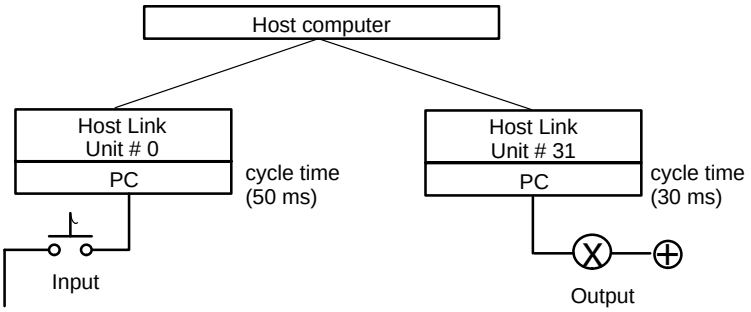
The processing that determines and the methods for calculating the minimum and maximum times required from an input on one PC with a Host Link Unit to an output on another PC with a Host Link Unit are described below. The transfer between the PCs is handled through a host computer connected to both these PCs.

Processing and calculations are described by PC model in the first subsection and for Systems combining C200H/HS/HX/HG/HE and C1000H PC models in the last subsection. Although more precise equations may be written if required, those used in the following calculations do not consider fractions of a cycle.

The calculations used in this section assume that all host computer commands and PC responses require no more than one host link servicing period to complete transmission. To compute response times for situations involving a longer command and/or response, the number of host link servicing periods (i.e., the number of cycles) required to complete the command or response would have to be incorporated into the equations.

In considering response times, it is important to remember the sequence of processing that occurs during the PC cycle. The main factor that affects the response time is the timing of inputs and outputs and of host computer processing in relation to this sequence.

The following diagram illustrates the setup used in response time calculations



The following equations can be used as required to calculate the minimum and maximum response times with the C200H. The maximum response time is an approximation.

Minimum response time = Input ON delay + Command transmission time + (cycle time of PC for Unit #0 x 3) + Response transmission time + Host computer processing time + Command transmission time + (cycle time of PC for Unit #31 x 3) + Output ON delay

Maximum response time = Input ON delay + Command transmission time + (cycle time of PC for Unit #0 x 10) + Response transmission time + Host computer processing time + Command transmission time + (cycle time of PC for Unit #31 x 10) + Output ON delay

Combined Systems

When transferring data from one model of PC through a host computer and then out to a different model of PC, all that is necessary is to combine the first half of the minimum/maximum equation for the origin PC with the second half of that for the destination PC. For example, the following equation can be used for the minimum response time when transferring from a C200H/HS/HX/HG/HE to a C1000H.

Minimum response time = Input ON delay + Command transmission time + (cycle time of PC for Unit #0 x 3) + Response transmission time + Host computer processing time + Command transmission time + Output ON delay

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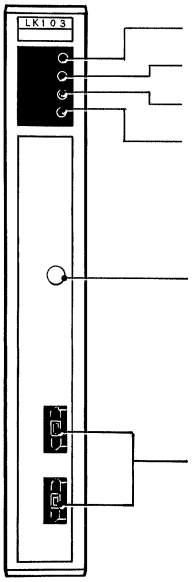
2-2 C500 (3G2A5) Host Link Units

2-2-1 Nomenclature and External Appearance

The following figures give details of switch types, selectors, and connectors for your Host Link Unit. It will be necessary to refer to these diagrams from time to time as you read further in the manual, particularly when reading the section on *2-2-2 Switch Settings*. These Units are suitable for use with C500, C1000H, and C2000H PCs.

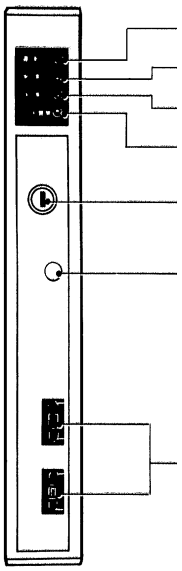
Front Panels

C500-LK103(-P)



RUN indicator
RCV (receive) indicator
XMT (transmit) indicator
ERROR indicator
(Parity, framing, overrun, and FCS errors)
Reset switch
Optical fiber connectors
* APF or PCF can be connected to the LK103-PEV1.
Only PCF can be connected to the LK103-EV1.

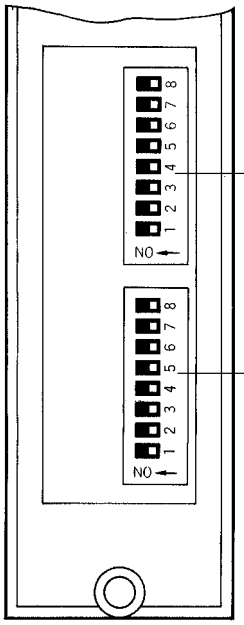
3G2A5-LK101-(P)EV1



RUN indicator
RCV (receive) indicator
XMT (transmit) indicator
ERROR indicator
(Parity, framing, overrun, and FCS errors)
Mode selector
Reset switch
Optical fiber connectors
* APF or PCF can be connected to the LK101-PEV1.
Only PCF can be connected to the LK101-EV1.

Rear Panels

3G2A5-LK101-(P)EV1
C500-LK103(-P)

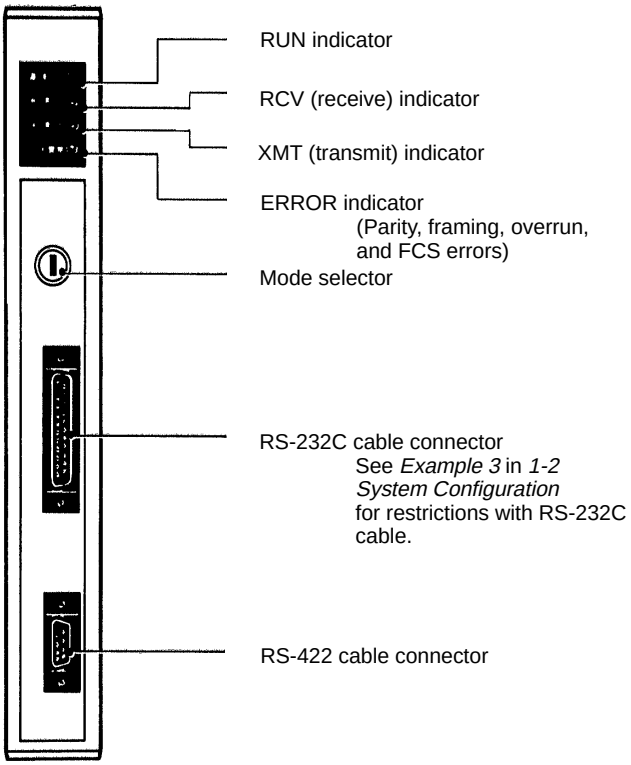


SW1
SW2

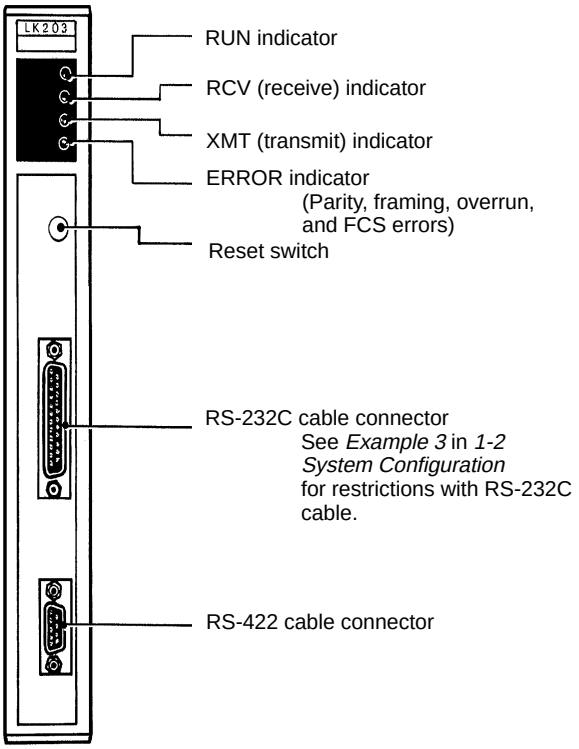
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Front Panels

3G2A5-LK201-EV1

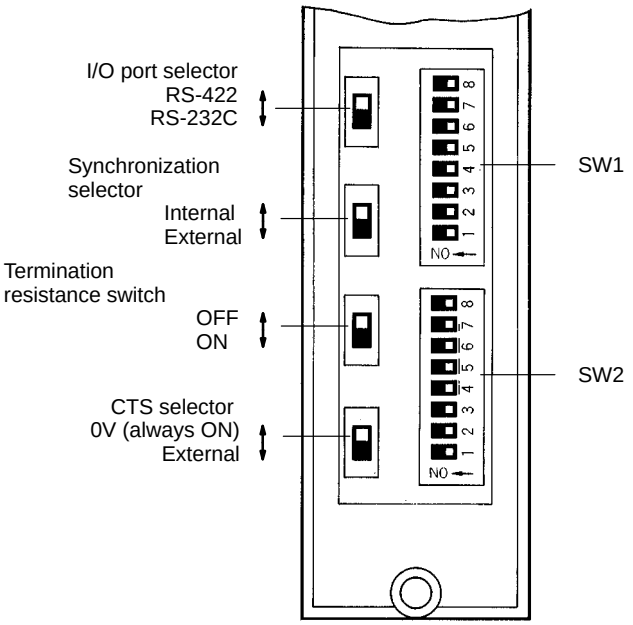


C500-LK203

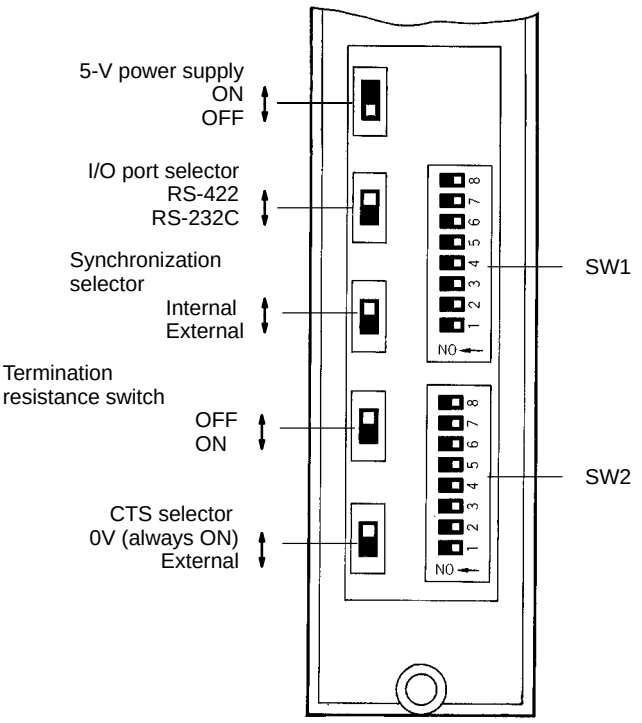


Rear Panels

3G2A5-LK201-EV1



C500-LK203



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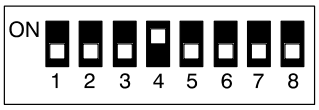
2-2-2 Switch Settings

The following information provides details on correct settings for the range of Host Link Units covered by this manual. Pay particular attention to the RUN/STOP and MONITOR/NORMAL switches on the C1000H-style cards.

SW1

SW1 will perform one of two different functions depending on the Unit. In both instances, the first five pins are used to set the Unit number as shown below. Details about SW1 and SW2 settings are included following the diagram.

SW1 C500-LK103(-P)/-LK203 and 3G2A5-LK101-(P)EV1/-LK201-EV1 Host Link Units



Unit No.

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

Note Each Unit must be given a different unit number.

MONITOR/NORMAL selector (C500 models)

ON	MONITOR
OFF	NORMAL

OR

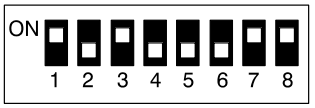
RUN/STOP selector (3G2A5 models)

ON	RUN
OFF	STOP

Parity/Transmission Code Selector (C500 models)

6	7	Parity	Transmission code
OFF	OFF	Even	ASCII 7-bit
OFF	ON	Odd	2 stop bits
ON	OFF	Even	JIS 8-bit
ON	ON	Odd	1 stop bit

SW2 C500-LK103(-P))/-LK203 and 3G2A5-LK101-(P)EV1/-LK201-EV1 Host Link Units



Baud rate

OFF	ON	OFF	ON	300bps
ON	OFF	OFF	ON	600bps
OFF	OFF	OFF	ON	1,200bps
ON	ON	ON	OFF	2,400bps
OFF	ON	ON	OFF	4,800bps
ON	OFF	ON	OFF	9,600bps
OFF	OFF	ON	OFF	19,200bps

Command Levels

7	8	Valid levels
OFF	OFF	---
ON	OFF	1
OFF	ON	1 and 2
ON	ON	1, 2, and 3

Link Type Selector

OFF: Multiple-link
ON: Single-link

Operating Level

ON: Level 0
OFF: Level 1

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RUN/STOP Selector (3G2A5-LK101/-LK201)

When pin 8 is set to RUN (ON), the CPU will start in RUN mode upon power application. When set to STOP (OFF), the CPU will start operation in PROGRAM mode. (Refer to to the *2-2-4 PC Operation Mode* for further details.)

MONITOR/NORMAL Selector (C500-LK103(-P), C500-LK203)

When pin 8 is set to MONITOR (ON), the PC will operate in MONITOR mode upon the application of power. When the pin is set to NORMAL (OFF), the PC is no longer controlled by the Host Link Unit (i.e., the mode of operation will be determined by other system conditions). Refer to the *2-2-4 PC Operating Mode* for details.

SW2

Operating Level

Set pin 5 of SW2 to OFF (operating level 1) when using a C500 PC and ON (operating level 0) when using the Host Link Unit together with a SYSMAC NET Link Unit. When using two Rack-mounting Host Link Units, set this pin to ON for one of the Units, and to OFF for the other.

⚠ Caution Failure to set pin 5 correctly may damage components or prevent operation.

Link Type Selector

ON (Single-link)

If pin 6 is set to ON, the Host Link Unit is connected to the host computer on a one-to-one basis (see *Example 3* under *1-2 System Configuration*). The Unit number and Frame Checksum (FCS) settings are not required. The normal setting is OFF (see below).

OFF (Multiple-link)

If pin 6 is set to OFF, up to 32 Host Link Units can be connected to one host computer. The unit number and FCS must be specified, even if only one Host Link Unit is connected to the host computer. When using Ladder Support Software, LSS, pin 6 must be set to OFF.

Command Levels

1. Enables data areas to be read and, when the CPU has been correctly set via the SC (Status Write) command, data can also be written.
2: Enables program transfers and reading or writing of I/O tables.
3: I/O reads can be performed and I/O tables can be registered. The Command Level should be set to *1, 2, and 3* for running LSS software, program transfers, etc. Other levels may be used for Systems Control Software, monitoring, Data Acquisition Software, etc.

Note Commands valid for each level are listed in *3-1 Command Levels.*

Mode Selector

The Mode Selector (3G2A5-LK101/201) sets the Host Link Unit in to HOST or LOCAL mode. In HOST mode, the host computer can set the operating mode of the PC or write data to its memory. In LOCAL mode, the operating mode is specified by a programming device connected to the PC; such as a Programming Console. This switch is locked by removing the key with the HOST mode selected. See *2-2-4 PC Operating Mode* for further details.

Reset Switch

By pressing the Reset Switch the Host Link Unit is forced to the initial status.

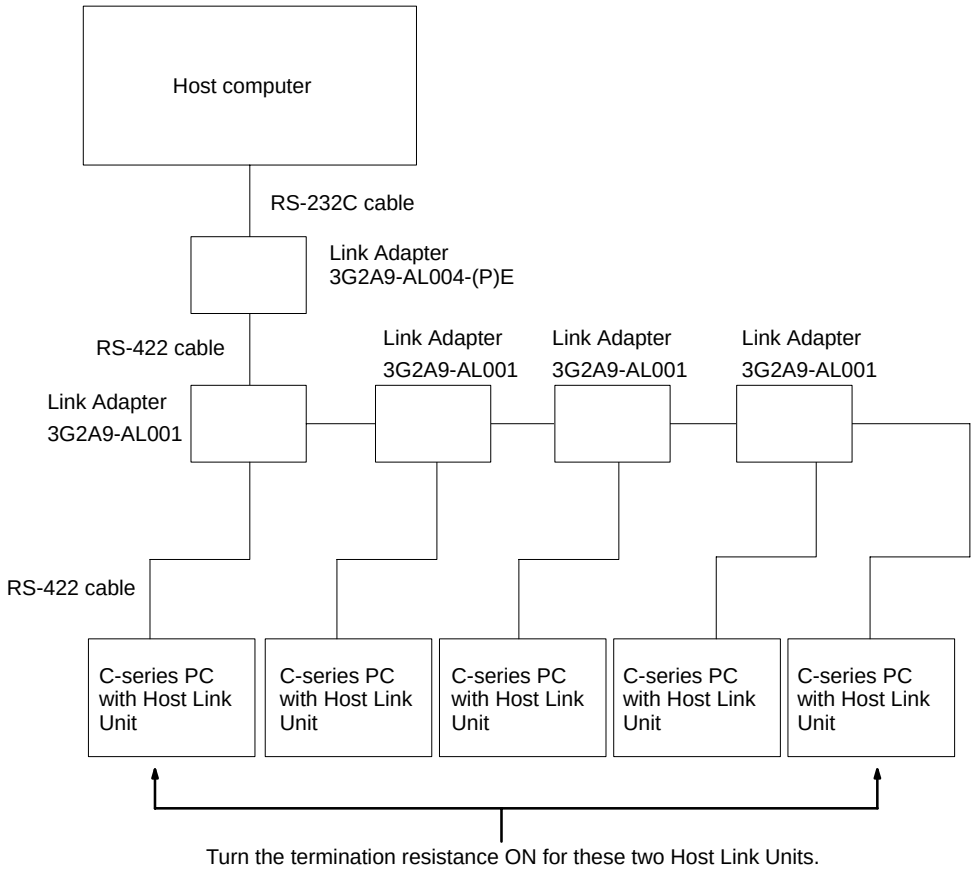
Synchronization Selector

Sets the Host Link Unit to either an internal or external clock. Normally, an internal clock is employed. But, when a synchronization modem with a baud rate of 2,400 bps or higher is used, the external clock setting must be selected.

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Termination Resistance

When this switch is set to ON, a built-in termination resistance of 220 Ω is connected. When set to OFF, the termination resistance is disconnected. When using a RS-422 cable throughout a system, the Host Link Unit at each end of the cable system must have the termination resistances connected by turning ON the switch as detailed in the following diagram. RS-232C systems provide point-to-point connections and do not require a termination resistance.



CTS Selector

When the selector is set to 0 V, the clear-to-send (CTS) signal is continuously ON. When the selector is set to external, the Unit will respond to externally generated CTS signals. This is normally set to CTS always ON, i.e., the switch is set to ON.

5-V Power Supply Switch

When using a Z3RN-A-5 Optical Interface, the 5 V power supply switch should be set to ON; otherwise it should be set to OFF.

I/O Port Selector

Sets the Host Link Unit (3G2A5-LK201-EV1 or C500-LK203) to either the RS-232C or the RS-422 interface.

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2-2-3 Indicators

Indicator	Function
RUN	ON when the Unit is operating.
RCV	ON when the Host Link Unit is receiving data.
XMT	ON when the Host Link Unit is transmitting data.
ERROR	Goes ON when a transfer error is detected (See note 1.); goes OFF when a new command is received normally.

Note 1. Transfer errors include parity, framing, overrun, and FCS errors.

2. Refer to *5-4 Troubleshooting* for details on correcting the following problems.
   - The RUN indicator does not light.
   - The Host Link Unit's RCV indicator does not light when data is transmitted from the host computer.
   - The RCV indicator lights, but the XMT indicator does not.
   - The ERROR indicator lights.
   - The XMT indicator lights, but the host computer does not receive the data.

2-2-4 PC Operating Modes

The operating mode of the PC depends an the setting of the mode selector on the Host Link Unit, the RUN/STOP or MONITOR/NORMAL selector on the Host Link Unit, and the status of any peripheral device connected to the PC. Refer to the following tables for details.

Host Link Units in C500, C1000H, or C2000H Systems (Except C500-LK103(-P) and C500-LK203 Host Link Units)

For Rack-mounting Host Link Units set to Host mode, the PC mode on initial application of power is as set on the Host Link Unit, i.e., RUN if the setting is RUN, and PROGRAM if the setting is STOP. (RUN/STOP setting is selected via pin 8 of DIP switch 1 for all models.) If the Host Link Unit is set to LOCAL, start-up mode will be as shown below.

System configuration and Host Link Unit setting*		Rack-mounting Host Link Unit in LOCAL mode
No CPU-mounting device		RUN
With CPU-mounting Host Link Unit	RUN	RUN
	STOP	PROGRAM
With CPU-mounting peripheral device		PROGRAM
With Programming Console**		The mode is determined by the mode selector on the Console, i.e., RUN, MONITOR or PROGRAM.

* If there is no Rack-mounting Host Link Unit mounted, the data for the Rack-mounting Host Link Unit LOCAL mode applies.

** With the Host Link Unit mode set to HOST, a MODE SET ERR alarm occurs if the Programming Console is set to MONTR or PROG and RUN is selected on the DIP switch, or if the Programming Console is set to RUN or MONTR with STOP selected.

The operating mode can be set from a host computer as long as the Host Link Unit is set to HOST mode. If the Host Link Unit is set to LOCAL mode, the operating mode cannot be set from the host computer and must be set from the host computer and must be set from a Peripheral Device, such as the Programming Console.

C500-LK103(-P) and C500-LK203 Host Link Units

System configuration and Host Link Unit setting		Host Link Unit mode	
		MONITOR	NORMAL
No other mounted device		MONITOR	RUN
Programming Console		The mode is determined by the mode selector on the Console., i.e., RUN, MONITOR, or PROGRAM.	
CPU-mounting Host Link Unit	RUN	*	RUN
	STOP	MONITOR	PROGRAM
Host Link Unit	MONITOR	MONITOR**	MONITOR**
	NORMAL	MONITOR**	RUN**
CPU-mounted peripheral device		MONITOR	PROGRAM

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* A CPU-mounting Host Link Unit must be set to STOP mode when used together with a Rack-mounting Host Link Unit that is set to MONITOR mode.
** If a Programming Console is also mounted, the mode selector on the Programming Console determines the PC operating mode.

If a peripheral device other than a CPU-mounting Host Link Unit is attached to the CPU, the PC's operating mode is determined by the peripheral device when the Host Link Unit's mode selector is set for LOCAL. With the mode selector set for HOST, the PC's operating mode is determined by the RUN/STOP selector on the Host Link Unit.

Unless programming is implemented to prevent starting, if the PC is in RUN mode, it will begin operation immediately the power is applied. Refer to *Controlling PC Start-up* at the end of this subsection for details on programming methods. These methods do not apply when using a 3G2A5-LK101-(P)EV1 or 3G2A5-LK201-EV1 Host Link Unit.

PC Mode When Mounting a CPU-mounting Host Link Unit with the Power ON

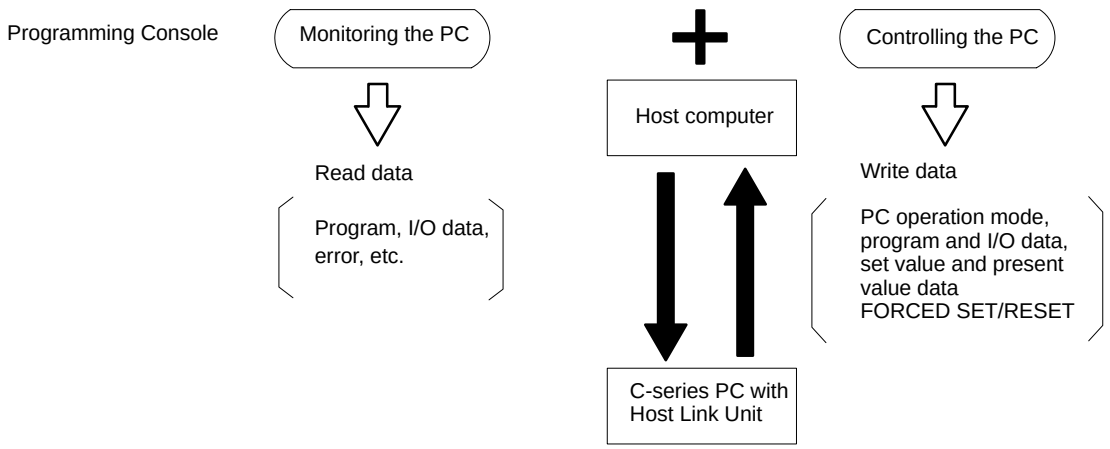
System configuration			Rack-mounting Host Link Unit*	
			LOCAL	HOST
V1 PCs**			Operating mode unchanged	Operating mode unchanged
Other PCs	Mounting for the first time	RUN	RUN	
		STOP	PROGRAM	
	Remounting (the Host Link Unit has been mounted before)		Operating mode unchanged	

* If there is no Rack-mounting Host Link Unit mounted, data for the Rack-mounting Host Link Unit LOCAL mode applies.
** V1 PCs are the C200H/HS/HX/HG/HE, C1000H, C2000H, and any other building-block PC with the suffix "V1" in the model number.

Data Flow

HOST Mode

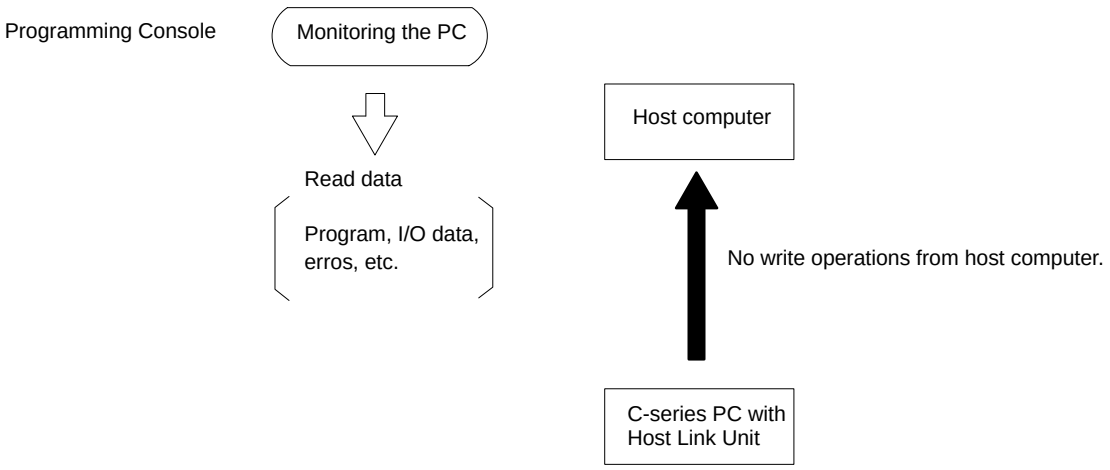
The following figures show the flow of data between the system and a Programming Console with the Host Link Unit set in HOST mode. As can be seen, the Programming Console can be used for monitoring or writing in this mode.



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LOCAL Mode

The following diagram shows the flow of data while the Host Link Unit is in LOCAL mode. Note that in this mode the Programming Console can be used for monitoring only.



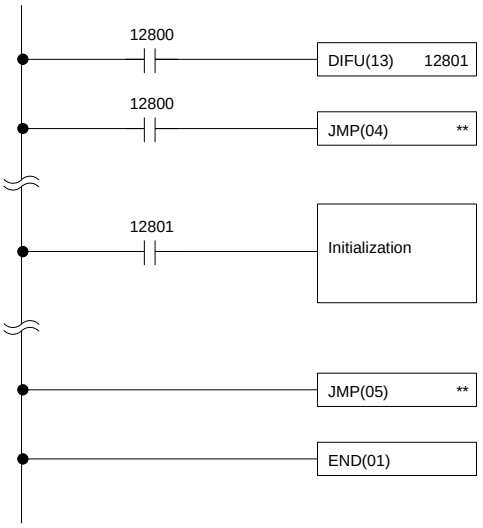
C500-LK103(-P) and C500-LK203 Host Link Unit Modes

These Units do not have mode selectors, i.e., PC operating modes can be set, data can be written, and similar operations can be performed without regard to HOST/LOCAL mode settings. Data flow is the same as that for HOST mode, shown above.

Controlling PC Start-up

C500-LK103(-P) and C500-LK203 Host Link Units

PROGRAM mode cannot be achieved manually when these Rack-mounting Host Link Units are used without a Programming Console or other peripheral device. Programming can be implemented, however, to prevent the PC from automatically starting when the power is applied. This allows greater control and the Unit can be started later with a command from the host computer. The following is an example of a programmed start-up of a C1000H PC.



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Appropriate initialization codes must be programmed between JMP(04) and JME(05). IR area bit 12800 can then be turned on to start PC operation from the host computer. The PC must be set in MONITOR mode for this to be possible. To initialize the PC when starting operation, use DIFU with the Always ON Flag; the Reset Flag cannot be used. Refer to your PC's operation manual for specific bits. The PC's operating mode can then be changed from the host computer after operation has begun. When programming in this fashion, note the following conditions:

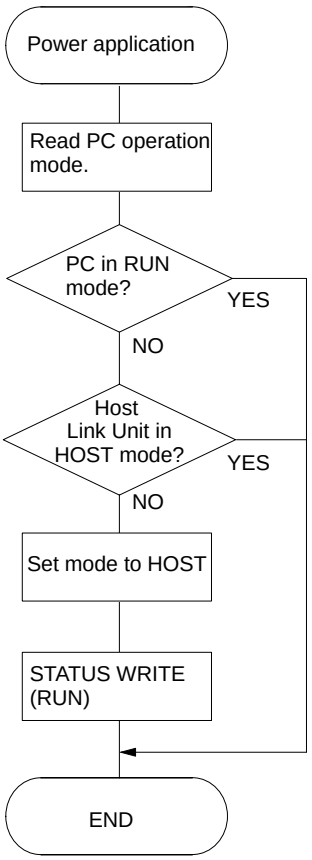
1, 2, 3...

1. Pin 8 of SW1 on C500-LK103(-P) or C500-LK203 Units should be set to MONITOR. If it is not, use the host computer to change it to the MONITOR mode before turning on IR area bit 12800.
2. JMP command numbers must be between 01 and 99 for C200H/HS, C1000H and C2000H PCs.
3. This programming example cannot be applied to C500 PCs, which do not support direct jumps. In this case, use a 3G2A5-LK101-(P)EV1 or 3G2A5-LK201-EV1 Host Link Unit so that the mode can be set manually.

Sending a RUN Start Command to the PC

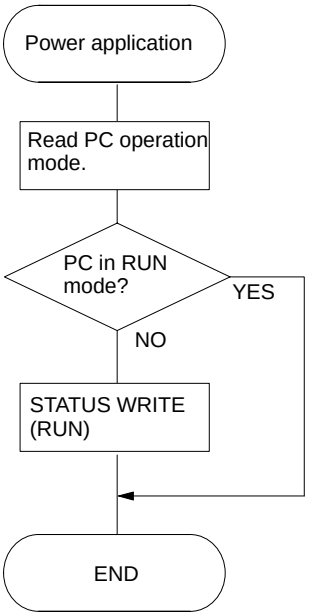
The following flowcharts show the computer decision making processes for ensuring that the PC is in RUN mode after start-up.

3G2A5-LK101-(P)EV1 and 3G2A5-LK201-EV1 Host Link Units



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C500-LK103(-P) and C500-LK203 Host Link Units



2-2-5 Restart Bits and Error Flags

Host Link Units use some of the Special Relay (SR) area and Auxiliary Relay (AR) area bits of the PC to restart the communications control program of the Host Link Unit and to indicate the occurrence of communications errors between the Unit and the computer. The word (Wd) addresses and bit numbers of these bits are as follows:

C500

	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SR Wd 60			RM* re-start bit				CM* restart bit	CM* error flag								
SR Wd 61					RM* error flag											

* RM: Rack-mounting Host Link Unit
CM: CPU-mounting Host Link Unit

C1000H and C2000H

	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SR Wd 252			RM* re-start bit				CM* restart bit	CM* error flag		RM* #1 error flag						
SR Wd 253					RM* #0 error flag											

* RM: Rack-mounting Host Link Unit
CM: CPU-mounting Host Link Unit

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C120

	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SR Wd 60							CM* restart bit	CM* error flag								

* CM: CPU-mounting Host Link Unit

Host Link Unit Restart Bit

When this bit is turned ON, the Host Link Unit is reset to its initial conditions, as if the power had just been applied.

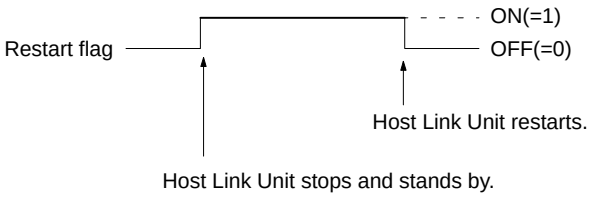
⚠ Caution Do not turn this bit ON in the user program; doing so could cause the memory to be lost.

Host Link Unit Error Flag

This flag turns ON if a transmission error occurs between the PC and the Host Link Unit. It turns ON the error indicator on the front of the Unit.

Note

1. When the Host Link Unit Restart bit is turned ON, the Host Link Unit Error Flag is turned OFF.
2. Set the Host Link Unit to LOCAL mode before force setting or force resetting an error flag.
3. Communications between the Host Link Unit and the host computer will not be resumed until the Restart bit is turned OFF. The initialization process is repeated as long as the Restart bit is ON.



4. If a reset switch is provided, pressing it should reset the Host Link Unit and clear the error state.
5. If the Unit still won't reset, disconnect and then reconnect the power to the PC.

2-2-6 I/O Response Time

The processing that determines and the methods for calculating the minimum and maximum times required from an input on one PC with a Host Link Unit to an output on another PC with a Host Link Unit are described below. The transfer between the PCs is handled through a host computer connected to both these PCs.

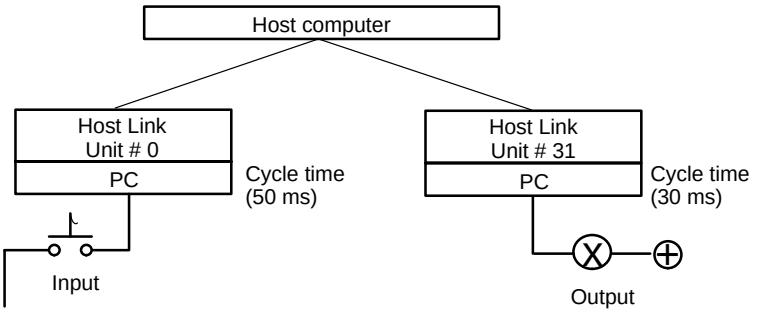
Processing and calculations are described by PC model in the first subsection. An example combining a C200H/HS/HX/HG/HE PC with a C1000H PC is included in the *C200H* section. Although more precise equations may be written if required, those used in the following calculations do not consider fractions of a cycle.

The calculations used in this section assume that all host computer commands and PC responses require no more than one host link servicing period to complete transmission. To compute response times for situations involving a longer command and/or response, the number of host link servicing periods (i.e., the number of cycles) required to complete the command or response would have to be incorporated into the equations.

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In considering response times, it is important to remember the sequence of processing that occurs during the PC cycle. The main factor that affects the response time is the timing of inputs and outputs and of host computer processing in relation to this sequence.

The following diagram illustrates the setup used in response time calculations

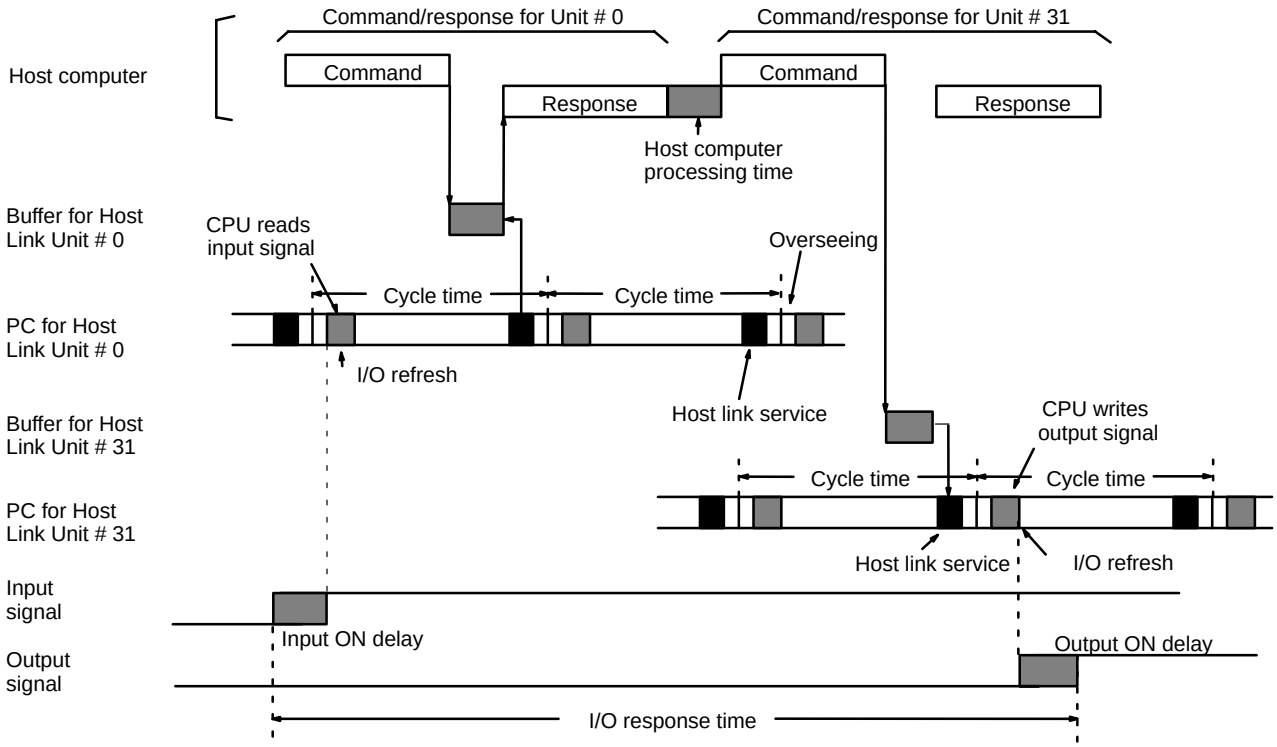


C120 and C500

Although the C120 and C500 equations for the minimum and maximum response times are the same as those for the C1000H and C2000H, the breakdown of the CPU's cycle differs. These groups are thus treated in different sections.

Minimum Response Time

The data flow that will produce the minimum response time is shown below. This flow assumes that all signals and data transmissions are processed as soon as they occur. The equation for the minimum response time is given below the diagram.

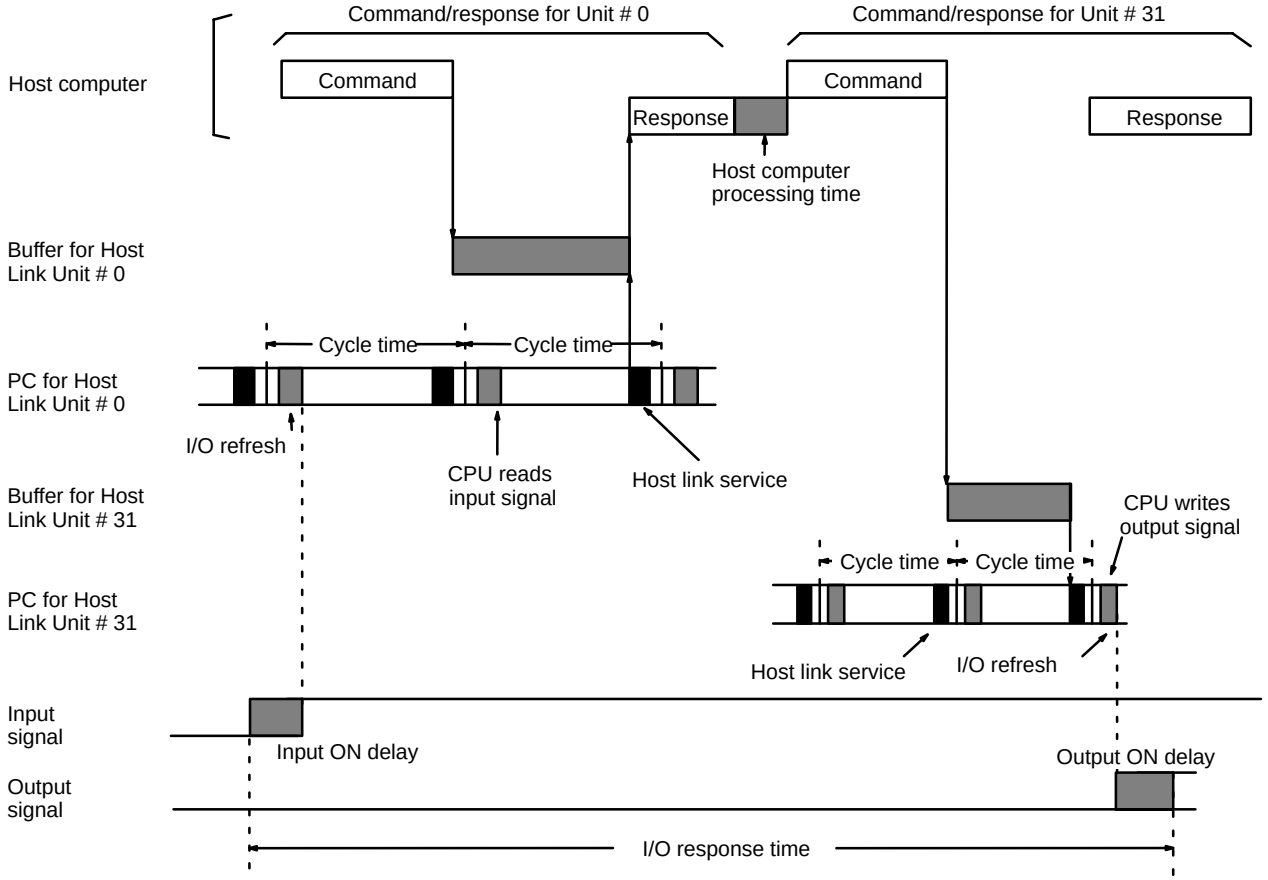


Minimum response time = Input ON delay + Command transmission time + Cycle time of PC for Unit #0 + Response transmission time + Host computer processing time + Command transmission time + Output ON delay

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Maximum Response Time

The data flow that will produce the maximum response time is shown below. Delays over the minimum response time occur because the input to be transferred through the host computer is received immediately following the I/O refresh period (requiring a wait to the next cycle) and because the command from the host computer to write the bit to be output from PC for Unit #31 is received immediately following host link servicing (again requiring a wait to the next cycle). The equation for the maximum response time is given below the diagram.



Maximum response time = Input ON delay + Command transmission time + (Cycle time of PC for Unit #0 x 2) + Response transmission time + Host computer processing time + Command transmission time + Cycle time of PC for Unit #31 + Output ON delay

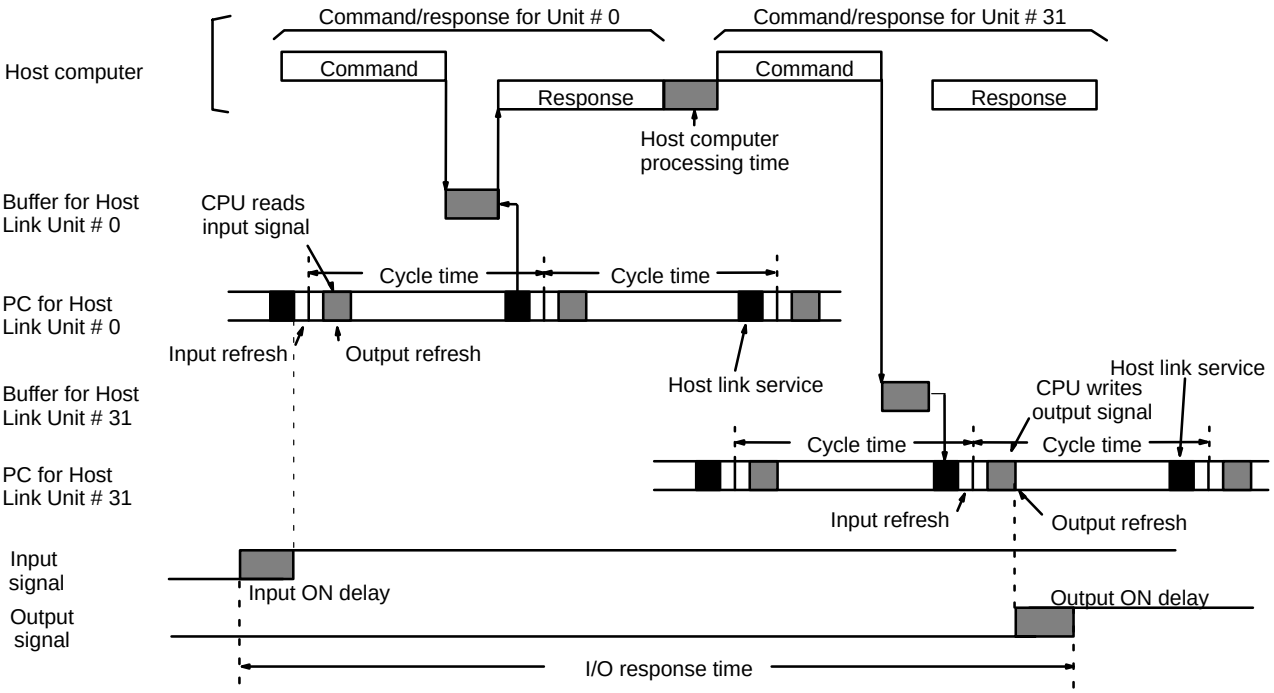
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C1000H and C2000H

Although the C1000H and C2000H equations for the minimum and maximum response times are the same as those for the 3G2A6 and C500, the breakdown of the CPU's cycle differs. These groups are thus treated in different sections.

Minimum Response Time

The data flow that will produce the minimum response time is shown below. This flow assumes that all signals and data transmissions are processed as soon as they occur. The equation for the minimum response time is given below the diagram.

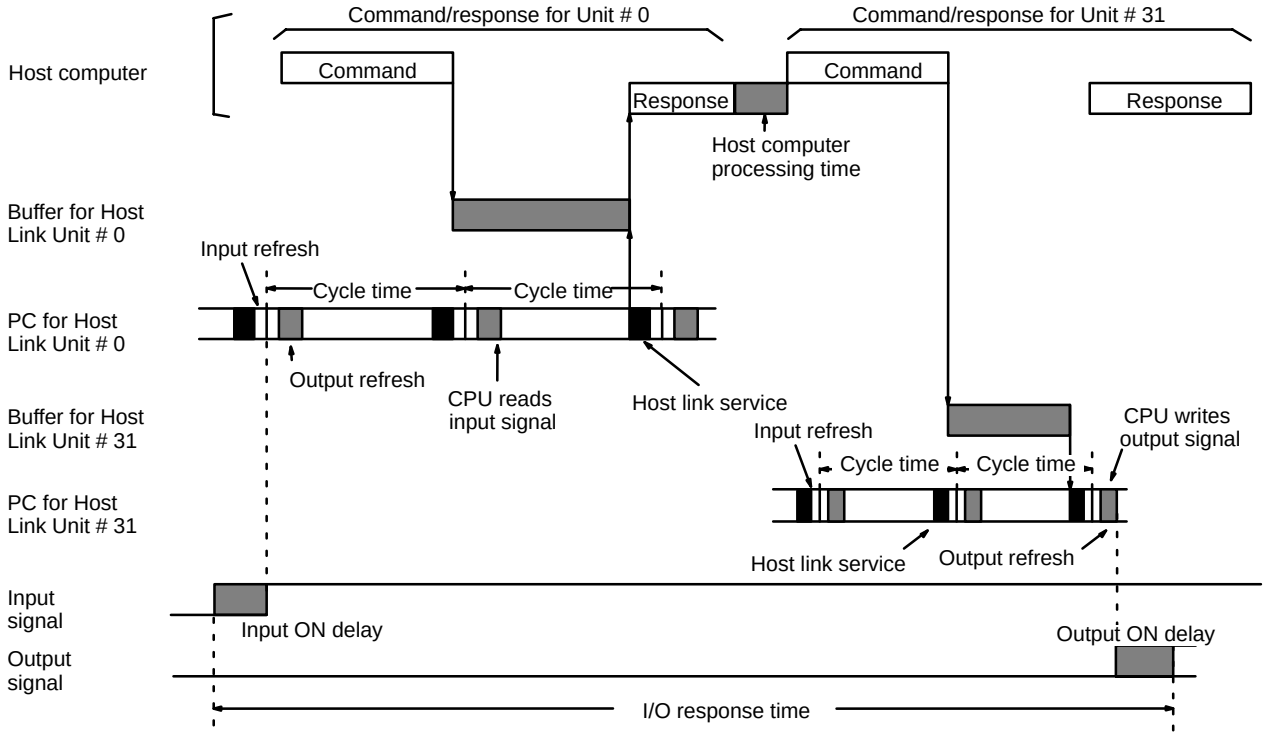


Minimum response time = Input ON delay + Command transmission time + Cycle time of PC for Unit #0 + Response transmission time + Host computer processing time + Command transmission time + Output ON delay

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Maximum Response Time

The data flow that will produce the maximum response time is shown below. Delays over the minimum response time occur because the input to be transferred through the host computer is received immediately following the I/O refresh period (requiring a wait to the next cycle) and because the command from the host computer to write the bit to be output from PC for Unit #31 is received immediately following host link servicing (again requiring a wait to the next cycle). The equation for the maximum response time is given below the diagram.



Maximum response time = Input ON delay + Command transmission time + (Cycle time of PC for Unit #0 x 2) + Response transmission time + Host computer processing time + Command transmission time + Cycle time of PC for Unit #31 + Output ON delay

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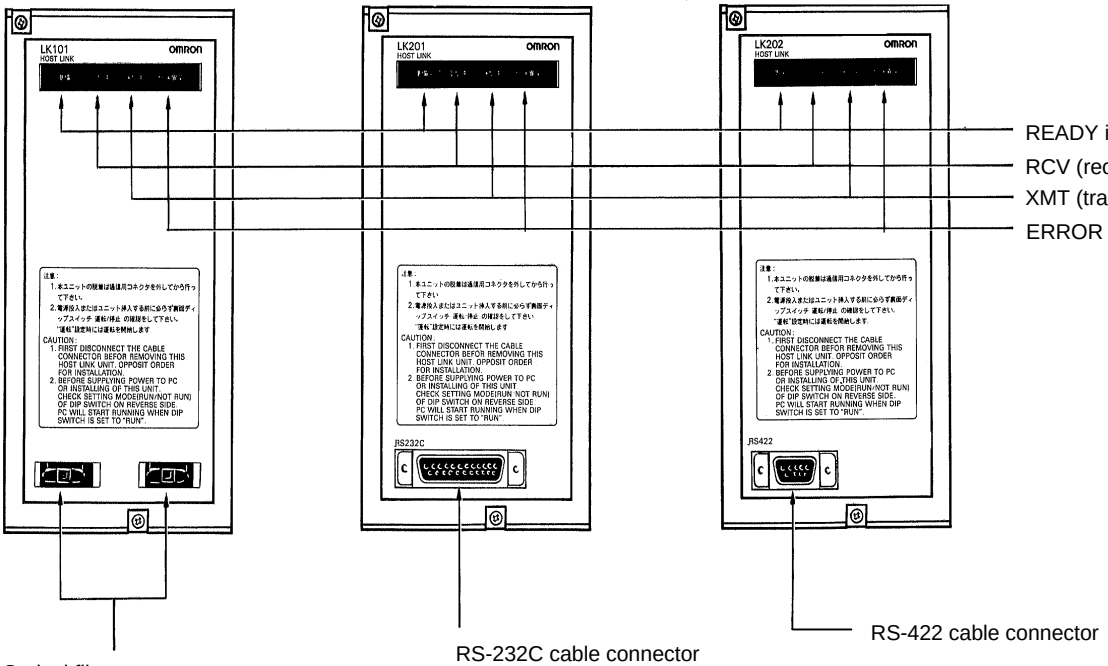
2-3 C120 (3G2A6) Host Link Units

2-3-1 Nomenclature and External Appearance

The following figures give details of switch types, selectors, and connectors for your Host Link Unit. It will be necessary to refer to these diagrams from time to time as you read further in the manual, particularly when reading the section on *2-3-2 Switch Settings*. These Units can be used with all of the C-series Rack-mounting PCs. (C120 Host Link Units are sometimes referred to as 3G2A6 Host Link Units.)

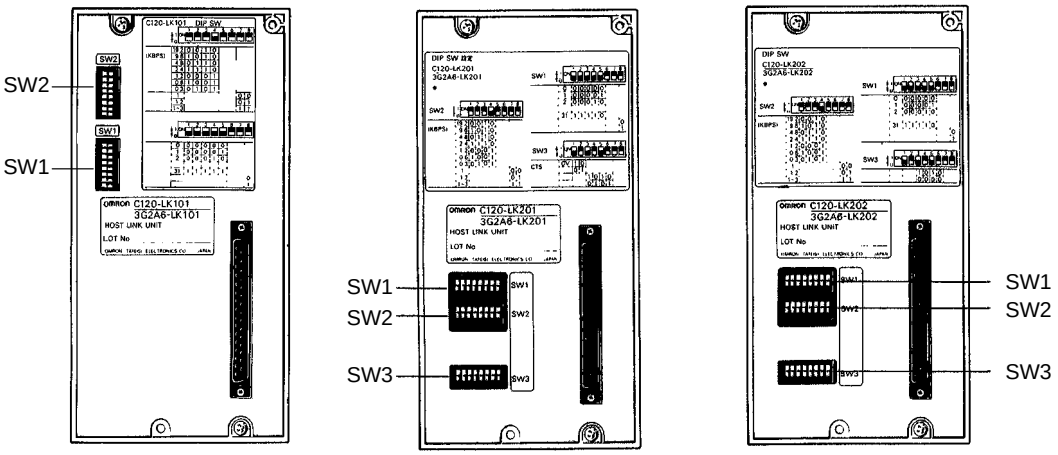
Front Panels

3G2A6-LK101-(P)EV1 **3G2A6-LK201-EV1** **3G2A6-LK-202-EV1**



Rear Panels

3G2A6-LK101-(P)EV1 **3G2A6-LK201-EV1** **3G2A6-LK-202-EV1**



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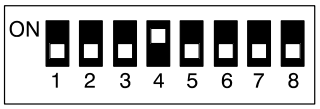
2-3-2 Switch Settings

The following information provides details on correct settings for the range of 3G2A6 Host Link Units covered by this manual.

SW1

For SW1, the first five pins are used to set the Unit number as shown below. Details about SW2 settings are given following the diagram.

SW1



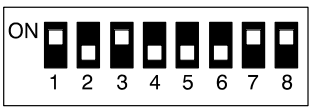
Unit No.

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

RUN/ STOP selector

ON	RUN
OFF	STOP

SW2



Baud rate

OFF	ON	OFF	ON	300bps
ON	OFF	OFF	ON	600bps
OFF	OFF	OFF	ON	1,200bps
ON	ON	ON	OFF	2,400bps
OFF	ON	ON	OFF	4,800bps
ON	OFF	ON	OFF	9,600bps
OFF	OFF	ON	OFF	19,200bps

Command levels

7	8	Valid levels
OFF	OFF	---
ON	OFF	1
OFF	ON	1 and 2
ON	ON	1, 2, and 3

Link Type Selector

OFF: Multiple-link
ON: Single-link

Note Each Unit must be given a different unit number.

RUN/STOP Selector Refer to *2-3-4 PC Operating Modes* for details.

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SW2

Operating Levels

Set pin 5 of SW2 to OFF (operating level 1) when using a C500(F) PC and ON (operating level 0) when using the Host Link Unit together with a SYSMAC NET Link Unit. When using two Rack-mounting Host Link Units, set this pin to ON for one of the Units, and to OFF for the other.

⚠ Caution Failure to set pin 5 correctly may damage components or prevent operation.

MONITOR/NORMAL Selector

When this switch is set to MONITOR, the PC will operate in MONITOR mode upon the application of power. When the pin is set to NORMAL, the PC is no longer controlled by the Host Link Unit (i.e., the mode of operation will be determined by other system conditions). Refer to *2-3-4 PC Operating Mode* for details.

Link Type Selector

ON (Single-link) If pin 6 is set to ON, the Host Link Unit is connected to the host computer on a one-to-one basis (see *Example 3* and *Example 5* under *1-2 System Configuration*. The Unit number and Frame Checksum (FCS) settings are not required. The normal setting is OFF (see below).

OFF (Multiple-link) If pin 6 is set to OFF, up to 32 Host Link Units can be connected to one host computer. The unit number and FCS must be specified, even if only one Host Link Unit is connected to the host computer. When using Ladder Support Software, LSS, pin 6 must be set to OFF.

Command Level

Pins 7 and 8 on SW2 control the operating command levels according to the following:

1: Enables data areas to be read and, when the CPU has been correctly set via the SC (Status Write) command, data can also be written.

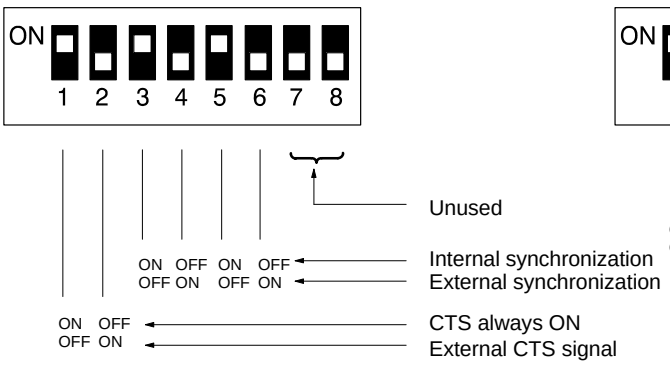
2: Enables program transfers and reading or writing of I/O tables.

3: I/O reads can be performed and I/O tables can be registered. The Command Level should be set to *1, 2, and 3* for running LSS software, program transfers, etc. Other levels may be used for Systems Control Software, monitoring, Data Acquisition Software, etc.

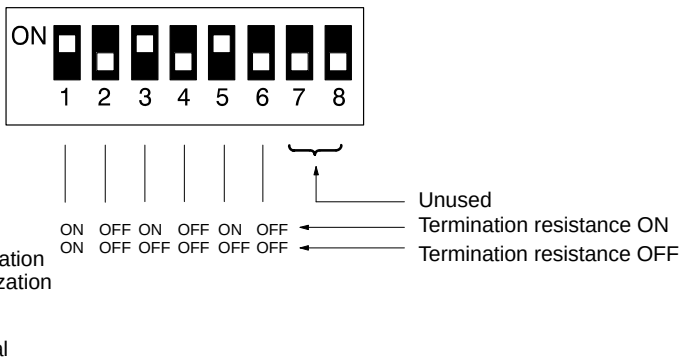
Note Commands valid for each level are listed in *3-1 Command Levels.*

SW3

3G2A6-LK201-EV1



3G2A6-LK202-EV1



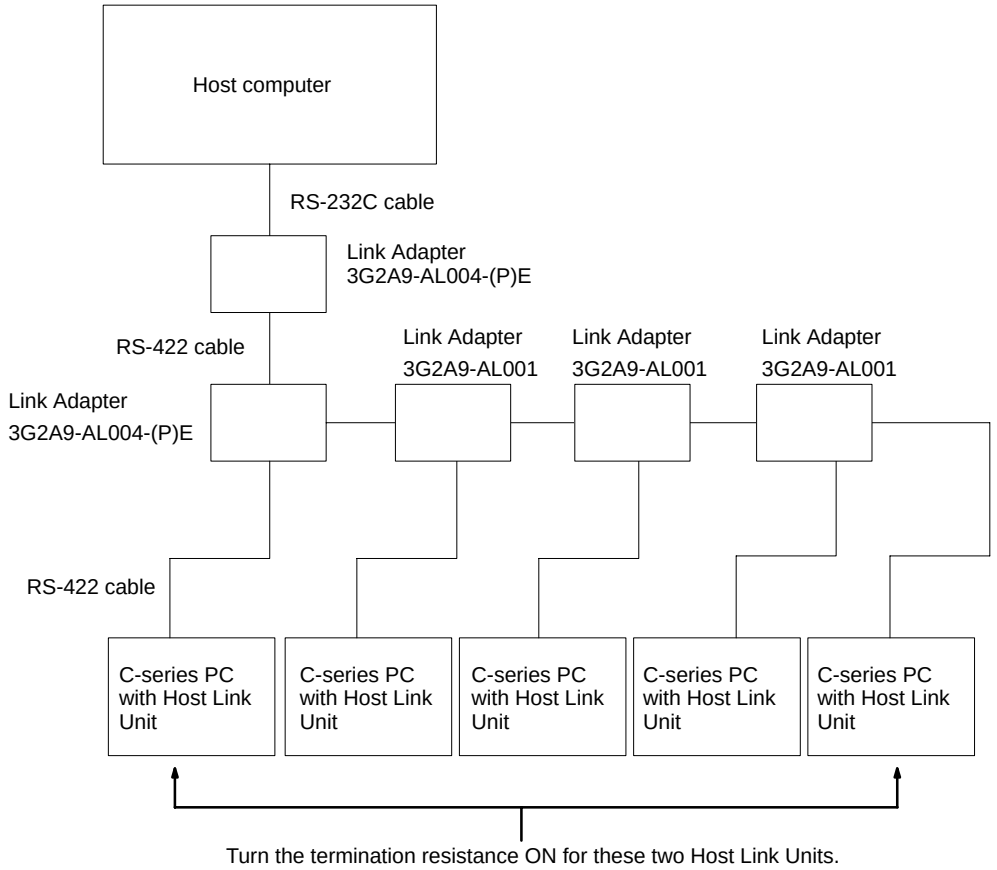
Synchronization Selector

Sets the Host Link Unit to either an internal or external clock. Normally, an internal clock is employed. But, when a synchronization modem with a baud rate of 2,400 bps or higher is used, the external clock setting must be selected.

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Termination Resistance

When this switch is set to ON, a built-in termination resistance of 220 Ω is connected. When set to OFF, the termination resistance is disconnected. When using a RS-422 cable throughout a system, the Host Link Unit at each end of the cable system must have the termination resistances connected by turning ON the switch as detailed in the following diagram. RS-232C systems provide point-to-point connections and do not require a termination resistance.



CTS Selector

When the selector is set to 0 V, the clear-to-send (CTS) signal is continuously ON. When the selector is set to external, the Unit will respond to externally generated CTS signals. This is normally set to CTS always ON, i.e., the switch is set to ON.

2-3-3 Indicators

Indicator	Function
Ready	ON when the power is on and the Unit is ready to transmit.
RCV	ON when the Host Link Unit is receiving data.
XMT	ON when the Host Link Unit is transmitting data.
ERROR	Goes ON when a transfer error is detected (See note 1.); goes OFF when a new command is received normally.

Note
1. Transfer errors include parity, framing, overrun, and FCS errors.
2. Refer to *5-4 Troubleshooting* for details on correcting the following problems.
   - The RUN indicator does not light.
   - The Host Link Unit's RCV indicator does not light when data is transmitted from the host computer.
   - The RCV indicator lights, but the XMT indicator does not.
   - The ERROR indicator lights.
   - The XMT indicator lights, but the host computer does not receive the data.

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2-3-4 PC Operating Modes

The operating mode of the PC depends an the setting of the mode selector on the Host Link Unit, the RUN/STOP or MONITOR/NORMAL selector on the Host Link Unit, and the status of any peripheral device connected to the PC. Refer to the following tables for details.

C500-LK103(-P), C500-LK203, and 3G2A6 Host Link Units

System configuration and Host Link Unit setting		Host Link Unit mode	
		MONITOR	NORMAL
No other mounted device		MONITOR	RUN
Programming Console		The mode is determined by the mode selector on the Console., i.e., RUN, MONITOR, or PROGRAM.	
CPU-mounting Host Link Unit	RUN	*	RUN
	STOP	MONITOR	PROGRAM
Host Link Unit	MONITOR	MONITOR**	MONITOR**
	NORMAL	MONITOR**	RUN**
CPU-mounted peripheral device		MONITOR	PROGRAM

* A CPU-mounting Host Link Unit must be set to STOP mode when used together with a Rack-mounting Host Link Unit that is set in MONITOR mode.

** If a Programming Console is also mounted, the mode selector on the Programming Console determines the PC operating mode.

If a peripheral device other than a CPU-mounting Host Link Unit is attached to the CPU, the PC's operating mode is determined by the peripheral device when the Host Link Unit's mode selector is set for LOCAL. With the mode selector set for HOST, the PC's operating mode is determined by the RUN/STOP selector on the Host Link Unit.

Unless programming is implemented to prevent starting, if the PC is in RUN mode, it will begin operation immediately the power is applied. Refer to *Controlling PC Start-up* at the end of this subsection for details on programming methods.

PC Mode When Mounting a CPU-mounting Host Link Unit with the Power ON

System configuration			Rack-mounting Host Link Unit*	
			LOCAL	HOST
V1 PCs**			Operating mode unchanged	Operating mode unchanged
Other PCs	Mounting for the first time	RUN	RUN	
		STOP	PROGRAM	
	Remounting (the Host Link Unit has been mounted before)		Operating mode unchanged	

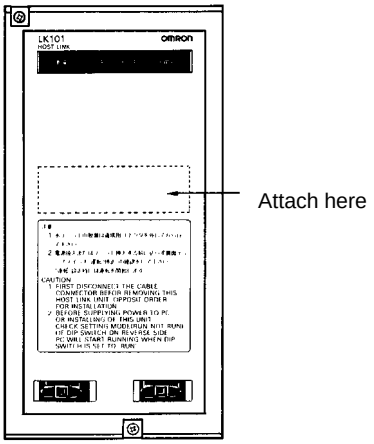
* If there is no Rack-mounting Host Link Unit mounted, data for the Rack-mounting Host Link Unit LOCAL mode applies.

** V1 PCs are the C200H/HS/HX/HG/HE, C1000H, C2000H, and any other building-block PC with the suffix "V1" in the model number.

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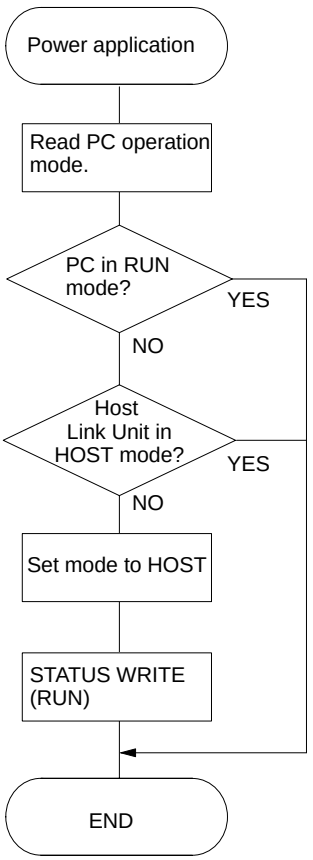
Caution Sticker

The CPU-mounting 3G2A6-LK101-(P)EV1 Host Link Unit is supplied with a caution sticker. The caution sticker should be attached as shown below if the RUN/STOP selector is set to RUN. This is to avoid the potential danger of the Host Link Unit being mounted to an unprepared system.



Sending a RUN Start Command to the PC

The following flowchart shows the computer decision making processes for ensuring that the PC is in RUN mode after start-up.



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2-3-5 Restart Bits and Error Flags

Host Link Units use some of the Special Relay (SR) area and Auxiliary Relay (AR) area bits of the PC to restart the communications control program of the Host Link Unit and to indicate the occurrence of communications errors between the Unit and the computer. The word (Wd) addresses and bit numbers of these bits are as follows:

C120 (3G2A6)

	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SR Wd 60							CM* restart bit	CM* error flag								

* CM: CPU-mounting Host Link Unit

Host Link Unit Restart Bit

When this bit is turned ON, the Host Link Unit is reset to its initial conditions, as if the power had just been applied.

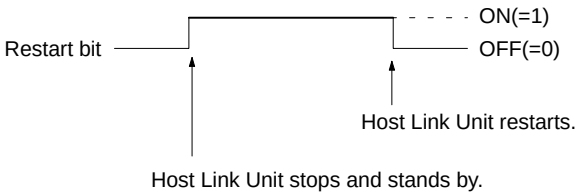
⚠ **Caution** Do not turn this bit ON in the user program; doing so could cause the memory to be lost.

Host Link Unit Error Flag

This flag turns ON if a transmission error occurs between the PC and the Host Link Unit. The error indicator on the front panel of the Unit lights while this flag is ON.

Note

1. When the Host Link Unit Restart bit is turned ON, the Host Link Unit Error Flag is turned OFF.
2. Set the Host Link Unit to LOCAL mode before force setting or force resetting an error flag.
3. Communications between the Host Link Unit and the host computer will not be resumed until the Restart bit is turned OFF. The initialization process is repeated as long as the Restart bit is ON.



4. To reset error condition on the Host Link Unit, disconnect and then reconnect the power to the PC.

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2-3-6 I/O Response Time

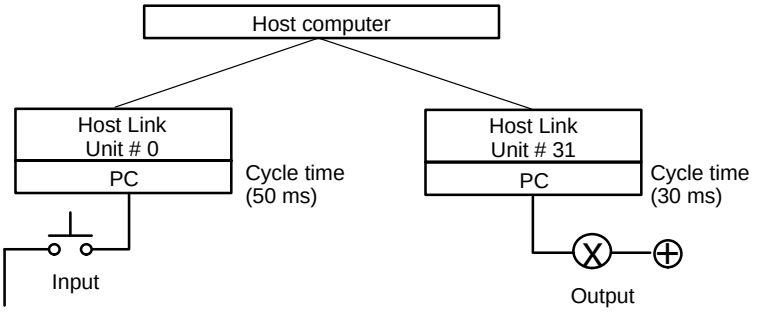
The processing that determines and the methods for calculating the minimum and maximum times required from an input on one PC with a Host Link Unit to an output on another PC with a Host Link Unit are described below. The transfer between the PCs is handled through a host computer connected to both these PCs.

Processing and calculations are described by PC model. Although more precise equations may be written if required, those used in the following calculations do not consider fractions of a cycle.

The calculations used in this section assume that all host computer commands and PC responses require no more than one host link servicing period to complete transmission. To compute response times for situations involving a longer command and/or response, the number of host link servicing periods (i.e., the number of cycles) required to complete the command or response would have to be incorporated into the equations.

In considering response times, it is important to remember the sequence of processing that occurs during the PC cycle. The main factor that affects the response time is the timing of inputs and outputs and of host computer processing in relation to this sequence.

The following diagram illustrates the setup used in response time calculations



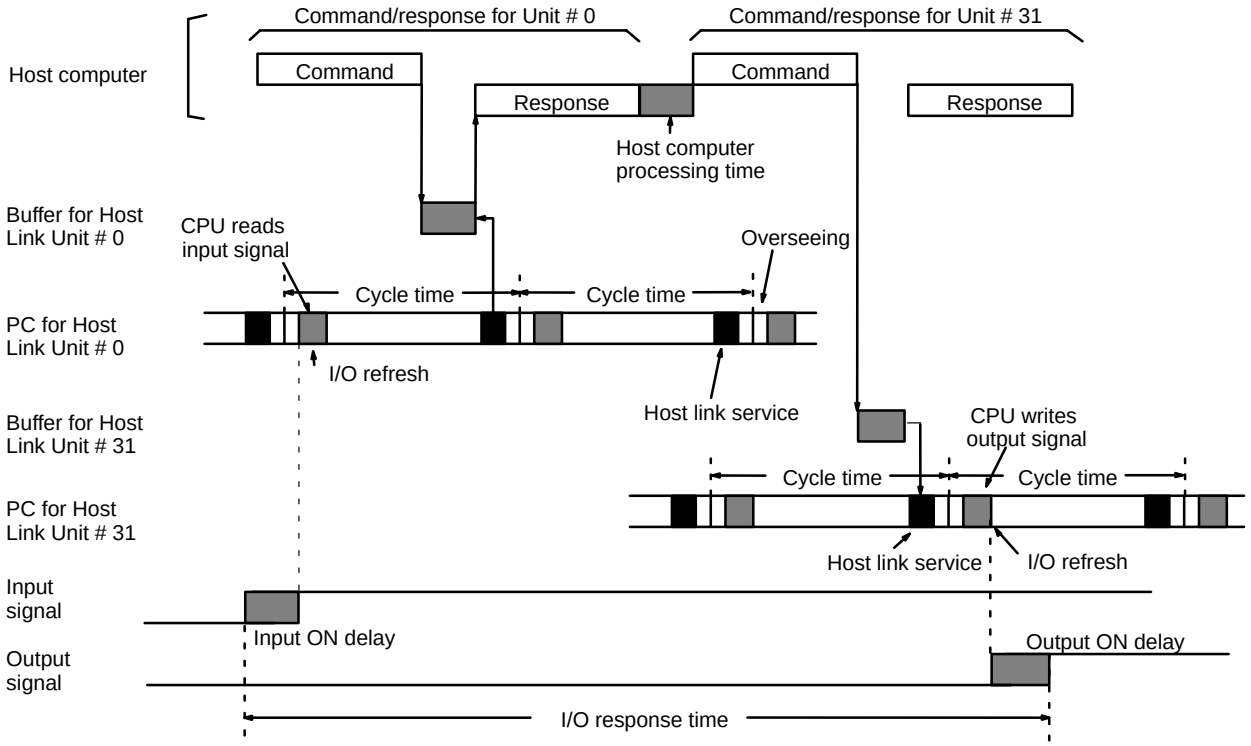
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C120 and C500

Although the C120 and C500 equations for the minimum and maximum response times are the same as those for the C1000H and C2000H, the breakdown of the CPU's cycle differs. These groups are thus treated in different sections.

Minimum Response Time

The data flow that will produce the minimum response time is shown below. This flow assumes that all signals and data transmissions are processed as soon as they occur. The equation for the minimum response time is given below the diagram.

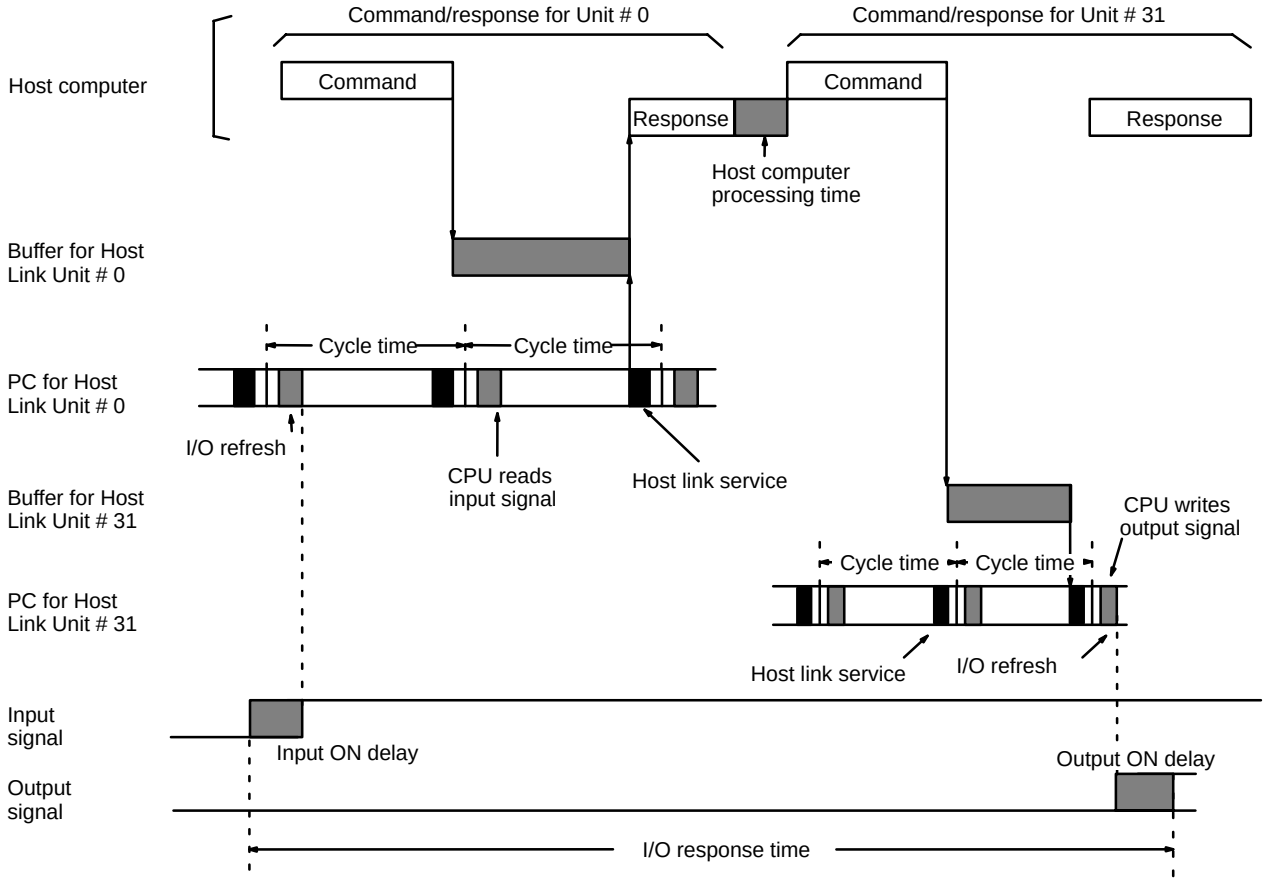


Minimum response time = Input ON delay + Command transmission time + Cycle time of PC for Unit #0 + Response transmission time + Host computer processing time + Command transmission time + Output ON delay

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Maximum Response Time

The data flow that will produce the maximum response time is shown below. Delays over the minimum response time occur because the input to be transferred through the host computer is received immediately following the I/O refresh period (requiring a wait to the next cycle) and because the command from the host computer to write the bit to be output from PC for Unit #31 is received immediately following host link servicing (again requiring a wait until the next cycle). The equation for the maximum response time is given below the diagram.



Maximum response time = Input ON delay + Command transmission time + (Cycle time of PC for Unit #0 x 2) + Response transmission time + Host computer processing time + Command transmission time + Cycle time of PC for Unit #31 + Output ON delay

2-4 Installing and Removing Host Link Units

This section explains the proper installation and removal of CPU-mounting Host Link Units.

Note Never install or remove Rack-mounting Host Link Units when the power supply is on.

Installation of a CPU-mounting Host Link Unit

Follow the procedure below when installing a CPU-mounting Host Link Unit on a PC.

1, 2, 3...

1. Remove the Connecting Cables.
2. Recheck the settings of the DIP switches on the back of the Unit.
   In particular, check the RUN/STOP switch. If the switch is set to RUN, the PC might begin operating when the Host Link Unit is inserted. The PC's mode will not change if the switch is set to STOP.
   Refer to *2-1-4 PC Operating Modes* for details on the Host Link Unit's effect on the PC's mode.

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3. Connect the Host Link Unit to the PC's Peripheral Device port and tighten the mounting screws.
4. Connect the Connecting Cable and tighten the mounting screws.

Removal of CPU-mounting Host Link Units

Follow the procedure below when removing a CPU-mounting Host Link Unit from a PC.

1, 2, 3...

1. Remove the Connecting Cable.
2. Remove the Host Link Unit.

Transmission Errors

When a CPU-mounting Host Link Unit is installed or removed during transmission, a transmission error will occur after removal if the host computer initiated communications with the affected Unit. The following table describes the appropriate procedure to follow.

Event	Host Link Unit Indicator Status	Host Computer Status	Corrective Action
Host Link Unit installed.	ERROR indicator lit.	Transmission error occurs.	Retransmit from the host computer.
Host Link Unit was removed.	---	Transmission error occurs.	Ignore the affected Host Link Unit's transmission error or reconfigure so that transmission to that Unit will not be attempted.
Host Link Unit has been removed.	---	Transmission error occurs.	

It is recommended to prepare a program that processes transmission errors in order to prevent an error with one Unit from stopping the entire system. Refer to *Section 5 Error Processing* for details.

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SECTION 3
Programming

This section gives the information required for effective programming of the Host Link Units. It lists the commands and responses for Host Link Units. The basic formats for that they can take are described and the data representation explained. *3-1 Command Levels* lists all of the commands and responses which apply to Host Link Units and the operation level at which they operate. Also refer to *3-2 Communications Protocol* for basic format information (see also *Section 4 Commands and Responses* for the command and response formats of each instruction).

3-1 Command Levels 58
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3-1 Command Levels

The following tables give the commands and responses available for the Host Link Units, the command levels, and the modes in which they are applicable. Details of the command and response formats are given in *Section 4 Commands and Responses*.

Level 1

Header Code	Name	PC Mode			Applicable PCs
		RUN	MNTR	PROG	
TS	TEST	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
MS	STATUS READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
MF	ERROR READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
RR	IR/SR AREA READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
RH	HR AREA READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
RJ	AR AREA READ	Valid	Valid	Valid	H-type: C200H/HS/ HX/HG/HE, C1000H, C2000H
RL	LR AREA READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
RG	TC STATUS READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
RD	DM AREA READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
RX	FM INDEX READ	Valid	Valid	Valid	C1000H, C2000H
RF	FM DATA READ	Valid	Valid	Valid	C1000H, C2000H
RC	TC PV READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
R#	SV READ 1	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
R$	SV READ 2	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
R%	SV READ 3	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
SC	STATUS WRITE	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
WR	IR/SR AREA WRITE	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
WH	HR AREA WRITE	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
WJ	AR AREA WRITE	Not valid	Valid	Valid	H-type: C200H(S), C1000H, C2000H

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Header Code	Name	PC Mode			Applicable PCs
		RUN	MNTR	PROG	
WL	LR AREA WRITE	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
WG	TC STATUS WRITE	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
WD	DM AREA WRITE	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
WF	FM AREA WRITE	Not Valid	Valid	Valid	C1000H, C2000H
WC	TC PV WRITE	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
W#	SV CHANGE 1	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
W$	SV CHANGE 2	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
W%	SV CHANGE 3	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
KS	FORCED SET	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
KR	FORCED RESET	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
FK	MULTIPLE FORCED SET/RESET	Not Valid	Valid	Valid	C200H/HS
FR	MULTIPLE FORCED SET/RESET STATUS READ	Not Valid	Valid	Valid	C200H/HS
KC	FORCED SET/RESET CANCEL	Not Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
MM	PC MODEL READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
CR	DM AREA HIGH-SPEED READ	Valid	Valid	Valid	C1000H, C2000H
XZ	ABORT and INITIAL (command only)	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
IC	Undefined command (response only)	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
EX	TRANSMIT	Valid	Valid	Not valid	C200HS
Varies	Unprocessed command (response only)	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H

Level 2

Header Code	Name	PC Mode			Applicable PCs
		RUN	MNTR	PROG	
RP	PROGRAM READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
WP	PROGRAM WRITE	Not valid	Not valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H

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Header Code	Name	PC Mode			Applicable PCs
		RUN	MNTR	PROG	
RI	I/O TABLE READ	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H
MI	I/O TABLE GENERATE	Not valid	Not valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H

Level 3

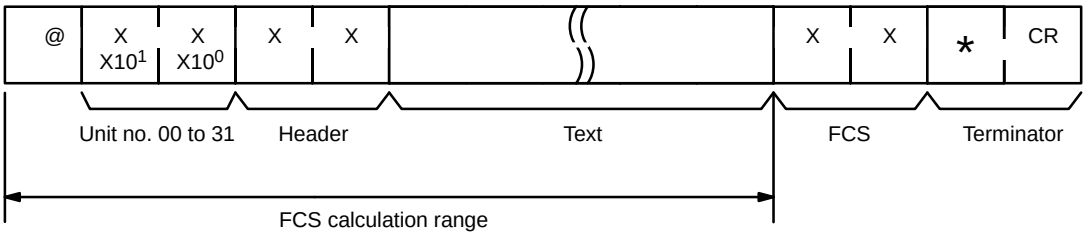
Header Code	Name	PC Mode			Applicable PCs
		RUN	MNTR	PROG	
QQ	COMPOUND COMMAND	Valid	Valid	Valid	All: C120, C200H/HS/ HX/HG/HE, C500, C1000H, C2000H

3-2 Communications Protocol

The host computer has initial transmission priority. Data transfer between the host computer and the Host Link System is, therefore, initiated when the computer sends a command to a PC in the Host Link System.

A set of data in a transmission is called a block. The data block sent from the host computer to the Host Link System is called a command block. The block sent from the Host Link System to the computer is called a response block. In a multiple-link communications system, each block starts with a unit number and a header, and ends with a Frame Checksum (FCS) code and a terminator (* and CR). In a single-link system, however, each block starts with only a header, and ends with only a terminator. The terminator in the command block enables the PC to send a response. The terminator in the response block enables the host computer to send another command. Examples of communications are included at the end of *Section 4 Commands and Responses*.

3-2-1 Block Format



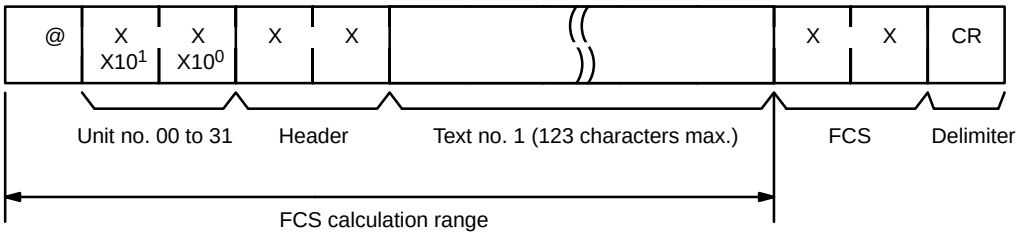
A block is usually made up of one unit called a frame, but long blocks of data (over 131 characters) must be divided into more than one frame before transmission. In a multiple-link system, the first frame can have up to 131 characters, and subsequent frames can have up to 128 characters. In a single-link system, however, every frame (the first included) has up to 128 characters. The data must then be divided into more than one frame when there is a block consisting of more than 131 characters in a multiple-link system, and of more than 128 characters in a single-link system. In this case, the beginning and intermediate blocks end with a delimiter (CR), instead of a terminator (*CR).

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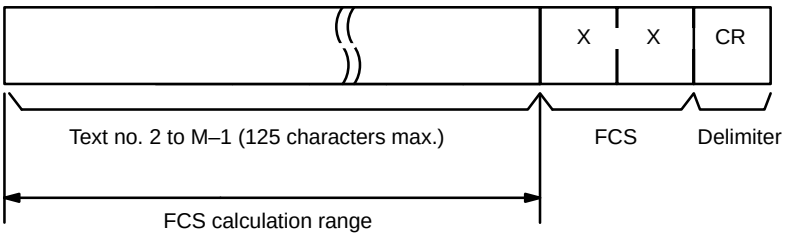
3-2-2 Block Format With More Than One Frame

Multiple-link System

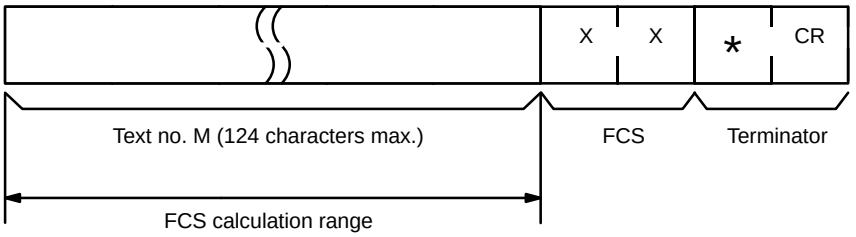
First Frame (131 Characters or Less)



Intermediate Frame(s) (128 Characters or Less)

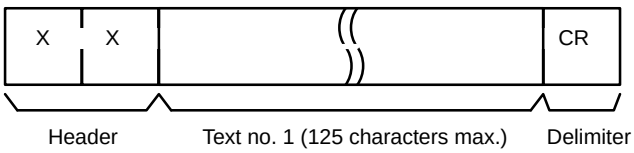


Last Frame (128 Characters or Less)

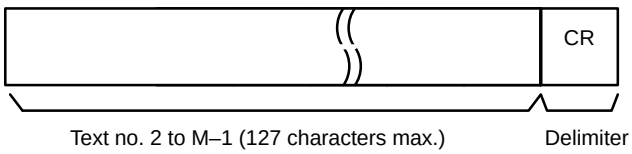


Single-link System

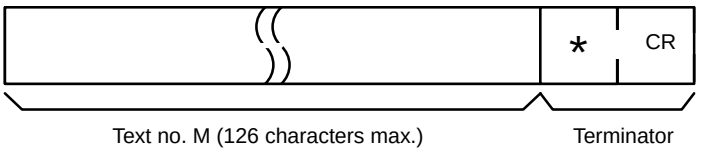
First Frame (128 Characters or Less)



Intermediate Frame(s) (128 Characters or Less)



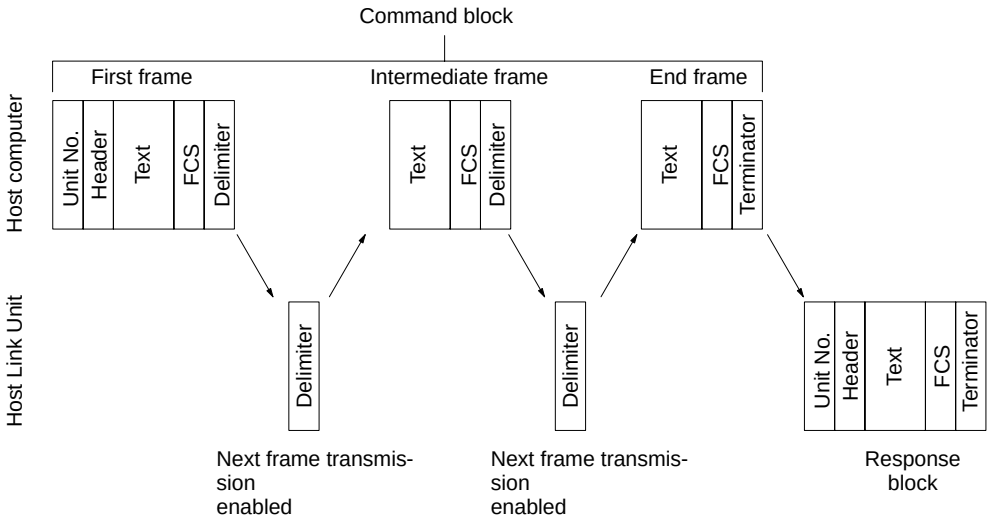
Last Frame (128 Characters or Less)



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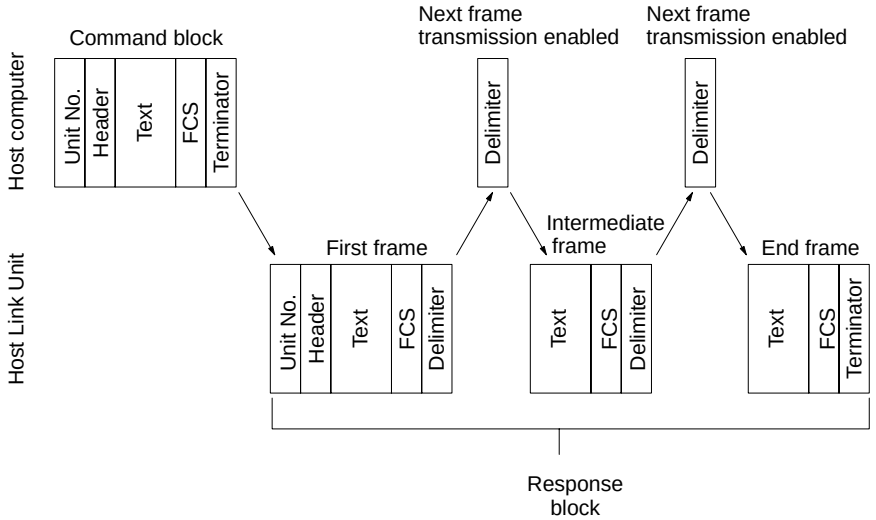
Sending Commands

To send a command block with more than one frame from the computer, initially send only the first frame in the block. Do not send the next frame until the host computer has received the delimiter which should have been sent back from the PC. Do not separate data from a single word into different frames for any write command.



Receiving Commands

To receive a response block consisting of more than one frame from the PC, the host computer must send the carriage return code (delimiter) to the PC after receiving the delimiter from the PC. This enables the PC to send the next frame.



3-2-3 Data Representation

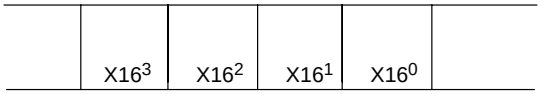
The format examples in this manual apply to multiple-link systems. The explanation for each command/response includes the ranges of the possible data (e.g., program instructions to be read, operand values, etc.). The actual data that is valid for the system depends on the PCs being used. Therefore, it is important that you check that the program instructions and the data areas (and sizes) are available for the PCs in your system.

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Numerical data within a transmission is expressed in hexadecimal, decimal, or binary format. Refer to the format example of each command for details. The appropriate range is indicated in the following manner. Conversion tables in *Appendix C* give data conversions from ASCII to hex, binary, and decimal, and those in *Appendix D* give conversions between hex, BCD, binary, and decimal up to the value 32_{dec}.

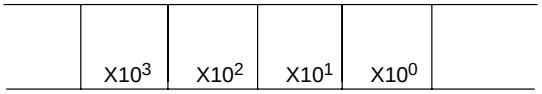
Note All ASCII data is stored as hex in the PCs.

Hexadecimal Data



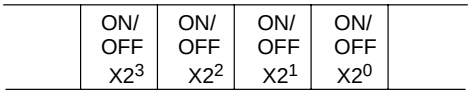
In the above diagram, the elements $X16^3$ to $X16^0$ indicate that the data is expressed in hexadecimal. Each digit can, therefore, be in the range from 0 (ASCII 48_{dec}, binary 0000) to 9 (ASCII 49_{dec}, binary 1001), or A (ASCII 65_{dec}, binary 1010) to F (ASCII 70_{dec}, binary 1111).

Decimal Data



In this figure, $X10^3$ to $X10^0$ indicate that the data is expressed in decimal. Each digit can, therefore, be in the range from 0 (binary 0000) to 9 (binary 1001).

Binary Data



In the above figure, the ON/OFF and $X2^3$ to $X2^0$ indicate that the data is binary. Each box therefore represents either 0 or 1 as follows:

0 (ASCII 48_{dec}): OFF
1 (ASCII 49_{dec}): ON.

Data Areas

Data area codes must be entered in capital letters and must be 4 characters wide. Names shorter than 4 characters must be followed by spaces (ASCII 32_{dec}) to make up the 4 characters. Data areas valid for each command are listed with the command.

A maximum of 29 words of PC data can be sent at the same time. If a command is used to read or write more than 29 words, the transmission will be divided into units of 29 words or less each.

Although the C200H/HS/HX/HG/HE, C1000H, and C2000H will complete processing a read or write command in one cycle, other PCs may require up to three cycles to complete processing for all the data being transferred.

If separate commands are used to read data from a PC, the data may not all result from the same PC program cycle.

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3-2-4 System Checks

Prior to an actual data transaction between the Host Link Unit and host computer, check the system by following the nine steps listed below.

1, 2, 3...

1. Check the settings of the Host Link Unit's DIP switches and selectors. make sure the transmission speeds, specified interfaces, and data formats of both the Host Link Unit and host computer match.
2. Mount the Host Link Unit to the PC.
3. Connect the Host Link Unit to the host computer with the proper cable. For details, refer to *Sections 1 Introduction* and *2 Host Link Unit Characteristics*.
4. Apply power to the PC and the host computer.
5. If the ERROR or ALARM indicators on the PC illuminate, rectify the error and then clear the alarm.
6. If the Host Link Unit is ready, the RUN indicator will illuminate. Confirm that this is ready before proceeding.
7. Prepare and execute a test program on the host computer.
8. If the data test is completed successfully, the system is operational.
9. If an error occurs, perform the required error processing as detailed in *Section 5 Error Processing*.

3-2-5 Data Transaction Test Program

The following program example is designed to send test data to the Host Link Unit and return it, unaltered, to the host computer. By executing this program, the transmit and receive data are both displayed on the screen of the host computer. If the transmit data and the receive data match, the system is operational. The example uses a multiple-link system, and the program is executed by Host Link Unit number 0. The following program is for NEC computers. For IBM compatibles, four lines must be changed as shown after the program.

NEC

```
10 CLOSE #1
20 CLS
30 ON ERROR GOTO *EROPE
40 OPEN "COM:E73" FOR OUTPUT AS #1 . ..................  Opens RS-232C
50 '*****************************************
60 *KEYIN
70 INPUT "TEST DATA INPUT -----",TDS . ................  Test data input
80 ICS="@OUTS" . ......................................  Creation of Unit no. and header code
90 TS=TCS+TDS . .......................................  Creation of test command
100 GOSUB *FCSSET . ...................................  Calculation of Frame Checksum
110 TXDS=TS+FCSS+"*" . ................................  Send data set
120 PRINT TXDS . ......................................  Send data display
130 PRINT #1,TXDS . ...................................  Transmission
140 INPUT #1,RXDS . ...................................  Reception
150 LINE PRINT RXDS . .................................  Receive data display
160 GOTO *KEYIN
170 '*****************************************
180 *FCSSET . ..........................................  *
190 L=LEN(TS) . .......................................  Number of transmit data before FCS
200 A=0 . .............................................  Setting of initial value for EOR calculation
210 FOR J=I TO L
220 TJS=MIDS(TS,J,1)
230 A=ASC(TJS) XOR A
240 NEXT J
250 FCSS=HEXS(A)
```


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```
260 IF LEN(FCS$)=1 THEN FCS$="0"+FCS$
270 RETURN
280 '*****************************************
290 *EROPE
300 PRINT "ERL=";ERL,"ERR=";ERR . ..................... Display of line no. containing error and error no.
310 CLOSE #1
320 END . ..................................................... Closes RS-232C
330 '*****************************************
```

* The FCS calculation subroutine starting from statement 180 is for data transmission. The data length L will differ for the response because the response contains other data such as FCS and *.

IBM

To adjust the above program for IBM compatibles replace the following four lines.

```
30    ON ERROR GOTO 300
40    OPEN “COM:E72” FOR OUTPUT AS#1

100   GOSUB 190

160   GOTO 70
```

3-3 Communications Protocol (C200HS/HX/HG/HE only)

Commands from the PC

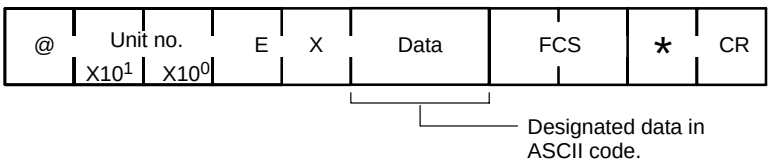
The C200HS/HX/HG/HE allows the PC to issue commands to the host computer under the following conditions. The command makes it possible to send the PC's data to the host computer without using any command from the host computer.

1, 2, 3...

1. The C200HS/HX/HG/HE must be connected to the host computer via a C200H-LK101-PV1, C200H-LK2□□-V1 Host Link Unit or the peripheral port of the C200HS/HX/HG/HE's CPU. Refer to the *C200HS Operation Manual* or *C200HX/HG/HE Operation Manual* for details.
2. The TRANSMIT (TXD (—)) must be executed from the user ladder-diagram program. Refer to *4-36 TRANSMIT* for details.

When the TXD (—) instruction is executed, data is transmitted to the host computer in the following format.

Command Format



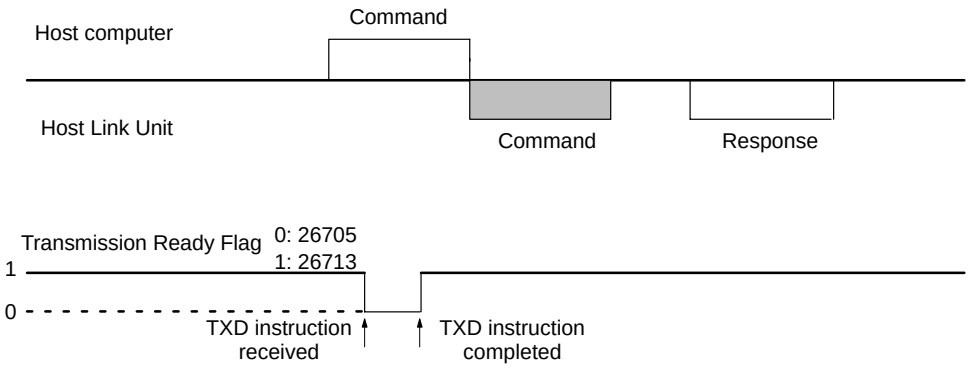
The data (61 bits maximum) specified by the TXD (—) instruction is converted into ASCII (122 characters maximum) and transmitted. There will be no response from the host computer for the above command.

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3-3-1 Command Timing

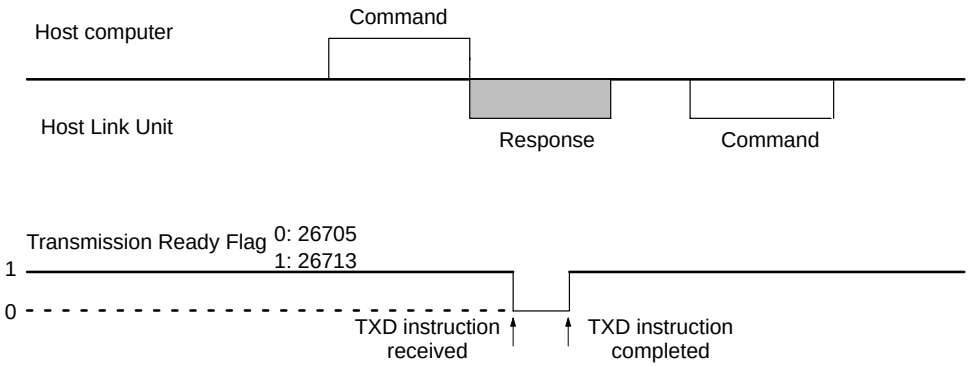
When the Host Link Unit is receiving a command from the host computer at the time the execution of the TRANSMIT instruction has been completed, command transmission to the host computer is possible only after the Host Link Unit completes receiving the command from the host computer. After receiving the command from the host computer, the Host Link Unit starts command transmission to the host computer. The transmission of a response for the command from the host computer is possible only after the command transmission to the host computer is completed.

PC Data Transmission



When the Host Link Unit is transmitting a response for a command transmitted from the host computer at the time the execution of the TRANSMIT instruction has been completed, command transmission to the host computer is possible only after the Host Link Unit completes transmitting the response to the host computer. After transmitting the response, the Host Link Unit starts command transmission to the host computer.

PC Data Reception

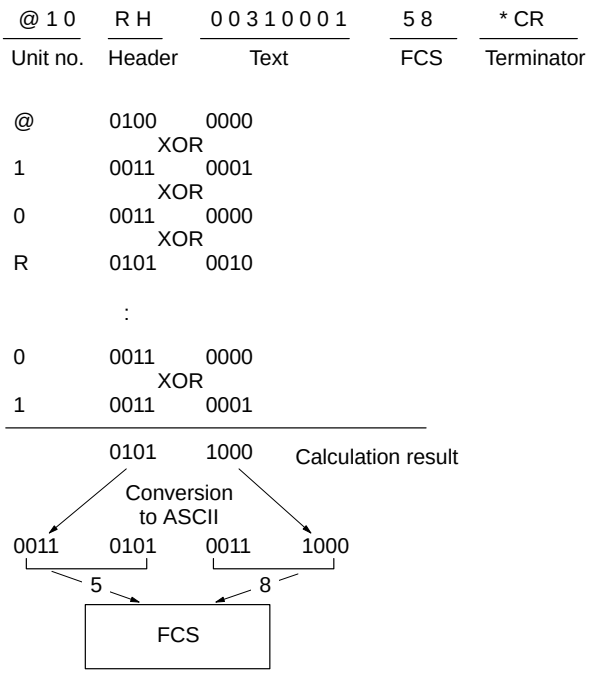


The transmission flag is ON when a command to the host computer is delivered from the PC to the Host Link Unit.

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3-4 Frame Checksum (FCS) Calculation

The Frame Checksum is 8-bit data converted into two ASCII characters. The 8-bit data is the result of an EXCLUSIVE OR sequentially performed between each character, from the first character in the frame to the last character of the text in that frame.



3-4-1 FCS Calculation Program Example

The following program is an example of how Frame Checksum calculations can be performed on received data. For an example of a program to calculate the FCS for Transmit Data, refer to *3-2-4 System Checks*.

```
400 *FCSCHECK
405 L=LEN(RESPONSE$)
410 Q=0:FCSCK$=" "
415 A$=RIGHT$(RESPONSE$,1)
417 PRINT RESPONSE$,A$,L
420 IF A$="*" THEN LENGS=LEN(RESPONSE$)-3 ELSE LENGS=LEN(RESPONSE$)-2
430 FCSP$=MID$(RESPONSE$,LENGS+1,2)
440 FOR I=1 TO LENGS
450 Q=ASC(MID$(RESPONSE$,I,1)) XOR Q
460 NEXT I
470 FCSD$=HEX$(Q)
480 IF LEN(FCSD$)=1 THEN FCSD$="0"+FCSD$
490 IF FCSD$<>FCSP$ THEN FCSCK$="ERR"
495 PRINT "FCSD$=";FCSD$,"FCSP$=";FCSP$,"FCSCK$=";
500 RETURN
```

Transmit/receive data

Number of characters in FCS calculation range.

Receive data contains an FCS, delimiter, terminator, etc. The ABORT command, however, does not contain an FCS.

FCS calculation result

Receive FCS data

A space follows the semicolon if the FCS reception is performed normally. If it is not performed, ERR is displayed.

Note: in this example, CR (CHR$(13)) is not included in RESPONSE$.

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SECTION 4
Commands and Responses

This section provides the command and response formats for all of the instructions covered by this manual. A table of the responses produced for different errors is included in *4-45 Response Code List*. Examples of communications between a Host Link Unit and PC, for several commands, are given at the end of the *4-46 Communications Examples*. The levels at which the commands are applicable are given in table form in *3-1 Command Levels*.

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4-1 TEST

Transmits one block of data to the PC and then returns it, unaltered, to the host computer. Each frame is treated as a block regardless of whether it uses a terminator or delimiter.

Command Format

@	Unit no. $X10^1$ $X10^0$	T	S	Any characters (122 max.) other than a carriage return	FCS	*	CR

Response Format

@	Unit no. $X10^1$ $X10^0$	T	S	Any characters (122 max.) other than a carriage return	FCS	*	CR

Response if Error Occurs

@	Unit no. $X10^1$ $X10^0$	T	S	Response code $X16^1$ $X16^0$	*	CR

4-2 STATUS READ

Reads the operating status of the PC.

Command Format

@	Unit no. $X10^1$ $X10^0$	M	S	FCS	*	CR

Response Format

@	Unit no. $X10^1$ $X10^0$	M	S	Response code $X16^1$ $X16^0$	Status data $X16^3$ $X16^2$ $X16^1$ $X16^0$	Message 0 1 ... 15	FCS	*	CR

Fixed to 16 characters

15	14	13	12	11	10	9	8

- 15: 1: Generation of FALS instruction
- 14: 1: Duplex, 0: Simplex *1
- 13: 1: Start switch is OFF
- 12: 1: Error diagnosis in progress
- 11: 1: FORCED SET/RESET in progress *2
- 10: 1: Remote I/O waiting for power application
- 9, 8:
  - 0 0: PROGRAM mode
  - 0 1: None
  - 1 0: RUN mode
  - 1 1: MONITOR mode

7	6	5	4	3	2	1	0

- 7: Duplex System Active: 1, Standby: 0 *1
- 6, 5, 4: Program area size
  - None: 0 0 0
  - 8 kbytes: 0 0 1
  - 16 kbytes: 0 1 0
  - 24 kbytes: 0 1 1
  - 32 kbytes: 1 0 0
  - 48 kbytes: 1 0 1
  - 64 kbytes: 1 1 0
- 3: Program area RAM: 1, ROM: 0
- 2, 1, 0: Not used

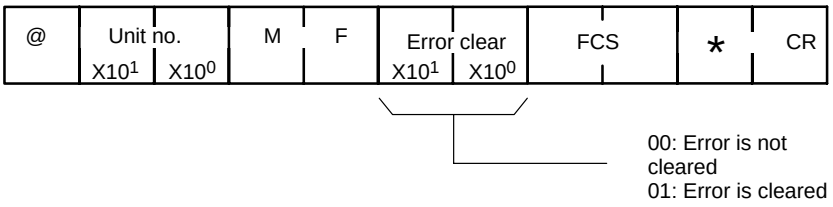
*1. Only possible for the C2000H
*2. Not possible for the C200H/HS/HX/HG/HE

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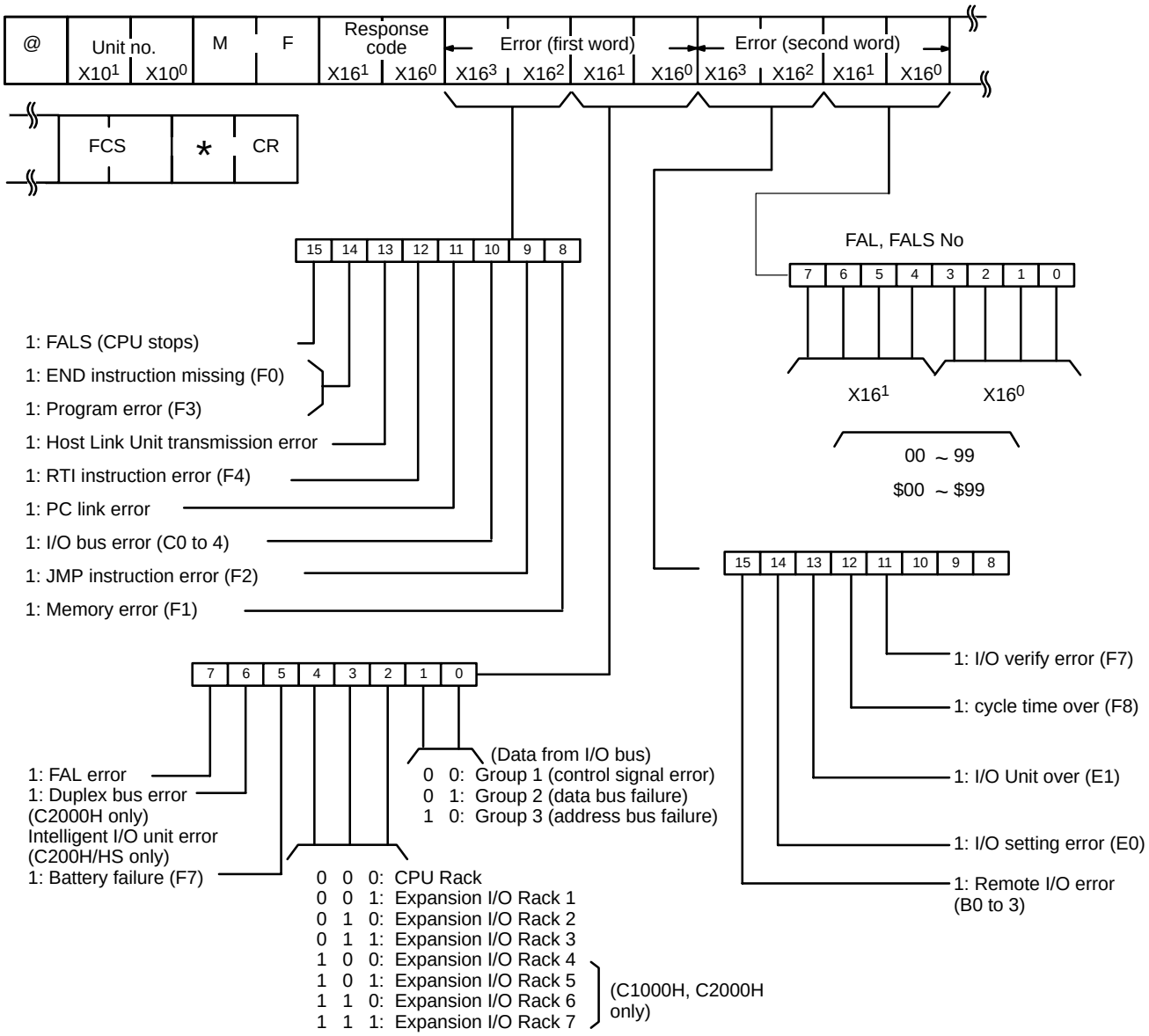
4-3 ERROR READ

Reads and clears errors in the PC. Also checks whether previous errors have already been cleared. When both Rack- and CPU-mounting Host Link Units are used in combination, errors in either type of Unit are indicated in the same manner.

Command Format



Response Format

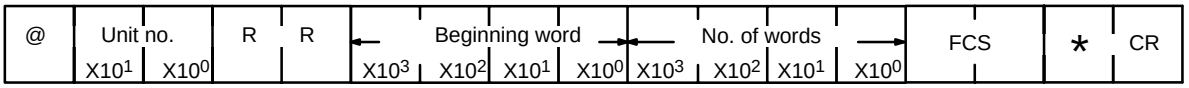


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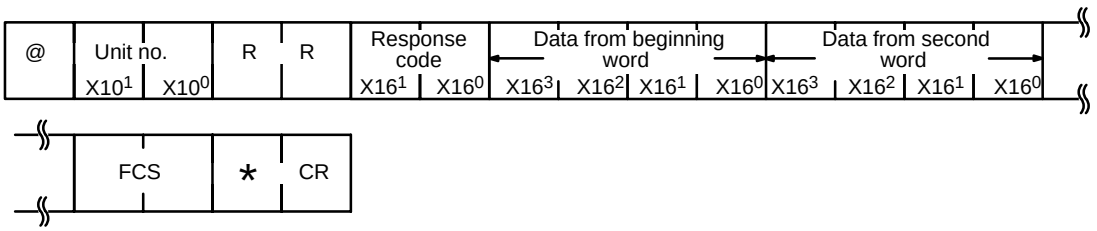
4-4 IR AREA READ

Reads the contents of the specified number of IR area words, starting from the specified word.

Command Format



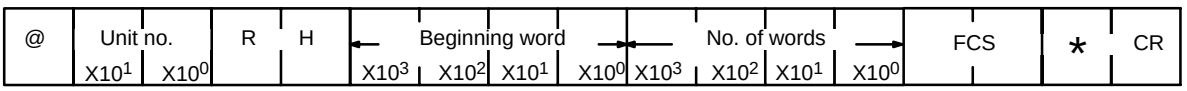
Response Format



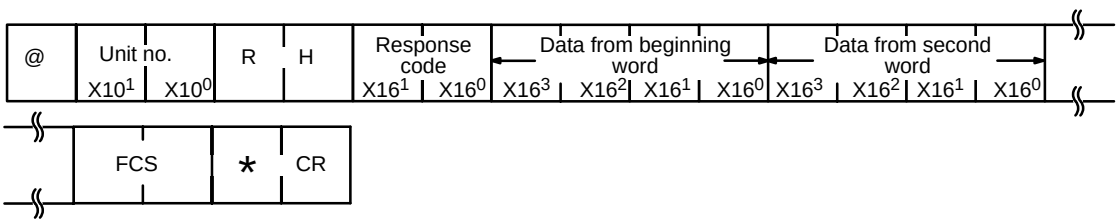
4-5 HR AREA READ

Reads the contents of the specified number of HR area words, starting from the specified word.

Command Format



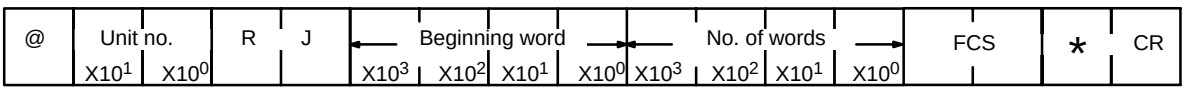
Response Format



4-6 AR AREA READ

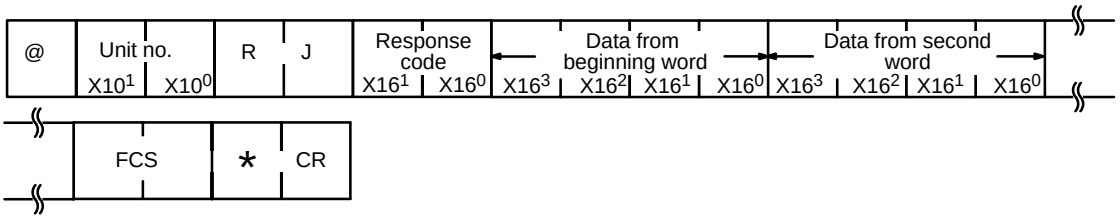
Reads the contents of the specified number of AR area words, starting from the specified word.

Command Format



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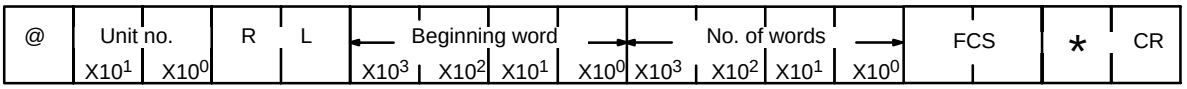
Response Format



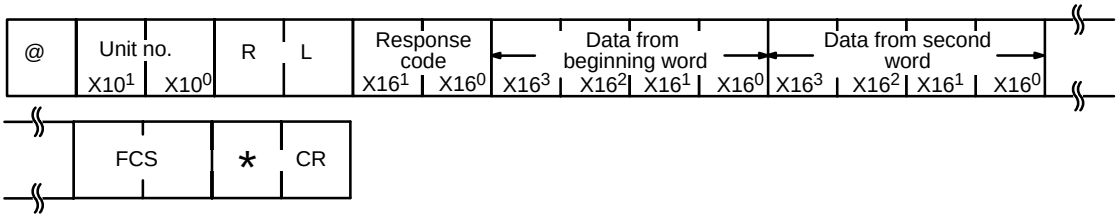
4-7 LR AREA READ

Reads the contents of the specified number of LR area words, starting from the specified word.

Command Format



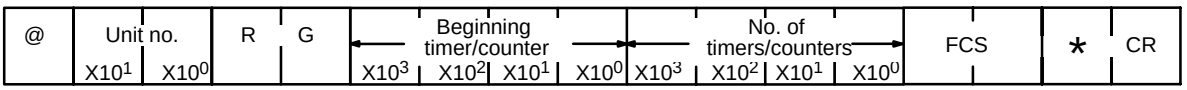
Response Format



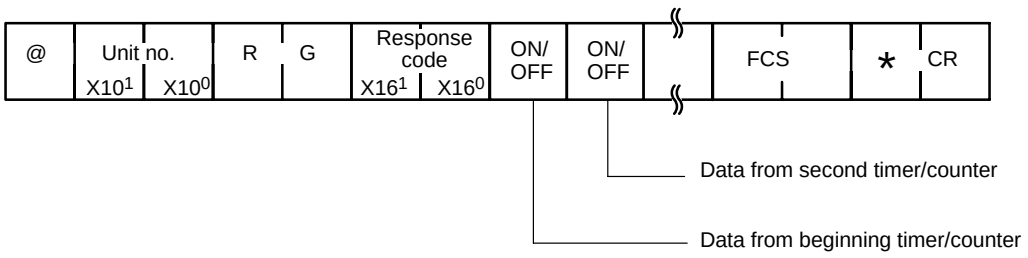
4-8 TC STATUS READ

Reads the status of the Completion Flags of the specified number of timers/counters, starting from the specified timer/counter.

Command Format



Response Format

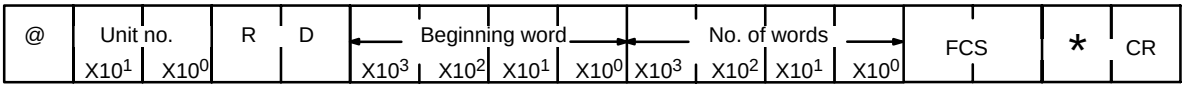


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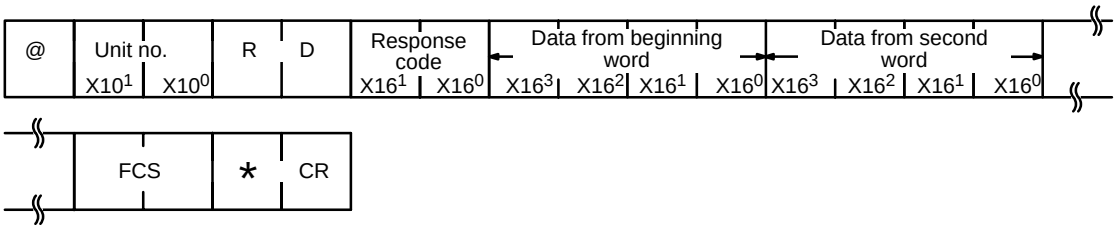
4-9 DM AREA READ

Reads the contents of the specified number of DM words, starting from the specified word.

Command Format



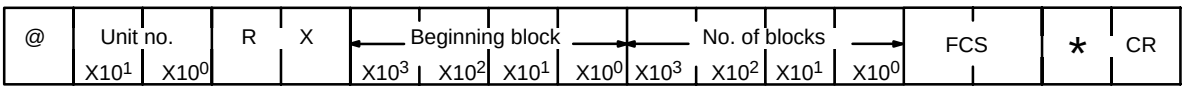
Response Format



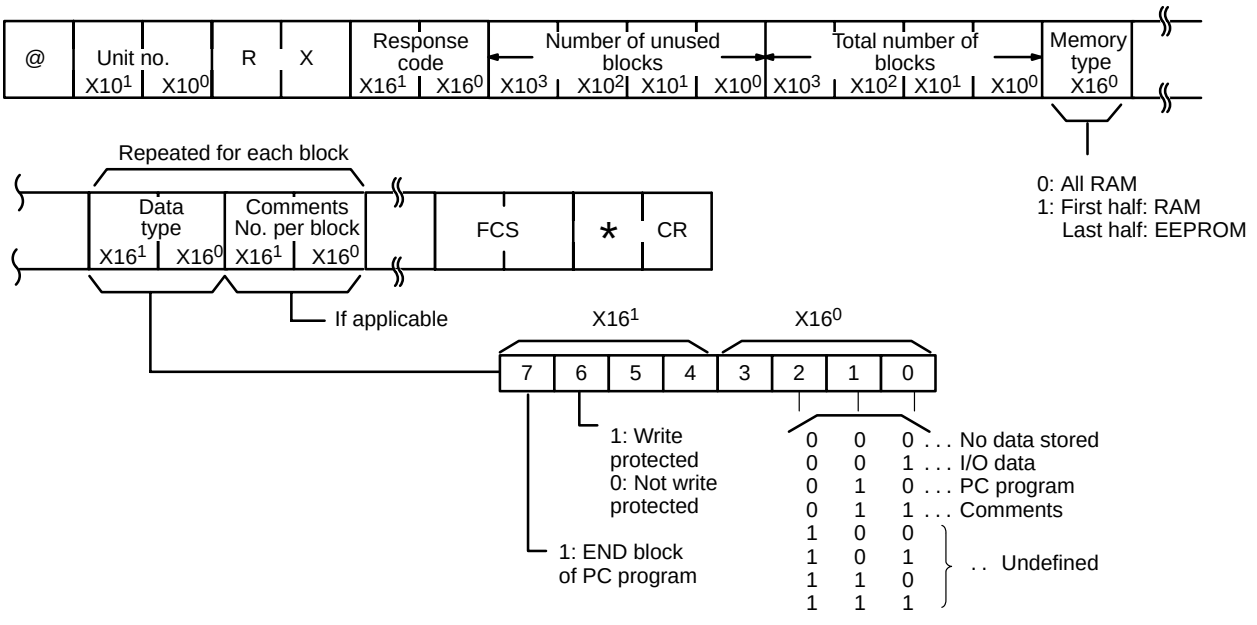
4-10 FM INDEX READ

Reads the contents of the specified number of FM index blocks, starting from the specified block.

Command Format



Response Format

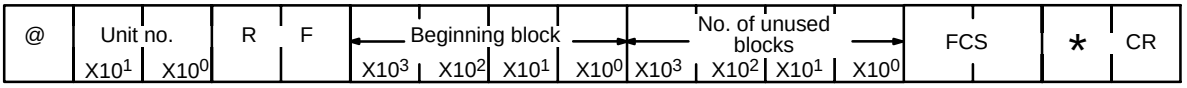


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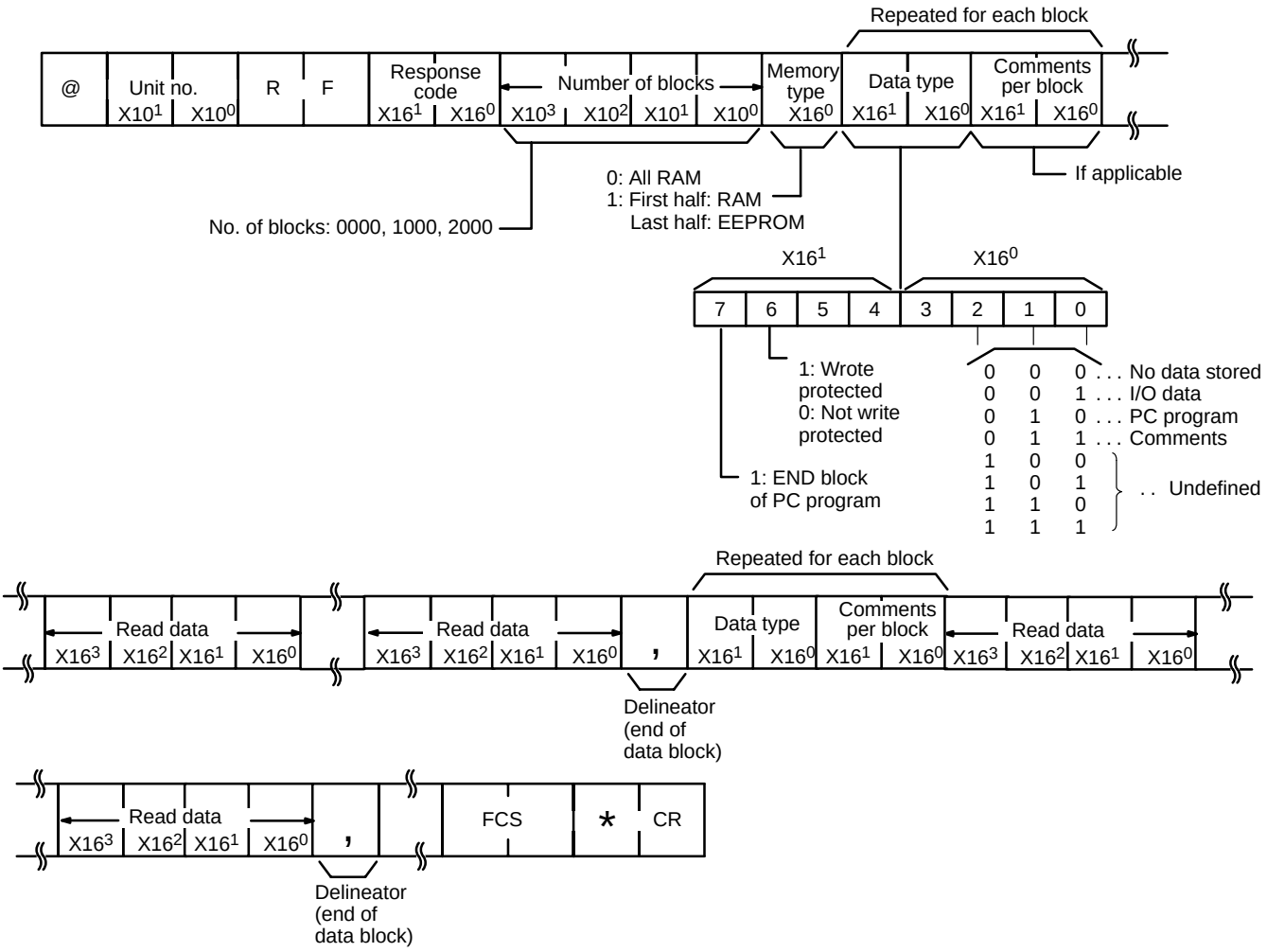
4-11 FM DATA READ

Reads the contents of the specified number of FM blocks, starting from the specified block. The “data type” and “comments per block” information can be added to each block, separated by a delineator, i.e., a comma (,).

Command Format



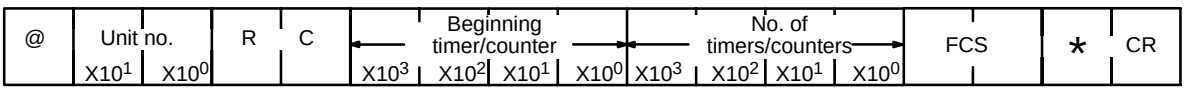
Response Format



4-12 PV READ

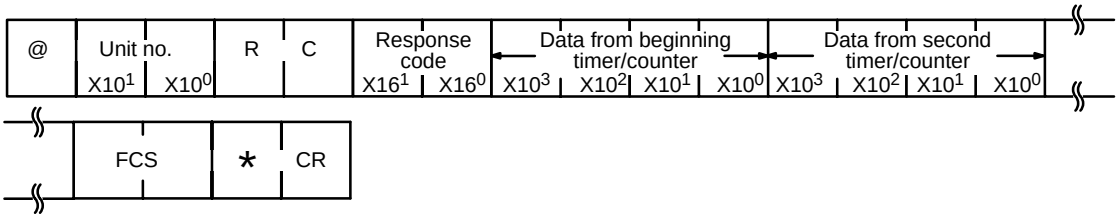
Reads the specified number of timer/counter PVs (present values), starting from the specified timer/counter.

Command Format



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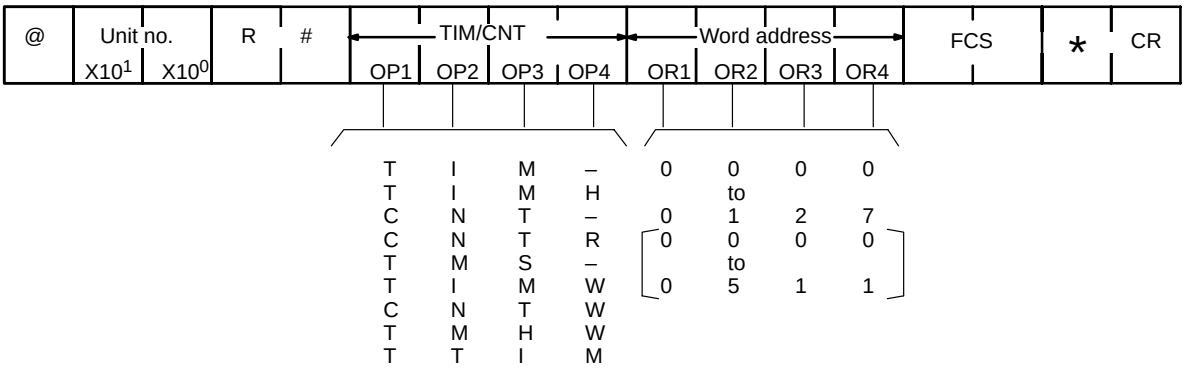
Response Format



4-13 SV READ 1

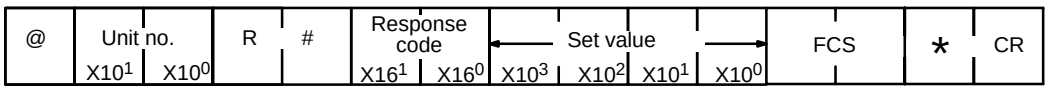
Reads the set value (a constant) of the specified timer/counter instruction. Reads from the beginning of the program and can therefore take up to 20 seconds to produce a response. Refer also to *4-14 SV READ 2* and *4-15 SV READ 3*.

Command Format



Note 1. Dashes represent spaces.
2. The data in the brackets apply to the C200H, C200HS, C200HX, C200HG, C200HE, C1000H, and C2000H.

Response Format



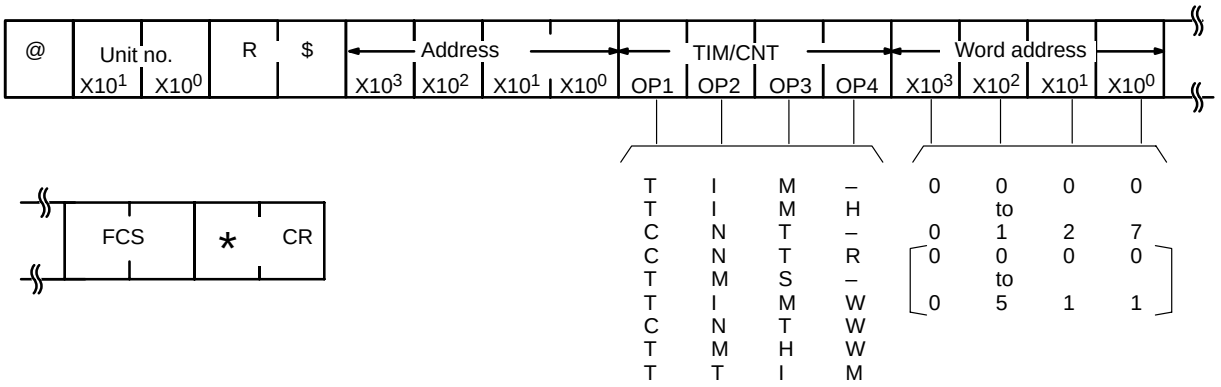
If the command is used more than once, the set value of only the first instruction will be read.

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4-14 SV READ 2

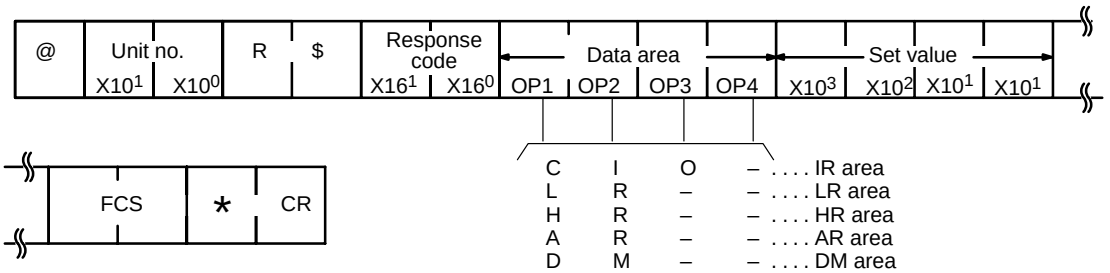
Reads the set value (a constant, or data area and word) of the specified timer/counter instruction. The timer/counter instruction is designated by its program address. If the program has more than 9,999 addresses, use SV READ 3, described in the next section.

Command Format



Note 1. Dashes represent spaces.
2. The data in the brackets apply to the C200H, C200HS, C200HX, C200HG, C200HE, C1000H, and C2000H.

Response Format



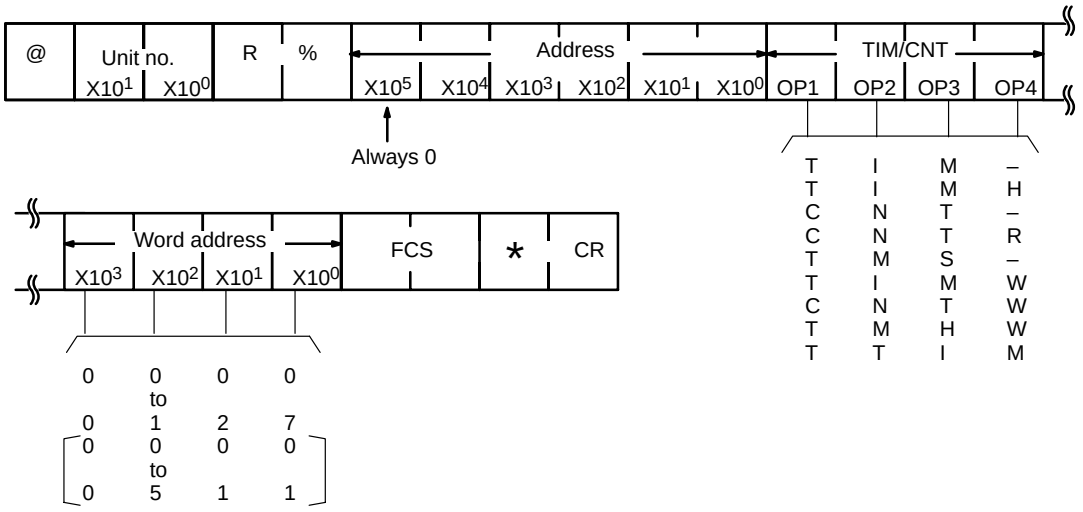
Note: Dashes represent spaces.

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4-15 SV READ 3

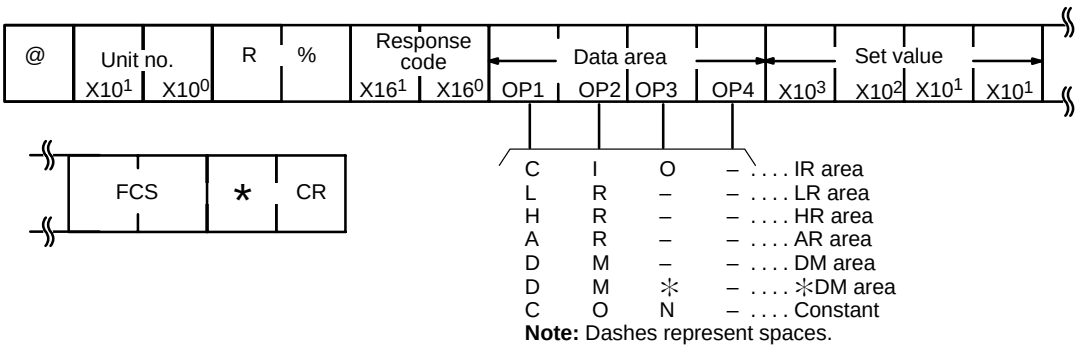
Reads the set value (a constant, or data area and word) of the specified timer/counter instruction. The operation is similar to SV READ 2, but the SV READ 3 is capable of reading from higher program addresses (up to 6 digits).

Command Format



Note 1. Dashes represent spaces.
2. The data in the brackets apply to the C200H, C200HS, C200HX, C200HG, C200HE, C1000H, and C2000H.

Response Format



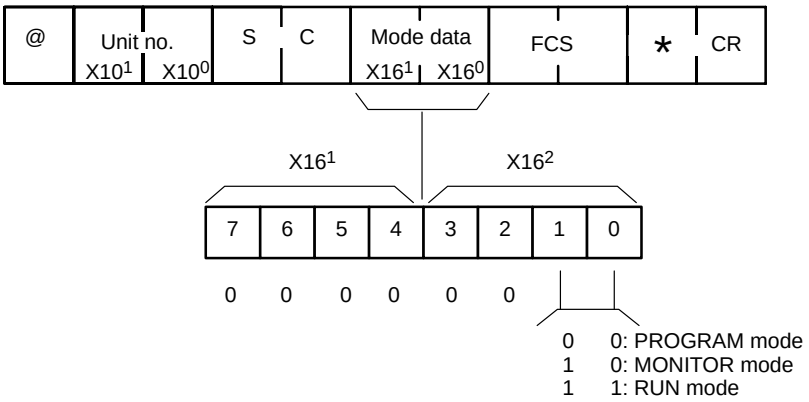
Note: Dashes represent spaces.

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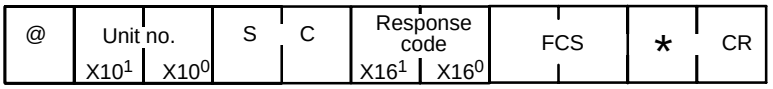
4-16 STATUS WRITE

Changes the operating mode of the PC according to the information entered into word $X16^0$.

Command Format



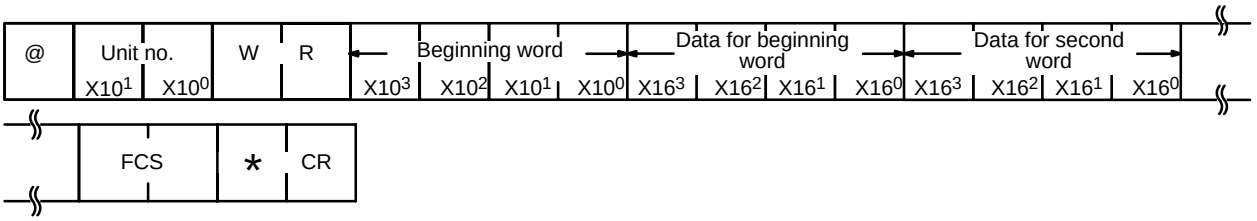
Response Format



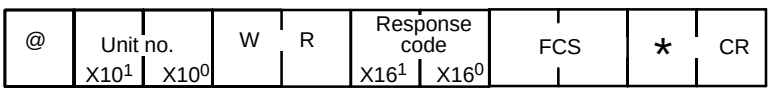
4-17 IR AREA WRITE

Writes data to the IR area, starting from the specified word. Writing is done word by word.

Command Format



Response Format

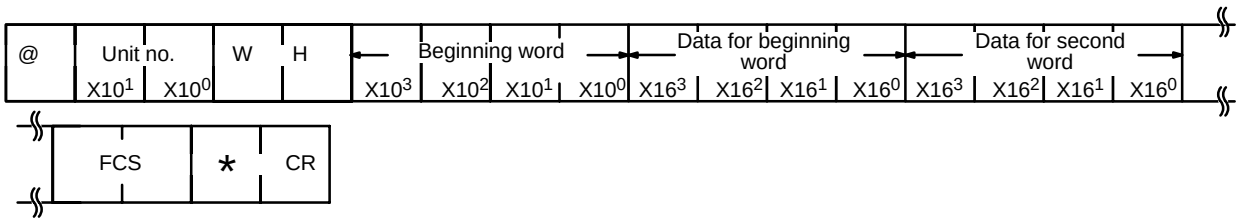


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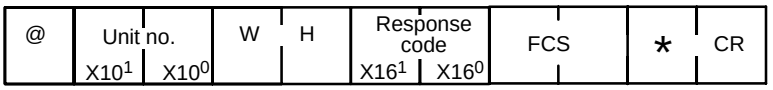
4-18 HR AREA WRITE

Writes data to the HR area, starting from the specified word. Writing is done word by word.

Command Format



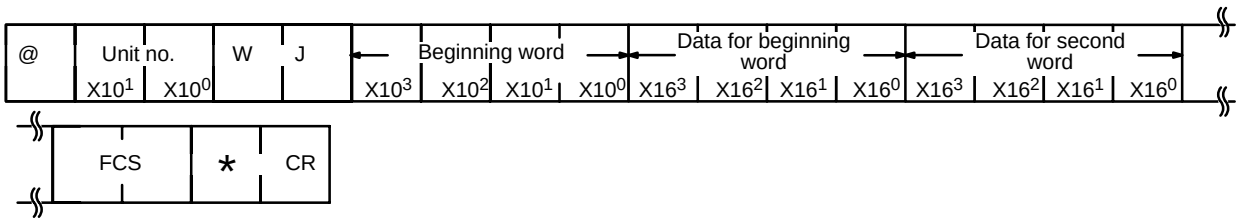
Response Format



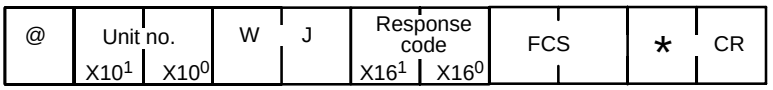
4-19 AR AREA WRITE

Writes data to the AR area, starting from the specified word. Writing is done word by word.

Command Format



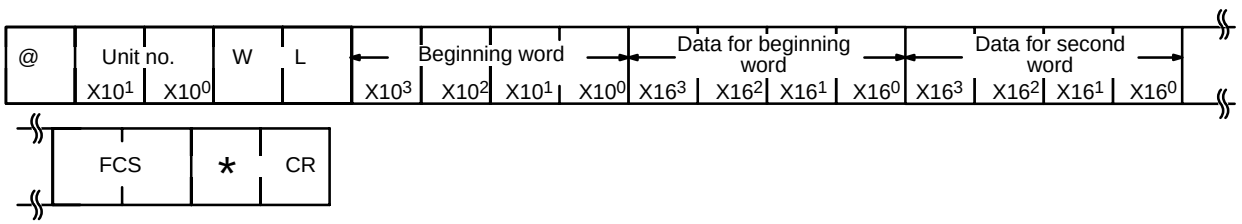
Response Format



4-20 LR AREA WRITE

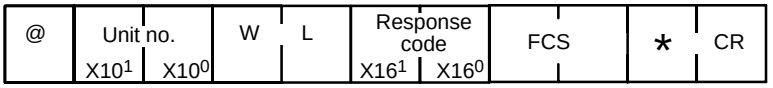
Writes data to the LR area, starting from the specified word. Writing is done word by word.

Command Format



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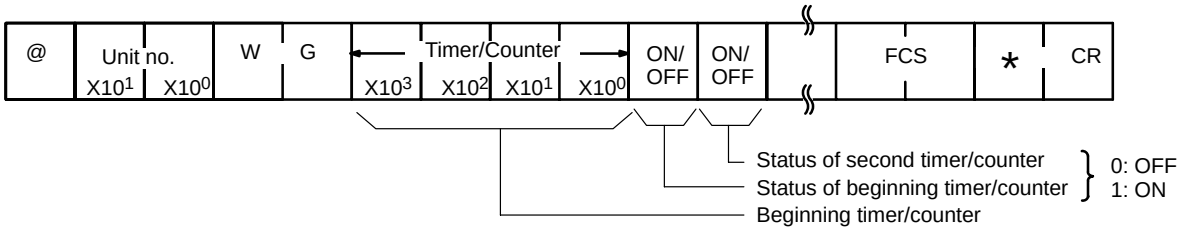
Response Format



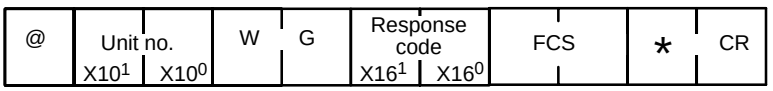
4-21 TC STATUS WRITE

Writes the status of the Completion Flags to the TC area, starting form the specified timer/counter.

Command Format



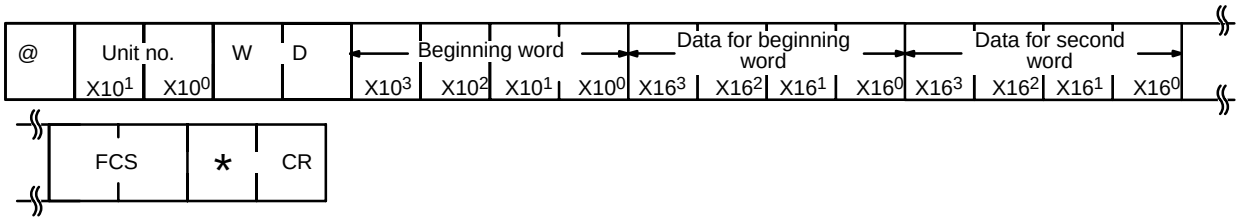
Response Format



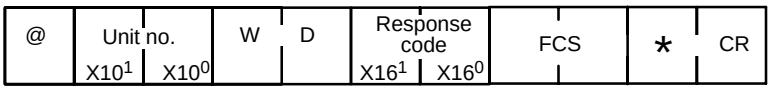
4-22 DM AREA WRITE

Writes data to the DM area, starting from the specified word. Writing is done word by word. If the Program Memory is in an EPROM chip, or if the write enable switch is set to OFF, the the writing range extends up to DM 0999 only.

Command Format



Response Format

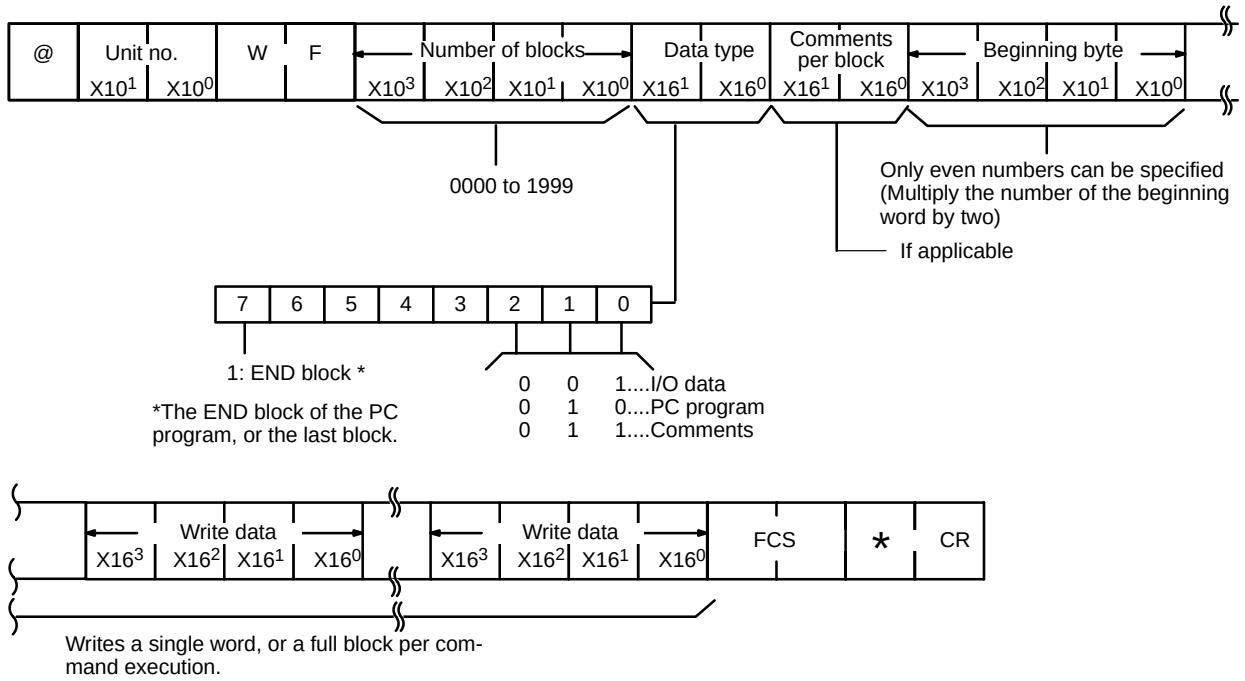


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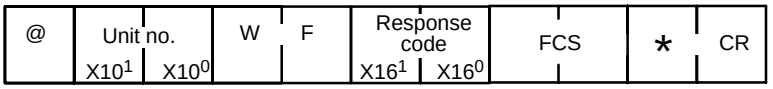
4-23 FM AREA WRITE

Writes data to a single specified word, or to an entire file memory block.

Command Format



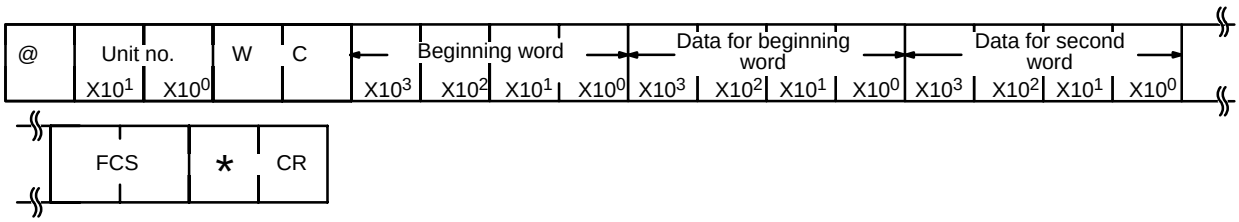
Response Format



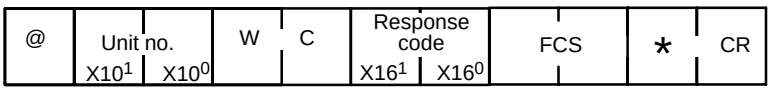
4-24 PV WRITE

Writes PVs (present values) of timers/counters, starting from the specified timer/counter.

Command Format



Response Format

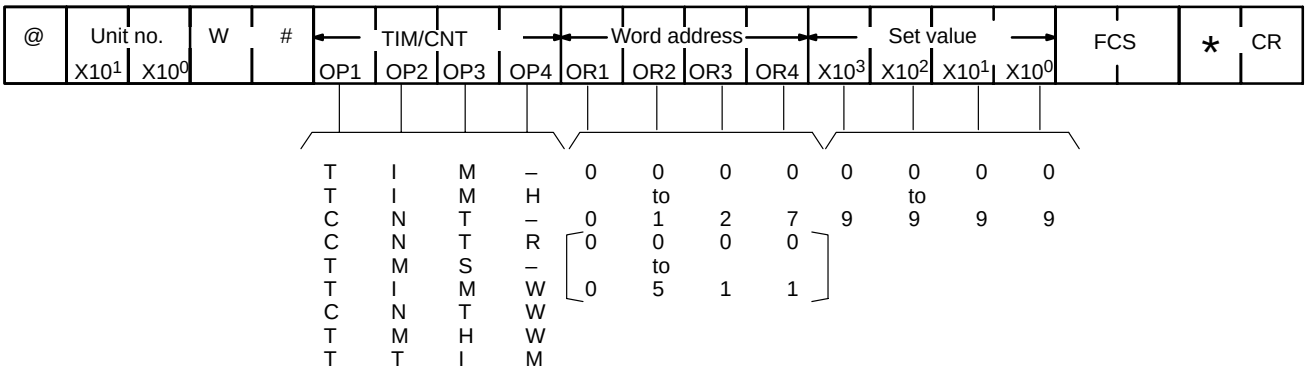


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4-25 SV CHANGE 1

Changes the set value (constant only) of the specified timer/counter instruction. Reads from the beginning of the program and therefore take up to 20 seconds to produce a response. Refer also to *4-26 SV CHANGE 2* and *4-27 SV CHANGE 3*.

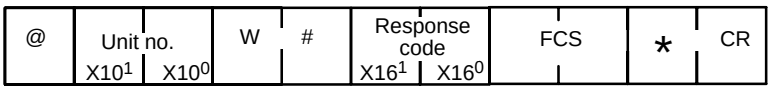
Command Format



Note 1. Dashes represent spaces.

2. The data in the brackets apply to the C200H, C200HS, C200HX, C200HG, C200HE, C1000H, and C2000H.

Response Format

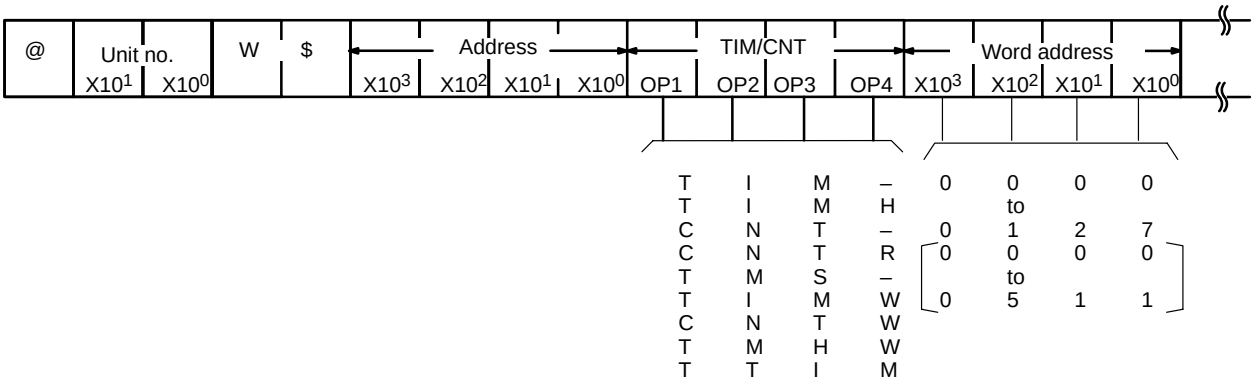


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4-26 SV CHANGE 2

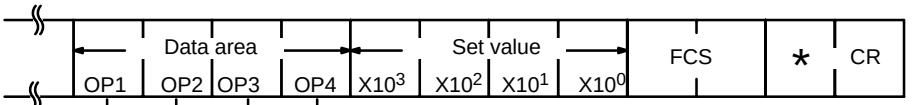
Changes the set value (a constant, or data area and word) of the specified timer/counter instruction. The instruction is specified by its program address. If the program has more than 9,999 addresses, use SV CHANGE 3, described in the next subsection.

Command Format



Note 1. Dashes represent spaces.

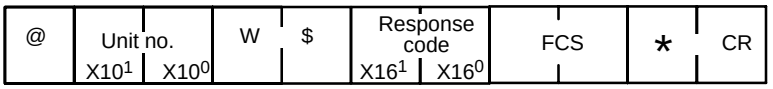
2. The data in the brackets apply to the C200H, C200HS, C200HX, C200HG, C200HE, C1000H, and C2000H.



C	I	O	– . . . . IR area
L	R	–	– . . . . LR area
H	R	–	– . . . . HR area
A	R	–	– . . . . AR area
D	M	–	– . . . . DM area
D	M	✳	– . . . . ✳DM area
C	O	N	– . . . . Constant

Note: Dashes represent spaces.

Response Format

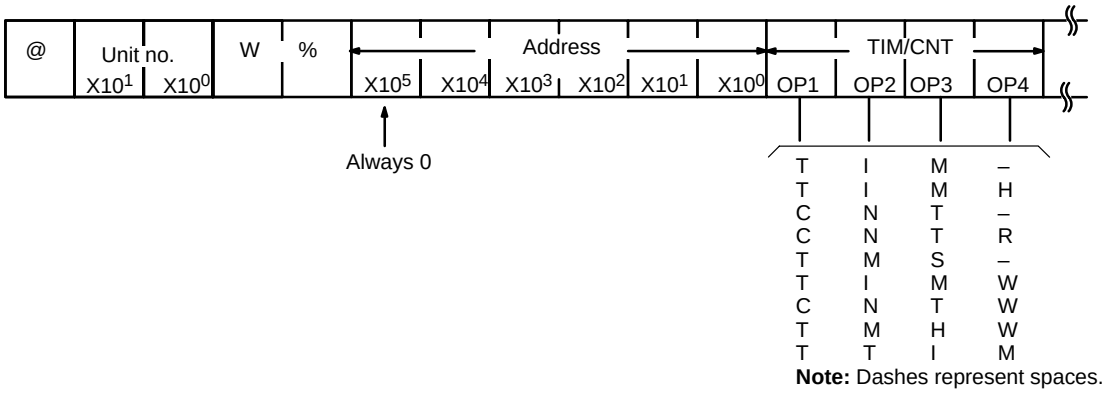


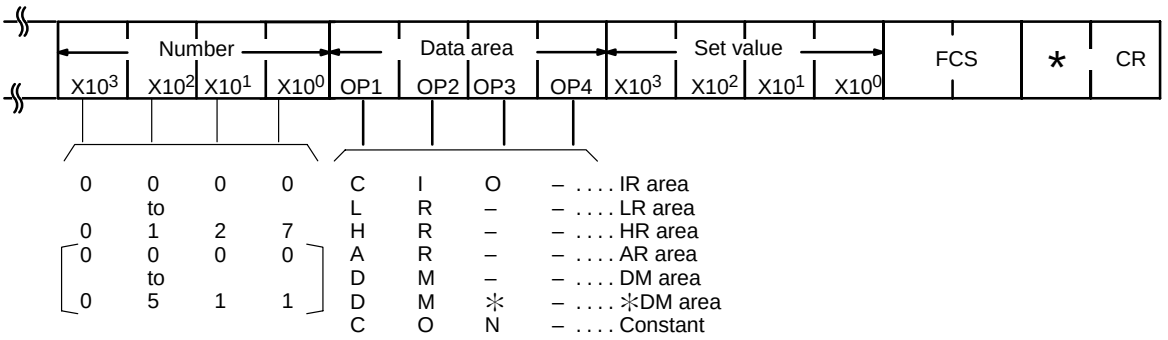
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4-27 SV CHANGE 3

Changes the set value (a constant, or data area and word) of the specified instruction. The operation is similar to SV CHANGE 2, but SV CHANGE 3 can change SVs at higher program addresses (up to 5 digits, note that the leftmost, i.e., the sixth, address bit is always zero).

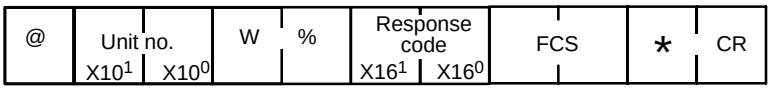
Command Format





Note 1. Dashes represent spaces.
2. The data in the brackets apply to the C200H, C200HS, C200HX, C200HG, C200HE, C1000H, and C2000H.

Response Format

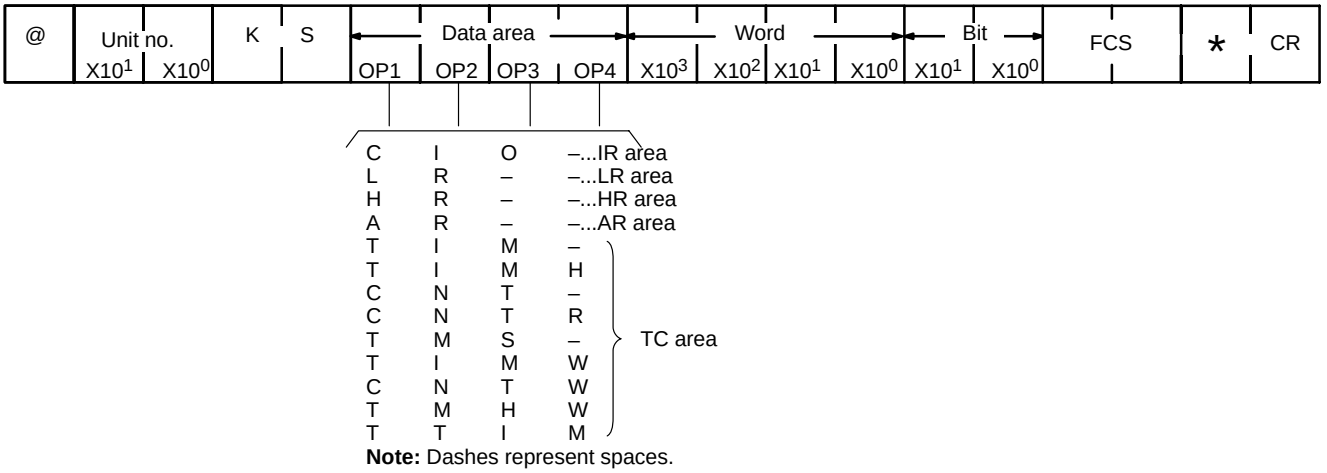


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4-28 FORCED SET

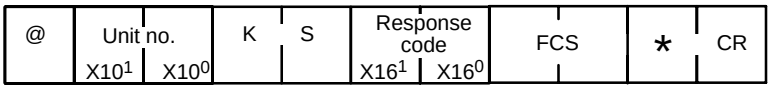
Forced sets a bit in an IR, LR, HR, AR, or TC area. Bits need to be force set one at a time.

Command Format



Note: Dashes represent spaces.

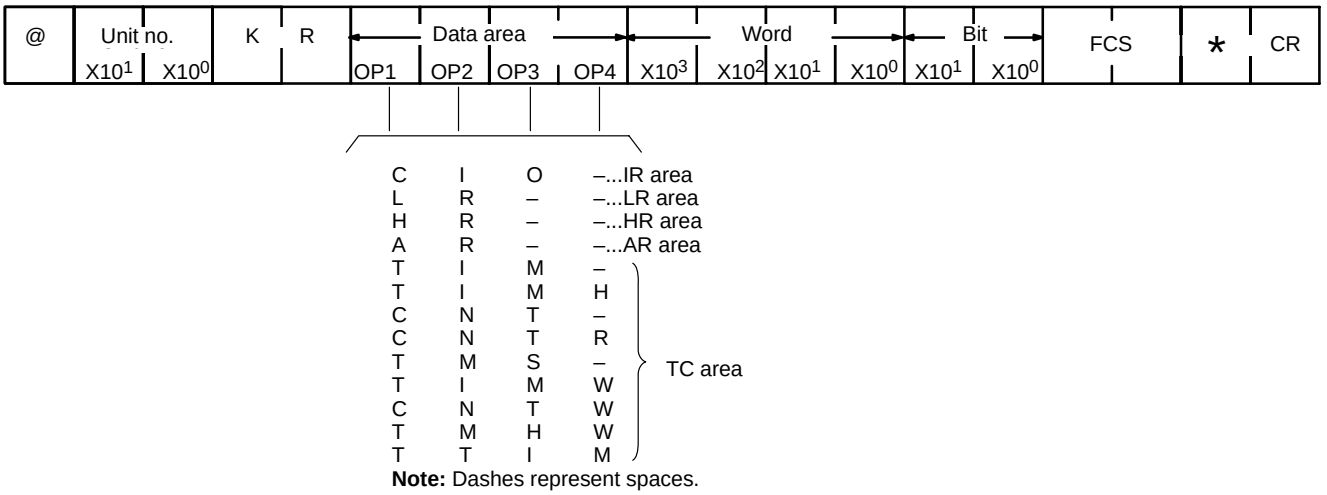
Response Format



4-29 FORCED RESET

Force resets a bit in an IR, LR, HR, AR, or TC area. Bits can only be force reset one at a time. If an attempt is made to simultaneously force reset more than one bit, none of the bits will reset.

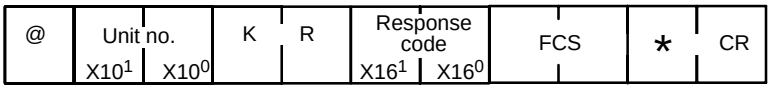
Command Format



Note: Dashes represent spaces.

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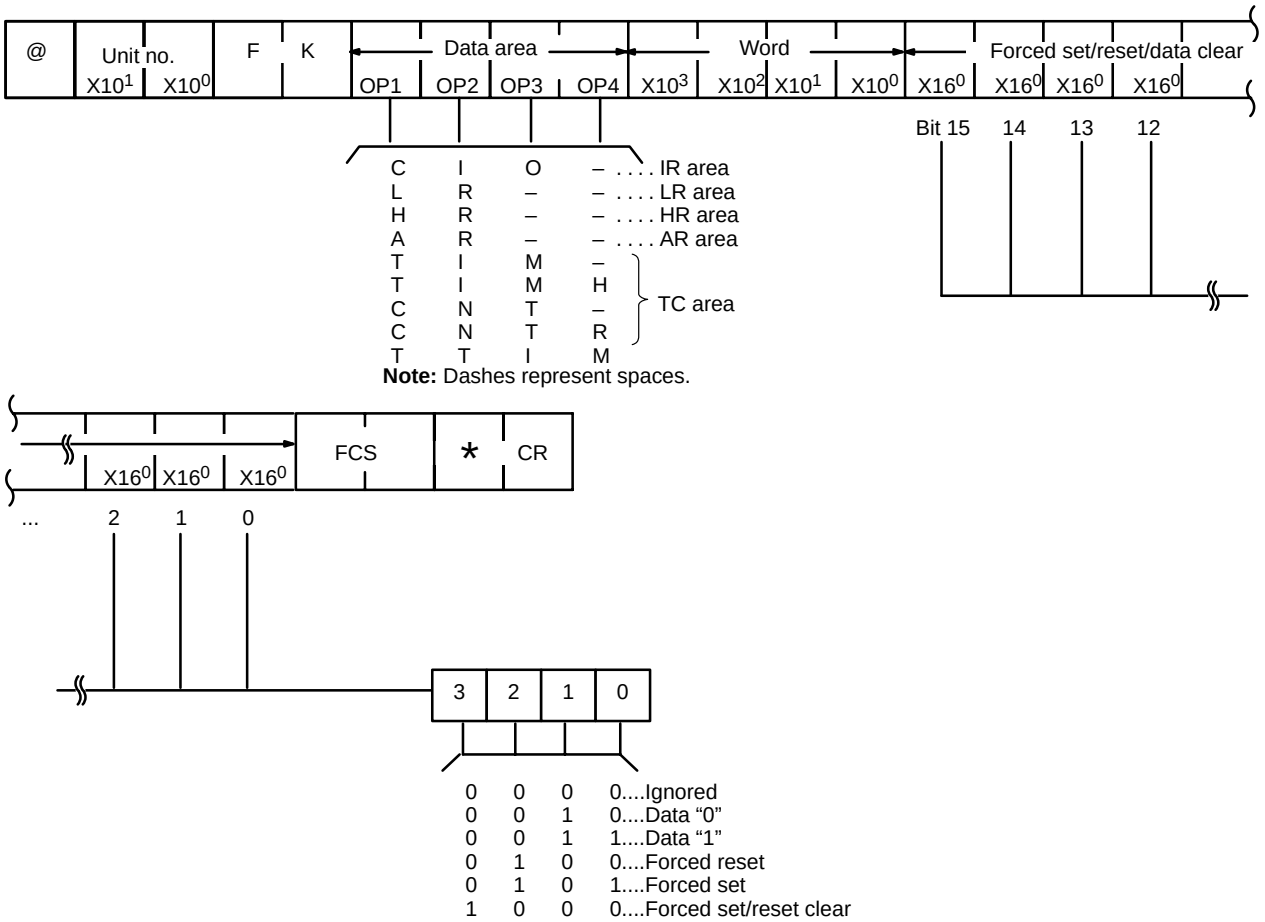
87Response Format



4-30 MULTIPLE FORCED SET/RESET

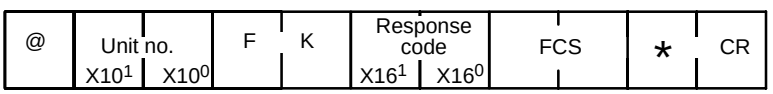
(C200H, C200HS, C200HX, C200HG, C200HE, and Mini H-type only.) This command force sets or resets bits in the IR, LR, HR, AR, or TC areas.

Command Format



Note: Dashes represent spaces.

Response Format

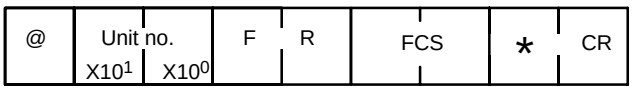


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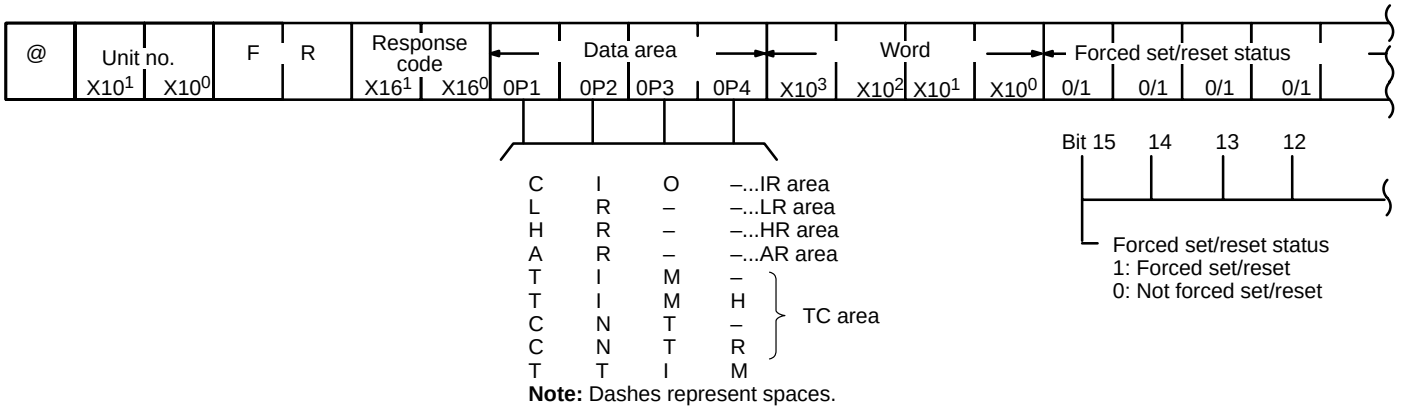
4-31 MULTIPLE FORCED SET/RESET STATUS READ

(C200H, C200HS, C200HX, C200HG, C200HE, and Mini H-type only.) Reads the forced set or forced reset status of the PC to which the specified Host Link Unit is mounted. When the operand is a timer/counter instruction (i.e., TIM(SP), TIMH, CNT(SP), CNTR, or TTIM), only the operands and words being force set/reset will be read.

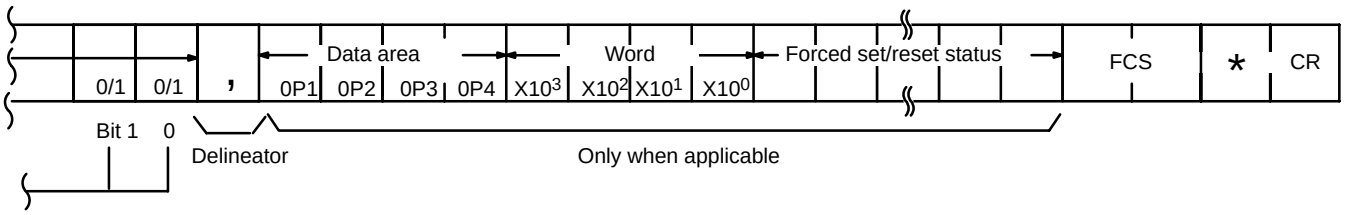
Command Format



Response Format



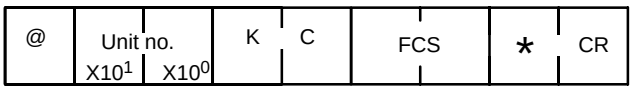
Note: Dashes represent spaces.



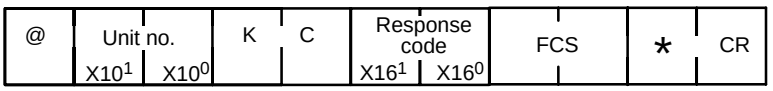
4-32 FORCED SET/RESET CANCEL

Cancels all forced set and forced reset bits (including those achieved via MULTIPLE FORCED SET/RESET for the C200H, C200HS, C200HX, C200HG, C200HE, and Mini H-type).

Command Format



Response Format

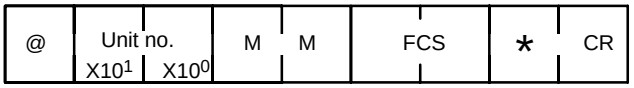


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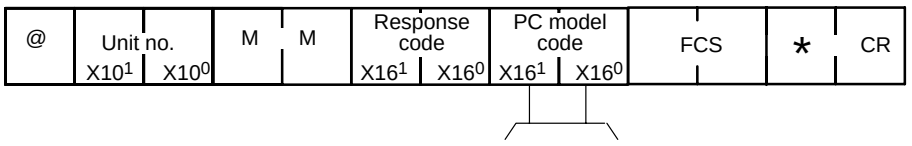
4-33 PC MODEL READ

Reads the model type of the PC.

Command Format



Response Format



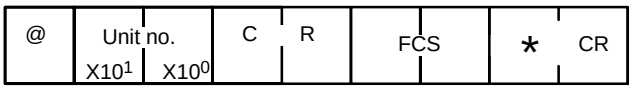
0	1	C250 or P-type
0	2	C500
0	3	C120
1	0	C1000H
1	1	C2000H
1	2	C200H/HS/HX/HG/HE

4-34 DM HIGH-SPEED READ

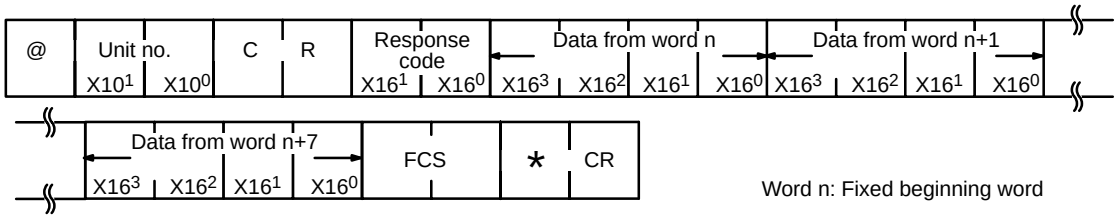
(C1000H and C2000H only) Reads a fixed group of eight DM area words at high-speed. The group of words to be read depends on the Host Link Unit and the PC as follows:

Host Link Unit		C1000H/C2000H
3G2A5-LK101-(P)EV1 3G2A5-LK201-EV1		Wd DM 0008 to 0015
C500-LK103(-P)	Operating level 0	Wd DM 0008 to 0015
C500-LK203	Operating level 1	Wd DM 0000 to 0007
3G2A6-LK101-(P)EV1 3G2A6-LK201-EV1 3G2A6-LK202-EV1		Wd DM 0016 to 0023

Command Format



Response Format



Word n: Fixed beginning word

Response time is not affected by the operating mode of the PC or the cycle time. The response transmission begins less than 10 ms after the reception of the command.

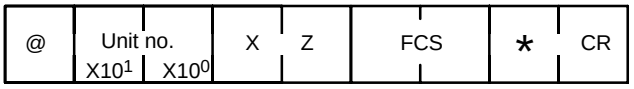
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4-35 ABORT and INITIALIZE

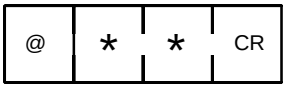
The ABORT command is used to abort the process being performed by the Host Link Unit and to then enable reception of the next command. The INITIALIZE command initializes the transmission control procedure of all the PCs connected to the host computer. Neither command receives a response.

A processing time of 100 ms is required between reception of the ABORT or INITIALIZE commands, and reception of the next command. If INITIALIZE is used in a single-link system, it will be regarded as undefined.

ABORT Command Format



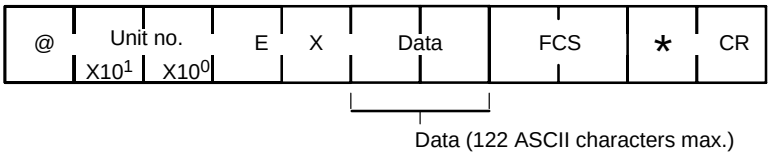
INITIALIZE Command Format



4-36 TRANSMIT (C200HS/HX/HG/HE only)

The Host Link Unit will transmit the specified data sent from the PC via the TXD (—) instruction in ASCII format. When the (TXD(—) instruction is executed in the ladder diagram, data is transmitted to the host computer in the following format. Refer to the *C200HS Operation Manual* or *C200HX/HG/HE Operation Manual* for further details on the TXD (—) instruction.

Response Format

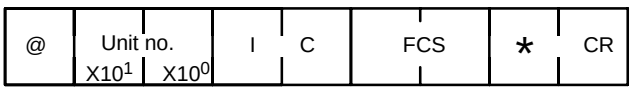


The data (61 bits maximum) specified in the operands of the TXD (—) instruction is converted into ASCII (122 characters maximum) and transmitted. There will be no response required from the host computer for TXD (—) instruction.

4-37 Response to an Undefined Command

This response is sent if the Host Link Unit cannot read the command's header code, or if the specified command is not valid for the command level or model of PC. If this response is received check the header code, command level, and PC model, then execute the correct command.

Response Format

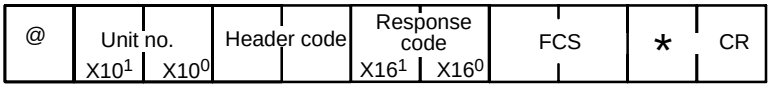


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4-38 Response Indicating an Unprocessed Command

This response is sent when the Host Link Unit cannot process a command. The type of error encountered by the Host Link Unit can be identified via the response code.

Response Format

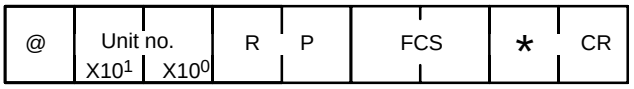


The header code varies according to the command which was sent. The headers of some commands include subheader codes (e.g., I/O REGISTER, I/O READ, and DM SIZE CHANGE).

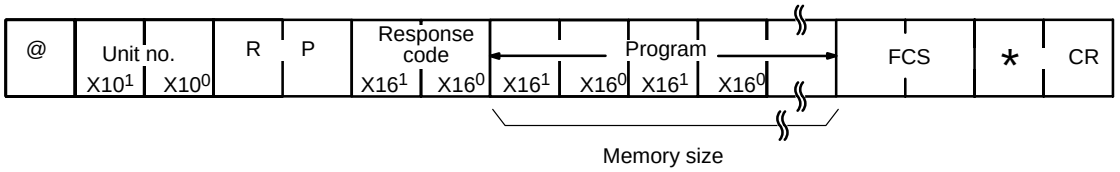
4-39 PROGRAM READ

Transmits the contents of the PC program memory.

Command Format



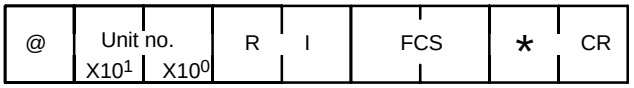
Response Format



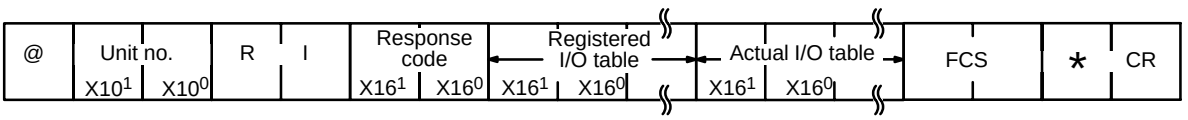
4-40 I/O TABLE READ

Reads the registered I/O table and the actual I/O table (i.e., the I/O Unit configuration connected to the PC).

Command Format



Response Format



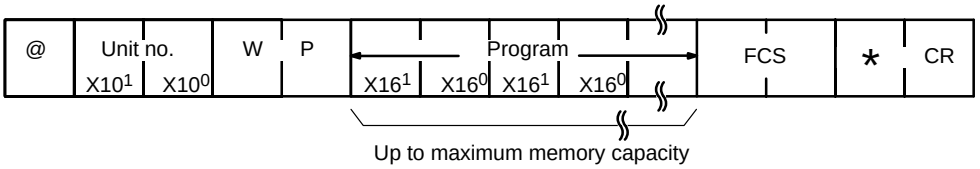
	Registered I/O table	Actual I/O table
C1000H/C2000H, C200H:	930	1408 characters
All others:	336	358

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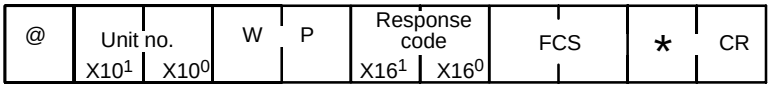
4-41 PROGRAM WRITE

Writes the received program into the PC program memory.

Command Format



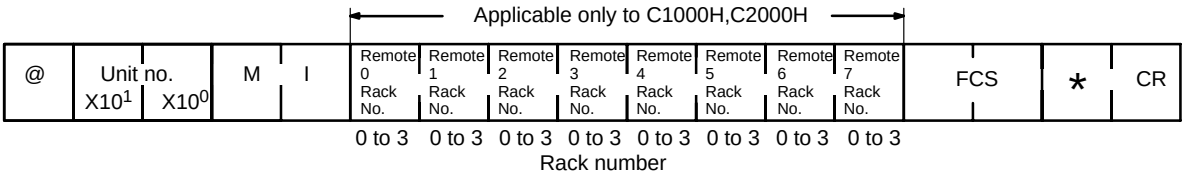
Response Format



4-42 I/O TABLE GENERATE

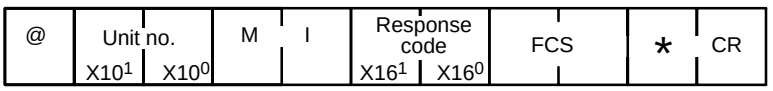
Corrects the registered I/O table to match the actual I/O table.

Command Format



Note When the Rack number is to remain unspecified, assign an ASCII character other than 0 to 3 to it.

Response Format

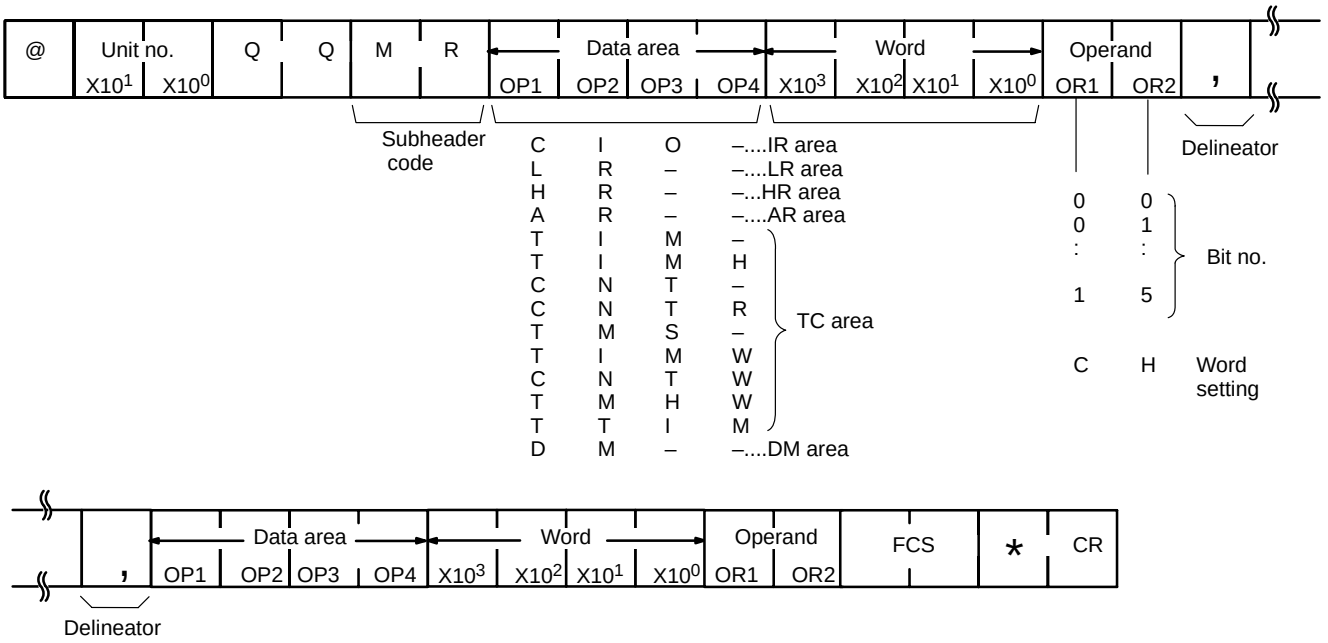


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4-43 I/O REGISTER

Registers the IR, LR, HR, AR, or TC area bit, or the DM word that is to be read via I/O READ (described in the next subsection). Registered data is retained until new data is registered, or the power is turned OFF.

Command Format



Setting Table

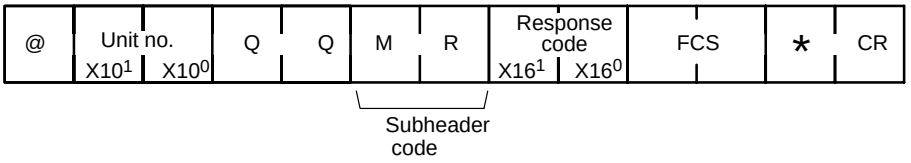
	Data Area	Word	Operand	Response
Bit	IR	0000 to max. Wd	00 to 15	ON/OFF status of specified bit
	LR	0000 to max. Wd	00 to 15	ON/OFF status of specified bit
	HR	0000 to max. Wd	00 to 15	ON/OFF status of specified bit
	AR	0000 to max. Wd	00 to 15	ON/OFF status of specified bit
	TIM/CNT	0000 to max. Wd	Anything other than "CH"	ON/OFF status of specified bit
Wd	IR	0000 to max. Wd	"CH"	Word contents
	LR	0000 to max. Wd	"CH"	Word contents
	HR	0000 to max. Wd	"CH"	Word contents
	AR	0000 to max. Wd	"CH"	Word contents
	TIM/CNT	0000 to max. Wd	"CH"	ON/OFF status of Completion Flag and PV
	DM	0000 to max. Wd	Any characters	Word contents

The maximum number of data items for the C120 and C500 PCs is 140; and for the C200H, C200HS, C200HX, C200HG, C200HE, C1000H, C2000H PCs the maximum is 128. However, the C200H, C200HS, C200HX, C200HG, C200HE, C1000H, C2000H PCs count the TC area word specification as two items.

The data is registered in the same sequence in which it was specified.

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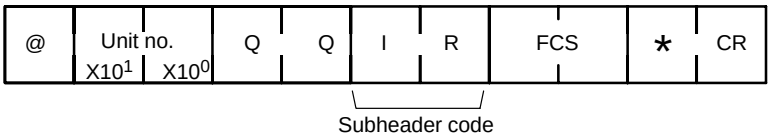
Response Format



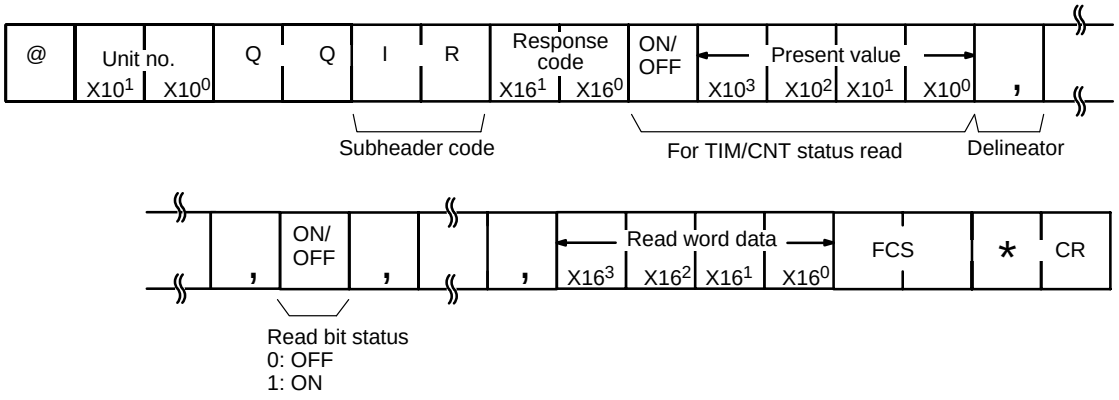
4-44 I/O READ

Reads the data specified by I/O REGISTER.

Command Format



Response Format



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4-45 Response Code List

A response code is returned with each response to a command to indicate the results of executing the command. A response code of 00 indicates that the command was completed normally. All other response codes indicate errors that prevented proper command execution and tell something about the cause of the error.

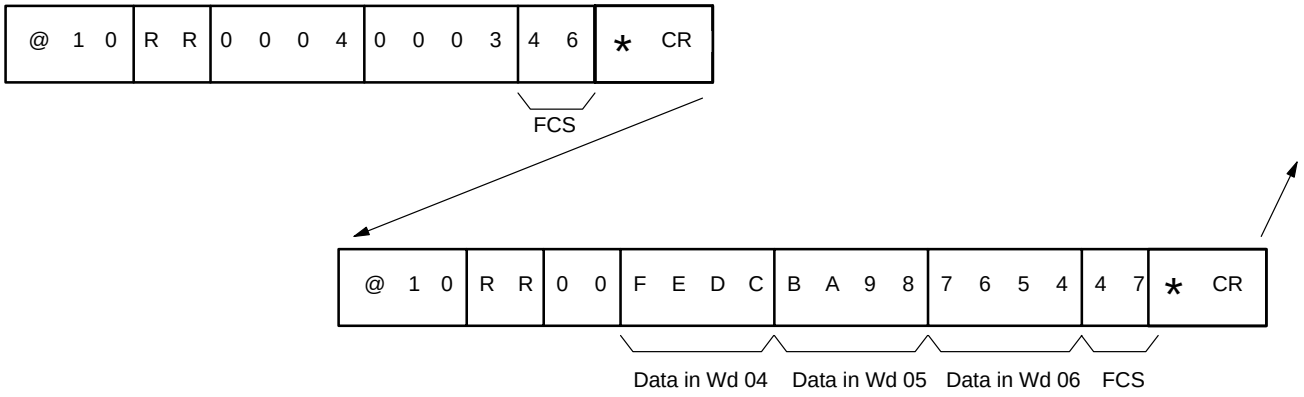
$x16^1$	$x16^0$	Description
0	0	Command completed normally.
0	1	Execution was not possible because the PC is in RUN mode. Change the PC mode.
0	2	Execution was not possible because the PC is in MONITOR mode. Change the PC mode.
0	3	Execution was not possible because PROM is mounted. Change the unit to RAM or EEPROM.
0	4	Address overflow (data overflow). Check the program.
0	B	Execution was not possible because the PC is in PROGRAM mode. Change the PC mode.
0	C	Execution was not possible because the PC is in DEBUG mode. Change the PC mode.
0	D	Execution was not possible because the Host Link Unit's keyswitch is set to LOCAL mode or because the command was sent to a C2000H CPU that was on standby. Change the mode or send the command to the active CPU.
1	0	Parity error.
1	1	Framing error (stop bit(s) not detected).
1	2	Overrun (the next command was received too soon).
1	3	FCS error (checksum error).
1	4	Command format error.
1	5	An incorrect data area designation was made for READ or WRITE.
1	6	Instruction not found.
1	8	Frame length error (maximum length exceeded).
1	9	Execution was not possible because of an unexecutable error clear, memory error, EEPROM write disabled, etc.
2	0	I/O table generation was not possible (unrecognized Remote I/O Unit, word overflow, duplicated word allocation).
2	1	An error occurred in the PC's CPU.
2	2	The specified Memory Unit does not exist.
2	3	The specified Memory Unit is write-protected.
A	0	Aborted due to parity error in transmit data.
A	1	Aborted due to framing error in transmit data.
A	2	Aborted due to overrun in transmit data.
A	3	Aborted due to FCS (checksum) error in transmit data.
A	4	Aborted due to format error in transmit data.
A	5	Aborted due to entry number data error in transmit data.
A	8	Aborted due to frame length error in transmit data.
B	0	Not executable because the program area is not 16 kbytes.
Other		Remove any possible causes of noise and resend the command.

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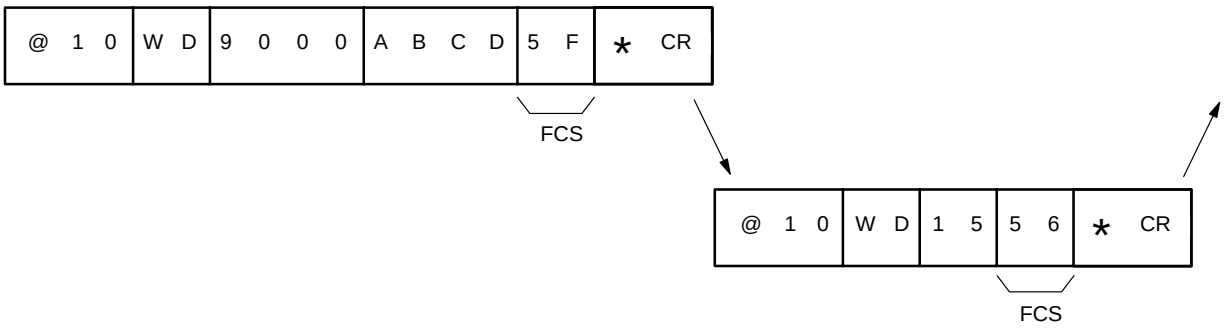
4-46 Communications Examples

The following are examples of commands from the host computer (first line) and the responses that would be given by the Host Link Unit (second line). The arrows indicate the transfer of the right to transmit.

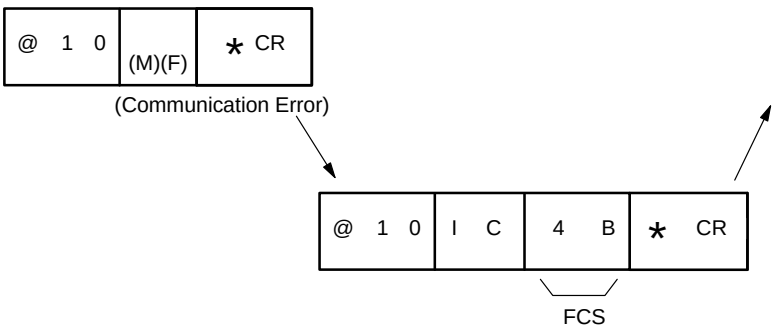
Reading Data from Multiple PC Words (Wd IR 04 to 06) (Normal Completion)



Wd 9000 Specified by Mistake in a DM AREA WRITE Command

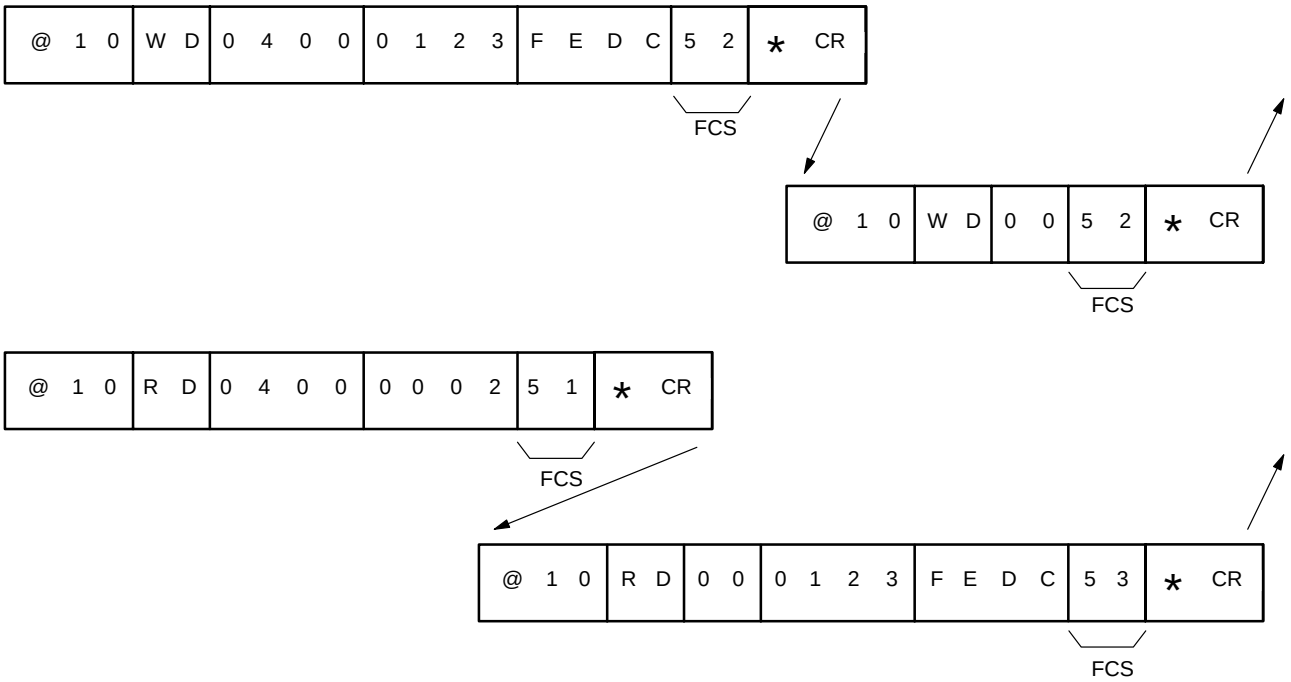


Header Code Destroyed During ERROR READ Operation



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Writing Data into PC Words (“0123” to Wd DM 400 and “FEDC” to Wd DM 401) and Confirming with DM AREA READ.



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SECTION 5
Error Processing

This section describes errors that can occur in a computer-linked system employing one or more Host Link Units and how to remedy them.

5-1 Development of an Error-processing Program 100
5-2 Error Control 101
5-2-1 Invalid Processing 101
5-2-2 Process Interruption 101
5-2-3 Time Monitoring 101
5-2-4 Retries 101
5-3 Example Host Computer Program 102
5-4 Troubleshooting 103

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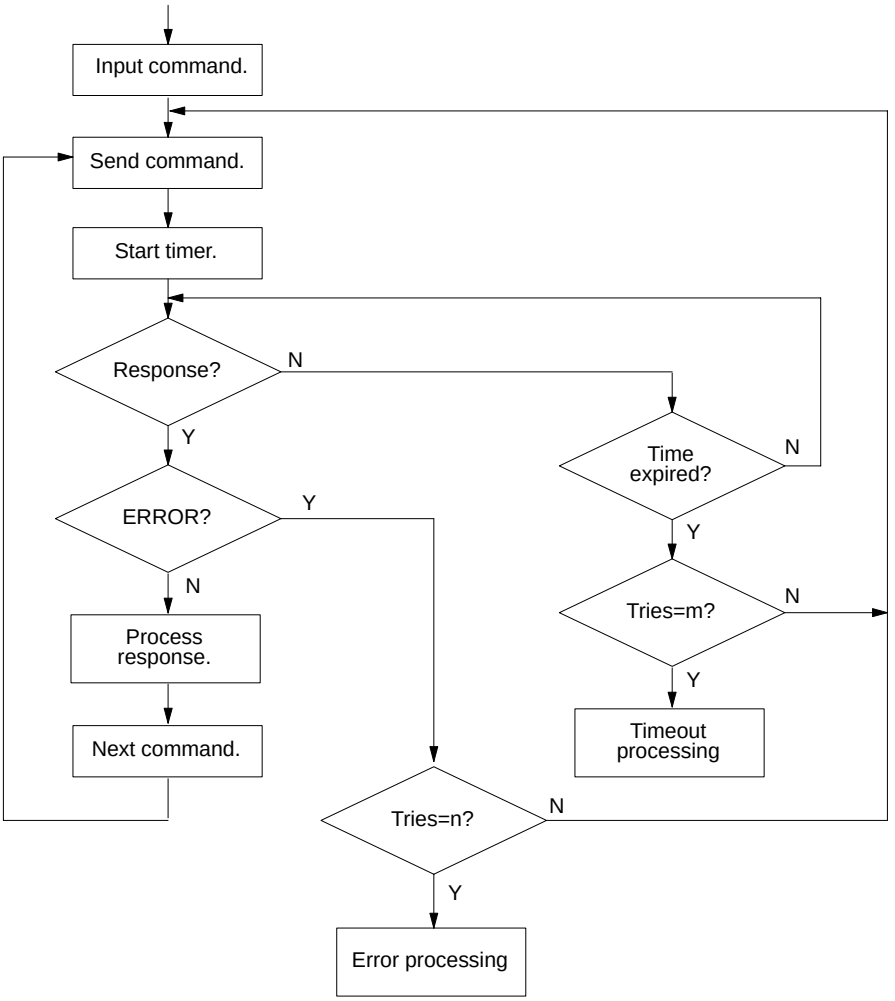
5-1 Development of an Error-processing Program

Errors that occur in Host Link systems are classified into the following three categories:

1, 2, 3...

1. Errors indicated by the Host Link Unit (see *5-4 Troubleshooting*).
2. Errors processed by the PC (see the *Restart and Error Flags* sub-section for each group of models in *Section 2 Host Link Unit Characteristics*).
3. Errors processed by the host computer (see *5-2 Error Control, 3-2 Communications Protocol,* and all of *Section 4 Commands and Responses*, especially *4-35 ABORT and INITIALIZE*, and *4-45 Response Code List*).

Programs to monitor communication times and error handling need to be developed on the host computer. Be sure that these include processes that can respond appropriately to errors and other abnormalities from the PC by taking into consideration the kinds of errors described in the sections listed above. An example of the logic processes that need to be considered is given in the in the following flow-chart.



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5-2 Error Control

The host computer is responsible for ensuring system recovery after errors occur in the Host Link Unit.

The Host Link Unit runs the following checks to detect errors:

1, 2, 3...

1. Parity check
2. Framing check
3. Overrun check
4. Format check
5. Entry data check (The start word, read word, etc., in the command format.)
6. Frame Checksum (An Exclusive OR check is performed on all command or response data, from the unit number to the end of the text.)

Of the above commands, 1 to 3 are performed on a character by character basis. Checks 4 to 6, however, are performed on each block (frame).

Transmit data in a multiple-link system is checked by means of a parity check and a Frame Checksum (FCS). The FCS check is not performed in single-link systems.

5-2-1 Invalid Processing

If the Host Link Unit detects an error in a single-frame command or the first frame of a command block, it will regard the command as invalid. The command will not be processed and, after the terminator is received, an error response will be sent to the host computer. (For details of the error response, refer to *4-38 Response Indicating an Unprocessed Command*.

5-2-2 Process Interruption

If the Host Link Unit detects an error in an intermediate frame, the commands up to that point will be processed normally. Those following the erroneous frame, however, will not be processed. After the Host Link Unit has received the terminator of the erroneous block, it responds with a response code that informs the host computer of the process interruption. (For details, refer to *4-45 Response Code List*.)

5-2-3 Time Monitoring

If the Host Link Unit does not receive a delimiter or terminator, it cannot send a response to the host computer. Similarly, if the computer does not receive a delimiter or terminator, it cannot transmit further commands to the Host Link Unit. To allow transmission to alternate smoothly between the computer and the Host Link Unit, the process times need to be monitored. It is therefore necessary to have a time-monitoring program on the host computer side. Its purpose is to initiate remedial action if the right to transmit is not transferred quickly enough.

5-2-4 Retries

An error response will be returned to the originating device if the Host Link Unit detects any communications line data that has been destroyed (e.g., by noise). If, however, the Unit number has also been lost, no response will be made at all. It is therefore necessary to have response monitoring and retry processing in the host computer to check for error responses.

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5-3 Example Host Computer Program

This example program causes arbitrary data to be written from the host computer to DM 0001. A timer is included to retry transmission if the timer times out. An error message is displayed after 3 time outs.

- OMRON FC-986 Host Computer
  Host Link Unit:
  C200H-LK101-PV1/LK201-V1/LK202-V1
  3G2A5-LK101-(P)EV1/LK201-EV1/LK103(-P)
  C500-LK203
  3G2A6-LK101-(P)EV1/LK201-EV1/LK202-EV1

```
10  OPEN "CQM1:E37NN" AS #1 . ..... Opens RS-232C
20  NG=0:I=0:CNT=0
30  INPUT "TEST DATA INPUT-----";TD$  . . Inputs test data.
40  TC$="@00WD0001"
50  TC$=TC$+TD$
60  GOSUM *FCSSET . ..................... Calculates FCS.
70  TXD$=T$+FCS$+"*"+CHR$(13)
80  PRINT  "TXD$=";TXD$
90  PRINT #1,TXD$; . ..................... Transmission
100  IF LOC(1)<>0 GOTO 140 . ............. Determines whether data was received.
110  CNT=CNT+1
120  IF CNT=1000 GOTO 1000 . ............. The value of CNT determines the timer setting.
130  GOTO 100
140  INPUT #1,RXD$
150  R$=MID$(RXD$,6,2)
160  IF R$<>"00" GOTO 2000 . ............. Determines whether communications were completed normally.
170  PRINT "RXD$=";RXD$+"           OK"
180  GOTO 20
1000  REM  *****TIME UP*****
1005  CNT=0
1020  ER$(NG)="TIME UP"
1025  NG=NG+1
1030  IF NG=3 GOTO 3000 . ................ Sets 3 retries.
1040  GOTO 80
2000  REM  *****ERROR RESPONSE****
2020  ER$(NG)=RXD$+"           NG"
2025  NG=NG+1
2030  IF NG=3 GOTO 3000 . ................ Sets 3 retries.
2040  GOTO 80
3000  REM  *****ERROR MESSAGE*****
3010  PRINT "AN ERROR OCCURRED"
3020  PRINT "RXD$-1=";ER$(0)
3030  PRINT "RXD$-2=";ER$(1)
3040  PRINT "RXD$-3=";ER$(2)
3050  GOTO 20
4000  REM  *****FCS CALCULATION*****
4010  *FCSSET
4020  L=LEN(T$)
4030  A=0
4040  FOR J=1 TO L
4050  TJ$=MID$(T$,J,1)
4060  A=ASC(TJ$) XOR A
4070  NEXT J
4080  FCS$=HEX$(A)
```


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```
4090  IF LEN(FCS$)=1 THEN FCS$="0"+FCS$
4100  RETURN
```

5-4 Troubleshooting

The following troubleshooting guide outlines the basic steps for remedying the errors most likely to occur when using Host Link Units.

Problem		Possible Cause	Remedy	Reference
RUN indicator does not light. (When power is applied to the Host Link Unit, and the reset is released, the indicator should illuminate.)		Power is not applied to the PC. Faulty contact in the connector between the PC and the Host Link Unit. PC is resetting the Host Link Unit. Host Link Unit is defective.	Apply power to the PC. Check and repair connections. Turn the PC OFF, then ON. If necessary, check the PC for an error or abnormal reset. Replace the Host Link Unit.	
RCV indicator does not blink. (When a signal is input at the receive connector, the indicator should blink regardless of the nature of the signal.)		No signal is being output form the host computer. The signal from the host computer is not reaching the Host Link Unit. The indicator circuit is defective.	Check the program and output of the host computer. Check the wiring: • Cable not connected? • Cable damaged? • Cable incorrectly connected? • Faulty contact in connector? If the signal is being transmitted and received normally, the Host Link Unit is faulty and needs to be replaced.	*Sections 1* and *2*
XMT indicator does not illuminate after the RCV indicator. (If the Unit number on the computer side matches that of the Host Link Unit, the Host Link Unit receives the terminator, the CTS signal then goes ON, and the Host Link Unit sends data irrespective of its nature.)		The unit numbers of the computer and the Host Link Unit do not match. The Host Link Unit is not receiving a terminator. The signal is ignored because the Host Link Unit cannot correctly read it. • Transmission speeds of the host computer and the Host Link Unit do not match. • Incorrect wiring. • Incorrect setting for the termination resistance. Parities or transmission codes don't match. Error in operating level setting.	Check the unit number settings. Check whether the host computer is outputting a terminator. Check the settings of the Host Link Unit and the Link Adapter. Check the wiring for the CTS signal. Check the parity or transmission code settings. Check the operating level settings.	*Section 2* *Section 1* *Section 2*
ERR indicator illuminates.		Parity error (even parity). Framing error. Overrun error. Occurrence of momentary power failure.	Send correct data. If a momentary power failure occurs, both the PC and the Host Link Unit are reset and initialized. The ERRor indicator will turn off.	*Sections 2* and 3
Although the XMT indicator illuminates, the Host Link Unit cannot send a response to the host computer.		Operation error on the host computer side. • I/O channel processing error. • Program error. The correct signal is not reaching the host computer. • Cable damage. • Incorrect cable wiring. • Faulty contact in connector.	---	*Section 2*
RUN indicator blinking. (C200H-LK101-PV1/ LK201-V1/ LK202-V1 only)	Error indicator not lit.	Error in unit number, transmission speed, command level, parity, or transmission code setting.	Correct the setting and restart the Host Link Unit.	*Section 2*
	Error indicator lit.	Error detected between the Host Link Unit and CPU.	Turn power off and then back on. Replace the Host Link Unit.	

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Appendix A
Standard Models

Product	Description	Model Number
Host Link Unit	C200H Rack-mounting (two per PC) (APF/PCF/H-PCF)	C200H-LK101-PV1
		C200H-LK201-V1
		C200H-LK202-V1
	C500 Rack-mounting (one per PC)	3G2A5-LK101-PEV1
		3G2A5-LK101-EV1
		3G2A5-LK201-EV1
	C500 Rack-mounting (two per PC) (APF/PCF/H-PCF)	C500-LK103-P
		C500-LK103
		C500-LK203
	CPU-mounting (APF/PCF/H-PCF)	3G2A6-LK101-PEV1
		3G2A6-LK101-EV1
		3G2A6-LK201-EV1
		3G2A6-LK202-EV1
Link Adapter	RS-422 (3 connectors)	3G2A9-AL001
	Optical (PCF/H-PCF) (3 connectors)	3G2A9-AL002-E
	Optical (APF/PCF/H-PCF) (3 connectors)	3G2A9-AL002-PE
	Optical (PCF/H-PCF), RS-232C, RS-422 (1 connector each)	3G2A9-AL004-E
	Optical (APF/PCF/H-PCF), RS-232C, RS-422 (1 connector each)	3G2A9-AL004-PE
	Optical (PCF/H-PCF), optical (AGF) (1 connector each)	3G2A9-AL005-E
	Optical (APF/PCF/H-PCF), optical (AGF) (1 connector each)	3G2A9-AL005-PE
	Optical (PCF/H-PCF) (1 connector), optical (AGF) (2 connectors)	3G2A9-AL006-E
	Optical (APF/PCF/H-PCF) (1 connector), optical (AGF) (2 connectors)	3G2A9-AL006-PE

Optical Interface

(Used to interface C500-LK203, 3G2A5-LK201-EV1, and 3G2A6-LK201-EV1 Host Link Units.)

Product	Description	Model Number
Optical Interface	RS-232C to optical converter	Z3RN-A-5
Optical Fiber Cable	1, 5, 10, 20, 30, 50, 100, 200, 400, or 500 m. (Replace "□" in model number with the desired cable length)	Z3F2-4D□M
AC Adapter	For Optical Interface power supply. One required for C500-LK203; two for 3G2A5-LK201-EV1 or 3G2A6-LK201-EV1 Host Link Units.	Z3GP-01

Connecting Cable

RS-422 and RS-232C connecting cables must be provided by the user.

I/O Cables

RS-422 and RS-232C connecting cables must be provided by the user.

Type	Connector	Connector cover	Maker
RS-232C	XM2A-2501	XM2S-2511	OMRON
	DB-25P	DB-C2-J9	JAE
RS-422	XM2A-0901	XM2S-0911	OMRON
	DE-9E	DE-C1-J6	JAE

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Plastic Optical Fiber Cable

Host Link Units with the suffix -P in the model number can be extended up to 20 m. The optical connector of the 3G5A2-PF002 must supplied by the user.

Product	Description	Model Number
Plastic optical fiber cable	Cable only (without optical connector). Order in multiples of 5 m (from 5 to 100 m), or in lengths of 200 m or 500 m.	3G5A2-PF002
Optical connector A	2 Optical connectors (brown). For plastic optical fiber cable 8 to 20 m long.	3G5A2-CO001
Optical connector B	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.	3G5A2-PF101

Hard-clad Plastic Optical Fiber (H-PCF)

Product	Description	Model Number
Hard-clad plastic optical fiber (H-PCF)	Two-core optical cord type. Length: 1,000 m; color: black	S3200-HBCB103
	Two-core optical cord type. Length: 10 m; color: black	S3200-HBCB101
	Two-core optical cord type. Length: 50 m; color: black	S3200-HBCB501
	Two-core optical cord type. Length: 100 m; color: black	S3200-HBCB102
	Two-core optical cord type. Length: 500 m; color: black	S3200-HBCB502
	Without tension member type (for fit). Length: 10 m; color: orange	S3200-HCCO101N
	Without tension member type (for fit). Length: 50 m; color: orange	S3200-HCCO102N
	Without tension member type (for fit). Length: 100 m; color: orange	S3200-HCCO501N
	Without tension member type (for fit). Length: 500 m; color: orange	S3200-HCCO502N
	Without tension member type (for fit) Length: 1,000 m; color: orange	S3200-HCCO103N
	With tension member type (for fit). Length: 10 m; color: black	S3200-HCCB101
	With tension member type (for fit) Length: 50 m; color: black	S3200-HCCB501
	With tension member type (for fit). Length: 100 m; color: black	S3200-HCCB102
	With tension member type (for fit). Length: 500 m; color: black	S3200-HCCB502
	With tension member type (for fit). Length: 1,000 m; color: black	S3200-HCCB103
	With tension member type (for fit). Length: 10 m; color: orange	S3200-HCCO101
	With tension member type (for fit). Length: 50 m; color: orange	S3200-HCCO501
	With tension member type (for fit). Length: 100 m; color: orange	S3200-HCCO102
	With tension member type (for fit). Length: 500 m; color: orange	S3200-HCCO502
	With tension member type (for fit) Length: 1,000 m; color: orange	S3200-HCCO103
Optical connector	SYSMAC BUS or SYSMAC WAY connector	S3200-COCH82
Optical power tester	SYSMAC BUS or SYSMAC WAY optical characteristics measurement power tester	S3200-CAT2820
Head set	SYSMAC BUS or SYSMAC WAY optical power tester head set	S3200-CAT2822
Master fiber set	SYSMAC BUS or SYSMAC WAY optical power tester master fiber	S3200-CAT2821

Note In the case of SYSMAC WAY and SYSMAC BUS, the maximum available length between units is 200 m.

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Plastic-clad Optical Fiber Cable

Host Link Units with the suffix -P in the model number can be extended up to 200 m by using plastic-clad optical fiber cable. Those without the suffix -P in the model number can be extended up to 800 m.

Cable Type	Description	Operating Environment	Model Number
Indoor	0.1 m, with connector	Operating temperature: –10° to 70°C	3G5A2-OF011
	1 m, with connector		3G5A2-OF101
	2 m, with connector		3G5A2-OF201
	3 m, with connector		3G5A2-OF301
	5 m, with connector		3G5A2-OF501
	10 m, with connector		3G5A2-OF111
	20 m, with connector		3G5A2-OF211
	30 m, with connector		3G5A2-OF311
	40 m, with connector		3G5A2-OF411
	50 m, with connector		3G5A2-OF511
Indoor/outdoor	1 to 500 m, with connector (order in multiples of 1 m)	Operating temperature: –10° to 70°C	3G5A2-OF002
	501 to 800 m, with connector (order in multiples of 1 m)	Operating temperature: 0° to 55°C (Do not expose to direct sunlight)	

Note Since the optical fiber cable cannot be spliced as easily as ordinary cables when damaged or extended, be sure to install an adequate length. The cable lengths above do not include connectors.

Crystal Fiber Cable (AGF)

Crystal fiber cable is not available from OMRON. It must be obtained from an alternative supplier.

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Appendix B
Specifications

Communications

Communications	2-fiber, half duplex: -LK10□ models 4-wire, half duplex: -LK20□ models
Synchronization	Start/stop: 1 stop bit (JIS) or 2 bits (ASCII)
Transmission speed	300, 600, 1,200, 2,400, 4,800, 9,600, or 19,200 bps (switch-selectable)
Character code	ASCII (7 bits) or JIS (8 bits)
Error check	Parity and FCS
Interface*	Optical fiber: -LK10□ models RS-232C, RS-422: -LK20□ models

*Model numbers indicate the maximum transmission distance as given in the following tables.

Transmission Distance

Optical Fiber Cables

Model Number	APF	H-PCF	PCF
C200H-LK101-PV1	20 m	100 m	200 m
3G2A5-LK101-PEV1	20 m	100 m	200 m
3G2A6-LK101-PEV1	20 m	100 m	200 m
C500-LK103-P	20 m	100 m	200 m
3G2A5-LK101-EV1	Cannot be connected	200 m	800 m
3G2A6-LK101-EV1	Cannot be connected	200 m	800 m
C500-LK103	Cannot be connected	200 m	800 m

Wire Cables

Model Number	Interface	Transmission Distance
C200H-LK202-V1	RS-422	10 m/branch (500 m total*)
C200H-LK201-V1	RS-232C	15 m
3G2A5-LK201-EV1	RS-232C	15 m
C500-LK203	RS-422	10 m/branch (500 m total*)
3G2A6-LK201-EV1	RS-232C	15 m
3G2A6-LK202-EV1	RS-422	10 m/branch (500 m total*)

*Total in the system.

Weight

C200H-LK101-PV1 C200H-LK201-V1 C200H-LK202-V1	400 g max.
3G2A5-LK101-(P)EV1 3G2A5-LK201-EV1 C500-LK103(-P) C500-LK203	800 g max.
3G2A6-LK101-(P)EV1 3G2A6-LK201-EV1 3G2A6-LK202-EV1	600 g max.

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Power Consumption

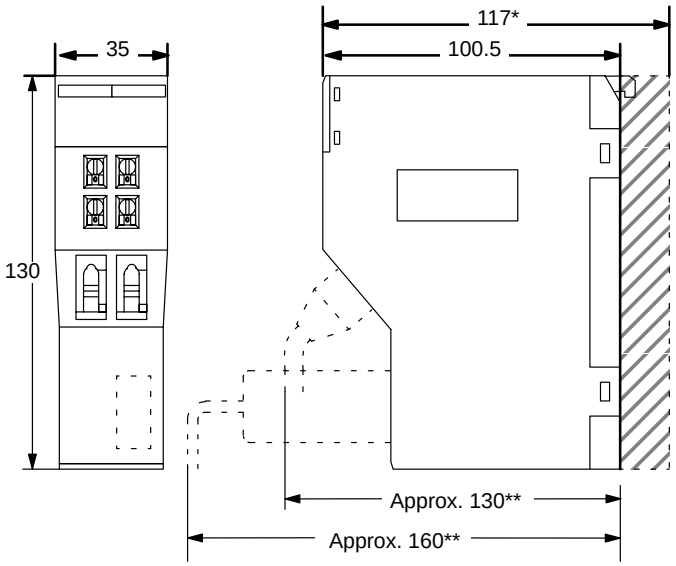
C200H-LK101-PV1 C200H-LK201-V1* C200H-LK202-V1	0.25 A max. at 5 VDC
3G2A5-LK101-(P)EV1 3G2A5-LK201-EV1 C500-LK103(-P) C500-LK203* 3G2A6-LK101-(P)EV1 3G2A6-LK201-EV1 3G2A6-LK202-EV1	1 A max. at 5 VDC

*Internal power consumption increases by 0.1 A when using the Z3RN-A-5.

Host Link Unit Dimensions

C200H

All C200H Units have dimensions as given below.

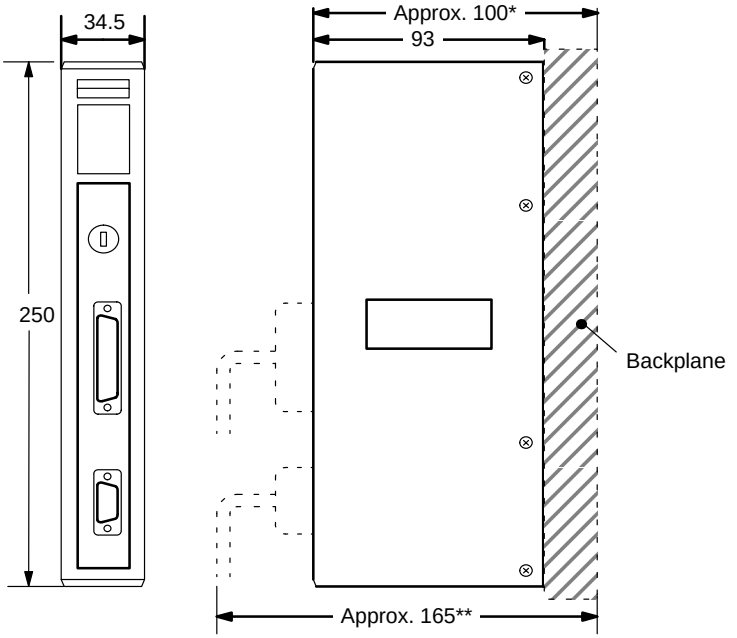


* Including backplane
** Including Connector

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C500 (3G2A5)

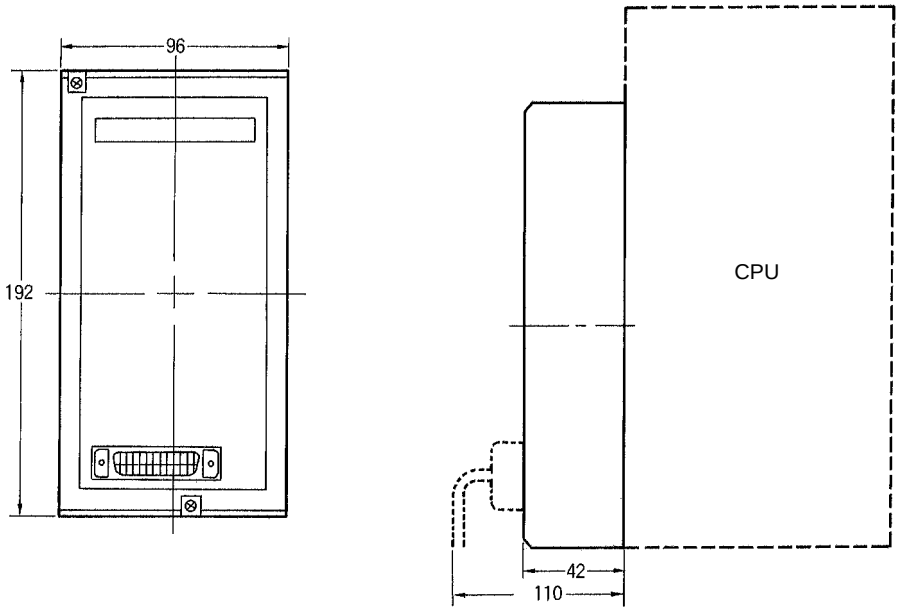
The dimensions for C500 (3G2A5) Units are as given below.



* Including Backplane
** Including Backplane and connector

C120 (3G2A6)

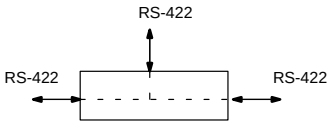
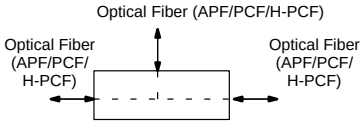
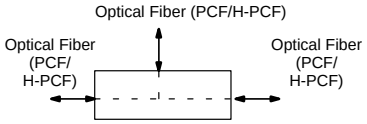
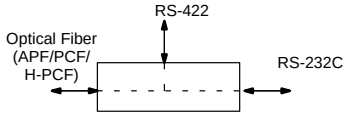
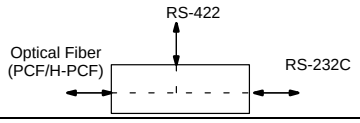
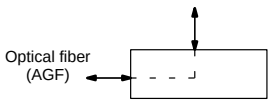
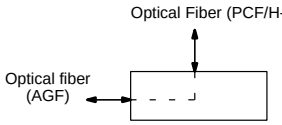
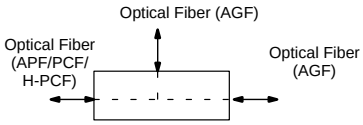
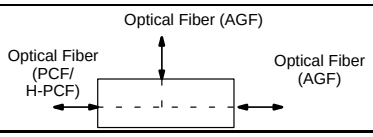
The dimensions for C120 (3G2A6) CPU-mounting Units are as detailed in the following diagrams.



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Link Adapter

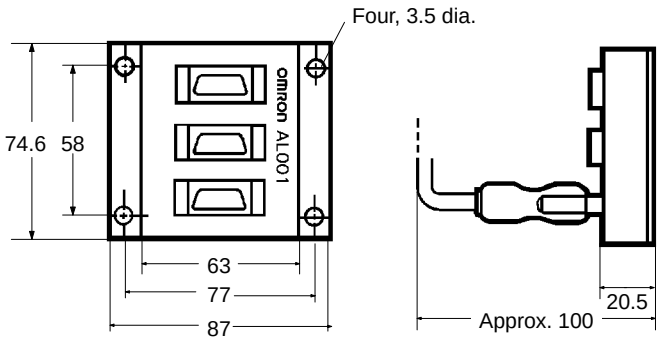
The following gives the specifications for Link Adapters suitable for use with the Host Link Units. Care should be taken to to choose a Link Adapter with the appropriate connections for the Units in the System. Other Link Adapters may be included in the System in association with other types of Host Link Units (refer to the applicable *Host Link Manual* or *Link Adapter Manual*).

Link Adapter	Connection	Supply voltage	Operating voltage range	Power Consumption	Weight
3G2A9-AL001		Not required	---	---	250 g max.
3G2A9-AL002-PE		100/200 VAC or 12 to 24 VAC/DC	85 to 132 /170 to 264 VAC or 10.2 to 26.4 VAC/DC	10 VA max.	900 g max.
3G2A9-AL002-E					
3G2A9-AL004-PE		110 to 120 VAC/ 220 to 240 VAC	94 to 132 VAC 187 to 264 VAC	10 VA max.	1 kg max.
3G2A9-AL004-E					
3G2A9-AL005-PE		100/200 VAC or 12 to 24 VAC/DC	85 to 132 /170 to 264 VAC or 10.2 to 26.4 VAC/DC	10 VA max.	1.5 kg max.
3G2A9-AL005-E					
3G2A9-AL006-PE		100/200 VAC or 12 to 24 VAC/DC	85 to 132 /170 to 264 VAC or 10.2 to 26.4 VAC/DC	10 VA max.	1.5 kg max.
3G2A9-AL006-E					

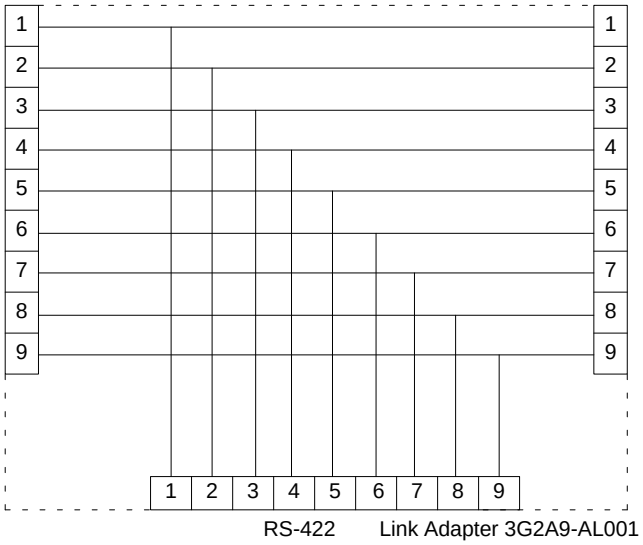
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3G2A9-AL001 Link Adapter

Dimensions



Cable Wiring



Applicable Connector

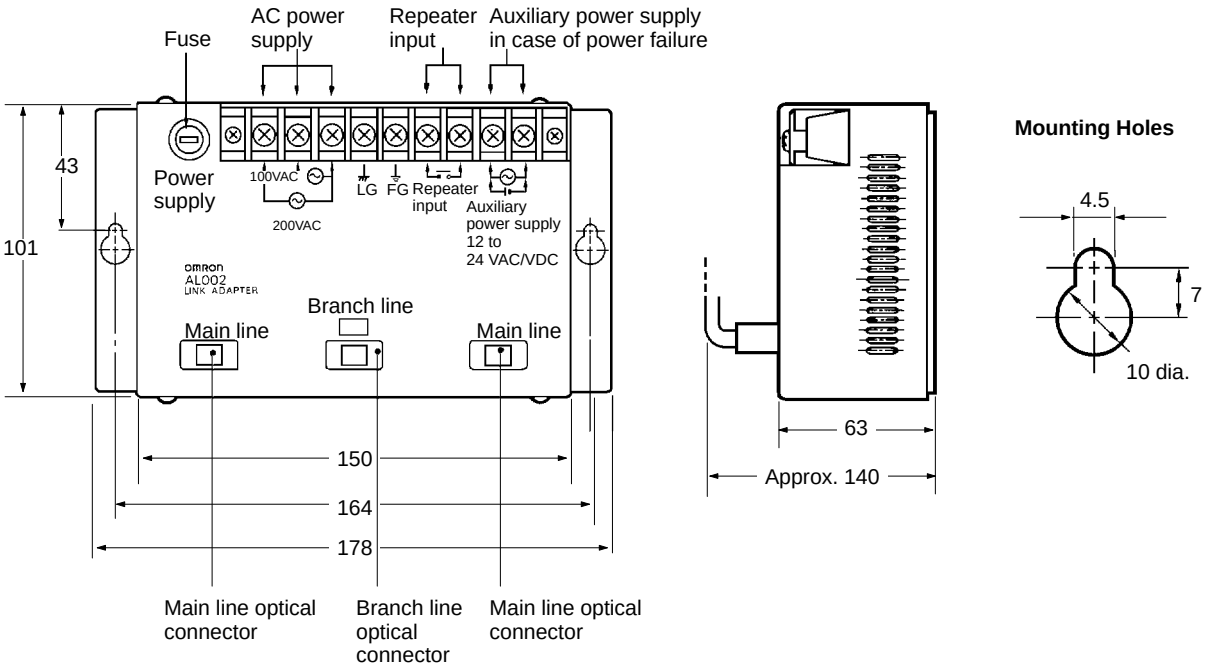
Connector	Cover	Maker
XM2A-0901	XM2S-0911	OMRON
DE-9P	DE-C1-J6	JAE

Three RS-422 connectors are included with the 3G2A9-AL001.

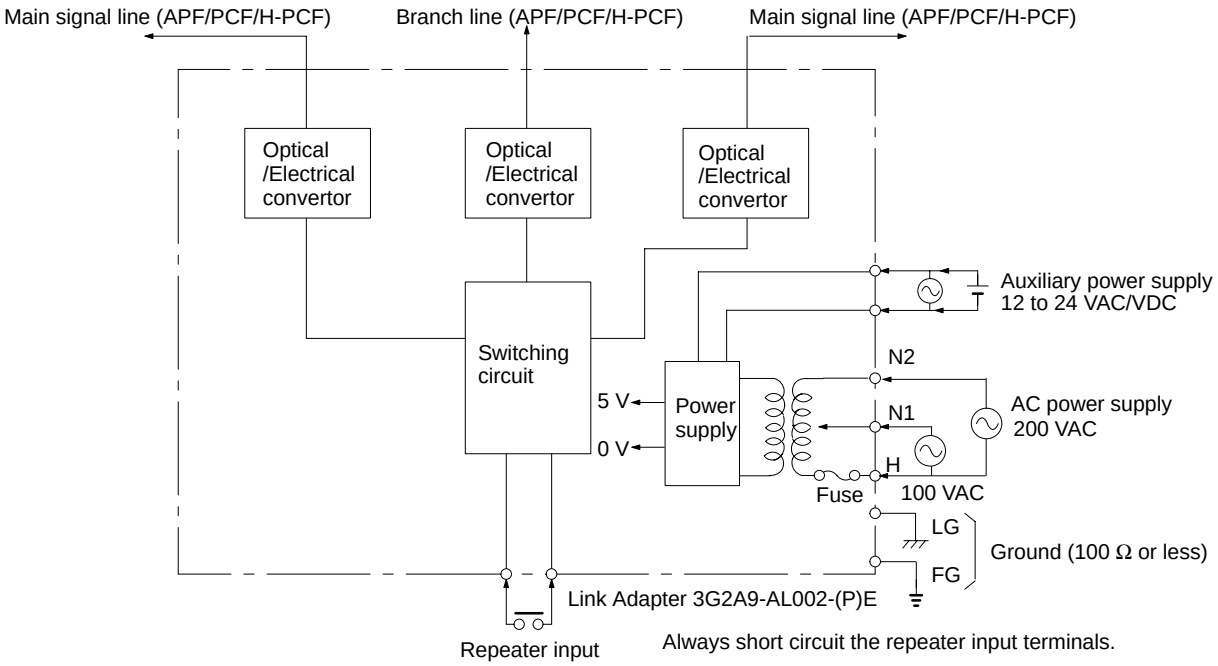
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3G2A9-AL002-(P)E Link Adapter

Dimensions



Internal Configuration



Power Supply Connection

100 V	200 V
	← Ground power line
← Ground power line	
← Live power line	← Live power line

The fuse is located on the common side of the power supply, so connect the live AC power line (HOT LINE) to the common terminal.

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Installing the Link Adapter

Use the Link Adapter with a supply of either 100/200 VAC or 12 to 24 VDC/VAC power.
Short circuit the repeater input terminals.
When installing the Link Adapter anywhere it could come into contact with people, be sure to set the Link Adapter up so that the terminal block won't be touched accidentally.

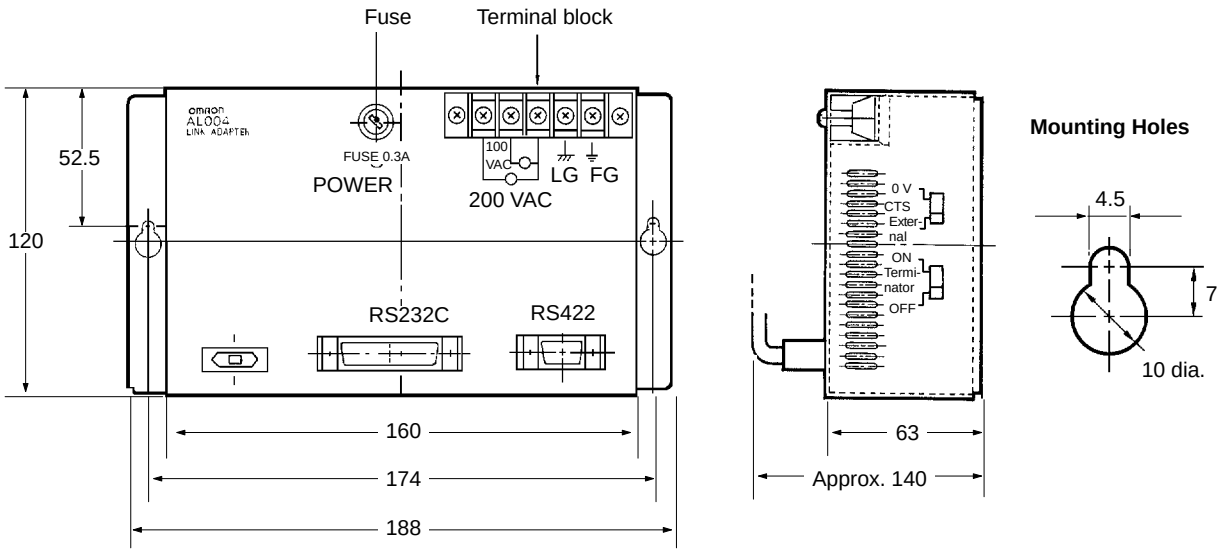
Cable Length

Cable	3G2A9-AL002-PE	3G2A9-AL002-E
APF	20 m	Not available
H-PCF	100 m	200 m
PCF	200 m	800 m

Note
1. Always short circuit the repeater input terminals. The Unit will not operate unless these terminals are shorted.
2. Always cap unused Optical Connectors. If the connectors are not capped, ambient light interference can enter the Optical Fiber Cable and cause transmission errors.

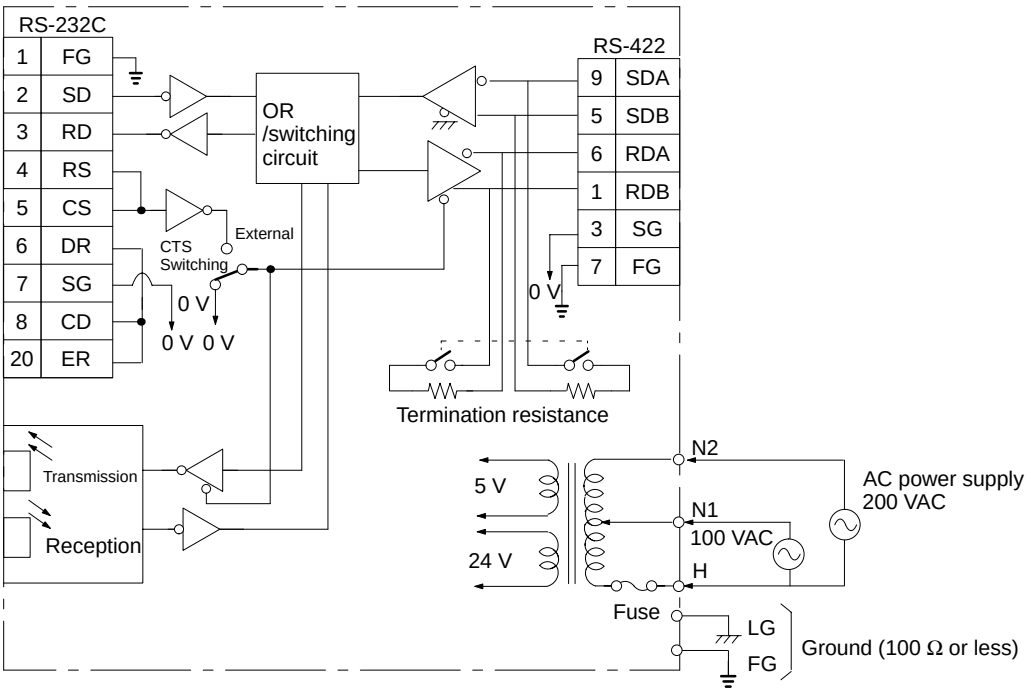
3G2A9-AL004-(P)E Link Adapter

Dimensions



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Internal Configuration



CTS (CS) Switching

Set to 0 V when the CTS (Clear-To-Send) signal will usually be ON. Set to External when the signal is received externally.

Termination Resistance Setting

Set to ON to connect the internal termination resistance (220 Ω) and set to OFF to disconnect the internal termination resistance.

Power Supply Connection

100 V	200 V
	← Ground power line
← Ground power line	
← Live power line	← Live power line

The fuse is located on the common side of the power supply, so connect the live AC power line (HOT LINE) to the common terminal.

Installing the Link Adapter

When installing the Link Adapter anywhere it could come into contact with people, be sure to set the Link Adapter up so that the terminal block won't be touched accidentally.
Never use the Unit when the Terminal Block Cover is off. Be sure that the Terminal Block Cover is securely attached.

Cable Length

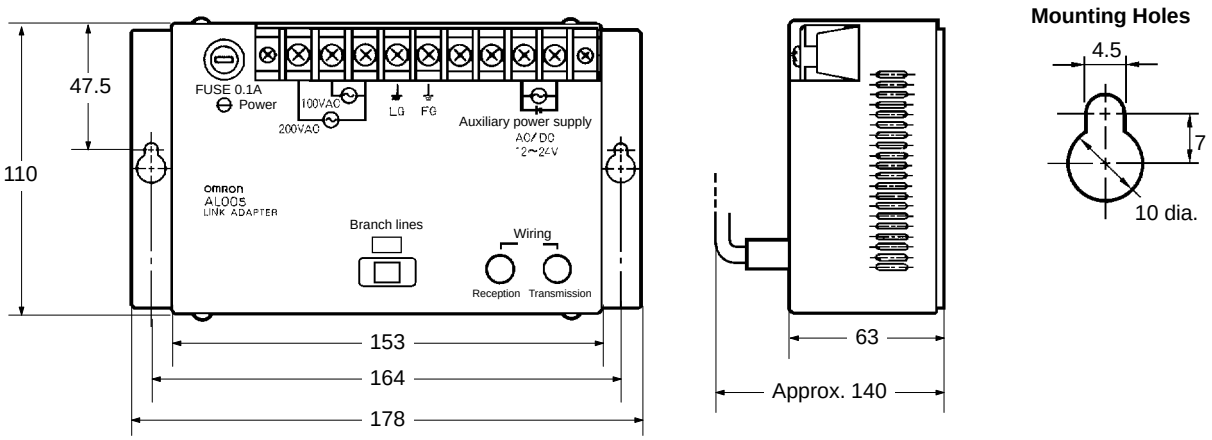
Cable	3G2A9-AL004-PE	3G2A9-AL004-E
APF	20 m	Not available
H-PCF	100 m	200 m
PCF	200 m	800 m

Note Always cap unused Optical Connectors. If the connectors are not capped, ambient light interference can enter the Optical Fiber Cable and cause transmission errors.

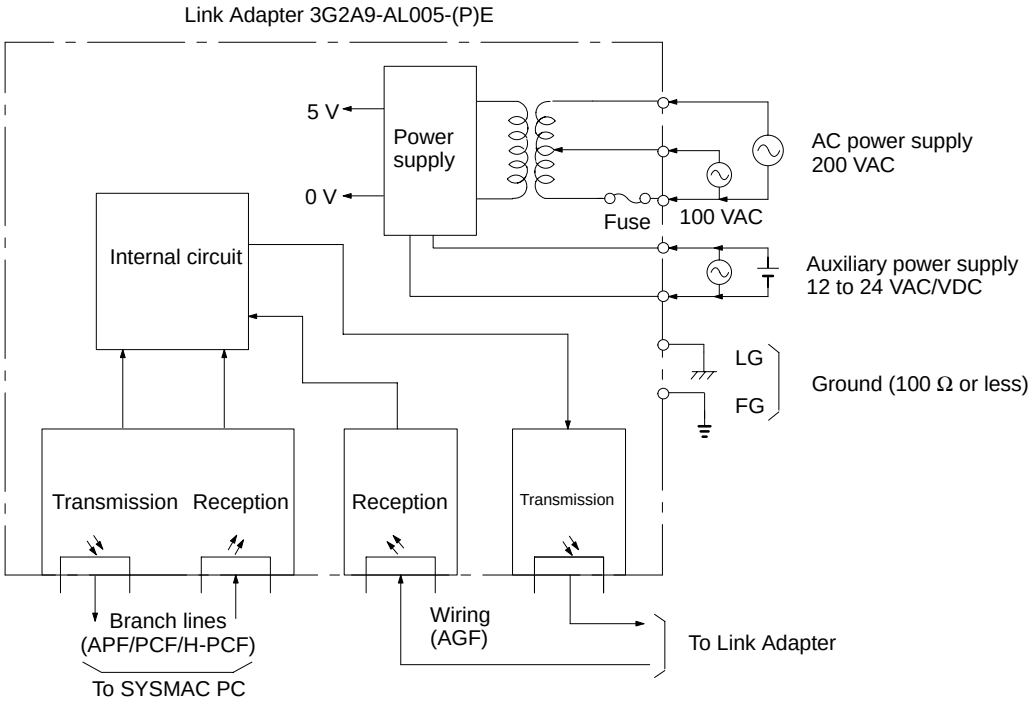
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3G2A9-AL005-(P)E Link Adapter

Dimensions



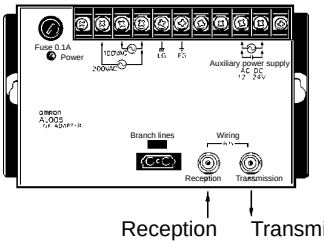
Internal Configuration



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Installing the Link Adapter

Use the Link Adapter with a supply of either 100/200 VAC or 12 to 24 VDC/VAC power.
Use FC connectors for the AGF cables.
Connect the AGF cables correctly to the transmission and reception terminals.

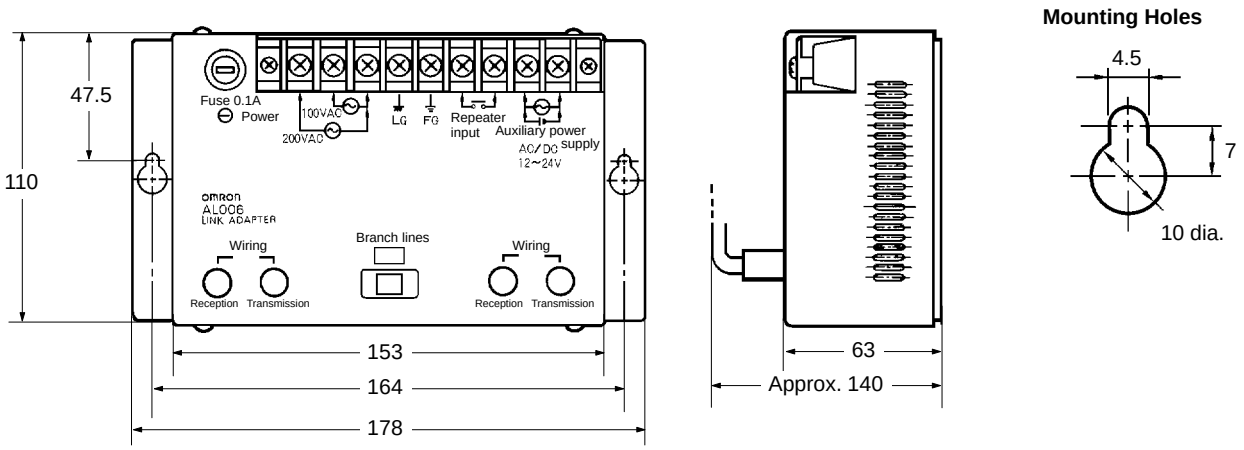


Cable Length (Max.)

Cable	3G2A9-AL005-PE	3G2A9-AL005-E
APF	20 m	Not available
H-PCF	100 m	200 m
PCF	200 m	800 m
AGF	3 km	3 km

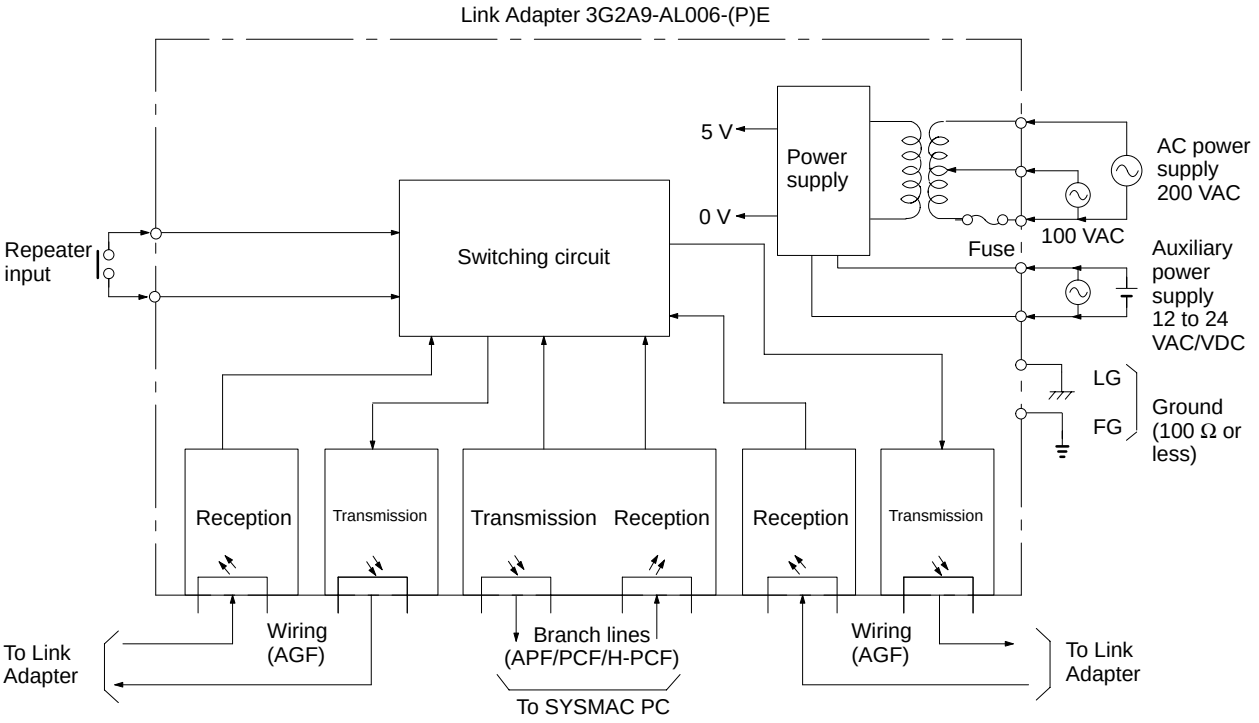
3G2A9-AL006-(P)E Link Adapter

Dimensions



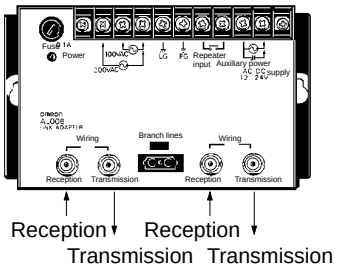
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Internal Configuration



Installing the Link Adapter

Use the Link Adapter with a supply of either 100/200 VAC or 12 to 24 VDC/VAC power.
Short circuit the repeater input terminals.
Use FC connectors for the AGF cables.
Connect the AGF cables correctly to the transmission and reception terminals.



Cable Length (Max.)

Cable	3G2A9-AL006-PE	3G2A9-AL006-E
APF	20 m	Not available
H-PCF	100 m	200 m
PCF	200 m	800 m
AGF	3 km	3 km

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Appendix C
ASCII Conversions

This appendix gives data conversions for ASCII characters. The decimal, binary and hexadecimal equivalents are given. Refer to *Appendix D* for conversions between binary, hexadecimal, binary-coded hexadecimal, and decimal data, up to 32_{dec}.

Extended ASCII to Binary and Hexadecimal

The following table gives the conversions for the standard ASCII character set to both binary and hexadecimal. In the Programmable Controller, all ASCII data is stored in it's hexadecimal equivalent.

Bits 0 to 3		Bits 4 to 7													
BIN		0000	0001	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
	HEX	0	1	2	3	4	5	6	7	A	B	C	D	E	F
0000	0	NUL	DLE	Space	0	@	P	`	p						
0001	1	SOH	DC_1	!	1	A	Q	a	q						
0010	2	STX	DC_2	"	2	B	R	b	r	"					
0011	3	ETX	DC_3	#	3	C	S	c	s						
0100	4	EOT	DC_4	$	4	D	T	d	t						
0101	5	ENQ	NAK	%	5	E	U	e	u						
0110	6	ACK	SYN	&	6	F	V	f	v						
0111	7	BEL	ETB	'	7	G	W	g	w						
1000	8	BS	CAN	(	8	H	X	h	x						
1001	9	HT	EM	)	9	I	Y	i	y						
1010	A	LF	SUB	*	:	J	Z	j	z						
1011	B	VT	ESC	+	;	K	[	k	{						
1100	C	FF	FS	,	<	L	¥	l	|						
1101	D	CR	GS	-	=	M	]	m	}						
1110	E	S0	RS	.	>	N	^	n	←						
1111	F	S1	US	/	?	O	_	o	→						

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ASCII to Decimal

The following table gives the decimal equivalents of the range of English language ASCII characters. The Programmable Controller stores ASCII data in hexadecimal form. Care should be taken when inputting ASCII data in equivalent forms.

ASCII	Decimal	ASCII	Decimal	ASCII	Decimal	ASCII	Decimal	ASCII	Decimal	ASCII	Decimal
Space	32	0	48	@	64	P	80	‘	96	p	112
!	33	1	49	A	65	Q	81	a	97	q	113
”	34	2	50	B	66	R	82	b	98	r	114
#	35	3	51	C	67	S	83	c	99	s	115
$	36	4	52	D	68	T	84	d	100	t	116
%	37	5	53	E	69	U	85	e	101	u	117
&	38	6	54	F	70	V	86	f	102	v	118
’	39	7	55	G	71	W	87	g	103	w	119
(	40	8	56	H	72	X	88	h	104	x	120
)	41	9	57	I	73	Y	89	i	105	y	121
*	42	:	58	J	74	Z	90	j	106	z	122
+	43	;	59	K	75	[	91	k	107	{	123
,	44	<	60	L	76	\	92	l	108	|	124
-	45	=	61	M	77	]	93	m	109	}	125
.	46	>	62	N	78	^	94	n	110	«	126
/	47	?	63	O	79	_	95	o	111	~	127

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Appendix D
Data Conversion Table

Decimal	BCD	Hex	Binary
00	0000 0000	00	0000 0000
01	0000 0001	01	0000 0001
02	0000 0010	02	0000 0010
03	0000 0011	03	0000 0011
04	0000 0100	04	0000 0100
05	0000 0101	05	0000 0101
06	0000 0110	06	0000 0110
07	0000 0111	07	0000 0111
08	0000 1000	08	0000 1000
09	0000 1001	09	0000 1001
10	0001 0000	0A	0000 1010
11	0001 0001	0B	0000 1011
12	0001 0010	0C	0000 1100
13	0001 0011	0D	0000 1101
14	0001 0100	0E	0000 1110
15	0001 0101	0F	0000 1111
16	0001 0110	10	0001 0000
17	0001 0111	11	0001 0001
18	0001 1000	12	0001 0010
19	0001 1001	13	0001 0011
20	0010 0000	14	0001 0100
21	0010 0001	15	0001 0101
22	0010 0010	16	0001 0110
23	0010 0011	17	0001 0111
24	0010 0100	18	0001 1000
25	0010 0101	19	0001 1001
26	0010 0110	1A	0001 1010
27	0010 0111	1B	0001 1011
28	0010 1000	1C	0001 1100
29	0010 1001	1D	0001 1101
30	0011 0000	1E	0001 1110
31	0011 0001	1F	0001 1111
32	0011 0010	20	0010 0000

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Glossary

address The location in memory where data is stored. For data areas, an address consists of a two-letter data area designation and a number that designate the word and/or bit location. For the UM area, an address designates the instruction location (UM area); for the FM area, the block location (FM area), etc.

AGF All-glass optical fiber cable, also known as crystal optical fiber cable.

allocation The process by which the PC assigns certain bits or words in memory for various functions. This includes pairing I/O bits to I/O points on Units.

AND A logic operation whereby the result is true if and only if both premises are true. In ladder-diagram programming the premises are usually ON/OFF states of bits or the logical combination of such states called execution conditions.

APF Acronym for all-plastic optical fiber cable.

AR area A PC data area allocated to flags, control bits, and word bits.

arithmetic shift A shift operation wherein the carry flag is included in the shift.

ASCII Short for American Standard Code for Information Interchange. ASCII is used to code characters for output to printers and other external devices.

ASCII Unit An Intelligent I/O Unit used to program in BASIC. When connected to an NSU on a Net Link System, commands can be sent to other nodes.

Backplane A base onto 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 according to the Units mounted to them.

BCD Short for binary-coded decimal.

BCD calculation An arithmetic calculation that uses numbers expressed in binary-coded decimal.

binary A number system where all numbers are expressed to the base 2, i.e., any number can be written using only 1's or 2's. Each group of four binary bits is equivalent to one hexadecimal digit.

binary calculation An arithmetic calculation that uses numbers expressed in binary.

binary-coded decimal A system used to represent numbers so that each four binary bits is numerically equivalent to one decimal digit.

bit A binary digit; hence a unit of data in binary notation. The smallest unit of information that can be electronically stored in a PC. The status of a bit is either ON or OFF. Different bits at particular addresses are allocated to special purposes, such as holding the status input from external devices, while other bits are available for general use in programming.

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bit address — The location in memory where a bit of data is stored. A bit address must specify (sometimes by default) the data area and word that is being addressed as well as the number of the bit.

bit designator — An operand that is used to designate the bit or bits of a word to be used by an instruction.

bit number — A number that indicates the location of a bit within a word. Bit 00 is the rightmost (least-significant) bit; bit 15 is the leftmost (most-significant) bit.

block — Block can refer to one of three aspects of PC operation: a block in the FM area, a block instruction (program), or a logic block. A block in the FM is the unit used to transfer data to and from the File Memory Unit and equals 128 words. Refer to *block instruction, block program,* and *logic block* for definitions of these.

block instruction — A special class of instruction used within ladder-diagram programming to allow flowchart-like coding, which is often difficult to write with ladder diagrams. Function codes for block instructions are indicated between pointed parentheses <like this>.

block program — A section of program written within a ladder diagram but based on block instructions. Block programs can also contain some, but not all, of the ladder-diagram instructions.

buffer — A temporary storage space for data in a computerized device.

building-block PC — A PC that is constructed from individual components, or “building blocks.” With building-block PCs, there is no one Unit that is independently identifiable as a PC. The PC is rather a functional assembly of components.

bus bar — The line leading down the left and sometimes right side of a ladder diagram. Instruction execution proceeds down the bus bar, which is the starting point for all instruction lines.

call — A process by which instruction execution shifts from the main program to a subroutine. The subroutine may be called by an instruction or by an interrupt.

carry flag — A flag that is used with arithmetic operations to hold a carry from an addition or multiplication operation, or to indicate that the result is negative in a subtraction operation. The carry flag is also used with certain types of shift operations.

clock pulse — A pulse available at a certain bit in memory for use in timing operations. Various clock pulses are available with different pulse widths.

clock pulse bit — A bit in memory that supplies a pulse that can be used to time operations. Various clock pulse bits are available with different pulse widths, and therefore different frequencies.

condition — An message placed in an instruction line to direct the way in which the terminal instructions, on the right side, are to be executed. Each condition is assigned to a bit in memory that determines its status. The status of the bit assigned to each condition determines, in turn, the execution condition for each instruction up to a terminal instruction on the right side of the ladder diagram.

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constant An operand for which the actual numeric value is specified by the user, and which is then stored in a particular address in the data memory.

control bit A bit in a memory area that is set either through the program or via a Programming Device to achieve a specific purpose, e.g., a Restart bit is turned ON and OFF to restart a Unit.

Control System All of the hardware and software components used to control other devices. A Control System includes the PC System, the PC programs, and all I/O devices that are used to control or obtain feedback from the controlled system.

controlled system The devices that are being controlled by a PC System.

control signal A signal sent from the PC to effect the operation of the controlled system.

counter Either a dedicated number of digits or words in memory used to count the number of times a specific process has occurred or a location in memory accessed through a TC bit and used to count the number of times the status of a bit or an execution condition has changed from OFF to ON.

CPU An acronym for central processing unit. In a PC System, the CPU executes the program, processes I/O signals, communicates with external devices, etc.

CPU Backplane A Backplane used to create a CPU Rack.

CPU Rack Part of a building-block PC, the CPU Rack contains the CPU, a power supply, and other Units. With most PCs, the CPU Rack is the only Rack that provides linkable slots.

crystal optical fiber cable See *AGF.*

CTS An acronym for clear-to-send, a signal used in communications between electronic devices to indicate that the receiver is ready to accept incoming data.

cycle The process used to execute a ladder-diagram program. The program is examined sequentially from start to finish and each instruction is executed in turn based on execution conditions.

cycle time The time required for a single cycle of the ladder-diagram program.

data area An area in the PC's memory that is designed to hold a specific type of data, e.g., the LR area is designed to hold common data in a PC Link System. Memory areas that hold programs are not considered data areas.

data area boundary The highest address available in a data area. When designating an operand that requires multiple words, it is necessary that the highest address in the data area is not exceeded.

data sharing An aspect of PC Link Systems and of Data Links in Net Link Systems in which common data areas or common data words are created between two or more PCs.

debug A process by which a draft program is corrected until it operates as intended. Debugging includes both removal of syntax errors, as well as fine-tuning of timing and coordination of control operations.

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decimal	A number system where all numbers are expressed to the base 10. Although in a PC all data is ultimately stored in binary form, four binary bits are often used to represent one decimal digit, via a system called binary-coded decimal.
decrement	Decreasing a numeric value.
default	A value assumed and automatically set by the PC when a specific value is not input by the user. Many devices will assume such default conditions upon the application of power.
definer	A number used as an operand for an instruction but that serves to define the instruction itself rather that the data on which the instruction is to operate. Definers include jump numbers, subroutine numbers, etc.
delimiter	A carriage return (CR) indicating the end of the current frame within a multi-frame block of information. A terminator indicates the end of the block.
destination	The location where data in an instruction is to be placed, as opposed to the location from which data is to be taken, for use in the instruction. The location from which data is to be taken is called the source.
differentiated instruction	An instruction that is executed only once each time its execution condition goes from OFF to ON. Nondifferentiated instructions are executed each cycle as long as the execution condition stays ON.
differentiation instruction	An instruction used to ensure that the operand bit is never turned ON for more than one cycle after the execution condition goes either from OFF to ON for a Differentiate Up instruction or from ON to OFF for a Differentiate Down instruction.
digit	A unit of storage in memory that consists of four bits.
digit designator	An operand that is used to designate the digit or digits of a word to be used by an instruction.
distributed control	An automation concept in which control of each portion of an automated system is located near the devices actually being controlled, i.e., control is decentralized and ‘distributed’ over the system. Distributed control is a concept basic to PC Systems.
DM area	A data area used to hold word data. A word in the DM area cannot be accessed bit by bit.
download	The process of transferring a program or data from a higher-level computer to a lower-level computer or PC.
Duplex CPU	A CPU arrangement available for a C2000H PC in which there is actually two CPUs. Each of the CPUs holds the same program and the same data. One of the CPUs is active and controls current PC operation; the other CPU serves as a backup and takes over PC operation if the active CPU fails.
Duplex System	A C2000H PC System that uses a Duplex CPU.
Duplex Unit	The Unit that coordinates the CPU activities of a Duplex System.

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electrical noise Electrical ‘static’ that can disturb electronic communications. The ‘snow’ that can appear on a TV screen is an example of the effects of electrical noise.

error code A numeric code output to indicate the existence, and something about the nature, of an error. Some error codes are generated by the system; others are defined in the program by the operator.

exclusive OR A logic operation whereby the result is true if one and only one of the premises is true. In ladder-diagram programming the premises are usually ON/OFF states of bits, or the logical combination of such states, called execution conditions.

exclusive NOR A logic operation whereby the result is true if and only if both of the premises are true or both of the premises are false. In ladder-diagram programming the premises are usually ON/OFF states of bits, or the logical combination of such states, called execution conditions.

exection condition The ON or OFF status under which an instruction is executed. The execution condition is determined by the logical combination of conditions on the same instruction line and up to the instruction being executed.

execution time The time required for the CPU to execute either an individual instruction or an entire program.

Expansion I/O Backplane A Backplane used to create an Expansion I/O Rack.

Expansion I/O Rack Part of a building-block PC, an Expansion I/O Rack is connected to either a CPU Rack or another Expansion I/O Rack to increase the number of slots available for mounting Units.

extended counter A counter created in a program that counts higher than any of the standard counters provided by the individual instructions.

extended timer A timer created in a program that times longer than any of the standard timers provided by the individual instructions.

Factory Intelligent Terminal A programming device provided with advanced programming and debugging capabilities to facilitate PC operation. The Factory Intelligent Terminal also provides various interfaces for external devices, such as floppy disk drives.

fatal error An error that will stop PC operation and require correction before operation can be continued.

FCS Acronym for Frame Checksum.

File Memory see *FM area.*

FIT Abbreviation for Factory Intelligent Terminal.

flag A dedicated bit in memory that is set by the system to indicate some type of operating status. Some flags, such as the carry flag, can also be set by the operator or program.

flicker bit A bit that is programmed to turn ON and OFF at a specific frequency.

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floating point decimal	A decimal number expressed as a number between 0 and 1 (the mantissa) multiplied by a power of 10, e.g., 0.538 x 10^{-5}.
Floppy Disk Interface Unit	A Unit used to interface a floppy disk drive to a PC so that programs and/or data can be stored on floppy disks.
FM area	A memory area located in a File Memory Unit used to store/backup programs and/or data.
force reset	The process of forcibly turning OFF a bit via a programming device. Bits are usually turned OFF as a result of program execution.
force set	The process of forcibly turning ON a bit via a programming device. Bits are usually turned ON as a result of program execution.
Frame Checksum	The result of exclusive ORing all data within the FCS calculation range. Used to confirm that the correct data is transmitted.
function code	A two-digit number used to input an instruction into the PC.
GPC	Acronym for Graphic Programming Console.
Graphic Programming Console	A programming device provided with advanced programming and debugging capabilities to facilitate PC operation. A Graphic Programming Console is provided with a large display onto which ladder-diagram programs can be written directly in ladder-diagram symbols for input into the PC without conversion to mnemonic form.
hardware error	An error originating in the hardware structure (electronic components) of the PC, as opposed to a software error, which originates in software (i.e., programs).
hexadecimal	A number system where all numbers are expressed to the base 16. Although in a PC all data is ultimately stored in binary form, displays on and inputs through Programming Devices are often expressed in hexadecimal to facilitate operation. Each group of four binary bits is numerically equivalent to one hexadecimal digit.
Host Link System	One or more host computers connected to one or more PCs through Host Link Units so that the host computer can be used to transfer data to, and to receive data from, the PC(s). Host Link Systems enable centralized management and control of PC Systems.
Host Link Unit	An interface used to connect a PC to a host computer in a Host Link System.
host computer	A computer that is used to transfer data or programs to or receive data or programs from a PC in a Host Link System. The host computer is used for data management and overall system control. Host computers are generally personal or business computers.
HR area	A data area used to store and manipulate data, and to preserve data when power to the PC is turned OFF.
increment	Increasing a numeric value.

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indirect address An address whose contents indicates another address. The contents of the second address will be used as the operand. Indirect addressing is possible in the DM area only.

initialization error An error that occurs either in hardware or software during the PC System startup, i.e., during initialization.

initialize Part of the startup process whereby some memory areas are cleared, system setup is checked, and default values are set.

input The signal coming from an external device into the PC. The term input is often used abstractly or collectively to refer to incoming signals.

input bit A bit in the IR area that is allocated to hold the status of an input.

input device An external device that sends signals into the PC System.

input point The point at which an input enters the PC System. Input points correspond physically to terminals or connector pins.

input signal A change in the status of a connection entering the PC. Generally an input signal is said to exist when, for example, a connection point goes from low to high voltage or from a nonconductive to a conductive state.

instruction A direction given in the program that tells the PC of an action to be carried out, and which data is to be used in carrying out the action. Instructions can be used to simply turn a bit ON or OFF, or they can perform much more complex actions, such as converting and/or transferring large blocks of data.

instruction block A group of instructions that is logically related in a ladder-diagram program. Although any logically related group of instructions could be called an instruction block, the term is generally used to refer to blocks of instructions called logic blocks that require logic block instructions to relate them to other instructions or logic blocks.

instruction execution time The time required to execute an instruction. The execution time for any one instruction can vary with the execution conditions for the instruction and the operands used within it.

instruction line A group of conditions that lie together on the same horizontal line of a ladder diagram. Instruction lines can branch apart or join together to form instruction blocks.

Intelligent I/O Unit A Unit, such as an ASCII Unit or Ladder Diagram I/O Unit, that is equipped with its own CPU and can be programmed.

interface 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 perform operations like changing the coding, format, or speed of the data.

interlock A programming method used to treat a number of instructions as a group so that the entire group can be reset together when individual execution is not required. An interlocked program section is executed normally for an ON execution condition and partially reset for an OFF execution condition.

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interrupt (signal) A signal that stops normal program execution and causes a subroutine to be run.

Interrupt Input Unit A Rack-mounting Unit used to input external interrupts into a PC System.

inverse condition see *normally closed condition*.

I/O capacity The number of inputs and outputs that a PC is able to handle. This number ranges from around one hundred for smaller PCs to two thousand for the largest ones.

I/O Control Unit A Unit mounted to the CPU Rack in certain PCs to monitor and control I/O points on Expansion I/O Units.

I/O devices The devices to which terminals on I/O Units, Special I/O Units, or Intelligent I/O Units are connected. I/O devices may be either part of the Control System, if they function to help control other devices, or they may be part of the controlled system.

I/O Interface Unit A Unit mounted to an Expansion I/O Rack in certain PCs to interface the Expansion I/O Rack to the CPU Rack.

I/O Link Created in an Optical Remote I/O System to enable input/output of one or two IR words directly between PCs. The words are input/output between the PC controlling the Master and a PC connected to the Remote I/O System through an I/O Link Unit or an I/O Link Rack.

I/O Link Unit A Unit used with certain PCs to create an I/O Link in an Optical Remote I/O System.

I/O point The place at which an input signal enters the PC System, or at which an output signal leaves the PC System. In physical terms, I/O points correspond to terminals or connector pins on a Unit; in terms of programming, an I/O points correspond to I/O bits in the IR area.

I/O response time The time required for an output signal to be sent from the PC in response to an input signal received from an external device.

I/O table A table created within the memory of the PC that lists the IR area words allocated to each Unit in the PC System. The I/O table can be created by, or modified from, a Programming Device.

I/O Unit The most basic type of Unit mounted to a backplane to create a Rack. I/O Units include Input Units and Output Units, each of which is available in a range of specifications. I/O Units do not include Special I/O Units, Link Units, etc.

I/O word A word in the IR area that is allocated to a Unit in the PC System.

IR area A data area whose principal function is to hold the status of inputs coming into the system and that of outputs that are to be set out of the system. Bits and words in the IR that are used this way are called I/O bits and I/O words. The remaining bits in the IR area are work bits.

JIS Acronym for Japanese Industrial Standards.

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jump	A type of programming where execution moves directly from one point in a program to another, without sequentially executing any instructions inbetween. Jumps are usually conditional on an execution condition.
jump number	A definer used with a jump that defines the points from and to which a jump is to be made.
ladder diagram (program)	A form of program arising out of relay-based control systems that uses circuit-type diagrams to represent the logic flow of programming instructions. The appearance of the program is similar to a ladder, and thus the name.
ladder diagram symbol	A symbol used in a ladder-diagram program.
ladder instruction	An instruction that represents the 'rung' portion of a ladder-diagram program. The other instructions in a ladder diagram fall along the right side of the diagram and are called terminal instructions.
Ladder Support Software	A software package that provides most of the functions of the Factory Intelligent Terminal on an IBM AT, IBM XT, or compatible computer.
LAN	An acronym for local area network.
leftmost (bit/word)	The highest numbered bits of a group of bits, generally of an entire word, or the highest numbered words of a group of words. These bits/words are often called most-significant bits/words.
Link Adapter	A Unit used to connect communications lines, either to branch the lines or to convert between different types of cable. There are two types of Link Adapter: Branching Link Adapters and Converting Link Adapters.
link	A hardware or software connection formed between two Units. "Link" can refer either to a part of the physical connection between two Units (e.g., optical links in Wired Remote I/O Systems) or a software connection created to data existing at another location (Network Data Links).
linkable slot	A slot on either a CPU or Expansion I/O Backplane to which a Link Unit can be mounted. Backplanes differ in the slots to which Link Units can be mounted.
Link System	A system that includes one or more of the following systems: Remote I/O System, PC Link System, Host Link System, or Net Link System.
Link Unit	Any of the Units used to connect a PC to a Link System. These are Remote I/O Units, I/O Link Units, PC Link Units, Host Link Units, and Net Link Units.
load	The processes of copying data either from an external device or from a storage area to an active portion of the system such as a display buffer. Also, an output device connected to the PC is called a load.
local area network	A network consisting of nodes or positions in a loop arrangement. Each node can be any one of a number of devices, which can transfer data to and from each other.
logic block	A group of instructions that is logically related in a ladder-diagram program and that requires logic block instructions to relate it to other instructions or logic blocks.

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logic block instruction An instruction used to locally combine the execution condition resulting from a logic block with a current execution condition. The current execution condition could be the result of a single condition, or of another logic block. AND Load and OR Load are the two logic block instructions.

logic instruction Instructions used to logically combine the content of two words and output the logical results to a specified result word. The logic instructions combine all the same-numbered bits in the two words and output the result to the bit of the same number in the specified result word.

loop A group of instructions that can be executed more than once in succession (i.e., repeated) depending on an execution condition or bit status.

LR area A data area that is used in a PC Link System so that data can be transferred between two or more PCs. If a PC Link System is not used, the LR area is available for use as work bits.

LSS Abbreviation for Ladder Support Software.

main program All of a program except for the subroutines.

masking 'Covering' an interrupt signal so that the interrupt is not effective until the mask is removed.

Master Short for Remote I/O Master Unit.

memory area Any of the areas in the PC used to hold data or programs.

mnemonic code A form of a ladder-diagram program that consists of a sequential list of the instructions without using a ladder diagram. Mnemonic code is required to input a program into a PC when using a Programming Console.

MONITOR mode A mode of PC operation in which normal program execution is possible, and which allows modification of data held in memory. Used for monitoring or debugging the PC.

most-significant (bit/word) See *leftmost (bit/word).*

NC input An input that is normally closed, i.e., the input signal is considered to be present when the circuit connected to the input opens.

nest Programming one loop within another loop, programming a call to a subroutine within another subroutine, or programming an IF-ELSE programming section within another IF-ELSE section.

Net Link System An optical LAN formed from PCs connected through Net Link Units. A Net Link System also normally contains nodes interfacing computers and other peripheral devices. PCs in the Net Link System can pass data back and forth, receive commands from any interfaced computer, and share any interfaced peripheral device.

Net Link Unit The Unit used to connect PCs to a Net Link System. The full name is "SYSMAC Net Link Unit."

Network Service Board A device with an interface to connect devices other than PCs to a Net Link System.

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Network Service Unit — A Unit that provides two interfaces to connect peripheral devices to a Net Link System.

node — One of the positions in a LAN. Each node incorporates a device that can communicate with the devices at all of the other nodes. The device at a node is identified by the node number. One loop of a Net Link System (OMRON's LAN) can consist of up to 126 nodes. Each node is occupied by a Net Link Unit mounted to a PC or a device providing an interface to a computer or other peripheral device.

NO input — An input that is normally open, i.e., the input signal is considered to be present when the circuit connected to the input closes.

noise interference — Disturbances in signals caused by electrical noise.

nonfatal error — A hardware or software error that produces a warning but does not stop the PC from operating.

normally closed condition — A condition that produces an ON execution condition when the bit assigned to it is OFF, and an OFF execution condition when the bit assigned to it is ON.

normally open condition — A condition that produces an ON execution condition when the bit assigned to it is ON, and an OFF execution condition when the bit assigned to it is OFF.

NOT — A logic operation which inverts the status of the operand. For example, AND NOT indicates an AND operation with the opposite of the actual status of the operand bit.

NSB — An acronym for Network Service Board.

NSU — An acronym for Network Service Unit.

OFF — The status of an input or output when a signal is said not to be present. The OFF state is generally represented by a low voltage or by non-conductivity, but can be defined as the opposite of either.

OFF delay — The delay between the time when a signal is switched OFF (e.g., by an input device or PC) and the time when the signal reaches a state readable as an OFF signal (i.e., as no signal) by a receiving party (e.g., output device or PC).

ON — The status of an input or output when a signal is said to be present. The ON state is generally represented by a high voltage or by conductivity, but can be defined as the opposite of either.

ON delay — The delay between the time when an ON signal is initiated (e.g., by an input device or PC) and the time when the signal reaches a state readable as an ON signal by a receiving party (e.g., output device or PC).

one-shot bit — A bit that is turned ON or OFF for a specified interval of time which is longer than one cycle.

on-line removal — Removing a Rack-mounted Unit for replacement or maintenance during PC operation.

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operand Bit(s) or word(s) designated as the data to be used for an instruction. An operand can be input as a constant expressing the actual numeric value to be used or as an address to express the location in memory of the data to be used.

operand bit A bit designated as an operand for an instruction.

operand word A word designated as an operand for an instruction.

operating error An error that occurs during actual PC operation as opposed to an initialization error, which occurs before actual operations can begin.

Optical I/O Unit A Unit that is connected in an Optical Remote I/O System to provide 8 I/O points. Optical I/O Units are not mounted to a Rack.

Optical Slave Rack A Slave Rack connected through an Optical Remote I/O Slave Unit.

OR A logic operation whereby the result is true if either of two premises is true, or if both are true. In ladder-diagram programming the premises are usually ON/OFF states of bits or the logical combination of such states called execution conditions.

output The signal sent from the PC to an external device. The term output is often used abstractly or collectively to refer to outgoing signals.

output bit A bit in the IR area that is allocated to hold the status to be sent to an output device.

output device An external device that receives signals from the PC System.

output point The point at which an output leaves the PC System. Output points correspond physically to terminals or connector pins.

output signal A signal being sent to an external device. Generally an output signal is said to exist when, for example, a connection point goes from low to high voltage or from a nonconductive to a conductive state.

overseeing Part of the processing performed by the CPU that includes general tasks required to operate the PC.

overwrite Changing the content of a memory location so that the previous content is lost.

parity Adjustment of the number of ON bits in a word or other unit of data so that the total is always an even number or always an odd number. Parity is generally used to check the accuracy of data after being transmitted by confirming that the number of ON bits is still even or still odd.

PC An acronym for Programmable Controller.

PCB An acronym for printed circuit board.

PC configuration The arrangement and interconnections of the Units that are put together to form a functional PC.

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PCF	Acronym for plastic-clad optical fiber cable.
PC Link System	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.
PC Link Unit	The Unit used to connect PCs in a PC Link System.
PC System	With building-block PCs, all of the Racks and independent Units connected directly to them up to, but not including the I/O devices. The boundaries of a PC System are the PC and the program in its CPU at the upper end; and the I/O Units, Special I/O Units, Optical I/O Units, Remote Terminals, etc., at the lower end.
peripheral device	Devices connected to a PC System to aid in system operation. Peripheral devices include printers, programming devices, external storage media, etc.
port	A connector on a PC or computer that serves as a connection to an external device.
present value	The current value registered in a device at any instant during its operation. Present value is abbreviated as PV.
printed circuit board	A board onto which electrical circuits are printed for mounting into a computer or electrical device.
Printer Interface Unit	A Unit used to interface a printer so that ladder diagrams and other data can be printed out.
program	The list of instructions that tells the PC the sequence of control actions to be carried out.
Programmable Controller	A computerized device that can accept inputs from external devices and generate outputs to external devices according to a program held in memory. Programmable Controllers are used to automate control of external devices. Although single-component Programmable Controllers are available, building-block Programmable Controllers are constructed from separate components. Such building-block Programmable Controllers are formed only when enough of these separate components are assembled to form a functional assembly, i.e., no one individual Unit is called a PC.
programmed alarm	An alarm given as a result of execution of an instruction designed to generate the alarm in the program, as opposed to one generated by the system.
programmed error	An error arising as a result of the execution of an instruction designed to generate the error in the program, as opposed to one generated by the system.
programmed message	A message generated as a result of execution of an instruction designed to generate the message in the program, as opposed to one generated by the system.
Programming Console	The simplest form or programming device available for a PC. Programming Consoles are available both as hand-held models and as CPU-mounting models.

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Programming Device A peripheral device used to input a program into a PC or to alter or monitor a program already held in the PC. There are dedicated programming devices, such as Programming Consoles, and there are non-dedicated devices, such as a host computer.

PROGRAM mode A mode of operation that allows inputting and debugging of programs to be carried out, but that does not permit normal execution of the program.

PROM Writer A peripheral device used to write programs and other data into a ROM for permanent storage and application.

prompt A message or symbol that appears on a display to request input from the operator.

PV Acronym for present value.

Rack An assembly of various Units on a Backplane that forms a functional unit in a building-block PC System. Racks include CPU Racks, Expansion I/O Racks, I/O Racks, and Slave Racks.

refresh The process of updating output status sent to external devices so that it agrees with the status of output bits held in memory and of updating input bits in memory so that they agree with the status of inputs from external devices.

relay-based control The forerunner of PCs. In relay-based control, groups of relays are interconnected to form control circuits. In a PC, these are replaced by programmable circuits.

Remote I/O Master Unit The Unit in a Remote I/O System through which signals are sent to all other Remote I/O Units. The Remote I/O Master Unit is mounted either to a CPU Rack or an Expansion I/O Rack connected to the CPU Rack. Remote I/O Master Unit is generally abbreviated to Master.

Remote I/O Slave Unit A Unit mounted to a Backplane to form a Slave Rack. Remote I/O Slave Unit is generally abbreviated to Slave. The operation of a Slave is controlled by a Master.

Remote I/O System A system in which remote I/O points are controlled through a Master mounted to a CPU Rack or an Expansion I/O Rack connected to the CPU Rack.

Remote I/O Unit Any of the Units in a Remote I/O System. Remote I/O Units include Masters, Slaves, Optical I/O Units, I/O Link Units, and Remote Terminals.

remote I/O word An I/O word allocated to a Unit in a Remote I/O System.

reset The process of turning a bit or signal OFF or of changing the present value of a timer or counter to its set value or to zero.

retry The process whereby a device will re-transmit data which has resulted in an error message from the receiving device.

return The process by which instruction execution shifts from a subroutine back to the main program (usually the point from which the subroutine was called).

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reversible counter	A counter that can be both incremented and decremented depending on the specified conditions.
reversible shift register	A shift register that can shift data in either direction depending on the specified conditions.
right-hand instruction	Another term for terminal instruction.
rightmost (bit/word)	The lowest numbered bits of a group of bits, generally of an entire word, or the lowest numbered words of a group of words. These bits/words are often called least-significant bits/words.
rotate register	A shift register in which the data moved out from one end is placed back into the shift register at the other end.
RUN mode	The operating mode used by the PC for normal control operations.
scheduled interrupt	An interrupt that is automatically generated by the system at a specific time or program location specified by the operator. Scheduled interrupts result in the execution of specific subroutines that can be used for instructions that must be executed repeatedly for a specified period of time.
self diagnosis	A process whereby the system checks its own operation and generates a warning or error if an abnormality is discovered.
self-maintaining bit	A bit that is programmed to maintain either an OFF or ON status until set or reset by specified conditions.
servicing	The process whereby the PC provides data to or receives data from external devices or remote I/O Units, or otherwise handles data transactions for Link Systems.
set	The process of turning a bit or signal ON.
set value	The value from which a decrementing counter starts counting down or to which an incrementing counter counts up (i.e., the maximum count), or the time from which or for which a timer starts timing. Set value is abbreviated SV.
shift register	One or more words in which data is shifted a specified number of units to the right or left in bit, digit, or word units. In a rotate register, data shifted out one end is shifted back into the other end. In other shift registers, new data (either specified data, zero(s) or one(s)) is shifted into one end and the data shifted out at the other end is lost.
Simplex CPU	A C2000H PC that uses only a single CPU as opposed to a Duplex CPU. This term is meaningless with other PCs, which are only available with simplex operation.
Simplex System	A C2000H PC System that uses a Simplex CPU.
Slave	Short for Remote I/O Slave Unit.
Slave Rack	A Rack containing a Remote I/O Slave Unit and controlled through a Remote I/O Master Unit. Slave Racks are generally located away from the CPU Rack.

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slot	A position on a Rack (Backplane) to which a Unit can be mounted.
software error	An error that originates in a software program.
software protect	A means of protecting data from being changed that uses software as opposed to a physical switch or other hardware setting.
source	The location from which data is taken for use in an instruction, as opposed to the location to which the result of an instruction is to be written. The latter is called the destination.
Special I/O Unit	A dedicated Unit that is designed for a specific purpose. Special I/O Units include Position Control Units, High-speed Counter Units, Analog I/O Units, etc.
SR area	A data area in a PC used mainly for flags, control bits, and other information provided about PC operation. The status of only certain SR bits may be controlled by the operator, i.e., most SR bits can only be read.
subroutine	A group of instructions placed after the main program and executed only if called from the main program or activated by an interrupt.
subroutine number	A definer used to identify the subroutine that a subroutine call or interrupt activates.
SV	Abbreviation for set value.
switching capacity	The maximum voltage/current that a relay can safely switch on and off.
syntax error	An error in the way in which a program is written. Syntax errors can include ‘spelling’ mistakes (i.e., a function code that does not exist), mistakes in specifying operands within acceptable parameters (e.g., specifying write-protected SR bits as a destination), and mistakes in actual application of instructions (e.g., a call to a subroutine that does not exist).
system configuration	The arrangement in which Units in a system are connected.
system error	An error generated by the system, as opposed to one resulting from execution of an instruction designed to generate an error.
system error message	An error message generated by the system, as opposed to one resulting from execution of an instruction designed to generate a message.
TC area	A data area that can be used only for timers and counters. Each bit in the TC area serves as the access point for the SV, PV, and Completion flag for the timer or counter defined with that bit.
TC number	A definer that corresponds to a bit in the TC area and used to define the bit as either a timer or a counter.
terminal instruction	An instruction placed on the right side of a ladder diagram that uses the final execution conditions of an instruction line.
terminator	The code comprising an asterisk and a carriage return (* CR) which indicates the end of a block of data, whether it is a single-frame or multi-frame block. Frames within a multi-frame block are separated by delimiters.

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timer A location in memory accessed through a TC bit and used to time down from the timer's set value. Timers are turned ON and reset according to their execution conditions.

TM area A memory area used to store the results of a trace.

transmission distance The distance that a signal can be transmitted.

TR area A data area used to store execution conditions so that they can be reloaded later for use with other instructions.

trace An operation whereby the program is executed and the resulting data is stored in TM memory to enable step-by-step analysis and debugging.

transfer The process of moving data from one location to another within the PC, or between the PC and external devices. When data is transferred, generally a copy of the data is sent to the destination, i.e., the content of the source of the transfer is not changed.

trigger address An address in the program that defines the beginning point for tracing. The actual beginning point can be altered from the trigger by defining either a positive or negative delay.

UM area The memory area used to hold the active program, i.e., the program that is being currently executed.

Unit In OMRON PC terminology, the word Unit is capitalized to indicate any product sold for a PC System. Though most of the names of these products end with the word Unit, not all do, e.g., a Remote Terminal is referred to in a collective sense as a Unit. Context generally makes any limitations of this word clear.

unit number A number assigned to some Link Units and Special I/O Units to facilitate identification when assigning words or other operating parameters to it.

watchdog timer A timer within the system that ensures that the cycle time stays within specified limits. When limits are reached, either warnings are given or PC operation is stopped depending on the particular limit that is reached.

Wired Slave Rack A Slave Rack connected through a Wired Remote I/O Slave Unit.

word A unit of data storage in memory that consists of 16 bits. All data areas consists of words. Some data areas can be accessed only by words; others, by either words or bits.

word address The location in memory where a word of data is stored. A word address must specify (sometimes by default) the data area and the number of the word that is being addressed.

word multiplier A value between 0 and 3 that is assigned to a Master in a Remote I/O System so that words can be allocated to non-Rack-mounting Units within the System. The word setting made on the Unit is added to 32 times the word multiplier to arrive at the actual word to be allocated.

work bit A bit in a work word.

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work word

A word that can be used for data calculation or other manipulation in programming, i.e., a ‘work space’ in memory. A large portion of the IR area is always reserved for work words. Parts of other areas not required for special purposes may also be used as work words, e.g., LR words not used in a PC Link or Net Link System.

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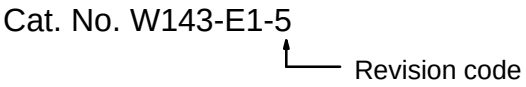
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Revision History

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



The following table outlines the changes made to the manual during each revision. Unless noted, page number refer to the previous version.

Revision code	Date	Revised content
2	March 1990	Converted to standard manual and page formats. The text was rewritten to give extra clarity. Link Adapters section omitted. The HR entry in table *Level 1* of *Section 3-4* now reads RH. *Section 3-6 I/O Response Times* has been redrawn for greater clarity. *Appendix C* has been split and the specifications for the accessories are now included in *Appendix D.*
3	April 1991	Layout of manual was restructured for greater clarity. Host Link Unit characteristics have been separated according to Host Link Unit groups. Hard-clad plastic optical fiber added to page 18 and *Appendix B*. **Page 6:** Description of DIP switch pins added to C200H-LK201 **Page 11:** *1-3 Host Link Unit* dimensions has been transferred to *App B* **Page 14:** A single-link system need not be specified if the I/O Port Selector is set to RS-232C. **Page 15:** The diagram in the *Termination Resistance* example has been changed. **Page 20:** The *Equipment Ready* symbol has been changed to DTR and the pin no. for ST corrected to 24. **Page 31:** The data flow diagram for sending a RUN Start Command using 3G2A5 and 3G2A6 models has been corrected. **Page 35:** No. of text characters for first and intermediate frames in a multiple-link system have been corrected to 123 and 125 respectively. **Page 39:** Names of the following commands have been changed: PV AREA READ → PV READ TC AREA READ → TC STATUS READ DM AREA READ → Data Memory READ DM AREA WRITE → Data Memory WRITE TC AREA WRITE → TC STATUS WRITE **Page 40**: Instructions applicable to Mini H-type PCs have been noted. **Pages 49-73:** Command and response formats have been corrected and standardized. A *Response Format if Error Occurs* has been added to *TEST*. **Page 5:** C2000H-LK201 corrected to C200H-LK201. **Page 7:** Table row headings corrected. **Page 93:** Old C500 Host Link Units removed. **Page 95:** C200-LK201 corrected to C200H-LK201 in 3rd table.
3A	December 1992	**Page 11:** “For all but C500-LK203 and insulated types” added to *1-5-3 RS-422 Interface*. **Page 87:** *Error Response Code List* corrected. **Page 101:** Model numbers 3G5A2-C0001 and 3G5A2-C0002 were corrected to 3G5A2-CO001 and 3G5A2-CO002 respectively. **Page 102:** Optical fiber cutter removed from table.
4	February 1994	This manual has been extensively revised throughout all sections and appendices. Units C200H-LK101-P and C200H-LK201/202 changed to C200H-LK101-PV1 and C200H-LK201-V1/202-V1 respectively; the C200HS PC has been added and the C2000 PC has been removed throughout the manual. The terms “scan” and “scan time” have been changed to “cycle” and “cycle time” throughout this manual.
4A	January 1995	**Page 36**: Text relating to the operating mode added after the second table. **Page 115**: Switches shown on the right side of the dimensions diagram corrected.
5	August 1996	SYSMAC α C200HX/HG/HE added throughout the manual. **Pages 25, 26:** The link type selector infromation corrected. **Page 87:** Data for Forced Set/Reset Clear corrected to 1000. **Page 112:** The table row containing AL004-PE/E corrected.

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