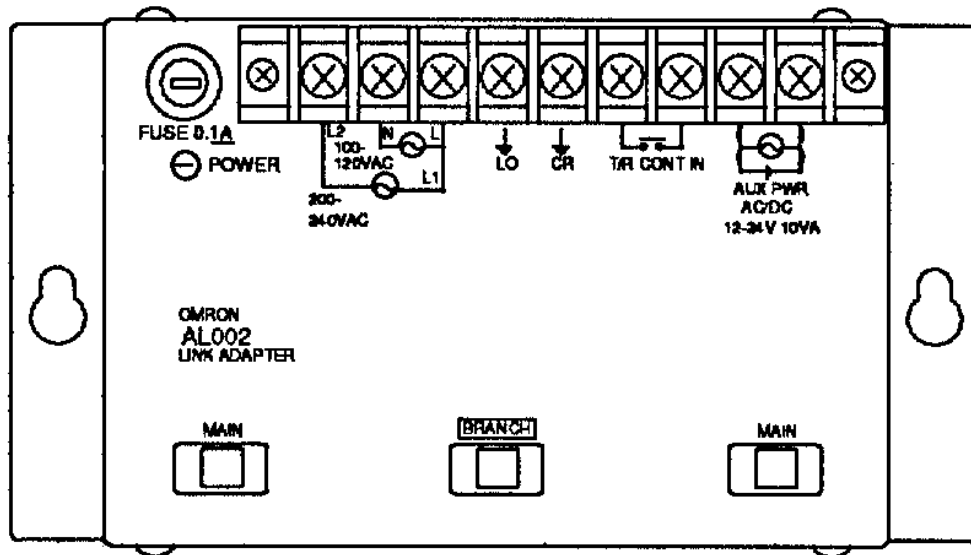


SYSMAC C-series Link Adapters

Installation Guide


Revised June 1999





Notice:

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

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

 **DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

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

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

The abbreviation “PC” means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

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

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

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

© OMRON, 1990

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

No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

TABLE OF CONTENTS

| | |
|--|--|
| PRECAUTIONS | |
| 1 Intended Audience | |
| 2 General Precautions | |
| 3 Safety Precautions | |
| 4 Operating Environment Precautions | |
| 5 Application Precautions | |
| SECTION 1 | |
| Introduction | |
| 1-1 Nomenclature | |
| 1-2 Link Adapters | |
| 1-3 Repeater Units | |
| 1-4 General Specifications | |
| SECTION 2 | |
| Wiring and Power Supply | |
| 2-1 Power Supply and Cable Lengths | |
| 2-2 RS-422 and RS-232C Cable | |
| 2-3 Optical Fiber Cable (APF/PCF) | |
| 2-4 Crystal Optical Fiber Cable (AGF) | |
| 2-5 Backup Power Supply | |
| 2-6 Link Adapter Repeater Input | |
| SECTION 3 | |
| Repeater Units | |
| SECTION 4 | |
| System Configuration | |
| 4-1 PC Link Systems | |
| 4-2 Host Link Systems | |
| 4-3 Optical Remote I/O Systems | |
| 4-4 Wired Remote I/O Systems | |
| SECTION 5 | |
| Dimensions and Internal Configuration | |
| 5-1 Link Adapter AL001 | |
| 5-2 Link Adapter AL002-(P)E | |
| 5-3 Link Adapter AL004-(P)E | |
| 5-4 Link Adapter AL005-(P)E | |
| 5-5 Link Adapter AL006-(P)E | |
| 5-6 Link Adapter AL007-P | |
| Appendix | |
| Standard Models | |
| Index | |
| Revision History | |

PRECAUTIONS

This section provides general precautions for using the SYSMAC C-series Link Adapters and related devices.

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

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

1 Intended Audience

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

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


2 General Precautions

The user must operate the product according to the performance specifications described in the relevant manuals.


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


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


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

 **WARNING** It is extremely important that the Link Adapter be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying the Link Adapter system to the above-mentioned applications.

3 Safety Precautions


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

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


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

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


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

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


4 Operating Environment Precautions

 **Caution** Do not operate the control system in the following locations:


- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

 **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations:


- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

 **Caution** The operating environment of the Link Adapter 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 Link Adapter 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

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

- Always ground the system to 100 Ω or less when installing the Units. Not connecting to a ground of 100 Ω or less may result in electric shock.
- Always turn OFF the power supply to the Link Adapter system before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
 - Mounting or dismounting the Units.
 - Assembling the Units.
 - Setting DIP switches or rotary switches.
 - Connecting cables or wiring the system.
 - Connecting or disconnecting the connectors.

 **Caution** Failure to abide by the following precautions could lead to faulty operation of the Link Adapters or the system, or could damage the Link Adapters or the system. Always heed these precautions.

Observe the following precautions when using the Link Adapter system.

- Tighten the screws on the terminal block of the AC Power Supply Unit to the torque specified in the operation manual. The loose screws may result in burning or malfunction.
- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.
- Always use the power supply voltages specified in this manual. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Disconnect the functional ground terminal when performing withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in the relevant manuals. Incorrect tightening torque may result in malfunction.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Be sure that the terminal blocks, cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.
- Do not place objects on top of the cables or other wiring lines. Doing so may break the cables.
- When replacing parts, be sure to confirm that the rating of a new part is correct. Not doing so may result in malfunction or burning.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.
- Install the Units properly as specified in the operation manuals. Improper installation of the Units may result in malfunction.

SECTION 1

Introduction

This document is designed to introduce the reader to the principles of Link Adapters and Repeater Units.

Link Adapters and Repeater Units are connecting devices for SYSMAC C-Series Programmable Controllers. Link Adapters are used to interconnect system devices such as host computers, PC Link Units, Host Link Units, and Remote I/O Units, and/or to convert back and forth between wire cable and optical fiber cable.

- 1-1 Nomenclature
- 1-2 Link Adapters
- 1-3 Repeater Units
- 1-4 General Specifications

1-1 Nomenclature

Names of specific OMRON products, as well as generic names for groups of OMRON products, are capitalized in this manual. Unit is also capitalized when it refers either specifically or generically to an OMRON product. For convenience, prefixes are omitted from model numbers of Link Adapters and Repeater Units. "(P)" in a model number indicates two Units, one with the P and one without. See the Appendix for a complete list of all products covered in this manual, along with their full model numbers. In addition, abbreviations are used for certain Units. In this manual, PC always means Programmable Controller; Master means Remote I/O Master Unit; and Slave means Remote I/O Slave Unit.

1-2 Link Adapters

Link Adapters are used to interconnect system devices such as host computers, PC Link Units, Host Link Units, and Remote I/O Units, and/or to convert between wire cable and optical fiber cable.

Using optical links between Units provides greater transmission distance and noise resistance. In addition, Link Adapters provide inputs to bypass a Unit which is improperly connected or which suffers a power interruption, thereby allowing other Units connected in series to continue operating normally.

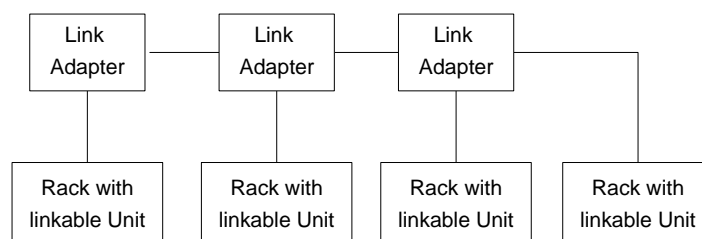
Some Link Adapters can ensure that a System will not begin operating until, for example, a particular Subsystem has started up.

There are various models of Link Adapters to perform a variety of functions. For example, the Link Adapter generally used for connecting PC Link Systems is the AL001, but when optical cable is used it is replaced by combinations of the AL002-(P)E and AL004-(P)E.

Link Adapter AL002-(P)E is used to branch optical cables; the AL004-(P)E is used to convert between optical and wire cables; and the AL005-(P)E and AL006-(P)E are used for branching and/or converting between different types of optical fiber cables. Link Adapter AL007-P is used exclusively in Wired Remote I/O Systems.

Link Adapters AL002-(P)E, AL005-(P)E, and AL006-(P)E have auxiliary power input terminals which can be connected to a battery to ensure continued operation even when the AC power supply is cut off. (See 2-5 *Backup Power Supply*.) Link Adapters AL002-(P)E and AL006-(P)E have repeater input terminals. (See 2-6 *Link Adapter Repeater Input*.)

The following diagram illustrates how Link Adapters can be used to connect several Units in a simple configuration.



1-3 Repeater Units

Repeater Units are used when the number of Optical Transmitting I/O Units, Optical Slave Racks, etc., connected in series exceeds 32. Insertion of a Repeater Unit after the 32nd Unit allows the connection of additional Units. The following Repeater Units are used with the cables shown here:

| Model | Applicable Cables |
|---------------|-------------------|
| 3G2A9-RPT01-P | APF/PCF |
| 3G2A9-RPT01 | PCF |

APF: All-plastic optical fiber cable
 PCF: Plastic-clad optical fiber cable

1-4 General Specifications

Basic specifications for the Link Adapters and Repeater Units are shown in the following table:

Link Adapters

| Model | Function | Connection | Supply voltage | Operating voltage range | Power consumption | Weight |
|----------|---|------------|--|---|-------------------|-------------|
| AL001 | Branching RS-422 cable | | Not necessary | --- | --- | 250 g max. |
| AL002-PE | Branching optical fiber (APF/PCF) cable | | 100 to 120/200 to 240 VAC or 12 to 24 VAC/DC | 85 to 132/170 to 246 VAC or 10.2 to 26.4 VAC/DC | 10 VA max. | 900 g max. |
| AL002-E | Branching optical fiber (PCF) cable | | | | | |
| AL004-PE | Converting between optical fiber (APC/PCF) and wire (RS-232C/RS-422) cable | | 110 to 120/220 to 240 VAC | 94 to 132/187 to 264 VAC | 10 VA max. | 1 kg max. |
| AL004-E | Converting between optical fiber (PCF) and wire (RS-232C/RS-422) cable | | | | | |
| AL005-PE | Converting between optical fiber (APF/PCF) and crystal optical fiber (AGF) cable | | 100 to 120/200 to 240 VAC or 12 to 24 VAC/DC | 85 to 132/170 to 254 VAC or 10.2 to 26.4 VAC/DC | 10 VA max. | 1.5 kg max. |
| AL005-E | Converting between optical fiber (PCF) and crystal optical fiber (AGF) cable | | | | | |
| AL006-PE | Converting between optical fiber (APF/PCF) and crystal optical fiber (AGF) cable | | 100 to 120/200 to 240 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. |
| AL006-E | Converting between optical fiber (PCF) and crystal optical fiber (AGF) cable | | | | | |
| AL007-P | Used exclusively for Wired Remote I/O Systems. Converts between optical fiber (APF/PCF) and wire (RS-485) cable | | 100 to 200 VAC | 85 to 264 VAC | 10 VA max. | 1 kg max. |

APF: All-plastic optical fiber cable
 PCF: Plastic-clad optical fiber cable
 AGF: Crystal optical fiber cable (GI 50 or 125)

Repeater Units

| Model | Function | Supply voltage | Operating voltage range | Power consumption | Weight |
|-------------------|--|--|--------------------------------|--------------------------|---------------|
| RPT01-P, RPT01 | Used when more than 32 Optical Transmitting I/O Units, Slave Racks, etc., are connected in series. | 100 to 120/200 to 240 VAC or 12 to 24 VAC/DC | 85 to 264 VAC | 8 VA max. | 600 g max. |

SECTION 2

Wiring and Power Supply

| | |
|-----|---|
| 2-1 | Power Supply and Cable Lengths |
| 2-2 | RS-422 and RS-232C Cable |
| 2-3 | Optical Fiber Cable (APF/PCF) |
| 2-4 | Crystal Optical Fiber Cable (AGF) |
| 2-5 | Backup Power Supply |
| 2-6 | Link Adapter Repeater Input |

2-1 Power Supply and Cable Lengths

Power Supply

For all but AL001 Link Adapters, connect the AC hot line to the common terminal of the Link Adapter. A fuse is internally connected to the common line.

Cable Lengths

Maximum length for RS-232C cable is 15 m. For RS-422 it is 500 m, with a maximum of 10 m for any given branch line. For RS-485 cable it is 200 m.

Maximum lengths for optical fiber cables connected to Link Adapters are determined by the type of cable and the particular model of Link Adapter employed. Link Adapters whose model numbers are followed by “-P” can be connected to either APF (all-plastic optical fiber) or PCF (plastic-clad optical fiber) cable. Those without “-P” can be connected only to PCF cable. The model numbers, cable types, and transmission distances are related as follows:

| Cable | Model No. With P | Model No. Without P |
|-------|------------------|---------------------|
| APF | 20 m | Not connectable |
| PCF | 200 m | 800 m |

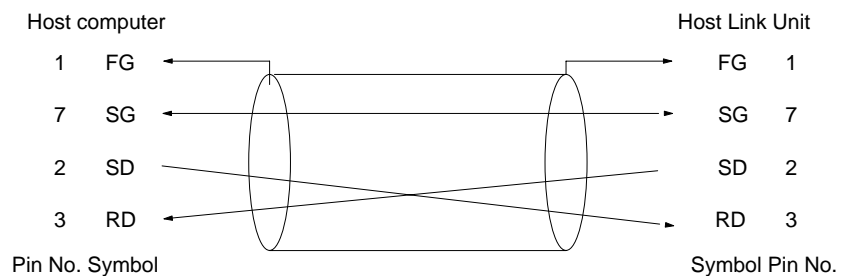
If transmission distances over 800 meters are required, it is necessary to use AGF (crystal optical fiber) cable, which calls for the use of specific Link Adapters (see 1-4 General Specifications). For calculating maximum length for AGF cable, see 2-4 Crystal Optical Fiber Cable (AGF).

! Caution Never use a Link Adapter with its terminal cover removed. Keep the cover securely attached. If the Link Adapter is installed in an office or on a desk, take extra care to avoid electrical shock.

2-2 RS-422 and RS-232C Cable

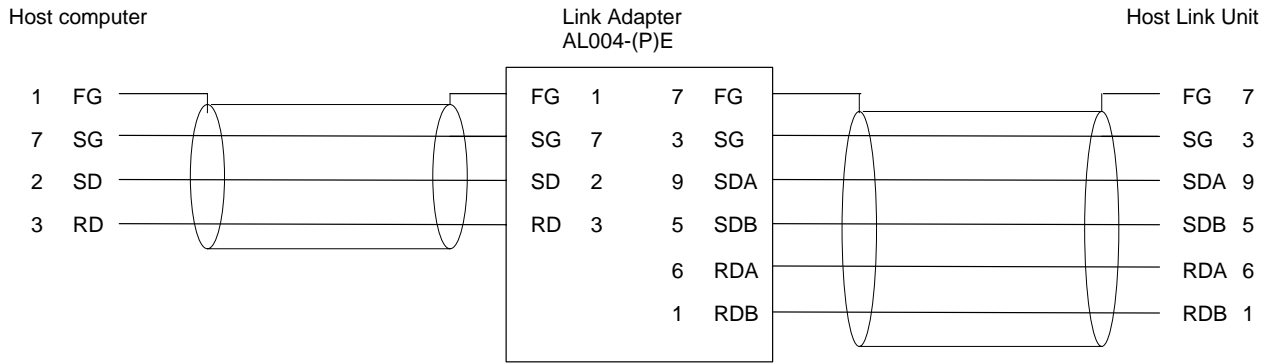
When using optical fiber or RS-422 cable, it is possible to connect several Host Link Units to one host computer. When RS-232C cable is used, however, the connection must either be on a one-to-one basis or a Link Adapter must be used to convert to optical or RS-422 cable. As described below, wiring will vary depending on whether a Host Link Unit is connected directly to a host computer or whether it is connected indirectly through a Link Adapter.

When a Host Link Unit is connected one-to-one to a host computer, with no Link Adapter, and RS-232C cable is being used, connect the SD (send data) terminal of the host computer to the RD (receive data) terminal of the Host Link Unit. Likewise, connect the RD terminal of the host computer to the SD terminal of the Host Link Unit. When using RS-422 cable, the SDA and RDA terminals and the SDB and RDB terminals should be connected in a similar way. The following diagram illustrates the proper connections when using RS-232C cable.



Connecting Link Adapter AL004-(P)E

When using a Link Adapter, connect both RS-232C and RS-422 cable straight across, as shown in the following diagram. Here the SD terminal of the host computer, for example, is connected to the SD terminal of the Link Adapter. See 5-4 Link Adapter AL004-(P)E for the internal configuration of the Link Adapter.

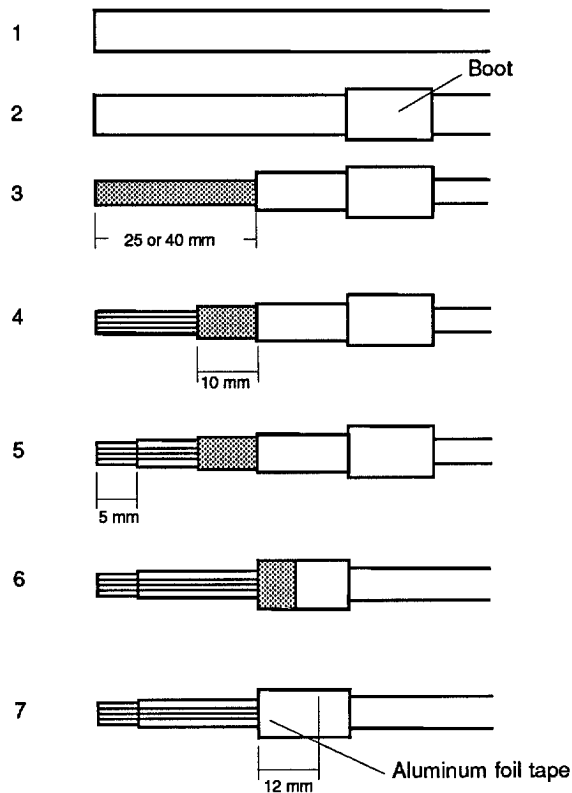


Wiring RS-232C and RS-422 Cable Connectors

Cable Preparation

Prepare cables as follows before soldering:

- 1, 2, 3...
1. Cut the cable to the required length.
 2. Thread the end of the cable through a boot at least 50 mm up the cable.
 3. Being careful not to damage the braiding underneath, use a razor blade to cut away 25 mm of sheath for an RS-442 cable or 40 mm for an RS-232C cable.
 4. Using scissors, cut away all but 10 mm of the exposed braiding.
 5. Using wire strippers, remove the covering from the last 5 mm of all wires.
 6. Move the boot to the cut edge of the sheath and fold the braiding back over the end of it.
 7. Wrap aluminum foil tape 1 1/2 turns over the top of the braiding on top of the boot.



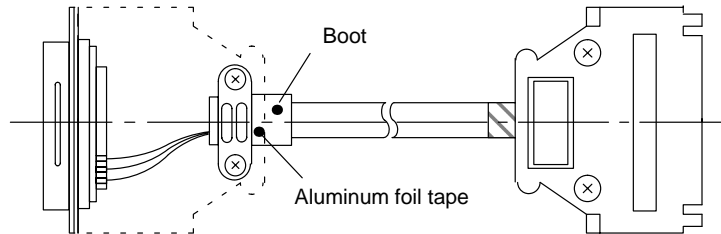
Soldering

Observe the following when soldering wires onto the connector.

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

Hood Assembly

Assemble the connector hood as shown in the following diagram.

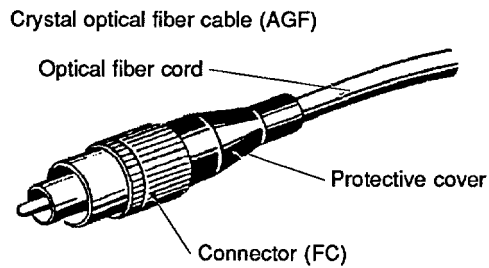
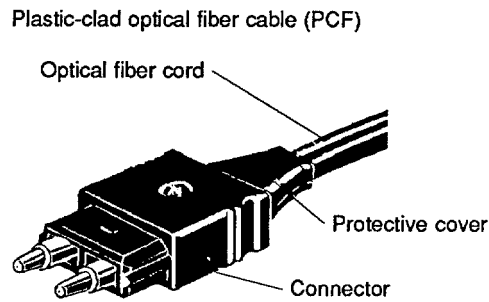
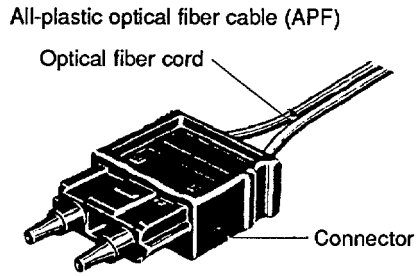


2-3 Optical Fiber Cable (APF/PCF)

Although the special characteristics of optical fiber call for care in connecting optical devices, laying optical fiber cables basically does not differ from laying wire cables. All OMRON PCF and the PF10I APF (length: 1 m) cables come with connectors attached. Connectors for all other APF cables must be assembled by the customer. Note the following precautions when handling optical fiber cables:

- 1, 2, 3...**
1. Always turn the power off to the Link Adapter when connecting or disconnecting an optical fiber cable.
 2. Always hold the connector when disconnecting an optical fiber cable; never pull on the cable.
 3. APF and PCF connectors are designed to be inserted only in one direction; do not try to force them in the wrong way.
 4. Insert APF and PCF connectors until they lock into position.
 5. Always place the protective caps on unused Link Adapter modules.
 6. If dirty, clean connectors gently with a tissue or sanitary cotton, using ethyl alcohol if necessary. Do not use any solvent other than ethyl alcohol.

7. Do not allow heavy objects to fall on optical cable or otherwise subject it to excessive shock or strain.



2-4 Crystal Optical Fiber Cable (AGF)

Link Adapters AL005-(P)E and AL006-(P)E can be connected with crystal optical fiber cable in accordance with the following specifications:

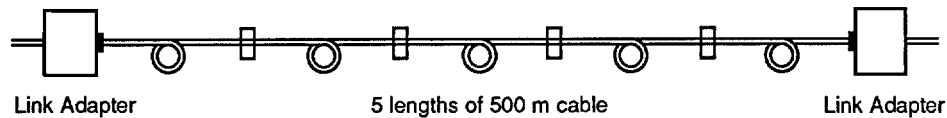
| Item | Specifications |
|-------------------------------|---------------------|
| Conforming optical fiber | Graded index 50/125 |
| Applicable wavelength | 800-900 nm |
| Transmit/receive differential | 13 dB (min) |

The transmission distance between Link Adapters AL005-(P)E and AL006-(P)E is basically determined by the difference between the transmitting and receiving levels of the Link Adapters and by the transmission loss over the crystal optical fiber cable. It is also affected, however, by the number of connecting points and the method of connection, as well as by the particular type of cable which is used. Use the calculation method shown below to determine whether a given cable length will fall within tolerable limits.

When total transmission loss from the system is subtracted from the transmit/receive differential of the Link Adapters, the margin must be at least 4 dB. To determine total transmission loss, first calculate the loss over the cable by multiplying the loss/km by the total length of the cable. Then calculate the loss at the connections by multiplying the loss/connection by the number of connections. Finally, add the cable loss and the connector loss. Subtract this figure, the total transmission loss, from the transmit/receive differential. If the difference is greater than 4 dB, then the cable length is acceptable.

Example 1

Distance: 2.5 km; Connecting points: 4; Connecting method: permanent



Transmission loss over the cable is 3 dB/km.

Cable loss $3 \text{ dB/km} \times 2.5 \text{ km} = 7.5 \text{ dB}$

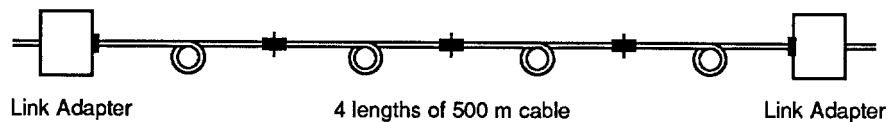
Connection loss... $0.1 \text{ dB/connection} \times 4 \text{ connections} = 0.4 \text{ dB}$

Total loss... 7.9 dB

When this total transmission loss of 7.9 dB is subtracted from the 13 dB transmit/receive differential of the Link Adapters, it leaves a margin of 5.1 dB. The 13 dB includes all loss at the Link Adapter connectors.

Example 2

Distance: 2 km; Connecting points: 3; Connecting method: connectors



Transmission loss over the cable is 3 dB/km

Cable loss... $3 \text{ dB/km} \times 2 \text{ km} = 6 \text{ dB}$

Connection loss... $0.7 \text{ dB/connector} \times 3 \text{ connectors} = 2.1 \text{ dB}$

Total loss... 8.1 dB

When this total transmission loss of 8.1 dB is subtracted from the 13 dB transmit/receive differential of the Link Adapters, it leaves a margin of 4.9 dB, safely above the minimum margin of 4 dB.

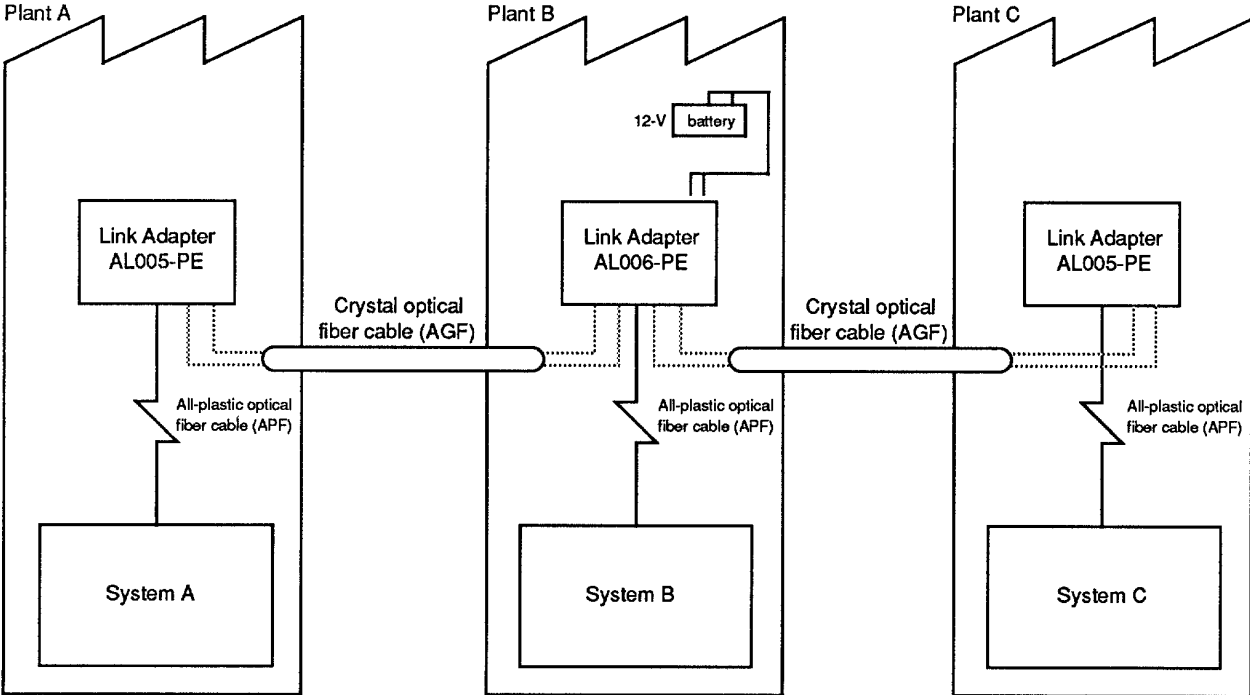
2-5 Backup Power Supply

Link Adapters which depend on a power supply (i.e., all except the AL001) are unable to transmit signals when power is cut off. Link Adapters AL002-(P)E, AL005-(P)E, and AL006-(P)E, however, have auxiliary power input terminals which can be connected to a battery to ensure continued operation even when the AC power supply is cut off.

Using the Auxiliary Power Input Terminal

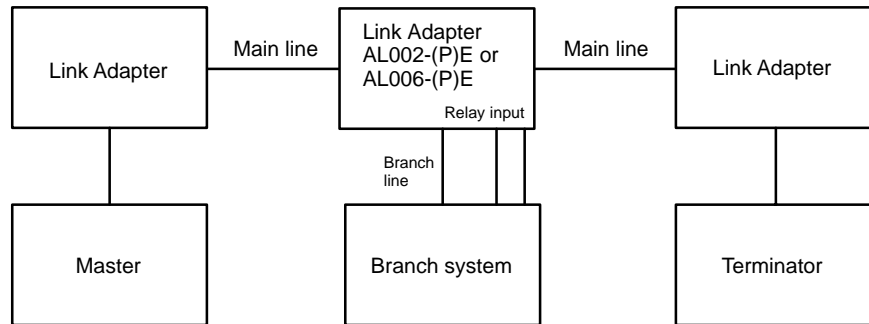
Only the three Link Adapters listed above have this terminal. They can operate on a low voltage (12-24 VAC/DC) power supply in place of their normal power supply of 100/200 VAC. When it is necessary to have a backup power supply, connect a 12V battery to this terminal. If the battery is left unused for a long period it will discharge. It must either be periodically charged or connected to a floating charging device. To avoid overcharging, set the output voltage at 13V. Do not use a 24V battery.

The following diagram illustrates a situation in which a 12V battery is used as a backup power supply, connected to the Link Adapter in Plant B. If there were no backup power supply in this case, then a power failure in Plant B would cut off signal transmission between Plant A and Plant C. By connecting the backup battery in Plant B this is avoided, and continued transmission is assured.



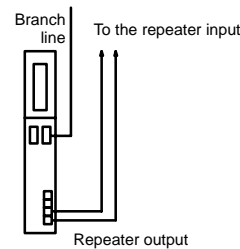
2-6 Link Adapter Repeater Input

Link Adapters AL002-(P)E and AL006-(P)E have repeater input terminals. They are used when it is necessary to be sure that power has already been turned on in a system connected to a branch line of the Link Adapter before signals are transmitted along the main line. They should be kept connected (ON) when not needed. When they are connected across, signals are relayed along the Link Adapter's main line. Once main line transmission has started, signals will continue to be relayed even if the repeater input terminals are opened (OFF).



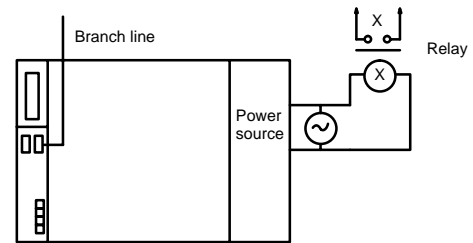
Units which may be connected to a branch line (as is branch system above)

Units with repeat input terminals (I/O Link Units)



Connect the Link Adapter's repeat input to the I/O Link Unit's repeater output.

Units without repeater input terminals (Units other than I/O Link Units)



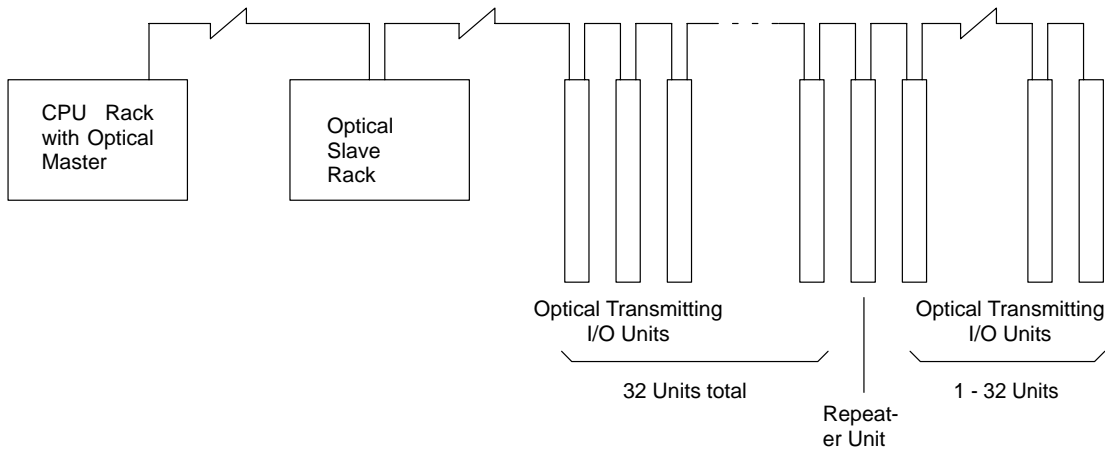
Connect so that the repeater input will be ON when power is turned on in the Unit connected to the branch line (in this case a Remote I/O Slave).

If the repeater input is connected across directly (not used) in the above example, control system operation will begin when the Master detects the terminator, even if power to the branch system is off. In other words, the branch system is ignored. The repeater input is used to prevent this from happening. When the repeater input is connected as shown above, then the Link Adapter's main line will not transmit data as long as power is not turned on in the branch system, thereby preventing the entire system from starting. Once the branch system is operating normally, however, signals will continue to be transmitted along the main line even if the repeater input turns OFF.

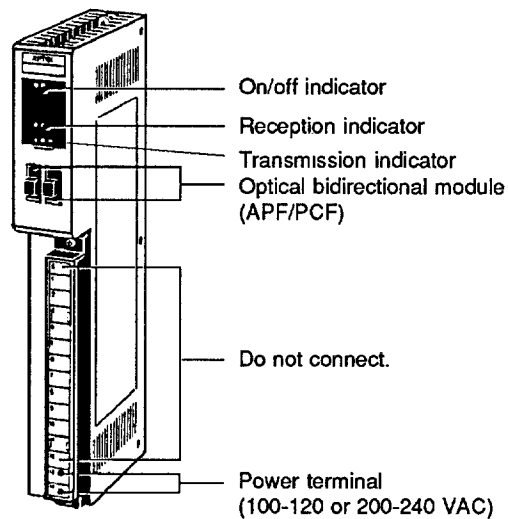
SECTION 3

Repeater Units

Repeater Unit RPT01-(P) must be used when the number of Optical Slave Racks, Optical Transmitting I/O Units, I/O Link Units, and Link Adapters connected in series exceeds 32. Insert a Repeater Unit between the 32nd and 33rd Units. The example below shows an Optical Slave Rack and Optical Transmitting I/O Units connected in series. Note that a Repeater Unit is inserted after the total of these Units reaches 32. When I/O Link Units or Link Adapters AL002-(P)E, AL005-(P)E or AL006-(P)E are used, each of them must also be counted as one of the 32 Units.

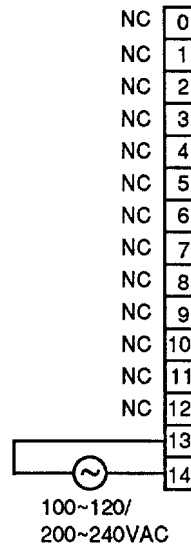


Nomenclature and Indicator Lights

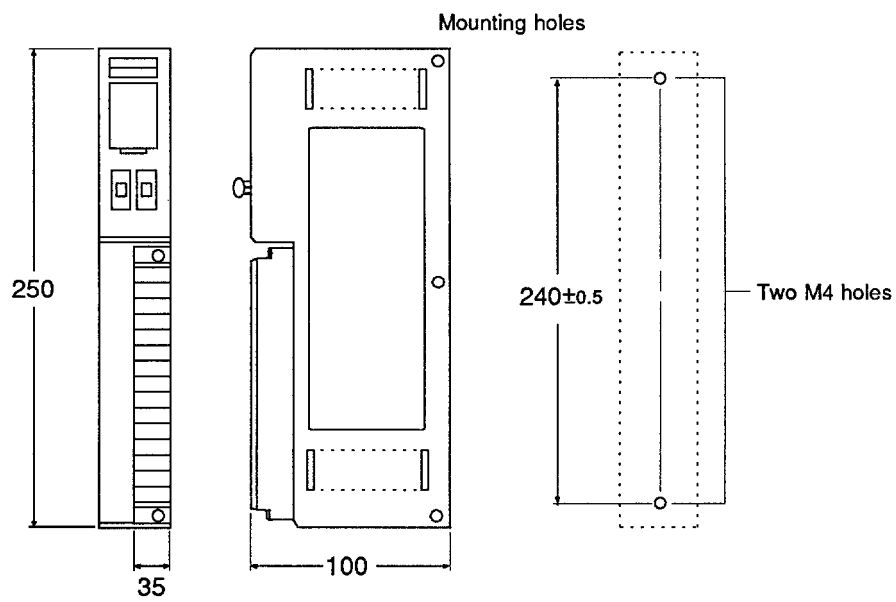


The on/off indicator stays lit while power is turned on. The reception indicator flashes when the optical bidirectional module receives signals from either side. The transmission indicator flashes when signals are sent to either side from the optical bidirectional module.

Connections



Dimensions



SECTION 4

System Configuration

Various system configurations call for the use of particular Link Adapters. This section presents a number of examples which illustrate the usage of Link Adapters in PC Link Systems, Host Link Systems, Optical Remote I/O Systems, and Wired Remote I/O Systems. See *1-4 General Specifications* for details on the functions and specifications of particular Link Adapters.

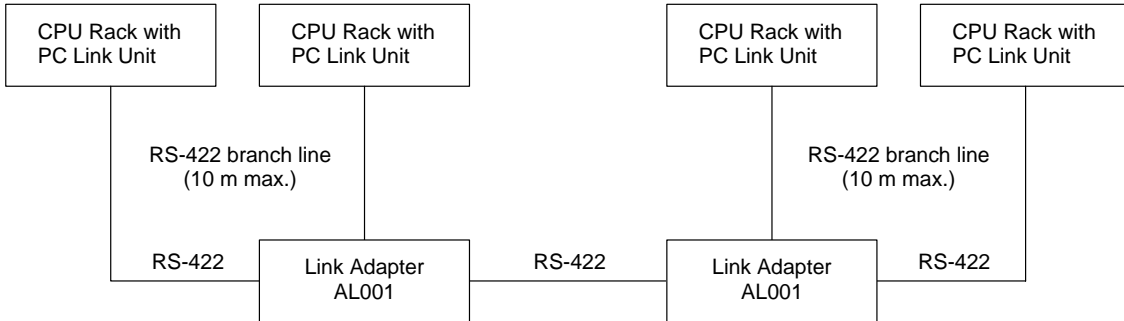
- 4-1 PC Link Systems
- 4-2 Host Link Systems
- 4-3 Optical Remote I/O Systems
- 4-4 Wired Remote I/O Systems

4-1 PC Link Systems

It is necessary to use Link Adapters when 3 or more PC Link Units are connected in a System.

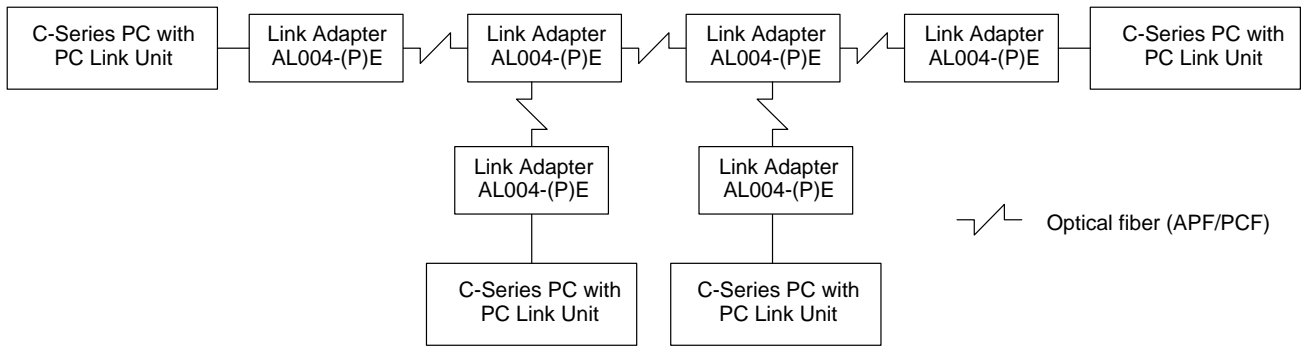
Example 1

A PC Link System can be connected using Link Adapter AL001 as shown in the diagram below.



Example 2

Link Adapters AL002-(P)E and AL004-(P)E can be used to insert optical links between PC Link Units to extend transmission distance and provide superior resistance to noise. Optical links connect only Link Adapters; they do not directly connect to the PC Link Units themselves. In the diagram below, the straight lines represent wire cables and the jagged lines represent optical fiber cables.

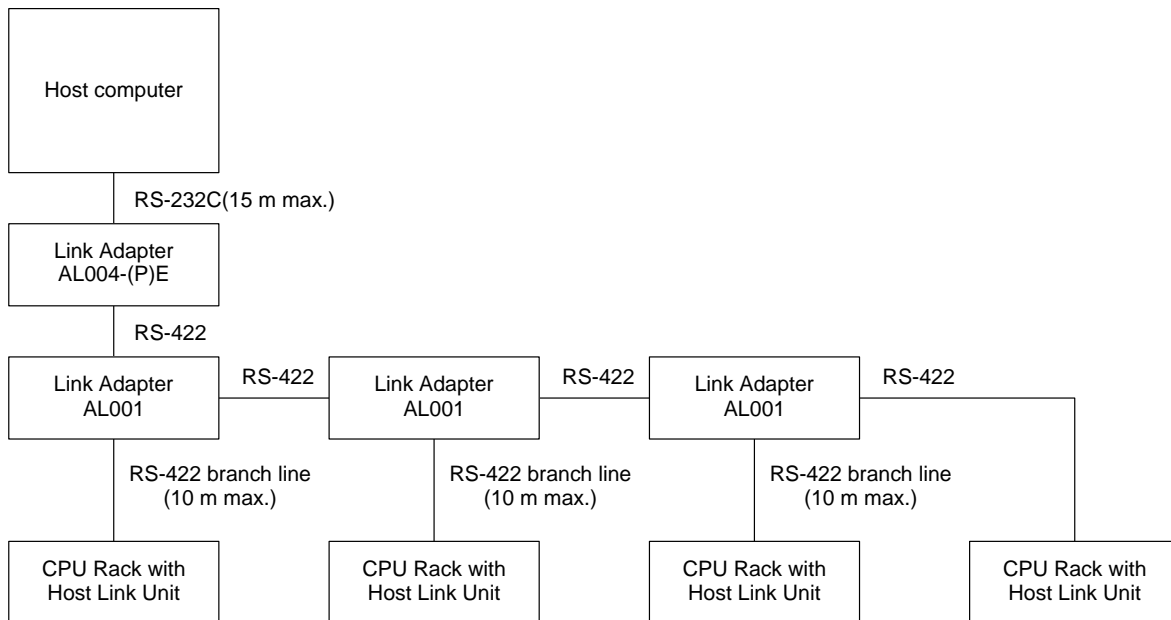


4-2 Host Link Systems

Link Adapters are used in Host Link Systems for branching and for converting to the type of cable required by the host computer.

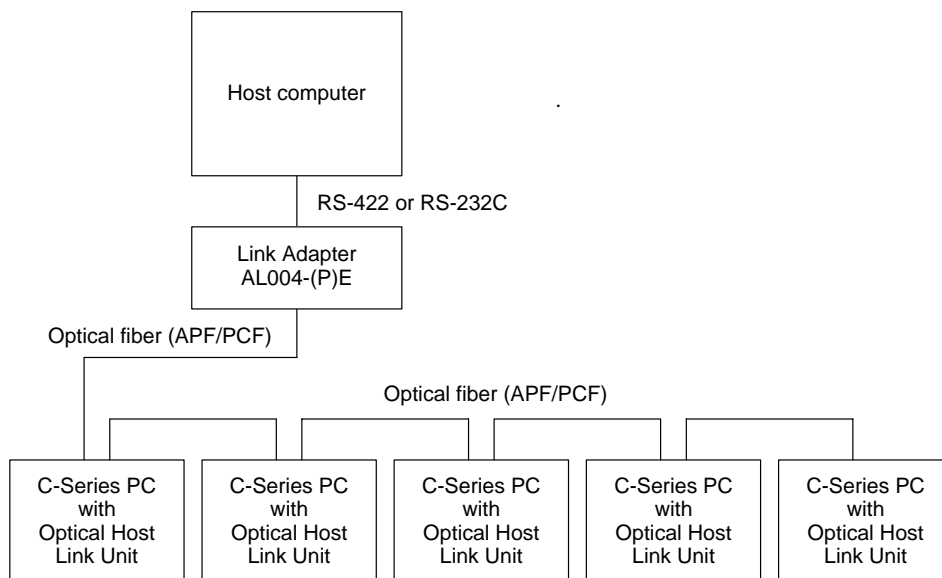
Example 1

A Wired Host Link System can be connected using Link Adapters AL004-(P)E and AL001 as shown below. Link Adapter AL004-(P)E is used to convert between RS-232C and RS-422 cable. Link Adapter AL001 is used for branching.



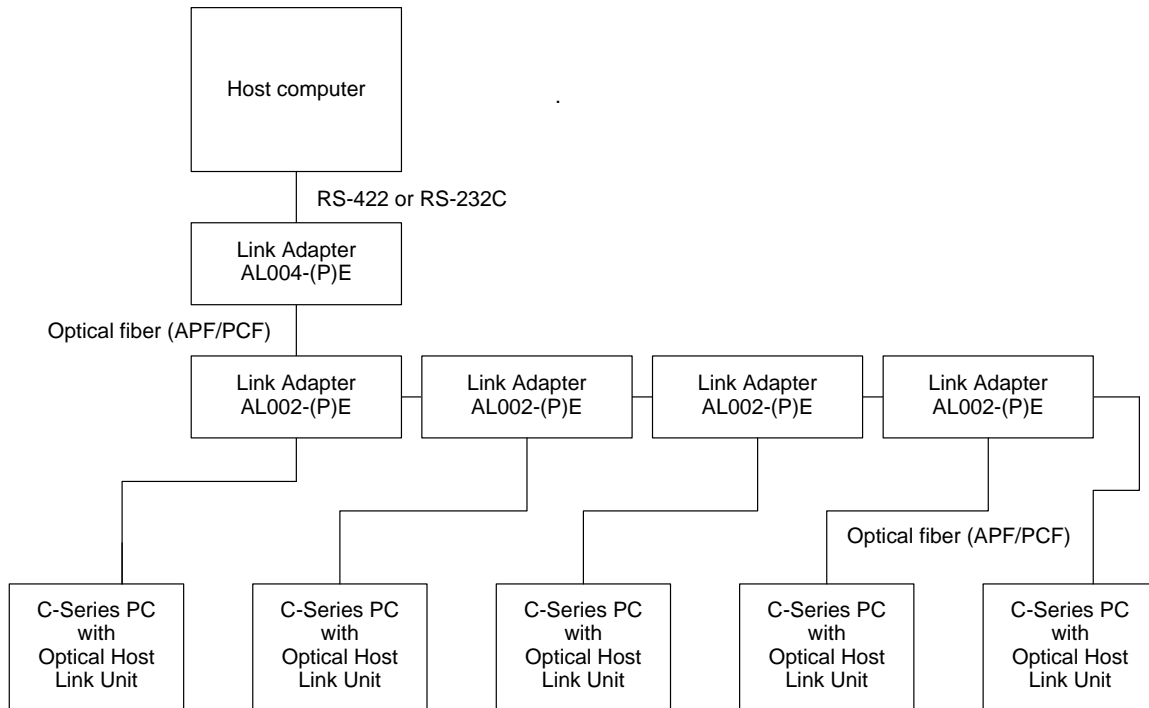
Example 2

Optical Host Link Systems can be connected in series using Link Adapter AL004-(P)E as shown below.



Example 3

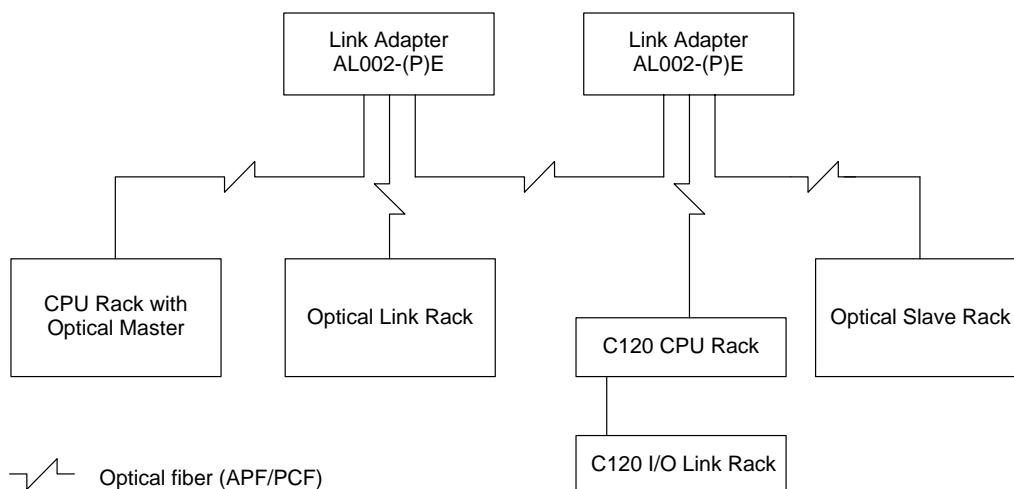
As shown in Example 3, more than one Optical Host Link Unit can be connected in series using optical fiber cables. However, if any failure (power failure, disconnection, etc.) occurs in one of the Units, all the subsequent Host Link Units will also cease to operate. This can be prevented by using Link Adapters such as the AL002-(P)E as shown below. These Link Adapters bypass any malfunctioning Host Link Unit, thereby allowing the rest of the system to operate normally. In other words, 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.



4-3 Optical Remote I/O Systems

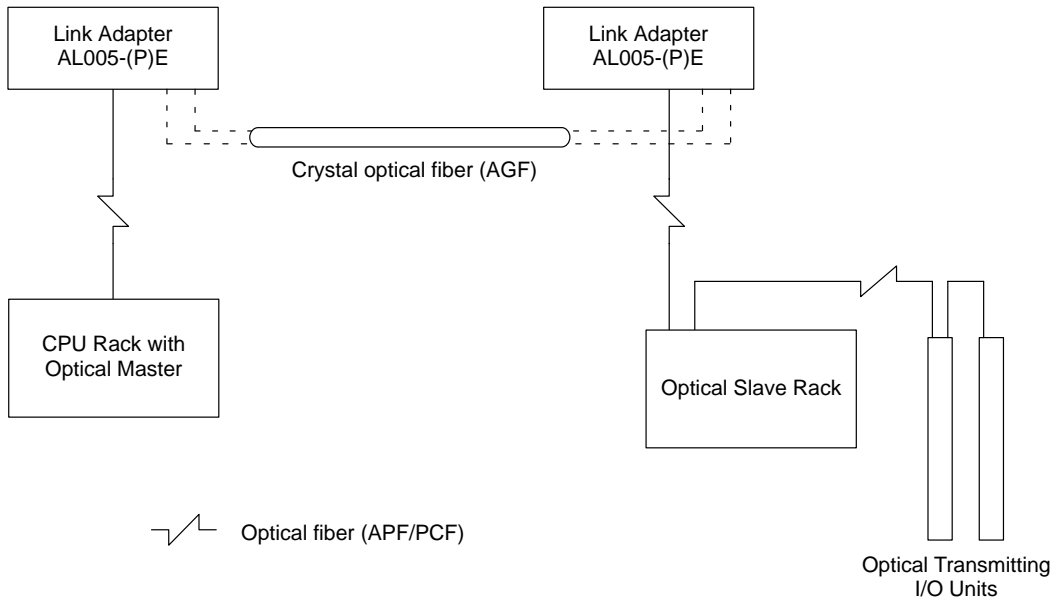
Example 1

Example 1: In an Optical System, Units can be connected in series. However, if any failure (power failure, disconnection, etc.) occurs in one of the Units, all of the subsequent Units will also cease to operate. This can be prevented by using Link Adapters such as the AL002-(P)E as shown below. These Link Adapters bypass any malfunctioning Unit connected to a branch line, thereby allowing the rest of the system to operate normally.



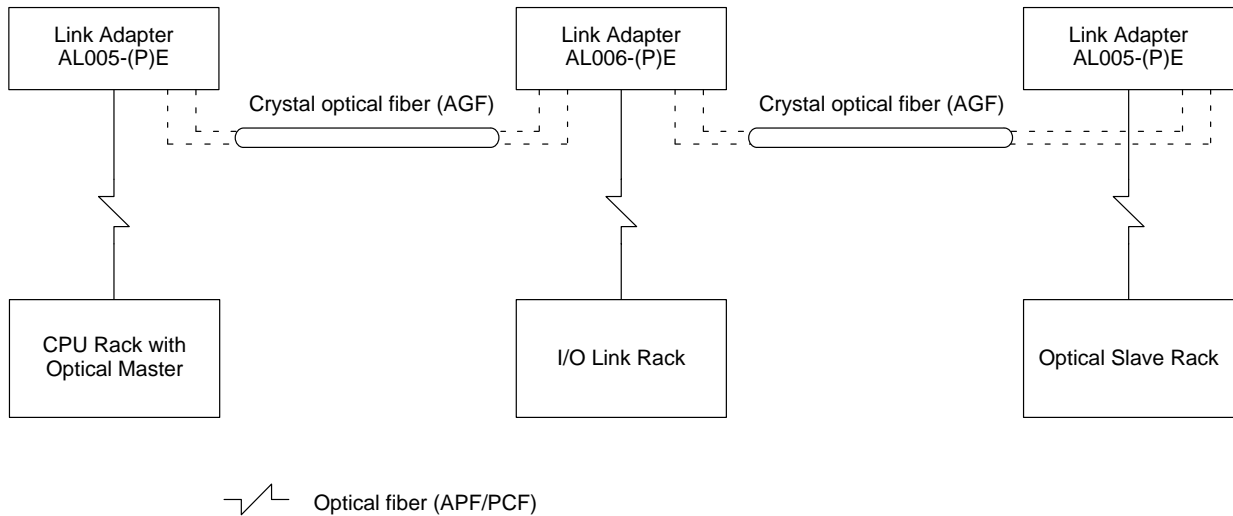
Example 2

An Optical System with Optical Transmitting I/O Units can be connected with crystal optical fiber cable (AGF) by using Link Adapter AL005-(P)E as shown below:



Example 3

An Optical System with an I/O Link Unit can be connected with crystal optical fiber cable by using Link Adapters AL005-(P)E and AL006-(P)E as shown below:



A maximum of 8 Link Adapters can be used in this configuration.

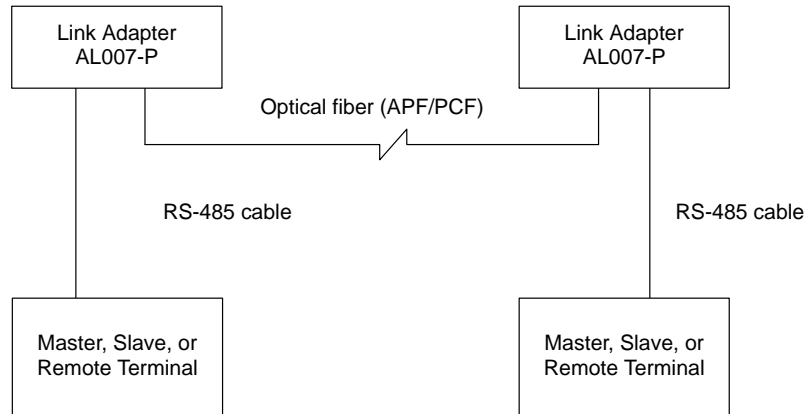
Cable Length

Maximum total cable length is 10 km. Follow the instructions contained in 2-4 *Crystal Optical Fiber Cable (AGF)* for calculating the length of AGF cable.

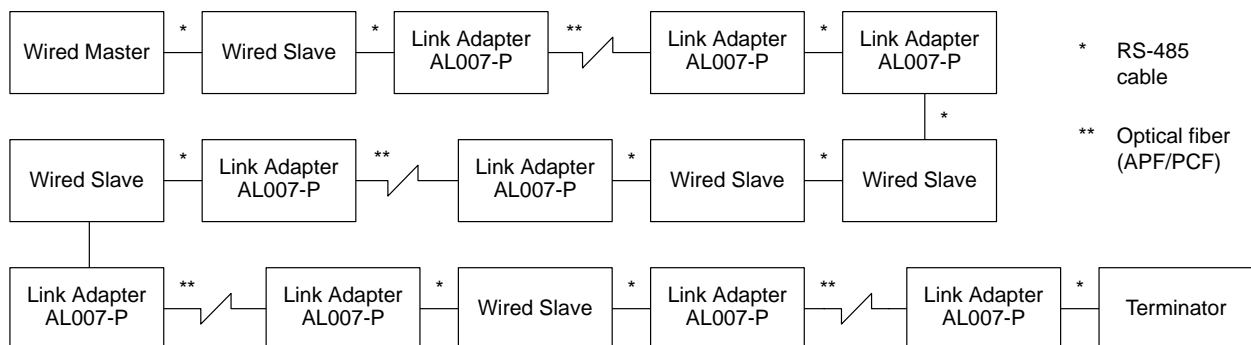
Be sure to turn power off before disconnecting a cable. If an optical fiber cable is disconnected while power is on in the Link Adapters and CPU, data may be retained in the Slave.

4-4 Wired Remote I/O Systems

Wired Remote I/O Master Units, Remote I/O Slave Units, and Remote Terminals can be directly connected with RS-485 cable, which has a maximum transmission distance of 200 m. In order to extend the transmission distance and/or to reduce noise interference, a pair of AL007-P Link Adapters can be used to insert an optical link between any two Remote I/O Units/Remote Terminals. The following example shows two Wired Remote I/O Units connected by optical fiber cable by using a pair of AL007-P Link Adapters.



The Link Adapters must always be used in pairs, as they convert between wire and optical signals, thereby allowing optical transmission between Units which cannot themselves be connected directly to optical fiber cable. The entire Subsystem, from Master to terminator, must be connected in series, with no branching. Up to 8 Link Adapters (4 pairs) can be used for each Master. The following diagram illustrates an acceptable configuration for a Wired Remote Master Subsystem, using the maximum of 8 Link Adapters for one Master. Note that all Units are connected in series and all Link Adapters are used in pairs.



Maximum cable length for any single section of optical cable is 20 m for all-plastic optical fiber cable (APF) and 200 m for plastic-clad optical fiber cable (PCF). To take full advantage of an optical link, shorten wire links as much as possible, even to the point of placing the Link Adapter on the same control panel as the Remote I/O Unit/Remote Terminal.

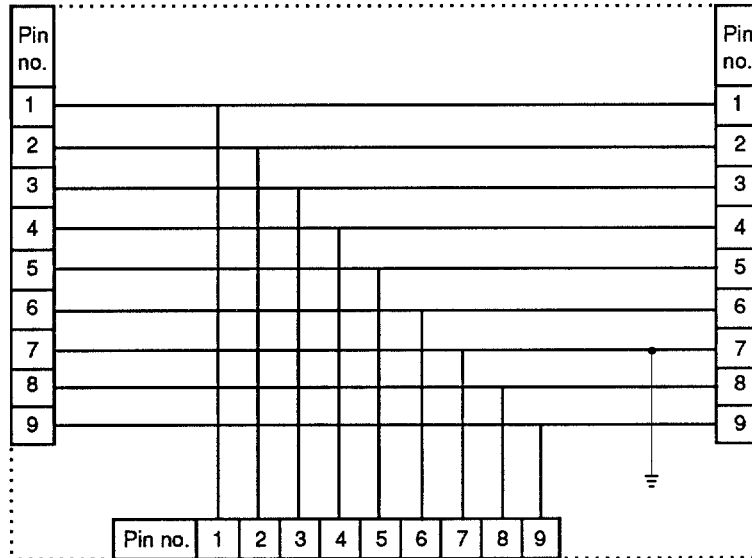
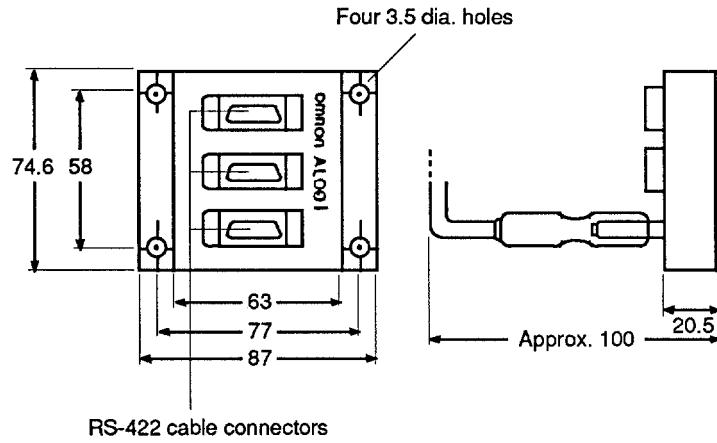
SECTION 5

Dimensions and Internal Configuration

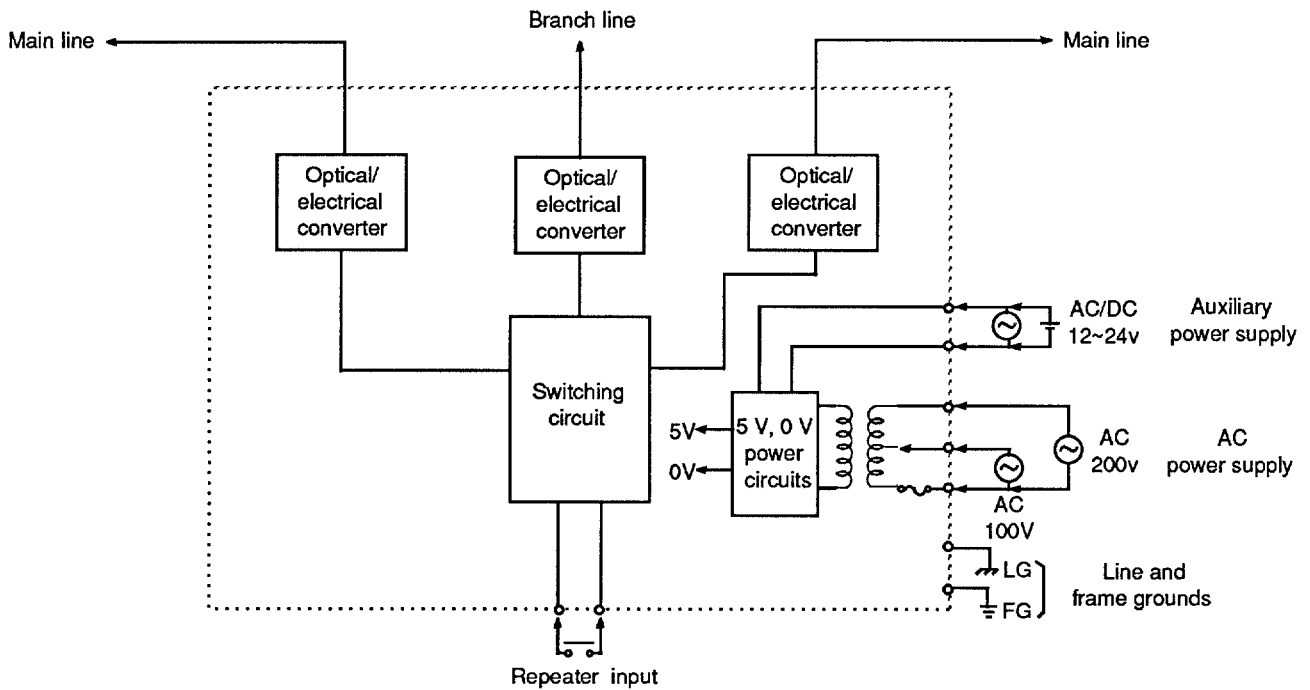
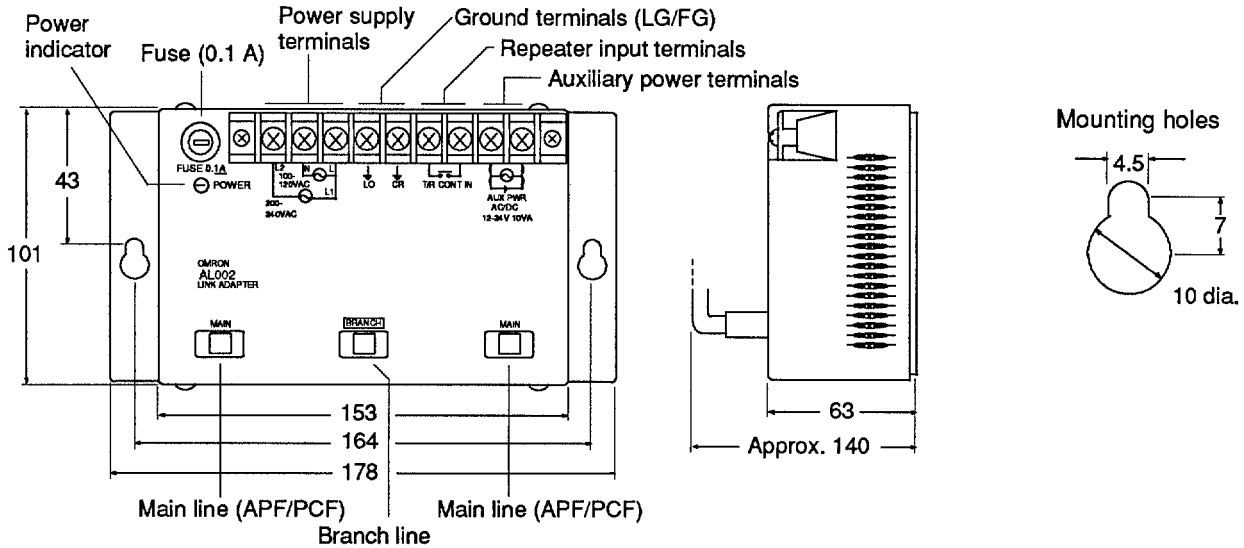
| | |
|-----|-------------------------------|
| 5-1 | Link Adapter AL001 |
| 5-2 | Link Adapter AL002-(P)E |
| 5-3 | Link Adapter AL004-(P)E |
| 5-4 | Link Adapter AL005-(P)E |
| 5-5 | Link Adapter AL006-(P)E |
| 5-6 | Link Adapter AL007-P |

5-1 Link Adapter AL001

Note Unit of measurement: mm

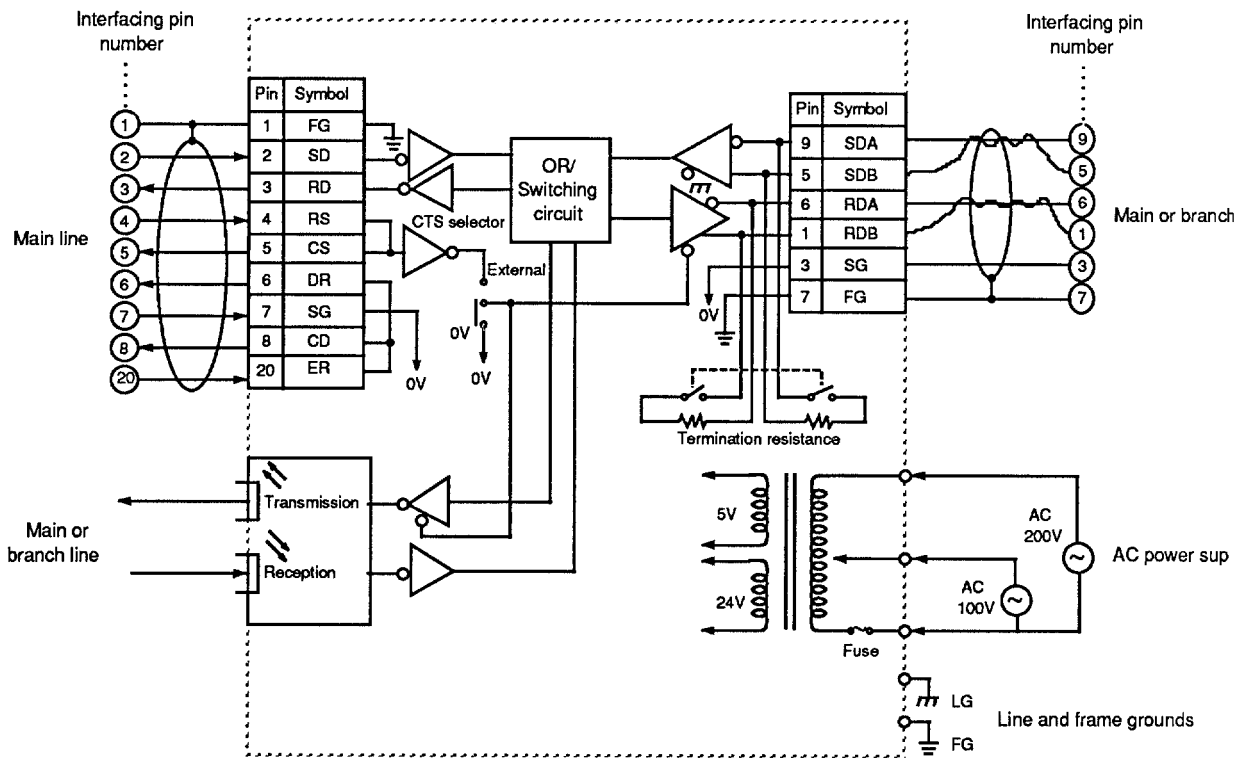
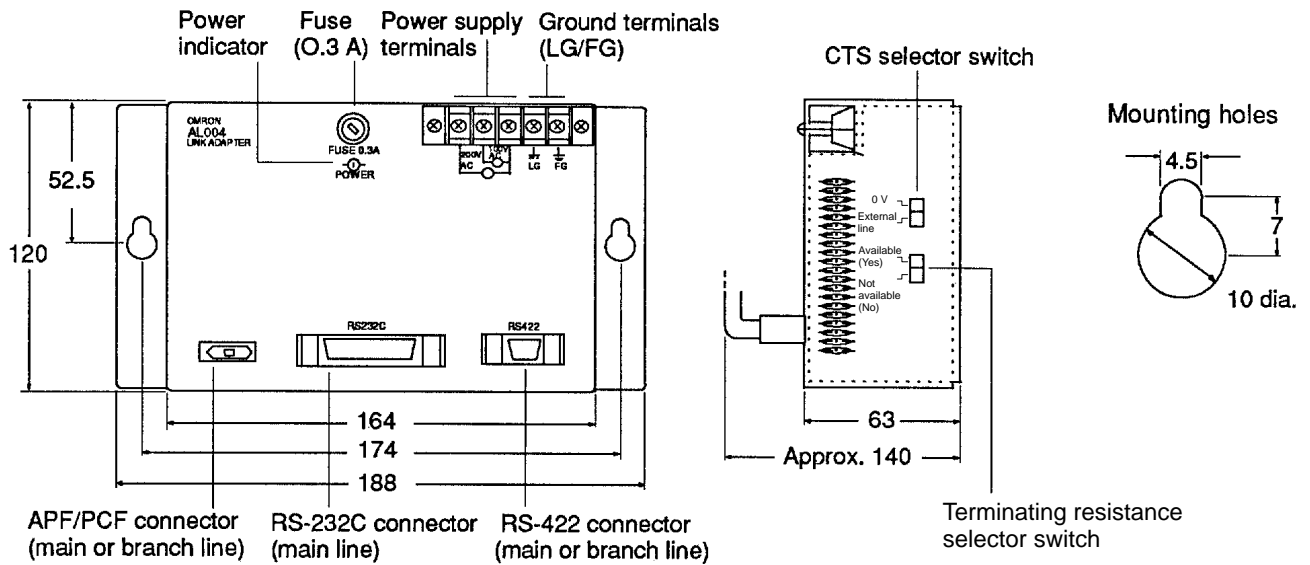


5-2 Link Adapter AL002-(P)E



The Link Adapter can run on either 100/200 VAC or 12-24 VAC/DC. The repeater input terminals should be shorted across when not being used. For details on the usage of the repeater input, refer to 2-6 *Link Adapter Repeater Input*. For backup power supplies, see 2-5 *Backup Power Supply*.

5-3 Link Adapter AL004-(P)E



Switch Settings

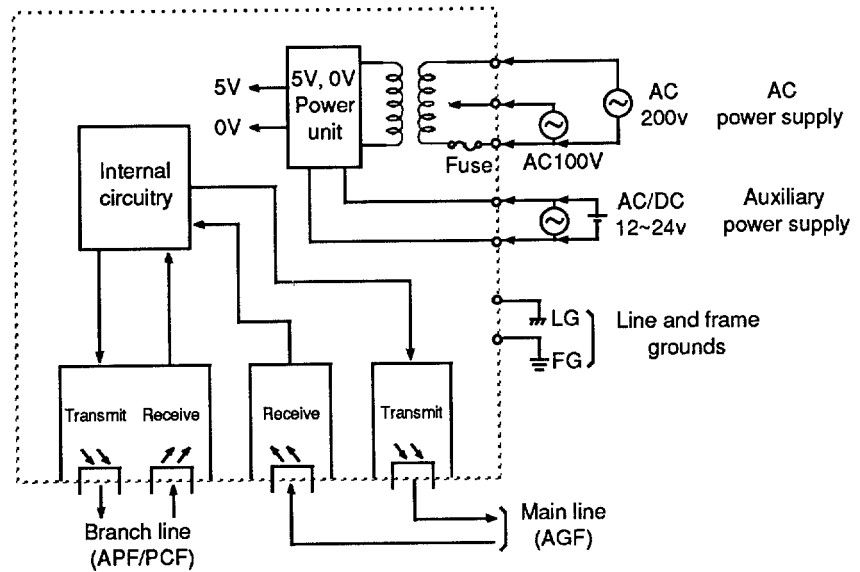
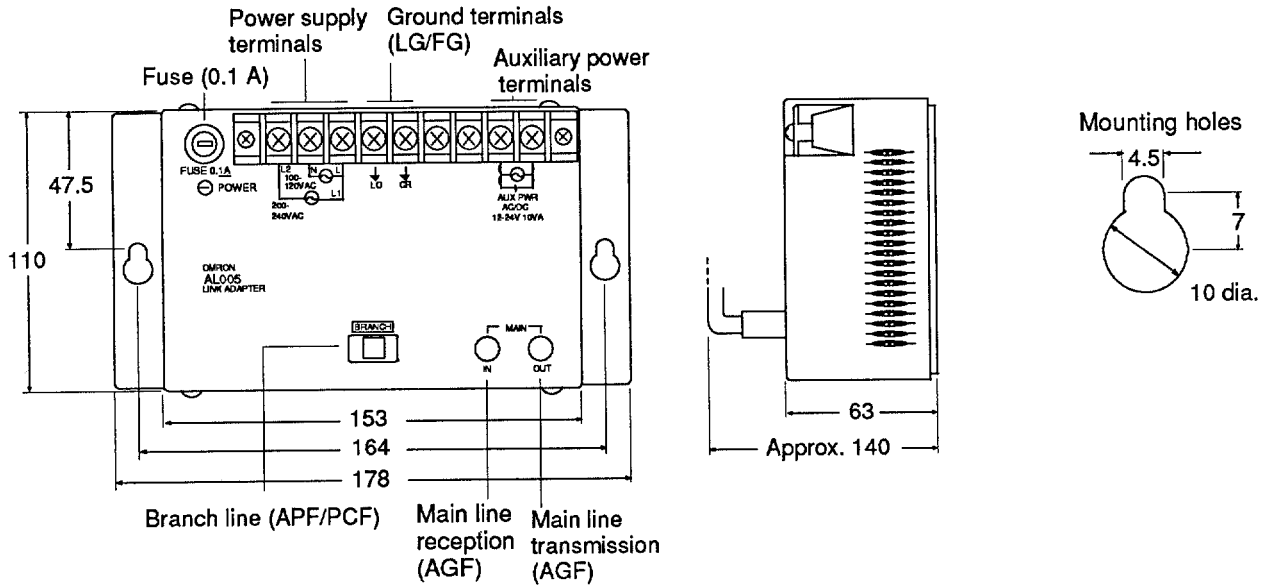
CTS Selector

Set to 0 V to have the clear-to-send (CTS) signal always ON. Set to external to receive an external CTS signal.

Termination Resistance

When set to ON, connects the built-in termination resistance (220 Ω); when set to OFF, disconnects it. Turn ON the termination resistance of the last Link Adapter at each end of each Subsystem.

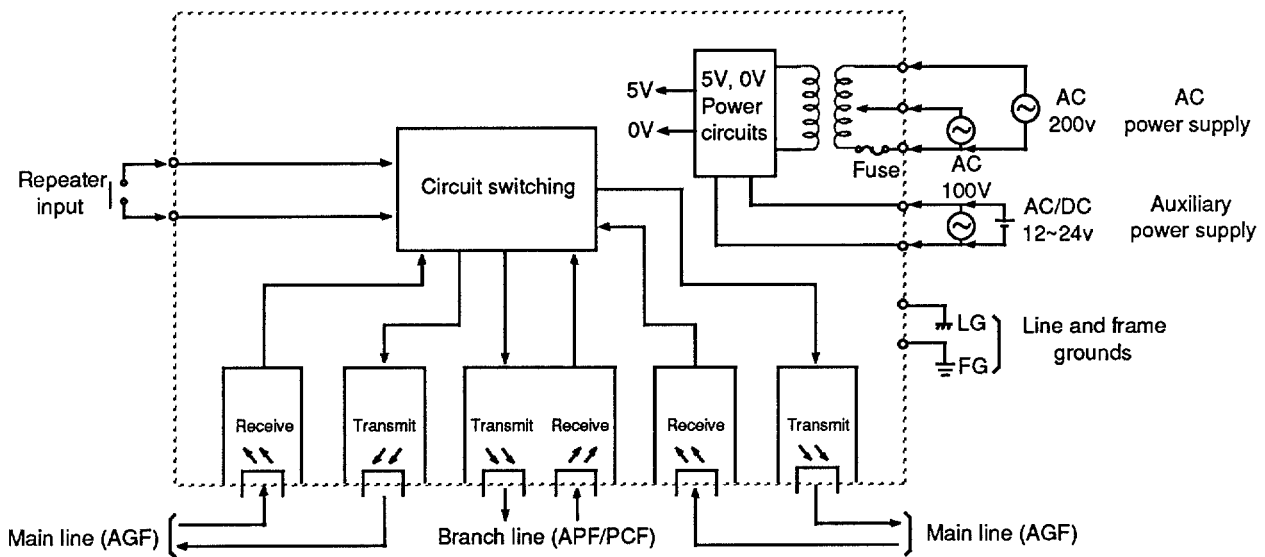
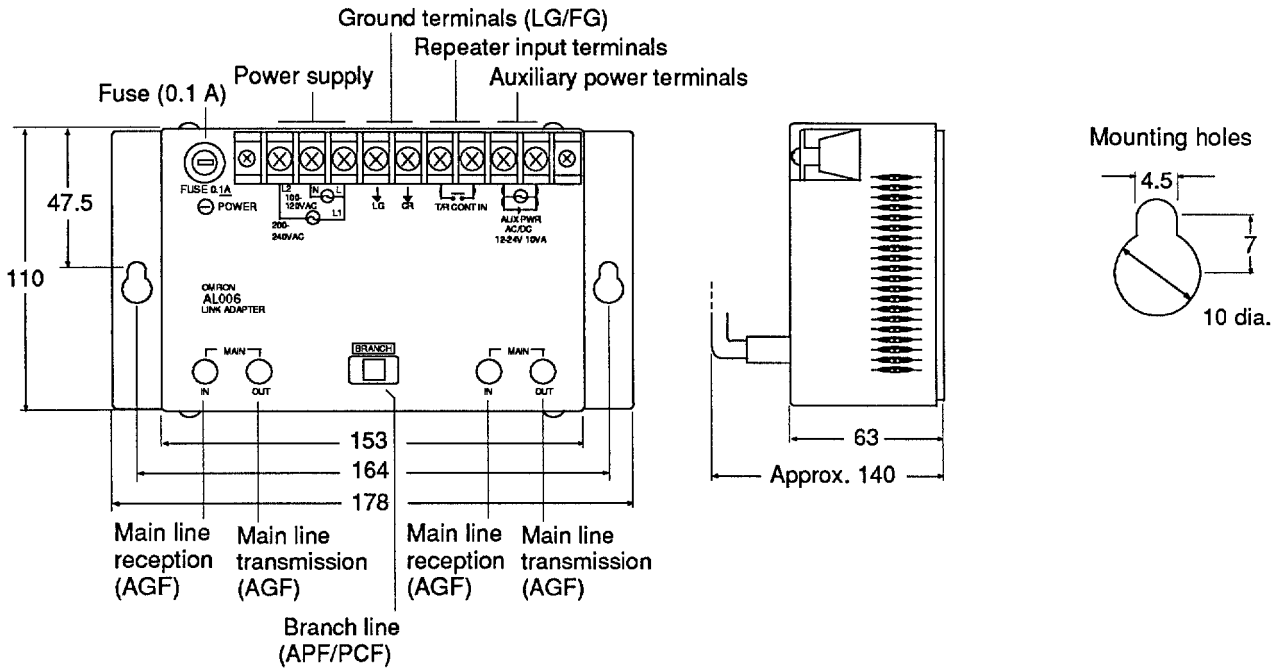
5-4 Link Adapter AL005-(P)E



Use FC connectors for AGF (crystal optical fiber;) cable. AGF connectors have fixed positions for reception and transmission, so be careful to connect them correctly.

The Link Adapter can operate on either 100/200 VAC or 12-24 VAC/DC. For details on auxiliary power supplies, see 2-5 Backup Power Supply.

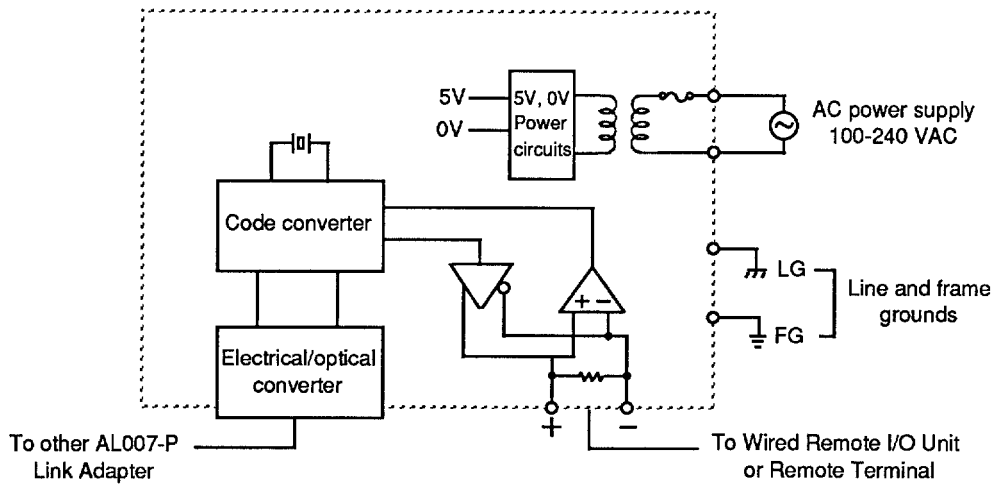
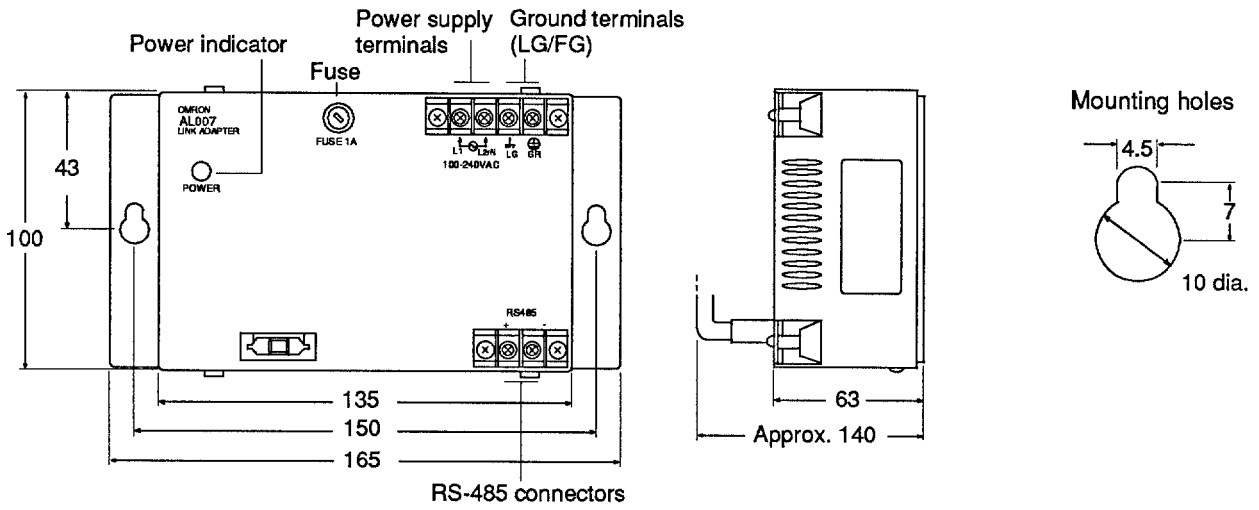
5-5 Link Adapter AL006-(P)E



Use FC connectors for AGF cable. AGF connectors have fixed positions for reception and transmission, so be careful to connect them correctly.

This Link Adapter can operate on either 100/200 VAC or 12-24 VAC/DC. The repeater input terminals should be shorted across when not being used. For details on how to use the repeater input, see 2-6 *Link Adapter Repeater Input*. For details on auxiliary power supplies, see 2-5 *Backup Power Supply*.

5-6 Link Adapter AL007-P



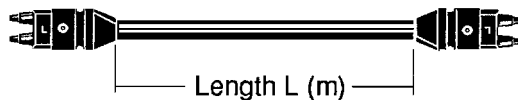
The AL007-P is used exclusively for Wired Remote I/O Systems. It cannot be used in Optical Remote I/O Systems, nor can it be used in combination with an AL002-(P)E.

Appendix A

Standard Models

| Name | Specifications | Model Number | |
|--|---|--------------------------------------|--------------------------------------|
| Link Adapter | Optical (APF/PCF) (3 connectors) | 3G2A9-AL002-PE | |
| | RS-422 (2 connectors), RS-232C (1 connector) | 3G2A9-AL003-E | |
| | Optical (APF/PCF), RS-422, RS-232C (1 conn. each) | 3G2A9-AL004-PE | |
| | Optical (APF/PCF), (AGF) (1 connector each) | 3G2A9-AL005-PE | |
| | Optical (APF/PCF) (1 connector), (AGF) (2 connectors) | 3G2A9-AL006-PE | |
| | RS-422 (3 connectors) | 3G2A9-AL001 | |
| | Optical (PCF) (3 connectors) | 3G2A9-AL002-E | |
| | Optical (PCF), RS-422, RS-232C (1 connector each) | 3G2A9-AL004-E | |
| | Optical (PCF), (AGF) (1 connector each) | 3G2A9-AL005-E | |
| | Optical (PCF) (1 connector), (AGF) (2 connectors) | 3G2A9-AL006-E | |
| | Optical (APF/PCF) (1 connector), (AGF) (2 connectors) | B500-AL007-P | |
| | Optical fiber cable (indoor) (PCF) | 0.1 m w/connector | Ambient temperature: -10° to 70°C |
| 1 m w/connector | | 3G5A2-0F101 | |
| 2 m w/connector | | 3G5A2-0F201 | |
| 3 m w/connector | | 3G5A2-0F301 | |
| 5 m w/connector | | 3G5A2-0F501 | |
| 10 m w/connector | | 3G5A2-0F111 | |
| 20 m w/connector | | 3G5A2-0F211 | |
| 30 m w/connector | | 3G5A2-0F311 | |
| 40 m w/connector | | 3G5A2-0F411 | |
| 50 m w/connector | | 3G5A2-0F511 | |
| Optical fiber cable (PCF) (for indoors or outdoors) | 10 to 500 m (Order in units of 10 m.) | Ambient temperature: -10° to 70°C | 3G5A2-OF002 |
| | 501 to 800 m (Order in units of 10 m) | | |
| Optical fiber cable (APF) | Cable only; for 5 m to 100 m, order in multiples of 5 m; or in multiples of 200 m or 500 m. | | 3G5A2-PF002 |
| Optical fiber cable set (APF) | 1 m cable with connector at each end (connector A) | | 3G5A2-PF101 |
| Optical connector A | 2 optical connectors (brown); for APF cable 10 m max. | | 3G5A2-CO001 |
| Optical connector B | 2 optical connectors (black); for APF cable 8 to 20 m long | | 3G5A2-CO002 |
| Repeater Unit | To use more than 32 Optical Transmitting I/O Units in series, 85 to 250 VAC | | 3G5A2-RPT01-P (APC/PCF) |
| | | | 3G5A2-RPT01 (PCF) |

Note Optical fiber cable is not easily connected. Figure in extra length when determining cable lengths for making connections and extensions.



Crystal Optical Fiber Cable

Crystal optical fiber cable is not available from OMRON. Order it directly from the manufacturer. (Applicable fiber: GI 50/25; connector: FC)

Wire Cable

We recommend the following cables for RS-422, RS-232C, and RS-485 connections.

| Cable type | Recommended Cable |
|-------------------|---|
| RS-232C | CO-DS-IREVV-SX-10P x 0.18 mm ² (Hitachi Cable) |
| RS-422 | CO-HC-ESV-3P x 7/0.2 (Hirakawa Cable) |
| RS-485 | VCTF 0.75 x 2C (JIS) |

Index

A

application precautions,

C

cable connectors
 optical fiber cable,
 soldering,
 wire cable,
 wiring,

CTS selector,

H

host computers, ,
 connecting to, ,

Host Link Systems, , , ,
 optical,
 wired,

I

I/O Link Units, ,

installation precautions,

O

operating environment precautions,

optical fiber cable,
 applicable Link Adapters,
 branching,
 cable length, ,
 converting to wire cable, , , ,
 crystal optical fiber, , ,
 calculating transmission distance, ,
 connectors, ,
 specifications,
 handling,
 Repeater Units,
 types,

Optical Host Link Units,

optical links between Units, ,

Optical Remote I/O Systems, , , ,

Optical Slave Racks, ,

Optical Transmitting I/O Units, , ,

P

PC Link Systems, , , ,

power interruption,
 backup power supply, ,
 bypassing malfunctioning Unit, ,

power supply,
 specifications, ,

precautions,
 applications,
 general,
 operating environment,
 safety,

R

Remote I/O Master Units, ,

Remote I/O Slave Units, ,

Remote Terminals,

repeater input, , ,

Repeater Units, , , ,

S

safety precautions. *See* precautions

specifications, ,

switch settings,

T

termination resistance,


W

wire cable,
 branching,
 cable length,
 converting to optical fiber cable, , , , ,
 RS-422 or RS-232C, ,
 RS-485,
 specifications,

Wired Remote I/O Systems, , , ,

Revision History

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

Cat. No. W123-E1-3
 Revision code

The following table outlines the changes made to the manual during each revision. Page numbers refer to previous version.

| Revision code | Date | Revised content |
|---------------|----------------|---|
| 1 | 1990 | Original production |
| 2 | September 1990 | First production in Interleaf. Put into current manual format. Changes: Added 3G2A9-AL003-E to Standard Model list Minor prose changes for readability |
| 2A | September 1995 | Page 3: The table row containing AL004-PE corrected. |
| 3 | June 1999 | Manual format changed. <i>Precautions</i> section added before Section 1. Page 3: Supply voltage and operating voltage range information changed for AL004-PE/E. Page 24: Grounding information added to the pin number diagram. Page 26: Switch information added to the upper-left diagram. |