

HITACHI

User's Manual

Option

OD.RING

(LQE510-E)

S10VE

SEE-1-101 (A)

User's Manual

Option

OD.RING

(LQE510-E)

S10VE

If you export this product, please check all restrictions (for example, Japan's Foreign Exchange and Foreign Trade Law, and USA export control laws and regulations), and carry out all required procedures. If you require more information or clarification, please contact your Hitachi sales representative.

Edition 1 (October 2019): SEE-1-101 (A)

- No part of this material may be reproduced in any form or by any means without permission in writing from the publisher.
- Information in this document is subject to change without notice.

For inquiries about this product, please visit the following URL:

<https://www.hitachi.com/s10/>

All Rights Reserved, Copyright © 2019, Hitachi, Ltd.

Safety Precautions

- Before installation, operation, maintenance, and inspection of this product, you must carefully read through this manual and other related manuals. When using the product, make sure that 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 for future reference when using the product.
- Safety precautions in this manual are classified into four levels according to the severity of potential hazards: DANGER, WARNING, CAUTION, and Notice.

Definitions of the safety labels



: Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



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



: Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



: Indicates a danger (resulting from incorrect use of the product) that can cause property damage or loss not related to personal injury if the safety precautions are not observed.

Failure to observe precautions marked with  or  could also lead to a serious consequence depending on the situation in which the product is used. Therefore, you must observe all of those precautions without fail.

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

Serious injury:

Is an injury that has aftereffects and requires hospitalization for medical treatment or long-term follow-up care. Examples of serious injuries are as follows: vision loss, burns (caused by dry heat), low-temperature burns, electric-shock injuries, broken bones, and poisoning.

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 include burns and electric-shock injuries.

Property damage or loss not related to personal injury:

Is damage other than personal injury. Examples of property damage or loss not related to personal injury are as follows: damage or loss of personal property, failure or damage of the main unit of the product, and loss of data.

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 considered 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 specific needs. A variety of industry standards are available to aid in establishing such safety rules and regulations.

1. General Safety Guidelines

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



Before starting work

- Follow all the instructions and operating procedures provided in this manual and related manuals.
- Pay particular attention to the cautionary notes in the manuals and on the equipment itself, and comply with their stipulations.
Failure to do so could cause personal injury or damage to the machine.
- Do not perform any operation or action that is not described in this manual. When in doubt, contact the relevant store or your sales staff.
- The hazard warnings on the machine and in the manual cannot cover every possible case, as it is impossible to predict and evaluate all circumstances.
You must be alert and use your common sense.
- Do not perform any installation, wiring, handling, or internal customization that is not described in this manual. Hitachi will not be responsible for any damage to Hitachi equipment or peripherals and personal injury resulting from such a practice.
- In case this product fails, configure an emergency stop circuit or interlock circuit outside the product. Failure of this product might damage the machine or cause an accident.
- Maintenance work must be done only by appropriately trained persons who have practical experience and understand the potential hazards (and how to avoid them) during operation.

 During work

- Follow the sequence of steps specific to each procedure.
- Use the relevant tools and instruments for each task as specified in the manual. If no particular tools are specified, use commercially available tools and instruments which fit the purpose.
- Make sure that all measurement instruments and powered tools have been properly calibrated or periodically inspected prior to use.
- Keep the maintenance area neat and tidy.
- Make sure that maintenance parts, materials, and removed parts are not placed in a passageway so they are not tripped on by personnel.
- Wear eye protection if there is a risk of flying debris.
- When using sharp objects or cutting tools, keep fingers and other parts of your body away from the path of the blade bit or point.
- After maintenance work is completed, before turning on power, make sure that all parts removed during maintenance have been installed back in their original positions in the machine. Also make sure that no tool or foreign material remains in the machine.



Prevention of electric shock

- Before starting work, make sure that there is no potential electrical hazard in the maintenance area.
Example: Insufficient grounding line or a wet floor
- Before starting work, check the location of the emergency power-off switches and how to operate them.
- Unless otherwise specifically instructed, isolate the machine from all power sources before starting maintenance. Turn off not only the power switches on the machine but also the switch on the distribution panel.
After turning off the switch on the power distribution panel, attach a notice saying *Do not turn on this switch* on the power distribution panel. If the power distribution panel is equipped with a lockout device, turn off the switch on the power distribution panel, lock the device, and then bring the key with you.
If you are resuming maintenance work performed by someone else, do not assume that the power is off. Make sure that the above-mentioned conditions, such as switches turned off, are satisfied. If necessary, use a measurement tool to ensure that the power is off.
- Some parts in the machine remain charged for a certain time even after the power supply to the machine is disconnected. (Follow the displayed instructions).
- 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 near an exposed live electric circuit, do not work alone. Work with another person who can immediately turn off the power.
- To prevent electric shock during work, do not wear any metallic items or an accessory such as a wristwatch with a metallic surface. 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.
- Use only one hand when it is necessary to work near an exposed live electric circuit. This mitigates the risk of current passing through your heart 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 the mirror 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.



Procedure in an emergency

In the case of 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 by using the emergency power-off switch. If there is no emergency power-off switch, use the 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.
- 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 must be performed by a trained and qualified person.

In the case of fire

- Call the fire department, and then take action to extinguish the fire.
- Shut off power to the machine by using the emergency power-off switch. If there is no emergency power-off switch, use the normal power-off switch.

2. Notes About Warning Indications

The following summarizes the warnings contained in this manual and their locations.

2.1 CAUTION

CAUTION

- Electrical hazards. Only optical fiber cables can be replaced online. Turn off the power switch of the power supply module before replacing cables other than optical fiber cables, such as power cables and grounding conductors.

(See page 6-3.)

2.2 Notice

Notice

- Do not connect the OD.RING module (LQE510-E) to the S10mini/S10V 1-km version OD.RING module (LQE015/515). The OD.RING module can be connected to the S10VE OD.RING module (LQE510-E) and S10mini/S10V 4-km version OD.RING module (LQE010/LQE510). Incorrect connections might cause malfunction.

(See page 1-1.)

- Do not connect the OD.RING module (LQE510-E) to the S10mini/S10V SD.LINK module (LQE030/530) because their optical fiber cabling specifications are different. Incorrect connections might cause malfunction.

(See page 1-1.)

- To avoid damaging the product, protect it with cushioning, and then store it in the environment shown in Table 1-2.
- To avoid damaging the product during transit, protect it with cushioning and handle it as a precision machine.

(See page 1-2.)

- Do not set the MODU No. setting switch to any position from 8 to F. An incorrect setting might cause data corruption.

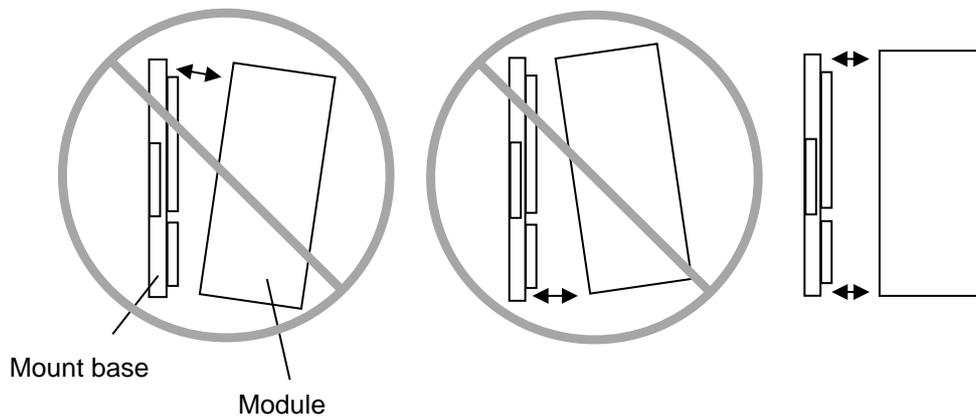
(See page 2-2.)

Notice

- Poor contact might cause malfunction. Mount the module and connect cabling to the module immediately after the module is unpacked so that dust or other foreign substances do not accumulate on connectors.
- To avoid damaging a module when removing or mounting it, turn off the power switch of the power supply module beforehand.
- To avoid damaging a module, observe the following precautions when mounting or removing the module:
 - Before mounting the module on the mount base connector, check that the connector pins are properly aligned and not bent, broken, or soiled.
 - Connecting or disconnecting a module that is tilted might damage connector pins. When moving the module, hold it vertically parallel to the mount base as shown below.

Bad examples

Good example



(See page 3-2.)

- Optical fiber cabling is an error-prone operation. Assign numbers to optical fiber cables to prevent misconnection. Incorrect cabling might cause malfunction.

(See page 3-4.)

Notice

- Insert the optical connector with its key aligned in the key groove of the optical module receptacle as shown in Figure 3-4. Then, turn the collar of the optical connector to secure it. If the key does not fit the key groove, do not forcibly insert the optical connector. Doing so might damage the optical connector and disable normal communication.
- Incorrect connection might disable normal communication and cause errors. As shown in Figure 3-3, the data flow direction in the primary ring differs from that in the secondary ring. Use the rings in dual-ring connection.
- Clamp optical fiber cables to allow a bending radius (R) of 30 mm or more. A bending radius smaller than 30 mm might cause internal fibers to break.
- Modules might be damaged or might malfunction due to static electricity. Discharge any static electricity in your body before touching a device. To prevent static electricity from damaging a module, cover the optical connectors with rubber boots or insulating material, as shown in Figure 3-4.

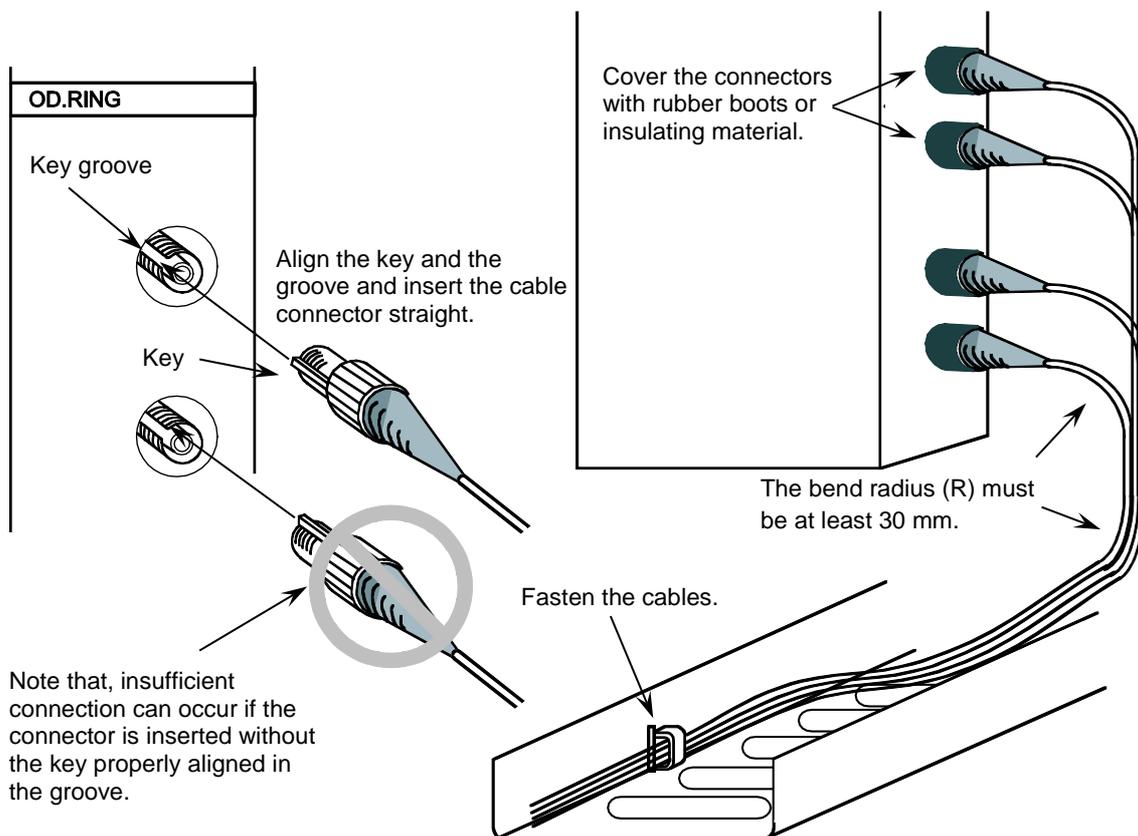


Figure 3-4 Handling optical fiber cables

(See page 3-5.)

- When using optical fiber cables containing tension members, ensure that enclosures are electrically isolated from one another. If enclosures are not electrically isolated, induced noise might cause malfunction of the equipment.

(See page 3-6.)

Notice

- Note that the following settings are prohibited:

- Two or more modules having the same CPL No. are configured in the dual ring.
- The CPL No. is set to outside the permitted range (see the following examples):

If the MODU No. setting switch is set to 0 or 1, CPL No. from 40 to FF are invalid.
If the MODU No. setting switch is set to 2 or 3, CPL No. from 20 to FF are invalid.
If the MODU No. setting switch is set to 4 or 5, CPL No. from 10 to FF are invalid.
If the MODU No. setting switch is set to 6 or 7, CPL No. from 08 to FF are invalid.

(See page 4-2.)

- Relationship between the OD.RING module and the LADDER RUN/STOP switch on the CPU module

The following shows OD.RING module operations according to the LADDER RUN/STOP switch setting on the CPU module.

- STOP

The OD.RING module receives data from a remote module and updates data in the memory transfer area, but it does not send local module data.

- RUN

The OD.RING module sends and receives data.

(See page 4-3.)

- To install or uninstall OD.RING SYSTEM/S10VE, use the administrator account. Using the standard account might result in incorrect installation or uninstallation.
- Before installing OD.RING SYSTEM/S10VE, terminate all Windows® programs, including resident programs in the memory (such as virus monitoring software). Installing OD.RING SYSTEM/S10VE while any of these programs are running might cause an error. If an error occurs, uninstall the tool being installed, terminate all Windows® programs, and then reinstall the tool. For details about the uninstallation procedure, see *4.4.3 Uninstallation*.
- Do not specify, as the OD.RING SYSTEM/S10VE installation folder, any of the following folders protected by User Account Control:
 - Program file folder (for example, C:\Program Files)
 - System root folder (for example, C:\Windows)
 - System drive root folder (for example, C:\)
 - Program data folder (for example, C:\ProgramData)

(See page 4-5.)

Notice

- OD.RING SYSTEM/S10VE cannot be installed on a per-user basis. To install OD.RING SYSTEM/S10VE successfully, you must first log on to the system with an administrator account. OD.RING SYSTEM/S10VE might not be installed properly in any of the following cases: 1) Administrator permissions are acquired by using User Account Control[#] from a standard user account, 2) The administrator account was created from a standard user account by using User Account Control. In this case, log on with the administrator account that was first created on your computer, and then reinstall OD.RING SYSTEM/S10VE.

If you log on with a user account other than that used for installing OD.RING SYSTEM/S10VE, the installed program might not appear in the program menu. In this case, log off and log on again with the administrator account that was first created on your computer, uninstall the installed program, and then install the program again.

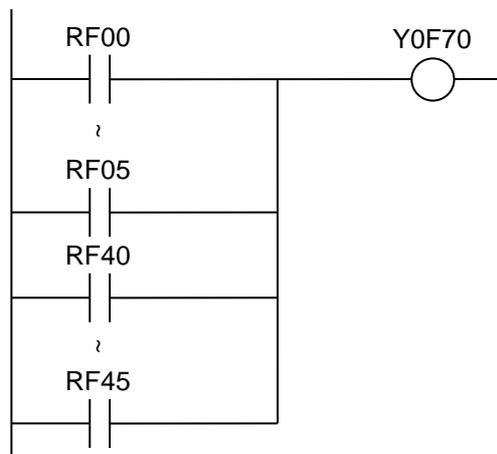
When you want to create a new account, log on with an administrator account without using User Account Control.

#: User Account Control is a Microsoft Windows feature that temporarily grants administrative rights to standard user accounts.

(See page 4-7.)

- If the primary ring and secondary ring are disconnected at different places (between different modules), normal communication might be disabled as shown in Figure 5-12. To prevent such a failure, program the modules so that they can detect an error and issue an alarm when the primary ring or secondary ring is disconnected at one place.

[Example] When the connected OD.RING module has CPL number 0 to 5 and the starting address of the RAS table is set to RWF00, the following ladder program assigns Y0F70 to the alarm report coil to report an alarm.



(See page 5-10.)

Notice

- If FW is set as a RAS bit area, data before reset might remain for two seconds after reset is canceled. Therefore, wait for at least two seconds before referencing the RAS table.

(See page 5-12.)

- Handle optical fiber cables with care to avoid breaking them. In particular, do not make their bend radius smaller than 30 mm.
- After measurement, clean the optical module receptacle and the optical connector. Dust or dirt on the connector might cause a malfunction.

(See pages 6-5 and 6-6.)

Application Conditions

- When using the product explained in this manual (called *this product* hereafter), we ask you to provide a backup or fail-safe system outside the product so that any failure or problem in this product will not cause serious consequences.
- This product is a general-purpose product designed for general industrial applications. This product shall not be used in applications that require a high level of safety or responsibility or special quality assurance. Hitachi assumes no responsibility for any loss or damage arising from the use of this product in such applications. Examples of such applications are as follows:

Applications where a high level of safety is required

Example: Power station control system (nuclear power, thermal power, or hydro power), combustion facility, aviation or space facility, railway facility, lift facility, facility for recreation and amusement, medical facility, safety equipment, on-vehicle equipment, ship facility, traffic light system, and other facilities where death or bodily harm might result in the event of an emergency

Applications where a high level of responsibility is required

Example: Systems that supply gas, water, or electricity, systems requiring round-the-clock operation, system responsible for legal settlement or other purpose of handling rights and properties

Applications under severe conditions or environment

Example: Outdoor facility environment that meets any of the following conditions:
Environment that is chemically contaminated, subject to electromagnetic interference, or subject to constant vibration or shock

However, use of this produce in any of the applications described above can be approved by the decision of Hitachi if the purpose is specifically limited, the customer has responsibility for providing redundancy, or no special quality is required. For details, contact a Hitachi sales representative.

Warranty and Servicing

1. Warranty period and scope

Warranty period

The warranty period of this product shall be one year after the product has been delivered to the specified site. The warranty period of repaired products shall be six months from the date of repair. The warranty period for repaired products takes precedence over the warranty period prior to repair.

Scope

If the product malfunctions during the warranty period described above while using this product as instructed by this manual, the product shall be repaired free of charge.

Repair service

Return repair is supported, and requires the customer to send the malfunctioning product to a designated repair service.

- Fill in the required items in the *Hitachi Programmable Controller S10VE Repair Request Sheet* in *Appendix A* in the *S10VE User's Manual General Description* (manual number SEE-1-001), and then enclose it in the package with the product to be returned for repair.
- The customer must cover the costs for sending the product for repair to Hitachi.
- Hitachi will pay the transport cost for returning the repaired product to the customer.
- Repair is limited to replacement of malfunctioning parts.
- Work other than replacement of malfunctioning parts, such as investigation into the cause of failure, shall be charged even during the warranty period.

2. Exception of warranty obligation

Regardless of the warranty period, Hitachi bears no responsibility in any of the following cases.

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 operation of this product or from malfunctions of this product. This warranty is valid only in Japan and is not transferable.

- 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 malfunction was caused by reasons that could not be anticipated, based on conventional technological understanding, at the time of shipment from Hitachi.

3. Range of services

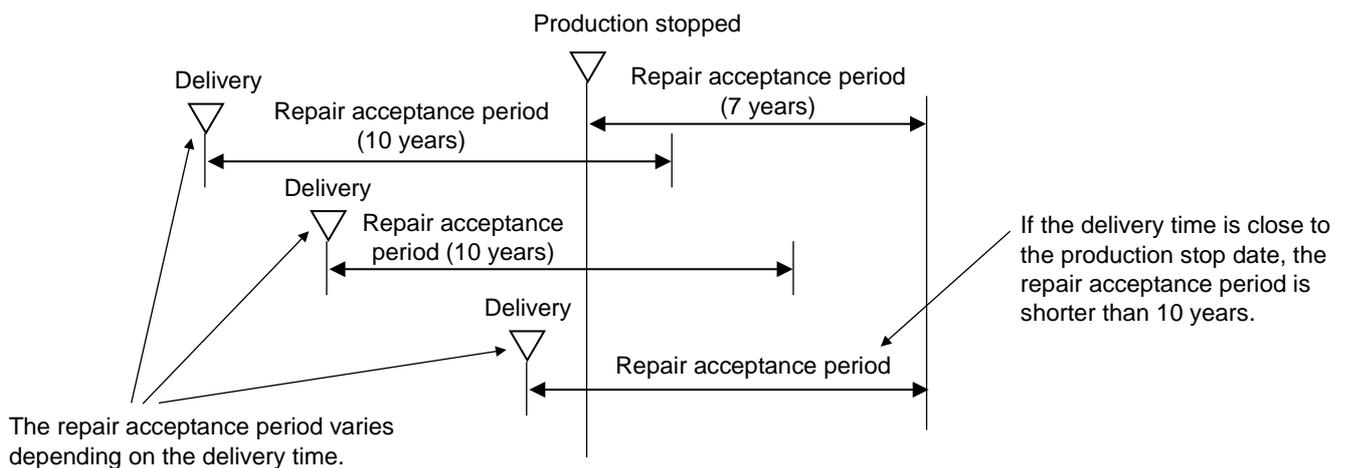
The price of the delivered product does not include on-site servicing fees by engineers. Extra fees will be charged for the following:

- Instruction for installation and adjustments, and witnessing trial operations
- Inspections, maintenance, and adjustments
- Technical instruction, technical training, and training facilities
- Examinations and repairs after the warranty period expires
- Examination of malfunctions caused by reasons outside the scope of the preceding warranty

4. Repair acceptance period

The repair acceptance period of S10VE products is 10 years after the product is delivered to the specified site or 7 years after production of the product is stopped, whichever comes earlier. The standard service life of S10VE is 10 years. We cannot accept repair of products whose designated repair acceptance periods (as described here) have been exceeded.

Payment for any repair after expiration of the warranty is the responsibility of the customer.



5. Service after production of the product is stopped

Products (including spare parts) cannot be supplied after production of those products is stopped.

6. Specification changes

Specifications described in this manual are subject to change without prior notice.

Revision History

Revision No.	History (revision details)	Issue date	Remarks
A	New edition	Oct. 2019	

Preface

Thank you for purchasing the OD.RING module, which is an option for use with the S10VE.

This manual *S10VE User's Manual Option OD.RING* describes how to use the OD.RING module. For proper use of the OD.RING module, thoroughly read this manual.

Trademarks

Microsoft® and Windows® are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Note about storage capacity calculations

- Memory capacities and requirements, file sizes and storage requirements must be calculated according to the formula 2^n . The following examples show the results of such calculations by 2^n (to the right of the equal signs).
 - 1 KB (kilobyte) = 1,024 bytes
 - 1 MB (megabyte) = 1,048,576 bytes
 - 1 GB (gigabyte) = 1,073,741,824 bytes
 - 1 TB (terabyte) = 1,099,511,627,776 bytes
- As for disk capacities, they must be calculated using the formula 10^n . Listed below are the results of calculating the above example capacities using 10^n in place of 2^n .
 - 1 KB (kilobyte) = 1,000 bytes
 - 1 MB (megabyte) = $1,000^2$ bytes
 - 1 GB (gigabyte) = $1,000^3$ bytes
 - 1 TB (terabyte) = $1,000^4$ bytes

Contents

1. Specifications	1-1
1.1 Application	1-1
1.2 Specifications	1-1
1.2.1 OD.RING module specifications	1-1
1.2.2 Environmental specifications	1-2
1.3 System software specifications	1-3
1.3.1 System overview	1-3
1.3.2 Required hardware and software	1-3
2. Names and Functions of Parts	2-1
2.1 Names and functions of parts	2-1
3. Mounting and Wiring	3-1
3.1 Mount base	3-1
3.2 Mounting the modules	3-1
3.3 External dimensions of the OD.RING module	3-3
3.4 Wiring	3-4
3.5 Optical fiber cables	3-6
3.5.1 Types of optical fiber cables	3-6
3.5.2 Optical fiber cable specifications	3-7
3.5.3 Recommended cables	3-8
4. Operation	4-1
4.1 Startup procedure	4-1
4.2 Setting switches	4-2
4.3 Turning on power	4-3
4.4 Installing and starting up the system	4-4
4.4.1 Notes on installation	4-4
4.4.2 Installation	4-6
4.4.3 Uninstallation	4-8
4.4.4 Reinstallation	4-8
4.4.5 Starting up the system	4-9
4.4.6 Closing the system	4-10
4.5 Commands	4-11
4.5.1 Organization of OD.RING SYSTEM/S10VE functions	4-11
4.5.2 Editing parameters	4-12

4.5.3 Registering parameters	4-16
4.5.4 Reading parameters	4-18
4.5.5 Deleting parameters	4-20
4.5.6 Saving parameter files	4-22
4.5.7 Reading a parameter file	4-24
4.5.8 Printing	4-27
4.5.9 CSV output	4-29
4.5.10 Main module (submodule) error information	4-31
4.5.11 Status	4-32
4.5.12 RAS table	4-33
4.5.13 Transfer area settings for combination of S10mini and S10V or S10VE	4-34
5. Programming	5-1
5.1 Operation	5-1
5.2 Communication time	5-2
5.3 Synchronism of transfer data	5-3
5.4 Memory transfer area	5-4
5.5 Failures and failure avoidance operation	5-6
5.6 RAS table	5-11
6. Maintenance	6-1
6.1 Maintenance and inspection	6-1
6.2 Handling optical fiber cables and cable connectors	6-2
6.3 Replacing optical fiber cables	6-3
6.4 Replacing or adding the module	6-3
6.5 Measuring optical levels	6-4
6.5.1 Measuring the received optical level	6-4
6.5.2 Measuring the transmitted optical level	6-6
6.5.3 Locating a fault location	6-7
6.6 Troubleshooting	6-8
7. Test and Maintenance Diagnosis	7-1
7.1 Details of Test and Maintenance diagnosis	7-1
7.2 Cabling	7-2
7.3 Starting Test and Maintenance	7-4
7.4 Checking errors	7-6

List of Figures

Figure 2-1 Front of the OD.RING module	2-1
Figure 3-1 Mounting the option module	3-1
Figure 3-2 External dimensions of the OD.RING module	3-3
Figure 3-3 Optical fiber cable connection	3-4
Figure 3-4 Handling optical fiber cables	3-5
Figure 4-1 Startup procedure	4-1
Figure 4-2 User Account Control message	4-6
Figure 4-3 SETUP window	4-6
Figure 4-4 OD.RING SYSTEM/S10VE InstallShield Wizard window	4-7
Figure 4-5 Confirmation message for uninstallation of OD.RING SYSTEM/S10VE	4-8
Figure 4-6 Setting Tool window of BASE SYSTEM/S10VE	4-9
Figure 4-7 OD.RING module selection window	4-9
Figure 4-8 Organization of OD.RING SYSTEM/S10VE functions	4-11
Figure 4-9 OD.RING module selection window	4-12
Figure 4-10 Set parameter window	4-12
Figure 4-11 Clicking the [PCs write] button in the Set parameter window	4-16
Figure 4-12 Option module parameter setup list window (registration)	4-16
Figure 4-13 Overwrite confirmation message (example of overwriting OD.RING (Sub))	4-17
Figure 4-14 Reset confirmation message	4-17
Figure 4-15 Clicking the [PCs read] button in the Set parameter window	4-18
Figure 4-16 Confirmation message for discarding parameter settings	4-18
Figure 4-17 Receiving agency selection window	4-19
Figure 4-18 Clicking the [Delete] button in the Set parameter window	4-20
Figure 4-19 Option module parameter setup list window (deletion)	4-20
Figure 4-20 Parameter deletion confirmation message	4-21
Figure 4-21 Reset confirmation message	4-21
Figure 4-22 Clicking the [File save] button in the Set parameter window	4-22
Figure 4-23 Save As window	4-22
Figure 4-24 File save window	4-23
Figure 4-25 Clicking the [File open] button in the Set parameter window	4-24
Figure 4-26 Confirmation message for discarding parameter settings	4-24
Figure 4-27 Open window	4-25
Figure 4-28 Incorrect file selection message	4-25
Figure 4-29 File open window	4-26
Figure 4-30 Clicking the [Print] button in the Set parameter window	4-27
Figure 4-31 Print window	4-27

Figure 4-32 Print example	4-28
Figure 4-33 Clicking the [CSV Output] button in the Set parameter window	4-29
Figure 4-34 Save As window	4-29
Figure 4-35 Example of CSV file output	4-30
Figure 4-36 Normal module message	4-31
Figure 4-37 [Module error] tab window	4-31
Figure 4-38 [Status] tab window	4-32
Figure 4-39 [RAS] tab window	4-33
Figure 4-40 Example of S10VE (CPU1) settings	4-34
Figure 5-1 Example of system configuration	5-1
Figure 5-2 Memory transfer	5-1
Figure 5-3 Communication time (transfer cycle)	5-2
Figure 5-4 Areas set by each module	5-5
Figure 5-5 Data flow in normal operation	5-6
Figure 5-6 One ring is disconnected at one place	5-7
Figure 5-7 One ring is disconnected at several places	5-7
Figure 5-8 Both rings are disconnected at the same place	5-8
Figure 5-9 One module stops	5-8
Figure 5-10 Adjacent multiple modules stop	5-9
Figure 5-11 Nonadjacent multiple modules stop	5-9
Figure 5-12 Primary ring and the secondary ring are disconnected at different places	5-10
Figure 5-13 Structure of RAS table	5-11
Figure 6-1 Example of measuring the received power level	6-5
Figure 6-2 Example of measuring the transmitted power level	6-6
Figure 6-3 Locating fault location	6-7
Figure 7-1 Wiring required for external loopback check	7-2
Figure 7-2 Wiring required for inter-module connection check	7-3
Figure 7-3 Switch settings on the OD.RING module	7-5
Figure 7-4 ERR LEDs of the OD.RING module	7-6

List of Tables

Table 1-1 OD.RING module specifications	1-1
Table 1-2 Environmental specifications	1-2
Table 1-3 System software (tool)	1-3
Table 2-1 Names and functions of parts	2-1
Table 2-2 Settings of the MODU No. setting switch	2-2
Table 3-1 Mount base applicable to the OD.RING module	3-1
Table 3-2 Types of optical fiber cables	3-6
Table 3-3 Optical fiber cable specifications	3-7
Table 4-1 Settings of the MODU No. and CPL No. setting switches	4-2
Table 4-2 Available registers	4-14
Table 5-1 Communication time (transfer cycle) calculation formula	5-2
Table 5-2 Memory transfer area	5-4
Table 5-3 Timeout period	5-12
Table 5-4 Failures and RAS table	5-12
Table 6-1 Maintenance and inspection items	6-1
Table 6-2 Notes on handling	6-2
Table 7-1 Details of Test and Maintenance diagnosis for OD.RING modules	7-1
Table 7-2 Test item selected by setting switches	7-4
Table 7-3 Location of problem for lighting ERR LED, and corrective actions	7-6

1. Specifications

1.1 Application

The OD.RING module (model: LQE510-E) shares data by performing memory transfer between CPU units. The maximum data sharing size is 4,096 points for both I/O data and word data.

1.2 Specifications

1.2.1 OD.RING module specifications

Table 1-1 OD.RING module specifications

Item		Specifications
Model		LQE510-E
System specifications	Maximum mountable number of modules	2 modules per CPU unit
	Number of lines	2 lines per module
	Weight	410 g or less
	Current consumption	900 mA or less
Network specifications	Network configuration	Dual rings
	Transmission rate	2 Mbps
	Maximum transmission distance	4 km between modules 60 km per ring
	Maximum number of connectable units	64
	Maximum data sharing size of the system	I/O data: 4,096 points Word data: 4,096 words
	Maximum data sharing size of the module	I/O data: 2,048 points per module Word data: 1,024 words per module
	Data transfer cycle	About 13 to 250 ms (depending on the number of modules connected and the amount of data transferred)
	Wavelength	840 to 890 nm
	Transmission level	-15 to -18 dBm
	Reception level	-15 to -30 dBm
Cable specifications	Optical connector	FC type
	Optical fiber cable	Graded index type
Hot swapping		Not supported

Notice

- Do not connect the OD.RING module (LQE510-E) to the S10mini/S10V 1-km version OD.RING module (LQE015/515). The OD.RING module can be connected to the S10VE OD.RING module (LQE510-E) and S10mini/S10V 4-km version OD.RING module (LQE010/LQE510). Incorrect connections might cause malfunction.
- Do not connect the OD.RING module (LQE510-E) to the S10mini/S10V SD.LINK module (LQE030/530) because their optical fiber cabling specifications are different. Incorrect connections might cause malfunction.

1. Specifications

1.2.2 Environmental specifications

Table 1-2 Environmental specifications

Item	Specifications
Operating ambient temperature	0 to 55°C
Storage ambient temperature	-20 to 75°C
Relative humidity	10 to 90% RH (operating and non-operating) (no condensing)
Vibration resistance	Frequency: 10 to 150 Hz, acceleration: 10 m/s ² Applied direction of vibration: directions X, Y, and Z Sweep time: 8 minutes, number of sweep cycles: 20
Shock resistance	Peak acceleration: 147 m/s ² , half-sine shock time: 11 ms, applied direction of shock: directions X, Y, and Z, three times for each case
Ambient air	Dust: 0.1mg/m ³ or less
Corrosive gas	JEITA IT-1004A Class B (no corrosive gas must exist)

Notice

- To avoid damaging the product, protect it with cushioning, and then store it in the environment shown in Table 1-2.
- To avoid damaging the product during transit, protect it with cushioning and handle it as a precision machine.

1.3 System software specifications

1.3.1 System overview

To use the OD.RING module, you need to register the hardware switch settings and various kinds of software information in the module. The system software (tool) shown in Table 1-3 allows you to register module information in a similar manner to the way you would do so by using a typical Windows®-based application.

Table 1-3 System software (tool)

Package name	Model
OD.RING SYSTEM/S10VE	S-7898-28

1.3.2 Required hardware and software

To use the system software of the OD.RING module, you need the following hardware and software:

- Personal computer (PC) with a CPU of 1 GHz or faster
- Display with a resolution of 1366 x 768 dots or higher (FWXGA)
- 2 GB (or more) RAM
- Free hard disk capacity of 200 MB or more
- Cable (UTP crossed twisted-pair cable of Category 5e or higher) connected between PC and CPU module
- Microsoft® Windows® 7 (64-bit) operating system, Microsoft® Windows® 10 (64-bit) operating system
- Microsoft .NET Framework 4
- Microsoft Visual C++ 2010 redistributable package (x64)

Users of this product must have a basic knowledge of the Windows® environment and user interfaces. This system complies with the Windows® standard. This manual is intended for users who have mastered a basic knowledge of how to use Windows®.

This page is intentionally left blank.

2. Names and Functions of Parts

2.1 Names and functions of parts

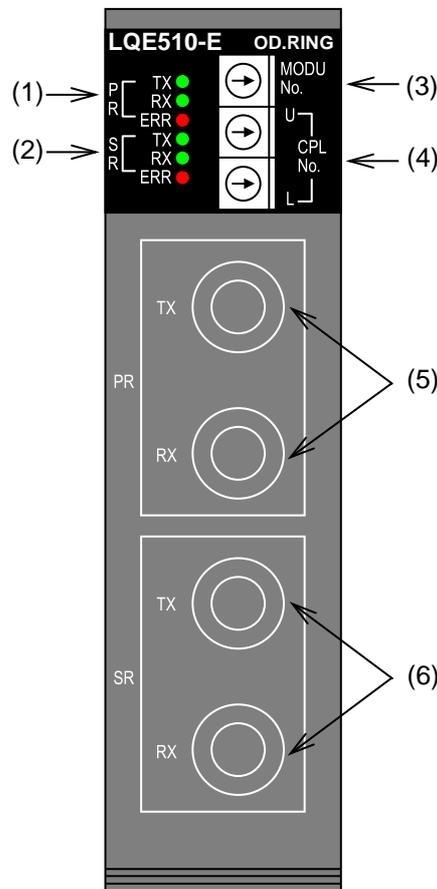


Figure 2-1 Front of the OD.RING module

Table 2-1 Names and functions of parts

No.	Name	Function
(1)	LEDs for the primary ring (PR)	TX: Lights when the local station is transmitting. RX: Lights when the local station is receiving data.
(2)	LEDs for the secondary ring (SR)	ERR: Lights if a hardware error occurs. If the module is mounted on a model different from the one specified by the parameters in <i>4.5 Commands</i> , a parameter error would occur and this LED also lights.
(3)	MODU No. setting switch	This switch is used to set the module number to specify the number of connected, and select main module or submodule. For details, see Table 2-2.
(4)	CPL No. setting switch	This switch is used to set the number (/00 to /3F) for identifying the module connected to the line. Set a unique number to avoid duplication with any other OD.RING module connected to the same line.
(5)	Optical module receptacles for the primary ring (PR)	TX (transmission): Used to connect the OD.RING module to the primary ring (RX) of the next-stage module. RX (reception): Used to connect the OD.RING module to the primary ring (TX) of the previous-stage module.
(6)	Optical module receptacles for the secondary ring (SR)	TX (transmission): Used to connect the OD.RING module to the secondary ring (RX) of the next-stage module. RX (reception): Used to connect the OD.RING module to the secondary ring (TX) of the previous-stage module.

Table 2-2 Settings of the MODU No. setting switch

Function	Main module setting number	Submodule setting number
Connecting 33 to 64 modules	0	1
Connecting 17 to 32 modules	2	3
Connecting 9 to 16 modules	4	5
Connecting 1 to 8 modules	6	7
Use prohibited (T/M1)	8	9
Use prohibited (T/M2)	A	B
Use prohibited (T/M3)	C	D
Use prohibited	Other than above	

Notice

- Do not set the MODU No. setting switch to any position from 8 to F. An incorrect setting might cause data corruption.

3. Mounting and Wiring

3.1 Mount base

The OD.RING module can be mounted in the mount bases shown in Table 3-1.

Table 3-1 Mount base applicable to the OD.RING module

Name	Model	Specification
7-slot mount base	HSC-1770	Power supply + RI/O-IF + CPU + 7 I/O slots

3.2 Mounting the modules

Mount the option module in the I/O slots (slot No. 1 to 7) on the mount base (see Figure 3-1).

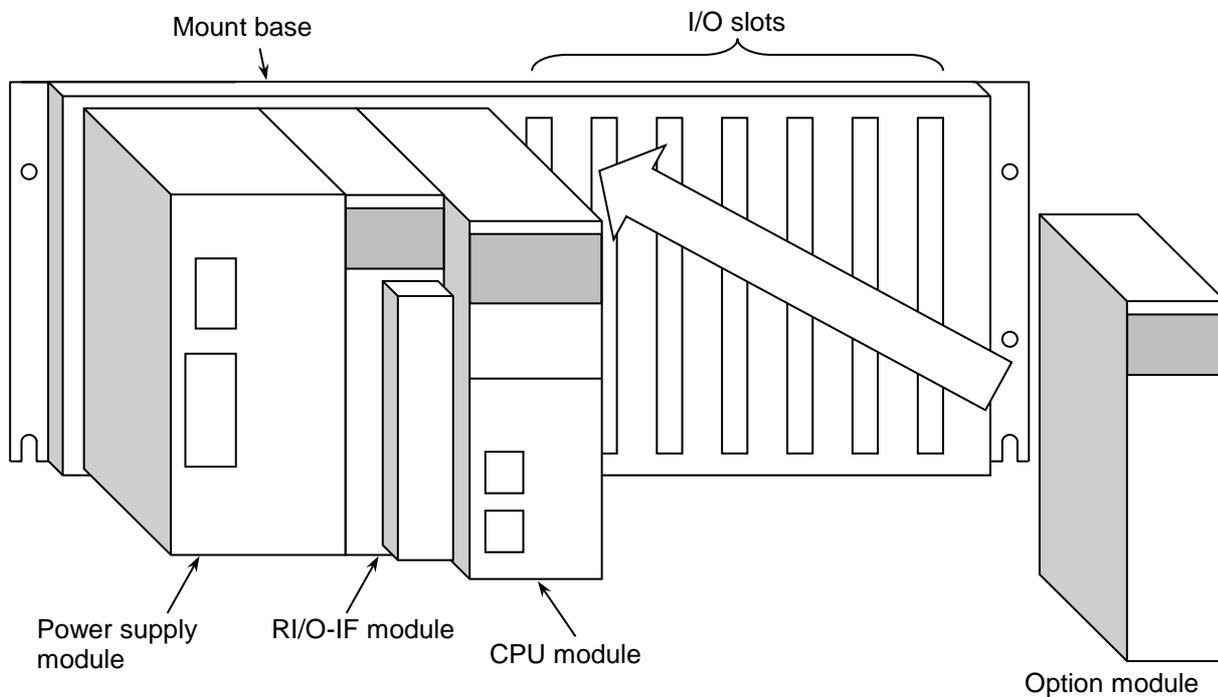


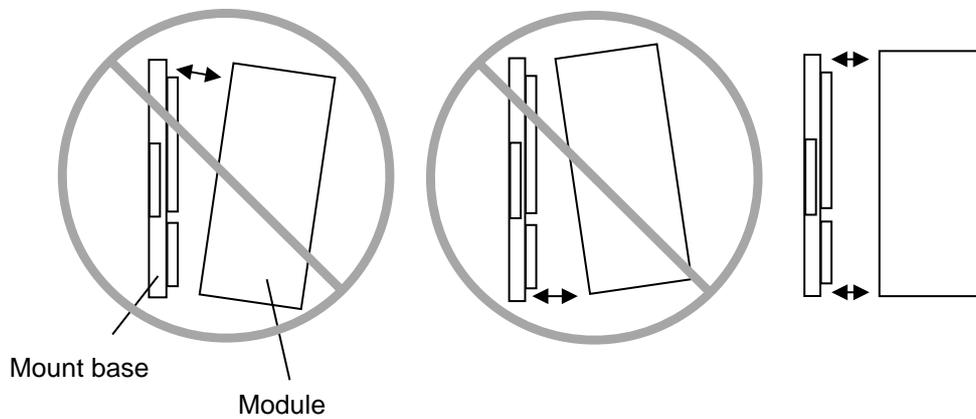
Figure 3-1 Mounting the option module

Notice

- Poor contact might cause malfunction. Mount the module and connect cabling to the module immediately after the module is unpacked so that dust or other foreign substances do not accumulate on connectors.
- To avoid damaging a module when removing or mounting it, turn off the power switch of the power supply module beforehand.
- To avoid damaging a module, observe the following precautions when mounting or removing the module:
 - Before mounting the module on the mount base connector, check that the connector pins are properly aligned and not bent, broken, or soiled.
 - Connecting or disconnecting a module that is tilted might damage connector pins. When moving the module, hold it vertically parallel to the mount base as shown below.

Bad example

Good example



3.3 External dimensions of the OD.RING module

Figure 3-2 shows the external dimensions of the OD.RING module.

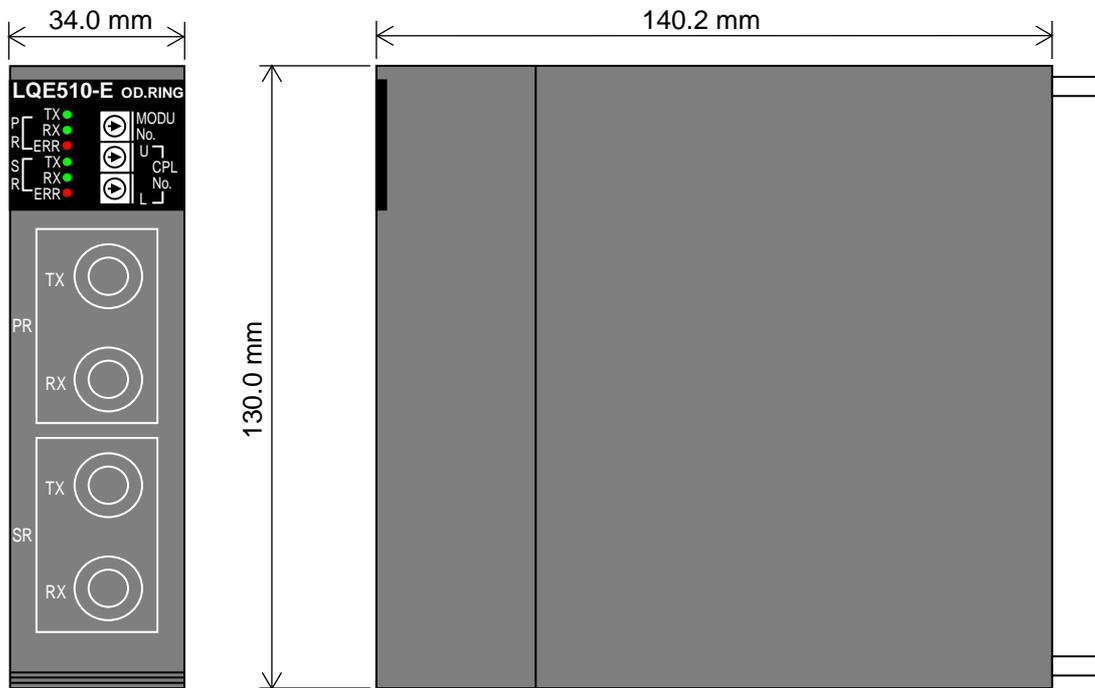


Figure 3-2 External dimensions of the OD.RING module

3.4 Wiring

This section describes wiring of optical cables.

Connector caps are attached to connectors on the OD.RING module upon shipment. Remove the connector caps before you start wiring. Store the removed connector caps.

After wiring of optical cables has been completed, you must measure the optical power level and make sure that the optical power levels are within the specified ranges (transmitted power level: -15 to -18 dBm, received power level: -15 to -30 dBm).

For details about how to measure the optical power levels, see 6.5 *Measuring optical power levels*.

(1) Primary ring (PR) wiring

As shown in Figure 3-2, connect the TX and RX receptacles of two adjacent OD.RING modules with optical fiber cables to configure the primary ring. Communication data flows from TX to RX in the direction indicated by the arrows.

(2) Secondary ring (SR) wiring

In secondary ring wiring, connect the TX and RX receptacles of two adjacent OD.RING modules with optical cables as in primary ring wiring. To ensure redundancy in the case of failure, connect the receptacles so that communication data flows in the reverse of the direction of the primary ring. (That is, the direction indicated by the arrow is the reverse of the direction of the primary ring.)

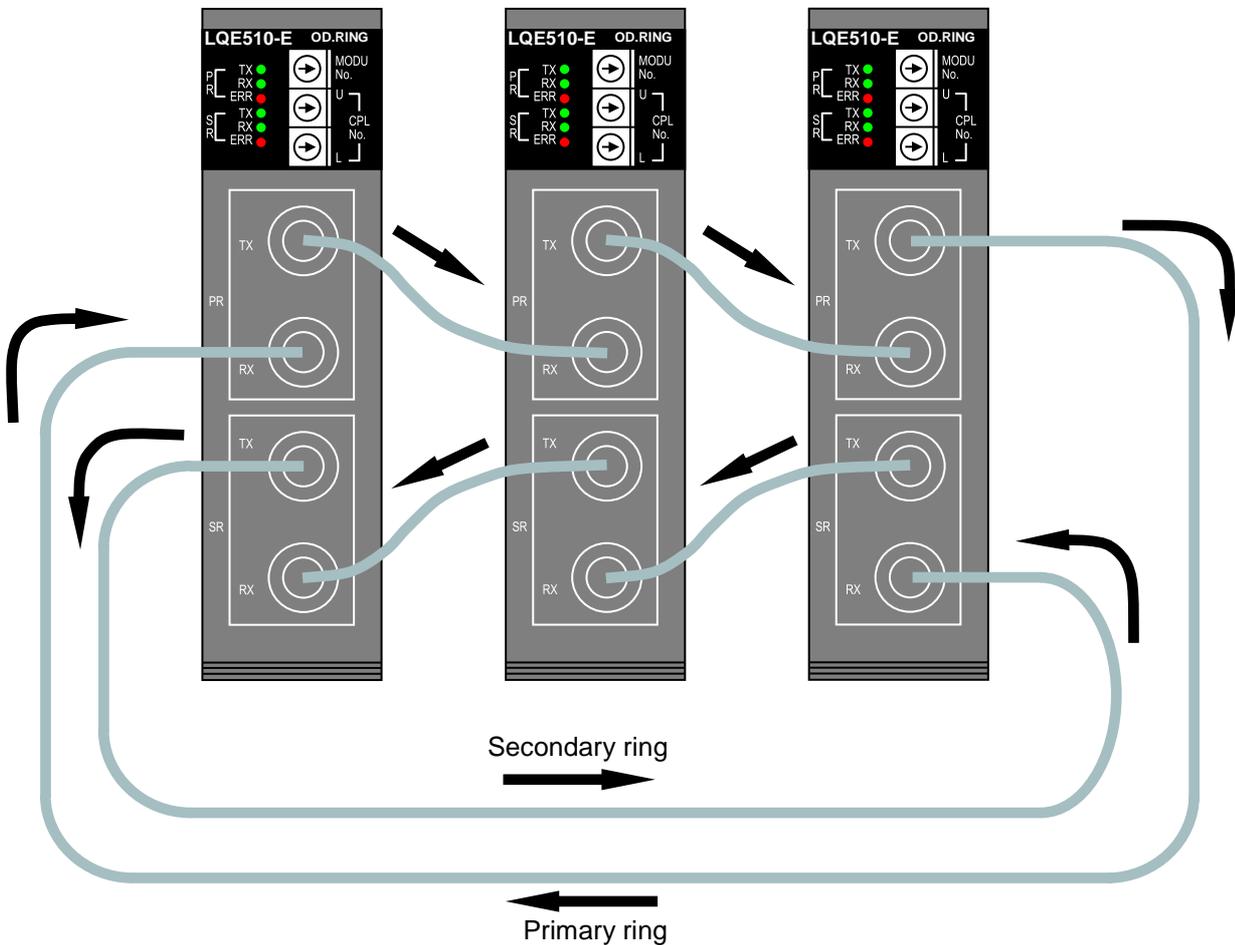


Figure 3-3 Optical fiber cable connection

Notice

- Optical fiber cabling is an error-prone operation. Assign numbers to optical fiber cables to prevent misconnection. Incorrect cabling might cause malfunction.

Notice

- Insert the optical connector with its key aligned in the key groove of the optical module receptacle as shown in Figure 3-4. Then, turn the collar of the optical connector to secure it. If the key does not fit the key groove, do not forcibly insert the optical connector. Doing so might damage the optical connector and disable normal communication.
- Incorrect connection might disable normal communication and cause errors. As shown in Figure 3-3, the data flow direction in the primary ring differs from that in the secondary ring. Use the rings in dual-ring connection.
- Clamp optical fiber cables to allow a bending radius (R) of 30 mm or more. A bending radius smaller than 30 mm might cause internal fibers to break.
- Modules might be damaged or might malfunction due to static electricity. Discharge any static electricity in your body before touching a device. To prevent static electricity from damaging a module, cover the optical connectors with rubber boots or insulating material, as shown in Figure 3-4.

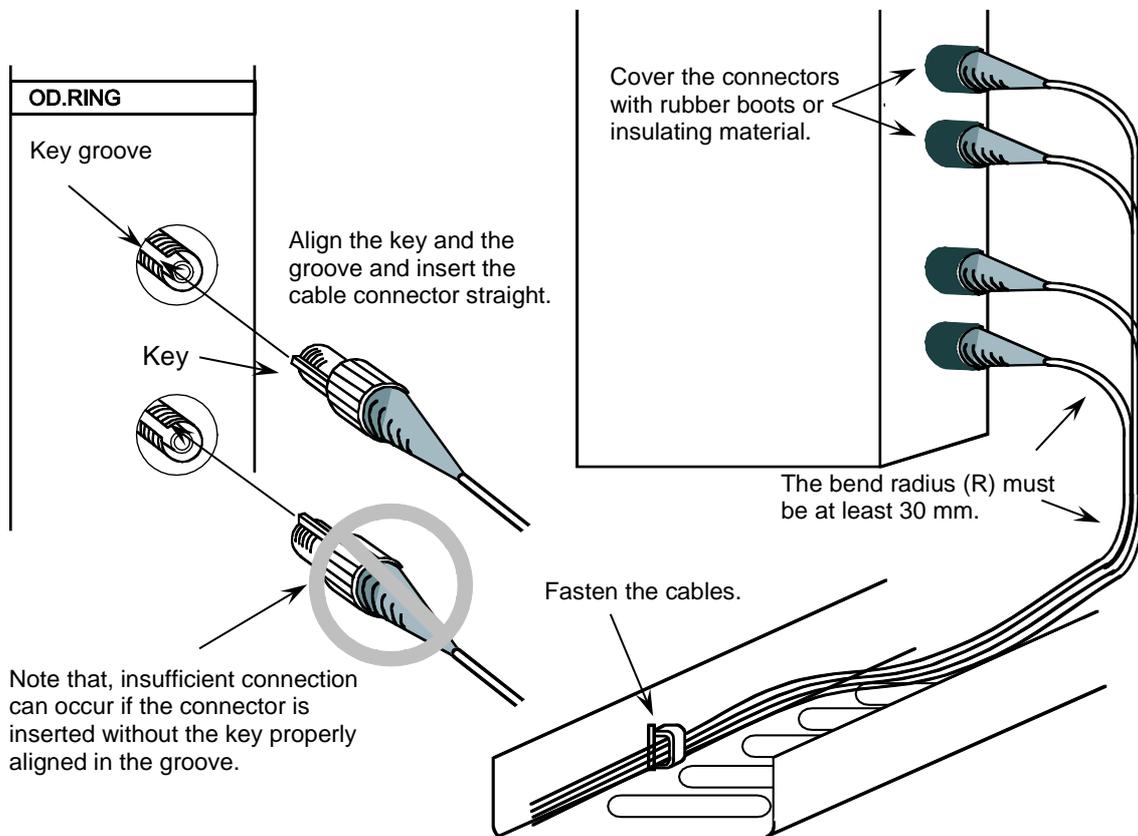


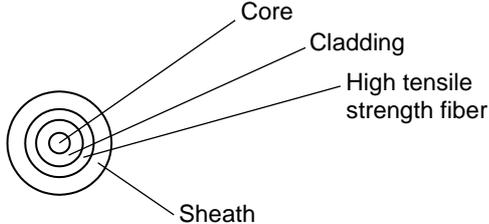
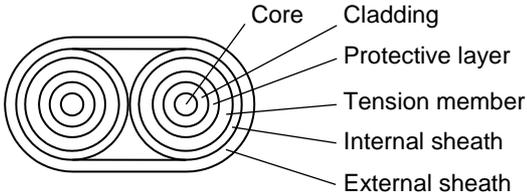
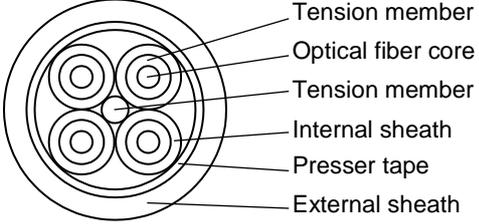
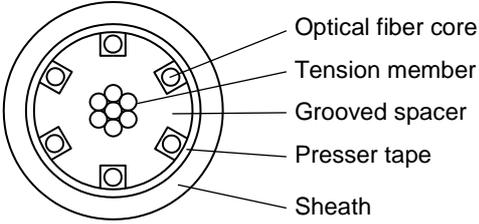
Figure 3-4 Handling optical fiber cables

3.5 Optical fiber cables

3.5.1 Types of optical fiber cables

There are various types of optical fiber cables. Select optical fiber cables suitable for the purpose. Table 3-2 lists typical optical fiber cables.

Table 3-2 Types of optical fiber cables

Type	Characteristics	Cross section
Single core	Use single core cables especially for panel wiring in indoor wiring.	 <p>Core Cladding High tensile strength fiber Sheath</p>
Flat	Use flat cables in indoor wiring where the laying distance is comparatively short and external force is rarely applied.	 <p>Core Cladding Protective layer Tension member Internal sheath External sheath</p>
Round	A round cable contains a tension member in its center to improve mechanical characteristics. Use round cables for indoor wiring where external force is comparatively small.	 <p>Tension member Optical fiber core Tension member Internal sheath Presser tape External sheath</p>
Spacer	The structure of a spacer cable is more complex than that of flat and round cables. Spacer cables have more superior mechanical characteristics. For this reason, use spacer cables where external force is large, such as in the case of outdoor wiring.	 <p>Optical fiber core Tension member Grooved spacer Presser tape Sheath</p>

Notice

- When using optical fiber cables containing tension members, ensure that enclosures are electrically isolated from one another. If enclosures are not electrically isolated, induced noise might cause malfunction of the equipment.

3.5.2 Optical fiber cable specifications

Table 3-3 shows the specifications of optical fiber cables that can be used with the OD.RING module. Use optical fiber cables of the same specifications.

Table 3-3 Optical fiber cable specifications

Item	Specifications
Fiber core material	Quartz glass
Type of optical fiber	Graded index type
Core diameter	50 μm
Clad diameter	125 μm
Transmission loss	3 dB/km maximum ($\lambda = 850 \text{ nm}$)
Optical connector	FC type (JIS C5970 F01 type)

3. Mounting and Wiring

3.5.3 Recommended cables

We recommend cables manufactured by Hitachi Metals, Ltd. for use with the OD.RING module. To obtain the appropriate cables, specify the following information as shown below: Optical fiber type ((1)), core diameter ((2)), transmission loss ((3)), number of cores ((4)), cable type ((5)), optical connector connection ((6)), optical connector type ((7)), and cable length ((8)). Use the following example as reference when ordering cables.

GI 50 3 - 2 R - C 7 - 500M
(1) (2) (3) (4) (5) (6) (7) (8)

The above designation indicates a graded index optical fiber cable of core diameter 50 um and transmission loss 3 dB/km or lower. It also indicates a 2-core round cable of length 500 m, fitted with an FC-type optical connector at each end.

- (1) Optical fiber type
GI: Graded index type
- (2) Core diameter
50: 50 um
- (3) Transmission loss
3: 3 dB/km
- (4) Number of cores
None: Valid for single core cables
2: Valid for flat 2-core cables
2, 3, 4, or 6: Valid for round cables
1 or greater: Valid for spacer cables
- (5) Cable type
None: Single core
R: Round
F: Flat
S: Spacer
- (6) Optical connector connection
B: Attached at either end of the cable
C: Attached at both ends of the cable
- (7) Optical connector type
7: FC type (JIS C5970 F01 type)
- (8) Cable length
500M: 500 m (Specify the cable length in meters).

4. Operation

4.1 Startup procedure

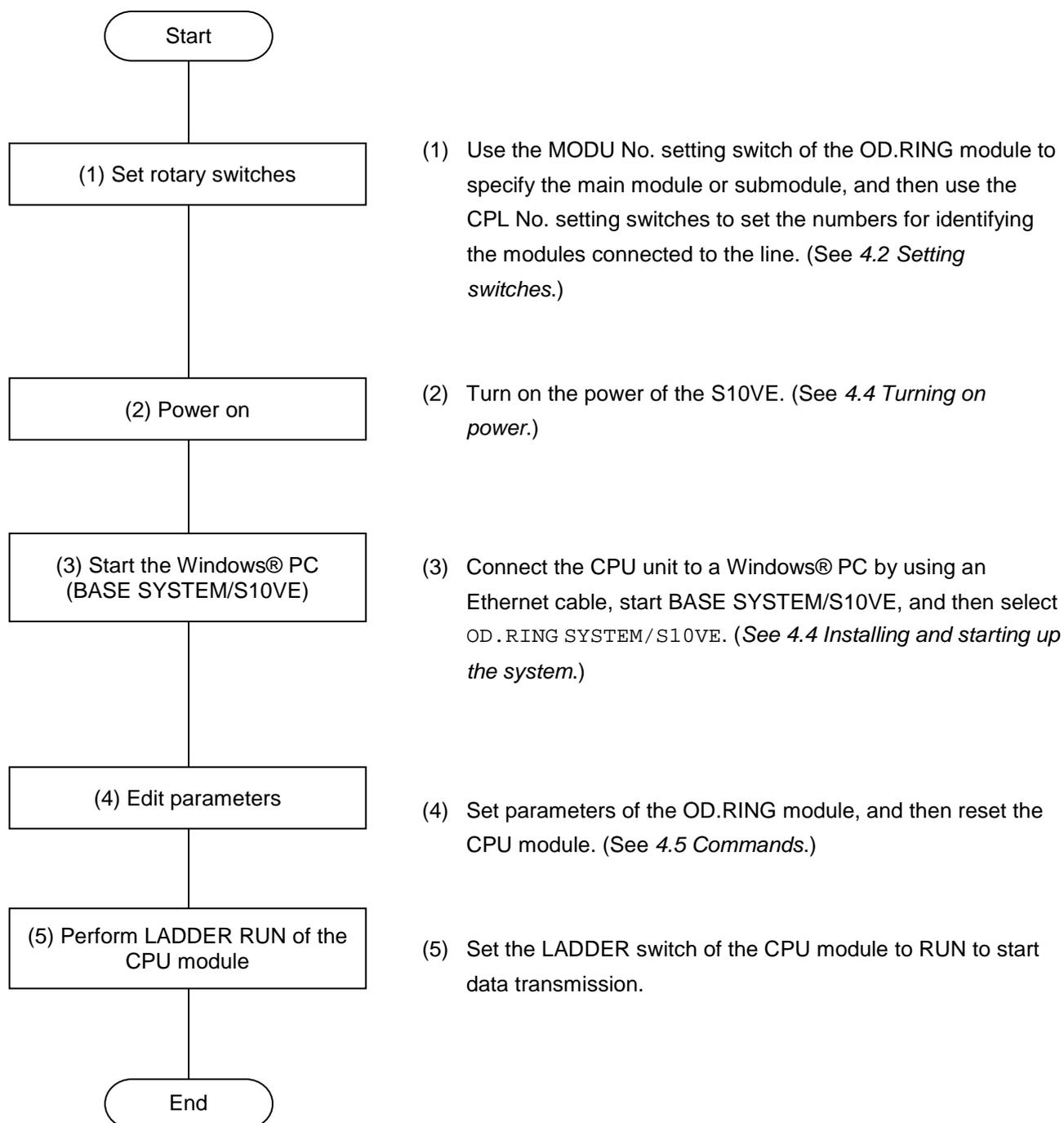


Figure 4-1 Startup procedure

4.2 Setting switches

- MODU No. setting switch
Set the MODU No. setting switch according to the number of connected modules (see *2.1 Names and functions of each part*).
- CPL No. setting switches
 - Set the CPL No. setting switches so that all the modules connected to the OD.RING are assigned different numbers. CPL Nos. need not be in sequence.
 - Set the MODU No. setting switch and CPL No. setting switches according to the number of modules connected as shown in Table 4-1.

Table 4-1 Settings of the MODU No. and CPL No. setting switches

Number of modules connected	MODU No. setting switch	CPL No. setting switch
33 to 64	0 or 1	Any value from 00 to 3F
17 to 32	2 or 3	Any value from 00 to 1F
9 to 16	4 or 5	Any value from 00 to 0F
1 to 8	6 or 7	Any value from 00 to 07

Notice

- Note that the following settings are prohibited:
 - Two or more modules having the same CPL No. are configured in the dual ring.
 - The CPL No. is set to outside the permitted range (see the following examples):

If the MODU No. setting switch is set to 0 or 1, CPL No. from 40 to FF are invalid.

If the MODU No. setting switch is set to 2 or 3, CPL No. from 20 to FF are invalid.

If the MODU No. setting switch is set to 4 or 5, CPL No. from 10 to FF are invalid.

If the MODU No. setting switch is set to 6 or 7, CPL No. from 08 to FF are invalid.

4.3 Turning on power

- (1) Set the LADDER RUN/STOP switch on the CPU module to STOP.
- (2) Set the POWER switch on the power supply module to ON to turn on the power.
- (3) Set the LADDER RUN/STOP switch on the CPU module to RUN to start data transmission.

Notice

- Relationship between the OD.RING module and the LADDER RUN/STOP switch on the CPU module
The following shows OD.RING module operations according to the LADDER RUN/STOP switch setting on the CPU module.
 - STOP
The OD.RING module receives data from a remote module and updates data in the memory transfer area, but it does not send local module data.
 - RUN
The OD.RING module sends and receives data.

4.4 Installing and starting up the system

4.4.1 Notes on installation

OD.RING SYSTEM/S10VE supports the Microsoft® Windows® 7 (64-bit) operating system and Microsoft® Windows® 10 (64-bit) operating system.

OD.RING SYSTEM/S10VE must be installed from the CD of BASE SET/S10VE. The Microsoft Visual C++ 2010 redistributable package (x64) is a prerequisite program for operating BASE SET/S10VE. If you double-click `SETUP.exe` (in BASE SET/S10VE) with this program not installed, the following message appears and installation fails: *The program can't start because MSVCR100.dll is missing from your computer. Try reinstalling the program to fix this problem.* Install the Microsoft Visual C++ 2010 redistributable package (x64) in advance from the Microsoft download center. Before you attempt to install OD.RING SYSTEM/S10VE, make sure that BASE SYSTEM/S10VE (software product model: S-7898-38) has been installed. If BASE SYSTEM/S10VE has not been installed, install it. OD.RING SYSTEM/S10VE cannot be installed if BASE SYSTEM/S10VE has not been installed.

The following runtime package must be installed before you can operate OD.RING SYSTEM/S10VE. If this runtime package has not been installed, install it in advance from the Microsoft download center.

- Microsoft .NET Framework 4

If you attempt to start BASE SYSTEM/S10VE with the Microsoft .NET Framework 4 not installed, an error message indicating a .NET Framework initialization error appears and startup fails.

- If you attempt to start BASE SET/S10VE with the Microsoft Visual C++ 2010 redistributable package (x64) not installed, the following error message appears during startup: *The program can't start because MSVCR100.dll is missing from your computer. Try reinstalling the program to solve this problem.* Then, BASE SET/S10VE terminates abnormally.
- If you attempt to start BASE SYSTEM/S10VE with Microsoft .NET Framework 4 not installed, an error message indicating a .NET Framework initialization error appears and startup fails.

Notice

- To install or uninstall OD.RING SYSTEM/S10VE, use the administrator account. Using the standard account might result in incorrect installation or uninstallation.
- Before installing OD.RING SYSTEM/S10VE, terminate all Windows® programs, including resident programs in the memory (such as virus monitoring software). Installing OD.RING SYSTEM/S10VE while any of these programs are running might cause an error. If an error occurs, uninstall the tool being installed, terminate all Windows® programs, and then reinstall the tool. For details about the uninstallation procedure, see *4.4.3 Uninstallation*.
- Do not specify, as the OD.RING SYSTEM/S10VE installation folder, any of the following folders protected by User Account Control:
 - Program file folder (for example, C:\Program Files)
 - System root folder (for example, C:\Windows)
 - System drive root folder (for example, C:\)
 - Program data folder (for example, C:\ProgramData)

4. Operation

4.4.2 Installation

This subsection describes how to install OD.RING SYSTEM/S10VE.

Before starting installation, log on to the system with an administrator account.

- (1) To install OD.RING SYSTEM/S10VE, double-click `setup.exe` stored in the CD (BASE SET/S10VE).
- (2) After double-clicking `SETUP.exe`, the following message (Figure 4-2) might be displayed. Click the **Yes** button to start setup.

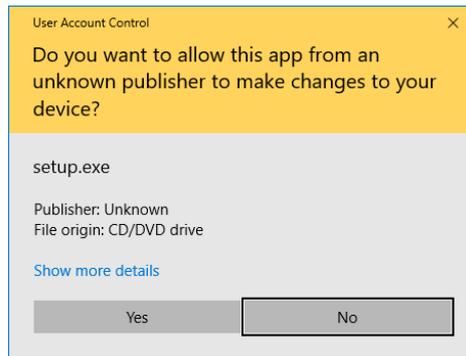


Figure 4-2 User Account Control message

- (3) In the `SETUP` window that appears (Figure 4-3), select `OD.RING SYSTEM/S10VE`, and then click the **Install** button.

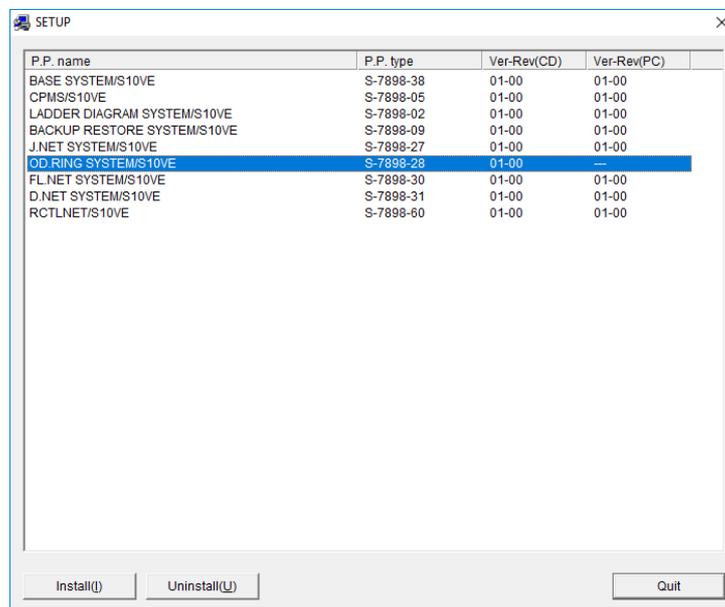


Figure 4-3 SETUP window

- (4) The OD.RING SYSTEM/S10VE InstallShield Wizard window (Figure 4-4) appears. Click the **Next** button.

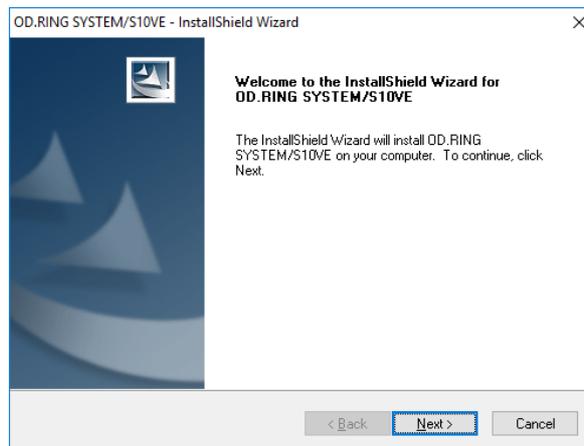


Figure 4-4 OD.RING SYSTEM/S10VE InstallShield Wizard window

If you click the **Cancel** button, a message appears, asking whether you want to cancel setup. Click the **Yes** or **No** button.

Yes: Cancels installation of OD.RING SYSTEM/S10VE.

In the InstallShield Wizard Completed window, click the **Complete** button.

No: Restarts installation of OD.RING SYSTEM/S10VE.

- (5) The Setup Status window appears.
- (6) When the installation is complete, the InstallShield Wizard Completed window appears. Click the **Complete** button.

Notice

- OD.RING SYSTEM/S10VE cannot be installed on a per-user basis. To install OD.RING SYSTEM/S10VE successfully, you must first log on to the system with an administrator account. OD.RING SYSTEM/S10VE might not be installed properly in any of the following cases: 1) Administrator permissions are acquired by using User Account Control# from a standard user account, 2) The administrator account was created from a standard user account by using User Account Control. In this case, log on with the administrator account that was first created on your computer, and then reinstall OD.RING SYSTEM/S10VE.

If you log on with a user account other than that used for installing OD.RING SYSTEM/S10VE, the installed program might not appear in the program menu. In this case, log off and log on again with the administrator account that was first created on your computer, uninstall the installed program, and then install the program again.

When you want to create a new account, log on with an administrator account without using User Account Control.

#: User Account Control is a Microsoft Windows feature that temporarily grants administrative rights to standard user accounts.

4. Operation

4.4.3 Uninstallation

This subsection describes how to uninstall OD.RING SYSTEM/S10VE.

Before starting uninstallation, log on to the system with the administrator account.

- (1) Click the **Start** button, and then open **Control Panel**. Click **Uninstall a program**, and then double-click OD.RING SYSTEM/S10VE.

A confirmation message for uninstallation of OD.RING SYSTEM/S10VE (Figure 4-5) appears. Click the **Yes** or **No** button.

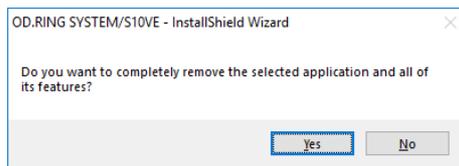


Figure 4-5 Confirmation message for uninstallation of OD.RING SYSTEM/S10VE

Yes: Starts uninstallation.

No: Cancels uninstallation.

- (2) When the uninstallation is complete, a message indicating completion of uninstallation appears. Click the **Complete** button.

4.4.4 Reinstallation

To reinstall OD.RING SYSTEM/S10VE, you must uninstall it beforehand. For the uninstallation procedure, see 4.4.3 *Uninstallation*. For the installation procedure, see 4.4.2 *Installation*.

4.4.5 Starting up the system

This subsection describes how to start up OD.RING SYSTEM/S10VE.

(1) Starting up BASE SYSTEM/S10VE

Start up BASE SYSTEM/S10VE, and then create or select the target project. For details about how to start up BASE SYSTEM/S10VE and create or select a project, see the *S10VE User's Manual General Description* (manual number SEE-1-001).

(2) Selecting the command

(a) To set OD.RING module parameters or display error information:

From the **Program** menu of BASE SYSTEM/S10VE, click **Setting Tool**.

The Setting Tool window (Figure 4-6) appears. Select OD.RING SYSTEM/S10VE, and then click the **Execute** button.

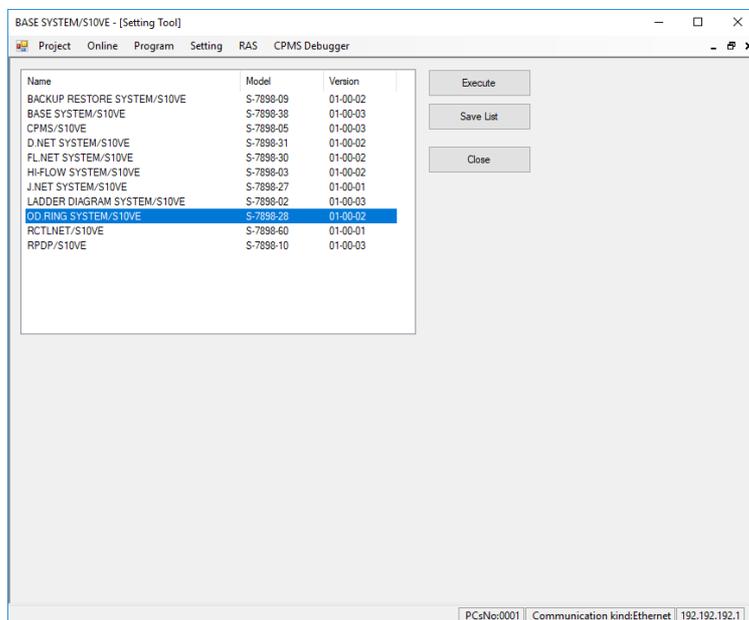


Figure 4-6 Setting Tool window of BASE SYSTEM/S10VE

The OD.RING module selection window (Figure 4-7) appears.

For details about subsequent operations, see *4.5 Commands*.

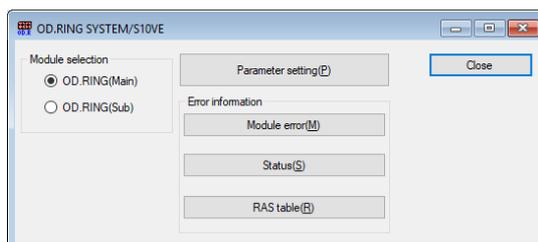


Figure 4-7 OD.RING module selection window

4. Operation

4.4.6 Closing the system

In the OD.RING module selection window (Figure 4-7), click the **Close** button.

4.5 Commands

4.5.1 Organization of OD.RING SYSTEM/S10VE functions

Figure 4-8 shows the organization of OD.RING SYSTEM/S10VE functions.

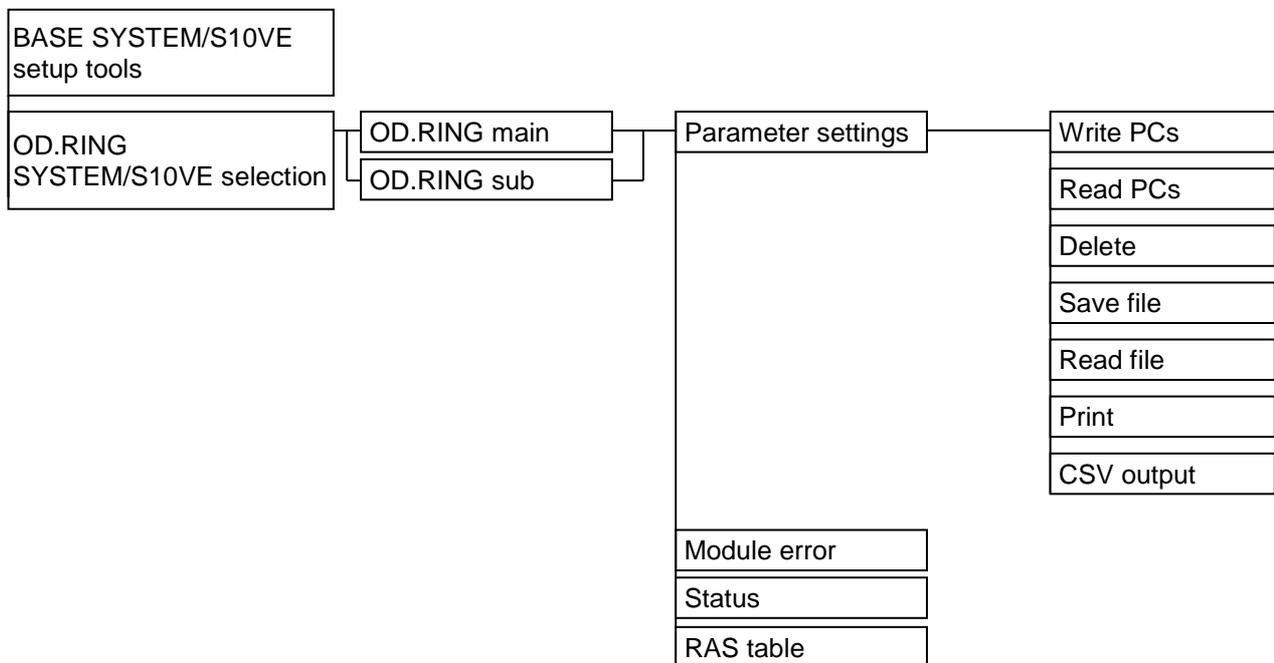


Figure 4-8 Organization of OD.RING SYSTEM/S10VE functions

4. Operation

4.5.2 Editing parameters

Function: Sets bit data, word data, and RAS table addresses for the main module (submodule).

Operation: The following describes the procedure for editing parameters.

- (1) In the OD.RING module selection window (Figure 4-9), select **OD.RING (Main)** or **OD.RING (Sub)**, and then click the **Parameter setting** button.

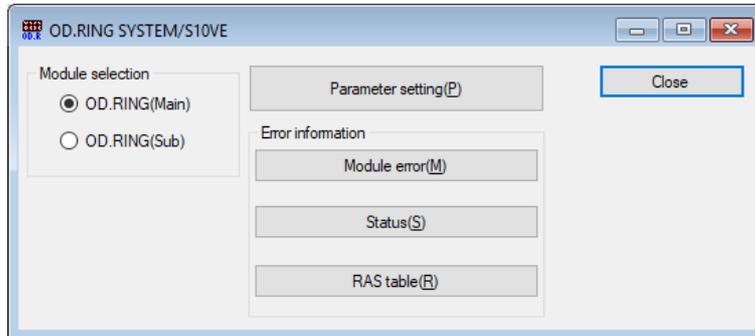


Figure 4-9 OD.RING module selection window

- (2) The Set parameter window (Figure 4-10) appears.

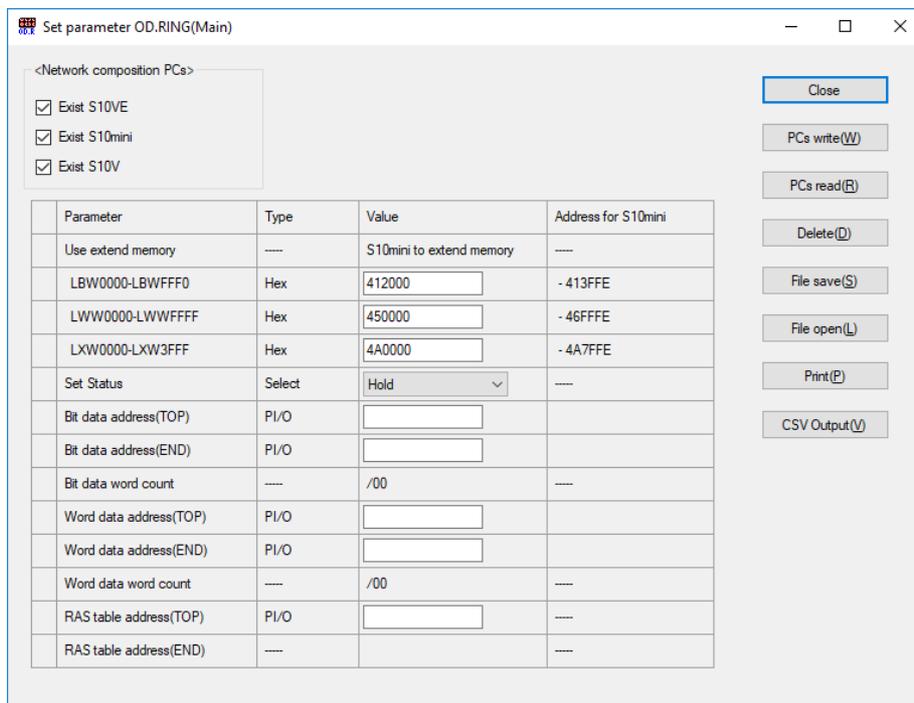


Figure 4-10 Set parameter window

- (3) Under **Network composition PCs**, select the check box to specify the presence of S10mini or S10V in the OD.RING communication network.

Exist S10VE: If selected, indicates that S10VE exists in the OD.RING communication network.

Exist S10mini: Select this check box if S10mini exists in the OD.RING communication network. If it does not exist, clear the check box.

Exist S10V: Select this check box if S10V exists in the OD.RING communication network. If it does not exist, clear the check box.

- (4) If S10mini exists in the OD.RING communication network, edit the extended area transmission/reception enable setting. To enable the S10V extension register (LBW0000 to LBWFFF0, LWW0000 to LWWFFFF, and LXW0000 to LXW3FFF) for transmission/reception of bit data and word data, edit the starting address of S10mini-compatible extended memory. If this setting does not exist, received data of S10mini extended memory will be discarded.

You can specify a value in the range from H10 0000 to H4F FFFE.

For details, see *4.5.13 Transfer area settings for combination of S10mini and S10V or S10VE*.

- (5) For each of **Bit data address** and **Word data address**, enter the starting address (**TOP**) and end address (**END**). For **RAS table address**, only enter the starting address (**TOP**). The end address is automatically calculated.

- **Set Status**

Select **Hold** or **Clear** as operation mode. This mode specifies that if data is no longer sent from another OD.RING module, the transfer area from the module is held or cleared to zero.

When the stopped module restarts communication, updating data in the registered area restarts irrespective of operation mode. The factory default setting is **Clear**.

- **Hold**

Data in the area where the stopped module is registered (for example, GW) is held as is. The data transferred last is retained.

- **Clear**

Data in the area where the stopped module is registered (for example, GW) is cleared to zero.

- **Bit data address**

Set the bit data address to be transferred to other modules. The permitted size of the bit data address is from H00 to H80 words.

The setting range depends on the check boxes selected under **Network composition PCs**.

See *Table 4-2 Available registers*.

- **Word data address**

Set the word data address to be transferred to other modules. The permitted size of the word data address is from H000 to H400 words.

The setting range depends on the check boxes selected under **Network composition PCs**.

See *Table 4-2 Available registers*.

- **RAS table address**

Set the RAS table address. The RAS table has a capacity of 9 words.

The setting range depends on the check boxes selected under **Network composition PCs**.

See *Table 4-2 Available registers*.

For details about the RAS table, see *5.6 RAS table*.

Table 4-2 Available registersWhen only the **S10VE exist** check box is selected under **Network composition PCs**

Setting range	Bit data	Word data	RAS table
FW000 to FWBFF	Setting disabled	Setting enabled	Setting enabled
XW0000 to XWFFF0	Setting enabled		
YW0000 to YWFFF0			
JW000 to JWFF0			
QW0000 to QWFFF0			
GW000 to GWFF0			
RW000 to RWFF0			
EW0400 to EWFFF0			
MW0000 to MWFFF0			
LBW0000 to LBWFFF0			
LWW0000 to LWWFFFF			
LXW0000 to LXW3FFF			

When a check box other than **S10VE exist** is selected under **Network composition PCs**

Setting range	Bit data	Word data	RAS table
FW000 to FWBFF	Setting disabled	Setting enabled	Setting enabled
XW000 to XWFF0 [#]	Setting enabled		
YW000 to YWFF0 [#]			
JW000 to JWFF0			
QW000 to QWFF0 [#]			
GW000 to GWFF0 [#]			
RW000 to RWFF0			
EW400 to EWFF0 [#]			
MW000 to MWFF0 [#]			
LBW0000 to LBWFFF0			
LWW0000 to LWWFFFF			
LXW0000 to LXW3FFF			

[#]: You cannot use 1000 to FFF0.

(6) After you have finished editing, click one of the following buttons according to your purpose:

PCs write: Writes edited data to the S10VE, and applies the data to OD.RING modules.

File save: Saves edited data in a binary-format file with a file name of your choice.

Print: Prints edited data.

CSV Output: Saves edited data in a CSV-format file with a file name of your choice.

4. Operation

4.5.3 Registering parameters

Function: Registers parameters displayed in the Set parameter window (Figure 4-11) to the S10VE CPU module.

Operation: The following describes the procedure for registering parameters to the S10VE CPU module.

- (1) Click the **PCs write** button.

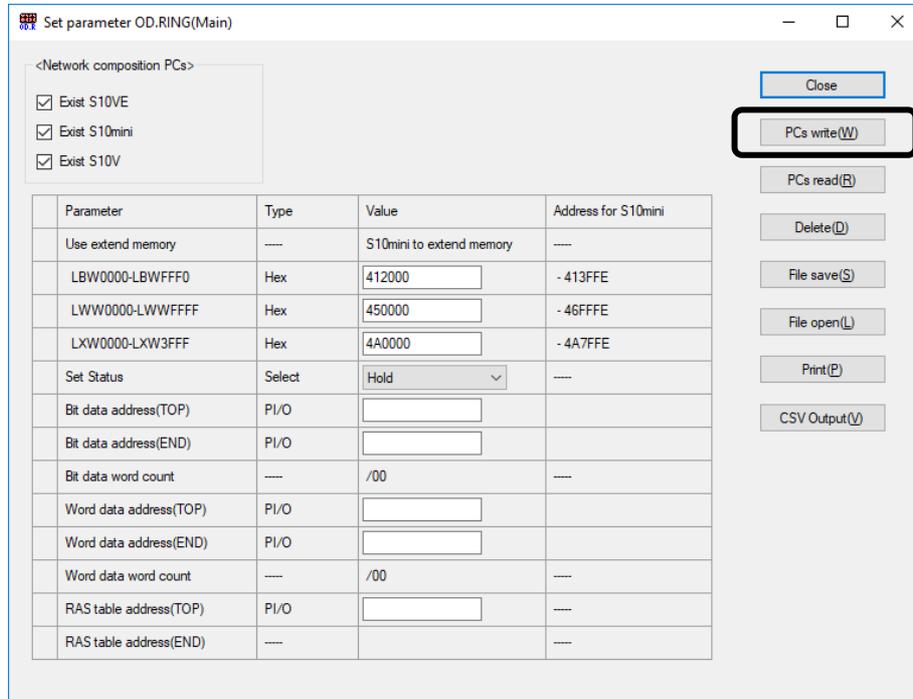


Figure 4-11 Clicking the [PCs write] button in the Set parameter window

- (2) If no error is contained in edited parameters, the Option module parameter setup list window (Figure 4-12) appears.

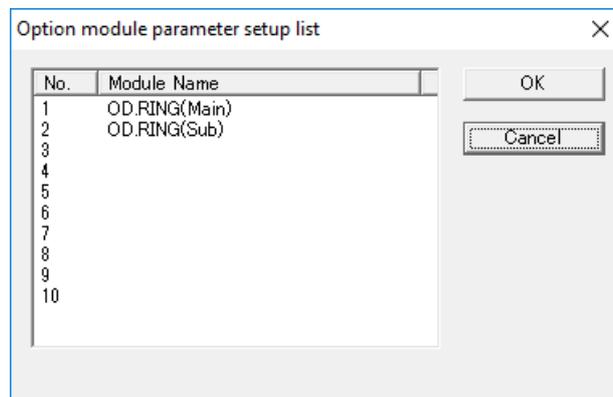


Figure 4-12 Option module parameter setup list window (registration)

- (3) Select a desired number, and then click the **OK** or **Cancel** button.

OK: Writes edited parameters to the S10VE CPU module#.

After the parameters have been written, a reset confirmation message appears.

Cancel: Cancels writing edited parameters to the S10VE CPU module.

#: When overwriting parameters that have been registered, an overwrite confirmation message (Figure 4-13) appears. Click the **OK** or **Cancel** button

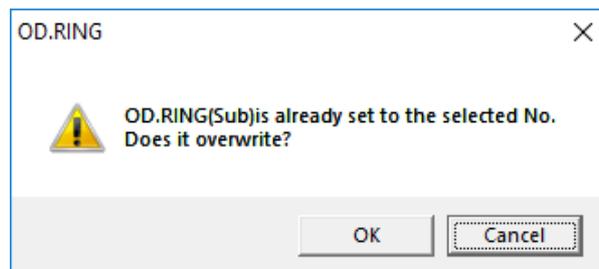


Figure 4-13 Overwrite confirmation message (example of overwriting OD.RING (Sub))

OK: Writes edited parameters to the S10VE CPU module.

Cancel: Returns to the Option module parameter setup list window (Figure 4-12).

- (4) In the dialog box showing a reset confirmation message (Figure 4-14), click the **OK** or **Cancel** button.

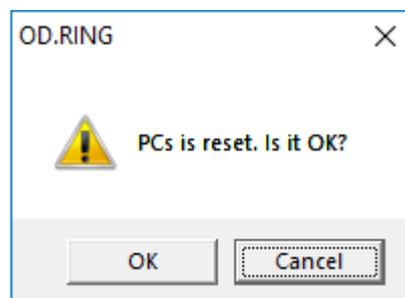


Figure 4-14 Reset confirmation message

OK: Resets PCs automatically.

Edited information is applied to the OD.RING module.

Cancel: Does not reset PCs.

Edited information is not applied to the OD.RING module.

A reset is required to apply the information.

- (5) Registration of OD.RING module parameters to the S10VE CPU module is now completed.

4. Operation

4.5.4 Reading parameters

Function: Reads parameters from the S10VE CPU module, and then display them in the Set parameter window (Figure 4-15).

Operation: The following describes the procedure for reading parameters from the S10VE CPU module.

- (1) Click the **PCs read** button.

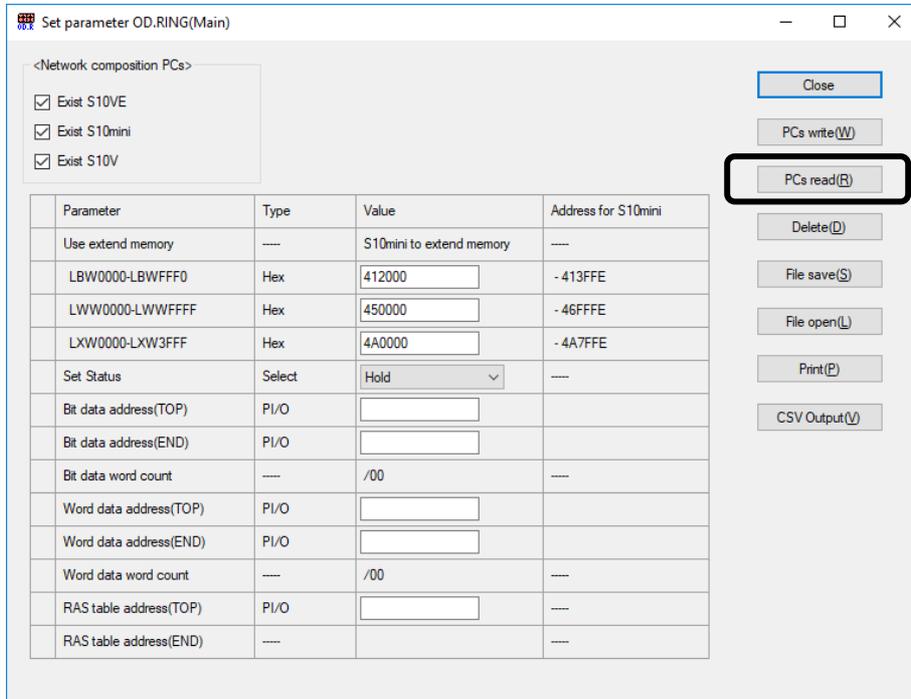


Figure 4-15 Clicking the [PCs read] button in the Set parameter window

- (2) If you have edited parameters, the following message appears (Figure 4-16) asking you whether you want to discard parameter settings. Click the **Yes** or **No** button.

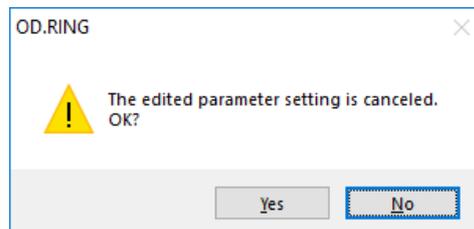


Figure 4-16 Confirmation message for discarding parameter settings

Yes: Edited parameters are discarded. However, parameters are not discarded if you click the **Cancel** button in the Receiving agency selection window (Figure 4-17).

No: Cancels reading parameters from the S10VE CPU module.

- (3) If the OD.RING module selected in the OD.RING module selection window is installed and parameters have been registered in the S10VE CPU module, the Receiving agency selection window (Figure 4-17) appears. If one of these conditions is met, the Receiving agency selection window does not appear and parameters are read from the module that meets the condition and are displayed in the Set parameter window (Figure 4-15).

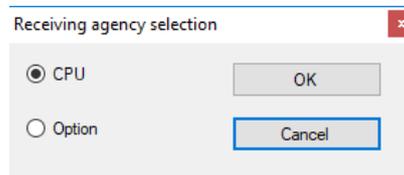


Figure 4-17 Receiving agency selection window

- (4) In the Receiving agency selection window, select **CPU** or **Option**.
- CPU:** Select this to read parameters registered in the S10VE CPU module of the OD.RING module selected in the OD.RING module selection window (Figure 4-9).
CPU is selected by default.
- Option:** Select this to read parameters from the OD.RING module selected in the OD.RING module selection window.
- (5) In the Receiving agency selection window, click the **OK** or **Cancel** button.
- OK:** Receives parameters of the OD.RING module from the module selected in step (4), and then displays them in the Set parameter window.
- Cancel:** Cancels receiving parameters of the OD.RING module.
- (6) Reading parameters from the S10VE CPU module is now completed.

4. Operation

4.5.5 Deleting parameters

Function: Deletes parameters from the registration table of the S10VE CPU module.

Operation: The following describes the procedure for deleting parameters from the registration table of the S10VE CPU module.

- (1) Click the **Delete** button.

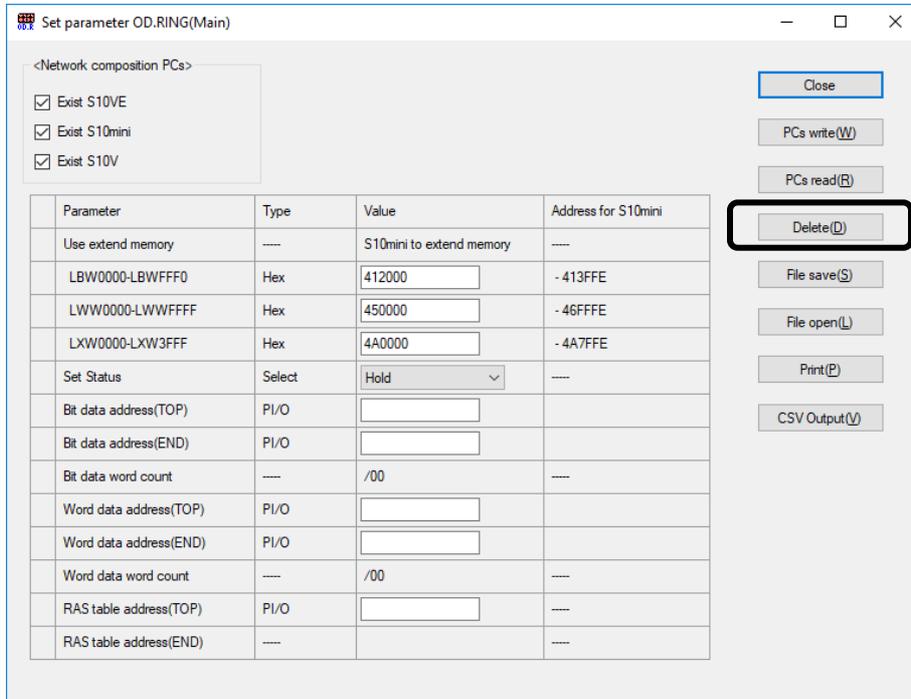


Figure 4-18 Clicking the [Delete] button in the Set parameter window

- (2) The Option module parameter setup list window (Figure 4-19) appears.

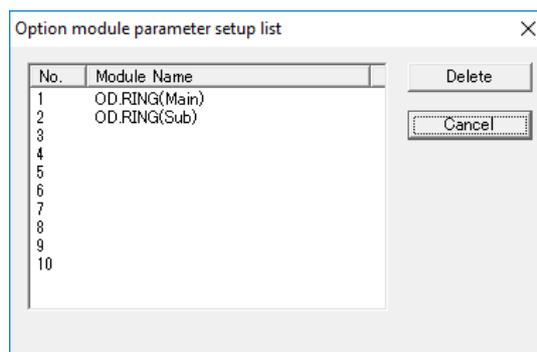


Figure 4-19 Option module parameter setup list window (deletion)

- (3) Select the option parameter you want to delete. To cancel deleting option parameters, click the **Cancel** button.

- (4) When you click the **Delete** button, a parameter deletion confirmation message (Figure 4-20) appears.

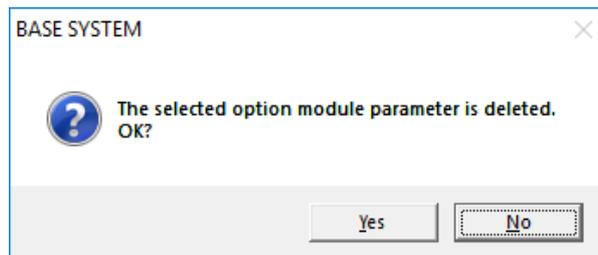


Figure 4-20 Parameter deletion confirmation message

In this message dialog box, click the **Yes** or **No** button.

Yes: Deletes the selected option parameter and displays the reset confirmation message (Figure 4-21).

No: Returns to the Option module parameter setup list window (Figure 4-19) without deleting parameters.

- (5) In the reset confirmation message dialog box, click the **OK** or **Cancel** button.

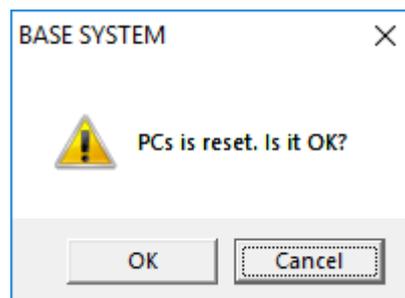


Figure 4-21 Reset confirmation message

OK: Resets the settings.

Note: Parameters set in OD.RING modules are not deleted.

Cancel: Does not reset settings.

- (6) Deleting option parameters from the S10VE CPU module is now completed.

4. Operation

4.5.6 Saving parameter files

Function: Saves parameters displayed in the Set parameter window (Figure 4-22) in a file with a file name of your choice. Parameters are saved in the binary format.

To use the saved file, click the **File open** button or use the BASE SYSTEM data transmit/receive function.

Operation: The following describes the procedure for saving the file.

- (1) Click the **File save** button.

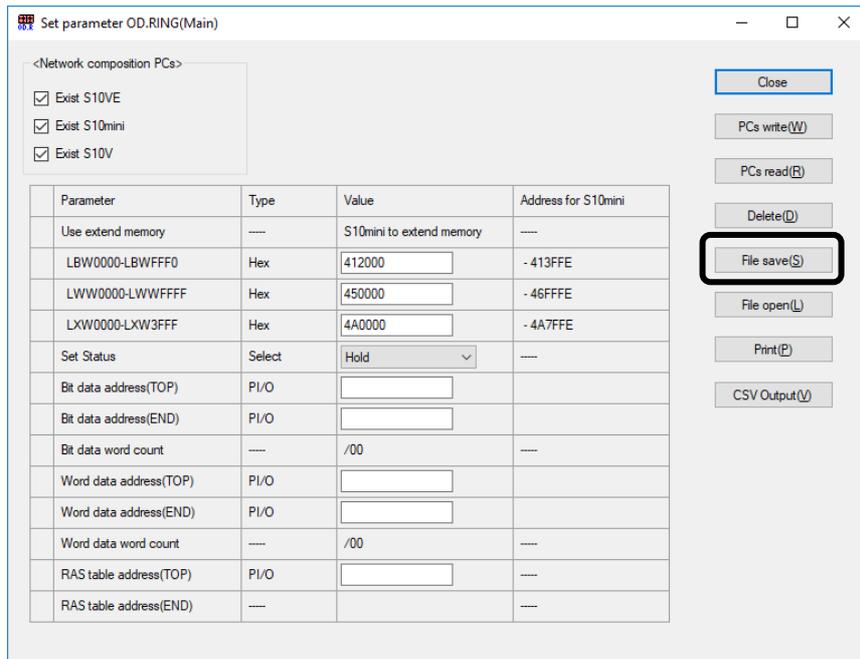


Figure 4-22 Clicking the [File save] button in the Set parameter window

- (2) If no error is contained in edited parameters, the Save As window (Figure 4-23) appears.

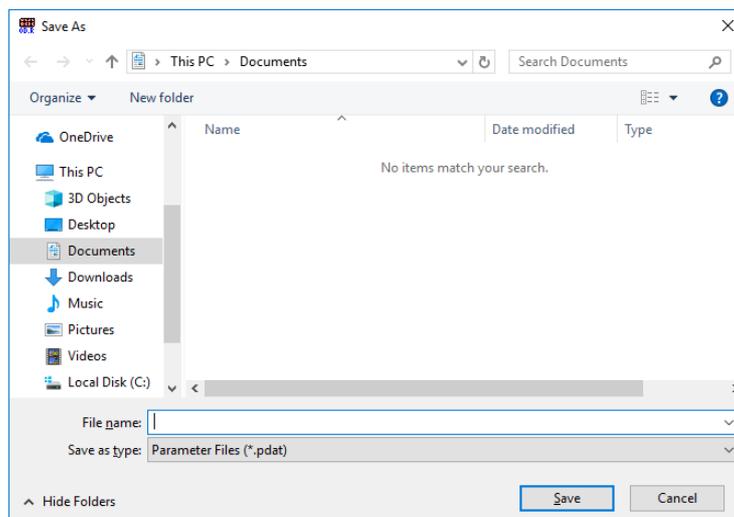


Figure 4-23 Save As window

- (3) Enter the name of the file to be saved, and then click the **Save** button.
If a file with the entered name already exists, the Save As confirmation message window appears.
Determine whether to overwrite the file.
- (4) The File save window (Figure 4-24) appears.

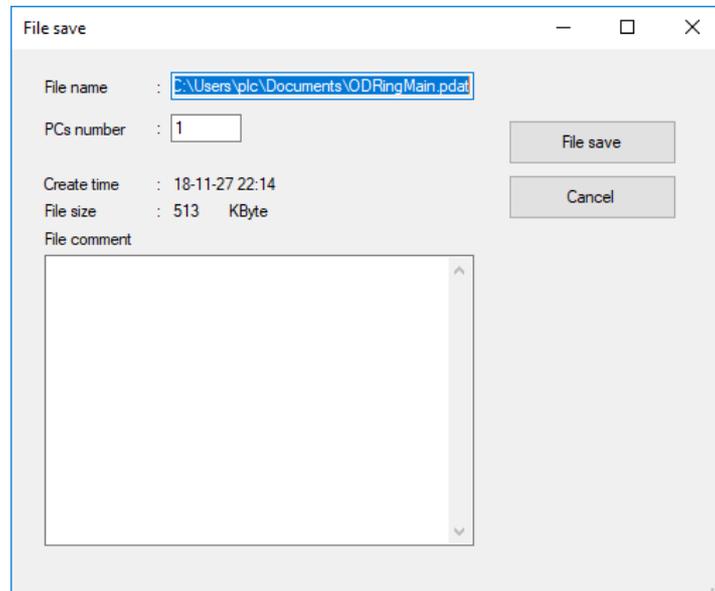


Figure 4-24 File save window

PCs number: The PCs number of the selected project is shown by default.

The PCs number can be modified. The following shows the range of specifiable PCs numbers:

Range of PCs numbers: 0 to 9999

Create time: Displays the date and time when the File save window appears.

File comment: You can enter a file comment optionally.

You can enter a maximum of 512 characters.

- (5) In the File save window, click the **File save** or **Cancel** button.
File save: The parameters displayed in the Set parameter window (Figure 4-22) are saved in a file.
Cancel: The parameters displayed in the Set parameter window (Figure 4-22) are not saved in a file.
- (6) Saving option parameters in a file is now completed.

4. Operation

4.5.7 Reading a parameter file

Function: Reads file data saved in the file saving procedure, and then display the read data in the Set parameter window (Figure 4-25).

Operation: The following describes the procedure for reading the file.

- (1) Click the **File open** button.

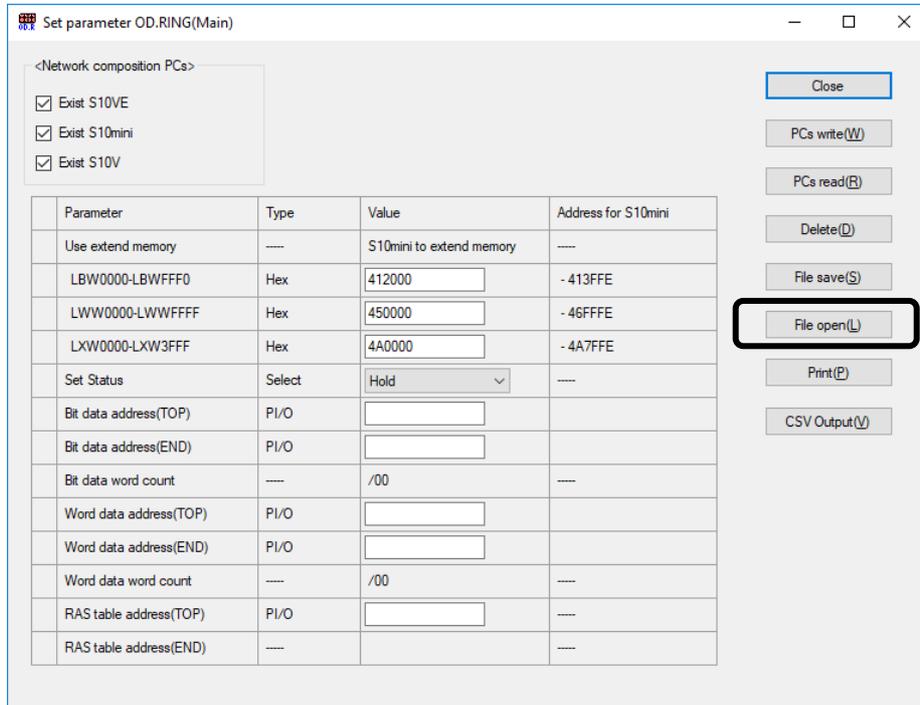


Figure 4-25 Clicking the [File open] button in the Set parameter window

- (2) If you have edited parameters, the following message appears (Figure 4-26), asking you whether you want to discard parameter settings. Click the **Yes** or **No** button.

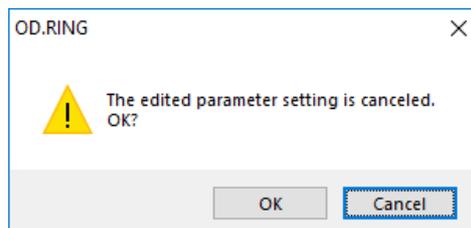


Figure 4-26 Confirmation message for discarding parameter settings

Yes: Edited parameters are discarded.

However, if you click the **Cancel** button (before clicking the **File open** button) in the File open window (Figure 4-29), parameters are not discarded.

No: Cancels reading parameters.

- (3) The Open window (Figure 4-27) appears.

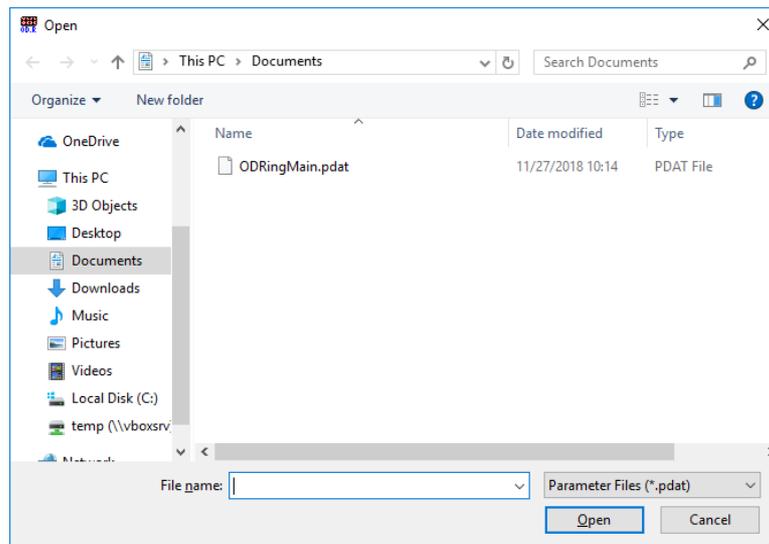


Figure 4-27 Open window

Select the parameter file you want to read, and then click the **Open** button.

To cancel reading the file, in the Open window, click the **Cancel** button.

- (4) If the selected parameter file does not contain parameters of the OD.RING module selected in the OD.RING module selection window (Figure 4-9), a message indicating incorrect file selection (Figure 4-28) appears.

Click the **OK** button, and then read the correct parameter file.

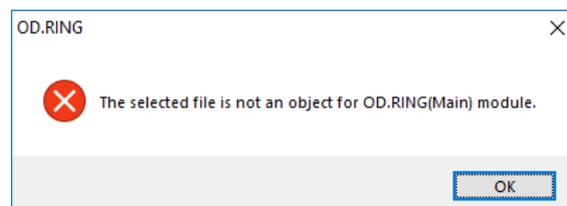


Figure 4-28 Incorrect file selection message

4. Operation

- (5) The File open window (Figure 4-29) appears, displaying the header information of the selected parameter file.

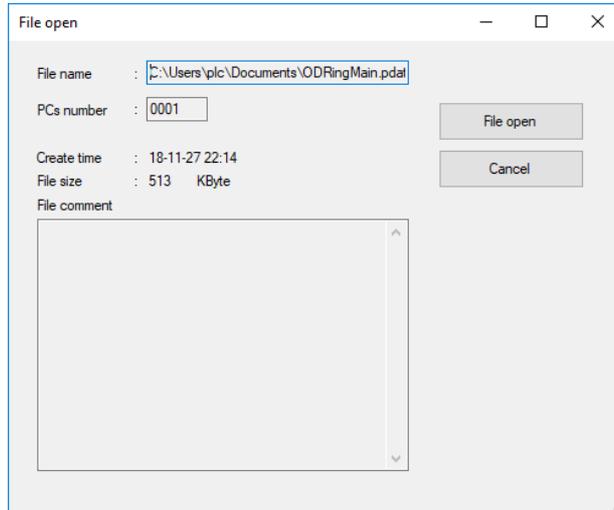


Figure 4-29 File open window

File name: The selected parameter file name is displayed.

PCs number: The PCs number of the selected parameter file is displayed.

Create time: The date and time when the selected parameter file was saved are displayed.

File comment: The comment of the selected parameter file is displayed.

- (6) In the File open window, click the **File open** or **Cancel** button.

File open: Clicking this button reads the selected parameter file and displays the read data in the Set parameter window (Figure 4-25).

Cancel: Clicking this button closes the File open window without reading data from the selected parameter file.

- (7) Reading the option parameter file is now completed.

4.5.8 Printing

Function: Prints the parameters displayed in the Set parameter window (Figure 4-30).

Operation: The following describes the procedure for printing parameters.

- (1) Click the **Print** button.

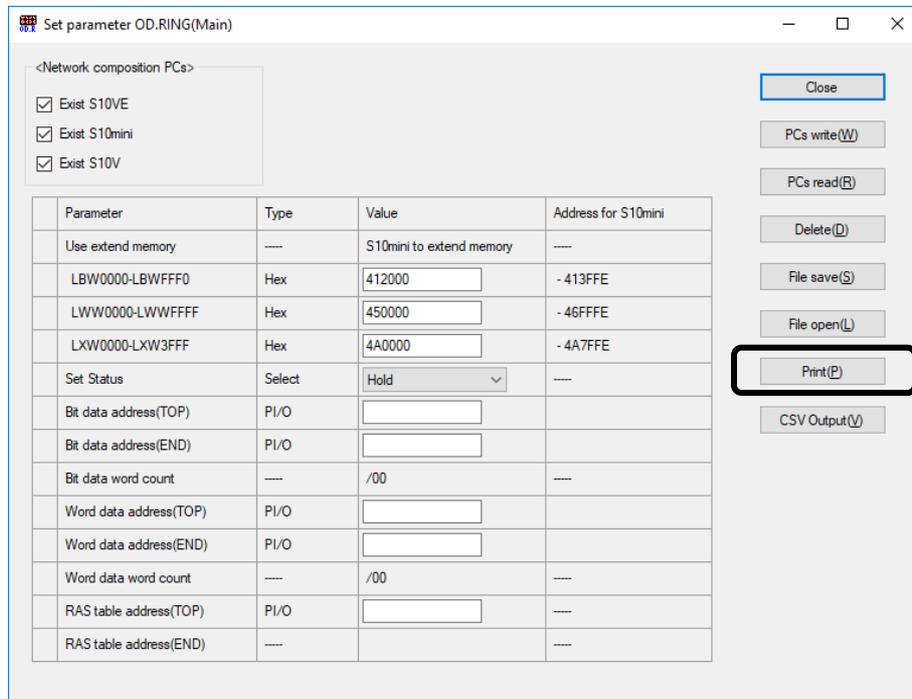


Figure 4-30 Clicking the [Print] button in the Set parameter window

- (2) If no error is contained in edited parameters, the Print window (Figure 4-31) appears. Specify the output printer and set properties, and then click the **Print** button.

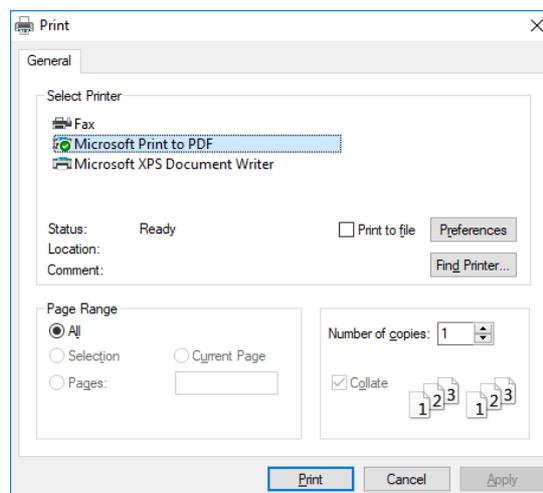


Figure 4-31 Print window

4. Operation

- (3) The parameters displayed in the Set parameter window are printed.

```
OD.RING 2018/01/15 15:50:48
PCsNo=200

Network configuration PCs
S10VE                Used
S10mini              Used
S10V                 Used

Extended area transmission/reception enabled
LBW0000 - LBWFFF0    412000 to 413FFE
LWW0000 - LWWFFFF    200000 to 21FFFE
LXW0000 - LXW3FFF    4A0000 to 4A7FFE

Status setting       Hold
Bit data address setting  XW000 - XW100
Bit data word count    /11
Word data address setting LBW0000 - LBW0100
Word data word count    /11
RAS table address     QW230 - QW2B0
```

Figure 4-32 Print example

4.5.9 CSV output

Function: Saves the parameters displayed in the Set parameter window (Figure 4-33) in a file in CSV format.

Operation: The following describes the procedure for outputting parameters to a CSV file.

- (1) Click the **CSV Output** button.

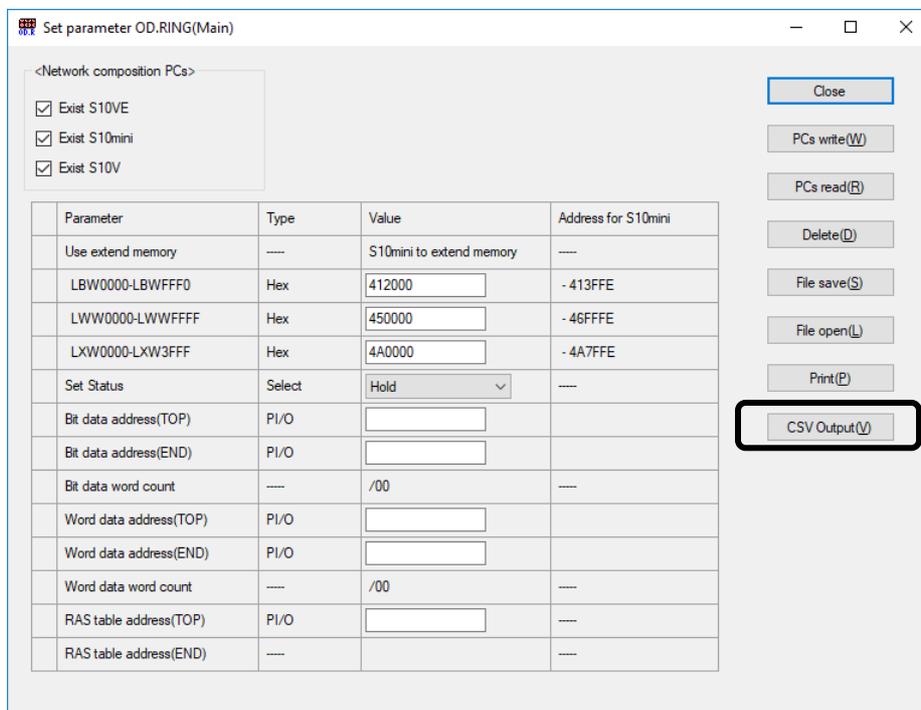


Figure 4-33 Clicking the [CSV Output] button in the Set parameter window

- (2) If no error is contained in edited parameters, the Save As window (Figure 4-34) appears.

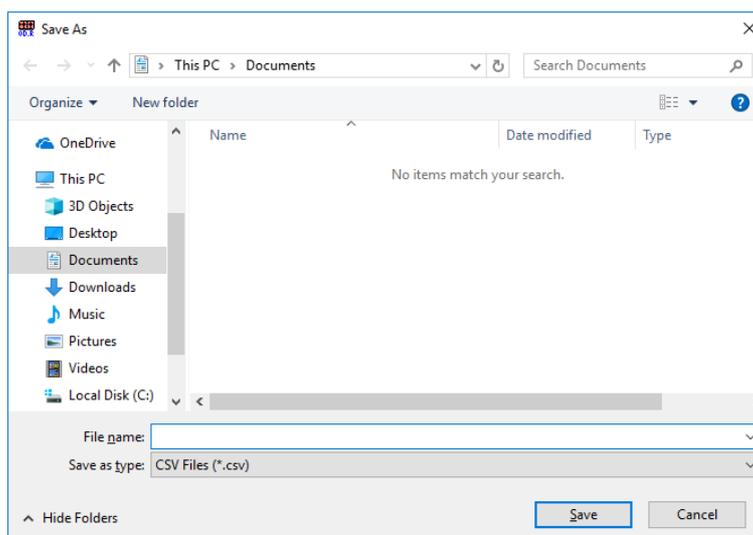


Figure 4-34 Save As window

4. Operation

- (4) Type the name of the file to be saved, and then click the **Save** button.
To cancel CSV output, click the **Cancel** button.
- (5) Parameters displayed in the Set parameter window (Figure 4-33) are saved in the file in CSV format.

```
OD.RING 2018/01/15 15:50:48
PCsNo=200

Network configuration PCs
S10VE,Used
S10mini,Used
S10V,Used

Extended area transmission/reception enabled
LBW0000 - LBWFFFF0,412000 to 413FFE
LWW0000 - LWWFFFFF,200000 to 21FFFE
LXW0000 - LXW3FFF,4A0000 to 4A7FFE

Status setting,Hold
Bit data address setting,XW000 - XW100
Bit data word count,/11
Word data address setting,LBW0000 - LBW0100
Word data word count,/11
RAS table address,QW230 - QW2B0
```

Figure 4-35 Example of CSV file output

4.5.10 Main module (submodule) error information

Function: Displays error information of the main module or submodule.

Operation: The following describes the operation procedure.

- (1) In the OD.RING module selection window (Figure 4-7), click the **Module error** button.
- (2) If no module error is present, a message indicating that the module is normal (Figure 4-36) appears. Click the **OK** button.

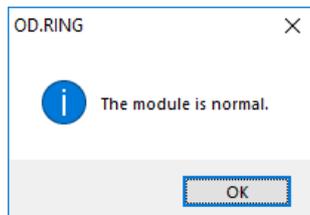


Figure 4-36 Normal module message

If a module error has occurred, the **Module error** tab window (Figure 4-37) appears.

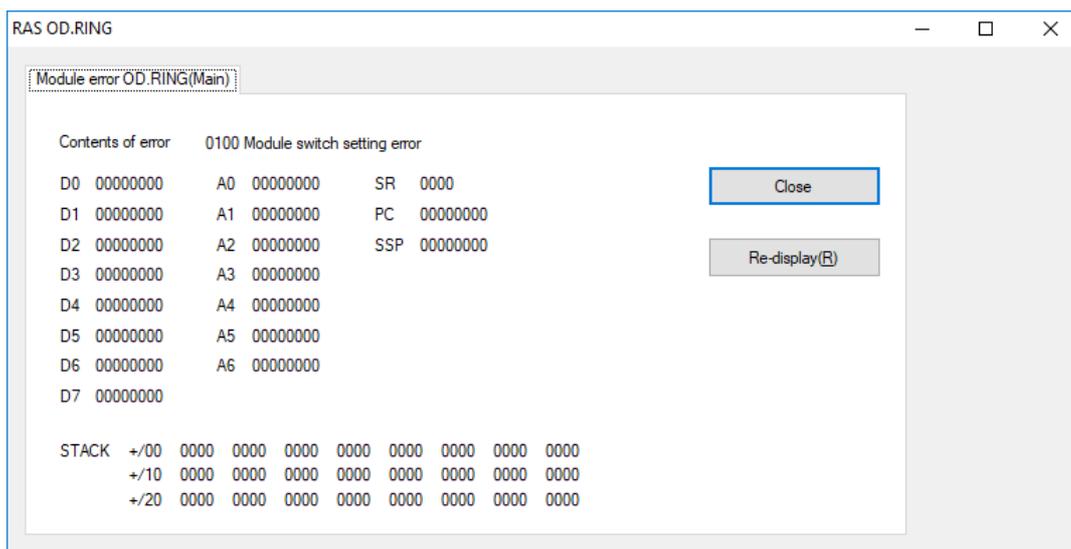


Figure 4-37 [Module error] tab window

- (3) Click the **Re-display** button to display the latest error information. To close this tab window, click the **Close** button.

4. Operation

4.5.11 Status

Function: Displays status information of the main module or submodule.

Operation: The following describes the operation procedure.

(1) In the OD.RING module selection window (Figure 4-7), click the **Status** button.

The **Status** tab window (Figure 4-38) appears.

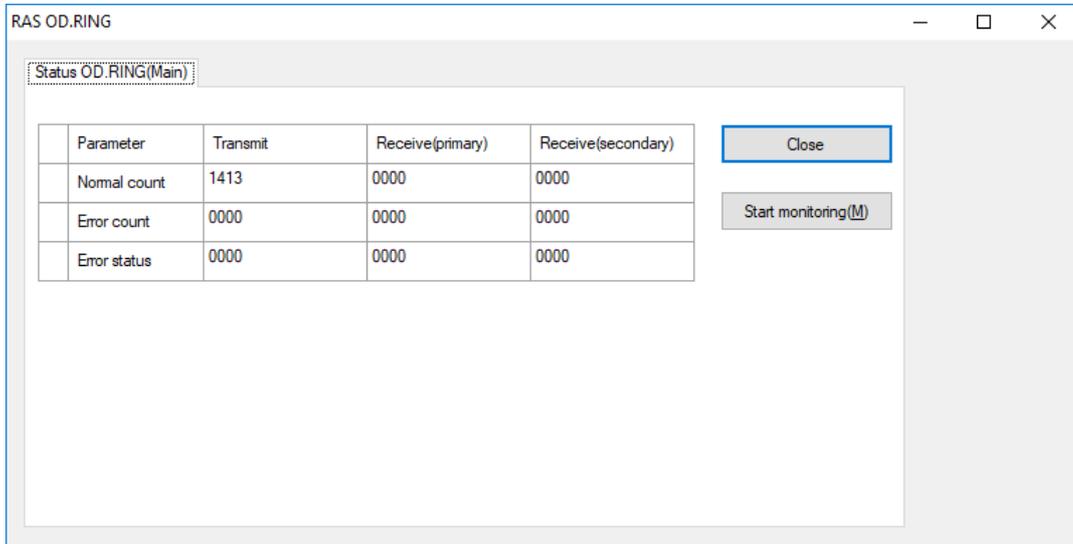


Figure 4-38 [Status] tab window

- (2) To start monitoring, click the **Start monitoring** button. After monitoring starts, this button changes to the **Stop monitoring** button.
- (3) To stop monitoring from the monitoring status, click the **Stop monitoring** button. After monitoring stops, this button changes to the **Start monitoring** button.
- (4) To close this tab window, click the **Close** button.

4.5.12 RAS table

Function: Displays RAS table information of the main module or submodule.

For details about the RAS table, see 5.6 RAS table.

Operation: The following describes the operation procedure.

- (1) In the OD.RING module selection window (Figure 4-7), click the **RAS table** button.
The **RAS** tab window (Figure 4-39) appears.

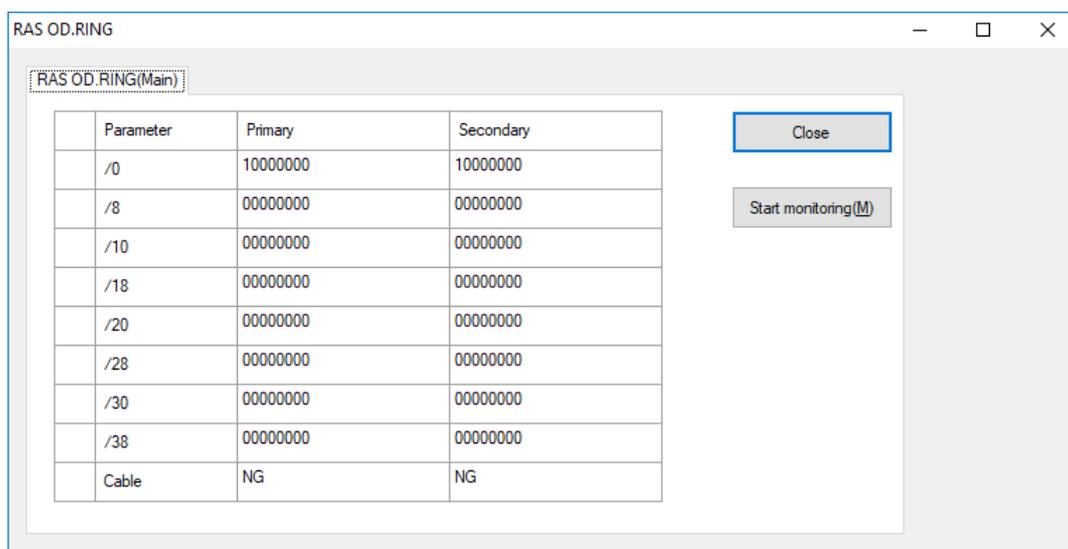


Figure 4-39 [RAS] tab window

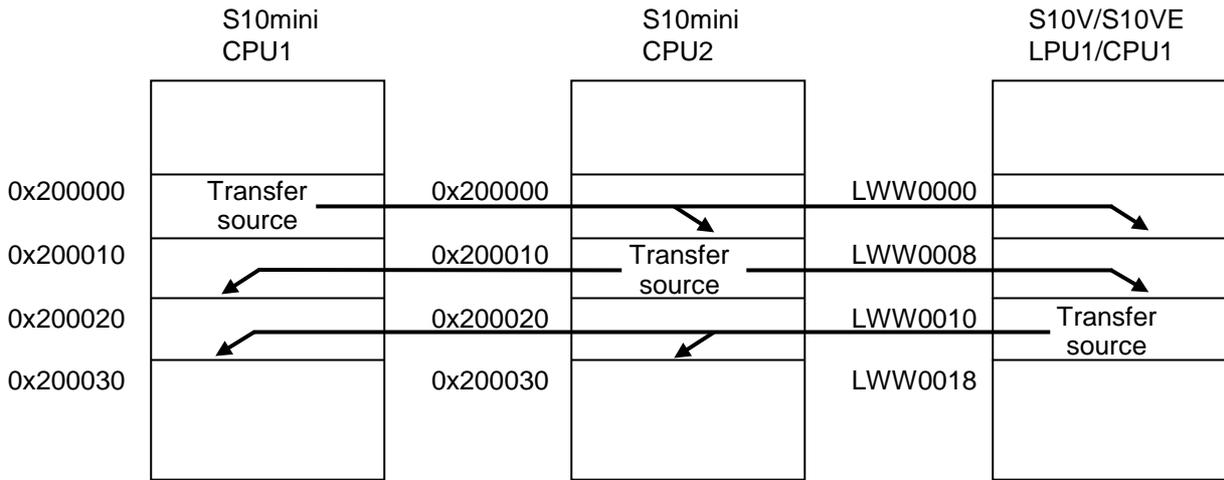
- (2) To start monitoring, click the **Start monitoring** button. After monitoring starts, this button changes to the **Stop monitoring** button.
- (3) To stop monitoring from the monitoring status, click the **Stop monitoring** button. After monitoring stops, this button changes to the **Start monitoring** button.
- (4) To close this tab window, click the **Close** button.

The data displayed in the **Primary** and **Secondary** columns indicates the status of bits corresponding to each CPL No.. For the meaning of each bit, see 5.6 RAS table.

4. Operation

4.5.13 Transfer area settings for combination of S10mini and S10V or S10VE

This subsection describes how to specify the setting required for adding the S10V or S10VE to the network where the OD.RING module transfer area is set in the extended memory in the S10mini. OD.RING modules perform transfer in consideration of absolute addresses. However, addresses corresponding to the S10mini extended memory are included in the ladder program and the system table in the S10V and S10VE. Therefore, data is not correctly applied to the specified address of the S10V and S10VE by simple transfer. To solve this problem, the setting is supported so that addresses of the S10mini extended memory are associated with the S10V extension register to transfer data between them. The following shows a specific example.



To transfer data from the S10mini extended memory to the S10V and S10VE, or from the S10V extension register to the S10mini extended memory, use the Set parameter window to associate this register with the S10mini extended memory. Figure 4-40 shows an example of settings to perform this operation.

Associate the LWW register starting address with the S10mini extended memory address.

Enter the address from which data is to be transferred from S10VE to another module.

Parameter	Type	Value	Address for S10mini
Use extend memory	---	S10mini to extend memory	---
LBW0000-LBWFFFF0	Hex	412000	- 413FFE
LWW0000-LWWFFFFF	Hex	200000	- 21FFFE
LXW0000-LXW3FFF	Hex	4A0000	- 4A7FFE
Set Status	Select	Hold	---
Bit data address(TOP)	PI/O	XW000	<->XW000
Bit data address(END)	PI/O	XW100	<->XW100
Bit data word count	---	/11	---
Word data address(TOP)	PI/O	LWW0010	<->200020
Word data address(END)	PI/O	LWW0017	<->20002E
Word data word count	---	/08	---
RAS table address(TOP)	PI/O	QW230	---
RAS table address(END)	---	QW280	---

Figure 4-40 Example of S10VE (CPU1) settings

5. Programming

5.1 Operation

The OD.RING module transfers data in a set area of memory from one CPU module to another.

Figure 5-1 shows an example of system configuration. Figure 5-2 shows the memory transfer operation by each CPU module.

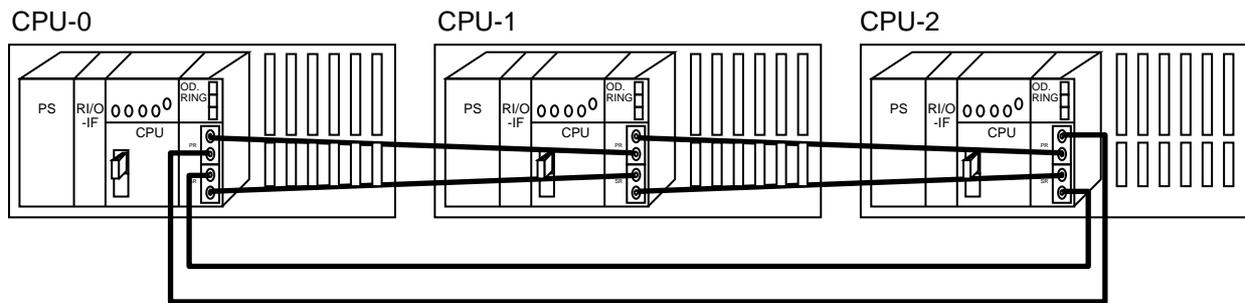
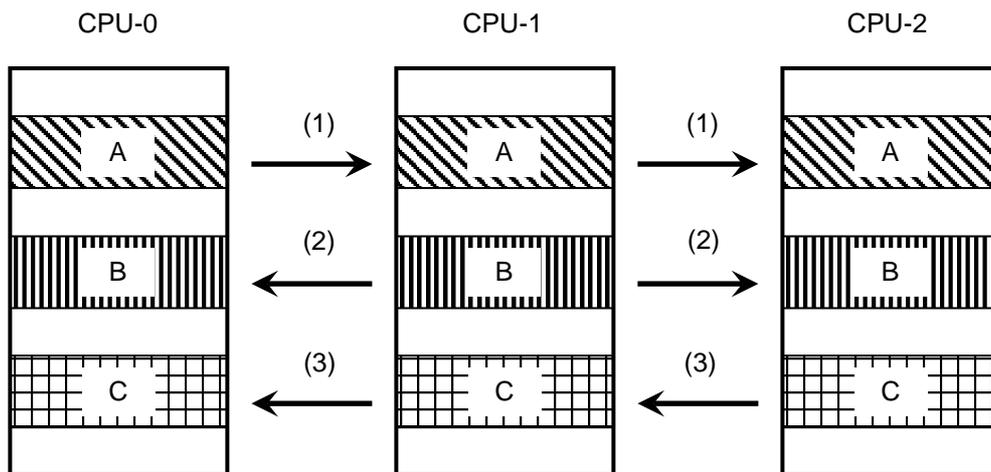


Figure 5-1 Example of system configuration



(1) CPU-0 transfers area A to CPU-1 and CPU-2.

(2) CPU-1 transfers area B to CPU-0 and CPU-2.

(3) CPU-2 transfers area C to CPU-0 and CPU-1.

The OD.RING module subsequently returns to (1) and repeats transfer.

Figure 5-2 Memory transfer

5.2 Communication time

Option modules (including the OD.RING module) regularly update input/output data during respective communication time. The CPU module is controlled by the ladder program by using the input/output data updated by option modules. Because the ladder program is repeatedly executed at fixed intervals (sequence cycle), the communication time of each option module must be 1/2 or less of the sequence cycle to prevent failure to obtain input/output data.

The communication time of option modules depends on the setting of the number of communication words of each option module and the number of option modules installed in the CPU unit. Calculate the communication time of the OD.RING module according to Table 5-1. For details about how to calculate the communication time of other option modules, see the manual of each option module.

The communication time per cycle of the OD.RING module is called the *transfer cycle*. Timing of memory transfer described in 5.1 is provided in Figure 5-3, where the time axis is shown in the horizontal direction. Shared operation begins with the CPU-0 transfer and ends with the CPU-2 transfer. The memory transfer area is shared by repeating this cycle at intervals.

The transfer cycle depends on the MODU No. setting switch, number of connected modules, and amount of transfer data volume, and is obtained by the calculation formula shown in Table 5-1.

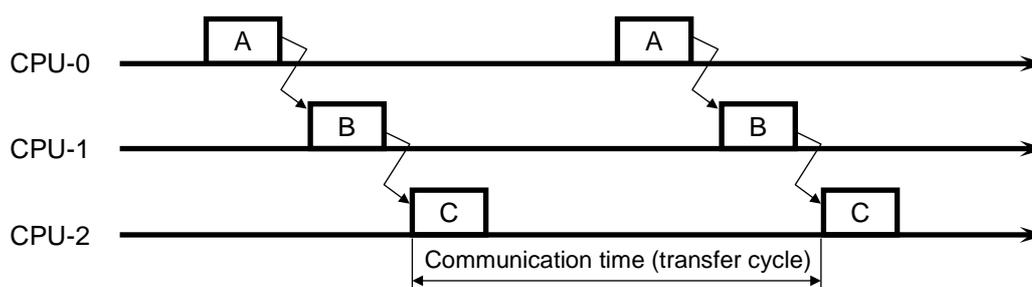


Figure 5-3 Communication time (transfer cycle)

Table 5-1 Communication time (transfer cycle) calculation formula

MODU No. setting switch	Communication time (transfer cycle) calculation formula
0 or 1	Communication time = $192 - 0.5964X + (0.0146 + 0.0013J)Y + 0.001Z + 0.005WX$ (ms)
2 or 3	Communication time = $96 - 0.5964X + (0.0146 + 0.0013J)Y + 0.001Z + 0.005WX$ (ms)
4 or 5	Communication time = $48 - 0.5964X + (0.0146 + 0.0013J)Y + 0.001Z + 0.005WX$ (ms)
6 or 7	Communication time = $24 - 0.5964X + (0.0146 + 0.0013J)Y + 0.001Z + 0.005WX$ (ms)

W: Total ring length (km)

X: Number of operating modules

J: Total number of option modules (in addition to the relevant OD.RING module) installed in the CPU unit. For details about applicable option module models, see *Table 2-1 List of CPU unit components* in the *S10VE User's Manual General Description* (manual number SEE-1-001).

Y: Amount of word data (words)

Z: Amount of bit data (points)

5.3 Synchronism of transfer data

The application software and the OD.RING module access the memory transfer area asynchronously. Note that if they access the memory transfer area at the same time, synchrony of data as a memory transfer area block is lost.

For example, if the application software reads the memory transfer area while the OD.RING module is updating the memory transfer area, continuity of data is lost.

However, the application software and the OD.RING module guarantee the bit synchronism within a word regardless of access timing. Therefore, analog data and counter values are transferred normally.

5.4 Memory transfer area

Bit data per module and word data per module can be separately specified as the memory transfer area (Table 5-2).

Table 5-2 Memory transfer area

When only the **S10VE exist** check box is selected under **Network composition PCs**

Setting range	Bit data	Word data	RAS table
FW000 to FWBFF	Setting disabled	Setting enabled	Setting enabled
XW0000 to XWFFF0	Setting enabled		
YW0000 to YWFFF0			
JW000 to JWFF0			
QW0000 to QWFFF0			
GW000 to GWFF0			
RW000 to RWFF0			
EW0400 to EWFFF0			
MW0000 to MWFFF0			
LBW0000 to LBWFFF0			
LWW0000 to LWWFFFF			
LXW0000 to LXW3FFF	Setting disabled		

When a check box other than **S10VE exist** is selected under **Network composition PCs**

Setting range	Bit data	Word data	RAS table
FW000 to FWBFF	Setting disabled	Setting enabled	Setting enabled
XW000 to XWFF0 [#]	Setting enabled		
YW000 to YWFF0 [#]			
JW000 to JWFF0			
QW000 to QWFF0 [#]			
GW000 to GWFF0 [#]			
RW000 to RWFF0			
EW400 to EWFF0 [#]			
MW000 to MWFF0 [#]			
LBW0000 to LBWFFF0			
LWW0000 to LWWFFFF			
LXW0000 to LXW3FFF	Setting disabled		

[#]: You cannot use 1000 to FFF0.

As shown in Figure 5-4, the areas set by each module can be non-continuous.

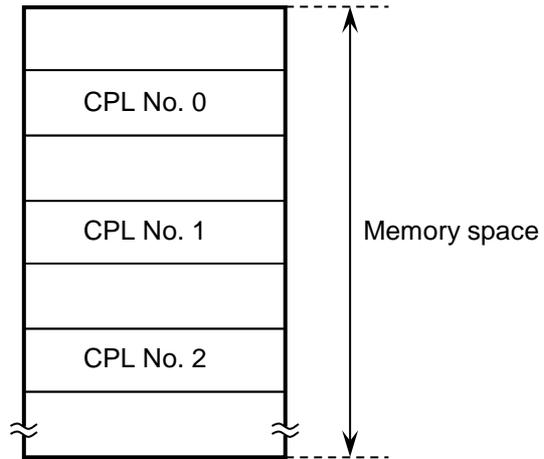
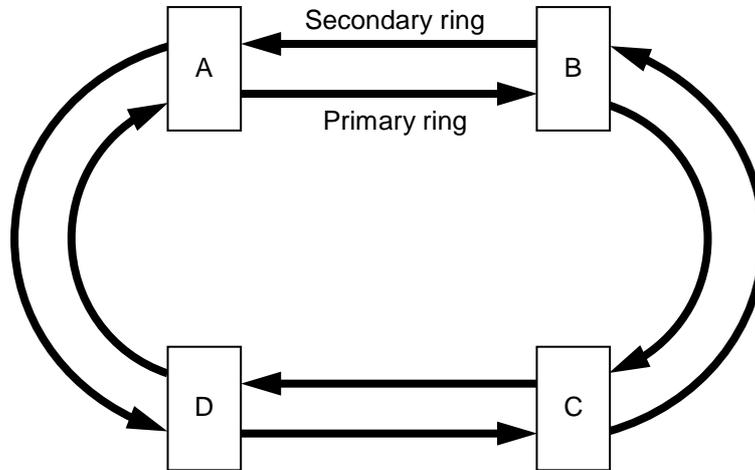


Figure 5-4 Areas set by each module

5.5 Failures and failure avoidance operation

When both the primary ring and secondary ring are communicating normally, each OD.RING module uses primary ring data, not secondary ring data.



Note: A to D are OD.RING modules.

Figure 5-5 Data flow in normal operation

The OD.RING modules use only primary ring data or secondary ring data. The data to be used is determined as follows:

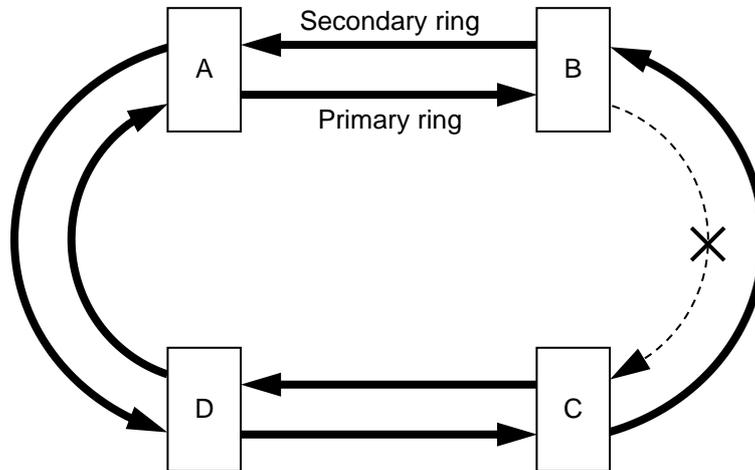
- When a module is receiving data normally from another module via both the primary ring and secondary ring: Primary ring data is used. The primary ring has higher priority.
- When a module is receiving data normally from another module via the primary ring: Primary ring data is used (if the secondary ring data cannot be received).
- When a module is receiving data normally from another module via the secondary ring: Secondary ring data is used (if the primary ring data cannot be received).

Even if a failure occurs, the OD.RING modules can automatically avoid this to continue communication normally.

The following pages give examples of failures and how to avoid them.

- If one ring is disconnected at one place:

If data from either ring cannot be received, data from the other ring is used. In the example of Figure 5-6, modules A, C, and D cannot receive module B data from the primary ring. Also, module C cannot receive data of modules A, B, and D from the primary ring. In this case, the data received from the secondary ring is used. In other cases, primary ring data is used.



Note: A to D are OD.RING modules.

x: Disconnected

(A bold line indicates data transfer is possible. A broken line indicates data transfer is disabled.)

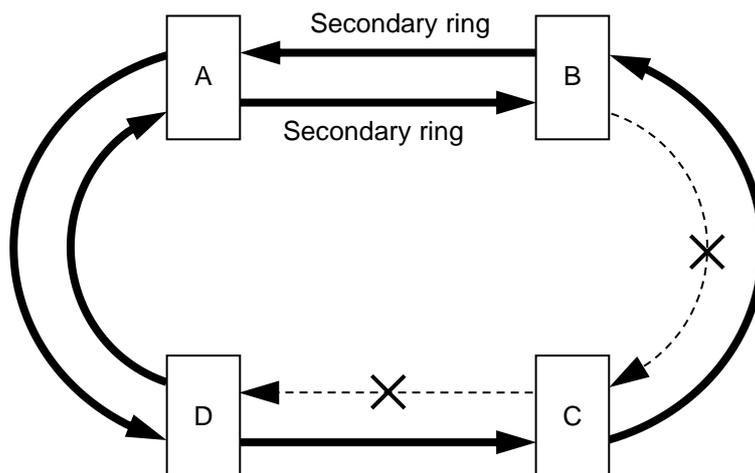
Figure 5-6 One ring is disconnected at one place

- If one ring is disconnected at several places:

If either ring is disconnected at several places, data from the other ring is used.

In the example in Figure 5-7, modules A, C, and D cannot receive module B data from the primary ring.

Modules A, B, and D cannot receive module C data from the primary ring. In this case, the data received from the secondary ring is used. Primary ring data is used in other cases.



Note: A to D are OD.RING modules.

x: Disconnected

(A bold line indicates data transfer is possible. A broken line indicates data transfer is disabled.)

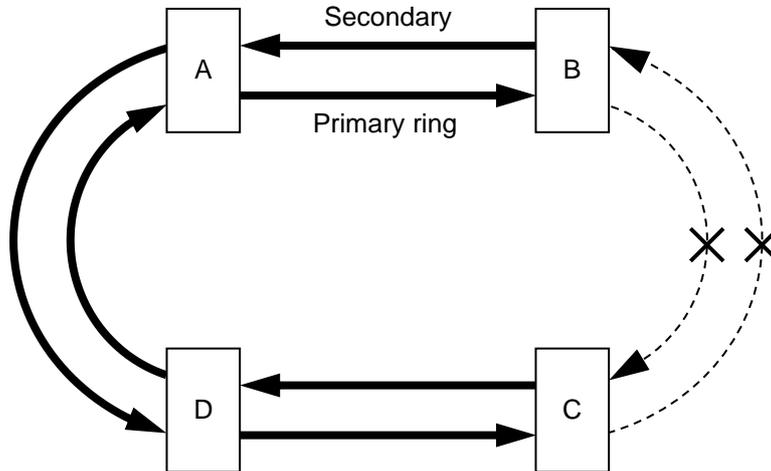
Figure 5-7 One ring is disconnected at several places

5. Programming

- If both rings are disconnected at the same place:

If both the primary ring and secondary ring are disconnected at the same place, a connected route is used to continue communication.

In the example in Figure 5-8, modules A, C, and D cannot receive module B data from the primary ring. Also, module C cannot receive data of modules A, B, and D from the primary ring. In this case, the data received from the secondary ring is used. Primary ring data is used in other cases.



Note: A to D are OD.RING modules.

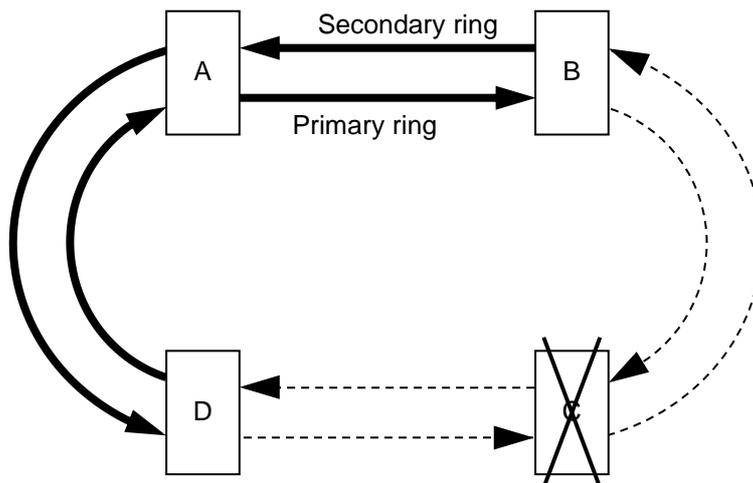
x: Disconnected

(A bold line indicates data transfer is possible. A broken line indicates data transfer is disabled.)

Figure 5-8 Both rings are disconnected at the same place

- If one module stops:

If one module stops, communication continues by using the remaining modules.



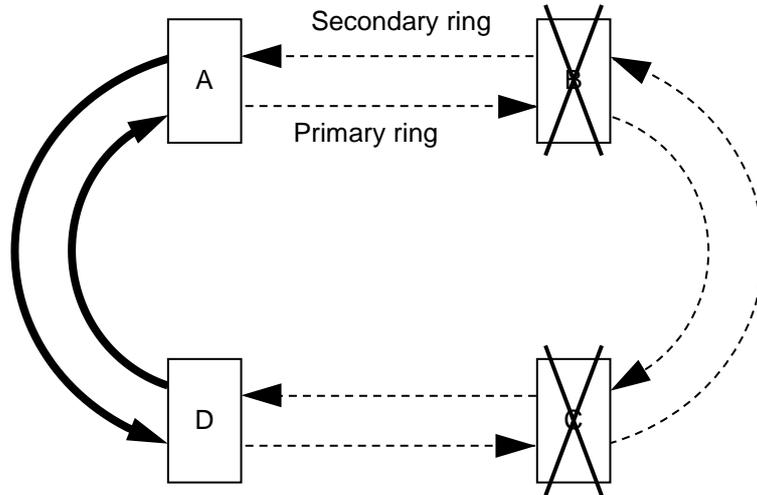
Note: A to D are OD.RING modules.

x: Disconnected

(A bold line indicates data transfer is possible. A broken line indicates data transfer is disabled.)

Figure 5-9 One module stops

- If adjacent multiple modules stop:
If adjacent multiple modules stop, communication continues by using the remaining modules.



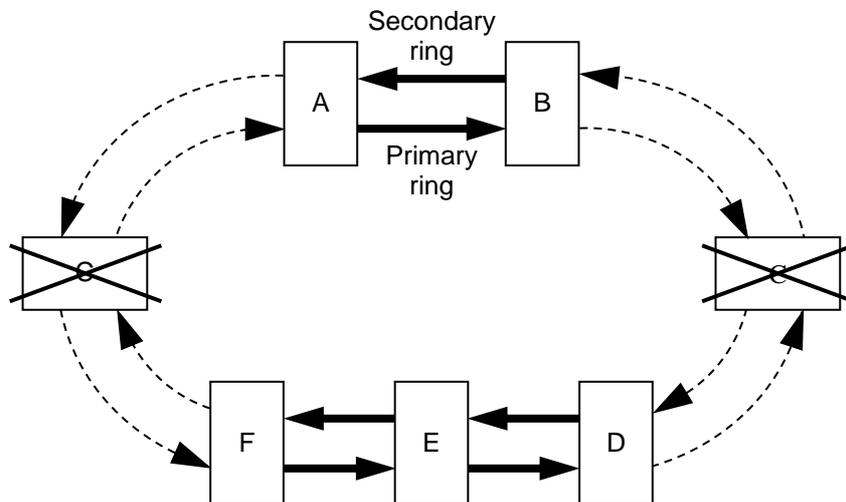
Note: A to D are OD.RING modules.

x: Disconnected

(A bold line indicates data transfer is possible. A broken line indicates data transfer is disabled.)

Figure 5-10 Adjacent multiple modules stop

- If nonadjacent multiple modules stop
If nonadjacent multiple modules stop, communication continues among adjacent modules.



Note: A to F are OD.RING modules.

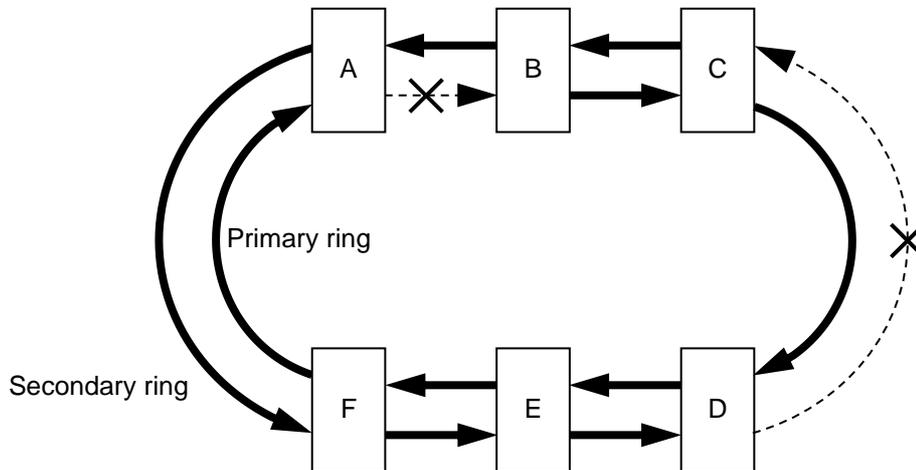
x: Inactive module

(A bold line indicates data transfer is possible. A broken line indicates data transfer is disabled.)

Figure 5-11 Nonadjacent multiple modules stop

5. Programming

- If the primary ring and the secondary ring are disconnected at different places:
If the primary ring and secondary ring are disconnected at different places (between different modules), normal communication is impossible. (Depending on the number of modules connected, CPL No., and number of words transferred, some modules might be unable to transfer data at all while other modules might also be unable to transfer data intermittently.)



Note: A to F are OD.RING modules.

x: Disconnected

(A bold line indicates data transfer is possible. A broken line indicates data transfer is disabled.)

Figure 5-12 Primary ring and the secondary ring are disconnected at different places

Notice

- If the primary ring and secondary ring are disconnected at different places (between different modules), normal communication might be disabled as shown in Figure 5-12. To prevent such a failure, program the modules so that they can detect an error and issue an alarm when the primary ring or secondary ring is disconnected at one place.

[Example] When the connected OD.RING module has CPL number 0 to 5 and the starting address of the RAS table is set to RWF00, the following ladder program assigns Y0F70 to the alarm report coil to report an alarm.

The diagram shows a single ladder logic rung. On the left, there are five normally open contacts in series, labeled RF00, RF05, RF40, and RF45, with vertical ellipses between RF00 and RF05, and between RF40 and RF45. On the right, there is a normally open coil labeled Y0F70.

5.6 RAS table

The RAS table contains communication module information. Figure 5-13 shows the structure of the RAS table. Information on this table can be referenced by using the OD.RING SYSTEM/S10VE setup tool. For details about the operation procedure, see 4.5.12 RAS table.

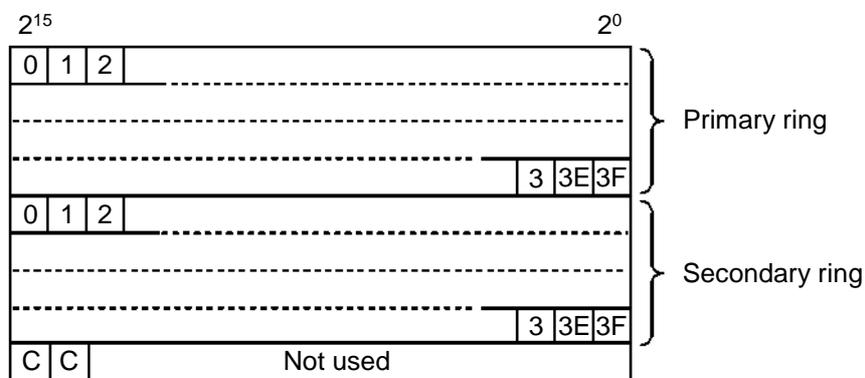


Figure 5-13 Structure of RAS table

- Values 0 to 3F correspond to the CPL Nos. of the module. A set bit indicates that the module is communicating with another module. When information is referenced by using the OD.RING SYSTEM/S10VE setup tool, the bit status of the primary ring shown in Figure 5-13 is displayed in the **Primary** column in the RAS tab window in Figure 4-39. The bit status of the secondary ring is displayed in the **Secondary** column.
 - 0: The switch of the CPU identified with the CPL No. might be set to STOP, the cable might be broken or disconnected, or power failed. Alternatively, the transmission area for the module having the CPL No. might not be set.
 - 1: Data is being received normally from the module identified with the CPL No..
- CP indicates detection of primary ring disconnection and CS indicates detection of secondary ring disconnection. When information is referenced by using the OD.RING SYSTEM/S10VE setup tool, the CP bit status is displayed in the **Cable** row in the **Primary** column in the RAS tab window in Figure 4-39. The CS bit status is displayed in the **Cable** row in the **Secondary** column.
 - 0: The module immediately preceding the local module is normal.
 - 1: Disconnection occurred in the module immediately before the local module, or the immediately preceding module is inactive or faulty.

The communicating module monitors other modules. When the communicating module receives data from a remote module, the remote module is judged as communicating with another, and then the associated bit in the RAS table is set. If the module does not receive data from the remote module before the timeout period in Table 5-3 expires, the remote module is judged as inactive, and then the associated bit in the RAS table is cleared. The bit corresponding to the CPL No. of the local module indicates the operating status of the local module. This bit is set when the local module is operating normally. The bit is cleared when the module stops abnormally.

Thus, the failures listed in Table 5-4 can be detected from the RAS table.

Table 5-3 Timeout period

MODU No. setting switch	Timeout period
0 or 1	4.3 sec.
2 or 3	2.2 sec.
4 or 5	1.5 sec.
6 or 7	0.7 sec.

Table 5-4 Failures and RAS table

Failure	RAS table status
Cable disconnection	The bits of all the modules before the place where the associated ring was disconnected are cleared.
Remote module stop	The bits of both the primary ring and secondary ring of the associated module are cleared.
Local module error stop	The bit of the local module is cleared. Because data cannot be received from other modules, all the bits of the primary ring and secondary ring are cleared.

Notice

- If FW is set as a RAS bit area, data before reset might remain for two seconds after reset is canceled. Therefore, wait for at least two seconds before referencing the RAS table.

6. Maintenance

6.1 Maintenance and inspection

To use OD.RING modules under optimum conditions, perform the inspections shown in Table 6-1 periodically (at least twice a year).

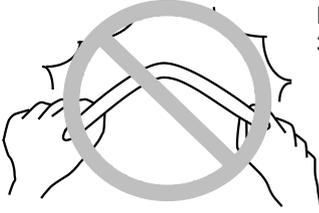
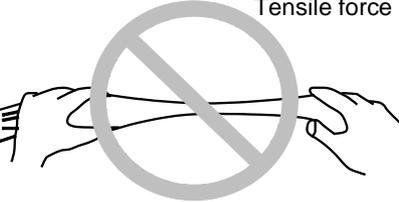
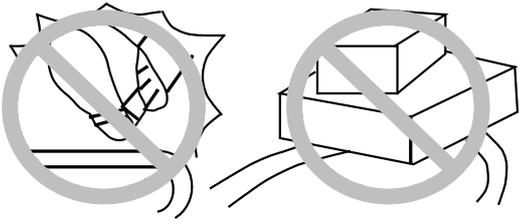
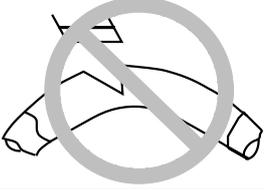
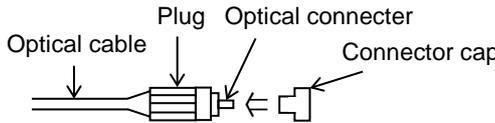
Table 6-1 Maintenance and inspection items

Item	Description	Frequency
Unit cleaning	Turn off all the power supplies and then vacuum the interior of the OD.RING module through the slits in its casing. Do not scatter dust during cleaning.	At least twice a year
Mechanical check	Check OD.RING module mounting screws and communication cable mounting screws for looseness and damage. Tighten any loose screws and replace any damaged ones.	At least twice a year

6.2 Handling optical fiber cables and cable connectors

As shown in Table 6-2, handling optical fiber cables and optical connectors requires considerable care.

Table 6-2 Notes on handling

Item	Description	Remarks
Optical fiber cable	<p>Do not bend the cable!</p>  <p>Bend radius must be 30 mm or more.</p>	If bend radius is less than 30 mm, the internal fibers will be broken.
	<p>Do not pull the cable!</p>  <p>Tensile force = 69 N or less</p>	The fibers will break if the cable is pulled excessively.
	<p>Do not step on the cable! Do not place anything on the cable!</p> 	Fibers might break, or the fiber transfer loss increases due to heavy load.
	<p>Do not scratch the cable!</p> 	Fiber transmission loss increases if the cable is exposed to excessive moisture.
Optical connector	<p>Attach the connector cap.</p> <p>Keep the connector cap attached when not using the optical connector.</p> 	The same precaution applies to the optical module receptacle of the OD.RING module.
	<p>Connection</p> <p>Do not forcibly insert or extract the optical connector. Its end face will be damaged.</p>	The neck of the optical connector is easily damaged by bending. Insert or extract the optical connector only when necessary.
	<p>Cleaning</p> <ul style="list-style-type: none"> - If dust is found on the optical connector plug, clean its end face with industrial gauze dampened with ethyl alcohol, and then reconnect the plug. - If dust is found on the optical module receptacle of the OD.RING module, gently remove the dust with industrial gauze dampened with ethyl alcohol, or by gently blowing. 	

6.3 Replacing optical fiber cables

The disconnected optical fiber cable of an OD.RING module can be replaced while communication continues online.



- Electrical hazards. Only optical fiber cables can be replaced online. Turn off the power switch of the power supply module before replacing cables other than optical fiber cables, such as power cables and grounding conductors.

6.4 Replacing or adding the module

For details about how to replace or add OD.RING modules, see *Chapter 14. Adding and Replacing Modules* in the *SIOVE User's Manual General Description* (manual number SEE-1-001).

6.5 Measuring optical power levels

6.5.1 Measuring the received power level

Measure the optical power level on the receiving side of the optical fiber cable as shown in Figure 6-1.

You must measure the optical power level for the primary ring and the secondary ring.

An FC-type optical connector is used in OD.RING modules (LQE510-E). When connecting the optical power meter, use an FC-type connector adapter (supplied with the optical power meter or optional).

Connector adapter: FC type (JIS C5970 F01 type) optical connector

- (1) Turn off the power switch of the power supply module.
- (2) Note down the current settings of the MODU No. setting switch of the OD.RING module.
- (3) Set the MODU No. setting switch of the OD.RING module to be measured to 8.
- (4) Set the CPU RUN/STOP switch of the CPU module to RUN, and then set the LADDER RUN/STOP switch to STOP.
- (5) Turn on the power switch of the power supply module.
- (6) Measure the optical power level.
- (7) After the measurement has been completed, turn off the power switch of the power supply module.
- (8) Set the switches of the CPU module and OD.RING module to the previous settings.
- (9) Clean the optical module receptacle and optical connector used for measurement, and then connect the cables.
- (10) After you finish cleaning, turn on the power switch of the power supply module, and then restart the CPU module.

Criterion

The received power level must be in the range from -15 to -30 dBm (optical power meter: wavelength = 840 to 890 nm).

If this criterion is not satisfied, measure the optical power level according to *6.5.3 Locating a fault position*, and then check the network.

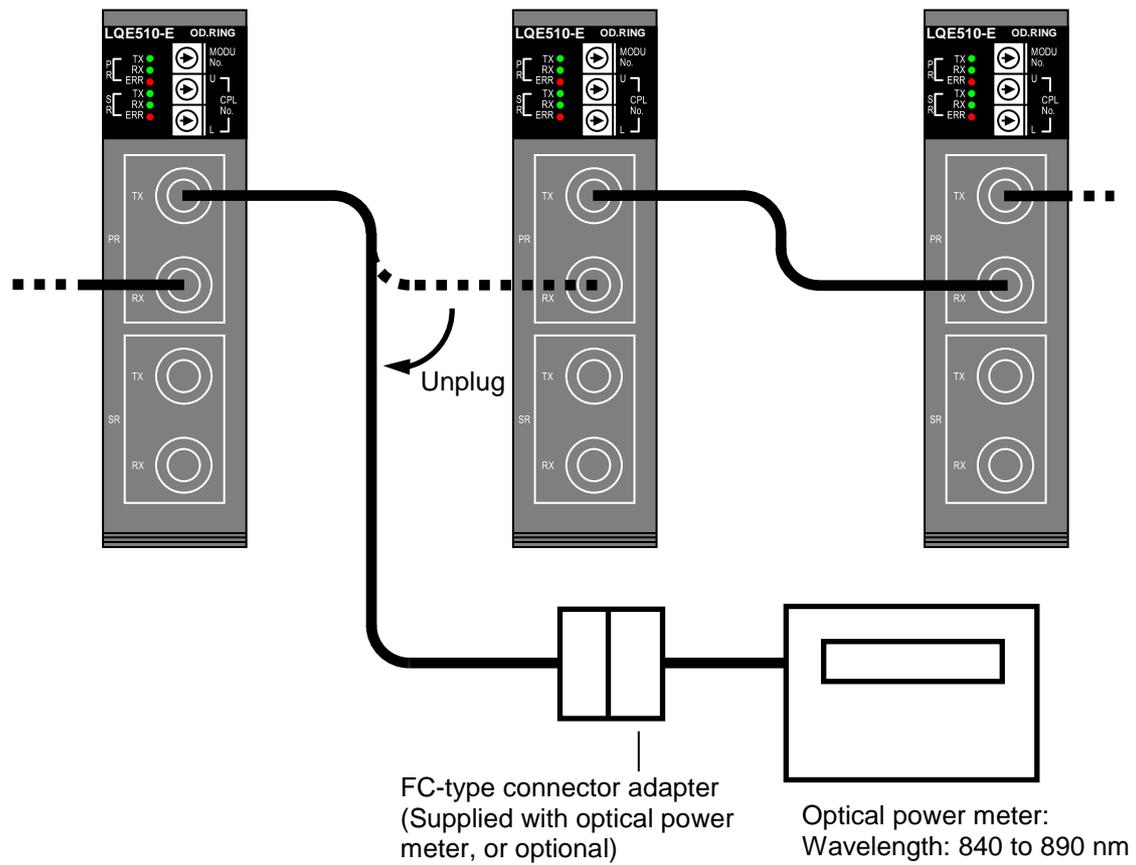


Figure 6-1 Example of measuring the received power level

Notice

- Handle optical fiber cables with care to avoid breaking them. In particular, do not make their bend radius smaller than 30 mm.
- After measurement, clean the optical module receptacle and the optical connector. Dust or dirt on the connector might cause a malfunction.

6.5.2 Measuring the transmitted power level

Measure the optical power level on the transmitting side by using a short optical fiber cable with a length of 1 m or less as shown in Figure 6-2.

A transmission path that satisfies the criterion at received power level measurement requires no transmitted power level measurement. An FC-type optical connector is used in OD.RING modules (LQE510-E). When connecting the optical power meter, use an FC-type connector adapter (supplied with the optical power meter or optional).

Connector adapter: FC type (JIS C5970 F01 type) optical connector

Criterion

The transmitted power level must be in the range from -15 to -18 dBm (optical power meter: wavelength = 840 to 890 nm).

If this criterion is not satisfied, replace the OD.RING module.

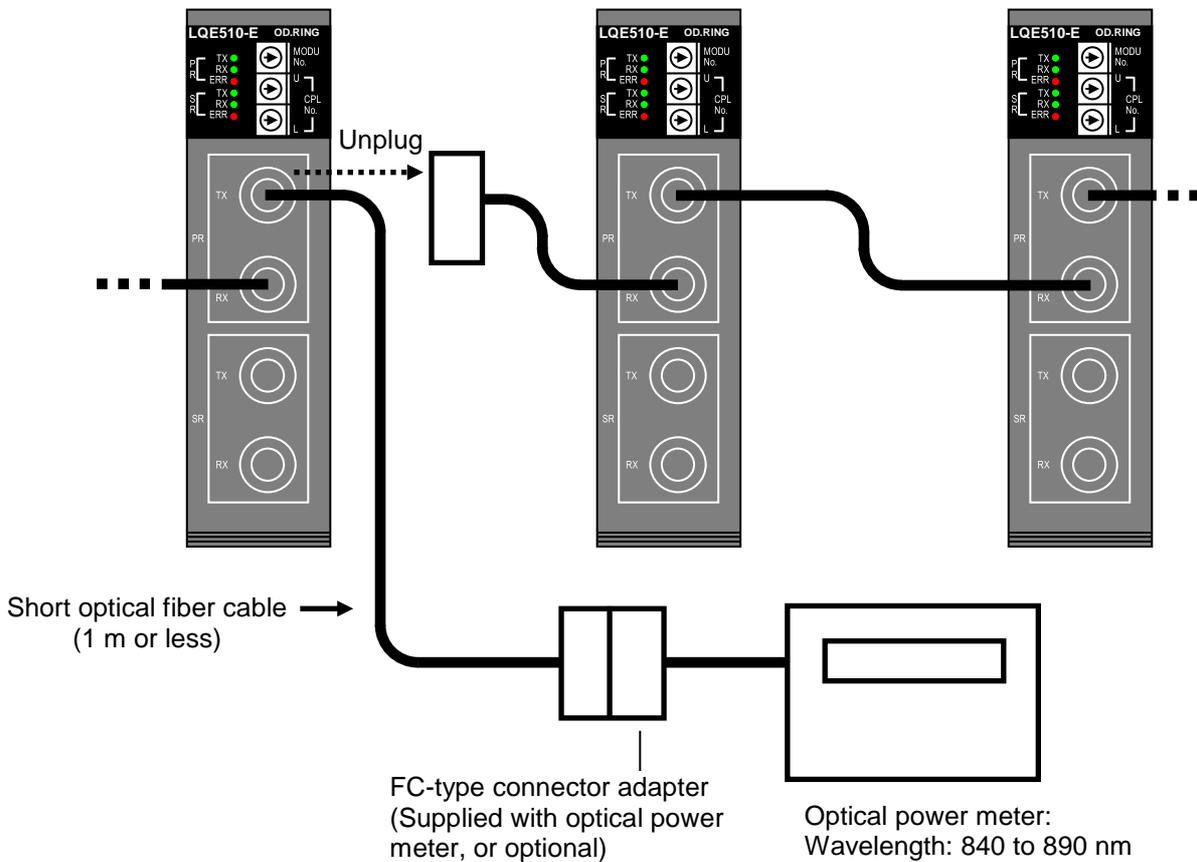
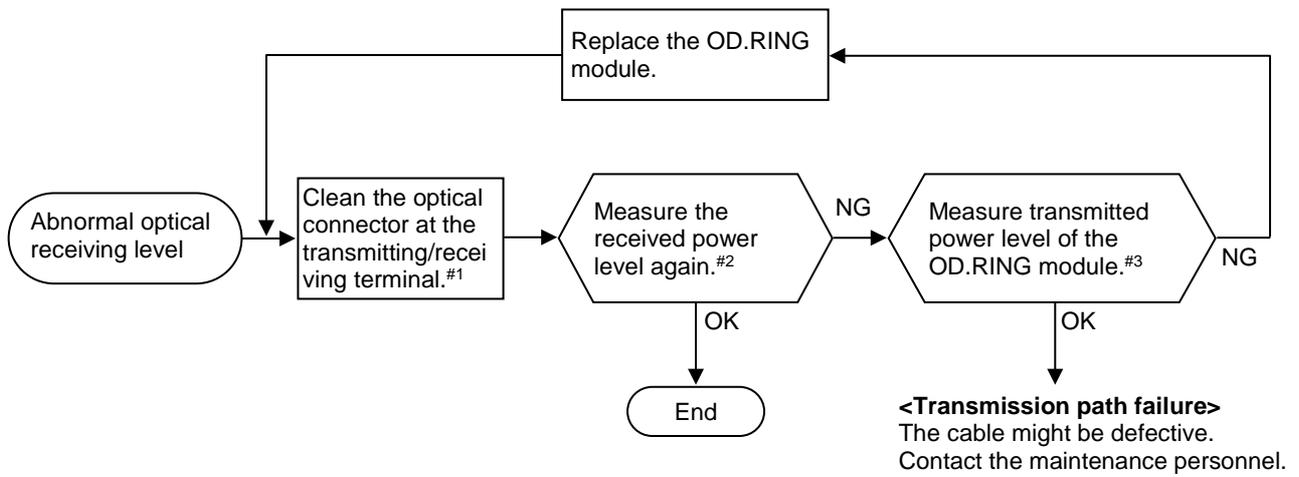


Figure 6-2 Example of measuring the transmitted power level

Notice	
<ul style="list-style-type: none"> ● Handle optical fiber cables with care to avoid breaking them. In particular, do not make their bend radius smaller than 30 mm. ● After measurement, clean the optical module receptacle and the optical connector. Dust or dirt on the connector might cause a malfunction. 	

6.5.3 Locating a fault location

Figure 6-3 shows the procedure for locating the location where a failure occurs.



#1: See 6.2 Handling optical fiber cables and cable connectors.

#2: See 6.5.1 Measuring the received power level.

#3: See 6.5.2 Measuring the transmitted power level.

Figure 6-3 Locating fault location

6.6 Troubleshooting

Troubleshooting of the OD.RING module is performed based on the information displayed on the indicator of the CPU module and the lighting LED (ERR LED, TX LED, or RX LED) of the OD.RING module.

For details of how to perform troubleshooting, see *Chapter 13. Troubleshooting* in the *SIOVE User's Manual General Description* (manual number SEE-1-001).

7. Test and Maintenance Diagnosis

7.1 Details of Test and Maintenance diagnosis

Table 7-1 describes details of Test and Maintenance diagnosis for OD.RING modules. You can select between three types of Test and Maintenance by using the MODU No. setting switch of the OD.RING module.

For details about how to start Test and Maintenance, see *7.3 Starting Test and Maintenance*.

Table 7-1 Details of Test and Maintenance diagnosis for OD.RING modules

No.	Test item	Description	Wiring required?
1	T/M1 Internal loopback check	Use this function to verify that data can be normally transmitted and received through the primary ring and secondary ring lines by using the internal loopback function of the module.	No
2	T/M2 External loopback check	Use this function to verify that data can be transmitted and received normally through the primary ring and secondary ring lines by the external loopback of the module (loop connection from optical module transmission to reception).	Yes
3	T/M3 Inter-module connection check	Use this function to verify that data can be transmitted and received normally through the primary ring and secondary ring lines by executing Test and Maintenance with the usual connection between OD.RING modules.	Yes

Note: To enable the diagnosis result of a test item for which wiring is necessary, perform wiring according to *7.2 Wiring method*, and then start Test and Maintenance.

7.2 Wiring method

- Wiring required for T/M2 external loopback check (No. 2)

Figure 7-1 shows the wiring required for TM/2 external loopback check for the OD.RING module.

Connect the wires so that loopback connection is configured between primary ring (PR) transmission and secondary ring (SR) reception, and between secondary ring (SR) transmission and primary ring (PR) reception. Connection between primary ring transmission and reception, or between secondary ring transmission and reception, is prohibited.

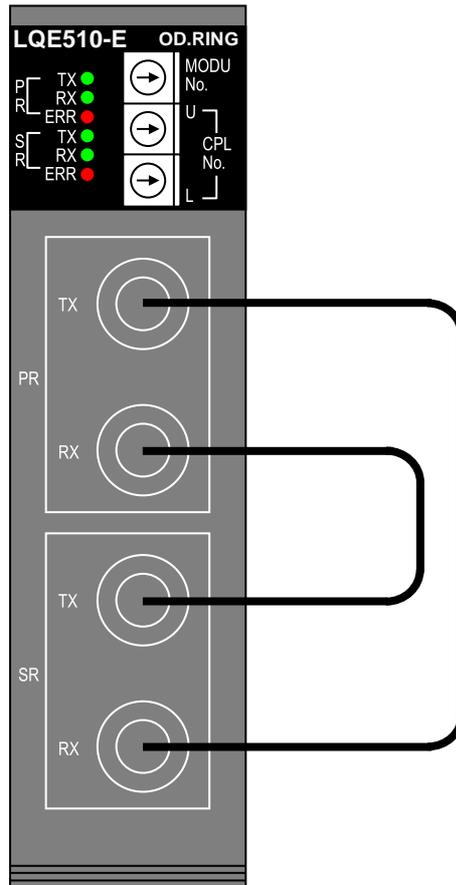


Figure 7-1 Wiring required for external loopback check

- Wiring required for T/M3 inter-module connection check (No. 3)
- Figure 7-2 shows the wiring required for inter-module connection check.
 Make sure that the wiring length is within the specifications for normal use.

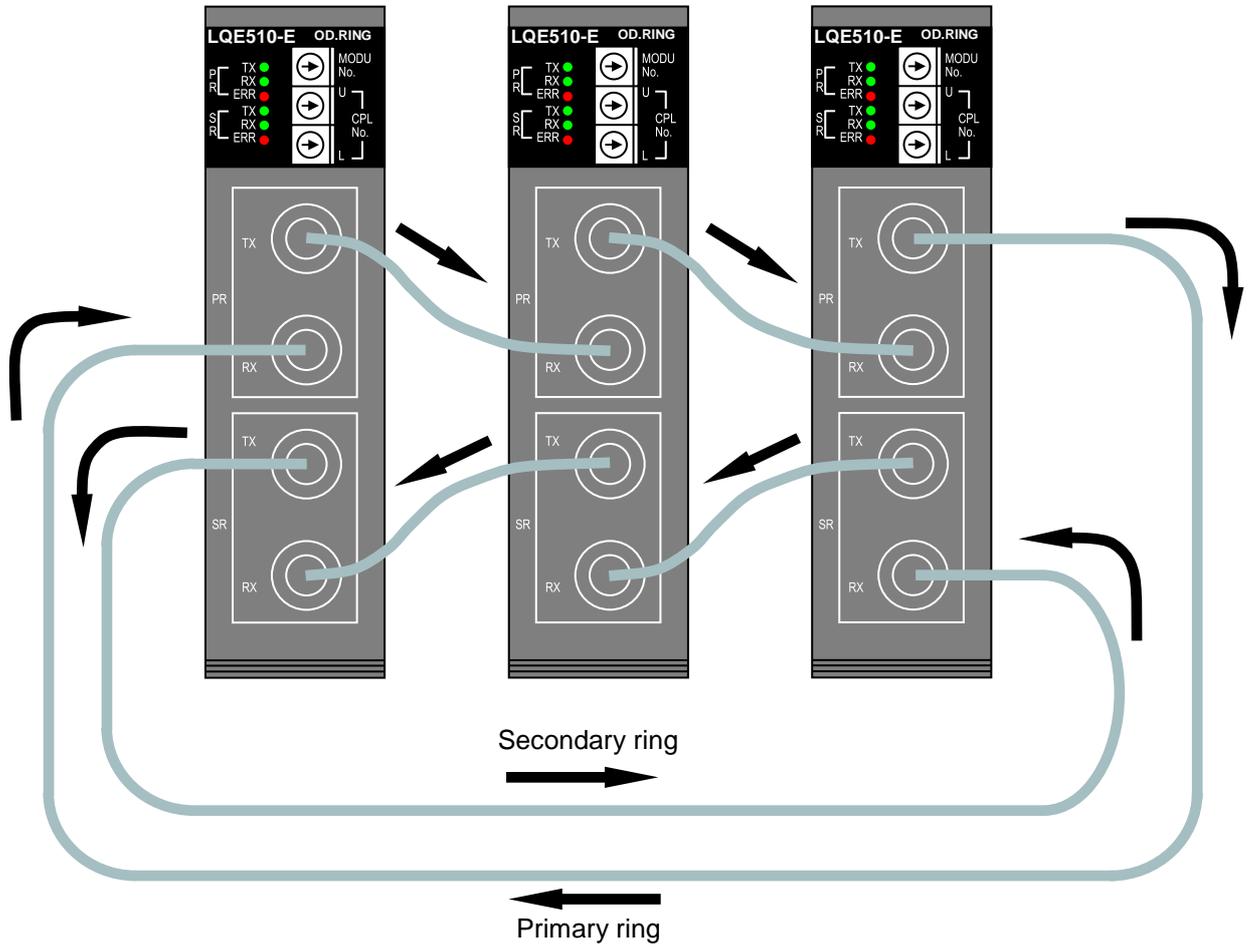


Figure 7-2 Wiring required for inter-module connection check

7.3 Starting Test and Maintenance

Observe the following and perform Test and Maintenance by using steps (1) to (7):

- Do not perform Test and Maintenance for other modules at the same time.
- Before starting Test and Maintenance, record the settings of all switches of the OD.RING module. This ensures that the original settings can be restored after Test and Maintenance is completed.
- Write down the settings of all switches in advance to ensure that the settings are restored after the Test and Maintenance operation is completed.
- Back up data.
- Turn off the power switch of the power supply module.

- (1) If necessary, perform wiring as shown in 7.2 *Wiring method*.
- (2) Select a test item by using the MODU No. setting switch of the OD.RING module shown in Figure 7-3. Table 7-2 shows the T/M (test item) selected by the MODU No. setting switch and the CPU switch settings required to start Test and Maintenance. To perform T/M3, set the MODU No. setting switch on all the connected OD.RING modules.

Table 7-2 Test item selected by setting switches

Module selection	Test item	Switch settings of OD.RING module		Switch settings of CPU module	
		MODU No.	CPL No. U/L	CPU RUN/STOP	LADDER RUN/STOP
Main module	T/M1	8	0/0	RUN	RUN
	T/M2	A	0/0		
	T/M3	C	Unique value		
Sub module	T/M1	9	0/0		
	T/M2	B	0/0		
	T/M3	C	Unique value		

- (3) On the OD.RING module shown in Figure 7-3, set both CPL No. setting switches to 0.
When T/M3 is selected, set these switches to unique values among connected modules.
- (4) Set the CPU RUN/STOP switch and LADDER RUN/STOP switch of the CPU module to RUN.

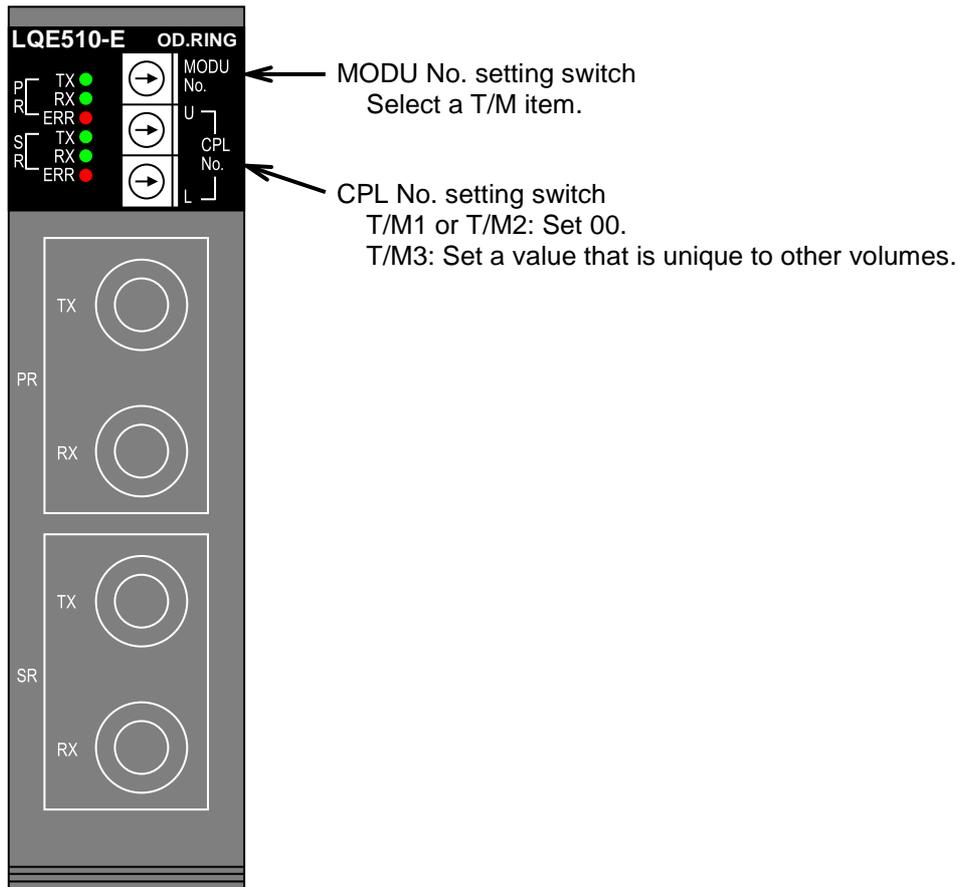


Figure 7-3 Switch settings on the OD.RING module

- (5) Turn on the power switch on the power module. This starts the Test and Maintenance operation. For T/M3, which uses multiple OD.RING modules, you can turn the modules on in any order.
While T/M1 is running, the TX LED flashes.
While T/M2 and T/M3 are running, the TX LED and the RX LED flash.
- (6) To stop the Test and Maintenance operation, turn off the power switch on the power module.
- (7) To return to normal operation, reset the switches to the settings that existed before the Test and Maintenance operation, and then restore backup data.

7.4 Checking errors

If an error is detected during the Test and Maintenance operation, the ERR LED of the OD.RING module turns on.

Determine the defective parts according to Table 7-3 and take appropriate action.

Table 7-3 Location of problem for lighting ERR LED, and corrective actions

Test item	Possible problem location	Corrective action
T/M1	Defective module	- The module is probably defective. Replace the module.
T/M2	Defective optical cable Defective optical module	- Check that the optical cable in loopback connection is properly connected. If it is not connected properly, properly connect it and then retry T/M2. - If the optical cable is properly connected, perform T/M1. If T/M1 operates normally, the optical cable or the optical module is probably defective. Replace the optical cable, and then retry T/M2. - If the ERR LED lights due to the preceding cause, the module is probably defective. Replace the module.
T/M3	Improper wiring Defective optical cable Duplicated CPL No.	- Check the wiring, cables, and CPL No. of the module whose ERR LED is lit. If no problem can be found, connect the tool system to the CPU unit for which the ERR LED is lit, and then check detailed information. For details about how to connect the tool, see <i>Chapter 8. Tools</i> in the <i>S10VE User's Manual General Description</i> (manual number SEE-1-001). For details about ERR LEDs, see <i>Chapter 13. Troubleshooting</i> in the <i>S10VE User's Manual General Description</i> (manual number SEE-1-001).

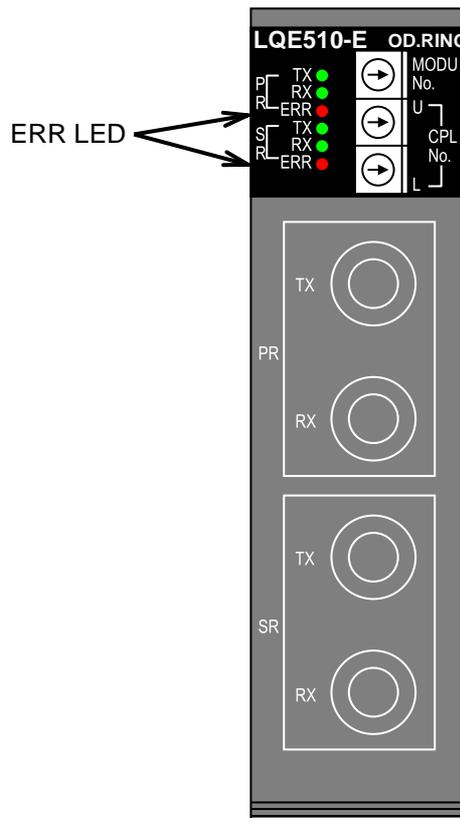


Figure 7-4 ERR LEDs of the OD.RING module