HITACHI

HARDWARE MANUAL

HSC-2100
I/O MODULES

SME-1-126（G）

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I/O MODULES

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SAFETY PRECAUTIONS

- Before installation, operation, maintenance, and/or inspection of this product, be sure to read through carefully this manual and other related manuals. Do not use this product until you are familiar with all the information concerning this product, safety information, and precautions provided in those manuals.
- Keep this manual in a readily accessible place so that users of this product may easily reach it.
- This manual contains information on potential hazards that is intended as a guide for safe use of this product. The potential hazards listed in the manual are divided into four hazard levels of danger, warning, caution, and notice, according to the level of their severity. The following are definitions of the safety labels containing the corresponding signal words DANGER, WARNING, CAUTION, and NOTICE.

⚠ DANGER : This safety label identifies precautions that, if not heeded, will result in death or serious injury.

⚠ WARNING : Identifies precautions that, if not heeded, could result in death or serious injury.

⚠ CAUTION : Identifies precautions that, if not heeded, could result in minor or moderate injury.

NOTICE : This safety label without a safety alert symbol identifies precautions that, if not heeded, could result in property damage or loss not related to personal injury.

Failure to observe any of the ⚠CAUTION and *NOTICE* statements used in this manual could also lead to a serious consequence, depending on the situation in which this product is used. Therefore, be sure to observe all of those statements without fail.

The following are definitions of the phrases “serious injury,” “minor or moderate injury,” and “property damage or loss not related to personal injury” used in the above definitions of the safety labels.

Serious injury: Is an injury that requires hospitalization for medical treatment, has aftereffects, and/or requires long-term follow-up care. Examples of serious injuries are as follows: vision loss, burn (caused by dry heat or extreme cold), electric-shock injury, broken bone, poisoning, etc.

Minor or moderate injury: Is an injury that does not require either hospitalization for medical treatment or long-term follow-up care. Examples of minor or moderate injuries are as follows: burn, electric-shock injury, etc.

Property damage or loss not related to personal injury: Is a damage to or loss of personal property. Examples of property damages or losses not related to personal injury are as follows: damage to this product or other equipment or their breakdown, loss of useful data, etc.

The safety precautions stated in this manual are based on the general rules of safety applicable to this product. These safety precautions are a necessary complement to the various safety measures included in this product. Although they have been planned carefully, the safety precautions posted on this product and in the manual do not cover every possible hazard. Common sense and caution must be used when operating this product. For safe operation and maintenance of this product, establish your own safety rules and regulations according to your unique needs. A variety of industry standards are available to establish such safety rules and regulations.

1. ⚠ General Safety Guidelines

Before installing, operating inspecting or conducting maintenance on this unit, read the following instructions carefully:

- Follow all the operating procedures provided in this manual.
- Pay special attention to and follow all the hazard warnings on the machine and in the manual. Failure to do so can cause injury to yourself or damage to the machine.
- Do not perform any operation or action in any way other than as provided in this manual. When in doubt, call the designated field engineer. Keep in mind that the hazard warnings in this manual or on the machine cannot cover every possible case, as it is impossible to predict and evaluate all circumstances beforehand.
  Be alert and use your common sense.
- Do not install, wire, handle, modify, or use maintenance parts in any manner not described in this manual. Such a practice may result in breakdown of this equipment or peripherals, injury or even death. Hitachi will not be responsible for any accident or failure resulting from such mishandling.

Read the following safety guidelines carefully and follow them when you conduct maintenance of the machine.

Before starting maintenance

- Maintenance of the machine must be done only by trained and qualified field engineers.
- Read and follow the safety guidelines and procedures in this manual and the related manuals.
- In this manual and on the machine, hazard warnings are provided to aid you in preventing or reducing the risk of death, personal injury, or product damage.
  Understand and follow these hazard warnings fully.
- Keep in mind that the hazard warnings in this manual or on the machine cannot cover every possible case, as it is impossible to predict and evaluate all circumstances beforehand.
  Be alert and use your common sense.

During work

- For each procedure, follow the given sequence of steps.
- Use the special tools and instruments, specified for the work in the manual or commercially available tools and instruments which fit the purpose.
- Use measurement instruments and powered tools which are properly calibrated or periodically inspected.
- Keep the maintenance area neat and tidy.
- Always put away parts, materials or tools when not in use.
- Wear an eye protector where anything may fly about.
- When using sharp objects or cutting tools, make sure that no part of your body lies in the path of the blade bit, or point.
- Before finishing your work, make sure that all parts removed during maintenance have been installed back in their original positions in the machine.
  Make sure that no tool or foreign material is left in the machine.

Prevention of electric shocks

- Before starting work, make sure that, unless otherwise specifically instructed, there is no potential electric hazard in the maintenance area such as insufficient grounding or a wet floor.
- Before starting work, note where the emergency power-off switches are located and make sure you know how to operate them.
- Unless otherwise specifically instructed, cut off all power sources to the machine before starting maintenance. Just switching off the machine power supplies is usually not enough.

  When power is fed from a wall or floor outlet, unplug the power supply cord, or turn off the switch on the power distribution panel or board. Attach a notice on the panel or board prohibiting the use of the switch.

  If the energy isolating device such as the switch on the power distribution panel or board accepts a lockout device, turn off the power, lock out the energy isolating device, and bring the key with you. When you take over the work and the key for the lockout device if applicable, do not assume that the power is off. Make sure yourself that the above-mentioned conditions such as switches are satisfied. If necessary, use a measurement tool to ensure that the power is off.
- Do not touch any uninsulated conductor or surface, where so instructed, which remains charged for a limited time after the external power supply to the machine is disconnected.
- When working on a machine which has a grounding terminal, make sure that the terminal is properly connected to the facility’s ground.
- When working close to a hazardously energized part, do not work alone; work with another person who can immediately turn off the power in an emergency.
- Do not wear any metallic item such as a wrist watch with a metallic surface, or metallic accessories.

  If you wear eyeglasses with a metallic frame, take care not to let the frame touch an uninsulated surface.
- Make sure that your hands and arms are dry.
- Unless otherwise specifically instructed, use only one hand when it is necessary to work near an exposed live electric circuit.

  This prevents the completion of the circuit through your heart even if you accidentally touch the circuit.
- Do not use a dental mirror near an exposed live electric circuit.

  The mirror surface is conductive and can become hazardous even if it is made of plastic.
- Unless otherwise specifically instructed, do not supply power to any subassembly such as a power supply unit or a motor while it is removed from the machine.

Procedures in an emergency

For electric shock

- Do not panic. Do not become another victim through contact with the injured person.
- First, shut off the electric current passing through the victim.
  Use the emergency power-off switch, if there is one, or, otherwise, a normal power-off switch. If this cannot be done, push the victim away from the source of the electric current by using a nonconductive object such as a dry wooden stick.
- Then, call an ambulance.
- If the victim is unconscious, artificial respiration may be necessary.
  A proper method for performing artificial respiration or resuscitation should be learned beforehand. If the victim's heart is not beating, cardio-pulmonary resuscitation should be performed by a trained and qualified person.

For outbreak of fire

- First, shut off all the power from the machine using the emergency power-off switch, if there is one, or the normal power-off switch.
- If the fire continues burning after the power is shut off, take suitable actions including the use of a fire extinguisher or a call for the fire department.

2. ⚠ Hazard Warning Statements

The following are the hazard warning statements contained in this manual.

2.1 NOTICE Statement

(chapter 1, page 1-8)

NOTICE

Where for some reason the programmable controller has to be installed at a location that has a possibility of being exposed to rain and water conditions, be sure to mount it in a drip-proof enclosure. Disregarding this rule may result in product failure.

(chapter 1, page 1-9)

NOTICE

Do not touch any of the modules in the programmable controller when they are in an energized state. Touching any of the modules in an energized state may lead to a discharge of static electricity from your body to the module, resulting in malfunction or breakage of the module. If you have no choice but to touch such a module, be sure to discharge the static electricity by touching the metal frame of the cubicle and then touch the module. This is also true when you perform any of the following actions on a module in its non-energized state: 1) setting a switch on the module; 2) connecting or disconnecting the cable from the module; or 3) inserting or removing the connector from the module.

(chapter 1, page 1-10)

NOTICE

The power supply module's input voltage which is within its specification may be close to the upper or lower limit of the specified range. In such a case, interpret the input power as abnormal and ask personnel in charge of electric supply facility management to check up the supply equipment.

(chapter 1, page 1-13)

NOTICE

- Construct an emergency stop circuit and an interlock circuit outside the programmable controller. Unless they are so constructed, failure of the product may result in machine breakdown or accident.
- Keep the input/output currents of I/O modules within the maximum permitted current values. If an overcurrent is allowed to flow in the I/O module, the component part(s) involved may be damaged, resulting an accident, fire, or product failure.

(chapter 1, page 1-13)

NOTICE

Do not use a transceiver, cellular phone, or the like near the I/O module.
Such communication equipment generates noise, which may result in malfunction or system failure.

(chapter 1, page 1-14)

NOTICE

- As the external power supply, select a power supply with overvoltage and overcurrent protection.
- If a product smokes or gives off an offensive smell, immediately turn off the power to the product and find the cause.
- As the power to each mounted module, use a power supply matching the ratings of the mounted module.
  If a power supply not matching its ratings is connected to the module, it may lead to a fire.
- Component parts containing gallium arsenide (GaAs) in a photocoupler or LED are used in products described in this manual.
  Gallium arsenide is designated as a harmful substance by law.
  Use extreme care in handling, particularly in scrapping the products.
  Have a specialized agent dispose of the products as industrial waste.
- Install a fuse or circuit protector for the external power supply for protection against short-circuit.
  The circuit protector selected must match the ratings of the external power supply.
- Before applying power to any product described in this manual, check that all the cable wiring for the product is correct.
- Before terminating the programmable controller (by shutting down or resetting), check that all the peripheral equipment is already stopped or will not be affected by the termination.
- Failure, breakdown, or the like of an installed module may damage the contents of memory spaces.
  Be sure to make a backup copy of any important data in memory.

(chapter 2, page 2-7)

NOTICE

Never mount a module other than the above listed modules on the mount base.
Disregarding this rule may result in malfunction.

(chapter 3, page 3-2)

NOTICE

In installation locations where there is a possibility of water leak, be sure to house the programmable controller in a water-proof enclosure. Disregarding this rule may result in hardware damage.

(chapter 3, page 3-3)

NOTICE

It may happen that the input voltage of the power supply module is within the above specifications but it is close to the upper or lower limit. In these cases, the user is advised to consider the input voltage as being abnormal and ask a power supply management specialist for inspection of the module.

(chapter 3, page 3-6)

NOTICE

- Construct an emergency stop circuit and an interlock circuit outside this product. Unless they are so constructed, failure of this product may result in machine breakdown or accident.
- Keep the input and output currents of any I/O module within the maximum permitted current values. If an overcurrent is allowed to flow in the I/O module, the component part(s) involved may be damaged, resulting an accident, fire, or product failure.

(chapter 3, page 3-6)

NOTICE

Do not use a transceiver, cellular phone, or the like near any I/O module. Such communication equipment generates noise, which may result in malfunction or system failure.

(chapter 3, page 3-7)

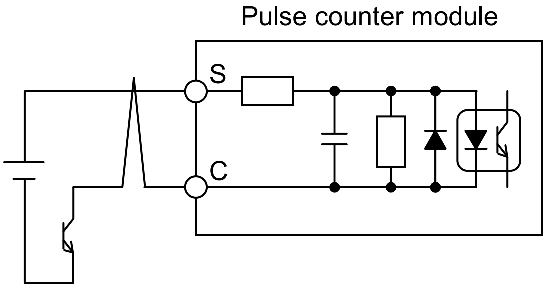
NOTICE

- As the external power supply, select a power supply with overvoltage and overcurrent protection.
- If a product smokes or gives off an offensive smell, immediately turn off the power to the product and find the cause.
- Install a fuse or circuit protector for the external power supply for protection against short-circuit. The circuit protector selected must match the ratings of the external power supply.
- Before applying power to the programmable controller, check that all the cable wirings for the product are correct.
- Before terminating the programmable controller (by shutting down or resetting), check that all the peripheral equipment is already stopped or will not be affected by the termination.
- Failure of an installed module may damage the contents of memory spaces. Be sure to make a backup copy of any important data in memory.
- Before carrying out such operations as program alteration, forced output, run, stop, etc. during operation of the programmable controller, ensure safety. Any mis-operation may result in machine breakage or an accident.
- Apply power to the various components of your application system in the proper order. If this is done in the wrong order, your system may malfunction, resulting in machine breakage or an accident.
- Component parts containing gallium arsenide (GaAs) in a photocoupler or LED are used in the programmable controller. Gallium arsenide is designated as a harmful substance by law. Use extreme care in handling, particularly in scrapping the product. Have a specialized agent dispose of the product as industrial waste.
- After the power supply has been switched off, wait for more than one second before you switch it on again. Disregarding this rule may cause product failure.
- Do not insert your finger or a foreign object into any opening in a connector or the mount base. Disregarding this rule may result in bodily injury.

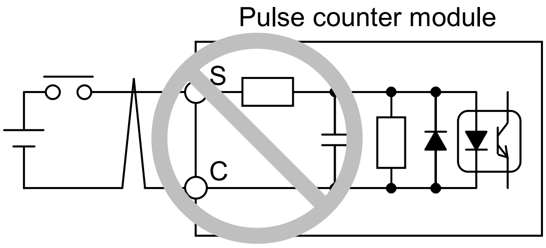
NOTICE

- When wiring a pulse counter module, be sure to wire it with a shielded twisted-pair cable and ground the cable by Class D grounding.
- The shielded twisted-pair cable must be laid at least 30 centimeters away from noise sources, such as power cables and input/output cables. Never lay it in parallel with those noise sources, and the length of the cable laid must be shortest possible.
- If a counting error occurs in the pulse counter module that has been wired according to the above rules, lay the shielded twisted-pair cable in a dedicated duct or conduit, and then ground the duct or conduit.
- Any input terminals that need not be used must be wired as follows:
  - If the pulse counter module is used with one-phase pulse input, short the two input terminals of each of the two pairs of two-phase pulse input terminals; that is, short A1S and A1C together, then short B1S and B1C together, and then ground them all together.
  - If it is used with two-phase pulse input, short the one-phase pulse input terminals A2S and A2C together and then ground them together.
  - If the stop-signal input terminals STOPS and STOPC need not be used, short them together and then ground them together.
- A pulse generator may be connected to the pulse counter module by using either voltage-transistor connection or no-voltage-transistor connection (see below). Voltage-transistor connection should be used when grounding is made on the pulse generator side. No-voltage-transistor connection should be used when grounding is made on the pulse counter module side.
- Do not connect a contact to any pulse input terminal. Disregarding this rule may result in counting errors due to contact bouncing during closing and opening of the contact.

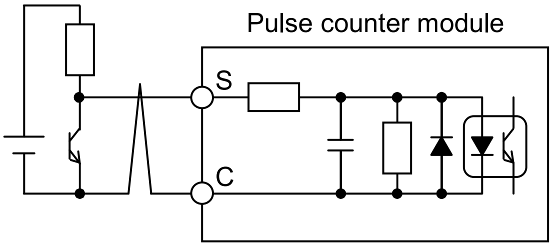
■Voltage-transistor connection



■No-voltage-transistor connection



■Voltage-contact connection (prohibited)



(chapter 6, page 6-2)

NOTICE

- Do not touch any of the modules in the programmable controller when they are in an energized state. Touching any of the modules in an energized state may lead to a discharge of static electricity from your body to the module, resulting in malfunction or breakage of the module. If you have no choice but to touch such a module, be sure to discharge the static electricity by touching the metal frame of the cubicle and then touch the module. This is also true when you perform any of the following actions on a module in its non-energized state: 1) setting a switch on the module; 2) connecting or disconnecting the cable from the module; or 3) inserting or removing the connector from the module.
- Every fixing or terminal screw must be secured tightly.
  Insufficiently tightened screws may result in malfunction, smoke, or fire.

(chapter 6, page 6-4)

NOTICE

- If the input voltage to a power supply module is close to the upper or lower limit of the prescribed range, ask a power supply management specialist to perform an inspection even if the input voltage is within the operating specifications.
- Power to the I/O modules mounted in the cubicle must be supplied from a power supply module with an appropriate wattage rating for the I/O modules.
  If a power supply module whose wattage rating is lower than expected is used, it may result in a fire.
- Be sure to power down your application system before replacing an existing module.
  Replacing a module in a power-on condition may cause damage to the hardware.

WARRANTY AND SERVICING

Unless a special warranty contract has been arranged, the following warranty is applicable to this product.

1. Warranty period and scope
   Warranty period
   The warranty period for this product is for one year after the product has been delivered to the specified delivery site.

   Scope
   If a malfunction should occur during the above warranty period while using this product under normal product specification conditions as described in this manual, please deliver the malfunctioning part of the product to the dealer or Hitachi Engineering & Services Co., Ltd. The malfunctioning part will be replaced or repaired free of charge. If the malfunctioning is shipped, however, the shipment charge and packaging expenses must be paid for by the customer.

   This warranty is not applicable if any of the following are true.

   - The malfunction was caused by handling or use of the product in a manner not specified in the product specifications.
   - The malfunction was caused by a unit other than that which was delivered.
   - The malfunction was caused by modifications or repairs made by a vendor other than the vendor that delivered the unit.
   - The malfunction was caused by a relay or other consumable which has passed the end of its service life.
   - The malfunction was caused by a disaster, natural or otherwise, for which the vendor is not responsible.

   The warranty mentioned here means the warranty for the individual product that is delivered. Therefore, we cannot be held responsible for any losses or lost profits that result from the operation of this product or from malfunctions of this product. This warranty is valid only in Japan and is not transferable.

2. Range of services
   The price of the delivered product does not include on-site servicing fees by engineers. Extra fees will be charged for the following:

   - Instruction for installation and adjustments, and witnessing trial operations.
   - Inspections, maintenance and adjustments.
   - Technical instruction, technical training and training schools.
   - Examinations and repairs after the warranty period is concluded.
   - Even if the warranty is valid, examination of malfunctions that are caused by reasons outside the above warranty scope.

Revision record

Revision No.	Revision record (revision details and reason for revision)	Month, Year	Remarks
F	First edition	November 2011	
G	Additional information is added concerning the service life of the relays contained in certain types of hardware modules.	March 2012	

PREFACE

Thank you for using Hitachi's model HSC-2100 input/output modules or, simply, modules.
This manual describes how to handle and apply HSC-2100 I/O modules. Please read this manual thoroughly and use the I/O modules properly.

<Trademark>

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CONTENTS

FIGURES

TABLES

1 GENERAL INFORMATION

1.1 Features

The HSC-2100 I/O modules covered in this manual are I/O modules provided as replacement modules to replace I/O modules used in S10/2α and S10/4α controllers. These replacement modules are functionally compatible with HSC-2000 I/O modules (in terms of the product specifications contained in their hardware manuals). However, there are differences in performance level between the two groups of I/O modules, as you can see from the product specifications. These differences are due to the fact that the HSC-2100 group of I/O modules has updated internal circuits and components used in them. Consequently, the two groups of I/O modules are not fully compatible with each other. For this reason, if an existing HSC-2000 I/O module is replaced with a latest HSC-2100 I/O module, influence from noise may pose a problem on the newly installed HSC-2100 I/O module, depending upon the installation environment in which the replaced HSC-2000 I/O module was previously used. In this case, please check the installation environment for noise source and take a measure to reduce the noise level.

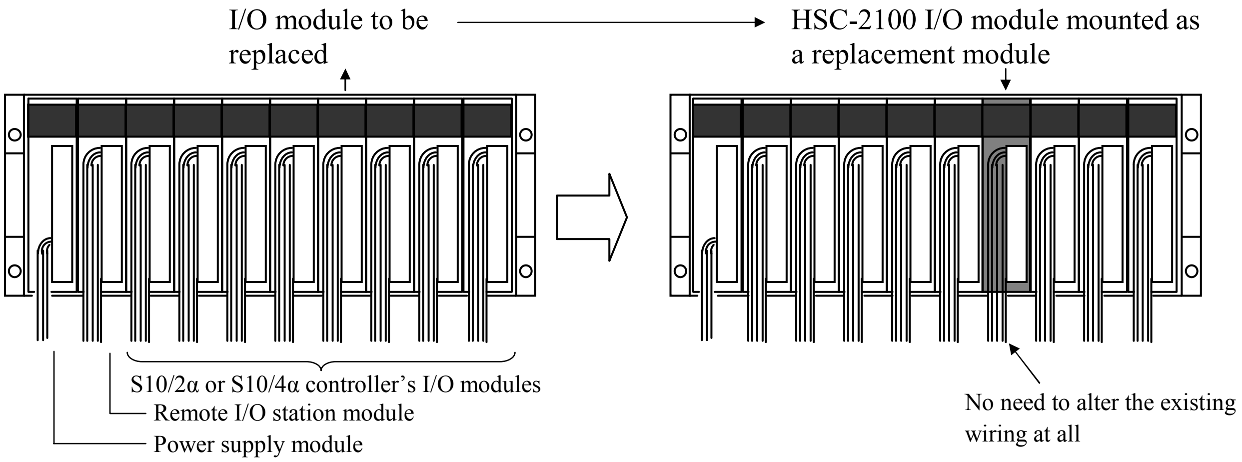
The HSC-2100 I/O modules have the following features:

- Making it possible to replace I/O modules in S10/2α and S10/4α controllers without the need to alter the existing wiring on the terminal blocks
- Compatible with the I/O voltage and current specifications of I/O modules used in S10/2α and S10/4α controllers, thus eliminating the need to re-design those programmable controllers
- Making it unnecessary to add changes to the existing software at the time of replacement, except when the programmable controller is S10/4α -- in the case of S10/4α controllers, their existing ladder programs need conversion at the replacement.
- Installable in HSC-2100 I/O units together with I/O modules of an S10/2α or S10/4α controller, or installable in I/O units of the S10/2α or S10/4α controller

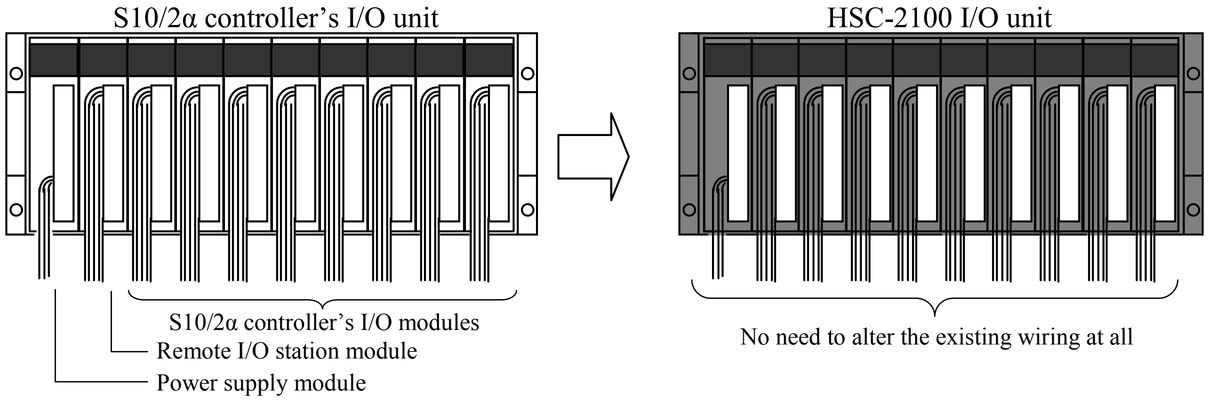
1.2 Examples of Replacement

This section shows some examples of replacement with HSC-2100 I/O modules (replacement modules are shown in gray color below).

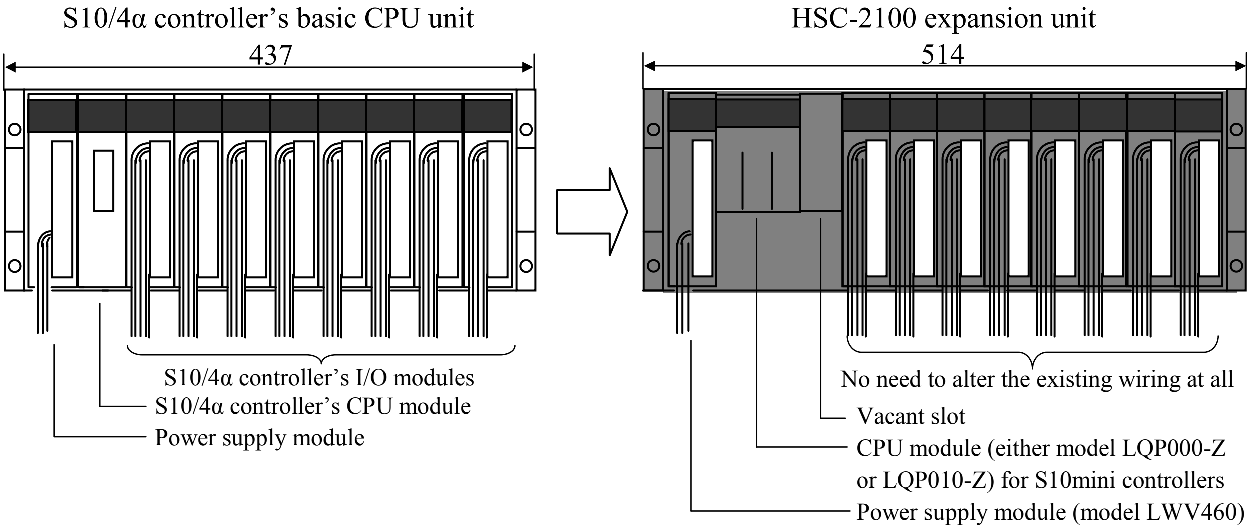
<Example 1: Replacing an S10/2α or S10/4α controller's I/O module with an HSC-2100 I/O module>



<Example 2: Replacing an S10/2α controller's whole I/O unit with an HSC-2100 I/O unit>



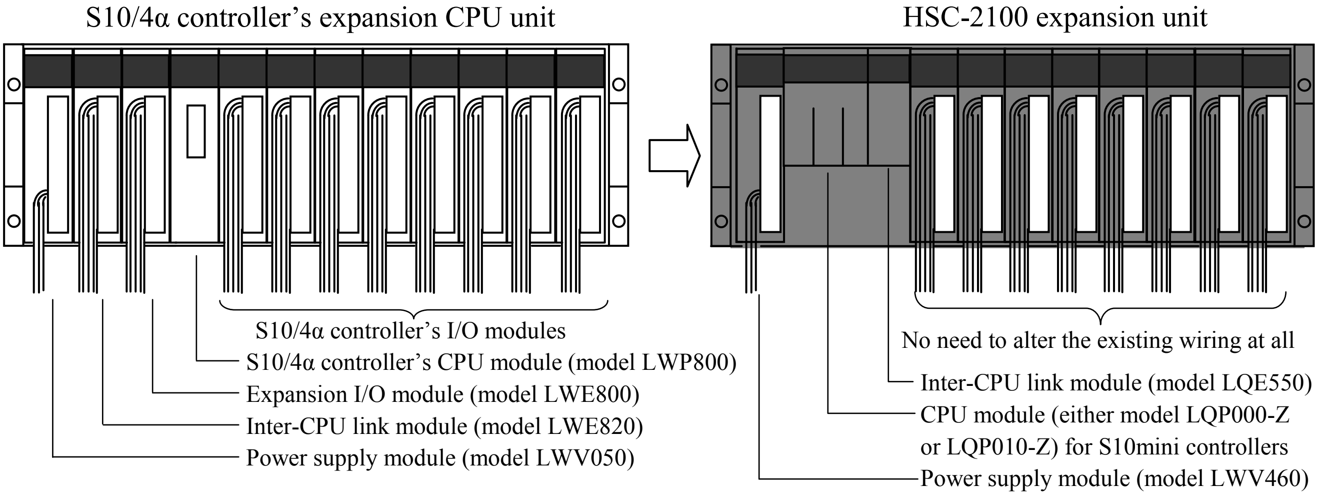
<Example 3: Replacing an S10/4α controller's basic CPU unit with an HSC-2100 expansion unit (with 8 slots)>



In the above example:

- The expansion unit must be either model HSC-2128 or HSC-2124, whose external horizontal dimension is larger than that of the S10/4α controller's basic CPU unit -- the external vertical dimensions of both units are the same.
- The power supply module for the expansion unit must be model LWV460, which requires no alteration of the existing wiring.
- The CPU module for S10mini controllers must be either model LQP000-Z or LQP010-Z.
- Do not mount anything in the vacant slot.
- The existing wiring needs to be altered for the CPU module.

<Example 4: Replacing an S10/4α controller's whole expansion CPU unit with an HSC-2100 expansion unit (with 8 slots)>



In the above example:

- The HSC-2100 expansion unit must be either model HSC-2128 or HSC-2124.
- The power supply module for the HSC-2100 expansion unit must be model LWV460, which requires no alteration of the existing wiring.
- The CPU module for S10mini controllers must be either model LQP000-Z or LQP010-Z.
- The existing wiring needs to be altered for the CPU module and inter-CPU link module.

1.3 Model Number Correspondence Between S10/2α and S10/4α Controllers' I/O Modules and HSC-2100 I/O Modules

Table 1-1 shows the model number correspondence between S10/2α and S10/4α controllers' I/O modules (listed as HSC-2000 I/O modules) and HSC-2100 I/O modules.

Table 1-1 Model Number Correspondence Between S10/2α and S10/4α Controllers' I/O Modules and HSC-2100 I/O Modules (1/2)

No.	Product name	HSC-2000 product model	HSC-2100 product model	Difference in specifications	Remarks
1	DI, 12 to 24 VDC, 32 points	LWI100	LWI400	None	
2	DI, 12 to 24 VDC, 16 points	LWI150	LWI450	None	
3	DI, 48 VDC, 16 points	LWI160	LWI460	None	
4	DI, 100 VDC, 16 points	LWI170	LWI470	None	
5	DI, 100 to 120 VAC, 32 points	LWI000	LWI600	None	
6	DI, 100 to 120 VAC, 16 points	LWI050	LWI650	None	
7	DO, relay contact output, 32 points	LWO000	LWO400	None	
8	DO, relay contact output, 16 points	LWO050	LWO450	None	
9	DO, relay output, 16 points (independent common)	LWO060	LWO460	None	
10	DO, transistor output sink type, 32 points	LWO100	LWO600	None	
11	DO, transistor output source type, 32 points	LWO110	LWO610	None	
12	DO, transistor output sink type, 16 points	LWO150	LWO650	Fuses are provided in the HSC-2000 DO module model but not in the HSC-2100 DO module model.	
13	DO, triac output, 16 points	PDS330	LWO670	None	
14	Pulse counter (0 to 16,383)	PTF320	LWC400	None	
15	Pulse counter (-8,192 to +8,191), high-speed version	PTF300	LWC401	None	
16	Pulse counter (-8,192 to +8,191), low-speed version	PTF301	LWC402	None	
17	AI, 4 channels, voltage input of ±5 VDC	PAF300	LWA400	Dielectric strength is 1,500 VAC in the HSC-2000 AI module models and 500 VAC in the HSC-2100 AI module models.	
18	AI, 4 channels, voltage input of ±5 VDC, high-speed version	PAF309	LWA401		
19	AI, 4 channels, voltage input of ±10 VDC	PAF320	LWA402		
20	AI, 4 channels, voltage input of ±10 VDC, high-speed version	PAF329	LWA403		
21	AI, 2 channels, voltage input of ±5 VDC, high-speed version	PAF308	LWA404		
22	AI, 4 channels, RTD (resistance temperature detector) input, -100 to +300°C	PAF301	LWA421		
23	AI, 4 channels, RTD input, -50 to +150°C	PAF302	LWA422		
24	AI, 4 channels, RTD input, -200 to +500°C	PAF303	LWA423		
25	AI, 4 channels (electrically insulated from each other), voltage input of ±5 VDC, 12-bit resolution	LWA820	LWA430	Overall accuracy is 0.3% of full scale in the HSC-2000 AI module model and 0.4% of full scale in the HSC-2100 AI module model.	
26	AI, 4 channels (electrically insulated from each other), voltage input of ±5 VDC, 14-bit resolution	–	LWA435	–	Used with S10V Ladder Chart System, Ver-Rev 01-21 or later.

(Continued on next page)

Table 1-1 Model Number Correspondence Between S10/2α and S10/4α Controllers' I/O Modules and HSC-2100 I/O Modules (2/2)

(Continued from preceding page)

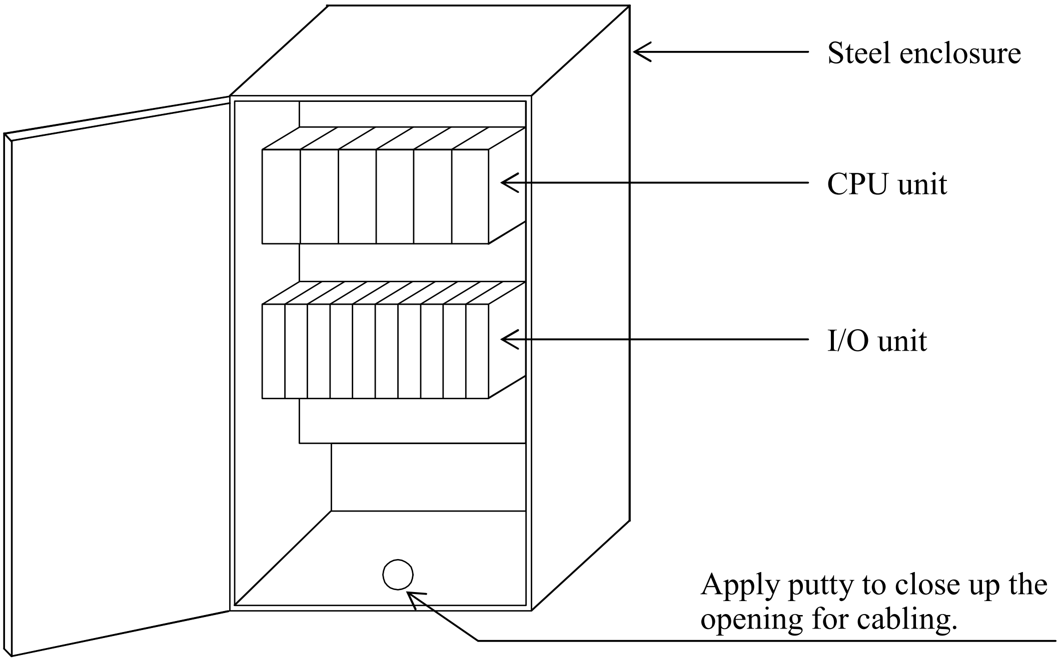
No.	Product name		HSC-2000 product model	HSC-2100 product model	Difference in specifications	Remarks
27	AI, 8 channels, voltage input of ±10 VDC		LWA000	LWA500	① Dielectric strength is 1,500 VAC in the HSC-2000 AI module models and 500 VAC in the HSC-2100 AI module models. ② The number of scanned channels that can be varied by setting in the HSC-2000 AI module models is fixed at 8 in the HSC-2100 AI module models. ③ The input impedance at power-on time is 5 MΩ in the HSC-2000 AI module models and 1 MΩ in the HSC-2100 AI module models.	
28	AI, 8 channels, voltage input of ±5 VDC		LWA001	LWA501		
29	AO, 4 channels, voltage output of ±5 VDC		PAN300B	LWA450	Dielectric strength is 1,500 VAC in the HSC-2000 AI module models and 500 VAC in the HSC-2100 AI module models.	
30	AO, 4 channels, current output of 4 to 20 mA DC		PAN301B	LWA460		
31	AO, 8 channels, voltage output of ±10 VDC		LWA100	LWA550		
32	AO, 8 channels, voltage output of ±5 VDC		LWA101	LWA551		
33	AO, 8 channels, current output of 4 to 20 mA DC		LWA110	LWA560		
34	Power supply, input 100 VAC, output 12 VDC / 3.5 A, 5 VDC / 0.8 A		LWV050	LWV450	None	
35	Power supply, input 100 VAC or 100/110 VDC, output 12 VDC / 3.5 A, 5 VDC / 2.0 A		LWV060	LWV460	None	
36	Power supply, input 100 to 110 VDC, output 12 VDC / 3.5 A, 5 VDC / 0.8 A		LWV150	LWV550	None	
37	Remote I/O station		LWS010	LWS410	None	
38	Mount base	8-slot I/O unit	HSC-2008	HSC-2108	None	
39		4-slot I/O unit	HSC-2004	HSC-2104	None	
40		2-slot I/O unit	HSC-2002	HSC-2102	None	
41		8-slot expansion unit as a replacement unit for S10/4α controllers	HPC-1128	HSC-2128	Some of the modules mounted in S10/4α controllers' CPU units are not mountable in these expansion units. (For details, see Subsection 2.3.2, "Expansion mount bases.")	
42		4-slot expansion unit as a replacement unit for S10/4α controllers	HPC-1124	HSC-2124		

1.4 Before Using PCs

Hitachi's programmable controllers (PCs) are a product of both electronic circuit technology and processor technology, and should be used in consideration of the following:

(1) Your application system should be constructed in such a way that it will not go beyond any of its maximum rated values, operating power supply voltage ranges, heat dissipation characteristics, installation conditions, etc. during its operation. If the application system is used beyond those limits, and this results in a system breakdown or accident, then the manufacturer will accept no liability for the result. For information on the range of warranty, see "WARRANTY AND SERVICING" in the front matter of this manual.

(2) The programmable controller is not of fire-, dust-, and drip-proof structure, so it must be mounted in a dust- and drip-proof steel enclosure as shown below.



NOTICE
Where for some reason the programmable controller has to be installed at a location that has a possibility of being exposed to rain and water conditions, be sure to mount it in a drip-proof enclosure. Disregarding this rule may result in product failure.

NOTICE

Do not touch any of the modules in the programmable controller when they are in an energized state. Touching any of the modules in an energized state may lead to a discharge of static electricity from your body to the module, resulting in malfunction or breakage of the module. If you have no choice but to touch such a module, be sure to discharge the static electricity by touching the metal frame of the cubicle and then touch the module. This is also true when you perform any of the following actions on a module in its non-energized state: 1) setting a switch on the module; 2) connecting or disconnecting the cable from the module; or 3) inserting or removing the connector from the module.

(3) The programmable controller must be used within the environmental specification shown in the table below. To make the product run stably for a long period of time, users are advised to use the product at normal temperature (15 to 35°C) and normal humidity (45 to 85%). If it is used in a location subject to high temperature and high humidity or where the temperature greatly fluctuates daily, its useful life will be shortened.

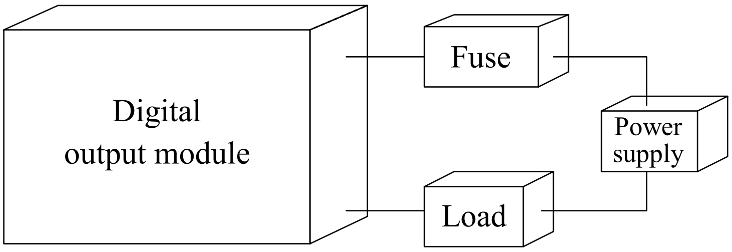
Power voltage	For LWV450: 100 to 120 VAC, single phase, 50/60 ±5 Hz For LWV460: 100 to 120 VAC, single phase, 50/60 ±5 Hz 100 to 110 VDC For LWV550: 100 to 110 VDC
Power voltage fluctuation range	For LWV450: 85 to 132 VAC For LWV460: 85 to 132 VAC 80 to 143 VDC For LWV550: 80 to 143 VDC
Temperature	Operating: 0 to 55°C; Storage: -20 to 70°C. (Temperature change rate: 10°C/hour or less)
Relative humidity	Operating: 30 to 90%RH; Storage: 10 to 90%RH (non-condensing)
Vibration resistance	Conforming to JIS C0040 standard; Frequency: 10 to 150 Hz; Acceleration: 10 m/s^2; Direction: each of X, Y, and Z; Sweep time: 8 minutes; Sweep cycles: 20.
Shock resistance	Conforming to JIS C0041 standard; Peak acceleration: 147 m/s^2; Half-sine pulses; 3 times in each of X, Y, and Z directions.
Ambient air	Dust class: 1 million (no corrosive gas)

NOTICE

The power supply module’s input voltage which is within its specification may be close to the upper or lower limit of the specified range. In such a case, interpret the input power as abnormal and ask personnel in charge of electric supply facility management to check up the supply equipment.

(4) Output modules

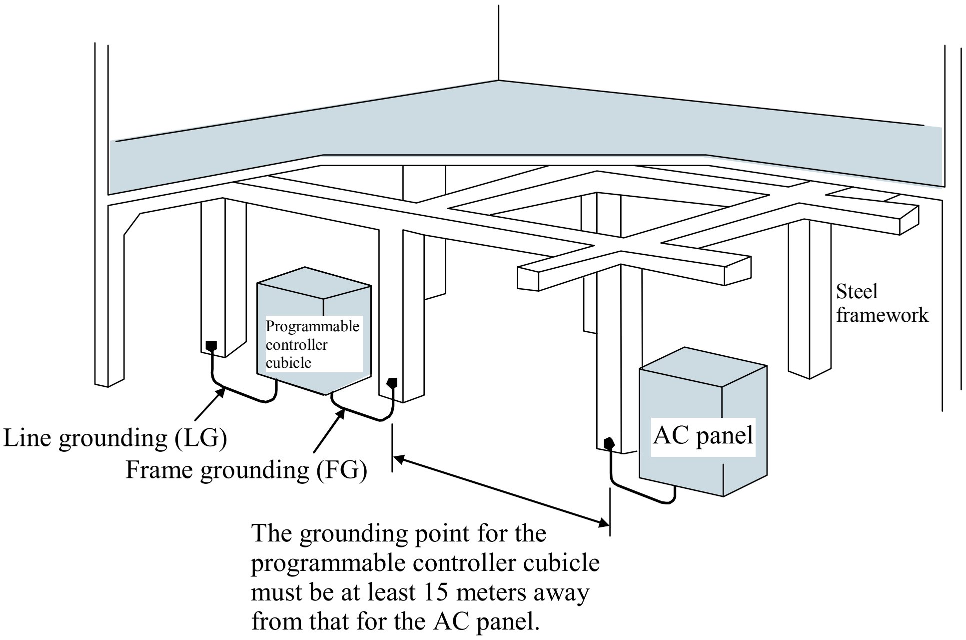
For each output module, connect a fuse to the power supply to the load for protection against load short-circuit. The connected fuse must be one that matches the ratings of the load. If a non-matching fuse is connected, the printed wiring board or casing used may be damaged when the load is short-circuited.



(5) Grounding points

Each grounding terminal of the programmable controller must be grounded separately from any other grounding terminals by using Class D grounding or higher (*). The grounding terminal of an AC panel for distribution, in particular, must be grounded at least 15 meters away from the grounding points of the aforementioned grounding terminals.

The best way to ground such grounding terminals is to weld the grounding cable from each grounding terminal to the steel framework of the building (see the figure below). If such welding cannot be accomplished, bury a grounding bar in the earth and ground the terminal through the bar.



(*) Class D grounding is defined in the Technical Standard for Electrical Facilities of Japan. This standard states that the grounding resistance must be 100 ohms or less for equipment operating on 300 VAC or less, and 500 ohms or less for devices that shut down automatically within 0.5 seconds when shorting occurs in low tension lines.

(6) Noise
Do not install the programmable controller in or near to a panel in which an inverter or other high-voltage device is installed. If such installation is essential for some reason, set shielding plates to protect the CPU unit or I/O unit and the cables from the influence of electromagnetic or electrostatic induction or both.

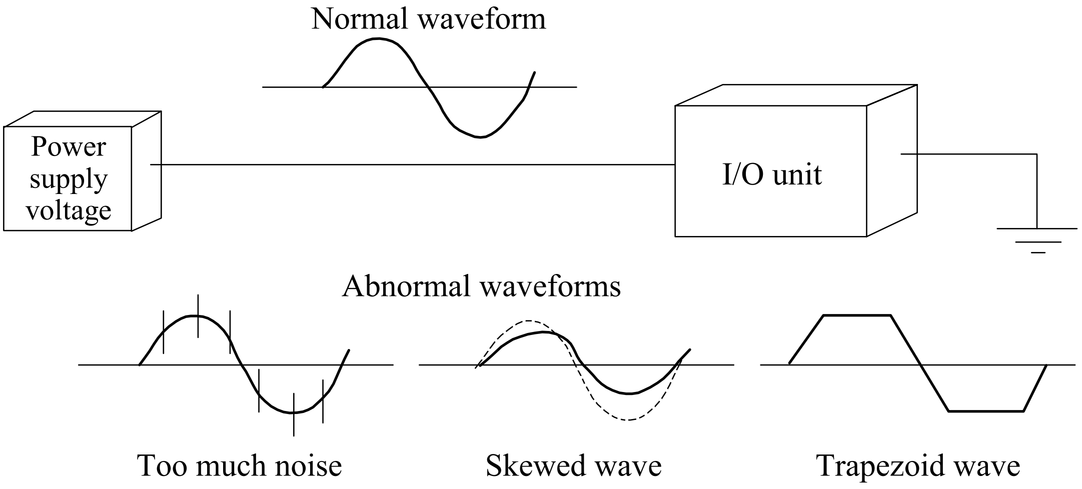
(7) Emergency stop circuit
Should a component part of the programmable controller fail, it may affect the entire product. The emergency stop circuit to be integrated into the product must be constructed with an external relay circuit.

(8) Replacement of component parts
Customers are not recommended to replace any component part of the programmable controller not mentioned in this manual. If a faulty part is found, replace the module containing it. The replacement of a component part other than those mentioned in this manual should be done by Hitachi's maintenance personnel.

(9) Replacement of modules
Before replacing a module, be sure to switch off the power supply.
Without doing so, such replacement may result in product failure or electric shock.

(10) Expansion of the existing equipment
If the existing equipment of the programmable controller is expanded by adding additional units, check the expanded equipment for any abnormality, according to the instructions given in Section 6.1, "Preventive Maintenance," and make sure that the programmable controller functions normally. For the power supply and grounding used, in particular, check the following items:

- Power supply checkup
  Check the voltage and its waveform.
  - Make sure that no voltage drop is caused.
  - Make sure that the amount of noise in the power line is not problematic.

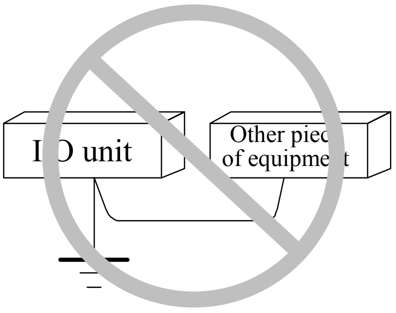


(11) Grounding

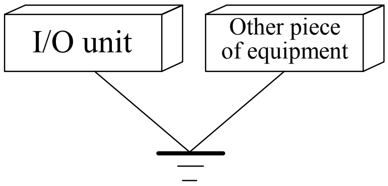
Check the wiring for grounding.

- Make sure that the grounding line is not shared with any other piece of equipment.
- Make sure that the grounding point is at least 15 meters away from that of the AC panel.

Check, also, that no power cable or lead cable (e.g., a motor lead cable) is placed near signal cables, such as a remote I/O cable.



Grounding line shared



Separate grounding line installed for the other piece

NOTICE
● Construct an emergency stop circuit and an interlock circuit outside the programmable controller. Unless they are so constructed, failure of the product may result in machine breakdown or accident. ● Keep the input/output currents of I/O modules within the maximum permitted current values. If an overcurrent is allowed to flow in the I/O module, the component part(s) involved may be damaged, resulting an accident, fire, or product failure.

NOTICE
Do not use a transceiver, cellular phone, or the like near the I/O module. Such communication equipment generates noise, which may result in malfunction or system failure.

NOTICE

- As the external power supply, select a power supply with overvoltage and overcurrent protection.
- If a product smokes or gives off an offensive smell, immediately turn off the power to the product and find the cause.
- As the power to each mounted module, use a power supply matching the ratings of the mounted module.
  If a power supply not matching its ratings is connected to the module, it may lead to a fire.
- Component parts containing gallium arsenide (GaAs) in a photocoupler or LED are used in products described in this manual.
  Gallium arsenide is designated as a harmful substance by law.
  Use extreme care in handling, particularly in scrapping the products.
  Have a specialized agent dispose of the products as industrial waste.
- Install a fuse or circuit protector for the external power supply for protection against short-circuit.
  The circuit protector selected must match the ratings of the external power supply.
- Before applying power to any product described in this manual, check that all the cable wiring for the product is correct.
- Before terminating the programmable controller (by shutting down or resetting), check that all the peripheral equipment is already stopped or will not be affected by the termination.
- Failure, breakdown, or the like of an installed module may damage the contents of memory spaces.
  Be sure to make a backup copy of any important data in memory.

2 SPECIFICATIONS OF INDIVIDUAL MODULES

2.1 Power Supply Modules

Table 2-1 Specifications of Power Supply Modules

Item		Specifications		
Model		LWV450	LWV460	LWV550
Rated input voltage		100 to 120 VAC	100 to 120 VAC 100 to 110 VDC	100 to 110 VDC
Input voltage fluctuation range		85 to 132 VAC	85 to 132 VAC 80 to 143 VDC	80 to 143 VDC
Output current	12 VDC	3.5 A	3.5 A	3.5 A
	5 VDC	0.8 A	2.0 A	0.8 A

Table 2-2 Names and Functions of Parts (the nos. below are keyed to those in the rightmost side of the figure)

No.	Name	Function
1	Power-supply operation indicator (POWER ON) LED	Indicates the power supply is energized. This indicator LED is lit when the power switch is turned on.
2	Voltage check terminal (DC12V CHECK)	Is a voltage check terminal that enables the user to check if the 12-volt output voltage is normal. This terminal should not be used for any other purpose than checking the voltage.
3	Voltage check terminal (DC5V CHECK)	Is a voltage check terminal that enables the user to check if the 5-volt output voltage is normal. This terminal should not be used for any other purpose than checking the voltage.
4	Voltage check terminal (GND)	Is a 0-volt reference voltage terminal that provides a reference voltage for voltage checking. This terminal should not be used for any other purpose than checking a voltage.
5	Power input terminals (H, N)	Allow a cable from a power source to be connected to the power supply module. The input voltage requirement of the power supply module depends on its model.
6	Line ground (LG) terminal	Is a grounding terminal to ground the power supply line. This terminal needs to be connected to the grounding terminal of the cubicle.
7	Frame ground (FG) terminal	Is a grounding terminal to ground the power supply module. (This terminal need not be connected either to the mount base's FG terminal or the grounding terminal block. Just leave it unwired.)

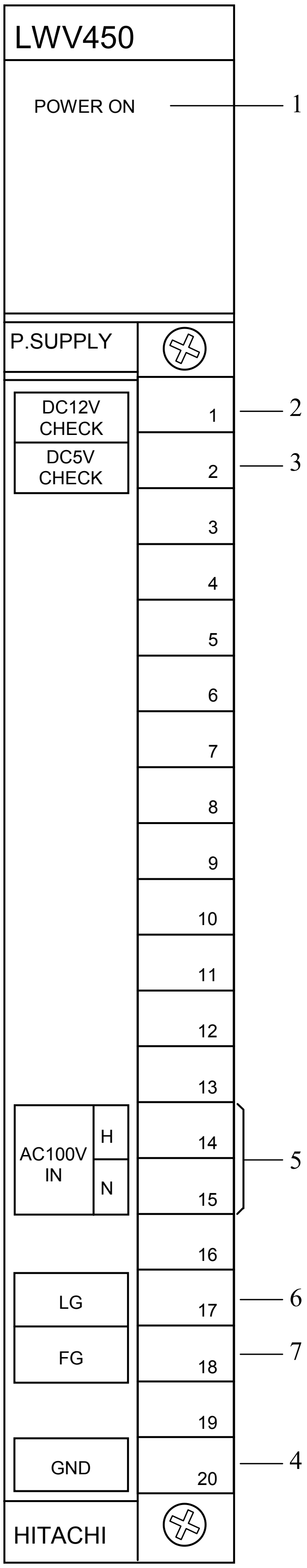


Figure 2-1 An External View of the LWV450 Power Supply Module

2.2 Remote I/O Station Modules

For the specifications of available remote I/O station modules, refer to the instruction manuals for the CPU and LPU modules to which they can be connected. Table 2-3 shows the instruction manuals for such CPU and LPU modules.

Table 2-3 Instruction Manuals Giving the Specifications of Available Remote I/O Station Modules

CPU/LPU module	CPU/LPU model	Instruction manual
S10/2α CPU	LWP000/LWP040/LWP070/LWP075	SAE-2-001
S10mini CPU	LQP000/LQP010/LQP011/LQP120	SME-1-100
S10V LPU	LQP510	SVE-1-100
R70 LPU	LQP710	SVE-1-111

Table 2-4 Names and Functions of Parts (the nos. below are keyed to those in the rightmost side of the figure)

No.	Name	Function
1	Station no. setting switches (STNO U and L)	Are used to set a station number, which is the 2-digit starting address of an I/O number. The upper digit of the starting address is set with the U-switch and the lower digit, with the L-switch.
2	I/O point count setting terminal pairs	Each sets a count of the number of input/output points per slot (16, 32, 64, or 128) on the mount base.
3	"Fix partitioning or not" setting terminal pair	Either fixes the partitioning of the mount base (when shorted) or does not fix it (when open).
4	Output hold setting terminal pair	Sets the output status of each output module connected to the remote I/O (RI/O) communication line either to "Reset" or "Hold" so that those output modules will automatically be placed in the set output state when the RI/O line is accidentally broken, disconnected, or de-energized.
5	RI/O line input terminal triplet	Is used to connect the remote I/O line cable. Terminals 1 and 4 are internally connected together. This is also the case with terminals 2 and 5.
6	RI/O line output terminal triplet	Is used to connect the remote I/O line cable. Terminals 1 and 4 are internally connected together. This is also the case with terminals 2 and 5.
7	Terminating-resistor setting terminal pair	Is shorted to terminate the RI/O line with the built-in terminating resistor (150 ohms) when the remote I/O station module is connected to one end of the RI/O line. Depending on the type of RI/O line cable used, however, a 100-ohm terminating resistor needs to be connected for use in place of the 150-ohm one.
8	Shield terminal	Is used to ground the shield of the RI/O line cable. This terminal is internally connected to the SHD terminals of both RI/O IN and RI/O OUT and needs to be wired to the FG terminal of the mount base.
9	Remote I/O operation indicator (RI/O) LED	Is lit when a remote I/O transfer operation is in progress.

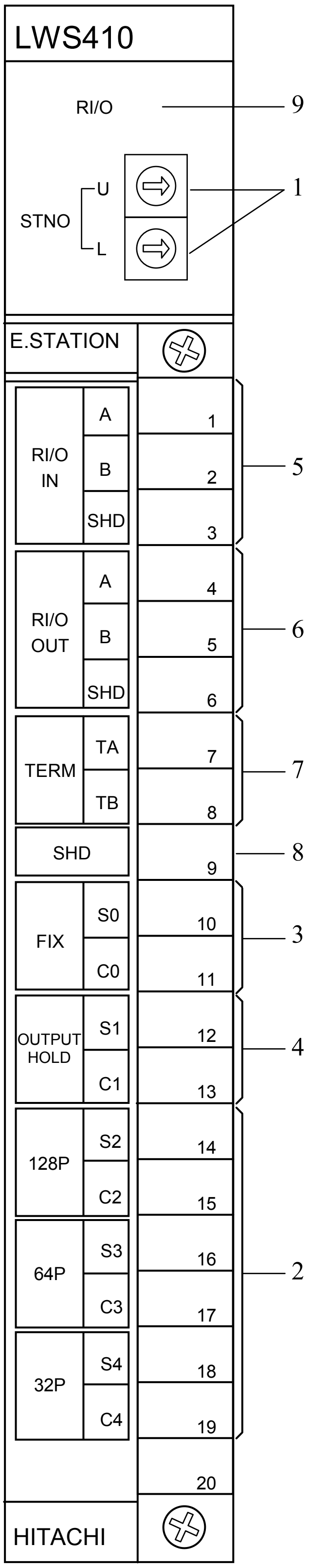


Figure 2-2 An External View of the LWS410 Remote I/O Station Module

2.3 Mount Bases

2.3.1 Basic mount bases

A basic mount base is used to mount a remote I/O station module, a power supply module, and a variety of I/O modules in the I/O unit, as shown below.

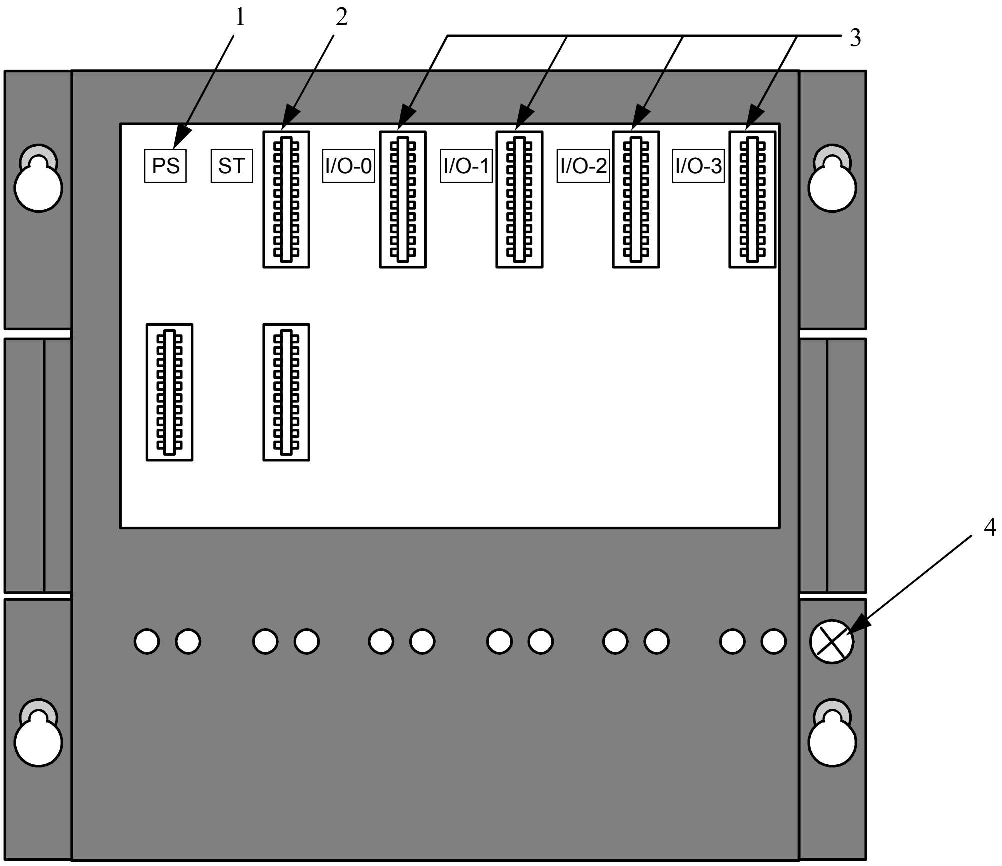


Figure 2-3 Parts of the Model HSC-2104 Mount Base (Shown as Representative) and Their Names

Table 2-5 Available Basic Mount Base Models

Name	Model	Remarks: Number of slots provided
2-slot I/O mount base	HSC-2102	A total of five -- one for a power supply module, two for a station module, and two for I/O modules.
4-slot I/O mount base	HSC-2104	A total of seven -- one for a power supply module, two for a station module, and four for I/O modules.
8-slot I/O mount base	HSC-2108	A total of eleven -- one for a power supply module, two for a station module, and eight for I/O modules.

Table 2-6 Parts of the Model HSC-2104 Mount Base (Shown as Representative) and Their Use

No.	Part name	Use
1	PS slot	Is used to mount a power supply module on the mount base.
2	ST slots	Are used to mount a station module on the mount base.
3	I/O slots	Each is used to mount an I/O module on the mount base.
4	FG terminal	Is wired to the frame ground (FG) terminal of each module among those modules that have an FG terminal.

2.3.2 Expansion mount bases

All available expansion mount bases are replacement mount bases to replace Hitachi S10/4α mount bases. Shown below is the model HSC-2128 expansion mount base.

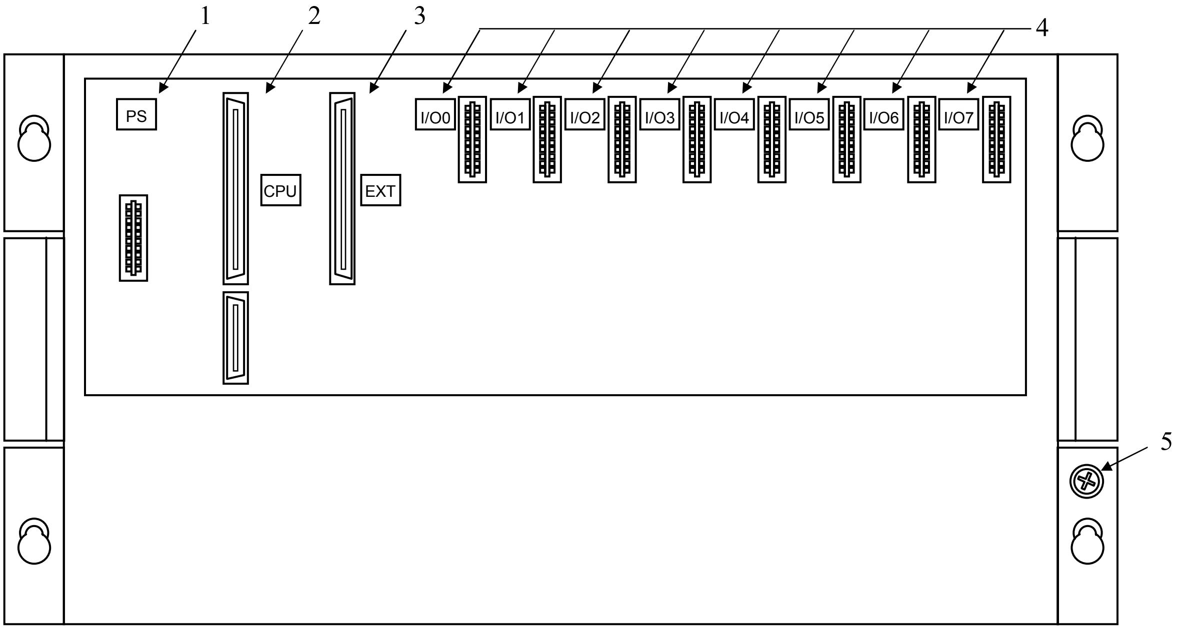


Figure 2-4 Parts of the Model HSC-2128 Expansion Mount Base (Shown as Representative) and Their Names

Table 2-7 Available Expansion Mount Base Models

Name	Model	Remarks: Number of slots provided
8-slot expansion mount base	HSC-2128	A total of twelve -- one for a power supply module, two for a CPU module, one for an inter-CPU link module, and eight for I/O modules
4-slot expansion mount base	HSC-2124	A total of eight -- one for a power supply module, two for a CPU module, one for an inter-CPU link module, and four for I/O modules

Table 2-8 Parts of the Model HSC-2128 Expansion Mount Base (Shown as Representative) and Their Use

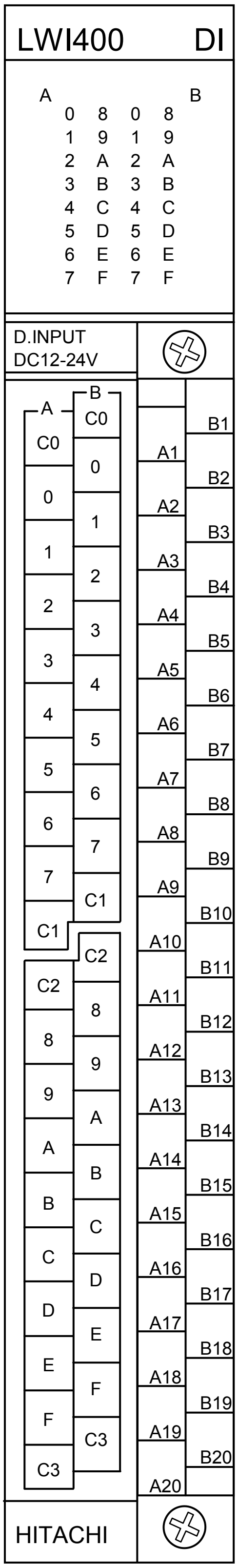
No.	Part name	Use
1	PS slot	Is used to mount a power supply module (model LWV460) on the mount base.
2	CPU slots	Are used to mount a CPU module (model LQP000) on the mount base.
3	EXT slot	Is used to mount an inter-CPU link module (model LQE550) on the mount base.
4	I/O slots	Each is used to mount an I/O module on the mount base.
5	FG terminal	Is wired to the frame ground (FG) terminal of each module among those modules that have an FG terminal.

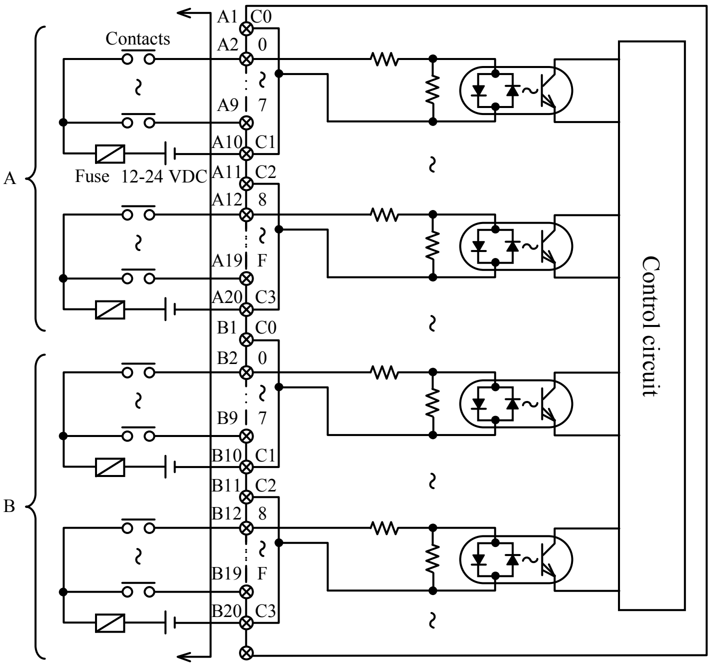
NOTICE

Never mount a module other than the above listed modules on the mount base. Disregarding this rule may result in malfunction.

2.4 Model LWI400 Input Module (12 to 24 VDC Input, 32 Points)

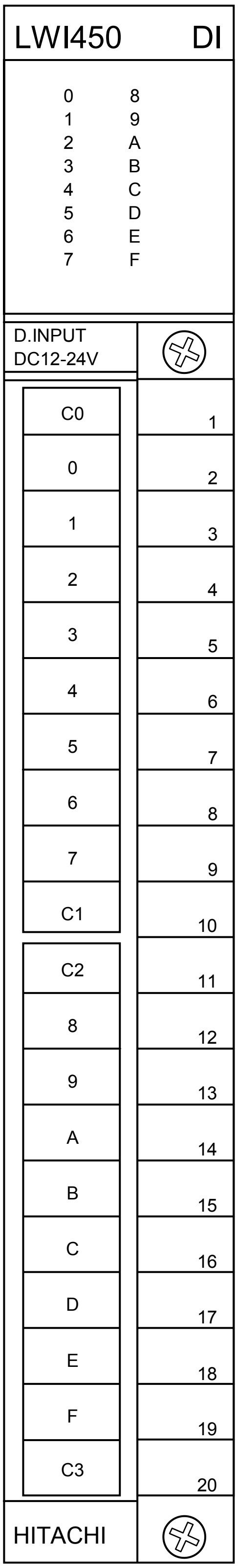
Item		Specification
Input points		32
Insulation method		Photocoupler
Rated input voltage		12 to 24 VDC
Rated input current		Approx. 10 mA (24 VDC), approx. 5 mA (12 VDC)
Input voltage range		10 to 28 VDC
ON voltage / current		10 VDC or higher / 4 mA or more
OFF voltage / current		4 VDC or lower / 1.5 mA or less
Input impedance		Approx. 2.2 kΩ
Response time	OFF→ON	10 ms or less
	ON→OFF	10 ms or less
Internal consumption current	12 VDC	0 mA
	5 VDC	5 mA + 2 mA × n, where n is the number of points in ON state.
Points per common		8
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		420 g

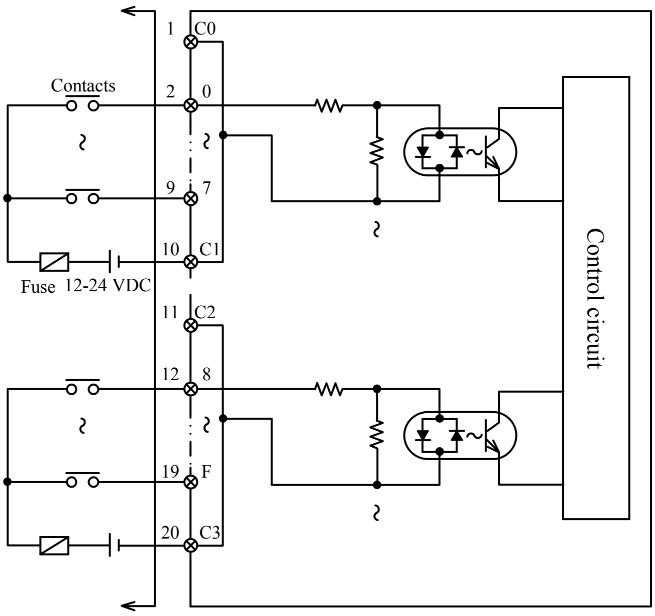




2.5 Model LWI450 Input Module (12 to 24 VDC Input, 16 Points)

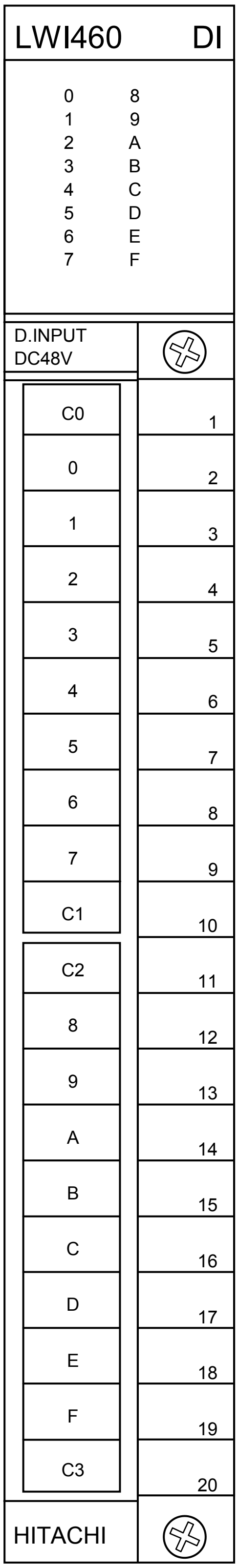
Item		Specification
Input points		16
Insulation method		Photocoupler
Rated input voltage		12 to 24 VDC
Rated input current		Approx. 10 mA (24 VDC), approx. 5 mA (12 VDC)
Input voltage range		10 to 28 VDC
ON voltage / current		10 VDC or higher / 4 mA or more
OFF voltage / current		4 VDC or lower / 1.5 mA or less
Input impedance		Approx. 2.2 kΩ
Response time	OFF→ON	10 ms or less
	ON→OFF	10 ms or less
Internal consumption current	12 VDC	0 mA
	5 VDC	4 mA + 2 mA × n, where n is the number of points in ON state.
Points per common		8
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		330 g

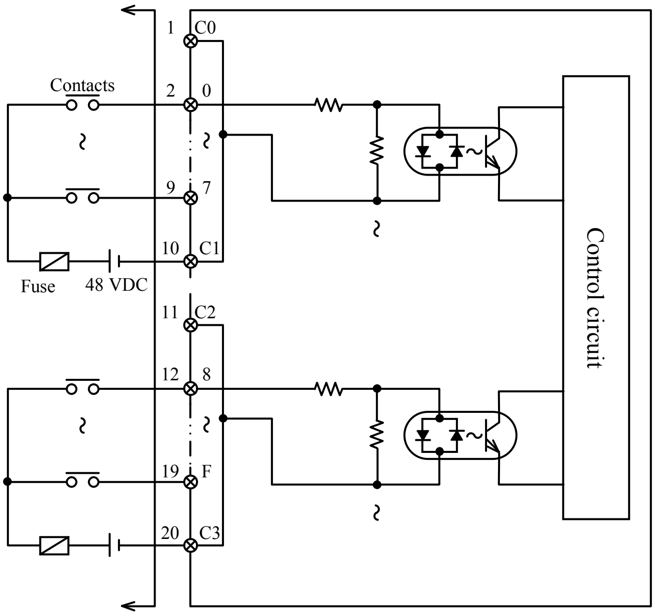




2.6 Model LWI460 Input Module (48 VDC Input, 16 Points)

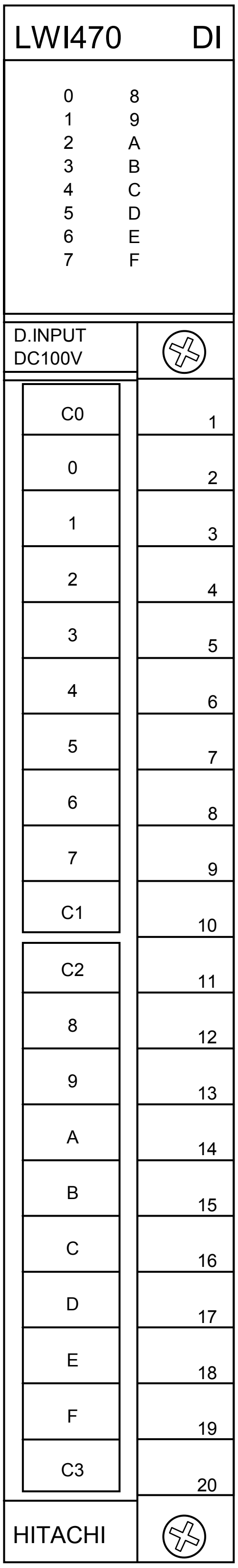
Item		Specification
Input points		16
Insulation method		Photocoupler
Rated input voltage		48 VDC
Rated input current		Approx. 10 mA
Input voltage range		40 to 56 VDC
ON voltage / current		40 VDC or higher / 8 mA or more
OFF voltage / current		8 VDC or lower / 1.5 mA or less
Input impedance		Approx. 48 kΩ
Response time	OFF→ON	15 ms or less
	ON→OFF	20 ms or less
Internal consumption current	12 VDC	0 mA
	5 VDC	4 mA + 2 mA × n, where n is the number of points in ON state.
Points per common		8
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		380 g

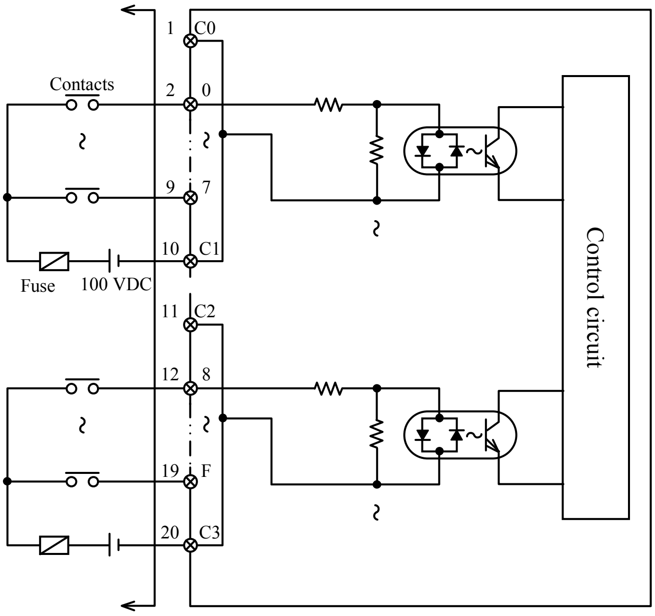




2.7 Model LWI470 Input Module (100 VDC Input, 16 Points)

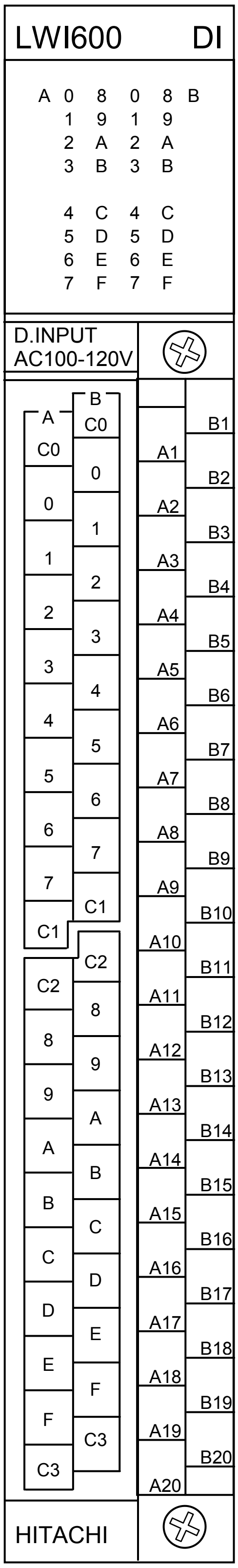
Item		Specification
Input points		16
Insulation method		Photocoupler
Rated input voltage		100 VDC
Rated input current		Approx. 5 mA
Input voltage range		85 to 110 VDC
ON voltage / current		85 VDC or higher / 4 mA or more
OFF voltage / current		25 VDC or lower / 1 mA or less
Input impedance		Approx. 22 kΩ
Response time	OFF→ON	15 ms or less
	ON→OFF	20 ms or less
Internal consumption current	12 VDC	0 mA
	5 VDC	4 mA + 2 mA × n, where n is the number of points in ON state.
Points per common		8
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		380 g

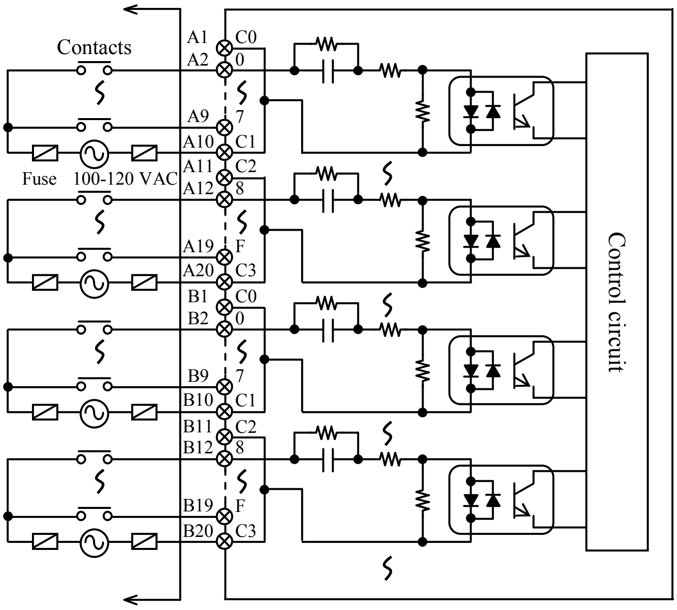




2.8 Model LWI600 Input Module (100 to 120 VAC Contact Input, 32 Points)

Item		Specification
Input points		32
Insulation method		Photocoupler
Rated input voltage		100 to 120 VAC, 50/60 Hz
Rated input current		8.5 mA (100 VAC, 50 Hz) 10 mA (100 VAC, 60 Hz)
Input voltage range		85 to 132 VAC (50/60 Hz ±5%)
Rush current		400 mA or less, 0.2 ms or less (132 VAC)
ON voltage / current		80 VAC or higher / 7 mA or more
OFF voltage / current		25 VAC or lower / 2.5 mA or less
Input impedance		Approx. 12 kΩ (50 Hz), approx. 10 kΩ (60 Hz)
Response time	OFF→ON	15 ms or less
	ON→OFF	25 ms or less
Internal consumption current	12 VDC	0 mA
	5 VDC	5 mA + 2 mA × n, where n is the number of points in ON state.
Points per common		8
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		460 g

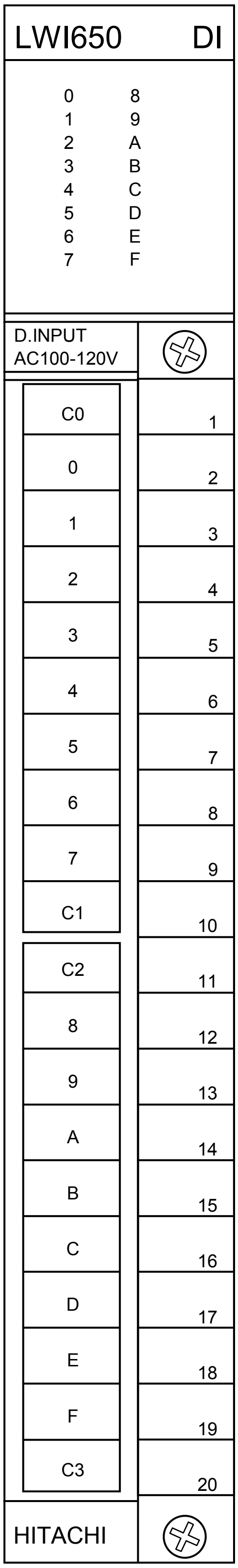


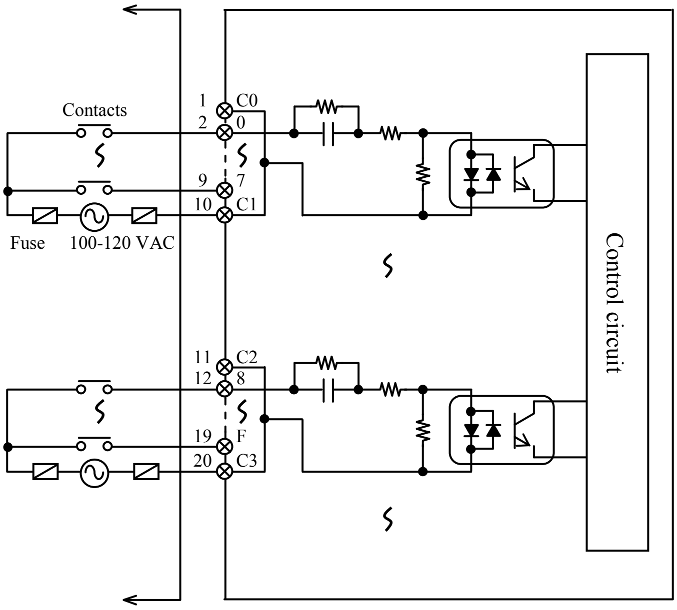


- Depending on its switching capacity, any reed relay used as the input contacts may have its contact materiel melted due to an in-rush current or, simply, rush current flowing in the input module.
  To prevent this, the user is recommended to choose a reed relay having a sufficiently large switching capacity.

2.9 Model LWI650 Input Module (100 to 120 VAC Contact Input, 16 Points)

Item		Specification
Input points		16
Insulation method		Photocoupler
Rated input voltage		100 to 120 VAC, 50/60 Hz
Rated input current		8.5 mA (100 VAC, 50 Hz) 10 mA (100 VAC, 60 Hz)
Input voltage range		85 to 132 VAC (50/60 Hz ±5%)
Rush current		400 mA or less, 0.2 ms or less (132 VAC)
ON voltage / current		80 VAC or higher / 7 mA or more
OFF voltage / current		25 VAC or lower / 2.5 mA or less
Input impedance		Approx. 12 kΩ (50 Hz), approx. 10 kΩ (60 Hz)
Response time	OFF→ON	15 ms or less
	ON→OFF	25 ms or less
Internal consumption current	12 VDC	0 mA
	5 VDC	4 mA + 2 mA × n, where n is the number of points in ON state.
Points per common		8
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		330 g

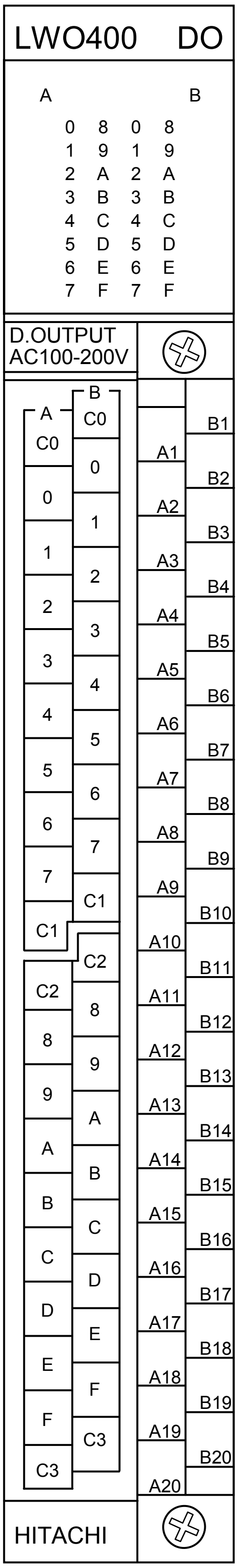


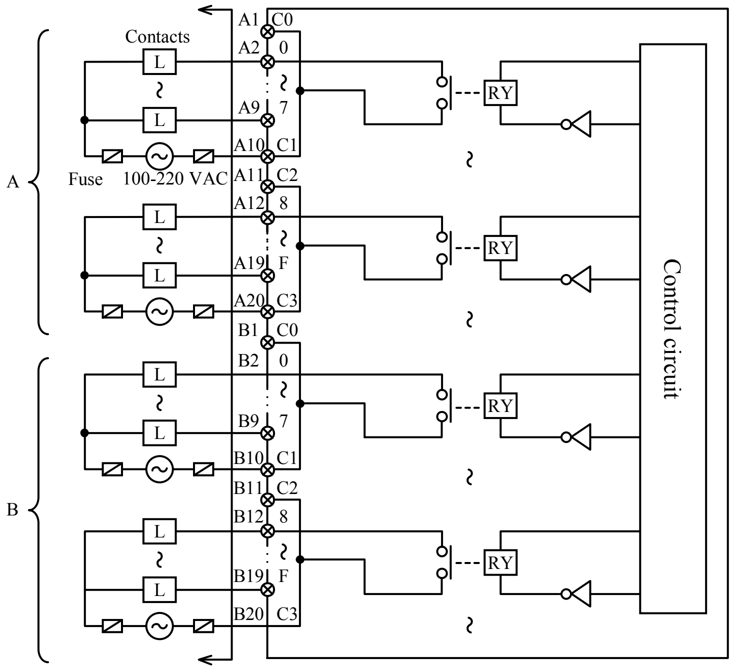


- Depending on its switching capacity, any reed relay used as the input contacts may have its contact materiel melted due to an in-rush current or, simply, rush current flowing in the input module.
  To prevent this, the user is recommended to choose a reed relay having a sufficiently large switching capacity.

2.10 Model LWO400 Output Module (100 to 200 VAC Contact Output, 32 Points)

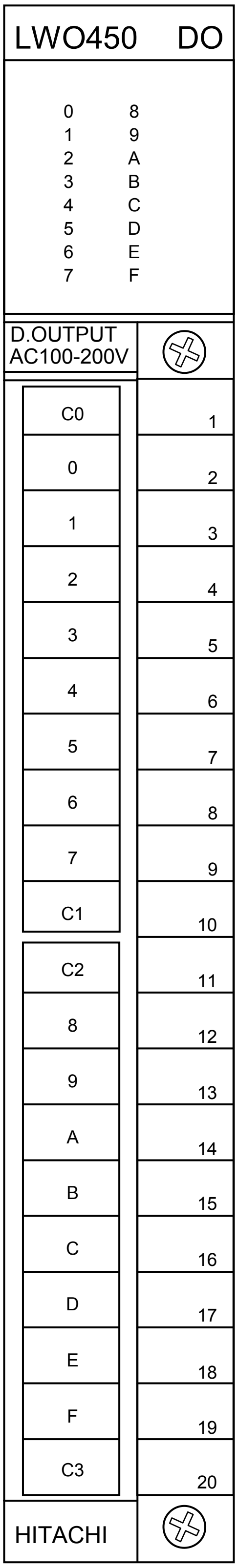
Item		Specification
Output points		32
Insulation method		Relay
Rated output		100 to 220 VAC: 2 A per point, 5 A per common 12 to 24 VDC: 2 A per point, 5 A per common 48 VDC: 0.5 A per point 100 to 110 VDC: 0.2 A per point
Maximum output voltages		250 VAC, 125 VDC
Minimum output current		20 mA
Maximum rush current		5 A, 100 ms or less
Response time	OFF→ON	15 ms or less
	ON→OFF	15 ms or less
Maximum switching frequency		1,800 times per hour
Service life (electrical) of relay		Approx. 100,000 cycles of make-and-break operation (2 A at 220 VAC [COS φ = 0.4], 2 A at 24 VDC [L/R = 7 ms], make-and-break operation frequency of 1,800 cycles per hour, normal temperature and normal humidity)
Internal consumption current	12 VDC	22 mA × n, where n is the number of points in ON state.
	5 VDC	25 mA
Points per common		8
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		560 g

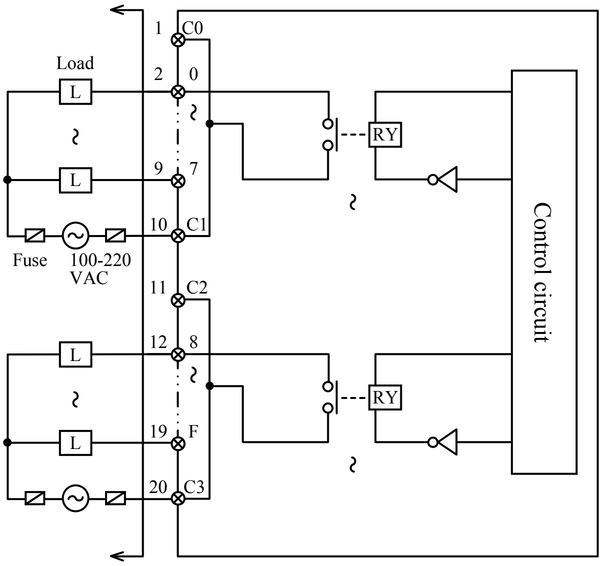




2.11 Model LWO450 Output Module (100 to 200 VAC Contact Output, 16 Points)

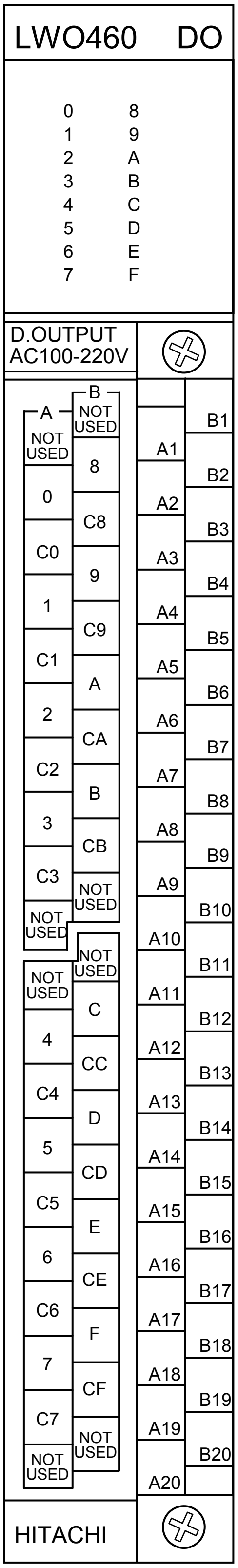
Item		Specification
Output points		16
Insulation method		Relay
Rated output		100 to 220 VAC: 2 A per point, 5 A per common 12 to 24 VDC: 2 A per point, 5 A per common 48 VDC: 0.5 A per point 100 to 110 VDC: 0.2 A per point
Maximum output voltages		250 VAC, 125 VDC
Minimum output current		20 mA
Maximum rush current		5 A, 100 ms or less
Response time	OFF→ON	15 ms or less
	ON→OFF	15 ms or less
Maximum switching frequency		1,800 times per hour
Service life (electrical) of relay		Approx. 100,000 cycles of make-and-break operation (2 A at 220 VAC [COS φ = 0.4], 2 A at 24 VDC [L/R = 7 ms], make-and-break operation frequency of 1,800 cycles per hour, normal temperature and normal humidity)
Internal consumption current	12 VDC	22 mA × n, where n is the number of points in ON state.
	5 VDC	25 mA
Points per common		8
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200m
Operation indication		LED (lit when the module is powered on)
Mass		410 g

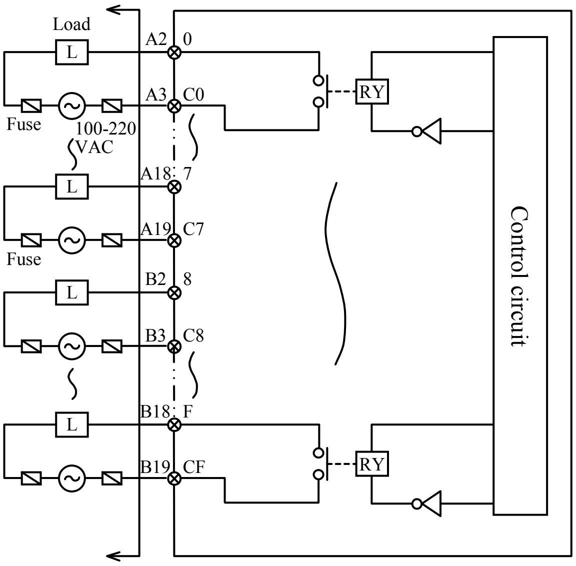




2.12 Model LWO460 Output Module (100 to 200 VAC Contact Output, Independent Common, 16 Points)

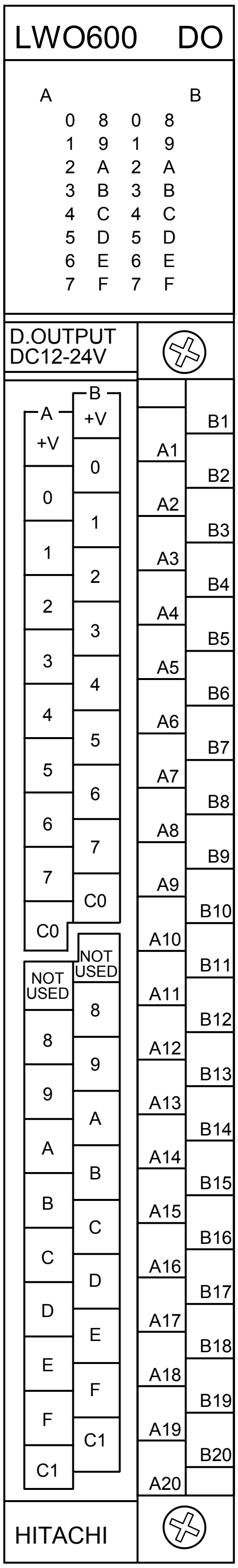
Item		Specification
Output points		16
Insulation method		Relay
Rated output		100 to 220 VAC: 2 A per point 12 to 24 VDC: 2 A per point 48 VDC: 0.5 A per point 100 to 110 VDC: 0.2 A per point
Maximum output voltages		250 VAC, 125 VDC
Minimum output current		20 mA
Maximum rush current		5 A, 100 ms or less
Response time	OFF→ON	15 ms or less
	ON→OFF	15 ms or less
Maximum switching frequency		1,800 times per hour
Service life (electrical) of relay		Approx. 100,000 cycles of make-and-break operation (2 A at 220 VAC [COS φ = 0.4], 2 A at 24 VDC [L/R = 7 ms], make-and-break operation frequency of 1,800 cycles per hour, normal temperature and normal humidity)
Internal consumption current	12 VDC	22 mA × n, where n is the number of points in ON state.
	5 VDC	15 mA
Points per common		1 (Independent common)
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200m
Operation indication		LED (lit when the module is powered on)
Mass		480 g





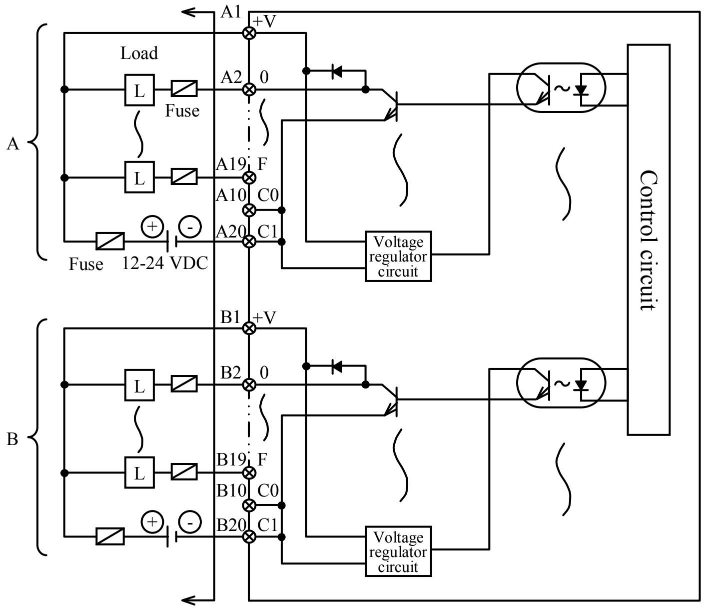
2.13 Model LWO600 Output Module (12 to 24 VDC Transistor Output, 32 Points [Sink])

Item		Specification
Output points		32
Insulation method		Photocoupler
Rated output voltage		12 to 24 VDC (*1)
Output voltage range		10 to 28 VDC
Maximum output current		0.3 A per point
Maximum rush current		2 A, 10 ms or less
Residual voltage		1.5 V or lower
Leakage current		0.1 mA or less
Response time	OFF→ON	0.2 ms or less
	ON→OFF	0.3 ms or less (resistive load) (*2)
Internal consumption current	12 VDC	16 mA × n, where n is the number of points in ON state.
	5 VDC	25 mA
Externally supplied voltage / current		10 to 28 VDC, 30 mA + 4 mA × n, where n is the number of points in ON state.
Points per common		16
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		510 g



(*1) Use the same power supply for both the load and external power.

(*2) The response time may increase to around one second if an inductive (L) load is used in place of the resistive (R) load.

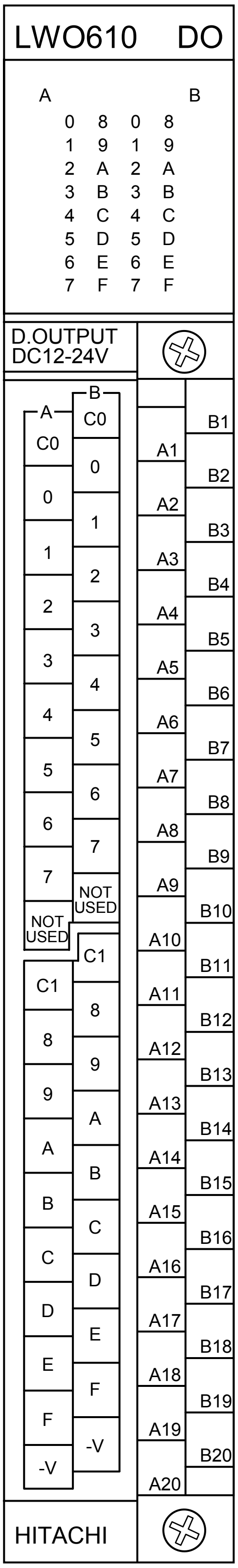


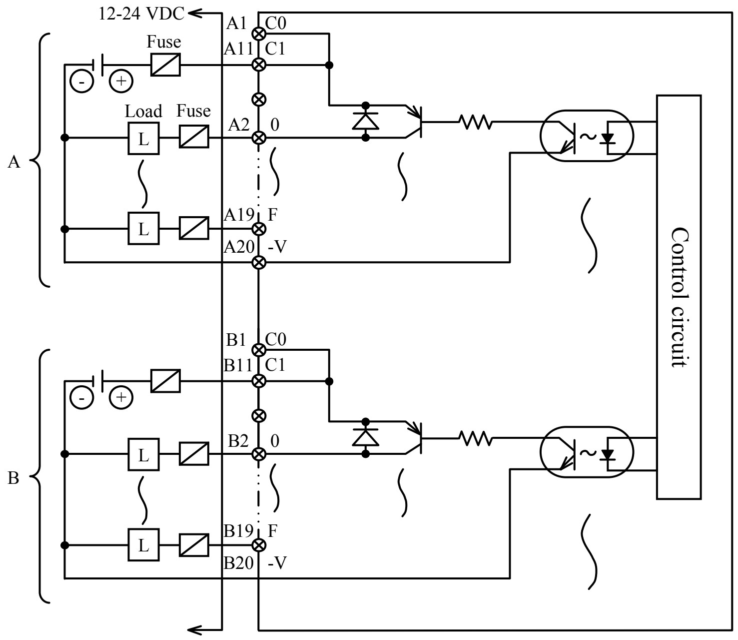
2.14 Model LWO610 Output Module (12 to 24 VDC Transistor Output, 32 Points [Source])

Item		Specification
Output points		32
Insulation method		Photocoupler
Rated output voltage		12 to 24 VDC (*1)
Output voltage range		10 to 28 VDC
Maximum output current		0.3 A per point
Maximum rush current		2 A, 10 ms or less
Residual voltage		1.5 V or lower
Leakage current		0.1 mA or less
Response time	OFF→ON	0.2 ms or less
	ON→OFF	0.3 ms or less (resistive load) (*2)
Internal consumption current	12 VDC	16 mA × n, where n is the number of points in ON state.
	5 VDC	25 mA
Externally supplied voltage / current		10 to 28 VDC, 30 mA + 4 mA + n, where n is the number of points in ON state.
Points per common		16
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		510 g

(*1) Use the same power supply for both the load and external power.

(*2) The response time may increase to around one second if an inductive (L) load is used in place of the resistive (R) load.



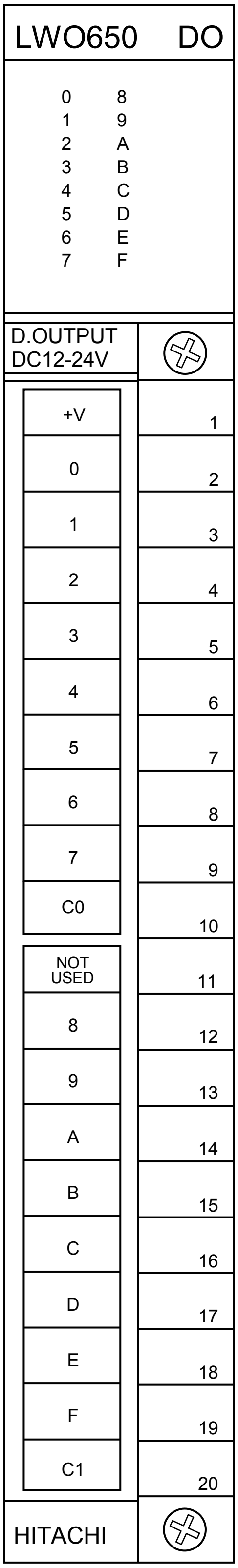


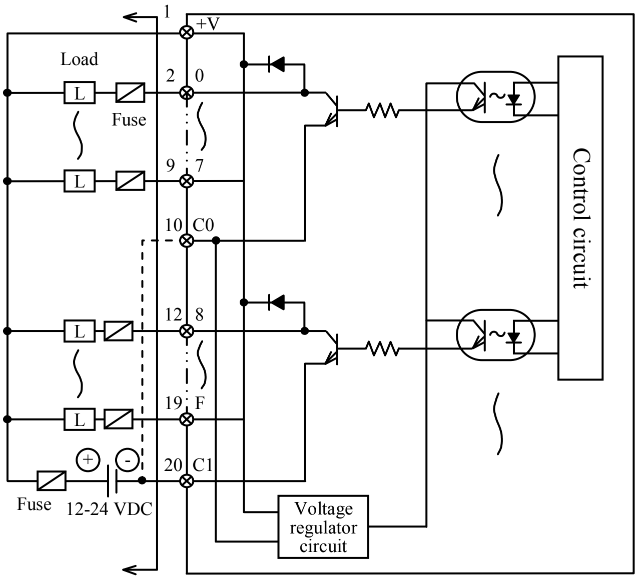
2.15 Model LWO650 Output Module (12 to 24 VDC Transistor Output, 16 Points [Sink])

Item		Specification
Output points		16
Insulation method		Photocoupler
Rated output voltage		12 to 24 VDC (*1)
Output voltage range		10 to 28 VDC
Maximum output current		0.5 A per point
Maximum rush current		2 A, 10 ms or less
Residual voltage		1.5 V or lower
Leakage current		0.1 mA or less
Response time	OFF→ON	0.2 ms or less
	ON→OFF	0.3 ms or less (resistive load) (*2)
Internal consumption current	12 VDC	16 mA × n, where n is the number of points in ON state.
	5 VDC	15 mA
Externally supplied voltage / current		10 to 28 VDC, 30 mA + 4 mA × n, where n is the number of points in ON state.
Points per common		16
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Mass		380 g

(*1) Use the same power supply for both the load and external power.

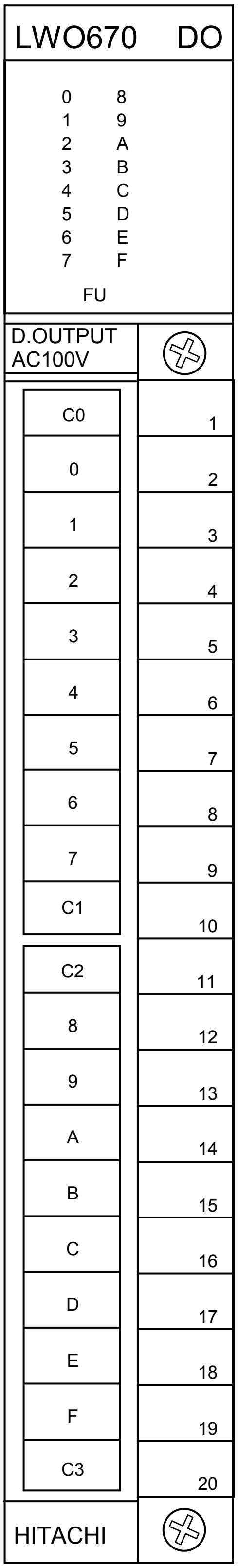
(*2) The response time may increase to around one second if an inductive (L) load is used in place of the resistive (R) load.

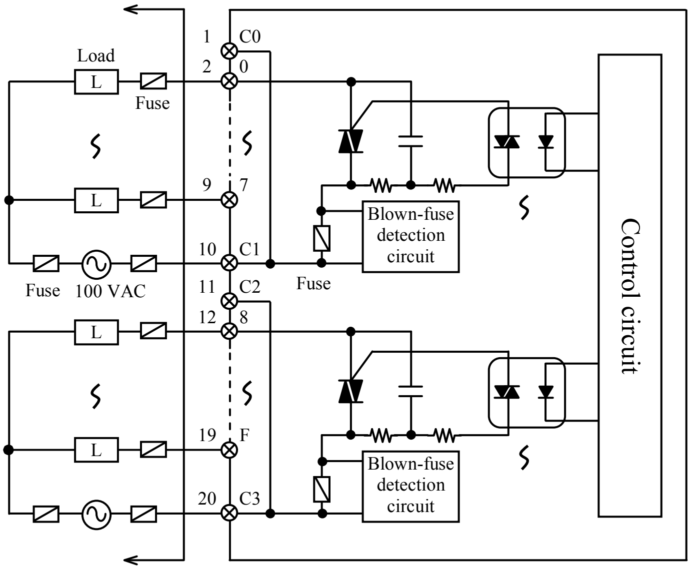




2.16 Model LWO670 Output Module (100 VAC Triac Output [with Fuse], 16 Points)

Item		Specification
Output points		16
Insulation method		Photocoupler
Rated output voltage		100 VAC
Output voltage range		80 to 120 VAC
Maximum output current		2 A per point, 5 A per common
Maximum rush current		20 A per common, 1 cycle
Residual voltage		2 V or lower (2 A)
Leakage current		2 mA or less
Fuse rating		125 VAC, 7.5 A (Model, MP75; Manufacturer, Daito Communication Apparatus Co., Ltd.)
Response time	OFF→ON	1 ms or less
	ON→OFF	10 ms or less
Internal consumption current	12 VDC	8 mA + 20 mA × n, where n is the number of points in ON state.
	5 VDC	8 mA
Points per common		8
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m
Operation indication		LED (lit when the module is powered on)
Blown-fuse indication		LED ("FU", lit when the fuse is blown)
Mass		510 g

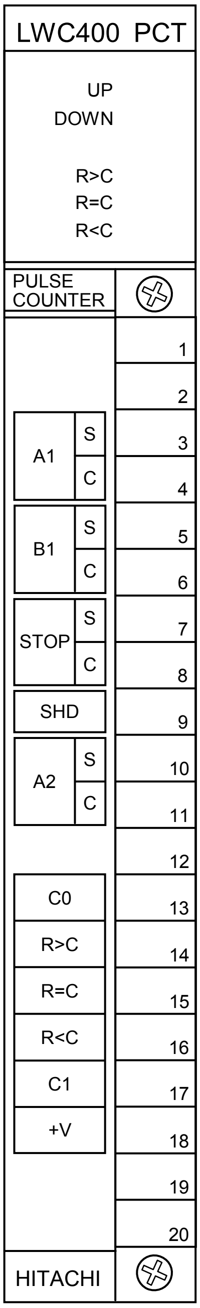


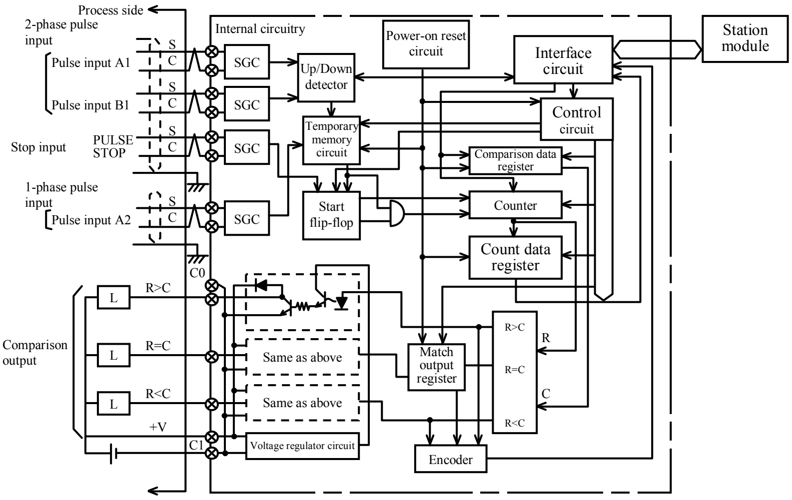


- When using this module, pay attention to the fact that this module is not capable of driving any loads including a capacitor (e.g., R-C and R-L-C).

2.17 Model LWC400 Counter Module (Pulse Counter, 20 kHz, Counting from 0 to 16,383)

Item		Specification
Counter inputs		2-phase input (up/down counting)
		1-phase input (up counting)
		Stop input (disabling and enabling pulse input when turned on and off)
Input channels		1
Insulation method		Photocoupler
Input frequency		20 kHz or less, voltage or no-voltage transistor input (Duty ratio 50%)
		Filter time constant: approx. 5 µs
Data bits		14
Counting range		0 to 16,383
Comparison output		Count value <, =, or > set value (Match output signal latched)
Voltage transistor input	Logic 1	+10 V to +30 V
	Logic 0	0 to +2 V
	Input impedance	Approx. 1.5 kΩ
No-voltage transistor input	Transistor ON	Not more than 100 Ω or 1 V; transistor current, 5 to 20 mA
	Transistor OFF	Not less than 100 kΩ
	External power supply voltage	+10 to +30 V
Output signal		No-voltage transistor output, 24 V, 0.1 A or less (External power supply voltage: 20 to 28 VDC)
		ON/OFF delay time: 1 ms or less
Internal consumption current	12 VDC	40 mA
	5 VDC	8 mA
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	50 m (shielded twisted-pair cable)
Mass		340 g

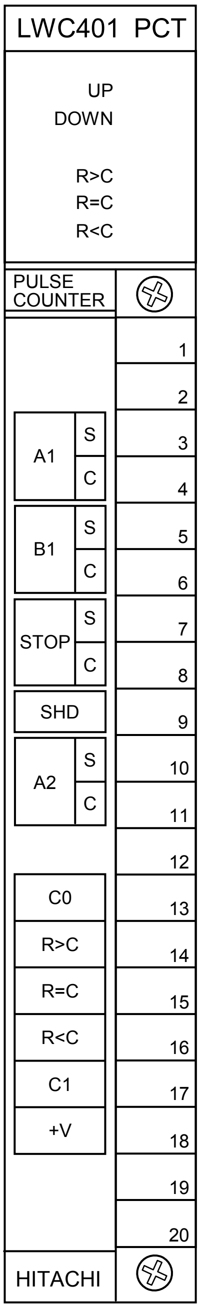


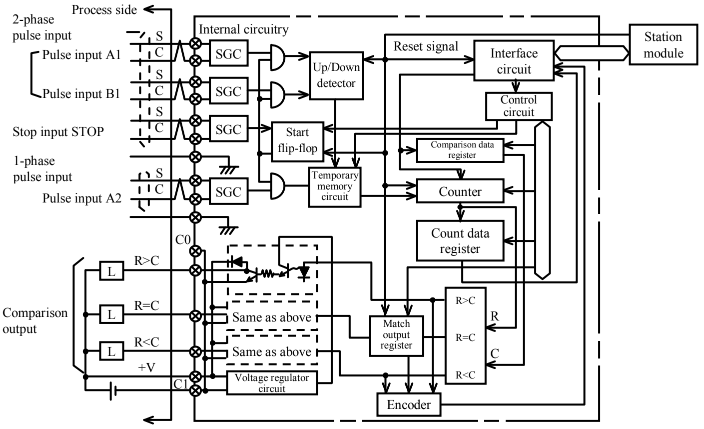


- It is often the case that the shield lead needs to be grounded on programmable-controller side. In these cases, be sure to connect the shield lead to terminal 9 of this module and then to the cubicle’s ground terminal.
- When connecting a load to the comparison output, connect a 24 V ±4 V DC power supply between the +V and C0/C1 terminals (C0 and C1 are intenally connected together).

2.18 Model LWC401 Counter Module (Pulse Counter, 20 kHz, Counting from -8,192 to +8,191)

Item		Specification
Counter inputs		2-phase input (up/down counting)
		1-phase input (up counting)
		Stop input (disabling pulse input when turned on, and enabling it when turned off and latched)
Input channels		1
Insulation method		Photocoupler
Input frequency		20 kHz or less, voltage or no-voltage transistor input (Duty ratio 50%)
		Filter time constant: approx. 5 µs
Data bits		14 (sign bit + 13 bits)
Counting range		-8,192 to +8,191
Comparison output		Count value <, =, or > set value (Match output signal latched)
Voltage transistor input	Logic 1	+10 V to +30 V
	Logic 0	0 to +2 V
	Input impedance	Approx. 1.5 kΩ
No-voltage transistor input	Transistor ON	Not more than 100 Ω or 1 V; transistor current, 5 to 20 mA
	Transistor OFF	Not less than 100 kΩ
	External power supply voltage	+10 to +30 V
Output signal		No-voltage transistor output, 24 V, 0.1 A or less (External power supply voltage: 20 to 28 VDC)
		ON/OFF delay time: 1 ms or less
Internal consumption current	12 VDC	40 mA
	5 VDC	8 mA
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	50 m (shielded twisted-pair cable)
Mass		340 g

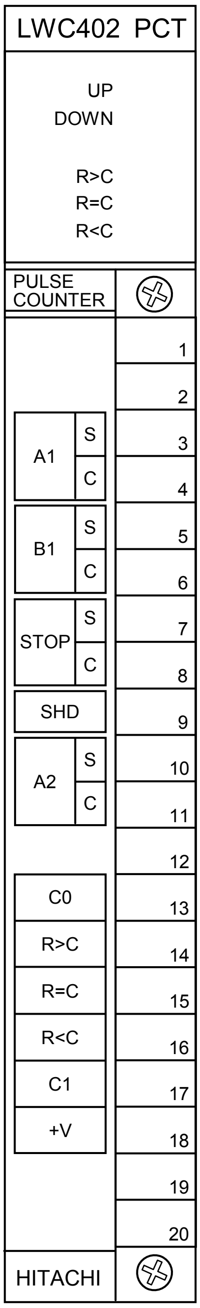


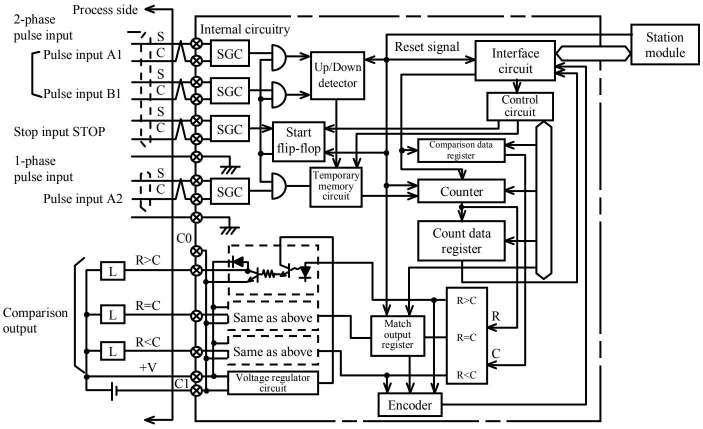


- ■ It is often the case that the shield lead needs to be grounded on programmable-controller side. In these cases, be sure to connect the shield lead to terminal 9 of this module and then to the cubicle’s ground terminal.
- ■ When connecting a load to the comparison output, connect a 24 V ±4 V DC power supply between the +V and C0/C1 terminals (C0 and C1 are intenally connected together).

2.19 Model LWC402 Counter Module (Pulse Counter, 100 Hz, Counting from -8,192 to +8,191)

Item		Specification
Counter inputs		2-phase input (up/down counting)
		1-phase input (up counting)
		Stop input (disabling pulse input when turned on, and enabling it when turned off and latched)
Input channels		1
Insulation method		Photocoupler
Input frequency		100 Hz or less, voltage or no-voltage transistor input (Duty ratio 50%)
		Filter time constant: approx. 1.5 ms
Data bits		14 (sign bit + 13 bits)
Counting range		-8,192 to +8,191
Comparison output		Count value <, =, or > set value (Match output signal latched)
Voltage transistor input	Logic 1	+10 V to +30 V
	Logic 0	0 to +2 V
	Input impedance	Approx. 1.5 kΩ
No-voltage transistor input	Transistor ON	Not more than 100 Ω or 1 V; transistor current, 5 to 20 mA
	Transistor OFF	Not less than 100 kΩ
	External power supply voltage	+10 to +30 V
Output signal		No-voltage transistor output, 24 V, 0.1 A or less (External power supply voltage: 20 to 28 VDC)
		ON/OFF delay time: 1 ms or less
Internal consumption current	12 VDC	40 mA
	5 VDC	8 mA
Insulation withstand voltage		1,500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	50 m (shielded twisted-pair cable)
Mass		340 g

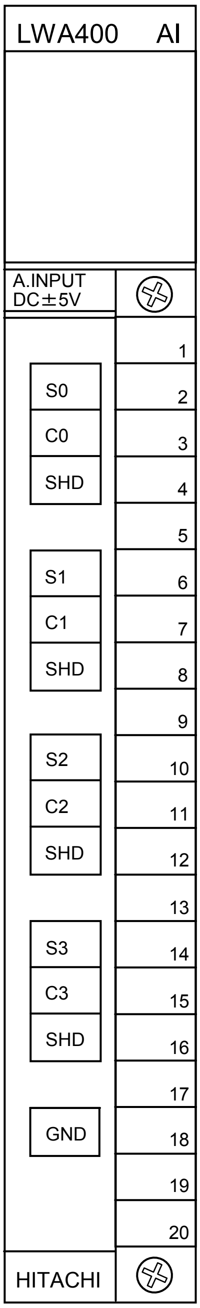


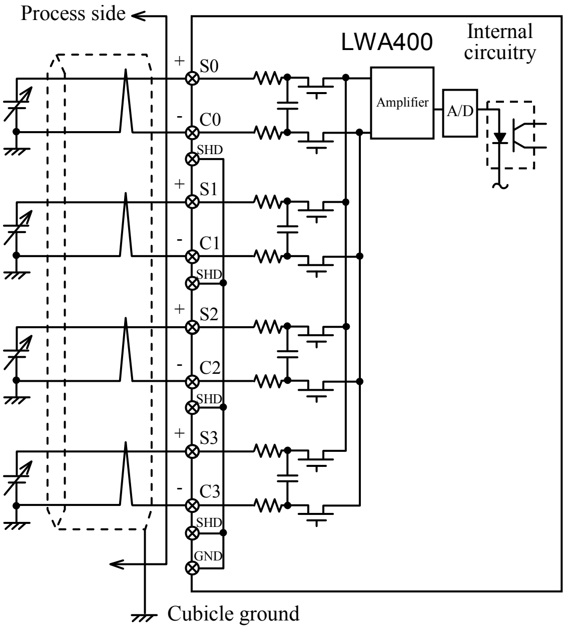


- ■ It is often the case that the shield lead needs to be grounded on programmable-controller side. In these cases, be sure to connect the shield lead to terminal 9 of this module and then to the cubicle's ground terminal.
- ■ When connecting a load to the comparison output, connect a 24 V ±4 V DC power supply between the +V and C0/C1 terminals (C0 and C1 are intenally connected together).

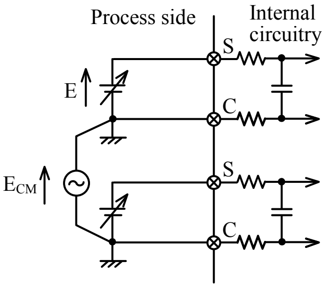
2.20 Model LWA400 Input Module (±5 VDC Voltage Input, 4 Channels)

Item		Specification
Module input		Voltage input
Input channels		4
Insulation method		Photocoupler (common to four channels)
Rated input voltage		0 to ±5 VDC
Input voltage range		±6 V (including potential difference between channels)
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 5 V
Overall accuracy (room temperature)		±0.3% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.6% full scale
Response time		30 + 5TRc ms or less (TRc: remote I/O transfer time) 30 + Rc ms or less (Rc: J.NET transfer time)
Input filter		33 dB at 60 Hz; Time constant, 0.15 s
Input impedance		5 MΩ or more (when power to the module is ON); approx. 20 kΩ or more (when power to the module is OFF).
Internal consumption current	12 VDC	150 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		340 g



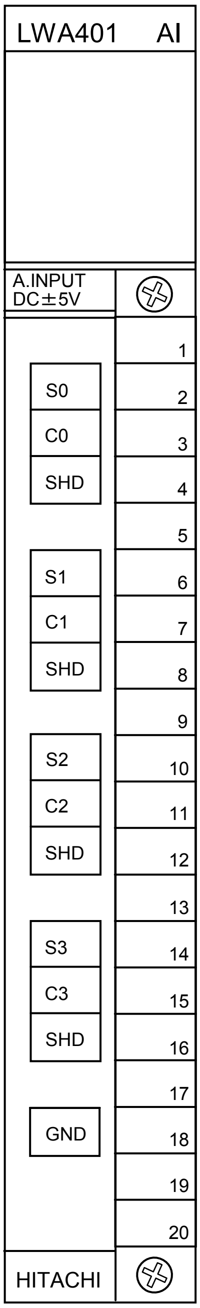


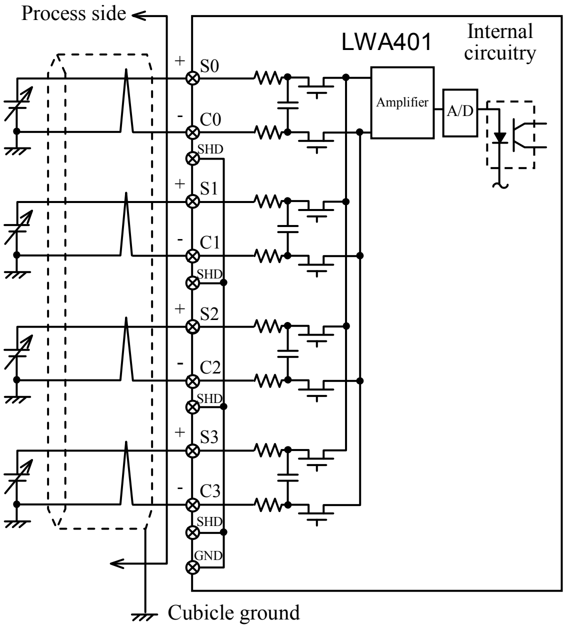
- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The symbol "E_{CM}" shown right is the potential difference between channels.
- This AI module can only be used with the station's number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.



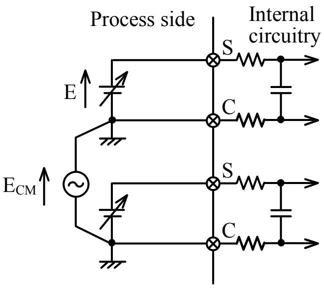
2.21 Model LWA401 Input Module (±5 VDC Voltage Input, 4 Channels)

Item		Specification
Module input		Voltage input
Input channels		4
Insulation method		Photocoupler (common to four channels)
Rated input voltage		0 to ±5 VDC
Input voltage range		±6 V (including potential difference between channels)
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 5 V
Overall accuracy (room temperature)		±0.3% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.6% full scale
Response time		6 + 5TRc ms or less (TRc: remote I/O transfer time) 6 + Rc ms or less (Rc: J.NET transfer time)
Input filter		6.5 dB at 60 Hz; Time constant, 5 ms
Input impedance		5 MΩ or more (when power to the module is ON); approx. 3 kΩ or more (when power to the module is OFF).
Internal consumption current	12 VDC	150 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		340 g



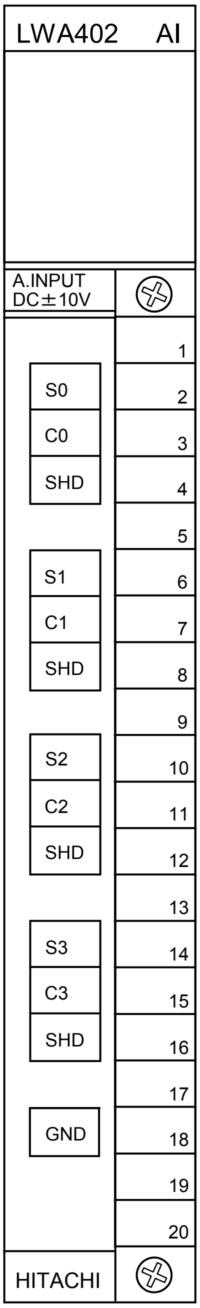


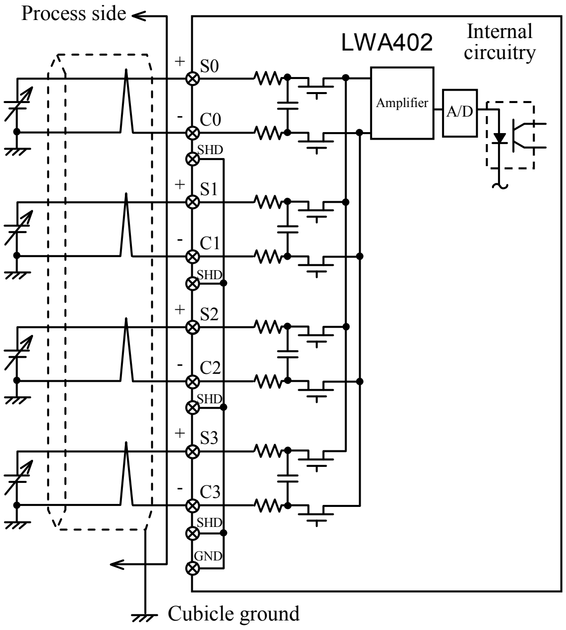
- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The symbol "E_{CM}" shown right is the potential difference between channels.
- This AI module can only be used with the station's number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.



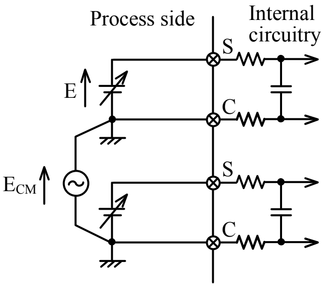
2.22 Model LWA402 Input Module (±10 VDC Voltage Input, 4 Channels)

Item		Specification
Module input		Voltage input
Input channels		4
Insulation method		Photocoupler (common to four channels)
Rated input voltage		0 to ±10 VDC
Input voltage range		±12 V (including potential difference between channels)
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 10 V
Overall accuracy (room temperature)		±0.3% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.6% full scale
Response time		30 + 5TRc ms or less (TRc: remote I/O transfer time) 30 + Rc ms or less (Rc: J.NET transfer time)
Input filter		33 dB at 60 Hz; Time constant, 0.15 s
Input impedance		5 MΩ or more (when power to the module is ON); approx. 20 kΩ or more (when power to the module is OFF).
Internal consumption current	12 VDC	150 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		340 g



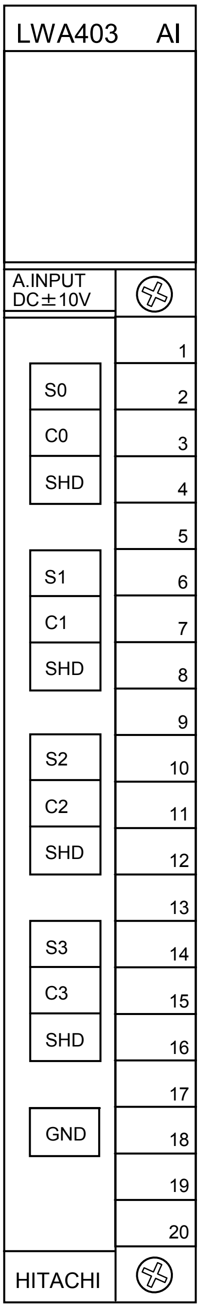


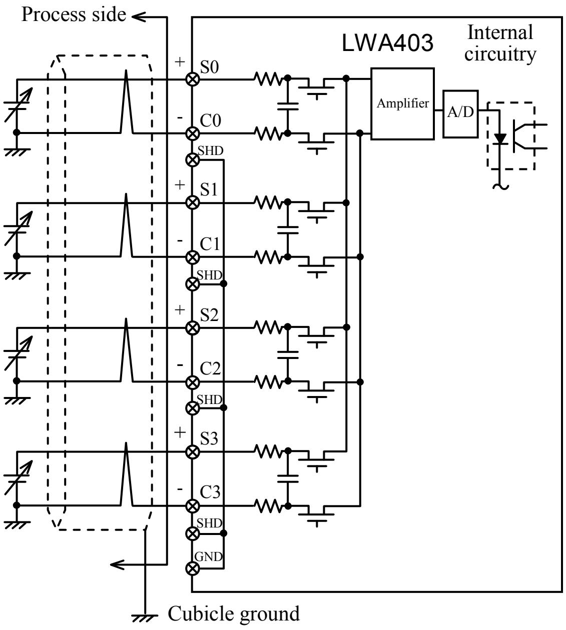
- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The symbol “E_{CM}” shown right is the potential difference between channels.
- This AI module can only be used with the station’s number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.



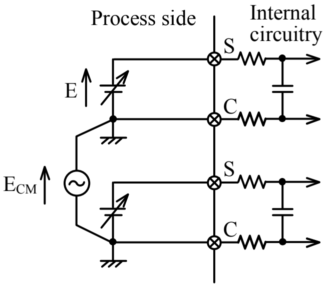
2.23 Model LWA403 Input Module (±10 VDC Voltage Input, 4 Channels)

Item		Specification
Module input		Voltage input
Input channels		4
Insulation method		Photocoupler (common to four channels)
Rated input voltage		0 to ±10 VDC
Input voltage range		±12 V (including potential difference between channels)
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 10 V
Overall accuracy (room temperature)		±0.3% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.6% full scale
Response time		6 + 5TRc ms or less (TRc: remote I/O transfer time) 6 + Rc ms or less (Rc: J.NET transfer time)
Input filter		6.5 dB at 60 Hz; Time constant, 5 ms
Input impedance		5 MΩ or more (when power to the module is ON); approx. 3 kΩ or more (when power to the module is OFF).
Internal consumption current	12 VDC	150 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		340 g



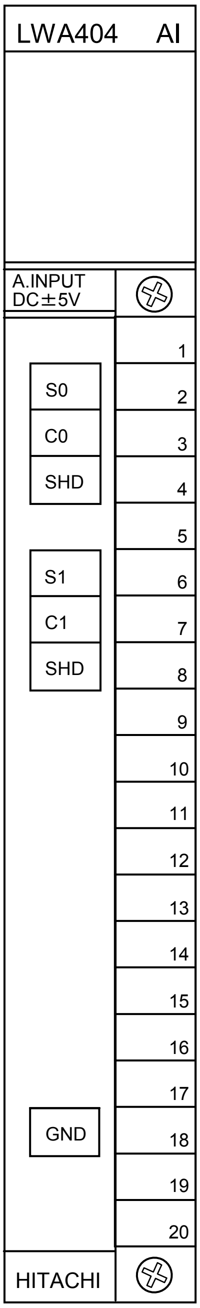


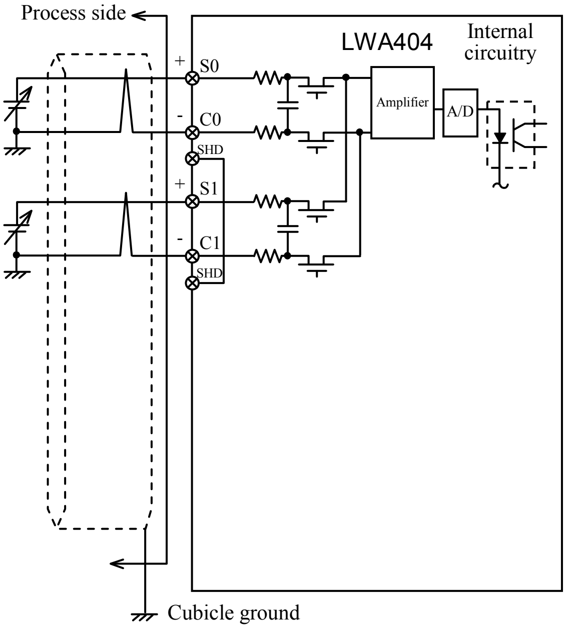
- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The symbol "E_{CM}" shown right is the potential difference between channels.
- This AI module can only be used with the station's number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.



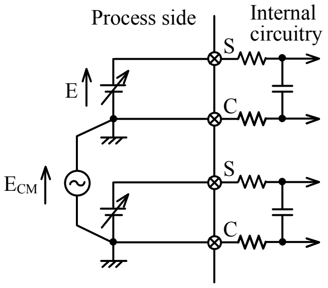
2.24 Model LWA404 Input Module (±5 VDC Voltage Input, 2 Channels)

Item		Specification
Module input		Voltage input
Input channels		2
Insulation method		Photocoupler (common to two channels)
Rated input voltage		0 to ±5 VDC
Input voltage range		±6 V (including potential difference between channels)
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 5 V
Overall accuracy (room temperature)		±0.3% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.6% full scale
Response time		6 + 3TRc ms or less (TRc: remote I/O transfer time) 6 + Rc ms or less (Rc: J.NET transfer time)
Input filter		6.5 dB at 60 Hz; Time constant, 5 ms
Input impedance		5 MΩ or more (when power to the module is ON); approx. 3 kΩ or more (when power to the module is OFF).
Internal consumption current	12 VDC	150 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		340 g



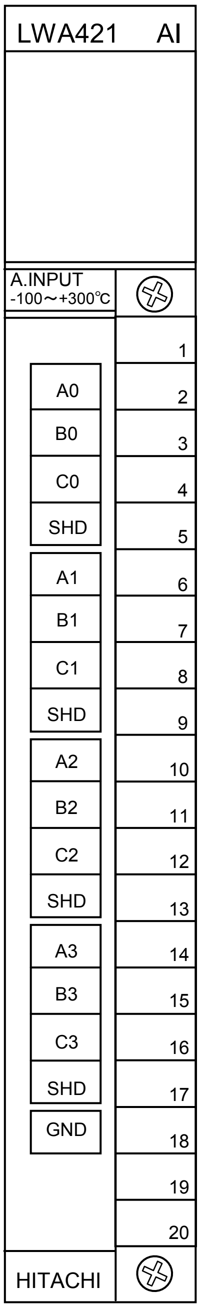


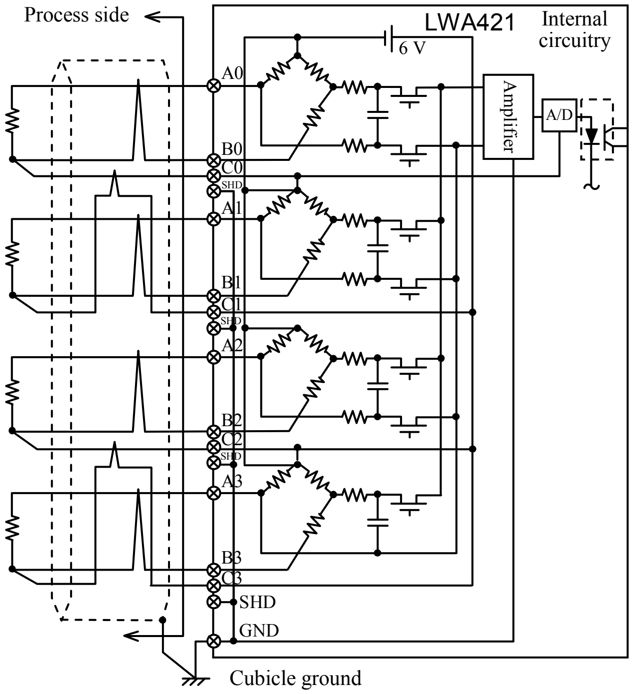
- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The symbol "E_{CM}" shown right is the potential difference between channels.
- This AI module can only be used with the station's number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.



2.25 Model LWA421 Input Module (RTD Input, 4 Channels)

Item		Specification
Module input		RTD (resistance temperature detector) input
Input channels		4
Insulation method		Photocoupler (common to four channels)
Measurement temperature range		-100°C to +300°C
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 250 mV
Overall accuracy (room temperature)		±0.6% full scale (ambient temperature from 20 to 25°C)
Influence of temperature on overall accuracy		±0.01%/°C
Response time		30 + 5TRc ms or less (TRc: remote I/O transfer time) 30 + Rc ms or less (Rc: J.NET transfer time)
Input filter		40 dB at 60 Hz; Time constant, 0.3 s
Internal consumption current	12 VDC	150 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		360 g





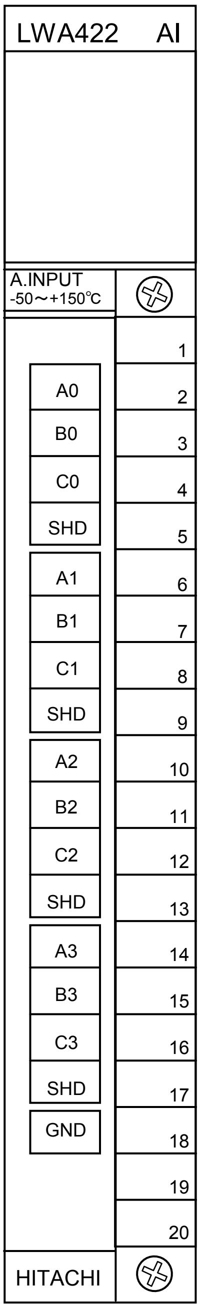
$$\text{Bridge output} = \left[\frac{25\ (\text{Rxt - 100})}{26\ (2{,}500 + \text{Rxt})} - \frac{4\text{r}\ (\text{Rxt - 100})}{6{,}250{,}000} \right] \times 6\ (\text{V})$$

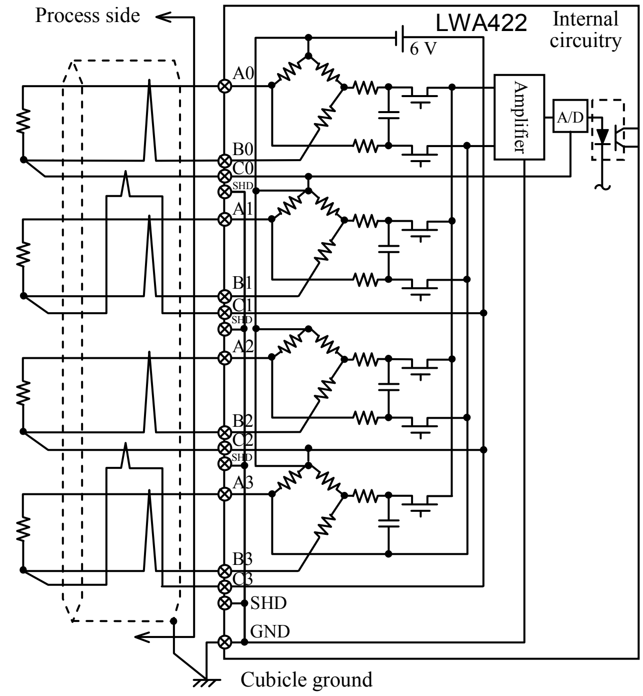
Rxt: RTD's resistance at t °C.
r: Resistance of a lead-in wire from the RTD.

- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The lead-in wires from each RTD may be shielded either separately from or together with the lead-in wires from the other RTDs.
- This AI module can only be used with the station's number-of-points setting set to 16. If it is set to any other value (32 to 128), the module will not function. The module supports only the value 16.

2.26 Model LWA422 Input Module (RTD Input, 4 Channels)

Item		Specification
Module input		RTD (resistance temperature detector) input
Input channels		4
Insulation method		Photocoupler (common to four channels)
Measurement temperature range		-50°C to +150°C
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 125 mV
Overall accuracy (room temperature)		±0.6% full scale (ambient temperature from 20 to 25°C)
Influence of temperature on overall accuracy		±0.01%/°C
Response time		30 + 5TRc ms or less (TRc: remote I/O transfer time) 30 + Rc ms or less (Rc: J.NET transfer time)
Input filter		40 dB at 60 Hz; Time constant, 0.3 s
Internal consumption current	12 VDC	150 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		360 g





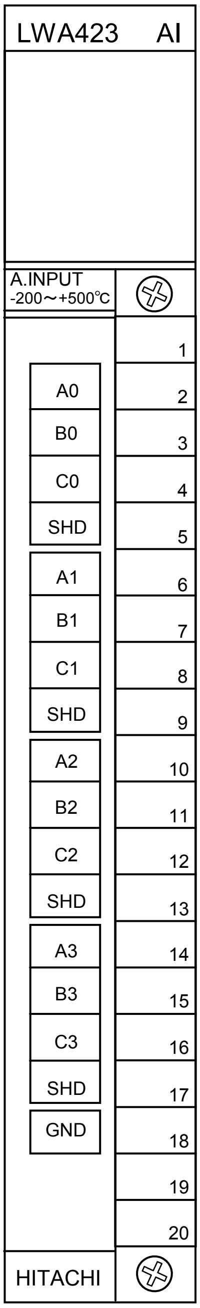
$$\text{Bridge output} = \left[\frac{25\ (\text{Rxt} - 100)}{26\ (2{,}500 + \text{Rxt})} - \frac{4\text{r}\ (\text{Rxt} - 100)}{6{,}250{,}000} \right] \times 6\ (\text{V})$$

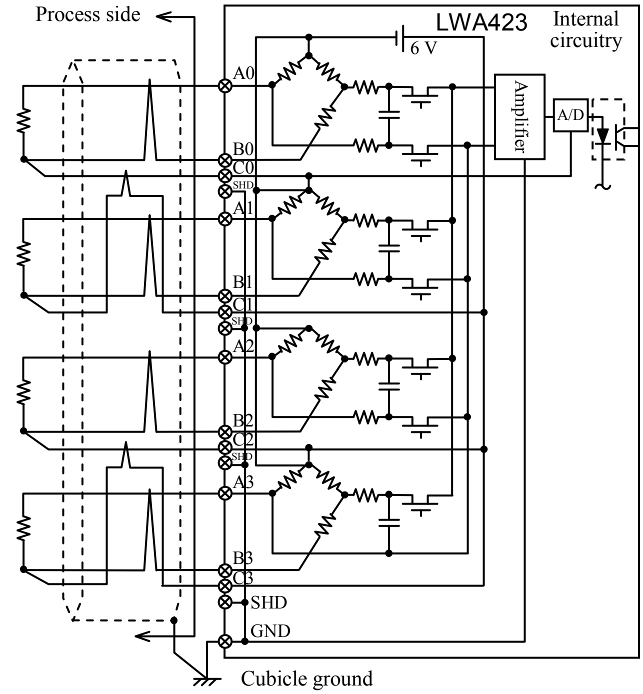
Rxt: RTD's resistance at t °C.
r: Resistance of a lead-in wire from the RTD.

- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The lead-in wires from each RTD may be shielded either separately from or together with the lead-in wires from the other RTDs.
- This AI module can only be used with the station's number-of-points setting set to 16. If it is set to any other value (32 to 128), the module will not function. The module supports only the value 16.

2.27 Model LWA423 Input Module (RTD Input, 4 Channels)

Item		Specification
Module input		RTD (resistance temperature detector) input
Input channels		4
Insulation method		Photocoupler (common to four channels)
Measurement temperature range		-200°C to +500°C
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 400 mV
Overall accuracy (room temperature)		±0.6% full scale (ambient temperature from 20 to 25°C)
Influence of temperature on overall accuracy		±0.01%/°C
Response time		30 + 5TRc ms or less (TRc: remote I/O transfer time) 30 + Rc ms or less (Rc: J.NET transfer time)
Input filter		40 dB at 60 Hz; Time constant, 0.3 s
Internal consumption current	12 VDC	150 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		360 g





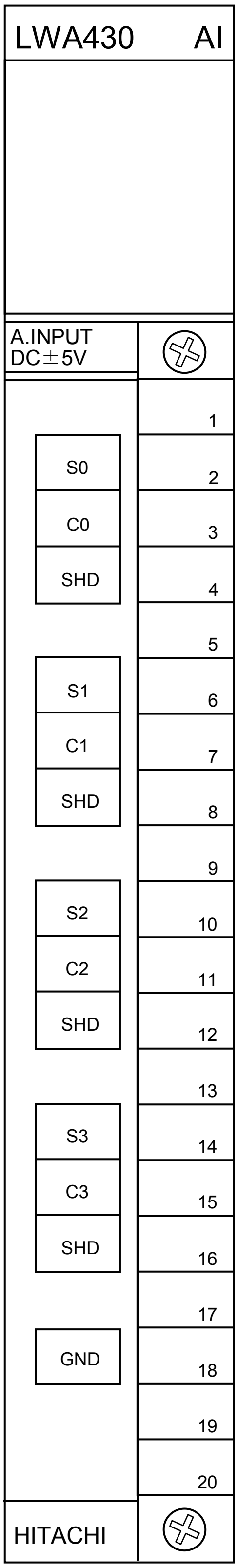
$$\text{Bridge output} = \left[\frac{25\ (Rxt - 100)}{26\ (2{,}500 + Rxt)} - \frac{4r\ (Rxt - 100)}{6{,}250{,}000}\right] \times 6\ (V)$$

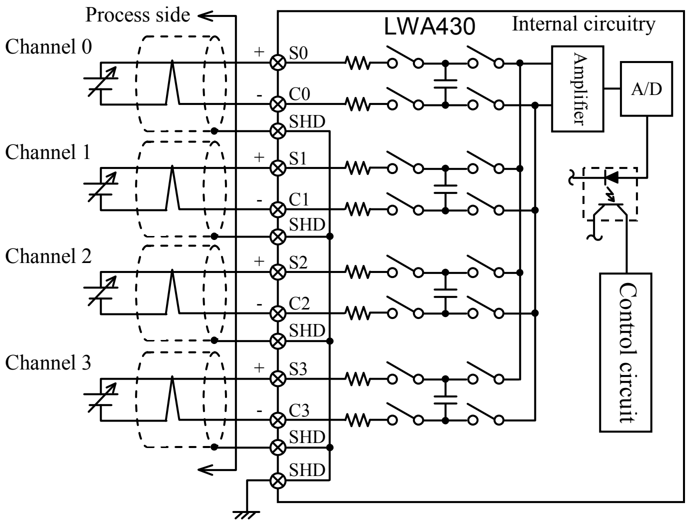
Rxt: RTD’s resistance at t °C.
r: Resistance of a lead-in wire from the RTD.

- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The lead-in wires from each RTD may be shielded either separately from or together with the lead-in wires from the other RTDs.
- This AI module can only be used with the station’s number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.

2.28 Model LWA430 Input Module (±5 VDC Voltage Input, 4 Channels)

Item		Specification
Module input		Voltage input
Input channels		4
Insulation method		Semiconductor-insulated flying-capacitor (each channel insulated separately by controlling photo-MOS switches)
Rated input voltage		0 to ±5 VDC
Input voltage range		±6 V
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 5 V
Overall accuracy (room temperature)		±0.3% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.4% full scale
Response time		45 + 5TRc ms or less (TRc: remote I/O transfer time) 45 + Rc ms or less (Rc: J.NET transfer time)
Input filter		Time constant, 0.15 s
Input impedance		1 MΩ or more
Internal consumption current	12 VDC	350 mA or less
	5 VDC	50 mA or less
Insulation withstand voltage		500 VDC, 1 minute (between external terminal and ground); 500 VDC, 1 minute (between channels)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		360 g

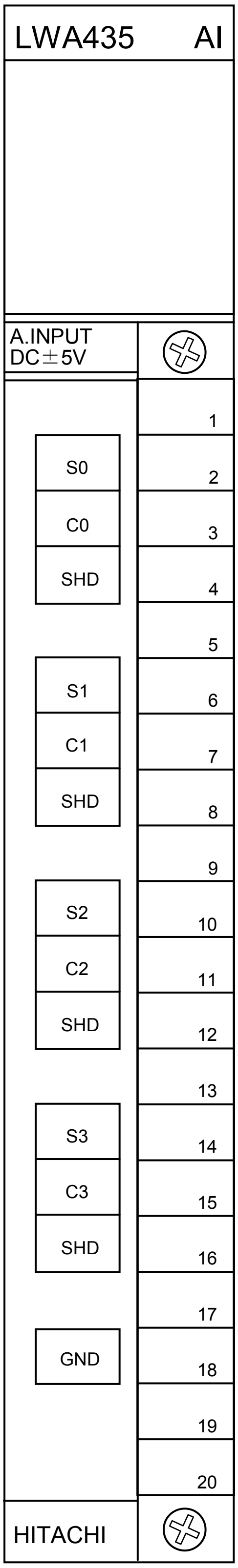


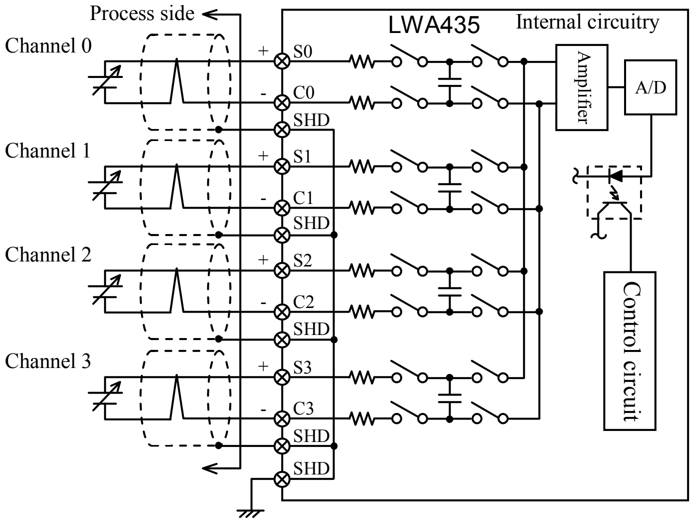


- ■ The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- ■ The response time listed above does not include the delay time of the input filter.
- ■ The cable connected to each channel is one that is shielded either separately from or together with the cables connected to the other channels.
- ■ This AI module can only be used with the station's number-of-points setting set to 16. If it is set to any other value (32 to 128), the module will not function. The module supports only the value 16.

2.29 Model LWA435 Input Module (±5 VDC Voltage Input, 4 Channels)

Item		Specification
Module input		Voltage input
Input channels		4
Insulation method		Semiconductor-insulated flying-capacitor (each channel insulated separately by controlling photo-MOS switches)
Rated input voltage		0 to ±5 VDC
Input voltage range		±6 V
A/D bits		14 (sign bit + 13 bits)
Conversion ratio		8,000 in digital value to 5 V
Overall accuracy (room temperature)		±0.3% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.4% full scale
Response time		45 + 5TRc ms or less (TRc: remote I/O transfer time)
Input filter		Time constant, 0.15 s
Input impedance		1 MΩ or more
Internal consumption current	12 VDC	350 mA or less
	5 VDC	50 mA or less
Insulation withstand voltage		500 VDC, 1 minute (between external terminal and ground); 500 VDC, 1 minute (between channels)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		360 g



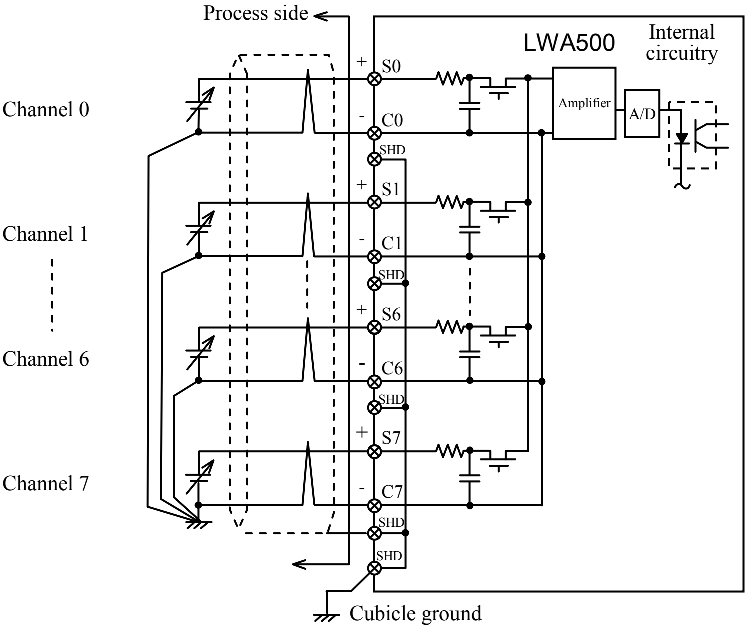


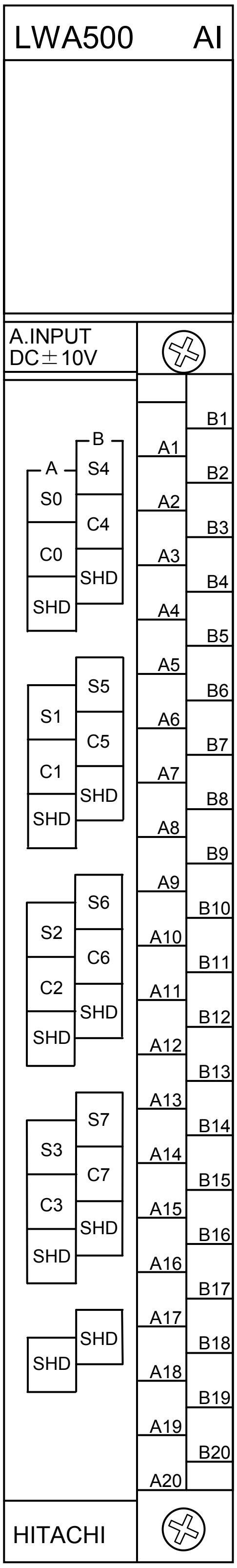
- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The cable connected to each channel is one that is shielded either separately from or together with the cables connected to the other channels.
- This AI module can only be used in conjunction with a model LQP510 LPU, Module Rev. R, or a model LQP710 LPU, Module Rev. N, and with a model LWS410 or LWS010 E.STATION.
  If it is selected for use with any other LPU or CPU and any other E.STATION, the module will not function.
  The module supports only the above-mentioned combinations.
- This AI module can only be used with the station's number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.
- AI data is updated by support program for this AI module only when all of the four channels are active.
- This AI module can be used with the S10V Ladder Chart System as long as the Ver-Rev of the latter is 01-21 or later.
  If this AI module is selected for use with any other Ver-Rev of the software product, the user can secure no data storage area for AI data.

2.30 Model LWA500 Input Module (±10 VDC Voltage Input, 8 Channels)

Item		Specification
Module input		Voltage input
Input channels (*)		8
Insulation method		Photocoupler (common to eight channels)
Rated input voltage		0 to ±10 VDC
Input voltage range		±14 V
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 10 V
Overall accuracy (room temperature)		±0.2% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.5% full scale
Response time		10 + TRc ms or less (TRc: remote I/O transfer time) 10 + Rc ms or less (Rc: J.NET transfer time)
Input filter		6.5 dB at 60 Hz; Time constant, approx. 5 ms (from 3.5 ms to 6.5 ms)
Input impedance (*)		1 MΩ or more (at power-on time); 3 kΩ or more (at power-off time)
Internal consumption current	12 VDC	250 mA or less
	5 VDC	50 mA or less
Insulation withstand voltage (*)		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		440 g

(*) The model LWA500 AI module has the following differences in specifications from the model LWA000 AI module available for use with HSC-2000 I/O units:
① Insulation withstand voltage is 500 VAC, compared with the 1,500 VAC of the model LWA000.
② The number of scanned channels is fixed at 8, while it can be varied by setting in the model LWA000.
③ The input impedance at power-on time is 1 MΩ, while it is 5 MΩ in the model LWA000.



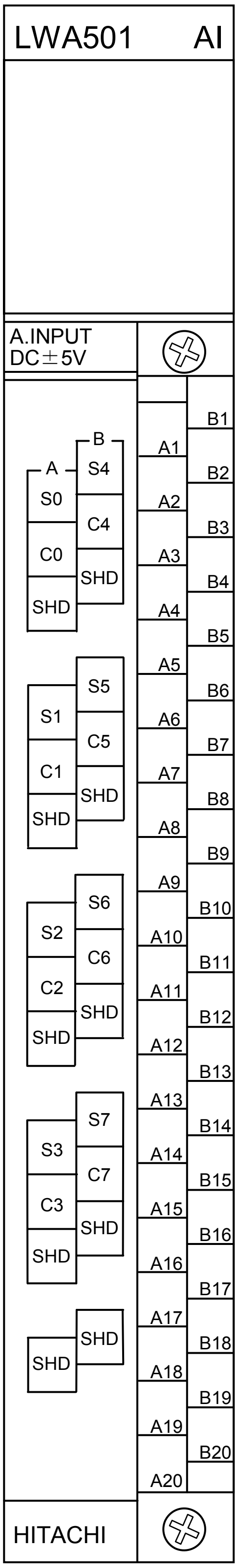


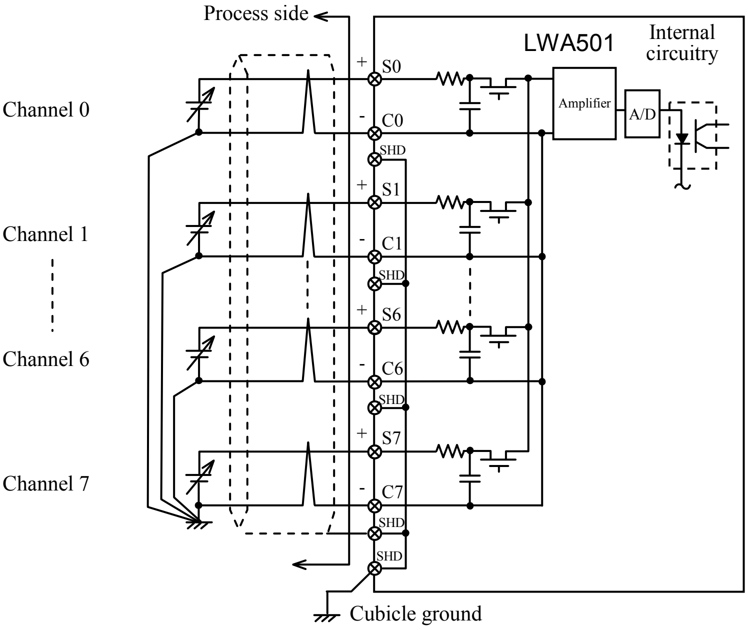
- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The cable connected to each channel is one that is shielded either separately from or together with the cables connected to the other channels.
- Input signals to channels 0 thru 7 must be grounded at the same potential level.

2.31 Model LWA501 Input Module (±5 VDC Voltage Input, 8 Channels)

Item		Specification
Module input		Voltage input
Input channels (*)		8
Insulation method		Photocoupler (common to eight channels)
Rated input voltage		0 to ±5 VDC
Input voltage range		±14 V
A/D bits		12 (sign bit + 11 bits)
Conversion ratio		2,000 in digital value to 5 V
Overall accuracy (room temperature)		±0.2% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.5% full scale
Response time		10 + TRc ms or less (TRc: remote I/O transfer time) 10 + Rc ms or less (Rc: J.NET transfer time)
Input filter		6.5 dB at 60 Hz; Time constant, approx. 5 ms (from 3.5 ms to 6.5 ms)
Input impedance (*)		1 MΩ or more (at power-on time); 3 kΩ or more (at power-off time)
Internal consumption current	12 VDC	250 mA or less
	5 VDC	50 mA or less
Insulation withstand voltage (*)		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		440 g

(*) The model LWA501 AI module has the following differences in specifications from the model LWA001 AI module available for use with HSC-2000 I/O units:
① Insulation withstand voltage is 500 VAC, compared with the 1,500 VAC of the model LWA001.
② The number of scanned channels is fixed at 8, while it can be varied by setting in the model LWA001.
③ The input impedance at power-on time is 1 MΩ, while it is 5 MΩ in the model LWA001.

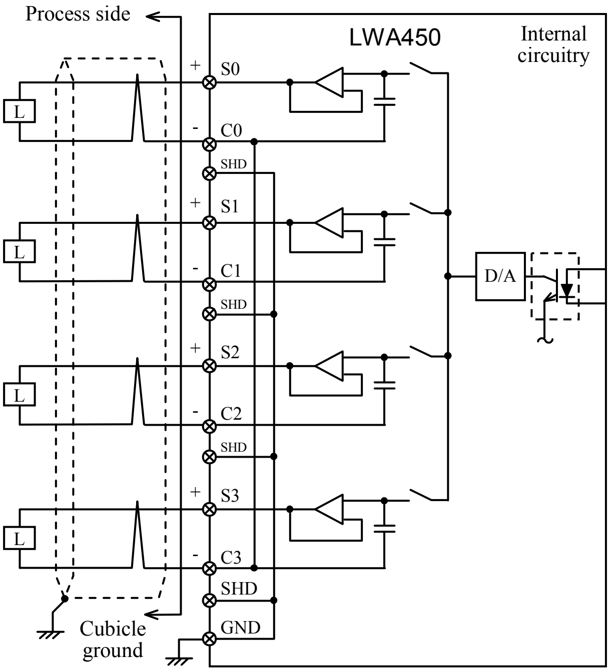


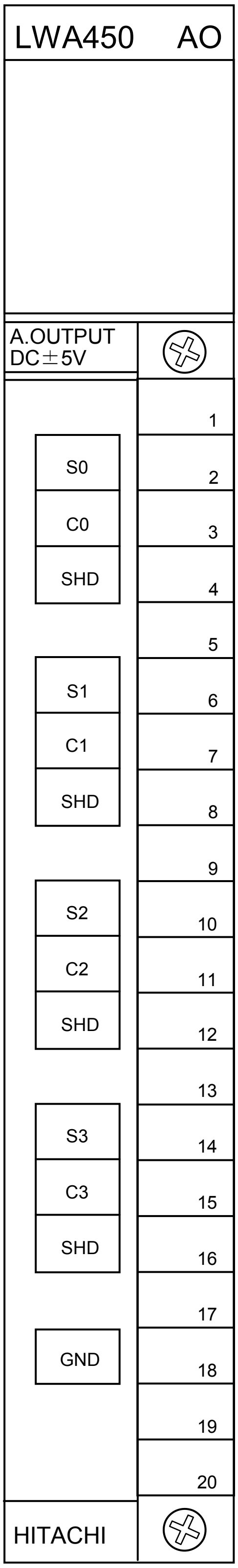


- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The response time listed above does not include the delay time of the input filter.
- The cable connected to each channel is one that is shielded either separately from or together with the cables connected to the other channels.
- Input signals to channels 0 thru 7 must be grounded at the same potential level.

2.32 Model LWA450 Output Module (±5 VDC Voltage Output, 4 Channels)

Item		Specification
Module output		Voltage output
Output channels		4
Insulation method		Photocoupler (common to four channels)
Rated output voltage		0 to ±5 VDC
D/A bits		12
Conversion ratio		5 V to 2,000 in digital value
Overall accuracy (room temperature)		±0.2% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.5% full scale
Response time		10 + 4TRc ms or less (TRc: remote I/O transfer time) 10 + Rc ms or less (Rc: J.NET transfer time)
Load resistance		2 kΩ or more
Internal consumption current	12 VDC	260 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		360 g

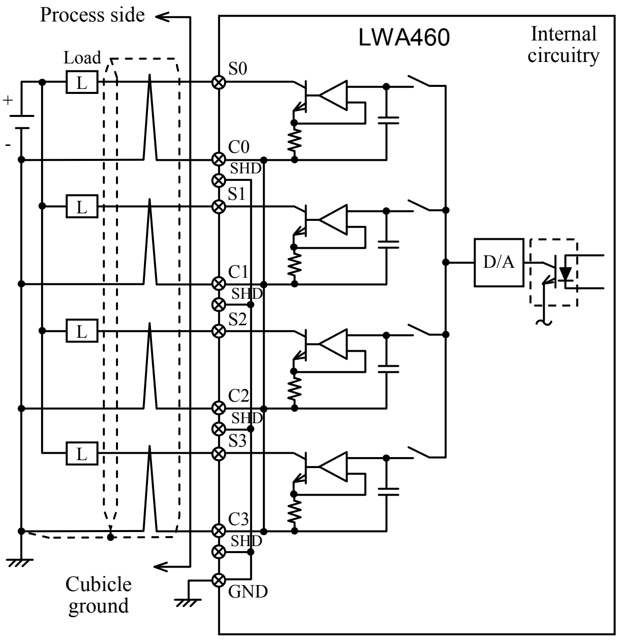




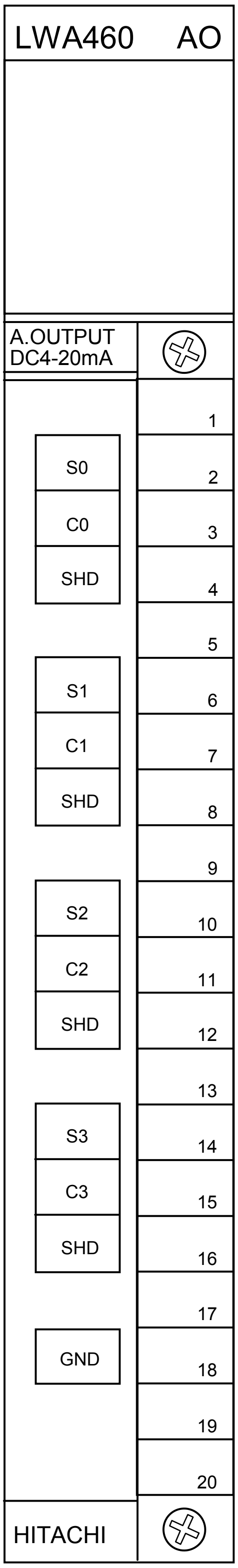
- ■ The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- ■ The loads may be used either in a grounded or a floated state.
- ■ The shielding of the cables must be grounded either on the load side or the I/O unit side.
- ■ The cable connected to each channel is one that is shielded either separately from or together with the cables connected to the other channels.
- ■ This AI module can only be used with the station's number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.

2.33 Model LWA460 Output Module (4 to 20 mA DC Current Output, 4 Channels)

Item		Specification
Module output		Current output
Output channels		4
Insulation method		Photocoupler (common to four channels)
Rated output voltage		4 to 20 mA DC
D/A bits		12
Conversion ratio		16 mA to 4,000 in digital value (4 mA to 0)
Overall accuracy (room temperature)		±0.2% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.5% full scale
Response time		10 + 4TRc ms or less (TRc: remote I/O transfer time) 10 + Rc ms or less (Rc: J.NET transfer time)
Load resistance		500 Ω or less
Internal consumption current	12 VDC	260 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	20-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		360 g

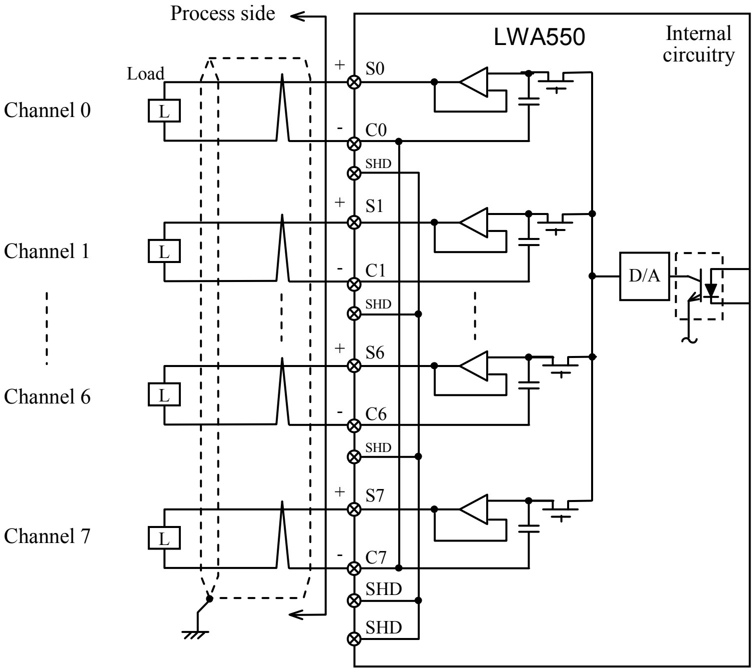


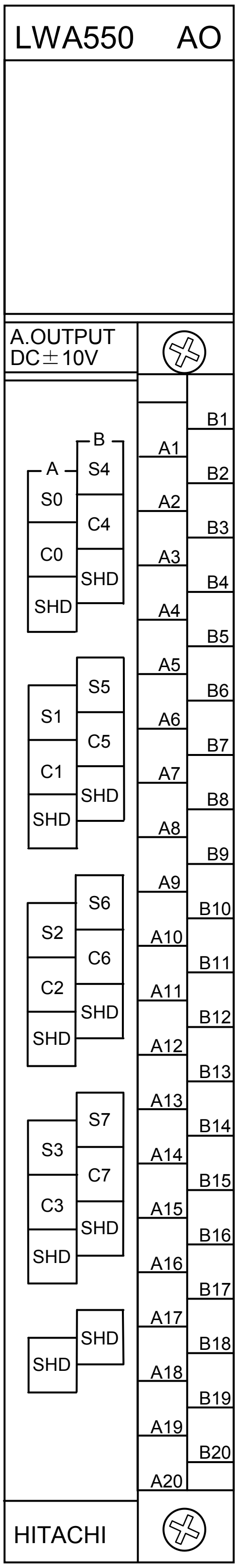
- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The loads may be used either in a grounded or a floated state.
- The shielding of the cables must be grounded either on the load side or the I/O unit side.
- The cable connected to each channel is one that is shielded either separately from or together with the cables connected to the other channels.
- This AI module can only be used with the station’s number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.



2.34 Model LWA550 Output Module (±10 VDC Voltage Output, 8 Channels)

Item		Specification
Module output		Voltage output
Output channels		8
Insulation method		Photocoupler (common to eight channels)
Rated output voltage		0 to ±10 VDC
D/A bits		12
Conversion ratio		10 V to 2,000 in digital value
Overall accuracy (room temperature)		±0.2% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.5% full scale
Response time		5 ms or less (resistive load)
Load resistance		4 kΩ or more
Internal consumption current	12 VDC	300 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		430 g

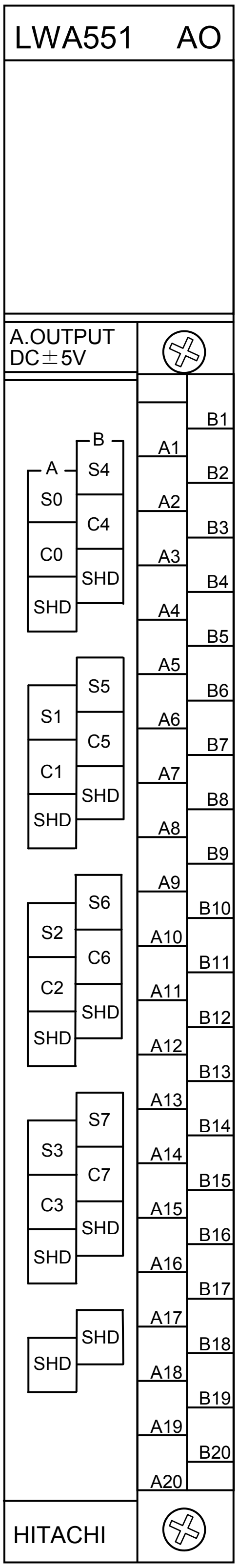


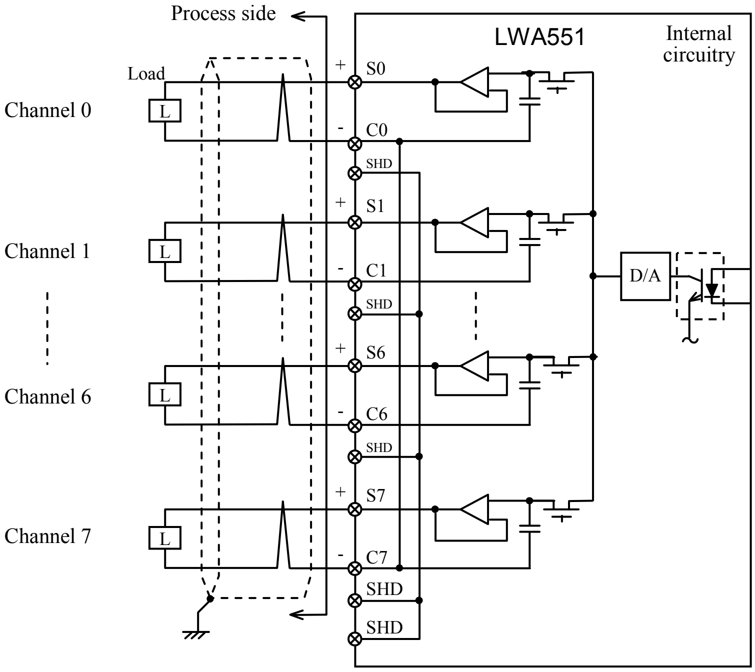


- The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- The loads may be used either in a grounded or a floated state.
- The shielding of the cables must be grounded either on the load side or the I/O unit side.
- The cable connected to each channel is one that is shielded either separately from or together with the cables connected to the other channels.
- This AI module can only be used with the station's number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.

2.35 Model LWA551 Output Module (±5 VDC Voltage Output, 8 Channels)

Item		Specification
Module output		Voltage output
Output channels		8
Insulation method		Photocoupler (common to eight channels)
Rated output voltage		0 to ±5 VDC
D/A bits		12
Conversion ratio		5 V to 2,000 in digital value
Overall accuracy (room temperature)		±0.2% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.5% full scale
Response time		5 ms or less (resistive load)
Load resistance		2 kΩ or more
Internal consumption current	12 VDC	300 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		430 g

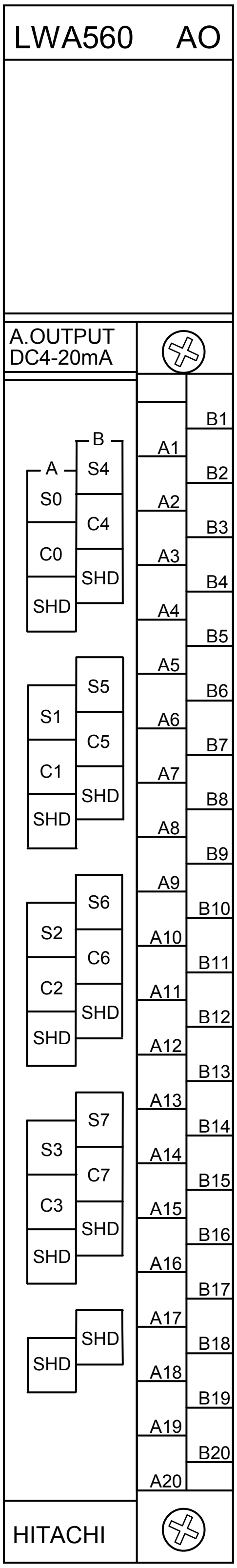


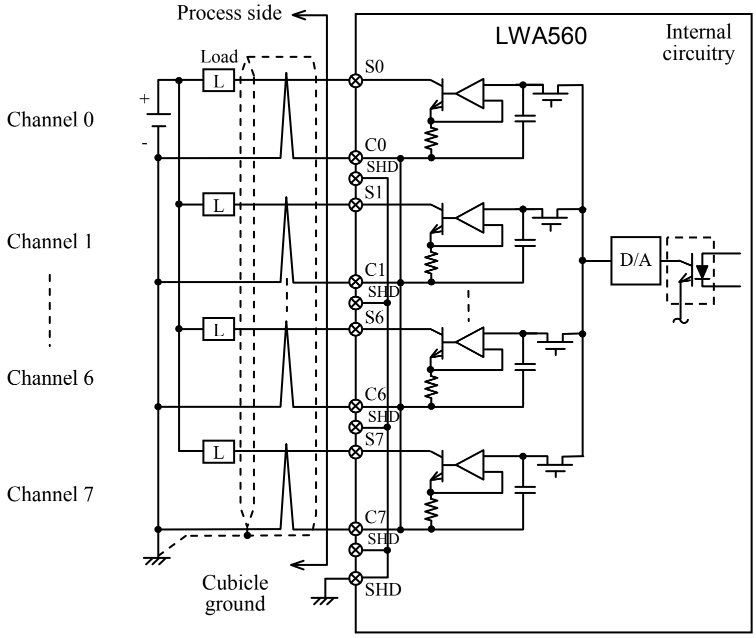


- ■ The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- ■ The loads may be used either in a grounded or a floated state.
- ■ The shielding of the cables must be grounded either on the load side or the I/O unit side.
- ■ The cable connected to each channel is one that is shielded either separately from or together with the cables connected to the other channels.
- ■ This AI module can only be used with the station's number-of-points setting set to 16.
  If it is set to any other value (32 to 128), the module will not function.
  The module supports only the value 16.

2.36 Model LWA560 Output Module (4 to 20 mA DC Current Output, 8 Channels)

Item		Specification
Module output		Current output
Output channels		8
Insulation method		Photocoupler (common to eight channels)
Rated output voltage		4 to 20 mA DC
D/A bits		11
Conversion ratio		16 mA to 2,000 in digital value (4 mA to 0)
Overall accuracy (room temperature)		±0.2% full scale (ambient temperature from 20 to 25°C)
Overall accuracy (0 to 55°C)		±0.5% full scale
Response time		5 ms or less (resistive load)
Load resistance		500 Ω or less
Internal consumption current	12 VDC	250 mA or less
	5 VDC	40 mA or less
Insulation withstand voltage		500 VAC, 1 minute (between external terminal and ground)
External wiring	Connection	40-point terminal block connector (Connector screw type: M3)
	Applicable cable size	0.5 to 1.25 mm^2
	Tightening torque	0.6 to 0.8 N·m
	Maximum wiring length	200 m (shielded twisted-pair cable)
Mass		430 g





- ■ The overall accuracy listed above is expressed as percentages of the full scale value of this AI module.
- ■ The external power supply must be grounded.
- ■ The loads may be used either in a grounded or a floated state.
- ■ The shielding of the cables must be grounded either on the load side or the I/O unit side.
- ■ The cable connected to each channel is one that is shielded either separately from or together with the cables connected to the other channels.

3 INSTALLATION AND MODULE MOUNTING

3.1 Where to Install

The programmable controller does not have a fire-proof, dust-proof, and water-proof structure, so it must be housed in a dust- and water-proof steel cubicle, as shown below, and must be installed in a location where no water will get into the controller.

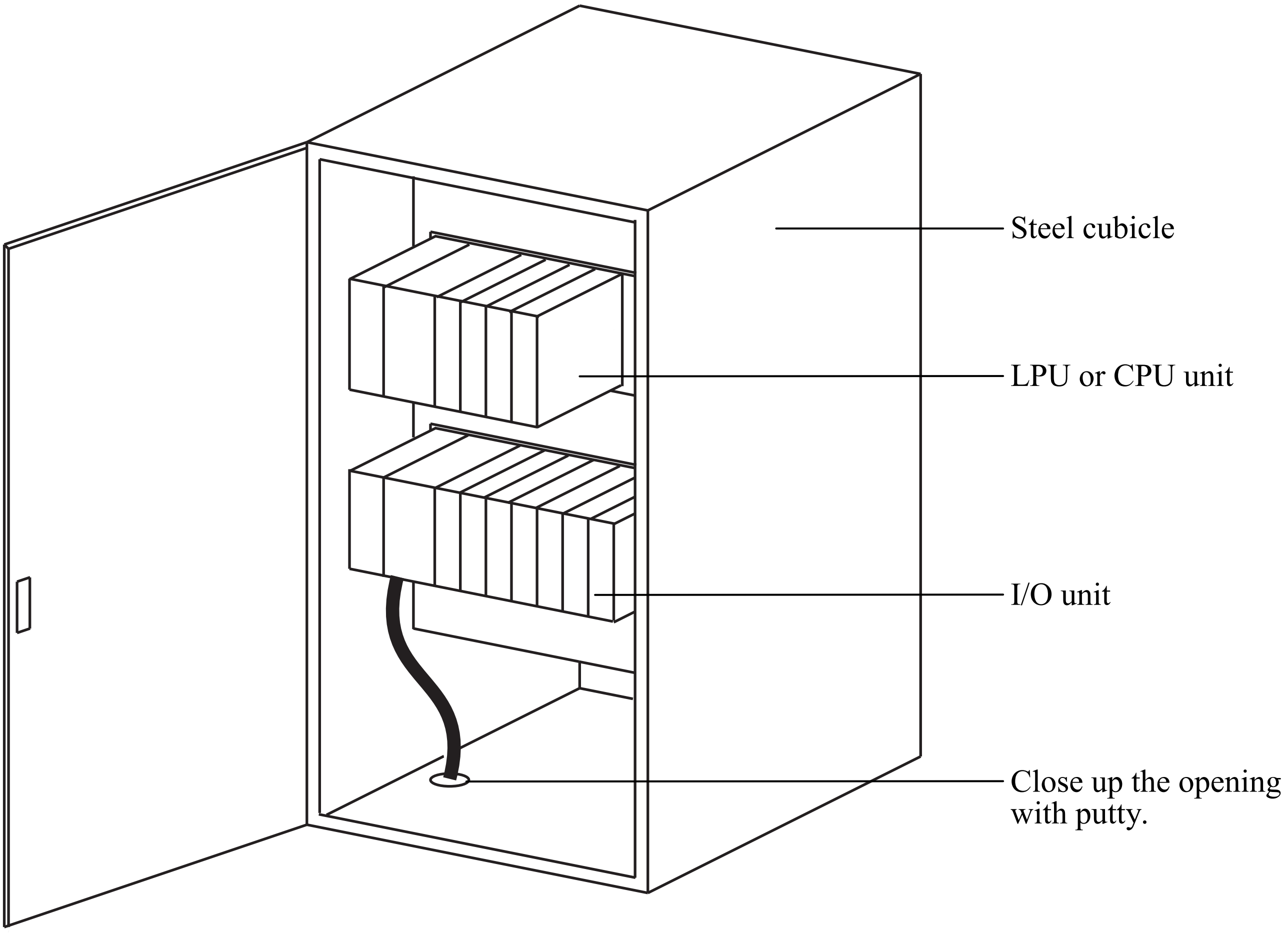


Figure 3-1 An Installed Programmable Controller

NOTICE
In installation locations where there is a possibility of water leak, be sure to house the programmable controller in a water-proof enclosure. Disregarding this rule may result in hardware damage.

3.2 Installation Environment

The programmable controller and I/O modules mounted in it must be used within the installation environment specified in Table 3-1. To ensure a long-term stable performance of these hardware products, the user is recommended to use them at normal temperature and normal humidity (15 to 35°C, 45 to 85%RH). If they are used in a high-temperature and high-humidity environment or an environment where the temperature fluctuates widely between day and night, their useful service life will be shortened.

Table 3-1 Installation Environment Specifications

Power supply voltage	100 to 120 VAC, single phase, 50/60 ±5 Hz for model LWV450; 100 to 120 VAC, single phase, 50/60 ±5 Hz, 100 to 110 VDC for model LWV460; 100 to 110 VDC for model LWV550
Power supply voltage range	85 to 132 VAC for model LWV450; 85 to 132 VAC, 80 to 143 VDC for model LWV460; 80 to 143 VDC for model LWV550
Ambient temperature	During operation, 0 to 55°C; During storage, -20 to 70°C (Temperature ramp rate: 10°C/hour or less)
Ambient humidity	During operation, 30 to 90%RH; During storage, 10 to 90%RH (non-condensing)
Vibration resistance	Conforming to JIS C0040 standard; Frequency, 10 to 150 Hz; Acceleration, 10 m/s^2; Directions, X, Y, and Z; Sweep time, 8 minutes; Sweep cycles, 20
Shock resistance	Conforming to JIS C0041 standard; Peak acceleration, 147 m/s^2; Half-sine pulses; Directions, X, Y, and Z; 3 times in each direction
Ambient air (cleanliness)	Class 1 million, with no corrosive gases

NOTICE

It may happen that the input voltage of the power supply module is within the above specifications but it is close to the upper or lower limit. In these cases, the user is advised to consider the input voltage as being abnormal and ask a power supply management specialist for inspection of the module.

3.3 Installation Styles

3.3.1 Concentrated installation

Concentrated installation is a style of installing the programmable controller. As shown in Figure 3-2, this installation style installs all of the CPU or LPU unit and I/O unit of a programmable controller in one single cubicle. This installation style, commonly applied to small-scale systems, enables the construction of a system relatively resistant to electric noise. This is because the style confines all the interconnecting cables in the single cubicle.

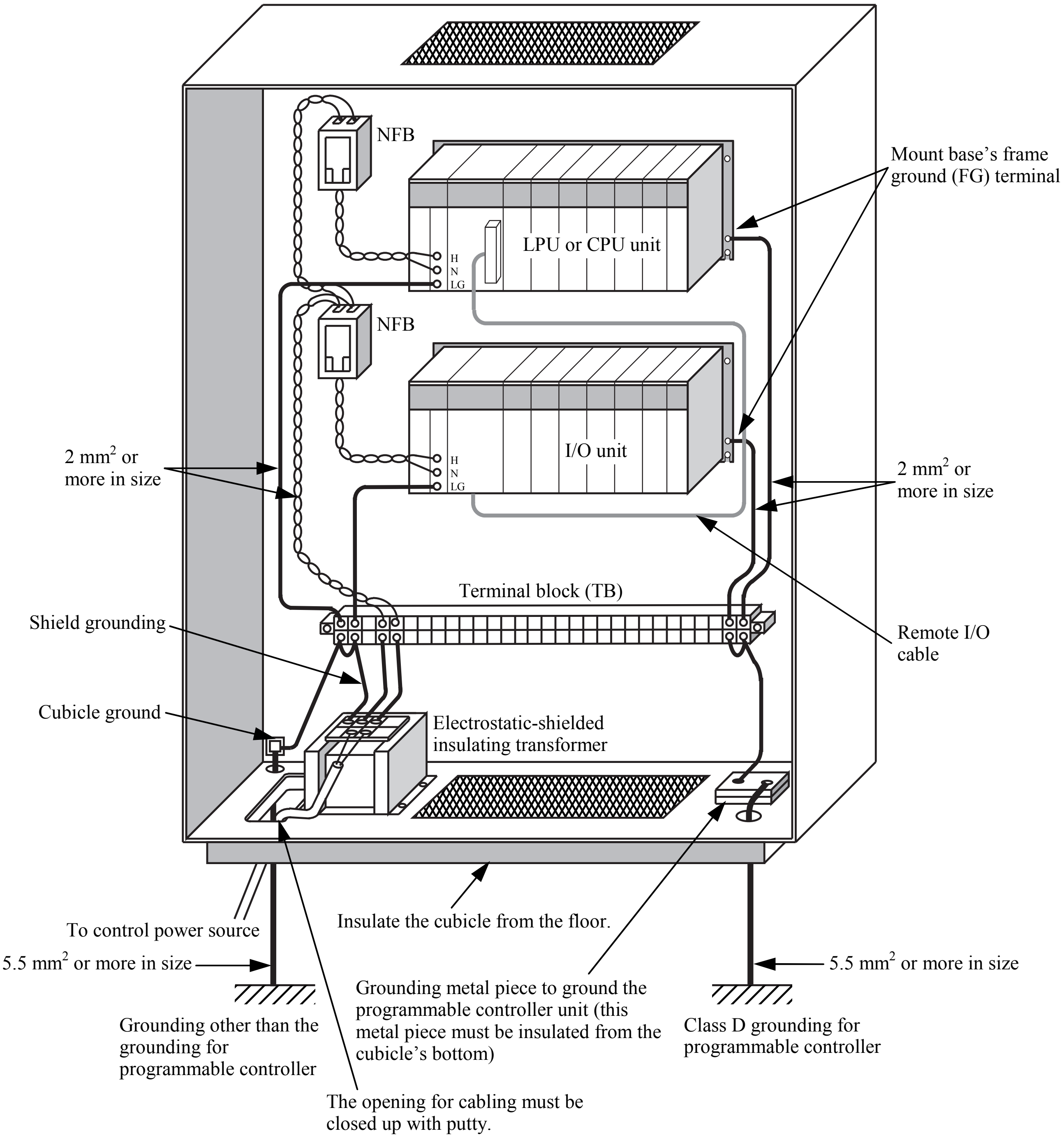
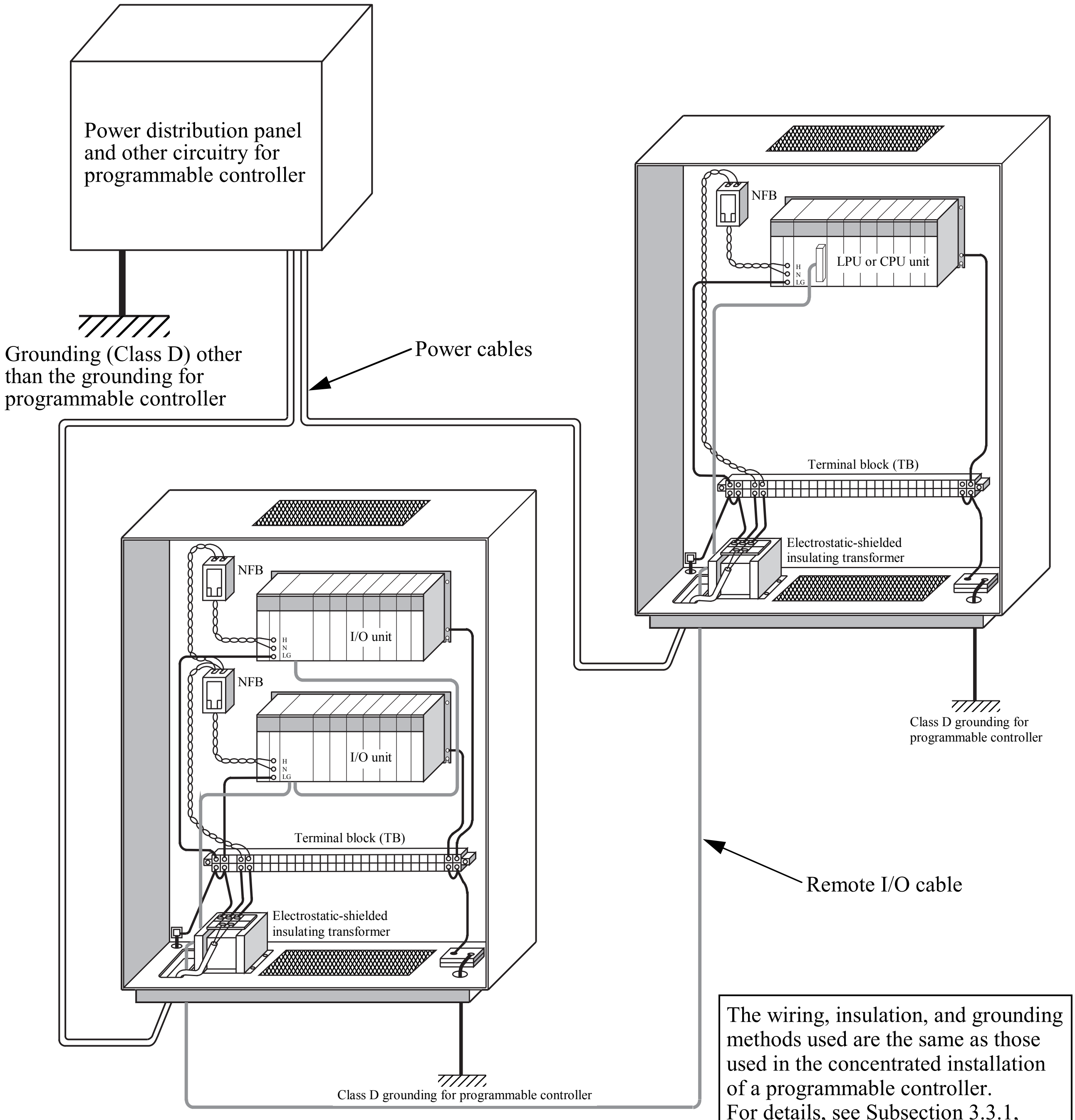


Figure 3-2 An Example of Concentrated Installation

3.3.2 Dispersed installation

As shown in Figure 3-3, dispersed installation installs the LPU or CPU unit of a programmable controller in one cubicle and the I/O units in another separate cubicle(s). This installation style is used when the I/O units of a programmable controller need to be installed in a distant location(s) from its CPU unit or LPU unit.



The wiring, insulation, and grounding methods used are the same as those used in the concentrated installation of a programmable controller.
For details, see Subsection 3.3.1, “Concentrated installation.”

Figure 3-3 An Example of Dispersed Installation

NOTICE

- Construct an emergency stop circuit and an interlock circuit outside this product. Unless they are so constructed, failure of this product may result in machine breakdown or accident.
- Keep the input and output currents of any I/O module within the maximum permitted current values. If an overcurrent is allowed to flow in the I/O module, the component part(s) involved may be damaged, resulting an accident, fire, or product failure.

NOTICE

Do not use a transceiver, cellular phone, or the like near any I/O module. Such communication equipment generates noise, which may result in malfunction or system failure.

NOTICE

- As the external power supply, select a power supply with overvoltage and overcurrent protection.
- If a product smokes or gives off an offensive smell, immediately turn off the power to the product and find the cause.
- Install a fuse or circuit protector for the external power supply for protection against short-circuit. The circuit protector selected must match the ratings of the external power supply.
- Before applying power to the programmable controller, check that all the cable wirings for the product are correct.
- Before terminating the programmable controller (by shutting down or resetting), check that all the peripheral equipment is already stopped or will not be affected by the termination.
- Failure of an installed module may damage the contents of memory spaces. Be sure to make a backup copy of any important data in memory.
- Before carrying out such operations as program alteration, forced output, run, stop, etc. during operation of the programmable controller, ensure safety. Any mis-operation may result in machine breakage or an accident.
- Apply power to the various components of your application system in the proper order. If this is done in the wrong order, your system may malfunction, resulting in machine breakage or an accident.
- Component parts containing gallium arsenide (GaAs) in a photocoupler or LED are used in the programmable controller. Gallium arsenide is designated as a harmful substance by law. Use extreme care in handling, particularly in scrapping the product. Have a specialized agent dispose of the product as industrial waste.
- After the power supply has been switched off, wait for more than one second before you switch it on again. Disregarding this rule may cause product failure.
- Do not insert your finger or a foreign object into any opening in a connector or the mount base. Disregarding this rule may result in bodily injury.

3.4 Installation Clearances

In order for the programmable controller's modules to function properly, air apertures must be provided in the top and bottom panels of the cubicle and must be equipped with a filter. In addition to these apertures, sufficient clearances must also be provided between modules, and between modules and cubicle walls, in the cubicle, as shown below. These clearance values are rough estimates. To check if the ambient temperatures around the modules are within the specified range, the user is advised to carry out a test operation and measure the temperatures.

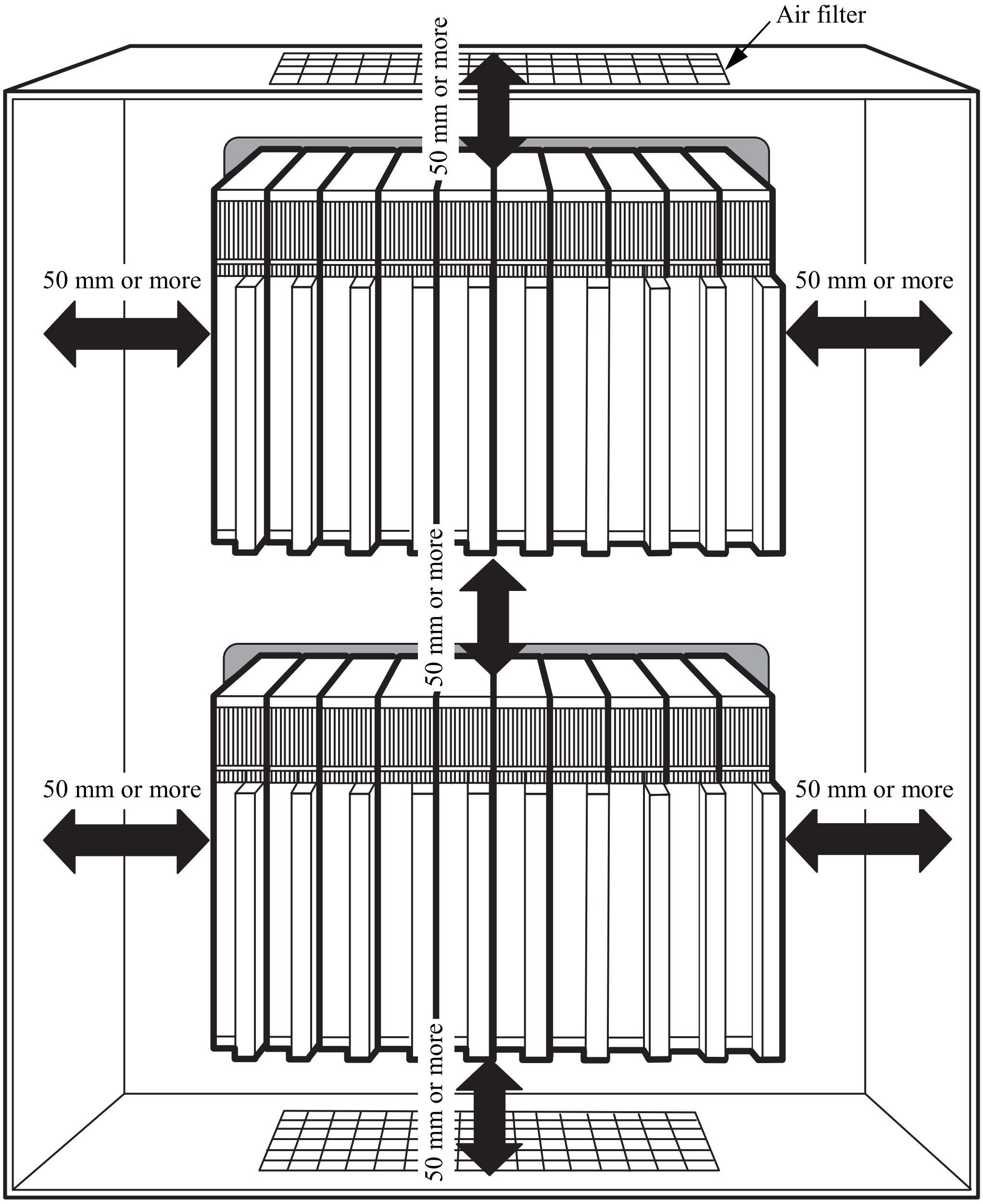
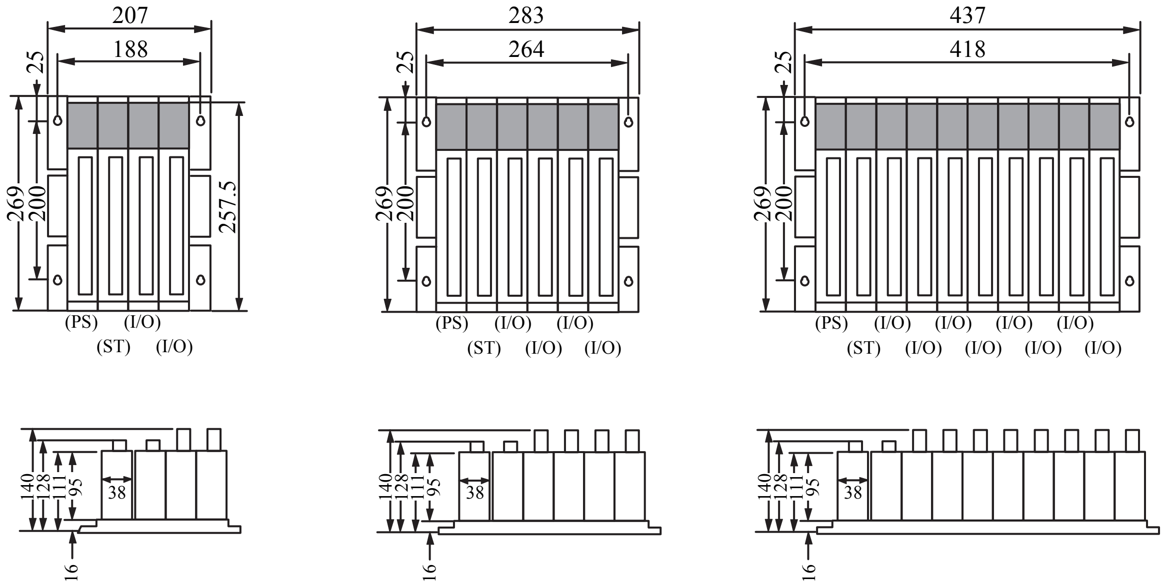


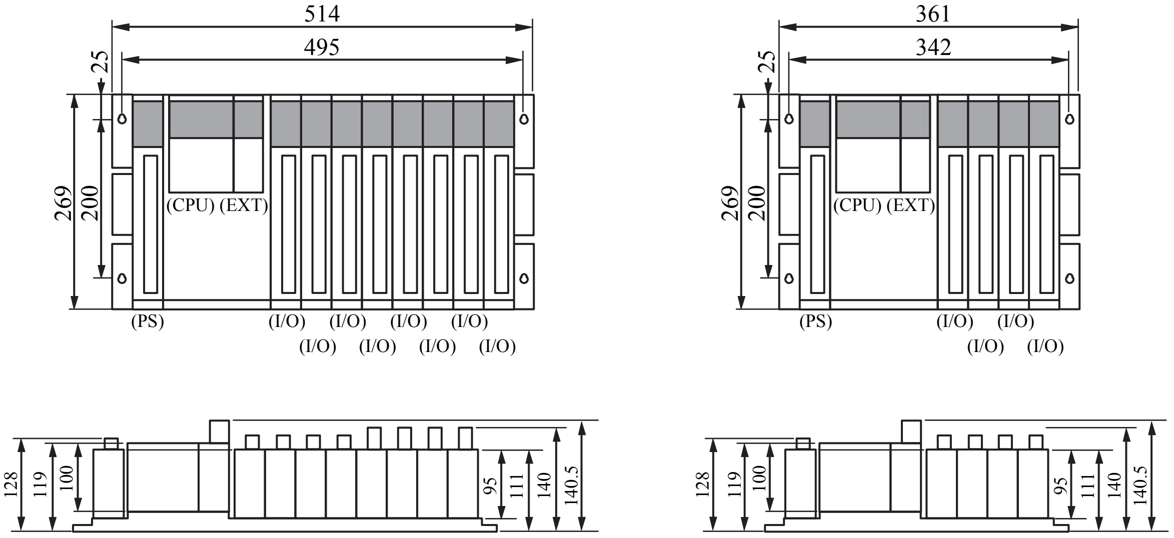
Figure 3-4 Installation Clearances

3.5 External Dimensions

Figure 3-5 shows the external dimensions of mounting units in which the modules of a programmable controller are mounted, and it also shows those of the mounted modules.



2-slot basic unit 4-slot basic unit 8-slot basic unit



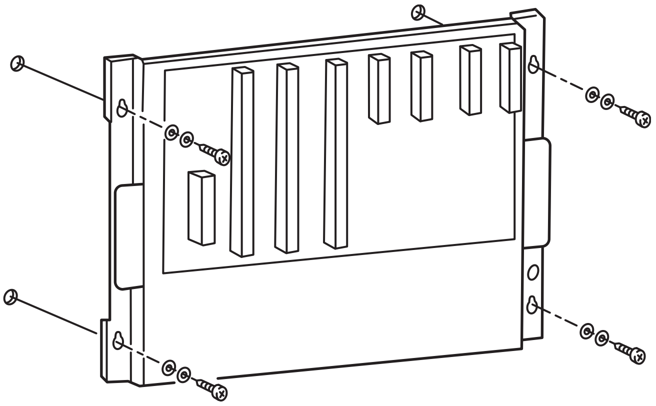
8-slot expansion unit 4-slot expansion unit

Unit: mm

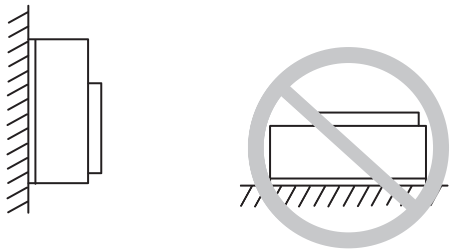
Figure 3-5 External Dimensions

3.6 Installing a Mount Base and Mounting a Module on It

■ Installing a mount base

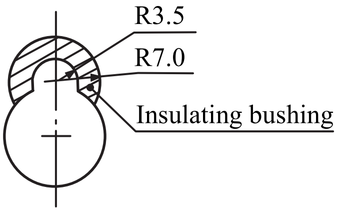


When installing a CPU unit or I/O unit in the cubicle, be sure to mount them vertically, as shown in figure (a) below. If they are mounted horizontally as shown in figure (b), the air flow inside the module will be restricted, resulting in temperature rise in it and eventually short service life for it.

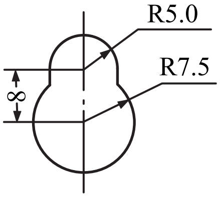


(a) Vertical mounting (b) Horizontal mounting

■ Mount base fixing holes

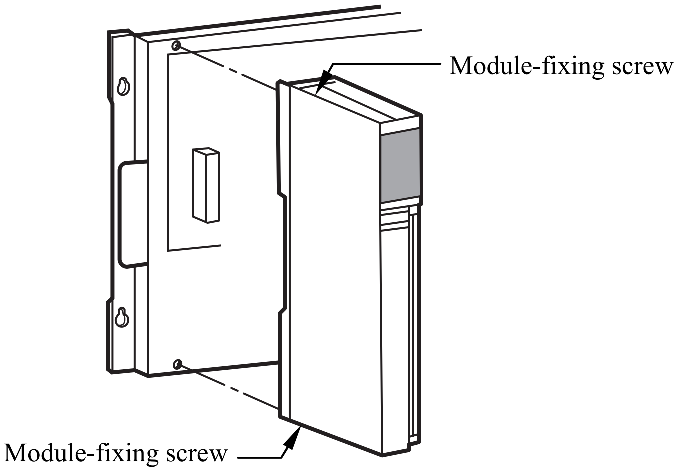


Fixing hole with an insulating bushing installed

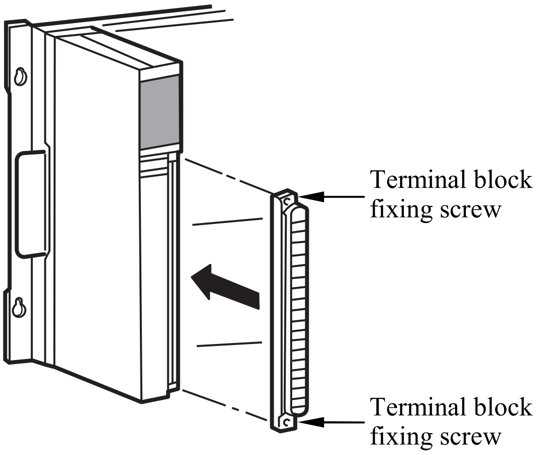


Fixing hole with no insulating bushing installed

■ Mounting a module



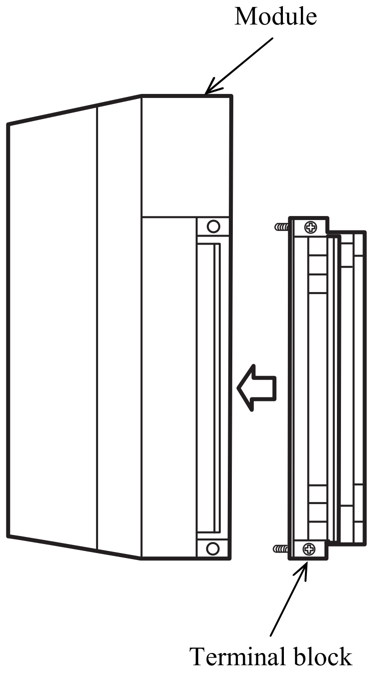
■ Installing a terminal block



3.7 Installing a Terminal Block

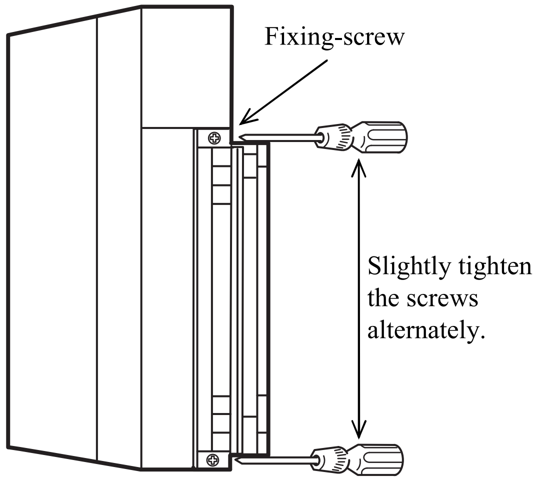
Terminal blocks, either 20-point or 40-point, can be installed by performing the procedure described below. Any terminal block, if installed improperly, may result in poor electrical contact between the module and the terminal block. To avoid this, be sure to follow the procedure properly.

Step 1:



Insert the terminal block into the receptacle provided in the module. When inserting it, hold the two ends of the terminal block with your fingers and, if it is a 40-point terminal block, push it in (approximately 1 millimeter) until it clicks into place.
If it is a 20-point one, it is impossible to push it in with your fingers until it clicks into place. So, push it in slightly, hold it with your hand, and follow the instructions given in Step 2.

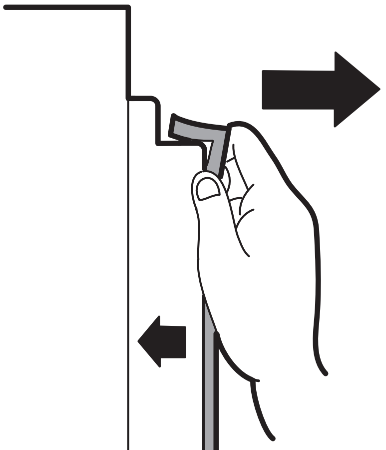
Step 2:



Tighten the upper fixing-screw of the terminal block slightly and then the lower screw in the same manner. Repeat this until the terminal block is fixed securely onto the module. When it is fixed securely, make sure that the terminal block is attached completely on the module.

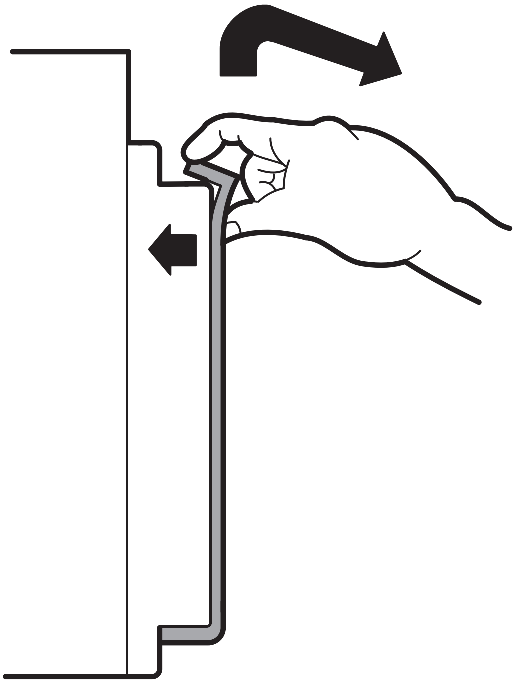
When removing the cover from the terminal block, do it as shown below.

<In the case of 20-point terminal block>



Gently press on the terminal block cover with the center of your palm, hold the top sides of the cover with your fingers, and pull the cover off the terminal block.

<In the case of 40-point terminal block>



While pushing the tip of your thumb on the top front of the terminal cover, place the tip of your forefinger on the top end portion of the cover and pull the top end portion off the module with your forefinger.

3.8 Mounting Design

3.8.1 Mounting limitations

When mounting I/O modules on the mount base, make sure that the total of the current consumptions of all of those I/O modules is within the specified output current of the power supply module. The tables below show the rated output currents of available power supply modules and consumption currents of available I/O modules.

Item		Specification	
Model		LWV450, LWV550	LWV460
Output current	12 VDC	3.5 A	3.5 A
	5 VDC	0.8 A	2.0 A

Model	12 VDC	5 VDC
LWS410	10 mA	150 mA
LWI400	0	5 mA + 2 mA × n
LWI450, LWI460, LWI470	0	4 mA + 2 mA × n
LWI600	0	5 mA + 2 mA × n
LWI650	0	4 mA + 2 mA × n
LWO400	22 mA × n	25 mA
LWO450, LWO460	22 mA × n	15 mA
LWO600	16 mA × n	25 mA
LWO610	16 mA × n	25 mA
LWO650	16 mA × n	15 mA
LWO670	8 mA + 20 mA × n	8 mA
LWA400 to LWA404, LWA421 to LWA423	150 mA	40 mA
LWA430, LWA435	350 mA	50 mA
LWA500, LWA501	250 mA	45 mA
LWA450, LWA460	260 mA	40 mA
LWA550, LWA551	300 mA	40 mA
LWA560	250 mA	40 mA
LWC400, LWC401, LWC402	40 mA	8 mA

n: Is the number of data points that are turned on simultaneously in the I/O module.

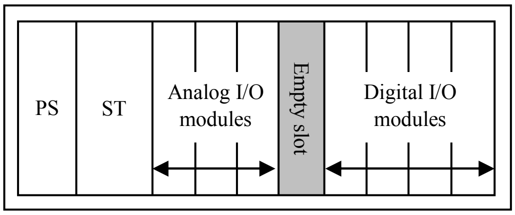
The table below shows the maximum numbers of I/O modules of each model that can be mounted in an 8-slot mount base.

Model	Maximum number of I/O modules mountable on mount base	
	LWV450, LWV550	LWV460
LWI400	8	8
LWI450, LWI460, LWI470	8	8
LWI600	8	8
LWI650	8	8
LWO400	4	4
LWO450, LWO460	8	8
LWO600, LWO610	6	8
LWO650	8	8
LWO670	8	8
LWA400 to LWA404, LWA421 to LWA423	8	8
LWA430, LWA435	8	8
LWA500, LWA501	8	8
LWA450, LWA460	8	8
LWA550, LWA551	8	8
LWA560	8	8
LWC400, LWC401, LWC402	8	8

Note: An I/O module(s) not listed above may be mounted on a mount base on which an I/O module(s) listed above are mounted. In these cases, the total of the consumption currents of all the I/O modules mounted on the mount base must not exceed the rated output current of the power supply module.

3.8.2 Module mounting

When mounting analog I/O modules (LWAxxx, PANxxx, and/or PAFxxx) and digital I/O modules (LWIxxx and/or LWOxxx) together on the same mount base, separate the two different types of I/O modules from each other and mount them on the mount base, leaving one slot empty between the two types, as shown below. The reason for this is to avoid any influence of the digital I/O module wiring on the analog I/O modules.

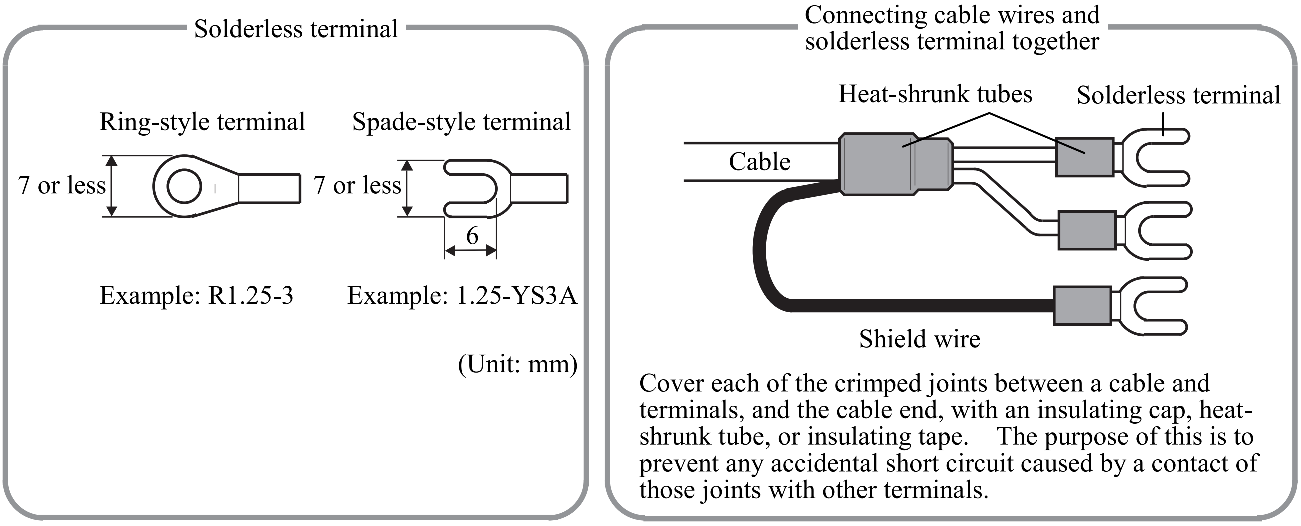


Leave one slot empty between the two different types of I/O modules

4 WIRING

4.1 Solderless Terminals

When connecting cable wires to a terminal block, use solderless terminals or crimp terminals. The following shows two different types of solderless terminal and how to crimp such terminals to cable wires.



Solderless terminal

Connecting cable wires and solderless terminal together

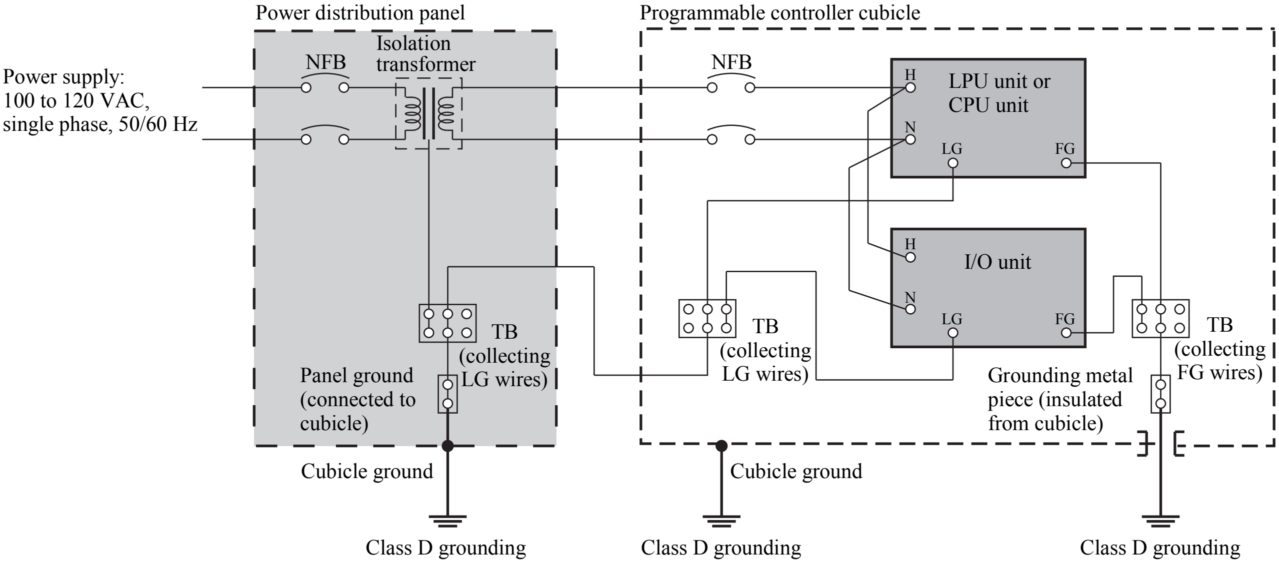
Cover each of the crimped joints between a cable and terminals, and the cable end, with an insulating cap, heat-shrunk tube, or insulating tape. The purpose of this is to prevent any accidental short circuit caused by a contact of those joints with other terminals.

Figure 4-1 Connecting Cable Wires and Solderless Terminal Together

4.2 Wiring for the Power Supply

The wiring for the power supply to I/O units must be insulated from the control power source by using an electrostatic shielded isolation transformer. Shown below is wiring diagrams of two different power supply installations, one in which an isolation transformer is mounted in the power distribution panel, and one in which an isolation transformer is mounted in the programmable controller cubicle.

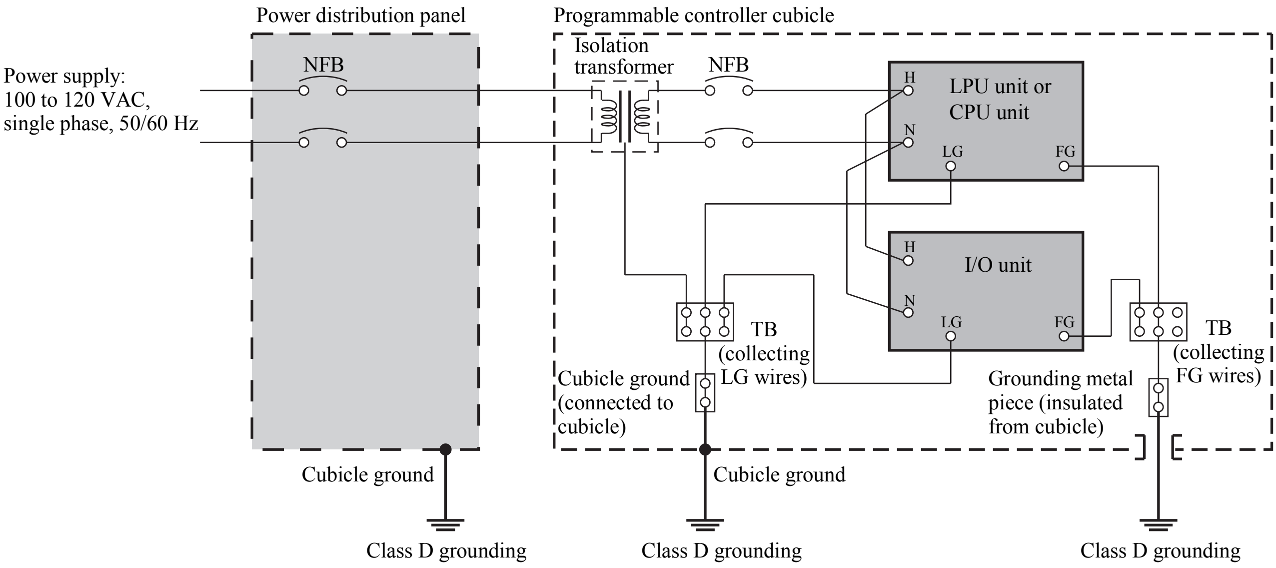
- Case 1 -- an isolation transformer is mounted in the power distribution panel:



Symbols: NFB, non-fuse breaker; TB, terminal block.

Figure 4-2 An Example of Power Supply Wiring with an Isolation Transformer Mounted in the Power Distribution Panel

- Case 2 -- an isolation transformer is mounted in the programmable controller cubicle:



Symbols: NFB, non-fuse breaker; TB, terminal block.

Figure 4-3 An Example of Power Supply Wiring with an Isolation Transformer Mounted in the Programmable Controller Cubicle

Note 1: The grounding metal piece must be electrically insulated from the programmable controller cubicle.

Note 2: The mount base must be electrically insulated from the programmable controller cubicle.

Note 3: The sizes of the cables used must be as follows:

Power cable: 2 mm^2 or more

Ground wires: 2 mm^2 or more in cubicle;

5.5 mm^2 or more outside of cubicle.

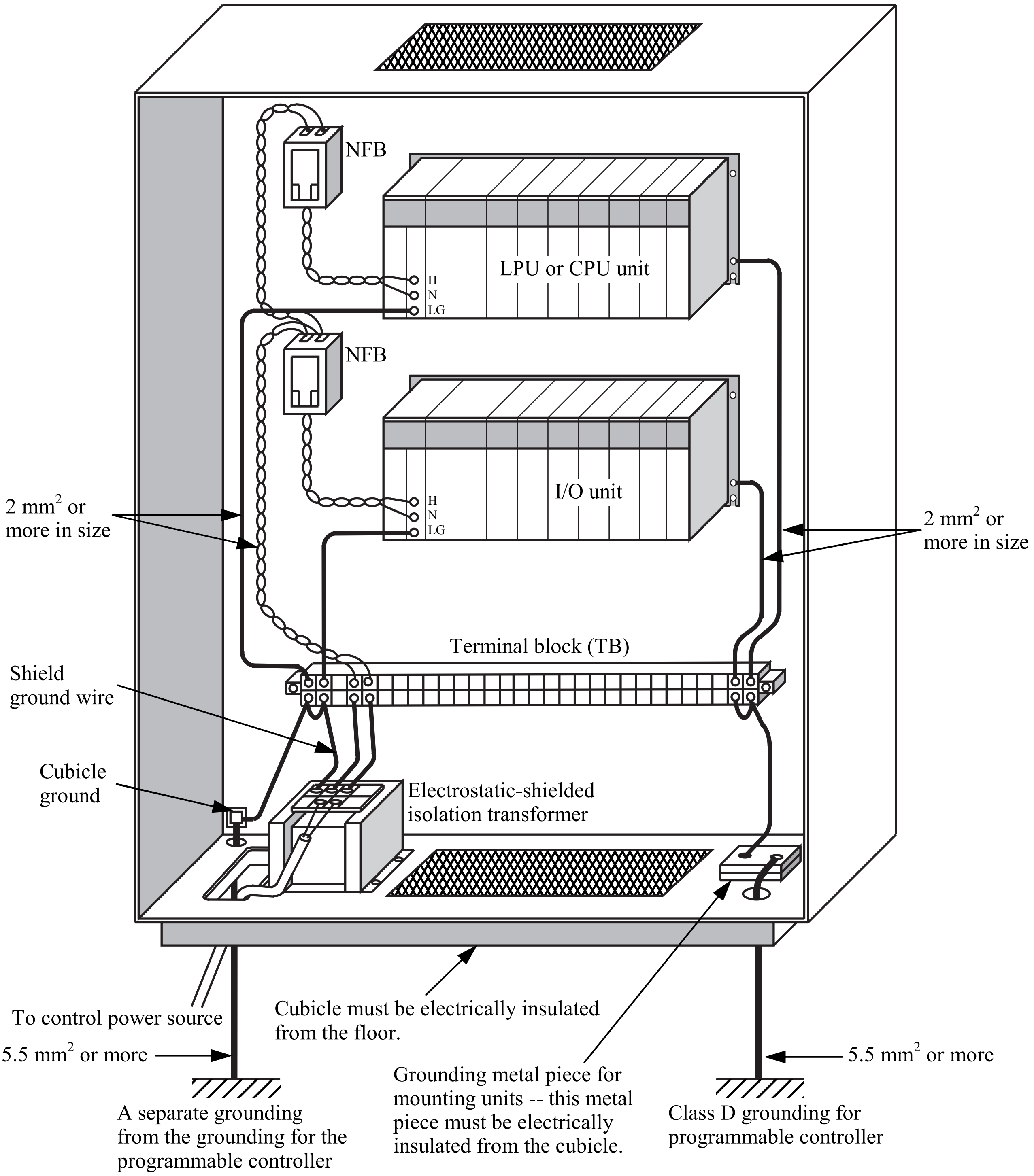
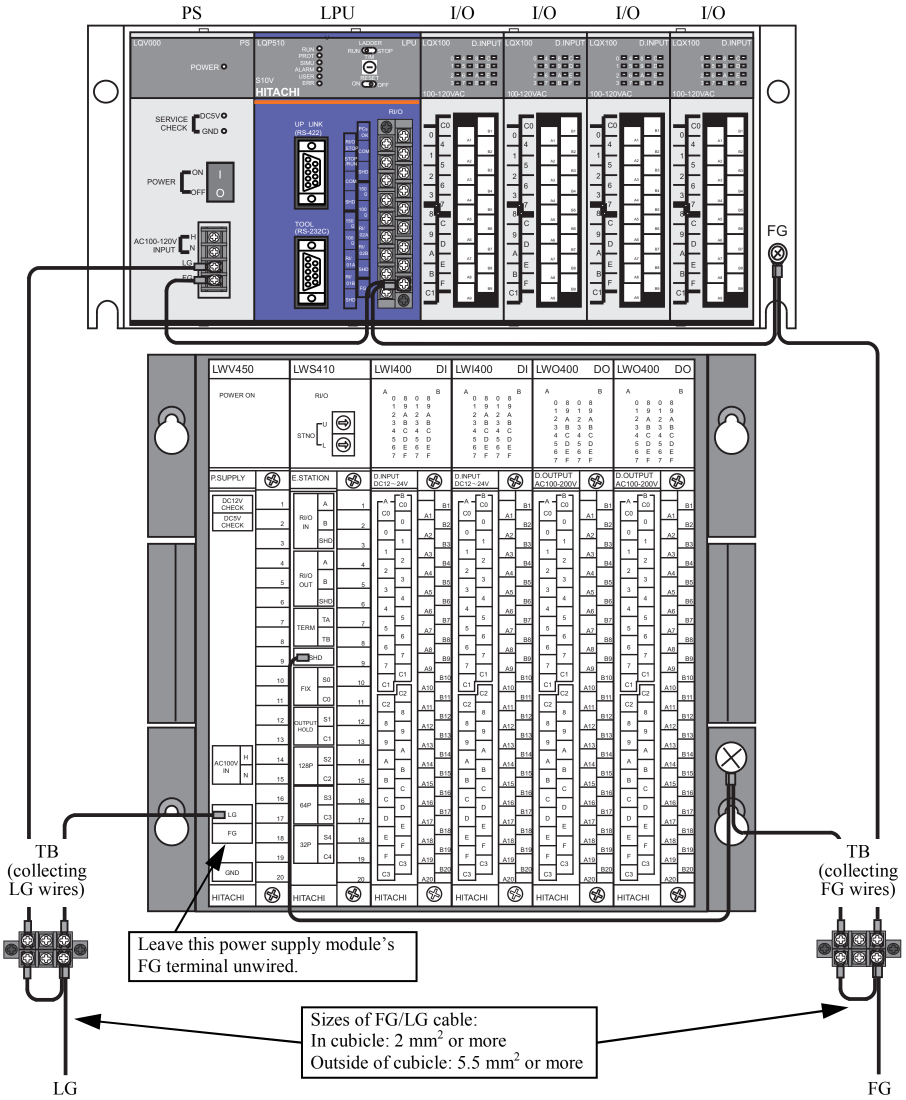


Figure 4-4 An Example of Wiring in the Cubicle

4.3 Ground Wiring

When running ground-wiring, satisfy the following requirements:

- Each of the LG (line ground) terminals of a programmable controller is a ground terminal to isolate power supply noise, and each of the FG (frame ground) terminals is a ground terminal to isolate network line noise. All of the LG terminals must be grounded separately from the FG terminals, in order to prevent electromagnetic interference between power supply and network lines.
- The FG terminal of any module requiring FG grounding must be connected, via the shorted possible route, to the FG terminal of the mount base on which the module is mounted.
- The FG terminal of any mount base must be insulated from the cubicle in which the mount base is installed, and must be grounded by Class D grounding (grounding resistance of 100 ohms or less).
  - ■ Example: Ground-wiring for the cubicle in a concentrated installation
    In cases where an LPU or CPU unit is mounted with an I/O unit in the same cubicle, the FG and SHD terminals of the LPU/CPU unit and remote I/O station module, respectively, must be connected to the FG terminals of the mount bases on which they are mounted. Further, the FG terminals of those mount bases must be grounded at the same point. The reason for this is to provide the same ground potential for both FG terminals and thereby increase noise resistance.



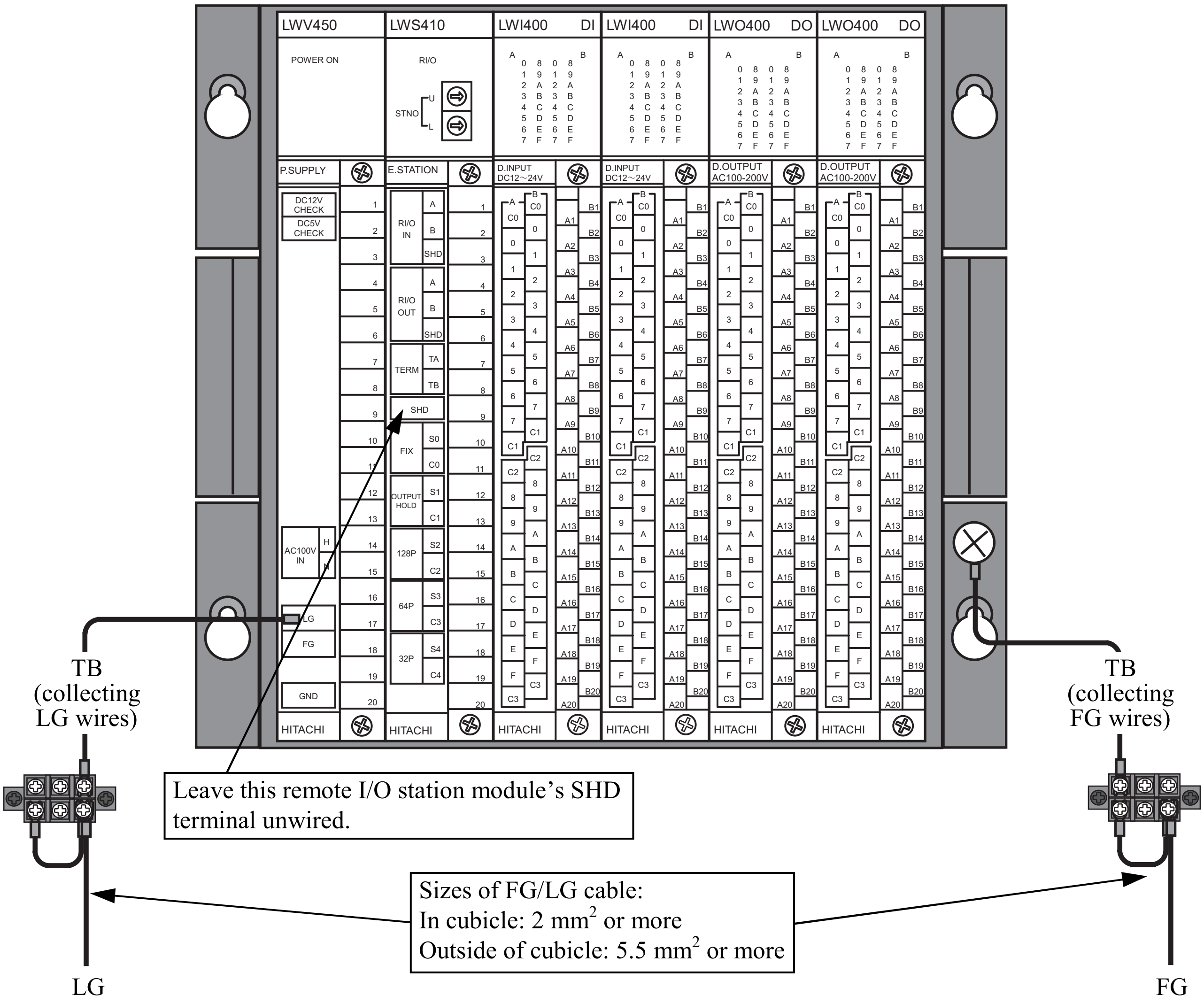
Leave this power supply module’s FG terminal unwired.

Sizes of FG/LG cable:
In cubicle: 2 mm^2 or more
Outside of cubicle: 5.5 mm^2 or more

Figure 4-5 An Example of Ground-Wiring in a Concentrated Installation

- Example: Ground-wiring for an I/O unit in a dispersed installation

In a dispersed installation, where the cubicles are interconnected by remote I/O cable wiring and single-point grounding is not applicable to the LPU/CPU unit and I/O unit(s), the SHD terminal of the remote I/O station module must be left unwired. If it is wired to ground, this will result in a decrease in noise resistance because of the different grounding potentials. FG-terminal grounding must be provided only on LPU/CPU unit side.



TB (collecting LG wires)

TB (collecting FG wires)

Leave this remote I/O station module's SHD terminal unwired.

Sizes of FG/LG cable:
In cubicle: 2 mm^2 or more
Outside of cubicle: 5.5 mm^2 or more

LG

FG

Figure 4-6 An Example of Ground-Wiring in a Dispersed Installation

4.4 Wiring the Remote I/O Cable

For information on how to wire the remote I/O cable to the LPU or CPU unit, refer to the instruction manual on the LPU or CPU.

4.5 Wiring I/O Modules

When wiring an I/O module, satisfy the following requirements:

- In any case where it is possible, the I/O cable to the I/O module should be set at least 10 cm apart from any AC power cable.
- If the I/O cable to the I/O module is long and it is unavoidable to lay part of the I/O cable in parallel with an AC power cable without satisfying the above requirement, use a multi-conductor shielded cable as the I/O cable and ground the shield wire of the cable.
- If the I/O cable to the I/O module is laid in a duct or conduit, be sure to ground the duct or conduit.
- When wiring the I/O cable to a terminal block, be sure to use solderless terminals.

In addition to the above requirements, the following additional requirements must also be satisfied because analog I/O modules process low-level analog signals.

- The I/O cables transferring analog signals may be tied together, but they may NEVER by tied together along with I/O cables carrying digital signals. The analog signal cables must be separated from the digital signal cables.
- When mounting an analog I/O module in a mount unit, take into consideration the easiness of separating the analog module from alternating digital signals. Such easiness can be realized by mounting only analog modules either in slots close to the station module or in the last (rightmost) and preceding slots, without leaving any empty slots in between.
- The cable used for an analog module must be a shielded twisted-pair cable.
- If the cable used for an analog module receives a significant influence from noise, its shield should be grounded at the cable entry of the cubicle and its length should be made as short as possible.

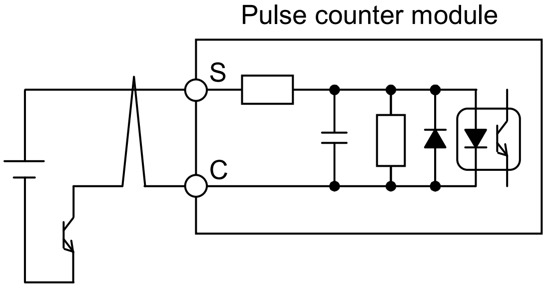
4.5.1 Wiring a pulse counter module

Pulse counter modules count pulses by detecting the rising and falling edges of the pulse signal input from the external source. These modules are inherently susceptible to noise, which you can see in their specifications. For this reason, when you wire these modules, follow the caution instructions listed below so that no significant noise may be added to the input signal.

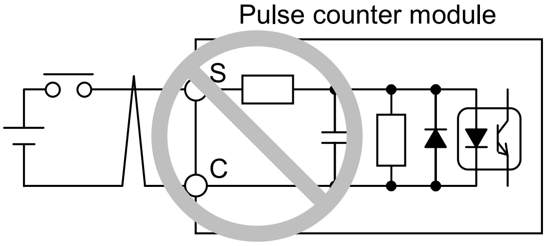
NOTICE

- When wiring a pulse counter module, be sure to wire it with a shielded twisted-pair cable and ground the cable by Class D grounding.
- The shielded twisted-pair cable must be laid at least 30 centimeters away from noise sources, such as power cables and input/output cables. Never lay it in parallel with those noise sources, and the length of the cable laid must be shortest possible.
- If a counting error occurs in the pulse counter module that has been wired according to the above rules, lay the shielded twisted-pair cable in a dedicated duct or conduit, and then ground the duct or conduit.
- Any input terminals that need not be used must be wired as follows:
  - If the pulse counter module is used with one-phase pulse input, short the two input terminals of each of the two pairs of two-phase pulse input terminals; that is, short A1S and A1C together, then short B1S and B1C together, and then ground them all together.
  - If it is used with two-phase pulse input, short the one-phase pulse input terminals A2S and A2C together and then ground them together.
  - If the stop-signal input terminals STOPS and STOPC need not be used, short them together and then ground them together.
- A pulse generator may be connected to the pulse counter module by using either voltage-transistor connection or no-voltage-transistor connection (see below). Voltage-transistor connection should be used when grounding is made on the pulse generator side. No-voltage-transistor connection should be used when grounding is made on the pulse counter module side.
- Do not connect a contact to any pulse input terminal. Disregarding this rule may result in counting errors due to contact bouncing during closing and opening of the contact.

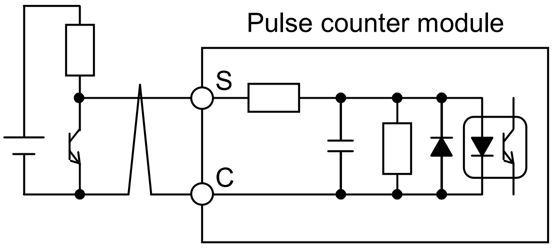
■Voltage-transistor connection



■No-voltage-transistor connection



■Voltage-contact connection (prohibited)



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5 MAKING USE OF MODULES

5.1 Using Digital I/O Modules

5.1.1 Using digital input modules

Digital input modules may encounter an input error due to leakage current when they are used for direct-current input through a switch with LED indicator. In these cases, add a special resistor between the input terminal and common, as shown below. The resistor has a resistance that produces a voltage lower than or equal to the OFF voltage.

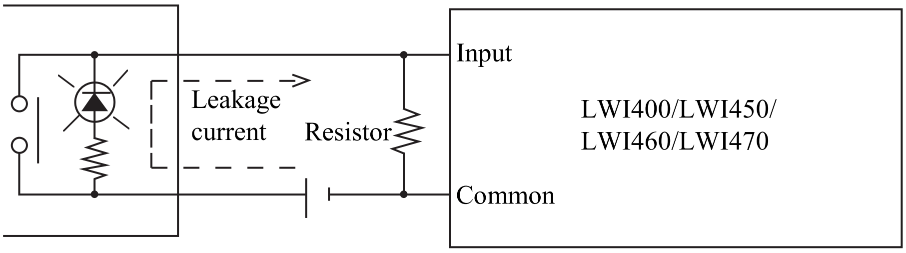


Figure 5-1 Connecting a Special Resistor to an LWI400/LWI450/LWI460/LWI470 Module

5.1.2 Using LWO400, LWO450, and LWO460 contact output modules

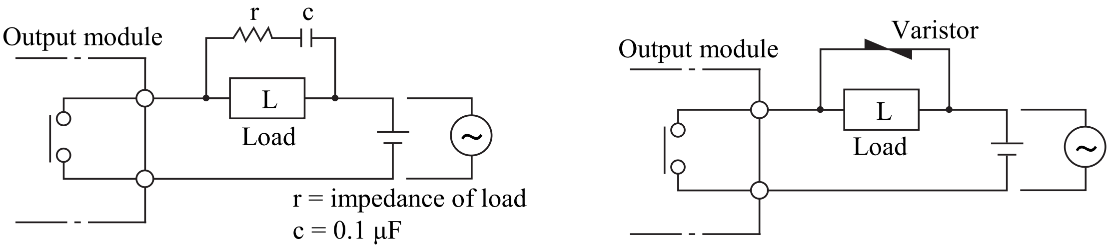
(1) Surge absorber circuit

Contact output modules may be used to drive an inductive (L) load. To drive an L-load successfully, it is recommended that a surge absorber circuit be attached to the contact output module, as shown below. The purpose of the surge absorber is to absorb flyback voltages that will be generated when current flow to the load is cut off. These flyback voltages may be a source of noise.

Note: When driving an L-load with DC power, be sure to attach a surge absorber circuit to the driver module.

(a) Driving an L-load with AC or DC power -- Case 1

(b) Driving an L-load with AC or DC power -- Case 2



(c) Driving an L-load only with DC power

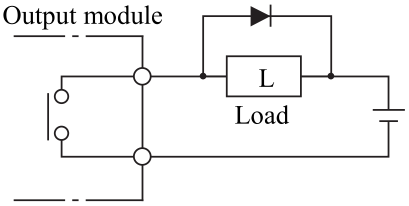


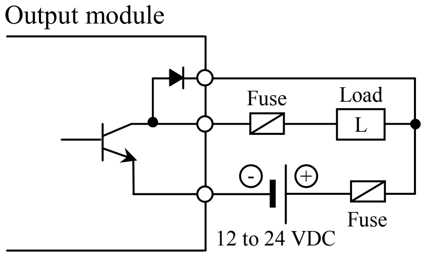
Figure 5-2 Surge Absorber Circuits

(2) Service life of relay contacts
If these relays are intended to be operated at rated voltage and rated current, their expected service life is approximately 100,000 switching operations (1,800 cycles per hour). However, if the relays are operated at a higher voltage and a higher current level than the rated, their useful service life will be shorter than expected. The other factors that will make the service life shorter than expected are the following: ambient operating environment, type of the load connected, in-rush current, and serge. So, pay special attention to those factors when installing any of the above-mentioned hardware modules. As a rule, each of those factors should be checked before using the hardware module to which a load is actually connected, or the hardware module should be replaced regularly before its service life is over. It is recommended that, where a long service life is required of a hardware module, the hardware module should be a transistor output module or triac output module, not a hardware module containing a relay for output.

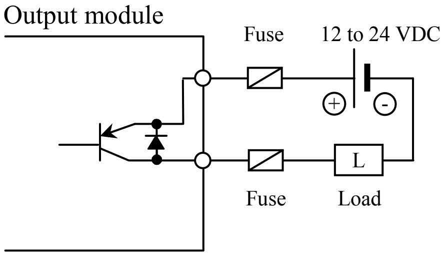
5.1.3 Using transistor and triac output modules

Transistor output modules and triac output modules may have their output device break down or burn if a large current flows in their output circuit in the event of a shorted load, cable miswiring, the accidental contact of wires, or other causes.
To avoid this, observe the following rule. When you connect a load to a transistor or triac output module, be sure to wire fuses between the load and the output terminals, as shown below. These fuses must be fast acting ones each of whose rated current is 2 or more times larger than the rated current of the load. However, you should note that, even if such fuses are installed in the circuit, the output device may be damaged due to a short circuit at the load, depending on the nature of the short circuit. For this reason, preventive maintenance should be carried out on the output module to eliminate any possibility of a short circuit. For example, check the cable and wiring periodically for any exposed part of a conductor, any damage to the cable, and so forth.

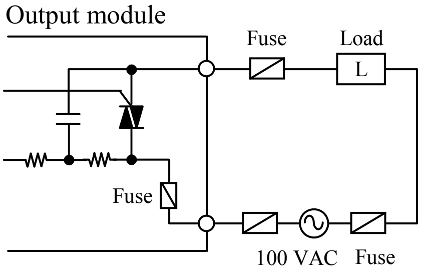
(a) Wiring fuses for the models LWO600 and LWO650



(b) Wiring fuses for the model LWO610

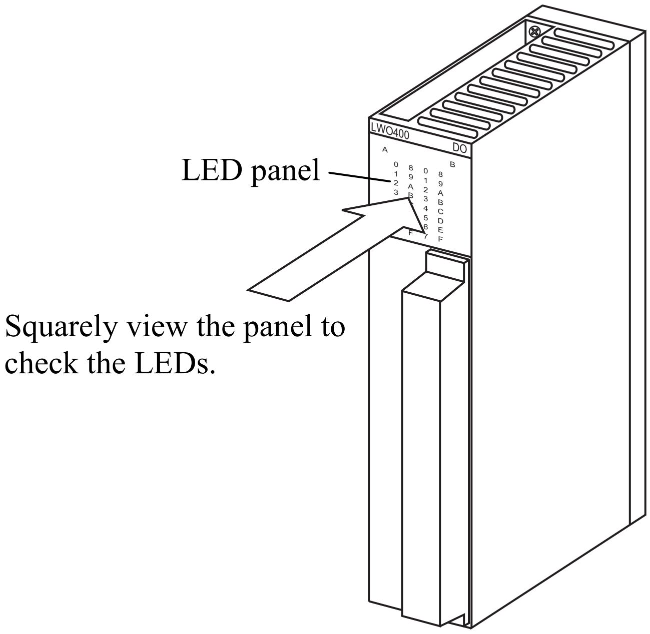


(c) Wiring fuses for the model LWO670



5.1.4 Checking the operation indicator LEDs

The operation of digital input/output modules can be monitored by checking the operation indicator LEDs. When checking these LEDs, squarely view the LED panel provided on the front of the module, as shown below.



LED panel

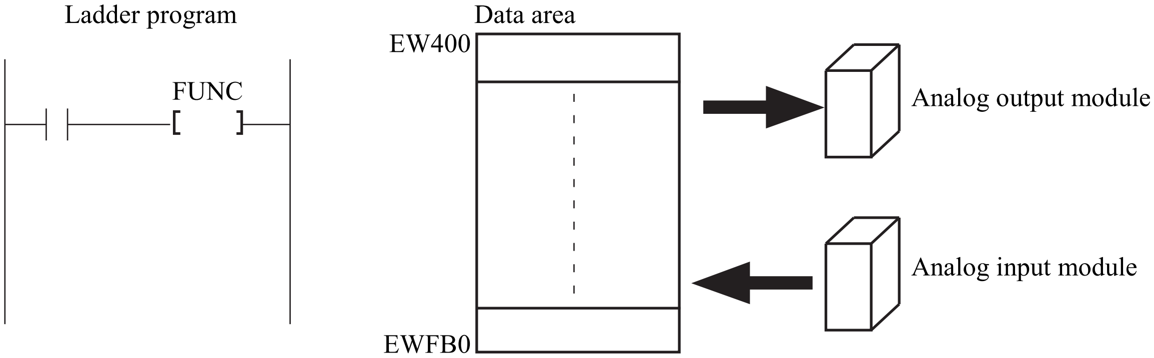
Squarely view the panel to check the LEDs.

Figure 5-3 Checking the Operation Indicator LEDs

5.2 Using Analog Input/Output Modules

5.2.1 Transferring data to or from analog modules

Data transfer to or from analog modules is done via storage areas selected from among those areas numbered EW400 through EWFB0, called data areas.



5.2.2 Registering data areas

Data areas can be registered in a dedicated software program, called the Analog Support Program, by using one of the software tools listed in Table 5-1. Information on how to register data areas is given in Section 5.4, "Registration in the Analog Support Program." Table 5-2 lists all available registration numbers and the corresponding data areas. In addition to the registration numbers, the model numbers of analog modules are also registered together. These model numbers may differ depending on the revision of the S10V Ladder Chart System used. For this reason, check the model number of an analog module in Table 5-3 when registering the module.

Table 5-1 Software Tools Used for the Registration of Data Areas

LPU/CPU module to be used online	Software tool	Remarks
S10V LPU or R70 LPU (Note 2)	S10V Ladder Chart System (Note 1)	
S10mini CPU or S10/2α CPU	Ladder chart system	
	Tool for 4-channel analog and pulse counter modules	This software tool is used only when the CPU module used is S10/2α CPU.

Where a model LWA435 AI module is used, observe the following:

Note 1: The S10V Ladder Chart System used must be Ver. 01, Rev. 21 or later. None of the earlier versions and revisions (Ver. 01, Rev. 20 or earlier) supports the registration of data areas.

Note 2: A model LQP510 LPU module, Rev. R or later, or a model LQP710 LPU module, Rev. N or later, may be used in conjunction with a model LWS410/LWS010 E.STATION module.

Table 5-2 Available Registration Numbers and the Corresponding Data Areas

Registration no.	Data area	Registration no.	Data area
01	EW400 to EW430	13	EWA00 to EWA30
02	EW480 to EW4B0	14	EWA80 to EWAB0
03	EW500 to EW530	15	EWB00 to EWB30
04	EW580 to EW5B0	16	EWB80 to EWBB0
05	EW600 to EW630	17	EWC00 to EWC30
06	EW680 to EW6B0	18	EWC80 to EWCB0
07	EW700 to EW730	19	EWD00 to EWD30
08	EW780 to EW7B0	20	EWD80 to EWDB0
09	EW800 to EW830	21	EWE00 to EWE30
10	EW880 to EW8B0	22	EWE80 to EWEB0
11	EW900 to EW930	23	EWF00 to EWF30
12	EW980 to EW9B0	24	EWF80 to EWFB0

Table 5-3 The Registration Model Numbers for Analog I/O and Counter Modules

- In the case of S10V Ladder Chart System, Ver. 01, Rev. 20 or earlier, or S10/2α / S10mini Ladder Chart System:

Actual model number	Registration model number
LWA400	PAF300
LWA401	PAF309
LWA402	PAF320
LWA403	PAF329
LWA404	PAF309
LWA421	PAF301
LWA422	PAF301
LWA423	PAF301
LWA430	PAF300
LWA450	PAN300B
LWA460	PAN301B
LWC400	PTF320
LWC401	PTF300
LWC402	PTF300

- In the case of S10V Ladder Chart System, Ver. 01, Rev. 21 or later:

Actual model number	Registration model number
LWA400	LWA400
LWA401	LWA401
LWA402	LWA402
LWA403	LWA403
LWA404	LWA404
LWA421	LWA421
LWA422	LWA422
LWA423	LWA421
LWA430	LWA430
LWA435	LWA435 (*)
LWA450	LWA450
LWA460	LWA460
LWC400	LWC400
LWC401	LWC401
LWC402	LWC402

(*) The model LWA435 may be used in conjunction with the following: a model LQP510 LPU module, Rev. R or later, or a model LQP710 LPU module, Rev. N or later, and a model LWS410/LWS010 E.STATION module.

5.2.3 Data area formats

(1) Formats for analog input modules

(a) Format used in remote I/O transfer -- for LWA400 to 404, LWA421 to 423, LWA430, LWA450, LWA460, LWC400 to 402

Data area: Registered data area (or EW area)

	2^{15} 2^{11}	2^{10} 2^{0}
1st word	S ··· S	Channel 0 input data
2nd word	S ··· S	Channel 1 input data
3rd word	S ··· S	Channel 2 input data
4th word	S ··· S	Channel 3 input data
	↑ Sign	↑ Data: Values in the range -2,048 to 2,047

- If an input value overflows in the data area, the result will be as follows:

  For positive-value overflow: 2,047

  For negative-value overflow: -2,048
- If an input value is insignificant, it is automatically set to H8000.

(b) Format used in remote I/O transfer -- for LWA435

Data area: Registered data area (or EW area)

	2^{15} 2^{13}	2^{12} 2^{0}
1st word	S ··· S	Channel 0 input data
2nd word	S ··· S	Channel 1 input data
3rd word	S ··· S	Channel 2 input data
4th word	S ··· S	Channel 3 input data
	↑ Sign	↑ Data: Values in the range -8,191 to 8,191 (the value -8,192 is not displayed)

- If an input value overflows in the data area, the result will be as follows:

  For positive-value overflow: 8,191

  For negative-value overflow: -8,191
- If an input value is insignificant, it is automatically set to H8000.

(c) Format used in J.NET data transfer -- for LWA400 to 404, LWA421 to 423, LWA430, LWA450, LWA460, LWC400 to 402

Data area: Storage area set by J.NET setup tool

	2^{15} 2^{12}	2^{11}	2^{10} 2^{0}
1st word	0 ··· 0	S	Channel 0 input data
2nd word	0 ··· 0	S	Channel 1 input data
3rd word	0 ··· 0	S	Channel 2 input data
4th word	0 ··· 0	S	Channel 3 input data

↑ Sign

↑ Data: Values in the range -2,048 to 2,047

(*) The J.NET system does not support a model LWA435 module and may not be used with it.

(2) Formats for analog output modules

(a) Formats used in remote I/O transfer

- For voltage output modules

Data area: Registered data area (or EW area)

	2^{15}	2^{11}	2^{10} 2^{0}
1st word	Unused	S	Channel 0 output data
2nd word	Unused	S	Channel 1 output data
3rd word	Unused	S	Channel 2 output data
4th word	Unused	S	Channel 3 output data

↑ Sign

↑ Data: Values in the range -2,048 to 2,047

- For current output modules

Data area: Registered data area (or EW area)

	2^{15}	2^{11} 2^{0}
1st word	Unused	Channel 0 output data
2nd word	Unused	Channel 1 output data
3rd word	Unused	Channel 2 output data
4th word	Unused	Channel 3 output data

↑ Data: Values in the range 0 to 4,095

(b) Formats used in J.NET data transfer

- For voltage output modules

Data area: Storage area set by J.NET setup tool

	2^{15}	2^{11}	2^{10} 2^{0}
1st word	Unused	S	Channel 0 output data
2nd word	Unused	S	Channel 1 output data
3rd word	Unused	S	Channel 2 output data
4th word	Unused	S	Channel 3 output data

Sign Data: Values in the range -2,048 to 2,047

- For current output modules

Data area: Storage area set by J.NET setup tool

	2^{15}	2^{11} 2^{0}
1st word	Unused	Channel 0 output data
2nd word	Unused	Channel 1 output data
3rd word	Unused	Channel 2 output data
4th word	Unused	Channel 3 output data

Data: Values in the range 0 to 4,095

5.2.4 Data areas for 8-channel analog input/output modules

Every 8-channel analog input module requires XW areas for input of analog data, and every 8-channel analog output module requires YW areas for output of analog data. The table below shows every such analog input/output module's usable channels, which are determined from the I/O point count setting used with the I/O station, and the corresponding data area addresses.

Channel no.	Input (output) data area address	I/O point count setting			
		128	64	32	16
0	XW (YW) △▲0+0	√	√	√	√
1	XW (YW) △▲0+10	√	√	√	–
2	XW (YW) △▲0+20	√	√	–	–
3	XW (YW) △▲0+30	√	√	–	–
4	XW (YW) △▲0+40	√	–	–	–
5	XW (YW) △▲0+50	√	–	–	–
6	XW (YW) △▲0+60	√	–	–	–
7	XW (YW) △▲0+70	√	–	–	–

Symbols: √: Usable; –: Not usable.

△▲: From 00 to 7F when the I/O point count setting is 16;
From 00 to 7E when the I/O point count setting is 32;
From 00 to 7C when the I/O point count setting is 64; or
From 00 to 78 when the I/O point count setting is 128.

5.2.5 Data formats of 8-channel analog input/output modules

(1) Data formats of 8-channel analog input modules

(a) Data format used at remote I/O transfer

Data area: XW area:

	2^{15}	2^{14} … 2^{4}	2^{3} … 2^{0}
1st word	S	Channel 0 input data	0 to 0
2nd word	S	Channel 1 input data	0 to 0
3rd word	S	Channel 2 input data	0 to 0
4th word	S	Channel 3 input data	0 to 0
5th word	S	Channel 4 input data	0 to 0
6th word	S	Channel 5 input data	0 to 0
7th word	S	Channel 6 input data	0 to 0
8th word	S	Channel 7 input data	0 to 0

↑ Sign ↑ Data: Values in the range -2,048 to 2,047

- If the input data area of any given channel overflows, the resulting data in the data area is as follows:
  2,047 when the overflow is caused by a positive value; or
  -2,048 when the overflow is caused by a negative value.
- Input data right after power-on of the I/O power supply is H0000.

(b) Data format used at data transfer by J.NET module

Data area: Storage area set for J.NET module:

	2^{15} 2^{12}	2^{11}	2^{10} 2^{0}
1st word	0 to 0	S	Channel 0 input data
2nd word	0 to 0	S	Channel 1 input data
3rd word	0 to 0	S	Channel 2 input data
4th word	0 to 0	S	Channel 3 input data
5th word	0 to 0	S	Channel 4 input data
6th word	0 to 0	S	Channel 5 input data
7th word	0 to 0	S	Channel 6 input data
8th word	0 to 0	S	Channel 7 input data

Sign ↑ Data: Values in the range -2,048 to 2,047 ↑

(2) Data formats of 8-channel analog output modules

(a) Data formats used at remote I/O transfer

- Data format of voltage output modules

Data area: YW area:

	2^{15}	2^{14} 2^{4}	2^{3} 2^{0}
1st word	S	Channel 0 output data	Unused
2nd word	S	Channel 1 output data	Unused
3rd word	S	Channel 2 output data	Unused
4th word	S	Channel 3 output data	Unused
5th word	S	Channel 4 output data	Unused
6th word	S	Channel 5 output data	Unused
7th word	S	Channel 6 output data	Unused
8th word	S	Channel 7 output data	Unused

Sign ↑ Data: Values in the range -2,048 to 2,047 ↑

- Data format of current output modules

Data area: YW area:

	2^{15}	2^{14} 2^{4}	2^{3} 2^{0}
1st word	X	Channel 0 output data	Unused
2nd word	X	Channel 1 output data	Unused
3rd word	X	Channel 2 output data	Unused
4th word	X	Channel 3 output data	Unused
5th word	X	Channel 4 output data	Unused
6th word	X	Channel 5 output data	Unused
7th word	X	Channel 6 output data	Unused
8th word	X	Channel 7 output data	Unused

Unused ↑ Data: Values in the range 0 to 2,047 ↑

(b) Data formats used at data transfer by J.NET module

- Data format of voltage output modules

Data area: Storage area set for J.NET module:

	2^{15} 2^{12}	2^{11}	2^{10} 2^{0}
1st word	Unused	S	Channel 0 output data
2nd word	Unused	S	Channel 1 output data
3rd word	Unused	S	Channel 2 output data
4th word	Unused	S	Channel 3 output data
5th word	Unused	S	Channel 4 output data
6th word	Unused	S	Channel 5 output data
7th word	Unused	S	Channel 6 output data
8th word	Unused	S	Channel 7 output data

↑ Sign ↑ Data: Values in the range -2,048 to 2,047

- Data format of current output modules

Data area: Storage area set for J.NET module:

	2^{15} 2^{11}	2^{10} 2^{0}
1st word	Unused	Channel 0 output data
2nd word	Unused	Channel 1 output data
3rd word	Unused	Channel 2 output data
4th word	Unused	Channel 3 output data
5th word	Unused	Channel 4 output data
6th word	Unused	Channel 5 output data
7th word	Unused	Channel 6 output data
8th word	Unused	Channel 7 output data

↑ Data: Values in the range 0 to 2,047

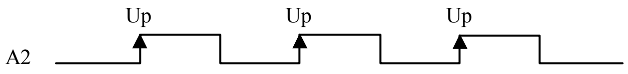
5.3 Using Pulse Counter Modules

5.3.1 Available functions

(1) Input

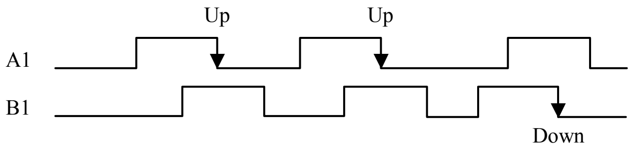
(a) 1-phase pulse input

Any available pulse counter module counts up the pulses in an input signal from input A2 by detecting their rising edge, as shown below.



(b) 2-phase pulse input

Any available pulse counter module counts up or down the pulses in one of two input signals from inputs A1 or B1 by detecting their rising edge, as shown below. The direction of counting is determined by detecting which input signal leads the other.



- All the available counter modules function as ring counters:
  - In the case of model LWC400:
    The count +16,383 is set to 0 when the counter is counted up by 1.
    Then, when the counter is counted down by 1, the count 0 is set to +16,383.
  - In the case of models LWC401 and LWC402:
    The count +8,191 is set to -8,192 when the counter is counted up by 1.
    Then, when the counter is counted down by 1, the count -8,192 is set to +8,191.
- Do not apply both of the 1-phase and 2-phase pulse inputs to any available counter module. If this rule is not observed, it will result in malfunction of the counter module.

(c) Stop input

- In the case of model LWC400:

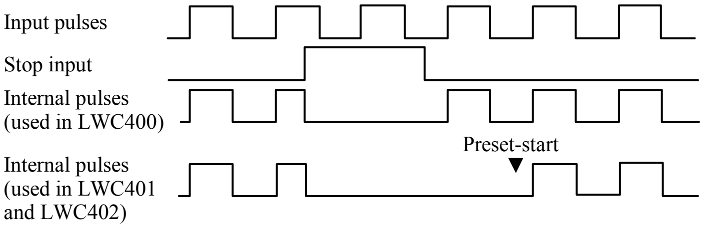
  The stop input function of the model LWC400 disables the input of pulse signals by the counter module when the stop input signal is turned on.

  When it is turned off, the function enables the input.

- In the case of models LWC401 and LWC402:

  The stop input function of the models LWC401 and LWC402 disables the input of pulse signals by the counter modules when the stop input signal is turned on.

  When it is turned off and a preset-start is made using an appropriate control code (described later in this section), the function enables the input.



(d) Comparison output

The comparison output function outputs the result of comparison of a comparison data value (R) and a count value (C).

The comparison operation performed is one of the following:

- R > C
- R < C
- R = C

In the last comparison operation above, the result will be held until the latch is reset by setting a control code.

(e) LED indication

- Pulse input indication LED:
  Comes on and goes out in synchronism with 1-phase or 2-phase pulse counting.
- Comparison result indication LED:
  Is lit in synchronism with comparison output.

■ The timing of comparison output and LED indication differs depending on models of counter modules:

- In the case of model LWC400:
  Every time the content of an internal register used for comparison output is updated with a new value, comparison output is performed automatically, and immediately, to output the new content of that register, regardless of whether a pulse input is made or not. For example, when a new data value is set in the comparison data register, it is automatically output by comparison output immediately and the comparison result indication LED is lit in synchronism with that output.
- In the case of models LWC401 and LWC402:
  Even if the content of an internal register used for comparison output is updated with a new value, comparison output is not automatically performed to output the new content of that register until a pulse input is made. For example, when a new data value is set in the comparison data register, it is not automatically output by comparison output. The new data value will be output later when a pulse input is made. In synchronism with that output, the comparison result indication LED will be lit.

5.3.2 How to use pulse counter modules

(1) Registering the registration number for a counter module

The registration number of a pulse counter module can be registered according to the instructions given in Subsection 5.2.2, “Registering data areas.”

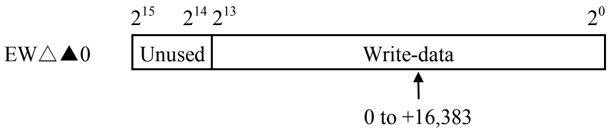
(a) General format of data areas

Data areas have the following general format:

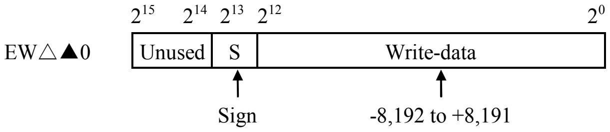
EW△▲0	Write-data
EW△▲0+10	Control code
EW△▲0+20	Read-data
EW△▲0+30	Status code

(b) Write-data

- ■ In the case of model LWC400:

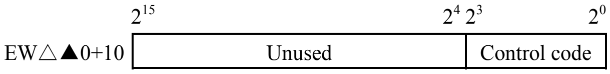


- ■ In the case of models LWC401 and LWC402:



(c) Control codes

A control code is set in the data area, as shown below, when, for example, you want to make a preset-start or set a comparison value in the comparison data register of the counter module. This should be done following the writing of a preset value or comparison value to the write-data storage location in the data area.



■ In the case of model LWC400:

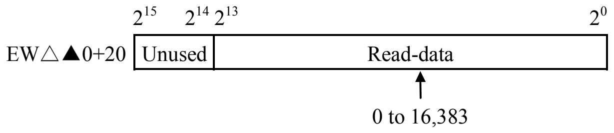
Control code	Code name	Function
8	Stop count	Stops the pulse measurement in progress.
4	Preset-start	Sets a specified preset value in the counter module and starts pulse measurement.
2	Set comparison value	Sets a specified comparison value in the comparison data register of the counter module and starts pulse measurement.
1	Reset latch	Resets the match output signal currently latched and starts pulse measurement.
Other	Unused	———

■ In the case of models LWC401 and LWC402:

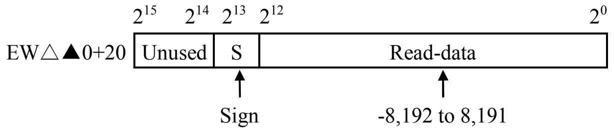
Control code	Code name	Function
8	Stop count	Stops the pulse measurement in progress.
4	Preset-start	Sets a specified preset value in the counter module and starts pulse measurement.
2	Set comparison value	Sets a specified comparison value in the comparison data register of the counter module.
1	Reset latch	Resets the match output signal currently latched.
Other	Unused	———

(d) Read-data

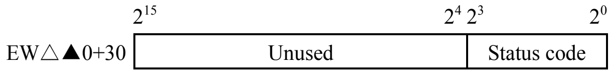
- In the case of model LWC400:



- In the case of models LWC401 and LWC402:



(e) Status codes



- In the case of model LWC400:

Status code	Code name	Reported state
8	Count stopped	Counting by the counter module is currently in stop state.
4	R>C	A given comparison value is larger than the count value.
2	R=C	A given comparison value is equal to the count value.
1	R<C	A given comparison value is smaller than the count value.

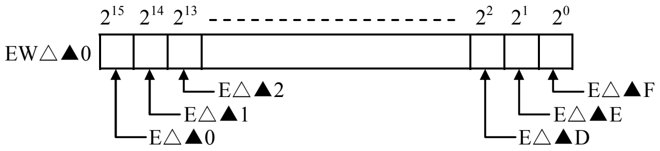
If the match (R = C) output signal is currently latched and the result of comparison is either R > C or R < C, then the status code set in place is 2 (R = C).

- In the case of models LWC401 and LWC402:

Status code	Code name	Reported state
8	Count stopped	The control code that was previously transferred is set in place.
4	Preset-started	
2	Comparison value set	
1	Latch reset	

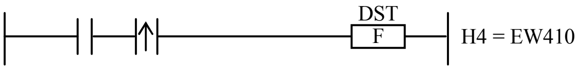
(f) Bit organization in data areas

The bit organization of the EW storage locations in a data area is as shown below.

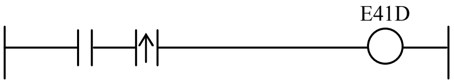


This bit organization makes it possible to use control codes and status codes either as arithmetic functions or coils. For example, a ladder program can use the following arithmetic function or coil to make a preset-start:

- An arithmetic function to make a preset-start:



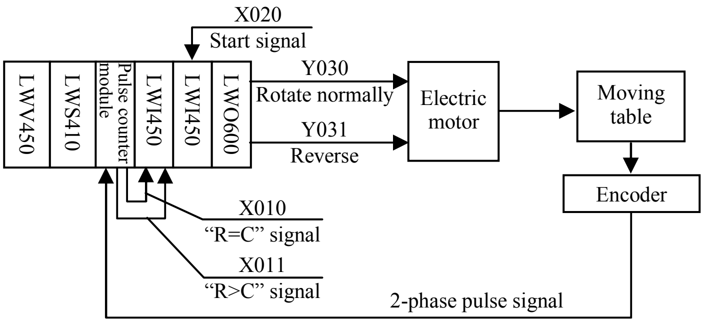
- A coil to make a preset-start:



(g) Example program

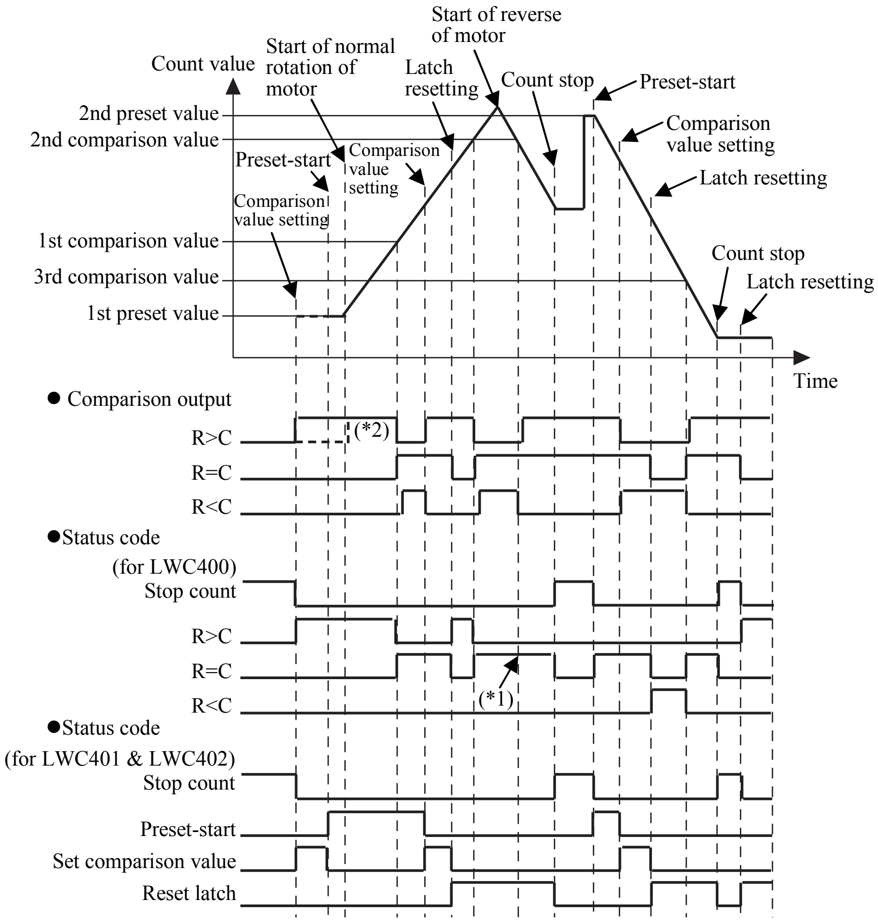
An example program using a pulse counter module is given below. The following describes what the program does, and shows the contents of the program.

- Operations: The program performs the following: 1) It starts an electric motor by reception of a start signal from external source, 2) measures pulses that are generated by an encoder rotating with the movement of a moving table, 3) moves the table to a predetermined position, and then 4) stops the motor.
- Operational details: The program operates as detailed in Figure 5-4, “Operational Chart.”
- Configuration: The things used in the program are as follows:



- Registering a registration number

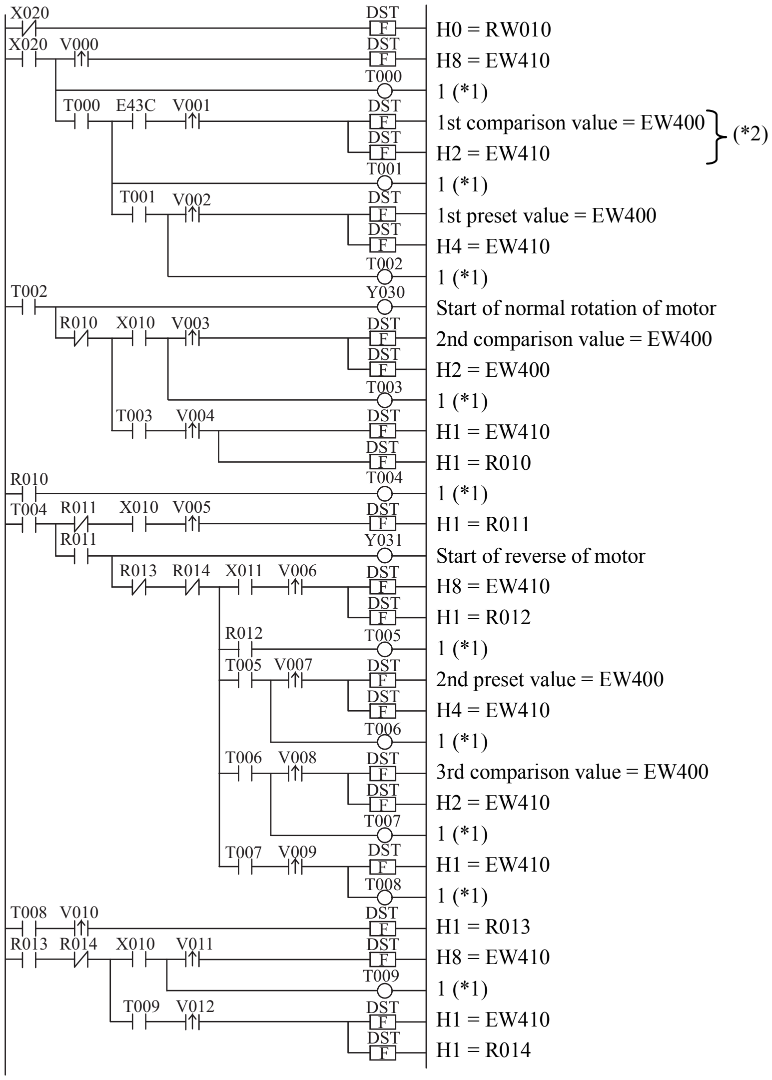
  In this example, the registration number 01 (EW400 to EW430) is assumed to be registered for the pulse counter module.



(*1) When the comparison result is “R=C”, the status code indicating “R=C” is set in place and remains unchanged thereafter until after latch resetting.

(*2) This part (dotted line) of the comparison output signal occurs when the operation mode used is mode 2.

Figure 5-4 Operational Chart



(*1) In this rung, it is necessary for the program to wait at least the remote I/O transfer time (for example, 100 ms).

(*2) Write the data to the write-data storage location in the data area and then store the control code in place.

Figure 5-5 The Contents of the Example Program

(2) The status of counter modules upon power-on

Table 5-4 shows the status of pulse counter modules that occurs immediately after the power to the I/O unit in which they are installed is tuned on. This table is also applicable to expansion units in which pulse counter modules are installed.

Table 5-4 The Status of Pulse Counter Modules upon Power-On

Item		Status
Module		Counting stopped
Internal registers	Preset value	0
	Comparison value	0
	Count value	0
Comparison output	R<C	Off
	R=C	Off
	R>C	Off
LED indication	R>C	Off
	R=C	Off
	R<C	Off

(3) The status of counter modules during stop state of remote I/O transfer

Table 5-5 shows the status of pulse counter modules that occurs while remote I/O transfer is stopped.

Table 5-5 The Status of Pulse Counter Modules during Stop State of Remote I/O Transfer

Module model		LWC400		LWC401 & LWC402 (*1)		LWC401 & LWC402 (*2)	
Remote I/O transfer		Stopped	In progress	Stopped	In progress	Stopped	In progress
Module		Operating normally (*3)	Operating normally	Operating normally (*3)	Operating normally	Counting stopped	Operating normally
Internal registers	Preset value	Same as above	Same as above	Same as above	Same as above	Cleared	Same as above
	Comparison value					Held	
	Count value					Cleared	
Comparison output	R<C					Held	
	R=C					Off	
	R>C					Held	
LED indication	R>C					Held	
	R=C					Off	
	R<C	Same as above	Same as above	Same as above	Same as above	Held	Same as above

(*1) These counter modules are used with the station module's output hold terminals (HOLD and COM) shorted.

(*2) These counter modules are used with the station module's output hold terminals (HOLD and COM) left open.

(*3) This normal operation proceeds according to the control code that was present immediately before remote I/O transfer has been stopped.

(4) The status of counter modules (in I/O units) upon power-up of the CPU unit

Table 5-6 shows the status of pulse counter modules, installed in I/O units, that occurs immediately after the power to the CPU unit used with them is tuned on.

Table 5-6 The Status of Pulse Counter Modules (in I/O Units) upon Power-Up of the CPU Unit

Module model		LWC400		LWC401 & LWC402 (*1)		LWC401 & LWC402 (*2)	
Power to CPU unit		Off	Powered up	Off	Powered up	Off	Powered up
Module		Operating normally (*3)	Operating normally	Operating normally (*3)	Operating normally	Counting stopped	Operating normally
Internal registers	Preset value	Same as above	Same as above	Same as above	Same as above	Cleared	Same as above
	Comparison value					Held	
	Count value					Cleared	
Comparison output	R<C					Held	
	R=C					Off	
	R>C					Held	
LED indication	R>C					Held	
	R=C					Off	
	R<C	Same as above	Same as above	Same as above	Same as above	Held	Same as above

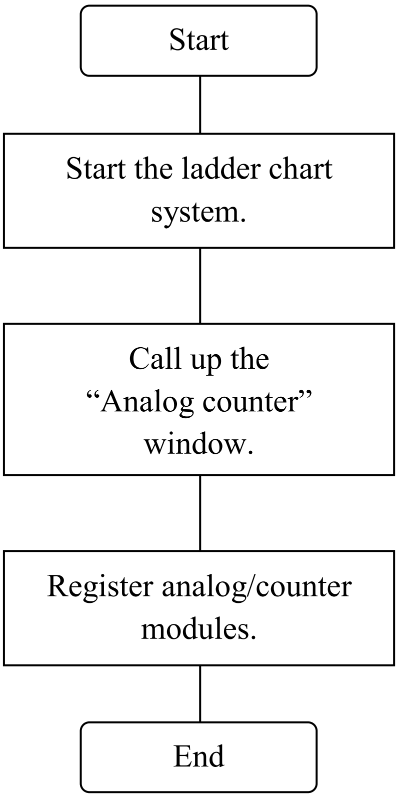
(*1) These counter modules are used with the station module's output hold terminals (HOLD and COM) shorted.

(*2) These counter modules are used with the station module's output hold terminals (HOLD and COM) left open.

(*3) This normal operation proceeds according to the control code that was present immediately before the CPU unit has been powered up.

5.4 Registration in the Analog Support Program

None of the analog modules (and pulse counter modules) covered in this manual can be used without prior registration in the Analog Support Program. This section describes the procedure used to register such modules in the program. The flowchart below shows the registration procedure that is used in cases where the LPU used is one of the following: the model LQP510 LPU, Module Rev. R, and the model LQP710 LPU, Module Rev. N.



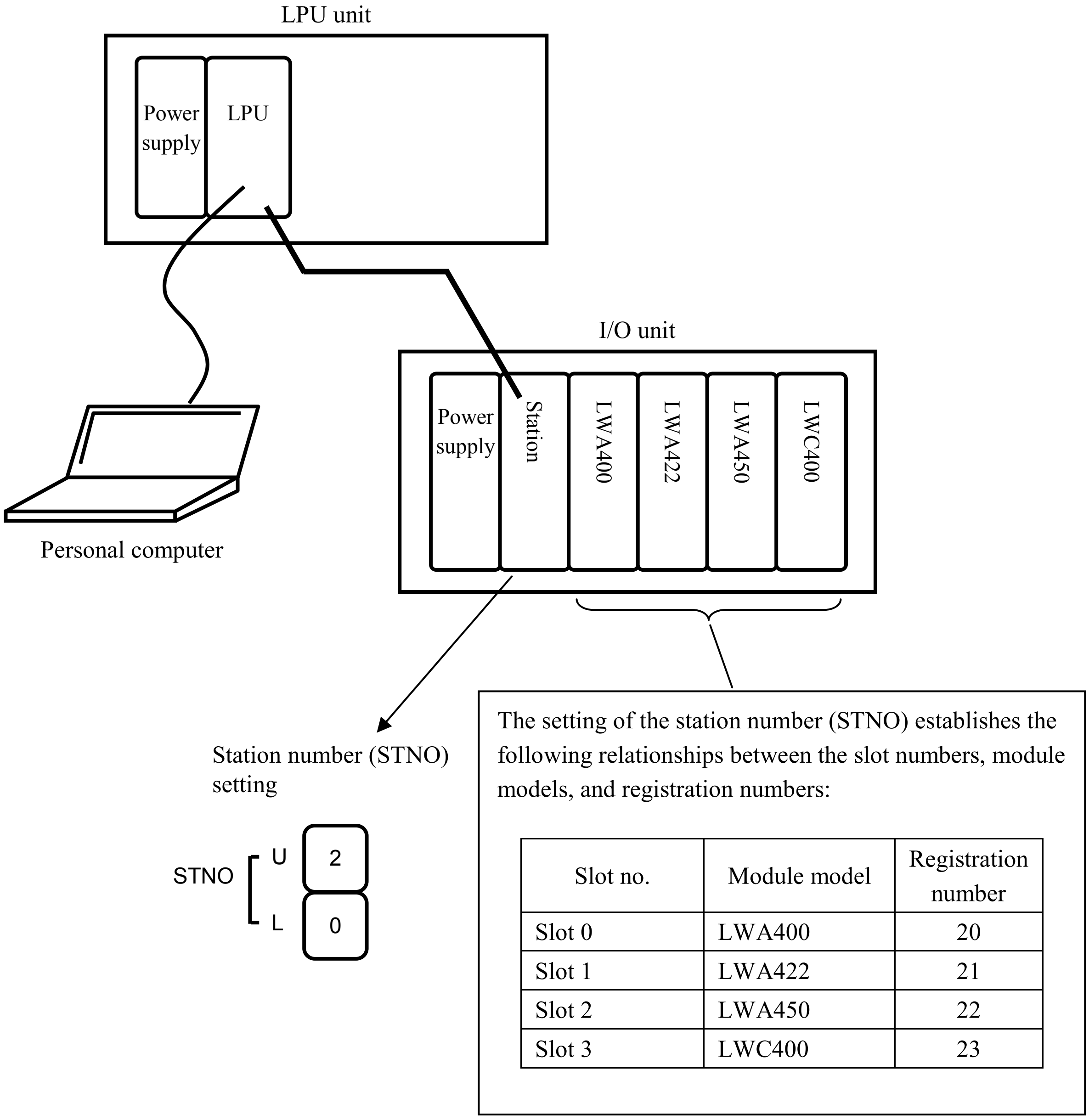
Launches the ladder chart system and establishes a connection with the tool (personal computer) in use.

Opens the "Analog counter" window.

Sets up the correspondence between the registration numbers and the analog/counter modules through registration.

5.4.1 An example of registration in the Analog Support Program

Figure 5-6 shows a hardware configuration in which three analog modules and one counter module are mounted in an I/O module. This subsection shows how to register those modules in the Analog Support Program.



The setting of the station number (STNO) establishes the following relationships between the slot numbers, module models, and registration numbers:

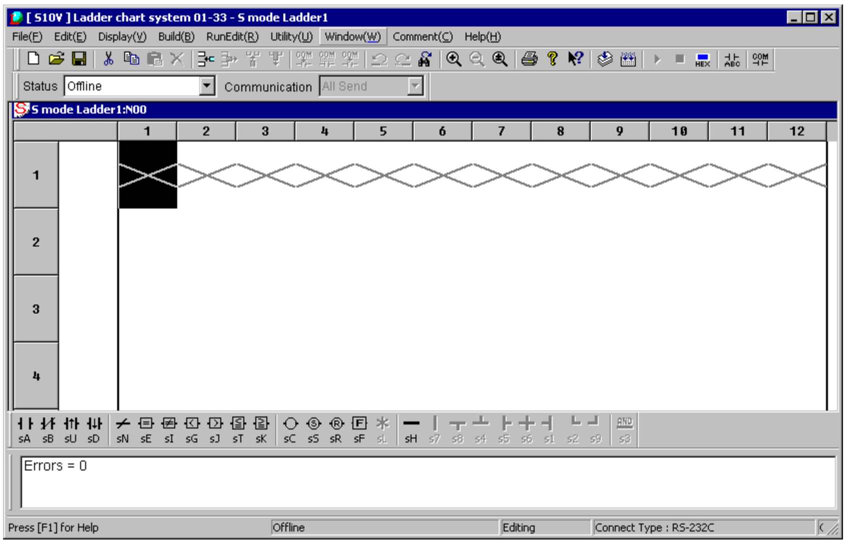
Slot no.	Module model	Registration number
Slot 0	LWA400	20
Slot 1	LWA422	21
Slot 2	LWA450	22
Slot 3	LWC400	23

Figure 5-6 An Example Hardware Configuration in Which Four Modules Are Mounted: Three Analog and One Counter.

<Starting the ladder chart system>

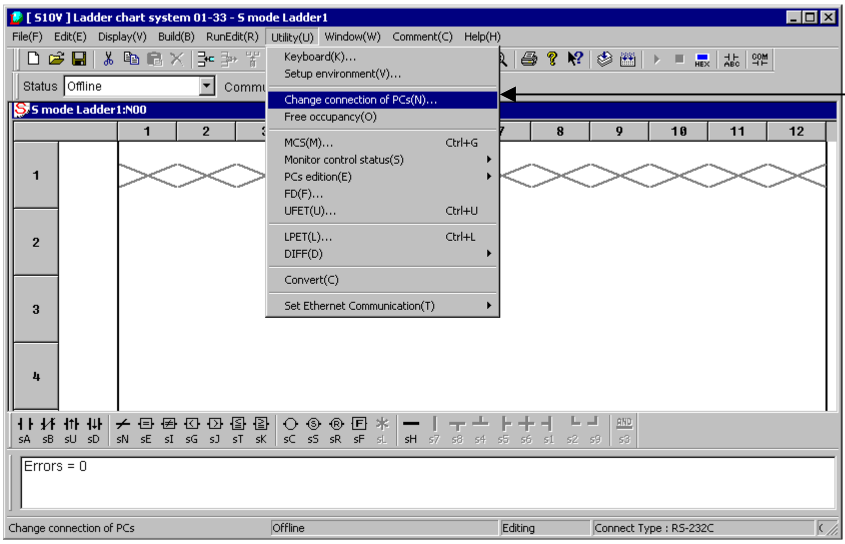
① Start the S10V ladder chart system on your personal computer.

② The [[S10V] Ladder chart system] window shown below will appear.



Errors = 0

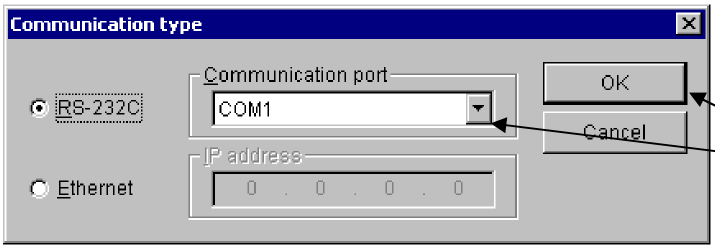
③ Click [Utility(U)] in the ladder chart system's main menu and choose [Change connection of PCs(N)] from the pulldown menu displayed.



Errors = 0

Choose [Change connection of PCs(N)] from the [Utility(U)] pulldown menu.

④ Specify the desired communication port and click the [OK] button.



Communication type

● RS-232C

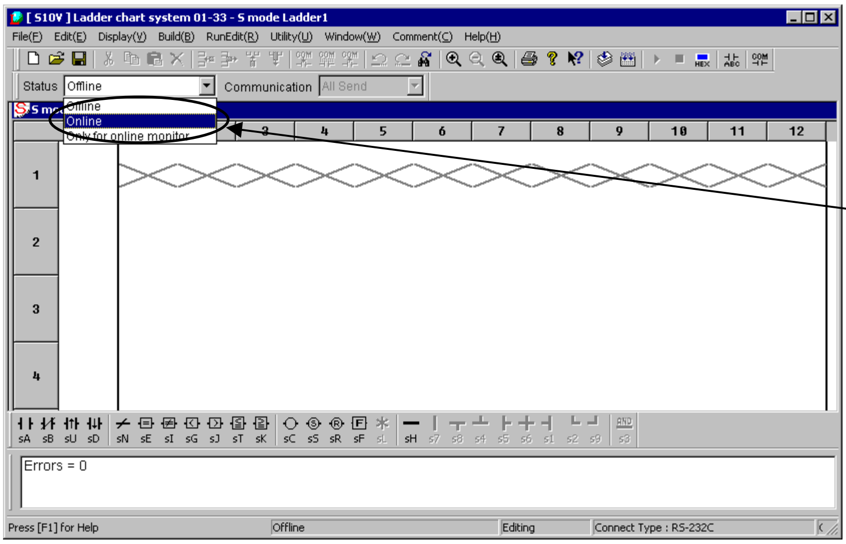
○ Ethernet

Communication port: COM1

IP address: 0 . 0 . 0 . 0

Specify the desired communication port and click [OK].

⑤ Choose [Online] from the [Status] list box.



[S10V] Ladder chart system 01-33 - S mode Ladder1

Status: Offline

Communication: All Send

Errors = 0

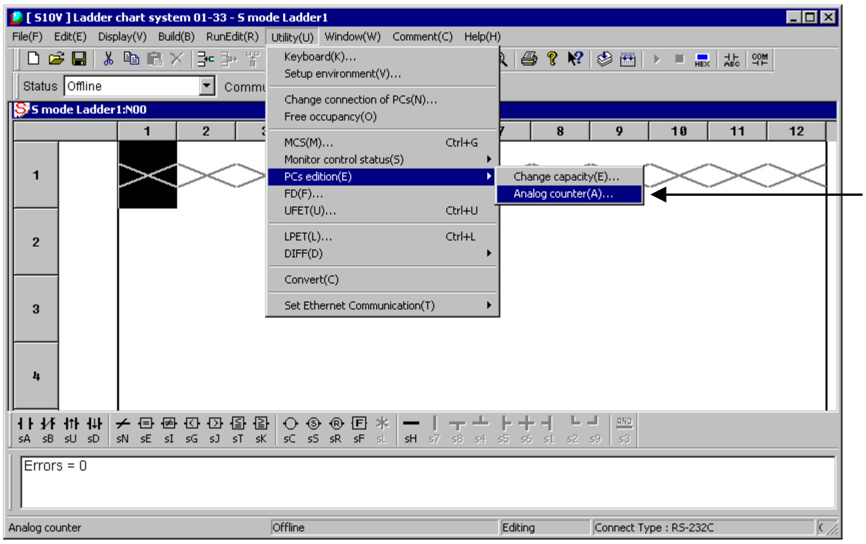
Press [F1] for Help | Offline | Editing | Connect Type : RS-232C

Change the communication status to [online].

Note: If registration in the Analog Support Program is attempted without changing the communication status to “online”, the result of the registration will be stored in a storage area related to ladder programs on the personal computer. However, if it is attempted in “online” state, the result will be written to the CPU or LPU.

<Calling up the “Analog counter ” window>

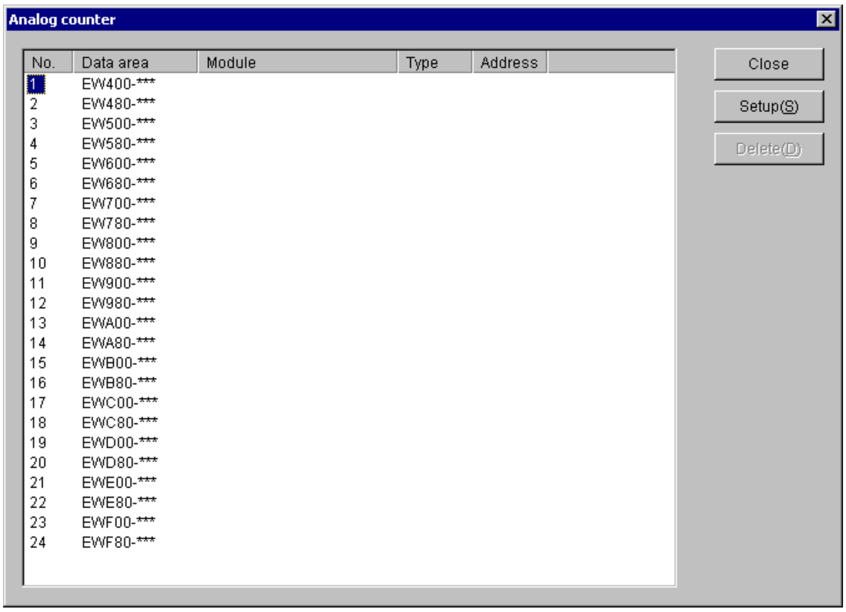
① Click [Utility(U)] in the ladder chart system’s main menu and choose [PCs edition(E)] - [Analog counter(A)] from the pulldown menu displayed.



Errors = 0

Choose [Analog counter(A)] from the pulldown menu.

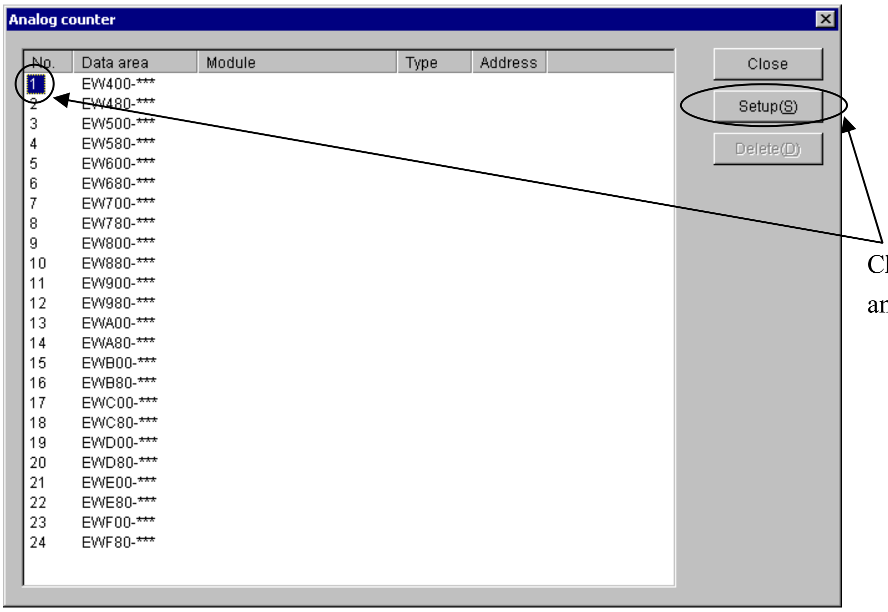
② The “Analog counter” window as shown below appears, which is the registration window to register registration numbers for analog and counter modules.



No.	Data area	Module	Type	Address
1	EW400-***			
2	EW480-***			
3	EW500-***			
4	EW580-***			
5	EW600-***			
6	EW680-***			
7	EW700-***			
8	EW780-***			
9	EW800-***			
10	EW880-***			
11	EW900-***			
12	EW980-***			
13	EWA00-***			
14	EWA80-***			
15	EWB00-***			
16	EWB80-***			
17	EWC00-***			
18	EWC80-***			
19	EWD00-***			
20	EWD80-***			
21	EWE00-***			
22	EWE80-***			
23	EWF00-***			
24	EWF80-***			

<Registering registration numbers for modules>

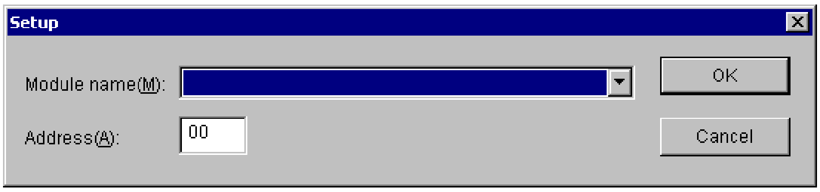
① Register the registration number for an analog or counter module via the “Analog counter” window displayed. To accomplish this, click the desired number in the “No.” column and click the [Setup] button.
In this example, we will register an analog module as the No. 1 module.



No.	Data area	Module	Type	Address
1	EW400-***			
2	EW480-***			
3	EW500-***			
4	EW580-***			
5	EW600-***			
6	EW680-***			
7	EW700-***			
8	EW780-***			
9	EW800-***			
10	EW880-***			
11	EW900-***			
12	EW980-***			
13	EWA00-***			
14	EWA80-***			
15	EWB00-***			
16	EWB80-***			
17	EWC00-***			
18	EWC80-***			
19	EWD00-***			
20	EWD80-***			
21	EWE00-***			
22	EWE80-***			
23	EWF00-***			
24	EWF80-***			

Choose No. 1 in the “No.” column and click the [Setup] button.

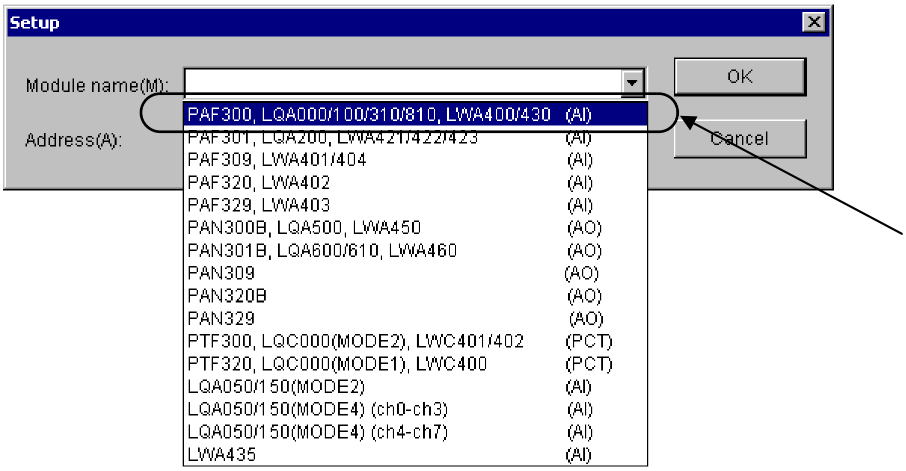
② The window as shown below appears, which is the registration window to register registration numbers for analog and counter modules.



Module name(M):

Address(A): 00

③ As an example, we will register the analog module mounted in slot 0 in the I/O unit, which is shown in Figure 5-6, “An Example Hardware Configuration in Which Four Modules Are Mounted: Three Analog and One Counter.” To accomplish this, choose the model number “LWA400” in the “Module name(M)” list box, as shown below.
If you are a user of the S10V Ladder Chart System, Ver. 01 and Rev. 21 or later, specify the model number of the analog module directly.
If not (i.e., you are a user of the S10V Ladder Chart System, Ver. 01 and Rev. 20 or earlier, or the ladder chart system for S10/2α and S10mini controllers), you cannot specify the model number directly. It must be replaced with its registration model number according to the information given in the table below, and the registration model number must be specified instead.

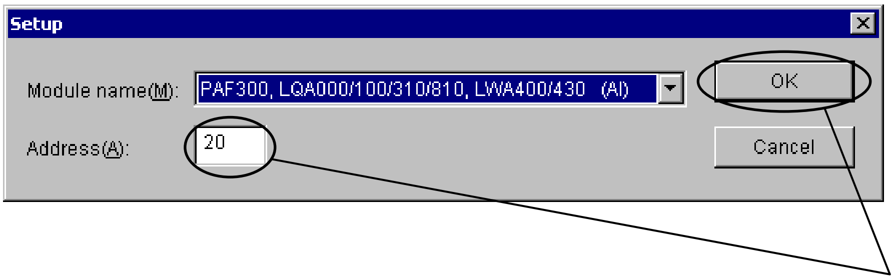


Choose the model number “LWA400” in the list box.

- The registration model numbers for analog I/O modules in the case of S10V Ladder Chart System, Ver. 01, Rev. 20 or earlier, or S10/2α / S10mini Ladder Chart System:

Actual model number	Registration model number
LWA400	PAF300
LWA401	PAF309
LWA402	PAF320
LWA403	PAF329
LWA404	PAF309
LWA421	PAF301
LWA422	PAF301
LWA423	PAF301
LWA430	PAF300
LWA450	PAN300B
LWA460	PAN301B
LWC400	PTF320
LWC401	PTF300
LWC402	PTF300

④ Following the specified model number, specify the registration number for the analog module. To accomplish this, enter a numeric value of 20 directly into the “Address” box, which is actually the address of slot 0 determined by the STNO setting, and then click the [OK] button.

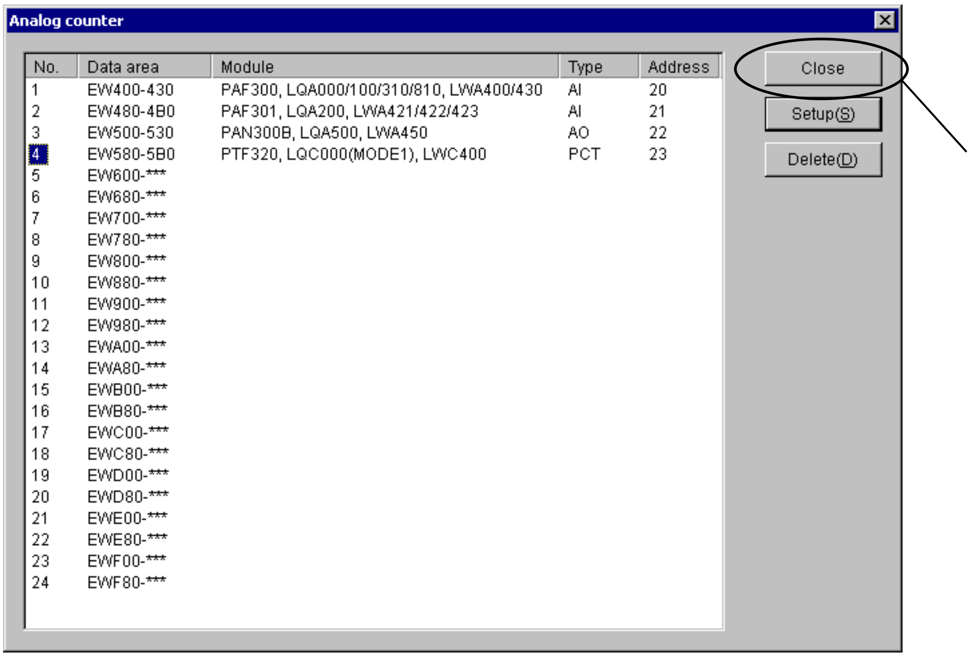


Module name(M): PAF300, LQA000/100/310/810, LWA400/430 (AI)

Address(A): 20

Enter a 20 and click [OK].

⑤ Repeat Steps ① through ⑤ for each of slots 1 through 3.
When all of the analog and counter modules are registered, the window as shown below appear. Click the [Close] button in the window to exit the module registration session.

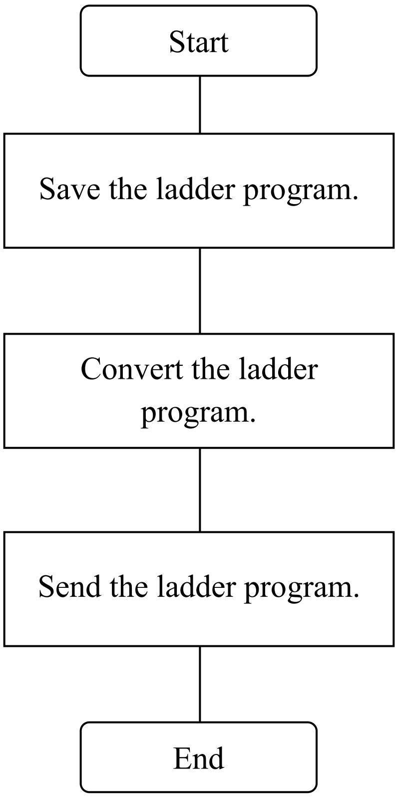


No.	Data area	Module	Type	Address
1	EW400-430	PAF300, LQA000/100/310/810, LWA400/430	AI	20
2	EW480-4B0	PAF301, LQA200, LWA421/422/423	AI	21
3	EW500-530	PAN300B, LQA500, LWA450	AO	22
4	EW580-5B0	PTF320, LQC000(MODE1), LWC400	PCT	23
5	EW600-***			
6	EW680-***			
7	EW700-***			
8	EW780-***			
9	EW800-***			
10	EW880-***			
11	EW900-***			
12	EW980-***			
13	EWA00-***			
14	EWA80-***			
15	EWB00-***			
16	EWB80-***			
17	EWC00-***			
18	EWC80-***			
19	EWD00-***			
20	EWD80-***			
21	EWE00-***			
22	EWE80-***			
23	EWF00-***			
24	EWF80-***			

Click [Close] to exit the registration session.

5.5 Ladder Program Conversion at the Replacement of S10/4α I/O Modules

When you replace I/O modules of an S10/4α controller by using an expansion mount base, be sure to convert the existing ladder program by performing the following procedure.



Saves the ladder program used on the S10/4α controller. Information on how to save it is given in Subsection 5.5.2, “Saving the ladder program.”

Converts the saved ladder program to S10mini version. Information on how to convert it is given in Subsection 5.5.3, “Converting the ladder program.”

Sends the converted ladder program to the S10mini controller. Information on how to send it is given in Subsection 5.5.4, “Sending the ladder program.”

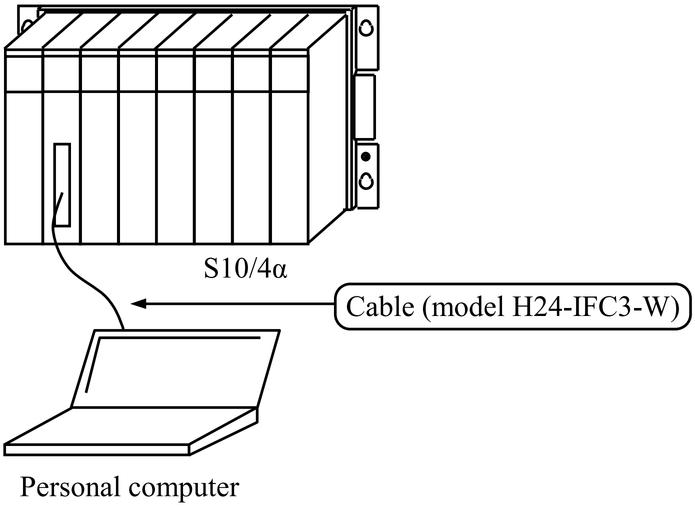
5.5.1 Items necessary for ladder program conversion work

No.	Item	Model	Description
1	Cable	H24-IFC3-W	Connects the S10/4α controller and a personal computer together.
2	Cable	S10m-IFC3-W	Connects the S10mini CPU mounted in an HSC-2100 expansion unit and a personal computer together.
3	Program	S7890-17	Is an S10/4α Ladder Chart System software product.
4	Program	S7890-02	Is an S10mini Ladder Chart System software product.
5	Personal computer	–	Is one that runs Microsoft® Windows® 2000 or Microsoft® Windows® XP operating system and in which both of the above software products are installed.

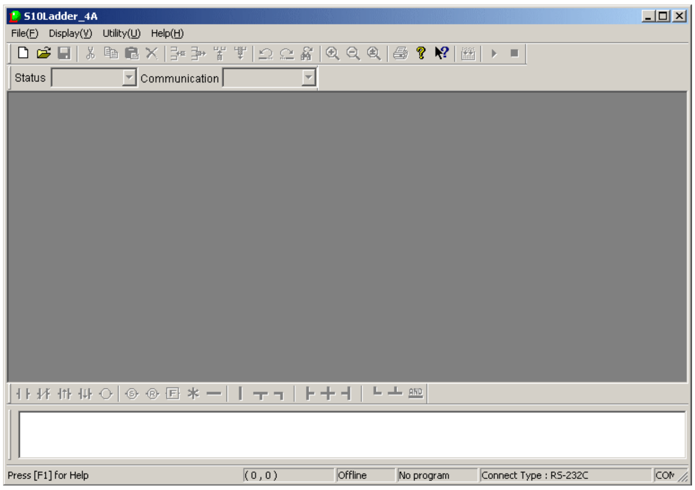
5.5.2 Saving the ladder program

To save the ladder program used on the S10/4α controller, perform the following procedure:

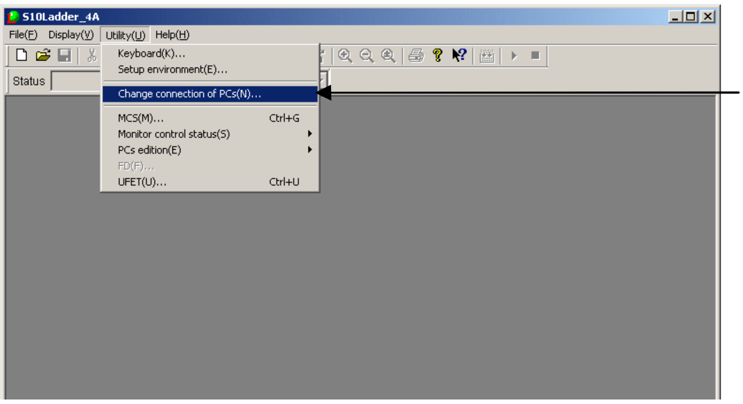
① Connect the S10/4α controller and the personal computer together, as shown below.



② Start the S10/4α Ladder Chart System. Then, the “S10Ladder_4A” window as shown below appears.



③ If a necessary connection setting is already made, proceed to Step ⑤.
Otherwise, choose [Change connection of PCs(N)] from the [Utility(U)] pulldown menu.



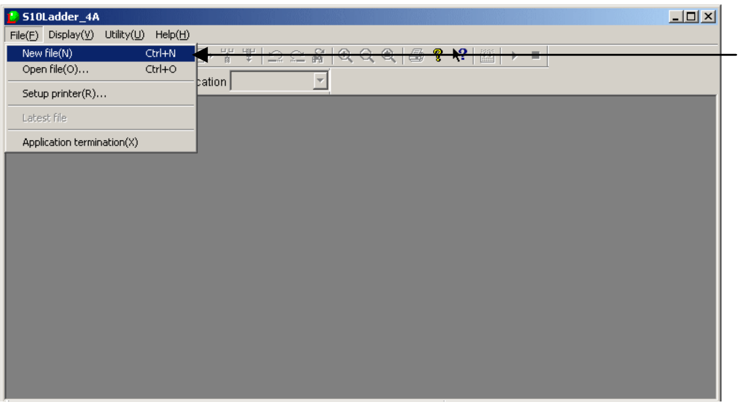
Choose [Change connection of PCs(N)] from [Utility(U)] pulldown menu.

④ Specify the desired communication port and click the [OK] button.

Communication port: COM1

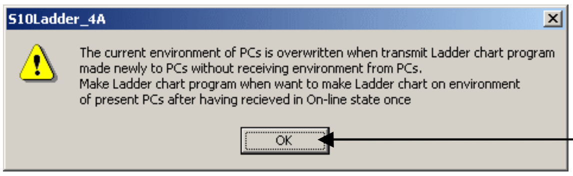
Specify the communication port and click [OK]. ("COM1" is specified as the communication port.)

⑤ Choose [New file(N)] from the [File(F)] pulldown menu.



Choose [New file(N)] from [File(F)] pulldown menu.

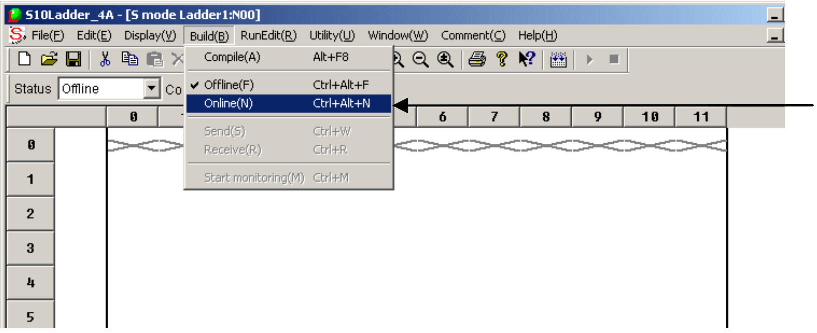
⑥ The dialog box shown below appears.   Click the [OK] button.



The current environment of PCs is overwritten when transmit Ladder chart program made newly to PCs without receiving environment from PCs.
Make Ladder chart program when want to make Ladder chart on environment of present PCs after having recieved in On-line state once

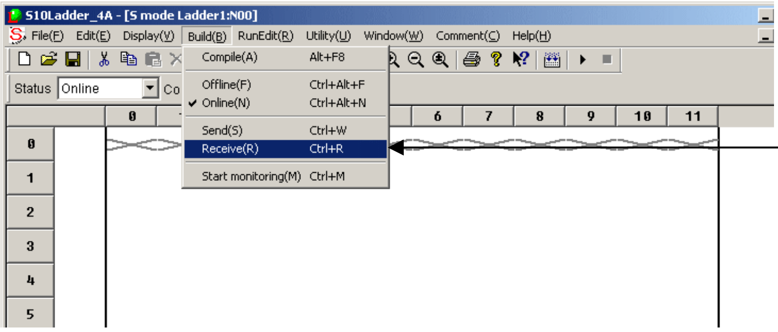
Click [OK].

⑦ Choose [Online(N)] from the [Build(B)] pulldown menu.
The personal computer will then become online with the S10/4α controller.



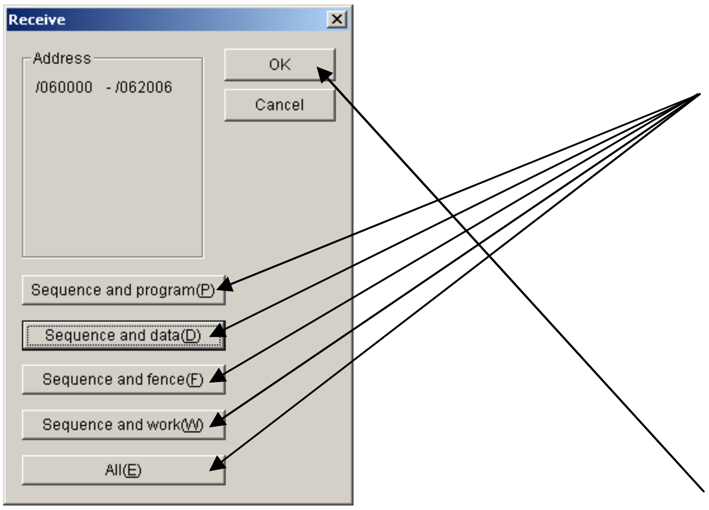
Choose [Online(N)] from [Build(B)] pulldown menu.

⑧ Choose [Receive(R)] from the [Build(B)] pulldown menu.
This starts a process of uploading the existing ladder program from the S10/4α controller.



Choose [Receive(R)] from [Build(B)] pulldown menu.

⑨ The receive-area selection window as shown below appears.
Select the desired receive-area meeting your needs and click the [OK] button.
(If you want to receive only the ladder chart, select [Sequence and program(P)].)



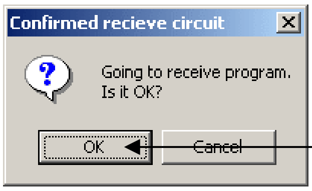
Address
/060000 - /062006

Buttons to select one of the following receive-areas:

- Sequence and program -- ladder chart area only
- Sequence and data -- ladder chart area and DW registers
- Sequence and fence -- entire ladder memory and DW registers
- Sequence and work -- entire ladder memory and DW and FW registers
- All -- entire ladder memory and entire I/O memory

(As an example, select "Sequence and data" and click [OK].)

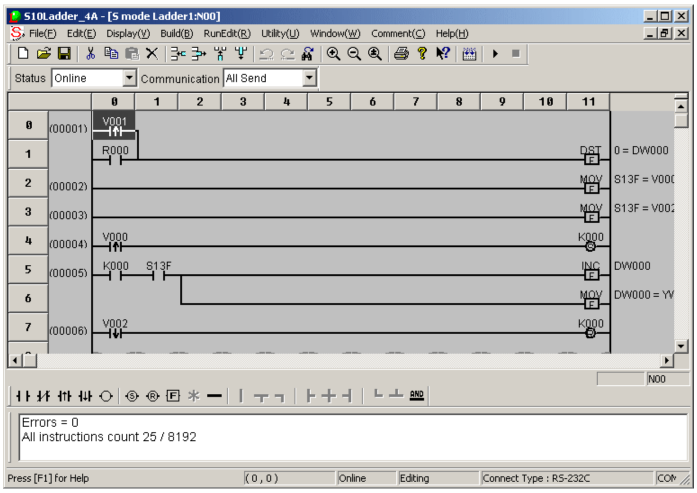
⑩ The [Confirmed receive circuit] dialog box shown below appears.
Click the [OK] button in the confirmation box. Uploading of the ladder chart from the S10/4α controller will then begin.



Going to receive program.
Is it OK?

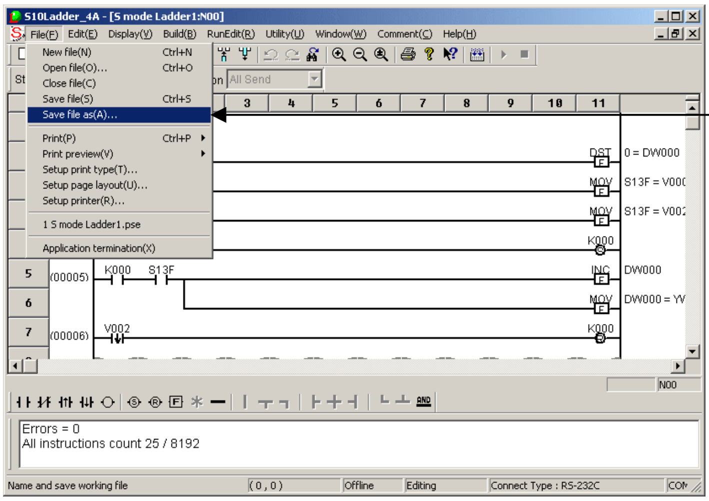
Click [OK].

⑪ Upon completion of the reception, the window as shown below appears, which indicates the uploading process is complete.
If you want to save the received program in a file, proceed to Step ⑫.
If you convert it to S10mini version without saving, perform the procedure described in Subsection 5.5.3, “Converting the ladder program.”



```
Errors = 0
All instructions count 25 / 8192
```

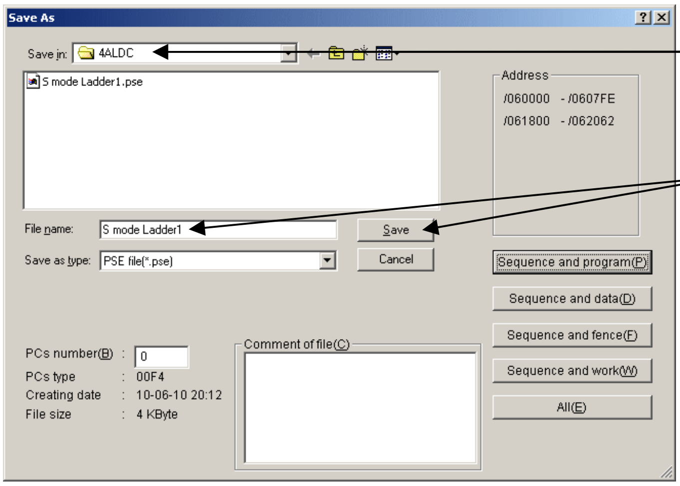
⑫ Choose [Save file as(A)] from the [File(F)] pulldown menu.



```
Errors = 0
All instructions count 25 / 8192
```

Choose [Save file as(A)] from [File(F)] pulldown menu.

⑬ Specify the folder in which to save the received program.
Then, enter the desired file name and click the [Save] button.
The received program will be saved in the specified folder.



Save As

Save in: 4ALDC

S mode Ladder1.pse

File name: S mode Ladder1

Save as type: PSE file(*.pse)

Address
/060000 - /0607FE
/061800 - /062062

PCs number(B) : 0
PCs type : 00F4
Creating date : 10-06-10 20:12
File size : 4 KByte

Comment of file(C)

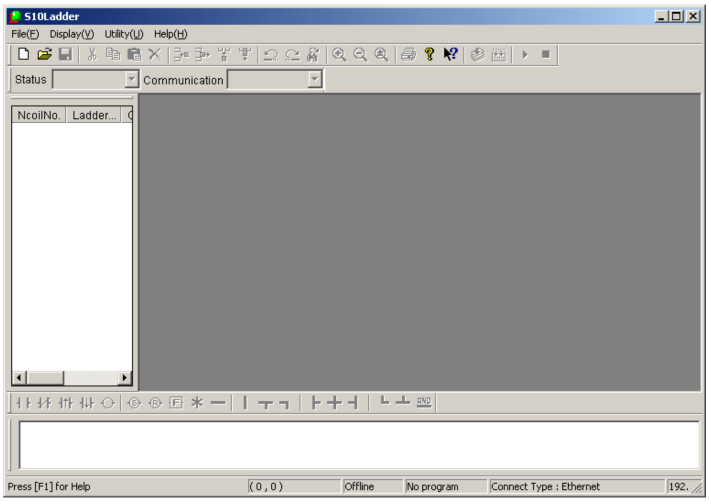
Specify the folder in which to save the program.

Enter the file name and click [Save] button.

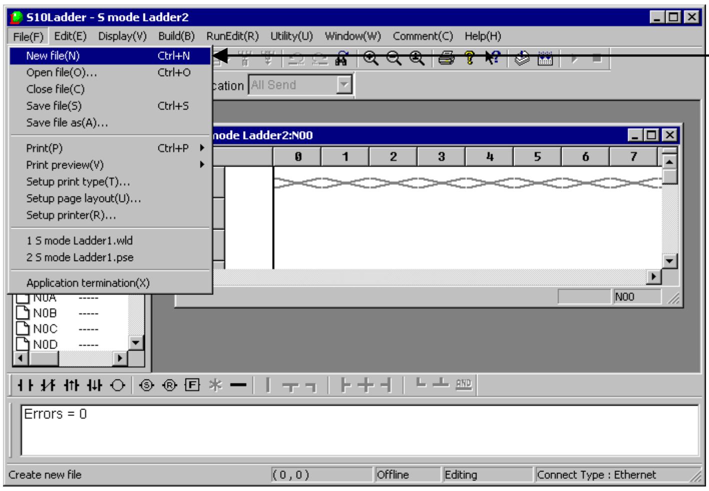
5.5.3 Converting the ladder program

The procedure described below converts into S10mini version the ladder program that has been obtained by performing the procedure described in Subsection 5.5.2, “Saving the ladder program,” and is currently open.

① Start the S10mini Ladder Chart System.



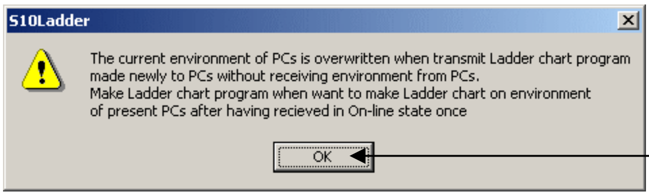
② Choose [New file(N)] from the [File(F)] pulldown menu.
A new ladder chart sheet will then be open as shown below.



Errors = 0

Choose [New file(N)] from [File(F)] pulldown menu.

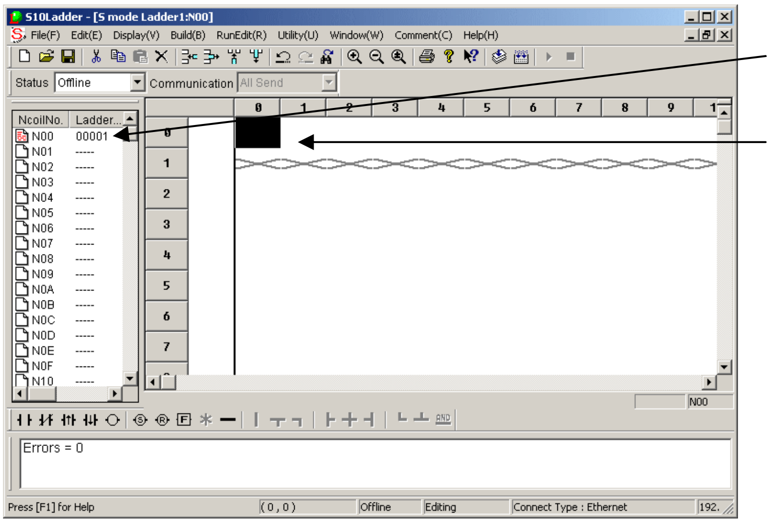
③ The dialog box shown below appears. Click the [OK] button.



The current environment of PCs is overwritten when transmit Ladder chart program made newly to PCs without receiving environment from PCs.
Make Ladder chart program when want to make Ladder chart on environment of present PCs after having recieved in On-line state once

Click [OK].

④ Press the [↓] key on the keyboard so that the ladder chart sheet will show an empty space in its top row.

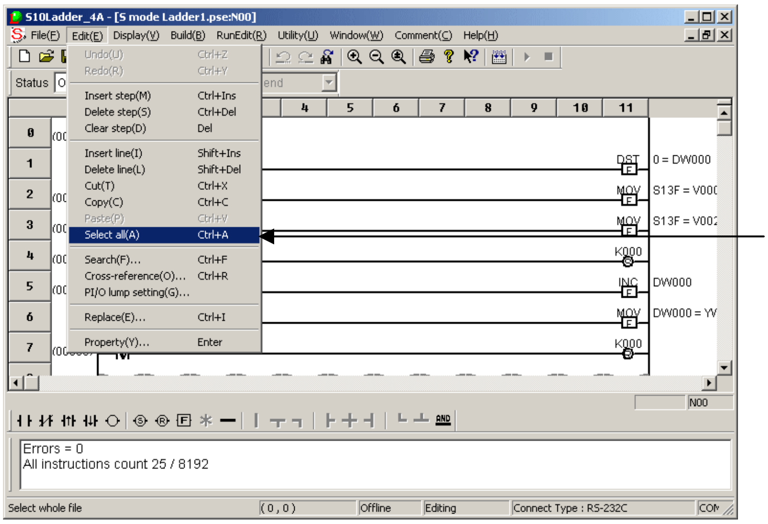


Errors = 0

The ladder chart sheet's current row number is changed to 00001.

An empty space is created in the top row.

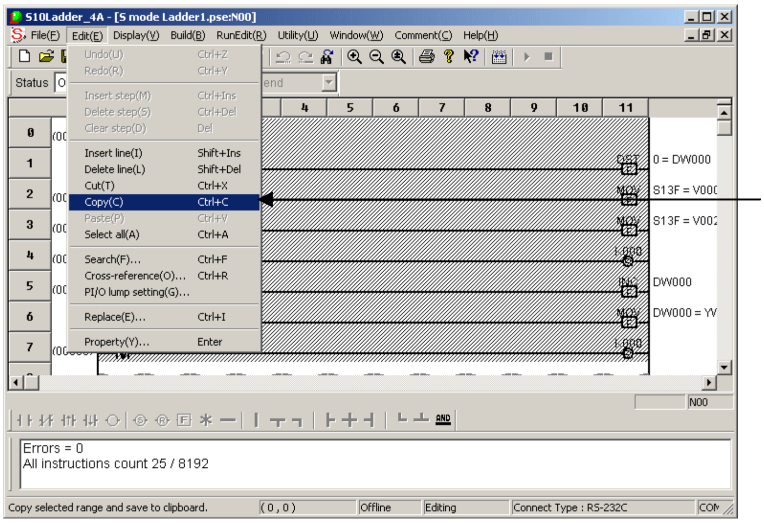
⑤ Go back to the S10/4α Ladder Chart System and choose [Select all(A)] from the [Edit(E)] pulldown menu in order to select the entire ladder chart.



Errors = 0
All instructions count 25 / 8192

Choose [Select all(A)] from [Edit(E)] pulldown menu.

⑥ Choose [Copy(C)] from the [Edit(E)] pulldown menu.

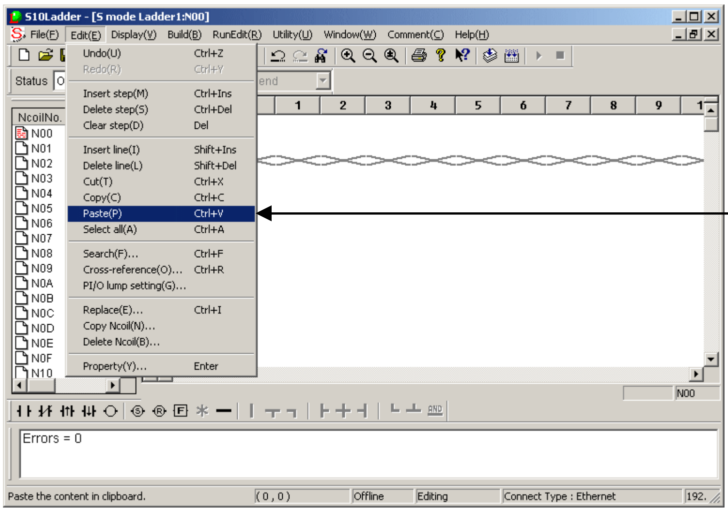


Errors = 0
All instructions count 25 / 8192

Copy selected range and save to clipboard. (0, 0) Offline Editing Connect Type : RS-232C COM

Choose [Copy(C)] from [Edit(E)] pulldown menu.

⑦ Make the S10mini Ladder Chart System active again and choose [Paste(P)] from the [Edit(E)] pulldown menu.

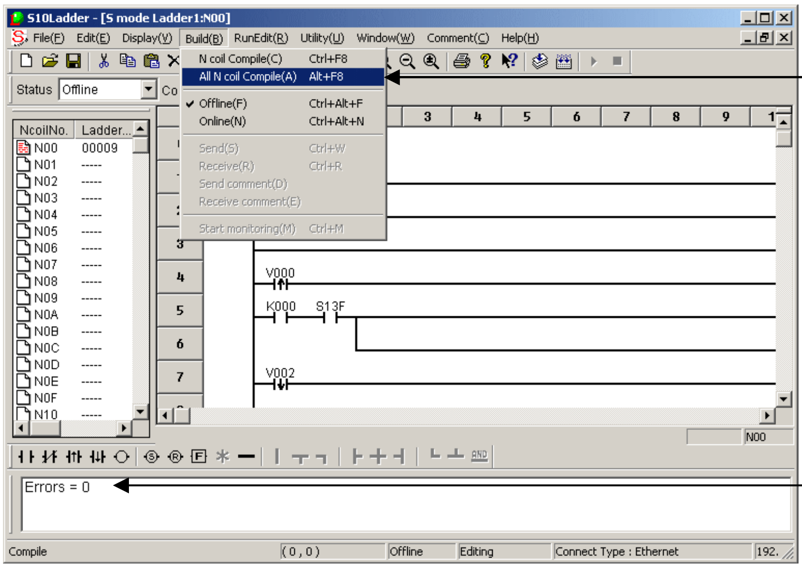


Errors = 0

Paste the content in clipboard. (0, 0) Offline Editing Connect Type : Ethernet 192.

Choose [Paste(P)] from [Edit(E)] pulldown menu.

⑧ Choose [All N coil Compile(A)] from the [Build(B)] pulldown menu.
The ladder chart is then checked for error.

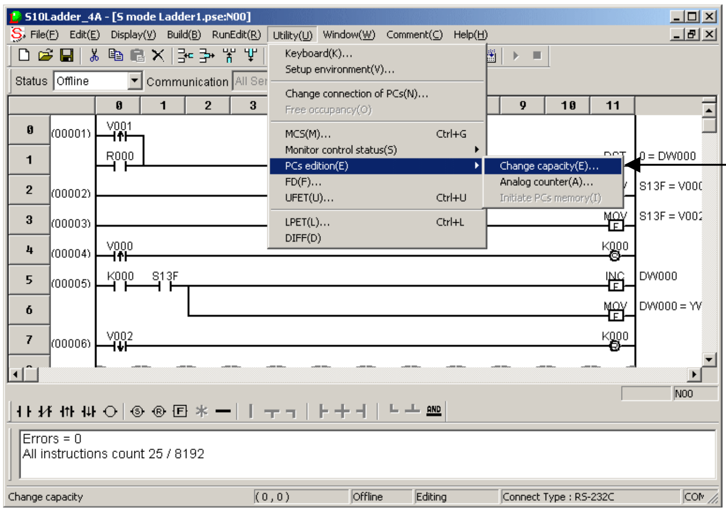


Errors = 0

Choose [All N coil Compile(A)] from [Build(B)] pulldown menu.

When no errors are reported in the message box, we can say that the ladder chart is undamaged.

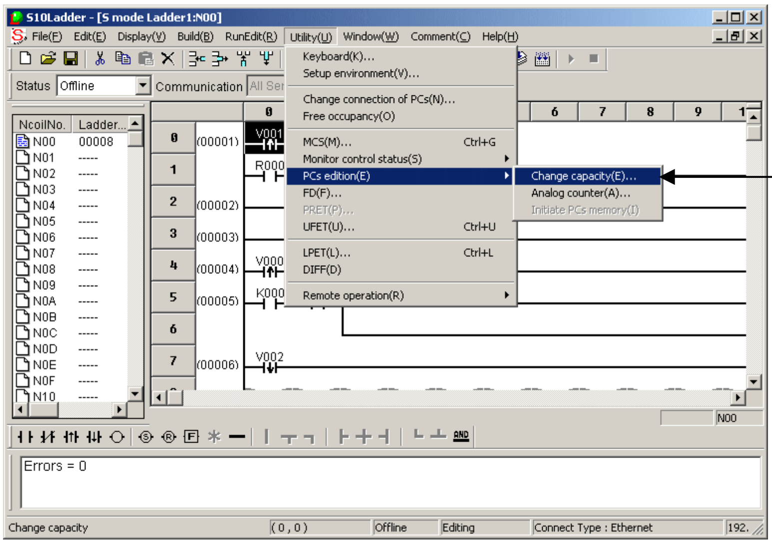
⑨ Go back to the S10/4α Ladder Chart System again and choose [PCs edition(E)] - [Change capacity(E)] from the [Utility(U)] pulldown menu.



Errors = 0
All instructions count 25 / 8192

Choose [PCs edition(E)] - [Change capacity(E)] from [Utility(U)] pulldown menu.

⑩ Make the S10mini Ladder Chart System active again and choose [PCs edition(E)] - [Change capacity(E)] from the [Utility(U)] pulldown menu.

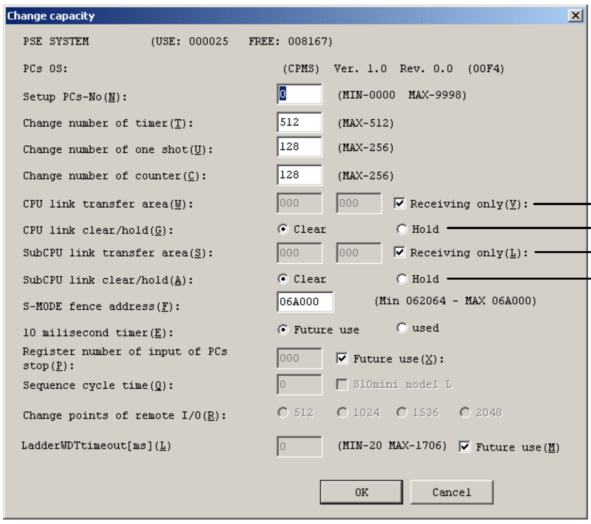


Errors = 0

Choose [PCs edition(E)] - [Change capacity(E)] from [Utility(U)] pulldown menu.

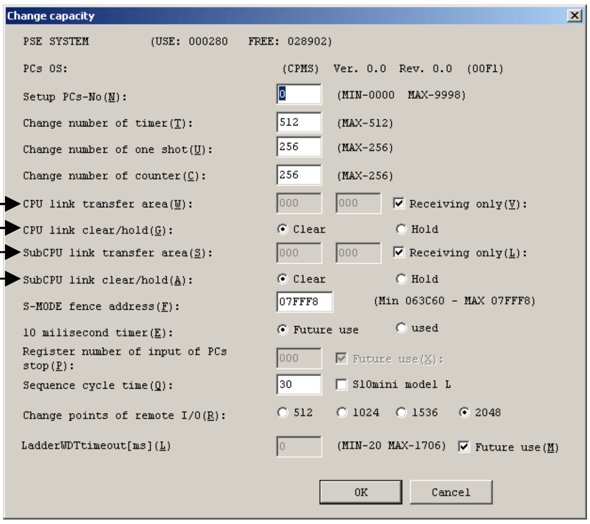
⑪ Add changes to the S10mini setup information shown below (right) to reflect the S10/4α setup information items listed below:

- CPU link send (transfer) area (and sub-CPU link send (transfer) area, if any)
- CPU link operation (clear/hold) mode (and sub-CPU link operation (clear/hold) mode, if any)



Change capacity

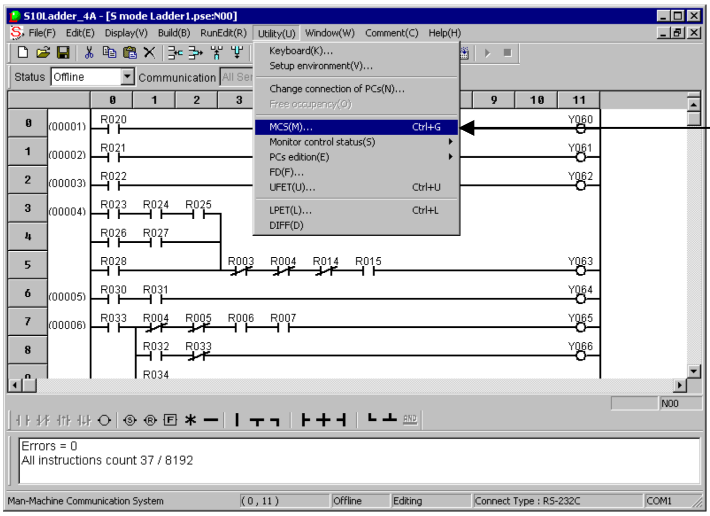
PSE SYSTEM (USE: 000025 FREE: 008167)
PCs OS: (CPMS) Ver. 1.0 Rev. 0.0 (00F4)
Setup PCs-No(N): 0 (MIN-0000 MAX-9998)
Change number of timer(T): 512 (MAX-512)
Change number of one shot(U): 128 (MAX-256)
Change number of counter(C): 128 (MAX-256)
CPU link transfer area(W): 000 000 ☑ Receiving only(V):
CPU link clear/hold(G): ● Clear ○ Hold
SubCPU link transfer area(S): 000 000 ☑ Receiving only(L):
SubCPU link clear/hold(A): ● Clear ○ Hold
S-MODE fence address(F): 06A000 (Min 062064 - MAX 06A000)
10 milisecond timer(E): ● Future use ○ used
Register number of input of PCs stop(P): 000 ☑ Future use(X):
Sequence cycle time(Q): 0 ☐ S10mini model L
Change points of remote I/O(R): ○ 512 ○ 1024 ○ 1536 ○ 2048
LadderWDTtimeout[ms](L) 0 (MIN-20 MAX-1706) ☑ Future use(M)



Change capacity

PSE SYSTEM (USE: 000280 FREE: 028902)
PCs OS: (CPMS) Ver. 0.0 Rev. 0.0 (00F1)
Setup PCs-No(N): 0 (MIN-0000 MAX-9998)
Change number of timer(T): 512 (MAX-512)
Change number of one shot(U): 256 (MAX-256)
Change number of counter(C): 256 (MAX-256)
CPU link transfer area(W): 000 000 ☑ Receiving only(V):
CPU link clear/hold(G): ● Clear ○ Hold
SubCPU link transfer area(S): 000 000 ☑ Receiving only(L):
SubCPU link clear/hold(A): ● Clear ○ Hold
S-MODE fence address(F): 07FFF8 (Min 063C60 - MAX 07FFF8)
10 milisecond timer(E): ● Future use ○ used
Register number of input of PCs stop(P): 000 ☑ Future use(X):
Sequence cycle time(Q): 30 ☐ S10mini model L
Change points of remote I/O(R): ○ 512 ○ 1024 ○ 1536 ● 2048
LadderWDTtimeout[ms](L) 0 (MIN-20 MAX-1706) ☑ Future use(M)

⑫ If any initial values are set in DW registers, copy those values by performing this step onwards of this procedure.
Otherwise, proceed to Step ⑰.
Go back to the S10/4α Ladder Chart System again and choose [MCS(M)] from the [Utility(U)] pulldown menu.

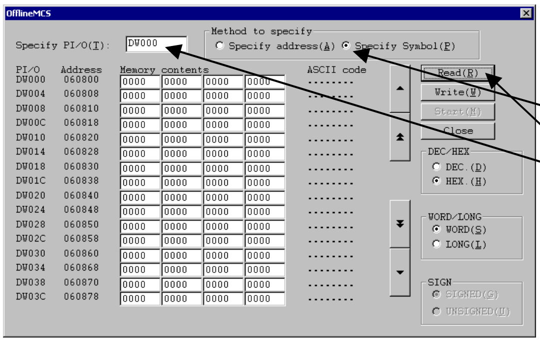


Errors = 0
All instructions count 37 / 8192

Man-Machine Communication System (0, 11) Offline Editing Connect Type : RS-232C COM1

Choose [MCS(M)] from [Utility(U)] pulldown menu.

⑬ Read the values from the DW registers according to the instructions given below.



Specify PI/O(T): DW000

Method to specify: ○ Specify address(A) ● Specify Symbol(P)

PI/O	Address	Memory contents				ASCII code
DW000	060800	0000	0000	0000	0000	--------
DW004	060808	0000	0000	0000	0000	--------
DW008	060810	0000	0000	0000	0000	--------
DW00C	060818	0000	0000	0000	0000	--------
DW010	060820	0000	0000	0000	0000	--------
DW014	060828	0000	0000	0000	0000	--------
DW018	060830	0000	0000	0000	0000	--------
DW01C	060838	0000	0000	0000	0000	--------
DW020	060840	0000	0000	0000	0000	--------
DW024	060848	0000	0000	0000	0000	--------
DW028	060850	0000	0000	0000	0000	--------
DW02C	060858	0000	0000	0000	0000	--------
DW030	060860	0000	0000	0000	0000	--------
DW034	060868	0000	0000	0000	0000	--------
DW038	060870	0000	0000	0000	0000	--------
DW03C	060878	0000	0000	0000	0000	--------

DEC/HEX: ○ DEC.(D) ● HEX.(H)

WORD/LONG: ● WORD(S) ○ LONG(L)

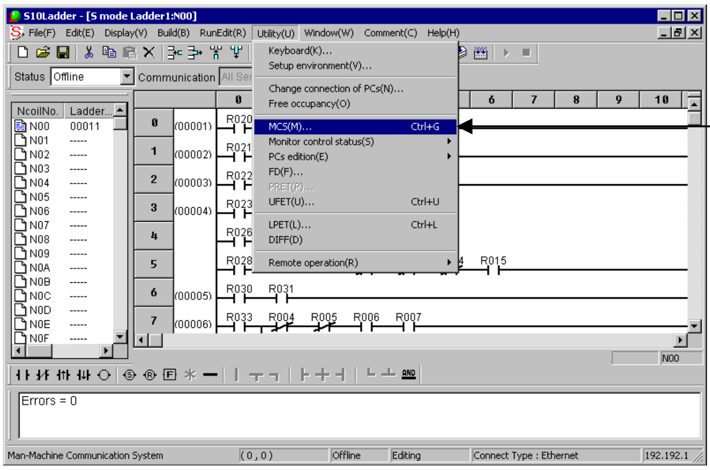
SIGN: ● SIGNED(G) ○ UNSIGNED(U)

Select the [Specify Symbol(P)] radio button.

Enter the symbol “DW000” in the edit box, for example.

Click the [Read(R)] button.

⑭ Make the S10mini Ladder Chart System active again and choose [MCS(M)] from the [Utility(U)] pulldown menu.



Status: Offline

NcoilNo.	Ladder...
N00	00011
N01	-----
N02	-----
N03	-----
N04	-----
N05	-----
N06	-----
N07	-----
N08	-----
N09	-----
N0A	-----
N0B	-----
N0C	-----
N0D	-----
N0E	-----
N0F	-----

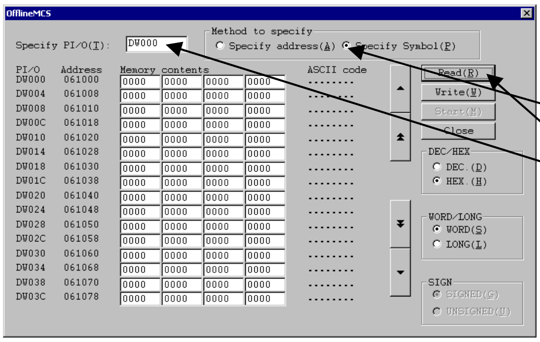
N00

```
Errors = 0
```

Man-Machine Communication System | (0 , 0) | Offline | Editing | Connect Type : Ethernet | 192.192.1

Choose [MCS(M)] from [Utility(U)] pulldown menu.

⑮ Read the values from the DW registers according to the instructions given below.



Specify PI/O(T): DW000

Method to specify: ○ Specify address(A) ● Specify Symbol(P)

DEC/HEX: ○ DEC.(D) ● HEX.(H)

WORD/LONG: ● WORD(S) ○ LONG(L)

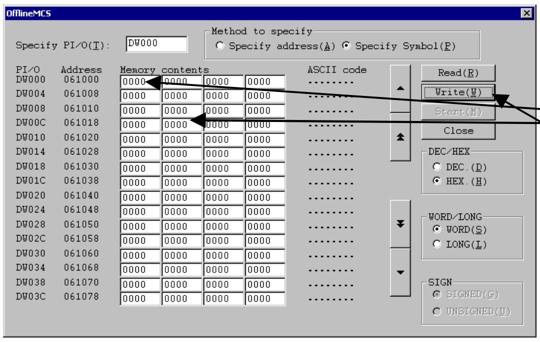
PI/O	Address	Memory contents				ASCII code
DW000	061000	0000	0000	0000	0000	....
DW004	061008	0000	0000	0000	0000	....
DW008	061010	0000	0000	0000	0000	....
DW00C	061018	0000	0000	0000	0000	....
DW010	061020	0000	0000	0000	0000	....
DW014	061028	0000	0000	0000	0000	....
DW018	061030	0000	0000	0000	0000	....
DW01C	061038	0000	0000	0000	0000	....
DW020	061040	0000	0000	0000	0000	....
DW024	061048	0000	0000	0000	0000	....
DW028	061050	0000	0000	0000	0000	....
DW02C	061058	0000	0000	0000	0000	....
DW030	061060	0000	0000	0000	0000	....
DW034	061068	0000	0000	0000	0000	....
DW038	061070	0000	0000	0000	0000	....
DW03C	061078	0000	0000	0000	0000	....

Select the “Specify Symbol(P)” radio button.

Enter the symbol “DW000” in the edit box, for example.

Click the [Read(R)] button.

⑯ Set those values equal to the contents of the DW registers used in the S10/4α controller, according to the instructions given below.



Specify PI/O(T): DW000

Method to specify: ○ Specify address(A) ● Specify Symbol(P)

DEC/HEX: ○ DEC.(D) ● HEX.(H)

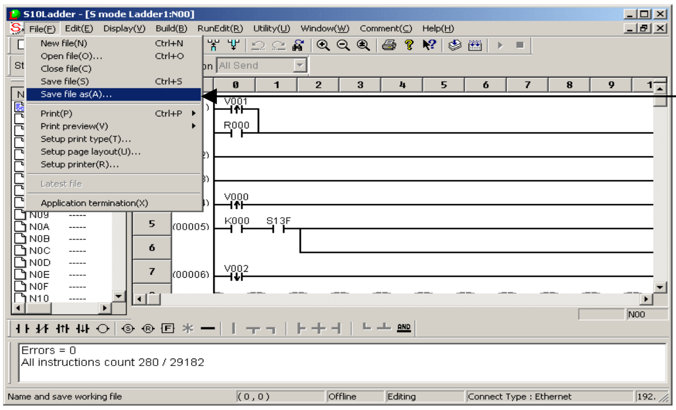
WORD/LONG: ● WORD(S) ○ LONG(L)

PI/O	Address	Memory contents				ASCII code
DW000	061000	0000	0000	0000	0000	....
DW004	061008	0000	0000	0000	0000	....
DW008	061010	0000	0000	0000	0000	....
DW00C	061018	0000	0000	0000	0000	....
DW010	061020	0000	0000	0000	0000	....
DW014	061028	0000	0000	0000	0000	....
DW018	061030	0000	0000	0000	0000	....
DW01C	061038	0000	0000	0000	0000	....
DW020	061040	0000	0000	0000	0000	....
DW024	061048	0000	0000	0000	0000	....
DW028	061050	0000	0000	0000	0000	....
DW02C	061058	0000	0000	0000	0000	....
DW030	061060	0000	0000	0000	0000	....
DW034	061068	0000	0000	0000	0000	....
DW038	061070	0000	0000	0000	0000	....
DW03C	061078	0000	0000	0000	0000	....

Enter the same value (as that used in the S10/4α controller) for the DW000 register in the edit box, for example.

Click the [Write(W)] button.

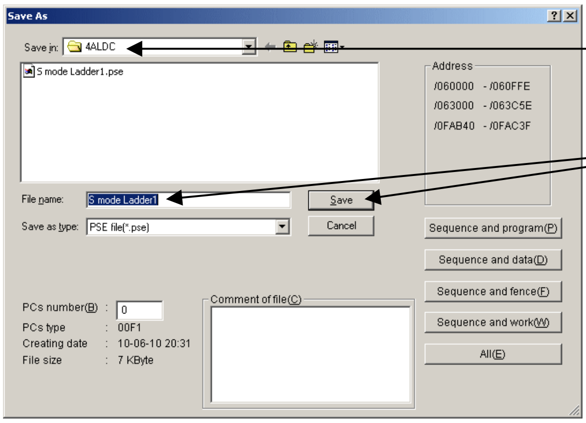
⑰ Choose [Save file as(A)] from the [File(F)] pulldown menu if you want to save the converted ladder program in a new file.
If you want to overwrite an existing file with the converted ladder program, proceed to Step ⑲.



Errors = 0
All instructions count 280 / 29182

Choose [Save file as(A)] from [File(F)] pulldown menu.

⑱ Specify the desired folder in which to save the converted ladder program.
Then, enter the desired file name and click the [Save] button.
The converted ladder program will be saved in the specified folder.



Save in: 4ALDC
File name: S mode Ladder1
Save as type: PSE file(*.pse)

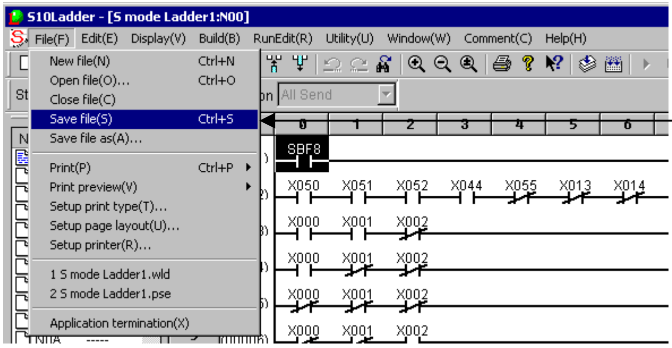
Address
/060000 - /060FFE
/063000 - /063C5E
/0FAB40 - /0FAC3F

PCs number(B) : 0
PCs type : 00F1
Creating date : 10-06-10 20:31
File size : 7 KByte

Specify the folder in which to save the ladder program.

Enter the file name and click [Save] button.

⑲ Choose [Save file(S)] from the [File(F)] pulldown menu.
The converted ladder program will then be saved in the currently active file by overwriting.

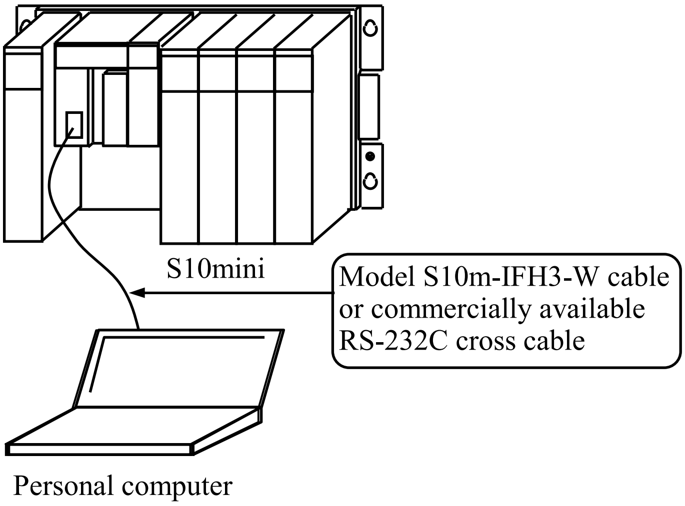


Choose [Save file(S)] from [File(F)] pulldown menu.

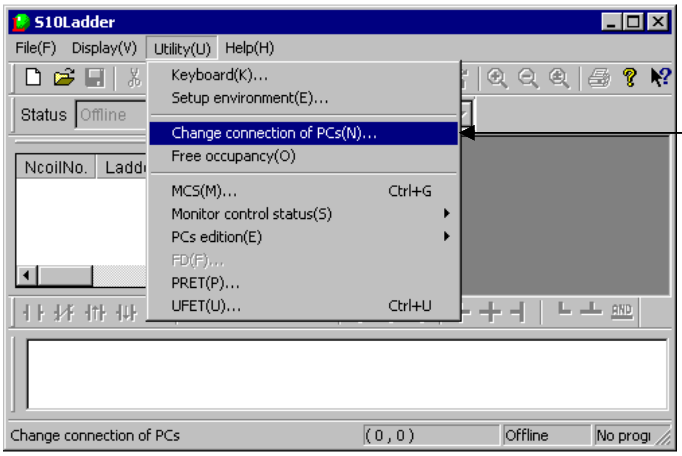
5.5.4 Sending the ladder program

To send the converted ladder program to the S10mini controller, perform the following procedure:

① As shown below, connect the following computers together by cable: the S10mini CPU mounted in an HSC-2100 expansion unit and the personal computer.

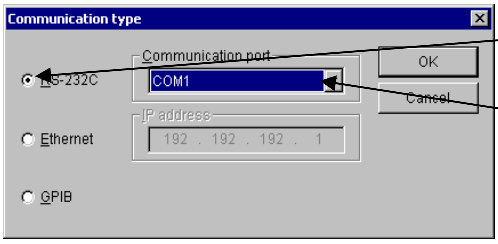


② Start the ladder chart system on the personal computer.
Then, if a necessary connection setting is already made, proceed to Step ④.
Otherwise, choose [Change connection of PCs(N)] from the [Utility(U)] pulldown menu.



Choose [Change connection of PCs(N)] from [Utility(U)] pulldown menu.

③ Select the [RS-232C] radio button.
Then, specify the desired communication port and click the [OK] button.



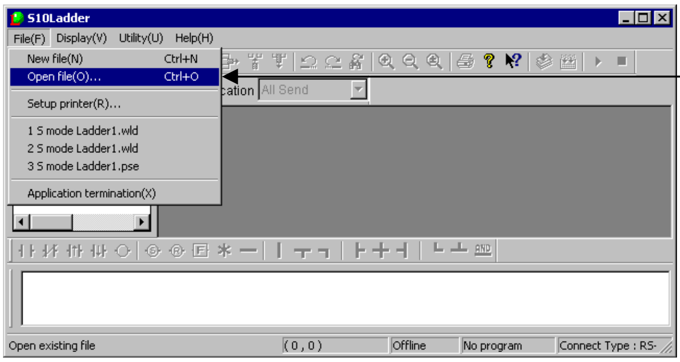
Communication port: COM1

IP address: 192 . 192 . 192 . 1

Select [RS-232C] radio button.

Specify the communication port.
(“COM1” is specified as the communication port.)

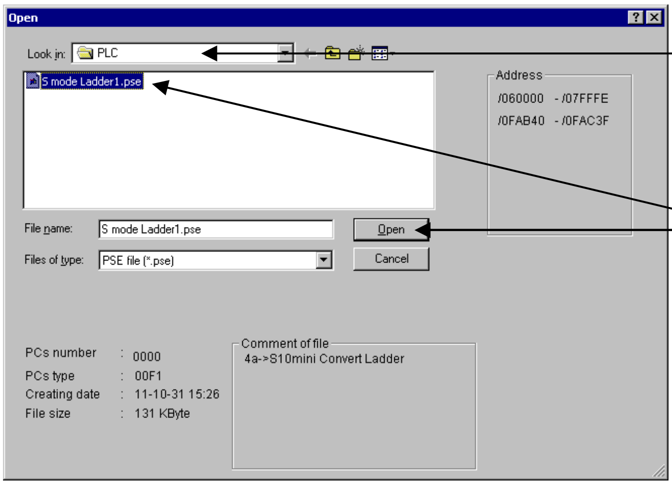
④ Choose [Open file(O)] from the [File(F)] pulldown menu, in order to open the converted ladder program to be downloaded to the S10mini controller.



Open existing file (0, 0) Offline No program Connect Type : RS-

Choose [Open file(O)] from [File(F)] pulldown menu.

⑤ The window as shown below appears.
Specify the directory in which the converted ladder program file is stored.
Then, select the file and click the [Open] button.



Look in: PLC

S mode Ladder1.pse

File name: S mode Ladder1.pse

Files of type: PSE file (*.pse)

Address
/060000 - /07FFFE
/0FAB40 - /0FAC3F

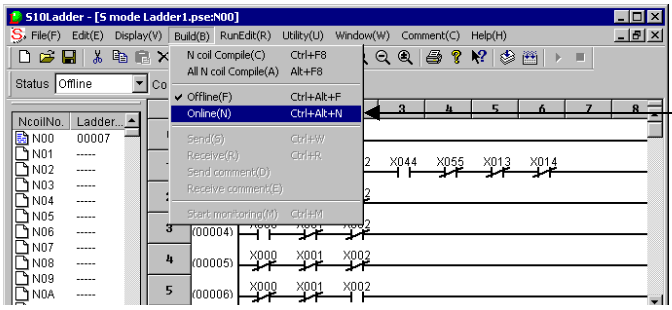
PCs number : 0000
PCs type : 00F1
Creating date : 11-10-31 15:26
File size : 131 KByte

Comment of file
4a->S10mini Convert Ladder

Specify where the converted ladder program file is stored.

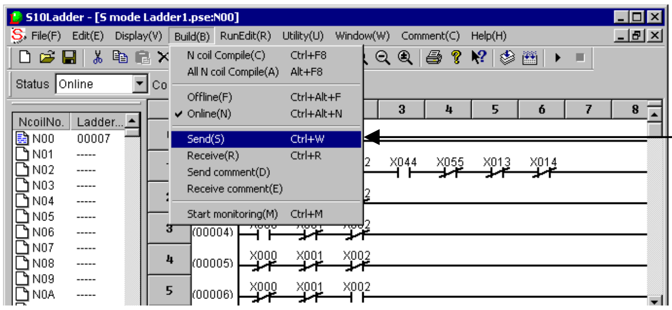
Select the file and click [Open] button.

⑥ Choose [Online(N)] from the [Build(B)] pulldown menu.
The personal computer will then become online with the S10mini controller.



Choose [Online(N)] from [Build(B)] pulldown menu.

⑦ Choose [Send(S)] from the [Build(B)] pulldown menu.
The converted ladder program file will then be transmitted from the personal computer to the S10mini controller.



Choose [Send(S)] from [Build(B)] pulldown menu.

6 MAINTENANCE

6.1 Preventive Maintenance

Every I/O module in a programmable controller should be given a daily or periodical (two or more times a year) inspection on the inspection items listed below.
The purpose of these inspections is to keep the I/O modules in an optimal condition and thereby ensure the problem-free use of the modules.

Table 6-1 Inspection Items

No.	Item
①	External appearance of each module
②	Lighting condition of each indicator or similar device
③	Loosened fixing screws, terminal block screws, and connector fastening
④	Condition of cable and wire jackets
⑤	Accumulation of dust and dirt
⑥	Input voltage to power supply
⑦	Voltage of power supply (power supply module and external power sources)
⑧	Remaining service life of relay contacts

NOTICE

- Do not touch any of the modules in the programmable controller when they are in an energized state. Touching any of the modules in an energized state may lead to a discharge of static electricity from your body to the module, resulting in malfunction or breakage of the module. If you have no choice but to touch such a module, be sure to discharge the static electricity by touching the metal frame of the cubicle and then touch the module. This is also true when you perform any of the following actions on a module in its non-energized state: 1) setting a switch on the module; 2) connecting or disconnecting the cable from the module; or 3) inserting or removing the connector from the module.
- Every fixing or terminal screw must be secured tightly.
  Insufficiently tightened screws may result in malfunction, smoke, or fire.

① External appearance of each module
Check each module for any trace of crack or flaw in its casing.
The presence of any such condition indicates that the internal circuitry may be damaged. Such damage may result in system malfunction.

② Lighting condition of each indicator or similar device
Check each indicator or similar device for any abnormal lighting condition.

③ Loosened fixing screws, terminal block screws, and connector fastening
Before performing an inspection for this inspection item, be sure to power down your application system.
Under this inspection item, check each module to see if any fixing screws, terminal block screws, and connector fastening are loosened.
If a loosened screw or fastening is found, secure them tightly.
Any loosened screw may result in system malfunction or burnout due to heat buildup.

④ Condition of cable and wire jackets
Check the outer jackets of all cables and wires for any overheating or other abnormal condition.
If the outer jacket of a cable or wire is overheated or flaked, it may result in system malfunction, electric shock hazard, or burnout due to shorting.

⑤ Accumulation of dust and dirt
Check each module to see if dust and dirt is accumulated on it.
Accumulated dust and dirt may cause shorting or burnout in the internal circuit of the module. It should be removed by vacuum-cleaning. Before using vacuum-cleaning, be sure to power down your application system.

⑥ Input voltage to power supply

⑦ Voltage of power supply (power supply module and external power sources)
Check each power supply module to see if the input and output voltages to or from it are within the prescribed ranges.
Also, check each external power source to see if the output voltage from it is within the prescribed range.
If any such voltage is out of its prescribed range, it may result in system malfunction.
The prescribed ranges of the power supply module are as follows:
Input voltage ranges: for LWV450: 85 to 132 VAC
for LWV460: 85 to 132 VAC, 80 to 143 VDC
for LWV550: 80 to 143 VDC
Output voltage range: 5 VDC ±5% (for all of LWV450, LWV460, and LWV550)

As shown below, the output voltage of each power supply module can be checked across the check terminals provided on the module.
(For information on the operating power supply voltage and external power source voltage for I/O modules, refer to the instruction manual on each I/O module.)

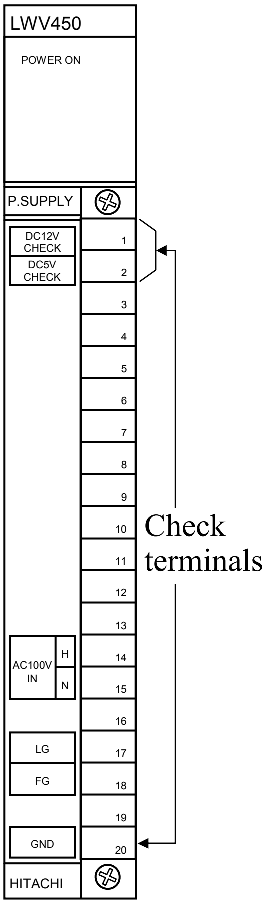


Figure 6-1 The Power Supply Module’s Check Terminals

⑧ Remaining service life of relay contacts

The relays used in contact output modules have a limited service life due to the wear of their contacts. If a contact output module's relay is intended to be used at rated voltage and rated current, its expected service life is 100,000 switching operations (1,800 cycles per hour). When the relay's service life reaches the limit, the contact output module needs to be replaced with a new one as long as the application using it needs to be used further.

NOTICE

- If the input voltage to a power supply module is close to the upper or lower limit of the prescribed range, ask a power supply management specialist to perform an inspection even if the input voltage is within the operating specifications.
- Power to the I/O modules mounted in the cubicle must be supplied from a power supply module with an appropriate wattage rating for the I/O modules.
  If a power supply module whose wattage rating is lower than expected is used, it may result in a fire.
- Be sure to power down your application system before replacing an existing module.
  Replacing a module in a power-on condition may cause damage to the hardware.

6.2 Troubleshooting

If a problem arises with the programmable controller, troubleshoot the problem based on the indications given by the operation indicators of the power supply, remote I/O station, and I/O modules.

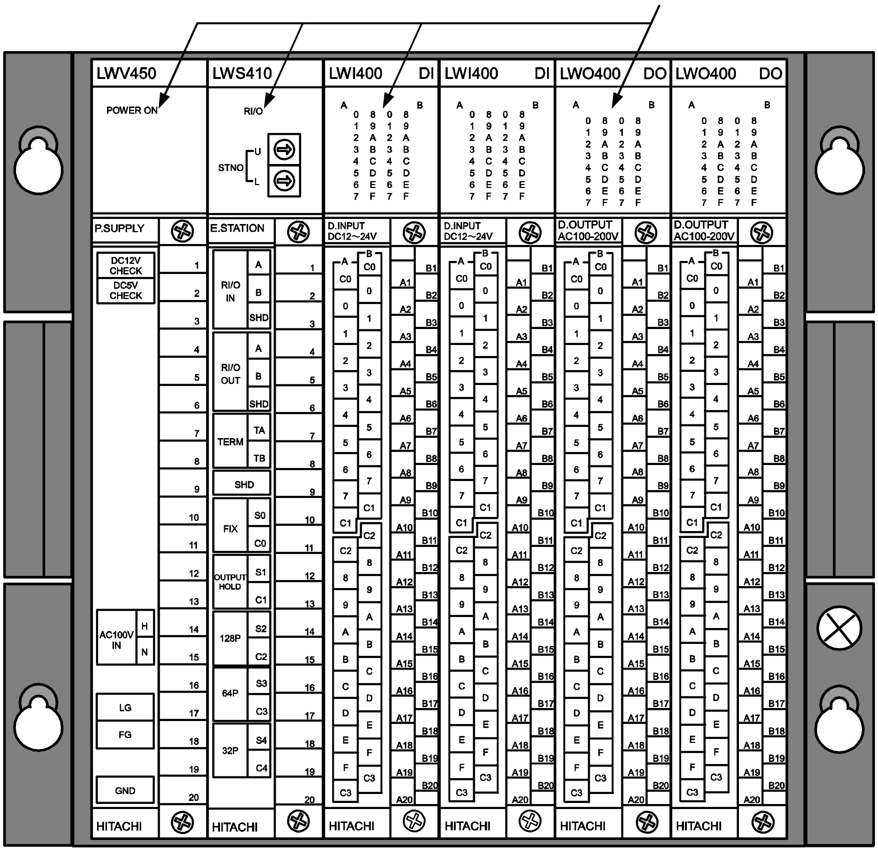

Operation indicators

Figure 6-2 An I/O Unit (4-Slot Mount Base) and the Locations of the Operation Indicators

6.2.1 Troubleshooting the power supply and remote I/O station modules

Indicator condition	Check item	Remedial action
POWER ON LED not lit	Improper power cable connection	Connect the power cable properly.
	Power cable breakage	Replace the power cable with a new one.
	Power supply abnormality (in voltage or waveform)	Supply normal power to the module.
	None of the above	Replace the power supply module with a new one.

6.2.2 Troubleshooting the remote I/O station module

Indicator condition	Check item		Remedial action
RI/O LED not lit	LPU or CPU module abnormality		Refer to the instruction manual on the LPU or CPU module and solve the problem.
	Ladder program running in SIMU RUN mode		Change the operation mode to STOP or RUN.
	Station no. setting error		Refer to the instruction manual on the LPU or CPU module and set the station no. correctly.
	Power supply module operation abnormality		Troubleshoot the power supply module according to the instructions given in Subsection 6.2.1.
	Remote I/O cable abnormality	Cable breakage	Replace the remote I/O cable with a new one.
		Cable length too long	Re-wire the remote I/O cable within the prescribed length limit, which is specified in the instruction manual on the LPU or CPU module.
		Cable connection incomplete	Refer to the instruction manual on the LPU or CPU module and connect the remote I/O cable correctly.
		Terminating-resistor connection incorrect	Refer to the instruction manual on the LPU or CPU module and connect the terminating resistor correctly.
	Power supply or remote I/O station module mounted in wrong slot		Mount the module in the right slot.
	None of the above		Replace the remote I/O station module with a new one.

6.2.3 Troubleshooting a digital input module

- Case 1 -- none of the input points is turned on:

Check item			Remedial action
Operation indicator LED condition	Not lit	Terminal block attached improperly	Attach the terminal block properly to the module.
		Module fixing-screws loosened	Apply additional tightening to the fixing screws.
		External power source not supplying power	Supply power from the external power source.
		Power supply module's output voltage abnormality	Check the output voltage across the check terminals of the power supply module.
		External wiring incorrect	Wire the module correctly.
	Lit	Remote I/O station module's operation abnormality	Troubleshoot the remote I/O station module according to the instructions given in Subsection 6.2.2.
None of the above			Replace the digital input module with a new one.

- Case 2 -- a particular input point(s) are not turned on:

Check item			Remedial action
Operation indicator LED condition	Not lit	External input's on-state duration too short	Adjust the external equipment.
		Wiring loosened or wire breakage	Wire the digital input module correctly.
	Lit	Program I/O address error	Corrent the erroneous address.
None of the above			Replace the digital input module with a new one.

- Case 3 -- all of the input points are always turned on:

Check item	Remedial action
Operation indicator LED not lit	Replace the digital input module with a new one.
Operation indicator LED lit	Check the external wiring of the digital input module for error. If the wiring is correct, replace the module with a new one.

- Case 4 -- all of the input points are turned on and off irregularly:

Check item	Remedial action
External input voltage too low	Apply rated input voltage to the digital input module.
Not the above	Replace the digital input module with a new one.

- Case 5 -- a particular input point(s) are not turned off:

Check item	Remedial action
External-equipment abnormality	Adjust the external equipment.
Not the above	Replace the digital input module with a new one.

6.2.4 Troubleshooting a digital output module

- Case 1 -- none of the load points is turned on:

Check item	Remedial action
Power supply module’s POWER ON LED not lit	Troubleshoot the power supply module according to the instructions given in Subsection 6.2.1.
Remote I/O station module’s RI/O LED not lit	Troubleshoot the remote I/O station module according to the instructions given in Subsection 6.2.2.
Power not supplied to the load	Suppy power to the load.
Applied load voltage other than the rated voltage	Apply the rated voltage to the load.
None of the above	Replace the digital input module with a new one.

- Case 2 -- a particular load point(s) are not turned on:

Check item			Remedial action
Operation indicator LED condition	Not lit	Load’s on-state duration too short	Correct the program.
		Program I/O address error	
	Lit	External wire breakage	Check the external wiring.
		Loosened terminal screw	Apply additional tightening to the screw.
		Incorrect external wiring	Corrent the external wiring.
None of the above			Replace the digital input module with a new one.

- Case 3 -- none of the load points is turned off:

Check item	Remedial action
Remote I/O station module's RI/O LED not lit	Troubleshoot the remote I/O station module according to the instructions given in Subsection 6.2.2.
LPU or CPU module operation abnormality	Refer to the instruction manual on the LPU or CPU module and troubleshoot it.
None of the above	Replace the digital output module with a new one.

- Case 4 -- a particular load point(s) are not turned off:

Check item			Remedial action
Operation indicator LED condition	Not lit	External-wiring abnormality	Check the external wiring and correct it.
	Lit	Remote I/O station module's RI/O LED not lit	Troubleshoot the remote I/O station module according to the instructions given in Subsection 6.2.2.
		LPU or CPU module operation abnormality	Refer to the instruction manual on the LPU or CPU module and troubleshoot it.
None of the above			Replace the digital output module with a new one.

- Case 5 -- all of the load points are turned on and off irregularly:

Check item	Remedial action
Applied load voltage other than the rated voltage	Apply the rated voltage to the load.
Noise reduction measure not taken	Install surge killers for the digital output module and change the cable laying if necessary.
Program error	Correct the program.
None of the above	Replace the digital output module with a new one.

6.2.5 Troubleshooting an analog input module

Check item	Remedial action
Power supply module's POWER ON LED not lit	Troubleshoot the power supply module according to the instructions given in Subsection 6.2.1.
Remote I/O station module's RI/O LED not lit	Troubleshoot the remote I/O station module according to the instructions given in Subsection 6.2.2.
Support program not loaded for the S10/2α controller with the analog input module installed in it	Load the support program to the S10/2α controller's CPU. (In the case of S10mini CPUs and S10V LPUs, no such loading is necessary.)
Analog input module not registered in the CPU	Register a data area for the analog input module by using an available tool.
Input wiring error	Correct the input wiring according to the information given in Chapters 2 and 4.
GND terminal not connected to mount-base FG terminal	Connect the GND terminal to the FG terminal provided on the mount base.
Applied input voltage exceeding the rated voltage	Apply the rated input voltage to the analog input module.
Remote I/O station module's I/O point count setting other than 16 (This check item is applicable only to the following module models: LWA400 thru LWA404, LWA421 thru LWA423, LWA430, and LWA435.)	Set the I/O point count to 16.
None of the above	Replace the analog input module with a new one.

6.2.6 Troubleshooting an analog output module

Check item	Remedial action
Power supply module's POWER ON LED not lit	Troubleshoot the power supply module according to the instructions given in Subsection 6.2.1.
Remote I/O station module's RI/O LED not lit	Troubleshoot the remote I/O station module according to the instructions given in Subsection 6.2.2.
Support program not loaded for the S10/2α controller with the analog input module installed in it	Load the support program to the S10/2α controller's CPU. (In the case of S10mini CPUs and S10V LPUs, no such loading is necessary.)
Analog output module not registered in the CPU	Register a data area for the analog output module by using an available tool.
Output wiring error	Correct the output wiring according to the information given in Chapters 2 and 4.
GND terminal not connected to mount-base FG terminal	Connect the GND terminal to the FG terminal provided on the mount base.
Output data error	Correct the program.
Remote I/O station module's I/O point count setting other than 16 (This check item is applicable only to the following module models: LWA450 and LWA460.)	Set the I/O point count to 16.
None of the above	Replace the analog output module with a new one.

6.2.7 Troubleshooting a pulse counter module

- Case 1 -- no pulse measurement (counting) is performed:

Check item		Remedial action
Power supply module's abnormality		Troubleshoot the power supply module according to the instructions given in Subsection 6.2.1.
Remote I/O station module's abnormality		Troubleshoot the remote I/O station module according to the instructions given in Subsection 6.2.2.
Support program not loaded for the S10/2α controller with the pulse counter module installed in it		Load the support program to the S10/2α controller's CPU. (In the case of S10mini CPUs and S10V LPUs, no such loading is necessary.)
Mounting error		Mount the pulse counter module properly.
External stop input made		Cancel the external stop input.
User program always in "counting stopped" state		Correct the user program.
UP or DOWN LED not flickering in pulse signal input	Input pulse signal wiring incorrect	Correct the wiring.
	External input power not supplied	Supply power to the external input.
	External power source voltage too low	Apply rated voltage (20 to 28 VDC) to the external input.
	Input pulse signal incorrect. The signal must satisfy the following: (Frequency: 20 kHz or less for LWC400 and LWC401; 100 kHz or less for LWC402 Duty ratio: 50%)	Apply correct input pulse signal to the pulse counter.
Pulse counter not registered in the CPU		Register a data area for the pulse counter module by using an available tool.
None of the above		Replace the pulse counter module with a new one.

- Case 2 -- the count value is abnormal:

Check item	Remedial action
Input pulse signal frequency exceeding its specification limit	Lower the frequency to 20 kHz or less if the module used is LWC400 or LWC401. If it is LWC402, lower it to 100 kHz or less.
Excessive pulse input due to noise	Take a noise reduction measure.
Relay contact make and break operations not counted	Replace the relay contact with a transistor contact.
None of the above	Replace the pulse counter module with a new one.

- Case 3 -- no comparison output is produced:

Check item	Remedial action
External power not supplied	Supply power to the external power source.
External power supply voltage too low	Apply rated voltage (20 to 28 VDC) to the pulse counter module.
External wiring incorrect	Correct the wiring.
None of the above	Replace the pulse counter module with a new one.

7 APPENDIX

7.1 Pt100 Resistance vs. Temperature Table

R_0=100.00Ω R_{100}/R_0=1.3850 (Source: JIS C 1604-1989)

°C	0	–1	–2	–3	–4	–5	–6	–7	–8	–9	–10	°C
–200	18.49	–	–	–	–	–	–	–	–	–	–	–200
–190	22.80	22.37	21.94	21.51	21.08	20.65	20.22	19.79	19.36	18.93	18.49	–190
–180	27.08	26.65	26.23	25.80	25.37	24.94	24.52	24.09	23.66	23.23	22.80	–180
–170	31.32	30.90	30.47	30.05	29.63	29.20	28.78	28.35	27.93	27.50	27.08	–170
–160	35.53	35.11	34.69	34.27	33.85	33.43	33.01	32.59	32.16	31.74	31.32	–160
–150	39.71	39.30	38.88	38.46	38.04	37.63	37.21	36.79	36.37	35.95	35.53	–150
–140	43.87	43.45	43.04	42.63	42.21	41.79	41.38	40.96	40.55	40.13	39.71	–140
–130	48.00	47.59	47.18	46.76	46.35	45.94	45.52	45.11	44.70	44.28	43.87	–130
–120	52.11	51.70	51.29	50.88	50.47	50.06	49.64	49.23	48.82	48.41	48.00	–120
–110	56.19	55.78	55.38	54.97	54.56	54.15	53.74	53.33	52.92	52.52	52.11	–110
–100	60.25	59.85	59.44	59.04	58.63	58.22	57.82	57.41	57.00	56.60	56.19	–100
– 90	64.30	63.90	63.49	63.09	62.68	62.28	61.87	61.47	61.06	60.66	60.25	– 90
– 80	68.33	67.92	67.52	67.12	66.72	66.31	65.91	65.51	65.11	64.70	64.30	– 80
– 70	72.33	71.93	71.53	71.13	70.73	70.33	69.93	69.53	69.13	68.73	68.33	– 70
– 60	76.33	75.93	75.53	75.13	74.73	74.33	73.93	73.53	73.13	72.73	72.33	– 60
– 50	80.31	79.91	79.51	79.11	78.72	78.32	77.92	77.52	77.13	76.73	76.33	– 50
– 40	84.27	83.88	83.48	83.08	82.69	82.29	81.89	81.50	81.10	80.70	80.31	– 40
– 30	88.22	87.83	87.43	87.04	86.64	86.25	85.85	85.46	85.06	84.67	84.27	– 30
– 20	92.16	91.77	91.37	90.98	90.59	90.19	89.80	89.40	89.01	88.62	88.22	– 20
– 10	96.09	95.69	95.30	94.91	94.52	94.12	93.73	93.34	92.95	92.55	92.16	– 10
0	100.00	99.61	99.22	98.83	98.44	98.04	97.65	97.26	96.87	96.48	96.09	0
	0	1	2	3	4	5	6	7	8	9	10	
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51	103.90	0
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40	107.79	10
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.28	111.67	20
30	111.67	112.06	112.45	112.83	113.22	113.61	113.99	114.38	114.77	115.15	115.54	30
40	115.54	115.93	116.31	116.70	117.08	117.47	117.85	118.24	118.62	119.01	119.40	40
50	119.40	119.78	120.16	120.55	120.93	121.32	121.70	122.09	122.47	122.86	123.24	50
60	123.24	123.62	124.01	124.39	124.77	125.16	125.54	125.92	126.31	126.69	127.07	60
70	127.07	127.45	127.84	128.22	128.60	128.98	129.37	129.75	130.13	130.51	130.89	70
80	130.89	131.27	131.66	132.04	132.42	132.80	133.18	133.56	133.94	134.32	134.70	80
90	134.70	135.08	135.46	135.84	136.22	136.60	136.98	137.36	137.74	138.12	138.50	90
100	138.50	138.88	139.26	139.64	140.02	140.39	140.77	141.15	141.53	141.91	142.29	100
110	142.29	142.66	143.04	143.42	143.80	144.17	144.55	144.93	145.31	145.68	146.06	110
120	146.06	146.44	146.81	147.19	147.57	147.94	148.32	148.70	149.07	149.45	149.82	120
130	149.82	150.20	150.57	150.95	151.33	151.70	152.08	152.45	152.83	153.20	153.58	130
140	153.58	153.95	154.32	154.70	155.07	155.45	155.82	156.19	156.57	156.94	157.31	140
150	157.31	157.69	158.06	158.43	158.81	159.18	159.55	159.93	160.30	160.67	161.04	150
160	161.04	161.42	161.79	162.16	162.53	162.90	163.27	163.65	164.02	164.39	164.76	160
170	164.76	165.13	165.50	165.87	166.24	166.61	166.98	167.35	167.72	168.09	168.46	170
180	168.46	168.83	169.20	169.57	169.94	170.31	170.68	171.05	171.42	171.79	172.16	180
190	172.16	172.53	172.90	173.26	173.63	174.00	174.37	174.74	175.10	175.47	175.84	190
200	175.84	176.21	176.57	176.94	177.31	177.68	178.04	178.41	178.78	179.14	179.51	200
210	179.51	179.88	180.24	180.61	180.97	181.34	181.71	182.07	182.44	182.80	183.17	210
220	183.17	183.53	183.90	184.26	184.63	184.99	185.36	185.72	186.09	186.45	186.82	220
230	186.82	187.18	187.54	187.91	188.27	188.63	189.00	189.36	189.72	190.09	190.45	230
240	190.45	190.81	191.18	191.54	191.90	192.26	192.63	192.99	193.35	193.71	194.07	240
°C	0	1	2	3	4	5	6	7	8	9	10	°C

°C	0	1	2	3	4	5	6	7	8	9	10	°C
250	194.07	194.44	194.80	195.16	195.52	195.88	196.24	196.60	196.96	197.33	197.69	250
260	197.69	198.05	198.41	198.77	199.13	199.49	199.85	200.21	200.57	200.93	201.29	260
270	201.29	201.65	202.01	202.36	202.72	203.08	203.44	203.80	204.16	204.52	204.88	270
280	204.88	205.23	205.59	205.95	206.31	206.67	207.02	207.38	207.74	208.10	208.45	280
290	208.45	208.81	209.17	209.52	209.88	210.24	210.59	210.95	211.31	211.66	212.02	290
300	212.02	212.37	212.73	213.09	213.44	213.80	214.15	214.51	214.86	215.22	215.57	300
310	215.57	215.93	216.28	216.64	216.99	217.35	217.70	218.05	218.41	218.76	219.12	310
320	219.12	219.47	219.82	220.18	220.53	220.88	221.24	221.59	221.94	222.29	222.65	320
330	222.65	223.00	223.35	223.70	224.06	224.41	224.76	225.11	225.46	225.81	226.17	330
340	226.17	226.52	226.87	227.22	227.57	227.92	228.27	228.62	228.97	229.32	229.67	340
350	229.67	230.02	230.37	230.72	231.07	231.42	231.77	232.12	232.47	232.82	233.17	350
360	233.17	233.52	233.87	234.22	234.56	234.91	235.26	235.61	235.96	236.31	236.65	360
370	236.65	237.00	237.35	237.70	238.04	238.39	238.74	239.09	239.43	239.78	240.13	370
380	240.13	240.47	240.82	241.17	241.51	241.86	242.20	242.55	242.90	243.24	243.59	380
390	243.59	243.93	244.28	244.62	244.97	245.31	245.66	246.00	246.35	246.69	247.04	390
400	247.04	247.38	247.73	248.07	248.41	248.76	249.10	249.45	249.79	250.13	250.48	400
410	250.48	250.82	251.16	251.50	251.85	252.19	252.53	252.88	253.22	253.56	253.90	410
420	253.90	254.24	254.59	254.93	255.27	255.61	255.95	256.29	256.64	256.98	257.32	420
430	257.32	257.66	258.00	258.34	258.68	259.02	259.36	259.70	260.04	260.38	260.72	430
440	260.72	261.06	261.40	261.74	262.08	262.42	262.76	263.10	263.43	263.77	264.11	440
450	264.11	264.45	264.79	265.13	265.47	265.80	266.14	266.48	266.82	267.15	267.49	450
460	267.49	267.83	268.17	268.50	268.84	269.18	269.51	269.85	270.19	270.52	270.86	460
470	270.86	271.20	271.53	271.87	272.20	272.54	272.88	273.21	273.55	273.88	274.22	470
480	274.22	274.55	274.89	275.22	275.56	275.89	276.23	276.56	276.89	277.23	277.56	480
490	277.56	277.90	278.23	278.56	278.90	279.23	279.56	279.90	280.23	280.56	280.90	490
500	280.90	281.23	281.56	281.89	282.23	282.56	282.89	283.22	283.55	283.89	284.22	500
510	284.22	284.55	284.88	285.21	285.54	285.87	286.21	286.54	286.87	287.20	287.53	510
520	287.53	287.86	288.19	288.52	288.85	289.18	289.51	289.84	290.17	290.50	290.83	520
530	290.83	291.16	291.49	291.81	292.14	292.47	292.80	293.13	293.46	293.79	294.11	530
540	294.11	294.44	294.77	295.10	295.43	295.75	296.08	296.41	296.74	297.06	297.39	540
550	297.39	297.72	298.04	298.37	298.70	299.02	299.35	299.68	300.00	300.33	300.65	550
560	300.65	300.98	301.31	301.63	301.96	302.28	302.61	302.93	303.26	303.58	303.91	560
570	303.91	304.23	304.56	304.88	305.20	305.53	305.85	306.18	306.50	306.82	307.15	570
580	307.15	307.47	307.79	308.12	308.44	308.76	309.09	309.41	309.73	310.05	310.38	580
590	310.38	310.70	311.02	311.34	311.67	311.99	312.31	312.63	312.95	313.27	313.59	590
600	313.59	313.92	314.24	314.56	314.88	315.20	315.52	315.84	316.16	316.48	316.80	600
610	316.80	317.12	317.44	317.76	318.08	318.40	318.72	319.04	319.36	319.68	319.99	610
620	319.99	320.31	320.63	320.95	321.27	321.59	321.91	322.22	322.54	322.86	323.18	620
630	323.18	323.49	323.81	324.13	324.45	324.76	325.08	325.40	325.72	326.03	326.35	630
640	326.35	326.66	326.98	327.30	327.61	327.93	328.25	328.56	328.88	329.19	329.51	640
650	329.51	329.82	330.14	330.45	330.77	331.08	331.40	331.71	332.03	332.34	332.66	650
°C	0	1	2	3	4	5	6	7	8	9	10	°C

7.2 JPt100 Resistance vs. Temperature Table

R_0=100.00Ω R_{100}/R_0=1.3916

°C	0	–1	–2	–3	–4	–5	–6	–7	–8	–9	–10	°C
–200	17.14											–200
–190	21.46	21.03	20.59	20.16	19.73	19.29	18.86	18.43	18.00	17.57	17.14	–190
–180	25.80	25.37	24.93	24.50	24.07	23.63	23.20	22.76	22.33	21.90	21.46	–180
–170	30.12	29.69	29.26	28.83	28.40	27.97	27.53	27.10	26.67	26.24	25.80	–170
–160	34.42	33.99	33.56	33.13	32.70	32.28	31.85	31.42	30.99	30.56	30.12	–160
–150	38.68	38.26	37.83	37.41	36.98	36.55	36.13	35.70	35.27	34.85	34.42	–150
–140	42.91	42.49	42.07	41.64	41.22	40.80	40.38	39.95	39.53	39.10	38.68	–140
–130	47.11	46.69	46.27	45.85	45.43	45.01	44.59	44.17	43.75	43.33	42.91	–130
–120	51.29	50.87	50.45	50.04	49.62	49.20	48.78	48.37	47.95	47.53	47.11	–120
–110	55.44	55.02	54.61	54.19	53.78	53.36	52.95	52.53	52.12	51.70	51.29	–110
–100	59.57	59.16	58.74	58.33	57.92	57.50	57.09	56.68	56.26	55.85	55.44	–100
– 90	63.68	63.27	62.86	62.45	62.04	61.63	61.21	60.80	60.39	59.98	59.57	– 90
– 80	67.77	67.36	66.96	66.55	66.14	65.73	65.32	64.91	64.50	64.09	63.68	– 80
– 70	71.85	71.44	71.04	70.63	70.22	69.81	69.41	69.00	68.59	68.18	67.77	– 70
– 60	75.91	75.51	75.10	74.70	74.29	73.88	73.43	73.07	72.66	72.26	71.85	– 60
– 50	79.96	79.56	79.15	78.75	78.34	77.94	77.53	77.13	76.72	76.32	75.91	– 50
– 40	83.99	83.59	83.19	82.79	82.38	81.98	81.58	81.17	80.77	80.36	79.96	– 40
– 30	88.01	87.61	87.21	86.81	86.41	86.01	85.60	85.20	84.80	84.40	83.99	– 30
– 20	92.02	92.62	91.22	90.82	90.42	90.02	89.62	89.22	85.82	88.42	88.01	– 20
– 10	96.02	95.62	95.22	94.82	94.42	94.02	93.62	93.22	92.82	92.42	92.02	– 10
0	100.00	99.60	99.20	98.81	98.41	98.01	97.61	97.21	96.81	96.42	96.02	0
	0	1	2	3	4	5	6	7	8	9	10	
0	100.00	100.40	100.80	101.19	101.59	101.99	102.38	102.78	103.18	103.57	103.97	0
10	103.97	104.37	104.76	105.16	105.56	105.95	106.35	106.74	107.14	107.53	107.93	10
20	107.93	108.32	108.72	109.11	109.51	109.90	110.30	110.69	111.09	111.48	111.88	20
30	111.88	112.27	112.66	113.06	113.45	113.84	114.24	114.63	115.02	115.42	115.81	30
40	115.81	116.20	116.59	116.99	117.38	117.77	118.16	118.56	118.95	119.34	119.73	40
50	119.73	120.12	120.51	120.91	121.30	121.69	122.08	122.47	122.86	123.25	123.64	50
60	123.64	124.03	124.42	124.81	125.20	125.59	125.98	126.37	126.76	127.15	127.54	60
70	127.54	127.93	128.32	128.71	129.09	129.48	129.87	130.26	130.65	131.04	131.42	70
80	131.42	131.81	132.20	132.59	132.98	133.36	133.75	134.14	134.52	134.91	135.30	80
90	135.30	135.68	136.07	136.46	136.84	137.23	137.62	138.00	138.39	138.77	139.16	90
100	139.16	139.55	139.93	140.32	140.70	141.09	141.47	141.86	142.24	142.63	143.01	100
110	143.01	143.39	143.78	144.16	144.55	144.93	145.31	145.70	146.08	146.46	146.85	110
120	146.85	147.23	147.61	148.00	148.38	148.76	149.15	149.53	149.91	150.29	150.67	120
130	150.67	151.06	151.44	151.82	152.20	152.58	152.96	153.35	153.73	154.11	154.49	130
140	154.49	154.87	155.25	155.63	156.01	156.39	156.77	157.15	157.53	157.91	158.29	140
150	158.29	158.67	159.05	159.43	159.81	160.19	160.57	160.95	161.33	161.70	162.08	150
160	162.08	162.46	162.84	163.22	163.60	163.97	164.35	164.73	165.11	165.48	165.86	160
170	165.86	166.24	166.62	166.99	167.37	167.75	168.12	168.50	168.88	169.25	169.63	170
180	169.63	170.00	170.38	170.76	171.13	171.51	171.88	172.26	172.63	173.01	173.38	180
190	173.38	173.76	174.13	174.51	173.88	175.26	175.63	176.01	176.38	176.75	177.13	190
200	177.13	177.50	177.88	178.25	178.62	179.00	179.37	179.74	180.12	180.49	180.86	200
210	180.86	181.23	181.61	181.98	182.35	182.72	183.09	183.47	183.84	184.21	184.58	210
220	184.58	184.95	185.32	185.70	186.07	186.44	186.81	187.18	187.55	187.92	188.29	220
230	188.29	188.66	189.03	189.40	189.77	190.14	190.51	190.88	191.25	191.62	191.99	230
240	191.99	192.36	192.73	193.09	193.46	193.83	194.20	194.57	194.94	195.31	195.67	240
°C	0	1	2	3	4	5	6	7	8	9	10	°C

°C	0	1	2	3	4	5	6	7	8	9	10	°C
250	195.67	196.04	196.41	196.78	197.14	197.51	197.88	198.25	198.61	198.98	199.35	250
260	199.35	199.71	200.08	200.45	200.81	201.18	201.55	201.91	202.28	202.64	203.01	260
270	203.01	203.38	203.74	204.11	204.47	204.84	205.20	205.57	205.93	206.30	206.66	270
280	206.66	207.02	207.39	207.75	208.12	208.48	208.85	209.21	209.57	209.94	210.30	280
290	210.30	210.66	211.03	211.39	211.75	212.11	212.48	212.84	213.20	213.56	213.93	290
300	213.93	214.29	214.65	215.01	215.37	215.74	216.10	216.46	216.82	217.18	217.54	300
310	217.54	217.90	218.26	218.63	218.99	219.35	219.71	220.07	220.43	220.79	221.15	310
320	221.15	221.51	221.87	222.23	222.59	222.94	223.30	223.66	224.02	224.38	224.74	320
330	224.74	225.10	225.46	225.81	226.17	226.53	226.89	227.25	227.61	227.96	228.32	330
340	228.32	228.68	229.04	229.39	229.75	230.11	230.46	230.82	231.18	231.53	231.89	340
350	231.89	232.25	232.60	232.96	233.31	233.67	234.03	234.38	234.74	235.09	235.45	350
360	235.45	235.80	236.16	236.51	236.87	237.22	237.58	237.93	238.28	238.64	238.99	360
370	238.99	239.35	239.70	240.05	240.41	240.76	241.11	241.47	241.82	242.17	242.53	370
380	242.53	242.88	243.23	243.58	243.94	244.29	244.64	244.99	245.35	245.70	246.05	380
390	246.05	246.40	246.75	247.10	247.46	247.81	248.16	248.51	248.86	249.21	249.56	390
400	249.56	249.91	250.26	250.61	250.96	251.31	251.66	252.01	252.36	252.71	253.06	400
410	253.06	253.41	253.76	254.11	254.46	254.80	255.15	255.50	255.85	256.20	256.55	410
420	256.55	256.89	257.24	257.59	257.94	258.29	258.63	258.98	259.33	259.67	260.02	420
430	260.02	260.37	260.72	261.06	261.41	261.75	262.10	262.45	262.79	263.14	263.49	430
440	263.49	263.83	264.18	264.52	264.87	265.21	265.56	265.90	266.25	266.59	266.94	440
450	266.94	267.28	267.63	267.97	268.31	268.66	269.00	269.35	269.69	270.03	270.38	450
460	270.38	270.72	271.06	271.41	271.75	272.09	272.44	272.78	273.12	273.46	273.80	460
470	273.80	274.15	274.49	274.83	275.17	275.51	275.86	276.20	276.54	276.88	277.22	470
480	277.22	277.56	277.90	278.24	278.58	278.92	279.26	279.61	279.95	280.29	280.63	480
490	280.63	280.96	281.30	281.64	281.98	282.32	282.66	283.00	283.34	283.68	284.02	490
500	284.02	284.36	284.69	285.03	285.37	285.71	286.05	286.39	286.72	287.06	287.40	500
°C	0	1	2	3	4	5	6	7	8	9	10	°C