

LL50A
Parameter Setting Software
with Ladder Program Building Function and
Network Profile Creating Function

IM 05P05A01-02EN

vigilantplant®

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Introduction

Thank you for purchasing the digital indicating controller UTAdvanced Series (hereinafter referred to as UT) and LL50A Parameter Setting Software.

This manual describes how to use LL50A and network profile tool, ladder program function. Please read through this user's manual carefully before using the product.

Note that the manuals for the UT comprise the following eight documents:

- **Printed manual**

Manual Name	Manual Number	Description
LL50A Parameter Setting Software Installation Manual	IM 05P05A01-01EN	This manual describes how to install and uninstall the LL50A. It is also contained in the provided CD-ROM.

- **Electronic manuals contained in the provided CD-ROM**

Manual Name	Manual Number	Description
UT35A/UT32A Operation Guide	IM 05P01D31-11EN	This manual describes the basic operation method.
UT35A/UT32A User's Manual	IM 05P01D31-01EN	This describes the usage of all functions except the ladder sequence and communication functions.
UT55A/UT52A Operation Guide	IM 05P01C31-11EN	This manual describes the basic operation method.
UT55A/UT52A User's Manual	IM 05P01C31-01EN	This describes the usage of all functions except the ladder sequence and communication functions.
UTAdvanced Series Communication Interface (RS-485, Ethernet) User's Manual	IM 05P07A01-01EN	This manual describes how to use UT in Ethernet and serial communications. For communication wiring, see the Operation Guide or User's Manual.
UTAdvanced Series Communication Interface (PROFIBUS-DP) User's Manual	IM 05P07A01-02EN	This manual describes how to use UT in PROFIBUS-DP communications. For communication wiring, see the Operation Guide or User's Manual.
LL50A Parameter Setting Software Installation Manual	IM 05P05A01-01EN	This manual describes how to install and uninstall the LL50A.
LL50A Parameter Setting Software User's Manual	IM 05P05A01-02EN	This manual. This manual describes how to use the LL50A, ladder sequence function, peer-to-peer communication, and network profile creating function.

Notice

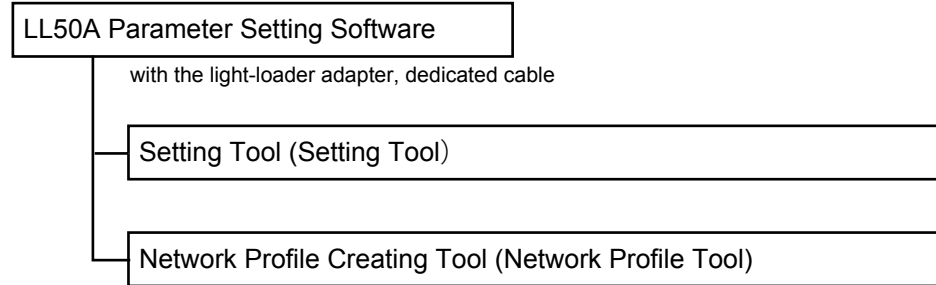
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Release Number

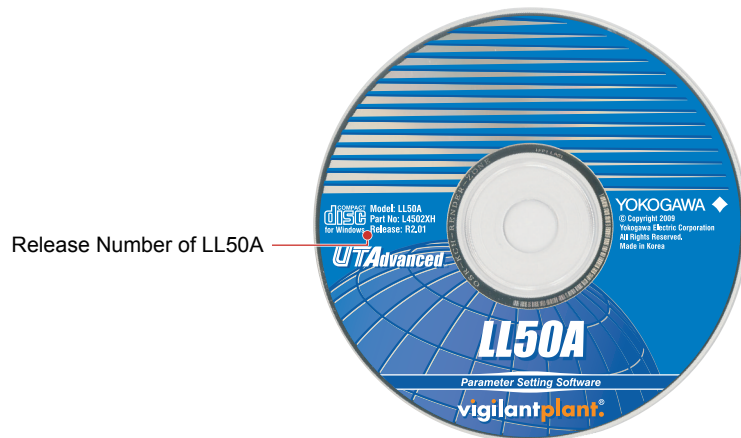
The LL50A Parameter Setting Software is a software suite of parameter setting and network profile creating tools.



The release numbers of LL50A Parameter Setting Software and each tool are as follows:

LL50A Parameter Setting Software	Setting Tool	Network Profile Creating Tool
R1.01	R1.01.**	None
R1.02	R1.01.**	R1.01.**
R2.01	R2.01.**	R1.01.**

The release number of the LL50A Parameter Setting Software is printed on the product CD.



The release number of the Setting Tool can be found by the operation in section 2.18. The number (except last two digits) displayed on the startup splash window is the release number for the Setting Tool itself. For the Network Profile Tool, the release number can be found by the operation in section 6.13.

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 - g) where you or your customer does not execute the proper trouble or non-conformity avoiding measures (including repair or replacement) Yokogawa proposed; or
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Concluded.

How to Use This Manual

Structure of the Manual

This user's manual is organized into Chapters 1 to 6 and appendix as shown below.

Chapter	Title	Description
1	Overview	Describes the main functional overview of the LL50A.
2	LL50A Operation Guide	Describes how to set parameters, and perform upload/download operations, monitoring, file management operations, and printing on the UT.
3	A Guide to Building Ladder Programs	Describes how to build ladder programs.
4	Operations of Ladder Program Instructions	Describes details of instructions, input/output registers and special registers used in ladder programs.
5	Using Ladder Program	Describes precautions for ladder program.
6	Profile Creating Guide	Describes how to create an Electronic Device Data Sheet required to connect the UT to the open network, and perform profile data download/upload operations, file management operations, and printing.
App	Worksheets / Input/Output Tables	Provides worksheets that are used when designing programs. Input/output tables

Scope of the Manual

This manual does not explain the basic operations of Windows XP and Windows Vista. For information regarding the basic operations of Windows, see the user's guide that came with Windows.

Symbols Used in the Manual

Indications of the button:

All of them are enclosed by brackets ([]).

CAUTION

Calls attention to actions or conditions that could cause injury to the user or damage to the instrument or property and indicates precautions that should be taken to prevent such occurrences.

Note

Identifies important information required to operate the instrument.



Indicates related operations or explanations for the user's reference.

Procedure

Describes operation procedures.

Description

Describes restrictions, etc. regarding a relevant operation.

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Revision Information

1.1 Functional Overview

This section describes the main functional overview of the LL50A Parameter Setting Software.

Parameter setting function

This function is used to set the parameters of the UT.

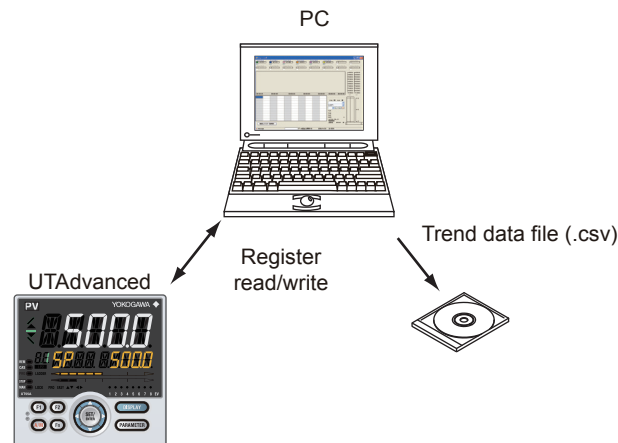
There are setup parameters for setting the basic functions of a UT controller and operation parameters used for setting functions necessary to operate the UT.

It is also possible to set them using the Setting wizard.

Monitoring function

Tuning/change

With the PC connected to one controller, the tuning function tunes PID parameters by displaying PV input values (PV), target setpoints (SP), control output values (OUT), etc. on the PC screen. Furthermore, it also enables the PV, SP, and OUT values to be displayed and acquired as trend data. Acquired trend data can be saved in a file of .csv format.



Monitoring/changing registers

The register monitoring function enables the UT's registers to be monitored and/or changed during ladder program debugging.



Ladder program monitoring function

This function is used to check the operation of a ladder program you have built.

Upload/download/comparison function

This function downloads parameter data and/or ladder program data to the UT, uploads it from the UT, and compares it with the UT data.
You can specify all data, or individual data items, to be uploaded or downloaded.

File management/print function

This function enables you to save created parameter data and/or ladder program data in a file. It also allows data to be printed out for submission to the customer.

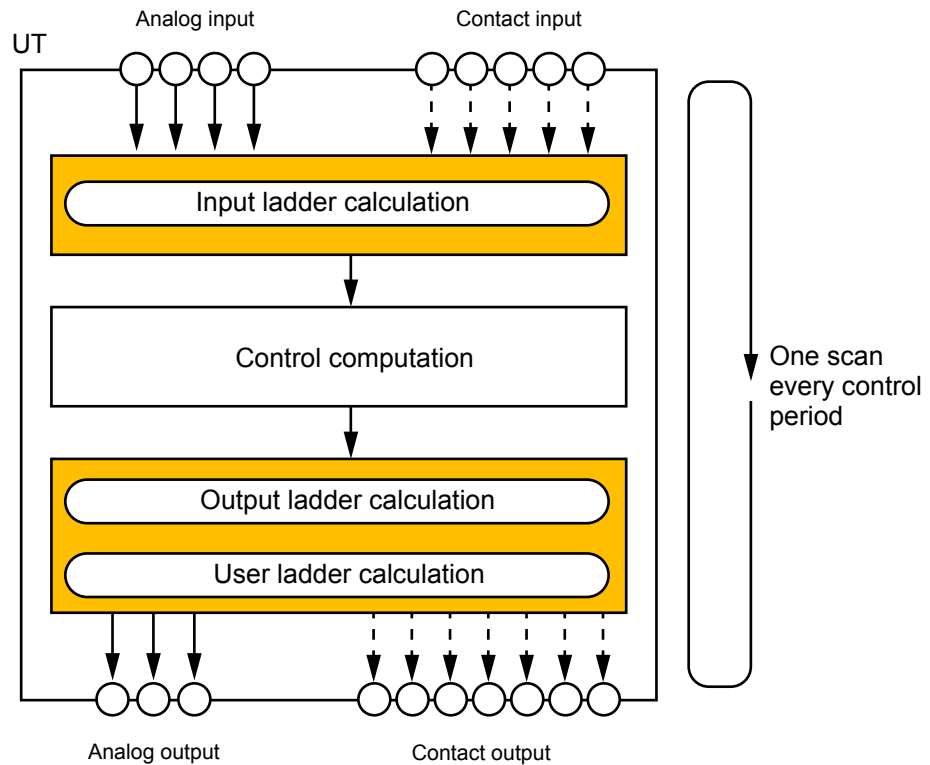
Ladder program building function

In ladder programs, there are various computations for input and output signals, and sequence processing can be built using four fundamental arithmetic operations, logical operation, temperature compensation factor calculation, and pressure compensation factor calculation and between input and output contacts.

Configuration of ladder program

A ladder program consists of three parts: the input ladder calculation executed before control computation, and the output ladder calculation and the user ladder calculation performed after control computation. Each calculation section is respectively executed every control period.

The sequence of calculation is: input, input ladder calculation, control computation, output ladder calculation, user ladder calculation, and output.



Building a ladder program

A ladder program is built by editing the default ladder programs provided for each control mode of system data.

It is recommended that the user ladder calculation section be used if a sequence is desired to be configured regardless of controller control computation.

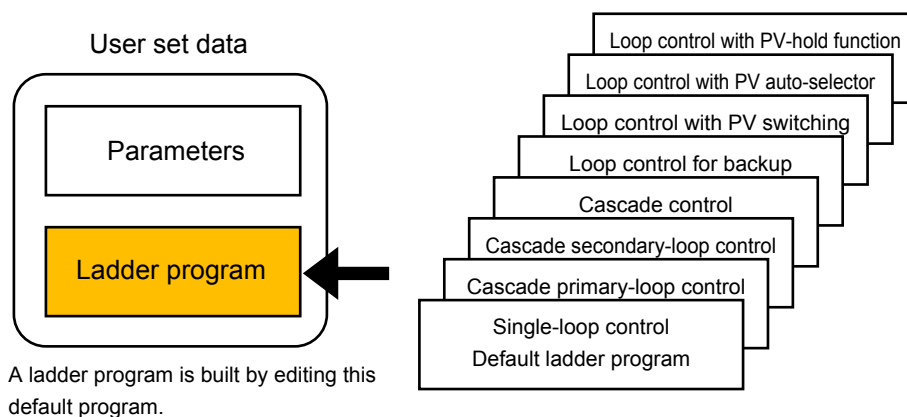
As the initial status, the default ladder programs are described in the input ladder calculation and output ladder calculation sections on a control mode basis. No program is written in the user ladder calculation section.

- ▶ [System data: Section 2.6, Setting System Data](#)
- ▶ [Default ladder programs: Section 3.10, Default Ladder Programs](#)

CAUTION

If a new ladder program is built or the system data's control mode is changed, the ladder program is initialized to the default ladder program.

UT35A/UT32A does not have the parameter CTLM (Control mode.)



Network Profile Creating Function

This function creates an Electronic Device Data Sheet for PROFIBUS-DP communication.

The following figure shows an example of one PROFIBUS-DP slave/Modbus master and 4 Modbus slaves. An arbitrary configuration like this can be created using the LL50A Network Profile Tool and PROFIBUS-DP Configuration tool.

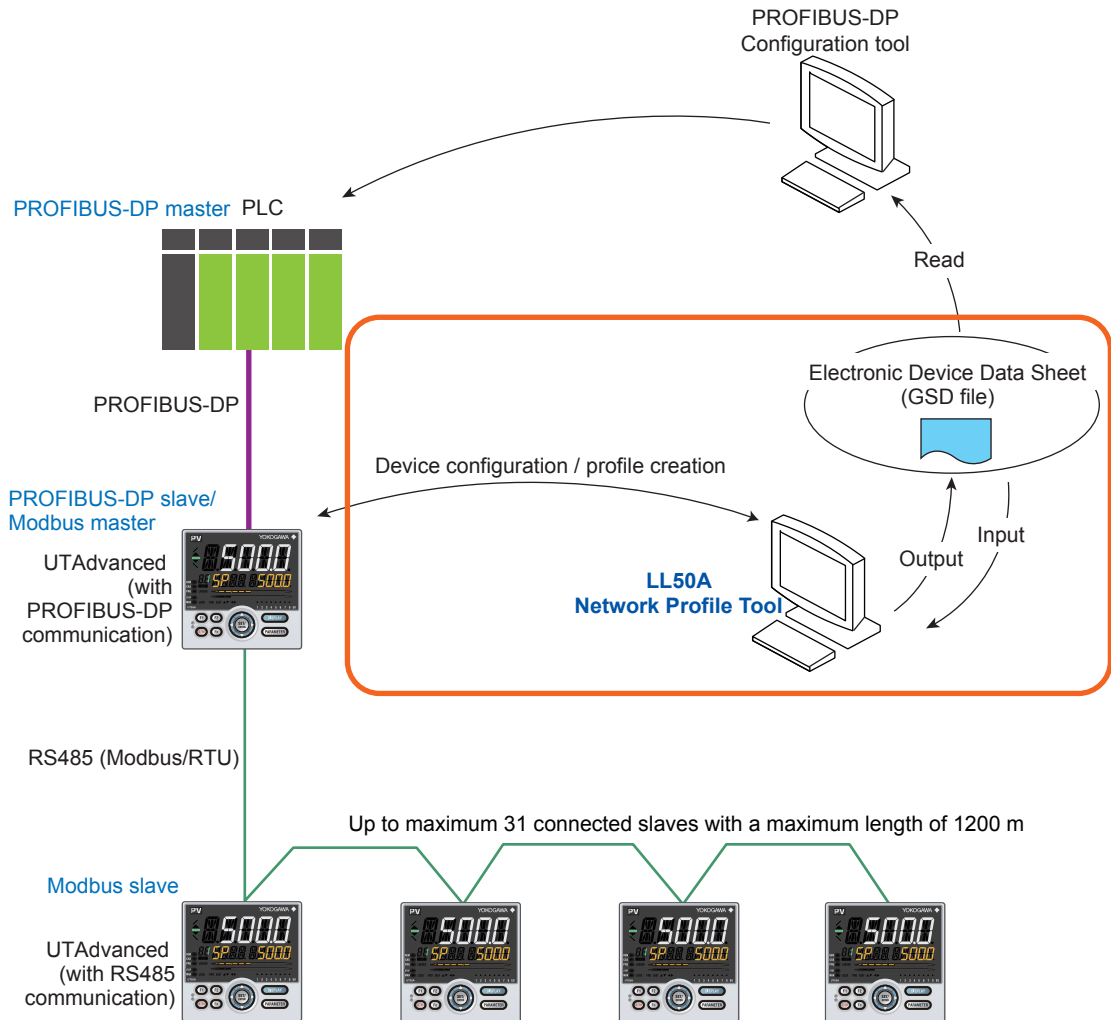
When using a fixed profile, a GSD file can be downloaded from the YOKOGAWA website. When not using a fixed profile, an Electronic Device Data Sheet can be created as a user profile.

URL: www.yokogawa.com/ns/utadv/

File name: YEC45F2.GSD

- ▶ [PROFIBUS-DP communication, fixed profile: UTAdvanced Series Communication Interface \(PROFIBUS-DP\) User's Manual](#)

For the configuration tool, contact the PROFIBUS-DP master vendor.



Note

Network Profile Tool is available only for the light-loader adapter and the dedicated cable.

- **Electronic Device Data Sheet (GSD File)**
This is a file in the format specified by the PROFIBUS-DP communication protocol. It is called a GSD file in PROFIBUS-DP communication. This file is provided to the external connection device via the PLC configurator. Electronic Device Data Sheets created by other than the LL50A cannot be loaded into the LL50A.
- **PROFIBUS-DP master**
Class 1 master is a controller for periodically exchanging information with slaves, and is a PLC or PC.
Class 2 master is an engineering or configuration device, and is a PC on which configuration software is installed or software.
- **PROFIBUS-DP slave/Modbus master**
This is an input and output device that is accessed by the master. UTAdvanced (with PROFIBUS-DP communication) runs as a PROFIBUS-DP slave.
Furthermore, UTAdvanced (with PROFIBUS-DP communication), which runs as a PROFIBUS-DP slave, also runs as a Modbus master using the RS-485 terminal. It reads and writes the parameters of Modbus slaves, which are connected via RS-485 communication, according to the profile definition.
- **Modbus slave**
This is UTAdvanced (with RS-485 terminal). Up to 31 slaves can be connected.

1.2 Operating Environment

PC

Applicable OS: Windows XP Professional (with Service Pack 2 or later)

Windows Vista Business (with Service Pack 1)

Only the 32 bit version of each of the above OSs

.NET Framework 3.5 installed.

Recommended CPUs: Pentium 4 Processor 2.4 GHz or higher

(3.0 GHz or higher in Windows Vista Business)

Pentium D Processor 2.6 GHz or higher

Pentium Core 2 Duo Processor 1.8 GHz or higher

Pentium Dual-Core Processor 1.6 GHz or higher

Recommended Main Memory:

Windows XP Professional; 512 MB or more

Windows Vista Business; 2 GB or more

Hard disk space:

Program storage capacity: 100 MB or more

.NET Framework 3.5 SP1 storage capacity: 620 MB or more

Display: 1024 x 768 pixels or more

Color: 256 or more colors

Communication port: For communication with a dedicated cable, use the USB port/one channel.

For communication via an RS-485 communication terminal, use an RS-232C port (An RS-232C/RS-485 converter is required; Model ML2 is recommended)

For Ethernet communication, use 10BASE-T/100BASE-TX.

CD-ROM drive: One (required for installation)

Printer: Paper size; Letter or A4 (required for printing)

Dedicated Adapter

Communication method:

- Non-contact, two-way, serial optical communication on the controller side
- Compliant with the USB Specification Rev. 1.1 on the PC side

Power supply: Supplied from the USB bus power

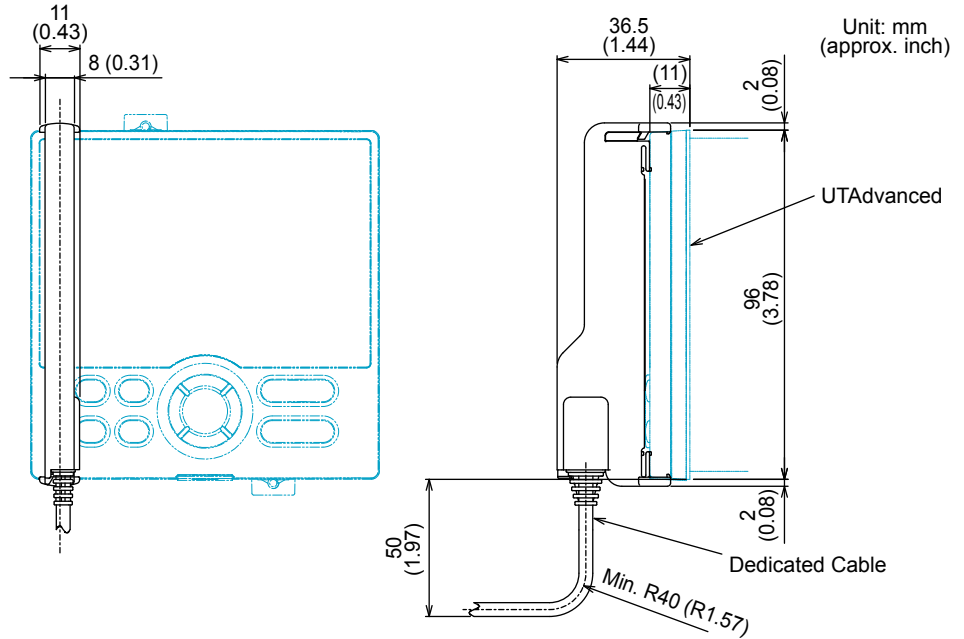
- Rated input voltage; 4.75 to 5.25 VDC,
- 100 mA DC (including the dedicated cable)

Ambient temperature: 0 to 50°C

Ambient humidity: 20 to 90%RH (No condensation)

Transport and storage conditions: -20 to 70°C, 5 to 90%RH (No condensation)

Dust-proof and drip-proof: IP3x



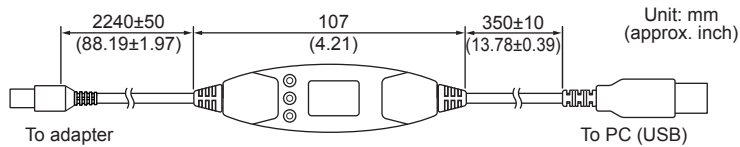
Dedicated Cable

USB serial converter is incorporated, Compliant with the USB Specification Rev. 1.1

USB Series "A" plug on the PC side

Dedicated plug (5-pin) on the adapter side

Cable length: About 2.7 m



CAUTION

- The dedicated cable is not waterproof. Do not use it in locations that are likely to be exposed to splashes of water or other liquids.
- Directly insert the USB plug into a USB port on the PC.

1.2 Operating Environment

EMC Standards

CE marking: EN61326-1 Class A, Table 2 (For use in industrial locations)

C-tick mark: EN 55011 Class A, Group1

CAUTION

This instrument is an EMC class A product. In a domestic environment, this product may cause radio interference in which case the user needs to take adequate measures.

Light-loader communication interface on the controller's front panel

Dedicated cable (with RS-232C/USB conversion function)

Compliant with the USB Specification Rev. 1.1 on the PC side

Maintenance port

Dedicated cable (with RS-232C/USB conversion function)

Ethernet communication

Specification: IEEE802.3 compliant, 10BASE-T/100BASE-TX, RJ45 connector

For a connection via a hub: Straight cable

For a direct connection: Cross cable

RS-485 communication

Specification: EIA RS-485 compliant

1.3 Connecting the UT to a PC and Setting Parameters

Dedicated cable

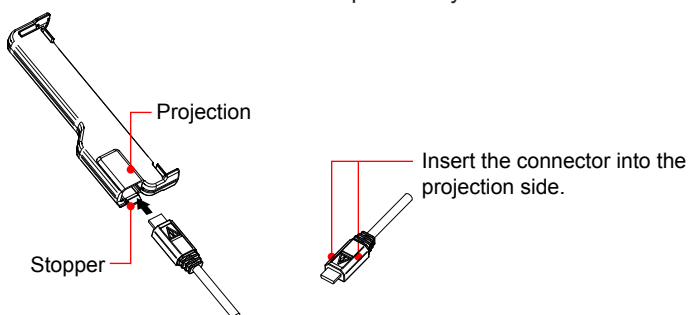
Light-loader Communication (front panel communication)

Attach the light-loader adapter to the UT's front panel and connect the dedicated cable between the PC's USB terminal and the light-loader adapter.

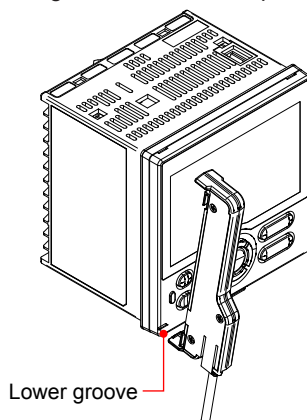
Network Profile Tool is available only for the light-loader adapter and the dedicated cable.

Attach the light-loader adapter and the dedicated cable

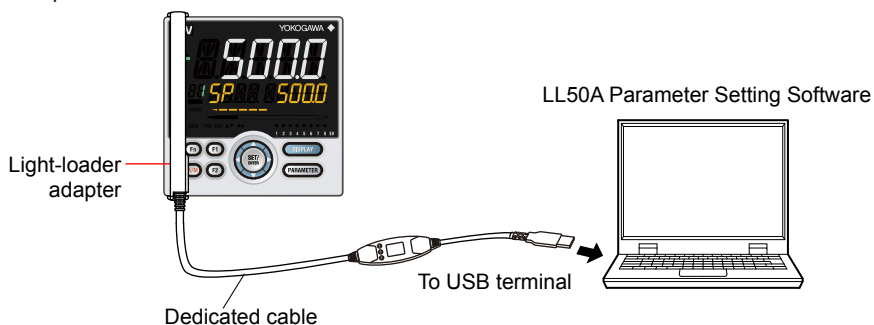
1. Attach the light-loader adapter and the dedicated cable.
Insert the connector into the adapter until you hear a click.



2. Attach the light-loader adapter to the UT's front panel.
Hang the dedicated adapter's bracket from the lower side groove.
Bring the dedicated adapter into contact with the UT's front panel.

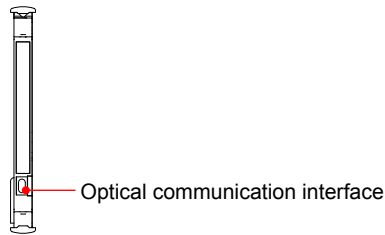


3. Connect the dedicated cable to the USB communication port of a personal computer.



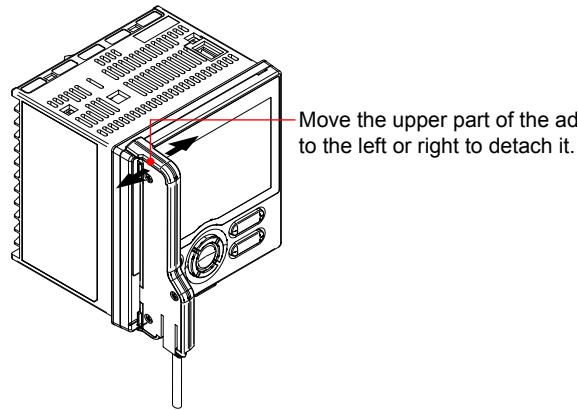
CAUTION

- Make sure the light-loader adapter is attached to the controller in a vertical orientation. Communication is not possible if the light-loader adapter is attached in a slanting position.
- Do not remove the dedicated cable while LL50A communicate, or it may affect the stability of the operation system.
- Do not suspend while LL50A communicate, or the system may fail to recover subsequently form the suspension.
- The dedicated adapter and the dedicated cable are not waterproof. Do not use them in locations that are likely to be exposed to splashes of water or other liquids.
- Do not make dirty the optical communication interface.

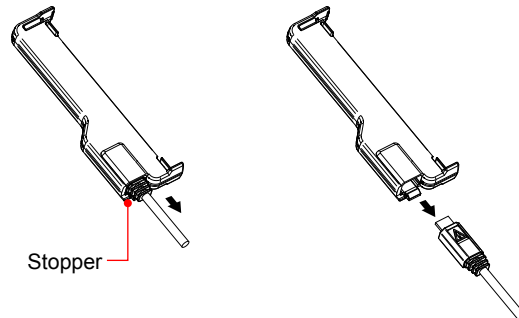


Detach the light-loader adapter and the dedicated cable

1. Detach the light-loader adapter from the UT.



2. Disconnect the dedicated cable from the light-loader adapter.

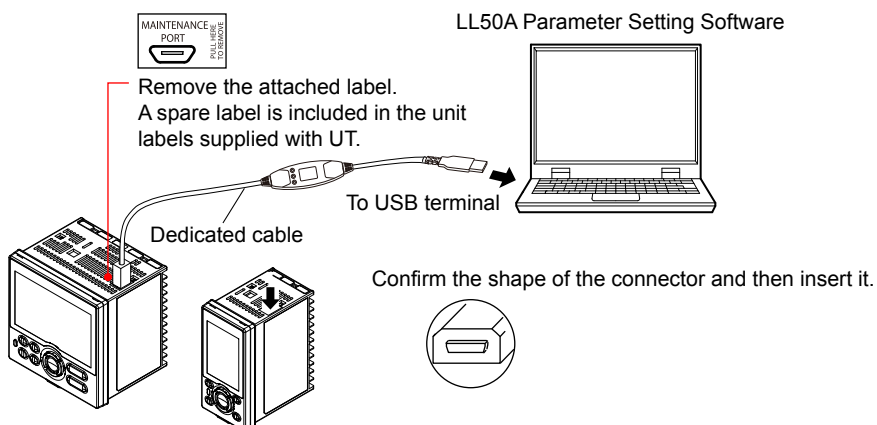


Maintenance Port (not necessary to supply power to the UT)

Connect the dedicated cable between the PC's USB terminal and the connection port on top of the UT.

Note

When connecting the PC to a UT using the maintenance port, do not supply power to the UT, otherwise the UT will not function properly. If the dedicated cable is connected to the UT and the power is turned on or if the UT's power supply is turned on and the dedicated cable is connected, disconnect the cable and turn the UT's power supply back on again. This returns the UT to the normal condition.



The following table shows the functions available between the UT and LL50A when the PC is connected using the UT's maintenance port.

Menu	Function
Communication	Upload all
	Download all
	Upload parameter data
	Download parameter data
	Upload ladder program
	Download ladder program
	Compare communication
Main unit operation	Factory defaults
	User defaults
	Set User defaults

Note

Network Profile Tool cannot be set via the maintenance port.

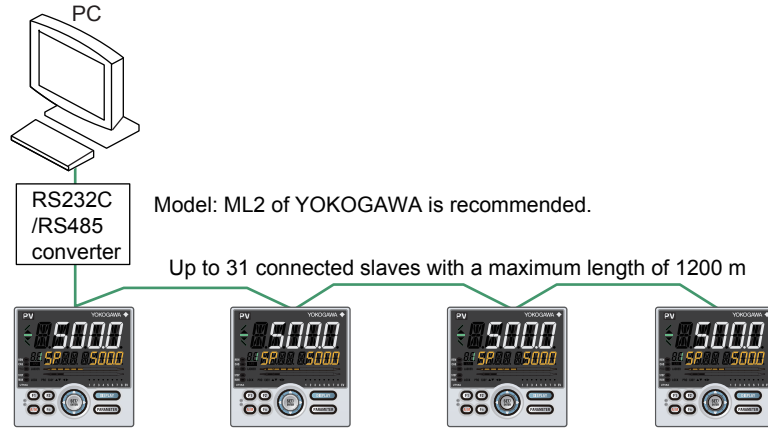
Setting parameters

It is not necessary to set communication parameters on the UT side.

1.3 Connecting the UT to a PC and Setup Parameters

RS-485 communication terminal

Connect the PC to the UT via the communication terminal on the UT's rear face. This connection requires an RS232C/RS485 converter (recommended model: ML2, Yokogawa Electric).



Note

Network Profile Tool cannot be set via the RS-485 communication terminal.

Setting parameters

Check the position of the RS-485 communication terminal and set the parameters. The terminal area to be used differs depending on the model and suffix codes. Confirm the specification of the main unit.

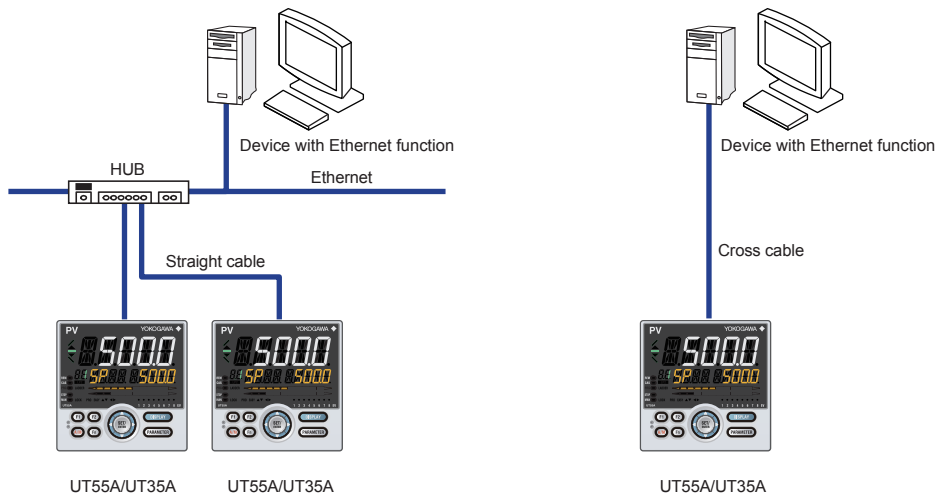
Parameter symbole	Name	Display level	Setting range	Menu symbol
PSL	Protocol selection		PCL: PC link communication PCLSM: PC link communication (with checksum) LADR: Ladder communication CO-M: Coordinated master station CO-S: Coordinated slave station MBASC: Modbus (ASCII) MBRTU: Modbus (RTU) CO-S1: Coordinated slave station (Loop-1 mode) CO-S2: Coordinated slave station (Loop-2 mode) P-P: Peer-to-peer communication	
BPS	Baud rate	EASY	600: 600 bps 1200: 1200 bps 2400: 2400 bps 4800: 4800 bps 9600: 9600 bps 19200: 19.2k bps 38400: 38.4k bps Up to 19.2k bps for RS-485 in E4-terminal area.	R485 Set
PRI	Parity		NONE: None EVEN: Even ODD: Odd	
STP	Stop bit		1: 1 bit, 2: 2 bits	
DLN	Data length		7: 7 bits, 8: 8 bits	
ADR	Address		1 to 99	

Set: Setup parameter

When parameters have been displayed, the terminal areas (E1 to E4) are indicated in the group display area according to the suffix and optional suffix codes.

Ethernet communication

Use a 10BASE-T/100BASE-TX compatible cable to connect the PC to a network through which the PC can communicate, and then connect to UTs on the network.



Note

When connecting a UT55A/UT35A to a network, the baud rate, connectors, etc. must match.

For more information, consult a network administrator who connects UT55A/UT35A devices to networks.

Note

Network Profile Tool cannot be set via the Ethernet communication terminal.

Setting parameters

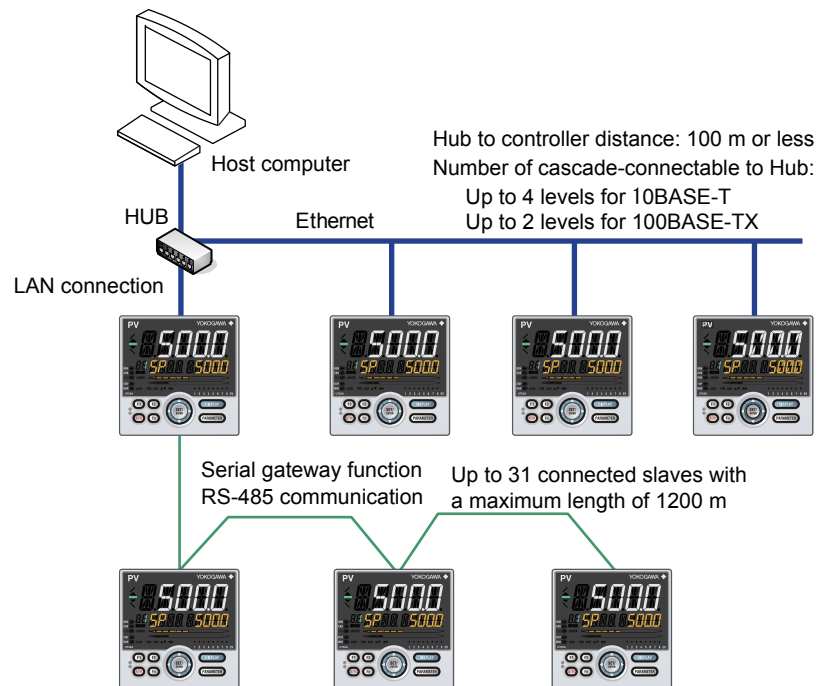
Parameter symbole	Name	Display level	Setting range	Menu symbol
HSR	High-speed response mode	EASY	OFF, 1 to 8	ETHR Set
IP1 to IP4	IP address 1 to 4		0 to 255 Default: (IP1).(IP2).(IP3).(IP4) =(192).(168).(1).(1)	
SM1 to SM4	Subnet mask 1 to 4		0 to 255 Default: (SM1).(SM2).(SM3).(SM4) =(255).(255).(255).(0)	
DG1 to DG4	Default gateway 1 to 4		0 to 255 Default: (DG1).(DG2).(DG3).(DG4) =(255).(255).(255).(0)	
PRT	Port number		502, 1024 to 65535	
IPAR	IP access restriction		OFF: Disable, ON: Enable	
1.IP1 to 1.IP4	Permitted IP address 1-1 to 1-4		0 to 255 Default: (1.IP1).(1.IP2).(1.IP3).(1.IP4) =(255).(255).(255).(255)	
2.IP1 to 2.IP4	Permitted IP address 2-1 to 2-4		0 to 255 Default: (2.IP1).(2.IP2).(2.IP3).(2.IP4) =(255).(255).(255).(255)	
ESW	Ethernet setting switch	Setting this parameter to "ON" enables the Ethernet parameter settings. OFF, ON		

Set : Setup parameter

1.3 Connecting the UT to a PC and Setup Parameters

Ethernet-serial gateway function

Connect the UT with RS-485 communication to the UT with Ethernet-serial gateway function. The PC can access data of UT with RS-485 communication.



The communication conditions between the UT with gateway function and the slave UTs should be the same settings (parameters PSL, STP, DLN, and ADR). It is necessary to set the following parameters in addition to the Ethernet parameters.

Note

Network Profile Tool cannot be set via the Ethernet-serial gateway function.

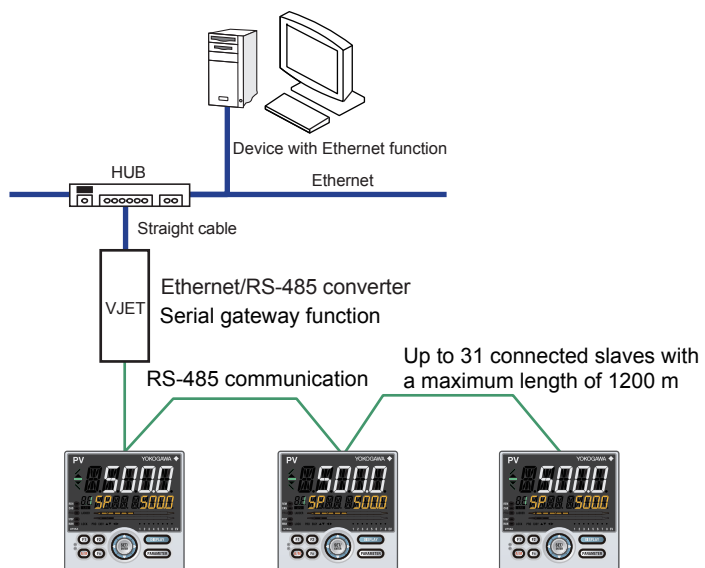
Setting parameters

Parameter symbole	Name	Display level	Setting range	Menu symbol
BPS	Baud rate	EASY	9600: 9600 bps 19200: 19.2k bps 38400: 38.4k bps	ETHR Set
PRI	Parity		NONE: None EVEN: Even ODD: Odd	

Set: Setup parameter

Connection via an Ethernet-RS485 converter

Connect the PC to UTs via the Ethernet/RS-485 converter (recommended model: VJET, Yokogawa Electric).



Note

Network Profile Tool cannot be set via the Ethernet-RS485 converter.

1.3 Connecting the UT to a PC and Setup Parameters

Setting parameters

Set the communication conditions of slave UTs in the same way as those of the VJET with the gateway function.

The VJET must be set using a VJET setting tool.

The VJET setting tool can be downloaded from:

<https://y-link.yokogawa.com/YL007.po>

Check the position of the RS-485 communication terminal and set the parameters. The terminal area to be used differs depending on the model and suffix codes. Confirm the specification of the main unit.

Parameter symbole	Name	Display level	Setting range	Menu symbol
PSL	Protocol selection		PCL: PC link communication PCLSM: PC link communication (with checksum) LADR: Ladder communication CO-M: Coordinated master station CO-S: Coordinated slave station MBASC: Modbus (ASCII) MBRTU: Modbus (RTU) CO-S1: Coordinated slave station (Loop-1 mode) CO-S2: Coordinated slave station (Loop-2 mode) P-P: Peer-to-peer communication	
BPS	Baud rate	EASY	600: 600 bps 1200: 1200 bps 2400: 2400 bps 4800: 4800 bps 9600: 9600 bps 19200: 19.2k bps 38400: 38.4k bps Up to 19.2k bps for RS-485 in E4-terminal area.	R485 Set
PRI	Parity		NONE: None EVEN: Even ODD: Odd	
STP	Stop bit		1: 1 bit 2: 2 bits	
DLN	Data length		7: 7 bits 8: 8 bits	
ADR	Address		1 to 99	

Set: Setup parameter

When parameters have been displayed, the terminal areas (E1 to E4) are indicated in the group display area according to the suffix and optional suffix codes.

1.4 Model Compatibility of LL50A Functions

The model compatibility of LL50A functions are as follows:

Functions		User File / Models	Release number of the Setting Tool		
			R1.xx.xx	R2.xx.xx	
			Setting model in the System Data window		
			UT55A or UT52A		UT35A or UT32A
File	Open	(1)	√	√	N/A
		(2)	N/A	N/A	√
	Save	(1)	√	√	N/A
		(2)	N/A	N/A	√
Compare Files	Parameter	(1)	√	√	N/A
		(2)	N/A	N/A	√
	Ladder Program	(1)	√	√	√√ (Note 1)
		(2)	N/A	√√ (Note 1)	√
Communication	Upload All	UT55A/UT52A	√	√	N/A
		UT35A/UT32A	N/A	N/A	√
	Download All	UT55A/UT52A	√	√	N/A
		UT35A/UT32A	N/A	N/A	√
	Upload Parameter Data	UT55A/UT52A	√	√	N/A
		UT35A/UT32A	N/A	N/A	√
	Download Parameter Data	UT55A/UT52A	√	√	N/A
		UT35A/UT32A	N/A	N/A	√
	Upload Ladder Program	UT55A/UT52A	√	√	√√ (Note 2)
		UT35A/UT32A	N/A	√√ (Note 1)	√
Download Ladder Program	UT55A/UT52A	√	√	√√ (Note 3)	
	UT35A/UT32A	N/A	√√ (Note 3)	√	
Compare Communication	Parameter	UT55A/UT52A	√	√	N/A
		UT35A/UT32A	N/A	N/A	√
	Ladder Program	UT55A/UT52A	√	√	√√ (Note 1)
		UT35A/UT32A	N/A	√√ (Note 1)	√

(1) : User file for UT55A/UT52A

(2) : User file for UT35A/UT32A

√ : Available

√√ : Available with condition

N/A : Not available

Note 1: Each ladder program of UT55A, UT52A, UT35A and UT32A can be compared mutually.

Note 2: If the models are UT35A/UT32A and UT55A/UT52A (single-loop control mode), the upload can be performed only when the condition is LL50A (maximum ladder program capacity) ≥ Main unit (the downloaded ladder program capacity).

Note 3: If the models are UT35A/UT32A and UT55A/UT52A (single-loop control mode), the download can be performed only when the condition is LL50A (maximum ladder program capacity) ≤ Main unit (the downloaded ladder program capacity).

An error may occur when using the ladder program of UT55A/UT52A on UT35A/UT32A.

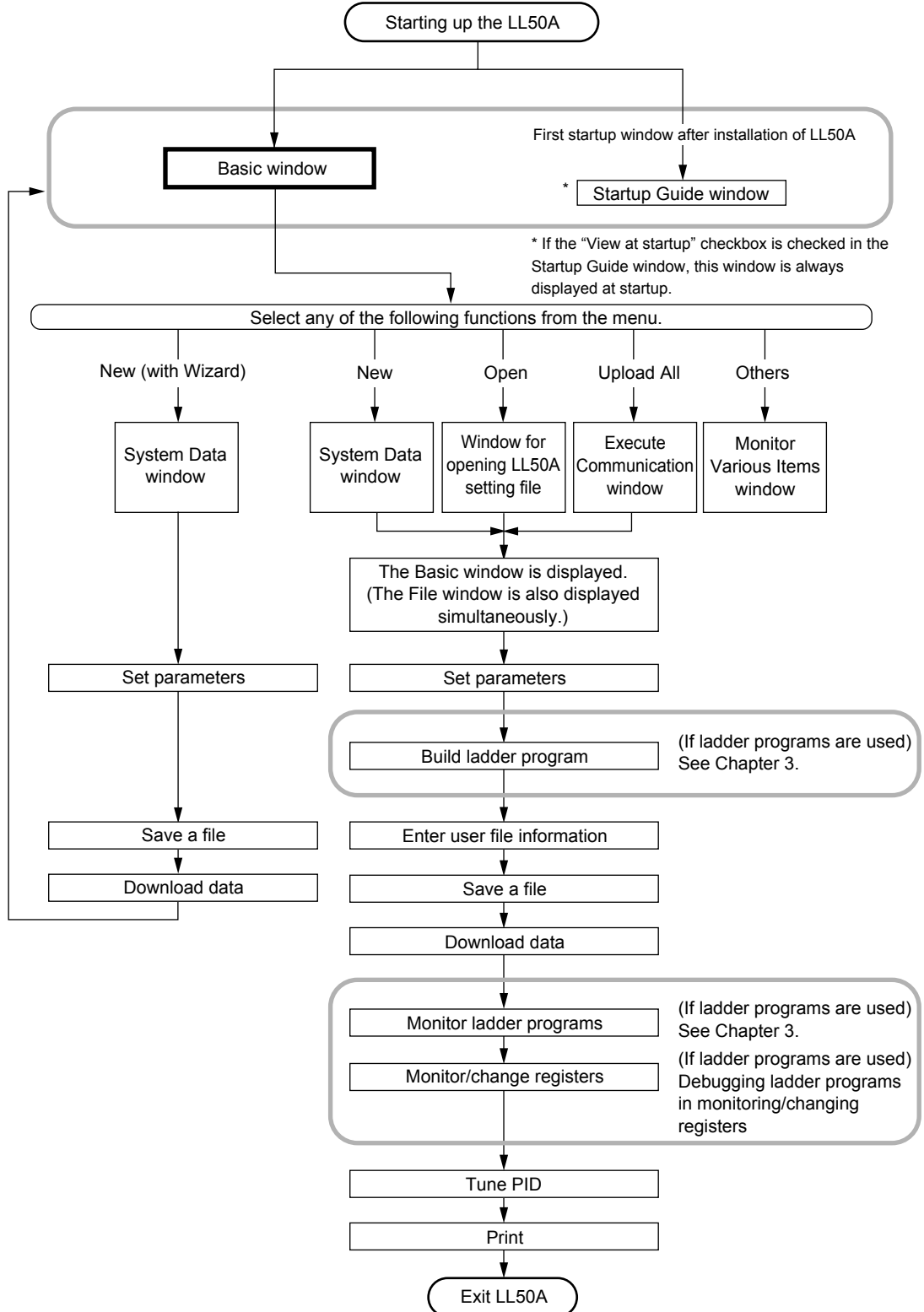
Max. ladder program capacity of UT55A/UT52A: 500 steps

Max. ladder program capacity of UT35A/UT32A: 300 steps

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2.1 Setting Flow

The LL50A operation guide describes how to set parameters to the UT, creating user file information, monitoring, downloading, uploading, file management, printing, etc. For how to build ladder programs, see Chapter 3, A Guide to Building Ladder Programs. For how to create network profile, see Chapter 6, Profile Creating Guide.

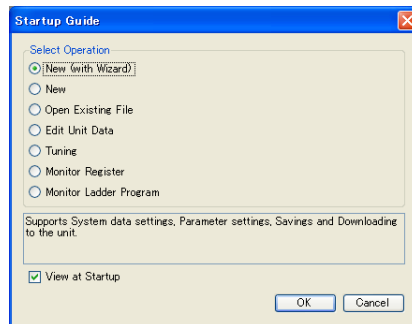


2.2 Starting up/Exiting the LL50A

Starting up the LL50A

Procedure

1. Click on Windows' [Start], select [Programs] – [UTAdvanced], and then click on [Setting Tool].



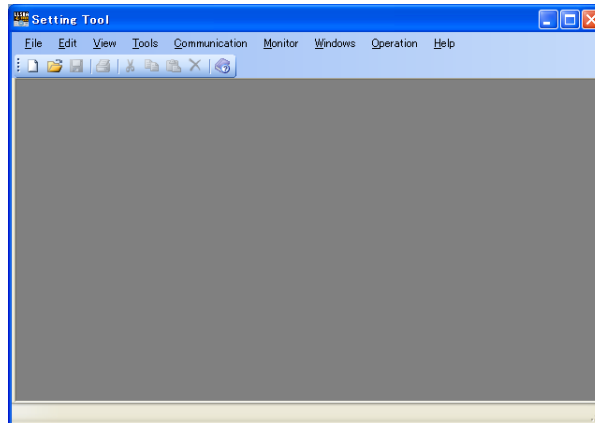
The Startup Guide window is displayed at the first startup after installing the LL50A and if the Use Startup Guide checkbox is checked in the Environmental Setting window.

- **New (with Wizard)**
Enables you to set system data, set parameters, save a file, and download data to the UT in sequence.
- **New**
Creates new parameters.
- **Open Existing File**
Enables you to open and edit an existing user file.
- **Edit Unit Data**
Enables you to read out and edit data from the UT.
- **Tuning**
Enables you to tune UT data.
- **Monitor Registers**
Monitors UT registers.
- **Monitor Ladder Programs**
Monitors UT ladder programs.
- **View at Startup**
If this checkbox is checked, the Startup Guide window is displayed at the next startup.
- **Guide message**
This section displays the description of a selected function.

2. Select a desired function and click the [OK] button. Clicking the [Cancel] button causes the Startup Guide window to close.


The Startup Guide window can also be started up by double-clicking on the Setting Tool shortcut or a setting file (user file extension: see section 2.13.2) on the Desktop.

If the Startup Guide window is disabled from being displayed at startup, the following Basic window appears.



Exiting the LL50A

Procedure

1. Click on [File] – [Exit] in the menu or click .

Note

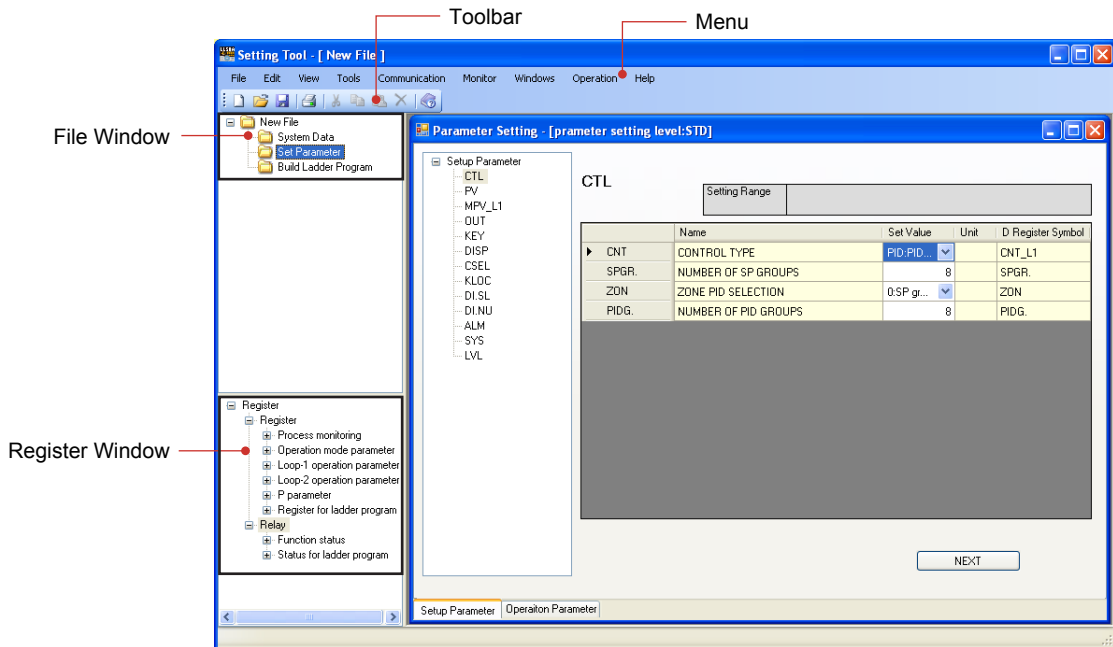
Save any data in use as necessary.

2.3 Part Names of Window and Their Functions

Basic window

The Basic window is a background window for setting system data, setting parameters, performing tuning, building ladder programs, etc.

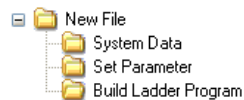
The window below shows an example display of the Parameter Setting window.



File window

The File window is displayed on the left of the Basic window. It can be made visible or invisible. If data is saved in a file, the file name is displayed.

Clicking on a folder on the tree causes the Set System Data, Set Parameter, or Build Ladder Program window to appear.

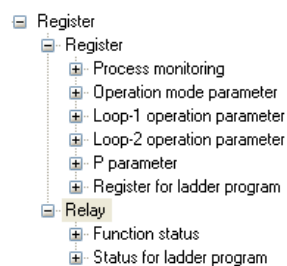


Clicking on “Build Ladder Program” in the File window causes the Build Ladder Program window to appear. In this case, the Instruction window is displayed. See Chapter 3, A Guide to Building Ladder Programs.

Register window

The Register window is also displayed on the left of the Basic window. It can be made visible or invisible. This window can be used to set parameters, perform tuning, monitor registers, or build ladder programs.

Right-clicking in the Register window enables the [Expand] or [Collapse] shortcut menu to be selected. When Expand is selected, a register can be searched by using the keyboard to enter search conditions or something similar.



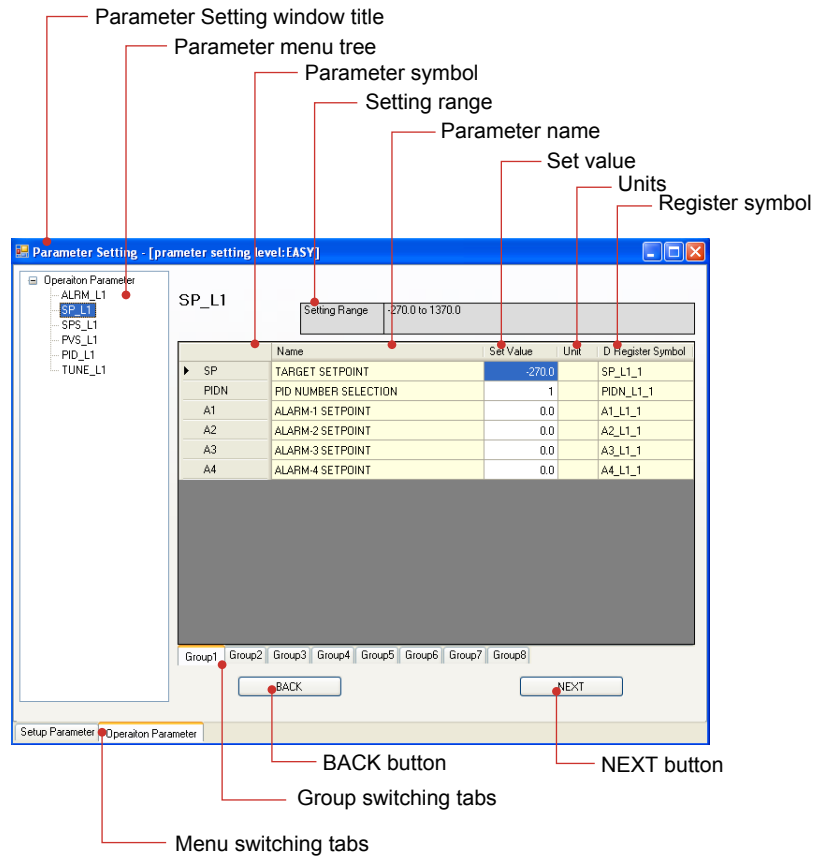
Data category of Register window

Large classification	Middle classification	Small classification	
Register	Process monitoring	Process data	
	Operaiton mode parameters	Loop-1/Loop-2 operation mode	
	Loop-1 operation parameters		SP and alarm setpoint setting
			SP-related setting
			Alarm function setting
			PV-related setting
			PID setting
			Control action-related setting
	Loop-2 operation parameters		SP and alarm setpoint setting
			SP-related setting
			Alarm function setting
			PV-related setting
			PID setting
			Control action-related setting
	P-parameters	P-parameter	
	Registers for ladder program		For input ladder calculation
			For output ladder calculation
			Status register
			Constant register
			Input range / scale
DAT register			
Special register			
Peer-to-peer communication register			
Relay	Function status	System error	
		Input error	
		Operaiton mode	
		Alarm	
		Alarm latch	
		Heater break alarm	
		SP number, PID number	
		Key	
		Display	
		Status for ladder program	
	Output (status) relay		
	Control (status) relay		
	Special relay		
	Internal relay		
	Peer-to-peer communication		

Note

The registers and relays of Loop-2 can be used only for UT55A/UT52A.

Parameter Setting window



Name	Specifications
Menu switching tabs	Used to switch to the operation parameter or setup parameter windows.
Parameter Setting window title	Parameter Setting – [Parameter display level:***] To set to easy setting mode display or parameter display level (LEVL = EASY): EASY To set to standard setting mode display or parameter display level (LEVL = STD): STD To set to professional setting mode display or parameter display level (LEVL = PRO): PRO
Parameter menu tree	A menu tree of operation parameters and setup parameters
Setting range	This section shows the setting range of a selected parameter.
Parameter symbol	Shows parameter symbols.
Parameter name	Shows parameter names.
Set value	Shows parameter set values. Enter a set value into a cell directly or select it from a dropdown list. To register a register, enter a register symbol by drag-and-drop from the Register window or input a register symbol into a cell directly.
Units	Shows the unit of a parameter set value.
Register symbol	Shows register symbols. Use these symbols when performing tuning or building ladder programs.
BACK	The parameter menu is switched over.
NEXT	

Build Ladder Program window

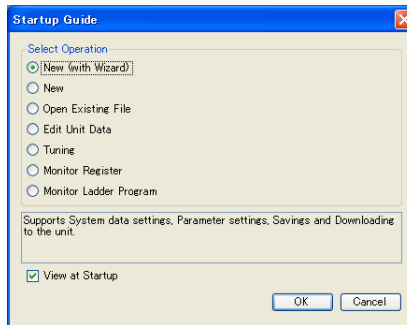
See Chapter 3, A Guide to Building Ladder Programs.

2.4 Creating New Parameters Using the Wizard Function

The Wizard function supports operations from system data setting, parameter setting, and a file save to downloading data to the UT. When using the Wizard function, parameters to be displayed are those available in the “easy setting mode” of the UT’s parameter display level (LEVL).

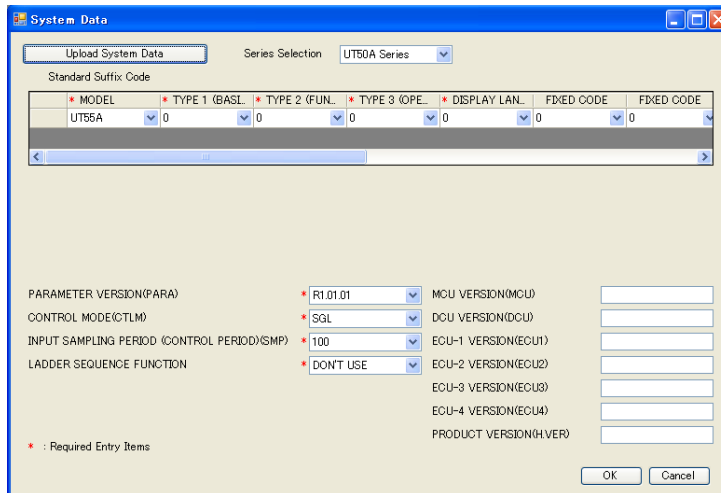
Procedure

1. Click on Windows’ [Start], select [All Programs] – [UTAdvanced], and then click on [Setting Tool].



The Startup Guide window appears at the first startup after installing the LL50A and if the Use Startup Guide checkbox is checked in the Environmental Setting window.

2. Click on New (with Wizard) and click the [OK] button to display the System Data window.



Items with an asterisk (*) are required to be entered.

CONTROL MODE (CTLM), INPUT SAMPLING PERIOD (CONTROL PERIOD) (SMP) and ECU-2 VERSION (ECU2) are displayed for UT55A/UT52A only.

Clicking the [Upload System Data] button enables the LL50A to communicate with the UT to load system data into it.

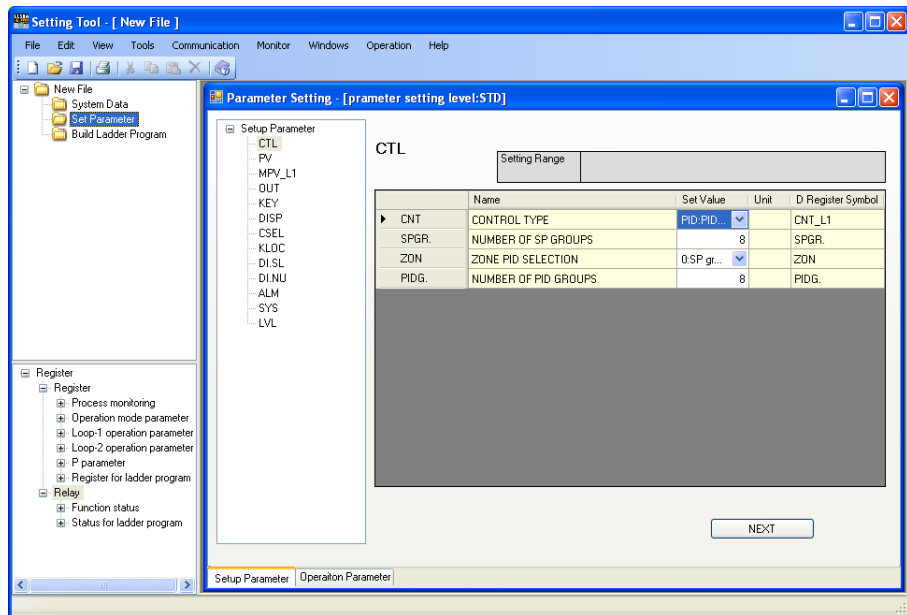
For the model and suffix codes, set them to the model and suffix codes of the UT to be set.

Note

For Model and Suffix codes, set the code except the hyphen in order.

2.4 Creating New Parameters Using the Wizard Function

3. Enter system data and click the [OK] button to display the Parameter Setting window. Clicking the [Cancel] button closes the System Data window and cancels the settings that have been made.





Setting parameters

- For entering a set value: Click in a cell to enable entry, enter the desired set value, then press the [Enter] key.
- For selecting a set value: Select it from a dropdown list.
- Entering a register symbol: Drag and drop register symbols from the Register window. When register symbols have been entered, candidates are displayed in a list; select a desired one from the list. It is also possible to register a register symbol by entering a register number. Entering and accepting a register number causes the indication to change to the register symbol.

The cell's background color is different, identifying it as a cell in which a register symbol can be entered. To disable setting, enter "OFF" or "0."

A cell's column width can be increased or decreased by dragging the boundary line between columns.

- ▶ Register symbol, register number: [UT Advanced Series Communication Interface User's Manual](#)

Icon	Status
	Status enabling a drop
	Status disabling a drop

Set parameters in turn, starting at the top of the parameter menu tree. Clicking [NEXT] causes a list of parameters to be switched to the next list. Clicking [BACK] causes a list of parameters to be switched to the previous list.

Parameter setting sequence

First set parameters relating to the input/output of setup parameters (menus CTL, PV, RSP, AIN2, AIN4, MPV_L1, MPV_L2, and OUT), then set the other setup parameters. After setting most of the setup parameters, set the operation parameters.

Note

- Parameters to be displayed are the same as those in the “easy setting mode” of the UT irrespective of the LL50A parameter view level.
- If setup parameter(s) are set after setting the operation parameters, there may be cases in which the operation parameters are initialized.

What are register symbols?

Register symbols are the symbols of registers containing data such as UT parameter, operation status, alarm status, contact input, and error information in 16 bits or 1 bit. When performing communication, registers are used as D-registers or I-relays. For more information on them, see the UTAdvanced Communication Interface (RS-485, Ethernet) User’s Manual.

D-register symbols

For some register symbols, the loop number, terminal area number, and group number are indicated by adding the underscore (_) to the end of a parameter symbol. If both the loop number and group number are added to a parameter symbol, they are added to it in the order of _loop number and _group number.

xxxx_Ln_Y

Ln: loop number (L1 or L2)

Y: group number (1 to 8 or 1 to 16, R)

xxxx_En

En: terminal area number (E1 to E4)

Example:

SP_L1_3: This means Loop-1 group-3 target setpoint.

PYS_2: This means group-2 PYS.

DI1.D_E1: This means E1-terminal area DI1.D.

Note

Since the UT35A/UT32A is a single-loop controller, it has no distinction between Loop-1 and Loop-2. However, the register symbol has "L1" which indicates Loop-1.


Menu symbols and parameter symbols different from those in the UT

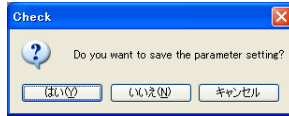
For menu symbols and parameter symbols, the loop number and terminal area number are indicated like register symbols. For example, the alarm function menu is indicated as ALRM in the UT, while it is indicated as ALRM_L1 in the LL50A.

For the notation, refer to “D-register symbols” above.

- Alarm function setting parameters
In the UT, the alarm type, stand-by action, energized/de-energized, and latch settings are made using one parameter. However, they are set using one parameter each in the LL50A.
- Output type parameters
These parameters are used only for setting during heating/cooling control. The output types are set using one parameter in the UT, while they are set using the heating- and cooling-side parameters in the LL50A.
- P-parameters (when the ladder is used)
The decimal point position can be set only in the LL50A.

2.4 Creating New Parameters Using the Wizard Function

4. Close the window or click . This causes the confirmation message to appear.

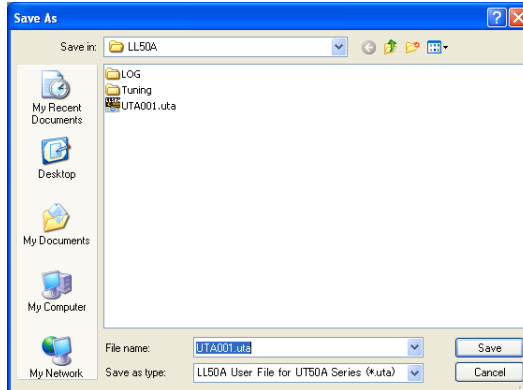


This message dialog is also displayed if the NEXT button is clicked until the end.

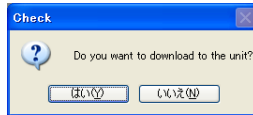
5. Click [Yes] to display the Save As window. Enter a name for the file and click the [Save] button.

LL50A User File for UT30A Series (*.utb)

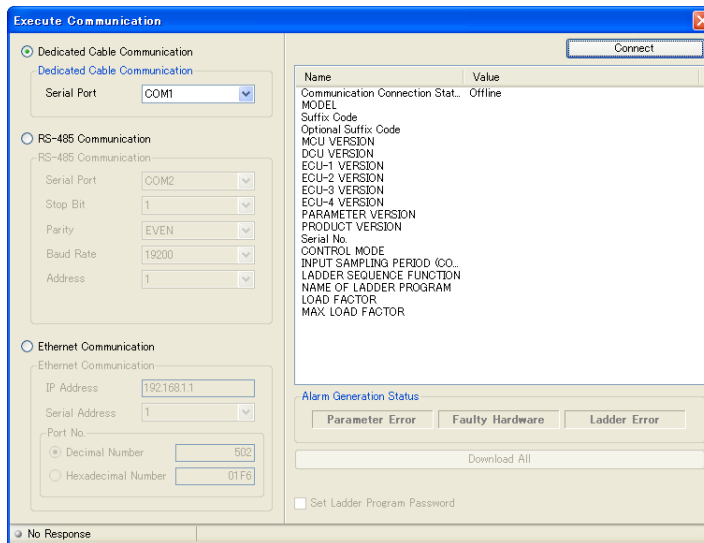
LL50A User File for UT50A Series (*.uta)



6. Next, the download message is displayed. Click the [Yes] button to proceed with the download, or the [No] button not to download. If you click the [No] button, move to step 9.



7. When download is selected, the Execute Communication window appears. Set up the communication conditions and click the [Download All] button.



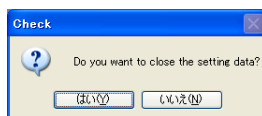
Alarm occurrence status (Lit when the corresponding errors occur.)

The symbols in parentheses indicate the register symbol.

Error display	Description
Parameter Error	System data error (SYSTEM_ERR) Calibration value error (CALB_ERR) User (parameter) default value error (UPARA_ERR) Setup parameter error (SETPA_ERR) Operation parameter error (OPEPA_ERR) Control parameter error (CTLPA_ERR) Faulty FRAM (FRAM_ERR)
Faulty Hardware	PV input A/D converter error (ADERR) RSP input A/D converter error (ADERR_E1) AIN2 input A/D converter error (ADERR_E2) AIN4 input A/D converter error (ADERR_E3) PV input RJC error (RJCERR) RSP input RJC error (RJCERR_E1) Nonresponding hardware of E1 terminal area (E1_ERR) Nonresponding hardware of E2 terminal area (E2_ERR) Nonresponding hardware of E3 terminal area (E3_ERR) Nonresponding hardware of E4 terminal area (E4_ERR)
Ladder Error	Corrupted ladder program (LAD_ERR)

8. When download has completed, a download completed message appears. Click [OK] to close the Execute Communication window.

9. Next, the message asking if you want to close setting data appears.



If you click [Yes], the user file is closed, causing the Startup Guide window to appear. If you click [No], the Basic window and File window are displayed.

Note

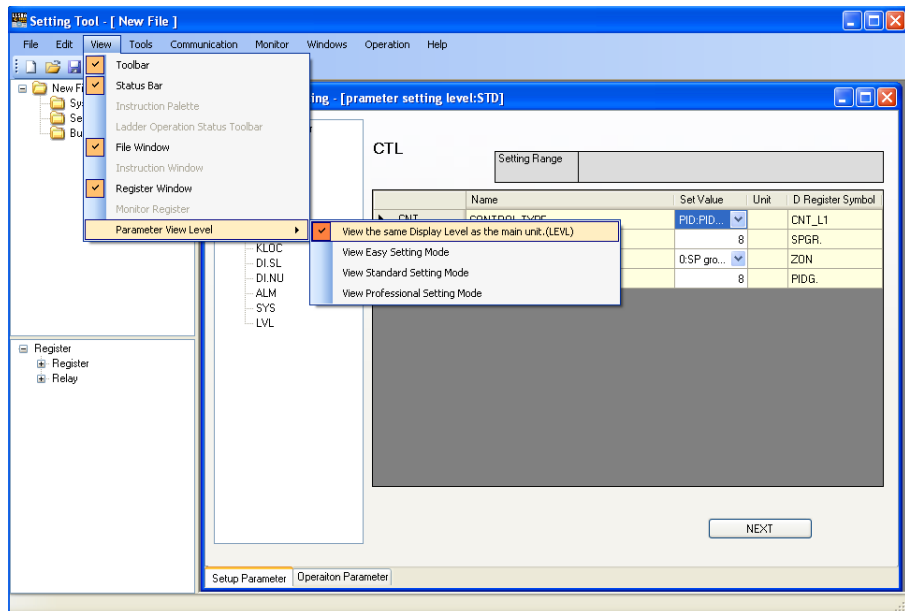
If data is downloaded using the Wizard function, the ladder programs in the UT will be initialized.

2.5 Setting the Parameter View Level

Aside from the UT's parameter display level, this section sets the view level of parameters to be displayed in the LL50A. It is different from the UT's parameter display level (LEVL).

Procedure

1. Click on [View], select [Parameter View Level], and click on the following command in the menu. This enables parameters to be set in each view level.
 - View the same Display Level as the main unit: The parameter view level changes to Easy Setting Mode, Standard Setting Mode, and Professional Setting Mode according to the LEVL parameter set value of the parameter setting function.
 - View Easy Setting Mode: Same as the UT's easy setting mode
 - View Standard Setting Mode: Same as the UT's standard setting mode
 - View Professional Setting Mode: Same as the UT's professional setting mode



The parameter view level is displayed on the Parameter Setting window's title bar. Parameter Setting window title: Parameter Setting – [Parameter display level: ***]


- To set to easy setting mode display or parameter display level (LEVL = EASY): EASY
- To set to standard setting mode display or parameter display level (LEVL = STD): STD
- To set to professional setting mode display or parameter display level (LEVL = PRO): PRO

For the parameter display levels, see the UT35A/UT32A User's Manual and UT55A/UT52A User's Manual (CD-ROM).

Parameters menu-locked in the UT unit can be displayed and set in the LL50A.

2.6 Setting System Data

Procedure

1. Open the System Data window in any of the following ways:
 - Click on (or select) "New (with Wizard)" in the Startup Guide window and click the [OK] button.
 - Click on (or select) "New" in the Startup Guide window and click the [OK] button.
 - Click on "System Data" in the File window.
 - Click on [File] – [New] in the menu.
 - Click on [File] – [New (with Wizard)] in the menu.
 - Click  on the toolbar.

Items with an asterisk (*) are required to be entered.

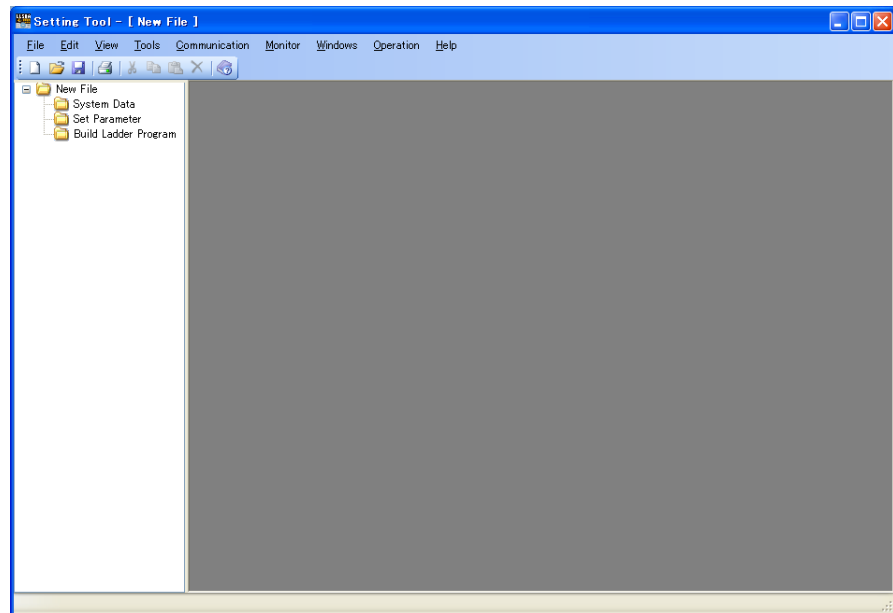
CONTROL MODE (CTLM), INPUT SAMPLING PERIOD (CONTROL PERIOD) (SMP) and ECU-2 VERSION (ECU2) are displayed for UT55A/UT52A only.

Note

For Model and Suffix codes, set the code except the hyphen in order.

2.6 Setting System Data

2. Enter system data or upload it from the UT and click the [OK] button. This causes the Basic window to appear. The File window is also displayed.



3. See each section for the successive operations.

Uploading system data

Connect a PC to the UT and upload system data from the UT to the PC. This makes it easy to set system data.

If a PC cannot be connected to the UT, set up system data manually.

Example

UT55A-000-00-00

- Model: UT55A
- Type 1 (basic control): 0
- Type 2 (functions): 0
- Type 3 (open network): 0
- Display language: 0
- Fixed: 0
- Fixed: 0
- Fixed: 0
- RSP direct input option: none
- LPS option: none
- Power supply option: none
- Additional treatment option: none
- Heater break alarm option: none
- Custom order: /Sxxx or /SxxxN
custom-order information can be displayed or input.

Set the UT's parameter PARA version.

Set the UT's control mode (CTLM).

Set the UT's input sampling period (control period).

Connect a PC to the UT and upload system data from the UT to the PC.
In this case, the following system data need not be set.

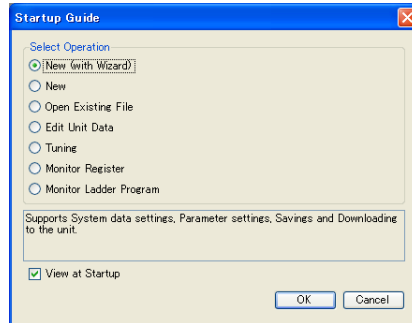
Series selection
When the model is UT55A/UT52A, set UT50A Series.
When the model is UT35A/UT32A, set UT30A Series.

Set the ladder sequence function to USE to use it
DON'T USE if not using it


2.7 Setting Parameters

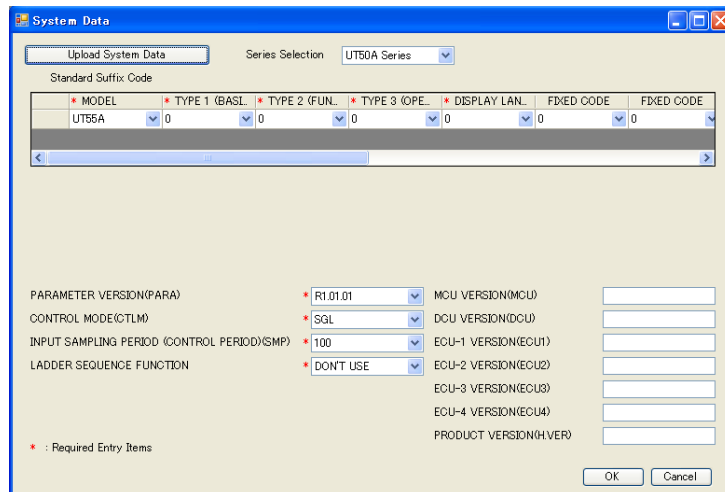
Procedure

1. Click on Windows' [Start], select [All Programs] – [UTAdvanced], and then click on [Setting Tool].



The Startup Guide window appears at the first startup after installing the LL50A and if the "Use the startup guide" checkbox is checked in the Environmental Setting window.

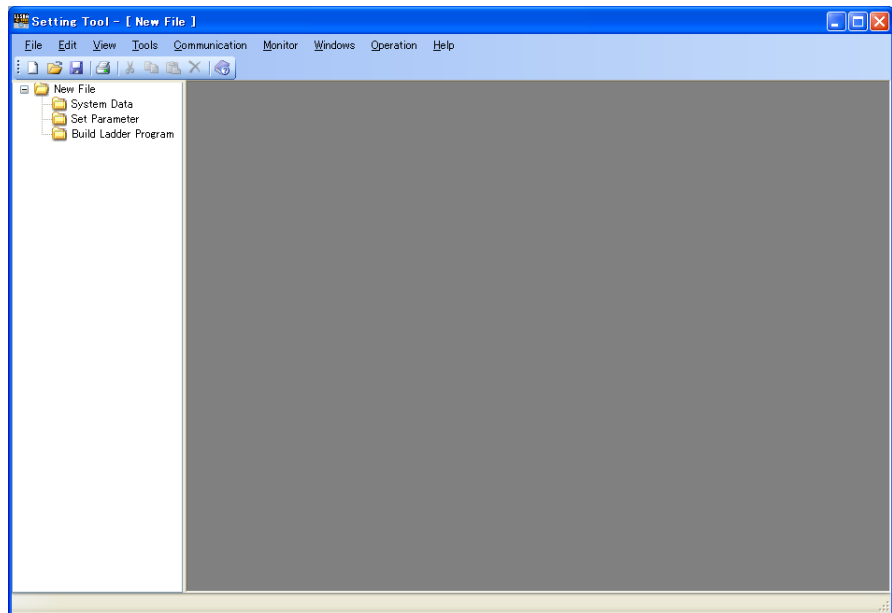
2. Click on "New" and click [OK] in the Startup Guide window, click on [File] – [New] in the menu, or click  on the toolbar to display the System Data window.



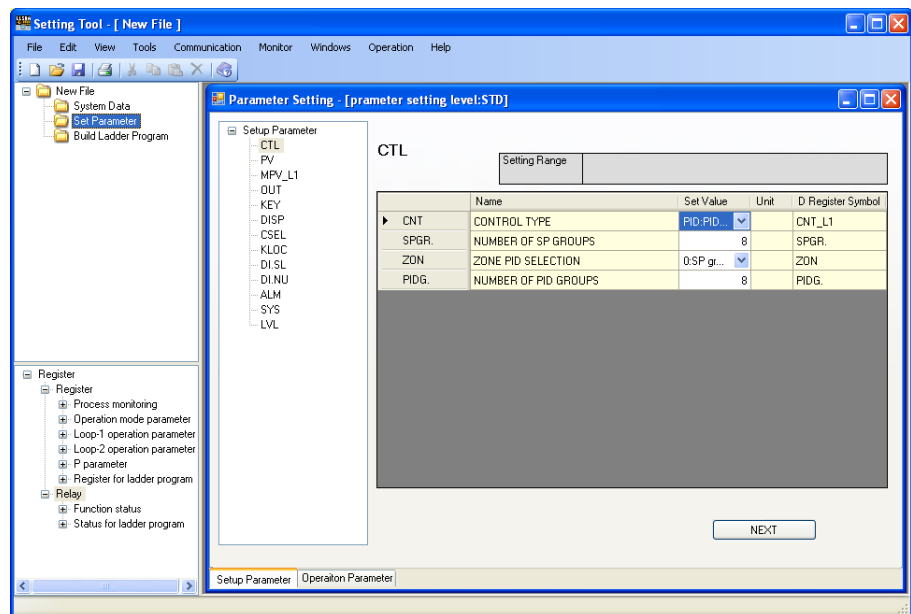
Items with an asterisk (*) are required to be entered.

CONTROL MODE (CTLM), INPUT SAMPLING PERIOD (CONTROL PERIOD) (SMP) and ECU-2 VERSION (ECU2) are displayed for UT55A/UT52A only.

3. Enter system data and click the [OK] button to display the Basic window. The File window is also displayed.



4. Click "Set Parameter" in the File window to display the Parameter Setting window at the right of the Basic window.



Parameter setting sequence

First set parameters relating to the input/output of setup parameters (menus CTL, PV, RSP, AIN2, AIN4, MPV_L1, MPV_L2, and OUT), then set the other setup parameters. After setting most of the setup parameters, set the operation parameters.

Note

- Parameters to be displayed are as given by the setting of the parameter view level.
- If setup parameter(s) are set after setting the operation parameters, there may be cases in which the operation parameters are initialized.



5. Click on the menu of a parameter that you want to set, to display a list of parameters in the Parameter Setting window. (Click the [+] button to expand the menu or click the [-] button to collapse it.)

6. Click on the parameter that you want to set.


7. Enter a value to be set.

- For entering a value to be set: Click in a cell to enable entry, enter the desired set value, then press the [Enter] key.
- For selecting a set value: Select it from a dropdown list.
- Entering a register symbol: Drag and drop register symbols from the Register window. When register symbols have been entered, candidates are displayed in a list; select a desired one from the list. It is also possible to register a register symbol by entering a register number. Entering and accepting a register number causes the indication to change to the corresponding register symbol. The cell's background color is different, identifying it as a cell in which a register symbol can be entered. To disable setting, enter "OFF" or "0."

▶ Register symbols and register numbers: [UTAdvanced Series Communication Interface \(RS-485, Ethernet\) User's Manual](#)

Icon	Status
	Status enabling a drop
	Status disabling a drop

8. Repeat steps 5 to 7 to set other parameters.

9. To finish parameter setting, click . If the data in use has not yet been saved, the following dialog box appears.

- To save the settings, click the [Yes] button.
- To discard the settings, click the [No] button.
- To return to parameter setting, click the [Cancel] button.

What are register symbols?

Register symbols are the symbols of registers containing data such as UT parameter, operation status, alarm status, contact input, or error information in 16 bits or 1 bit. When performing communication, registers are used as D-registers or I-relays. For more information on them, see the UTAdvanced Communication Interface (RS-485, Ethernet) User's Manual.

D-register symbols

For some register symbols, the loop number, terminal area number, and group number are indicated by adding the underscore (_) to the end of a parameter symbol. If both the loop number and group number are added to a parameter symbol, they are added to it in the order of _loop number and _group number.

xxxx_Ln_Y

Ln: loop number (L1 or L2)

Y: group number (1 to 8 or 1 to 16, R)

xxxx_En

En: terminal area number (E1 to E4)

Example:

SP_L1_3: This means Loop-1 group-3 target setpoint.

PYS_2: This means group-2 PYS.

DI1.D_E1: This means E1-terminal area DI1.D.

Note

Since the UT35A/UT32A is a single-loop controller, it has no distinction between Loop-1 and Loop-2. However, the register symbol has "L1" which indicates Loop-1.

Menu symbols and parameter symbols different from those in the UT

For menu symbols and parameter symbols, the loop number and terminal area number are indicated like register symbols. For example, the alarm function menu is indicated as ALRM in the UT, while it is indicated as ALRM_L1 in the LL50A.

For the notation, refer to "D-register symbols" above.

- Alarm function setting parameters
In the UT, the alarm type, standby operation, energized/non-energized, and latch settings are made using one parameter. However, they are set using one parameter each in the LL50A.
- Output type parameters
These parameters are used only for setting during heating/cooling control. The output types are set using one parameter in the UT, while they are set using the heating- and cooling-side parameters in the LL50A.
- P-parameters (when the ladder is used)
The decimal point position can be set only in the LL50A.

Message registration

Register message to be displayed on the UT.

Setup parameter menu: DI.SL

Symbol: MSG1 to MSG2

- ▶ [Message function: Section 13.1.10 Setting Message Function, of UT35A/UT32A Digital Indicating Controllers User's Manual, or Section 13.1.11 Setting Message Function, of UT55A/UT52A Digital Indicating Controllers User's Manual](#)
- ▶ [Characters to be registered: Section 3.3 List of Display Symbols, of UT55A/UT52A Digital Indicating Controllers User's Manual, or Section 3.3 List of Display Symbols, of UT55A/UT52A Digital Indicating Controllers User's Manual](#)

2.8 Creating User File Information

User file information is used for creating data sheets that are submitted to the customer. Data sheets can also be printed out. User file information is saved in a user file and will not be downloaded to the UT.

Procedure


1. Click on [File] – [Set User File Information] in the menu. Enter user file information in the window displayed.

The screenshot shows a window titled "User File Information" with a table for data entry and a memo field. Red lines and dots point to specific fields with descriptive text.

Customer Name	
Delivery Destination	
Device Name	
Model Name	
Order No.	
Serial Number	
Author	
Date Created	
Specification Number	
Revision No.	
Function Overview	
Memo	

Annotations:

- Up to 20 two-byte characters or 40 single-byte characters (points to Customer Name)
- Each item can be up to 20 two-byte characters or 40 single-byte characters. (points to Delivery Destination, Device Name, Model Name, Order No., Serial Number, Author, Date Created, Specification Number, Revision No.)
- Up to 16 two-byte characters or 32 single-byte characters (points to Function Overview)
- Up to 600 two-byte characters or 1200 single-byte characters (points to Memo)
- These items can be changed. Each item can be up to 16 two-byte characters or 32 single-byte characters. (points to the table header area)

2. To close the window, click .

2.9 Downloading Data

CAUTION

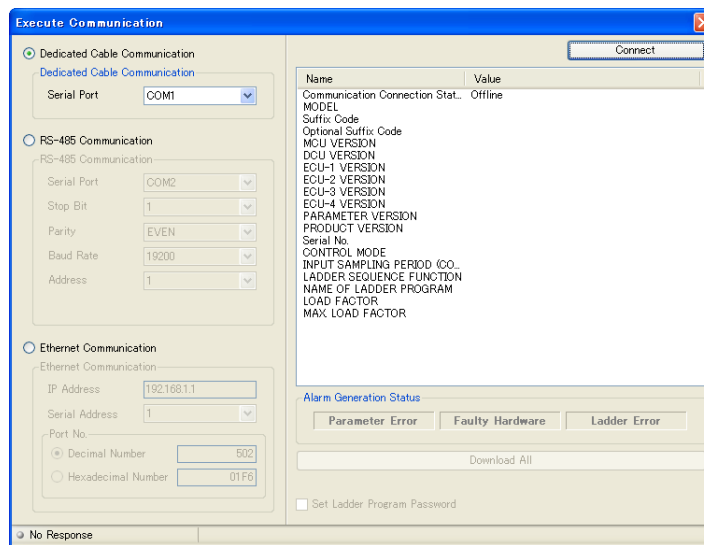
Do not download data while the controller is being used for control loop. Otherwise, it may cause a sudden change of the control output.

Be sure to disconnect the UT from the target unit before downloading data.

Download All

Procedure

1. Click on [File] – [Download All] in the menu to display the Execute Communication window.



2. Set up the communication conditions and click the [Download All] button. When download is complete, the following message appears.

3. Click [OK] to close the Execute Communication window.

After clicking the [Download All] button, follow the prompts that are displayed.

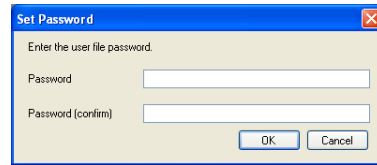
If the data in use has not yet been saved, a dialog box asking if you want to save data appears.

- To save the data, click the [Yes] button.
- To download data to the UT without saving it, click the [Cancel] button.

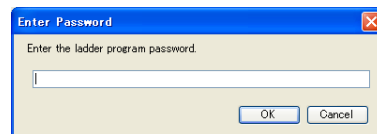
2.9 Downloading Data

If the “Set a ladder program password” checkbox is checked in the Execute Communication window, a dialog box asking if you want to set a password appears. Set a password using eight single-byte alphanumeric characters. If you do not want to set it, click the [OK] button without entering a password.

To change the password once it has been set to no password, click the [OK] button without entering a password.



In overwriting the UT parameters for which a password has been set, entering the set password enables new data to be downloaded.



Description

Data which can be downloaded by one operation are a user file name, system data (only control mode, control period, and ladder program USE/DON'T USE information), parameter data, K-constant (K-register), and ladder program data. Circuit comment of ladder program is not downloaded.

Once a password has been set, it must be entered whenever you upload/download, compare, or monitor the ladder programs.

The password default value is non-setting. The password can be up to eight single-byte alphanumeric characters and is case sensitive.

Individual data can be downloaded as follows.

- Click on [Communication] – [Download Parameter Data] in the menu.
- Click on [Communication] – [Download Ladder Programs] in the menu.
K-constant can be also downloaded by [Download Ladder Programs].

<Execute Communication window>

- Serial Port: A port available for a PC is automatically displayed.
- Stop Bit, Parity, Baud Rate, and address: Set these items according to the UT's communication conditions. Data length: fixed 8 bit
- IP Address: Set this address according to the UT's IP address (for Ethernet communication).
- Serial Address: Set the UT's RS-485 communication address if communication is made via an Ethernet/RS-485 converter (e.g., model VJET). (Not allowed to be duplicated)
- Port Number: Set the port number. (Decimal Number or Hexadecimal Number)

If data is downloaded via a maintenance port, nothing is displayed in the Alarm Generation Status in the Excute Communication window. In addition, “-” is displayed for the Load Factor and Max Load Factor when using a ladder program.

Note

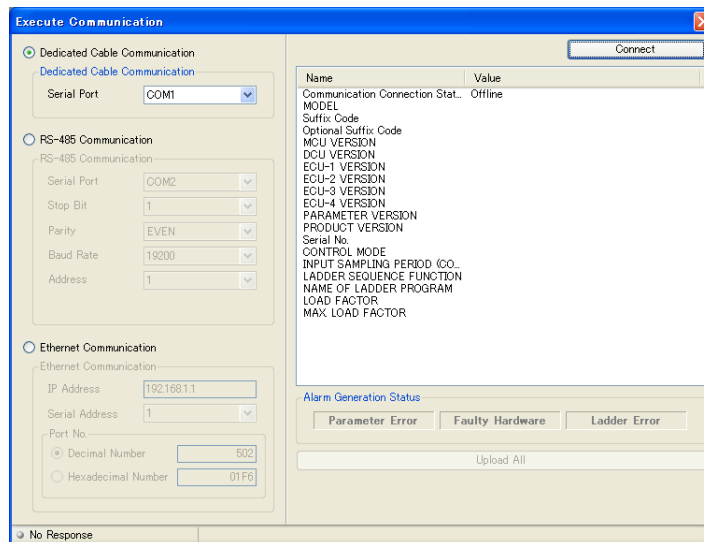
Do not disconnect a connection cable or turn off the UT power supply during a download.

2.10 Uploading Data

Upload All

Procedure

1. Click on [Communication] – [Upload All] in the menu to display the Execute Communication window.



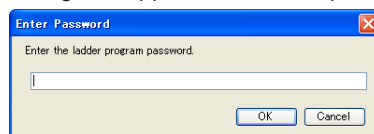
2. Set up the communication conditions and click the [Upload All] button. When an upload is complete, the Execute Communication window.

If the data in use has not yet been saved, a dialog box asking if you want to save data appears.

- To save the data, click the [Yes] button.
- To cancel an upload, click the [Cancel] button.

If the following message appears after clicking the [Upload All] button, follow the instructions of the message.

If a ladder program password has been set to data to be uploaded, the Enter Password dialog box appears. Enter the password and click the [OK] button.



Description

Data which are uploaded at once are a user file name, system data, parameter data, and ladder program data.

Once a password has been set, it must be entered whenever you upload, download, compare, or monitor the ladder programs.

The password default value is non-setting. The password can be up to eight single-byte alphanumeric characters and is case-sensitive.

Individual data can be uploaded as follows.

- Click on [Communication] – [Upload Parameter Data] in the menu.
- Click on [Communication] – [Upload Ladder Programs] in the menu.

<Execute Communication window>

- Serial Port: A port available for a PC is automatically displayed.
- Stop Bit, Parity, Baud Rate, and address: Set these items according to the UT's communication conditions. Data length: fixed 8 bit
- IP Address: Set this address according to the UT's IP address (for Ethernet communication).
- Serial Address: Set the UT's RS-485 communication address if communication is made via an Ethernet/RS-485 converter (e.g., model VJET). (Not allowed to be duplicated)
- Port Number: Set the port number. (Decimal Number or Hexadecimal Number)

If data is downloaded via a maintenance port, nothing is displayed in the Alarm Generation Status in the Execute Communication window. In addition, "-" is displayed for the Load Factor and Max Load Factor when using a ladder program.

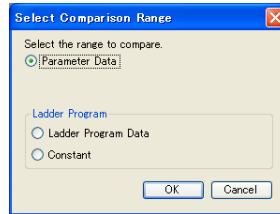
Note

Do not disconnect a connection cable or turn off the UT power supply during an upload.

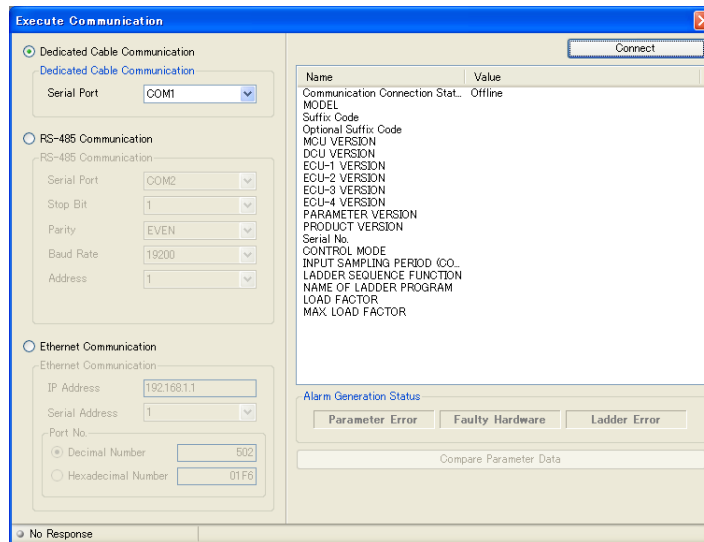
2.11 Comparing Data with UT's Data

Procedure

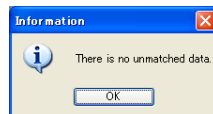
1. Click on [Communication] – [Compare Communication] in the menu to display the Select Comparison Range window.



2. Select the comparison range and click the [OK] button to display the Execute Communication window.

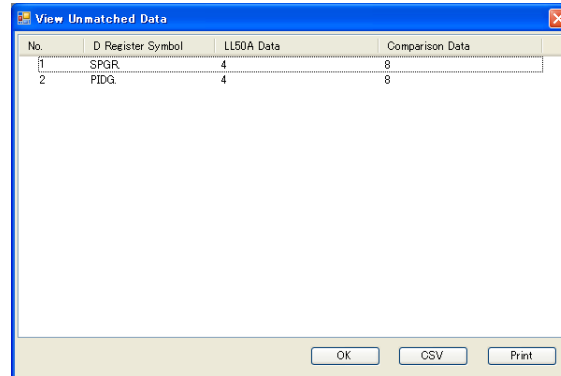


3. Set up the communication conditions and click the [Execute Parameter Comparison] button to start parameter comparison. When parameter data matches the UT's data, the following message appears. If there is any mismatch, the mismatched data is displayed.



2.11 Comparing Data with UT's Data

Window displayed if there is mismatched data



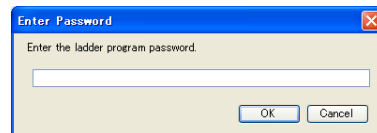
The contents of mismatch can be output to a .csv format file.

If the following message appears during data comparison, follow the instructions of the message.

If the parameter version is different, data may not be properly compared.

- To cancel comparison, click the [No] button.
- To continue comparison, click the [Yes] button.

If a ladder program password has been set to data to be compared, the Enter Password dialog box appears. Enter the password and click the [OK] button.



Description

The password can be up to eight single-byte alphanumeric characters and is case-sensitive.

<Execute Communication window>

- Serial Port: A port available for a PC is automatically displayed.
- Stop Bit, Parity, Baud Rate, and address: Set these items according to the UT's communication conditions. Data length: fixed 8 bit
- IP Address: Set this address according to the UT's IP address (for Ethernet communication).
- Serial Address: Set the UT's RS-485 communication address if communication is made via an Ethernet/RS-485 converter (e.g., model VJET). (Not allowed to be duplicated)
- Port Number: Set the port number. (Decimal Number or Hexadecimal Number)

If data is downloaded via a maintenance port, nothing is displayed in the Alarm Generation Status in the Excute Communication window. In addition, "-" is displayed for the Load Factor and Max Load Factor when using a ladder program.

Note

- Do not disconnect a connection cable or turn off the UT power supply during data comparison.
- If the downloaded data includes the ladder program, UT runs the program as soon as the download is completed.

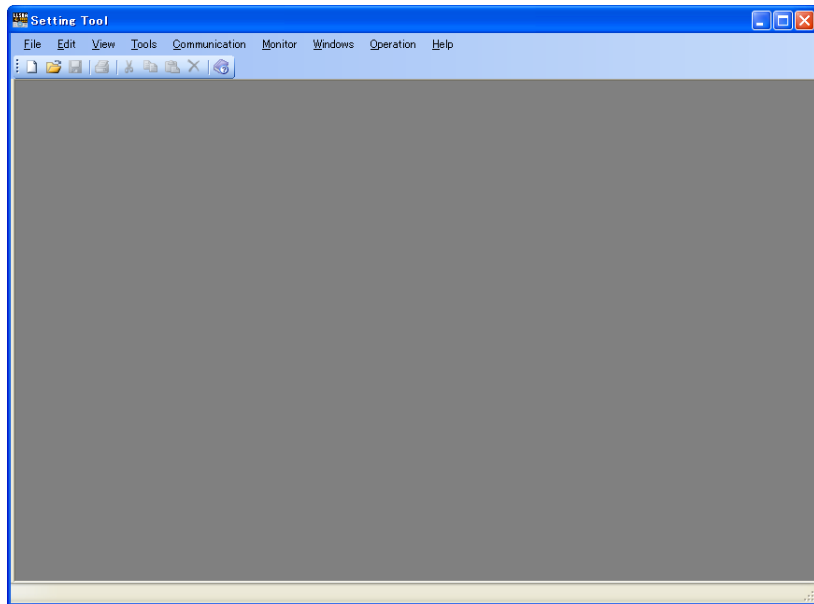
2.12 Monitoring/Changing Data

2.12.1 Monitoring/Changing Tuning Data

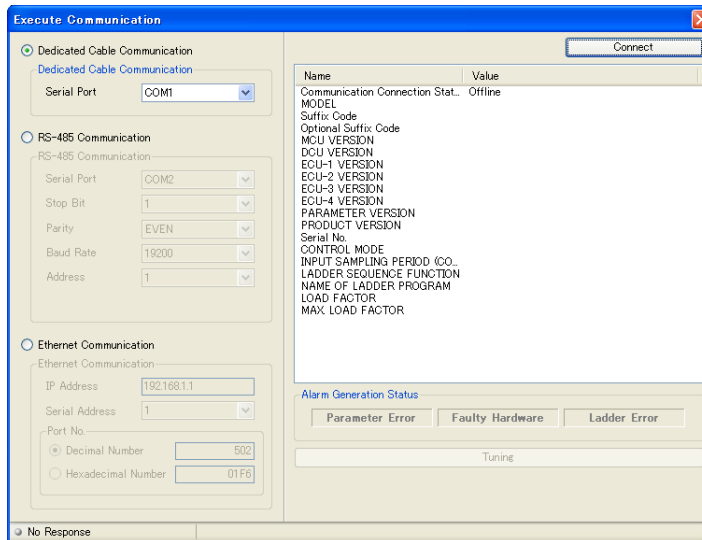
For details of the tuning function, see the “description” given later.

Procedure

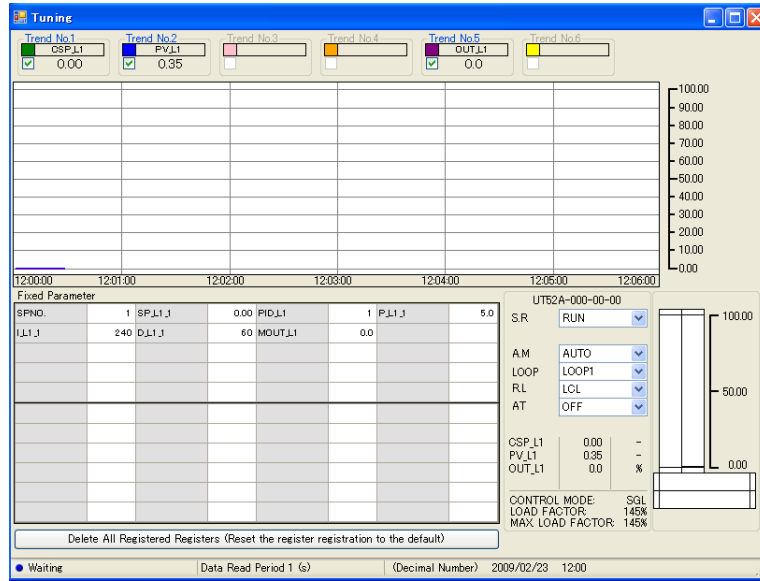
1. Display the Basic window.



2. Click on [Monitor] – [Tuning] in the menu to display the Execute Communication window.

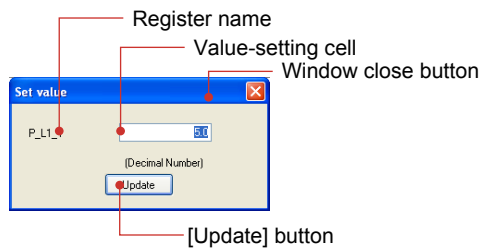


3. Set up the communication conditions and click the [Execute Tuning] button to display the Tuning window.




4. By observing PV, SP, and OUT trends, change the proportional band, integral time, and derivative time according to the register values in the register monitor display area.

5. Double-click in the cell of a register value that you want to change to display the Set Value window.



A value is displayed in the data format selected by clicking on [Monitor] – [Display Format] in the menu.

6. Enter a value and click the [Update] button.
7. To close the window, click .

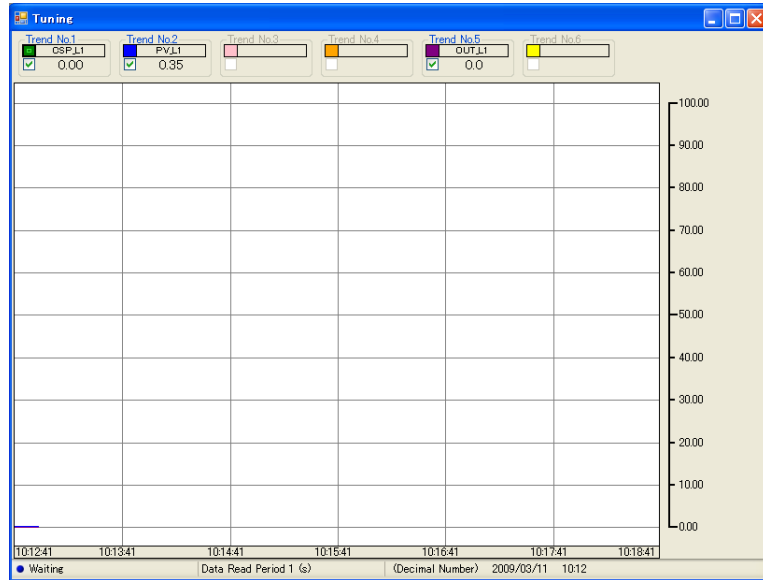
If trend data has not yet been saved during tuning, a dialog box asking if you want to save data appears.

- To save the data, click the [Yes] button.
- To discard the data, click the [No] button.
- To return to tuning, click the [Cancel] button.

Making register-monitoring display invisible

Procedure

1. Click on [View] – [Monitor Register] in the menu.



Clearing tuning trend

Procedure

1. Click on [Monitor] – [Clear Trend] in the menu.

This function clears only the display; no data will be deleted.

Description

The tuning function performs tuning by communicating with one UT.

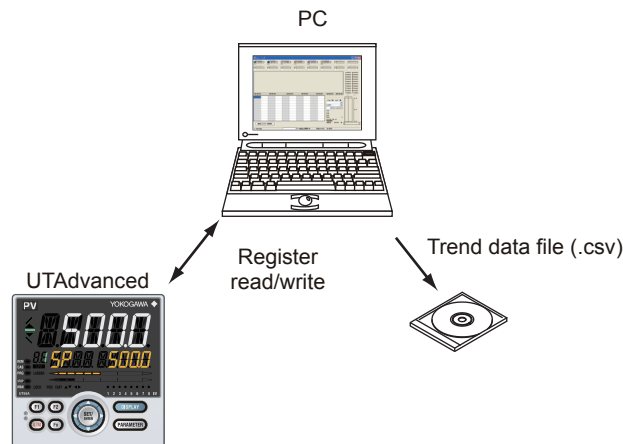
This function is primarily used at system startup. The recommended trend acquisition period is one day. The tuning function displays and acquires PV, SP, and OUT values as trend data. Acquired trend data can be saved in a file in .csv format. A maximum of 65,000 acquisition times of trend data can be saved irrespective of the data read cycle. If the number of acquisition times exceeds 65,000, acquired data will automatically be saved in another file.

Example: If data acquisition is performed the 65,000st time at 21:30:50 on May 20, 2009, the name of the file containing this data is 2009_05_20_21_30_50.csv.

Note

If the control mode, control type, scale parameter, or another item is changed while the Tuning window is displayed, once close the Tuning window and then re-open it to refresh the displayed values.

If a register value is changed, the change is reflected in the UT.
Multiple Tuning windows cannot be displayed simultaneously.



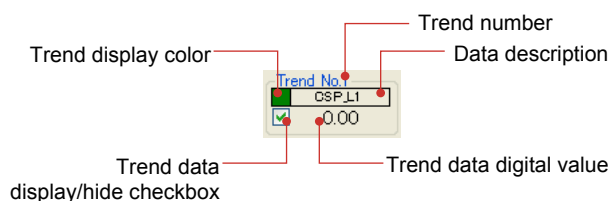
<Execute Communication window>

- Serial port: A port available for a PC is automatically displayed.
- Stop bit, parity, baud rate, data length, and address: Set these items according to the UT's communication conditions.
- IP address: Set this address according to the UT's IP address (for Ethernet communication).
- Serial address: Set the UT's RS-485 communication address if communication is made via an Ethernet/RS-485 converter (e.g., model VJET). (Not allowed to be duplicated)
- Port number: Set the port number.

Note

Do not disconnect a connection cable or turn off the UT power supply during trend data tuning.

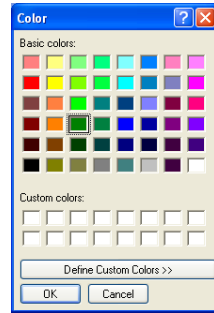
(1) Trend data digital-value display section



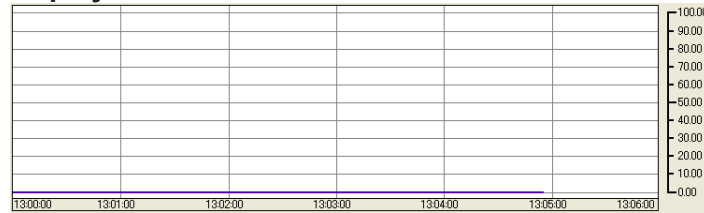
Display	Description
Number of trend data displayed	Up to six data
Trend data display/ hide checkbox	Select whether or not to display trend data on a graph using a check mark. Even if trend data is made invisible, a trend data digital value is displayed and can be output in .csv file format as trend data.
Trend display color	Clicking on the trend display color causes the Color dialog box to appear, enabling you to change the display color.
Data description	<p><When suffix code type 1 (basic control) is standard type or Position proportional type></p> <p>When the control mode is anything other than Cascade control and the control type is anything other than Two-position two-level control or Heating/cooling control:</p> <p>Trend 1: CSP_L1 (target setpoint) Trend 2: PV_L1 (measured input value) Trend 3: None Trend 4: None Trend 5: OUT_L1 (control output value) Trend 6: None</p> <p>When the Control mode is Cascade control and the control type is anything other than Two-position two-level control or Heating/cooling control:</p> <p>Trend 1: CSP_L1 (Loop-1 target setpoint) Trend 2: PV_L1 (Loop-1 measured input value) Trend 3: CSP_L2 (Loop-2 target setpoint) Trend 4: PV_L2 (Loop-2 measured input value) Trend 5: OUT_L2 (control output value) Trend 6: None</p> <p><When suffix code type 1 (basic control) is Heating/cooling type></p> <p>When the control mode is anything other than Cascade control and the control type is anything other than Heating/cooling control or Two-position two-level control:</p> <p>Trend 1: CSP_L1 (target setpoint) Trend 2: PV_L1 (measured input value) Trend 3: None Trend 4: None Trend 5: HOUT_L1 (heating-side or main setting-side control output value) Trend 6: COUT_L1 (cooling-side or sub-setting-side control output value)</p> <p>When the control mode is Cascade control and the control type is anything other than Two-position two-level control or Heating/cooling control:</p> <p>Trend 1: CSP_L1 (Loop-1 target setpoint) Trend 2: PV_L1 (Loop-1 measured input value) Trend 3: CSP_L2 (Loop-2 target setpoint) Trend 4: PV_L2 (Loop-2 measured input value) Trend 5: HOUT_L2 (heating-side or main setting-side control output value) Trend 6: COUT_L2 (cooling-side or sub-setting-side control output value)</p>
Trend data digital value	Data read from the UT (Max. 7 digits including the sign and decimal point) is displayed.

2.12 Monitoring/Changing Data

Color Setting window



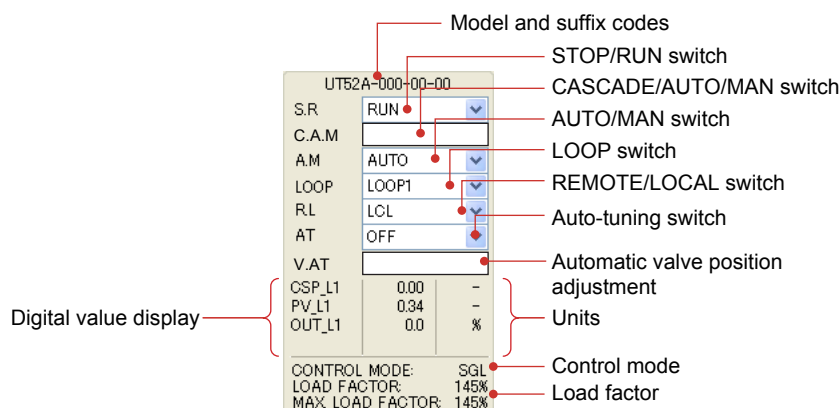
(2) Trend display area



Display	Description
Scale display	Maximum value to minimum value of the input range (Loop 1 and Loop 2) Scale divisions: 11
Trend	Trend data of -5.0 to 105.0% (0 to 100% scale) is displayed. Display update period: Data read cycle Plotting: Plotting from the left When the trend is plotted up to the right end, the display area is scrolled to the left by 2/3 hours on the time-axis scale. If a value exceeds the range, trend display is limited. However, read data is saved as is in a .csv file. Trend data is displayed starting on the left end.
X-axis (time-axis) scale	The time axis is automatically calculated according to the data read cycle.
Background color	Right-clicking on the trend graph and selecting Background Color from the shortcut menu which appears causes the Color dialog box to appear, enabling you to change the trend display color.

(3) Loop information display area

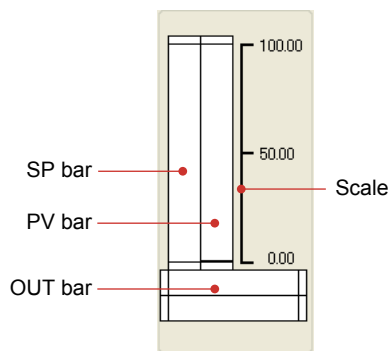
This area displays loop information selected by LOOP switching.



Display	Description
Model and suffix codes	This field displays the model and suffix codes read out when the window is opened.
STOP/RUN switching	Displays the operation status, which can be switched. RUN: Starts operation. STOP: Stops operation.
CASCADE/AUTO/MAN switching (only for UT55A/UT52A)	Displays the operation status. It is displayed when the control mode is Cascade control or Secondary-loop cascade control. It can be switched. CAS: Cascade AUTO: Automatic MAN: Manual
AUTO/MAN switching	Displays the operation status. It is displayed when the control mode is anything other than Cascade control or Secondary-loop cascade control. It can be switched. AUTO: Automatic MAN: Manual
LOOP switching (only for UT55A/UT52A)	The loop can be switched between LOOP1 and LOOP2 when the control mode is Cascade control.
REMOTE/LOCAL switching (only for UT35A/UT32A with communication)	Displays the operation status. It is displayed when the control mode is anything other than Secondary-loop cascade control. It can be switched. LCL: Local REM: Remote
Auto-tuning switching	Enables auto-tuning to be activated or deactivated. When auto-tuning is activated, optimized PID values are set to the UT and are displayed and updated in the register monitor display area at the next data read cycle. When auto-tuning finishes, OFF is displayed at the next read cycle. UT35A/UT32A: Switchable among OFF, 1 to 4, and R UT55A/UT52A: Switchable among OFF, 1 to 8, and R
Automatic valve position adjustment	Activates and deactivates automatic valve position adjustment. This is available only in position proportional type. When automatic valve position adjustment finishes, OFF is displayed at the next data read cycle. Switchable between OFF and ON If an automatic valve position adjustment error occurs in the UT, an error icon is displayed.
SV and PV digital value display	PV and SV digital values are read from the UT and displayed. The values are max. 7 digits including the sign and decimal point.
OUT digital value display	OUT digital values are read from the UT and displayed. The values are max. 7 digits including the sign and decimal point.
Unit display	Displays units.
Control mode (only for UT55A/UT52A)	Displays control mode.
Load factor and maximum load factor	Displays the load factor and maximum load factor of ladder programs.

The display update period is the data read cycle. Data to be updated are those other than the model and suffix codes, unit display, and control mode.

(4) Bar graph display area



Display	Description
SP and PV bars	Display the SP and PV values of the loop selected by LOOP switching in a bar graph. LOOP1 SP bar: green, PV bar: blue LOOP2 SP bar: pink, PV bar: orange
OUT bar	Displays OUT values in a bar graph. Control output or heating-side control output: purple Cooling-side control output: yellow
Scale	The maximum value to minimum value of the input scale (Loop 1 and Loop 2) Memory: 3 points

The display update period is the data read cycle. Data to be updated are SP bar, PV bar, and OUT bar.

D-register symbols

For some register symbols, the loop number, terminal area number, and group number are indicated by adding the underscore (_) to the end of a parameter symbol. If both the loop number and group number are added to a parameter symbol, they are added to it in the order of _loop number and _group number.

xxxx_Ln_Y

Ln: loop number (L1 or L2)

Y: group number (1 to 8 or 1 to 16, R)

xxxx_En

En: terminal area number (E1 to E4)

Example:

SP_L1_3: This means Loop-1 group-3 target setpoint.

PYS_2: This means group-2 PYS.

DI1.D_E1: This means E1-terminal area DI1.D.

Note

Since the UT35A/UT32A is a single-loop controller, it has no distinction between Loop-1 and Loop-2. However, the register symbol has "L1" which indicates Loop-1.

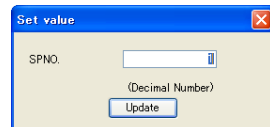
Note

When hexadecimal display is selected, the integers of registers are displayed in hexadecimal numbers, except DAT01 to DAT20. (No decimal point position is displayed.)

DAT01 to DATA20 use 32-bit floating-point numbers of the IEEE 754 format in hexadecimal notation.

Set Value window

When a register set value is registered in the register monitor display area, the following Set Value window appears.

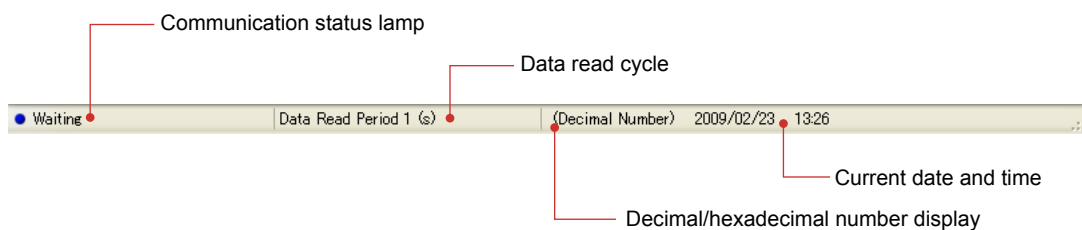


Actions to be taken when the Set Value window is closed

The display of the following data will be updated:

- Trend data digital value
- LOOP information display area
- Bar graph display
- Register monitor display area

Even if the Set Value window is opened and then closed without changing a set value, the displays will be updated irrespective of the data read cycle.

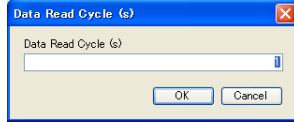
(6) Status bar display area

Display	Description
Communication status lamp	Green: Communicating Blinks at the data read cycle. Blue: Waiting (lit) Red: Delay occurring (Lit) Gray: No response
Progress bar display	The progress rate is indicated in a bar display. (when Save Tuning Data)
Data read cycle	Double-clicking on this item causes the Set Data Read Cycle window to open.
Decimal/hexadecimal display	Enables you to check if a register value is displayed in whichever data format of decimal or hexadecimal numbers. It can be switched by the command from the menu. Click on [Monitor], select [Display Format], and click on [Decimal] or [Hexadecimal] in the menu.
Current date	PC system date (year/month/day)
Current time	PC system time (hour : minute)

2.12.2 Setting Data Read Cycle

Procedure

1. Double-click on the data read cycle display field in the status bar display area.



2. Set a data read cycle and click the [OK] button.

Description

Data is read during tuning, while monitoring registers, and at the set data read cycle.
Setting range: 1 to 3600 sec

If the data read cycle is changed during tuning, the X-axis (time-axis) span of the trend graph changes as shown in the table below. The trend graph displayed is deleted, and trend data starts to be plotted from the left end of the X axis (time axis).

Data Read Cycle	X-axis (Time-axis) Span
1 sec	6 min
2 sec	12 min
60 sec	6 hr


Note

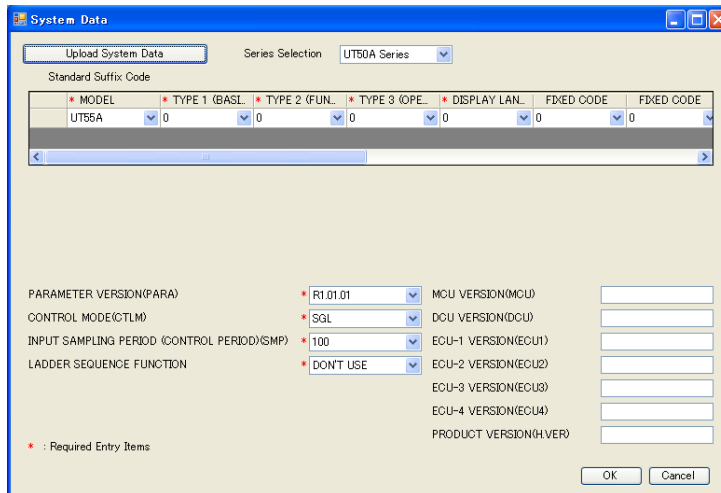
If communication processing is unable to meet the set data read cycle, a communication delay occurs.

2.13 Managing Files

2.13.1 Creating a New File

Procedure

1. Click on [File] – [New] in the menu or click  on the toolbar to display the Set System Data window.



* MODEL	* TYPE 1 (BASL.)	* TYPE 2 (FUN.)	* TYPE 3 (OPE.)	* DISPLAY LAN.	FIXED CODE	FIXED CODE
UT55A	0	0	0	0	0	0

PARAMETER VERSION(PARA) * R1.01.01 MCU VERSION(MCU)

CONTROL MODE(CTLM) * SGL DCU VERSION(DCU)

INPUT SAMPLING PERIOD (CONTROL PERIOD)(SMP) * 100 ECU-1 VERSION(ECU1)

LADDER SEQUENCE FUNCTION * DONT USE ECU-2 VERSION(ECU2)

ECU-3 VERSION(ECU3)

ECU-4 VERSION(ECU4)

PRODUCT VERSION(H.VER)

* : Required Entry Items

OK Cancel


Items with an asterisk (*) are required to be entered.

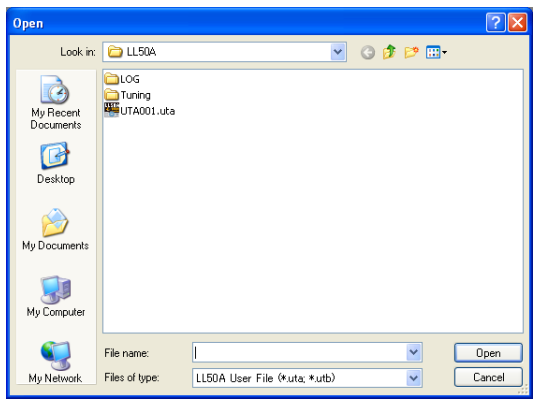
CONTROL MODE (CTLM), INPUT SAMPLING PERIOD (CONTROL PERIOD) (SMP) and ECU-2 VERSION (ECU2) are displayed for UT55A/UT52A only.

2. Enter system data or click the [Upload System Data] button and then click the [OK] button.
3. For operations such as setting parameters and creating user file information, see the relevant section.

2.13.2 Opening a User File

Procedure

1. Click on [File] – [Open] in the menu or click  on the toolbar to display the Open File window.



2. See the following table for the user file extension.
For operations such as setting parameters and creating user file information, see the relevant section.

If a password has been set to a user file, enter the user file password.

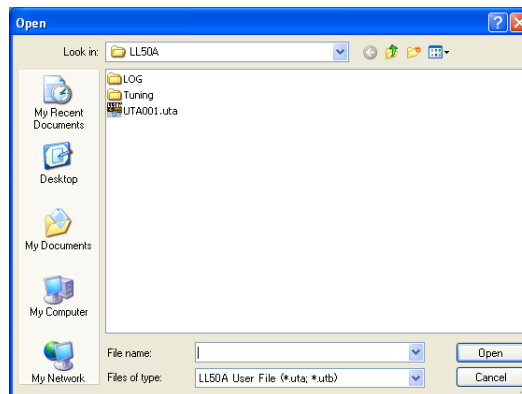
Extension

Model	Extension
UT55A/UT52A	uta
UT35A/UT32A	utb

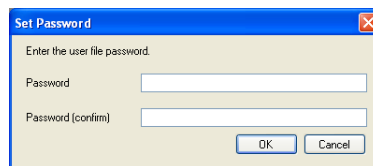
2.13.3 Setting a User File Password

Procedure

1. With the file concerned closed, click on [File] – [Set User File Password] in the menu to display the Open File window.



2. Select the user file to which you want to set a password and then click [Open].
3. Enter the password and click the [OK] button. The password can be up to eight single-byte alphanumeric characters.



Description

If a user file password is set to the user file, it is necessary to enter the password in the opening a user file or comparing with file data.

When setting a user file password, it is necessary to close the file in use.


2.13.4 Closing a File

Procedure

1. Click on [File] – [Close] in the menu to close the file in use.
To save a file in use, save it by entering a file name.

2.13.5 Saving by Overwrite

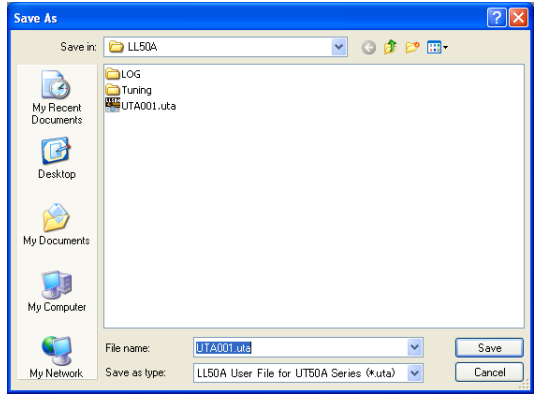
Procedure

1. Click on [File] – [Save] in the menu or click  on the toolbar to save data in use.

2.13.6 Saving a File

Procedure

1. Click on [File] – [Save As] in the menu to display the Save As window. A file name can be up to 40 single-byte characters (20 two-byte characters).
LL50A User File for UT30A Series (*.utb)
LL50A User File for UT50A Series (*.uta)

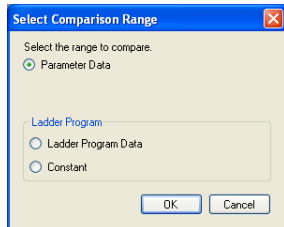


2. Enter a name for the file and click the [Save] button. The user file extension is “uta.”

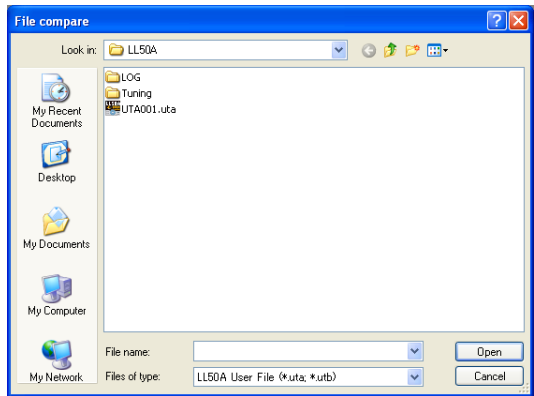
2.13.7 Comparing with File Data

Procedure

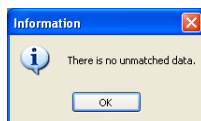
1. Click on [File] – [Compare File] in the menu to display the Select Compare Range window.



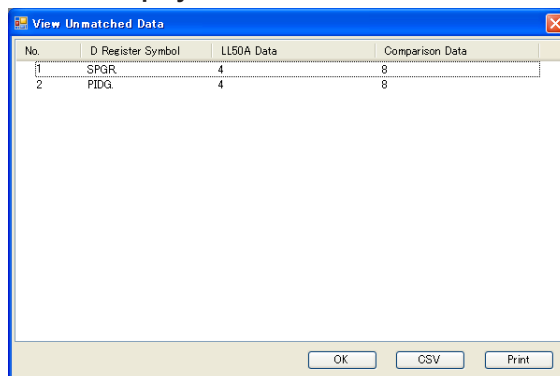
2. Select the comparison range and click the [OK] button.
3. Open a file to be compared and click the [Open] button.



4. Execute data comparison. When working data matches the file data, the following message appears. If there is any mismatch, the mismatched data is displayed.



Window displayed if there is mismatched data



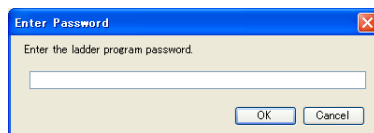
The details of the mismatch can be output to a file in .csv format.

If the following message appears during data comparison, follow the instructions of the message.

If there is a difference in the parameter version, data may not be properly compared.

- To cancel comparison, click the [No] button.
- To continue comparison, click the [Yes] button.

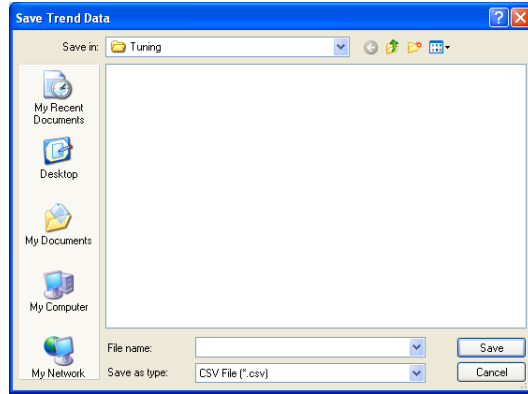
If a password has been set to data to be compared, the Enter Password dialog box appears. Enter the password and click the [OK] button.



2.13.8 Saving Tuning Data

Procedure

1. Click on [File] – [Save Trend Data] in the menu during tuning to display the Save Trend Data window.



2. Enter a name for the file and click the [Save] button.

Description

Trend data can be saved in .csv file format. A maximum of 65,000 acquisition times of trend data can be saved irrespective of the data read cycle. If the number of acquisition times exceeds 65,000, acquired data will automatically be saved in another file.

The save folder cannot be changed.

Example: If data acquisition is performed the 65,000st time at 21:30:50 on May 20, 2009, the name of the file containing this data is 2009_05_20_21_30_50.csv.

Example of Single-loop control for UT55A/UT52A

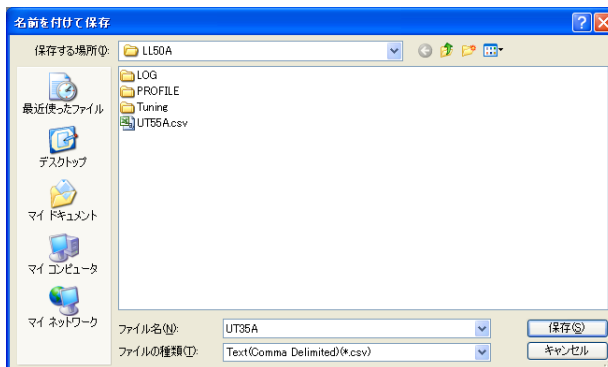
Title		Unit data		IP Address		Serial AddressLoop		Control mode		Control type	
UT55A-000-00-00								1 SGL		Standard type	
Trend information		Loop number	Data	Decimal point position	Unit	Line color	Min.	Max.			
Trend number1	LOOP1	CSP_L1		1 -		Green	-2700	13700			
Trend number2	LOOP1	PV_L1		1 -		Blue	-2700	13700			
Trend number3											
Trend number4	LOOP1	OUT_L1			1 %	Purple	0	100			
Trend number5											
Trend number6											

Trend data		Time	Trend1	Trend2	Trend3	Trend4	Trend5	Trend6
Date								
	2009/3/11	9:36:40	-270		0.1		0	
	2009/3/11	9:36:40	-270		0.1		0	
	2009/3/11	9:36:41	-270		0.1		0	
	2009/3/11	9:36:42	-270		0.1		0	
	2009/3/11	9:36:43	-270		0.1		0	
	2009/3/11	9:36:44	-270		0.1		0	
	2009/3/11	9:36:45	-270		0.1		0	
	2009/3/11	9:36:46	-270		0.1		0	
	2009/3/11	9:36:47	-270		0.1		0	
	2009/3/11	9:36:48	-270		0.1		0	
	2009/3/11	9:36:49	-270		0.1		0	
	2009/3/11	9:36:50	-270		0.1		0	
	2009/3/11	9:36:51	-270		0.1		0	
	2009/3/11	9:36:52	-270		0.1		0	
	2009/3/11	9:36:53	-270		0.1		0	
	2009/3/11	9:36:54	-270		0.1		0	
	2009/3/11	9:36:55	-270		0.1		0	
	2009/3/11	9:36:56	-270		0.1		0	
	2009/3/11	9:36:57	-270		0.1		0	
	2009/3/11	9:36:58	-270		0.1		0	
	2009/3/11	9:36:59	-270		0.1		0	
	2009/3/11	9:37:00	-270		0.1		0	
	2009/3/11	9:37:01	-270		0.1		0	
	2009/3/11	9:37:02	-270		0.1		0	
	2009/3/11	9:37:03	-270		0.1		0	
	2009/3/11	9:37:04	-270		0.1		0	
	2009/3/11	9:37:05	-270		0.1		0	
	2009/3/11	9:37:06	-270		0.1		0	
	2009/3/11	9:37:07	-270		0.1		0	
	2009/3/11	9:37:08	-270		0.1		0	
	2009/3/11	9:37:09	-270		0.1		0	
	2009/3/11	9:37:10	-270		0.1		0	

2.13.9 Saving a CSV File

Procedure

1. Click on [File] – [Save as CSV File] in the menu to display the Save As window. A file name can be up to 40 single-byte characters (20 two-byte characters).



2. Enter a name for the file and click the [Save] button. The user file extension is “uta.”

Description

Example of CSV format

```
File          New File
Model         UT35A-000-00-00
Control       SGL
Product
Parameter     R0.01.05
```

```
File Information
File Information
Customer Name
Delivery Destination
Device Name
Model Name
Order No.
Serial Number
Author
Date Created
Specification Number
Revision No.
Function Overview
Memo
```

```
System Data
Name          Set Value
Model and suffix codes : UT35A-000-00-00
PARAMETER VERSION R0.01.05
LADDER SEQUENCE FUNCTION DONT USE
MCU VERSION
DCU VERSION
ECU-1 VERSION
ECU-3 VERSION
ECU-4 VERSION
PRODUCT VERSION
```

```
Setup Parameter - CTL
D Register Symbol      Name          Set Value          Unit
ONT.L1                 CONTROL TYPE  PID:PID control
ALG.L1                 PID CONTROL MODE  0:Standard PID control mode
SPGR                   NUMBER OF SP GROUPS  4
ALNO.L1                NUMBER OF ALARMS  4
ZON                     ZONE PID SELECTION  0:SP group number selection 1
PIDG.                  NUMBER OF PID GROUPS  4
```

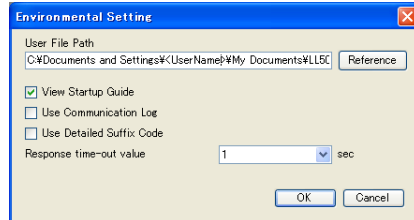
```
Setup Parameter - PV
D Register Symbol      Name          Set Value          Unit
IN                     PV INPUT TYPE  OFF:OFF:Disable
UNIT                   PV INPUT UNIT  C:Degree Celsius
RH                     MAXIMUM VALUE OF PV INPUT RANGE  13700
RL                     MINIMUM VALUE OF PV INPUT RANGE  -2700
```

•
•
•
•

2.13.10 Making Environmental Settings

Procedure

1. Click on [File] – [Environmental Setting] in the menu to display the Environmental Setting window.



2. Set the path and click the [OK] button.

Description

- **User File Path**
Shows the predetermined LL50A user file storage location.

Note

For Windows Vista, do not set a path that includes the Program Files folder. Otherwise, the LL50A Parameter Setting Software will not run properly.

- **View Startup Guide**
If this item is checked, the Startup Guide is displayed at startup.
- **Use Communication Log**
If this item is checked, communication logs are output to the specified location.
- **Use Detailed Suffix Code**
If this item is checked, the detailed model and suffix codes are available when creating a new file.
- **Response time-out value**
Set the response time-out value longer if the response of UT is late in each monitoring. The value can be set for 1 to 10 seconds.

The directories (default values) to which each file is stored are as shown below:

For Windows Vista

File Type	Storage Directory (Default)
User files for UT55A/UT52A (.uta)	C:\Users\<UserName>\Documents\LL50A
User files for UT35A/UT32A (.utb)	
Trend files (.csv)	C:\Users\<UserName>\Documents\LL50A\Tuning
Communication log files (.log)	C:\Users\<UserName>\Documents\LL50A\LOG The directory cannot be changed.

For Windows XP

File Type	Storage Directory (Default)
User files for UT55A/UT52A (.uta)	C:\Documents and Settings\<UserName>\My Documents\LL50A
User files for UT35A/UT32A (.utb)	
Trend files (.csv)	C:\Documents and Settings\<UserName>\My Documents\LL50A\Tuning
Communication log files (.log)	C:\Documents and Settings\<UserName>\My Documents\LL50A\LOG The directory cannot be changed.

2.14 Window Operations

Window operations

Procedure

1. Click on [Window] – [following command] in the menu.

The following window operations are available:

- Cascade
- Tile Horizontal
- Tile Vertical
- Arrange Icons
- Close All

Making the toolbar, palette, or window visible/invisible

Procedure

1. Click on [View] – [following command] in the menu.

The following operations are available:

- Making the toolbar visible/invisible



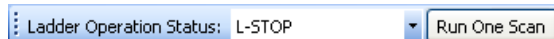
- Making the status bar visible/invisible

Number of steps: 69 / 500 Edit Mode: Overwrite

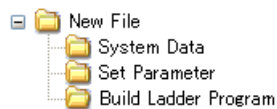
- Making the Instruction palette visible/invisible



- Making the ladder operation status toolbar visible/invisible

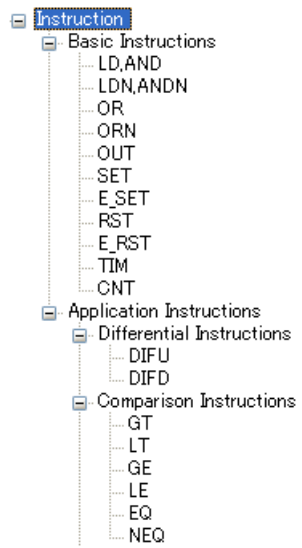


- Making the File window visible/invisible

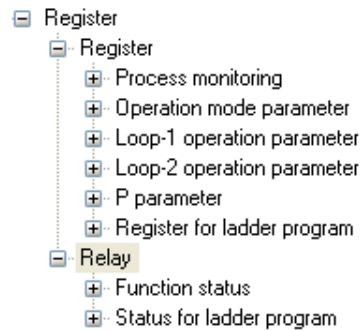


2.14 Window Operations

- Making the Instruction window visible/invisible



- Making the Register window visible/invisible

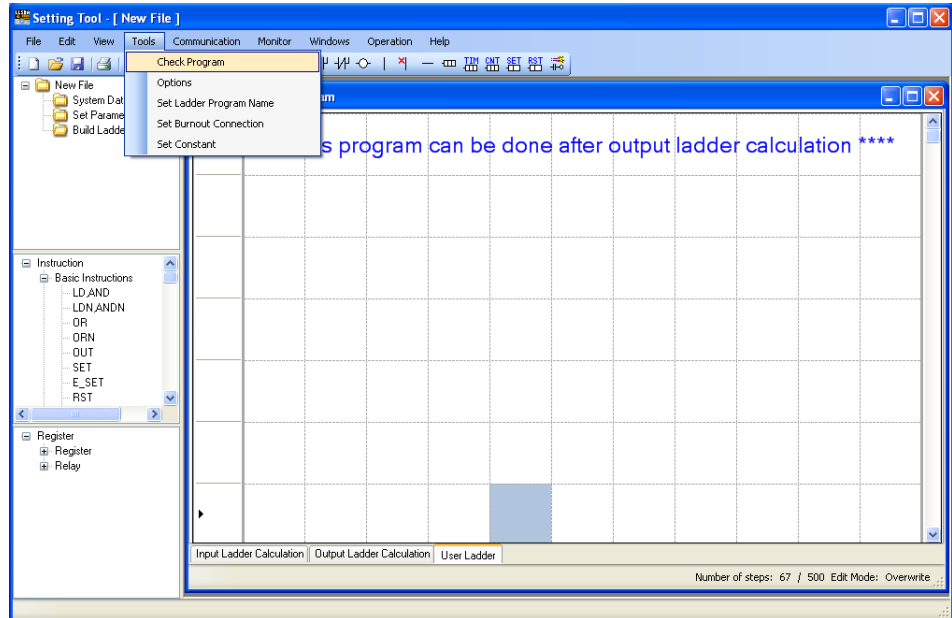


- Making the Monitor Register window visible/invisible
See 2.12.1, Monitoring/Changing Tuning Data.

2.15 Activating Single-byte Character Entry

Procedure

1. Click on [Tool] and place a checkmark in [Single-byte Input Mode] in the menu to enable single-byte character entry.




Description

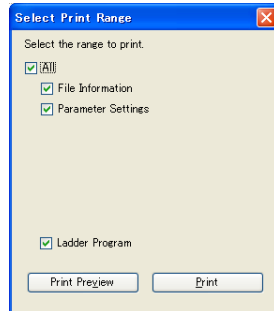
The Single-byte Input mode is used for entering user file information or program comments. To upload/download data between operating systems (OS) of different languages or to open a file, do so in the Single-byte Input mode to prevent the corruption of characters.


To cancel the Single-byte Input mode, remove the checkmark as described above.

2.16 Printing

Procedure

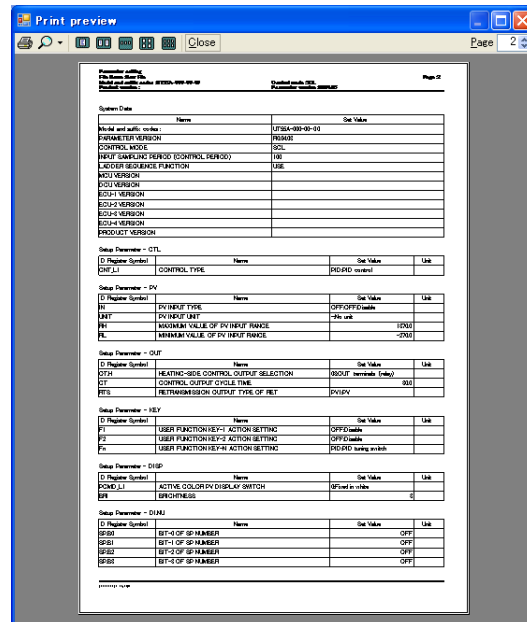
1. Click on [File] – [Print] in the menu or click  on the toolbar to display the Select Printing Range window.



2. Select the data to be printed and click the [Print] button to display the Printing window.
Clicking [Printing Preview] enables a printing image to be displayed as shown below.
3. After finishing printing, click .

Description

The following shows a printing image.



2.17 Initializing the UT

Initializing the UT to Factory Defaults

Use this feature if you have forgotten the password of ladder programs downloaded to the UT and want to download new ladder programs.

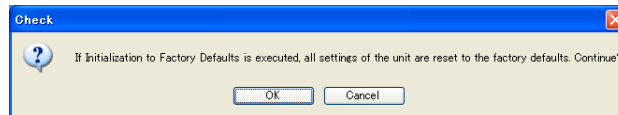
Take care to prevent casual use of the password assigned in this section.

Note

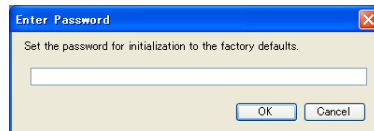
The user setting values are not initialized even if the parameter setting values are initialized to the factory default values.


Procedure

1. Change to the status that enables communication with the UT.
2. Click on [Operation] – [Initialize] – [Initialize to Factory Defaults] in the menu. The following confirmation message is displayed; click the [OK] button.



3. Enter the initialization password "UTAdvanced_INIT" and click the [OK] button. (Single-byte alphanumeric characters)



4. The Execute Communication window appears. Click the [Initialize to Factory Defaults] button to start initialization. To cancel initialization, click .

Setting the User Default Values

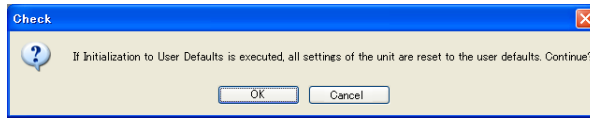
Parameter data set to the UT can be set as the user default values.

CAUTION

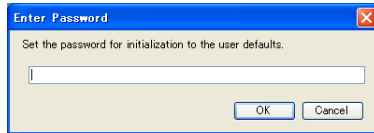
Before registering the user setting value as the user default value, make sure that the user setting value is set to the parameter. The ladder program can not be registered as user default values.


Procedure

1. Change to the status that enables communication with the UT.
2. Click on [Operation] – [Set User Defaults] in the menu. The following confirmation message is displayed; click the [OK] button.



3. Enter the initialization password “UTAdvanced_INIT_SET” and click the [OK] button. (Single-byte alphanumeric characters)

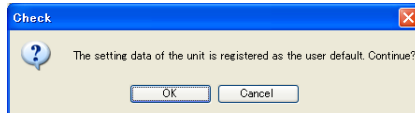


4. The Execute Communication window appears. Click the [Set User Defaults] button to start user default value setting.
To cancel user default value setting, Click .

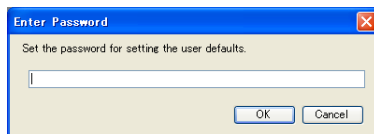
Initializing to the User Default Values


Procedure

1. Change to the status that enables communication with the UT.
2. Click on [Operation] – [Initialize] – [Initialize to User Defaults] in the menu. The following confirmation message is displayed; click the [OK] button.



3. Enter the initialization password “UTAdvanced_USER_INIT” and click the [OK] button. (Single-byte alphanumeric characters)

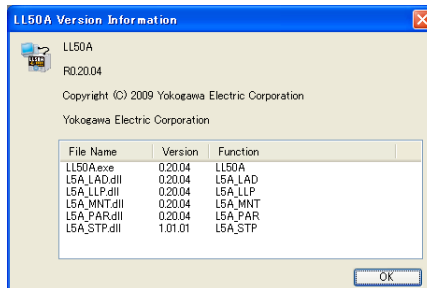



4. The Execute Communication window appears. Click the [Initialize to User Defaults] button to start initialization.
To cancel initialization, click .

2.18 Checking Software Version

Procedure

1. Click on [Help] – [Version Information] in the menu to display the LL50A Version Information window.



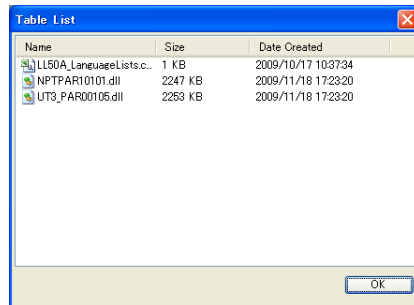
2. To close the window, click the [OK] button or .


2.19 Viewing the List of Tables

The list of tables shows the names of .dll and .xml files contained in the Table folder of the LL50A Parameter Setting Software.

Procedure

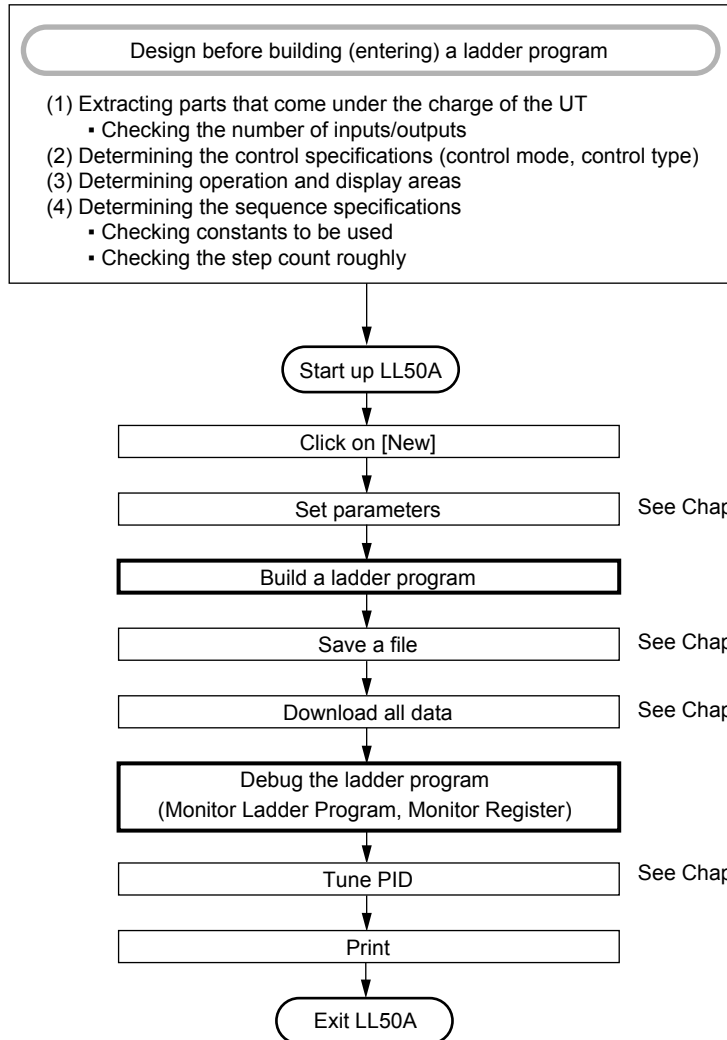
1. Click on [Help] – [Table List] in the menu to display the Table List window.



2. To close the window, click the [OK] button or .

3.1 Flow of Building a New Ladder Program

The ladder sequence function must be set to "USE" and the control mode must be set in the System Data window beforehand. UT35A/UT32A does not have the parameter CTLM (Control mode.)

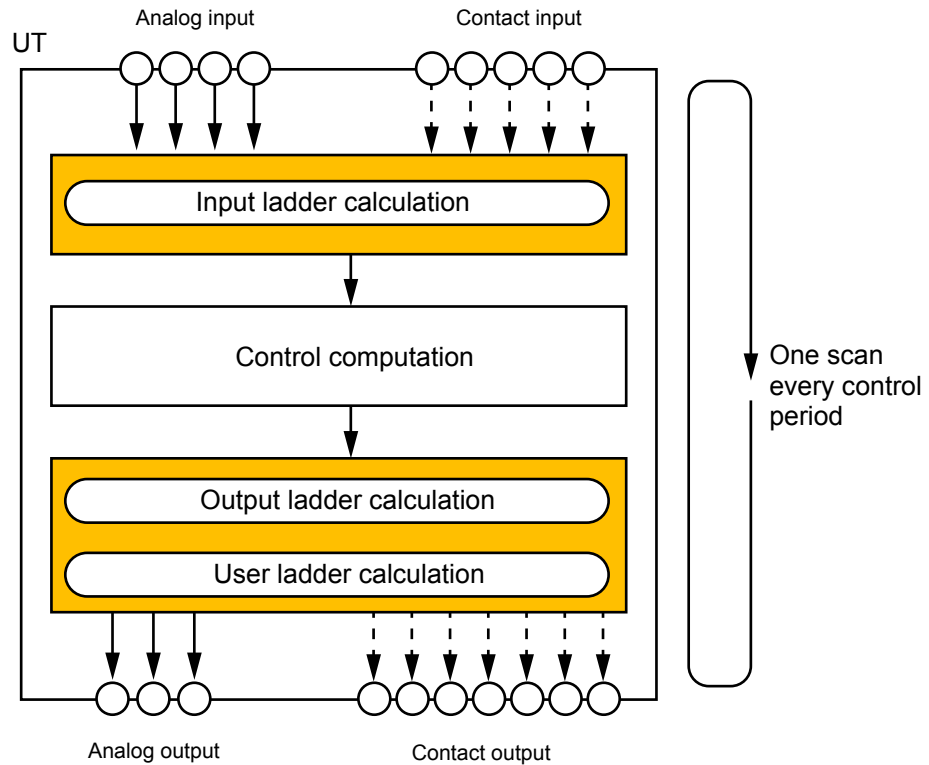


3.1 Flow of Building a New Ladder Program

Configuration of ladder program

A ladder program consists of three parts: the input ladder calculation executed before control computation, the output ladder calculation performed after control computation, and user ladder calculation. Each calculation section is repetitively executed every control period.

The sequence of calculation/computation is: input, input ladder calculation, control computation, output ladder calculation, user ladder calculation, and output.

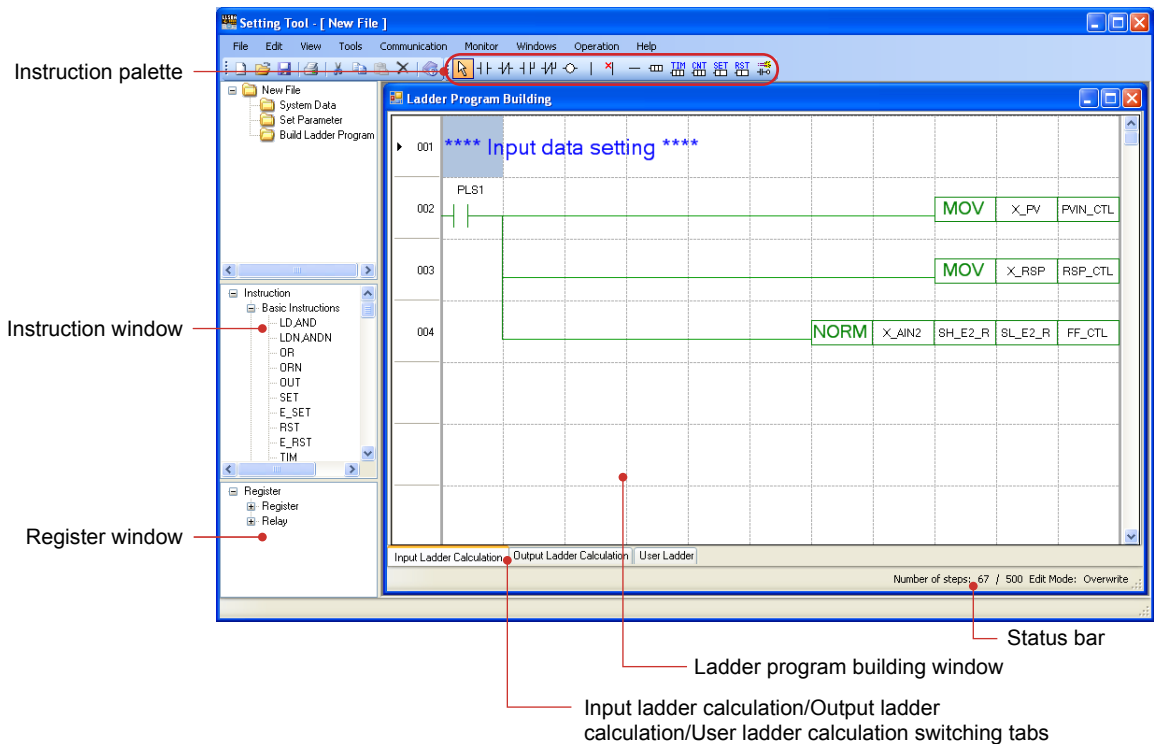


Load Factor of Ladder Program

Normally, use the ladder program with the load factor of the range not more than 100%. However, if the control period is set to 50 ms, the maximum load factor should be the value which subtracted the load factor for the following function usage from 100%.

- Filter function: 10%
- Alarm setpoints more than 5 points (ALNO \geq 5): 10%
- Optional suffix code "/DR": 15%
- UT55A-x7x (AIN2/AIN4): 10%
- 10-segment linearizer function: 5%

3.2 Part Names of the Window and Their Functions




Ladder program building window

This window is used to edit a circuit. It enables you to edit a ladder program of up to 200 lines x 11 columns.

Instruction palette

This area displays instruction icons. You select instruction(s) from the instruction palette to build a circuit.

Instruction window

This window displays a list of ladder instructions. An instruction can be dragged and dropped from the Instruction window to be registered in any column. The instructions in this window are the same as those available in the Input Instruction window displayed by clicking  (application instruction) on the instruction palette.

Register window

This window displays a list of UT registers. A register can be dragged and dropped from the Register window to input the address to any instruction.

Input ladder calculation/output ladder calculation/user ladder window switching tabs

Clicking on a tab below the Build Ladder Program window enables you to switch between the input ladder calculation, output ladder calculation, and user ladder calculation. In the initial status, nothing is described in the user ladder calculation section. These tabs are used to operate only DI and DO regardless of control.

Status bar

- Step count
Displays the number of steps of the ladder program being edited and the maximum number of steps.
Display format: Number of steps being edited/maximum step count
- Edit mode
Displays whether the build ladder program function is in Overwrite mode or in Insert mode.

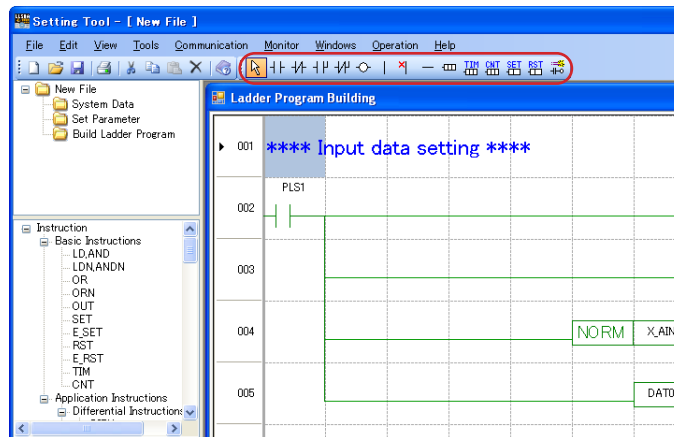
3.3 How to Build a Ladder Program

3.3.1 Registering Basic Instructions (Instruction Palette)

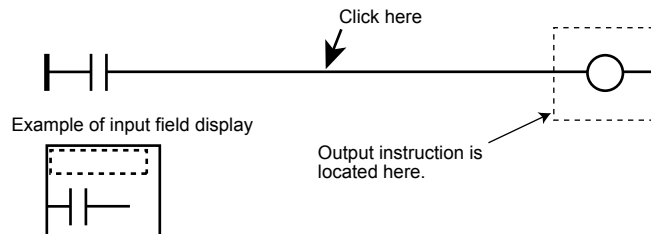
Register a basic instruction from the instruction palette.

Procedure

1. Click a basic instruction button on the instruction palette to change the shape of the mouse cursor to the shape of the selected instruction.



2. Click on the location where you want to enter the instruction. This enables the input field for data entry.
(If an output instruction is input, it is located at the final column instead of the location where you have clicked. In this case, a horizontal connection line is drawn up to the input instruction existing immediately before the clicked position. It is not possible to locate an output instruction in front of an input instruction.)


















3. Enter a register in the input field directly or input it by drag-and-drop from the Register window.
4. Press the Enter key. This causes a parameter to be input to the field, making the instruction accepted.
5. Selected instructions can be registered in succession.
To cancel instruction selection, press the ESC key or click the Selector on the instruction palette.

Note

An input field allows only a register to be registered. Constants, etc. cannot be directly entered in an input field. If you want to enter a constant, use K- or P-register.

List of instructions on the instruction palette

Icon	Name	Description
	Selector	Returns the mouse cursor shape to the ordinary cursor. Clicking on a circuit element causes it to be selected and double-clicking on it enables functions with respect to each circuit element to be selected.
	"a" contact (LD, AND)	Changes the mouse cursor shape to the "a" contact cursor. This function enters an "a" contact at any clicked position.
	"b" contact (LDN, NDN)	Changes the mouse cursor shape to the "b" contact cursor. This function enters a "b" contact at any clicked position.
	"a" contact OR (LDOR)	Changes the mouse cursor shape to the "a" contact OR cursor. This function enters an "a" contact OR at any clicked position.
	"b" contact OR (LDORN)	Changes the mouse cursor shape to the "b" contact OR cursor. This function enters a "b" contact OR at any clicked position.
	Out	Changes the mouse cursor shape to the Out cursor (output coil cursor). This function enters the Out instruction in the final column at any clicked position.
	OR connection line	Changes the mouse cursor shape to the OR connection-line cursor. This function enters an OR connection line to the right end of the column at any clicked position.
	Delete OR connection line	Changes the mouse cursor shape to the OR connection-line cursor. This function deletes an OR connection line from the right end of the column at any clicked position.
	Connection line	Changes the mouse cursor shape to the connection-line cursor. This function enters a connection line at any clicked position.
	Application instruction	Changes the mouse cursor shape to the application instruction cursor. This function displays the Input Instruction dialog box at any clicked position.
	Timer	Changes the mouse cursor shape to the timer cursor. This function enters a timer in the final column at any clicked position.
	Counter	Changes the mouse cursor shape to the counter cursor. This function enters a counter in the final column at any clicked position.
	Set	Changes the mouse cursor shape to the Set cursor. This function enters the Set instruction in the final column at any clicked position.
	Reset	Changes the mouse cursor shape to the Reset cursor. This function enters the Reset instruction in the final column at any clicked position.
	Circuit comment	Changes the mouse cursor shape to the circuit comment cursor. This function enters a circuit comment line at any clicked position.

Making the instruction palette visible/invisible

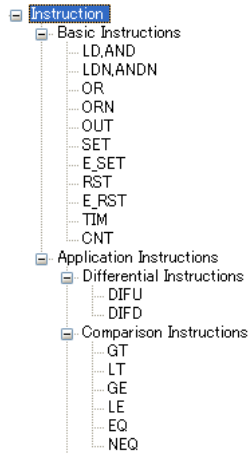
Procedure

1. Click on [View] – [Instruction Palette] in the menu to place a check mark () in front of the menu item. This causes the instruction palette to be displayed. Removing the check mark () causes it to be invisible.

Making the Instruction window visible/invisible

Procedure


1. Click on [View] – [Instruction Window] in the menu to place a check mark () in front of the menu item. This causes the Instruction window to be displayed. Removing the check mark () causes it to be invisible.

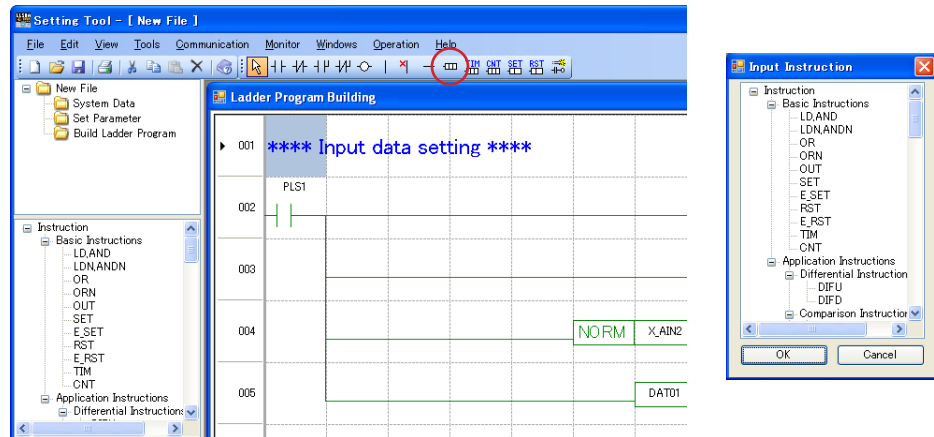


3.3.2 Registering an Application Instruction (Instruction Palette)

Register an application instruction from the instruction palette.

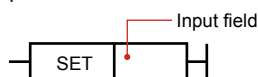
Procedure

1. Click  (application instruction) on the instruction palette to display the Input Instruction window.



2. Click on an instruction that you want to input from among those in the Input Instruction window.
3. Click the [OK] button.
This causes the mouse cursor to change to the shape of the selected instruction. To cancel instruction selection, click the [Cancel] button.

4. Click on the location where you want to input the instruction to describe it at the clicked position. This enables the input field for data entry.
(If an output type instruction is input, it is located at the final column instead of the location where you have clicked. In this case, a horizontal connection line is drawn up to the input instruction immediately before the clicked position. It is not possible to locate an output instruction in front of an input instruction.)



5. Enter a register in the input field directly or input it by drag-and-drop from the Register window.
6. Press the Enter key. This causes a parameter to be input to the field, making the instruction accepted.
For an instruction with multiple input fields, move to the next field to enter a register, and after entering a register in the last field, press the Enter key to accept the instruction.
Even if all input fields are not filled with data, clicking on another column causes the instruction to be accepted.
7. Selected instructions can be registered in succession.
To cancel instruction selection, press the ESC key or click the Selector on the instruction palette.

Note


An input field allows only a register to be registered. Constants, etc. cannot be directly entered in an input field. If you want to enter a constant, use K- or P-register.

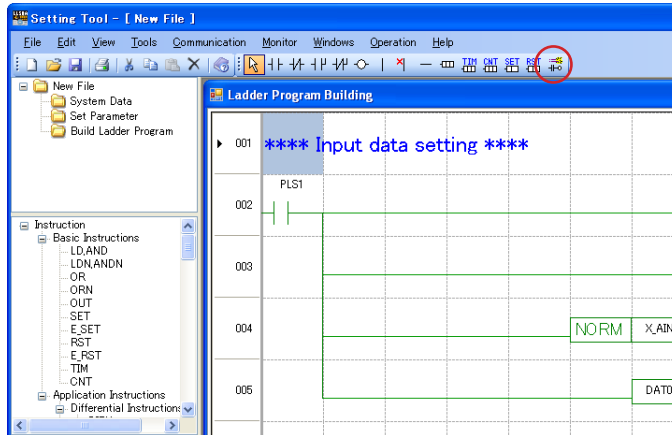
3.3 How to Build a Ladder Program

3.3.3 Registering Circuit Comments (Instruction Palette)

Enter circuit comments from the instruction palette.

Procedure

1. Click  (circuit comment) on the instruction palette. This causes the mouse cursor shape to change to the circuit comment cursor.



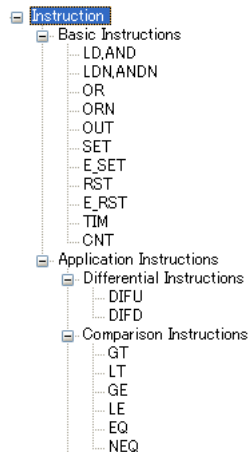
2. Click on the location where you want to input a circuit comment. This causes the circuit comment input field to be displayed at the clicked position.
3. Enter a circuit comment and press the Enter key. This causes the circuit comment to be accepted.

3.3.4 Registering Basic Instructions (Instruction Window)

Enter a basic instruction from the Instruction window.

Procedure

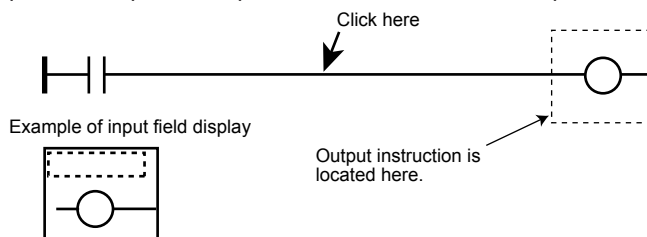
1. Drag a basic instruction that you want to input from among those in the instruction tree.



2. Drop the instruction on the location where you want it.

This causes the instruction to be entered at the dropped location, and the input field to appear.

(If an output instruction is input, it is located at the final column instead of the location where you clicked. In this case, a horizontal connection line is drawn up to the input instruction existing immediately before the clicked position. It is not possible to put an output instruction in front of an input instruction.)



3. Enter a register in the input field directly or input it by drag-and-drop from the Register window.
4. Press the Enter key. This causes a parameter to be input to the field, making the instruction accepted.

Note

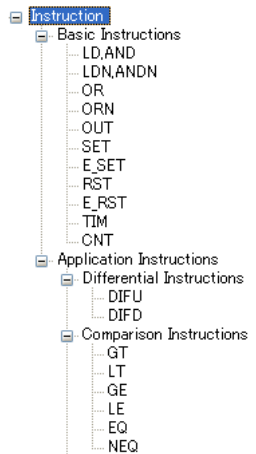
An input field allows only a register to be registered. Constants, etc. cannot be directly entered in an input field. If you want to enter a constant, use K- or P-register.

3.3.5 Registering an Application Instruction (Instruction Window)

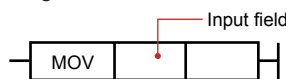
Enter an application instruction from the Instruction window.

Procedure

1. Drag an application instruction that you want to input from among those in the instruction tree.



2. Drop the instruction on the location where you want it.
This causes the instruction to be described at the dropped location, and the input field to be enabled.
(If an output type instruction is input, it is located at the final column instead of the location where you clicked. In this case, a horizontal connection line is drawn up to the input instruction immediately before the clicked position. It is not possible to put an output instruction in front of an input instruction.)
3. Enter a register in the input field directly or input it by drag-and-drop from the Register window.



4. Press the Enter key. This causes a parameter to be input to the field, making the instruction accepted.
For an instruction with multiple input fields, move to the next field to enter a register, and after entering a register in the last field, press the Enter key to accept the instruction.
Even if all input fields are not filled with data, clicking on another column causes the instruction to be accepted.

Note

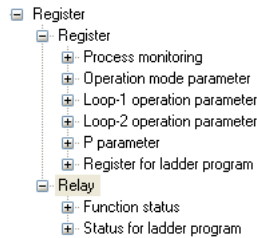
An input field allows only a register to be registered. Constants, etc. cannot be directly entered in an input field. If you want to enter a constant, use K- or P-register.

3.3.6 Registering a Register

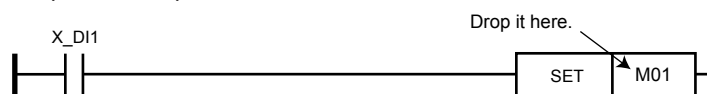
Register a register by drag-and-drop from the Register window.

Procedure

1. Drag a register that you want to register from the Register window.



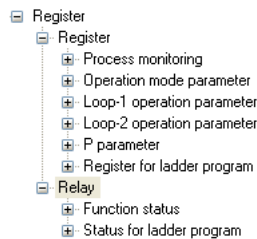
2. Drop it at the input field of an instruction.



Making the Register window visible/invisible

Procedure

1. Click on [View] – [Register Window] in the menu to place a check mark () in front of the menu item. This causes the Register window to appear. Removing the check mark () causes it to be invisible.



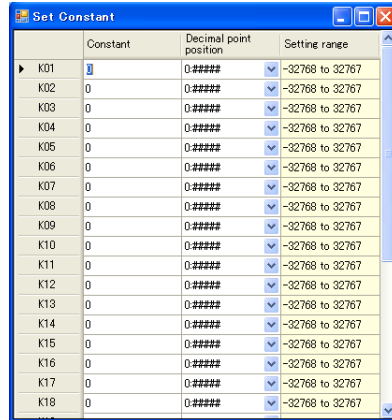
3.3 How to Build a Ladder Program

3.3.7 Setting a K-constant (K-register)

This section sets a constant to be used in a ladder program.

Procedure

1. Click on [Tool] – [Set Constant] in the menu to display the Set Constant window.



2. Click on the cell where you want to enter a constant.
3. After entering the settings for the constant, click the [OK] button.

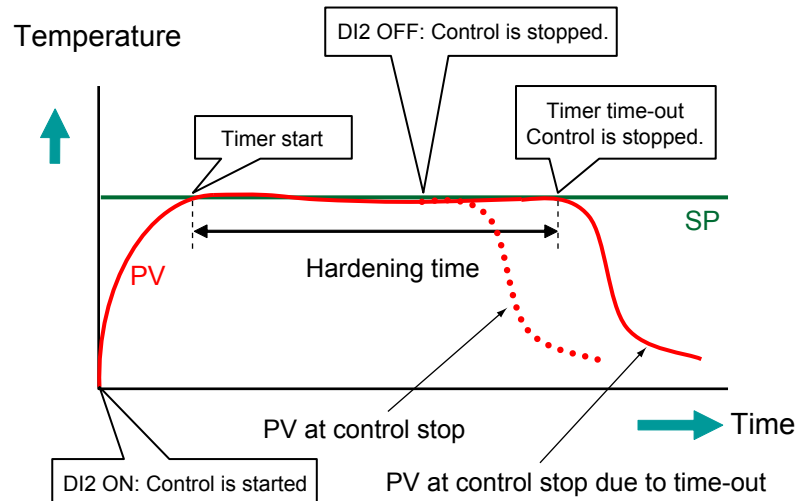
The Set Constant window

Item	Specification
Constant symbol	The symbol for the constant is displayed in the line header.
Constant	Enter a value for the constant.
Decimal point position	Set the decimal point position.
Range	Indicates the range that can be set.

3.4 Building a Ladder Program

The ladder sequence function is used by building a ladder program using the LL50A Parameter Setting Software and then downloading it to a UT controller. This section describes the examples for UT55A/UT52A. The ladder program for UT35A/UT32A can be created in the same way as UT55A/UT52A.

The figure below shows an example of part hardening temperature control.



Specifications

- Control is started when the contact input is ON.
- Timer starts when PV is within 1% of the input scale for SP.
- During the timer operation, if the power supply fails and resumes, control is restarted with the ongoing timer.
- Control stops when the hardening timer is up or when the contact input DI2 is OFF.

Parameter settings (main unit)

- Control mode (CTLM): Single-loop control
- Control period (SMP): 200ms
- STOP/RUN switch (S/R): 0 (disables the contact input-basis switching function)
- P-parameter (P01): Timer current value
- P-parameter (P09): Timer set value
- P-parameter (P10): Condition of timer action

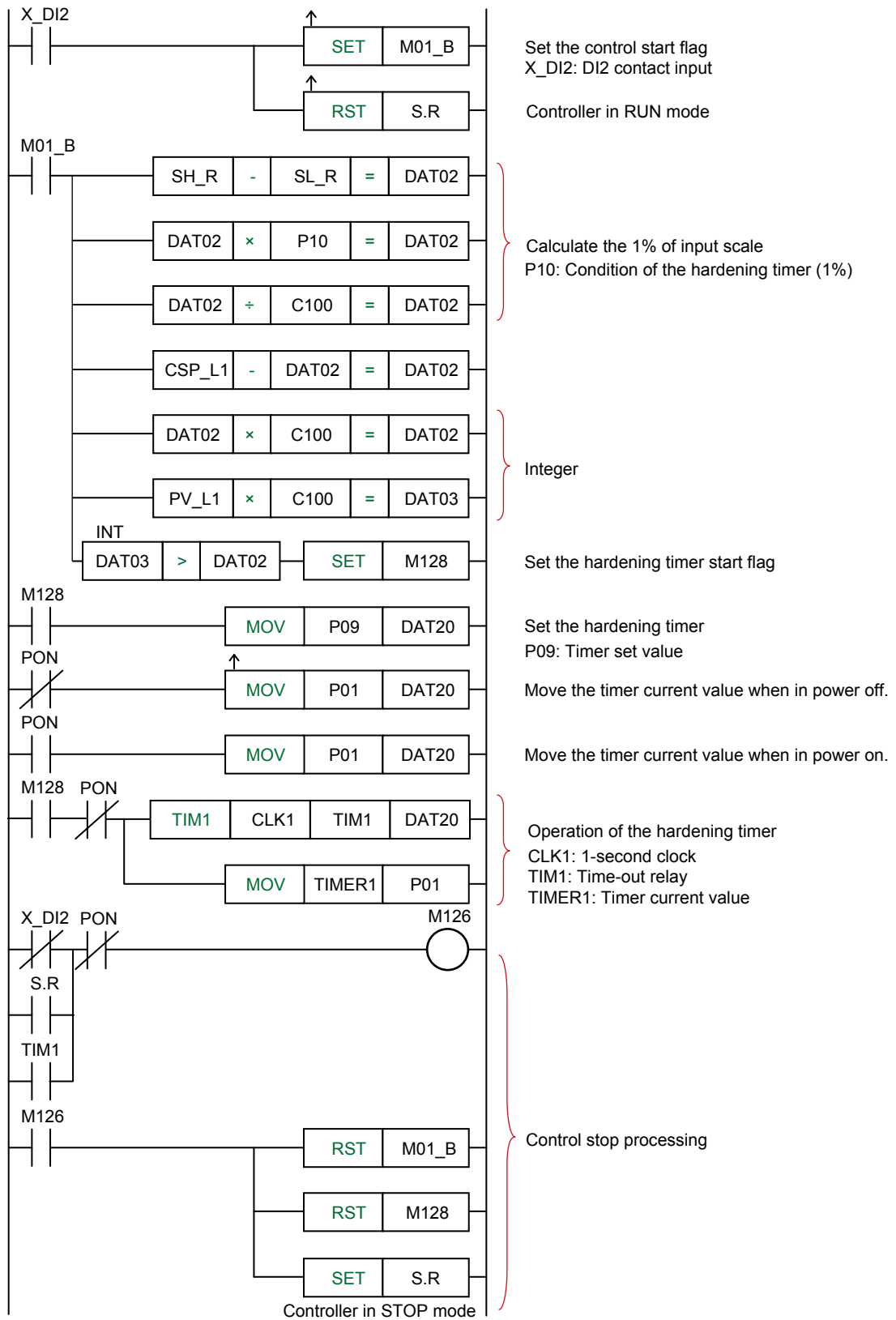
Devices used

- Internal relay: M01_B, M128
- DAT register: DAT02, DAT03, DAT20
- Parameter register: S.R, SH_R, SL_R, CSP_L1, PV_L1, P01, P09, and P10
- Constant register: C100
- Special relay: TIM1

► [Details of the instruction: See Chapter 4 , Operations of Ladder Program Instructions.](#)

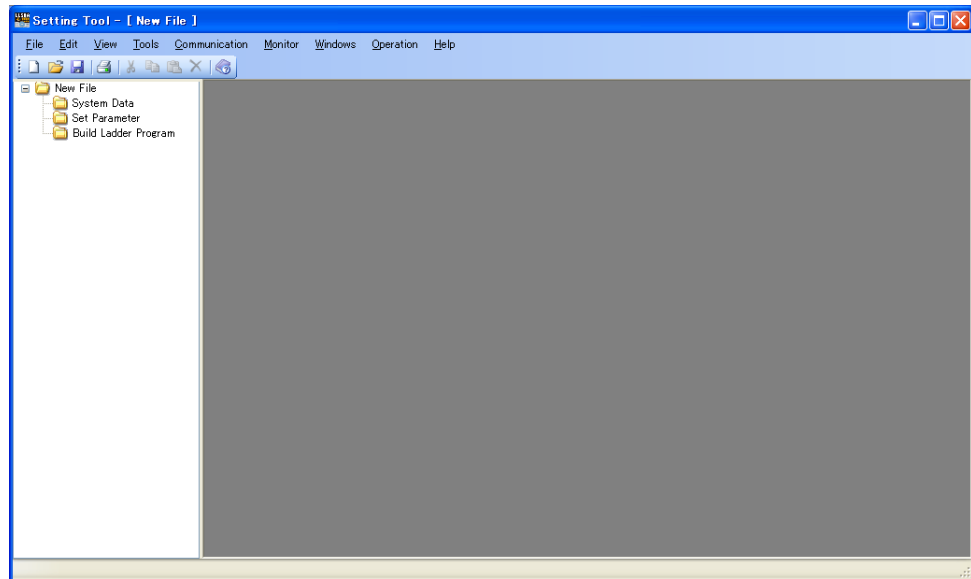
3.4 Building a Ladder Program

Example of a ladder program (input ladder calculation program)

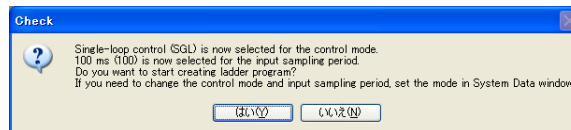


Procedure

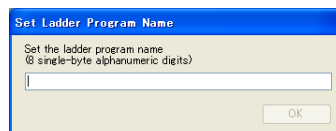
1. Display the Basic window.



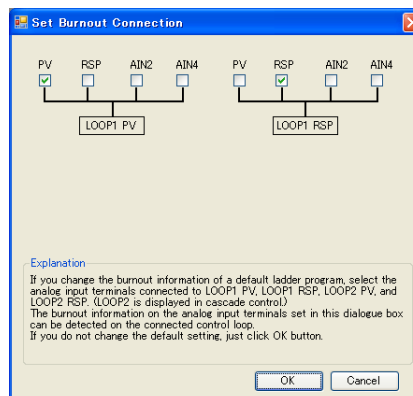
2. Click “Build Ladder Program” in the File window. This causes the control mode confirmation message to appear (when creating a new ladder program for UT55A/UT52A.)



3. Click [Yes] to display the Set Ladder Program Name window. Set a ladder program name of up to eight single-byte alphanumeric characters and click [OK]. If you click [No], the System Data window appears.



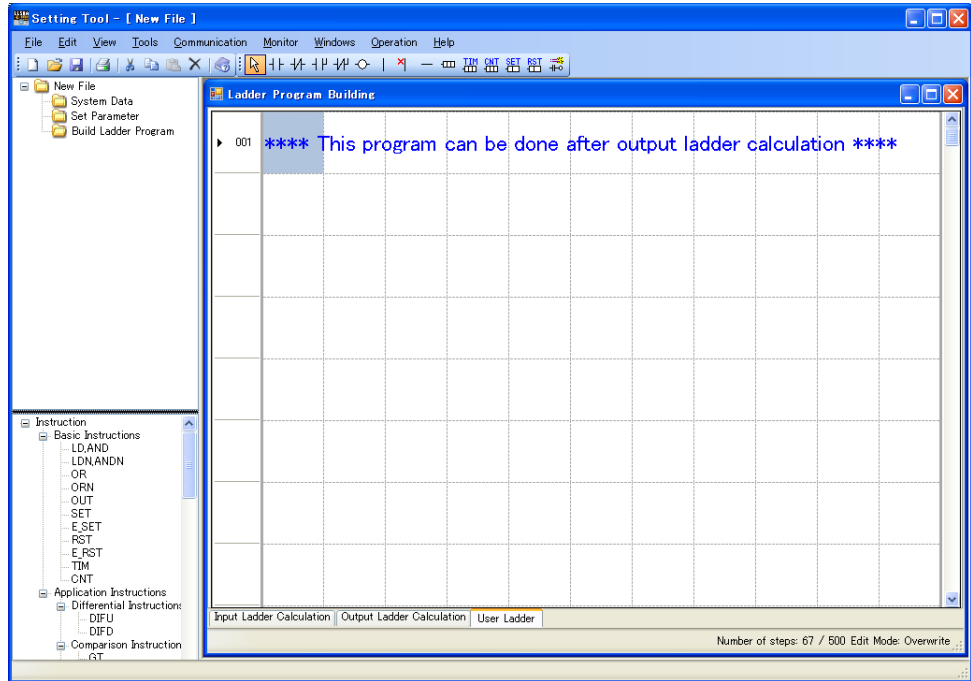
4. The Set Burnout Connection window appears. (LOOP1 PV: PV, LOOP1 RSP: RSP) (only for UT55A/UT52A)



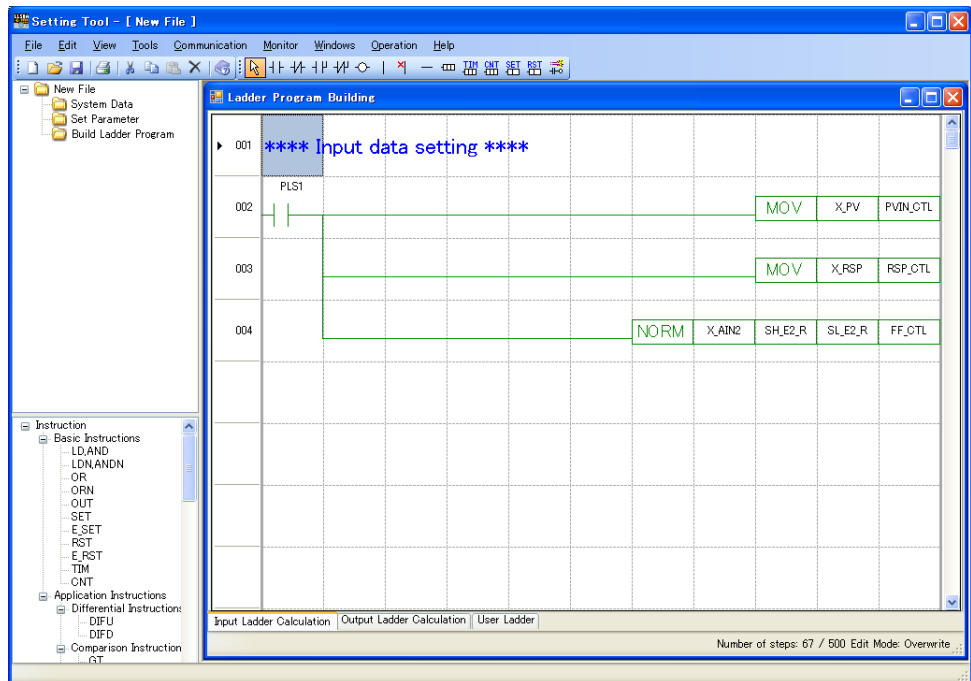
- Burnout connection settings: See 3.5.10, Setting a Burnout Connection.

3.4 Building a Ladder Program


5. Set burnout connection information and click the [OK] button. This causes the Ladder Program Building window to appear.

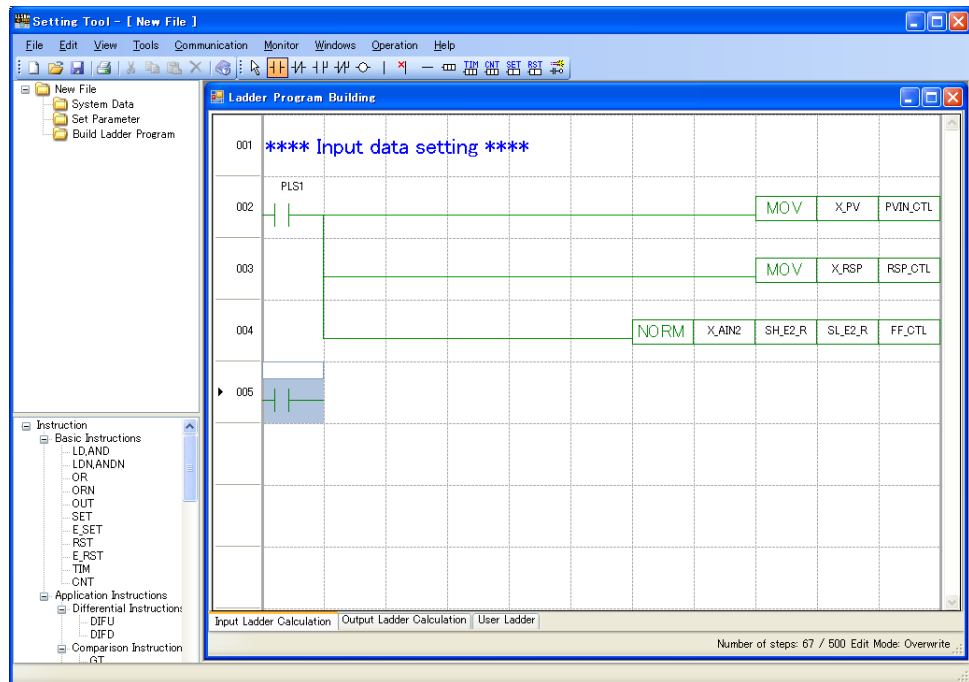


6. Click the [Input Ladder Calculation] tab.

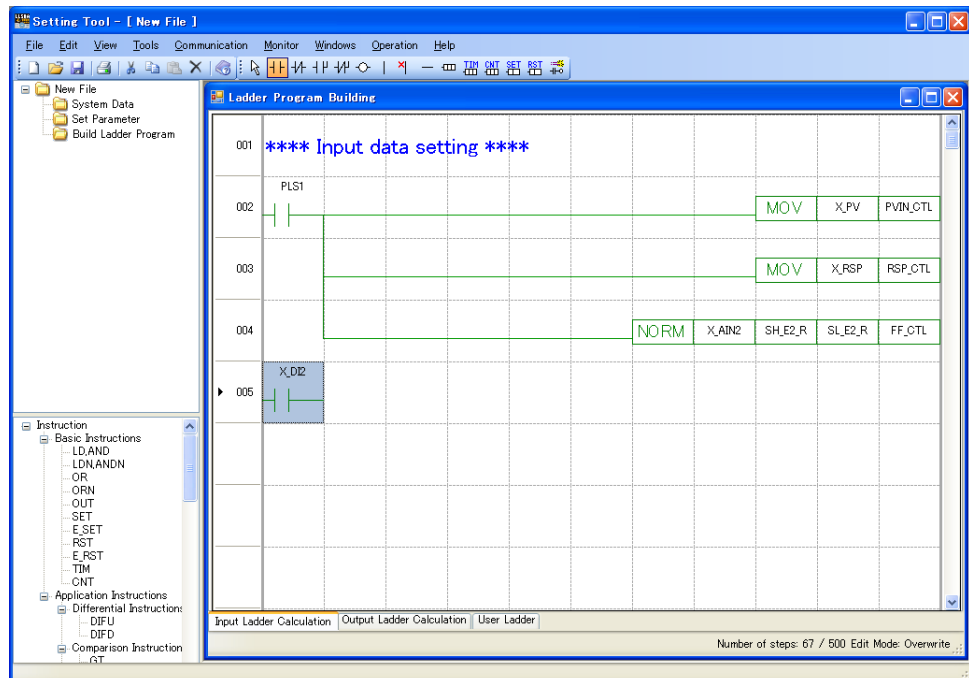


7. Build a circuit on the 5th line.


Click on (select)  ("a" contact instruction) on the instruction palette and click on the column of the location where you want to input the instruction.

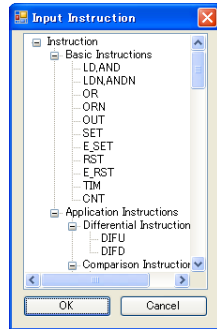


8. This causes the input field to appear. Input a DI2 register (X_DI2) in the "a" contact instruction's input field. (It is also possible to input a register by drag-and-drop from the Register window.)

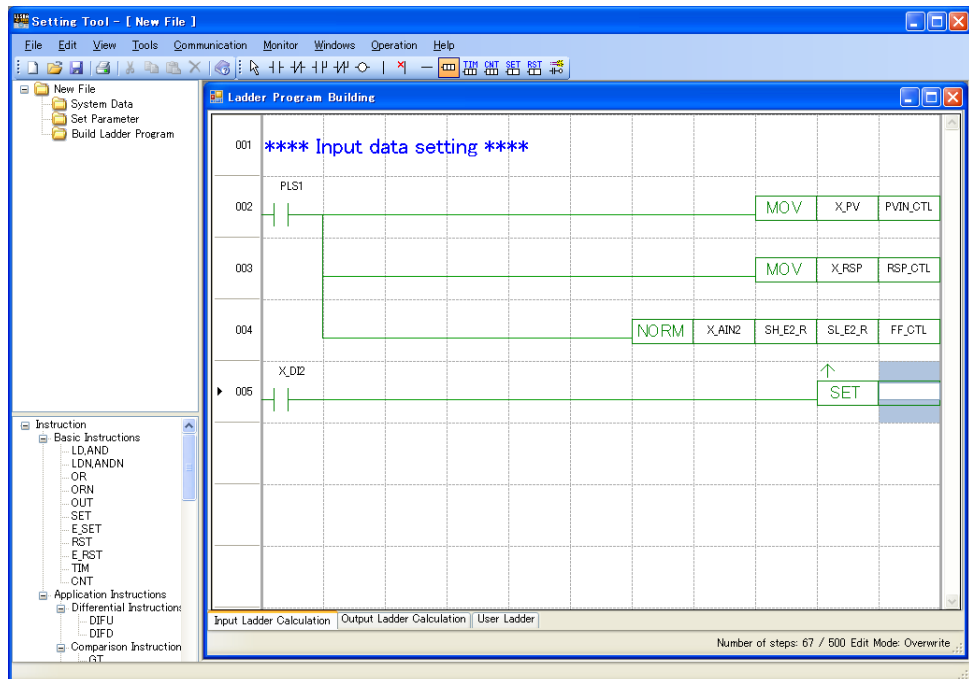


3.4 Building a Ladder Program

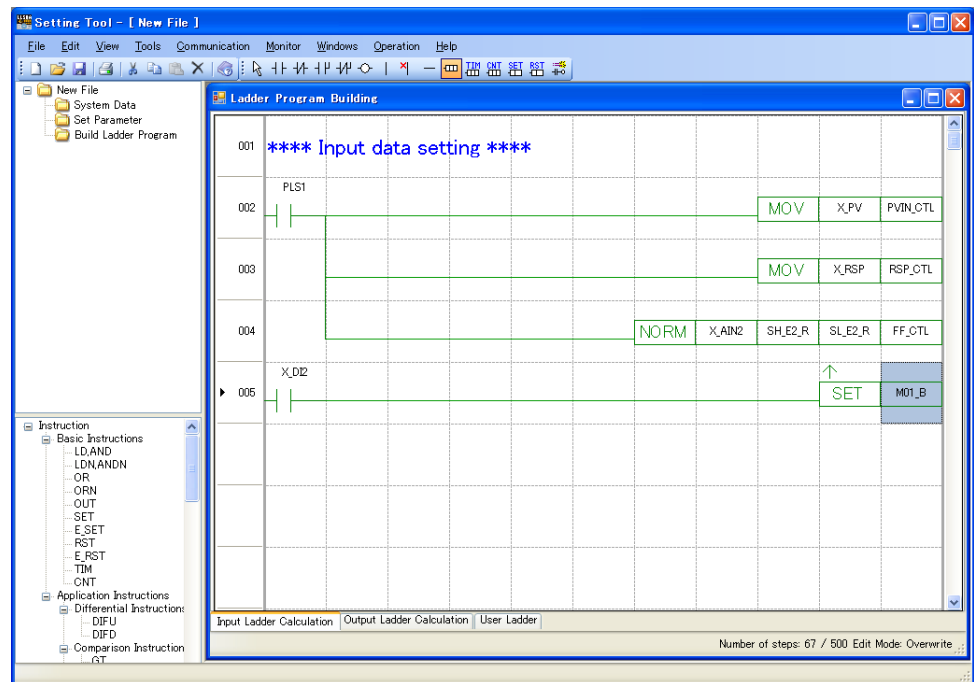
9. Click on  (Application Instructions) on the instruction palette to display the Input Instruction window.




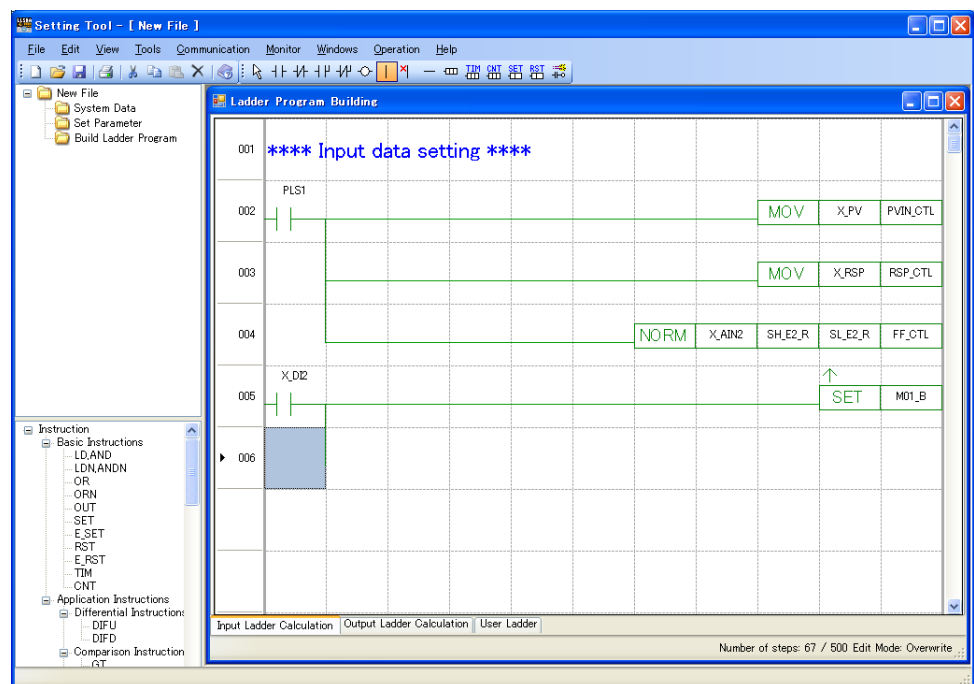
10. Click on (select) the E_SET instruction and click the column of the location where you want to input the instruction. This causes a connection line to be drawn from the “a” contact instruction to the E_SET instruction.



11. This causes the input field to appear. Enter an M127 register (M127) in the E_SET instruction's input field. (It is also possible to input a register by drag-and-drop from the Register window.)

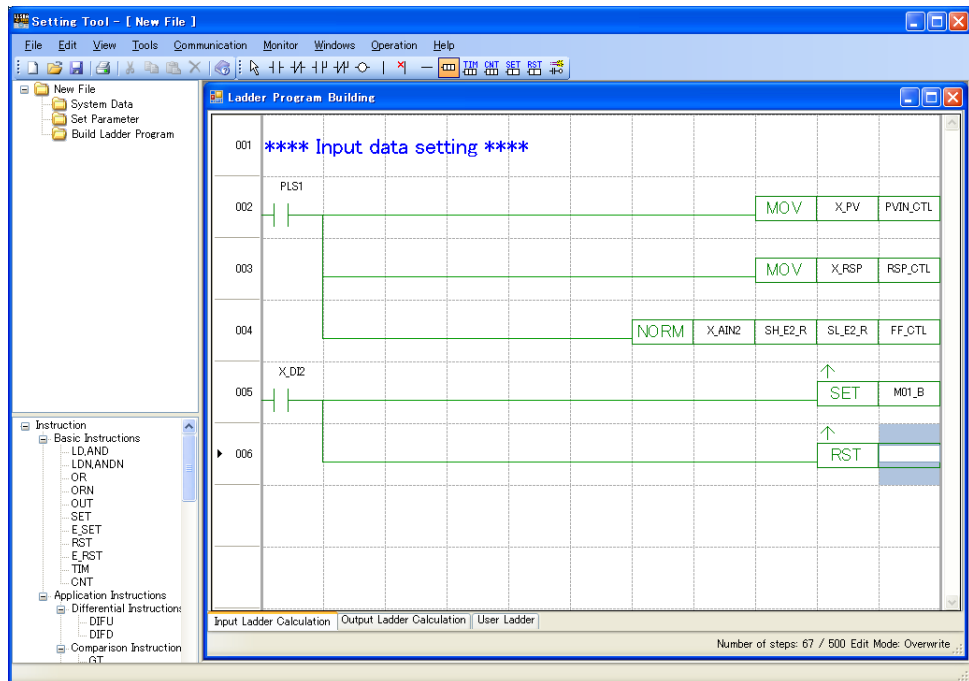


12. Locate  (OR Connection Line) on the 6th line.

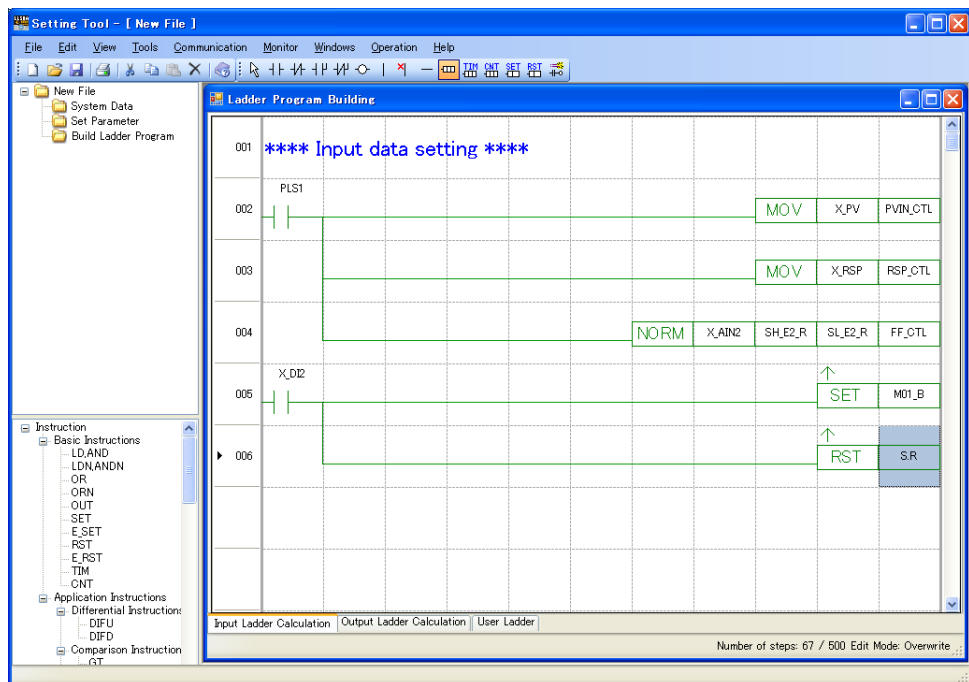


3.4 Building a Ladder Program


13. Locate the E_RST instruction on the 6th line.

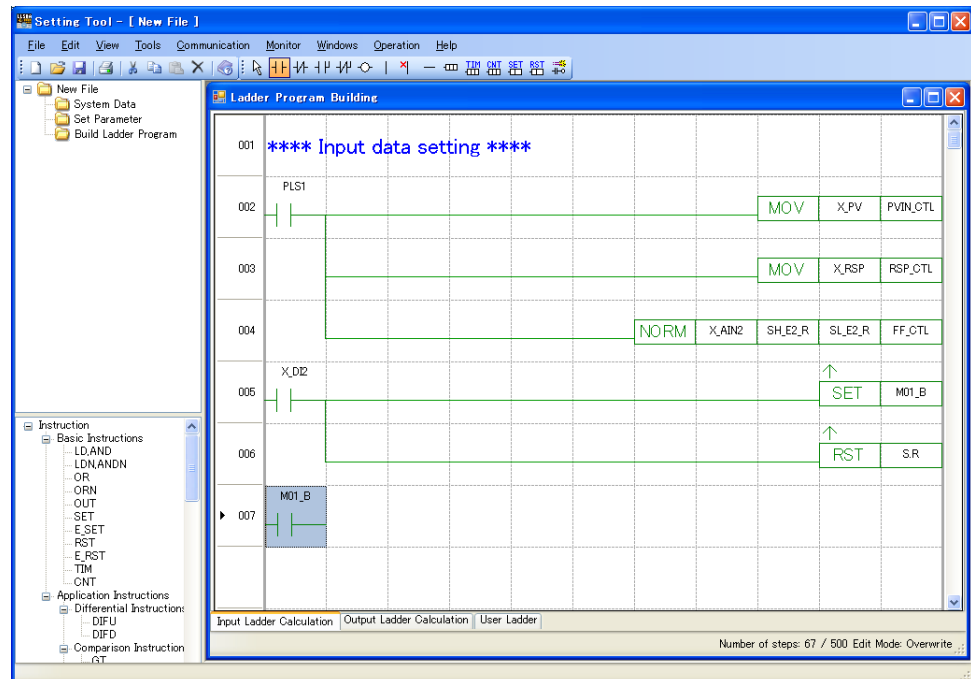


14. This causes the input field to appear. Enter an S/R register (S.R) in the E_RST instruction's input field. (It is also possible to input a register by drag-and-drop from the Register window.)

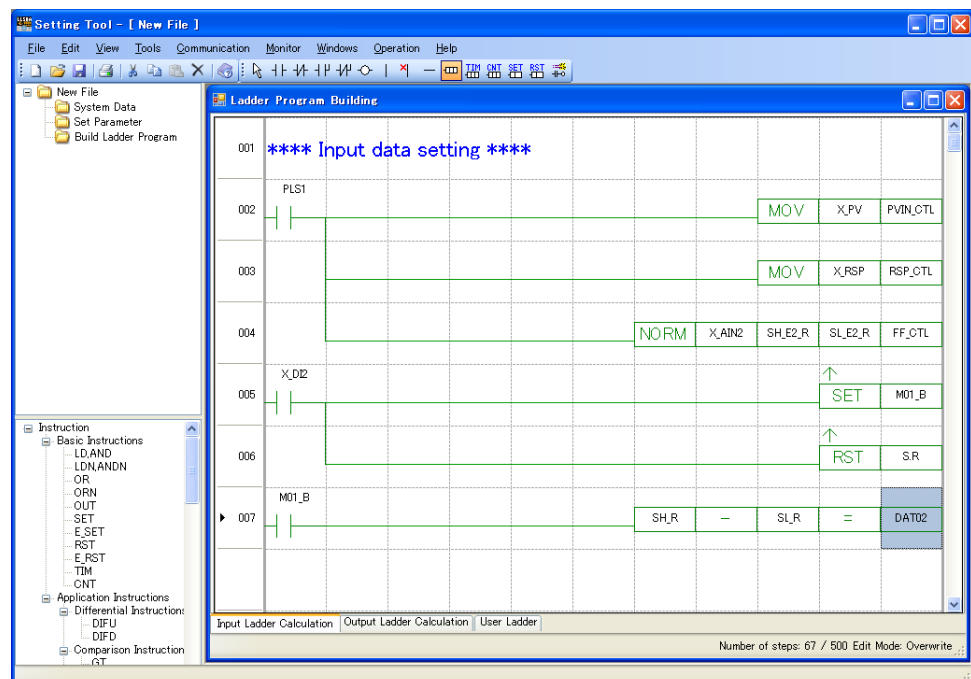


15. Build a circuit on the 7th line.

Click on (select)  (“a” contact instruction) on the instruction palette and click the column of the location where you want to input the instruction. Enter “M01_B” in the input field. (It is also possible to input a register by drag-and-drop from the Register window.)




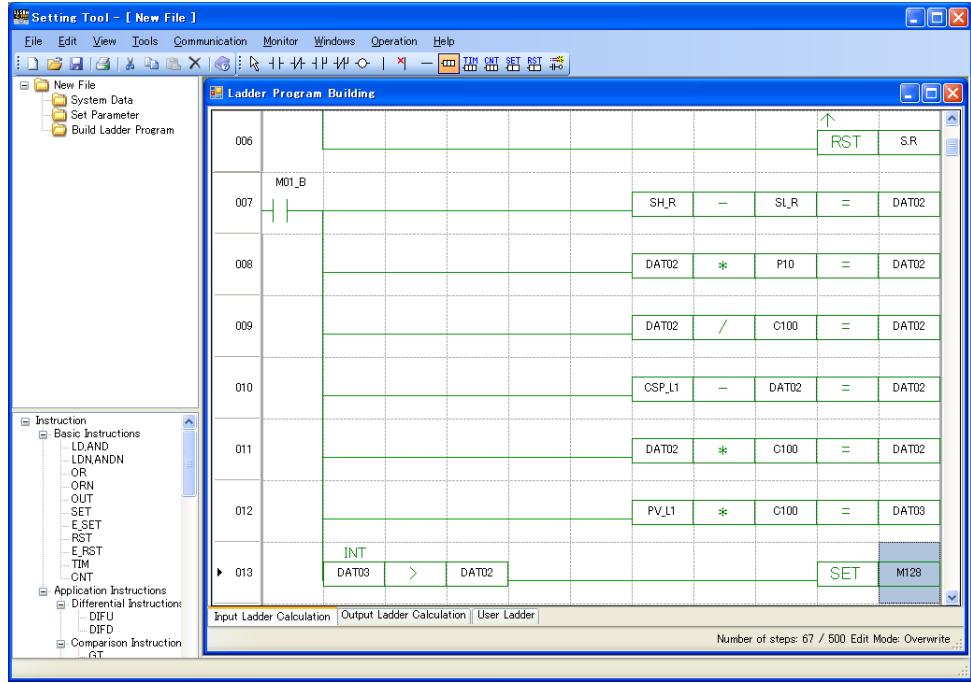
16. Select SUB (Subtraction) from the Input Instruction window by clicking on (Application Instructions) of the instruction palette and locate it as shown below. Enter “SH_R”, “SL_R”, and “DAT02” in the input fields.






3.4 Building a Ladder Program

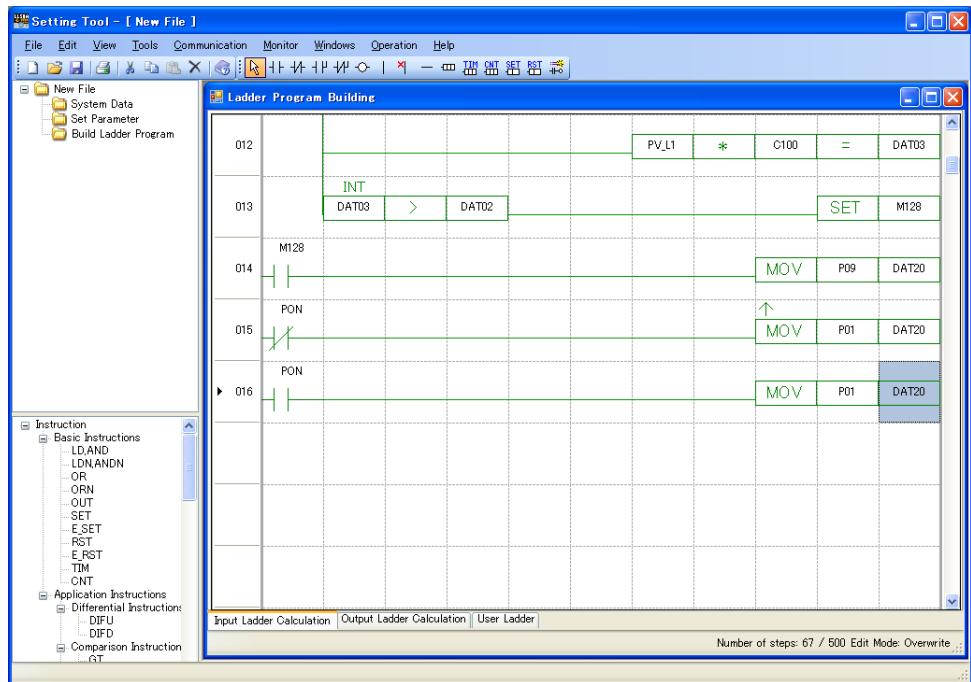
17. Build a circuit on the 8th to 13th lines.

Locate  (OR Connection Line) on the 8th to 13th lines first. Then, Locate MUL (Multiplication) instruction on the 8th line, DIV (Division) instruction on the 9th line, SUB (Subtraction) instruction on the 10th line, MUL instruction on the 11th to 12th lines, GT (>) and SET instruction on the 13th line. Also enter the register in the input field.




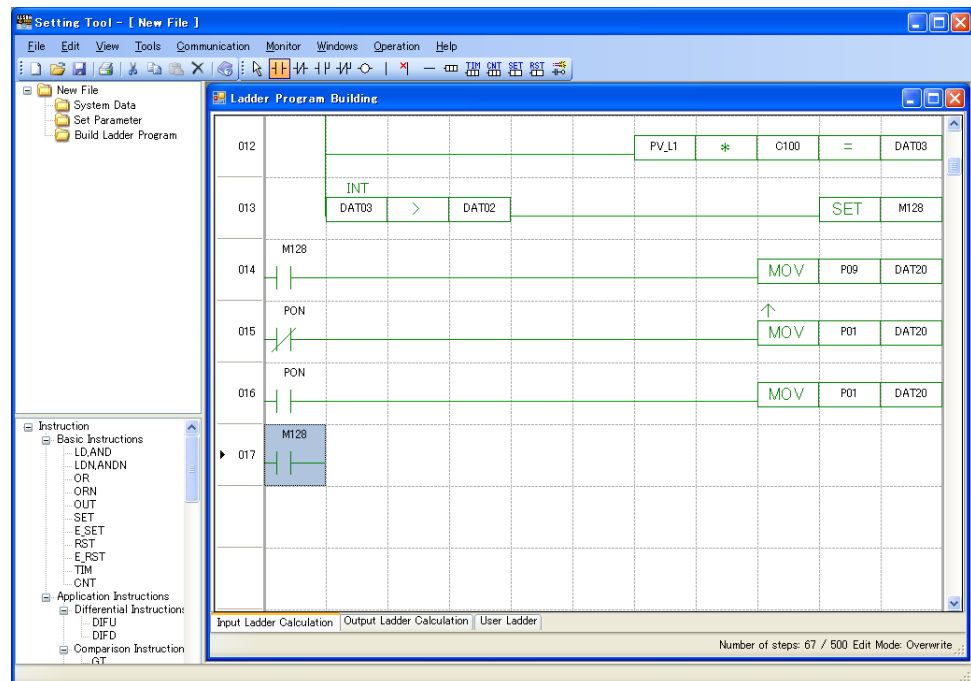

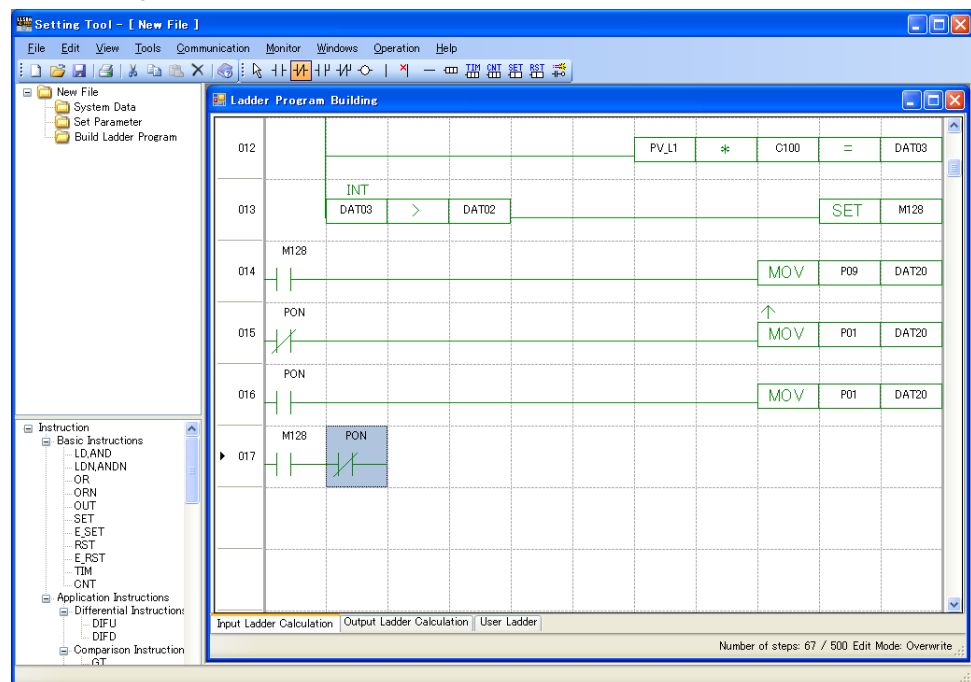
18. Build a circuit on the 14th to 16th lines same as above.

Locate  ("a" contact instruction) and MOV (Move) instruction on the 14th line,  ("b" contact instruction) and E_MOV instruction on the 15th line,  ("a" contact instruction) and MOV instruction on the 16th line. Also enter the register in the input field.




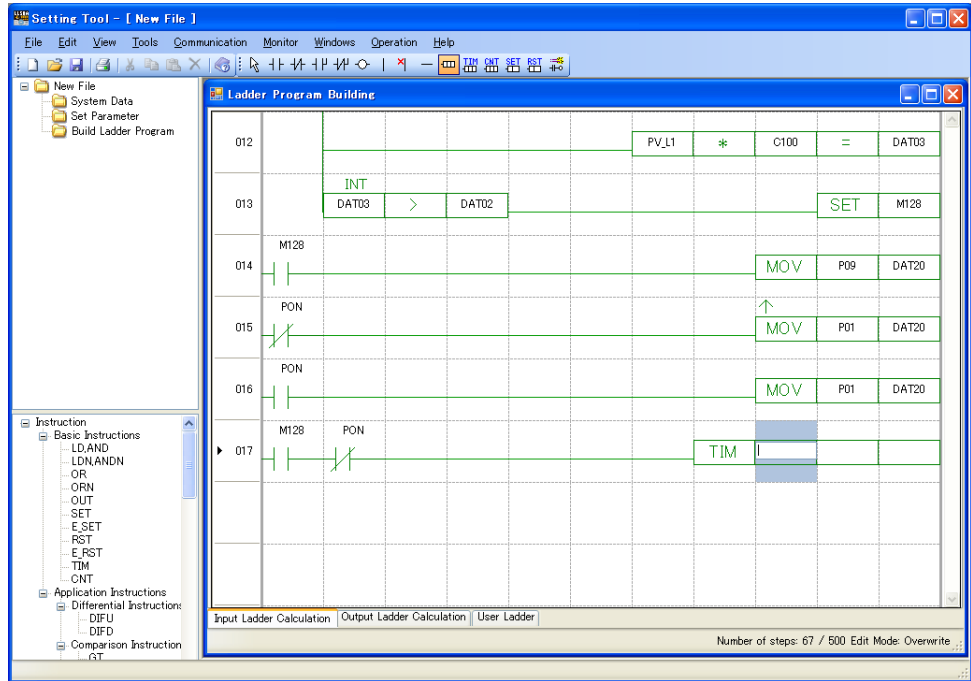
19. Build a circuit on the 17th line.

Click on (select)  (“a” contact instruction) on the instruction palette and click the column of the location where you want to input the instruction. Enter “M128” in the input field.

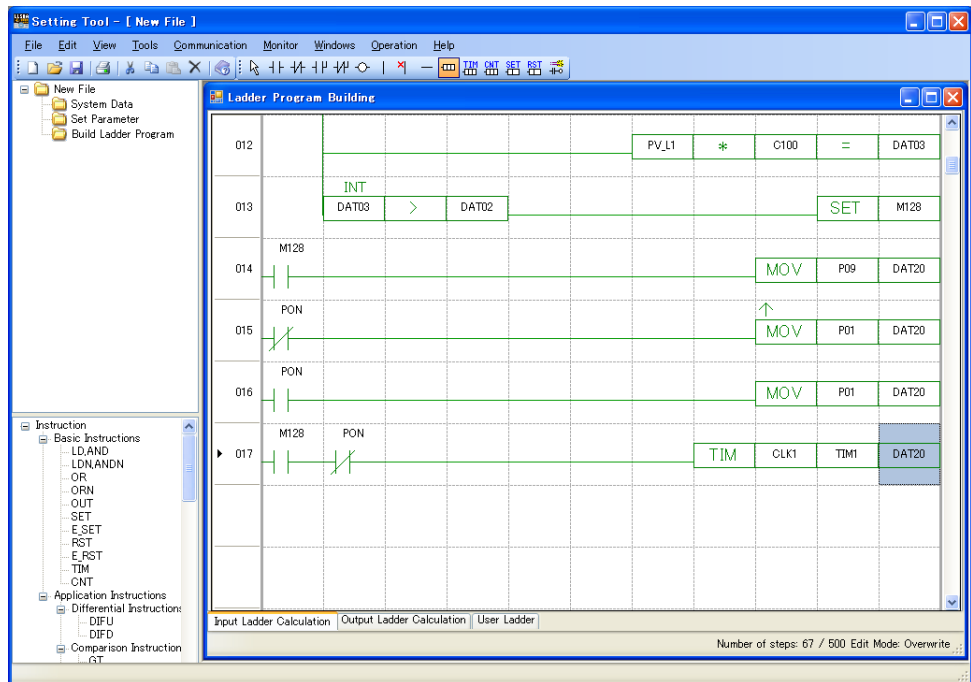
**20.** Click on (select)  (“b” contact instruction) on the instruction palette and click the column of the location where you want to input the instruction. Enter “PON” in the input field. (It is also possible to input a register by drag-and-drop from the Register window.)

3.4 Building a Ladder Program

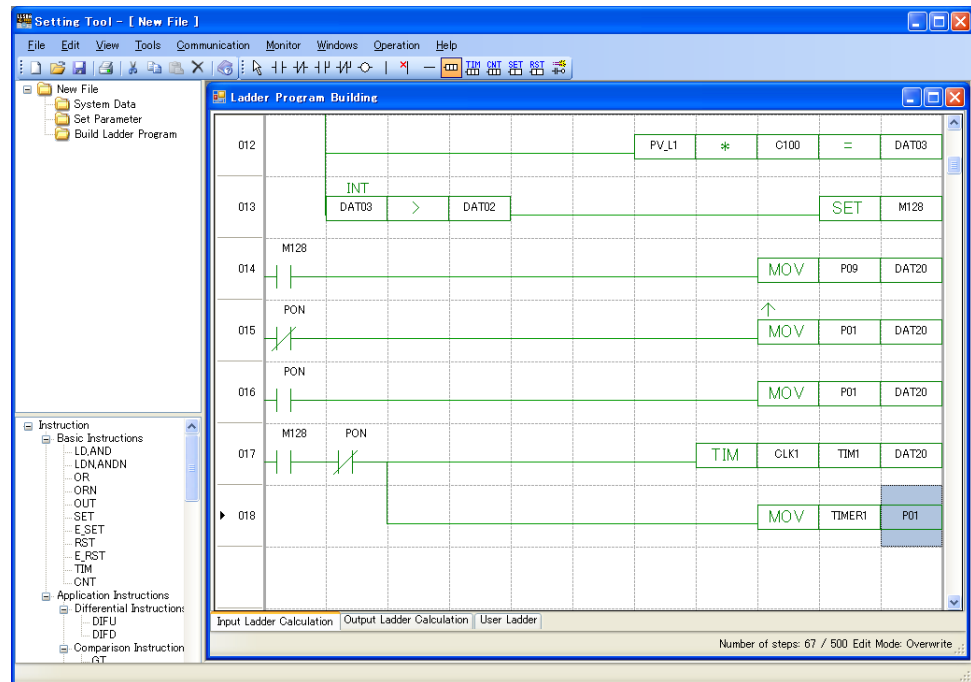
- 21.** Select TIM (Timer) from the Input Instruction window by clicking on  (Application Instructions) of the Instruction Palette and locate it as shown below.






- 22.** Enter “CLK1” (1-sec clock), “TIM1” (time-out relay), and “DAT20” (timer set value) in the input fields.

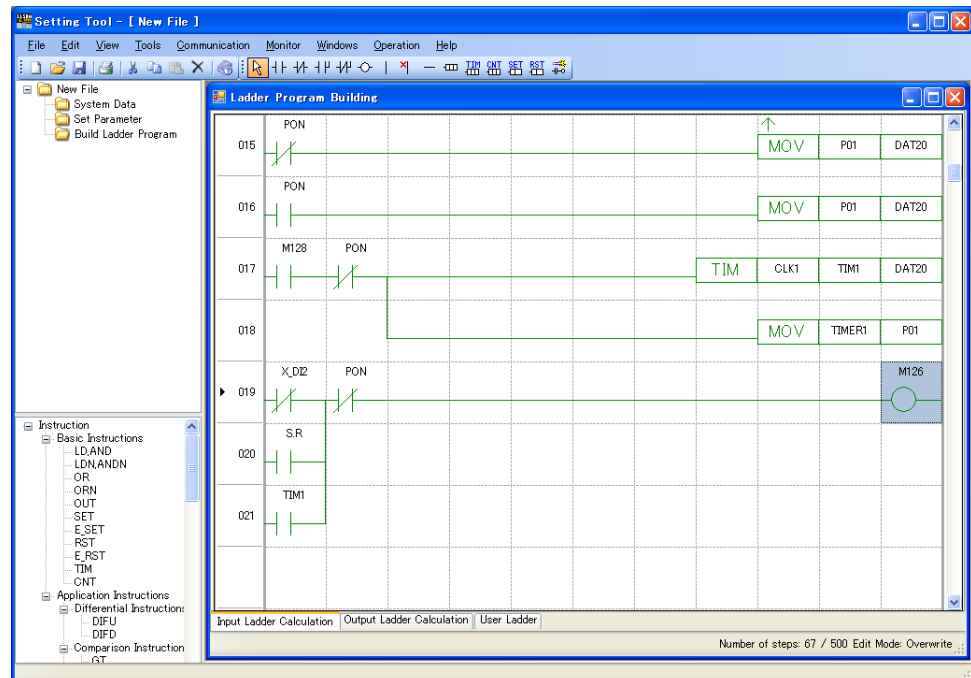


- 23.** Locate the MOV instruction on the 18th line.
Enter "TIMER1" (timer current value) and "P01" in the input fields.





- 24.** Build a circuit on the 19th to 21th lines.

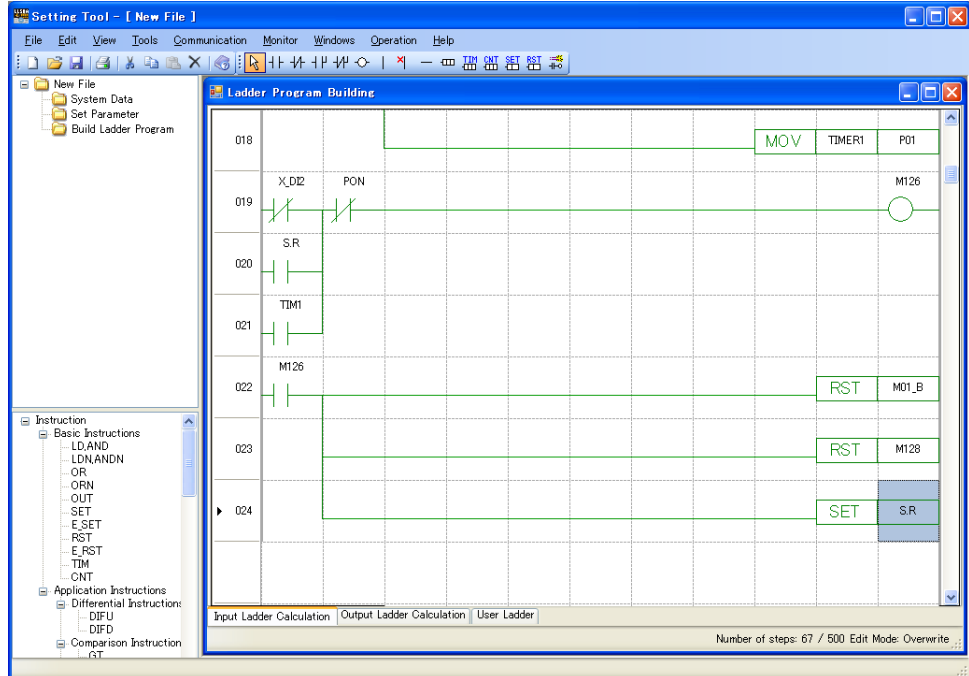
Locate  ("b" contact instruction) and  (OUT instruction) on the 19th line,  ("a" contact OR instruction) on the 20th and 21th lines. Also enter the register in the input field.



3.4 Building a Ladder Program

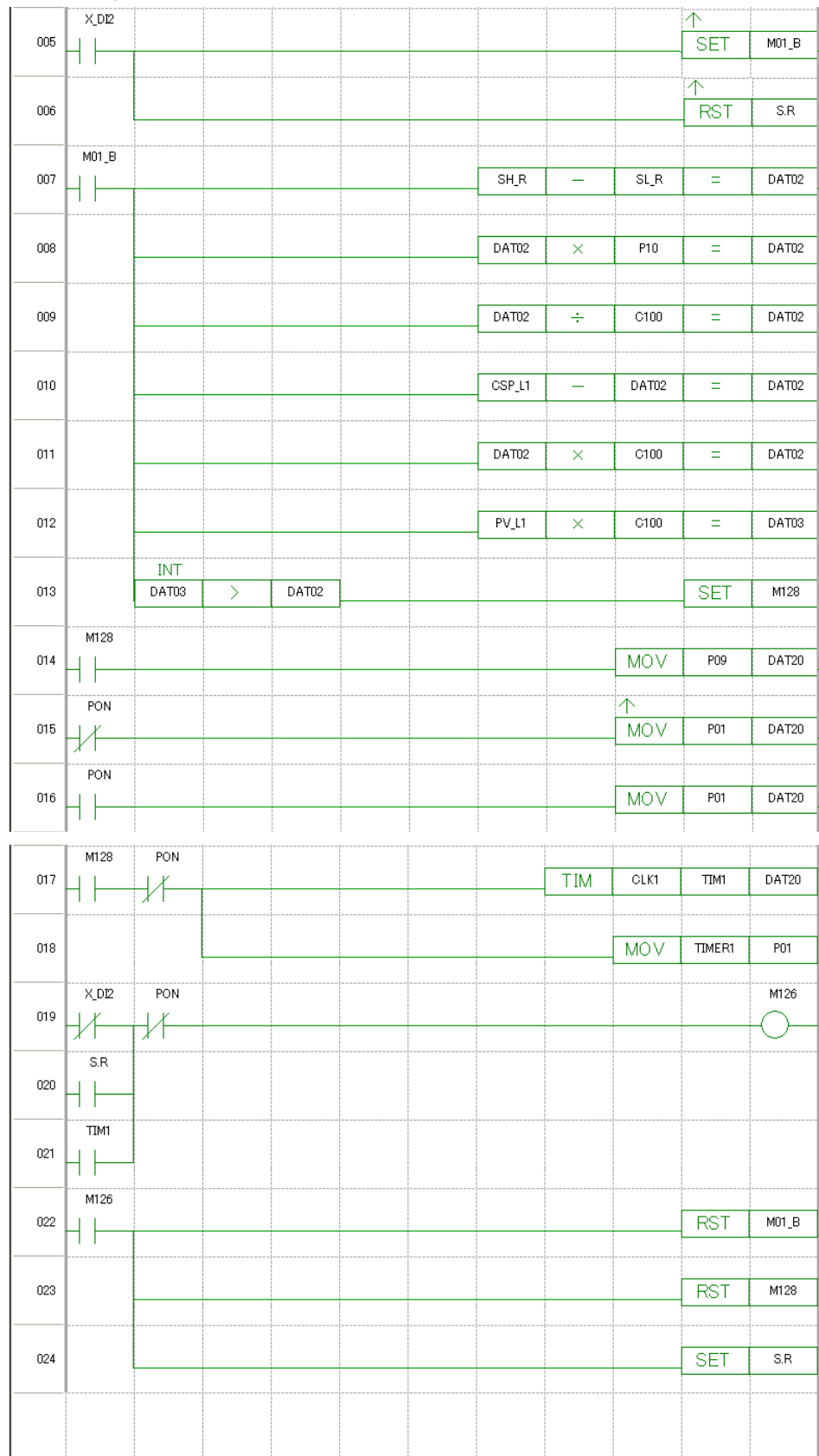
25. Build a circuit on the 22th to 24th lines same as above.

Locate  ("a" contact instruction) and RST (Reset) instruction on the 22th line,  (OR connection line) on the 23th to 24th lines, RST instruction on the 23th line, SET instruction on the 24th line. (It is also possible to input a register by drag-and-drop from the Register window.)



26. Complete the ladder program building.

Ladder program



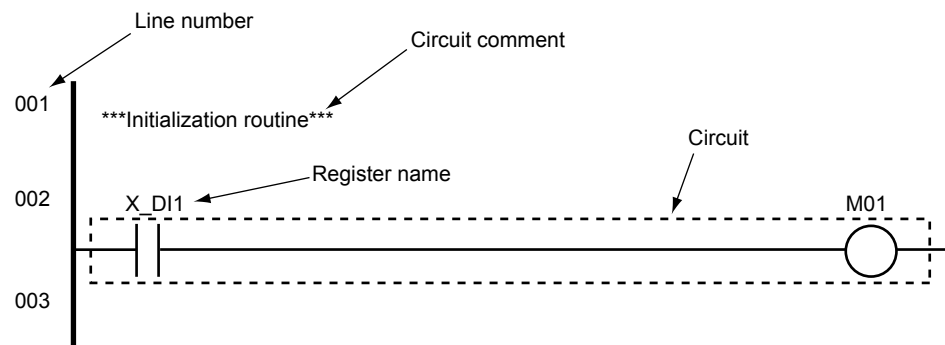
3.5 Editing Ladder Programs

3.5.1 Overwrite and Insert Modes

Instructions are input in either the Overwrite or Insert mode. The Insert key is used to switch between the two modes.

- Overwrite mode
Inputting an instruction in Overwrite mode when there is already an instruction at the location of the cursor erases the existing instruction and causes the new instruction to be entered there.
- Insert mode
Inputting an instruction in Insert mode when there is already an instruction at the location of the cursor causes the existing instruction to be shifted to the right and the new instruction to be entered at that location. If the existing instruction cannot be moved to the right or if moving an instruction to the right would cause it to be placed at the 11th column, no instruction can be input.

3.5.2 Circuit Editing Elements



Circuit	Item	Specifications
Circuit	Number of lines per circuit	15 lines or less
	Number of instructions per circuit	125 instructions or less
	Continuous line	None
	Horizontal columns	Fixed to 11 columns
Circuit comment	Number of characters	70 single-byte characters (35 two-byte characters) or less
	Available characters	Alphanumeric characters and symbols
	Number of items registered	50
Register name	Specification method	Contact input: X Contact output: Y Others: Register symbols

Limitations

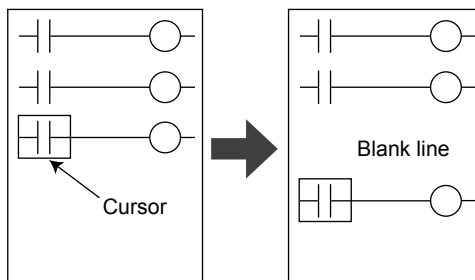
- Only one output instruction can be registered in one line.
- No input instruction can be registered at the 11th column, or an input instruction extending to the 11th column cannot be registered.

3.5.3 Inserting a Blank Line

This section describes how to insert a blank line in a ladder program.

Procedure

1. Place the cursor at the location where you want to insert a blank line.
2. Click on [Edit] – [Insert Line] in the menu.



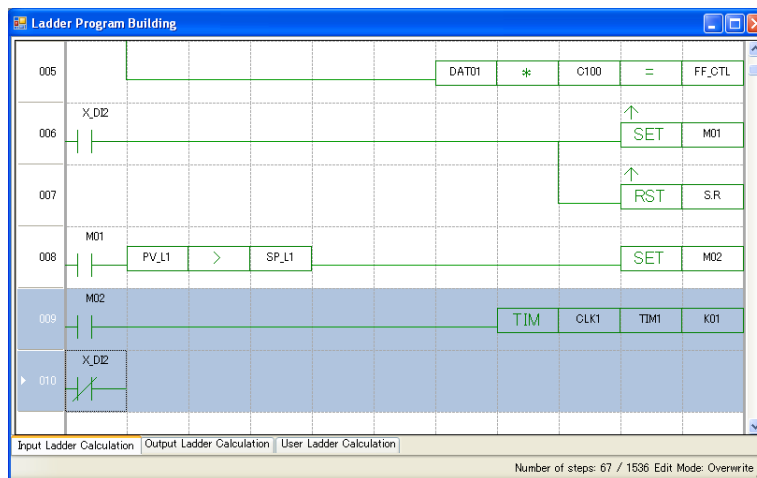
3.5.4 Selecting a Circuit Range

The following describes how to specify a circuit range. A cut, copy, or delete is performed by specifying the range of a circuit.

Selection in units of lines

Selecting a range using the mouse

To select a circuit range using the mouse, generally drag across the line number area with the cursor.



Selecting a range using the keyboard

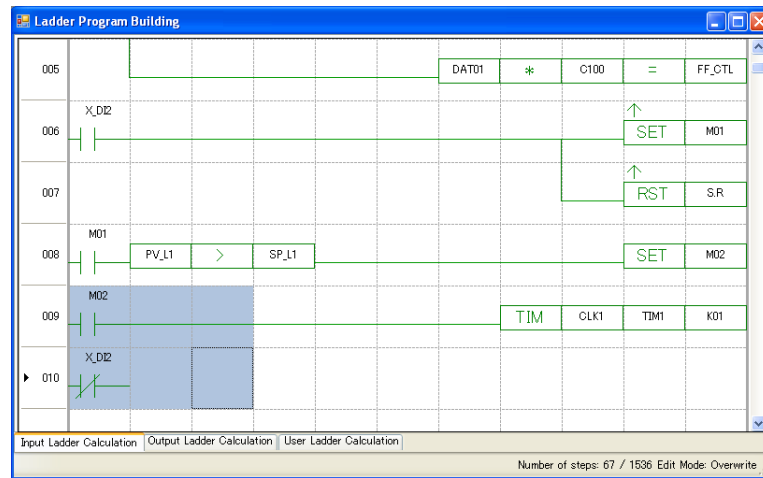
To select a circuit range using the keyboard, move the cursor to any cell on the line where you want to start selection, press the Ctrl + Space keys to activate a line-selection status, or press the Shift + [Up arrow] keys or Shift + [Down arrow] keys to select the range.

3.5 Editing Ladder Programs

Selection in units of cells

Selecting a range using the mouse

To select a circuit range using the mouse, drag across the cell range area with the mouse cursor.



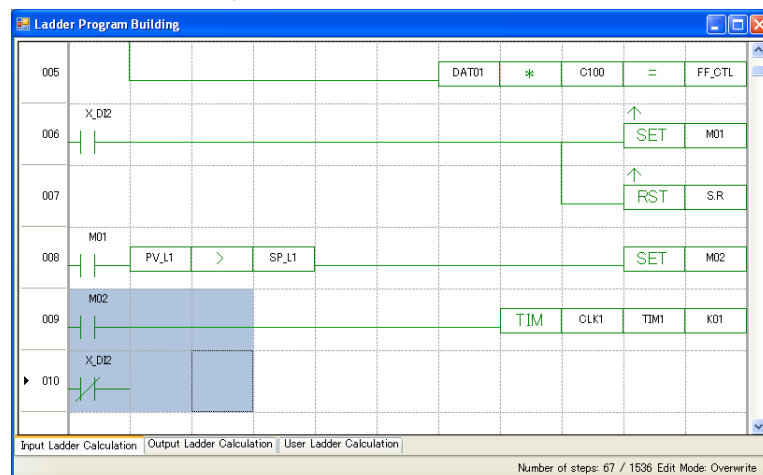
Selecting a range using the keyboard

To select a circuit range using the keyboard, press:

- Shift + [Right arrow] keys
- Shift + [Left arrow] keys
- Shift + [Up arrow] keys
- Shift + [Down arrow] keys

If the line-selection status has been activated, press the TAB key to cancel it.

With the SHIFT key held down, press any of the [Right arrow], [Left arrow], [Up arrow], and [Down arrow] keys.



3.5.5 Deleting a Circuit

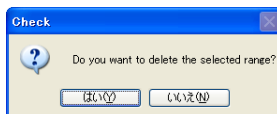
This section describes how to delete a circuit.

Deleting circuits in units of lines

Circuits can be deleted on a line basis by specifying the range of circuit lines and then selecting either [Edit] – [Delete] in the menu, or [Edit] – [Delete Line].

To select a circuit range:

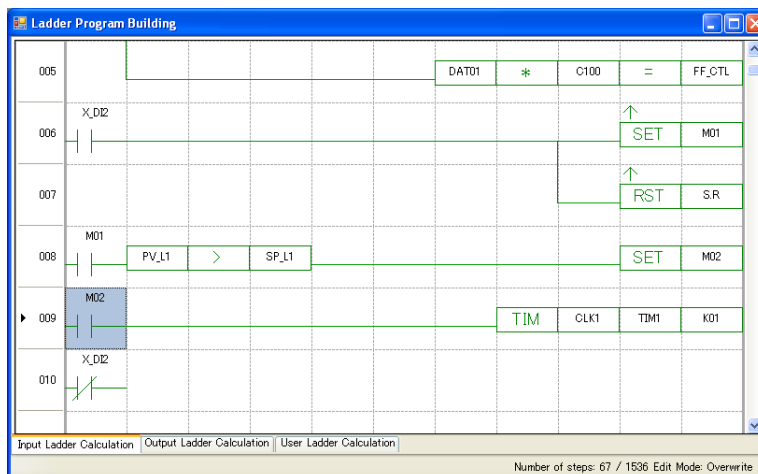
1. Specify a circuit range in lines (see Section 3.5.4).
2. Click on [Edit] – [Delete] or [Edit] – [Delete Line] in the menu.
3. The line deletion confirmation message appears.



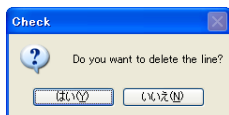
When not selecting a circuit range:

Click on [Edit] – [Delete Line] in the menu. This causes one selected line to be deleted.

1. Move the cursor to any cell on the line that you want to delete.

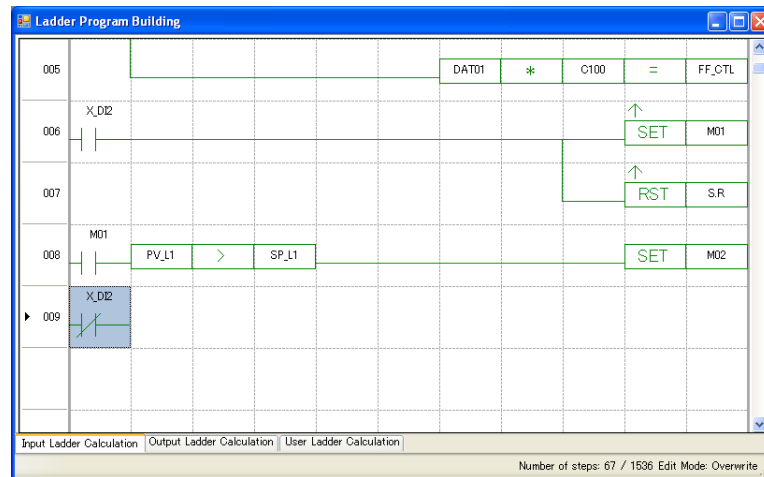


2. Click on [Edit] – [Delete Line] in the menu.
3. The line deletion confirmation message appears.



3.5 Editing Ladder Programs

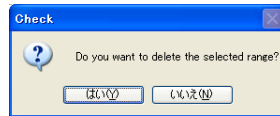
Results of deletion



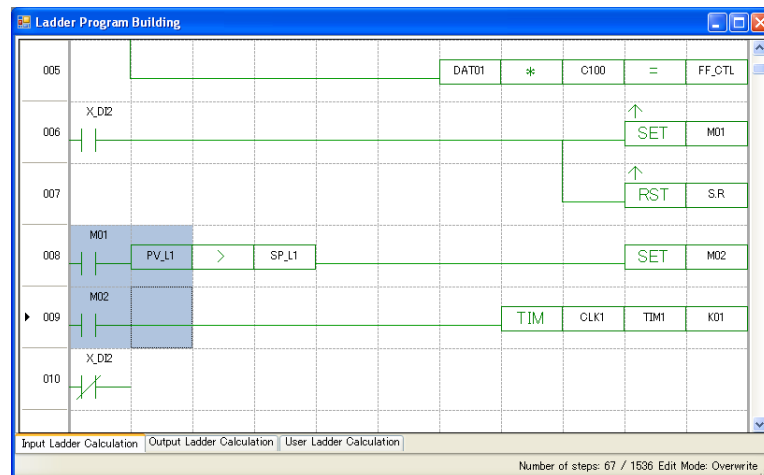
Deleting circuits in units of cells

To delete a specified circuit range in cells, click on [Edit] – [Delete] in the menu.

1. Specify a circuit range in cells (see Section 3.5.4).
2. Click on [Edit] – [Delete] in the menu.
3. This causes the line deletion confirmation message to appear.



Deletion is not possible if a selected circuit range includes part of an instruction.



3.5.6 Copying a Circuit

This section describes how to copy a circuit.

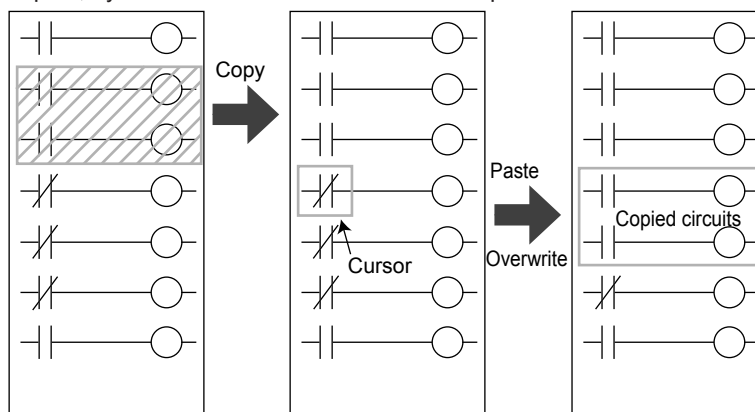
Copying circuits in units of lines

1. Specify a circuit range in lines (see 3.5.4).
2. Click on [Edit] – [Copy] in the menu.
3. Move the cursor to left side cell on the line at the copy destination.
4. Click on [Edit] – [Paste] in the menu.

The circuits are copied to lines starting at the line where the cursor is placed.

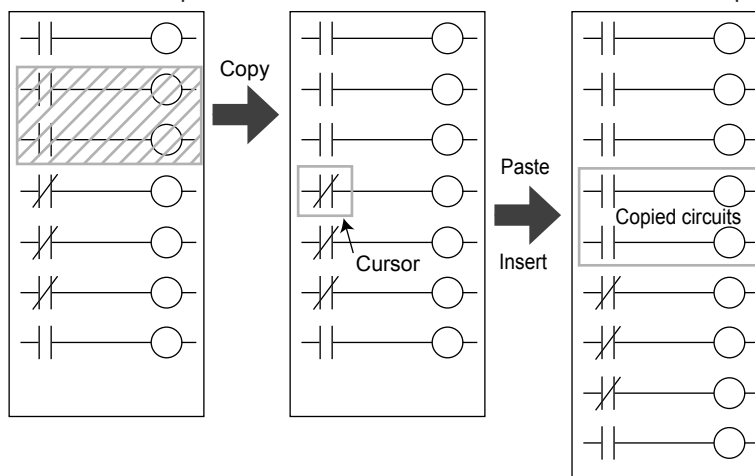
In Overwrite mode

Circuits starting at the line where the cursor is placed are replaced with the circuits to be copied, by the number of circuit lines to be copied.



In Insert mode

Circuits to be copied are inserted before the line where the cursor is placed.



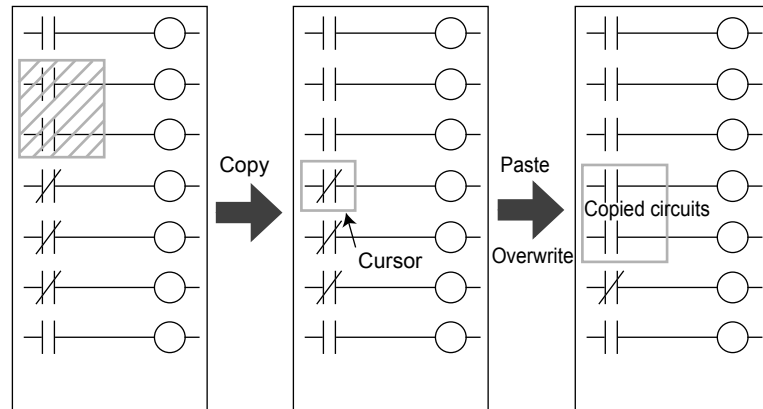
In Insert mode, it is not possible to copy if the number of circuit lines exceeds 200 lines after making the copy.

Copying circuits in units of cells

1. Specify a circuit range in cells (see 3.5.4).
2. Click on [Edit] – [Copy] in the menu.
3. Move the cursor to a cell at the copy destination.
4. Click on [Edit] – [Paste] in the menu.
Circuits start to be copied to cells starting at the position of the cursor.

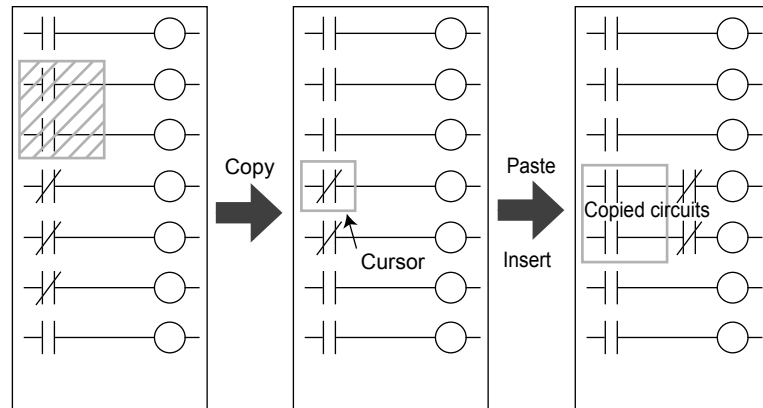
In Overwrite mode

The cells of circuits starting at the line where the cursor is placed are replaced with those of the circuits to be copied, by the number of circuit lines to be copied.



In Insert mode

The cells of circuits to be copied are inserted before the line where the cursor is placed.



Copying cannot be made on a cell basis in the following cases:

- An input instruction is pasted to column 11
- A paste in which an output instruction does not extend to column 11
- Data obtained after pasting exceeds the display range of columns
- A paste range in Overwrite mode reaches to within an instruction
- The number of instructions per line after a paste in Insert mode exceeds 11
- A line in a paste range in Insert mode is ORed with a line out of the paste range

3.5.7 Moving a Circuit

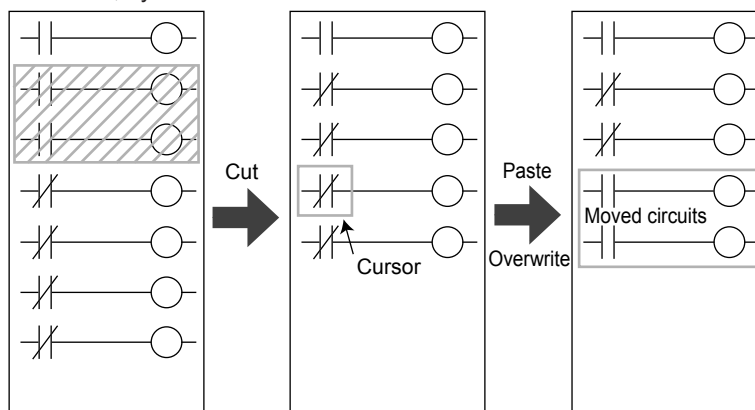
This section describes how to move a circuit.

Moving circuits in units of lines

1. Specify a circuit range in lines (see 3.5.4).
2. Click on [Edit] – [Cut] in the menu.
3. Move the cursor to left side cell on the line at the move destination.
4. Click on [Edit] – [Paste] in the menu.
Circuits are moved to lines starting at the position of the cursor.

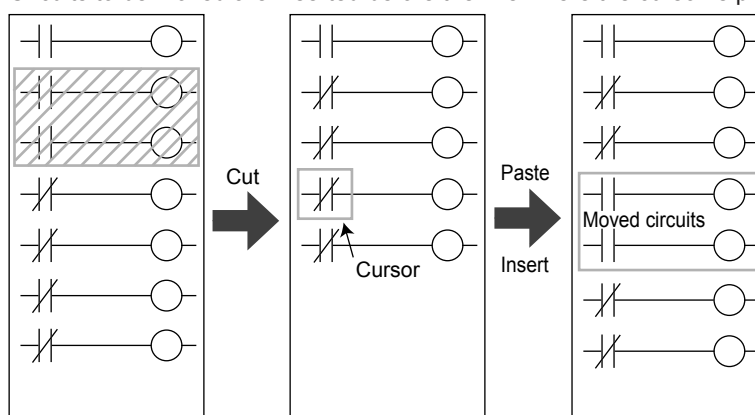
In Overwrite mode

The circuits starting at the line where the cursor is placed are replaced with the circuits to be moved, by the number of circuit lines to be moved.



In Insert mode

Circuits to be moved are inserted before the line where the cursor is placed.



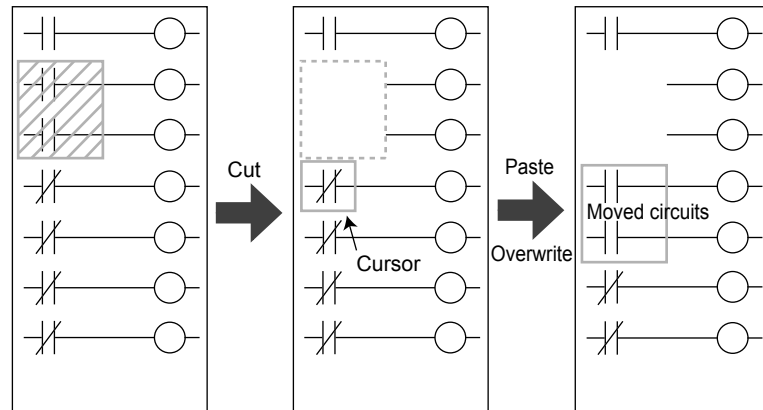
Moving circuits in units of cells

1. Specify a circuit range in cells (see 3.5.4).
2. Click on [Edit] – [Move] in the menu.
3. Move the cursor to a cell at the move destination.
4. Click on [Edit] – [Paste] in the menu.
Circuits are moved to cells starting at the position of the cursor.

3.5 Editing Ladder Programs

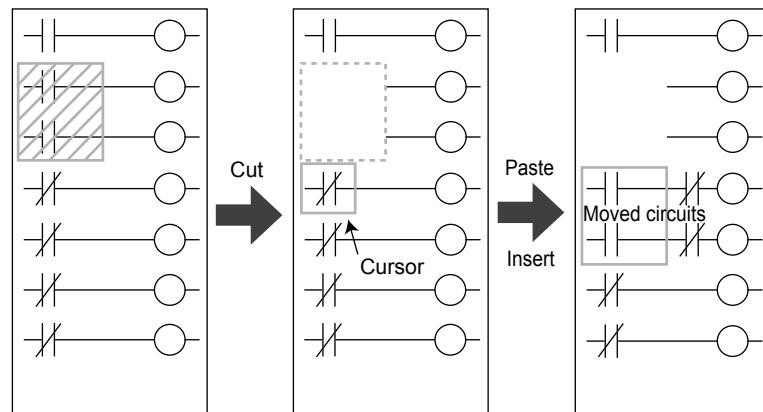
In Overwrite mode

The cells of circuits starting at the line where the cursor is placed are replaced with those of the circuits to be moved, by the number of circuit lines to be moved.



In Insert mode

The cells of circuits to be moved are inserted before the line where the cursor is placed.



A move cannot be made on a cell basis in the following cases:

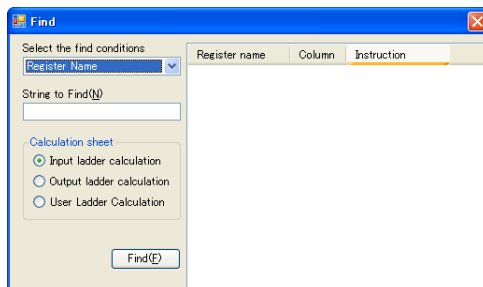
- An input instruction is pasted to column 11
- A paste in which an output instruction does not extend to column 11
- Data obtained after pasting exceeds the display range of columns
- A paste range in Overwrite mode reaches to within an instruction
- The number of instructions per line after a paste in Insert mode exceeds 11
- A line in a paste range in Insert mode is ORed with a line out of the paste range

3.5.8 Finding a Register or Instruction

This section describes how to find a register name or instruction in a ladder program.

Procedure

1. Click on [Edit] – [Find] in the menu to display the Find window.



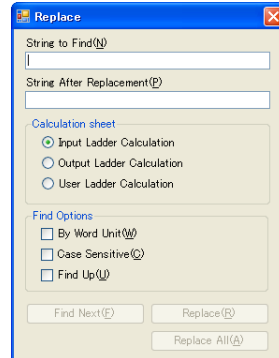
2. Input the character string you want to find.
Number of characters: Up to 20
Input characters: Single-byte alphanumeric characters + wildcard characters (*: number of characters is undefined, ?: 1 character)
3. Click the Find button to display a list of the results.
4. Clicking on a result causes the cursor to move to that position.

3.5.9 Replacing a Register or Instruction

This section describes how to replace a register name or instruction in a ladder program with a character string.

Procedure

1. Click on [Edit] – [Replace] in the menu to display the Replace window.



2. Enter the character string you want to search.
Number of characters: Up to 20
Input characters: Single-byte alphanumeric characters + wildcard characters (*: number of characters is undefined, ?: 1 character)
Number of characters after replacement: Up to 20
Input characters after replacement: Single-byte alphanumeric characters

Search options
Word basis: Character strings contained in a sentence are excluded.
Case sensitive
Upward search: with checkmark, Downward search: without checkmark
3. Click the [Replace Next] button to move the cursor to the position where the searched results are displayed.
4. Click the [Replace] button to replace the searched character string with the replacement character string. To replace all searched character strings in the program, click the [Replace All] button.

3.5.10 Setting a Burnout Connection

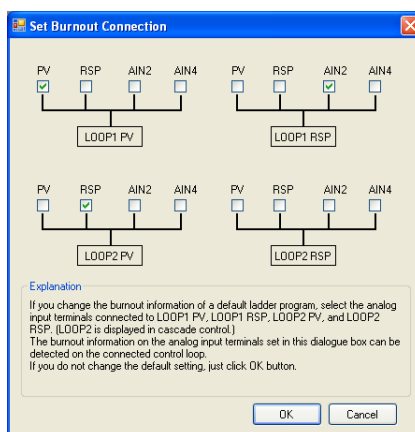
Burnout Connection Setting is only for UT55A/UT52A.

To change the burnout connection setting of the default ladder programs, select the analog input terminals connected to LOOP1 PV, LOOP1 RSP, LOOP2 PV, and LOOP2 RSP. (LOOP2 is displayed in Cascade control.)

The burnout information of the analog input terminals set up here can be detected by the control loop connected.

Procedure

1. Click on [Tool] – [Set Burnout Connection] in the menu to display the Set Burnout Connection window.



Item	Specification
LOOP1 PV	Select the input terminal connecting burnout information to loop-1 PV from among PV, RSP, AIN2, and AIN4.
LOOP1 RSP	Select the input terminal connecting burnout information to loop-1 RSP from among PV, RSP, AIN2, and AIN4.
LOOP2 PV	Select the input terminal connecting burnout information to loop-2 PV from among PV, RSP, AIN2, and AIN4.
LOOP2 RSP	Select the input terminal connecting burnout information to loop-2 RSP from among PV, RSP, AIN2, and AIN4.

LOOP2 PV and LOOP2 RSP are displayed in Cascade control.

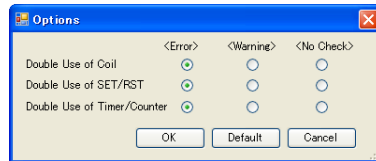
3.6 Checking Ladder Programs

This section describes how to check the program calculation instructions, program syntax, and step count when creating or editing a ladder program.

Setting up a syntax check

Procedure

1. Click [Tool] – [Set Option] in the menu to display the Options window.



2. Click on (select) the syntax check level and click the [OK] button.

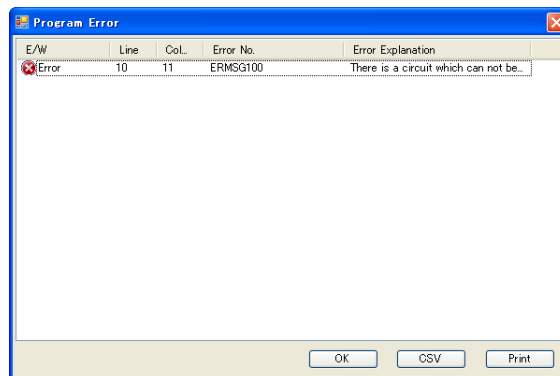
The Options window

Item	Specification
Double use of coil	This option sets whether an error or warning is generated or whether no check is made if a coil (OUT) is used for the same device twice or more. Default: Error
Double use of SET/RST	This option sets whether an error or warning is generated or whether no check is made if SET/RST is used for the same device twice or more. Default: Error
Double use of timer/counter	This option sets whether an error or warning is generated or whether no check is made if the timer/counter instruction is used for the same device twice or more. Default: Error
Default	Returns the settings of the options to the defaults.

Checking the syntax

Procedure

1. After building a ladder program, click on [Tool] – [Check Program] in the menu to conduct a syntax check.
2. If an error is found, the Program Error window appears.



List of the Ladder Program Error Message

Error No.	Error Explanation
ERMSG11	The number of steps has been exceeded.
ERMSG100	There is a circuit which can not be converted.
ERMSG101	Exceeded max line number.
ERMSG102	Exceeded max step number.
ERMSG103	Exceeded max comment number.
ERMSG104	Exceeded max commands number.
ERMSG105	Double Use of Coil
ERMSG106	Double Use of SET
ERMSG107	Double Use of RST
ERMSG108	Double Use of Timer
ERMSG109	Double Use of Counter
ERMSG110	The address has not entered.
ERMSG111	The address is not suitable.

3.7 Saving a Ladder Program in a File and Downloading/Uploading It

After building and editing a ladder program, save it in a file, download it to the UT, monitor and debug it, and then upload it from the UT to save in the file.

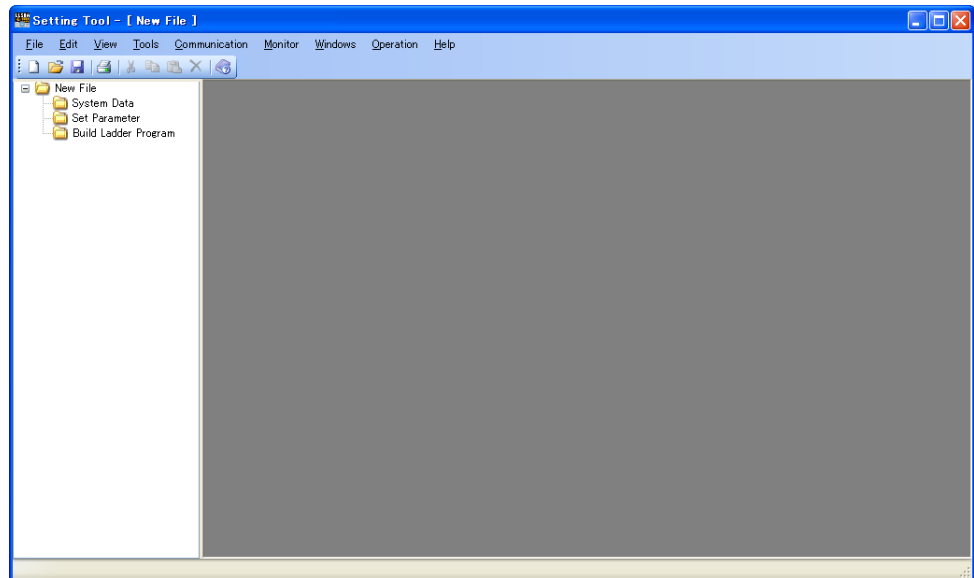
For the details of each operation, see the following sections:

- Saving in a file: Section 2.13, Managing files
- Downloading to UT: Section 2.9, Downloading Data
- Uploading from UT: Section 2.10, Uploading Data

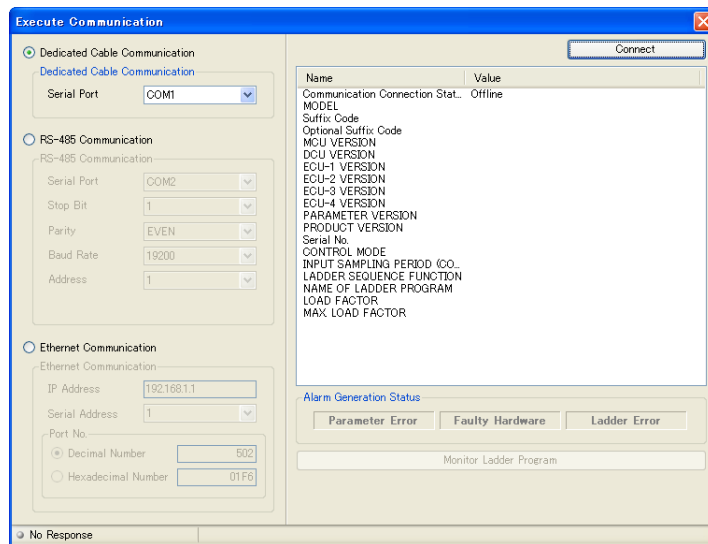
3.8 Monitoring a Ladder Program

Procedure

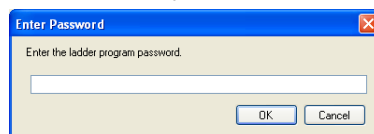
1. Display the Basic window.



2. Click on [Monitor] – [Monitor Ladder Program] in the menu to display the Execute Communication window.

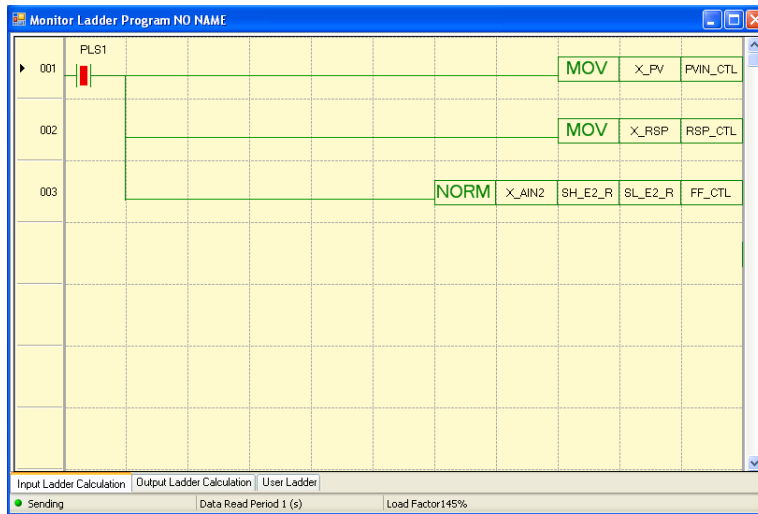



3. Set up the communication conditions and click the [Monitor Ladder Program] button to display the Enter Password dialog box.



3.8 Monitoring a Ladder Program

4. If a ladder program password has been set to the ladder program, enter the password and click the [OK] button.
If a ladder program password has not been set to the ladder program, click the [OK] button as is. The Monitor Ladder Program window appears.



5. To close the window, click .

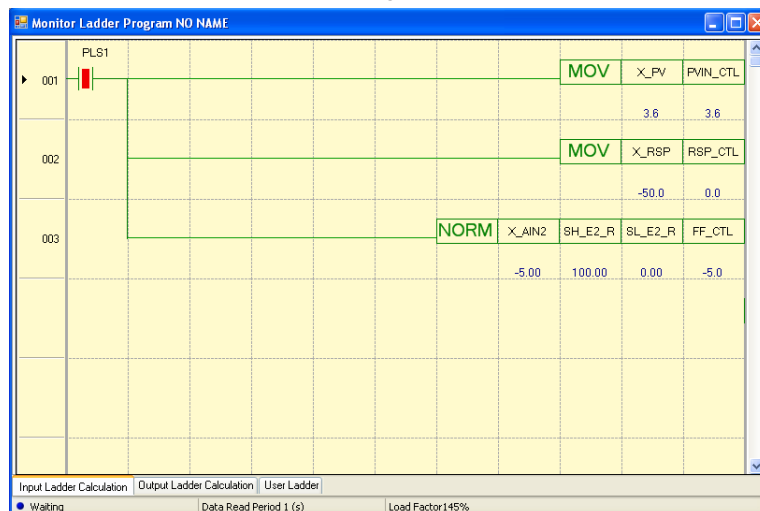
Switching between the input ladder calculation, output ladder calculation, and user ladder windows

Click on the desired tab at the bottom of the Monitor Ladder Program window to switch to any of these windows.

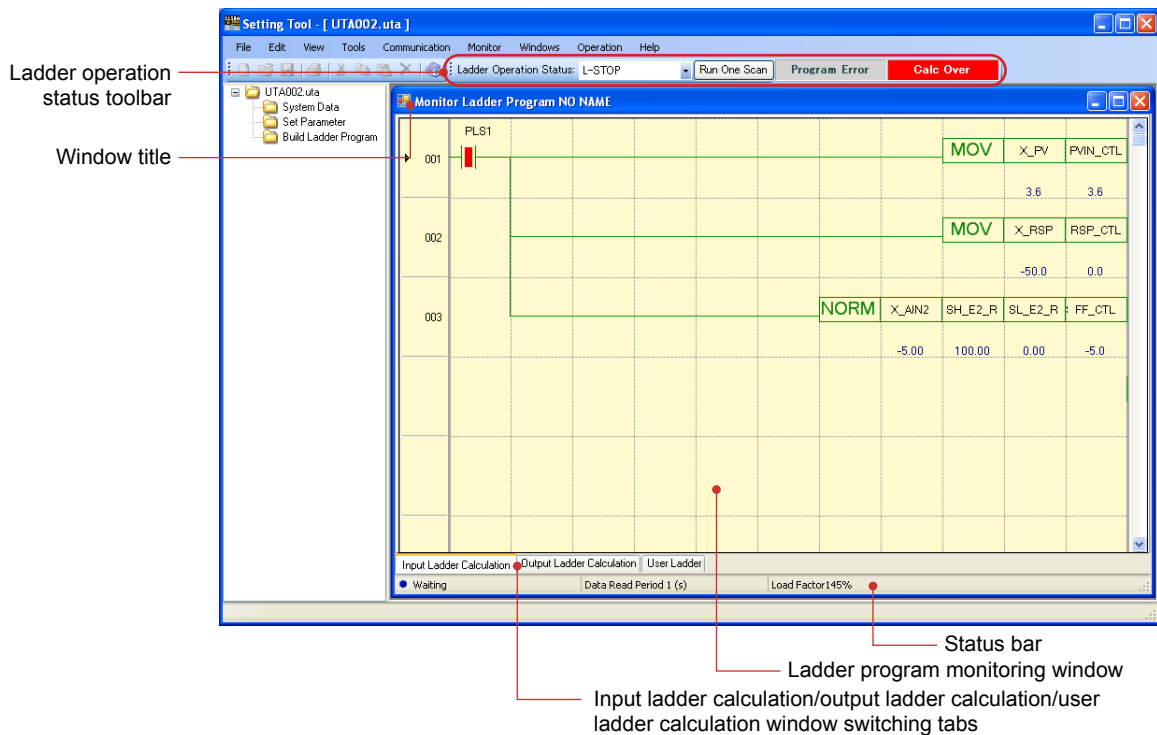
Detailed display of the Monitor Ladder Program window

Procedure

1. Place a check mark () in front of [Detail View] that is accessed from [Monitor] in the menu to show a detailed view of the Monitor Ladder Program window. This view shows the current values of registers, etc.



The Monitor Ladder Program window



Window title

Indicates “Monitor Ladder Program, a program name read from the UT.”

Monitor Ladder Program window

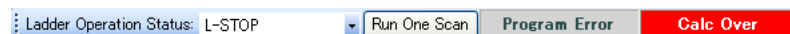
Displays the UT ladder program. This is the monitor window used when debugging the ladder program. This window displays ladder program switches, lamp ON/OFF, and register values.

Input ladder calculation/output ladder calculation/user ladder calculation window switching tabs

Click on a tab at the bottom of the Ladder Program Building window to switch between the input ladder calculation, output ladder calculation, and user ladder calculation.

Ladder operation status toolbar

The following toolbar is displayed during ladder program monitoring.



- **Ladder Operation Status**
Indicates the operating status of the UT’s ladder program.
Running: L-RUN
Stopped: L-STOP
The status in the combo box can be switched to change the ladder program operation status of the UT.
- **Run One Scan (1SCAN)**
When this button is pressed, the LL50A runs one scan of the UT ladder program and then stops it. This button is not available during L-RUN.
- **Reset Start (L-RESET RUN)**
When this button is pressed, the UT will perform the same operation as at power-on.
- **Ladder program error (Program Error)**
If the ladder program is corrupted, “Program Error” is lit.
- **Ladder calculation overflow (Calc Over)**
If a non-numerical value or infinity occurs during calculation or arises as a result, “Calc over” is lit.

3.8 Monitoring a Ladder Program

Status bar

Communication status

This item displays the status of communication with the UT.

Green (blinking): Communicating

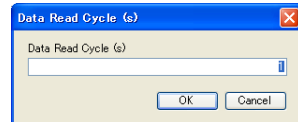
Red (lit): A communication delay occurred.

Data read cycle

Double-clicking on this area causes the Set Data Read Cycle window to appear. This item sets the read cycle for displaying UT data on a PC.

If communication does not meet the set update cycle, a communication delay occurs.

Setting range: 1 to 3600 sec



Load factor

Indicates the load factor of the UT's ladder program.

Displaying the current value of a timer or counter

The current value of a timer or counter is displayed in the detail view.

TIM	CLK1	TIM1	K01
		10	10

The current value can also be confirmed on the Monitor Register window.

- Register symbol of Timer-1 current value: TIMER1
- Register symbol of Timer-2 current value: TIMER2
- Register symbol of Timer-3 current value: TIMER3
- Register symbol of Timer-4 current value: TIMER4

- Register symbol of Counter-1 current value: COUNTER1
- Register symbol of Counter-2 current value: COUNTER2
- Register symbol of Counter-3 current value: COUNTER3
- Register symbol of Counter-4 current value: COUNTER4

Description


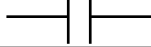


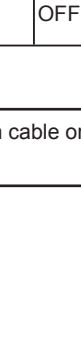
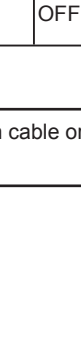
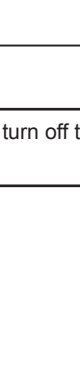
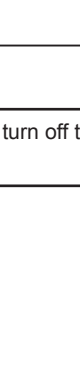
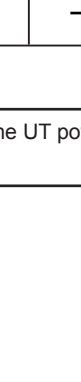
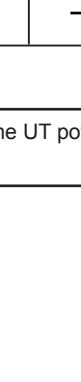
The Monitor Ladder Program window and Monitor Register window can be simultaneously displayed. The monitored data is refreshed only on the active window. For the Monitor Register window, see Section 3.9, Monitoring/Changing Register Data.

Execute Communication window

- Serial port: A port available for a PC is automatically displayed.
- Stop bit, parity, baud rate, data length, and address: Set these items according to the UT's communication conditions.
- IP address: Set this address according to the UT's IP address (for Ethernet communication).
- Serial address: Set the UT's RS-485 communication address if communication is made via an Ethernet/RS-485 converter (e.g., model VJET). (Not allowed to be duplicated)
- Port number: Set the port number.

ON/OFF display of relays

The ON/OFF status of relays in the Monitor Ladder Program window is displayed as shown below. Other instructions are also displayed in the same way.

Device Type		Status	Display
Input	"a" contact	ON	
		OFF	
	"b" contact	ON	
		OFF	
Output	Out	ON	
		OFF	
	SET	ON	
		OFF	
	RST	ON	
		OFF	

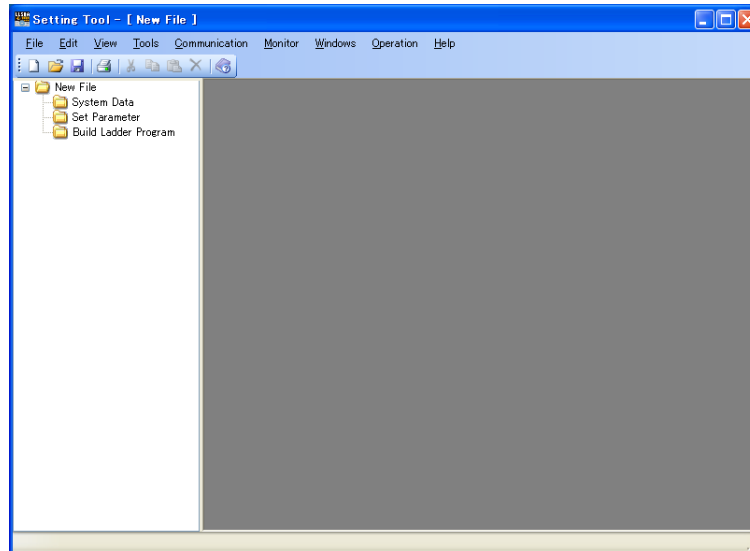
Note

Do not disconnect a connection cable or turn off the UT power supply during register monitoring.

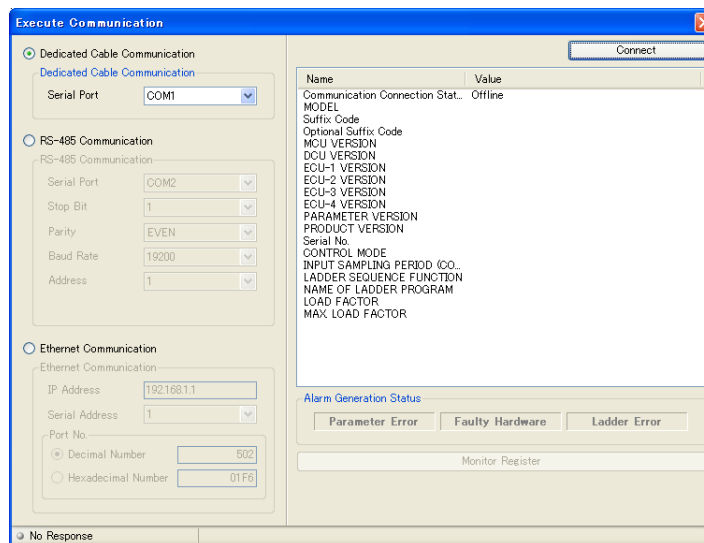
3.9 Monitoring/Changing Register Data

Procedure

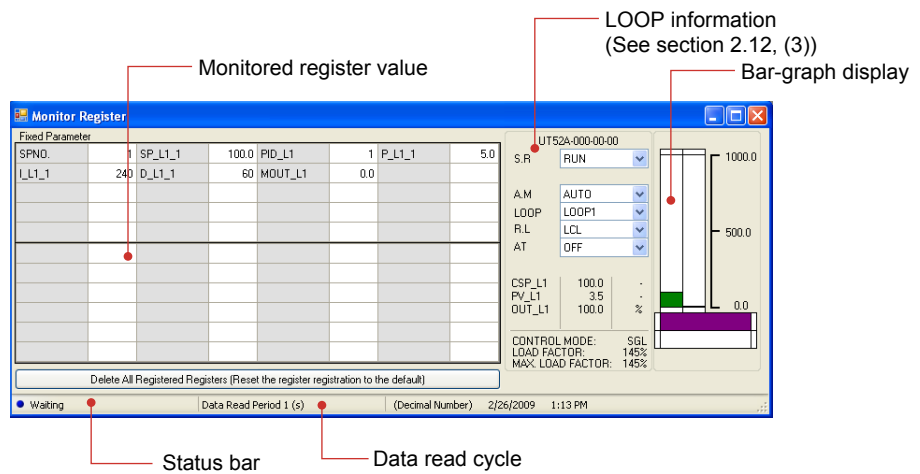
1. Display the Basic window.



2. Click on [Monitor] – [Monitor Register] in the menu to display the Execute Communication window.



3. Set up the communication conditions and click the [Execute Register Monitoring] button to display the Monitor Register window.



4. By observing PV, SP, and OUT trends, change the register settings.
5. Click to close the window.

What are register symbols?

Register symbols are the symbols of registers containing data such as UT parameters, operation status, alarm status, contact input, and error information in 16 bits or 1 bit. When performing communication, registers are used as D-registers or I-relays. For more information on them, see the UTAdvanced Communication Interface (RS-485, Ethernet) User's Manual.

D-register symbols

For some register symbols, the loop number, terminal area number, and group number are indicated with an underscore (_) added after the parameter symbol. If a parameter symbol has both a loop number and group number, they are added to it in the order of _loop number and _group number.

xxxx_Ln_Y

Ln: loop number (L1 or L2)

Y: group number (1 to 8 or 1 to 16, R)

xxxx_En

En: terminal area number (E1 to E4)

Example: SP_L1_3: This means loop-1 group-3 target setpoint.

PYS_2: This means group-2 PYS.

DI1.D_E1: This means E1-terminal area DI1.D.

Note

Since the UT35A/UT32A is a single-loop controller, it has no distinction between Loop-1 and Loop-2. However, the register symbol has "L1" which indicates Loop-1.

Switching between decimal and hexadecimal displays

Procedure

1. Click on [Monitor], select [Display Format], and click on [Decimal] or [Hexadecimal] in the menu.

Description

The monitor register function is used to check the operation of the UT's ladder program. If a register value is modified, the modification is reflected in the UT.

Note

If the control mode, control type, scale parameter, or other item is changed while the Monitor Register window is displayed, once close the Monitor Register window and then re-open it to display the new values.



Execute Communication window

- Serial Port: A port available for a PC is automatically displayed.
- Stop Bit, Parity, Baud Rate, and address: Set these items according to the UT's communication conditions. Data length: fixed 8 bit
- IP Address: Set this address according to the UT's IP address (for Ethernet communication).
- Serial Address: Set the UT's RS-485 communication address if communication is made via an Ethernet/RS-485 converter (e.g., model VJET). (Not allowed to be duplicated)
- Port Number: Set the port number. (Decimal Number or Hexadecimal Number)

Note

Do not disconnect a connection cable or turn off the UT power supply during register monitoring.

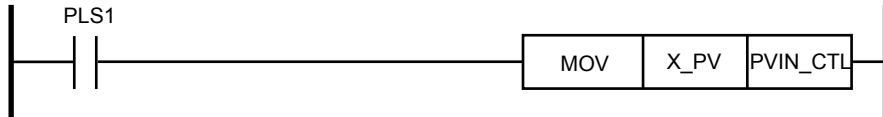
3.10 Default Ladder Programs

3.10.1 UT35A/UT32A

Input ladder calculation program

Input registers	X_PV
Output registers	PVIN_CTL

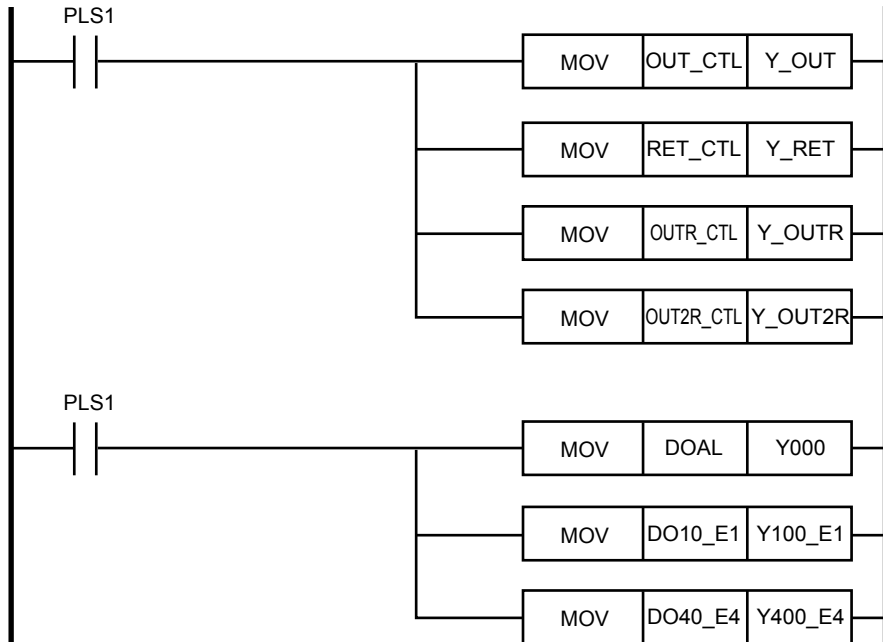
For an explanation of the registers, see Section 4.2, Registers.



Output ladder calculation program

Input registers	OUT_CTL, RET_CTL, OTR_CTL, OUT2R_CTL, DOAL, DO10_E1, DO40_E3
Output registers	Y_OUT, Y_RET, Y_OTR, Y_OUT2R, Y000, Y100_E1, Y400_E4

For an explanation of the registers, see Section 4.2, Registers.

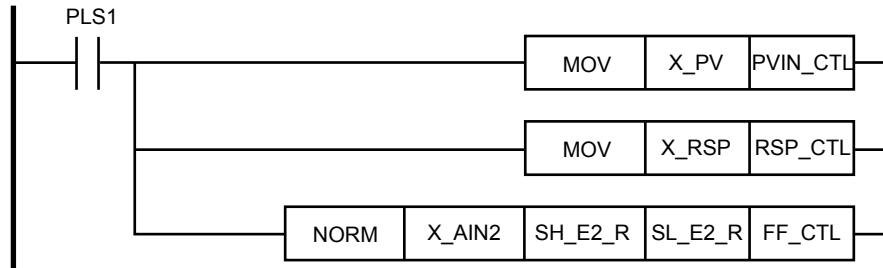


3.10.2 UT55A/UT52A Single-loop Control

Input ladder calculation program

Input registers	X_PV, X_RSP, X_AIN2
Parameter registers	SH_E2_R, SL_E2_R
Output registers	PVIN_CTL, RSP_CTL, FF_CTL

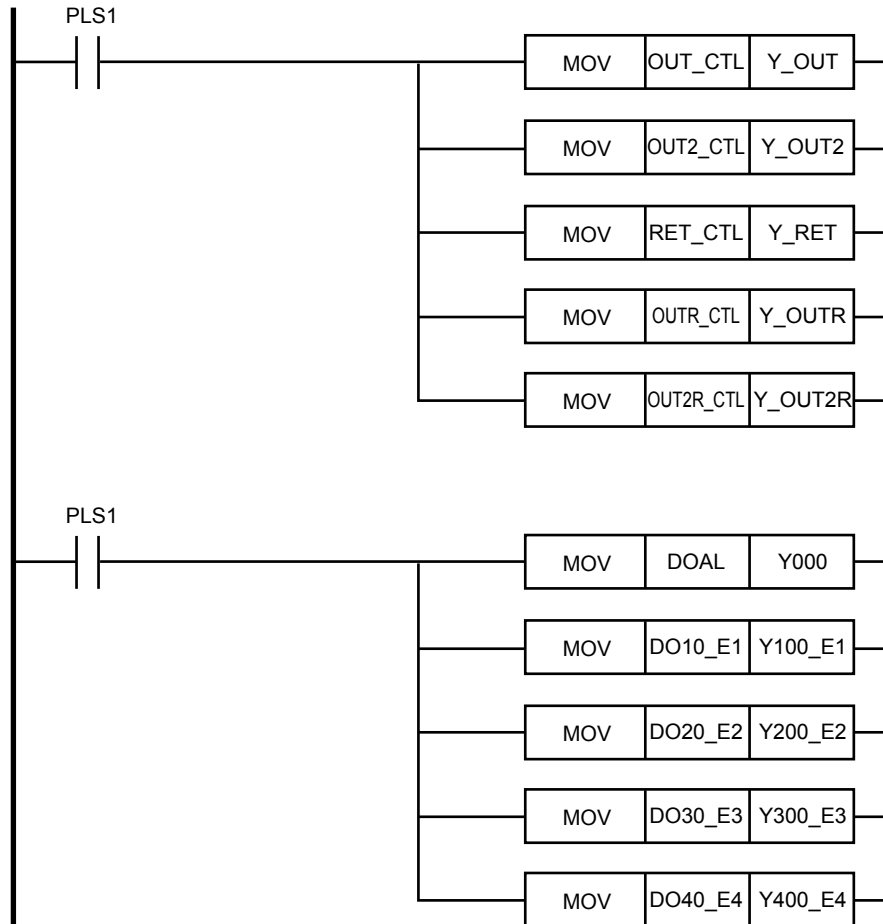
For an explanation of the registers, see Section 4.2, Registers.



Output ladder calculation program

Input registers	OUT_CTL, OUT2_CTL, RET_CTL, OUTR_CTL, OUT2R_CTL, DOAL, DO10_E1, DO20_E2, DO30_E3, DO40_E3
Output registers	Y_OUT, Y_OUT2, Y_RET, Y_OUTR, Y_OUT2R, Y000, Y100_E1, Y200_E2, Y300_E3, Y400_E4

For an explanation of the registers, see Section 4.2, Registers.

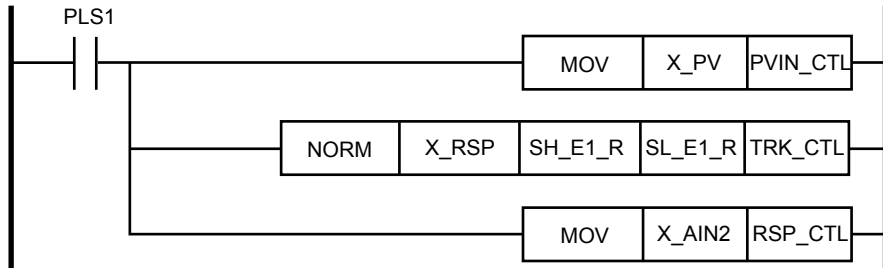


3.10.3 UT55A/UT52A Cascade Primary-loop Control

Input ladder calculation program

Input registers	X_PV, X_RSP, X_AIN2
Parameter registers	SH_E1_R, SL_E1_R
Output registers	PVIN_CTL, TRK_CTL, RSP_CTL

For an explanation of the registers, see Section 4.2, Registers.



Output ladder calculation program

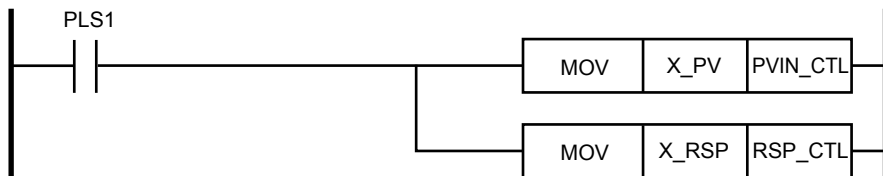
The output ladder calculation program is the same as that of UT55A/UT52A Single-loop control.

3.10.4 UT55A/UT52A Cascade Secondary-loop Control

Input ladder calculation program

Input registers	X_PV, X_RSP
Output registers	PVIN_CTL, RSP_CTL

For an explanation of the registers, see Section 4.2, Registers.



Output ladder calculation program

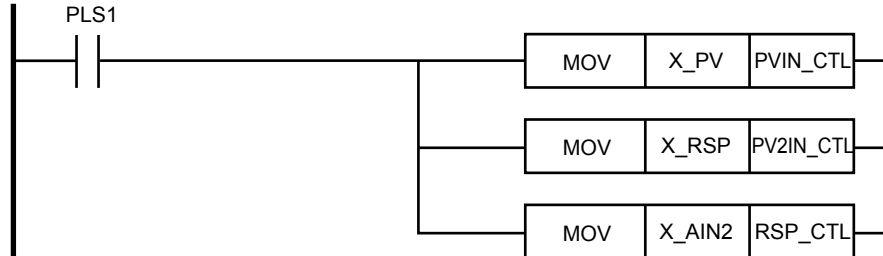
The output ladder calculation program is the same as that of UT55A/UT52A Single-loop control.

3.10.5 UT55A/UT52A Cascade Control

Input ladder calculation program

Input registers	X_PV, X_RSP, X_AIN2
Output registers	PVIN_CTL, PV2IN_CTL, RSP_CTL

For an explanation of the registers, see Section 4.2, Registers.



Output ladder calculation program

The output ladder calculation program is the same as that of UT55A/UT52A Single-loop control.

3.10.6 UT55A/UT52A Loop Control for Backup

Input ladder calculation program

The input ladder calculation program is the same as that of UT55A/UT52A Cascade primary-loop control.

Output ladder calculation program

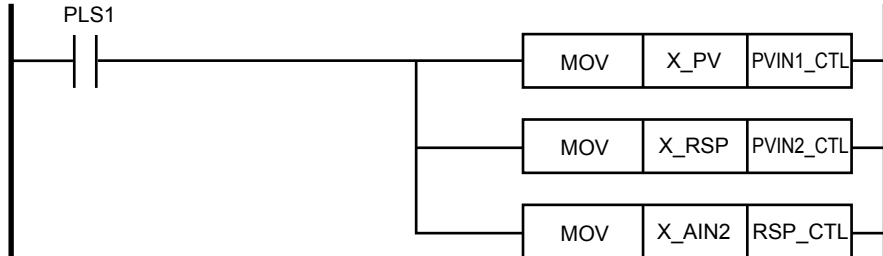
The output ladder calculation program is the same as that of UT55A/UT52A Single-loop control.

3.10.7 UT55A/UT52A Loop Control with PV Switching

Input ladder calculation program

Input registers	X_PV, X_RSP, X_AIN2
Output registers	PVIN1_CTL, PVIN2_CTL, RSP_CTL

For an explanation of the registers, see Section 4.2, Registers.



Output ladder calculation program

The output ladder calculation program is the same as that of UT55A/UT52A Single-loop control.

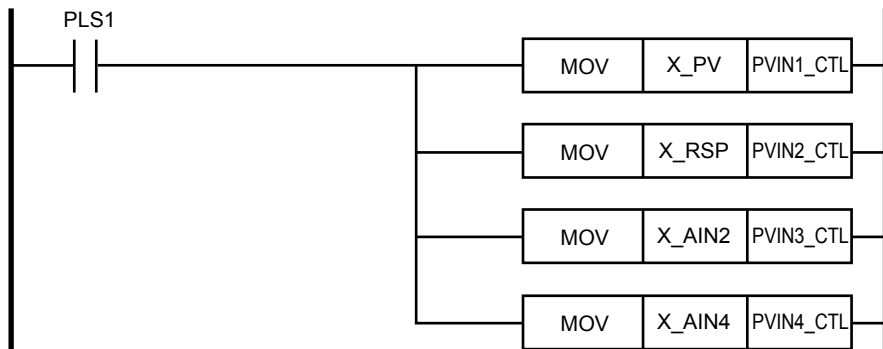
3.10.8 UT55A/UT52A Loop Control with PV Auto-selector

Input ladder calculation program

Input registers	X_PV, X_RSP, X_AIN2, X_AIN4
Output registers	PVIN1_CTL, PVIN2_CTL, PVIN3_CTL, PVIN4_CTL

PVIN3_CTL and PVIN4_CTL can be used according to the number of inputs.

For an explanation of the registers, see Section 4.2, Registers.



Output ladder calculation program

The output ladder calculation program is the same as that of UT55A/UT52A Single-loop control.

3.10.9 UT55A/UT52A Loop Control with PV-hold Function

Input ladder calculation program

The input ladder calculation program is the same as that of UT55A/UT52A Single-loop control.

Output ladder calculation program

The output ladder calculation program is the same as that of UT55A/UT52A Single-loop control.

4.1 Basic Specifications

4.1.1 Control Period (Scan Time)

The control period is set using the parameter (SMP). The control period of UT35A/UT32A is fixed to 200 ms. The control period functions in the set period irrespective of the ladder program capacity. The table below shows guidelines for the ladder program capacity (approximate average value) for each control period. The average of one ladder instruction is equivalent to four steps. In performing actual operations, check the load factor with the Monitor Ladder Program before using the ladder programs. The step count varies depending on the types of instructions used, parameter setting in the main unit, and control period. This step count includes the step count for the default ladder program.

The step count of the ladder program is the step count for Mnemonics into which the ladder program has been converted from a ladder diagram. For the number of steps of ladder instructions, see the lists of basic instructions and application instructions described later.

- ▶ Parameters: [UT35A/UT32A Digital Indicating Controllers User's Manual or Operation Guide](#)
- ▶ Parameters: [UT55A/UT52A Digital Indicating Controllers User's Manual or Operation Guide](#)
- ▶ Default ladder programs: [Section 3.10, Default Ladder Programs](#)

UT35A/UT32A

Control period	Ladder program capacity (as a guide)
200 ms	300 steps

UT55A/UT52A

Control period	Ladder program capacity (as a guide)
50 ms	100 steps
100 ms	200 steps
200 ms	400 steps

Max. Ladder Program Capacity

Model	Ladder program capacity (Max.)
UT35A/UT32A	300 steps
UT55A/UT52A	500 steps

4.1.2 Number of Inputs/Outputs

The table below shows the maximum number of inputs/outputs, which varies depending on the model and suffix codes. See App.2, Input/Output Tables.

	UT35A	UT32A	UT55A	UT52A
Contact inputs	Max. 7 points	Max. 4 points	Max. 9 points	Max. 5 points
Contact outputs	Max. 8 points	Max. 5 points	Max. 18 points	Max. 5 points

* The number of contact outputs excludes control relays.

4.1.3 Types of Instructions

There are 13 types of basic instructions and 73 types of application instructions. For more information, see section 4.4 or later.

4.1.4 Sequence Devices

Device Type		Number of Points	Remarks
Contact inputs/outputs	Input relay (bit data)	See 4.1.2.	
	Output relay (bit data)		
Internal devices	M: relay (bit data)	256	Holding type/non-holding type
	DAT: register (floating point number)	28	Holding type/non-holding type
	P: register (floating point number, held at power failure)	10	Parameter settable
	K: register (floating point number)	30	
Timers	Time-out relay (bit data)	4	
Counters	Count-out relay (bit data)	4	
Special devices	Relay (bit data)	12	
Registers	Process data, operation mode, parameter data, etc.	See Communication Interface User's Manual.	
Relays	Alarm status, alarm output status, key status, display status, events, etc.		

4.1.5 Operation Status

Whether or not to use the ladder sequence can be set.

When using the ladder sequence, there are four operation modes:

- L-STOP (No ladder program is run.)
- 1SCAN (The ladder program is run by one scan.)
- L-RUN (The ladder program is run.)
- L-RESET RUN (The UT will perform the same operation as at power-on.)

These operation modes can be specified on the Monitor Ladder Program window.

▶ [Monitor Ladder Program: Section 3.8, Monitoring a Ladder Program](#)

4.1.6 Operation Conditions

The ladder programs run in all control modes (CTLM). UT35A/UT32A does not have the parameter CTLM (Control mode.)

To use a ladder program, set the Ladder Sequence Function to "USE" on the System Data window.

4.1.7 Operation in Operation Mode L-RUN/L-STOP on the Monitor Ladder Program

When the operation mode is set to L-STOP on the Monitor Ladder Program, control computation and sequence control stop, the output is fixed to the value before stop, and input measurement is stopped.

When ladder operation is executed by one scan, the input is measured during one scan and control computation and sequence calculation are made. The ladder operation then enters the L-STOP status.

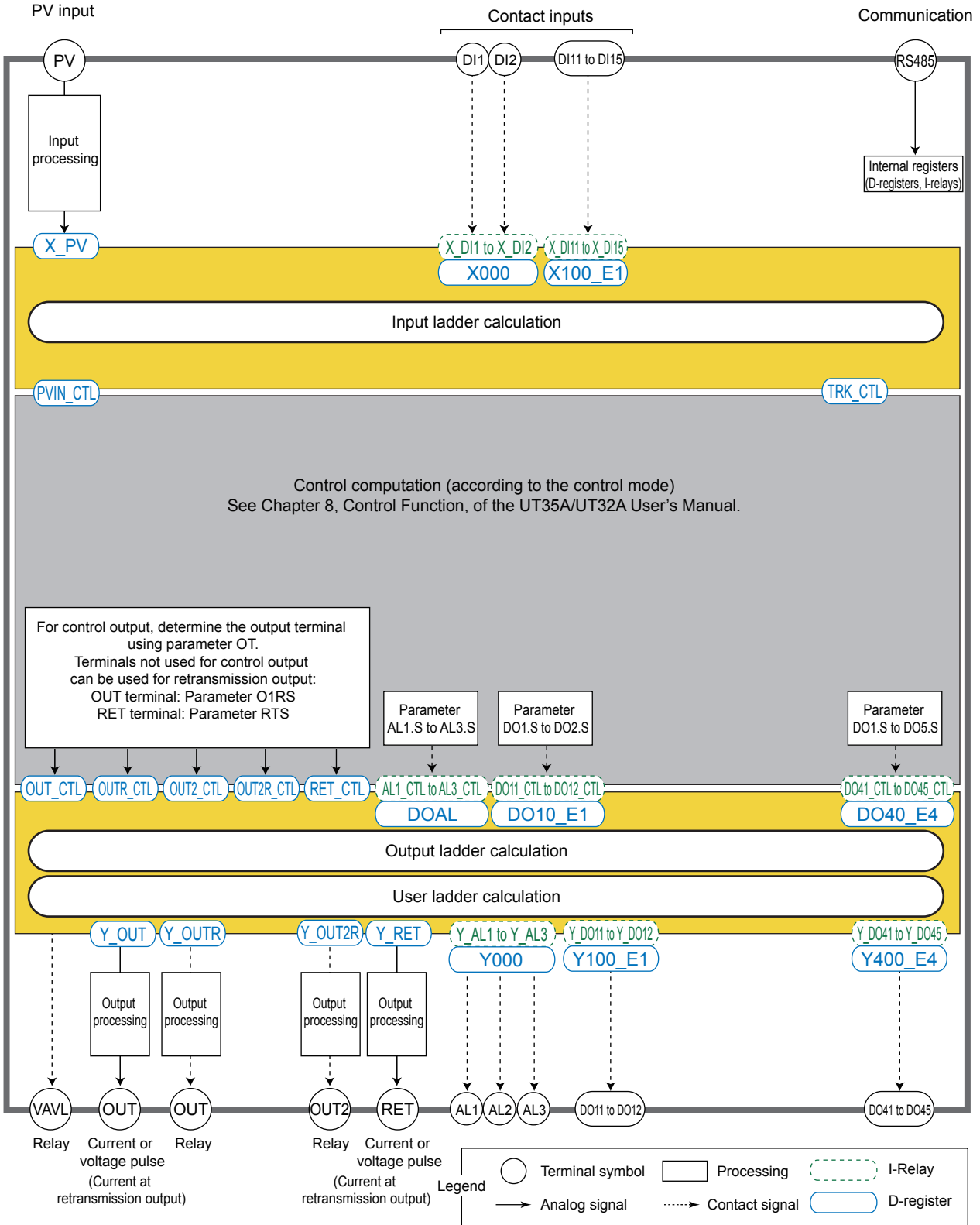
If the Monitor Ladder Program is exited and the main unit's power is restarted, the timer's current value, etc. are initialized. The timer's current value, etc. will be held unless the main unit's power is restarted.

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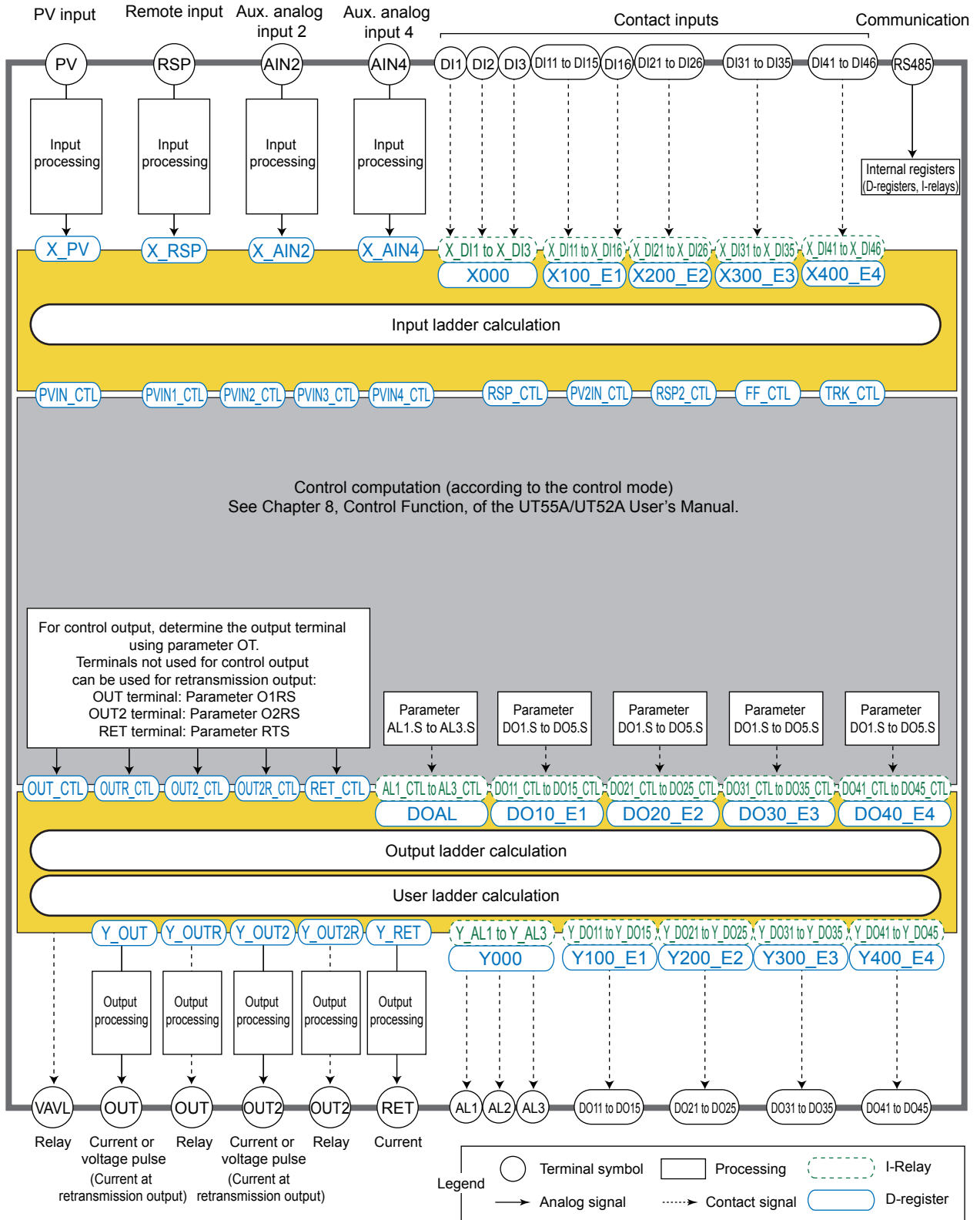
4.2 Registers

4.2.1 Input/Output Ladder Calculation Relays/Registers

■ UT35A/UT32A



■ UT55A/UT52A



Input ladder calculation

Analog input registers (X_PV, X_RSP, X_AIN2, and X_AIN4) and input (status) relays (X_DI1 to X_DI3, X_DI11 to X_DI16, X_DI21 to X_DI26, X_DI31 to X_DI35, and X_DI41 to X_DI46) are captured to perform calculation in the input ladder calculation section.

The calculated results are written into control input registers (PVIN_CTL, PVIN1_CTL, PVIN2_CTL, PVIN3_CTL, PVIN4_CTL, RSP_CTL, PV2IN_CTL, RSP2_CTL, FF_CTL, and TRK_CTL) and then passed to the control computation section.

Input (status) relays (X_DI1 to X_DI3, X_DI11 to X_DI16, X_DI21 to X_DI26, X_DI31 to X_DI35, and X_DI41 to X_DI46) are also stored in the input status registers (X000, X100_E1, X200_E2, X300_E3, and X400_E4).

Output ladder calculation

Control computation registers computed in the control computation section (OUT_CTL, OUTR_CTL, OUT2_CTL, OUT2R_CTL, and RET_CTL), and control status registers (DOAL, DO10_E1, DO20_E2, DO30_E3, and DO40_E4) are captured to perform calculation in the output ladder calculation or user ladder calculation section. The calculated results are written into output registers (Y_OUT, Y_OUTR, Y_OUT2, Y_OUT2R, and Y_RET), and output status registers (Y000, Y100_E1, Y200_E2, Y300_E3, and E400_E4) and then output to the terminals.

Control status registers are also stored in control (status) relays (AL1_CTL to AL3_CTL, DO11_CTL to DO45_CTL).

Output status registers are also stored in the output (status) relays (Y_AL1 to Y_AL3, Y_DO11 to Y_DO45).

User ladder calculation

It is recommended that the user ladder calculation section be used if a sequence is desired to be configured regardless of controller control computation.

As the initial status, the default ladder programs are described in the input ladder calculation and output ladder calculation sections on a control mode basis. No program is written in the user ladder calculation section.

▶ [Default ladder programs: Section 3.10, Default Ladder Programs](#)

Order of executing computation/calculation

The order of executing computation/calculation is as follows:

- (1) Input ladder calculation
- (2) Control computation
- (3) Output ladder calculation
- (4) User ladder calculation

Inputs/outputs differ depending on the model and suffix codes:

▶ [Input/output: App.2, Input/Output Tables.](#)

Input Ladder Calculation: Analog Input Registers (Read Only)

Position	Terminal Symbol	Register (16 bits)	Description
Standard terminal area	PV	X_PV	PV analog input
E1-terminal area	RSP	X_RSP	RSP analog input
E2-terminal area	AIN2	X_AIN2	AIN2 aux. analog input
E4-terminal area	AIN4	X_AIN4	AIN4 aux. analog input

Registers can also be read in the output ladder calculation section or user ladder calculation section.

Data format

These registers handle analog inputs as values consisting of signed two-byte data of -19999 to 30000 including the decimal point position. They are range or scaling processed values (actual quantities).

Internal processing handles data as 4-byte floating-point numbers (IEEE 754 single-precision floating-point format).

Input Ladder Calculation: Input (Status) Relays/Input Status Registers (Read Only)

Position	Terminal Symbol	Relay (1 bit)	Status Register (16 bits)	Description
Standard terminal area	DI1	X_DI1	X000	DI1 status
	DI2	X_DI2		DI2 status
	DI3	X_DI3		DI3 status
E1-terminal area	DI11	X_DI11	X100_E1	DI11 status
	DI12	X_DI12		DI12 status
	DI13	X_DI13		DI13 status
	DI14	X_DI14		DI14 status
	DI15	X_DI15		DI15 status
	DI16	X_DI16		DI16 status
E2-terminal area	DI21	X_DI21	X200_E2	DI21 status
	DI22	X_DI22		DI22 status
	DI23	X_DI23		DI23 status
	DI24	X_DI24		DI24 status
	DI25	X_DI25		DI25 status
	DI26	X_DI26		DI26 status
E3-terminal area	DI31	X_DI31	X300_E3	DI31 status
	DI32	X_DI32		DI32 status
	DI33	X_DI33		DI33 status
	DI34	X_DI34		DI34 status
	DI35	X_DI35		DI35 status
E4-terminal area	DI41	X_DI41	X400_E4	DI41 status
	DI42	X_DI42		DI42 status
	DI43	X_DI43		DI43 status
	DI44	X_DI44		DI44 status
	DI45	X_DI45		DI45 status
	DI46	X_DI46		DI46 status

Relays/status registers can also be read in the output ladder calculation section or user ladder calculation section.

Data format

- Input ladder calculation Relays: 0 or 1
- Input ladder calculation Status registers: Unsigned 16-bit integers

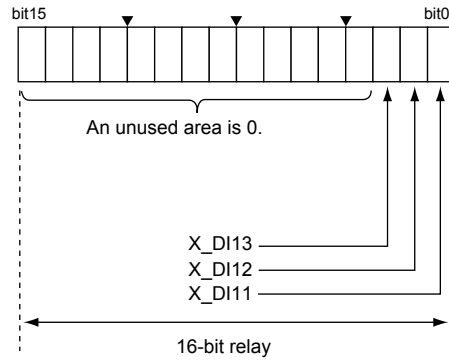
4.2 Registers

Note

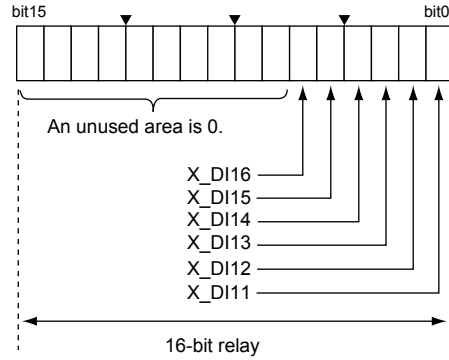
When the contact input status is used in the ladder, deactivate the contact input function (STOP/RUN switch, AUTO/MAN switch, etc.) using the main UT's parameter.

Check the parameter settings belonging to the setup parameter menu DI.SL (DI function registration menu) or DI.NU (DI function numbering menu).

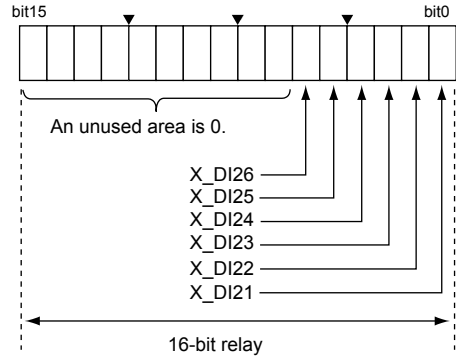
Status register: X000



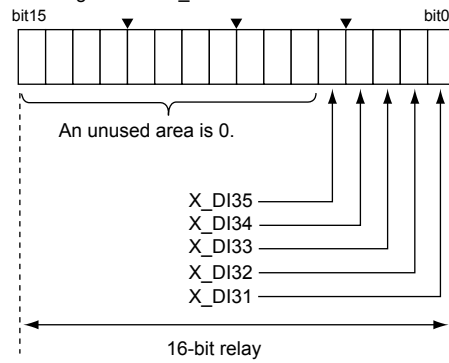
Status register: X100_E1



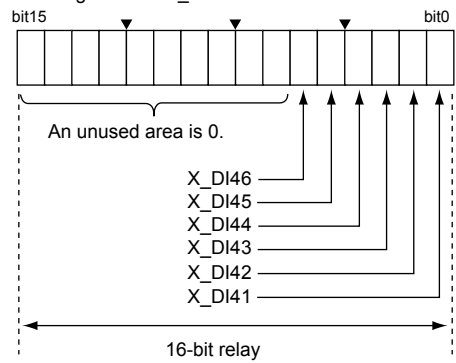
Status register: X200_E2



Status register: X300_E3



Status register: X400_E4



Input Ladder Calculation: Control Input Registers (Read/Write)

Register (16 bits)	Description
PVIN_CTL	Control PV input (in controls other than Loop control with PV switching or Loop control with PV auto-selector)
PVIN1_CTL	Control PV input 1 (in Loop control with PV switching or Loop control with PV auto-selector)
PVIN2_CTL	Control PV input 2 (in Loop control with PV auto-selector or Loop control with PV switching)
PVIN3_CTL	Control PV input 3 (in Loop control with PV auto-selector)
PVIN4_CTL	Control PV input 4 (in Loop control with PV auto-selector)
PV2IN_CTL	Control PV2 input (in Cascade control)
RSP_CTL	Control RSP input
RSP2_CTL	Control RSP2 input (in Cascade control)
TRK_CTL	Control tracking input (except for Cascade control)
FF_CTL	Control feedforward input (in Single-loop control or Loop control with PV-hold function)

Registers can also be read in the output ladder calculation section or user ladder calculation section.

Data format

These registers handle calculated results as values consisting of signed two-byte data of -19999 to 30000 including the decimal point position.

Internal processing handles data as 4-byte floating-point numbers (IEEE 754 single-precision floating-point format).

Output Ladder Calculation: Control Computation Registers (Read Only)

Register (16 bits)	Description
OUT_CTL	Control OUT output (current and voltage pulses)
OUTR_CTL	Control OUT output (relays)
OUT2_CTL	Control OUT2 output (current and voltage pulses)
OUT2R_CTL	Control OUT2 output (relays)
RET_CTL	Control RET output (current)

Registers can also be read in the input ladder calculation section or user ladder calculation section.

Data format

These registers handle computed data as values consisting of signed two-byte data of -19999 to 30000 including the decimal point position.

Scaling

Internal processing handles data as 4-byte floating-point numbers (IEEE 754 single-precision floating-point format).

Output Ladder Calculation: Control (Status) Relays/Control Status Registers (Read Only)

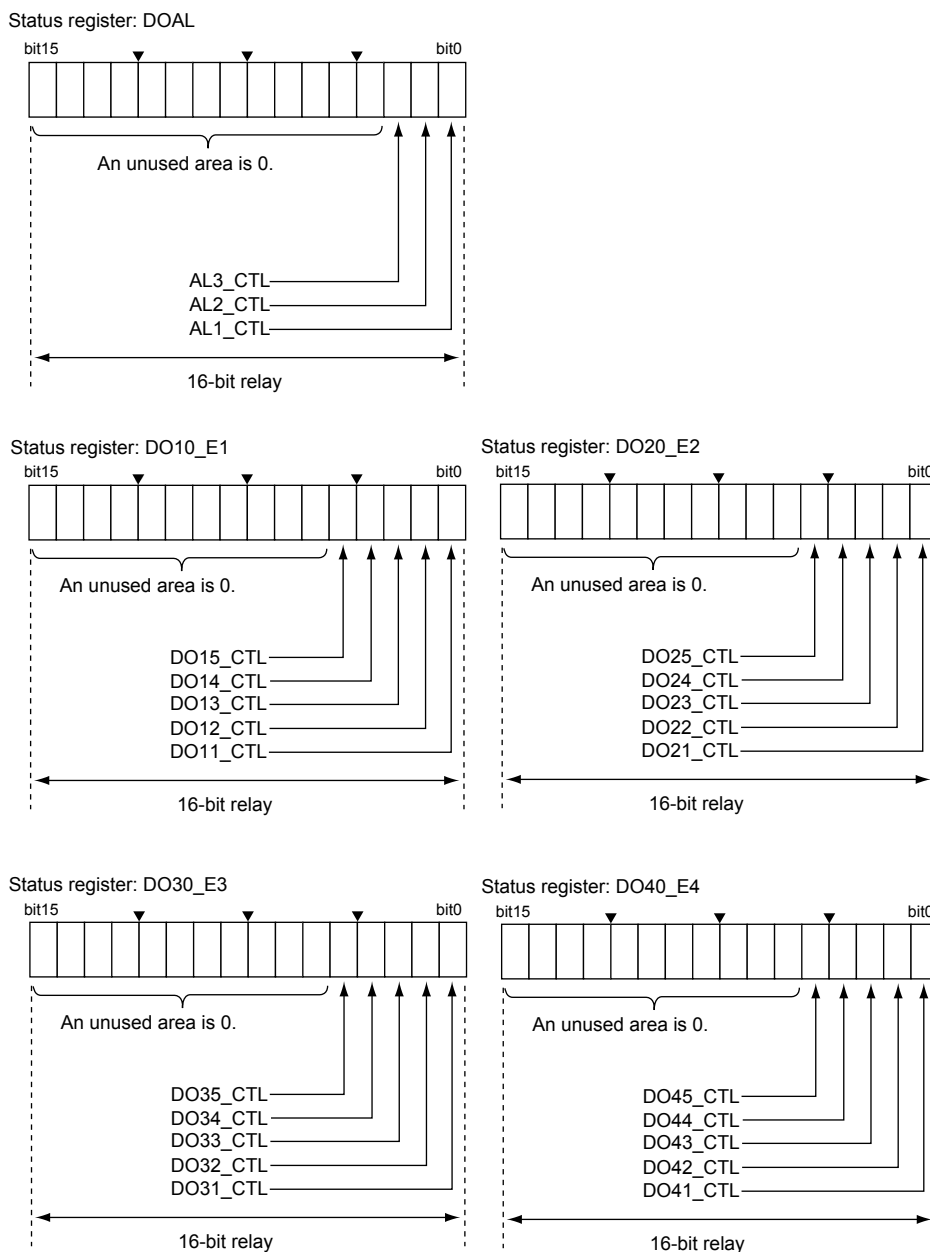
Relay (1 bit)	Status Register (16 bits)	Description	
AL1_CTL	DOAL	Control AL1 status	Function set using parameter AL1.S
AL2_CTL		Control AL2 status	Function set using parameter AL2.S
AL3_CTL		Control AL3 status	Function set using parameter AL3.S
DO11_CTL	DO10_E1	Control DO11 status	Function set using parameter DO1.S
DO12_CTL		Control DO12 status	Function set using parameter DO2.S
DO13_CTL		Control DO13 status	Function set using parameter DO3.S
DO14_CTL		Control DO14 status	Function set using parameter DO4.S
DO15_CTL		Control DO15 status	Function set using parameter DO5.S
DO21_CTL	DO20_E2	Control DO21 status	Function set using parameter DO1.S
DO22_CTL		Control DO22 status	Function set using parameter DO2.S
DO23_CTL		Control DO23 status	Function set using parameter DO3.S
DO24_CTL		Control DO24 status	Function set using parameter DO4.S
DO25_CTL		Control DO25 status	Function set using parameter DO5.S
DO31_CTL	DO30_E3	Control DO31 status	Function set using parameter DO1.S
DO32_CTL		Control DO32 status	Function set using parameter DO2.S
DO33_CTL		Control DO33 status	Function set using parameter DO3.S
DO34_CTL		Control DO34 status	Function set using parameter DO4.S
DO35_CTL		Control DO35 status	Function set using parameter DO5.S
DO41_CTL	DO40_E4	Control DO41 status	Function set using parameter DO1.S
DO42_CTL		Control DO42 status	Function set using parameter DO2.S
DO43_CTL		Control DO43 status	Function set using parameter DO3.S
DO44_CTL		Control DO44 status	Function set using parameter DO4.S
DO45_CTL		Control DO45 status	Function set using parameter DO5.S

Relays/status registers can also be read in the input ladder calculation section or user ladder calculation section.

► [Parameters: UT35A/UT32A Digital Indicating Controllers User's Manual or Operation Guide or UT55A/UT52A Digital Indicating Controllers User's Manual or Operation Guide](#)

Data format

- Output ladder calculation Relays: 0 or 1
Internal processing handles a value of less than 0.5 as "0" and a value of 0.5 or more as "1." This is internal processing used for transferring register data to relays, etc.
- Output ladder calculation Status registers: Unsigned 16-bit integers



The default ladder programs transfer control status registers in the output ladder calculation section to the output status registers collectively.

	Control Status Registers	Output Status Registers
AL1 to AL3 status outputs	DOAL	Y000
DO11 to DO15 status outputs	DO10_E1	Y100_E1
DO21 to DO25 status outputs	DO20_E2	Y200_E2
DO31 to DO35 status outputs	DO30_E3	Y300_E3
DO41 to DO45 status outputs	DO40_E4	Y400_E4

► Default ladder programs: Section 3.10, Default Ladder Programs

Leaving the default ladder programs as is and describing a ladder program desired to be computed after the default ladder programs causes data to be overwritten and executed.

Output Ladder Calculation: Output Registers (Read/Write)

Position	Terminal Symbol	Register (16 bits)	Description
Standard terminal area	OUT	Y_OUT	OUT control output (current and voltage pulses)
	OUT	Y_OUTR	OUTR control output (relays)
	OUT2	Y_OUT2	OUT2 control output (current and voltage pulses)
	OUT2	Y_OUT2R	OUT2R control output (relays)
	RET	Y_RET	RET retransmission output (current)

Registers can also be read/write in the input ladder calculation section or user ladder calculation section.

Data format

These registers handle calculated results as values consisting of signed two-byte data of -19999 to 30000 including the decimal point position.

Output data is -5.0 to 105.0% data; the range of data that can be actually handled is from -50 to 1050.

Internal processing handles data as 4-byte floating-point numbers (IEEE 754 single-precision floating-point format).

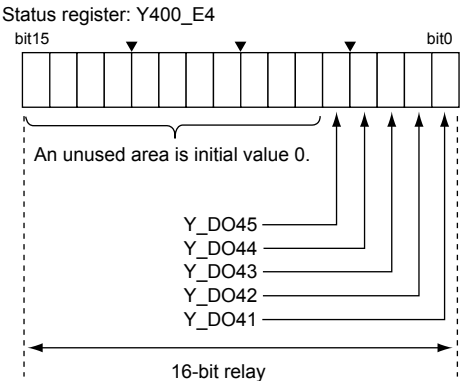
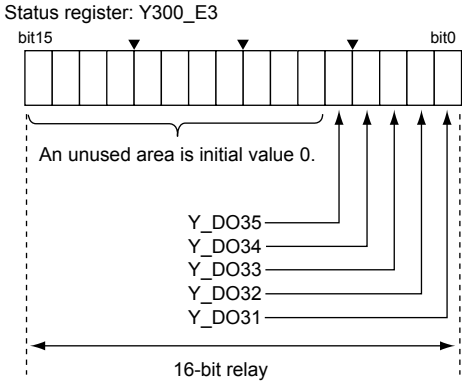
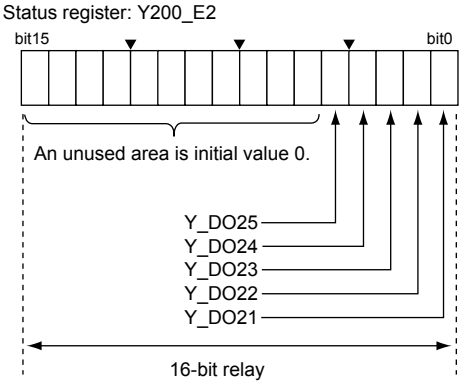
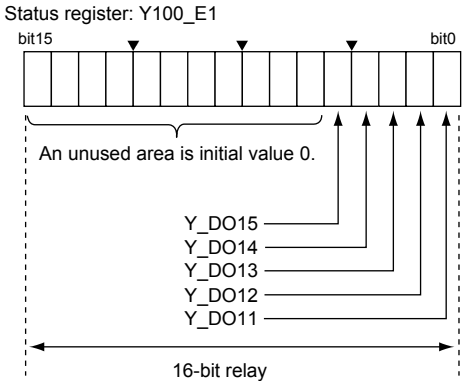
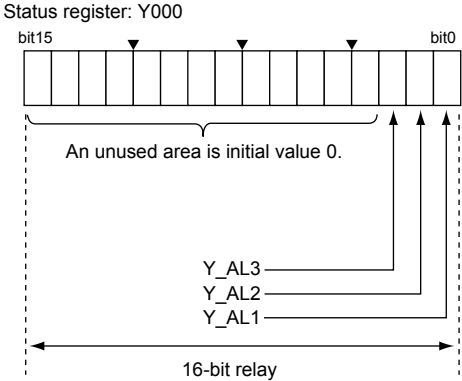
Output Ladder Calculation: Output (Status) Relays/Output Status Registers (Read/Write)

Position	Terminal Symbol	Relay (1 bit)	Status Register (16 bits)	Description
Standard terminal area	AL1	Y_AL1	Y000	AL1 status
	AL2	Y_AL2		AL2 status
	AL3	Y_AL3		AL3 status
E1-terminal area	DO11	Y_DO11	Y100_E1	DO11 status
	DO12	Y_DO12		DO12 status
	DO13	Y_DO13		DO13 status
	DO14	Y_DO14		DO14 status
	DO15	Y_DO15		DO15 status
E2-terminal area	DO21	Y_DO21	Y200_E2	DO21 status
	DO22	Y_DO22		DO22 status
	DO23	Y_DO23		DO23 status
	DO24	Y_DO24		DO24 status
	DO25	Y_DO25		DO25 status
E3-terminal area	DO31	Y_DO31	Y300_E3	DO31 status
	DO32	Y_DO32		DO32 status
	DO33	Y_DO33		DO33 status
	DO34	Y_DO34		DO34 status
	DO35	Y_DO35		DO35 status
E4-terminal area	DO41	Y_DO41	Y400_E4	DO41 status
	DO42	Y_DO42		DO42 status
	DO43	Y_DO43		DO43 status
	DO44	Y_DO44		DO44 status
	DO45	Y_DO45		DO45 status

Relays/status registers can also be read/write in the input ladder calculation section or user ladder calculation section.

Data format

- Output ladder calculation Relays: 0 or 1
Internal processing handles a value of less than 0.5 as “0” and a value of 0.5 or more as “1.” This is internal processing used for transferring register data to relays, etc.
- Output ladder calculation Status registers: Unsigned 16-bit integers



Note

- The presence/absence of inputs/outputs differs depending on the model and suffix codes. See App.2, Input/Output Tables.
- For function registers other than the input/output registers, see the “UTAdvanced Series Communication Interface User’s Manual.”

Note

The contact output links the event display. When the contact output is changed in a ladder program, check the event display settings (parameters EV1 to EV8).

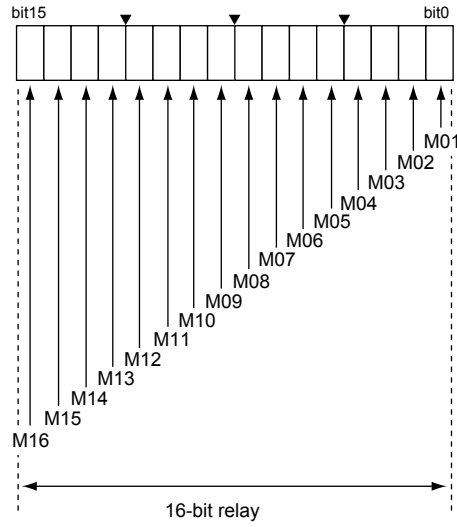
4.2.2 Internal Devices (Read/Write)

Device Name	Relay/Register	Data Format	Remarks
Internal (M) relays	M01 to M128	0 or 1 Internal processing handles a value of less than 0.5 as "0" and a value of 0.5 or more as "1." M1_16: status registers of M01 to M16 relays M17_32: status registers of M17 to M32 relays M33_48: status registers of M33 to M48 relays M49_64: status registers of M49 to M64 relays M65_80: status registers of M65 to M80 relays M81_96: status registers of M81 to M96 relays M97_112: status registers of M97 to M112 relays M113_128: status registers of M113 to M128 relays	Non-holding type
	M01_B to M32_B	0 or 1 Internal processing handles a value of less than 0.5 as "0" and a value of 0.5 or more as "1." M1_16_B: status registers of M01_B to M16_B relays M17_32_B: status registers of M17_B to M32_B relays	Holding type
	M33_B to M128_B	0 or 1 Internal processing handles a value of less than 0.5 as "0" and a value of 0.5 or more as "1." M33_48_B: status registers of M33_B to M48_B relays M49_64_B: status registers of M49_B to M64_B relays M65_80_B: status registers of M65_B to M80_B relays M81_96_B: status registers of M81_B to M96_B relays M97_112_B: status registers of M97_B to M112_B relays M113_128_B: status registers of M113_B to M128_B relays	Holding type However, when the control period is 50ms, the data is non-holding type.
DAT registers	DAT01 to DAT20		Non-holding type
	DAT01_B to DAT08_B	Handles data as 4-byte floating-point numbers (IEEE 754 single-precision floating-point format).	Holding type However, when the control period is 50ms, the data is non-holding type.
P-registers	P01 to P10	Handles 2-byte integer ranging from -19999 to 30000 and the decimal point position.	Holding type, parameter setting P-registers are the same as P-parameters displayed on the UT.

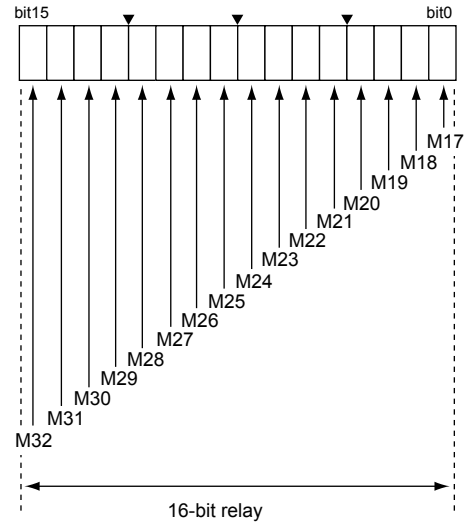
Device Name	Relay/Register	Data Format	Remarks
K-registers	K01 to K30	K01 to K20: Handles 2-byte integer ranging from -32768 to 32767 and the decimal point position. K21 to K30: Handles 2-byte integer ranging from 0 to 65535 and the decimal point position.	Holding type In the ladder program, do not write to K-registers. K-register constants are set in the Parameter Setting window.
Constant registers	C_1	Constant -1 (unsigned 2-byte integer)	Fixed values. Write disabled.
	C0	Constant 0 (unsigned 2-byte integer)	
	C1	Constant 1 (unsigned 2-byte integer)	
	C2	Constant 2 (unsigned 2-byte integer)	
	C3	Constant 3 (unsigned 2-byte integer)	
	C4	Constant 4 (unsigned 2-byte integer)	
	C5	Constant 5 (unsigned 2-byte integer)	
	C10	Constant 10 (unsigned 2-byte integer)	
	C50	Constant 50 (unsigned 2-byte integer)	
	C60	Constant 60 (unsigned 2-byte integer)	
	C100	Constant 100 (unsigned 2-byte integer)	
	C1000	Constant 1000 (unsigned 2-byte integer)	
C10000	Constant 10000 (unsigned 2-byte integer)		
Time-out relays	TIM1 to TIM4	"1" at time-out or "0" at reset TIM_RELAY: status registers of TIM1 to TIM4 relays	Used by a timer instruction. Write disabled.
Count-out relays	CNT1 to CNT4	"1" at count-out or "0" at reset CNT1 to CNT4: status registers of CNT_RELAY relays	Used by a counter instruction. Write disabled.

Internal relays

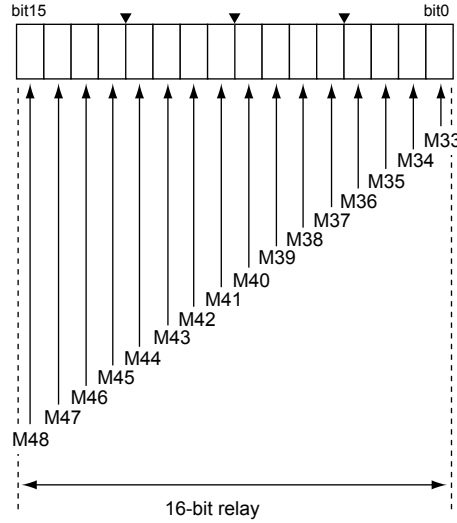
Status registers: M1_16



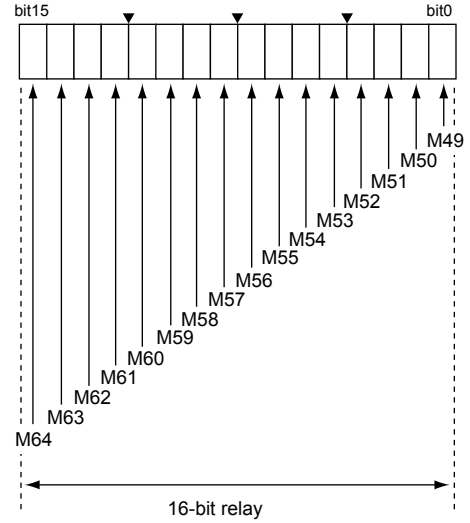
Status registers: M17_32



Status registers: M33_48

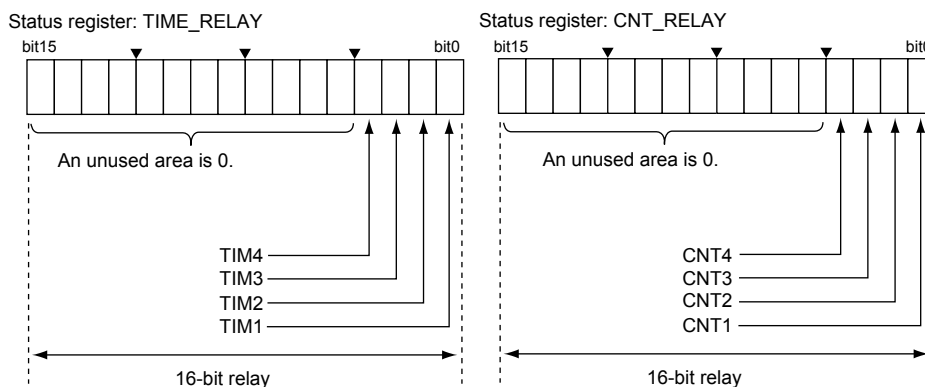


Status registers: M49_64



Bits M65 to M128 are also arranged in the status registers in the same way.

Time-out relay and count-out relay



No power failure is detected in the following cases, and the unit maintains normal operations.

- A momentary power failure of 20 ms or less in the case of 100 – 240 V AC
- A momentary power failure of 1 ms in the case of 24 V AC/DC

In case of a power failure, the timer and counter will be initialized.

4.2.3 Parameter Registers and Status Relays (Read/Write)

Parameter registers contain UT's target setpoints, alarm setpoints, etc. Parameter register data is 16-bit integers.

Registers are provided for process data and operation modes in addition to parameters.

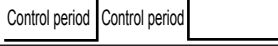
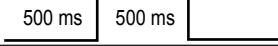
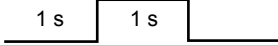
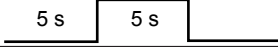
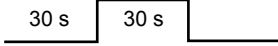
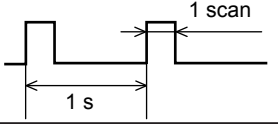
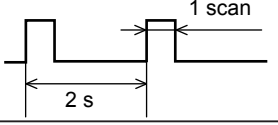
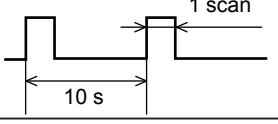
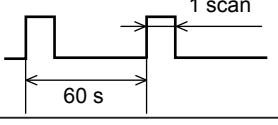
Relays are provided for the alarm statuses, operation modes, bar graphs, events, etc.

► [Parameter Registers: UTAdvanced Series Communication Interface User's Manual](#)

Note

In the ladder programs, read/write of setup parameter data is impossible. However, the range, decimal point position, and scale of each analog input can be read only. (D registers D7501 to 7539)

4.2.4 Special Relays (Read Only)

Special Relay	Action
PON	Activates a device for control period at power-on, reset start (L-RESET RUN), download the ladder program, or change of each input type and control period.
PLS1	Always ON
ZERO	Always OFF
SMPCLK	Control period clock 
CLK1	1-second clock 
CLK2	2-second clock 
CLK10	10-second clock 
CLK60	60-second clock 
CLK1P	1-second clock pulse 
CLK2P	2-second clock pulse 
CLK10P	10-second clock pulse 
CLK60P	60-second clock pulse 

Data format

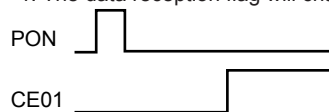
0 or 1

Internal processing handles a value of less than 0.5 as “0” and a value of 0.5 or more as “1.”

4.2.5 Registers/Relays for Peer-to-peer Communication (Read/Write)

Device Name	Address	Data Format
Analog input registers for peer-to-peer communication	CX01 to CX16	Handles data as 4-byte floating-point numbers (IEEE 754 single-precision floating-point format).
Analog output registers for peer-to-peer communication	CY01 to CY04	
Status input relays for peer-to-peer communication	CI01 to CI64	0 or 1
Status output relays for peer-to-peer communication	CO1 to CO16	Internal processing handles a value of less than 0.5 as “0” and a value of 0.5 or more as “1.”
Reception time-out flag for peer-to-peer communication	CF01 to CF04	0 (normal) or 1 (error)
End of data reception flag for peer-to-peer communication	CE01 to CE04	0 (during reception) or 1 (end of reception) (*1)

*1: The data reception flag will change from 0 to 1 after the PON relay is turned on.

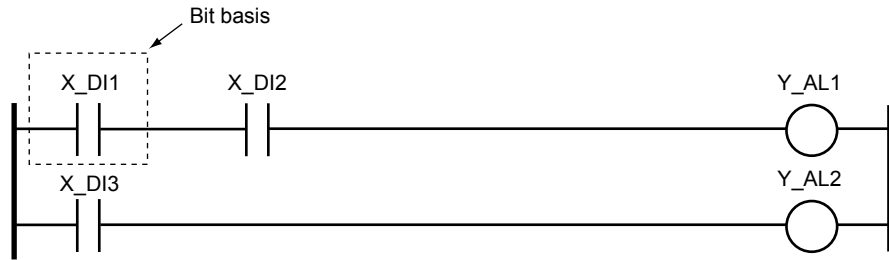


4.3 Data Format

This section gives an overview of the instructions. For more details, see sections 4.4 and 4.5.

4.3.1 Relay (Bit) Processing

Bit processing refers to processing that is performed when a bit device is specified in a basic instruction. It is executed in bits.



Type	Display Data	Internal Processing Data
Relay	0 or 1	Floating point number (Float)

4.3.2 Data (Register) Processing

Data processing refers to the processing of registers whose data is computed in 16-bit integers or in floating-point numbers.

Type	Display Data	Internal Processing Data
D-register	Signed 16-bit integer	Floating point number (Float)
Status register	Unsigned 16-bit integer	Unsigned 16-bit integer
DAT register	Floating point number (Float)	Floating point number (Float)

D-registers

Contain parameter data or process data. In the ladder programs, D-register data is handled as signed 16-bit integers (-19999 to 31500). In internal processing, it is handled as 4-byte floating-point numbers.

P-registers and K-registers are also in the same data format as D-registers.

Transfer source data is restricted according to the data format of the storage destination in case of using a transfer instruction, etc., so check and use the data format of the storage destination.

► [D-Registers: UTAdvanced Series Communication Interface User's Manual](#)

Status registers

M1_16 (status registers of internal relays M01 to M16), M17_32 (status registers of internal relays M17 to M32), M33_48 (status registers of internal relays M33 to M48), and M49_64 (status registers of internal relays M49 to M64)

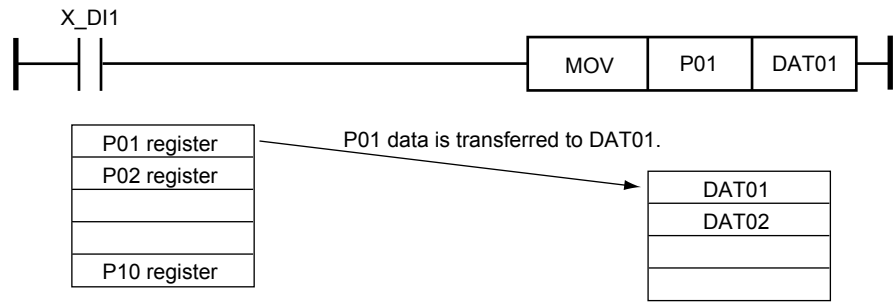
These status registers are used to capture the statuses of contact inputs, etc. in 16 bits or to output the bit-basis ladder calculation results in 16 bits.

DAT registers

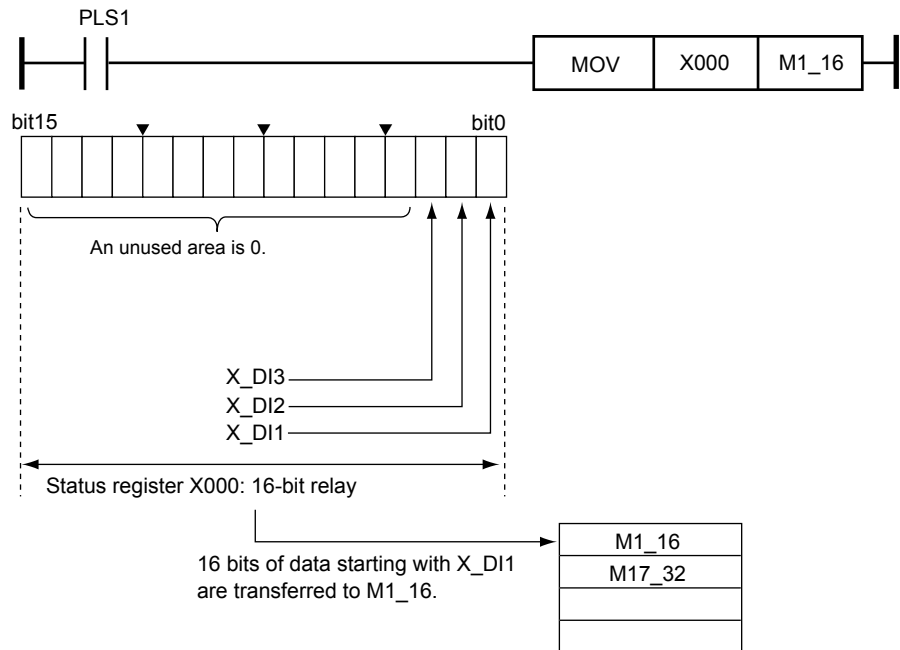
These registers are temporary registers used to store data during calculations. The Monitor Ladder Program window enables data to be monitored in floating-point numbers.

4.3 Data format

■ Data register processing

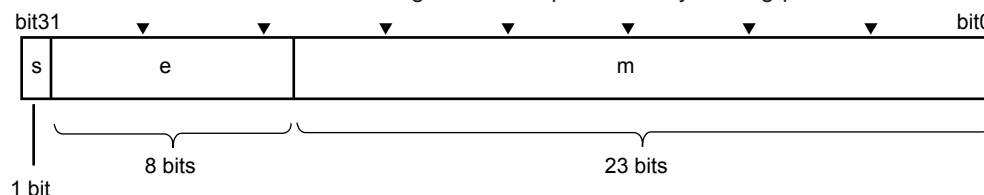


■ Status register processing



4.3.3 Floating Point Processing (Float)

Floating point data is represented by the IEEE 754 single-precision floating-point number format shown below. The DAT registers are represented by floating-point numbers.



s: sign specification (1 bit) (0: +, 1: -)
 e: exponential specification (8 bits)
 m: argument specification (23 bits)

(1) When $e \neq 0$, $r = (-1)^s \times 1.m \times 2^{e-127}$

(2) When $e = 0$, $m = 0$ and $r = 0$ (0 for all bits, indicating a numerical value "0")

When a floating point data is stored in a short integer, the integer which rounded off below the decimal point is stored. For example, "1234.5f will be 1235.

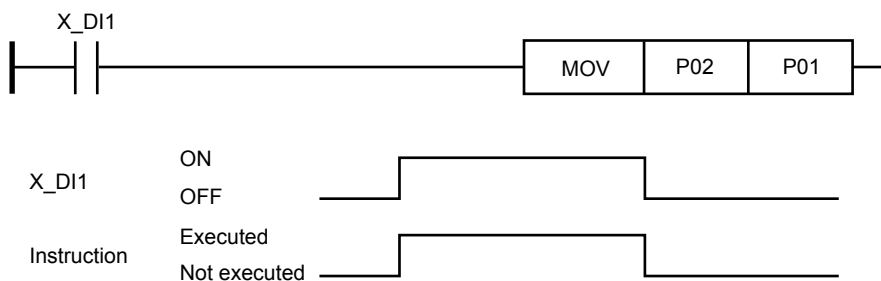
It is displayed in the form of *****E-**** on the Monitor Register or Monitor Ladder Program window. For a tool tip (placing the mouse on a register), it is displayed as *******E-****.

4.3.4 Execution-while-ON Instructions and Input Differential Instructions

There are execution-while-ON and input differential types in application instructions.

Execution-while-ON type

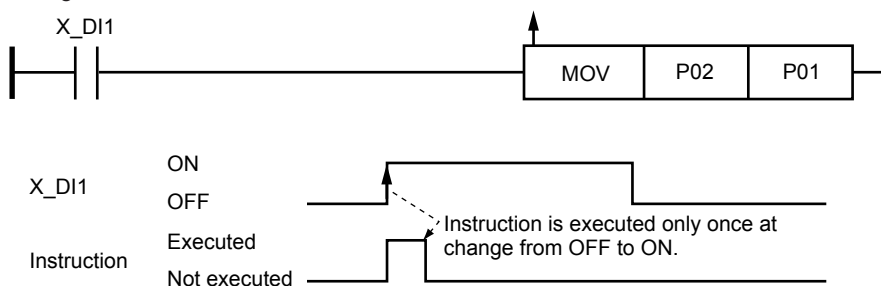
An instruction is executed for each scan while the execution condition of the application instruction is ON.



Input differential type

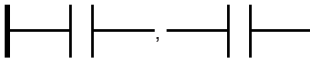
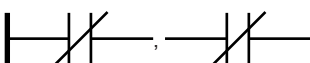
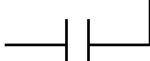



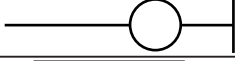

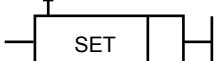
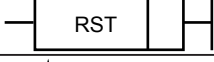
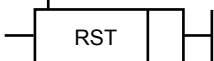
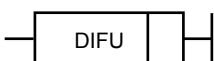
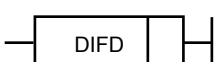
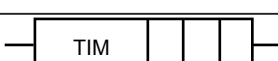
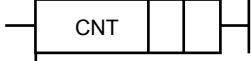
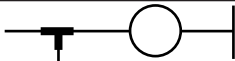
An instruction is executed only once when the execution condition of the application instruction changes from OFF to ON.

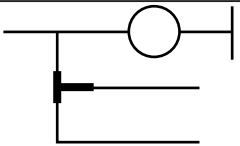
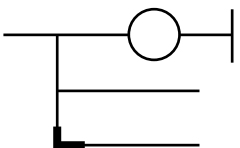
When you want to execute an instruction only for one scan, using this type of instruction conserves programs and shortens scan time because no input circuit needs to be configured in a differential instruction.



4.4 List of Instructions

4.4.1 List of Basic Instructions

Instruction	Mnemonic	Display on Instruction Window	Number of Instructions	Symbol	Function
Load, And	LD, AND	√	1		Starts logic ("a" contact) Performs connection in logical AND ("a" contact in series).
Load Not, And Not	LDN, ANDN	√	1		Starts logical NOT ("b" contact). Performs connection in NAND ("b" contact in series).
Or	OR	√	1		Performs connection in logical OR ("a" contact in parallel).
Or Not	ORN	√	1		Performs connection in NOR ("b" contact in parallel).
And Load	ANDLD	*1	1		Executes logical AND between circuit elements.
Or Load	ORLD	*1	1		Executes logical OR between circuit elements.
Out	OUT	√	1		Outputs the previous calculation result.
Set	SET	√	1		Activates a specified device when input is ON.
	E_SET	√	1		Activates a specified device when an input changes from OFF to ON.
Reset	RST	√	1		Deactivates a specified device when input is ON.
	E_RST	√	1		Deactivates a specified device when an input changes from OFF to ON.
Differential Up	DIFU	√	1		Activates a device only for one scan when an input signal changes from OFF to ON.
Differential Down	DIFD	√	1		Activates a device only for one scan when an input signal changes from ON to OFF.
Timer	TIM	√	4		Performs a synchronous backward timer action.
Counter	CNT	√	3		Performs a backward counter action.
Push	PUSH	*1	1		Stores the calculation result (ON/OFF) obtained immediately before a Push.

Instruction	Mnemonic	Display on Instruction Window	Number of Instructions	Symbol	Function
Stack Read	STCRD	*1	1		Reads out the calculation result stored by Push and passes it to the next calculation processing.
Pop	POP	*1	1		Reads out the calculation result stored by Push and passes it to the next calculation processing. In addition, it clears the calculation result stored by Push.
End	-	*1	4	-	Indicates the exit of the input ladder calculation.

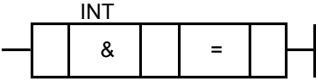
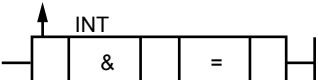

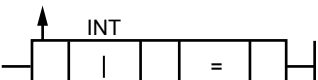
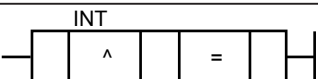
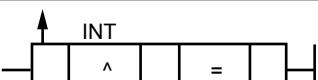
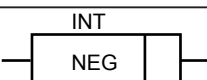
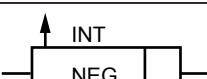
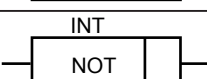
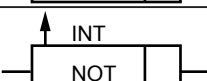
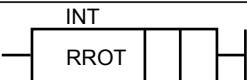
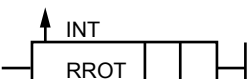
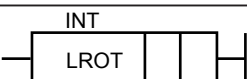
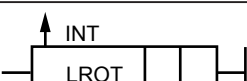
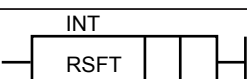
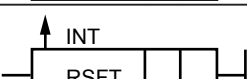
√: Visible

*1: Automatically appended when a ladder program is created.

4.4 List of Instructions

4.4.2 List of Application Instructions

Instruction	Mnemonic	Display on Instruction Window	Number of Instructions	Symbol	Function
Comparison	GT	√	4		Performs comparison and activates a device if the condition is met or deactivates it if the condition is not met.
	LT	√	4		
	GE	√	4		
	LE	√	4		
	EQ	√	4		
	NEQ	√	4		
Addition	ADD	√	4		Performs addition when an input signal is ON.
	E_ADD	√	4		Performs addition when an input signal changes from OFF to ON.
Subtraction	SUB	√	4		Performs subtraction when an input signal is ON.
	E_SUB	√	4		Performs subtraction when an input signal changes from OFF to ON.
Multiplication	MUL	√	4		Performs multiplication when an input signal is ON.
	E_MUL	√	4		Performs multiplication when an input signal changes from OFF to ON.
Division	DIV	√	4		Performs division when an input signal is ON.
	E_DIV	√	4		Performs division when an input signal changes from OFF to ON.
Square Root Extraction	SQR	√	3		Performs square root extraction when an input signal is ON.
	E_SQR	√	3		Performs square root extraction when an input signal changes from OFF to ON.
Absolute Value	ABS	√	3		Performs absolute-value calculation when an input signal is ON.
	E_ABS	√	3		Performs absolute-value calculation when an input signal changes from OFF to ON.

Instruction	Mnemonic	Display on Instruction Window	Number of Instructions	Symbol	Function
Logical AND	AND	√	4		Executes logical AND when an input signal is ON.
	E_AND	√	4		Executes logical AND when an input signal changes from OFF to ON.
Logical OR	OR	√	4		Executes logical OR when an input signal is ON.
	E_OR	√	4		Executes logical OR when an input signal changes from OFF to ON.
Logical XOR	XOR	√	4		Executes logical XOR when an input signal is ON.
	E_XOR	√	4		Executes logical XOR when an input signal changes from OFF to ON.
Two's Complement	NEG	√	2		Converts data to two's complement when an input signal is ON.
	E_NEG	√	2		Converts data to two's complement when an input signal changes from OFF to ON.
Not	NOT	√	2		Inverts data when an input signal is ON.
	E_NOT	√	2		Inverts data when an input signal changes from OFF to ON.
Right Rotate	RROT	√	3		Turns data to the right when an input signal is ON.
	E_RROT	√	3		Turns data to the right when an input signal changes from OFF to ON.
Left Rotate	LROT	√	3		Turns data to the left when an input signal is ON.
	E_LROT	√	3		Turns data to the left when an input signal changes from OFF to ON.
Right Shift	RSFT	√	3		Shifts data to the right when an input signal is ON.
	E_RSFT	√	3		Shifts data to the right when an input signal changes from OFF to ON.

4.4 List of Instructions

Instruction	Mnemonic	Display on Instruction Window	Number of Instructions	Symbol	Function
Left Shift	LSFT	√	3		Shifts data to the left when an input signal is ON.
	E_LSFT	√	3		Shifts data to the left when an input signal changes from OFF to ON.
Shift Register	E_SFT	√	3		Shifts data to the right or left by 1 bit when an input signal changes from OFF to ON.
Move	MOV	√	2		Moves data to a destination when an input signal is ON.
	E_MOV	√	2		Moves data to a destination when an input signal changes from OFF to ON.
Binary Conversion	BIN	√	3		Converts data to binary data when an input signal is ON.
	E_BIN	√	3		Converts data to binary data when an input signal changes from OFF to ON.
BCD Conversion	BCD	√	3		Converts data to BCD codes when an input signal is ON.
	E_BCD	√	3		Converts data to BCD codes when an input signal changes from OFF to ON.
Ratio	RATIO	√	5		Calculates a ratio when an input signal is ON.
	E_RATIO	√	5		Calculates a ratio when an input signal changes from OFF to ON.
High Selector	HSL	√	4		Selects a higher value when an input signal is ON.
	E_HSL	√	4		Selects a higher value when an input signal changes from OFF to ON.
Low Selector	LSL	√	4		Selects a lower value when an input signal is ON.
	E_LSL	√	4		Selects a lower value when an input signal changes from OFF to ON.
High Limiter	HLM	√	4		Imposes a high limit on the input value when an input signal is ON.
	E_HLM	√	4		Imposes a high limit on the input value when an input signal changes from OFF to ON.

Instruction	Mnemonic	Display on Instruction Window	Number of Instructions	Symbol	Function
Low Limiter	LLM	√	4		Imposes a low limit on the input value when an input signal is ON.
	E_LLM	√	4		Imposes a low limit on the input value when an input signal changes from OFF to ON.
Scaling	SCAL	√	5		Scales an input value when an input signal is ON.
	E_SCAL	√	5		Scales an input value when an input signal changes from OFF to ON.
Normalization	NORM	√	5		Normalizes an input value when an input signal is ON.
	E_NORM	√	5		Normalizes an input value when an input signal changes from OFF to ON.
Maximum Value	MAX	√	7		Selects the maximum value when an input signal is ON.
	E_MAX	√	7		Selects the maximum value when an input signal changes from OFF to ON.
Minimum Value	MIN	√	7		Selects the minimum value when an input signal is ON.
	E_MIN	√	7		Selects the minimum value when an input signal changes from OFF to ON.
Average Value	AVE	√	7		Obtains the average value of input values when an input signal is ON.
	E_AVE	√	7		Obtains the average value of input values when an input signal changes from OFF to ON.
Temperature Compensation (deg C)	TCMP1	√	5		Performs temperature compensation (in °C) when an input signal is ON.
	E_TCMP1	√	5		Performs temperature compensation (in °C) when an input signal changes from OFF to ON.
Temperature Compensation (deg F)	TCMP2	√	5		Performs temperature compensation (in °F) when an input signal is ON.
	E_TCMP2	√	5		Performs temperature compensation (in °F) when an input signal changes from OFF to ON.

4.4 List of Instructions

Instruction	Mnemonic	Display on Instruction Window	Number of Instructions	Symbol	Function
Pressure Compensation (MPa)	PCMP1	√	5		Performs pressure compensation (in MPa) when an input signal is ON.
	E_PCMP1	√	5		Performs pressure compensation (in MPa) when an input signal changes from OFF to ON.
Pressure Compensation (kgf/cm ²)	PCMP2	√	5		Performs pressure compensation (in kgf/cm ²) when an input signal is ON.
	E_PCMP2	√	5		Performs pressure compensation (in kgf/cm ²) when an input signal changes from OFF to ON.
Pressure Compensation (psi)	PCMP3	√	5		Performs pressure compensation (in psi) when an input signal is ON.
	E_PCMP3	√	5		Performs pressure compensation (in psi) when an input signal changes from OFF to ON.

√: Visible

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4.5 Details of Basic Instructions

Functional quick reference guide

The following functional quick reference guide is provided at the start of the explanation of all the application instructions.

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format		
			Yes	No					
Set	SET		√	-		1	Relay		
	E_SET		√	-		1			
			(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) Instruction

Indicates an instruction name.

(2) Mnemonic

Indicates the representation of an instruction by Mnemonic.

(3) Symbol

Indicates a representation method on LL50A.

(4) Input Condition Required?

Indicates whether the input condition is required for the instruction concerned.

An instruction with the "√" symbol in the Yes column always requires the input condition.

An instruction with the "-" symbol in the No column requires no input condition.

(5) Execution Condition

Symbol	Execution Condition
	This represents an execute-while-ON instruction. The instruction is executed only when the pre-condition of that instruction is ON. It is not executed if the pre-condition is OFF.
	This represents an instruction that is executed once when the pre-condition is set to ON. The instruction is executed only when the pre-condition of the instruction changes from OFF to ON, or a rise. After that, it is not executed even if the pre-condition is ON.
	This represents an instruction that is executed once when the pre-condition is set to OFF. The instruction is executed only when the pre-condition of the instruction changes from ON to OFF, or a fall. After that, it is not executed even if the pre-condition is OFF.
-	This indicates an instruction that is always executed. The instruction is executed irrespective of ON/OFF of the pre-condition of the instruction.

(6) Step Count

Indicates the number of steps of the instruction concerned. The step count differs depending on the presence/absence of the execution condition.

(7) Data Format

Indicates the processing unit to be used during execution of the instruction concerned. In principle, all data formats are available for each instruction. The column shows the data format that is mainly used.

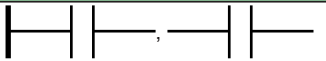
Instructions whose processing unit is a relay are intended for relays.

Instructions whose processing unit is a D-register, status register, or DAT register are intended for registers.

Relay data can be handled by integrating it in 16 bits or 32 bits.

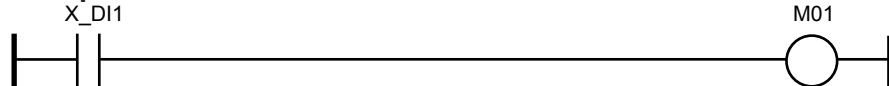
► [Data format: Section 4.3, Data Format](#)

4.5.1 Load, And

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Load, And	LD, AND		-	√	-	1	Relay

Load is a logical ("a" contact) operation start instruction. It captures the ON/OFF information of a specified device and regards it as the calculation result.

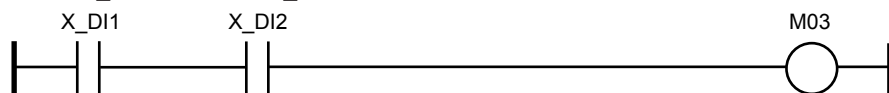
Program example:



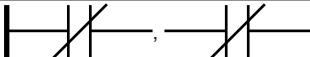
And is a logical AND ("a" contact in series connection) instruction. It captures the ON/OFF information of a specified device, ANDs it with the previous calculation result, and takes the obtained value as the calculation result.

Program example:

When X_DI1 is ON and X_DI2 is ON, M03 becomes ON. M03 is OFF in all other cases.

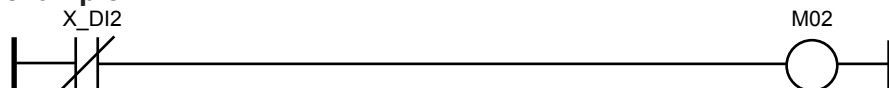


4.5.2 Load Not, And Not

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Load Not, And Not	LDN, ANDN		-	√	-	1	Relay

Load Not is a logical NOT ("b" contact) operation start instruction. It captures the ON/OFF information of a specified device and regards it as the calculation result.

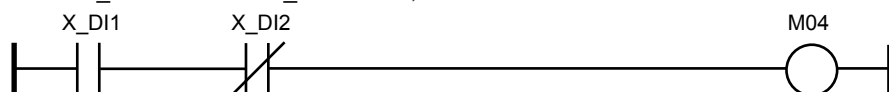
Program example:



And Not is an NAND ("b" contact in series connection) instruction. It captures the ON/OFF information of a specified device, ANDs it with the previous calculation result, and takes the obtained value as the calculation result.

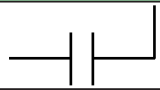
Program example:

When X_DI1 is ON and X_DI2 is OFF, M04 becomes ON. M04 is OFF in all other cases.



4.5 Details of Basic Instructions

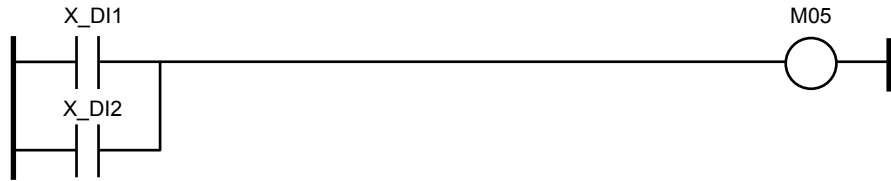
4.5.3 Or

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Or	OR		-	√	-	1	Relay


Or is a logical OR ("a" contact in parallel connection) instruction. It captures the ON/OFF information of a specified device, ORs it with the previous calculation result, and takes the obtained value as the calculation result.

Program example:

When X_DI1 is ON or X_DI2 is ON, M05 becomes ON. M05 is OFF in all other cases.



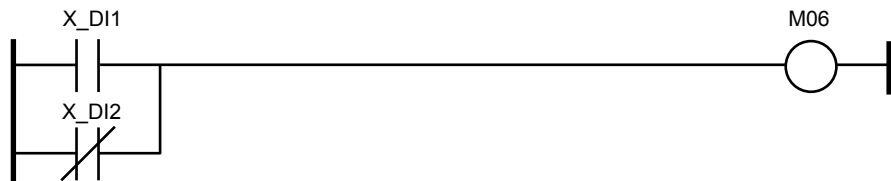
4.5.4 Or Not

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Or Not	ORN		-	√	-	1	Relay

Or Not is an NOR ("b" contact in parallel connection) instruction. It captures the ON/OFF information of a specified device, ORs it with the previous calculation result, and takes the obtained value as the calculation result.

Program example:

When X_DI1 is ON or X_DI2 is OFF, M06 is activated. M06 is OFF in all other cases.



4.5.5 And Load

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
And Load	ANDLD		-	√	-	1	-

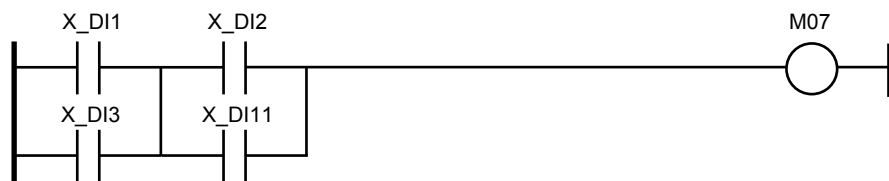
An And load instruction is not represented in thick lines in the actual ladder sequence program (circuit).

This instruction performs logical AND between circuit elements and passes the ANDed result to the next calculation processing.

An And Load instruction is automatically added to the ladder program by the combination of "a" contacts, "b" contacts, and compare instructions. The step counts are also added.

Program example:

When X_DI1 is ON or X_DI3 is ON and X_DI2 is ON or X_DI11 is ON, M07 is activated. M07 is OFF in all other cases.



4.5.6 Or Load

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Or Load	ORLD		-	√	-	1	-

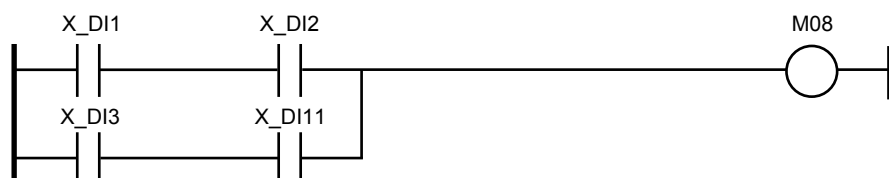
An Or load instruction is not represented in thick lines in the actual ladder sequence program (circuit).

This instruction performs logical OR between circuit elements and passes the ORed result to the next calculation processing.

An Or Load instruction is automatically added to the ladder program by the combination of "a" contacts, "b" contacts, and compare instructions. The step counts are also added.

Program example:

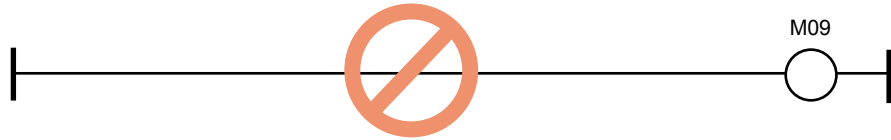
When X_DI1 is ON and X_DI2 is ON or X_DI3 is ON and X_DI11 is ON, M08 is activated. M08 is OFF in all other cases.



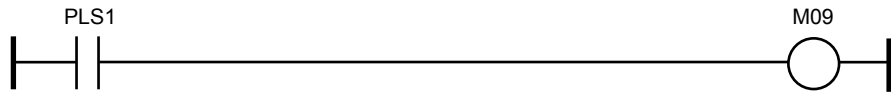
4.5.7 Out

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Out	OUT		√	-		1	Relay

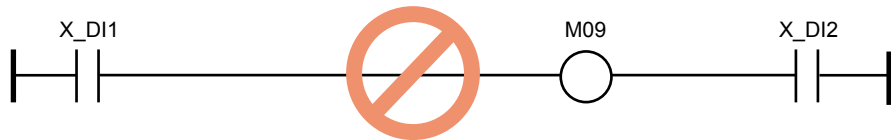
Out is an output instruction. It outputs the previous calculation result to a specified device as is. Direct output from the bus bar to a device is not possible.



Furthermore, if output to a device is required irrespective of ON/OFF of a contact, use an always-ON relay (PLS1).



It is not possible to insert a contact next to an Out instruction.



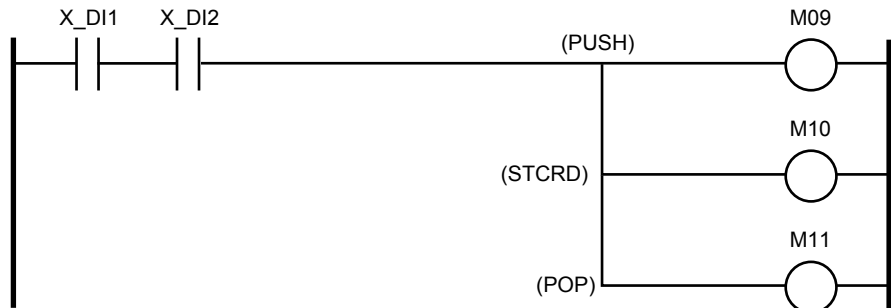
If the same device is used for two or more Out instructions, only the last Out is enabled and the results of Out instructions before that Out will be ignored.



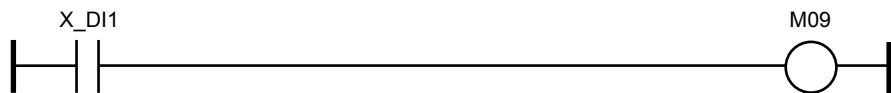
Same relay number
Only the last Out is enabled.

► Double use of coil: [Section 3.6, Checking Ladder Programs](#)

Out instructions can be used in parallel.



Program example:

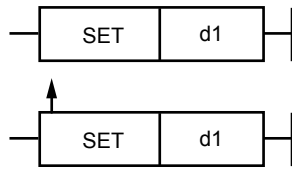


4.5.8 Set

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Set	SET		√	-		1	Relay
	E_SET		√	-		1	Relay

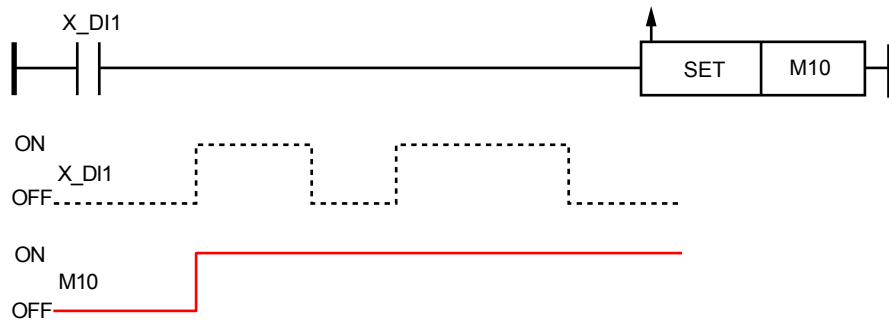
Parameter

When the execution condition is met, a specified device (d1) is activated.



Program example:

When X_DI1 changes from OFF to ON, M10 is activated.

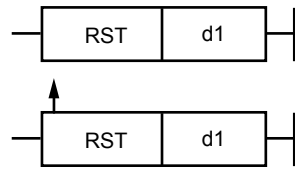


4.5.9 Reset

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Reset	RST		√	-		1	Relay
	E_RST		√	-		1	Relay

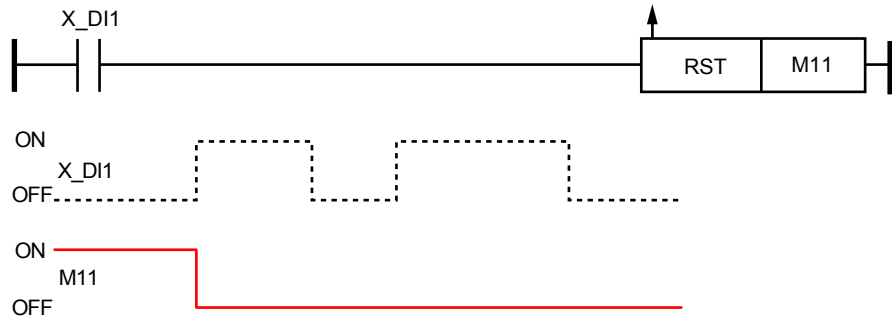
Parameter

When the execution condition is met, a specified device (d1) is deactivated.



Program example:

When X_DI1 changes from OFF to ON, M11 is OFF.

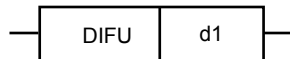


4.5.10 Differential Up and Differential Down

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Differential Up	DIFU		√	-		1	Relay
Differential Down	DIFD		√	-		1	Relay

Parameters

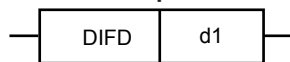
Differential up



When an input signal changes from OFF to ON (raise), a specified device (d1) is activated for one scan.

For any condition other than a change of input signal from OFF to ON (raise), a specified device (d1) is OFF.

Differential up

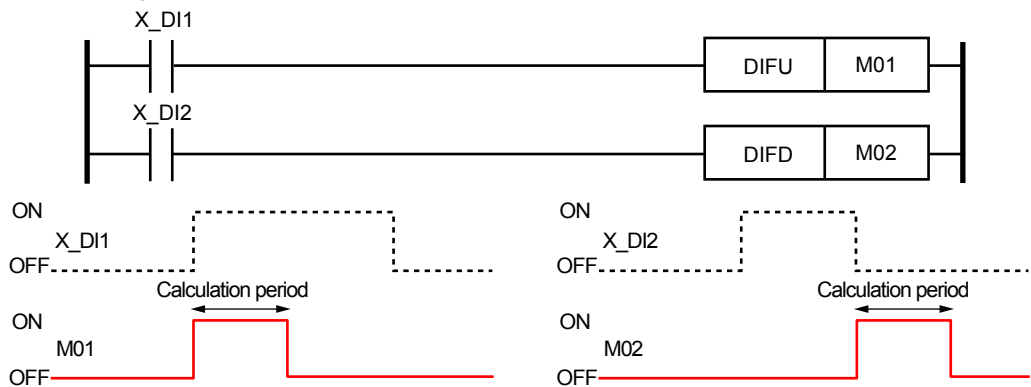


When an input signal changes from ON to OFF (fall), a specified device (d1) is activated for one scan.

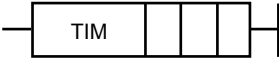

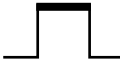
For any condition other than a change of input signal from ON to OFF (fall), a specified device (d1) is OFF.

Program example

When X_DI1 changes from OFF to ON, M01 is activated for one scan. Also, when X_DI2 changes from ON to OFF, M02 is activated for one scan.



4.5.11 Timer

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Timer	TIM		√	-	<p>at start</p>  <p>during count</p> 	4	<p>Time-out Relay (TIM1 to TIM4): Relay</p> <p>Timer's current value (TIMER1 to TIMER4)</p> <p>Unsigned 16-bit integers</p>

Parameter



This instruction performs synchronous backward timer operation.

The synchronous type refers to the condition that ON/OFF of a timeout relay (d1) and the timer's current value (value obtained by subtraction from the timer set value (s)) do not change during the execution of one scan of the program. TIM1 to TIM4 are described in the timeout relay (d1).

For the timer, if the input condition is ON (while it is ON), the timer's current value is subtracted, and when it reaches 0, the corresponding timeout relay (d1) is activated. (The action of the timer's current value reaching "0" is called "to time out.")

When the input condition is ON and the timer set value (s) is "0," the timeout relay is always ON.

If the following actions are implemented while the input condition is ON, the timer's current value is set to "0" and time-out relay is set to OFF; power OFF/ON, Reset Start (L-RESET RUN), ladder sequence program download, change of the input type and control period. Change the input condition into OFF again.

If the input condition is OFF and is switched from OFF to ON, the timer's current value returns to the timer set value (s) (namely initialized). If the timer set value (s) is other than "0", the time-out relay (d1) is OFF.

The timer's current value can be checked using the Monitor Ladder Program function of the LL50A Parameter Setting Software.

Timer (t1) should be selected from among five types: the special register's control period clock (SMPCLK), one-sec clock (CLK1), two-sec clock (CLK2), 10-sec clock (CLK10), and 60-sec clock (CLK60).

When timer (t1) is selected, it functions according to each attribute.

The setting time of the timer differs depending on the timer (t1) used. See the timer types and setting times described below.

The timer set value (s) should be set using a K-register or P-register.

If the timer set value (s) is a negative value (value of less than "0"), it is handled as "0," and If it is "65535" or more, it is handled as "65535." Moreover, digits to the right of the decimal point will be discarded.

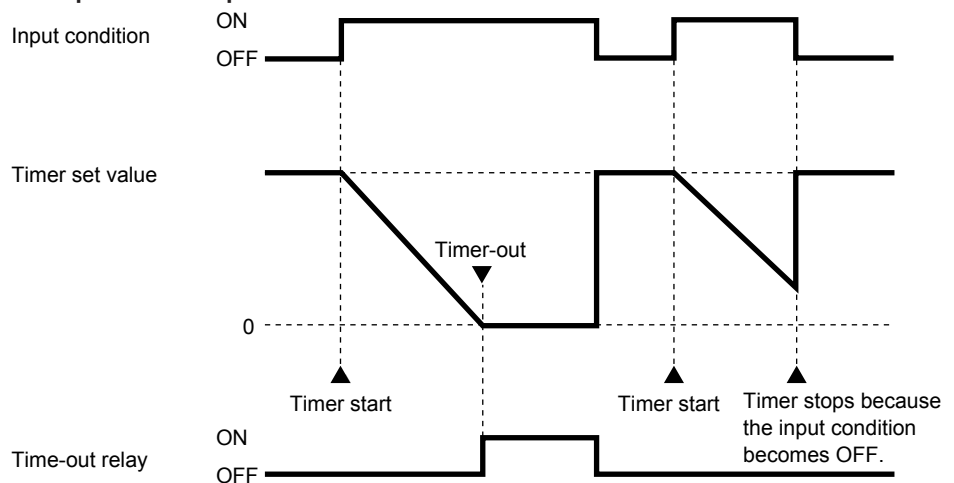
Timer types and setting time

Timer Type	Resolution	Setting Time
SMPCLK	50 ms	0 ms to 3276.75 seconds
	100 ms	0 ms to 6553.5 seconds
	200 ms	0 ms to 13107 seconds
CLK1	1 sec	0 sec to 65535 seconds
CLK2	2 sec	0 sec to 131070 seconds
CLK10	10 sec	0 sec to 655350 seconds
CLK60	60 sec	0 sec to 2199180 seconds

Note 1: SMPCLK works in the period set with the input sampling period (control period) parameter SMP.

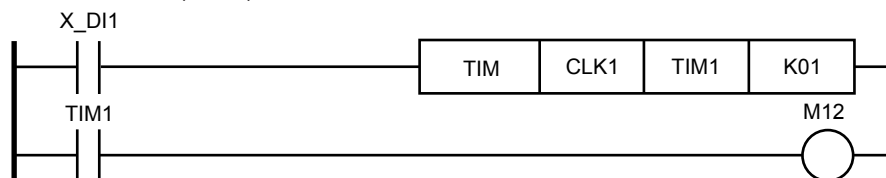
Note 2: The maximum value of the set time is within the range handled by a K-register or P-register.

Example of timer operation



Program example:

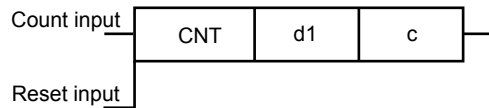
When X_DI1 becomes ON, M12 is activated 10 seconds later. The example uses a 1-second clock (CLK1). K01 = 10



4.5.12 Counter

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Counter	CNT		√	-		3	Count-out Relay (CNT1 to CNT4): Relay Current timer (COUNTER1 to COUNTER4) Unsigned 16-bit integers

Parameter



This instruction performs backward counter operation.

When the count input changes from OFF to ON once, one count is subtracted from the counter set value (c).

When the counter's current value (value obtained by subtraction from the counter set value (s)) reaches 0, the corresponding count-out relay (d1) is activated.

(The action of the counter's current value reaching "0" is called "to count out.")

No counting is performed excepting when the count input changes from OFF to ON.

CNT1 to CNT4 are described in the count-out relay.

The counter current value is reset to the counter set value while the reset input is ON or power is switched from ON to OFF.

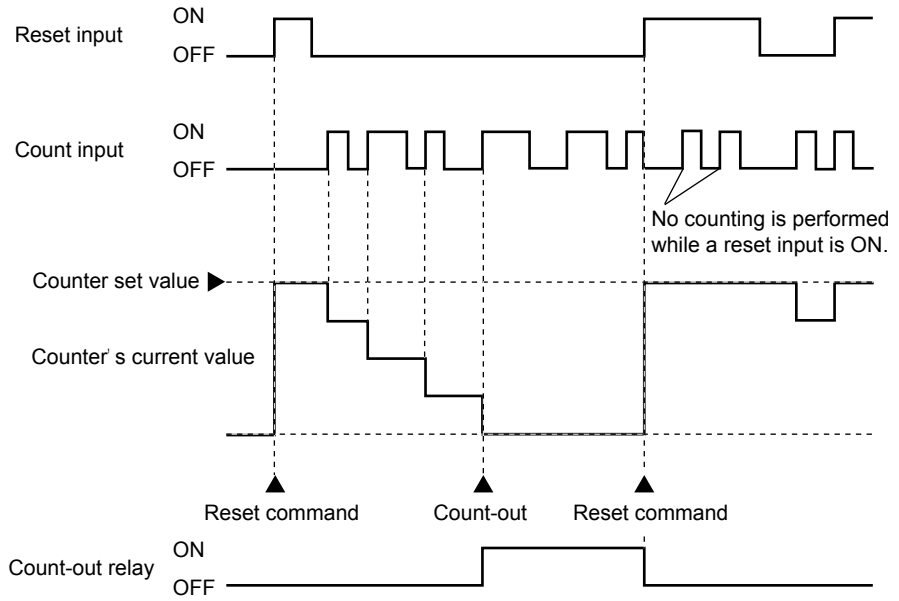
If the following actions are implemented while the reset input is OFF, the counter's current value is set to "0" and count-out flag is set to OFF; power OFF/ON, Reset Start (L-RESET RUN), ladder sequence program download, change of the input type and control period. Change the reset input into ON again.

The counter set value (c) should be set using a K-register or P-register.

If the counter set value (s) is a negative value (value of less than "0"), it is handled as "0." and If it is more than "65535", it is handled as "65535."

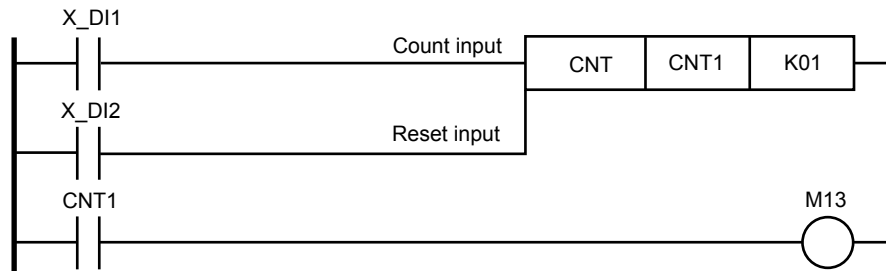
Moreover, values at the right of the decimal point will be discarded.

Before entering a count input, reset the counter's current value by reset input. If a count input and reset input are simultaneously made, the reset input has priority.

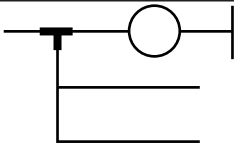
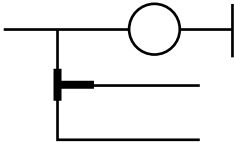
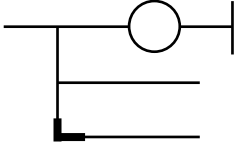


Program example:

When X_DI1 becomes ON 15 times, M13 is activated. K01 = 15



4.5.13 Push, Stack Read, and Pop

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Push	PUSH		-	√	-	1	-
Stack Read	STCRD		-	√	-	1	-
Pop	POP		-	√	-	1	-

The Push, Stack read, and Pop instructions are not represented by thick lines in the actual ladder sequence program (circuit).

Push

This instruction stores the calculation result (ON/OFF) obtained immediately before a Push. The number of pushes available in a circuit is up to 16.

Stack read

This instruction reads out the calculation result stored by Push and passes it to the next calculation processing.

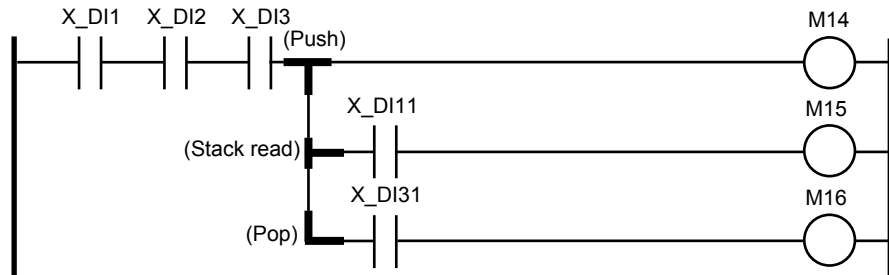
Pop

This instruction reads out the calculation result stored by Push and passes it to the next calculation processing. Moreover, it clears the calculation result stored by Push. The number of Push instructions used and the number of Pop instructions used must be the same.

Note that it is not necessary for the user to program a Push, Stack read, or Pop instruction. These instructions are automatically appended.

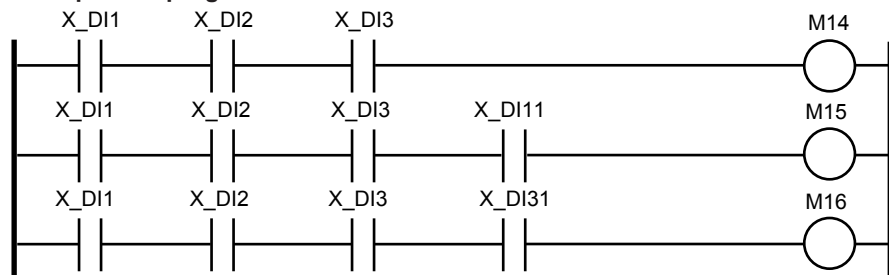
Program example:

Example of a program using braches



Step count = 11 steps

Example of a program without branches



Step count = 14 steps

4.5.14 End

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
End	-	-	-	√	-	4	-

The End instruction is automatically appended to the end of a ladder sequence program created.

4.6 Details of Application Instructions

Functional quick reference guide

The following functional quick reference guide is provided at the start of the explanation of all the application instructions.

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Move	MOV		√	-		2	D-register, status register, relay, or DAT register
	E_MOV		√	-		2	

↑ (1) ↑ (2) ↑ (3) ↑ (4) ↑ (5) ↑ (6) ↑ (7)

(1) Instruction

Indicates an instruction name.

(2) Mnemonic

Indicates the representation of an instruction by Mnemonic.

(3) Symbol

Indicates a representation method on LL50A.

(4) Input Condition Required?

Indicates whether the input condition is required for the instruction concerned.

An instruction with the "√" symbol in the Yes column always requires the input condition.

An instruction with the "-" symbol in the No column requires no input condition.

(5) Execution Condition

Symbol	Execution Condition
	This represents an execute-while-ON instruction. The instruction is executed only when the pre-condition of that instruction is ON. It is not executed if the pre-condition is OFF.
	This represents an instruction that is executed once when the pre-condition is set to ON. The instruction is executed only when the pre-condition of the instruction changes from OFF to ON, or a rise. After that, it is not executed even if the pre-condition is ON.
	This represents an instruction that is executed once when the pre-condition is set to OFF. The instruction is executed only when the pre-condition of the instruction changes from ON to OFF, or a fall. After that, it is not executed even if the pre-condition is OFF.
-	This indicates an instruction that is always executed. The instruction is executed irrespective of ON/OFF of the pre-condition of the instruction.

(6) Step Count

Indicates the number of steps of the instruction concerned.

(7) Data Format

Indicates the processing unit to be used during execution of the instruction concerned.

In principle, all data formats are available for each instruction. The column shows the data format that is mainly used.

Instructions whose processing unit is a relay are intended for relays.

Instructions whose processing unit is a D-register, status register, or DAT register are intended for registers.

Relay data can be handled by integrating it in 16 bits or 32 bits.

▶ [Data format: Section 4.3, Data Format](#)

4.6.1 Comparison

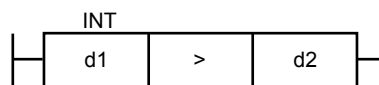
Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Comparison	GT		-	√	-	4	D-register, DAT register or status register
	LT		-	√	-	4	
	GE		-	√	-	4	
	LE		-	√	-	4	
	EQ		-	√	-	4	
	NEQ		-	√	-	4	

Parameter

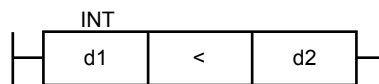
This instruction compares two integers and outputs the calculation result as “a” contact. An Compare instruction is the instruction comparing the integer part (rounded-off below the decimal point). For the comparison including decimal points, execute a compare instruction after applying required multipliers such as C10 (constant 10) and C100 (constant 100.)

Mnemonic	Condition and Calculation Result			
	Condition	Result	Condition	Result
GT	d1>d2	ON (1)	d1<=d2	OFF (0)
LT	d1<d2		d1>=d2	
GE	d1>=d2		d1<d2	
LE	d1<=d2		d1>d2	
EQ	d1=d2		d1<>d2	
NEQ	d1<>d2		d1=d2	

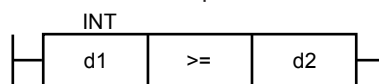
Greater than



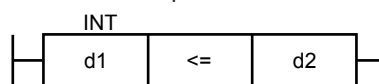
Less than



Greater than or equal

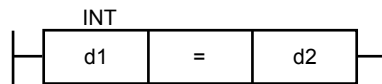


Less than or equal

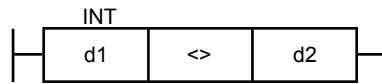


4.6 Details of Application Instructions

Equal



Not equal

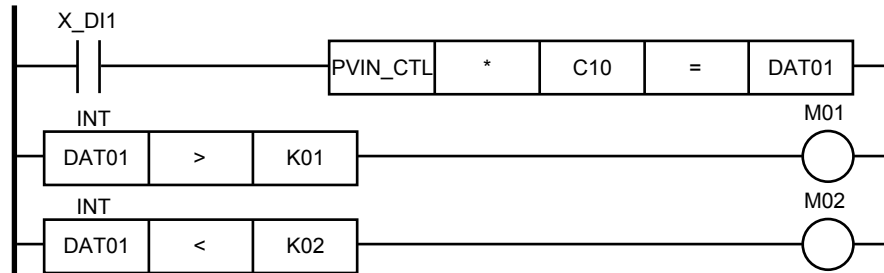


Program example

DAT01 is always calculated (PLS1).

When PVIN_CTL is more than 300.0 (3000) °C, M01 is activated. Moreover, when PVIN_CTL is less than 150.0 (1500) °C, M02 is activated.

(K01: 3000, K02: 1500)



4.6.2 Four Fundamental Arithmetic Operations

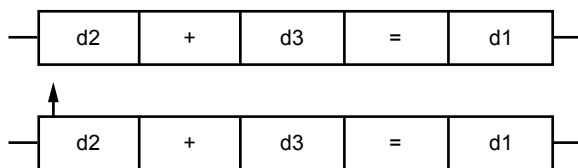
Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Addition	ADD		√	-		4	D-register or DAT register
	E_ADD		√	-		4	
Subtraction	SUB		√	-		4	
	E_SUB		√	-		4	
Multiplication	MUL		√	-		4	
	E_MUL		√	-		4	
Division	DIV		√	-		4	
	E_DIV		√	-		4	

Parameter

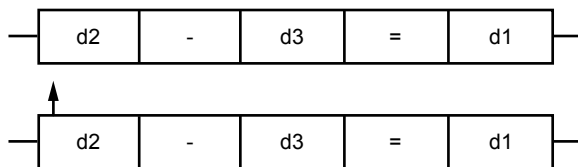
When the calculation result immediately before any of the four fundamental arithmetic operations is ON or changes from OFF to ON, the fundamental arithmetic operation concerned is performed using two single-precision floating-point numbers d2 and d3 (32 bits) and stores the result in a specified device (d1).

However, if a non-numerical value or infinity occurs during calculation or arises as a result, a ladder calculation overflow error occurs.

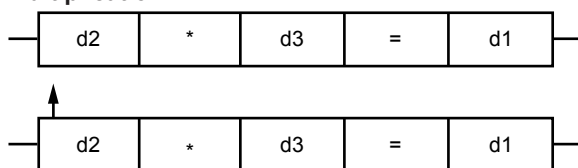
Addition



Subtraction

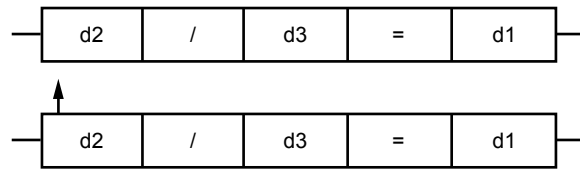


Multiplication



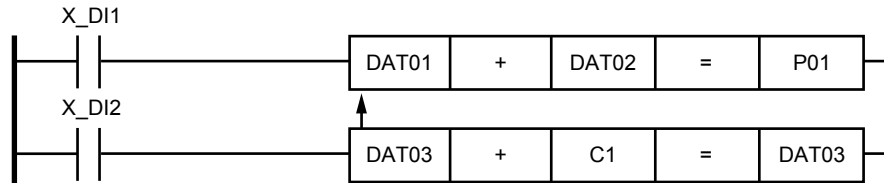
4.6 Details of Application Instructions

Division



Program example

When X_DI1 becomes ON, DAT01 and DAT02 are added together and stored in P01. Each time X_DI2 is turned off and on, DAT03 is incremented.



4.6.3 Square Root Extraction

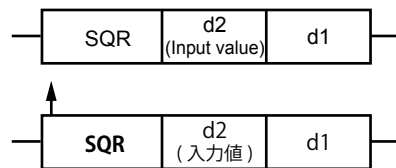
Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Square Root Extraction	SQR		√	-		3	D-register or DAT register
	E_SQR		√	-		3	

Parameter

Square root extraction is performed to the normalized input value (0 to 100%), and the calculated result is stored in the specified device (d1.)

In a square root, the input value and the calculated result are expressed as percent data, i.e. the calculated result for the input value 100 (%) is 100 (%); 50 (%) is 70.71 (%); 25 (%) is 50 (%).

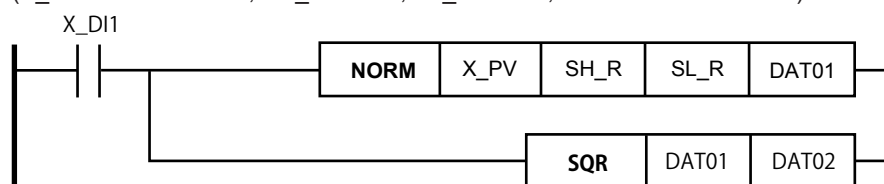
Furthermore, negative input values are calculated as "0" (%). The calculated result is 0 (%).



Program example

When X_DI1 becomes ON, X_PV data is normalized to SL_R to SH_R and the result is stored in DAT01. The SQR instruction obtains the square root extraction of DAT01 data and stores it in DAT02.

(X_PV=100.0 to 500.0, SH_R=500.0, SL_R=100.0, DAT01=0.0 to 100.0%)

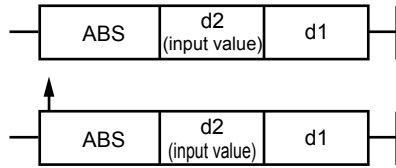


4.6.4 Absolute Value

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Absolute Value	ABS		√	-		3	D-register or DAT register
	E_ABS		√	-		3	

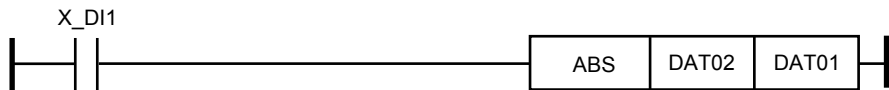
Parameter

This instruction obtains the absolute value from the input value (d2) and the result is stored in a specified device (d1).



Program example

When X_DI1 becomes ON, the instruction obtains the absolute value of DAT02 data and stores it in DAT01.



4.6.5 Logical Operation

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Logical AND	AND		√	-		4	Status register
	E_AND		√	-		4	
Logical OR	OR		√	-		4	
	E_OR		√	-		4	
Logical XOR	XOR		√	-		4	
	E_XOR		√	-		4	
Two's Complement	NEG		√	-		2	
	E_NEG		√	-		2	
Not	NOT		√	-		2	
	E_NOT		√	-		2	

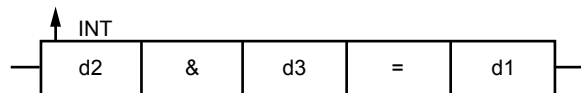
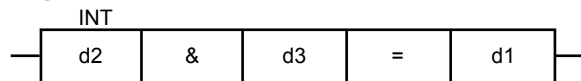
Parameter

Data format: 16-bit integer

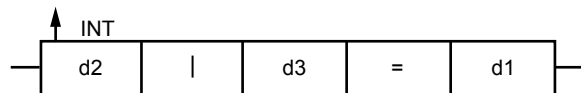
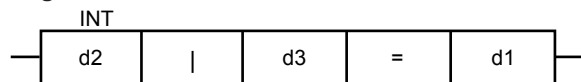
(Logical AND, logical OR, and logical XOR)

These instructions perform logical operations using two 16-bit data (d2 and d3) and store the result in a specified device (d1). If two 16-bit data (d2 and d3) is greater than negative or 65535, the calculation is not executed. In this case, a ladder calculation overflow error occurs.

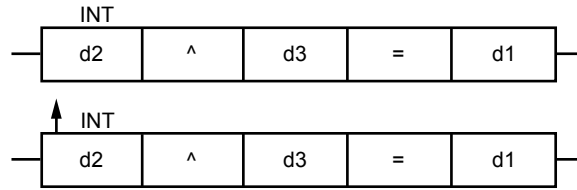
Logical AND



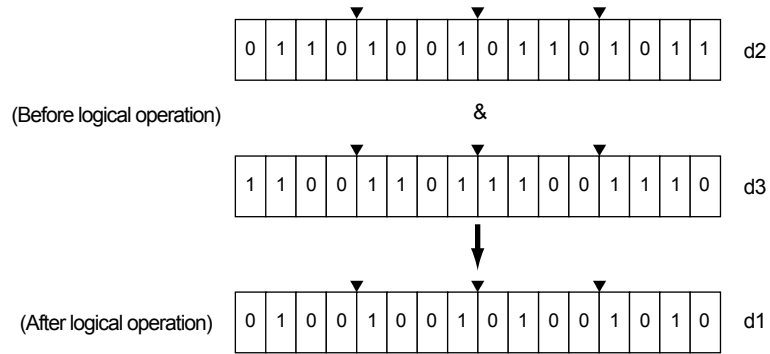
Logical OR



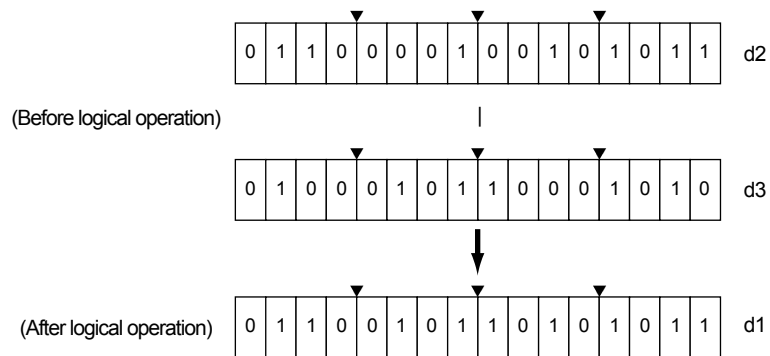
Logical XOR



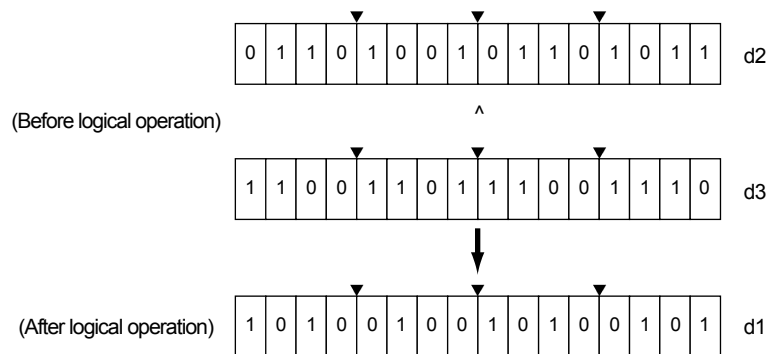
Logical AND (16-bit data)



Logical OR (16-bit data)



Logical XOR (16-bit data)



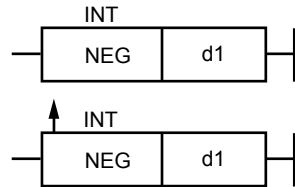
4.6 Details of Application Instructions

(Not and Two's complement)

Two's complement

This instruction obtains the two's complement of 16-bit data (d1) and the result is stored in a specified device (d1).

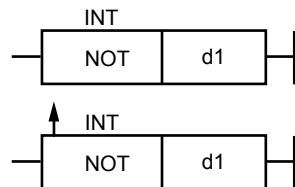
If 16-bit data (d1) is greater than negative or 65535, the calculation is not executed. In this case, a ladder calculation overflow error occurs.



Not

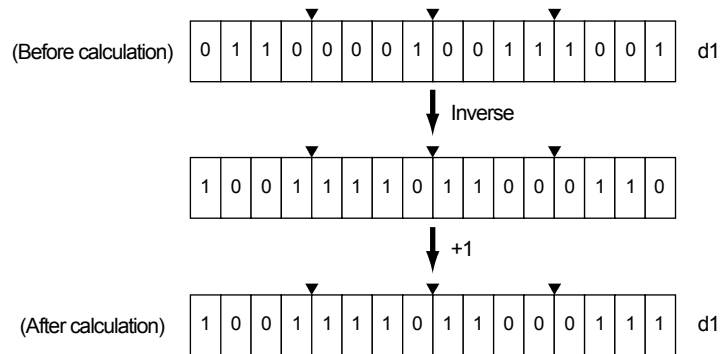
This instruction invert 16-bit data (d1) and the result is stored in a specified device (d1).

If 16-bit data (d1) is greater than negative or 65535, the calculation is not executed. In this case, a ladder calculation overflow error occurs.

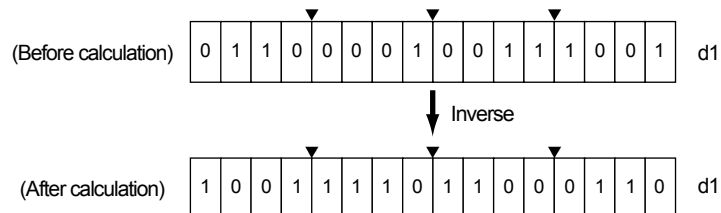


These instructions invert 16-bit data (d1) or obtain the two's complement of it and store the result in a specified device (d1).

Two's complement (16-bit data)



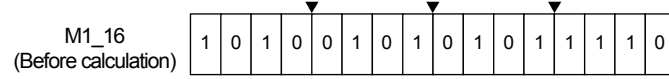
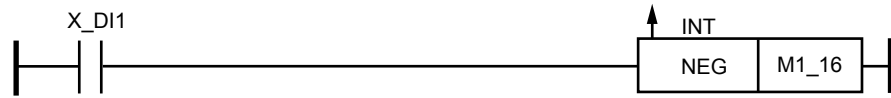
Not (16-bit data)



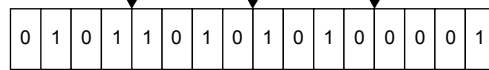
If the relay data is specified to the parameter, the data is handled as 16-bit data "0" (0x000) or "1" (0x0001).

Program example

When X_DI1 becomes ON, the instruction converts M1_16 data to the two's complement.



↓ Inverse



↓ +1



4.6.6 Rotation

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Right Rotate	RROT		√	-		3	Status register
	E_RROT		√	-		3	
Left Rotate	LROT		√	-		3	
	E_LROT		√	-		3	

Parameter

These instructions rotate 16-bit data (d1) to the right or left by “n” bits and store the rotation result in a specified device (d1).

If 16-bit data (d1) is greater than negative or 65535, the calculation is not executed. In this case, a ladder calculation overflow error occurs.

Specify the number of bits (n) within the range 1 to 16 when the number of bits out of the range is specified, the Rotation instruction is not executed.

The number of bits (n) is handled as

“1” if $0.5 \leq d2 < 1.5$

“2” if $1.5 \leq d2 < 2.5$

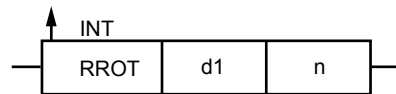
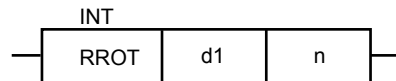
⋮

⋮

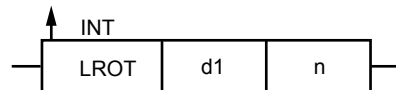
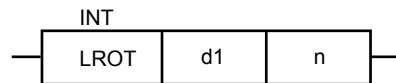
⋮

“16” if $15.5 \leq d2 < 16.5$

Right rotate



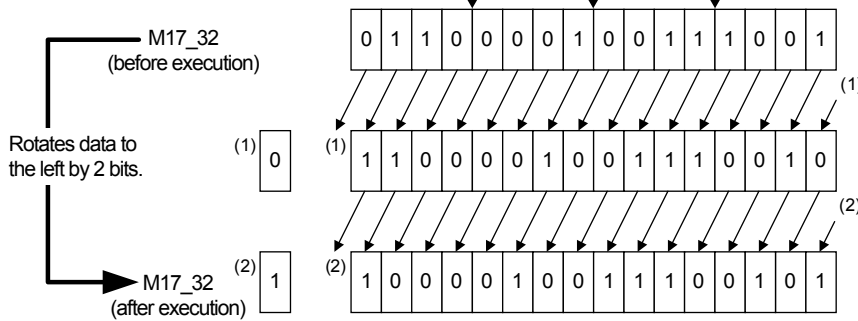
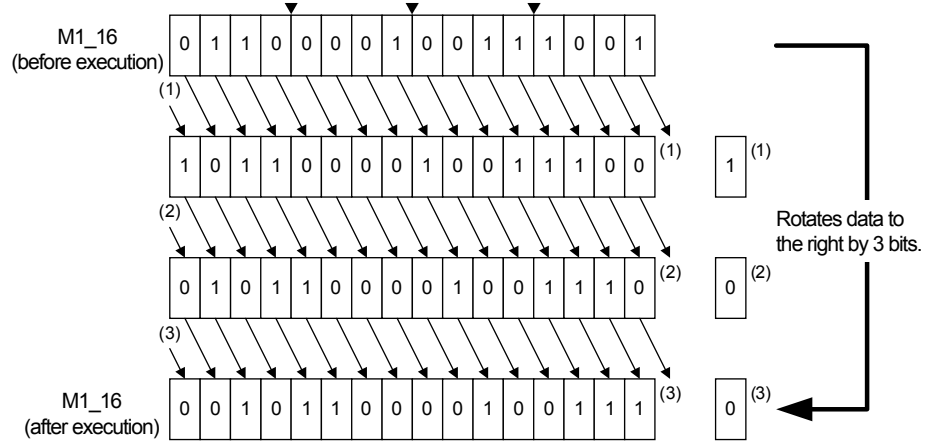
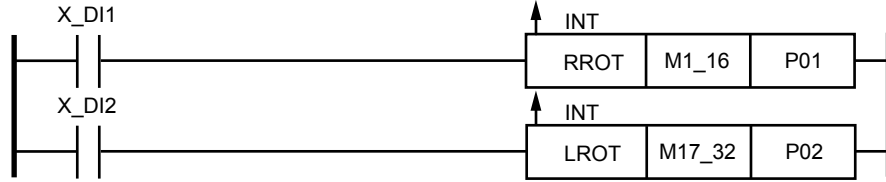
Left rotate



Program example

When X_DI1 becomes ON, M1_16 data is rotated to the right by P01 (number of rotations) bits.

When X_DI2 changes from OFF to ON, M17_32 data is rotated to the left by P02 (number of rotations) bits.



4.6.7 Shift

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Right Shift	RSFT		√	-		3	Status register
	E_RSFT		√	-		3	
Left Shift	LSFT		√	-		3	
	E_LSFT		√	-		3	
Shift Register	SFT		√	-		3	

Parameter

Right and left shifts

These instructions shift 16-bit data (d1) to the right or left by “n” bits and store the shift result in a specified device (d1).

If 16-bit data (d1) is greater than negative or 65535, the calculation is not executed. In this case, a ladder calculation overflow error occurs.

Specify the number of bits (n) within the range 1 to 16 when the number of bits out of the range is specified, the Right/Left shift instructions are not executed.

The number of bits (n) is handled as

“1” if $0.5 \leq d2 < 1.5$

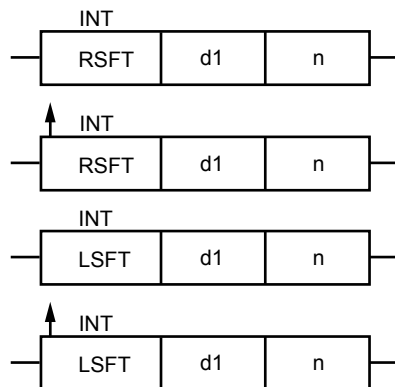
“2” if $1.5 \leq d2 < 2.5$

⋮

⋮

⋮

“16” if $15.5 \leq d2 < 16.5$



Shift register

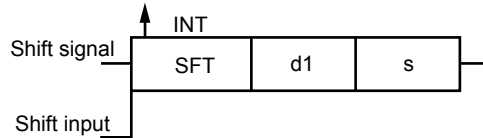
This instruction shifts 16-bit data (d1) to either the right or the left by one bit.

If 16-bit data (d1) is greater than negative or 65535, the calculation is not executed. In this case, a ladder calculation overflow error occurs.

The shift timing is at the rise of a shift signal (OFF to ON) and the shift direction is specified by “s.”

The instruction shifts data to the left if the value of the device specified by “s” is “0” or to the right if the value is “1.” (“s” is handled a value of less than 0.5 as “0” and a value of 0.5 or more as “1.”)

When data is shifted to the right or left, the shift input value enters the leftmost bit or rightmost bit.

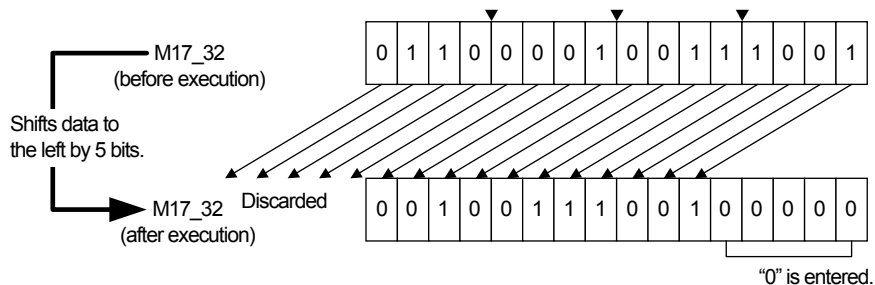
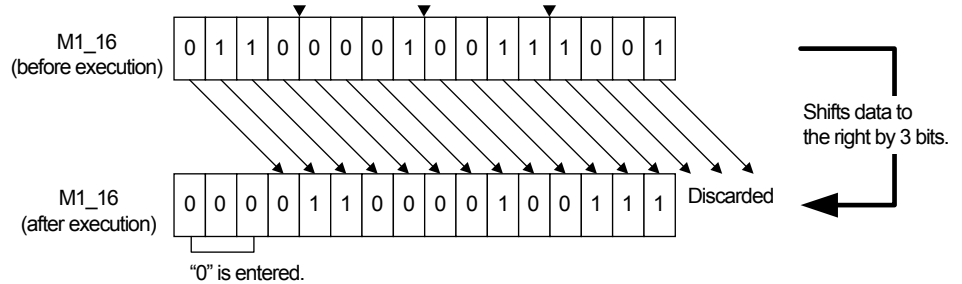
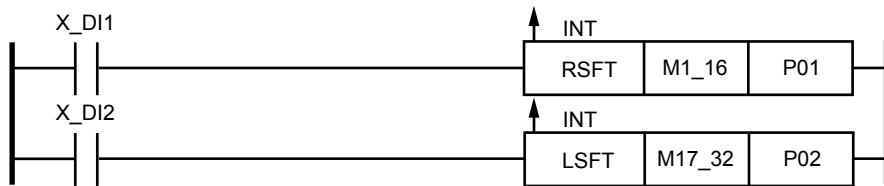


Program example

Right and left shifts

When X_DI1 changes from OFF to ON, M1_16 data is shifted to the right by P01 (number of shifts) bits. P01 = 3

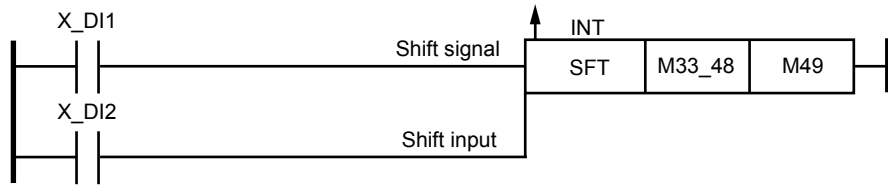
When X_DI2 becomes ON, M17_32 data is shifted to the left by P02 (number of shifts) bits. P02 = 5



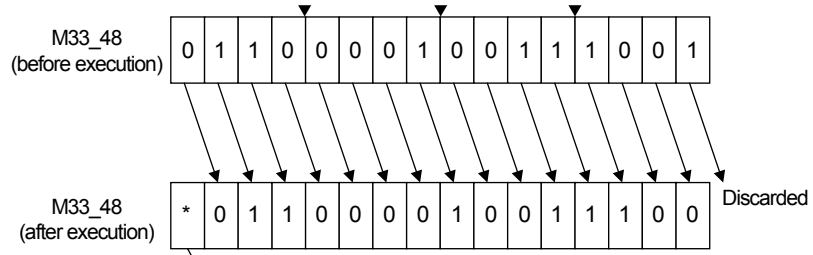
4.6 Details of Application Instructions

Shift register

When X_DI1 or X_DI2 becomes ON, the instruction shifts M33_48 data to the right by M49 bits (0 or 1.)



For right shift



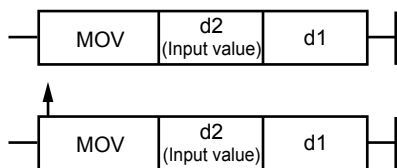
"0" or "1" is entered according to shift input.

4.6.8 Move

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Move	MOV		√	-		2	D-register, status register, relay or DAT register
	E_MOV		√	-		2	

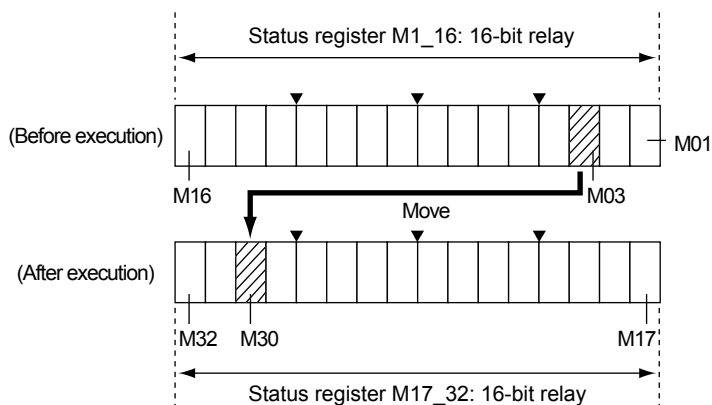
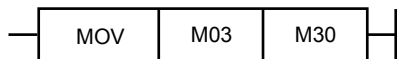
Parameter

This instruction moves data from the transfer source (d2) to transfer destination (d1).



(1) For specification of d2 (relay) to d1 (relay)

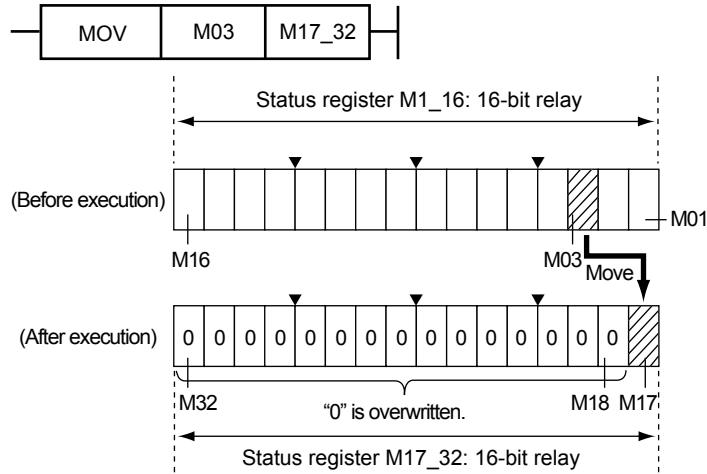
The instruction moves M03 relay data (0 or 1) to the M30 relay.



4.6 Details of Application Instructions

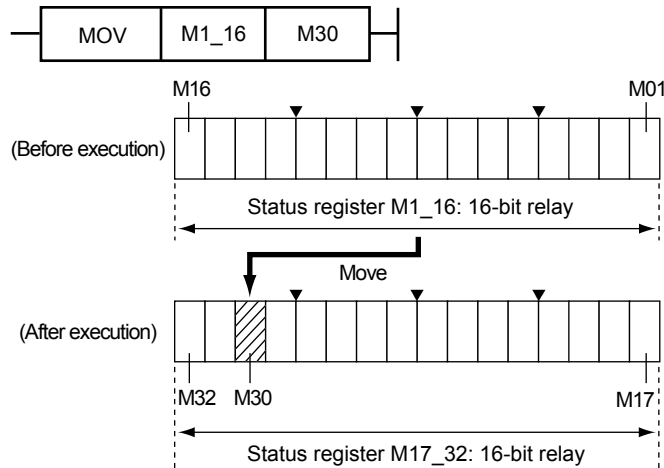
(2) For specification of d2 (relay) to d1 (status register)

The instruction moves M03 relay data (0 or 1) to the M17_32 status registers. The M03 relay data is stored in the M17 relay, and the M18 to M32 relays become "0."



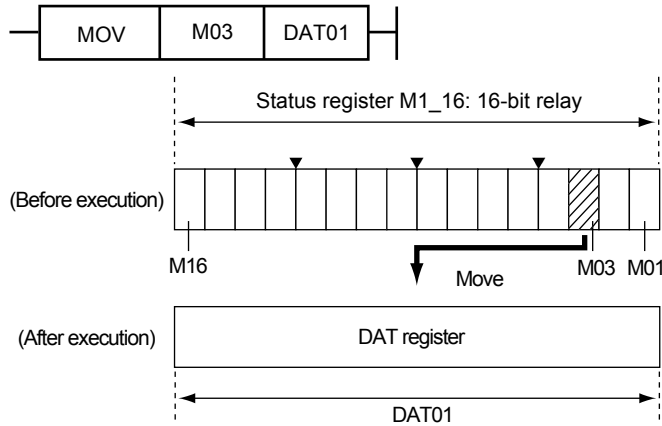
(3) For specification of d2 (status register) to d1 (relay)

The instruction moves M1_16 status register data (0 to 65535) to the M30 relay. If any one of the M01 to M16 relays is "1," "1" is stored in the M30 relay and if the M01 to M16 are all "0," "0" is stored in the M30 relay.



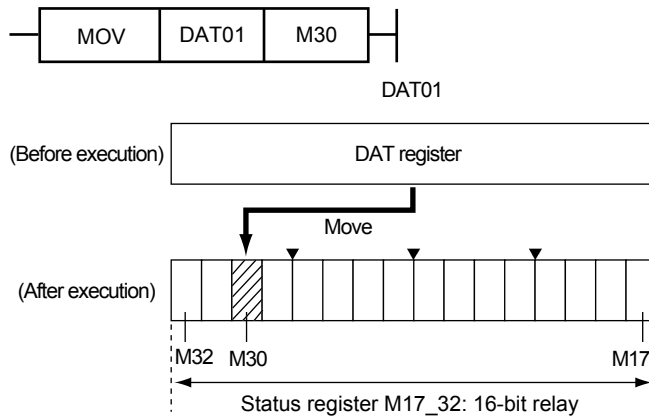
(4) For specification of d2 (relay) to d1 (DAT register)

The instruction moves M03 relay data (0 or 1) to the DAT01 register. If the M03 relay data is 0, "0.0f (0x00000000)" is stored in DAT01, and if it is 1, "1.0f (0x3F800000)" is stored in DAT01.



(5) For specification of d2 (DAT register) to d1 (relay)

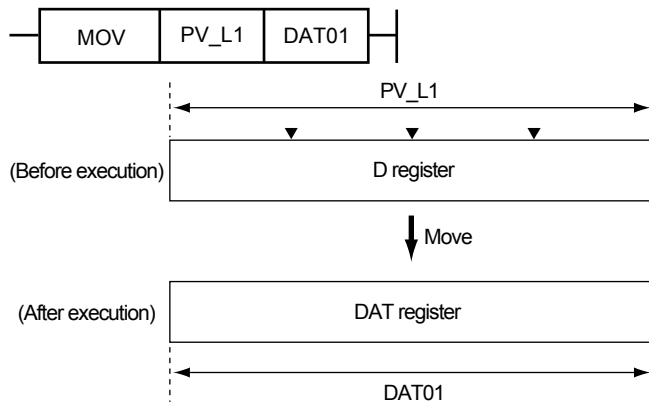
The instruction moves data in the DAT01 register to the M30 relay. If the DAT01 register data is less than "0.5f", "0" is stored in the M30 relay, and if it is "0.5f" or more, "1" is stored in the M30 relay.



(6) For specification of d2 (D register) to d1 (DAT register)

The instruction moves data in the D register (PV_L1) to the DAT01 register.

Example: When the PV input range is -270.0 to 1370.0 °C and PV is 250.3 °C, if the PV (PV_L1 register) is moved to the DAT01 register, "250.3f" is stored. The data to move includes decimal point position.

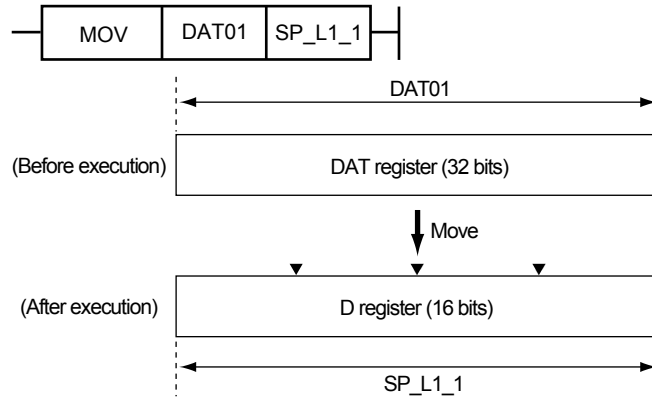


4.6 Details of Application Instructions

(7) For specification of d2 (DAT register) to d1 (D register)

The instruction moves data in the DAT01 register to the SP_L1_1 register.

Example: When the PV input range is -270.0 to 1370.0 °C, if the DAT01 register data "250.3f" is moved to the SP (SP_L1_1 register), "250.3f" is stored. When the DAT01 register data is out of the range of the storage destination register (parameter), data at the transfer source is restricted to the setting range of the storage destination register. The data to move includes decimal point position.



For data other than range and scale

If the data "1" to "8" of the SPNO. register is moved to the DAT01 register, data "1.0f" to "8.0f" is stored.



If the DAT01 register data "5.4f" is moved to the SPNO. register, data "5" is stored. If "5.5f" is moved to the SPNO. register, data "6" is stored.

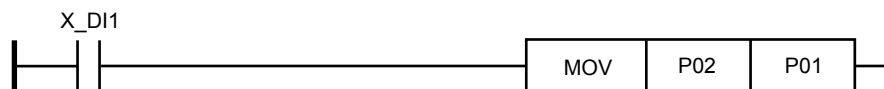


(8) Specification of d2 (DAT register) to d1 (DAT register)

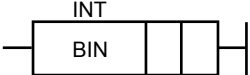

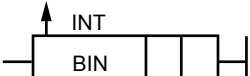
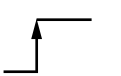
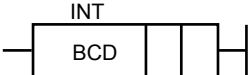

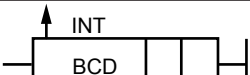

The instruction moves DAT register of the transfer source (d2) to the storage destination (d1) (DAT register).

Program example

When X_DI1 becomes ON, P02 data is moved to the P01 register.



4.6.9 Binary/BCD Conversion

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Binary Conversion	BIN		√	-		3	D-register or status register
	E_BIN		√	-		3	
BCD Conversion	BCD		√	-		3	
	E_BCD		√	-		3	

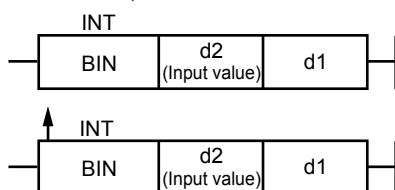
Parameter

Binary conversion

This instruction converts the data of the transfer source for BCD code (d2) to an integer, and stores it to the transfer destination (d1).

If the data before binary conversion is negative or out of the BCD codes (each digit: 10 (0xa) to 15 (0xf)), binary conversion is not executed and the source value (d1) is not changed.

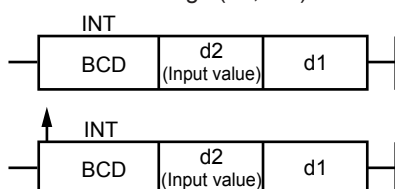
In this case, a ladder calculation overflow error occurs.

**BCD conversion**

This instruction converts the data of the transfer source for 16-bit binary code (an integer) to BCD, and stores it to the transfer destination (d1).

If the binary code (an integer) of the transfer source (d2) is greater than negative or 65535, BCD conversion is not executed and the transfer source value (d1) is not changed. In this case, a ladder calculation overflow error occurs.

If the binary code (an integer) of the transfer source (d2) is greater than ten-thousand (10,000), the value is BCD converted up to the thousands digit (1,000) and more than ten-thousands digit (10,000) is not converted.

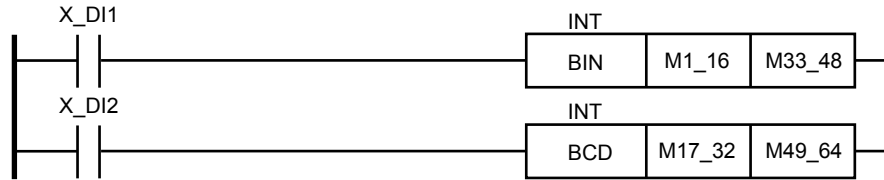


4.6 Details of Application Instructions

Program example

When X_DI1 becomes ON, M1_16 data is binary converted and the result is stored in M33_48.

When X_DI2 becomes ON, M17_32 data is BCD converted and the result is stored in M49_64.



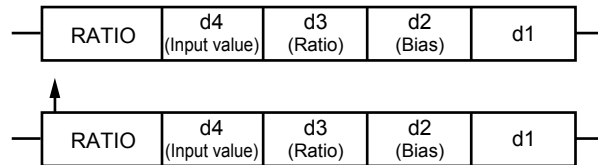
4.6.10 Ratio

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Ratio	RATIO		√	-		5	D-register or DAT register
	E_RATIO		√	-		5	

Parameter

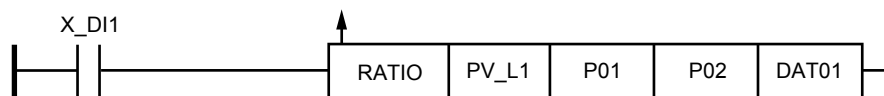
This instruction obtains the ratio from the equation “input value (d4) x ratio (d3) + bias value (d2)” and stores the result in a specified device (d1).

If a non-numerical value or infinity occurs during calculation or arises as a result, a ladder calculation overflow error occurs.



Program example

When X_DI1 changes from OFF to ON, PV_L1 input data is multiplied by P01, P02 is added to the value obtained, and the result is stored in DAT01.



4.6.11 Selectors

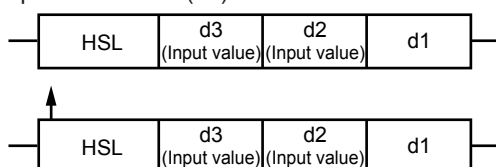
Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
High Selector	HSL		√	-		4	D-register
	E_HSL		√	-		4	
Low Selector	LSL		√	-		4	
	E_LSL		√	-		4	

Parameter

High selector

When input value (d3) > input value (d2), this instruction stores the input value (d3) in a specified device (d1).

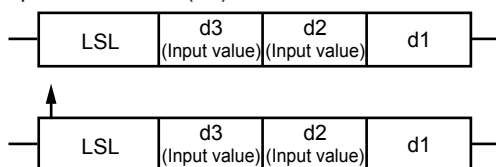
When input value (d3) ≤ input value (d2), the instruction stores the input value (d2) in a specified device (d1).



Low selector

When input value (d3) > input value (d2), this instruction stores the input value (d2) in a specified device (d1).

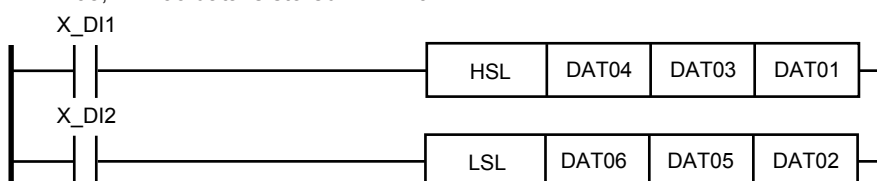
When input value (d3) ≤ input value (d2), the instruction stores the input value (d3) in a specified device (d1).



Program example

When X_DI1 becomes ON, DAT04 data is stored in DAT01 if DAT04 > DAT03. If DAT04 ≤ DAT03, DAT03 data is stored in DAT01.

When X_DI2 becomes ON, DAT05 data is stored in DAT02 if DAT06 > DAT05. If DAT06 ≤ DAT05, DAT06 data is stored in DAT02.



4.6.12 Limiters

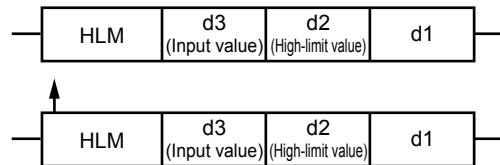
Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
High Limiter	HLM		√	-		4	D-register
	E_HLM		√	-		4	
Low Limiter	LLM		√	-		4	
	E_LLM		√	-		4	

Parameter

High limiter

When input value (d3) < high-limit value (d2), this instruction stores the input value (d3) in a specified device (d1).

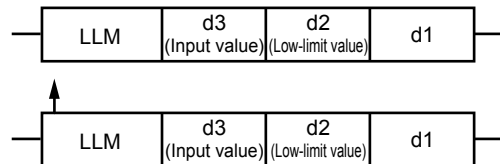
When input value (d3) ≥ high-limit value (d2), the instruction stores the high-limit value (d2) in a specified device (d1).



Low limiter

When input value (d3) < low-limit value (d2), this instruction stores the low-limit value (d2) in a specified device (d1).

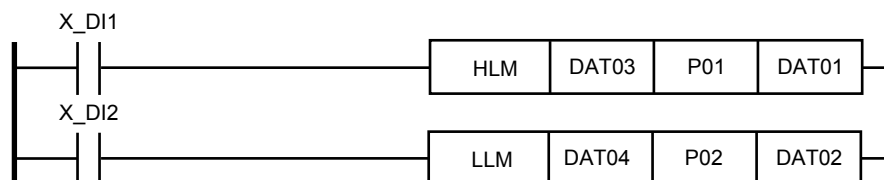
When input value (d3) ≥ low-limit value (d2), the instruction stores the input value (d3) in a specified device (d1).



Program example

When X_DI1 becomes ON, DAT03 data is stored in DAT01 if DAT03 < P01. If DAT03 ≥ P1, P01 data is stored in DAT01.

When X_DI2 becomes ON, P02 data is stored in DAT02 if DAT04 < P02. If DAT04 ≥ P02, DAT04 data is stored in DAT02.



4.6.13 Scaling and Normalization

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Scaling	SCAL		√	-		5	D-register or DAT register
	E_SCAL		√	-		5	
Normalization	NORM		√	-		5	
	E_NORM		√	-		5	

Parameter

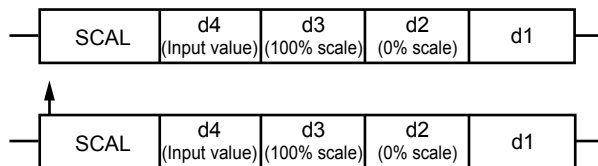
Scaling

This instruction performs scaling calculation for normalized input value (d5) and stores the result in a specified device (d1).

Scaling calculation is done by the following equation:

$$d1 = \text{input value (d4)} / 100 \times (100\% \text{ scale (d3)} - 0\% \text{ scale (d2)}) + 0\% \text{ scale value (d2)}$$

If a non-numerical value or infinity occurs during calculation or arises as a result, a ladder calculation overflow error occurs.



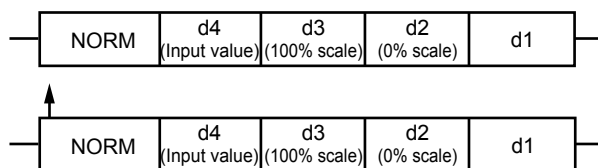
Normalization

This instruction performs normalization calculation for scaled input value (d4) and stores the result in a specified device (d1).

Normalization is done by percent data of 0.0 to 100.0, and the following equation:

$$d1 = (\text{input value (d4)} - 0\% \text{ scale (d2)}) / (100\% \text{ scale (d3)} - 0\% \text{ scale value (d2)}) \times 100$$

If a non-numerical value or infinity occurs during calculation or arises as a result, a ladder calculation overflow error occurs.

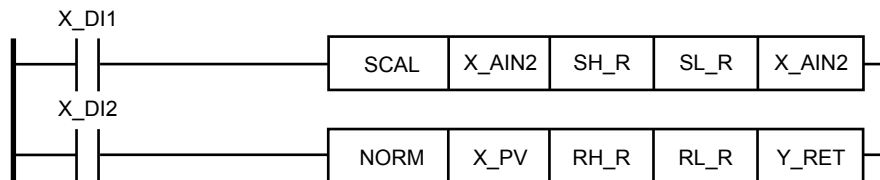


4.6 Details of Application Instructions

Program example

When X_DI1 changes from OFF to ON, X_AIN2 data is scaled with SL_R to SH_R and the result is stored in DAT01.

When X_DI2 becomes ON, X_PV data is normalized with RL_R to RH_R and the result is stored in Y_RET.



4.6.14 Maximum, Minimum, and Average Values

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Maximum	MAX		√	-		7	D-register or DAT register
	E_MAX		√	-		7	
Minimum	MIN		√	-		7	
	E_MIN		√	-		7	
Average	AVE		√	-		7	
	E_AVE		√	-		7	

Parameter

Maximum value

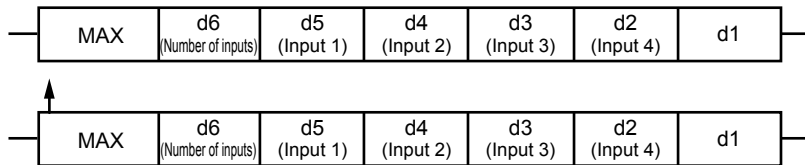
This instruction obtains the maximum value from up to four inputs: inputs 1 to 4 (d5 to d2) and stores the result in a specified device (d1).

If the number of inputs (d6) is one, the instruction stores input 1 (d5) in the specified device (d1).

If the number of inputs (d6) is two, it stores input 1 (d5) or input 2 (d4), whichever is the greater, in the specified device (d1).

If the number of inputs (d6) is three, it stores the maximum value of input 1 (d5) through input 3 (d3) in the specified device (d1).

If the number of inputs (d6) is four, it stores the maximum value of input 1 (d5) through input 4 (d2) in the specified device (d1).



4.6 Details of Application Instructions

Minimum value

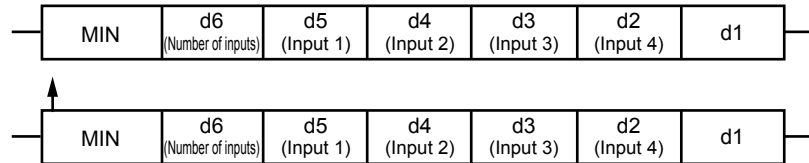
This instruction obtains the minimum value from up to four inputs: inputs 1 to 4 (d5 to d2) and stores the result in a specified device (d1).

If the number of inputs (d6) is one, the instruction stores input 1 (d5) in the specified device (d1).

If the number of inputs (d6) is two, it stores input 1 (d5) or input 2 (d4), whichever is the smaller, in the specified device (d1).

If the number of inputs (d6) is three, it stores the minimum value of input 1 (d5) through input 3 (d3) in the specified device (d1).

If the number of inputs (d6) is four, it stores the minimum value of input 1 (d5) through input 4 (d2) in the specified device (d1).



Average value

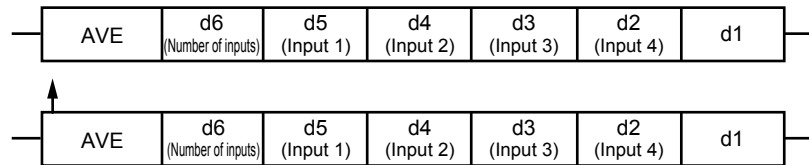
This instruction obtains the average value of up to four inputs: inputs 1 to 4 (d5 to d2) and stores the result in a specified device (d1).

If the number of inputs (d6) is one, the instruction stores input 1 (d5) in the specified device (d1).

If the number of inputs (d6) is two, it obtains the average value of input 1 (d5) and input 2 (d4) and stores it in the specified device (d1).

If the number of inputs (d6) is three, it stores the average value of input 1 (d5) through input 3 (d3) in the specified device (d1).

If the number of inputs (d6) is four, it stores the average value of input 1 (d5) through input 4 (d2) in the specified device (d1).

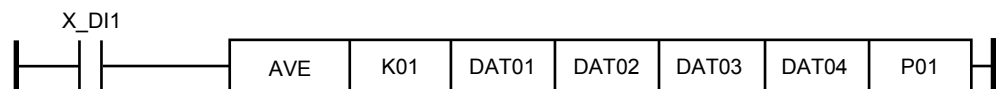


The number of inputs (d6) is regarded as

- “1” if $d6 < 1.5$
- “2” if $1.5 \leq d6 < 2.5$
- “3” if $2.5 \leq d6 < 3.5$
- “4” if $3.5 \leq d6$

Digits to the right of the decimal point will be discarded.

Program example



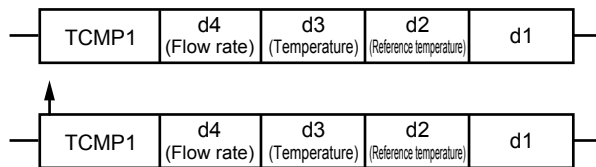
4.6.15 Temperature Compensation

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Temperature Compensation (deg C)	TCMP1		√	-		5	D-register or DAT register
	E_TCMP1		√	-		5	
Temperature Compensation (deg F)	TCMP2		√	-		5	
	E_TCMP2		√	-		5	

Parameter

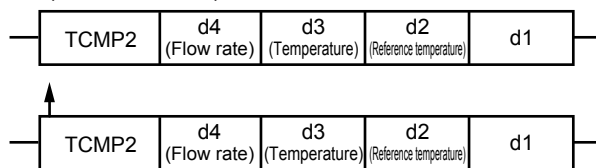
Temperature compensation (°C)

This instruction performs temperature compensation (in °C) based on the reference temperature d2 (°C), temperature d3 (°C), and flow rate d4 and stores the result in a specified device (d1). Temperature compensation (°C) is done by the following equation.
 $d1 = \text{flow rate (d4)} \times (\text{reference temperature (d2)} + 273.15) / (\text{temperature (d3)} + 273.15)$



Temperature compensation (°F)

This instruction performs temperature compensation (in °F) based on the reference temperature d2 (°F), temperature d3 (°F), and flow rate d4 and stores the result in a specified device (d1). Temperature compensation (°F) is done by the following equation.
 $d1 = \text{flow rate (d4)} \times ((\text{reference temperature (d2)} - 32) / 1.8 + 273.15) / ((\text{temperature (d3)} - 32) / 1.8 + 273.15)$



If a non-numerical value or infinity occurs during calculation or arises as a result, a ladder calculation overflow error occurs.

Program example

In the following program, the control PV input range (P.RH/P.RL) [PVIN_CTL: 0 to 100% scale] and the PV input range (RH/RL) or PV input scale (SH/SL) need to be equal.

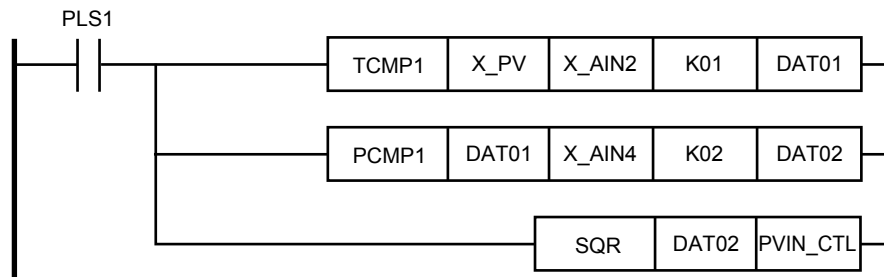
X_PV: Flow input that is scaled to 0 to 100%.

X_AIN2: Temperature input that is scaled to 0 to 500°C.

K01: Reference temperature 300°C.

X_AIN4: Pressure input that is scaled to 0 to 1MPa.

K02: Reference pressure 0.6MPa.



4.6.16 Pressure Compensation

Instruction	Mnemonic	Symbol	Input Condition Required?		Execution Condition	Step Count	Data Format
			Yes	No			
Pressure Compensation (MPa)	PCMP1		√	-		5	D-register
	E_PCMP1		√	-		5	
Pressure Compensation (kgf/cm ²)	PCMP2		√	-		5	
	E_PCMP2		√	-		5	
Pressure Compensation (psi)	PCMP3		√	-		5	
	E_PCMP3		√	-		5	

psi:pound per square inch

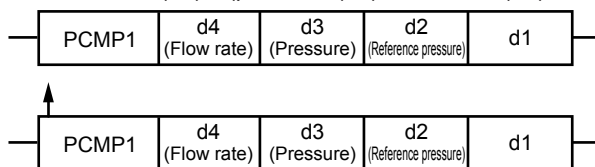
Parameter

Pressure compensation (MPa)

This instruction performs pressure compensation (in MPa) based on the reference pressure d2 (MPa), pressure d3 (MPa), and flow rate d4 and stores the result in a specified device (d1).

Pressure compensation (MPa) is done by the following equation.

$$d1 = \text{flow rate (d4)} \times (\text{pressure (d3)} + 0.101325) / (\text{reference pressure (d2)} + 0.101325)$$

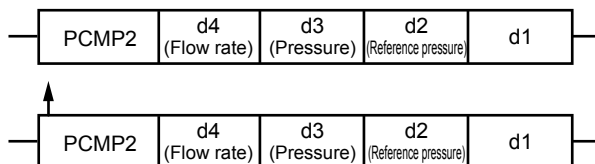


Pressure compensation (kgf/cm²)

This instruction performs pressure compensation (in kgf/cm²) based on the reference pressure d2 (kgf/cm²), pressure d3 (kgf/cm²), and flow rate d4 and stores the result in a specified device (d1).

Pressure compensation (kgf/cm²) is done by the following equation.

$$d1 = \text{flow rate (d4)} \times (\text{pressure (d3)} + 1.03323) / (\text{reference pressure (d2)} + 1.03323)$$



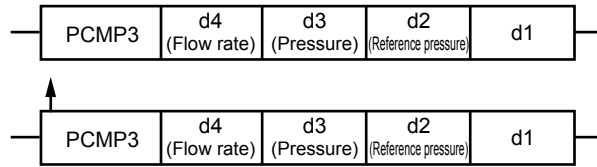
4.6 Details of Application Instructions

Pressure compensation (psi)

This instruction performs pressure compensation (in psi) based on the reference pressure d2 (psi), pressure d3 (psi), and flow rate d4 and stores the result in a specified device (d1).

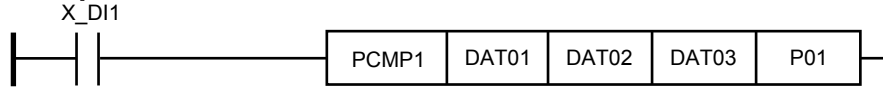
Pressure compensation (psi) is done by the following equation.

$$d1 = \text{flow rate (d4)} \times (\text{pressure (d3)} + 14.6959) / (\text{reference pressure (d2)} + 14.6959)$$



If a non-numerical value or infinity occurs during calculation or arises as a result, a ladder calculation overflow error occurs.

Program example



5.1 Precautions for Using Ladder Program

When building a ladder program, its actions upon power restoration should also be considered. This chapter explains the key items related to the actions of a ladder program upon power recovery.

UT35A/UT32A does not have the parameter CTLM (Control mode.)

This chapter describes the examples for UT55A/UT52A.

The ladder program for UT35A/UT32A can be created in the same way as UT55A/UT52A.

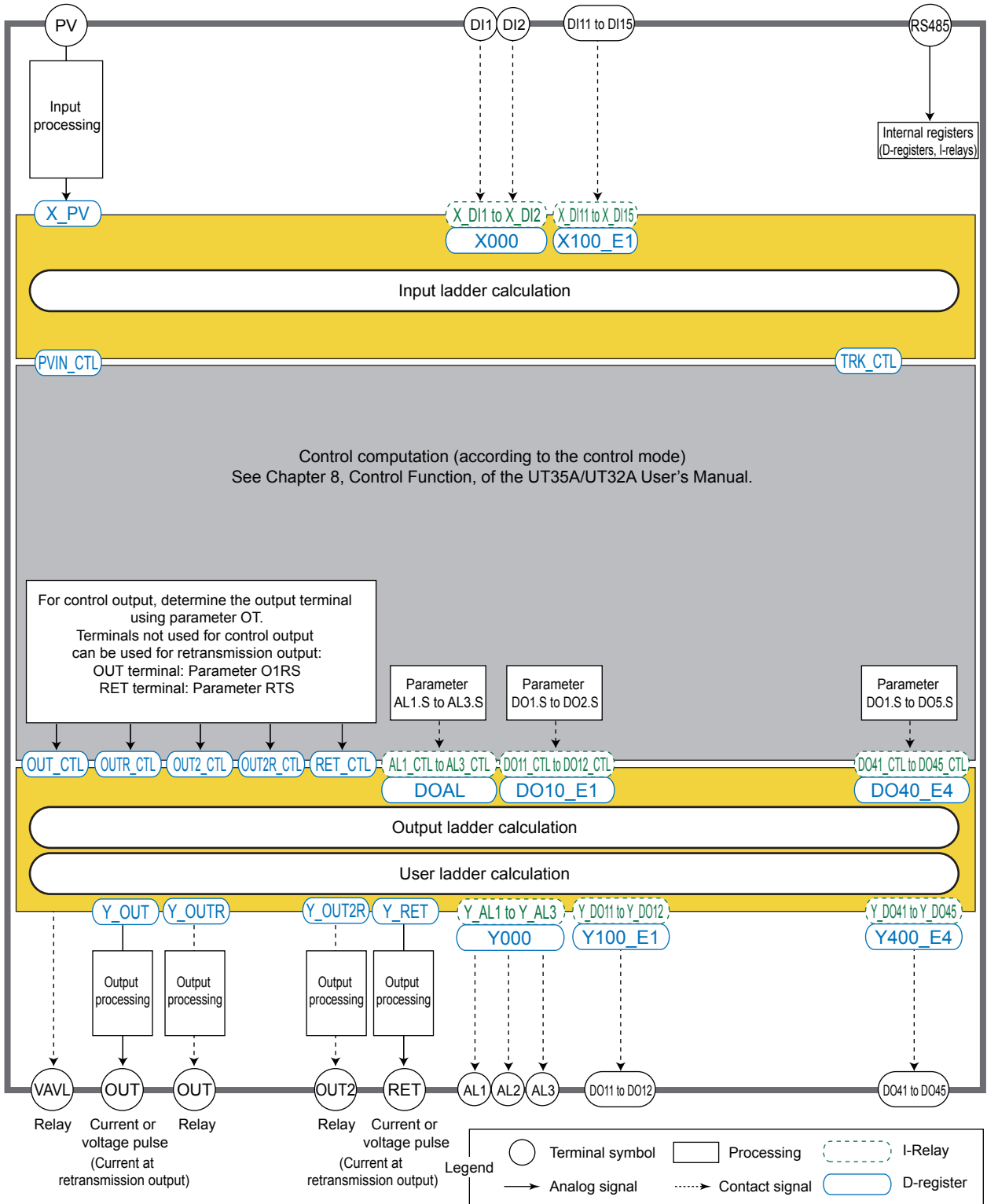
5.1 Precautions for Using Ladder Program

■ UT35A/UT32A

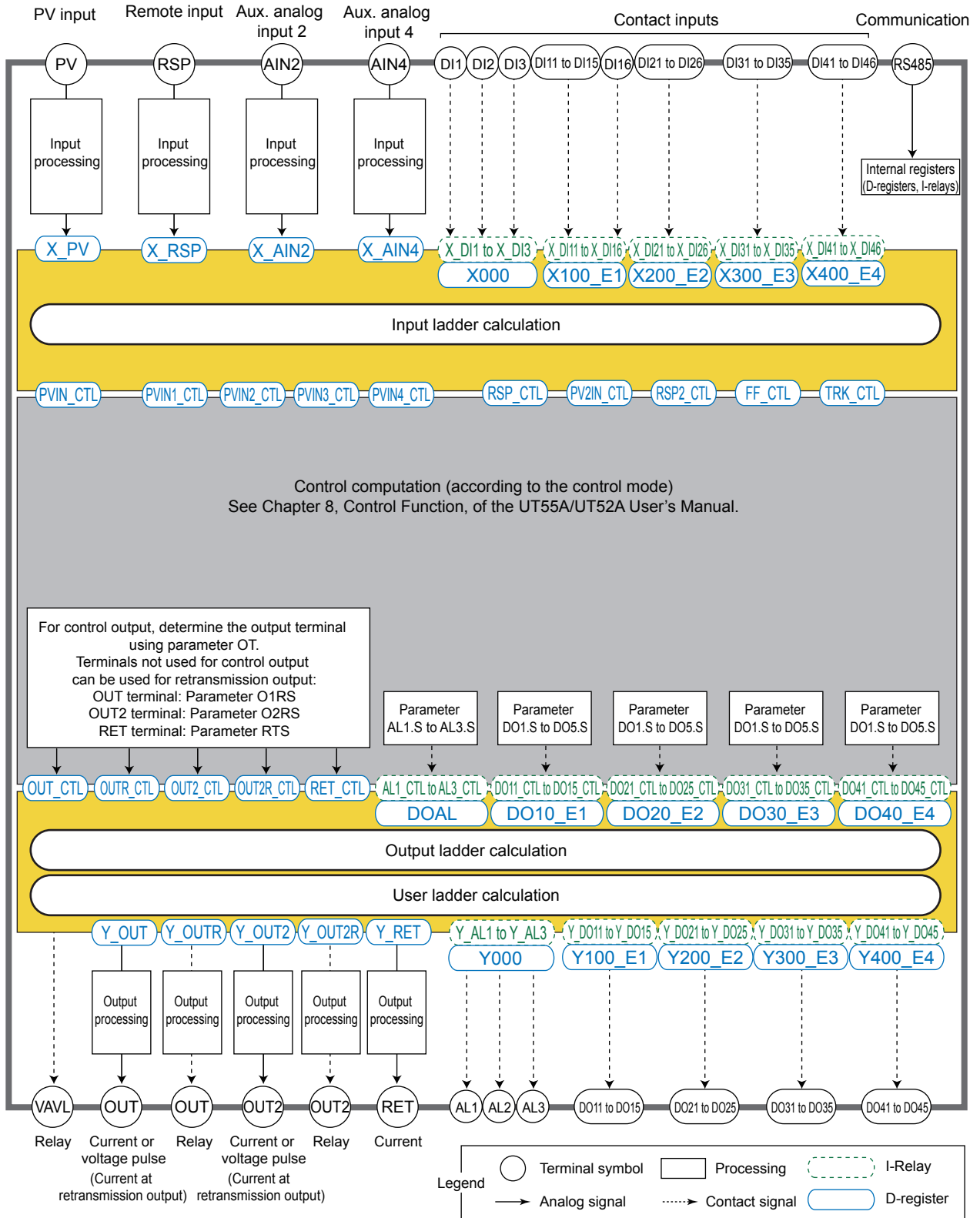
PV input

Contact inputs

Communication



■ UT55A/UT52A



5.1 Precautions for Using Ladder Program

Input ladder calculation

It is recommended that the input ladder calculation section is used for sequence or arithmetic process before outputting the signal from input terminals into the control computation section.

Output ladder calculation

It is recommended that the output ladder calculation section is used in cases where control, alarm, and status outputs are outputted to output terminals after sequence or arithmetic process.

User ladder calculation

It is recommended that the user ladder calculation section be used if a sequence is desired to be configured regardless of controller control computation.

Order of executing computation/calculation

The order of executing computation/calculation is as follows:

- (1) Input ladder calculation
- (2) Control computation
- (3) Output ladder calculation
- (4) User ladder calculation

Note

Create your own programs using examples described in this manual.

5.1.1 Relay and Register Values upon Recovery from Power Failure

- Analog input registers (X_PV, X_RSP, X_AIN2, and X_AIN4), input (status) relays (X_DI1 to X_DI3, X_DI11 to X_DI16, X_DI21 to X_DI26, X_DI31 to X_DI35, and X_DI41 to X_DI46) and status input registers (X000, X100_E1, X200_E2, X300_E3, and X400_E4): The values must be defined before execution of the input ladder calculation.
- Control input registers (PVIN_CTL, PVIN1_CTL, PVIN2_CTL, PVIN3_CTL, PVIN4_CTL, RSP_CTL, PV2IN_CTL, RSP2_CTL, FF_CTL, and TRK_CTL): Reset to zeros immediately when the power supply recovers, and then their respective values will be defined by the input ladder calculation during execution.
- Control computation registers (OUT_CTL, OUTR_CTL, OUT2_CTL, OUT2R_CTL, and RET_CTL), control status registers (DOAL, DO10_E1, DO20_E2, DO30_E3, and DO40_E4), and control (status) relays (AL1_CTL to AL3_CTL, and DO11_CTL to DO45_CTL): Reset to zeros immediately when the power supply recovers, and then their respective values will be defined by the control computation during execution. Thus, all values must be defined before execution of the output ladder calculation.
- Output registers (Y_OUT, Y_OUTR, Y_OUT2, Y_OUT2R, and Y_RET), status output registers (Y000, Y100_E1, Y200_E2, Y300_E3, and Y400_E4), and output (status) relays (Y_AL1 to Y_AL3 and Y_DO11 to Y_DO45): The values are defined by the output ladder calculation.
- Operation parameters of Loops 1 and 2 (such as SPs, SPNo's, alarm settings, PID tuning parameters): The values must be defined before execution of the input ladder calculation.
- Process data (such as PV, CSP, DEV, and PIDNo): The values must be defined when the control computation runs. Thus, their values will not be defined by execution of the input ladder calculation for the first time after a power recovery.
- Internal relays, internal status registers, and DAT registers: Whether the values are held or not is determined by the control period.

Device Name	Relay/Register	Holding type/Non-holding type		
		Control period		
		50 ms	100 ms	200 ms
Internal (M) relays	M01 to M128	N/A	N/A	N/A
	M01_B to M32_B	√	√	√
	M33_B to M128_B	N/A	√	√
Internal status registers	M1_M16, M17_32, M33_48, M49_64, M65_80, M81_96, M97_112, M113_M128	N/A	N/A	N/A
	M1_16_B, M17_32_B	√	√	√
	M33_48_B, M49_64_B, M65_80_B, M81_96_B, M97_112_B, M113_128_B	N/A	√	√
DAT registers	DAT01 to DAT20	N/A	N/A	N/A
	DAT01_B to DAT08_B	N/A	√	√
Time-out relays	TIM1 to TIM4	N/A	N/A	N/A
Timer registers (current value)	TIMER1 to TIMER4	N/A	N/A	N/A
Count-out relays	CNT1 to CNT4	N/A	N/A	N/A
Counter registers (Current value)	COUNTER1 to COUNTER4	N/A	N/A	N/A

√: Available, N/A: Not available

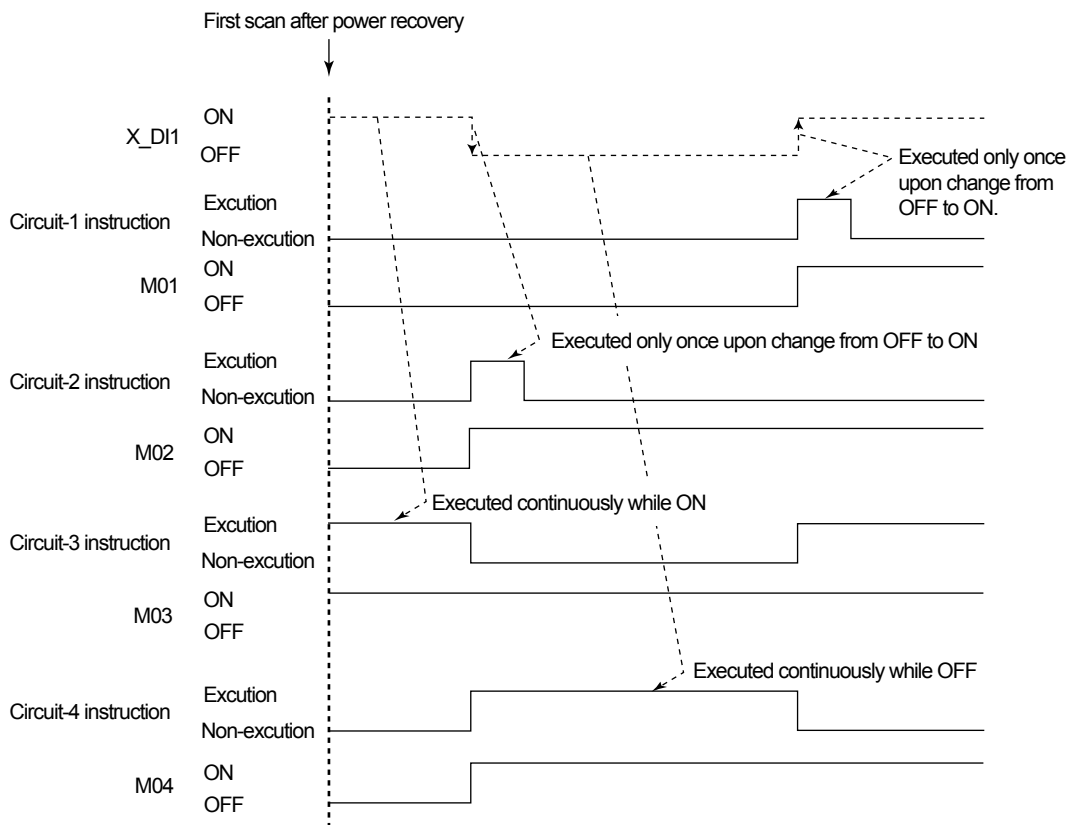
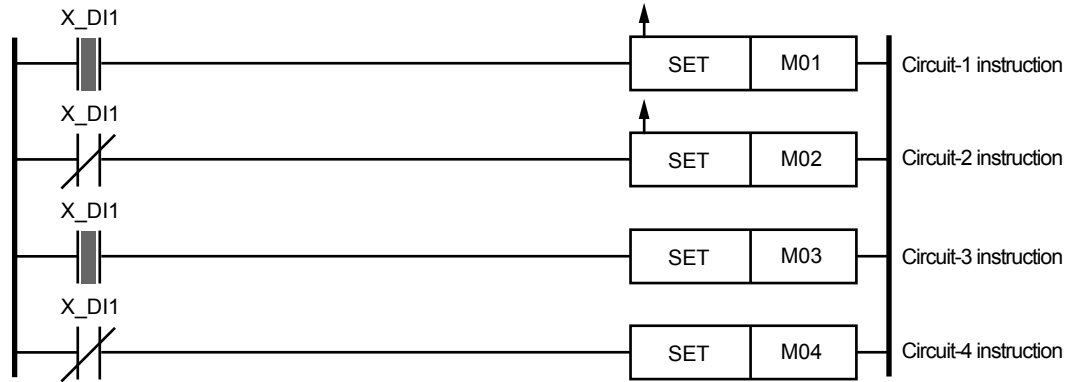
5.1 Precautions for Using Ladder Program

- The internal relays and registers are either the holding or the non-holding type. The non-holding type includes non-holding internal relays, non-holding DAT registers, time-out relays, count-out relays, timer registers, and counter registers, which will be reset to zeros upon power recovery. While, the holding type includes holding internal relays, holding DAT registers, P registers, and K registers, whose respective values immediately before a power failure will remain after power recovery. Holding internal relays in groups of 16 bits each can be used as status registers.

- ▶ [Internal relay, internal register: Section 4.2.2, Internal Devices \(Read/Write\)](#)
- ▶ [Process data, operation mode, alarm status, alarm output status, key status, display status: UTAdvanced Series Communication Interface \(RS-485, Ethernet\) User's Manual](#)

5.1.2 Circuit Actions upon Recovery from Power Failure

Instructions are divided into two main types: those instructions that are executed continuously during the period when the execution condition is met; and those that are executed only once when the condition is met. Upon power recovery, instructions of the former type will be executed from the first time after the recovery, whereas instructions of the latter type will ignore the respective conditions at the first time and start judging the conditions and being executed depending on the condition from the second time.

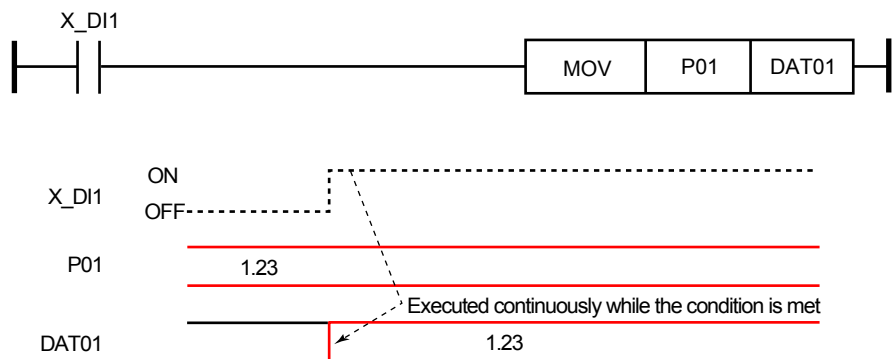


5.2 Functions That Require Parameter Setting

Some ladder programs require parameter setting before running. You can set parameters either with the keys on the front panel of the UT controller, or using the LL50A parameter setting software and downloading the settings to the UT controller. The following explains the method of using the LL50A parameter setting software.

5.2.1 Setting P Parameters

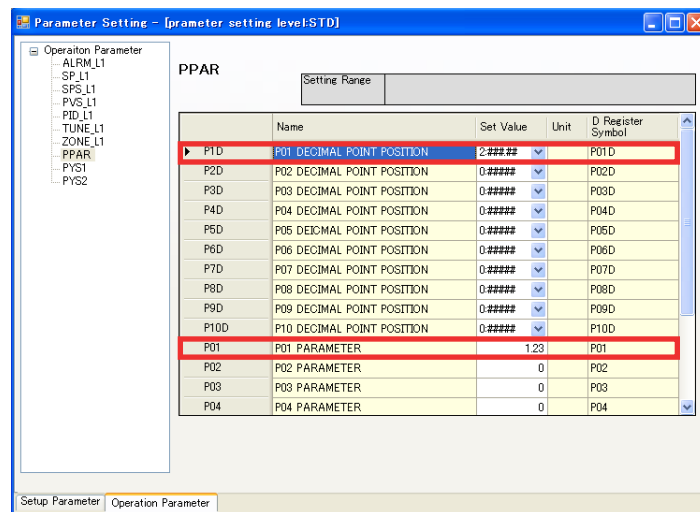
To set the values and decimal point positions of the individual P parameters, use the Parameter Setting window. The decimal point positions can only be set by using the LL50A parameter setting software.



Parameter Settings

P1D: 2:###.##

P01: 1.23



5.2.2 Setting Contact Inputs for Switching Operation Mode from Ladder Program

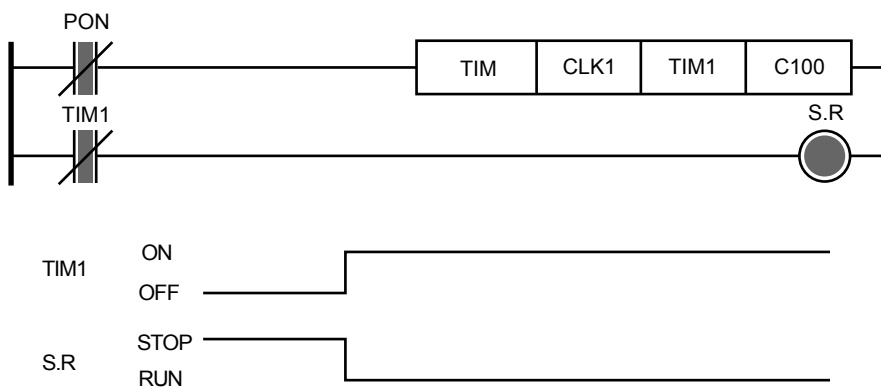
Operation mode switching can be performed in a ladder program. However, when contact inputs have been assigned to remote operation mode switching, those contact input statuses take precedence over the ladder program.

DI Function Registration Menu

Parameter	Name	Action type	Default
			Contact name (I relay number)
A/M	AUTO/MAN switch	Status	X_DI1 (5026)
R/L	REM/LCL switch	Status	X_DI16 (5046)
S/R	STOP/RUN switch	Status	X_DI2 (5027)

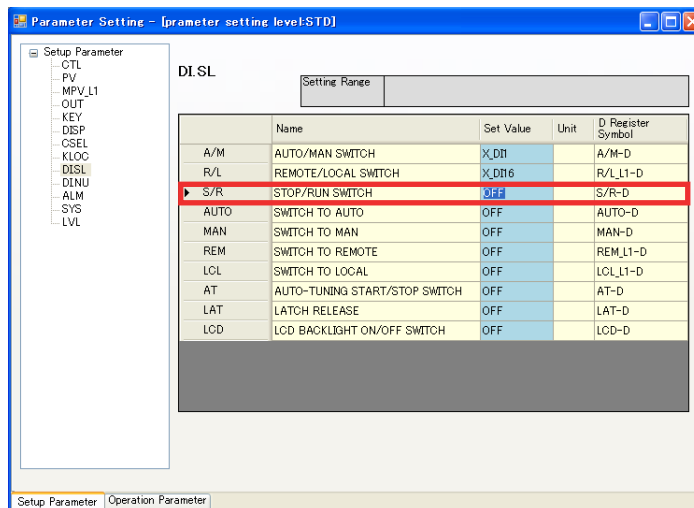
Note: An edge action results when in cascade mode.

The table above shows the contact inputs assigned to mode switching by default. Use the LL50A parameter setting software or keys on the front panel of the UT to change the parameter settings. The following shows an example when using LL50A.



Parameter Settings

S/R: OFF



5.2 Functions That Require Parameter Setting

5.2.3 Assigning Operation Mode Switching Functions to Keys on UT's Front Panel

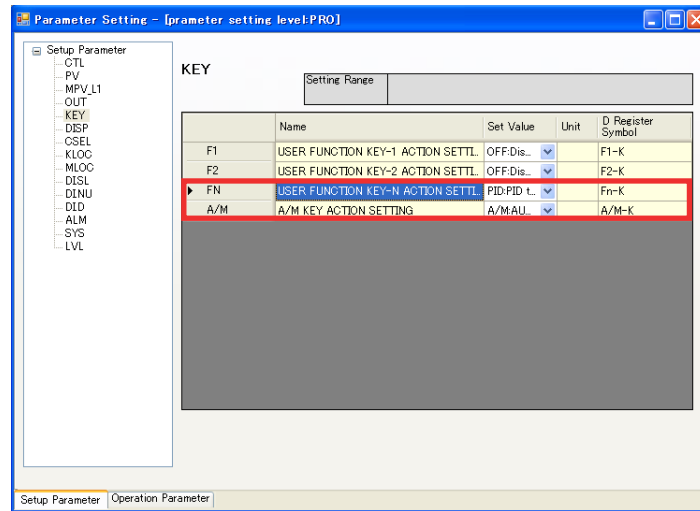
Operation mode switching can be performed from a ladder program as mentioned above. The mode switching functions can also be assigned to keys on the front panel of the UT controller.

The keys to which the mode switching functions can be assigned and the window for setting are shown below.

Front keys to which mode switching functions can be assigned

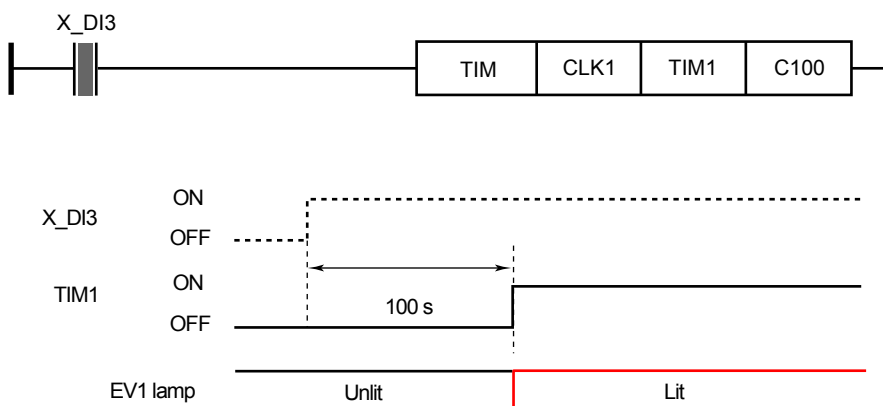
Parameter	Factory set default
FN	PID tunig swtich
A/M	AUTO/MAN switch

Parameter Settings



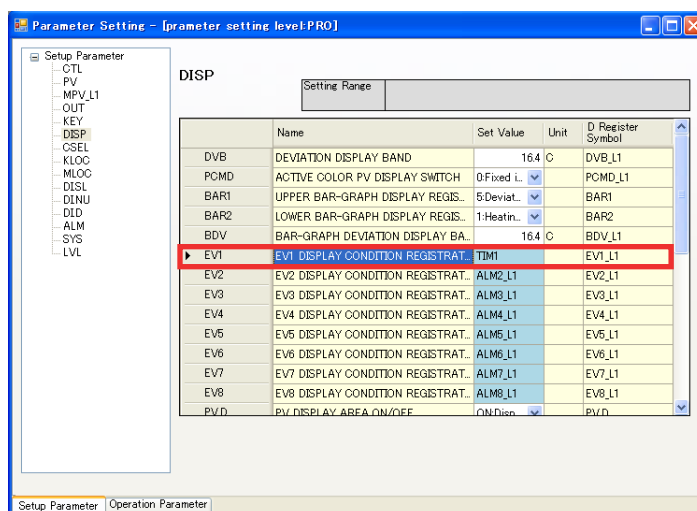
5.2.4 Settings for Activating Contact Outputs and Event Lamps

To activate contact outputs and event lamps from a ladder program for event status indications, the respective parameters must be set in the UT controller. An example of setting using the LL50A parameter setting software is shown below.



Parameter Settings

EV1: TIM1



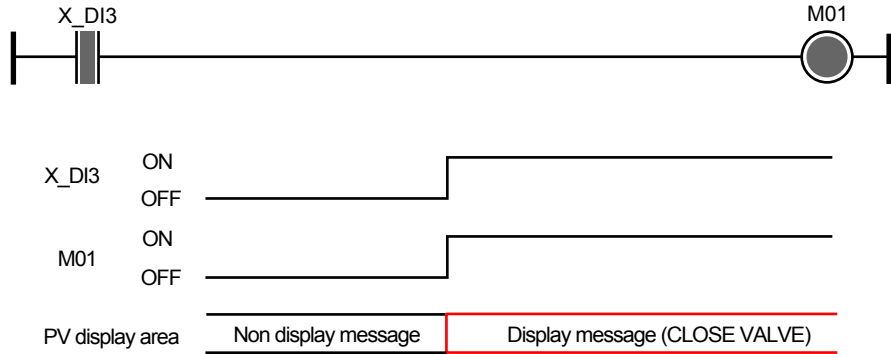
5.2 Functions That Require Parameter Setting

5.2.5 Settings for Interrupt Message Display in PV Display Area

To let a ladder program display interrupt messages, the respective parameters must be set in the UT controller. An example of setting using the LL50A parameter setting software is shown below.

Note

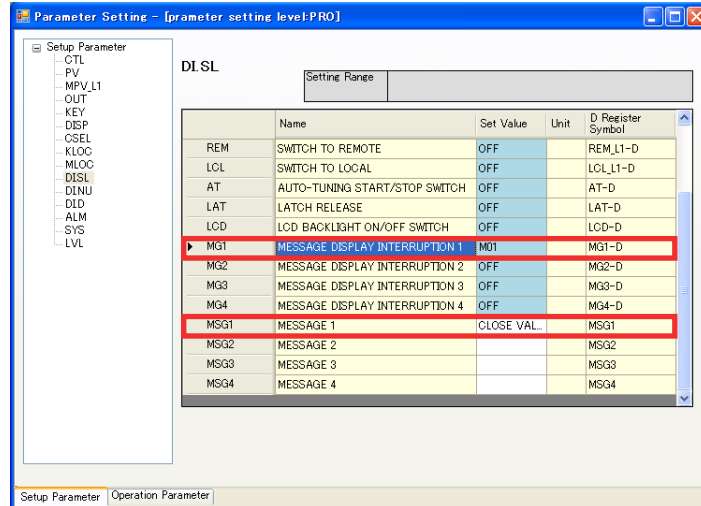
Merely writing "1" in the D registers for interrupt message display (MG1 to MG4) inside a ladder program does not cause the message to appear.



Parameter Settings

MG1: M01

MSG1: CLOSE VALVE



5.3 Examples of Supplementing Instructions and General Specifications in Ladder Programming

Some functions cannot be achieved using only instructions provided with a ladder program. The following are examples of implementing such functions.

5.3.1 Retaining Timers and Counters from Previous Values after Power Failure

Examples of restarting a timer and counter after the power recovery with the value immediately before the power failure are shown below.

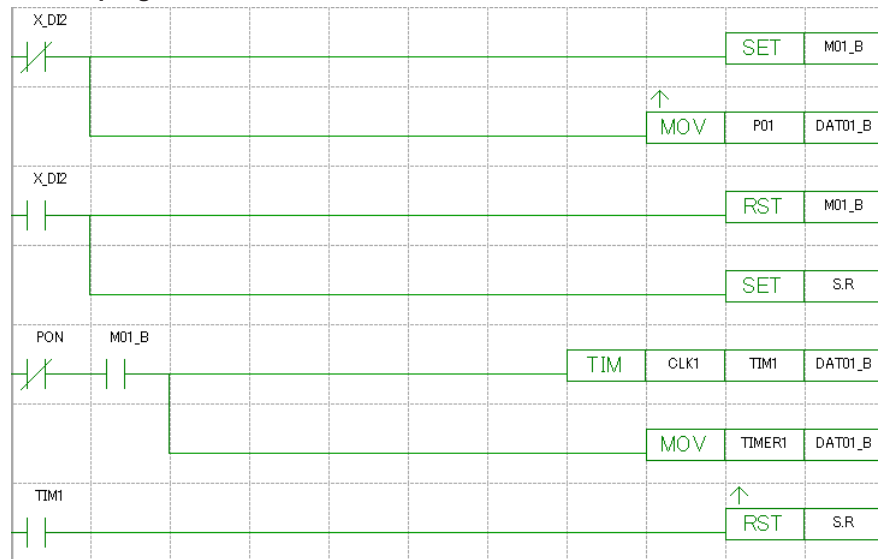
Timer

A timer instruction does not retain the current timer value during a power failure. The following shows an example of ladder programming when it is desired to restart a timer after the power recovery from the value immediately before the power failure.

Specifications of Example:

- If DI2 is ON, set STOP/RUN (S.R) to STOP.
- When DI2 turns ON to OFF, start the timer. When the timer value reaches the time (in seconds) set in P01, namely, when time-out is reached, set STOP/RUN (S.R) to RUN.
- If a power failure and recovery occur while the timer is running, the timer restarts continuously without its value being reset.

Ladder program

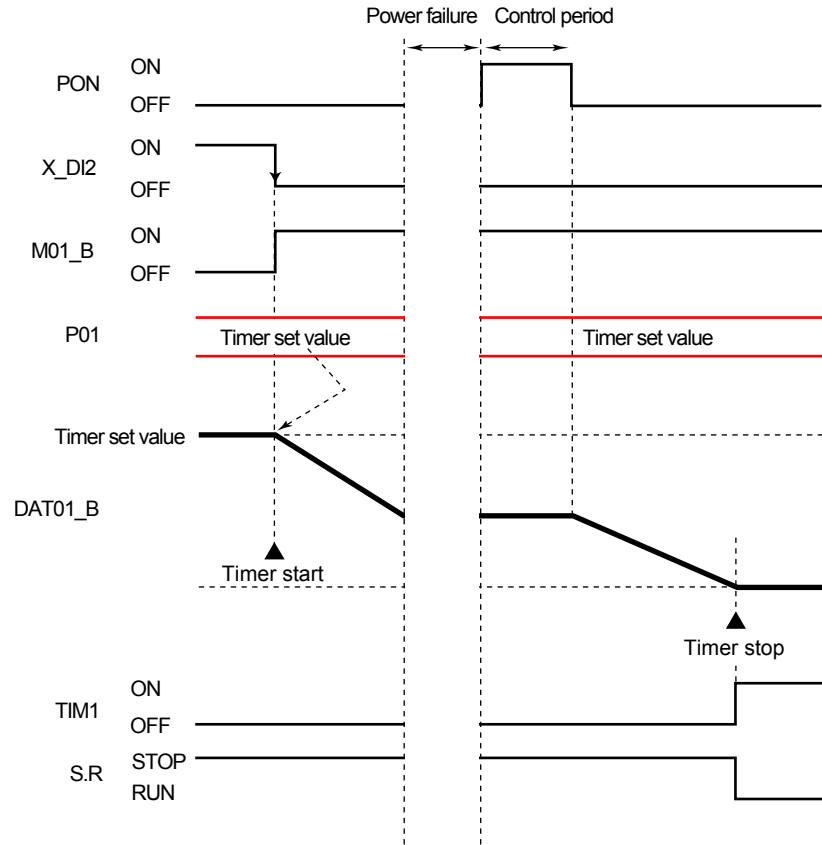


Note: Code the ladder program above in the input ladder calculation.

Note: Make sure to disable the contact input function for DI2.

Register	Function
X_DI2	OFF: Timer start ON: Timer stop
P01	Timer set value (s)
S.R	STOP/RUN ON: STOP OFF: RUN
M01_B	ON: Timer enable flag OFF: Timer disable flag
DAT01_B	Timer set value (use value)
TIM1	Time-out relay
TIMER1	Timer current value

5.3 Examples of Supplementing Instructions and General Specifications in Ladder Programming



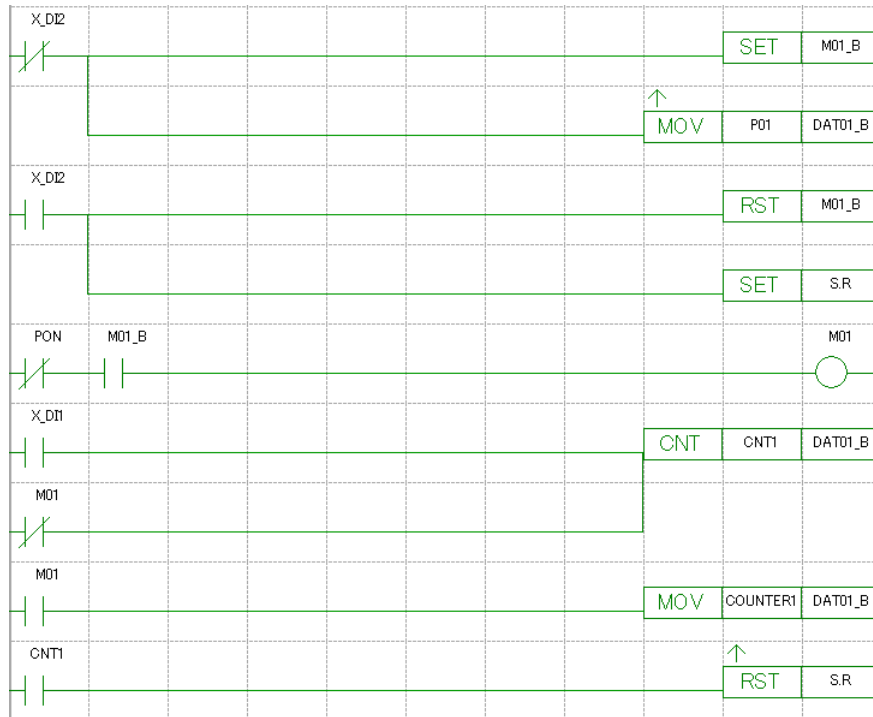
Counter

A counter instruction does not retain the current counter value during a power failure. The following shows an example of ladder programming when it is desired to restart a counter after the power recovery from the value immediately before the power failure.

Specifications of example:

- When DI1 turns ON, increment the counter by 1.
- If DI2 is ON, set STOP/RUN (S.R) to STOP.
- When DI2 turns ON to OFF, start the counter. When the counter value reaches the number set in P01, namely, when count-out is reached, set STOP/RUN (S.R) to RUN.
- If a power failure and recovery occur while the counter is running, the counter restarts continuously without its value being reset.

Ladder program



Note: Code the ladder program above in the input ladder calculation.

Note: Make sure to disable the contact input function for DI1 and DI2.

5.3.2 Holding Timer and Counter Values

Examples of programming to hold a timer and counter depending on a contact input status are shown below.

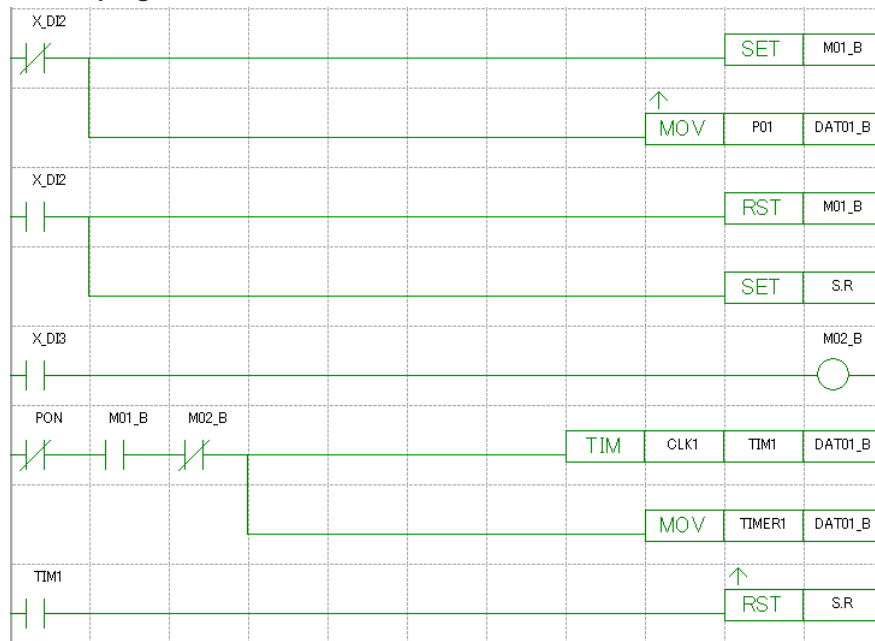
Timer

A timer instruction does not retain the current timer value. The following shows an example of ladder programming to hold the timer value.

Specifications of example

- If DI2 is ON, set STOP/RUN (S.R) to STOP.
- When DI2 turns ON to OFF, the timer starts. When the timer value reaches the time (in seconds) set in P01, namely, when time-out is reached, set STOP/RUN (S.R) to RUN.
- If a power failure and recovery occur while the timer is running, the timer restarts continuously without its value being reset.
- If DI3 turns OFF to request holding while the timer is running, the timer pauses holding the current value. If DI3 turns ON to release the timer holding, restart the timer from the value held.

Ladder program

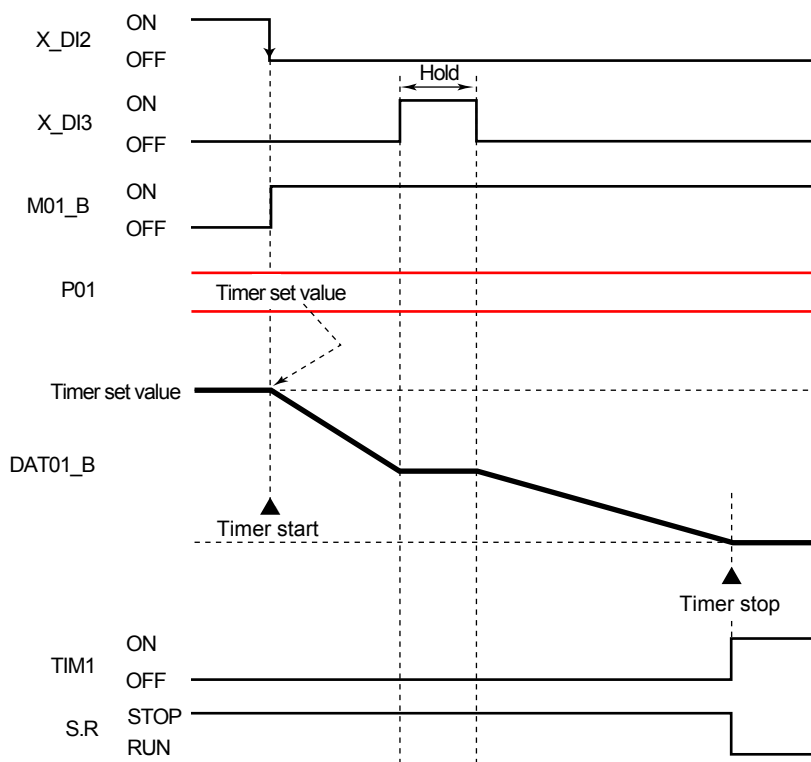


Note: Code the ladder program above in the input ladder calculation.

Note: Make sure to disable the contact input function for DI2 and DI3.

5.3 Examples of Supplementing Instructions and General Specifications in Ladder Programming

Register	Function
X_DI2	OFF: Timer start ON: Timer stop
X_DI3	ON: Timer hold OFF: Timer holding release
P01	Timer set value (s)
S.R	STOP/RUN ON: STOP OFF: RUN
M01_B	ON: Timer enable flag OFF: Timer disable flag
M02_B	ON: Timer hold flag OFF: Timer holding release flag
DAT01_B	Timer set value (use value)
TIM1	Time-out relay
TIMER1	Timer current value



5.3 Examples of Supplementing Instructions and General Specifications in Ladder Programming

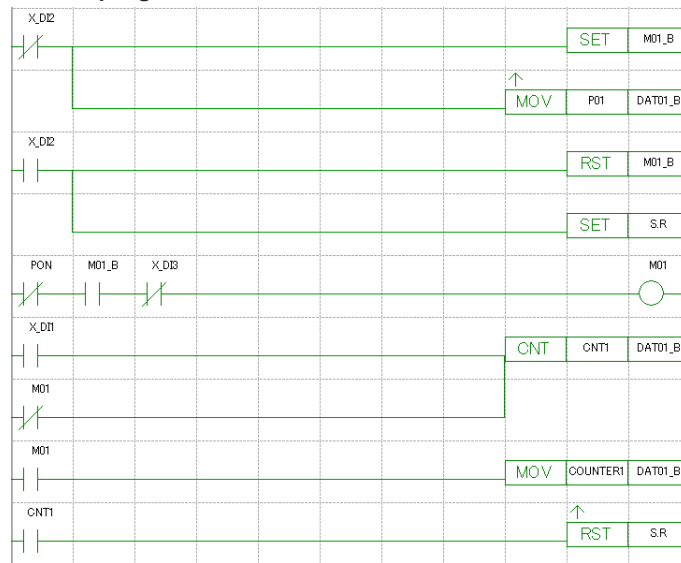
Counter

A counter instruction does not retain the current counter value. The following shows an example of ladder programming to hold the counter value.

Specifications of example

- When DI1 turns ON, increment the counter by 1.
- If DI2 is ON, set STOP/RUN (S.R) to STOP.
- When DI2 turns ON to OFF, the counter starts. When the counter value reaches the number set in P01, namely, when count-out is reached, set STOP/RUN (S.R) to RUN.
- If a power failure and recovery occur while the counter is running, the counter restarts continuously without its value being reset.
- If DI3 turns OFF to request holding while the counter is running, the counter pauses holding the current value. If DI3 turns ON to release the counter holding, restart the counter from the value held.

Ladder program



Note: Code the ladder program above in the input ladder calculation.

Note: Make sure to disable the contact input function for DI1 and DI2.

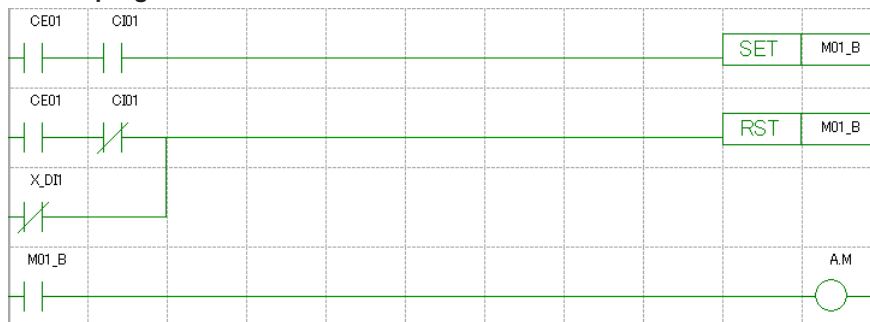
5.3.3 Retaining the Values of Peer-to-Peer Communication Status Input Relays (CI_n) during Power Failure of Master or Slave UT

This section describes the program to retain the values in peer-to-peer communication status input relays (CI_n) during a power failure of the master or slave UT by the time when the power recovers and receipt of communication data is completed.

Specifications of example:

- The automatic/manual mode (A.M) of the master UT is controlled depending on the status of a slave UT. Communication address 1 in peer-to-peer communication indicates the master UT, and its status is written to peer-to-peer communication status input relay CI01.
- If communication is established, and if CI01 is ON, then set the automatic/manual mode (A.M) to manual (1). If communication is established, and if CI01 is OFF, then set the automatic/manual mode (A.M) to automatic (0).
- Immediately after the power to the master UT recovers, the automatic/manual mode (A.M) is retained at the value before the power failure. Then, when reception is enabled, the normal action based on the value of CI01 takes place. This is controlled based on flag CE01.
- When the communication is interrupted, the automatic/manual mode (A.M) is retained at the value before the communication failure.
- Control by communication is enabled only while DI1 is ON. If DI1 is OFF, then set A.M forcibly to automatic.

Ladder program

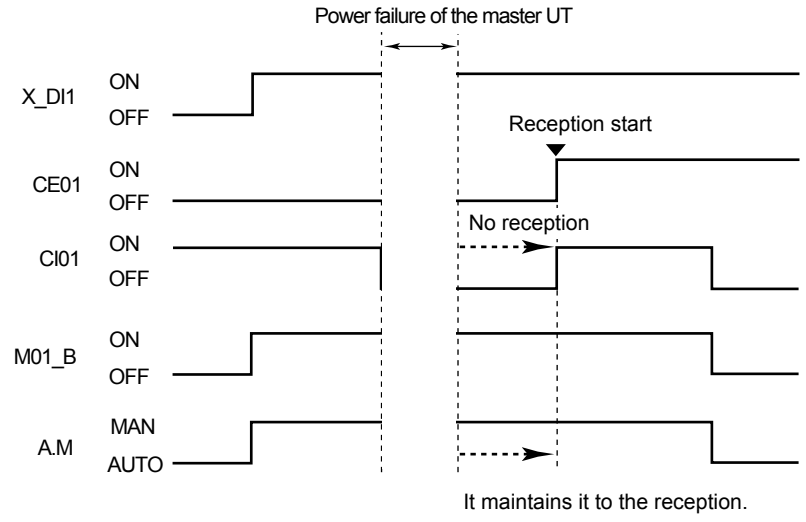


Note: Code the ladder program above in the input ladder calculation.

Note: Make sure to disable the contact input function for DI1.

Register	Function
DI1	ON: Enable control by peer-to-peer communication. OFF: Set the mode to automatic forcibly.
CI01	ON: Request switching to manual. OFF: Request switching to automatic.
CE01	OFF from the time of power recovery by the time of communication restart; ON after communication restart, and kept ON during communication interrupt
A.M	AUTO/MAN 1: Manual 0: Automatic
M01_B	ON: Manual OFF: Automatic

5.3 Examples of Supplementing Instructions and General Specifications in Ladder Programming



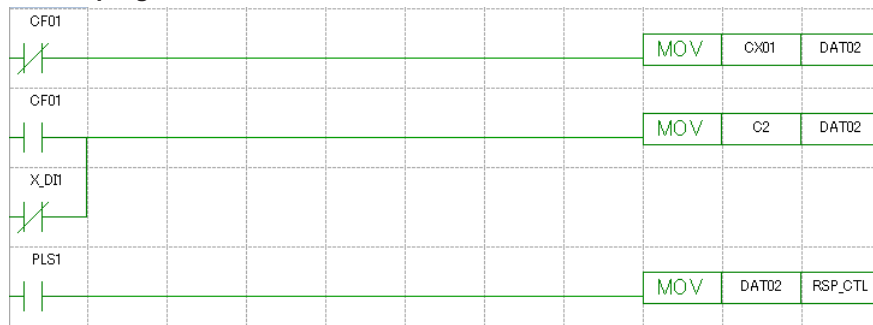
5.3.4 Retaining the Values of Peer-to-Peer Communication Analog Input Registers (CXn) during Power Failure of Master or Slave UT

This section describes the program to retain the values in peer-to-peer communication analog input registers (CXn) during a power failure of the master or slave UT by the time when the power recovers and receipt of communication data is complete.

Specifications of example:

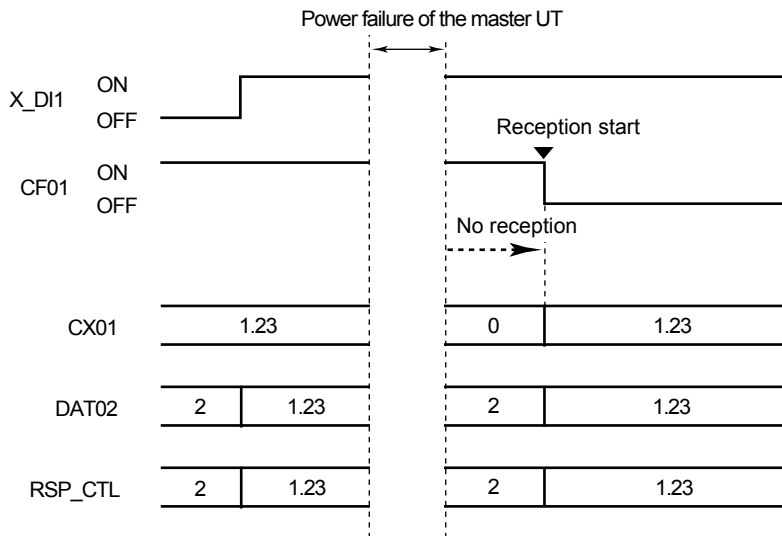
- A register value in a slave UT is set in RSP_CTL of the master UT. Communication address 1 in peer-to-peer communication indicates the master UT, and its register value is written to peer-to-peer communication analog input register CX01.
- If a communication error has been detected, the set value for RSP_CTL will be "2".
- Communication is available only when DI1 is ON. When DI1 is OFF, the set value for RSP_CTL is "2".

Ladder program



Note: Code the ladder program above in the input ladder calculation.

Register	Function
CX01	Specified register for storing communication value
CF01	ON: Communication failure OFF: Normal
RSP_CTL	Remote setpoint for control



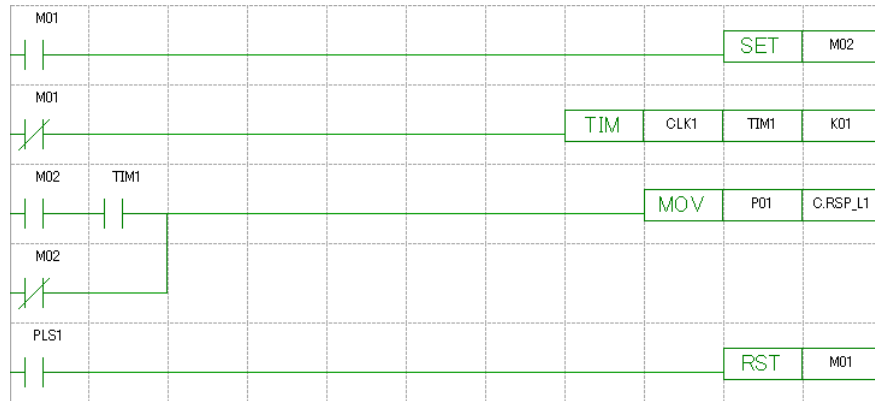
5.3.5 Detecting Communication Failure and Recovery Other Than Using Peer-to-Peer Communication

Communication failures and recoveries can also be detected using a non-holding internal relay (M).

An example to detect communication failures and recoveries using a non-holding internal relay (M) for setting of holding-type data C.RSP is shown below.

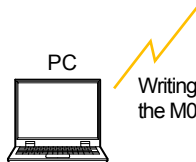
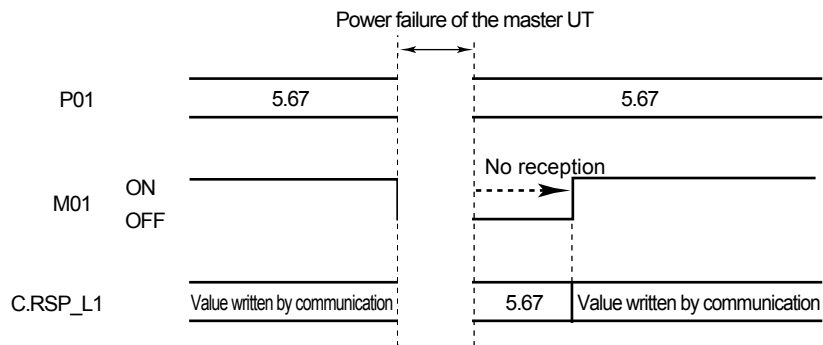
- During a communication failure, an internal value is written to C.RSP.
- P01 is outputted when a communication error is determined. A margin (sec) assigned in K01 is set for the communication error determination.
- After a power supply returns, P01 is outputted until the communication becomes normal.

Ladder program



Note: Code the ladder program above in the input ladder calculation.

Register	Function
M01	Communication decision flag Write "1" from the upper device.
K01	A margin (timer value) for communication disconnect
P01	Output value at the communication error determination



Writing to the register by means other than peer-to-peer communication; the M01 and C.RSP values are written to communication registers directly.

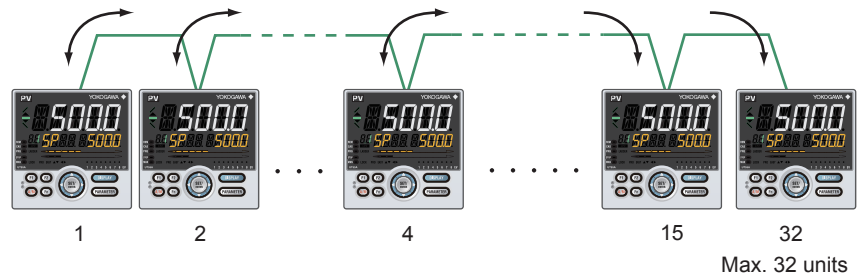
5.4 Peer-to-peer Communication

5.4.1 Overview of Function Peer-to-peer Communication

Peer-to-peer communication enables up to 32 UTs to be connected. Of these 32 UTs, four units can send four analog data and 16 status data, and receive 16 analog data and 64 status data. The remaining 28 units can only receive 16 analog data and 64 status data. The user can send and receive data simply by reading data from peer-to-peer communication registers (data reception) or writing data to peer-to-peer communication registers (data transmission) by the ladder program on the UT without being aware that communications is being performed.

Controller Nos.1 to 4 can send and receive data.

Controller Nos.5 to 32 can only receive data.



Specifications of Peer-to-peer Communications

Item	Specifications
Number of connected units	Max. 32 (4 transmitting/receiving controllers, 28 receiving-only controllers)
Amount of data transmitted	(4 analog data + 16 status data) per send/receiving controller
Amount of data received	16 analog data + 64 status data
Transmitted data update period	200 ms

5.4.2 Setting Peer-to-peer Communication and Communication Address

Setting Details

Parameter symbol	Name	Display level	Setting range	Menu symbol
PSL	Protocol selection	EASY	PCL: PC link communication PCLSM: PC link communication (with checksum) LADR: Ladder communication CO-M: Coordinated master station CO-S: Coordinated slave station MBASC: Modbus (ASCII) MBRTU: Modbus (RTU) CO-S1: Coordinated slave station (Loop-1 mode) CO-S2: Coordinated slave station (Loop-2 mode) P-P: Peer-to-peer communication	R485 Set
ADR	Address	EASY	1 to 4: Controllers that can send and receive data 5 to 99: Controllers that only can receive data (Note)	

Set: Setup parameter

Note: Do not set the same communication address to two or more controllers.

- **Protocol selection**
Set "P-P" to the controllers that are made to perform peer-to-peer communication.
- **Address**
Set any communication address between 1 to 4 to controllers that transmit and receive data. Set a unique address to each controller. Do not set the same address to two or more controllers.
Set any communication address within the range 5 to 32 to controllers that only receive data. Set a unique address to each controller. Do not set the same address to two or more controllers.

5.4.3 Peer-to-peer Communication Relays and Registers

Data that can be transferred by peer-to-peer communication is analog data and status relay data. Status relay data is in either of two states, ON (1) or OFF (0), depending on the rules of the ladder program.

Transmitted/received data can be used in the ladder program via peer-to-peer communication registers.

The following table shows the peer-to-peer communication registers and the read/write operations performed on these registers by the ladder program.

*Registers are floating point numbers (single-precision real numbers).

Peer-to-peer Communication Registers

Register symbol	Name	Explanation	Data Type
CX_n	Peer-to-peer communication analog input register	n: 01 to 04 Data received from communication address 1 n: 05 to 08 Data received from communication address 2 n: 09 to 12 Data received from communication address 3 n: 13 to 16 Data received from communication address 4	Floating point number (single-precision real number)
CY_n	Peer-to-peer communication analog output register	n: 01 to 04 Data transmitted to other controllers	Floating point number (single-precision real number)
CI_n	Peer-to-peer communication status input relay	n: 01 to 16 Data received from communication address 1 n: 17 to 32 Data received from communication address 2 n: 33 to 48 Data received from communication address 3 n: 49 to 64 Data received from communication address 4	Relay status data (0, 1)
CO_n	Peer-to-peer communication status output relay	n: 01 to 16 Data transmitted to other controllers	Relay status data (0, 1)
CF_n	Reception time-out flag	n: 01 to 04 Indicates the status (normal/error) of the data received from communication address n.	Status data (0: normal, 1: error)
CE_n	End of data reception flag	n: 01 to 04 Indicates the status (end of reception/during of reception) of the data received from communication address n.	Status data (0: during reception, 1: end of reception)

5.4 Peer-to-peer Communication

Processing at Communication Failure

Item	Cause of Failure	Processing on Receiving Controller	Processing on Transmitting Controller
1	Broken communication line Receiving controller communication card malfunction	The receiving controller holds the previously received peer-to-peer communication input data. If the error continues for two seconds, the reception timeout flag changes the state to 1 (error).	An error cannot be detected. When the transmitting controller receives data, it detects an error on the transmitting controller as the receiving controller.
2	The user program is being downloaded or uploaded, or parameters are being set the transmitting controller.	Same as above	Functions are stopped.
3	The user program is being downloaded or uploaded, or parameters are being set the receiving controller.	Functions are stopped. Even if functions are stopped, peer-to-peer communication input data is received normally, and stored to registers CX and CI.	An error cannot be detected. When the transmitting controller receives data, it detects an error on the transmitting controller as the receiving controller.
4	Failure of transmitting controller	The receiving controller holds the previously received peer-to-peer communication input data. If the error continues for two seconds, the reception timeout flag changes the state to 1 (error).	Failure
5	Power failure on transmitting controller	The receiving controller holds the previously received peer-to-peer communication input data. If the error continues for two seconds, the reception timeout flag changes the state to 1 (error).	A power failure has occurred. For details on processing during a power failure, see "Processing at Power Failure."
6	Power failure on receiving controller	A power failure has occurred. For details on processing during a power failure, see "Processing at Power Failure."	An error cannot be detected. When the transmitting controller receives data, it detects an error on the transmitting controller as the receiving controller.
7	Communication error (parity error, framing error)	The receiving controller holds the previously received peer-to-peer communication input data. If the error continues for two seconds, the reception timeout flag changes the state to 1 (error).	An error cannot be detected. When the transmitting controller receives data, it detects an error on the transmitting controller as the receiving controller.

Processing at Power Failure

This item describes the processing when a UT controller is recovered from a power failure during peer-to-peer communication.

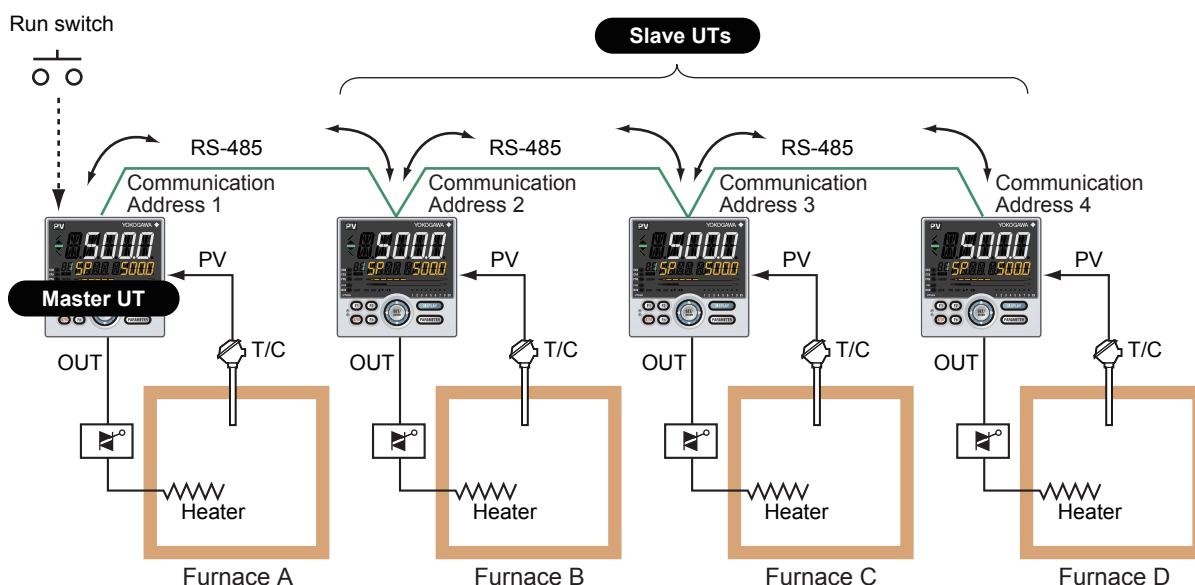
The values of registers CX, CY, CI, and CO start from 0%.

When the transmitting controller or ladder program writes data to these registers, that data becomes valid.

At a start, the state of the reception time-out flag (CFn) is 1 (error). However, when communication is recovered, it changes to 0 (normal).

5.4.4 Ladder Programming Example

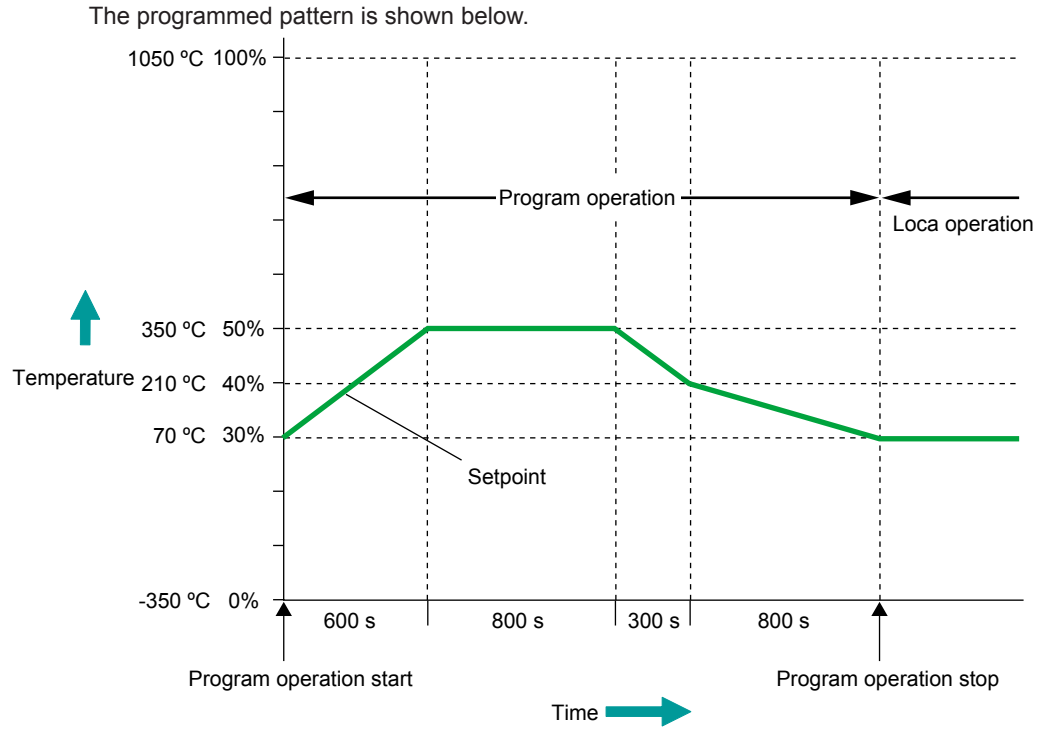
The following is an example of making four UT controllers perform the same programmed-setpoint control synchronously.



Specifications of example:

- Four UT controllers are linked via peer-to-peer communication, where one serves as the master UT and others as slave UTs. Slave UTs perform programmed-setpoint control and change their modes synchronously with the master UT.
- There are four operation modes: Run/Stop and Remote/Local.
- The program control starts when a contact input for the master UT is turned on, and stops when the same input is turned off.
- When the program control starts, the modes of the master and slave UTs are forcibly changed to Remote and Run.
- The program pattern is set as the remote setpoints.
- The time span of the program pattern is calculated based on the control period (200 ms).
- The operation mode changes to Stop when the program pattern has been implemented to the end. The modes of the master and local UTs are changed to Local. Concurrently, and the setpoints are the final value of the programmed pattern.
- The control is forcibly stopped immediately when the contact input to the master UT turns off or when an A/D converter error or burn-out error is detected in one of the four UTs. The modes of the master and local UTs are changed to Local. Concurrently, and the setpoints are the final value of the programmed pattern.

5.4 Peer-to-peer Communication



Setting of master UT

Parameter settings (main unit)

- Control mode (CTLM): SGL (Single-loop control)
- Input sampling period (control period) (SMP): 200 ms
- STOP/RUN switch (S/R): 0 (disable switching by a contact input)
- REMOTE/LOCAL switch (R/L): 0 (disable switching by a contact input)

Burnout connection settings

- LOOP1 PV: PV, LOOP1 RSP: RSP

Parameter settings (LL50A)

- K constant

Symbol	Set value	Description
K01	0.2	Control period at 200 ms, for program time span calculation
K02	4	Number of program pattern segments
K03	7	Slave UT communication time-out interval (added to the time-out interval CF)

- P parameter

Symbol	Set value	Decimal point position	Description
P01	-	-	Unused
P02	30	0	Starting target setpoint (SSP)
P03	50	2	Segment-1 target setpoint (%)
P04	600	0	Segment-1 time (s)
P05	50	2	Segment-2 target setpoint (%)
P06	800	0	Segment-2 time (s)
P07	40	2	Segment-3 target setpoint (%)
P08	300	0	Segment-3 time (s)
P09	30	2	Segment-4 target setpoint (%)
P10	800	0	Segment-4 time (s)

5.4 Peer-to-peer Communication

Devices used

- Registers for peer-to-peer communication

Symbol		Description
CO01	CI01	UT of communication address 1 1: Start program operation (LOCAL -> REMOTE) 0: Stop program operation (REMOTE -> LOCAL)
CY01	CX01	UT of communication address 1 Programmed setpoint (CSP) output/input
CO01	CI17	UT of communication address 2 1: Input error in UT of communication address 2 0: Input normal in UT of communication address 2
CO01	CI33	UT of communication address 3 1: Input error in UT of communication address 3 0: Input normal in UT of communication address 3
CO01	CI49	UT of communication address 4 1: Input error in UT of communication address 4 0: Input normal in UT of communication address 4
CF01		1: Communication time-out in UT of communication address 1 0: Communication normal in UT of communication address 1
CF02		1: Communication time-out in UT of communication address 2 0: Communication normal in UT of communication address 2
CF03		1: Communication time-out in UT of communication address 3 0: Communication normal in UT of communication address 3
CF04		1: Communication time-out in UT of communication address 4 0: Communication normal in UT of communication address 4

- Parameter registers and control registers

Symbol	Description
S.R	1: Stop program control; 0: Start program control
R.L_L1	1: REMOTE; 0: LOCAL
ADERR	1: ADC error of PV input, 0: normal
BOERR	1: PV input burnout error, 0: normal
RSP_CTL	Control RSP input

- DAT registers

Symbol	Set value	Description
DAT02_B	0	Segment number
DAT03_B	0.00	CSP
DAT04_B		Elapsed time (1-second increment)
DAT07		Target setpoint of previous segment
DAT08		Target setpoint (TSP)
DAT09		Segment time
DAT10		Work data 1
DAT11		Work data 2

- M relays

Symbol	Set value	Description
M01		Master-slave communication input status 0: Normal, 1: Abnormal
M02		Forced stop by contact input, or master-slave communication input status 0: Normal, 1: Abnormal
M03		Segment end flag 0: Running within a segment interval 1: Segment end (for one scan only)
M04		Slave UT communication error flag. Start a timer when this value changes to 1 for time-out monitoring.
M11		ADC error or burnout error in master UT
M03_B		Flag used to delay the mode switching from Remote to Local by one scan
M02_B		Single-segment interval timeout
M01_B		1: Program running 0: Program stopped

Contact input:

DI2: Start/stop program control

Setting of slave units (identical for all units)

Parameter settings (main unit)

- Control mode (CTLM): SGL (Single-loop control)
- Input sampling period (control period) (SMP): 200 ms
- STOP/RUN switch (S/R): 0 (disable switching by a contact input)
- REMOTE/LOCAL switch (R/L): 0 (disable switching by a contact input)

Burnout connection setting

- LOOP1 PV: PV, LOOP1 RSP: RSP

Burnout connection setting

- K constant

Symbol	Set value	Description
K01	0.2	Control period at 200 ms, for program time span calculation
K02	4	Number of program pattern segments
K03	7	Slave UT communication time-out interval (added to the time-out interval CF)

5.4 Peer-to-peer Communication

Devices used

- Registers for peer-to-peer communication

Symbol		Description
CO01	CI01	UT of communication address 1 1: Start program operation (LOCAL -> REMOTE) 0: Stop program operation (REMOTE -> LOCAL)
CY01	CX01	UT of communication address 1 Programmed setpoint (CSP) output/input
CO01	CI17	UT of communication address 2 1: Input error in UT of communication address 2 0: Input normal in UT of communication address 2
CO01	CI33	UT of communication address 3 1: Input error in UT of communication address 3 0: Input normal in UT of communication address 3
CO01	CI49	UT of communication address 4 1: Input error in UT of communication address 4 0: Input normal in UT of communication address 4
CF01		1: Communication time-out in UT of communication address 1 0: Communication normal in UT of communication address 1
CF02		1: Communication time-out in UT of communication address 2 0: Communication normal in UT of communication address 2
CF03		1: Communication time-out in UT of communication address 3 0: Communication normal in UT of communication address 3
CF04		1: Communication time-out in UT of communication address 4 0: Communication normal in UT of communication address 4

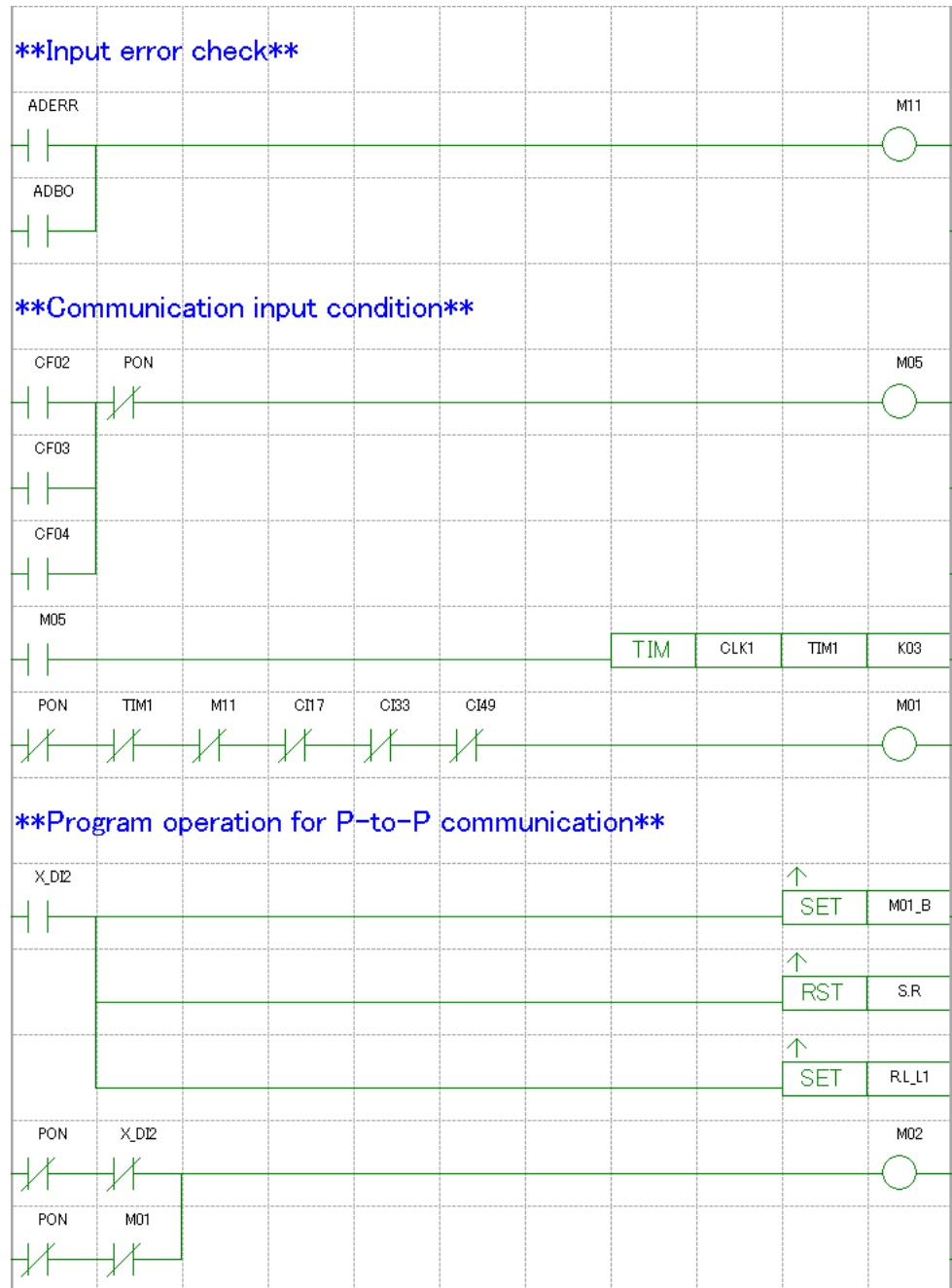
- M relays

Symbol	Set value	Description
M01		Master-slave communication input status 0: Normal, 1: Abnormal
M03_B		Flag used to delay the mode switching from Remote to Local by one scan
M01_B		1: Program running 0: Program stopped

- Parameter registers and control registers

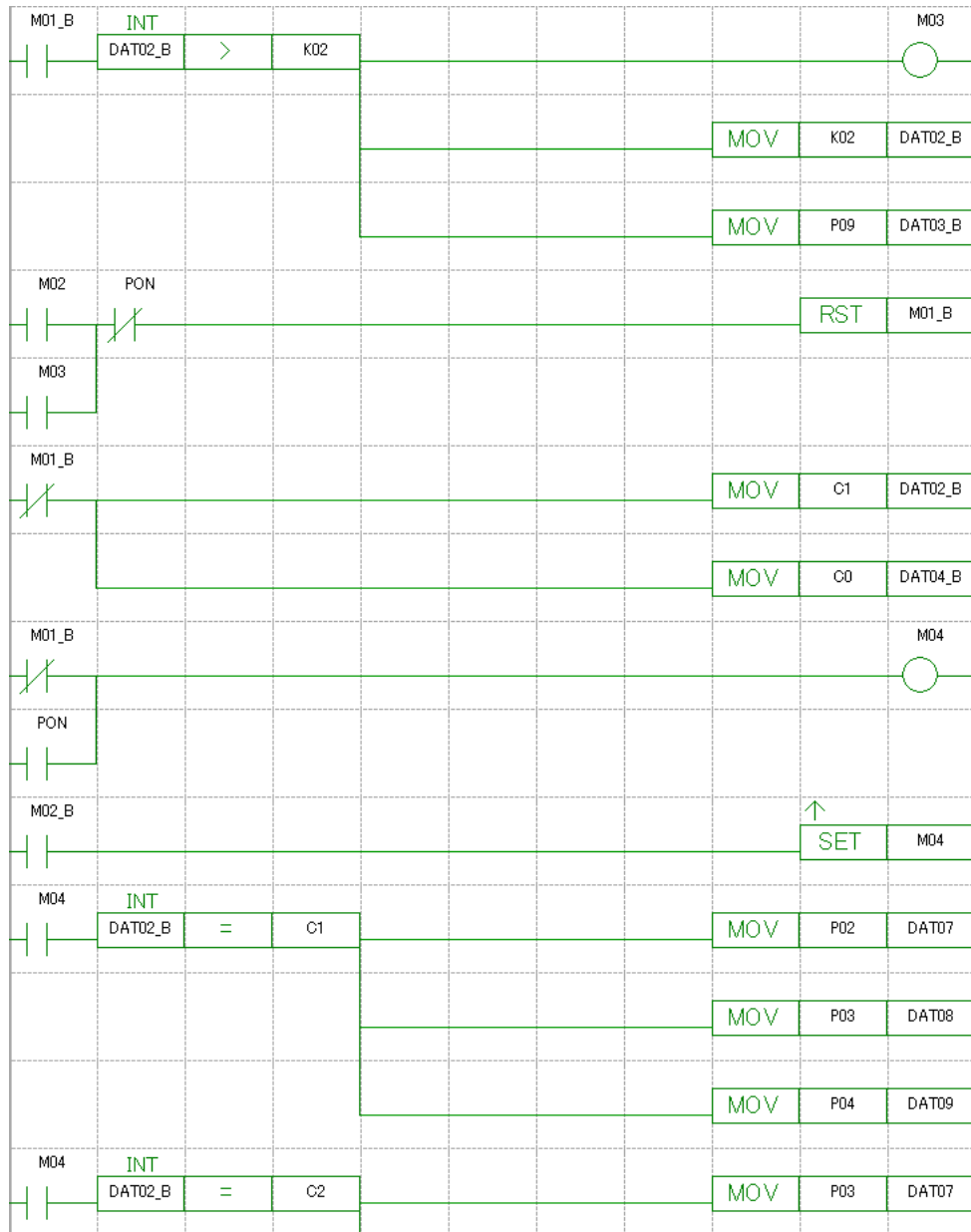
Symbol	Description
S.R	1: Stop program control; 0: Start program control
R.L_L1	1: REMOTE; 0: LOCAL
ADERR	1: ADC error of PV input, 0: normal
BOERR	1: PV input burnout error, 0: normal
RSP_CTL	Control RSP input

Ladder program in master UT

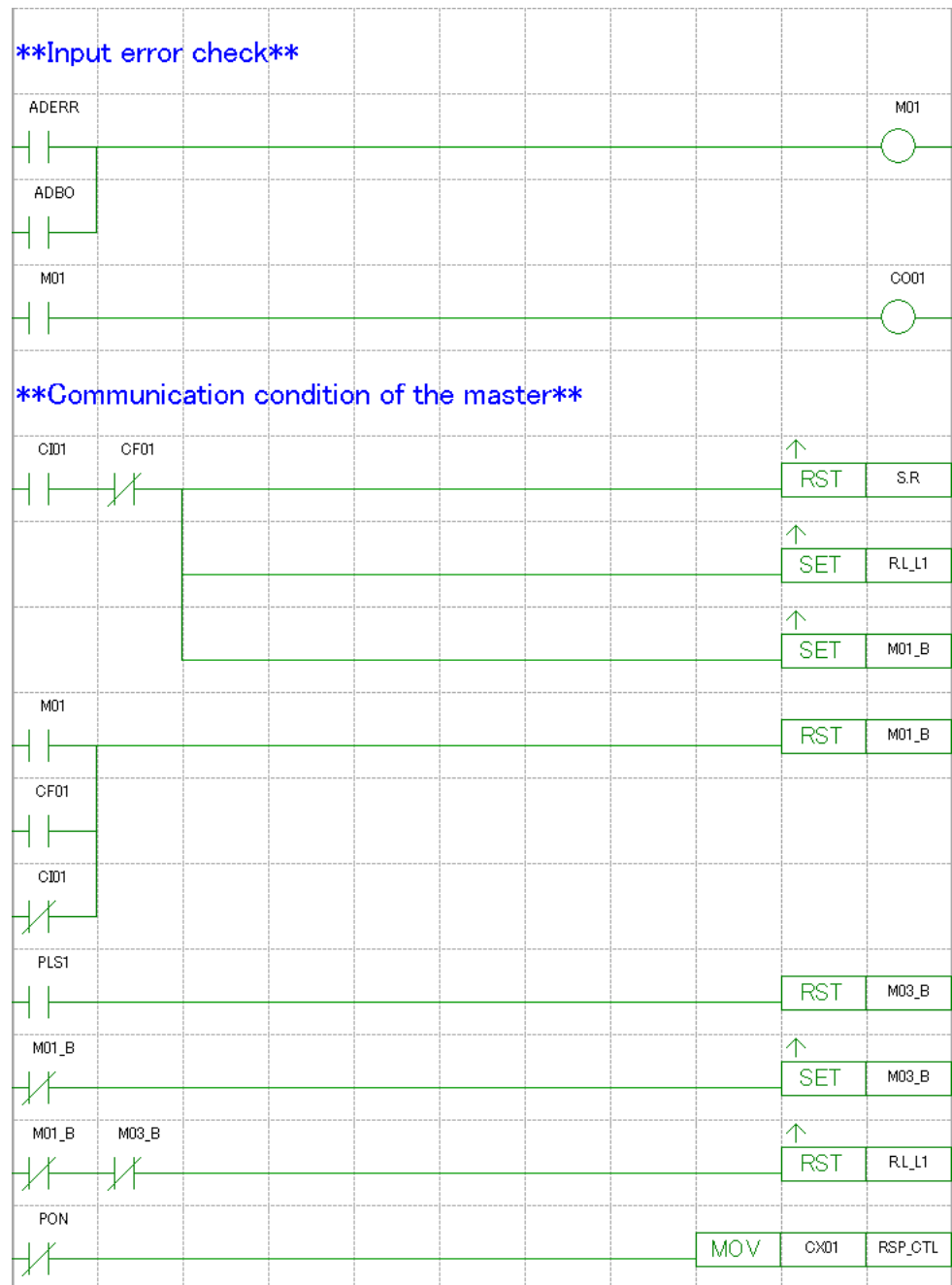


5.4 Peer-to-peer Communication

(continuing)



Ladder program of slave UTs

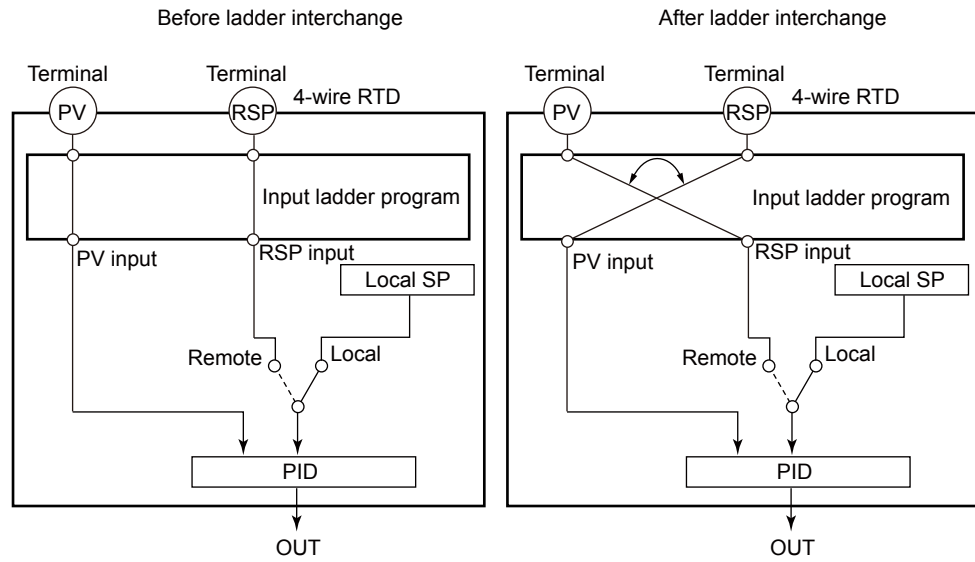


5.5 Extension Method of Control Input Combination

The description in this section applies to UT55A/UT52A only.

5.5.1 Using Four-wired RTD as PV

The following example shows interchanging the connection of a PV input terminal and RSP input terminal using the ladder in Single-loop control. The parameter RTD.S must needs to set to 4-W.



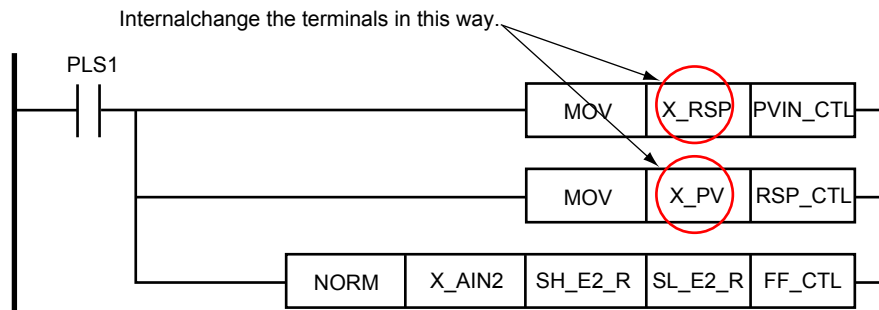
If the PV and RSP terminal inputs are interchanged with each other, it is also necessary to change the burnout connection settings.

► [Burnout connection settings: Section 3.5.10, Setting a Burnout Connection](#)

Input ladder calculation program

Input registers	X_PV, X_RSP, X_AIN2
Parameter registers	SH_E2_R, SL_E2_R
Output registers	PVIN_CTL, RSP_CTL, FF_CTL

For an explanation of the registers, see Section 4.2, Registers.



Output ladder calculation program

The output ladder calculation program is the same as that of Single-loop control.

5.5.2 Build the Loop-2 RSP of Cascade Control Using the Ladder Program

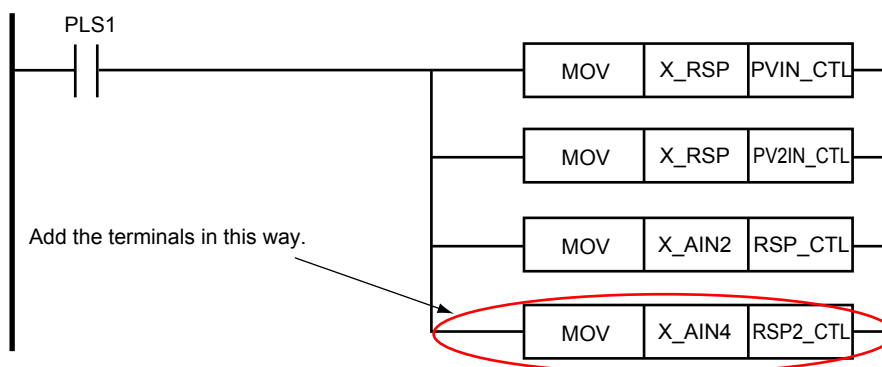
To capture the Loop-2 RSP via an analog input, build the function using the ladder program. This section describes an example to use AIN4 aux. analog input. AIN4 aux. analog input can be used when the suffix code: Type 2 = 7.

Change the default ladder program for Cascade control as follows.

Input ladder calculation program

Input registers	X_PV, X_RSP, X_AIN2, X_AIN4
Output registers	PVIN_CTL, PV2IN_CTL, RSP_CTL, RSP2_CTL

For an explanation of the registers, see Section 4.2, Registers.



Output ladder calculation program

Do not change it.

5.5.3 Build the Feedforward Control Using the Ladder Program

To use Feedforward control, use the prebuild Feedforward control (AIN2 aux. analog input) or any aux. analog input.

Feedforward control is available when the control mode is Single-loop control or Loop control with PV-hold function.

- ▶ [Feedforward Control: Section 8.2.8, Feedforward Control, of the UT55A/UT52A Digital Indicating Controllers User's Manual](#)

To use any aux. analog input, build the function using the ladder program.

This section describes an example to use AIN4 aux. analog input as feedforward input.

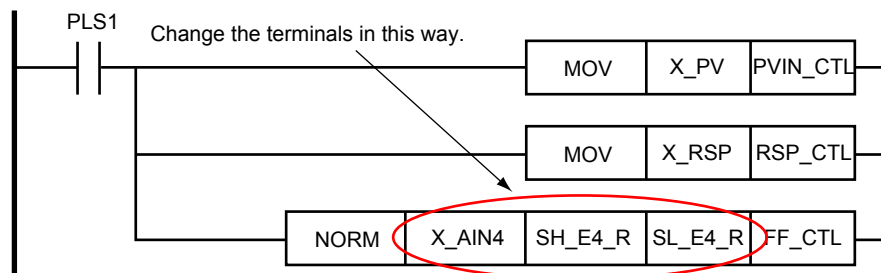
AIN4 aux. analog input can be used when the suffix code: Type 2 = 7.

Change the default ladder program for Single-loop control as follows.

Input ladder calculation program

Input registers	X_PV, X_RSP, X_AIN4
Parameter registers	SH_E4_R, SL_E4_R
Output registers	PVIN_CTL, RSP_CTL, FF_CTL

For an explanation of the registers, see Section 4.2, Registers.

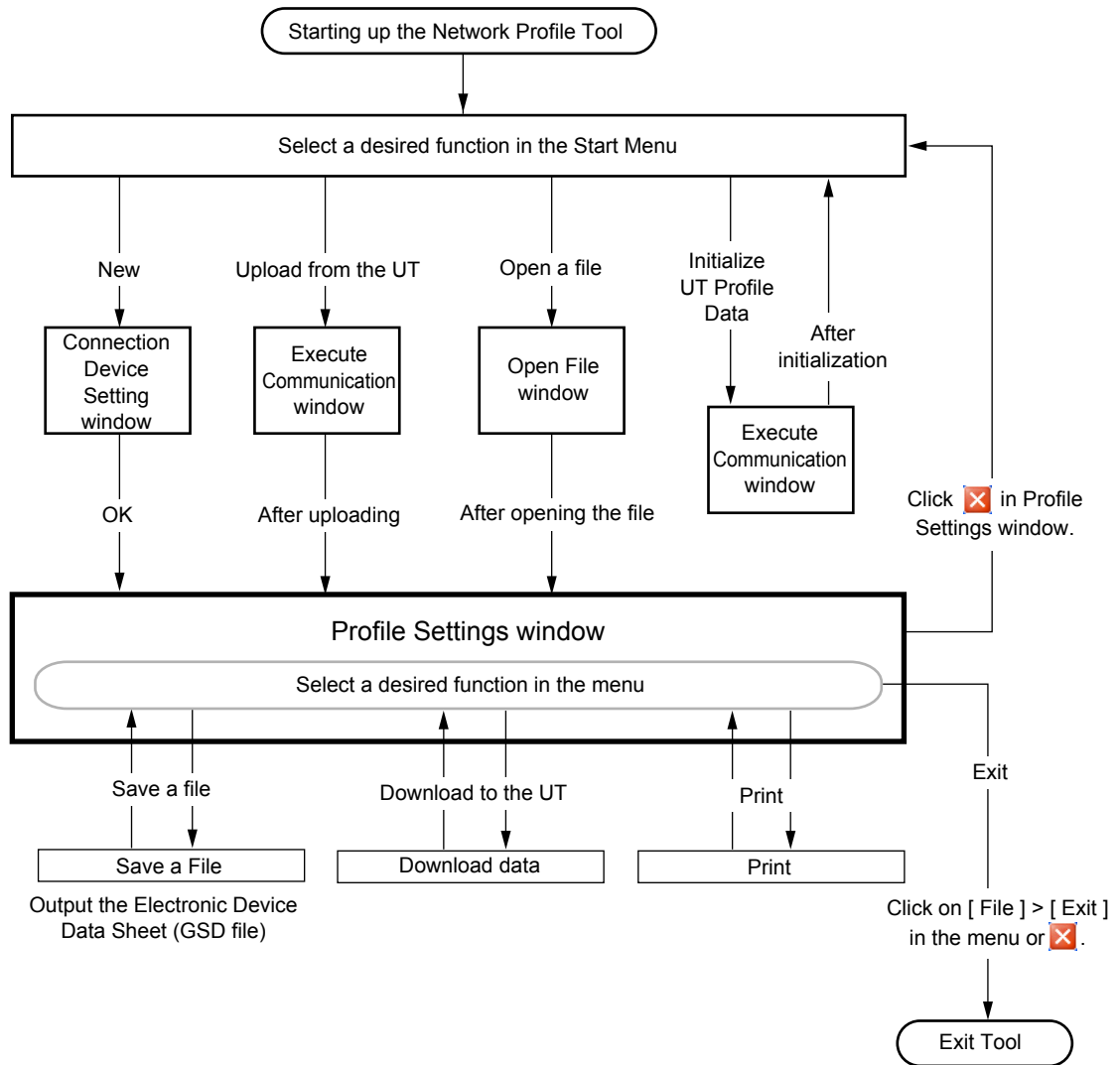


Output ladder calculation program

Do not change it.

6.1 Creating Flow

The profile creating guide describes how to set connection device, setting the profile, downloading, uploading, file management, printing, etc. For PROFIBUS-DP communication functions, see UTAdvanced Series Communication Interface (PROFIBUS-DP) User's Manual.

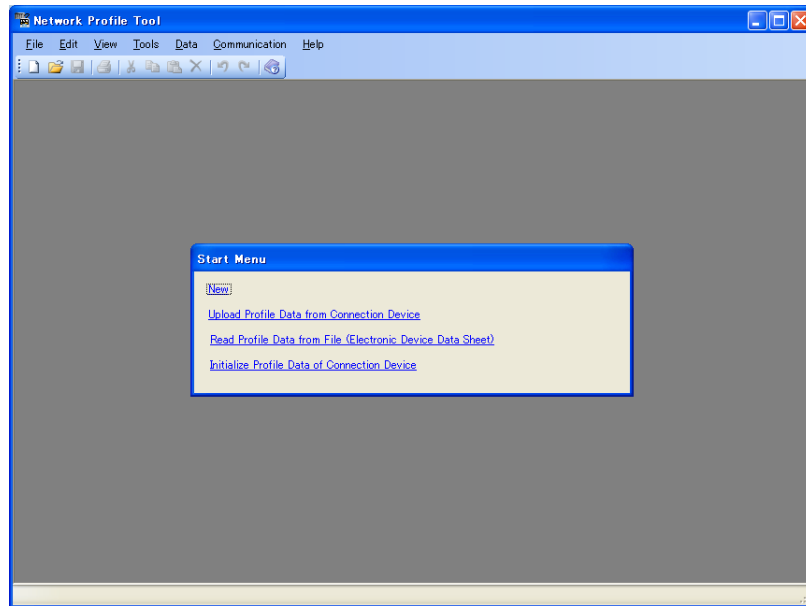


6.2 Starting up/Exiting the Network Profile Tool

Starting up the Network Profile Tool

Procedure

1. Click on Windows' [Start], select [Programs] – [UTAdvanced], and then click on [Network Profile Tool].




2. Select a desired function in the Start Menu.
 - New
Enables you to create a new profile.
Enables you to configure the connection device settings and profile settings, respectively.
 - Upload Profile Data from Connection Device
Enables you to read out and edit data from the UT.
 - Read Profile Data from File (Electronic Device Data Sheet)
Enables you to open and edit an existing user file.
 - Initialize Profile Data of Connection Device
See 6.12 Initializing the UT's Profile Data

The Network Profile Tool can also be started up by double-clicking on the Network Profile Tool shortcut on the Desktop.

Exiting the Network Profile Tool

Procedure

1. Click on [File] – [Exit] in the menu or click .

Note

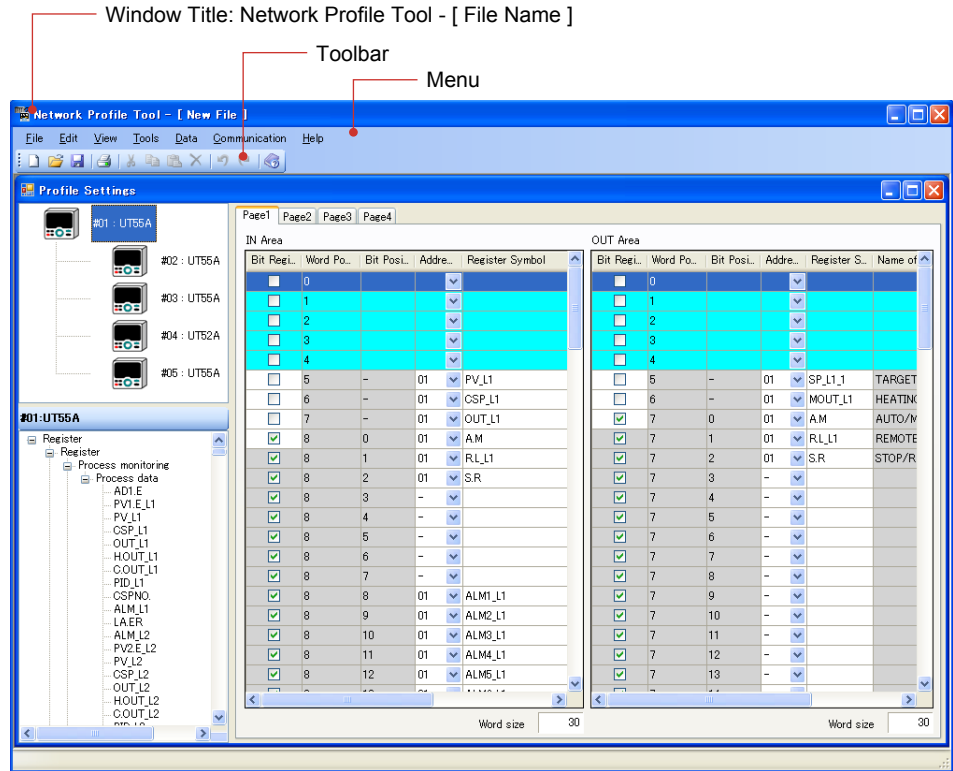
Save any data in use as necessary.

6.3 Part Names of Window and Their Functions

Basic window

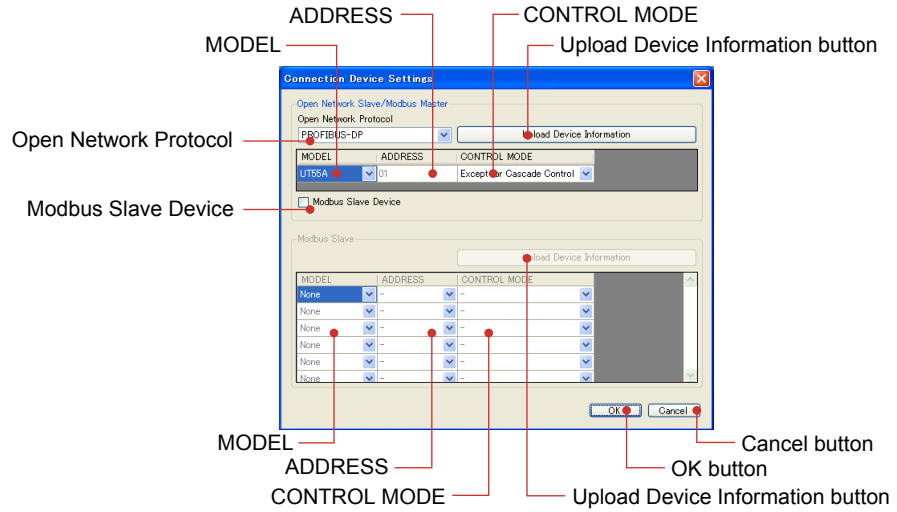
The Basic window is a background window for connection device settings, profile settings etc.

The window below shows an example display of the Profile Settings window.



Connection Device Settings window

This is a window that enables you to set the device information for the open network slave/Modbus master device and Modbus slave devices.



Name		Specifications
Open Network Slave/Modbus Master Device	Open Network Protocol	Displays only PROFIBUS-DP.
	Upload Device Information button	Connecting the open network slave/Modbus master device and clicking this button in a communication state loads the device information such as the model and control mode.
	MODEL	Displays only UT55A.
	ADDRESS	Fixed to 01. This is a Modbus/RTU communication address. There is no parameter in the UT.
Modbus Slave Device	CONTROL MODE	Enables you to select the control mode. Except for Cascade Control: Single-loop Control, Cascade Primary-loop Control, Cascade Secondary-loop Control, Loop Control for Backup, Loop Control with PV Switching, Loop Control with PV Auto-selector, Loop Control with PV-hold Function For Cascade Control: Cascade Control The default for the area setting is determined by the control mode when creating a new profile. (See Area Setting for Data Part in Each Control Mode [Default])
	Modbus Slave Device	Select the checkbox when connecting Modbus slave devices.
	Upload Device Information button	Connecting Modbus slave devices and clicking this button in a communication state loads the device information such as the model, address, and control mode.
	MODEL	Enables you to select UT55A, UT52A, or None.
	ADDRESS	This is a Modbus/RTU communication address. Enables you to select from 02 to 30. Duplicate addresses cannot be selected.
	CONTROL MODE	Enables you to select the control mode. Except for Cascade Control: Single-loop Control, Cascade Primary-loop Control, Cascade Secondary-loop Control, Loop Control for Backup, Loop Control with PV Switching, Loop Control with PV Auto-selector, Loop Control with PV-hold Function For Cascade Control: Cascade Control The default for the area setting is determined by the control mode when creating a new profile. (See Area Setting for Data Part in Each Control Mode [Default])
	[OK] button	Clicking the [OK] button displays the Profile Settings window according to the setting details.
	[Cancel] button	Clicking the [Cancel] button closes the Connection Device Settings window.

Area Setting for Data Part in Each Control Mode (Default)

Other than UT55A/UT52A Cascade Control (for One Model)

Page	IN area PROFIBUS-DP slave (UTAdvanced) → PROFIBUS-DP master			OUT area PROFIBUS-DP master → PROFIBUS-DP slave (UTAdvanced)		
	Data Format	Register Symbol	Name of Parameter	Data Format	Register Symbol	Name of Parameter
1	Word	PV_L1	Measurement value	Word		
		CSP_L1	Control setpoint		SP_L1_1	Target setpoint of group 1
		OUT_L1	Control output (Valve opening in Position proportional control)		MOUT_L1	Control output in MAN mode (Heating-side)
		H.OUT_L1	Heating-side control output		MOUTc_L1	Cooling-side control output in MAN mode
	Bit	A.M	AUTO/MAN switch	Bit	A.M	AUTO/MAN switch
		R.L_L1	REMOTE/LOCAL switch		R.L_L1	REMOTE/LOCAL switch
		S.R	STOP/RUN switch		S.R	STOP/RUN switch
		ALM1_L1	Alarm-1 status			
		ALM2_L1	Alarm-2 status			
		ALM3_L1	Alarm-3 status			
		ALM4_L1	Alarm-4 status			
		ALM5_L1	Alarm-5 status			
	ALM6_L1	Alarm-6 status				
ALM7_L1	Alarm-7 status					
ALM8_L1	Alarm-8 status					
2	Word	P_L1_1	Proportional band of group 1	Word	P_L1_1	Proportional band of group 1
		I_L1_1	Integral time of group 1		I_L1_1	Integral time of group 1
		D_L1_1	Derivative time of group 1		D_L1_1	Derivative time of group 1
		SPNO.	SP number selection		SPNO.	SP number selection
3	Word	Pc_L1_1	Cooling-side proportional band of group 1	Word	Pc_L1_1	Cooling-side proportional band of group 1
		Ic_L1_1	Cooling-side integral time of group 1		Ic_L1_1	Cooling-side integral time of group 1
		Dc_L1_1	Cooling-side derivative time of group 1		Dc_L1_1	Cooling-side derivative time of group 1
		SPNO.	SP number selection		SPNO.	SP number selection
4	Word	A1_L1_1	Alarm-1 setpoint of group 1	Word	A1_L1_1	Alarm-1 setpoint of group 1
		A2_L1_1	Alarm-2 setpoint of group 1		A2_L1_1	Alarm-2 setpoint of group 1
		A3_L1_1	Alarm-3 setpoint of group 1		A3_L1_1	Alarm-3 setpoint of group 1
		A4_L1_1	Alarm-4 setpoint of group 1		A4_L1_1	Alarm-4 setpoint of group 1
		A5_L1_1	Alarm-5 setpoint of group 1		A5_L1_1	Alarm-5 setpoint of group 1

6.3 Part Names of Window and Their Functions

UT55A/UT52A Cascade Control (for One Model)

Page	IN area PROFIBUS-DP slave (UTAdvanced) → PROFIBUS-DP master			OUT area PROFIBUS-DP master → PROFIBUS-DP slave (UTAdvanced)		
	Data Format	Register Symbol	Name of Parameter	Data Format	Register Symbol	Name of Parameter
1	Word	PV_L1	Loop-1 measurment value	Word		
		PV_L2	Loop-2 measurment value			
		CSP_L1	Loop-1 control setpoint		SP_L1_1	Loop-1 target setpoint of group 1
		CSP_L2	Loop-2 control setpoint		SP_L2_1	Loop-2 target setpoint of group 1
		C.A.M	CAS/AUTO/MAN switch		C.A.M	CAS/AUTO/MAN switch
		OUT_L2	Control output (Valve opening in Position proportional control)		MOUT_L2	Control output in MAN mode (Heating-side)
		H.OUT_L2	Heating-side control output			
		C.OUT_L2	Cooling-side control output		MOUc_L2	Cooling-side control output in MAN mode
	Bit	R.L_L1	REMOTE/LOCAL switch	Bit	R.L_L1	REMOTE/LOCAL switch
		S.R	STOP/RUN switch	S.R	STOP/RUN switch	
		ALM1_L1	Loop-1 alarm-1 status			
		ALM2_L1	Loop-1 alarm-2 status			
		ALM3_L1	Loop-1 alarm-3 status			
		ALM4_L1	Loop-1 alarm-4 status			
		ALM5_L1	Loop-1 alarm-5 status			
		ALM6_L1	Loop-1 alarm-6 status			
		ALM7_L1	Loop-1 alarm-7 status			
		ALM8_L1	Loop-1 alarm-8 status			
		ALM1_L2	Loop-2 alarm-1 status			
		ALM2_L2	Loop-2 alarm-2 status			
ALM3_L2	Loop-2 alarm-3 status					
ALM4_L2	Loop-2 alarm-4 status					
ALM5_L2	Loop-2 alarm-5 status					
ALM6_L2	Loop-2 alarm-6 status					
ALM7_L2	Loop-2 alarm-7 status					
ALM8_L2	Loop-2 alarm-8 status					
2	Word	P_L1_1	Loop-1 Proportional band of group 1	Word	P_L1_1	Loop-1 Proportional band of group 1
		I_L1_1	Loop-1 Integral time of group 1		I_L1_1	Loop-1 Integral time of group 1
		D_L1_1	Loop-1 Derivative time of group 1		D_L1_1	Loop-1 Derivative time of group 1
		P_L2_1	Loop-2 Proportional band of group 1		P_L2_1	Loop-2 Proportional band of group 1
		I_L2_1	Loop-2 Integral time of group 1		I_L2_1	Loop-2 Integral time of group 1
		D_L2_1	Loop-2 Derivative time of group 1		D_L2_1	Loop-2 Derivative time of group 1
		SPNO.	SP number selection		SPNO.	SP number selection
3	Word	Pc_L1_1	Loop-1 Cooling-side proportional band of group 1	Word	Pc_L1_1	Loop-1 Cooling-side proportional band of group 1
		Ic_L1_1	Loop-1 Cooling-side integral time of group 1		Ic_L1_1	Loop-1 Cooling-side integral time of group 1
		Dc_L1_1	Loop-1 Cooling-side derivative time of group 1		Dc_L1_1	Loop-1 Cooling-side derivative time of group 1
		Pc_L2_1	Loop-2 Cooling-side proportional band of group 1		Pc_L2_1	Loop-2 Cooling-side proportional band of group 1
		Ic_L2_1	Loop-2 Cooling-side integral time of group 1		Ic_L2_1	Loop-2 Cooling-side integral time of group 1
		Dc_L2_1	Loop-2 Cooling-side derivative time of group 1		Dc_L2_1	Loop-2 Cooling-side derivative time of group 1
		SPNO.	SP number selection		SPNO.	SP number selection
4	Word	A1_L1_1	Loop-1 Alarm-1 setpoint of group 1	Word	A1_L1_1	Loop-1 Alarm-1 setpoint of group 1
		A2_L1_1	Loop-1 Alarm-2 setpoint of group 1		A2_L1_1	Loop-1 Alarm-2 setpoint of group 1
		A3_L1_1	Loop-1 Alarm-3 setpoint of group 1		A3_L1_1	Loop-1 Alarm-3 setpoint of group 1
		A4_L1_1	Loop-1 Alarm-4 setpoint of group 1		A4_L1_1	Loop-1 Alarm-4 setpoint of group 1
		A5_L1_1	Loop-1 Alarm-5 setpoint of group 1		A5_L1_1	Loop-1 Alarm-5 setpoint of group 1
		A1_L2_1	Loop-2 Alarm-1 setpoint of group 1		A1_L2_1	Loop-2 Alarm-1 setpoint of group 1
		A2_L2_1	Loop-2 Alarm-2 setpoint of group 1		A2_L2_1	Loop-2 Alarm-2 setpoint of group 1
		A3_L2_1	Loop-2 Alarm-3 setpoint of group 1		A3_L2_1	Loop-2 Alarm-3 setpoint of group 1
		A4_L2_1	Loop-2 Alarm-4 setpoint of group 1		A4_L2_1	Loop-2 Alarm-4 setpoint of group 1
		A5_L2_1	Loop-2 Alarm-5 setpoint of group 1		A5_L2_1	Loop-2 Alarm-5 setpoint of group 1

IN area

This is an area for a PLC to refer to the slave data. Parameters of the PROFIBUS-DP and Modbus slaves that are defined in the profile are always updated.

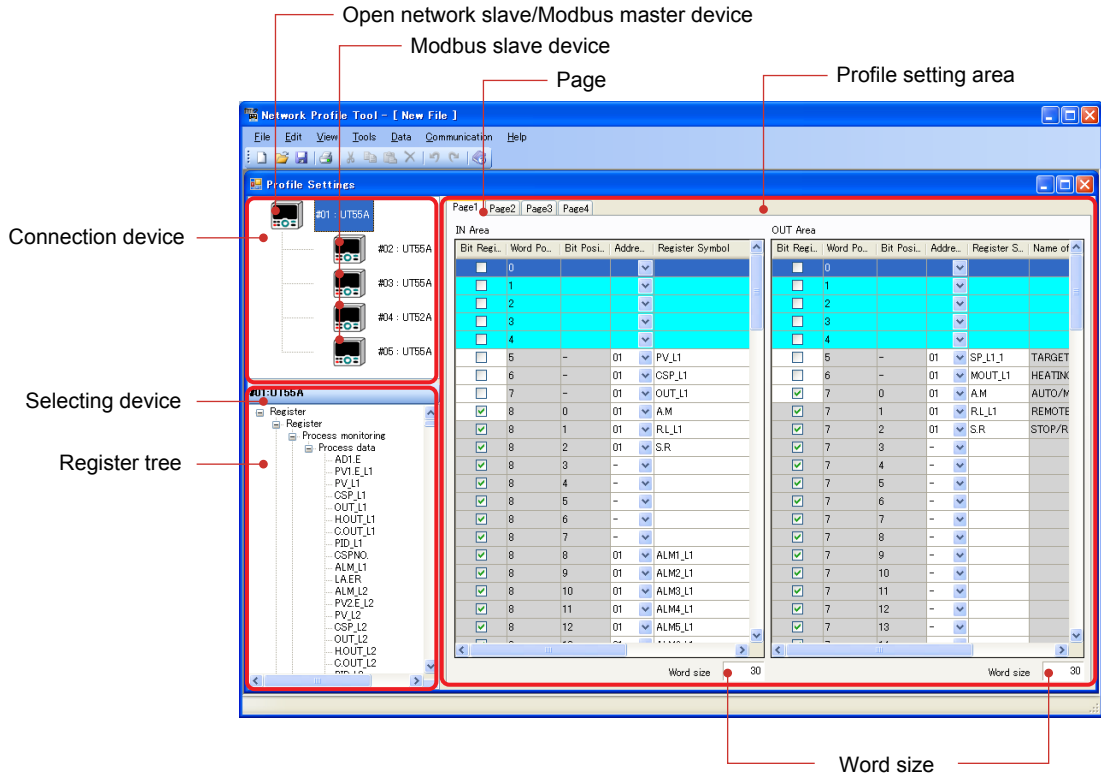
OUT area

This is an area for a PLC to rewrite the slave parameters. When the OUT area is rewritten, the corresponding parameters of the PROFIBUS-DP and Modbus slaves are also rewritten.

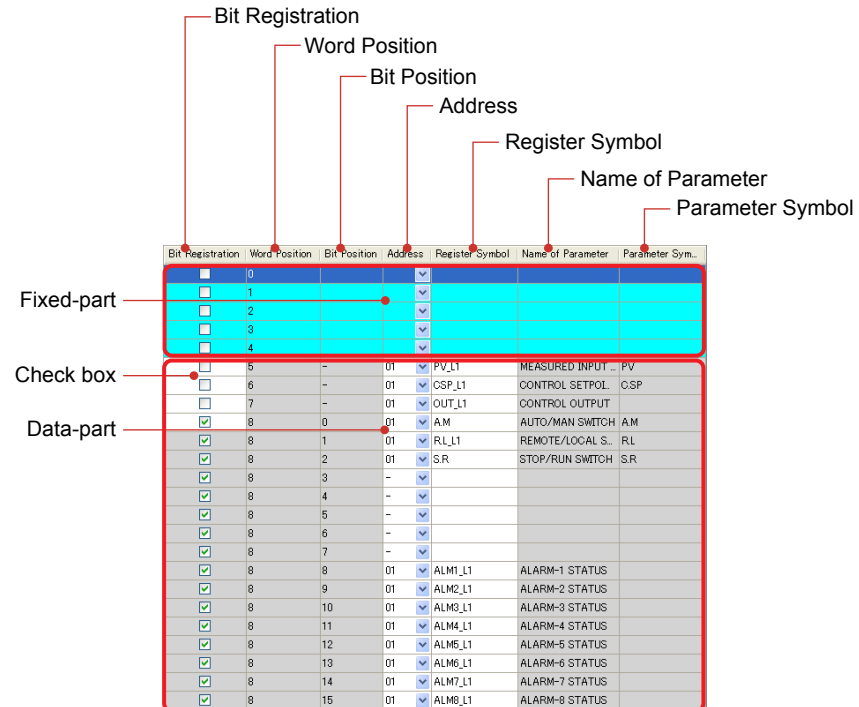
6.3 Part Names of Window and Their Functions

Profile Settings window

This is a window that enables you to set the profile.



Profile setting area (Example of IN area)



Name	Specifications
Connection device	<p>Connection devices are displayed on the left in the Profile Settings window. They can be displayed and hidden.</p> <p>The device configuration set in the Connection Device Settings window is displayed.</p> <p>Clicking on the connection device switches to the display of the register tree for the device.</p>
Open network slave/Modbus master device	This is a diagram for the device with address 01.
Modbus slave device	This is a diagram for the devices with addresses 02 to 32.
Register tree	<p>The register tree is displayed on the left in the Profile Settings window. It can be displayed and hidden. It is used when creating the profile.</p> <p>To register a parameter, drag the register and drop it on the table (in the white area) for the profile.</p> <p>Right-clicking on the register tree enables you to select Expand or Collapse in the shortcut menu. When the register tree is expanded, a desired register can be searched for by keyboard input.</p> <p>More information on the register classification is described later in this page.</p>
Selecting device	<p>Displays the model and address for the device that is clicked in Connection device.</p> <p>Example: #02: UT55A (UT55A with Modbus/RTU communication address 02)</p>
Profile setting area	<p>The profile setting area consists of an IN Area, OUT Area, and Pages 1 to 4. Displays the details according to the connection device settings.</p> <p>Data can be set in the white cells and cannot be set in the gray cells.</p>
Page	Parameters that are supposed to be frequently read/written are registered with Page 1 and parameters that are supposed to be less frequently read/written are registered with Pages 2 to 4 when creating a new profile. The number of pages is fixed.
Word size	<p>Displays the size for the area in the range of 5 to 122 words.</p> <p>Click on [Data] - [Set Word Size] in the menu.</p> <p>Specify the data for the profile by word size.</p> <p>The word size can be set in the IN and OUT areas, respectively. The word size is the same on each page.</p>
Bit Registration	<p>When the checkbox is unselected, the registered parameter is handled as word data.</p> <p>When the checkbox is selected, the parameter registered with each bit is handled as bit data.</p> <p>Selecting the [Bit Registration] checkbox when registered as word data deletes the content registered as word data.</p>
Word Position	Displays the word numbers from the top up to the set word size.
Bit Position	<p>When the [Bit Registration] checkbox is unselected, "-" is displayed.</p> <p>When the [Bit Registration] checkbox is selected, 0 to 15 (from 16 bits) is displayed.</p>
Address	<p>Sets the Modbus/RTU communication address for each device.</p> <p>Modbus master device: Fixed to 01.</p> <p>Modbus slave device: 02 to 32.</p>
Register Symbol	The register symbol for the parameter to register can be dragged from the register tree and dropped. The register symbol can also be directly input into the cell, or selected from the drop-down list.
Name of Parameter	Displays the parameter name.
Parameter Symbol	Displays the parameter symbol. Display is the same as that in the UT.
Fixed-part	<p>The fixed part is an area for flags for received data valid, normal connection, rescan request, write request, batch write request, and so on. It is a fixed 5-word area. The details in the fixed part cannot be changed.</p> <p>Select [Display] in the menu and then select or deselect the [Display Fixed Part] checkbox to display or hide the fixed part. The fixed part is the same on each page.</p>
Data-part	<p>Enables you to register the UTAdvanced data.</p> <p>The data part can be used by switching the page</p>

6.3 Part Names of Window and Their Functions

Details in the fixed part (same on each page)

IN area PROFIBUS-DP slave (UTAdvanced) → PROFIBUS-DP master			OUT area PROFIBUS-DP master → PROFIBUS-DP slave (UTAdvanced)		
Word position	Bit position	Contents of assignment	Word position	Bit position	Contents of assignment
0	0	Receive data valid	0	0	Rescan request
	1	During-write		1	(Reserved)
	2	Write acknowledgement		2	Write request
	3	(Reserved)		3	(Reserved)
	4	(Reserved)		4	(Reserved)
	5	(Reserved)		5	(Reserved)
	6	(Reserved)		6	(Reserved)
	7	(Reserved)		7	(Reserved)
	8	(Reserved)		8	(Reserved)
	9	(Reserved)		9	(Reserved)
	10	(Reserved)		10	(Reserved)
	11	(Reserved)		11	(Reserved)
	12	(Reserved)		12	(Reserved)
	13	(Reserved)		13	(Reserved)
	14	(Reserved)		14	(Reserved)
	15	(Reserved)		15	(Reserved)
1	0	Normal connection slave (address 01)	1	0	Batch write request (address 01)
	1	Normal connection slave (address 02)		1	Batch write request (address 02)
	2	Normal connection slave (address 03)		2	Batch write request (address 03)
	3	Normal connection slave (address 04)		3	Batch write request (address 04)
	4	Normal connection slave (address 05)		4	Batch write request (address 05)
	5	Normal connection slave (address 06)		5	Batch write request (address 06)
	6	Normal connection slave (address 07)		6	Batch write request (address 07)
	7	Normal connection slave (address 08)		7	Batch write request (address 08)
	8	Normal connection slave (address 09)		8	Batch write request (address 09)
	9	Normal connection slave (address 10)		9	Batch write request (address 10)
	10	Normal connection slave (address 11)		10	Batch write request (address 11)
	11	Normal connection slave (address 12)		11	Batch write request (address 12)
	12	Normal connection slave (address 13)		12	Batch write request (address 13)
	13	Normal connection slave (address 14)		13	Batch write request (address 14)
	14	Normal connection slave (address 15)		14	Batch write request (address 15)
	15	Normal connection slave (address 16)		15	Batch write request (address 16)
2	0	Normal connection slave (address 17)	2	0	Batch write request (address 17)
	1	Normal connection slave (address 18)		1	Batch write request (address 18)
	2	Normal connection slave (address 19)		2	Batch write request (address 19)
	3	Normal connection slave (address 20)		3	Batch write request (address 20)
	4	Normal connection slave (address 21)		4	Batch write request (address 21)
	5	Normal connection slave (address 22)		5	Batch write request (address 22)
	6	Normal connection slave (address 23)		6	Batch write request (address 23)
	7	Normal connection slave (address 24)		7	Batch write request (address 24)
	8	Normal connection slave (address 25)		8	Batch write request (address 25)
	9	Normal connection slave (address 26)		9	Batch write request (address 26)
	10	Normal connection slave (address 27)		10	Batch write request (address 27)
	11	Normal connection slave (address 28)		11	Batch write request (address 28)
	12	Normal connection slave (address 29)		12	Batch write request (address 29)
	13	Normal connection slave (address 30)		13	Batch write request (address 30)
	14	Normal connection slave (address 31)		14	Batch write request (address 31)
	15	Normal connection slave (address 32)		15	Batch write request (address 32)
3		Current profile number	3		(Unused)
4		Current page	4		Page change request

► [Fixed-part contents: UTAdvanced Series Communication Interface \(PROFIBUS-DP\) User's Manual](#)

Data category of Register window

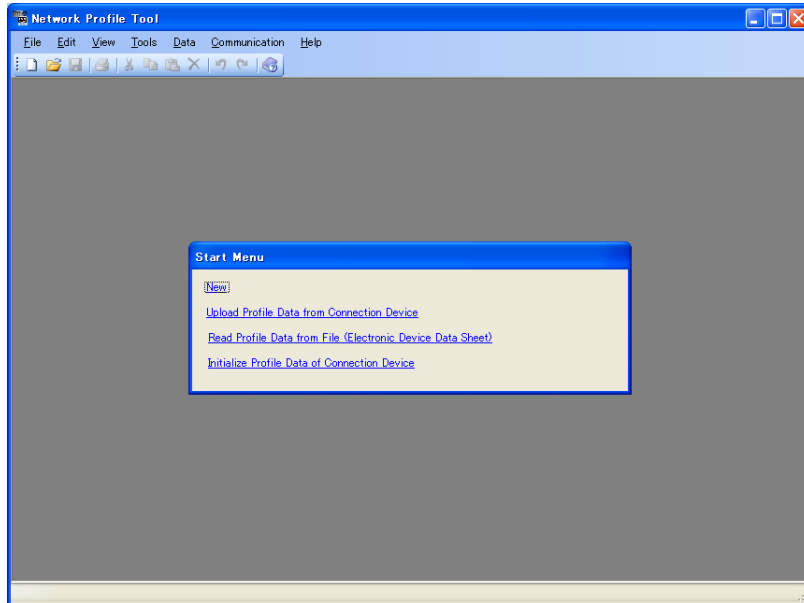
Large classification	Middle classification	Small classification	
Register	Process monitoring	Process data	
	Operaiton mode parameters	Loop-1/Loop-2 operation mode	
	Loop-1 operation parameters		SP and alarm setpoint setting
			SP-related setting
			Alarm function setting
			PV-related setting
			PID setting
			Control action-related setting
	Loop-2 operation parameters		SP and alarm setpoint setting
			SP-related setting
			Alarm function setting
			PV-related setting
			PID setting
Control action-related setting			
P-parameters	P-parameter		
Registers for ladder program		For input ladder calculation	
		For output ladder calculation	
		Input range / scale	
Relay	Function status	System error	
		Input error	
		Operaiton mode	
		Alarm	
		Alarm latch	
		Heater break alarm	
		SP number, PID number	
		Key	
		Display	
	Status for ladder program		Input (status) relay
			Output (status) relay
			Control (status) relay
			Special relay


- ▶ Register symbols and register numbers: [UTAdvanced Series Communication Interface \(RS-485, Ethernet\) User's Manual](#)

6.4 Create the Profile

Procedure

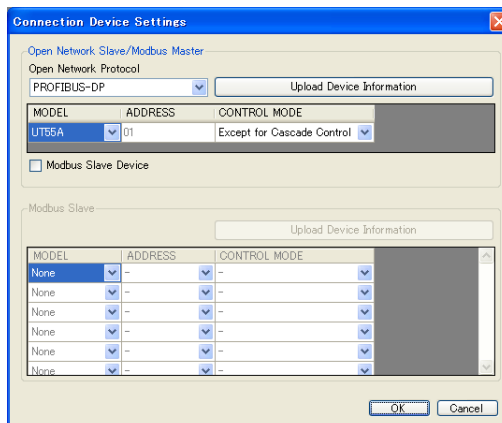
1. Click on Windows' [Start], select [All Programs] – [UTAdvanced], and then click on [Network Profile Tool].



2. Click on "New" and click [OK] in the Start Menu window, click on [File] – [New] in the menu, or click  on the toolbar to display the Connection Device Settings window.

In addition to New, there are the following options.

- Upload Profile Data from Connection Device
Enables you to read out and edit data from the UT.
- Read Profile Data from File (Electronic Device Data Sheet)
Enables you to open and edit an existing user file.
- Initialize Profile Data of Connection Device
See 6.12 Initializing the UT's Profile Data

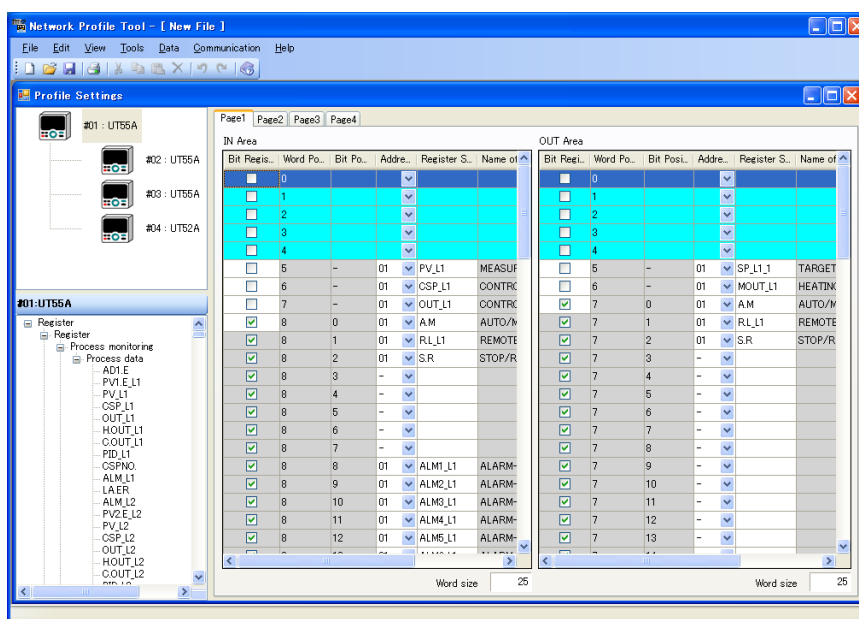
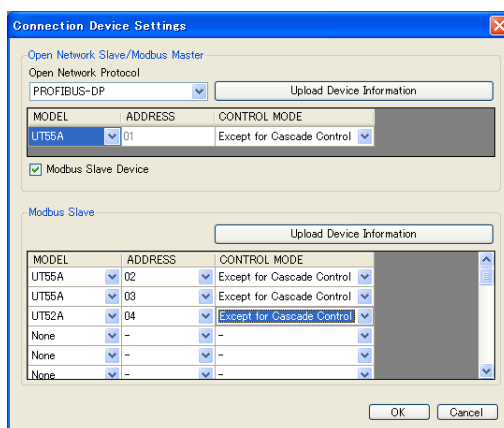


3. The following shows how to set the device information for the open network slave /Modbus master device.

To upload the device information from the open network slave/Modbus master device, click the [Upload Connection Device Information] button to display the Execute Communication window, and execute the upload.

If there are Modbus slave devices, select the [Modbus Slave Device] checkbox, set the device information for the Modbus slave devices, and click the [OK] button to display the Profile Settings window.

The following window shows an example of one open network slave/Modbus master device and three Modbus slave devices.



4. Clicking on the device diagram for which to set a profile enables you to switch to the register tree for that device.

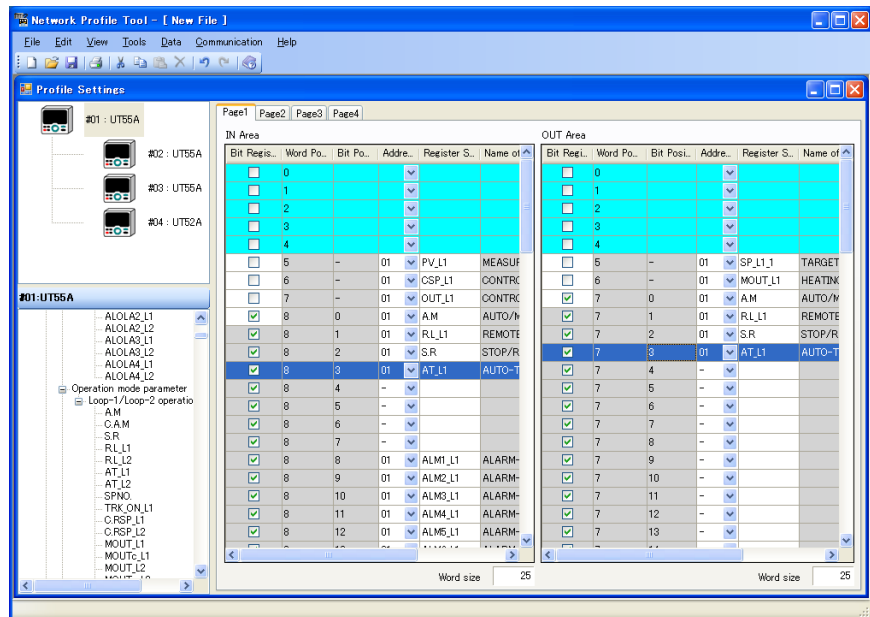
The default is registered in the profile setting area according to the control mode (other than cascade control or cascade control). Check the default conditions and set the word size and add or delete registers as necessary.

To cancel the profile settings, click . The Start Menu window appears.



The following describes how to add or delete a register.

6.4 Create the Profile

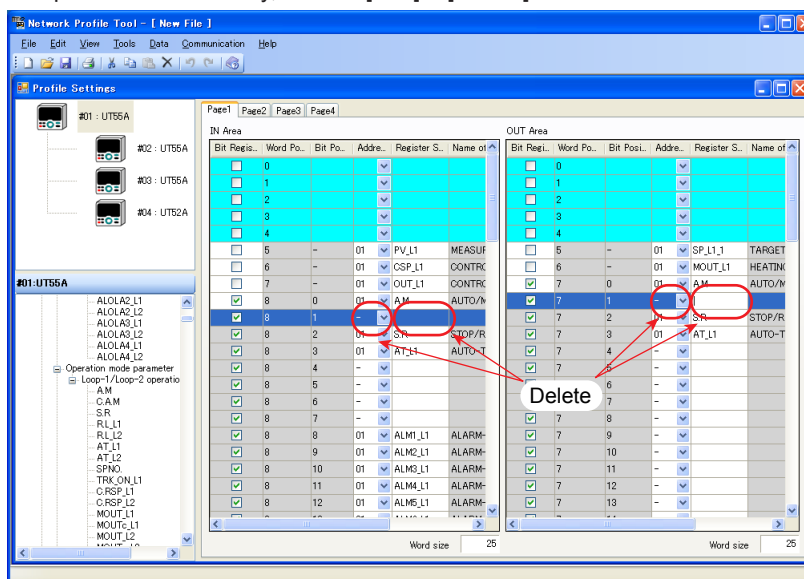
5. The following describes how to add a register. The following shows an example of registering the auto-tuning execution register (AT_L1) with the IN and OUT areas.



- The address can be selected from the drop-down list.
 - The register symbol can be dragged from the register tree and dropped into the cell to which to register it. Inputting the register symbol displays a candidate list. Select the desired one from the list.
- [Register symbols and register numbers: UTAdvanced Series Communication Interface \(RS-485, Ethernet\) User's Manual](#)

Icon	Status
	Status enabling a drop
	Status disabling a drop

- 6.** The following describes how to delete a register. The following shows an example of deleting the remote/local switching register (R.L_L1) from the IN and OUT areas. Place the cursor on the cells marked in red and press the Delete key, or click [Edit] – [Delete] in the menu.



- 7.** To add or delete other registers, repeat steps 5 and 6. For more information on the other editing methods, see 6.5, Edit the Profile.
- 8.** Next, check the area setting. Click [Tool] – [Check Area Setting] in the menu to execute the check. If an error occurs, the Area Setting window appears.
- 9.** Perform the following operations as necessary.
- Save the file: Saves the data as an Electronic Device Data Sheet (GSD file). See 6.10, Managing Files. The file name for the GSD file is fixed to YEC45F2.GSD because it needs to be loaded into the configuration tool.
 - Download: Downloads the created profile data to the UT. See 6.7, Downloading the Profile Data.
 - Print: Printing data. See 6.11, Printing.
- 10.** Saving the file and executing the download completes the profile setting.

What are register symbols?

Register symbols are the symbols of registers containing data such as UT parameter, operation status, alarm status, contact input, or error information in 16 bits or 1 bit. When performing communication, registers are used as D-registers or I-relays. For more information on them, see the UTAdvanced Communication Interface (RS-485, Ethernet) User's Manual.

D-register symbols

For some register symbols, the loop number, terminal area number, and group number are indicated by adding the underscore (_) to the end of a parameter symbol. If both the loop number and group number are added to a parameter symbol, they are added to it in the order of _loop number and _group number.

xxxx_Ln_Y

Ln: loop number (L1 or L2)

Y: group number (1 to 8 or 1 to 16, R)

xxxx_En

En: terminal area number (E1 to E4)

Example:

SP_L1_3: This means Loop-1 group-3 target setpoint.

PYS_2: This means group-2 PYS.

DI1.D_E1: This means E1-terminal area DI1.D.

Menu symbols and parameter symbols different from those in the UT

For menu symbols and parameter symbols, the loop number and terminal area number are indicated like register symbols. For example, the alarm function menu is indicated as ALRM in the UT, while it is indicated as ALRM_L1 in the LL50A.

For the notation, refer to "D-register symbols" above.

- Alarm function setting parameters
In the UT, the alarm type, standby operation, energized/non-energized, and latch settings are made using one parameter. However, they are set using one parameter each in the LL50A.
- Output type parameters
These parameters are used only for setting during heating/cooling control. The output types are set using one parameter in the UT, while they are set using the heating- and cooling-side parameters in the LL50A.
- P-parameters (when the ladder is used)
The decimal point position can be set only in the LL50A.

6.5 Edit the Profile

6.5.1 Inserting a Row

The following shows how to insert rows in the editable area. Insertion into a bit row is not possible. The inserted rows delete the word data for the rows that cannot fit in the area as a result of the row insertion.

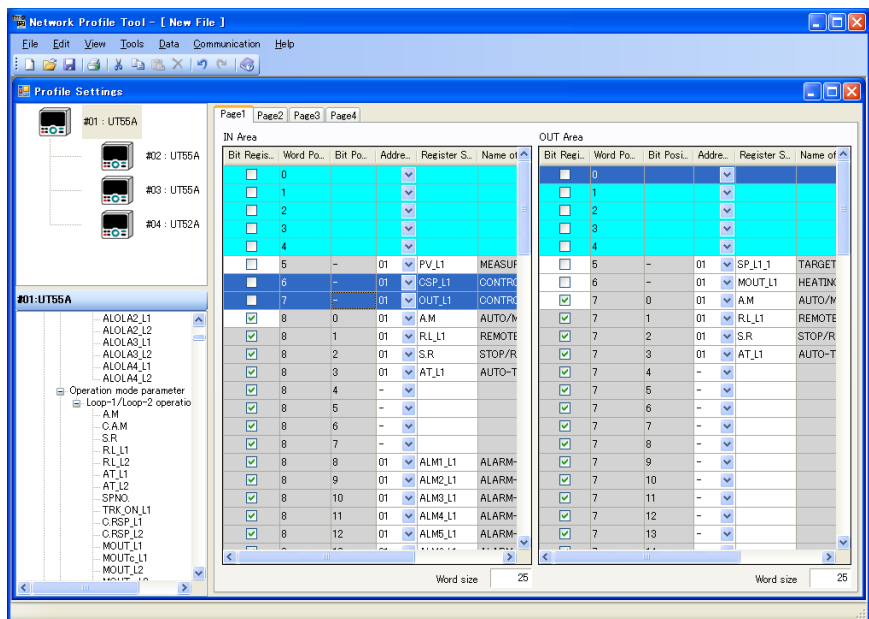
Selecting multiple rows

Select the row area with the cursor (from the current cursor position using the Shift key + up/down keys) or mouse. The rows are inserted into the top row of the selected row area.

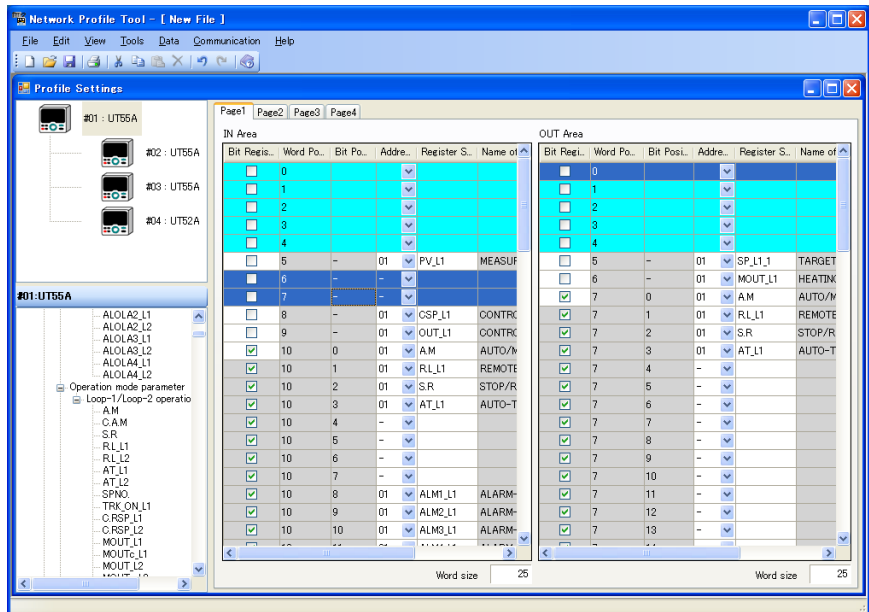
The following shows an example of inserting 2 rows from the word position 6.

Procedure

1. Select the inserting row.



2. Click on [Edit] – [Insert Row] in the menu.



6.5 Edit the Profile

6.5.2 Deleting a Row

The following shows how to delete rows from the editable area. A bit row cannot be deleted. When a row is deleted, the space for the deleted row is replaced by the next row.

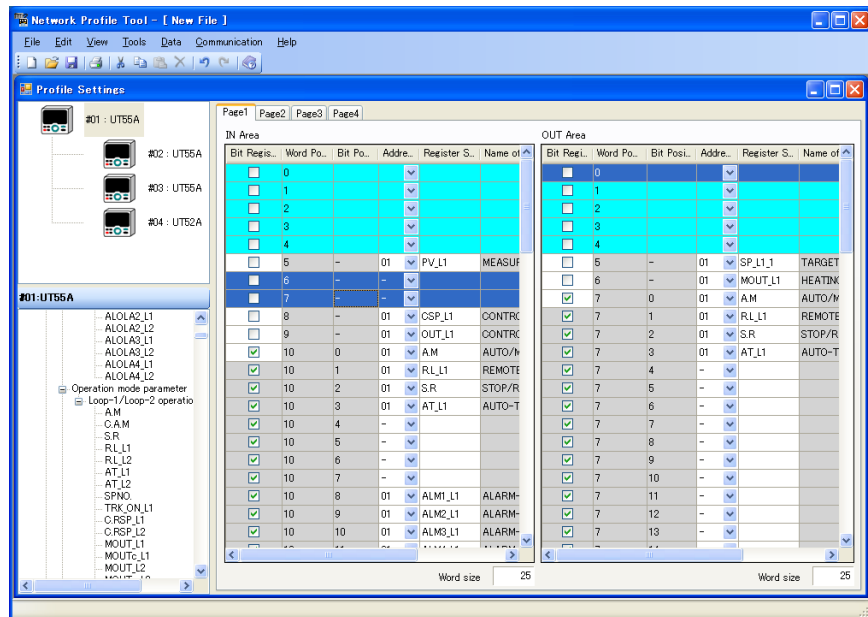
Selecting multiple rows

Select the row area with the cursor (from the current cursor position using the Shift key + up/down keys) or mouse.

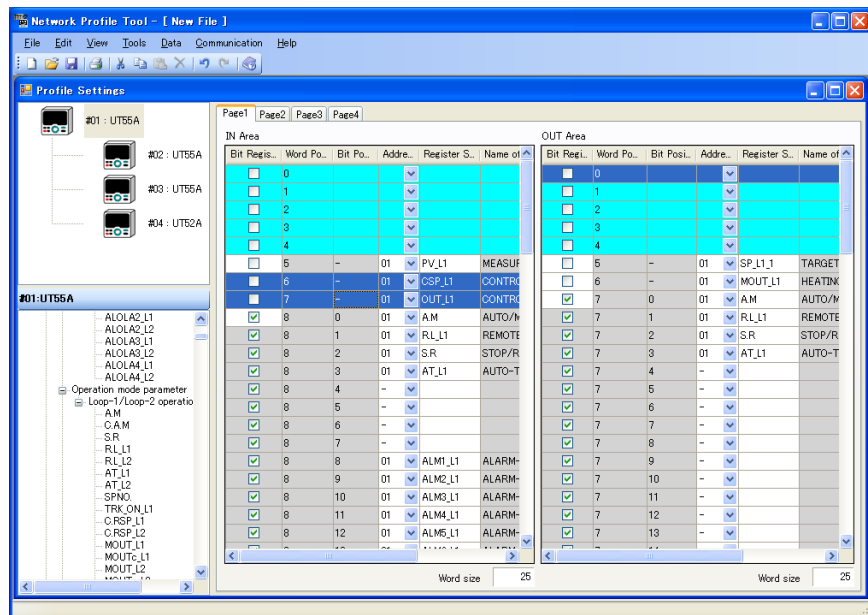
The following shows an example of deleting 2 rows from the word position 6.

Procedure

1. Select the deleting row.



2. Click on [Edit] – [Delete Row] in the menu.



6.5.3 Copying a Row

The following shows how to copy rows in the editable area. The copied row overwrites the copy destination.

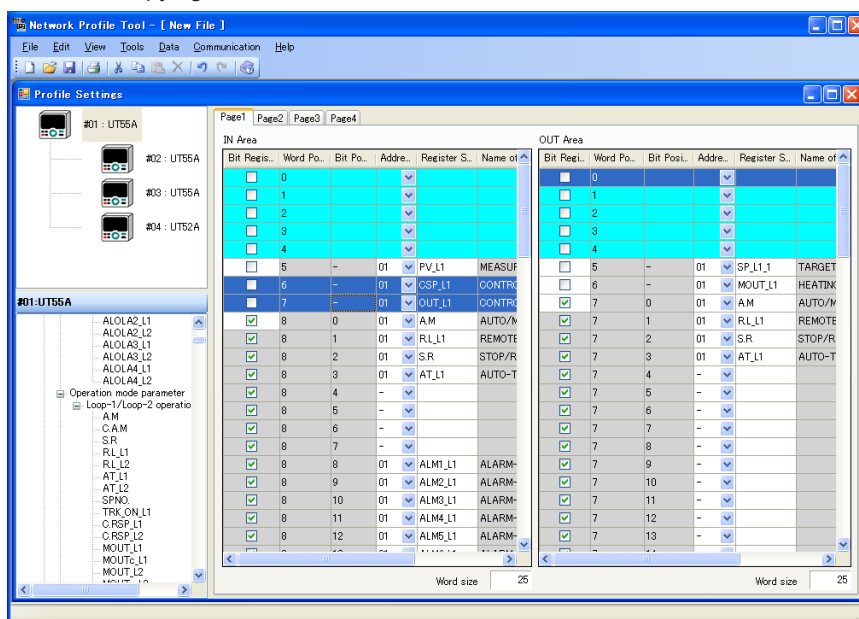
Selecting multiple rows

Select the row area with the cursor (from the current cursor position using the Shift key + up/down keys) or mouse.

The following shows an example of copying 2 rows from the word position 6 to the word position 10.

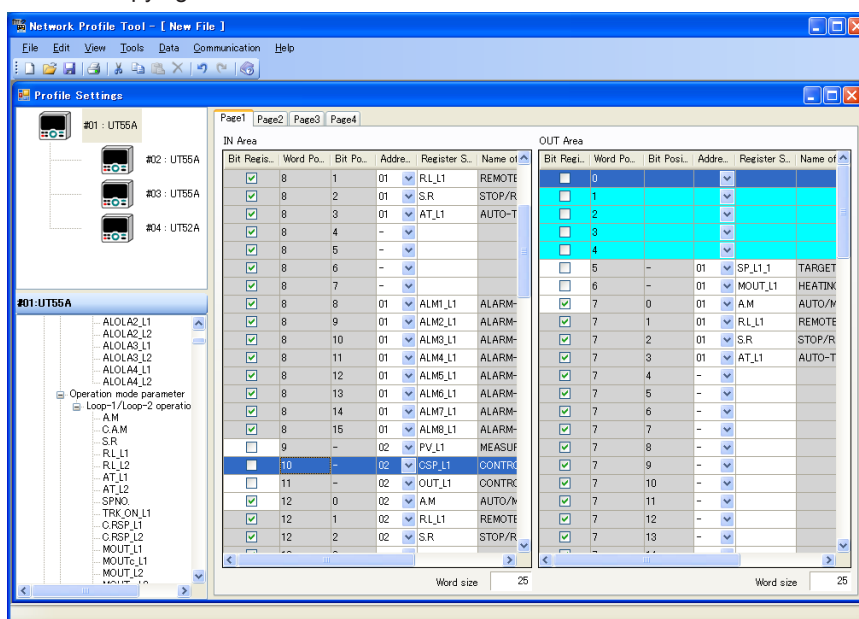
Procedure

1. Select the copying row.

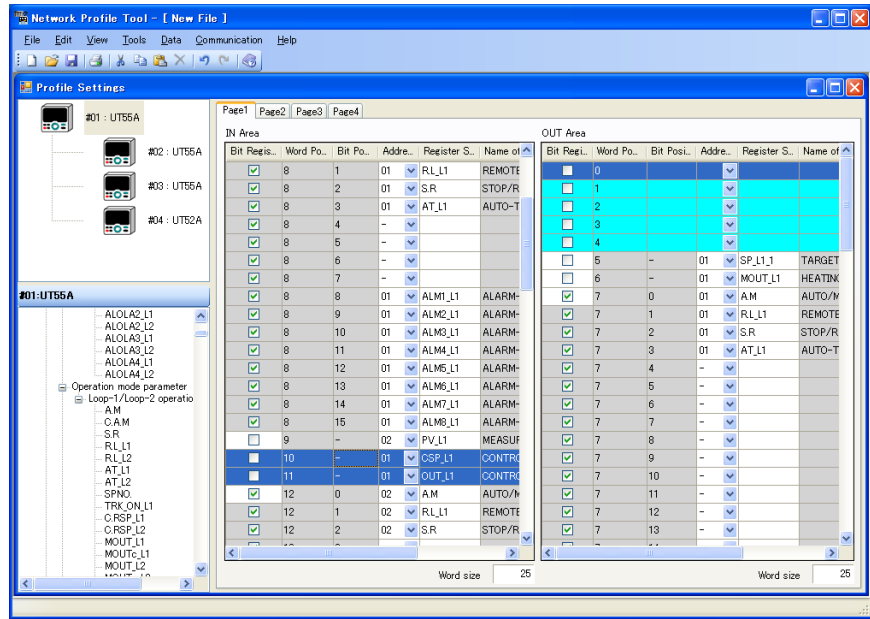


2. Click on [Edit] – [Copy] in the menu.

3. Click the copying row.



- Click on [Edit] – [Paste] in the menu.



6.5.4 Setting the Word Size

The following shows how to set the data size for the IN and OUT areas for the profile. The word size is the same on Pages 1 through 4.

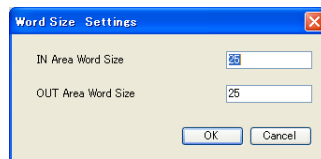
Protocol	Area	Setting range of word size
PROFIBUS-DP	IN	5 to 122 words
	OUT	5 to 122 words

Note

Reducing the word size deletes the word data for the rows that cannot fit in the area as a result of reducing the word size.

Procedure

- Click on [Data] – [Set Word Size] in the menu.



- Enter the word size and click the [OK] button. To cancel the settings, click the [Cancel] button.

6.5.5 Others

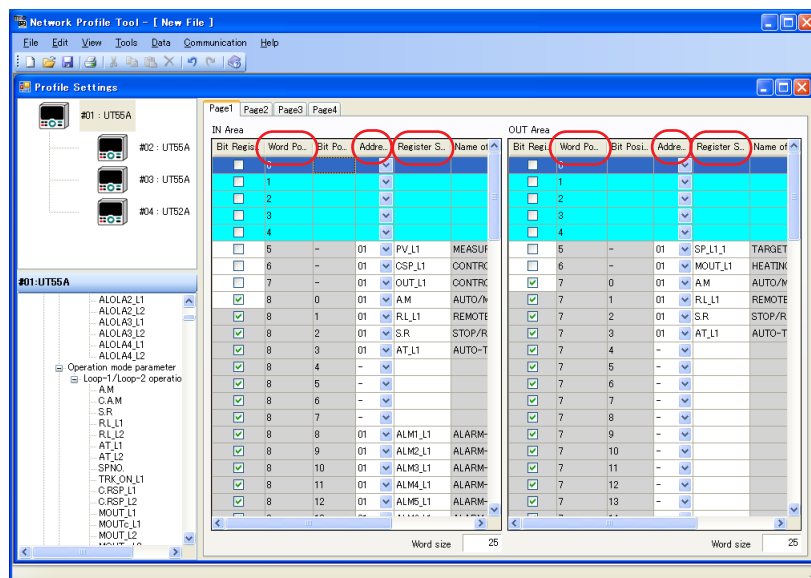
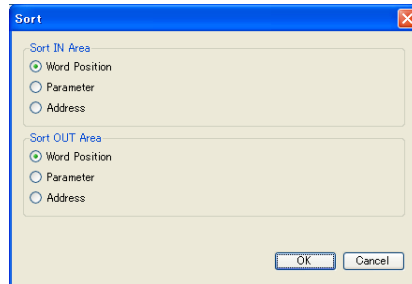
Functions	Specifications
Undo	Returns the area setting to the previous state. (Undo can be performed up to 5 times including the redo operation) The following operations can be undone. <ul style="list-style-type: none">▪ Changing the profile data▪ Changing the area size
Redo	Redo the operation that was undone. (Redo can be performed up to 5 times including the undo operation) The following operations can be redone. <ul style="list-style-type: none">▪ Changing the profile data▪ Changing the area size
Cut	Cut the string. The row is not deleted.
Paste	Paste the string and row.
Delete	Delete the string.

6.6 Window Operations

Sort Profile

Procedure

1. Click on [Data] – [Sort] in the menu, and select "Word Position", "Address" or "Register Symbol" in the Profile Settings window. Then click [OK] button. Click "Word Position", "Address" or "Register Symbol" in the Profile setting area of Profile Settings window.



Note

When the registers are sorted by register symbol, the registers are listed in order with the smallest D register number at the top and with the largest D register number at the bottom. A D register number is assigned to all the registers.

- ▶ Register symbols and register numbers: [UTAdvanced Series Communication Interface \(RS-485, Ethernet\) User's Manual](#)

Making the toolbar, status bar, Connection Device, Register Tree, Fixed-part of the profile or Connection Device Settings window visible/invisible

Procedure

1. Click on [View] – [following command] in the menu.

The following operations are available:

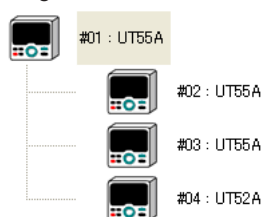
- Making the toolbar visible/invisible



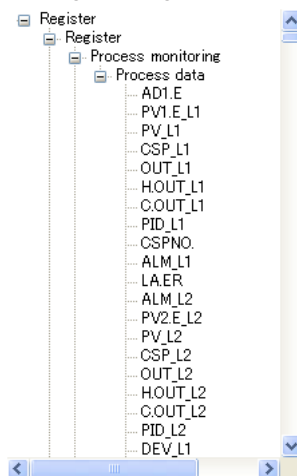
- Making the status bar visible/invisible

Communicating

- Making the Connection Device visible/invisible



- Making the Register Tree visible/invisible



6.6 Window Operations

- Making the fixed-part of the profile visible/invisible

Bit Registration	Word Position	Bit Position	Address	Register Symbol	Name of Para...
<input checked="" type="checkbox"/>	0	0	-	Receive data valid	
<input checked="" type="checkbox"/>	0	1	-	Write completed	
<input checked="" type="checkbox"/>	0	2	-	Write acknowledgement	
<input checked="" type="checkbox"/>	0	3	-	(reserved)	
<input checked="" type="checkbox"/>	0	4	-	(reserved)	
<input checked="" type="checkbox"/>	0	5	-	(reserved)	
<input checked="" type="checkbox"/>	0	6	-	(reserved)	
<input checked="" type="checkbox"/>	0	7	-	(reserved)	
<input checked="" type="checkbox"/>	0	8	-	(reserved)	
<input checked="" type="checkbox"/>	0	9	-	(reserved)	
<input checked="" type="checkbox"/>	0	10	-	(reserved)	
<input checked="" type="checkbox"/>	0	11	-	(reserved)	
<input checked="" type="checkbox"/>	0	12	-	(reserved)	
<input checked="" type="checkbox"/>	0	13	-	(reserved)	
<input checked="" type="checkbox"/>	0	14	-	(reserved)	
<input checked="" type="checkbox"/>	0	15	-	(reserved)	
<input checked="" type="checkbox"/>	1	0	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	1	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	2	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	3	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	4	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	5	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	6	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	7	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	8	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	9	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	10	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	11	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	12	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	13	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	14	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	1	15	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	2	0	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	2	1	-	Normal connection slave ...	
<input checked="" type="checkbox"/>	2	2	-	Normal connection slave ...	

Word size 25

- Making the Connection Device Settings window visible/invisible

Connection Device Settings

Open Network Slave/Modbus Master

Open Network Protocol: PROFIBUS-DP Upload Device Information

MODEL	ADDRESS	CONTROL MODE
UT55A	01	Except for Cascade Control

Modbus Slave Device

Modbus Slave Upload Device Information

MODEL	ADDRESS	CONTROL MODE
UT55A	02	Except for Cascade Control
UT55A	03	Except for Cascade Control
UT52A	04	Except for Cascade Control
None	-	-
None	-	-
None	-	-

OK Cancel

6.7 Downloading the Profile Data

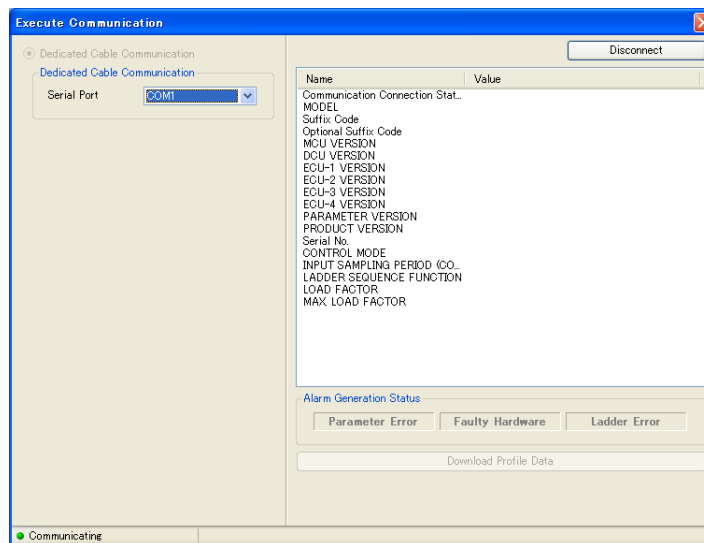
CAUTION

Do not download data while the controller is being used for control loop. Otherwise, it may cause a sudden change of the control output.

Be sure to disconnect the UT from the target unit before downloading data.

Procedure

1. Click on [Communication] – [Download] in the menu to display the Execute Communication window.



2. Set up the communication conditions and click the [Download Profile Data] button. When download is complete, the message appears.
3. Click [OK] to close the Execute Communication window.

To save a file in use, save it by entering a file name.

- ▶ Saving file: [Section 6.10.5 Saving a File as](#)

Description

Downloading the user file from the LL50A stops PROFIBUS-DP communication. The RDY LED (green) turns off and the ERR LED (red) blinks.

After the download is completed, the UT changes the profile number (in the parameter file) to 0, and restarts PROFIBUS-DP communication. If the I/O size of the user profile matches the I/O size configured in the PLC, a connection can be established. If the size does not match, a connection cannot be established. The PLC does not recognize the UT during downloading.

<Execute Communication window>

- Serial Port: A port available for a PC is automatically displayed.

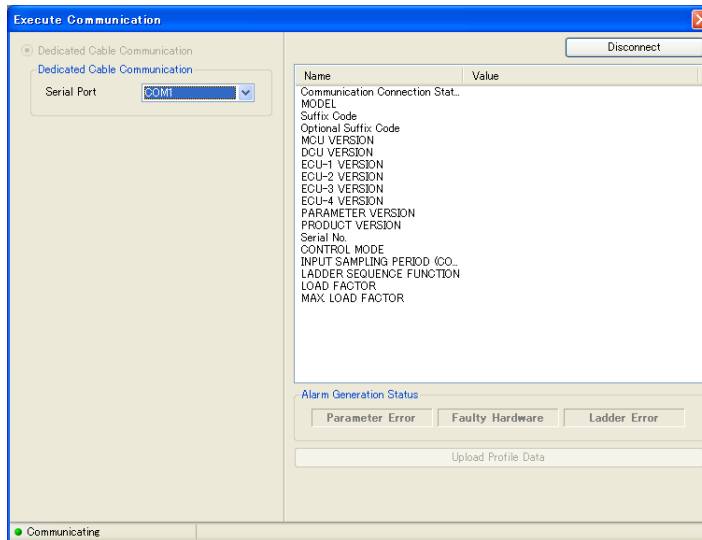
Note

Do not disconnect a connection cable or turn off the UT power supply during a download.

6.8 Uploading the Profile Data

Procedure

1. Click on [Communication] – [Upload] in the menu to display the Execute Communication window.



2. Set up the communication conditions and click the [Upload Profile Data] button. When an upload is complete, the Execute Communication window.

If the data in use has not yet been saved, a dialog box asking if you want to save data appears.

- To save the data, click the [Yes] button.
 - To cancel an upload, click the [Cancel] button.
- ▶ Saving file: [Section 6.10.5 Saving a File as](#)

Description

<Execute Communication window>

- Serial Port: A port available for a PC is automatically displayed.

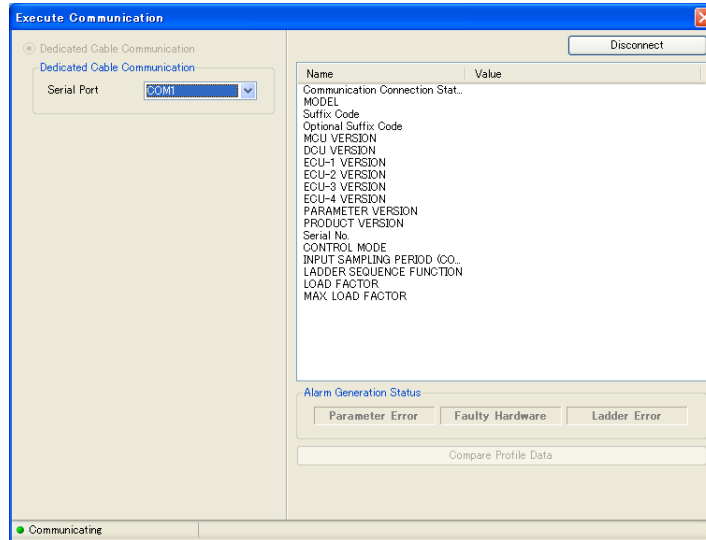
Note

Do not disconnect a connection cable or turn off the UT power supply during an upload.

6.9 Comparing Data with UT's Profile Data

Procedure

1. Click on [Communication] – [Compare Communication] in the menu to display the Execute Communication window.



2. Set up the communication conditions and click the [Compare Profile Data] button to start parameter comparison. When parameter data matches/mismatch the UT's data, the message appears.

Description

<Execute Communication window>

- Serial Port: A port available for a PC is automatically displayed.


Note

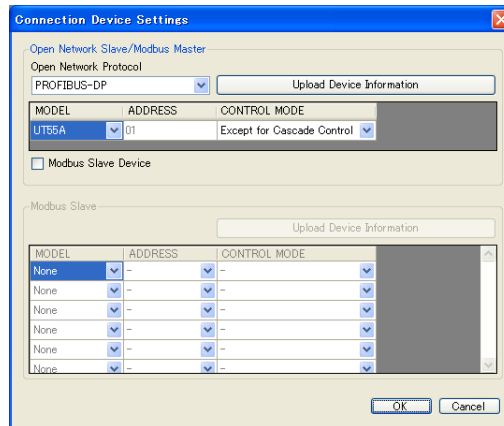
Do not disconnect a connection cable or turn off the UT power supply during a comparing.

6.10 Managing Files

6.10.1 Creating a New File

Procedure


1. Click on [File] – [New] in the menu or click  on the toolbar to display the Connection Device Settings window.

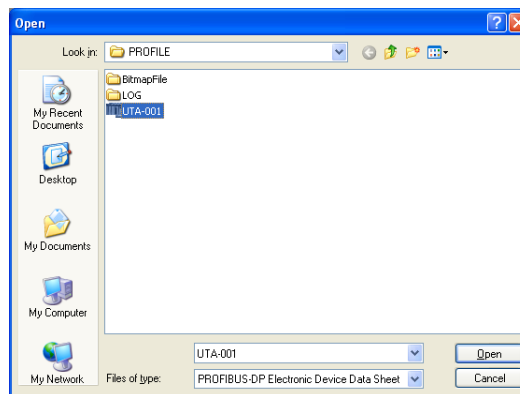



2. Set the connection device or click the [OK] button.
3. For operations such as setting profile, see section 6.4 or 6.5.

6.10.2 Opening a User File

Procedure


1. Click on [File] – [Open] in the menu or click  on the toolbar to display the Open File window.



2. Specify the folder for which icon () is displayed. The folder contains the GSD file and connection device bitmap file. The GSD file name is fixed to YEC45F2.GSD. For more information on the profile setting operation, see 6.4 and 6.5.

6.10.3 Saving by Overwrite

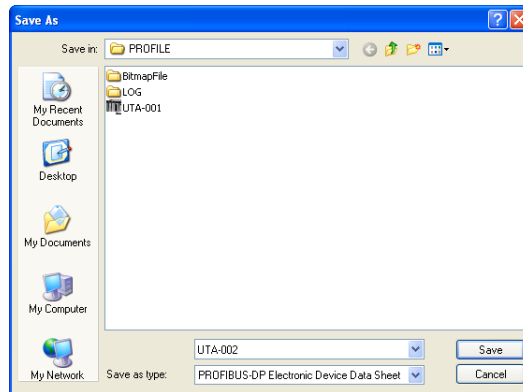
Procedure

1. Click on [File] – [Save] in the menu or click  on the toolbar to save data in use.


6.10.4 Saving a File as

Procedure




1. Click on [File] – [Save as] in the menu to display the Save As window.



2. Name the folder and click the [Save] button.


The folder icon () appears in the LL50A.
The GSD file and connection device bitmap file are created in the created folder.
The file name for the GSD file is fixed to YEC45F2.GSD because it needs to be loaded into the configuration tool.

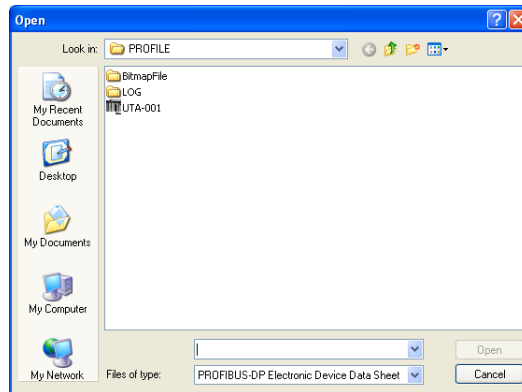
Connection Device Bitmap

UTA_SF.DIB	UTA_DE.DIB	UTA_DI.DIB
		

6.10.5 Comparing with File Data

Procedure

1. Click on [File] – [Compare File] in the menu to display the Select Compare Range window.
2. Select the comparison folder for which the icon () appears and click the [Open] button.

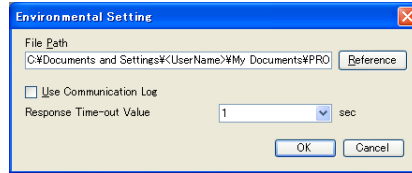


3. Execute the comparison. When parameter data matches/mismatch the file data, the message appears.

6.10.6 Making Environmental Settings

Procedure

1. Click on [File] – [Environmental Setting] in the menu to display the Environmental Setting window.



2. Set the path and click the [OK] button.

Description

- File Path
Shows the predetermined Electronic Device Data Sheet storage location.

Note

For Windows Vista, do not set a path that includes the Program Files folder. Otherwise, the LL50A Parameter Setting Software will not run properly.

- Use Communication Log
If this item is checked, communication logs are output to the specified location.
- Response time-out value
Set the response time-out value longer if the response of UT is late in each monitoring. The value can be set for 1 to 10 seconds.

The directories (default values) to which each file is stored are as shown below:

For Windows Vista


File Type	Storage Directory (Default)
Electronic Device Data Sheet (.gsd)	C:\Users\<UserName>\My Documents\PROFILE
Communication log files (.log)	C:\Users\<UserName>\Documents\PROFILE\Log The directory cannot be changed.

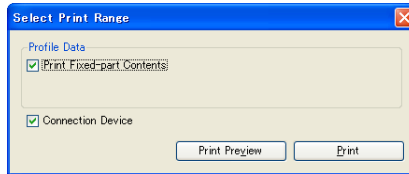
For Windows XP


File Type	Storage Directory (Default)
Electronic Device Data Sheet (.gsd)	C:\Documents and Settings\<UserName>\My Documents\PROFILE
Communication log files (.log)	C:\Documents and Settings\<UserName>\My Documents\PROFILE\Log The directory cannot be changed.

6.11 Printing

Procedure

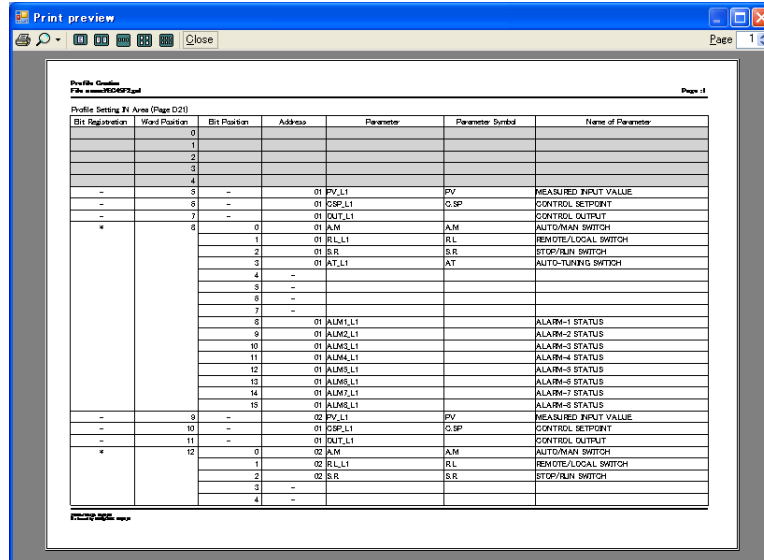
1. Click on [File] – [Print] in the menu or click  on the toolbar to display the Select Print Range window.



2. Select the data to be printed and click the [Print] button to display the Printing window.
Clicking [Print Preview] enables a printing image to be displayed as shown below.
3. After finishing printing, click .

Description

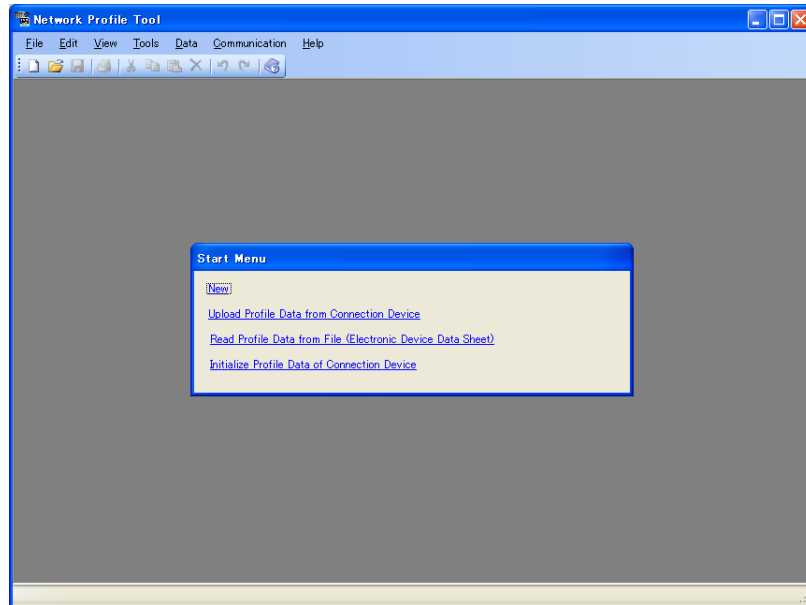
The following shows a printing image.



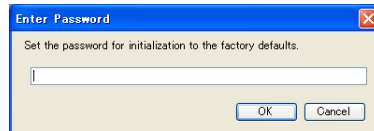
6.12 Initializing the UT's Profile Data


Procedure

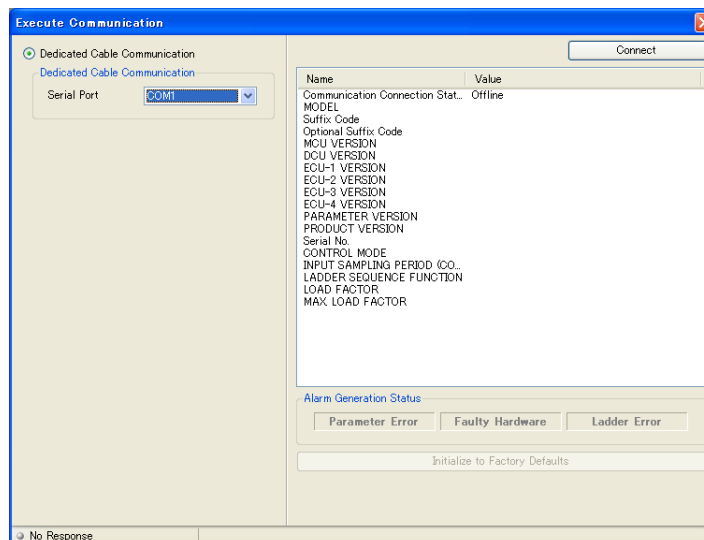
1. Change to the status that enables communication with the UT.
2. Click on [Initialize Profile Data of Connection Device] while the Start Menu window is displayed to display the confirmation message.



3. Enter the initialization password "UTAdvanced_INIT" and click the [OK] button. (Single-byte alphanumeric characters)



4. When the Execute Communication window appears, click on the [Initialize to Factory Defaults] button to start the initialization. Click on  to stop the initialization. When the initialization is completed, a message appears.



Description

Executing the initialization initializes the profile data for the UT. The initialized profile data is the default for the profile number 0 (in the parameter file).

Use this method if the profile is broken.

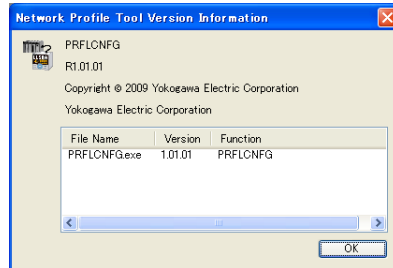
Be careful to make sure that the password described here is not used by unauthorized users.


▶ [Initial value: UTAdvanced Series Communication Interface \(PROFIBUS-DP\) User's Manual](#)

6.13 Checking Network Profile Tool Version

Procedure

1. Click on [Help] – [About...] in the menu to display the Network Profile Tool Version Information window.



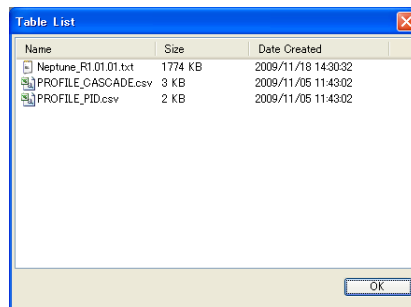
2. To close the window, click the [OK] button or .


6.14 Viewing the List of Tables

The list of tables shows the names of .dll and .xml files contained in the Table folder of the LL50A Network Profile Tool.

Procedure

1. Click on [Help] – [Table List] in the menu to display the Table List window.



2. To close the window, click the [OK] button or .

App.1 Worksheet

UTAdvanced WORKSHEET	<input type="checkbox"/> UT35A <input type="checkbox"/> UT32A <input type="checkbox"/> UT55A <input type="checkbox"/> UT52A	Doc. No.			P. /
	Order No.		Sec.	Loop	Item
	Serial No.				
Customer		Model and Suffix			
Plant		Tag No.			

					CUSTOMER		REP.		ENGINEER		
					DR.	CH.	DR.	CH.	DR.	CH.	
REV.	n	REMARKS	DATE	REV. BY							



WS 05P05A01-01JA
2nd Edition: 2010. 01.30

App.2 Input/Output Tables

UT35A Model and Suffix Codes

Model	Suffix code					Optional suffix code	INPUT				
							PV	OUT	OUT2	VALV	RET
UT35A	-x	x	x	-x0	-00	/x	●				●
Type 1: Basic control	-0							●			
	-1									●	
	-2							●	◆		
Type 2: Functions	0										
	1										
	2										
Type 3: Open networks	x										
Display language						-x0					
Fixed code						-00					
Optional suffix codes						/HA					

- : Equipped
- ◆: Relay output only

UT32A Model and Suffix Codes

Model	Suffix code					Optional suffix code	INPUT				
							PV	OUT	OUT2	VALV	RET
UT32A	-x	x	x	-x0	-00	/x	●				●
Type 1: Basic control	-0							●			
	-1									●	
	-2							●	◆		
Type 2: Functions	0										
	1										
	2										
Type 3: Open networks	x										
Display language						-x0					
Fixed code						-00					
Optional suffix codes						/HA					

- : Equipped
- ◆: Relay output only

Description of symbol

- PV: Measured input
- OUT, OUT2: Control output
- VALV: Position proportional output
- RET: Retransmission output
- DI1 to DI2: Contact input
- DI11 to DI15: Contact input
- AL1 to AL3: Alarm output
- DO11 to DO45: Contact output
- HAL1 to HAL2: Heater break alarm output

UT35A (Continued)

DI							DO											
DI1	DI2	DI11	DI12	DI13	DI14	DI15	AL1	AL2	AL3	DO11	DO12	DO41	DO42	DO43	DO44	DO45	HAL1	HAL2
•	•						•	•	•									
		•	•							•	•							
		•	•	•	•	•						•	•	•	•	•		
																	•	•

•: Equipped

UT32A (Continued)

DI				DO						
DI1	DI2	DI11	DI12	AL1	AL2	AL3	DO11	DO12	HAL1	HAL2
•	•			•	•	•				
		•	•				•	•		
									•	•

UT55A Model and Suffix codes

Model	Suffix code					Optional suffix code	INPUT				OUTPUT			
							PV	RSP	AIN2	AIN4	OUT	OUT2	VALV	RET
UT55A	-x	x	-x	-x0	-00	/x	√							√
Type 1 (Basic control)	-0										√			
	-1											√		
	-2									√	√			
Type 2 (Functions)	0													
	1							√						
	2							√						
	3													
	4							√						
	5							√						
	6													
Type 3 (Open Networks)	-x													
	-x0													
Display language	-00													
Fixed code														
Optional suffix codes						/DR		*1						
						/HA								

Continued to page App.3

- √: Equipped
- *1: If the /DR option is additionally specified to the remote input, RSP terminal can be used as universal input. However, DI16 is deleted.

Description of symbol

- PV: Measured input
- RSP: Remote setpoint input
- AIN2, AIN4: Auxiliary analog input
- OUT, OUT2: Control output
- VALV: Position proportional output
- RET: Retransmission output
- DI1 to DI46: Contact input
- AL1 to AL3: Alarm output
- DO11 to DO35: Contact output
- HAL1 to HAL2: Heater break alarm output

UT52A Model and Suffix codes

Model	Suffix code					Optional suffix code	INPUT				OUTPUT			
							PV	RSP	OUT	OUT2	VALV	RET		
UT52A	-x	x	-x	-x0	-00	/□	√							√
Type 1 (Basic control)	-0								√					
	-1										√			
	-2								√	√				
Type 2 (Functions)	0													
	1							√						
	2							√						
	3													
Type 3 (Open Networks)	-x													
Display language	-x0													
Fixed code	-00													
Optional suffix codes						/DR		*1						
						/HA								

Continued to page App.3

- √: Equipped
- *1: If the /DR option is additionally specified to the remote input, RSP terminal can be used as universal input. However, DI16 is deleted.

UT55A (continued from page App.2)

DI																				
DI1	DI2	DI3	DI11	DI12	DI13	DI14	DI15	DI16	DI26	DI31	DI32	DI33	DI34	DI35	DI41	DI42	DI43	DI44	DI45	DI46
•	•	•																		
								√		√	√	√	√	√						
								√												
			√	√	√	√	√													
								√												
								√							√	√	√	√	√	
								√	√						√	√	√	√	√	
																				√
								▲												

UT55A (continued from above)

DO																				
AL1	AL2	AL3	DO11	DO12	DO13	DO14	DO15	DO21	DO22	DO23	DO24	DO25	DO31	DO32	DO33	DO34	DO35	HAL1	HAL2	
•	•	•																		
								√	√	√	√	√								
								√	√	√	√	√								
								√	√	√	√	√								
			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			
																			√	√

UT52A (continued from page App.2)

DI						DO						
DI1	DI2	DI3	DI11	DI12	DI16	AL1	AL2	AL3	DO11	DO12	HAL1	HAL2
√	√	√				√	√	√				
					√							
					√							
			√	√					√	√		
					▲							
											√	√

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