NETWORKS

CC-Link/LT

User's Manual
(Detailed Volume)

CL1PAD1
(Power Adapter for CC-Link/LT)

01 03 2003
JY997D06601
Version B

Foreword

- This manual contains text, diagrams and explanations which will guide the reader in the correct installation and operation of the CL1PAD1 (Power Adapter for CC-Link/LT). It should be read and understood before attempting to install or use the unit.
- If in doubt at any stage of the CL1PAD1 (Power Adapter for CC-Link/LT) installation of always consult a professional electrical engineer who is qualified and trained to the local and national standards that applies to the installation site.
- If in doubt about the operation or use of the CL1PAD1 (Power Adapter for CC-Link/LT) please consult the nearest Mitsubishi Electric distributor.
- This manual is subject to change without notice.

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(Power Adapter for CC-Link/LT)

USER'S MANUAL (Detailed Volume)

Manual number : JY997D06601
Manual revision : B
Date : MARCH 2003

FAX BACK

Mitsubishi has a world wide reputation for its efforts in continually developing and pushing back the frontiers of industrial automation. What is sometimes overlooked by the user is the care and attention to detail that is taken with the documentation. However, to continue this process of improvement, the comments of the Mitsubishi users are always welcomed. This page has been designed for you, the reader, to fill in your comments and fax them back to us. We look forward to hearing from you.

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Thank you for taking the time to fill out this questionnaire. We hope you found both the product and this manual easy to use.

Guidelines for the Safety of the User and Protection of the CL1PAD1

This manual provides information for the use of the CL1PAD1. The manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows;

a) Any engineer who is responsible for the planning, design and construction of automatic equipment using the product associated with this manual should be of a competent nature, trained and qualified to the local and national standards required to fulfill that role. These engineers should be fully aware of all aspects of safety with regards to automated equipment.

b) Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards required to fulfill that job. These engineers should also be trained in the use and maintenance of the completed product. This includes being completely familiar with all associated documentation for the said product. All maintenance should be carried out in accordance with established safety practices.

c) All operators of the completed equipment (see Note) should be trained to use this product in a safe manner in compliance to established safety practices. The operators should also be familiar with documentation which is associated with the operation of the completed equipment.

Note : Note: the term 'completed equipment' refers to a third party constructed device which contains or uses the product associated with this manual.

Notes on the Symbols Used in this Manual

At various times throughout this manual certain symbols will be used to highlight points of information which are intended to ensure the users personal safety and protect the integrity of equipment. Whenever any of the following symbols are encountered its associated note must be read and understood. Each of the symbols used will now be listed with a brief description of its meaning.

Hardware Warnings

1) Indicates that the identified danger **WILL** cause physical and property damage.

2) Indicates that the identified danger could **POSSIBLY** cause physical and property damage.

3) Indicates a point of further interest or further explanation.

Software Warnings

4) Indicates special care must be taken when using this element of software.

5) Indicates a special point which the user of the associate software element should be aware of.

6) Indicates a point of interest or further explanation.

- Under no circumstances will Mitsubishi Electric be liable responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
- All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- Please contact a Mitsubishi Electric distributor for more information concerning applications in life critical situations or high reliability.

Table of Contents

1. Outline

Cautions on design

DANGER
• If a failure occurs in the I/O module the output may switch to the ON or OFF status. For output signals which can lead to a severe accident, install a circuit monitoring device outside the module.

CAUTION
• Do not bind the control cable or the flat cable dedicated to CC-Link/LT together with the main circuit and power cable. Keep such cables far from the main circuit and power cable. Assure a distance of 100mm (3.94") or more, otherwise malfunction may occur due to excessive noise. • Use the power adapter without applying any force on the connector of the CC-Link/LT interface and the flat cable dedicated to CC-Link/LT. Otherwise, such cables may break or fail.

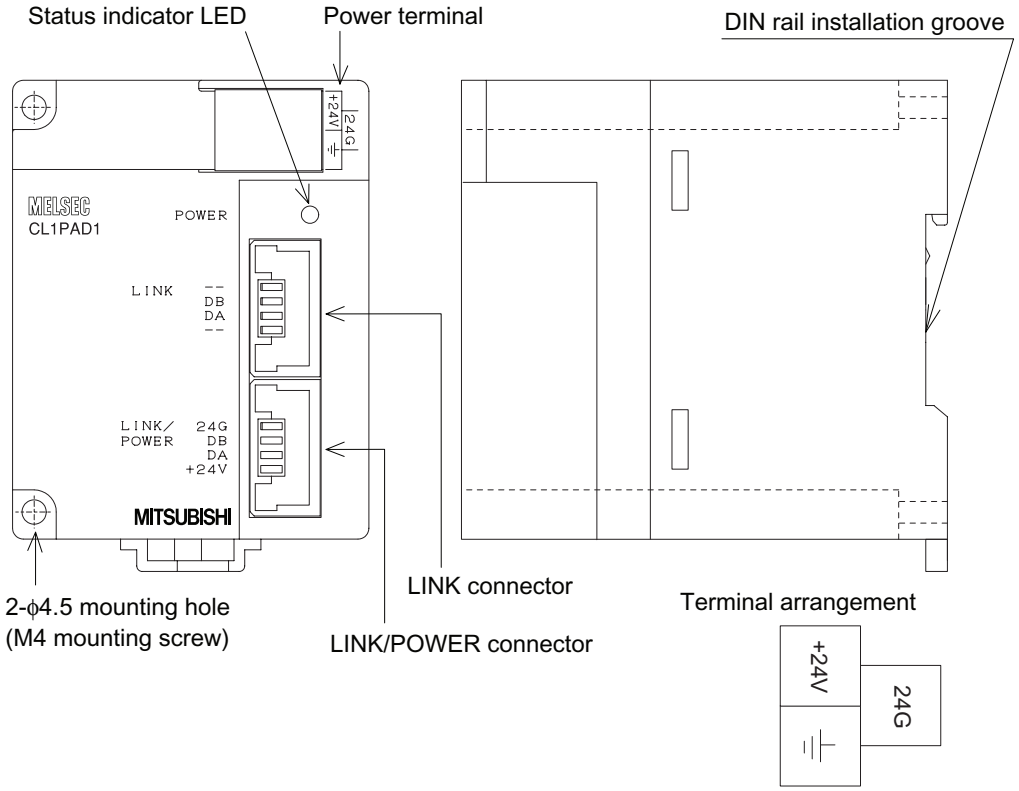
Caution on disposal

CAUTION
• When disposing of the product, treat it as industrial waste.

1.1 Outline of Product

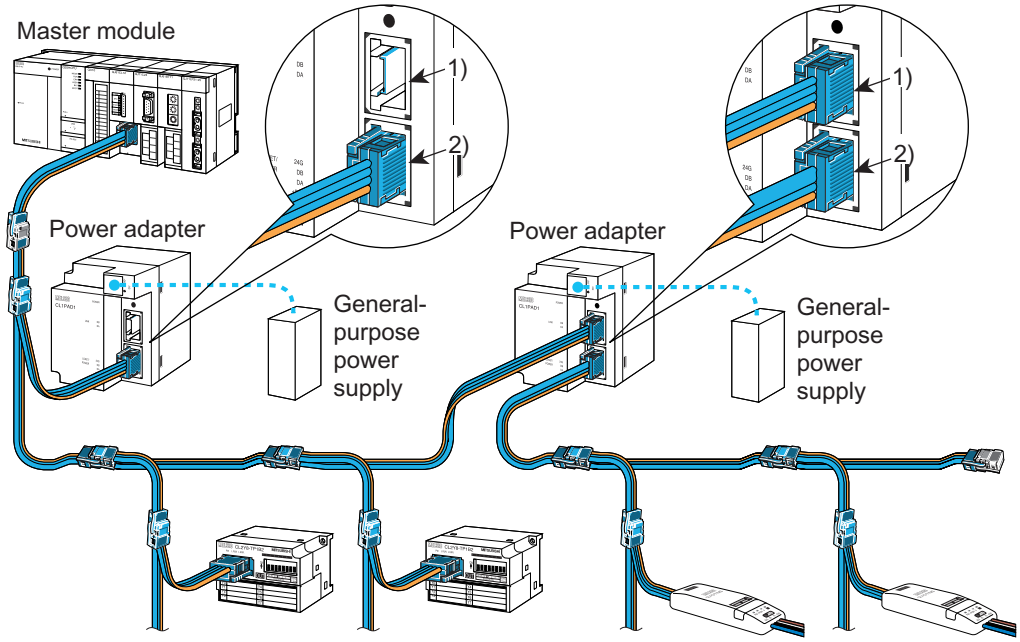
This product is a power adapter dedicated to the CC-Link/LT network.
This product supplies 24V DC power from an general-purpose power supply to the CC-Link/LT system.
At least one power adapter is required in the CC-Link/LT system.

1.2 Name of each part and assignment



Name			Description
Status indicator LED	POWER		Lit while the power is supplied
Interface	LINK connector	DB	For communication
		DA	For communication
	LINK/ POWER connector	24G	Power supply for communication (-)
		DB	For communication
		DA	For communication
		+24V	Power supply for communication (+)
Power terminal	+24V		Supplies power from an external source to the power adapter. Input voltage: 28.8V DC or less (depending on connected model) Rated input current:5.0 A (Use a proper general-purpose power supply with consideration to the initial current of the remote I/O modules.)
	24G		
	⏚		Terminal for grounding (100Ω or less)

1.3 Handling of LINK and LINK/POWER connector



1) LINK connector
   Executes communication only.
   Used when two or more power adapters are in the CC-Link/LT system.

2) LINK/POWER connector
   Executes communication and supplies power to the CC-Link/LT system.

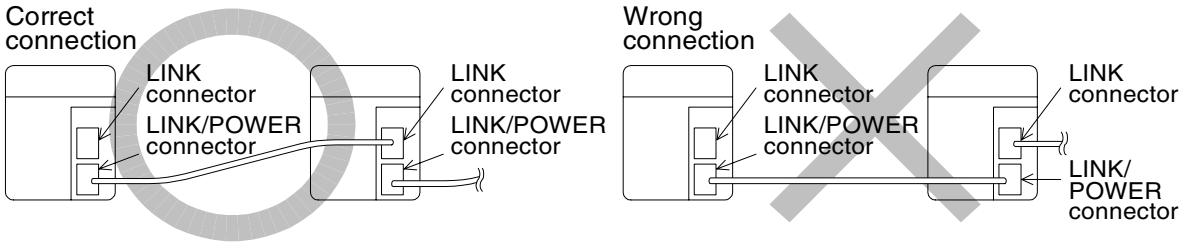
Notes:

- The LINK connector in the power adapter executes communication only.
  This connector is used for communication relay when two or more power adapters are used.
- The LINK/POWER connector in the power adapter executes communication and supplies power to the CC-Link/LT system.
  This connector communicates with and supplies the power to the master module and remote I/O modules used in the system.

Caution on wiring

⚠CAUTION

- Confirm the rated voltage and the terminal arrangement of the power adapter, then correctly wire the power adapter.
  Fire or failure may occur due to a voltage exceeding the rated specification has been connected or incorrect wiring has been performed.
- When two or more power adapters exist in a system, take care in connecting the first LINK/POWER connector to the second LINK connector as indicated below. If the LINK/POWER connector in the two adapters are connected to each other, the adapters may fail.



2. Specifications

2.1 General specifications

<table>
<tr><th>Item</th><th colspan="5">Description</th></tr>
<tr><td>Ambient operating temperature</td><td colspan="5">0 to 55°C (32 to 131°F) (*1)</td></tr>
<tr><td>Ambient storage temperature</td><td colspan="5">-25 to 75°C (-13 to 167°F) (*1)</td></tr>
<tr><td>Ambient operating humidity</td><td colspan="5">Conforming to JIS B3502 and IEC61131-2, Level RH-2
(5 to 95%RH: Dew condensation shall not be allowed.)</td></tr>
<tr><td>Ambient storage humidity</td><td colspan="5">Conforming to JIS B3502 and IEC61131-2, Level RH-2
(5 to 95%RH: Dew condensation shall not be allowed.)</td></tr>
<tr><td rowspan="8">Vibration resistance</td><td rowspan="8">Conforming to JIS B3502 and IEC61131-2</td><td colspan="3">When intermittent vibration is present</td><td>Number of sweep times</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Half amplitude</td><td rowspan="6">10 times in each of the X, Y and Z directions (for 80 min)</td></tr>
<tr><td>10 to 57Hz</td><td>--</td><td>0.075mm</td></tr>
<tr><td>57 to 150Hz</td><td>9.8m/s^2</td><td>--</td></tr>
<tr><td colspan="3">When continuous vibration is present</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Half amplitude</td></tr>
<tr><td>10 to 57Hz</td><td>--</td><td>0.035mm</td></tr>
<tr><td>57 to 150Hz</td><td>4.9m/s^2</td><td>--</td></tr>
<tr><td>Impact resistance</td><td colspan="5">Conforming to JIS B3502 and IEC61131-2
(147 m/s2, 3 times in each of X, Y and Z directions)</td></tr>
<tr><td>Operating atmosphere</td><td colspan="5">Corrosive gas shall not be present.</td></tr>
<tr><td>Operating altitude</td><td colspan="5">Conforming to JIS B3502 and IEC61131-2 (2,000m(6561'8") or less)(*2)</td></tr>
<tr><td>Installation place</td><td colspan="5">Inside control panel</td></tr>
<tr><td>Over-voltage category</td><td colspan="5">Conforming to JIS B3502 and IEC61131-2 (Category II or less)(*3)</td></tr>
<tr><td>Degree of contamination</td><td colspan="5">Conforming to JIS B3502 and IEC61131-2, Degree of contamination 2 or less (*4)</td></tr>
</table>

Notes:

*1 The ambient operating/storage temperature satisfies the requirements beyond the specification in the JIS B3502 and the IEC61131-2.

*2 The module cannot be used in an environment pressurized above atmospheric pressure that can be generated around the altitude of 0 m. If the module is used in such an environment, it may fail.

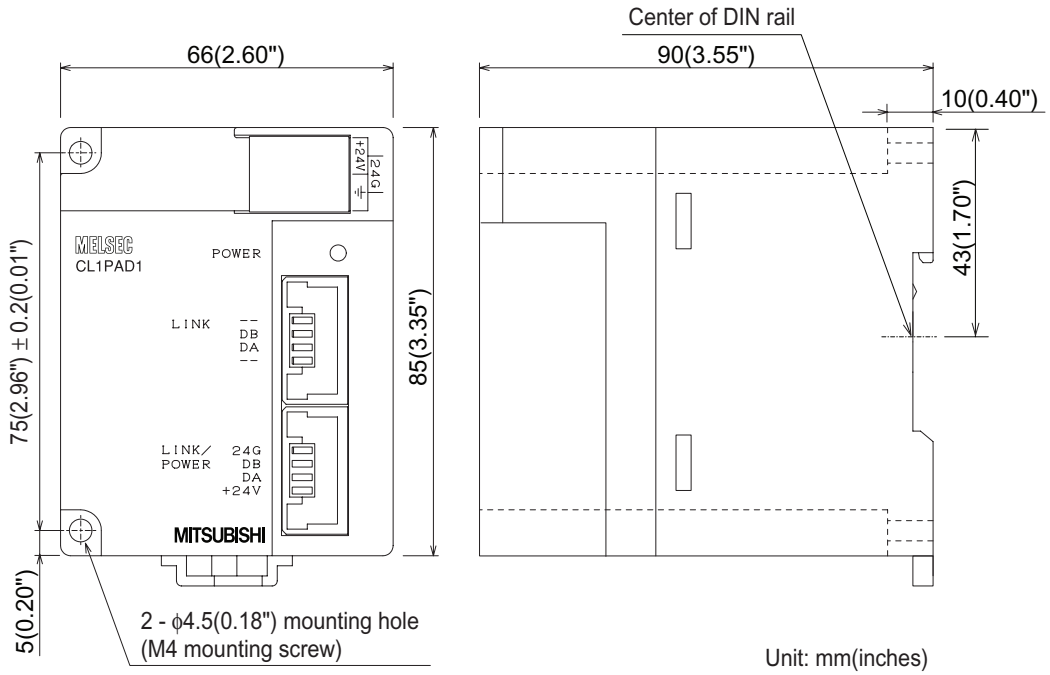
*3 It indicates in which wiring area from the public wiring net to the mechanical module inside the site the equipment is assumed to be connected.
Category II applies, for example, to equipment whose power is supplied from a fixed facility.
The surge-resistant voltage of equipment whose rating is up to 300V equator to 2,500V.

*4 This index indicates the degree of generation of conductive substances in the environment in which the module is used. The degree of contamination 2 indicates that contamination is caused by a generation of only non-conductive substances, however, temporary conduction may be caused by accidental condensation.

2.2 Performance specifications

Item	Description
Voltage input range	24V DC (maximum of 28.8V DC)
Maximum ratings current	5.0A (Use the power adapter in the range in which the total current consumption of each module does not exceed the maximum rated current while the power is supplied (except the period immediately after the power is turned on).)
Insulation resistance	10MΩ between the external terminals and the ground terminal by 500V DC megger
External connection method	• Supplies power from outside to power adapter: 3 points (M3 screws) on terminal block • Communication line/module power supply module: Compatible with flat cable dedicated to CC-Link/LT Connector (with 4 pins) dedicated to CC-Link/LT × 2

2.3 Outside Dimensions



3. Installation

Cautions on installation

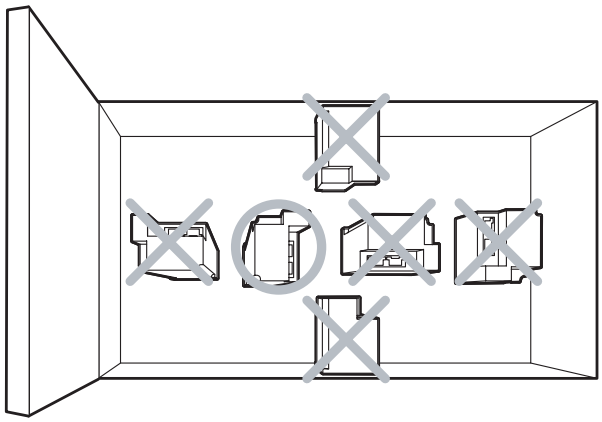
⚠ CAUTION
• Use the power adapter in an environment for which the general specifications are described in this manual. If the power adapter is used in any environment outside the range for the general specifications the electrical shock, fire, malfunction, product damage or product deterioration may be occur.
• Do not directly touch the conductive area of the power adapter. Malfunction or damage of the power adapter may be caused by such touching.
• Securely fix the power adapter with DIN rail or mounting screws. Securely tighten the mounting screws within the specified torque range. If the screws are insufficiently tightened, the power adapter may fall, be short-circuited or malfunction. If the screws are excessively tightened, the screws may be damaged, and the power adapter may fall or be short-circuited.
• Install the power adapter on a flat surface. If the mounting surface is concave and/or convex, excessive force applied to the PC board may damage the product.

3.1 Installation method

The power adapter can be installed on to DIN rail or directly installed using screws.
Installation procedures are described below.

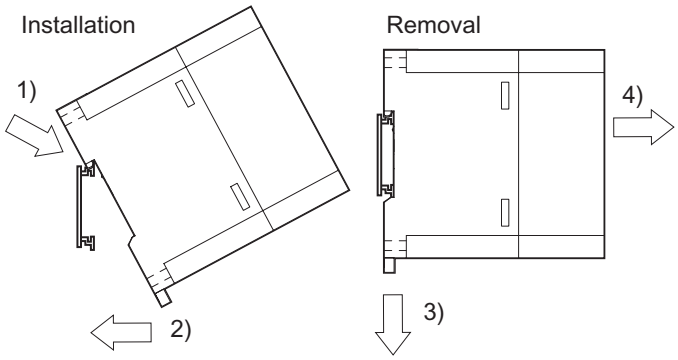
3.1.1 Installation direction

- Do not install the power adapter on the floor surface, ceiling surface or in a horizontal direction. If the power adapter is installed on such a surface or direction, the temperature may rise.
  Install the power adapter on the wall vertically.
- Assure a distance of 50mm (1.97") or more between the power adapter and other equipment or structures. Keep the power adapter away from high voltage cables or power equipment as much as possible.



3.1.2 Installation to DIN rail

Align the upper DIN rail installation groove in the power adapter as described in DIN rail 1), and press the power adapter to status 2).
When removing the power adapter, pull the hook downwards for installation as described in DIN rail 3), then remove the power adapter 4).



Applicable DIN rail	TH35-7.5Fe and TH35-7.5Al (conforming to JIS C2812)

3.1.3 Direct installation

Screw-tighten the power adapter by tightening M4 screws to the upper and lower mounting holes (two holes in all) provided in the power adapter.
Install the power adapter so that a clearance of 1 to 2mm (0.04" to 0.08") is assured between the power adapter and another module.

Applicable screw	M4 height: 16mm(0.63") or more (Tightening torque range: 78 to 108 N·cm)

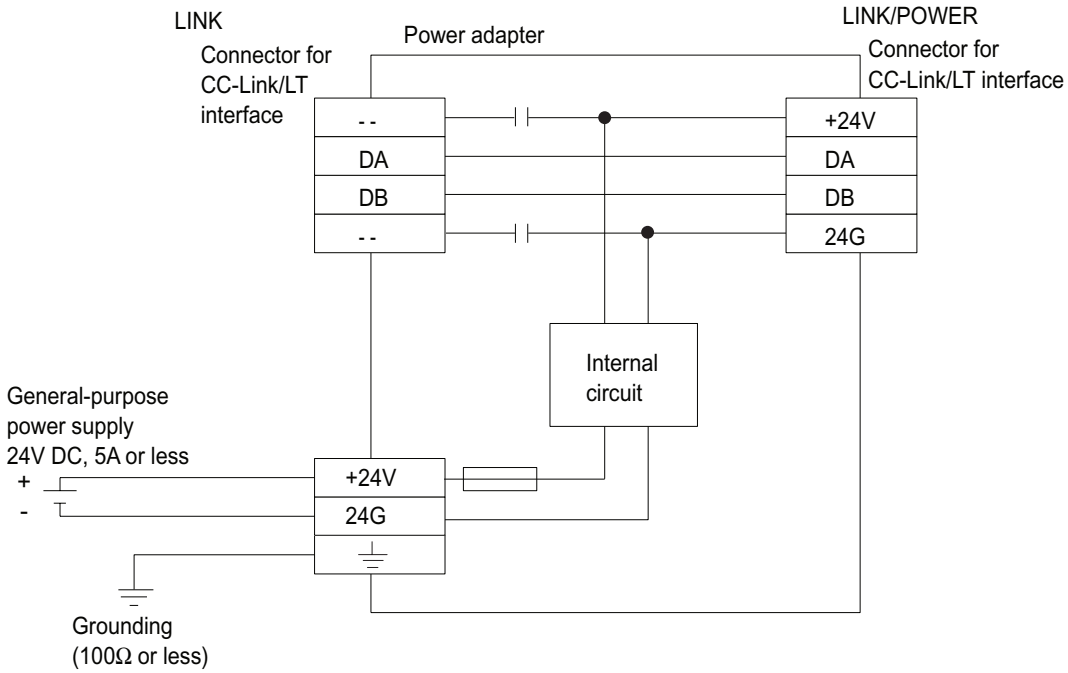
4. Power Wiring

Caution on wiring

DANGER
• Shut down all external phases of power supply to the module before starting installation or wiring work. If all phases are not shut down, electrical shock or product damage may occur.

CAUTION
• Confirm the rated voltage and the terminal arrangement of the power adapter, then correctly wire the power adapter. If a power supply not conforming to the specification rating is connected or the power adapter is wired incorrectly, fire or failure may occur. • Tighten the terminal screws within the specified torque range. If the terminal screws are insufficiently tightened, fire or malfunction may occur. If the terminal screws are excessively tightened, the screws may be damaged, and the module may be short-circuited or malfunction. • Make sure that foreign objects such as cutting and wire chips do not enter the power adapter. Fire, failure or malfunction may occur.

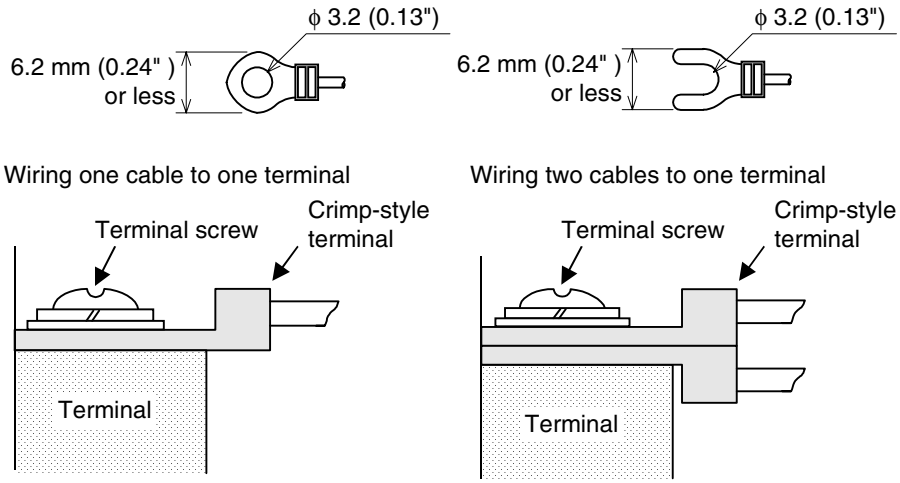
4.1 Power wiring diagram



- The general-purpose power supply is to be prepared by the user.
- Use a proper general-purpose power supply with consideration for total current consumption and total initial current of remote I/O modules and I/O equipment (such as sensors) connected to the power adapter.

4.2 Crimp-style terminal

For power wiring, use crimp-style terminals of the following dimensions.



Applicable crimp-style terminal	RAV1.25-3 (conforming to JIS C2805) V1.25-3 (manufactured by JST Mfg. Co., Ltd.) 1.25-3 and TG1.25-3 (manufactured by NICHIFU Co., Ltd.)
Applicable wire size	0.3 to 1.25 mm^2

5. Cautions on Construction

Cautions on startup/maintenance

DANGER
• Do not touch the terminals while the power is supplied. Electrical shock or malfunction may be caused by such touching. • Make sure to shut down all external phases of the power supply before cleaning or tightening the terminal screws. If all phases are not shut down, the power adapter may fail or malfunction.

CAUTION
• Do not disassemble or modify the power adapter. Failure, malfunction, injury or fire may be caused by any such disassembly or modification. • The power adapter case is made of a resin. The power adapter may be damaged by dropping or strong impact. • Shut down all external phases of the power supply before attaching or removing the power adapter to/from the panel. If all phases are not shut down, the power adapter may fail or malfunction.

5.1 Installation concept of power adapters

5.1.1 Number of power adapters

At least one power adapter is required in the CC-Link/LT system.
When constructing the system using only one power adapter, the following two conditions should be satisfied.
If the following three conditions are not satisfied, use of two or more power adapters should be examined in constructing the system.

1) Because the current capacity of the power adapter is 5A, the total current consumption of remote I/O modules, I/O equipment and the master module receiving the power from the power adapter shall be equivalent to or less than 5A.
2) In order to operate the system in a stable environment, the voltage drop should be equivalent to or less than 3.6V.
3) As the minimum operating voltage of each module connected to the power adapter is 20.4V, the supply voltage subtracted by the voltage drop should be equivalent to or more than 20.4V.

There is a formula (Refer to section 5.3.) to test the system configuration with regard to the voltage drop of the cable.
If the total current consumption or the voltage drop due to the cable is far too large, take the following countermeasures.

When the total current consumption is large

- Add power adapters.
  (Use several power adapters so that the power supplied to the system is divided accordingly.)

When the voltage drop value is large

- Change the power adapter position.
  (Shorten the maximum distance from the power adapter to a remote I/O module or the master module.)
- Shorten the cable dedicated to the CC-Link/LT.
  (Shorten the maximum distance from the power adapter to a remote I/O module or the master module.)
- Add power adapters.
  (Use several power adapters so that the power supplied to the system is divided accordingly.)

5.1.2 Selection of general-purpose power supply

The general-purpose power supply connected with a power adapter must satisfy all of the following conditions.

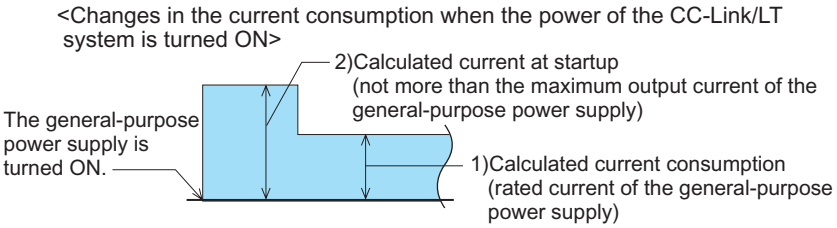
1) The power source must supply a minimum of 20.4V DC to the CC-Link/LT system for the I/O modules to operate correctly.
   Do not exceed the maximum input voltage (28.8V DC) of the power adapter.
   20.4V + voltage drop ≤ General purpose power supply output voltage ≤ 28.8V

2) Select a general-purpose power supply (general-purpose power supply used to supply 24V DC to the power adapter) whose rated current can cope with the value obtained in the "Total current consumption".
   Rated output current of general-purpose power supply ≥ Total current consumption

3) Select a general-purpose power supply whose maximum output current*1 can cope with the calculated current value expected when the CC-Link/LT system is started up (when the power is turned on).

   Notes:

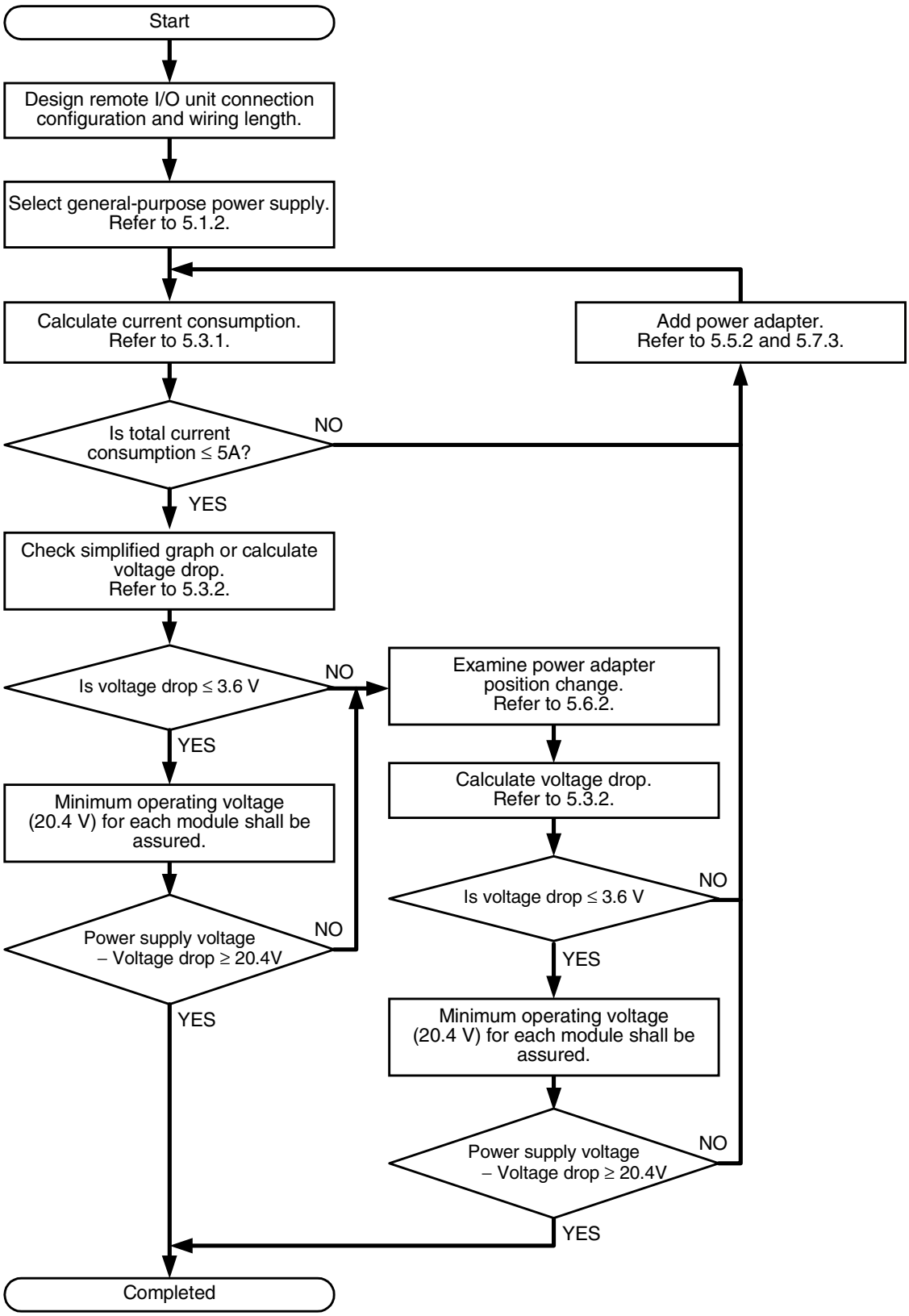
   *1 Maximum output current: Referred to as "peak output current" or "overcurrent (protection) function".
   Maximum output current of general-purpose power supply ≥ Total current at startup of each module in CC-Link/LT system + Total current consumption of I/O modules (such as sensors)



5.2 System power calculation procedure

Calculate the system power using the following procedure.

Calculation procedure



5.3 System power calculation method

5.3.1 Current consumption calculation

Using the formula below, calculate the total current consumption of the remote I/O modules, I/O equipment and the master module receiving power from the power adapter.

Current consumption in CC-Link/LT system	=	Total current consumption of each module in CC-Link/LT system	+	Total current consumption of I/O equipment (such as sensors) (to which power is supplied via communication cable)*1	≤ 5A

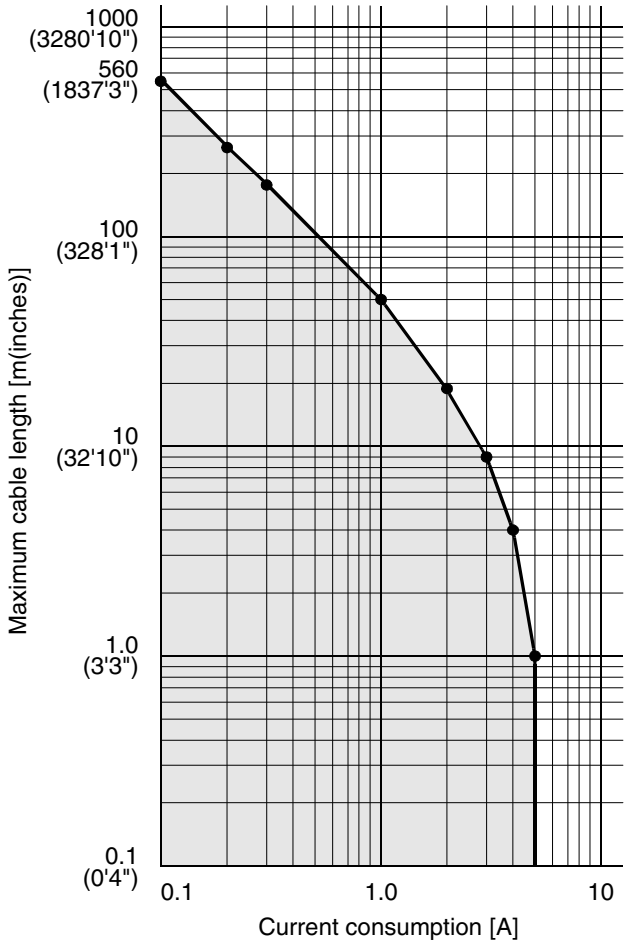
Notes:

*1 Some remote I/O modules for CC-Link/LT supply the power for I/O via the flat cable dedicated to CC-Link/LT.
For details, refer to the instruction manual of each remote I/O module.

5.3.2 Voltage drop

The voltage drop can be calculated using the "1) Simplified graph" or "2) Calculation formula". The voltage drop is in proportion to the length of the flat cable dedicated to CC-Link/LT and the current consumption of connected modules.
Calculate the voltage drop with respect to the cable length up to a remote I/O module or the master module that is located furthest from the power adapter.

1) Selection based on the simplified graph
(at supply voltage: 24V DC, ambient temperature: 20°C)



The graph on the left shows the relationship between current consumption (A) and the cable length (m(inches)) that causes a voltage drop of 3.6 V.

If the relationship between the current consumption and the cable length is within the shaded range of the graph, a system can be configured using only one power adapter.
However, the available main line length, branch line length and total branch line length are restricted by transmission speed.

- Maximum cable length:
  Cable length between the power adapter and a remote I/O module or the master module located furthest from the power adapter

2) Selection based on the calculation formula
(at supply voltage: 24V DC, ambient temperature: 20°C)

Voltage drop (V)	=	Maximum distance (m) + 11 (Constant)	×	0.06 (Constant)	×	Total current consumption (A)	≤ 3.6V

Maximum distance	Distance from power adapter, regarded as the target of voltage drop calculation to the furthest station among the remote I/O module and master unit receiving power from the power adapter		
Total current consumption	Total current consumption of each unit within the CC-Link/LT system receiving power from the power adapter is regarded as the target of voltage drop calculation	+	Total current consumption of the I/O equipment (such as sensors) connected to each unit within the CC-Link/LT system receiving power from the power adapter is regarded as the target of voltage drop calculation (to which power is supplied via communication cable) *1

*1 Some remote I/O modules for CC-Link/LT supply power for I/O via the flat cable dedicated to CC-Link/LT.
For the details, refer to the instruction manual of each remote I/O module.

When the current consumption is determined, the distance from the power adapter to the furthest station can be obtained from the following formula.

Maximum distance (m)	≤ 3.6V ÷	Total current consumption (A)	÷	0.06 (Constant)	-	11 (Constant)

Or when the distance from the power adapter to the furthest station is determined, the allowable current consumption can be obtained from the formula below.

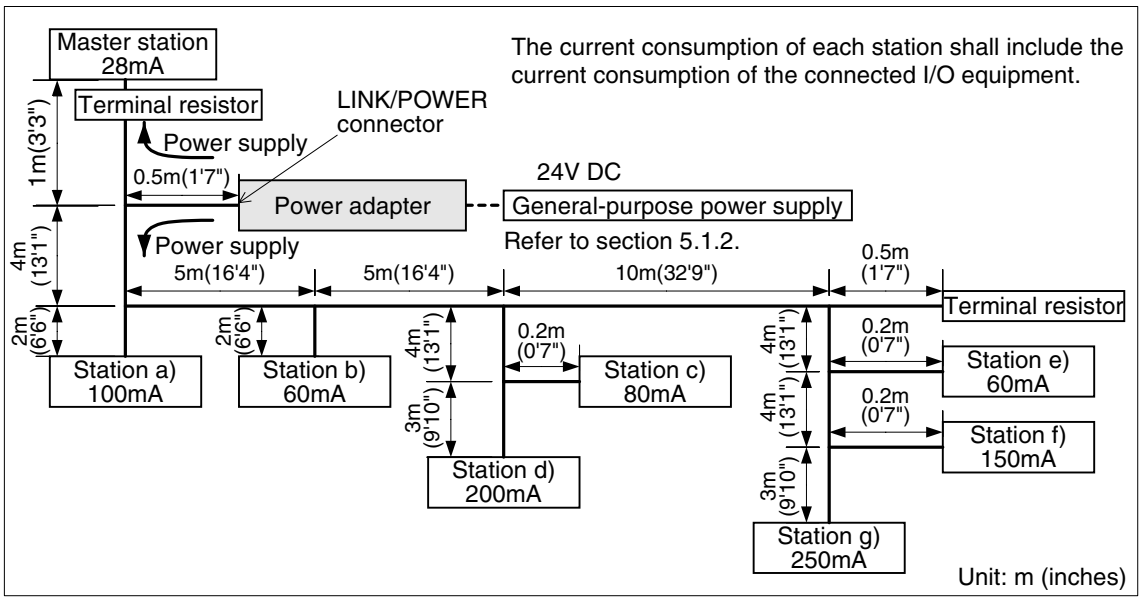
Total current consumption (A)	≤ 3.6V ÷	0.06 (Constant)	÷	Maximum distance (m) + 11 (Constant)

The simplified graph and the calculation formula for voltage drop may not be justified as effects such as ambient temperature and the number of connectors used can be influential.
If the conditions of "5.1 Installation concept of power adapters" are not satisfied, more then one power adapter should be considered when constructing the system.
And if the driving voltage (20.4 V) cannot be assured in a remote I/O module, take proper countermeasures. (Refer to 5.1.)

5.4 System configuration example 1

This paragraph describes a configuration example when both the current consumption and the voltage drop are minimal.

System configuration example



1) Current consumption calculation
   Total current consumption

28mA + 100mA + 60mA + 80mA + 200mA + 60mA + 150mA + 250mA = 928mA = 0.928A ≤ 5A

Master station / Station a) / Station b) / Station c) / Station d) / Station e) / Station f) / Station g)

2) Voltage drop calculation

(35.5m(116'5") + Constant: 11) × Constant:0.06 × 0.928A = 2.59V ≤ 3.6V

Maximum distance:
From the power adapter to the farthest station = Station g) in the branch line D

0.5m(1'7") + 4m(13'1") + 5m(16'4") + 5m(16'4") + 10m(32'9") + 4m(13'1") + 4m(13'1") + 3m(9'10") = 35.5m(116'5")

3) Confirmation related to the minimum operating voltage (20.4 V) of the module
   24V - 2.59V = 21.41V ≥ 20.4V

From 1), 2) and 3) above, the system can be configured using only one power adapter with regard to both the current and voltage conditions.

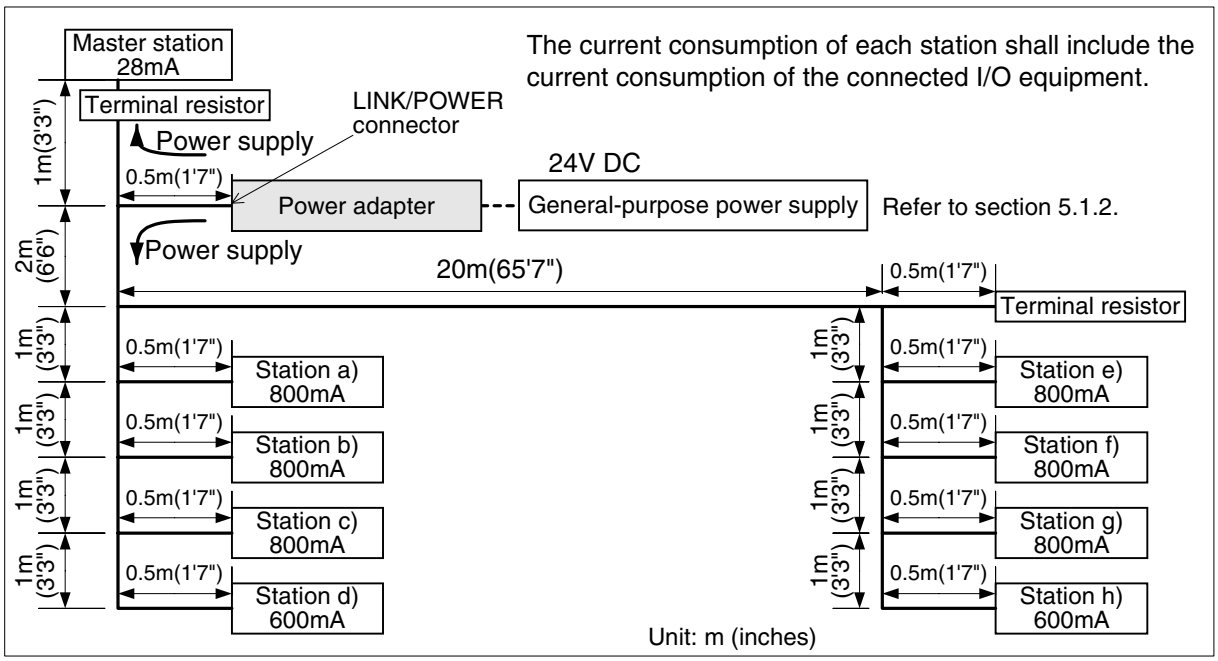
5.5 System configuration example 2 (when current consumption is large)

This paragraph describes a configuration example and countermeasures needed for when the current consumption is too large.
When the current consumption is large, increase the number of power adapters without regard to the voltage drop value so that the total current consumption of the modules connected to each power adapter is 5 A or less.

5.5.1 System configuration example having large current consumption

In the system configuration example shown below, the total current consumption of the connected modules exceeds 5 A.

System configuration example



1) Current consumption calculation
Total current consumption

28mA (Master station) + 800mA (Station a) + 800mA (Station b) + 800mA (Station c) + 600mA (Station d) + 800mA (Station e) + 800mA (Station f) + 800mA (Station g) + 800mA (Station h) = 6028mA = 6.028A > 5A

2) Voltage drop calculation

(27m(88'6") + Constant:11) × Constant: 0.06 × 6.028A = 13.74384V > 3.6V

Maximum distance: From the power adapter to the furthest station = Station h)

0.5m(1'7") + 2m(6'6") + 20m(65'7") + 1m(3'3") + 1m(3'3") + 1m(3'3") + 1m(3'3") + 0.5m(1'7") = 27m(88'6")

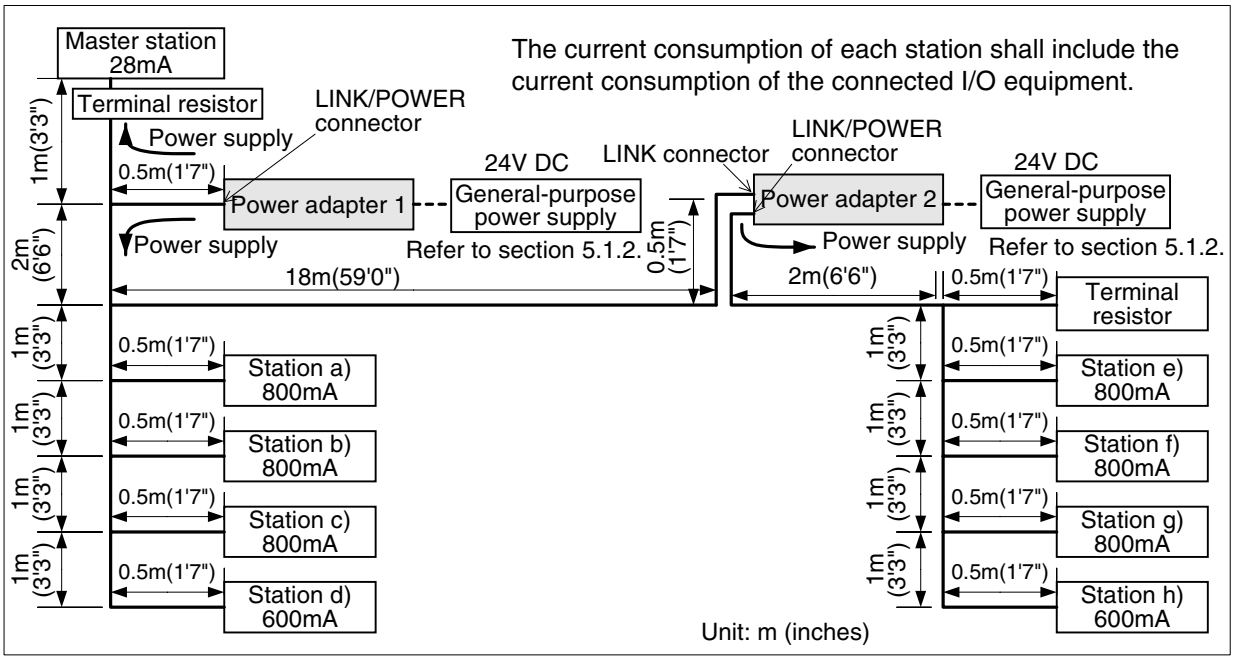
3) Confirmation related to the minimum operating voltage (20.4 V) of the module
24V - 13.74384V = 10.25616V < 20.4V

From 1), 2) and 3) above, the system cannot be configured using only one power adapter with regard to both the current and voltage conditions.
Add a power adapter as shown in the next page.

5.5.2 Countermeasures (addition of power adapter)

When the current consumption exceeds 5 A, add power adapters in constructing the system so that the total current consumption of modules connected to each power adapter is 5 A or less.

System configuration example when two power adapters are used



1) Current consumption calculation

Total current consumption in the power adapter 1

28mA + 800mA + 800mA + 800mA + 600mA = 3028mA = 3.028A ≤ 5A

Master station / Station a) / Station b) / Station c) / Station d)

Total current consumption in the power adapter 2

800mA + 800mA + 800mA + 600mA = 3000mA = 3A ≤ 5A

Station e) / Station f) / Station g) / Station h)

2) Voltage drop calculation

Voltage drop in the power adapter 1

(7m(22'11") + Constant:11) × Constant: 0.06 × 3.028A = 3.27024V ≤ 3.6V

Maximum distance: From the power adapter to the furthest station = Station d)

0.5m(1'7") + 2m(6'6") + 1m(3'3") + 1m(3'3") + 1m(3'3") + 1m(3'3") + 0.5m(1'7") = 7m(22'11")

Voltage drop in the power adapter 2

(7m(22'11") + Constant:11) × Constant: 0.06 × 3A = 3.24V ≤ 3.6V

Maximum distance: From the power adapter to the furthest station = Station h)

0.5m(1'7") + 2m(6'6") + 1m(3'3") + 1m(3'3") + 1m(3'3") + 1m(3'3") + 0.5m(1'7") = 7m(22'11")

3) Confirmation related to the minimum operating voltage (20.4 V) of the module

24V - 3.24V = 20.76V ≥ 20.4V

From 1), 2) and 3) above, the system can be configured using two power adapters with regard to both the current and voltage conditions.

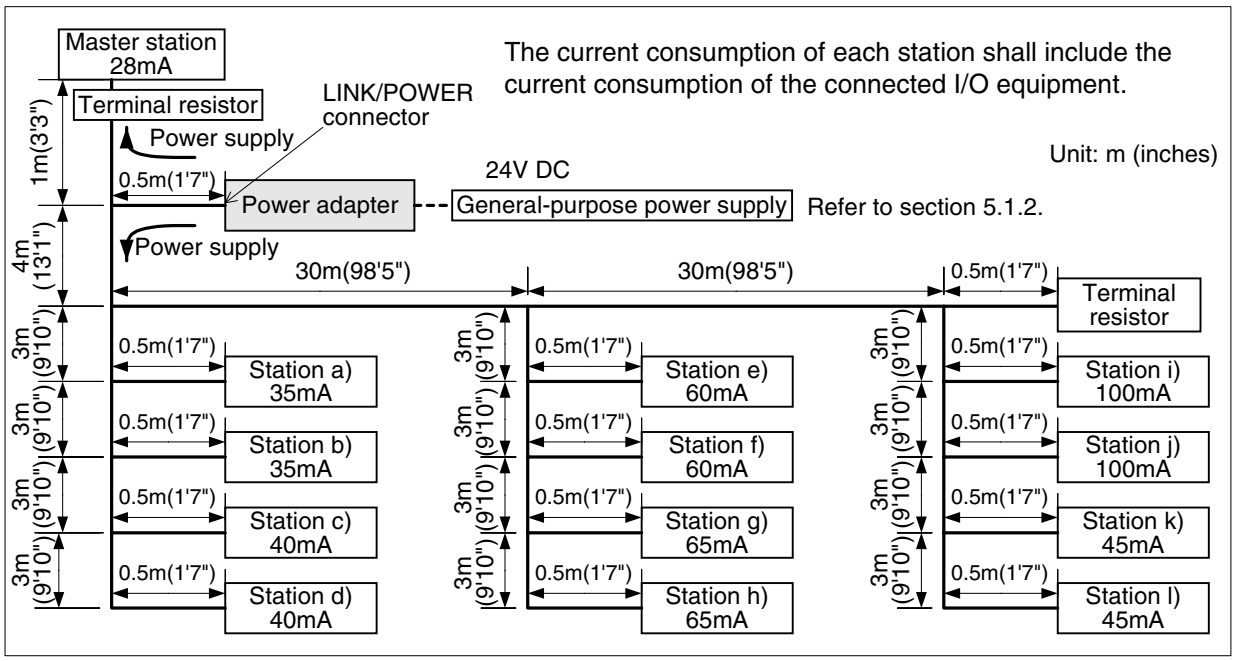
5.6 System configuration example 3 (when voltage drop is large)

This paragraph describes a configuration example and countermeasures needed for when the voltage drop is too large.
When the voltage drop is large, please change the power adapter position.
When the minimum operating voltage (20.4 V) for each module connected to the power adapter cannot be assured even if the power adapter position is changed, increase the number of power adapters. (Refer to 5.7.)
When the current consumption is also too large, increase the number of used power adapters. (Refer to 5.5.)

5.6.1 System configuration example disabling operation

In the system configuration example shown below, some modules cannot operate normally because the voltage drop is too large.

System configuration example



1) Current consumption calculation
Total current consumption

28mA (Master station) + 35mA (Station a) + 35mA (Station b) + 40mA (Station c) + 40mA (Station d) + 60mA (Station e) + 60mA (Station f) + 65mA (Station g) + 65mA (Station h)
+ 100mA (Station i) + 100mA (Station j) + 45mA (Station k) + 45mA (Station l) = 718mA = 0.718A < 5A

2) Voltage drop calculation

(77m(252'7") + Constant:11) × Constant: 0.06 × 0.718A = 3.79104V > 3.6V

Maximum distance: From the power adapter to the furthest station = Station l)

0.5m(1'7") + 4m(13'1") + 30m(98'5") + 30m(98'5") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 0.5m(1'7") = 77m(252'7")

3) Confirmation related to the minimum operating voltage (20.4 V) of the module
24V - 3.79104V = 20.20896V < 20.4V

From 2) and 3) above, the system cannot be configured because the voltage drop is too large.
Change the power adapter position as shown in the next page.

5.6.2 Countermeasures (change of power adapter position)

When the current consumption is determined, the maximum allowable distance can be obtained using the following formula.

Max. distance (m(inches)) ≤ 3.6(V) ÷ Total current consumption (A) ÷ 0.06 (constant) - 11 (constant)

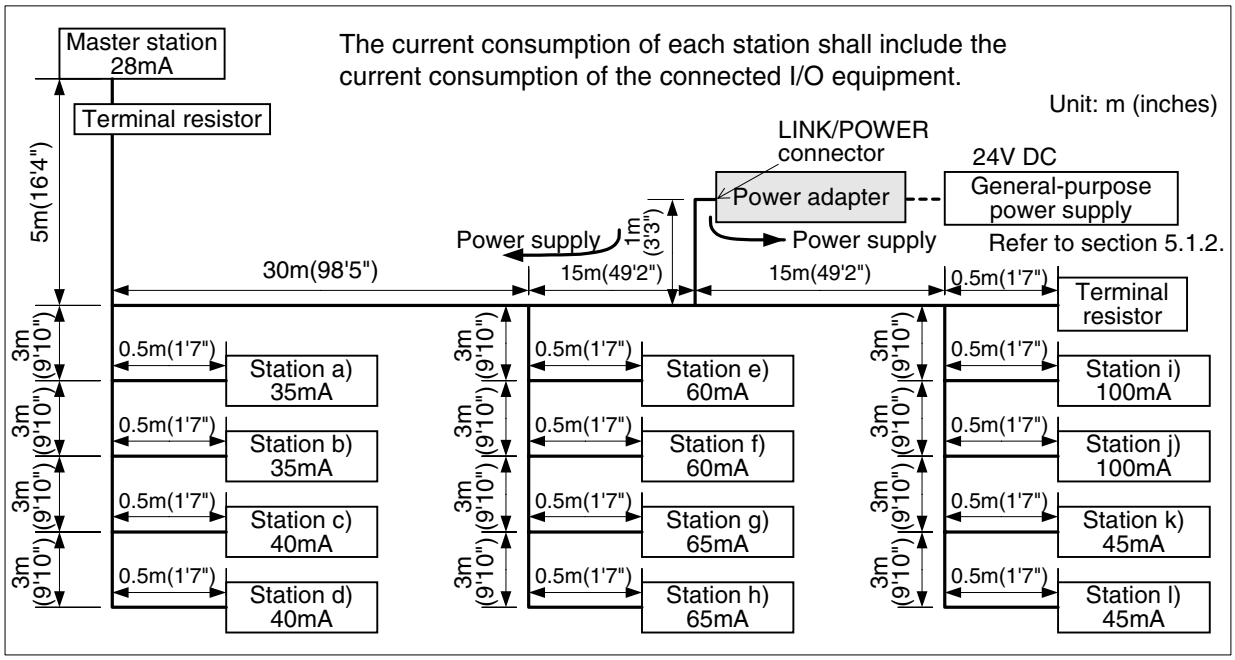
In this example, the maximum allowable distance is as follows.

Max. distance (m(inches)) ≤ 3.6(V) ÷ 0.718(A) ÷ 0.06 (constant) - 11 (constant)

≤ 72.565458(m)(238'0")

Accordingly, the power adapter can be connected in such a position that the distance between the power adapter and a remote I/O module or the master module located furthest from the power adapter is approximately less than 72.5 (m) (238' 0").

System configuration example when the power adapter position is changed.



1) Current consumption calculation
Total current consumption

28mA (Master station) + 35mA (Station a) + 35mA (Station b) + 40mA (Station c) + 40mA (Station d) + 60mA (Station e) + 60mA (Station f) + 65mA (Station g) + 65mA (Station h) + 100mA (Station i) + 100mA (Station j) + 45mA (Station k) + 45mA (Station l) = 718mA = 0.718A < 5A

2) Voltage drop calculation

(58.5m(191'11") + Constant:11) × Constant: 0.06 × 0.718A = 2.99406V ≤ 3.6V

Maximum distance: From the power adapter to the furthest station = Station d)

1m(3'3") + 15m(49'2") + 30m(98'5") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 0.5m(1'7") = 58.5m(191'11")

3) Confirmation related to the minimum operating voltage (20.4 V) of the module
24V - 2.99406V = 21.00594V ≥ 20.4V

From 1), 2) and 3) above, the system can be configured using only one power adapter with regard to both the current and voltage conditions.

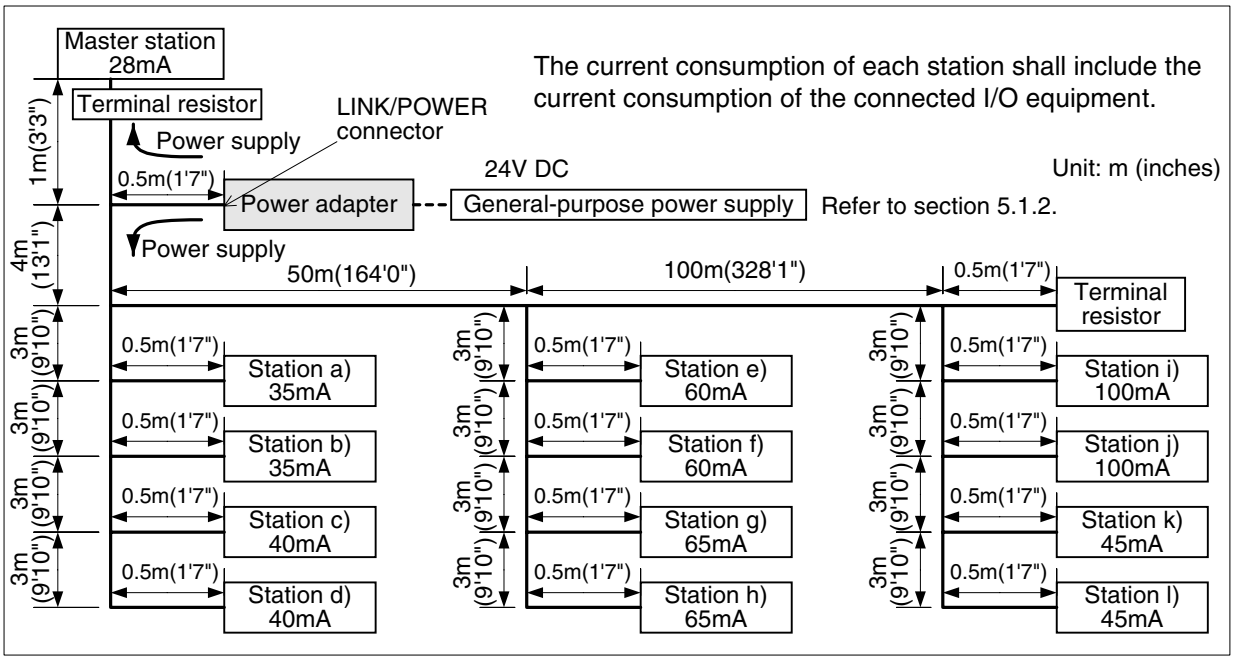
5.7 System configuration example 4 (when voltage drop is large)

This paragraph describes a configuration example and countermeasures needed for when the voltage drop is large, and the minimum operating voltage (20.4 V) for each module connected to the power adapter cannot be assured even if the power adapter position is changed.
When the voltage drop is large, change the voltage drop position as described in "5.6 System configuration example 3". However, in some conditions, the minimum operating voltage (20.4 V) for each module connected to the power adapter cannot be assured even if the power adapter position is changed.
Therefore, increase the number of power adapters so that the minimum operating voltage (20.4 V) for each module is assured.
And when not only the voltage drop but also the current consumption is too large, increase the number of power adapters. (Refer to 5.5.)

5.7.1 System configuration example 1 disabling operation

In the system configuration example shown below, some modules cannot operate normally because the voltage drop is large.

System configuration example



1) Current consumption calculation
Total current consumption

28mA (Master station) + 35mA (Station a) + 35mA (Station b) + 40mA (Station c) + 40mA (Station d) + 60mA (Station e) + 60mA (Station f) + 65mA (Station g) + 65mA (Station h) + 100mA (Station i) + 100mA (Station j) + 45mA (Station k) + 45mA (Station l) = 718mA = 0.718A < 5A

2) Voltage drop calculation

(167m(547'10") + Constant:11) × Constant: 0.06 × 0.718A = 7.66824V > 3.6V

Maximum distance: From the power adapter to the furthest station = Station l)

0.5m(1'7") + 4m(13'1") + 50m(164'0") + 100m(328'1") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 0.5m(1'7") = 167m(547'10")

3) Confirmation related to the minimum operating voltage (20.4 V) of the module
   24V - 7.66824V = 16.33176V < 20.4V

From 2) and 3) above, the system cannot be configured because the voltage drop is too large. Add a power adapter as described in 5.7.3. The fact that the system cannot be configured in this example even if the power adapter position is changed is described in the next page.

5.7.2 System configuration example 2 disabling operation (even if power adapter position is changed)

When the current consumption is determined, the maximum allowable distance can be obtained using the following formula.

Max. distance (m(inches)) ≤ 3.6(V) ÷ Total current consumption (A) ÷ 0.06 (constant) - 11 (constant)

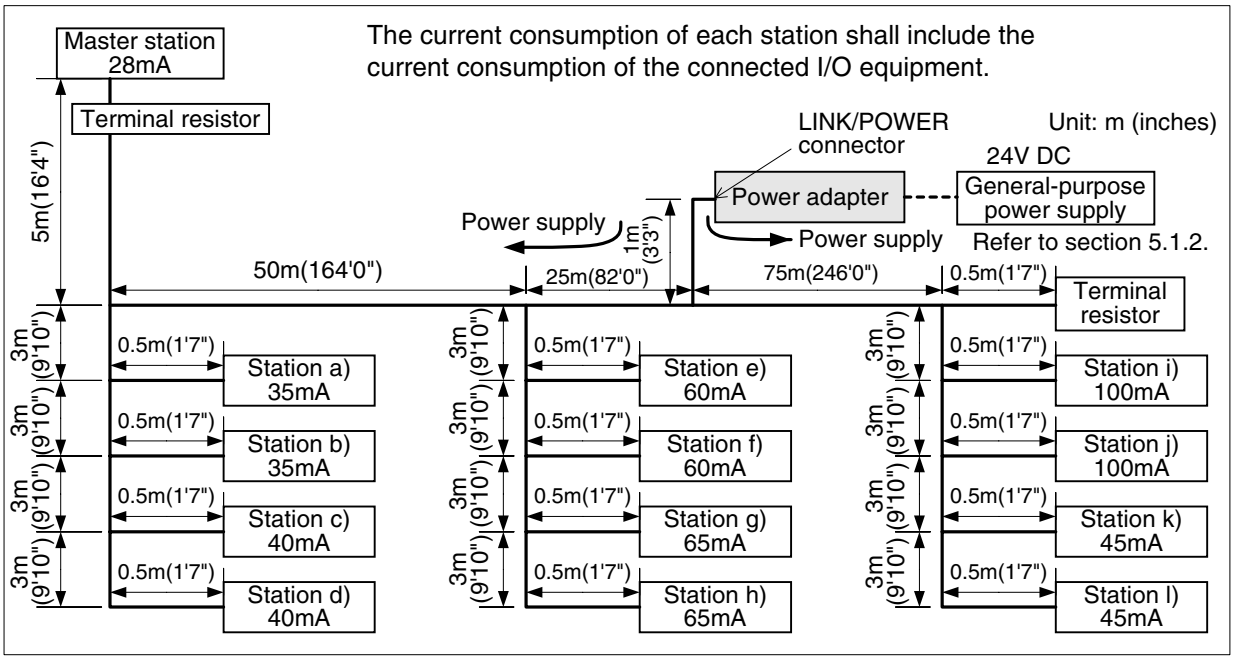
In this example, the maximum allowable distance is as follows.

Max. distance (m(inches)) ≤ 3.6(V) ÷ 0.718(A) ÷ 0.06 (constant) - 11 (constant)

≤ 72.565458(m)(238'0")

Accordingly, the power adapter can be connected in such a position that the distance between the power adapter and a remote I/O module or the master module located furthest from the power adapter is approximately less than 72.5 (m) (238' 0").
However, when the maximum distance is long as shown in this example, the system cannot be configured using only one power adapter.

System configuration example



1) Current consumption calculation

Total current consumption

28mA (Master station) + 35mA (Station a) + 35mA (Station b) + 40mA (Station c) + 40mA (Station d) + 60mA (Station e) + 60mA (Station f) + 65mA (Station g) + 65mA (Station h)
+ 100mA (Station i) + 100mA (Station j) + 45mA (Station k) + 45mA (Station l) = 718mA = 0.718A < 5A

2) Voltage drop calculation

(88.5m(290'4") + Constant:11) × Constant: 0.06 × 0.718A = 4.28646V > 3.6V

Maximum distance: From the power adapter to the furthest station = Station d)

1m(3'3") + 75m(246'0") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 0.5m(1'7")
= 88.5m(290'4")

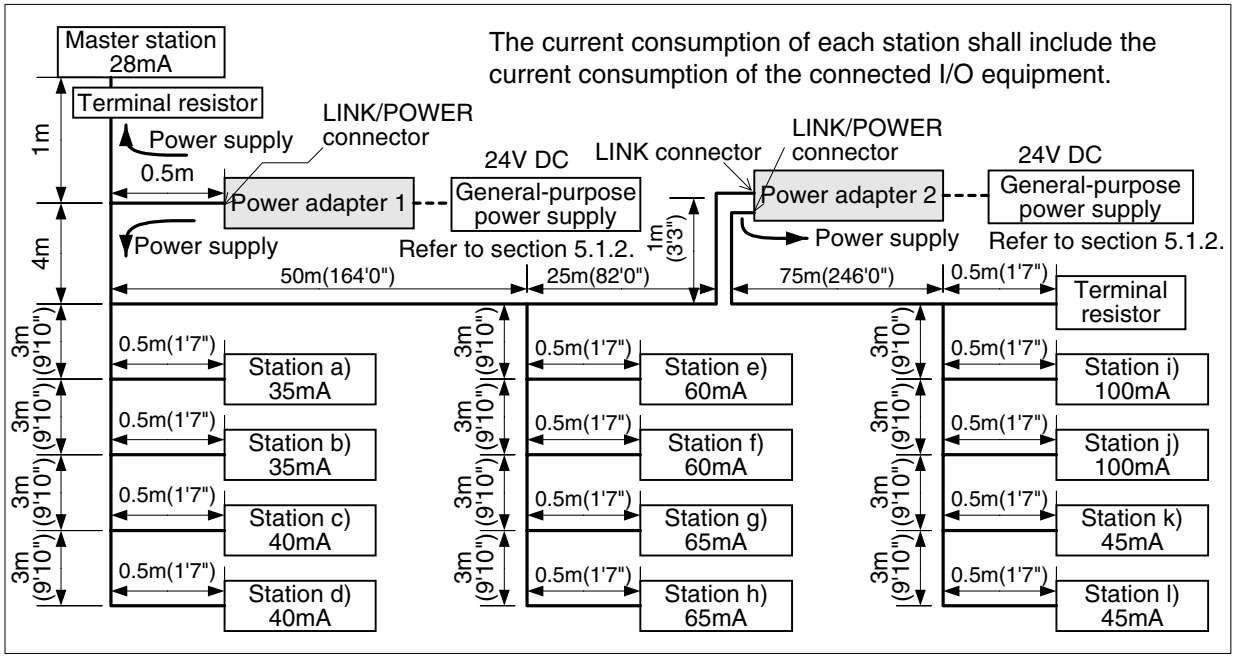
3) Confirmation related to the minimum operating voltage (20.4 V) of the module
   24V - 4.28646V = 19.71354V < 20.4V

From 2) and 3) above, the system cannot be configured because the voltage drop is too large.
Add a power adapter as shown in the next page.

5.7.3 Countermeasures (addition of power adapter)

When the minimum operating voltage (20.4 V) for each module connected to the power adapter cannot be assured even if the power adapter position is changed as described in 5.7.2, increase the number of power adapters.

System configuration example when two power adapters are used



1) Current consumption calculation

Total current consumption in the power adapter 1

28mA (Master station) + 35mA (Station a) + 35mA (Station b) + 40mA (Station c) + 40mA (Station d) + 60mA (Station e) + 60mA (Station f) + 65mA (Station g) + 65mA (Station h)

= 428mA = 0.428A ≤ 5A

Total current consumption in the power adapter 2

100mA (Station i) + 100mA (Station j) + 45mA (Station k) + 45mA (Station l) = 290mA = 0.29A ≤ 5A

2) Voltage drop calculation

Voltage drop in the power adapter 1

(67m(219'9") + Constant:11) × Constant: 0.06 × 0.428A = 2.00304V ≤ 3.6V

Maximum distance: From the power adapter to the furthest station = Station h)

0.5m(1'7") + 4m(13'1") + 50m(164'0") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 0.5m(1'7") = 67m(219'9")

Voltage drop in the power adapter 2

(88.5m(290'4") + Constant:11) × Constant: 0.06 × 0.29A = 1.7313V ≤ 3.6V

Maximum distance: From the power adapter to the furthest station = Station l)

1m(3'3") + 75m(246'0") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 3m(9'10") + 0.5m(1'7") = 88.5m(290'4")

3) Confirmation related to the minimum operating voltage (20.4 V) of the module
24V - 1.7313V = 22.2687V ≥ 20.4V

From 1), 2) and 3) above, the system can be configured using two power adapters with regard to both the current and voltage conditions.

MEMO

USER'S MANUAL (Detailed Volume)

CL1PAD1 (Power Adapter for CC-Link/LT)

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100-8310
HIMEJI WORKS: 840, CHIYODA CHO, HIMEJI, JAPAN

MODEL	CL1PAD1-U-SY-E
MODEL CODE	09R712

JY997D06601B
(MEE)

Effective Mar. 2003
Specificationd are subject to change without notice.

HEADQUARTERS

MITSUBISHI ELECTRIC EUROPE B.V. **EUROPE**
German Branch
Gothaer Straße 8
D-40880 Ratingen
Phone: +49 (0)2102 / 486-0
Fax: +49 (0)2102 / 486-1120

MITSUBISHI ELECTRIC EUROPE B.V.-org.sl. **CZECH REP.**
Czech Branch
Avenir Business Park, Radlická 714/113a
CZ-158 00 Praha 5
Phone: +420 - 251 551 470
Fax: +420 - 251-551-471

MITSUBISHI ELECTRIC EUROPE B.V. **FRANCE**
French Branch
25, Boulevard des Bouvets
F-92741 Nanterre Cedex
Phone: +33 (0)1 / 55 68 55 68
Fax: +33 (0)1 / 55 68 57 57

MITSUBISHI ELECTRIC EUROPE B.V. **IRELAND**
Irish Branch
Westgate Business Park, Ballymount
IRL-Dublin 24
Phone: +353 (0)1 4198800
Fax: +353 (0)1 4198890

MITSUBISHI ELECTRIC EUROPE B.V. **ITALY**
Italian Branch
Viale Colleoni 7
I-20041 Agrate Brianza (MB)
Phone: +39 039 / 60 53 1
Fax: +39 039 / 60 53 312

MITSUBISHI ELECTRIC EUROPE B.V. **POLAND**
Poland Branch
Krakowska 50
PL-32-083 Balice
Phone: +48 (0)12 / 630 47 00
Fax: +48 (0)12 / 630 47 01

MITSUBISHI ELECTRIC EUROPE B.V. **RUSSIA**
52, bld. 3 Kosmodamianskaya nab 8 floor
RU-115054 Moscow
Phone: +7 495 721-2070
Fax: +7 495 721-2071

MITSUBISHI ELECTRIC EUROPE B.V. **SPAIN**
Spanish Branch
Carretera de Rubí 76-80
E-08190 Sant Cugat del Vallés (Barcelona)
Phone: 902 131121 // +34 935653131
Fax: +34 935891579

MITSUBISHI ELECTRIC EUROPE B.V. **UK**
UK Branch
Travellers Lane
UK-Hatfield, Herts. AL10 8XB
Phone: +44 (0)1707 / 27 61 00
Fax: +44 (0)1707 / 27 86 95

MITSUBISHI ELECTRIC CORPORATION **JAPAN**
Office Tower "Z" 14 F
8-12,1 chome, Harumi Chuo-Ku
Tokyo 104-6212
Phone: +81 3 622 160 60
Fax: +81 3 622 160 75

MITSUBISHI ELECTRIC AUTOMATION, Inc. **USA**
500 Corporate Woods Parkway
Vernon Hills, IL 60061
Phone: +1 847 478 21 00
Fax: +1 847 478 22 53

EUROPEAN REPRESENTATIVES

GEVA **AUSTRIA**
Wiener Straße 89
AT-2500 Baden
Phone: +43 (0)2252 / 85 55 20
Fax: +43 (0)2252 / 488 60

TEHNIKON **BELARUS**
Oktyabrskaya 16/5, Off. 703-711
BY-220030 Minsk
Phone: +375 (0)17 / 210 46 26
Fax: +375 (0)17 / 210 46 26

ESCO DRIVES & AUTOMATION **BELGIUM**
Culliganlaan 3
BE-1831 Diegem
Phone: +32 (0)2 / 717 64 30
Fax: +32 (0)2 / 717 64 31

Koning & Hartman b.v. **BELGIUM**
Woluwelaan 31
BE-1800 Vilvoorde
Phone: +32 (0)2 / 257 02 40
Fax: +32 (0)2 / 257 02 49

INEA BH d.o.o. **BOSNIA AND HERZEGOVINA**
Aleja Lipa 56
BA-71000 Sarajevo
Phone: +387 (0)33 / 921 164
Fax: +387 (0)33/ 524 539

AKHNATON **BULGARIA**
4 Andrej Ljapchev Blvd. Pb 21
BG-1756 Sofia
Phone: +359 (0)2 / 817 6044
Fax: +359 (0)2 / 97 44 06 1

INEA CR d.o.o. **CROATIA**
Losinjska 4 a
HR-10000 Zagreb
Phone: +385 (0)1 / 36 940 - 01/ -02/ -03
Fax: +385 (0)1 / 36 940 - 03

AutoCont C.S. s.r.o. **CZECH REPUBLIC**
Technologická 374/6
CZ-708 00 Ostrava-Pustkovec
Phone: +420 595 691 150
Fax: +420 595 691 199

Beijer Electronics A/S **DENMARK**
Lykkegårdsvej 17
DK-4000 Roskilde
Phone: +45 (0)46/ 75 76 66
Fax: +45 (0)46 / 75 56 26

Beijer Electronics Eesti OÜ **ESTONIA**
Pärnu mnt.160i
EE-11317 Tallinn
Phone: +372 (0)6 / 51 81 40
Fax: +372 (0)6 / 51 81 49

Beijer Electronics OY **FINLAND**
Peltoie 37
FIN-28400 Ulvila
Phone: +358 (0)207 / 463 540
Fax: +358 (0)207 / 463 541

UTECO **GREECE**
5, Mavrogenous Str.
GR-18542 Piraeus
Phone: +30 211 / 1206 900
Fax: +30 211 / 1206 999

MELTRADE Kft. **HUNGARY**
Fertő utca 14.
HU-1107 Budapest
Phone: +36 (0)1 / 431-9726
Fax: +36 (0)1 / 431-9727

Beijer Electronics SIA **LATVIA**
Ritausmas iela 23
LV-1058 Riga
Phone: +371 (0)784 / 2280
Fax: +371 (0)784 / 2281

Beijer Electronics UAB **LITHUANIA**
Savanoriu Pr. 187
LT-02300 Vilnius
Phone: +370 (0)5 / 232 3101
Fax: +370 (0)5 / 232 2980

EUROPEAN REPRESENTATIVES

ALFATRADE Ltd. **MALTA**
99, Paola Hill
Malta- Paola PLA 1702
Phone: +356 (0)21 / 697 816
Fax: +356 (0)21 / 697 817

INTEHSIS srl **MOLDOVA**
bld. Traian 23/1
MD-2060 Kishinev
Phone: +373 (0)22 / 66 4242
Fax: +373 (0)22 / 66 4280

HIFLEX AUTOM.TECHNIEK B.V. **NETHERLANDS**
Wolweverstraat 22
NL-2984 CD Ridderkerk
Phone: +31 (0)180 – 46 60 04
Fax: +31 (0)180 – 44 23 55

Koning & Hartman b.v. **NETHERLANDS**
Haarlerbergweg 21-23
NL-1101 CH Amsterdam
Phone: +31 (0)20 / 587 76 00
Fax: +31 (0)20 / 587 76 05

Beijer Electronics AS **NORWAY**
Postboks 487
NO-3002 Drammen
Phone: +47 (0)32 / 24 30 00
Fax: +47 (0)32 / 84 85 77

Fonseca S.A. **PORTUGAL**
R. João Francisco do Casal 87/89
PT - 3801-997 Aveiro, Esgueira
Phone: +351 (0)234 / 303 900
Fax: +351 (0)234 / 303 910

Sirius Trading & Services srl **ROMANIA**
Aleea Lacul Morii Nr. 3
RO-060841 Bucuresti, Sector 6
Phone: +40 (0)21 / 430 40 06
Fax: +40 (0)21 / 430 40 02

Craft Con. & Engineering d.o.o. **SERBIA**
Bulevar Svetog Cara Konstantina 80-86
SER-18106 Nis
Phone: +381 (0)18 / 292-24-4/5
Fax: +381 (0)18 / 292-24-4/5

INEA SR d.o.o. **SERBIA**
Izletnicka 10
SER-113000 Smederevo
Phone: +381 (0)26 / 617 163
Fax: +381 (0)26 / 617 163

SIMAP s.r.o. **SLOVAKIA**
Jána Derku 1671
SK-911 01 Trencín
Phone: +421 (0)32 743 04 72
Fax: +421 (0)32 743 75 20

PROCONT, spol. s r.o. Prešov **SLOVAKIA**
Kúpelná 1/A
SK-080 01 Prešov
Phone: +421 (0)51 7580 611
Fax: +421 (0)51 7580 650

INEA d.o.o. **SLOVENIA**
Stegne 11
SI-1000 Ljubljana
Phone: +386 (0)1 / 513 8100
Fax: +386 (0)1 / 513 8170

Beijer Electronics AB **SWEDEN**
Box 426
SE-20124 Malmö
Phone: +46 (0)40 / 35 86 00
Fax: +46 (0)40 / 93 23 01

Omni Ray AG **SWITZERLAND**
Im Schörli 5
CH-8600 Dübendorf
Phone: +41 (0)44 / 802 28 80
Fax: +41 (0)44 / 802 28 28

GTS **TURKEY**
Bayraktar Bulvari Nutuk Sok. No:5
TR-34775 Yukarı Dudullu-Ümraniye-İSTANBUL
Phone: +90 (0)216 526 39 90
Fax: +90 (0)216 526 3995

CSC Automation Ltd. **UKRAINE**
4-B, M. Raskovoyi St.
UA-02660 Kiev
Phone: +380 (0)44 / 494 33 55
Fax: +380 (0)44 / 494-33-66

EURASIAN REPRESENTATIVES

Kazpromautomatics Ltd. **KAZAKHSTAN**
Mustafina Str. 7/2
KAZ-470046 Karaganda
Phone: +7 7212 / 50 11 50
Fax: +7 7212 / 50 11 50

MIDDLE EAST REPRESENTATIVES

ILAN & GAVISH Ltd. **ISRAEL**
24 Shenkar St., Kiryat Arie
IL-49001 Petah-Tiqva
Phone: +972 (0)3 / 922 18 24
Fax: +972 (0)3 / 924 0761

TEXEL ELECTRONICS Ltd. **ISRAEL**
2 Ha´umanut, P.O.B. 6272
IL-42160 Netanya
Phone: +972 (0)9 / 863 39 80
Fax: +972 (0)9 / 885 24 30

CEG INTERNATIONAL **LEBANON**
Cebaco Center/Block A Autostrade DORA
Lebanon - Beirut
Phone: +961 (0)1 / 240 430
Fax: +961 (0)1 / 240 438

AFRICAN REPRESENTATIVE

CBI Ltd. **SOUTH AFRICA**
Private Bag 2016
ZA-1600 Isando
Phone: + 27 (0)11 / 977 0770
Fax: + 27 (0)11 / 977 0761