No. CP-SP-1463E

azbil

User's Manual for Detailed Functions of Smart Loader Package

Model SLP-C1F

for Single Loop Controller Model C1A/C1M



Thank you for purchasing this Azbil Corporation product.

This manual contains information for ensuring the correct use of the smart loader package.

Those designing, configuring, or maintaining equipment that uses this product should first read and understand this manual. It provides necessary information not only for initial setup, but also for changing of settings, troubleshooting, etc. Be sure to keep it nearby for handy reference.

Azbil Corporation



NOTICE

Please make sure that this manual is available to the user of the product.

Unauthorized duplication of this user's manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is complete and accurate, but if you should find an omission or error, please contact us.

In no event is Azbil Corporation liable to anyone for any indirect, special, or consequential damages as a result of using this product.

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Conventions Used in This Manual

The safety precautions explained below aim to prevent injury to you and others, and to prevent property damage.



The Role of This Manual

There are seven different manuals related to Smart Loader Package model SLP-C1F (hereafter "the loader"). Read them as necessary for your specific requirements.

If you do not have a manual you require, please contact us or your dealer.

Alternatively, you can download the necessary manuals from https://www.azbil.com.



User's Manual for Detailed Functions of Smart Loader Package Model SLP-C1F for Single Loop Controller Model C1A/C1M

Document No. CP-SP-1463E

This manual.

This manual describes the software used on a PC to configure model C1A/C1M. Those designing or setting up equipment that uses model C1A/C1M should read this manual. The manual describes installation of the software into a PC, operation of the PC, various functions, and setup procedures.

Smart Loader Package Model SLP-C1F Installation Manual

Document No. CP-UM-5986JEC

This manual is supplied with the product. It has descriptions in Japanese, English, and Chinese. Personnel in charge of the design or manufacture of equipment that incorporates this device should read this manual thoroughly. This manual covers safety precautions, installation, wiring, main specifications, and parameters of this device. For further information about operation, refer to the user's manual for installation and configuration.



Single Loop Controller Model C1M User's Manual for Installation and Configuration

Document No. CP-SP-1448E

This manual describes the hardware and all functions of this device. Personnel in charge of the design, manufacture, operation, or maintenance of equipment that incorporates this device, or those in charge of communication software for equipment that uses this device's communication functions, should read this manual thoroughly.

This manual also describes the installation, wiring, connections for communication, functions and settings of this device, operating procedures, communication with a master station (PC, etc.), communication addresses, troubleshooting, and detailed specifications.



Single Loop Controller Model C1M User's Manual

Document No. CP-UM-5964JEC

This manual is supplied with the product. It has descriptions in Japanese, English and Chinese. Personnel in charge of the design or manufacture of equipment that incorporates this device should read this manual thoroughly. This manual covers safety precautions, installation, wiring, main specifications, and parameters of this device. For further information about operation, refer to the user's manual for installation and configuration.



Quick Reference Guide for Model C1M

Document No. CP-SP-1450E

For those using this device for the first time or for operators on the work site, this guide serves as a reference when specifying parameters.

Key operations, menu flowcharts and parameter settings are described with color illustrations.



Single Loop Controller Model C1A User's Manual for Installation and Configuration

Document No. CP-SP-1468E

This manual describes the hardware and all functions of this device. Personnel in charge of the design, manufacture, operation, or maintenance of equipment that incorporates this device, or those in charge of communication software for equipment that uses this device's communication functions, should read this manual thoroughly.

This manual also describes the installation, wiring, connections for communication, functions and settings of this device, operating procedures, communication with a master station (PC, etc.), communication addresses, troubleshooting, and detailed specifications.



Single Loop Controller Model C1A User's Manual

Document No. CP-UM-5996JEC

This manual is supplied with the product. It has descriptions in Japanese, English and Chinese. Personnel in charge of the design or manufacture of equipment that incorporates this device should read this manual thoroughly. This manual covers safety precautions, installation, wiring, main specifications, and parameters of this device. For further information about operation, refer to the user's manual for installation and configuration. This manual is organized as shown below.

Chapter 1 Introduction	
	Be sure to read this chapter before you start using this software.
	Describes the required PC operating environment and briefly introduces the features of the software.
Chapter 2 Installing, Starting	, and Exiting the Loader
	Tells how to install, start and quit the software.
Chapter 3 Setup	
	Tells how to configure settings.
Chapter 4 Monitoring	
	Describes the screens for changing or monitoring the status of operation, etc.
Chapter 5 Adjusting PID Valu	es
	Describes the PID Simulator support software for adjusting PID values and tells how to adjust the PID values.
Chapter 6 Troubleshooting	
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Chapter 1. Introduction

1-1 Overview

This software, model No. SLP-C1F (hereafter called "the loader"), is an engineering tool equipped not only with the basic functions for configuring and monitoring the C1A/C1M single loop controller, but also with a PID Simulator for improving controllability.

The loader is a software package that runs on a PC with the Microsoft Windows 10 operating system.



• C Install the loader on a PC by following Installation procedure (p. 2-1).

Functions of the loader

The loader has the following functions:

- Setup
- Monitoring
- Calibration and checking
- PID Simulator

Setup

This function is for setting the required controller parameters on the PC and writing (transferring) them to the controller. For details, refer to the following. Chapter 3. Setup

Monitoring

The user can do a trial run and change control constants, tune the controller, switch modes (RUN/READY, AUTO/MANUAL, etc.), and check the status of operation and of alarms.

The operating status can also be checked and collected on the Trend screen, and collected data can be output in CSV format so that it can be used in third-party spreadsheet software such as Microsoft Excel. For details, refer to the following.

Calibration and checking

This function is used to calibrate and check controller input.

For details on the calibration/inspection function, refer to the following.

Single Loop Controller Model C1A User's Manual for Installation and Configuration (CP-SP-1468E) or Single Loop Controller Model C1M User's Manual for Installation and Configuration (CP-SP-1448E).

PID Simulator

The PID Simulator assists in adjusting PID values using Azbil's proprietary simulation technology.

Chapter 5. Adjusting PID Values (p. 5-1)

1-2 System Requirements

The following system environment is required to use the loader.

Hardware

ltem	Description					
Hardware	CPU Windows PC with an Intel CPU					
		Recommended: 1.5 GHz or more. Minimum: 1 GHz				
	Operating system	Windows 10				
	Memory (RAM)	Recommended: 4 GB or more. Minimum: 2 GB				
	Hard disk	Recommended free space: 20 GB or more. Minimum: 10 GB				
	Monitor resolution	1366 × 768 or higher				
	USB ports	1 or more				
		(Necessary in order to connect to the instrument.)				
	Optical drive	Used to install the software from the installation media (CD-ROM)				
	Input devices	Keyboard, mouse, and touchpad				
Other	PDF	Adobe Acrobat DC or a later version				

! Handling Precautions

 Make sure that [Decimal symbol] has been set to "." in [Control Panel] → [Regional Settings] → [Number]. If it is set to some other character, the loader program will not function correctly.

Connection cable

The cable for the SLP-C1F differs depending on the instrument to be connected.

USB loader cable for connecting to the C1M: model 81441177-001 USB loader cable (A-microB) for connecting to the C1A: model SLP-ULCJA0

! Handling Precautions

- To use the cable model 81441177-001, a special device driver must be installed.
- If an A-microB USB cable other than SLP-ULCJA0 is used to connect to the C1A, a loader cable error (AL50) will occur and the loader will not be able to communicate with the C1A.

Hardware configuration

• General configuration



• When using RS-485 communication



Chapter 2. Installing, Starting, and Exiting the Loader

2-1 Installing the Loader

To use the loader, the loader program (SLP-C1F) and the device driver for the USB loader cable must be installed.

! Handling Precautions

• Log into Windows as an administrator to install the loader.

Installation procedure

This section describes how to install the loader on a PC.

! Handling Precautions

• If you start the installer while another application is running, the installer may malfunction.

Shut down other applications and then start the installer. The loader may not be able to start with certain combinations of applications and drivers. For details on Windows and PC settings, refer to the user's manuals provided with Windows and with the PC.

• Uninstalling SLP-C1F ver. 1

If SLP-C1F ver. 1 is installed, uninstall it first using the procedure below.

- (1) Open the Windows [Settings].
- (2) Select [Apps & Features].
- (3) Select [SLP-C1F 1.x.x] and click [Uninstall] ("x.x" represents the version that is installed).
- (4) Follow the messages displayed to uninstall the loader.

Installing the loader

- (1) Insert the CD-ROM in the CD-ROM drive of your PC.
- (2) Double-click the Setup icon on the CD-ROM.



 \gg The following screen is displayed.



(3) Click [Next].

 \gg The following screen is displayed.



(4) Check the license agreement.

(5) If you agree to the license agreement and wish to install the loader, click [Next].

🚽 SLP-C1F 1.2.2 Setup			×
Destination Folder Click Next to install to the default folder or click Ch	ange to choose another.		Ð
Install SLP-C1F 1.2.2 to:			
C:\Program Files (x86)\SLP\SLPC1\ Change]
B	ack <u>N</u> ext	Can	cel

- (6) Set the installation destination folder and click [Next].
 - \gg The following screen is displayed.

😸 SLP-C1F 1.2.2 Setup	_		×
Ready to install SLP-C1F 1.2.2			Ð
Click Install to begin the installation. Click Back to review or change a installation settings. Click Cancel to exit the wizard.	any of you	ır	
Back Pinstall		Car	ncel

Note

• To change the installation destination folder, click [Change...].

- (7) Click [Install] to install the loader.
 - \gg The following screen is displayed.



- (8) Installation is complete.
 - \gg The following screen is displayed.

🖟 SLP-C1F 1.2.2 Setup	- 🗆 X
Ð	Completed the SLP-C1F 1.2.2 Setup Wizard
	Click the Finish button to exit the Setup Wizard.
	Back Einish Cancel

(9) Click [<u>Finish</u>].

 \gg When the installation is complete, the screen will return to Windows.

2-2 Installing the Device Driver for the USB Loader Cable

To use USB loader cable model 81441177-001 for connecting to the C1M, a device driver must be installed.

Follow the procedure below to install the device driver.

! Handling Precautions

• Installation of a device driver is not necessary when using the SLP-ULCJA0 loader cable (A-microB) to connect to the C1A.

Installing the USB loader cable device driver

If this is the first time the USB loader cable has been used on your computer, it is necessary to install the driver.

If an old driver is installed, uninstall it first.

• How to check the version of the USB loader cable

The version is shown on the sticker attached to the USB loader cable.

azbil	81441177-001 REV.06				
MADE IN JAPAN					

REV.05 to 06	Driver installation is required.
	If an old driver is installed, uninstall it first.
No "REV" number	Not supported.
	Use a Rev. 05 or higher version of the USB loader cable.

• Checking the driver

- (1) Plug the USB loader cable into a USB port.
- (2) Open the Device Manager.

To open it, right-click the [Start] button and click [Device Manager].

(3) Check the version.

Open the properties of "Yamatake USB Loader Comm. Port (COMx)" in "Port (COM and LPT)" in the Device Manager, and go to the Driver tab to check the driver version.

Versions 0.x.x.x to 4.x.x.x are old drivers.

• Uninstalling the old driver

- (1) Unplug the USB loader cable from the computer.
- (2) Open Apps & features.

From the Start menu, select [Settings], open [Windows Settings], and select [Apps].



(3) Select the driver to be uninstalled.

From the list, select "Azbil Loader Cable Driver."

(4) Uninstall the driver.

Follow the message displayed to uninstall the driver.



Installing the new driver

- (1) Unplug the USB loader cable from the computer.
- (2) Run the installer.

Execute "Setup_v5_0_17.exe."



Follow the messages displayed to proceed with the installation.

When the message below is displayed, installation is complete.



Click the [Finish] button to exit the installer.

- Checking the driver
- (1) Plug the USB loader cable into a USB port.
- (2) Open the Device Manager.

To open it, right-click the [Start] button and click [Device Manager].

(3) Check the COM port number.

If "Yamatake USB Loader Comm. Port (COMx)" is displayed in [Port (COM and LPT)] of Device Manager, the driver has been installed successfully.

The x in COMx is the COM port number. (In the example below, the port number is COM3.)

📇 Device Manager	-	\times
<u>File</u> <u>Action</u> <u>View</u> <u>H</u> elp		
> Memory technology devices		^
Mice and other pointing devices		
> 🛄 Monitors		
> 🚽 Network adapters		
 Ports (COM & LPT) 		
🛱 Yamatake USB Loader Comm. Port (COM3)		- 6
> 🚍 Print queues		
> Processors		
> I Security devices		
> Provide Software components		
> Software devices		
> 💐 Sound, video and game controllers		
Gen Storage controllers		~

(4) Change the COM port number.

The COM port number can be changed to suit your computer environment.

Open the properties of "Yamatake USB Loader Comm. Port (COMx)" and select [Advanced...] on the [Port Settings] tab.

The COM port number can be changed as desired in the COM port number setting section.

'amatak	e USB Loader	Comm. Port	(COM3)	Properties	5	
General	Port Settings	Driver De	atails Ev	vents		
		<u>B</u> its per s	econd [600		•
		Dat	ta bits: 8			•
			Barity:	lone		•
		Sto	op bits: 1			•
		Elow o	ontrol:	lone		•
			∆dvar	noed	Restore De	faults
		0010				

(5) Check the version.

Open the properties of "Yamatake USB Loader Comm. Port (COMx)," and go to the Driver tab to check the driver version.

Yamatake USB Loader Co	mm. Port (COM3) Properties	×
General Port Settings	Driver Details Events	
Yamatake USB L	oader Comm. Port (COM3)	
Driver Provider:	Azbil Corporation	
Driver Date:	10/7/2020	
Driver Version:	5.0.17.9	
Digital Signer:	Microsoft Windows Hardware Compatibility Publisher	
Driver Details	View details about the installed driver files.	
Ugdate Driver	Update the driver for this device.	
Roll Back Driver	If the device fails after updating the driver, roll back to the previously installed driver.	
Disable Device	Disable the device.	
Uninstall Device	Uninstall the device from the system (Advanced).	
	OK Cance	əl

Handling precautions for uses other than SLP-C1F

After installing the driver, the automatic USB loader cable selection provided by Azbil's smart loader package may stop working.

If this happens, check the COM port number in the Device Manager and set it manually.

Uninstalling the device driver

! Handling Precautions

- Close other applications and then uninstall the driver. Removing the driver requires restarting the computer.
- To uninstall the driver, the user must have administrator rights on the computer. Uninstallation should be done by the administrator or by a user who belongs to the administrator group.

• Execute the driver removal program.

(1) Select [Control Panel] \rightarrow [Programs and Features] \rightarrow "Azbil Loader Cable Driver", and click the [Uninstall] button.

>> Uninstallation of the loader starts and the following screen is displayed.

Azbil Loader Cable - InstallShield Wizard	—		×
Preparing Setup Please wait while the InstallShield Wizard prepares the setup.			1
Azbil Loader Cable Setup is preparing the InstallShield Wizard, which will rest of the setup process. Please wait.	juide yo	u through	the
	_		
Install5hield -		Cano	el



• When [Uninstall] is selected, the Windows User Account Control message appears.

When it is displayed, click the [Yes] button.

(2) To delete the driver completely, select [Remove] and then click the [Next >] button.



 \gg The following confirmation screen is displayed.

Azbil Loader Cable Driver Installer Program	\times
Confirm Uninstall Do you want to completely remove the selected application and all of its features?	
はい(1) いいえ(1)	

(3) Execute the driver removal program, and then click the [Finish] button.



2-3 Starting and Exiting the Loader

SLP-C1F ver. 2 includes two types of loader software, one for the C1A and the other for the C1M. The instrument can be selected by the launcher.

Starting the launcher

Double-click the SLP-C1F 2.0.0 icon on the desktop. Or, from the Start menu, select [SLP] \rightarrow [SLP-C1F 2.0.0].

 \gg The launcher screen is displayed.



• Starting and exiting the loader for the C1M

To configure and monitor the C1M, start the loader for the C1M. Click the [C1M] button on the launcher screen.

» The following startup screen is displayed.



>> When startup of the C1M's loader is complete, the following main menu screen is displayed.



To exit the loader, click the [×] button at the top right, or select [Menu] \rightarrow [Quit] from the menu bar.

Starting the loader for the C1A

To configure and monitor the C1A, start the loader for the C1A. Click the [C1A] button on the launcher screen.

» The following startup screen is displayed.



>> When startup of the C1A's loader is complete, the following main menu screen is displayed.



>> When the loader is started for the first time, the following handling precautions is displayed.



Check or don't check the [Do not show this again] check box as desired.

To exit the loader, click the [×] button at the top right of the menu screen, or select [Menu] \rightarrow [Quit] from the menu bar.

• Changing the display language

The display language can be specified for each SLP. Select [Language] from the menu bar and select the display language from the following.

Japanese	Japanese
English	English
Chinese	Simplified Chinese
Auto	Use the Windows display language setting

Exiting the launcher

Click the [X] button at the top right of the launcher screen.

Chapter 3. Setup

3-1 Setup Function

Setup procedure using the loaders is the same for the C1M and C1A. Use the loader that the controller is configured and monitored with. For illustration, the descriptions below use the screens of the C1M's loader.

Overview

With the setup function the user can set up the environment, set various parameters, and write the parameters to the controller so that it functions according to the user's particular control requirements.

If the parameters are not set, the controller will not operate as required.

Be sure to set each parameter.

SP (set point) and control constants (PID values) that are changed relatively frequently while the controller is running can also be set on the monitor function screen. Parameters that rarely need to be changed once they are set are saved to a file in list format by the setup function and are all loaded into the controller before operation begins.

Flowchart for setup

The following is the general process of configuring the settings.



Screen explanations

Main menu screen

CIF SLP-C1F Version1.2.2			_		×
<u>M</u> enu Language <u>H</u> elp					
				~	
Setup	Monitor	F	PID Si	mulat	or

• Menu list

Menu	lcon	Submenu	Description	Shortcut keys
Menu S		Setup	Displays the Setup screen.	Ctrl + S
Henry Monito		Monitor	Displays the [Numeric Monitor] and [Trend Monitor] screens.	Ctrl + M
	<u>_</u>	PID Simulator	Displays the PID Simulator screen.	Ctrl + P
		Calibration and checking (J)	Displays the Calibration and checking screen.	Ctrl + J
		Option (E)	Changes the environment setup.	Ctrl + E
		Quit	Quits the application.	Ctrl + Q
Language*		Japanese	Sets the display language to Japanese.	
		English	Sets the display language to English.	
		Chinese	Sets the display language to Chinese (simplified).	
		Auto	Automatically determines Japanese, English, or Chinese (simplified) from the Windows operating language.	
Help		Version (A)	Displays the version information.	Ctrl + A

* [Language] will be disabled if the loader is started from the launcher.

Setup screen



Menu list

Menu	lcon	Submenu	Description	Shortcut keys
File	Ľ	New	Creates new data.	Ctrl + N
	Þ	Open	Opens existing data.	Ctrl + O
		Save	Saves data.	Ctrl + S
		Save As	Saves current data with a new name.	Ctrl + A
		CSV out (X)	Saves data in CSV format.	Ctrl + X
		HTML Out (H)	Saves data in HTML format.	Ctrl + H
		Print	Prints out data. (Same contents as the data saved in HTML format.)	
		Quit	Quits the application.	Ctrl + Q
Edit		Data Check	Checks the value of all settings.	Ctrl + D
	v	Bit edit	Inputs to bit lists.	Ctrl + B
	티	Logical operation setup	Displays the logical operation setup screen.	Ctrl + P
		PLC Link	Displays the PLC link setup screen.	
	Φ	Сору	Copies the source.	Ctrl + C
	ß	Paste	Pastes the copy.	Ctrl + V
Display	-	Simple (1)		
	E	Standard (2)		
		Advanced (3)		
		Parameter disp area	Shows the parameter display area.	
		Auto size	Enables auto-sizing of cells.	
		Size initialize	Resets the cell size.	
		Cell size adjust	Matches the size of the cell to the window.	
	\sim	Pattern graph	Displays the SP pattern.	
Communication	1	Read (C1A/C1M→SLP)	Reads controller data.	Ctrl + R
	Ŧ	Write (SLP \rightarrow C1A/C1M)	Writes data to the controller.	Ctrl + W
		Read settings from SDC15*	Reads settings from SDC15.	
User Function	UF	User Function register	Displays the User Function registration screen.	Ctrl+U
		User Function Clear	Deletes contents of the User Function register.	
Option	•0	Type Setting	Changes the model No. setting.	Ctrl + T

3-2 Setting Method

Configure and change settings offline (without connecting the cable to the controller).

Click [Setup] on the menu screen.

Then do the following.

Step 1: Set up the environment
↓
Step 2: Set the model No. of the controller
↓
Step 3: Initialize parameters (deletes previous parameter settings)
↓
Step 4: Set parameters
↓
Step 5: Save parameters
↓
Step 6: Write parameters to the controller

! Handling Precautions

 Steps 2 and 3 are necessary before inputting the parameter settings to the controller. Be sure to do these steps. Otherwise, the controller may be set up incorrectly. For example, items that require setup may not be displayed or unnecessary items may be displayed.

Step 1: Set up the environment

Set the communications port of the PC.

- (1) Display the main menu screen.
- (2) Select [Menu] \rightarrow [Option (E)] to open the Environment setting screen.
 - » The Environment setting screen is displayed.

USB loader cable au	uto select		Device manager	
Communication setu	p	Station address/Sub	address	
 Use loader cable Use RS-485 converter 		Station address	1	
		Sub address	0	
Transmission speed	Data length	Parity	Stop bits	
_ 4800bps	• 7 bits	Even parity	1 stop bit	
9600bps		Odd parity		
19200bps	8 bits	0.111	○ 2 stop bits	
38400bps		O No parity		
Fixed cell width				

- (3) Select "Use loader cable."
- (4) Set the communication port. Select the communication port. If you click [USB loader cable auto select], the number of the port connected to the PC will be set automatically.
- (5) Click the [OK] button.

!	Hane

Handling Precautions

- Normally, select "Use loader cable."
- For the C1M's loader, COM port selection is not displayed unless USB loader cable model 81441177-001 is connected.
- For the C1A's loader, COM port selection is not displayed unless USB loader cable (A-microB) model SLPULCJA0 is connected to the C1A.

• Step 2: Set the model No. of the controller

Set the controller's model No. in the loader.

(1) Display the setup screen.

(2) Click the \Box_0 icon.

Selecting [Option] \rightarrow [Type Setting] gives the same result. Pressing the [Ctrl]+[T] keys also gives the same result.

» The [Type Setting] dialog box is displayed.

ype Setting		×
(1)Basic Model No.	(2)Mounting	(4)PV Input T:Thermocouple R:RTD L:Linear
CTMTR0TA00XX	(3)Output (3)R0:Relay (3)Output	(5)Power voltage (6)Option (6)Option (6)OkNone 01:3EV 02:3EV+2CT+2DI 03:3EV+2CT+85-485 04:2EV(independent)+2CT+2DI 05:2EV(independent)+2CT+RS-485 09:RS-485

- (3) Specify the settings for Mounting, Output, PV Input, Power voltage, and Option as required. Select the desired option for each setting.
- (4) Click the [OK] button.

Note

• When you click the [Read] button, data is read from the controller. This can prevent incorrect parameters from being written due to a model No. setting error.

| ! | Handling Precautions

- The model No. set in this dialog box is used internally by the loader. Changing the model No. in the loader will not change the model No. of the controller.
- Single Loop Controller Model C1A User's Manual for Installation and Configuration (CP-SP-1468E) or Single Loop Controller Model C1M User's Manual for Installation and Configuration (CP-SP-1448E) (for details on specifications).

• Step 3: Initialize parameters (delete previous parameter settings)

(1) Click the **b** icon.

Selecting [File] \rightarrow [New] gives the same result. Pressing the [Ctrl]+[N] keys also gives the same result.

 \gg The initialization dialog box is displayed.

Information	×
Initial	lize Data
ОК	Cancel

- (2) Click the [OK] button.
 - » Initial parameter settings are set according to the specified model No.

Step 4: Set parameters

Move the cursor to each item and do the following:

- If the item to be set is numerical Enter the desired number and press the [Return] key.
- If the setting is selected by a number Right-click the item.
 The list of settings you can select will appear.
 Select the desired item.

Set each of the parameters required for running the controller. Parameters can be set for the following two types of functions.

- Standard Functions for basic device operations, such as control and communication
- Optional

Functions related to optional specifications, such as PLC link communication, user functions, DO assignment, and tuning

! Handling Precautions

- "----" is displayed in the cell if setup of a parameter is not required or is prohibited by other settings. The parameter cannot be set. In such a case, if needed, recheck the model No. setting or related settings.
- The items on the horizontal axis are SP numbers, event numbers, or external switch input numbers when setting the standard functions, and are output numbers when setting the optional functions.

 About connection to the PC Normally, one controller unit is connected to the PC with the USB loader cable.

If you click [Menu] \rightarrow [Option (E)] to open the Environment setting screen, and select "Use RS-485 converter" for [Communication setup], multiple controllers can be connected using the RS-485 communication converter. In this case, the environment setting and the communication setting on the controller unit must be configured to match each other beforehand. The setting on the controller side must be configured in advance on the controller console or by connecting the controller with the loader cable.

Note

- Single Loop Controller Model C1A User's Manual for Installation and Configuration (CP-SP-1468E) or Single Loop Controller Model C1M User's Manual for Installation and Configuration (CP-SP-1448E) (for details on functions)
- C> Single Loop Controller Model C1A User's Manual for Installation and Configuration (CP-SP-1468E) or Single Loop Controller Model C1M User's Manual for Installation and Configuration (CP-SP-1448E), section 9-3, "PLC Link Setup" (for details on PLC link communication)

• Step 5: Save parameters

When you have finished with the settings, save them to a file. Saving settings in advance and using saved settings greatly reduces the time required to set up the loader program.

The following items are saved:

- Model No.
- Parameter settings
- Select [File] → [Save As].
 Pressing the [Ctrl]+[A] keys gives the same result.
 - \gg The Save As dialog box is displayed.

CIF Save As										×
← → • ↑ 🗎	> Tł	his PC > Docume	ents	~	õ			ments		
Organize 🔻 Ne	w fold	ler								
This PC 3 D Objects Desktop Documents Downloads Music Pictures	^	Name	~	No items match you	r searc	h.	Date modified		Туре	
Videos	~	<								3
File <u>n</u> ame:	*.c1x	c .								~
Save as <u>t</u> ype:	C1X I	File (*.c1x)								~
∧ Hide Folders							Save	Car	ncel	

(2) Enter the file name and click the [Save] button.

• Step 6: Write parameters to the controller

Write the set parameters or parameters recalled from a saved file to the controller.

- (1) Connect the controller to the PC with the USB loader cable.
- (2) Turn the controller power on.
- (3) Click the ↓ icon. Selecting [Communication] → [Write (SLP→C1A/C1M)] from the pull-down menu gives the same result.

» A message saying "Start to write?" is displayed.

- (4) Click the [OK] button.
 - >> Writing of the setup parameters begins. While the settings are being written, "Wait" is displayed. When writing is successfully completed, a message saying "Write Complete" is displayed.

! Handling Precautions

• If writing fails, a message saying "Communications error has occurred" is displayed.

If writing is not possible, refer to:

Chapter 6, Troubleshooting

Chapter 4. Monitoring

4-1 Monitoring Function

Overview

The status of the controller can be checked using the monitoring function. To display the monitor screen, click [Monitor] on the main menu screen.

The monitor screen consists of the following two screens.

Numeric Monitor

This screen is for operations like changing settings or switching modes.

- Numeric display of the various operating parameters, with ability to change parameters
- Indicators for the various operation modes (display and operation)
- Alarm display (summary and details)
- Trend Monitor

This screen is for monitoring the operating status of the controller in the form of a trend graph.

- Display of trends for a maximum of 16 data items
- Display of digital data trends for a maximum of 5 data items
- Export of sampled data as a CSV file
- Saving of trend screens
- Data type PV, SP, MV, user-defined data (all analog data that can be communicated)
- Sampling cycle 0.25 to 3600 s, changeable
- Max. sampling number 60,000 cycles (fixed regardless of the number of sampled data items)

Note

• CSV (comma-separated values) is a data format that can be handled by third-party spreadsheet software such as Microsoft Excel. With this format, sampled trend data can be interpreted by spreadsheet software.

These screens can be used for the following operations:

- Monitoring of operating status and changing of parameters on the Numeric Monitor screen
- Switching of the operating mode on the Numeric Monitor screen
- Tuning of control constants on the Numeric Monitor screen
- · Monitoring of trends and sampling of data while the controller is running
- Monitoring of alarm status on the Numeric Monitor screen

! Handling Precautions

- Before starting the Trend Monitor, configure suitable monitoring settings.
- The sampling cycle sometimes shifts due to fluctuations in the communications cycle. To perform measurement at exact times, use a special recorder or data logger.

Screen explanations

Numeric Monitor



• Menu list

Menu	lcon	Submenu	Description	Shortcut keys
File		Quit	Quits the application.	Ctrl + Q
Numeric Monitor (M)		Numeric Monitor Start (M)	Starts the monitor.	Ctrl + M
	B	Numeric Monitor Stop (M)	Stops the monitor.	Ctrl + M
Option (O)	×	Setup	Displays the monitor setup screen.	
	•	Alarm (A)	Displays the alarm details screen.	
	>_	Command Line (C)	Displays the command line screen.	
Trend Monitor (T)			Switches the display to the Trend Monitor.	
• Trend Monitor

CIF Trend Mon	itor					-	- 🗆	×
File Trend mo	ile Trend monitor Option Numeric Monitor							
Trend Mo	onitor Start 🔂 (CSV Read Se	tup 🥢 Run PID	Simulator				
		N Im	in	~				
				-				
1,200 -							F 110	
1,100 -							100	
1,000 -	L						90	
900 -							80	
800 -							70	
700 -							60	
600 -							50	
500 -							50	
300 -							40	
200 -							30	
100 -							20	
0 -							10	
-100 -								
-200 -	L						-10	
			0	0:00:00				
	r							
-								
							· ·	
			0	0:00:00				
■ 🗹 1:PV	■ 🗹 2:MV	■ 🗹 3:SP	■ _ 4:H-MV	■ _ 5:C-MV	□ <u>6:CT</u> 1	□ <u></u> 7:CT2	■ <u></u> 8:U	F
9:UF	■ 🗌 10:UF	■ 🗌 11:UF	■ 12:UF	■ 🗌 13:UF	■ 🗌 14:UF	0 🗌 15:UF	I [] 16:	UF
■ 🗹 OUT1		EV1	EV2	EV3				

• Menu list

Menu	lcon	Submenu	Description	Shortcut keys
File		Print	Prints the trend graph.	
		Quit	Stops the monitor.	Ctrl + Q
Trend monitor	б	Trend Monitor Start (T)	Starts the Trend Monitor.	Ctrl + T
	6	Trend Monitor Stop (T)	Stops the Trend Monitor.	Ctrl + T
	Þ	CSV Read	Reads the trend data.	
	ō.	Clipboard Graph Out	Exports a graph image to the clipboard.	Ctrl + C
		Log save folder display	Displays the folder for saving trend log files.	
		Save for PID Simulator	Saves the trend data for the PID Simulator.	
	<i>/</i> /~	Run PID Simulator	Starts the PID Simulator.	
Option	×	Setup	Displays the monitor setup screen.	
Numeric Monitor			Switches the display to Numeric Monitor.	

• Icon list

lcon	Description	
l<<	Moves the graph to the start time.	
~	Moves the graph segment 1/2 screen to the left.	
<	Moves the graph segment 1/4 screen to the left.	
>	Moves the graph segment 1/4 screen to the right.	
>>	Moves the graph segment 1/2 screen to the right.	
>>I	Moves the graph to the latest time.	
1min 🗸	Specify a time scale for the graph.	
	1 min	
	2 min	
	10 min	
	1 h	
	12 h	
	24 h	
	Auto	

• Zooming the graph

Drag (click the left mouse button and hold it down while moving) from upper left to lower right.



• Canceling the zoomed graph Drag from lower right to upper left.



4-2 Method of Operation

How to operate the Numeric Monitor screen

• Start of monitoring (start of communications)

The operation described below is required to start monitoring.

Otherwise, it is not possible to monitor or rewrite data.

- Click the
 icon.
 Selecting [Numeric Monitor] → [Numeric Monitor Start] gives the same result.
 - » Normal state: The data in the controller is displayed.

Abnormal state: A message saying "Connected instruments may not be supported by this loader. Check the listing." is displayed. Chapter 6. Troubleshooting (p. 6-1) (for corrective action)

The following operations are possible when the controller and loader are correctly connected:

Numeric monitor (displayed in table	Tag name
format)	Process variable (PV)
Numeric group monitor	Set point (SP)
	CD group coloritier
	SP group selection
	Proportional band (P)
	Derivative time (D)
	Output low limit (OL)
	Output low limit (OL)
	Constant value / nattern (C1A version only)
	Auto Tuning
	PIC abnormal state
	PLC communication num
	PLC error num
	PLC scan count
	PLC scan time
	PLC scan time (max.)
	PLC nodes (max.)
	Heater current (CT1)
	Heater current (CT2)
	AT progress
	UF4
	UF5
	UF6
	UF7
	UF8
Status monitor	Power supply status (C1A version only)
(displayed by indicator status)	Main power
	Loader connector power
	Mode Status
	RUN/READY status
	AUTO/MANUAL status
	Constant value operation / pattern operation (C1A version only)
	Auto-tuning start/stop status
	ALARM mode
	Functional status
	Event output ON/OFF status
	Ditorminal ON/OFF status
	Internal over tON/OFF status
	Internal contact ON/OFF status
	User-defined bit ON/OFF status
Operation	SP value change
(Numeric values can be changed in	SP group change
the monitor only for the parameters	MV change in MANUAL status
on the right.)	PID value change
	RUN/READY mode selection
	AUTO/MANUAL mode selection
	Constant value operation / pattern operation selection (C1A version only)
	Auto-tuning start/stop
Operation mode	RUN/READY status (0: RUN, 1: READY)
	AUTO/MANUAL status (0: AUTO, 1: MANUAL)

• Monitoring of operating status and changing of parameters

• Changing of data

Manipulation by numeric input \rightarrow Enter the number and press the [Return] key.

Setting of user-defined address

Optional data not in the table can be registered to user configuration addresses UF 1 to 8 in the table. Data can be read or written depending on the data type.

• Setting method

- (1) From the [Option (O)] pull-down menu, select [Setup(S)] and then the [Numeric Monitor] tab.
- (2) Enter the address of the data to be displayed in accordance with the list of all communication parameters in Single Loop Controller Model C1A User's Manual for Installation and Configuration (CP-SP-1468E) or Single Loop Controller Model C1M User's Manual for Installation and Configuration (CP-SP-1448E).

Use of the command line

Data can be read or written or the mode can be switched by directly entering communication commands on the command line.

! Handling Precautions

- Be careful when writing command types, addresses, or data since sending a mistaken command may cause problems.
- Single Loop Controller Model C1A User's Manual for Installation and Configuration (CP-SP-1468E) or Single Loop Controller Model C1M User's Manual for Installation and Configuration (CP-SP-1448E) (for information on communications commands and data addresses)

Checking details of alarms

You can view alarm details on the alarm details screen when an alarm occurs.

- Click the ① icon.
 Selecting [Option (O)] → [Alarm (A)] gives the same result.
- Details of currently occurring alarms are displayed.

! Handling Precautions

• This window displays the details of currently occurring alarms, and cannot be used to reset the alarms. To reset alarms, follow the instructions in troubleshooting.

• About the numeric group monitor

The numeric group monitor can be used when "Use RS-485 converter" is selected for [Communication setup] in the Environment setting screen.

Up to eight groups can be monitored.

How to operate the Trend Monitor

Configuration

Select [Trend Monitor], [Trend Monitor (individual)], and [Digital Trend Monitor] under [Option] \rightarrow [Setup], and configure the following settings for each data sample (1 to 16).

The cycle and display upper/lower limits are common to all Trend Monitor graphs.

• Trend Monitor

Item Description		Setting range	lnitial value
Cycle	Sampling cycle setting	1 to 3600 s	1
Left axis low limit	Lower limit value of the screen display vertical axis	For C1M connection: –1999 to left axis high limit	0
		For C1A connection: –19999 to left axis high limit	
Left axis high limit	Upper limit value of the screen display vertical axis	For C1M connection: Left axis low limit to 9999	1200
		For C1A connection: Left axis low limit to 19999	
Right axis low limit	Lower limit value of the screen display vertical axis	For C1M connection: –1999 to right axis high limit	-10
		For C1A connection: –19999 to right axis high limit	
Right axis high limit	Upper limit value of the screen display vertical axis	For C1M connection: Right axis low limit to 9999	110
		For C1A connection: Right axis low limit to 19999	
High-speed	Data acquisition time	Disabled (unit: seconds)	Disabled
trend	trend	250ms	seconds)
		500ms	
Trend save folder	Folder for saving trend log files	Any folder	User's My Documents folder

•	Trend	Monitor	(individual)
---	-------	---------	--------------

ltem	Description	Setting range	lnitial value
Data type	Type of sampled data	0: Disabled	
		1: PV	
		2: MV	
		3: SP	
		4: H-MV	
		5: C-MV	
		6: CT1	
		7: CT2	
		8: User-defined data	
Axis	Specify the axis used for the	0: Left	
	graph.	1: Right	
CPL address	Address of the relevant	256 to 32767	256
	parameter when user-defined data is set as the data type	(a parameter address that allows communication)	
Decimal point	Specify the number of decimal places for user- defined data	0 to 3	0
Station address	Set the device address if	0 to 127	0
	using an RS-485 converter, etc.	If 0 is set, the device address on the Environment setting screen is used.	

! Handling Precautions

- When specifying user-defined data, set the decimal point manually.
- Digital Trend Monitor

ltem	Description	Setting range
CPL address	Parameter address	256 to 32767
Bit	Specified parameter bit	0 to 15
Item	Parameter name	Up to 10 characters
Station address	Set the device address if using an RS-485 converter, etc.	0 to 127 If 0 is set, the device address on the Environment setting screen is used.

CIF Setup File				×
Numeric Monitor Trend Monitor	Trend Monitor(individual)	Digital Trend Monitor	Trend Monitor Color	Trend t
Trend Monitor		Digital Trend		
Graph 1	Graph9	Graph 1	Defa	ult
Graph2	Graph 10	Graph2		
Graph3	Graph11	Graph3		
Graph4	Graph 12	Graph4		
Graph5	Graph 13	Graph5		
Graph6	Graph 14			
Graph7	Graph 15			
Graph8	Graph 16			
	ОК	Gancel		

When selecting [Graph 1] to [Graph 16], the color selection screen will appear. Select the desired color.

Clicking [Default] will return the color setting to its initial value.



Chapter 5. Adjusting PID Values

5 - 1 What Is the PID Simulator?

Overview

The PID Simulator is software that aids in the adjustment of PID values. It has the following features:

• PID control simulation

The PID Simulator uses operating data to create mathematical models* that reproduce device characteristics, enabling it to simulate PID control of the device on the PC. The Simulator allows you to adjust PID values quickly, without repeatedly operating the device.

- Modeling Wizard The Modeling Wizard allows you, by means of simple operations, to create mathematical models.
- A user interface that makes it easy to adjust PID values With the PID Simulator, PID values can be changed by simply using the mouse. You can adjust PID values intuitively without typing in values.
- Checking the effects of PID control You can check the effects of control algorithms before using them in actual operation.
 - * A mathematical model is an expression of the physical phenomena of the PV and MV of the device you want to control.



Precautions

Pay attention to the following when using the PID Simulator.

- Depending on the characteristics of the device, the PID Simulator's result and the actual control result may not match.
- The PID Simulator cannot be used for devices whose characteristics cannot be expressed using mathematical models. This includes, for example, a device with very strong nonlinear characteristics* or a device that has characteristics that cannot be expressed using mathematical models due to some special implementation.
- The PID Simulator does not support SP groups, PID groups, multi-ramping, and SP step operations.
- The PID Simulator does not support cascade control and heat/cool operation.
 - * In other words, the characteristics significantly change depending on the process variables or manipulated variables. A typical example is the characteristics of pH control near the neutral point.

Screen explanations

PID Simulator screen (at start-up)

When starting the PID Simulator, the "Welcome to PID Simulator" dialog box appears and prompts you to select the startup method.



Make a model from a data file (*.spd3)

The PID Simulator reads data from a data file and starts the Modeling Wizard. This is the same as selecting [File] \rightarrow [Make Model from Data File] from the menu.

• Load a model from a model file (*.spm3)

The PID Simulator reads an existing model file. This is the same as selecting [File] \rightarrow [Load Model from Model File] from the menu.

• Make a model from trend data

The PID Simulator reads data directly from the Trend Monitor without a data file and starts the Modeling Wizard. Selection of this item is enabled only when the PID Simulator was started from the Trend Monitor after sampling data.

🛱 Note

- A data file consists of device operating data that was sampled by the Trend Monitor and saved in the PID Simulator's proprietary format. 5-3 Data Sampling Method (p. 5-21) (for details)
- A model file contains mathematical models created from the data file and parameters used when the PID Simulator runs simulations.

• PID Simulator screen (when executing a PID control simulation)



• Menu list

Menu	lcon	Submenu	Description	Shortcut keys
File	0101	Make Model from Data File	Opens a data file (*.spd3) and creates a mathematical model.	Ctrl + M
	Þ	Load Model from Model File	Loads a model file (*.spm3).	Ctrl + L
		Save Model	Saves data (overwriting existing model file).	Ctrl + S
		Save Model As	Saves data to the specified filename.	
		Save Simulation Data	Saves the data used in the simulation in CSV format.	
		Copy graph to clipboard	Copies a graph to the Windows clipboard.	
		Convert SPD3 to CSV	Converts a data file (*.spd3) to a file in CSV format.	
		Quit	Quits the PID Simulator.	Ctrl + Q
View		Toolbar	Shows or hides the toolbar.	
		Show PID Slider	Shows or hides the PID slider.	
Simulation	٩Ţ	Auto Tuning	Auto-tuning calculates the PID values according to a simulation based on the created mathematical model.	Ctrl + T
Option	₿t	Add Current Parameters to Memo	Adds the parameters currently being used to the memo.	Ctrl + A
		Delete Selected Memo	Deletes the currently selected memo.	
		Rename Selected Memo	Renames the currently selected memo.	
	<u>↓</u> ↑	Load/Save Parameters	Writes PID values or other parameters to the controller.	Ctrl + P
Graph	PV	Auto Adjust PV-Axis	Auto-adjusts the Y-axis (PV axis) of the graph.	Ctrl + J
	Y-ax	Adjust Y-Axes	Displays a dialog for adjusting the Y-axes (for the PV and MV) of the graph.	Ctrl + Y
	100	Undo Zoom	Cancels the graph zoom.	Ctrl + U
		Properties (P)	Changes the colors used for the graph.	

* [Numeric Monitor] and [Trend Monitor] are displayed if the PID Simulator was started from the Trend Monitor, but not if it was started from the main menu screen.

• Toolbar

Control	Description
Memol 🗸	Selects a memo that has been saved.

• Simulation graph

The simulation graph displays the control results of a PID control simulation. Additionally, the following functions are available:

Zoom function

Enlarges the area selected by the mouse. Place the cursor at the top left corner of the area to be enlarged. While holding down the mouse button, drag to the bottom right corner of the desired area and release the button. The area will be enlarged.



To restore the original size, place the cursor at any position, hold down the mouse button, drag toward the upper left, and release the button at a convenient position.

Any of the following operations will also give the same result.

- Select [Graph] \rightarrow [Undo Zoom] from the menu bar.
- Click the 🙀 icon.
- Press the [Ctrl] + [U] keys.



• Set point / default process variable (default PV) change function You can change set points and default process variables (default PV) by moving the slider on the simulation graph up or down using the mouse.



! Handling Precautions

- With this slider you may not be able to set the exact desired value, depending on the size of the simulation graph (e.g., the value following the set point 100 may be 102). In such a case, change the size of the PID Simulator screen to enlarge the simulation graph, or change the value on the parameter tabs.
- This slider is hidden when the graph is enlarged using the zoom function.
- Disturbance setup function

When [Disturbance] is selected in the parameter tabs, sliders like those shown below appear on the simulation graph and enable you to define a disturbance. The slider for changing the disturbance start time moves in the horizontal direction, and the slider for changing the disturbance strength moves in the vertical direction.



! Handling Precautions

- With these sliders, you may not be able to set the exact desired values, depending on the size of the simulation graph (e.g., the value following disturbance start time 100 may be 102). In such a case, change the size of the PID Simulator screen to enlarge the simulation graph, or change the value on the parameter tabs.
- This slider is hidden when the graph is enlarged using the zoom function.
- This disturbance may differ from an actual disturbance. Use the result obtained with this function as a reference.

PID sliders

Using the PID sliders, the PID values can be changed with the mouse.



The slider range can be changed using the [2], [3], and [3] (max. slider range change) buttons. Each time one of these buttons is clicked, the maximum value of the slider gets bigger. When it exceeds the upper limit, it returns to the minimum setting range. When you click $[\mathbf{\nabla}]$ on the right side of the button, a menu as shown in the figure below appears and you can directly select a range.

Q	•		
	0.	1 - 100.0	
	0.	1 - 200.0	
	0.	1 - 500.0	
	0.	1 - 999.9	
_	_	-	_

🕮 Note

• The slider's value can also be changed using the $[\rightarrow], [\downarrow], [\leftarrow], \text{ and } [\uparrow]$ keys. The value increases with the $[\uparrow]$ and $[\rightarrow]$ keys and decreases with the $[\downarrow]$ and $[\leftarrow]$ keys. By pressing the $[\rightarrow], [\downarrow], [\leftarrow], [\uparrow]$ keys and [Shift] key simultaneously, you can increment or decrement the value by a factor of 10.



| ! | Handling Precautions

- If the slider's range is made smaller than the current value of the slider, the slider's value will be forced to the upper limit of the range. For example, if the slider's range is changed to 0.1–100.0 when the proportional band is set to 150.0, the value of the proportional band will be set to 100.0.
- If the slider's value is increased with the $[\rightarrow]$ or $[\uparrow]$ key and exceeds the upper limit of the currently set range, the range will automatically change to the next larger one.

If the slider value is decreased with the $[\downarrow]$ or $[\leftarrow]$ key and becomes smaller than the upper limit of the next smaller range, the range will automatically change to the next smaller one. This also happens when changing PID values on the parameter tabs.

For example, if the value set by the $[\rightarrow]$ or $[\uparrow]$ key exceeds 100.0 when the range of the proportional band is set to 0.1 to 100.0, the range will automatically change to 0.1 to 200.0.

Likewise, if the value is changed by the $[\downarrow]$ or $[\leftarrow]$ key to 100.0 or less when the range of the proportional band is 0.1 to 200.0, the range will automatically change to 0.1 to 100.0.

When the slider's range is changed, its minimum movement (the value of one slider step of increase or decrease) also changes automatically as shown in the table below.

• Proportional band (P)

Setting range	0.1–100.0	0.1–200.0	0.1–500.0	0.1–999.9
Minimum movement	0.5	1.0	5.0	10.0

• Integral time (I) / derivative time (D) (when control parameters have no decimal point)

Setting range	0–100	0–200	0–500	0–1000
Minimum movement	1	1	5	5
Setting range	0–2000	0–5000	0–9999	
Minimum movement	10	25	50	

• Integral time (I) / derivative time (D) (when control parameters have a decimal point)

Setting range	0.0-100.0	0.0-200.0	0.0–500.0	0.0–999.9
Minimum movement	0.5	1.0	5.0	10.0

Parameter tabs

On the parameter tabs, PID values and various other parameters can be set.

Control	Other	Disturbance	
Name			Value
SP(0.0-20	00.0)		100.0
Initial PV	(0.0-200.	0)	50.0
Proporti	onal Ban	d(P)	30.0
Integral '	Time(l)		20
Derivativ	e Time(D))	5
Output L	ow Limit	t	0.0
Output H	ligh Lim	it	100.0
Control a	algorithn	า	PID
PV Filter			0.0
SP lag tir	ne		0.0
Samplin	g cycle		50ms
PID Deci	mal poin	t position	0

Control Other	Disturbance	
Name		Value
SP Up Ramp		0.00
SP Down Ramp		0.00
SP Ramp Unit		Unit/sec
Simulation Period	(sec)	102.5
MV Switching Poi	nt Type for AT	Default
MV Switching Poi	nt PV for AT	0

Tag name		Tag name	
Control Other Disturbance		Control Other Disturbance	
Name	Value	Name	Value
SP Up Ramp	0.00	Strength	0
SP Down Ramp	0.00	Start Time(sec)	51.00
SP Ramp Unit	Unit/sec		
Simulation Period(sec)	102.5		
MV Switching Point Type for AT	Default		
MV Switching Point PV for AT	0		

• [Control] tab

Parameters related to control, including PID values and set points, can be specified. Set points and default process variables can also be set on a simulation graph. PID values can also be set with the PID sliders.

• [Other] tab

Parameters related to the SP ramp, MV change rate limit, and simulation period can be set.

• [Disturbance] tab

Parameters related to disturbance simulation can be specified. The strength and start time of disturbances can also be set on a simulation graph.

Handling Precautions

- The PID Simulator does not support SP groups and PID groups.
- The PID Simulator does not support changing the manual reset value. Use the controller value at the time of data sampling for the manual reset value.

Note Note

- Single Loop Controller Model C1A User's Manual for Installation and Configuration (CP-SP-1468E) or Single Loop Controller Model C1M User's Manual for Installation and Configuration (CP-SP-1448E) (for the meaning of each parameter)
- To change a parameter, use one of the following methods:
 - Enter a value on the keyboard.
 - On the parameter tabs, use the [←] and [→] keys to increase or decrease the value, and use the [↑] and [↓] keys to select the item. The value cannot be changed using the [↑] and [↓] keys.
 - By pressing the [Shift] + [←] or [Shift] + [→] keys, you can increment or decrement the value by a factor of 10.

Adjustment procedure

Follow the procedure below to adjust PID values using the PID Simulator.

	Adjustment procedure	Screen example	Reference
1.	Obtain a sample of process variable (PV) and manipulated variable (MV) data from the controller while it is running.	Image: set of the set of th	Chapter 4. Monitoring 5 - 3 Data Sampling Method (p. 5-21)
2.	Start the PID Simulator, and create a mathematical model from the sampled data.	(Winders Houst Paralement Termen and instruction (Mark Hade) tamin	€ 5 - 2 Functions of the PID Simulator Modeling wizard (p. 5-11)
3.	Adjust the PID values by running a PID control simulation.		5 - 1 What Is the PID Simulator? Screen explanations (p. 5-2) 5 - 2 Functions of the PID Simulator Auto tuning (p. 5-16), Memo (p. 5-17), Graph adjustment (p. 5-19)
4	Check the control result after adjusting the PID values on the actual device.	With the point of the second secon	Chapter 4. Monitoring 5 - 2 Functions of the PID Simulator Loading/saving parameters (p. 5-20)

! Handling Precautions

• The actual result may differ from the result of simulation due to the effect of measurement errors in the data or disturbances. If that happens, repeat the procedure above.

5-2 Functions of the PID Simulator

Modeling wizard

Creates a mathematical model from the operating data (process variables, manipulated variables) of the device.

How to start the wizard

• When creating a model from a data file

(1) Click the **b** icon.

Selecting [File] \rightarrow [Make Model from Data File] from the menu will give the same result.

Pressing the [Ctrl] + [M] keys also gives the same result.

 \gg The [Open] dialog box appears.

CIF Open				×
\leftarrow \rightarrow \checkmark \bigstar This PC	> Documents	ٽ ~		
Organize 🔻 New folder				
> 🍊 OneDrive	lame		Date modified	Туре
🗸 💻 This PC	Sample.spd3		4/6/2022 7:36 AM	SPD3 File
> 🧊 3D Objects				
> Desktop				
> 🗄 Documents				
> 🕹 Downloads				
> 🁌 Music				
> 📰 Pictures				
> 📑 Videos				
> 🏪 Local Disk (C:) 🗸 🧹				>
File <u>n</u> ame:		~	PID Simulator data file(*.s	ancel

(2) Enter the file name and click the [Open] button.

Handling Precautions

 Data files in a format other than the proprietary PID Simulator format (*.spd3) saved by the Trend Monitor cannot be opened. For instructions on creating a PID Simulator file, refer to the following.
 5-3, Data Sampling Method (page 5-19)

• When creating a model from trend data

To start the PID Simulator from the Trend Monitor, sample data in accordance with the procedure described in 5-3 Data Sampling Method (p. 5-21).

 Click the icon of the Trend Monitor Selecting [Trend monitor] → [Run PID Simulator] of the Trend Monitor menu also gives the same result.

\gg	The "Welcome to the PID Simulator" dialo	og b	ox appears.
	Welcome to the PID Simulator	\times	
	Please select a method to construct a control target model		
	O Make model from Data File (*.spd3)		
	○ Load model from Model File (*.spm3)		
	> Make model from Trend Data		
	OK Cancel		

(2) Select [Make model from Trend Data] and click [OK].



! Handling Precautions

• When a CSV file is open in the Trend Monitor, the data cannot be used in the PID Simulator.

Start screen

When the Modeling Wizard starts, the following screen appears. On this screen you can specify a range if you wish to use only some of the data for model creation.



To select a data range, click with the left mouse button at the left end of the desired range. A line indicating the left end of the area to be enlarged will be displayed. While holding down the mouse button, move to the right end of the desired range and then release the mouse button.



To cancel the selection, hold down the left mouse button at any position on the graph, move to the right, and release the button at any position. Clicking the [Unzoom] button gives the same result.



Once the data is selected, click the [Next (N) >] button.

! Handling Precautions

When selecting data, make sure that the first 10 data items are stable.
 5 - 3 Data Sampling Method (p. 5-21) (for details)

Screen during model creation

On the start screen, click the [Next (N) >] button.

» Model creation starts and the following screen appears.



To cancel model creation, click the [Cancel] button in the [Running...] dialog box.

Model creation completion screen

When model creation is done, the following screen appears. On this screen, you can view the created mathematical model.



Model check graph

Model check graph

The PV and MV data loaded from the data file and the output of the mathematical model when the MV is input are displayed. The graph can be enlarged. The methods for enlarging/canceling are the same as those for the simulation graph on the PID Simulator screen.

explanations (p. 5-2) (for details)

You can also cancel the zoom by clicking the [Unzoom] button.

Model error display area

This area displays a value that indicates the difference between the PV data and the model output data. The smaller this value, the better the mathematical model reproduces the device characteristics.

Based on this value, the mathematical model is classified into the following categories:

0-25	An appropriate model
25-100	A somewhat faulty model
100+	A faulty model

In the case of a faulty model, the result of a PID control simulation and the control result from the actual device may be very different.

! Handling Precautions

 This classification is a rough guideline, and does not guarantee the accuracy of a mathematical model or a PID control simulation result.

Model parameter display grid

The parameters of the mathematical model are displayed. This mathematical model is represented by the following transfer function:

$$G(s) = \frac{Kp \cdot e^{Lp \cdot s}}{(1 + T_1 \cdot s)(1 + T_2 \cdot s)}$$

Kp: Gain T_1 : 1st order lag T_2 : 2nd order lag Lp: Dead time

! Handling Precautions

• The model parameter values may differ depending on the data, even for the same device.

[Make Model] button

You can start model creation with this button. Also use this button if model creation was interrupted or was not successful.

G 5-4 When PID Adjustment is Unsuccessful (p. 5-29) (for solutions if model creation was unsuccessful)

Auto tuning

Auto tuning automatically calculates the PID values.

- (1) Click the bicon.
 Selecting [Simulation] → [Auto Tuning] gives the same result. Pressing the [Ctrl] + [T] keys also gives the same result.
 - \gg The Auto tuning dialog box appears.

Auto tuning	×
Auto tuning type Recommended:	
0: Past (Fast response, relatively short lag control)	\sim
OK Cancel	

- (2) Select the auto tuning type. The following three types can be selected, as in the case of the controller main unit:
 - 0: Normal (regular control characteristics)
 - 1: Fast (priority on fast response to disturbance)
 - 2: Stable (priority on minimal up/down PV fluctuation)

The PID Simulator automatically selects the type that seems best and displays it as "Recommended" when the "Auto tuning" dialog box is shown.

(3) Click [OK].

» Use auto tuning to change the PID values and update the simulation graph.

Memo

Saves all parameters on the parameter tabs ([Control], [Other], and [Disturbance] tabs) as memos. Up to 256 memos can be saved.

Adding

Adds a memo to the list.

(1) Click the icon.

Selecting [Option] \rightarrow [Add Current Parameters to Memo] gives the same result. Pressing the [Ctrl] + [A] keys also gives the same result.

 \gg The "Name" dialog box appears.

Add memo	×
Name	
Memol	
Menor	
OK Cancel	

(2) Enter the name of the memo and click the [OK] button.To replace an existing memo, select the name of the memo to be replaced from the drop-down list and click the [OK] button.

Add	memo			×
Na	me			
	Memo4			\sim
	Memo1			
	Memo2			
	Memo3			
		UK	Cancel	

 \gg A confirmation dialog box appears.



(3) Click [Yes].

Deleting

Deletes the currently selected memo.

Click the \square icon. Selecting [Option] \rightarrow [Delete Selected Memo] gives the same result.

Renaming

Rename the currently selected memo.

- (1) Select [Option] \rightarrow [Rename Selected Memo] from the menu.
 - » The "Rename" dialog box appears.

Rename			×
New name			
Memo1			
	OK	Cancel	

(2) Enter the new name and click the [OK] button.

Selecting

Selects a memo from the list.

Select the name of a memo from the drop-down list on the toolbar.



Graph adjustment

Auto-adjustment of the PV-axis
 Adjusts the PV-axis (left Y-axis) of the simulation graph automatically to make
 the process variable (PV) graph easy to see.
 Click the PV icon.
 Selecting [Graph] → [Auto Adjust PV-Axis] from the menu gives the same result.
 Pressing the [Ctrl] + [J] keys also gives the same result.

• Adjustment of the Y-axes

Specifies the ranges of the Y-axes of the simulation graph.

(1) Click the 4 icon.

Selecting [Graph] \rightarrow [Adjust Y-Axes] from the menu gives the same result. Pressing the [Ctrl] + [Y] keys also gives the same result.

 \gg The "Adjust axes" dialog box appears.

Adjust axes				
	Minimum	Maximum		
PV axis(Left)	0	200		
MV axis(Right)	-10	110		
ОК	Cancel	Default		

(2) Enter the maximum and minimum display values for each axis and click the [OK] button.

If you press the [Default] button, the minimum and maximum values of the PV axis change to the minimum value (PL) and maximum value (PH) of the PV range, and the minimum and maximum values of the MV axis are set to the lower limit (-10 %) and upper limit (110 %) of the manipulated variable setting.

Loading/saving parameters

Reads/writes PID values, Ra-PID, and other parameters from/to the controller.

- (1) Click the icon.
 Selecting [Option] → [Load/Save Parameters] gives the same result. Pressing the [Ctrl] + [P] keys also gives the same result.
 - \gg The "Load/Save Parameters" dialog box appears.

	C1M grid		PID simulator grid				
Load/Save Parameters X							
PID	1 v ~		V				
Name	C1M	< Save	PID Sim.				
Proportional Band(P)	5.0		30.0				
Integral time(I)	120		20				
Derivative time(D)	30		5				
Output high limit	100.0		100.0				
Output low limit	0.0		0.0				
Control algorithm	PID		PID				
PV filter(sec)	0.0		0.0				
SP lag time(sec)	0.0		0.0				
Sampling cycle	50ms		100ms				
PID Decimal point position	0		0				
OK Cancel							

(2) Select a PID group and click the [< Save] button. Parameters in the PID simulator grid will be saved to the C1M grid.
Click the [Load >] button. Parameters from the C1M grid will be loaded into the PID simulator grid.
Click [OK]. The contents of the C1M grid will be written to the controller and reflected in the PID Simulator grid and PID Simulator screen.

! Handling Precautions

- To use this function, the PC needs to be connected to the controller with the USB loader cable.
- This function cannot be used while the Trend Monitor is running.

5-3 Data Sampling Method

Overview

To create a mathematical model, data on the manipulated variable (MV) and process variable (PV) sampled when the controller is performing operations such as the following is necessary:

- Step response to a change of the set point
- Step response to a change of the manipulated variable (MV)
- Auto-tuning

This section describes the data sampling procedure during step response to a change in the set point. The data sampling procedure is as follows:

Step 1: Choose a default process variable (PV) and set point
↓
Step 2: Stabilize the process variable (PV) and manipulated variable (MV)
↓
Step 3: Start data sampling
↓
Step 4: Start step response
↓
Step 5: End data sampling
↓
Step 5: End data sampling
↓
Step 6: Save the sampled data

For data sampling, the Numeric Monitor and Trend Monitor of the SLP-C1F are used. C Chapter 4. Monitoring (on the use of the Numeric and Trend Monitors)

! Handling Precautions

• Perform data collection carefully, following the provided procedure. A control result matching the simulation result may not be obtained if data sampling is not performed correctly.

Step 1: Choose a default process variable (PV) and set point

The sampled data must include data in which the PV and MV are stable near certain values and data on the step response to a change of the set point, as shown in the figure below.



In preparation for sampling such data, determine a default process variable (the PV in a stable state) and step response set point that satisfy the following conditions.

Step response set point

If there are no particular constraints on the step response set point, set it to a value used in actual operation. A result matching the PID control simulation result may not be obtained if the set point when data is sampled differs from the set point used in actual operation.

Default process variable (default PV)

Make sure that the default PV satisfies the following condition.

- The controller should be able to continuously output the MV when the device is in a stable state near the default PV. For example, in temperature control using just a heater, set the default PV higher than the room temperature.
- If the device is performing a reverse operation (heating operation), set the default PV so that it is less than the step response set point.
 If the device is performing a direct operation (cooling operation), set the default PV so that it is greater than the step response set point.

- So that the difference between the default PV and step response set point does not become too small, choose a default PV using the following guideline: | Step response set point default PV | ≥ (5 to 10 % of the PV range). For example, if the step response set point is 200 and the PV range is from -200 to +400, set the default PV in a range from 140 to 170. However, if the device is a heater and it does not satisfy the above condition because the step response set point is close to the room temperature, place priority on making the default PV higher than the room temperature.
- If the sensor or actuator has a deadband (a range in which it does not operate correctly), set the default PV so that the PV or MV is not in that range.

Step 2: Stabilize the process variable (PV) and manipulated variable (MV)

Stabilize the PV and MV near the default PV that was determined in Step 1.

Standard for a stable state

A stable state refers to a state in which variations in the PV and MV are within a certain range. As a standard, use 10 % maximum variation in the MV, and PV variation of 1 % or less of the PV range (6 or less if the PV range is -200 to +400), as shown in the figure below.



Data such as that shown in the following figures is not suitable as data for the PID Simulator.

• There is large variation in both the PV and MV.



• The PV is mostly constant and only the MV has a large variation (10 % or more). Process variable (matches the SP)



• Stabilizing the PV and MV

Try the following methods when the PV and MV are unstable.

- Make the proportional band larger (2 to 3 times the current value).
- Make the integral time larger (2 to 3 times the current value).
- Do both of the above.

If the PV and MV are still unstable, switch to MANUAL mode to stabilize them. If the PV and MV are behaving as shown in the figure below, set a value close to the midpoint between the upper and lower limits of the MV variation for the MV.



Handling Precautions

- After switching to MANUAL mode, allow sufficient time for the PV to stabilize.
- It is not a problem if the PV takes a value different from the default PV by switching to MANUAL mode. If the default PV condition in Step 1 is not met, change the MV.

Step 3: Start data sampling

Once the PV and MV are stable, select [Trend monitor] \rightarrow [Trend Monitor Start (T)] from the Trend Monitor menu or click on the toolbar to start sampling data.

After data sampling is started, collect 10 or more data items (for 10 seconds if the sampling cycle is 1 second) in a state in which the PV and MV are stable, as shown in the figure below.



10 or more stable data items

📖 Note

• If the PV and MV are stable in MANUAL mode, set the set point of the controller to the same value as the current stable PV (if the current PV is 60.5 °C, set the controller set point to 60.5) while sampling stable data. If necessary, change the PID values as well. These operations are performed in Step 4, but doing them in this step can reduce the number of operations in Step 4.

Step 4: Start step response

Start step response after sampling 10 or more data items of the stable PV and MV. The method for starting step response differs depending on the current mode.

In AUTO mode

- (1) Change the PID values if necessary. This operation may make the PV or MV unstable; however, continue the operation.
- (2) Change the set point of the controller to the step response set point.

In MANUAL mode

- Change the PID values if necessary (it is not necessary if it was already done in Step 3).
- (2) Change the set point of the controller to the same value as the current PV. For example, if the current PV is 60.5 °C, change the set point of the controller to 60.5. (it is not necessary if it was already done in Step 3).
- (3) Switch from MANUAL mode to AUTO mode. Continue the operation even though the PV or MV may become unstable after switching to AUTO mode.
- (4) Change the set point of the controller to the step response set point.

! Handling Precautions

• If you have a PID value with a problem to be solved, do the step response using that PID value.

Step 5: End data sampling

Once the step response is complete, stop the data sampling. When to stop data sampling differs depending on the step response result.

When overshoot is occurring

End data sampling after sampling data for about three times longer than the time from the start of step response until the PV reached the set point, as shown in the figure below.



• When hunting is occurring

End data sampling after sampling data about three times longer than the time from the start of the step response until the PV reached the set point, as in the case of overshoot.



When the PV is slow to reach the SP

End data sampling after sampling data about three times longer than the time from the start of the step response until the MV became mostly constant, as shown in the figure below.



Step 6: Save the sampled data

Save the sampled data in the proprietary PID simulator format. Select [Trend monitor] \rightarrow [Save for PID Simulator] from the Trend Monitor menu bar to open the following dialog box.



Enter a filename and click the [Save] button to save the data file.

! Handling Precautions

• If a CSV file is open in the Trend Monitor, it is not possible to save the data.

5-4 When PID Adjustment is Unsuccessful

Problems with adjustment or PID control simulation

The PID Simulator cannot output correct adjustment results if the device operation data is not sampled correctly.

Depending on the sampled data, problems such as deviations in the graph after model creation can occur.

The following describes a sample problem and how to fix it.

Deviation in the graph after model creation Problem

After creating a model using the Modeling Wizard, deviation occurs between the graph of the PV of the device and the graph of the model output displayed in the model check graph.





Solution

Deviation may occur in cases such as when the device characteristics cannot be represented by the transfer function (Model parameter display grid" (p. 5-15). In this case, click the [Make Model] button several times.

The model error will become smaller, and the deviation between the graphs will be minimized. (It will not be completely eliminated.)



Problems with the PID simulator operation

• Simulator slowdown with long simulation period

• Problem

Simulator operation slows down as the simulation period is made longer.

• Solution

The PID Simulator performs operations repeatedly to create a simulation graph. With a longer simulation period, the number of times operations are repeated also increases, resulting in slower operation. Therefore, it is recommended to use the PID Simulator with a practical simulation period length.

Chapter 6. Troubleshooting

6-1 Error Messages and Countermeasures

Error messages during communication

Message	Description	Countermeasures
Can't open the communications port.	The communication port could not be opened.	Check if the communication port to which the USB loader cable is assigned is being used. Do not use this software with other software that also uses a communication port.
Timeout	No message was received within the timeout time.	Check the connections and contacts of the USB loader cable.
	The controller is not connected.	Connect the C1M or C1A.
Connected instruments may not be supported by this loader. Check the listing.	The connected instrument is not supported.	Connect the C1M or C1A.
Can't support the connected instruments.	The versions of the loader and of the controller do not match.	Contact one of our branches, sales offices, or dealers.
Communications error has occurred.	There was a system error.	Try the operation again, or quit the loader and restart Windows.
Trend Monitor is active.	The monitor screen cannot be closed while the Trend Monitor is running.	Stop the Trend Monitor and then close the monitor screen.
Loader Lock or Communication Lock	Writing from the loader is being prevented by the loader lock or a password.	Try again after canceling the loader lock or password.

Error messages during file operations

Message	Description	Countermeasures
Illegal file size.	The file was corrupted.	Corrupt files cannot be used. Recreate the file.

Error messages while using the Trend Monitor

Message	Description	Countermeasures
Trend cycle is 250 ms. Please stop a numerical monitor before starting a trend.	The Trend Monitor cannot run while the Numeric Monitor is running if the trend cycle is 250 ms.	Stop the Numeric Monitor.
250 ms trend is under operation. A numerical monitor cannot be started.	The Numeric Monitor cannot run while the Trend Monitor is running with a trend cycle of 250 ms.	Stop the Trend Monitor.

Message	Description	Countermeasures
Some address settings have not been specified.	There is an item for which no address has been set.	Delete the item or set an address for it.
Set the Transfer type to something other than "None" if the transfer settings are enabled.	"None" is set for the transfer type but the transfer setting is enabled.	Set a transfer type other than "None."
The PLC address is out of the setting range.	The PLC address setting is outside the allowable range.	Change the PLC address setting to be within the setting range. Lines for which "ERR" is displayed for PLC address are outside of the setting range.
An out-of-range value was specified for Notification Device.	An out-of-range value was specified for a notification device.	Change the value set for the notification device indicated in the message.
A register not specified in the protocol was used.	A register not specified in the protocol was set.	Check the PLC address setting and set a register specified in the protocol.

Error messages while setting up PLC link communication

6-2 Other Troubleshooting

Problem	Description	Countermeasures
Numerical values are not displayed correctly.	If any character other than a period (".") is set for the decimal marker, the loader will not function correctly.	Check if period ("") is set for the decimal marker, and set it to period if it is not.

Revision History of CP-SP-1463E

Date	Rev.	(New) Page No.	Description
July 2022	1		
Mar. 2023	2	Cover	Added "C1A" to the title.
		ii	Changed the title and description of CP-SP-1463E.
		iii – V	Added descriptions of the C1A.
		1-1, 1-2, 1-3	Added descriptions of the C1A.
		1-2	Added "Connection cable."
		2-1	Added "Uninstalling SLP-C1F ver. 1."
		2-5	Added "Handling Precautions."
		2-11, 2-12, 2-13	"2-3 Starting and Exiting the Loader": Overall revision.
		3-1	Added descriptions of the C1A.
		3-2	Menu list: Added a note.
		3-3	Submenu "Input/output port setup" was changed to "Logical operation setup."
			A note about the C1A was added.
		3-4	"Step 1: Set up the environment": Changed the figures.
		3-5	Handling Precautions: Changed the descriptions.
		3-6	(2): Changed the descriptions.
		3-7	Added descriptions of the C1A.
		3-8	Added descriptions of the C1A.
		4-3	Menu list: Changed the descriptions.
		4-7	Monitoring of operating status and changing of parameters: Changed the
			descriptions.
		4-8	Added descriptions of the C1A.
		4-9	Trend Monitor: Changed the descriptions.
		4-12, 4-13	The pages were deleted.
		5-9	Added descriptions of the C1A.
		6-1, 6-2	Added descriptions of the C1A.

-MEMO-

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's product;
- Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
- (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*¹ and fail-safe design*² (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*³ fault tolerance,*⁴ or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.
 - *1. A design that is safe even if the user makes an error.
 - *2. A design that is safe even if the device fails.
 - *3. Avoidance of device failure by using highly reliable components, etc.
 - *4. The use of redundancy.

3. Precautions and restrictions on application

3.1 Restrictions on application

Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality* ⁵ required	Nuclear power quality* ⁵ not required
Within a radiation controlled area* ⁶	Cannot be used (except for limit switches for nuclear power* ⁷)	Cannot be used (except for limit switches for nuclear power* ⁷)
Outside a radiation controlled area* ⁶	Cannot be used (except for limit switches for nuclear power*7)	Can be used

- *5. Nuclear power quality: compliance with JEAG 4121 required
- *6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes,"etc.
- *7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

Any Azbil Corporation's products shall not be used for/with medical equipment.

The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

3.2 Precautions on application

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, antiflame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
 - * Nuclear energy/radiation related facilities [When used outside a radiation controlled area and where nuclear power quality is not required] [When the limit switch for nuclear power is used]
 - Machinery or equipment for space/sea bottom
 - * Transportation equipment
 - [Railway, aircraft, vessels, vehicle equipment, etc.]
 - * Antidisaster/crime-prevention equipment
 - * Burning appliances
 - * Electrothermal equipment
 - * Amusement facilities
 - * Facilities/applications associated directly with billing
- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
- (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
- (5) Machinery or equipment that may affect human lives, human bodies or properties
- (6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety
- 4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

- (1) Installation, adjustment, guidance, and attendance at a test run
- (2) Maintenance, inspection, adjustment, and repair
- (3) Technical guidance and technical education
- (4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.



Azbil Corporation Advanced Automation Company

1-12-2 Kawana, Fujisawa Kanagawa 251-8522 Japan URL: https://www.azbil.com Specifications are subject to change without notice. (11)