Graphic Logic Controllers

LT3000 SERIES

Quick-Start Manual (GP-Pro EX Version)

Pro-face
Human Machine Interface

Preface

This textbook explains summary of the LT and how to operate software.

Contents of this textbook are intended for users who have good knowledge of PLCs of other manufactures.

This textbook explains the flow of basic settings and points of designing for the LT.

- Software
  GP-Pro EX (Ver.2.0)
- Hardware
  LT- 3201A
- Other
  PC: Windows PC

Notes

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3. Differences may occur between the descriptions found in this textbook and the actual functioning of this product. Please refer to the manual of each product or contact your local LT distributor for the latest information on this product.
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Digital Electronics Corporation, January 2005

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Trademark / Trade Name	Right Holder
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Intel, Pentium	Intel Corporation, USA
Pro-face	Digital Electronics Corporation
Ethernet	Western Digital Electric Corporation, USA
IBM, PC/AT, VGA, OS/2	IBM Corporation, USA

The following terms differ from the above mentioned formal trade names and trade marks.

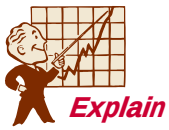
Term used in this textbook	Formal Trade Name or Trademark
Windows 95	Microsoft ® Windows ®95 Operating System
Windows 98	Microsoft ® Windows ®98 Operating System
Windows Me	Microsoft ® Windows ®Me Operating System
Windows NT	Microsoft ® Windows NT ® Operating System
Windows 2000	Microsoft ® Windows ®2000 Operating System
Windows XP	Microsoft ® Windows ®XP Operating System
MS-DOS	Microsoft ® MS-DOS ® Operating System

Manual Symbols and Terminology

This textbook uses the following symbols and terminology.
■ Safety Symbols and Terms.

Symbol	Description
	1.Indicates a potentially hazardous situation that could result in minor injury or equipment damage.
	2.Indicates a potentially damaging action or dangerous situation that could result in abnormal equipment operation or data loss.
	3.Indicates instructions or procedures that must be performed to ensure correct product use.

■ General Information Symbols and Terms

Symbol	Description
	Indicates information which helps you understand more about the LT.
	Indicates useful information.
	Explains features of the LT.
*	Indicates supplemental information .
Important!	Indicates important information.
LT	Generic name for LogiTouch, the graphic logic controller made by Digital Electronics Corporation.
Controller	Controlling function built in the LT.
PLC	Generic name for a programmable logic controller, or a control sequencer.
GP-Pro EX	Software for creating the LT logic programs and creating screens. Also used for GP3000 Series.

For Your Safety

System Design

- Be sure to design your LT control system so that, in the event of a main power supply failure or an LT accident, the user system's overall safety integrity will be maintained. If this is not done, incorrect output signals or an LT malfunction may cause an accident.

  1) Interlock and other circuits designed to interrupt or oppose normal machine movement (such as Emergency Stop, General Protection, and forward and reverse rotation), as well as those designed to prevent machine damage (such as upper, lower and traverse movement limit positioning) should all be designed to be located outside of the LT.
  2) When the LT generates a "Watchdog Timer Error," LT operation will halt. Also, when Errors occur in Input/Output control areas that the LT cannot detect, unexpected movement may occur in those areas. Therefore to prevent unsafe machine movement, a "Failsafe Circuit" should be created which is completely external to the LT.
  3) If a problem arises with an external unit's relay or transistor, causing an output (coil) to remain either ON or OFF, a major accident can occur, To prevent this, be sure to set up external watchdog circuits that will monitor vital output signals.

- Design a circuit that will supply power to the LT unit's I/O before starting up the LT. If the LT unit's internal program enters RUN mode prior to the I/O unit's load control power turning ON, an incorrect output (signal) or malfunction could cause an accident.
- Design a user program that ensures the safety of the user's system, in the event of an LT display or control error, or either a data transmission error or power failure between the LT and a connected unit. These types of problems can lead to an incorrect output (signal) or malfunction, resulting in an accident.
- Do not make switches using the switches on the touch panels which may cause operator injury and machine damage. An output may remain either ON or OFF and a major accident can occur. To prevent this, set up circuits such as limiters that will monitor vital output signals. Design switches for important operations to be performed by separate devices. An incorrect output or malfunction can occur and thereby cause an accident.
- Do not create LT touch panel switches to control machine safety operations, such as an emergency stop switch. Install these switches as separate hardware switches, otherwise severe bodily injury or equipment damage can occur.
- Be sure to design your system so that a communication fault between the LT and its host controller will not cause equipment to malfunction. This is to prevent any possibility of bodily injury or equipment damage.
- Do not use the LT as a warning device for critical alarms that can cause serious operator injury, machine damage or can halt system operation. Critical alarm indicators and their control/activator units must be designed using stand-alone hardware and/or mechanical interlocks.
- Do not use the LT with aircraft control devices, aerospace equipment, central trunk data transmission (communication) devices, nuclear power control devices, or medical life support equipment, due to these devices' inherent requirements of extremely high levels of safety and reliability.
- Be sure to design your system so that a communication fault between the LT and its host controller will not cause equipment to malfunction. This is to prevent any possibility of bodily injury or equipment damage.

- After the LT unit's backlight burns out, the touch panel is still active, unlike the LT unit's "Standby Mode". If the operator fails to notice that the backlight is burned out and touches the panel, a potentially dangerous machine operation error can occur. Therefore, do not create LT unit touch panel switches that may cause injury and/or equipment damage. If your LT unit's backlight suddenly turns OFF, the followings may occur.

  1) If the LT unit's "Backlight Control" is not set and the screen has gone blank, your backlight is burned out.
  2) If the LT unit's "Backlight Control" is set to Standby Mode and the screen has gone blank, and touching the screen or performing another input operation does not cause the display to reappear, your backlight is burned out.

Handling

- Do not disassemble or modify the LT unit. Doing so may cause a fire or an electric shock.
- Do not operate the LT in an environment where flammable gases are present, since it may cause an explosion.

Wiring

- To prevent an electrical shock or equipment damage, unplug the LT unit's power cord from the power supply prior to installing or wiring the LT.
- To prevent an electric shock, be sure to disconnect your LT unit's power cord from the power supply before wiring the LT.
- Do not use the voltage not specified in the manual. Doing so may cause a fire or an electric shock.
- The cables connected to the LT should be secured by cable clamps to prevent weight or tension of the cables added to the connectors or terminals.
- The LT unit's wiring should be checked to confirm that both the operating voltage and wiring terminal locations are correct. If either the voltage or the wiring terminal location is incorrect, it can cause a fire or accident.

Maintenance

- NEVER touch a live power terminal. Doing so could cause an electrical shock or a machine malfunction.
- To prevent an electrical shock, unplug the LT unit's power cord before either cleaning the LT or attaching/detaching the power terminal attachment screws.
- Do not connect or disconnect Host and LT unit communication cables while the LT is turned ON.
- Do not replace the LT unit's battery yourself. The LT uses a lithium battery for backing up its internal clock data and the battery may explode if it is replaced incorrectly. When replacement is required, please contact your local LT distributor.

Wiring Layout Precautions

- To prevent an LT unit malfunction due to excessive noise, isolate all LT input/ output signal lines from all power wiring or power cables via a separate wiring duct.

Installation

- Be sure all cable connectors are securely attached to the LT unit. A loose connection may cause incorrect input or output signals.

Wiring

- Be sure to ground the LT unit's FG wire separately from other equipment FG lines. Also, be sure to use a grounding resistance of 100Ω or less and a 2mm² [0.0062inch²] or thicker wire, or your country's applicable standard. Otherwise, an electric shock or malfunctions may result.
- Be sure to use only the designated torque to tighten the LT unit's terminal block screws. If these screws are not tightened firmly, it may cause a short-circuit, fire or incorrect unit operation.
- Be sure that metal particles and wiring debris do not fall inside the LT unit. They can cause a fire, malfunction or incorrect unit operation.

Maintenance

- Be sure to read the LT unit manual carefully before performing program changes, entering forced output, or using the RUN, STOP, or PAUSE commands while the LT is operating. Mistakes made when using these items can cause machine accidents or damage.
- Be sure the electricity is turned OFF before attaching or detaching an I/O unit. If the electricity is ON when an I/O unit is attached or detached, damage or malfunction to the I/O unit may occur.

Unit Disposal

- When the product is disposed of, it should be done so according to your country's regulations for similar types of industrial waste.

General Safety Precautions

- Do not press on the LT unit display with excessive force or with a hard object, since it can damage the display. Also do not press on the touch panel with a pointed object, such as the tip of a mechanical pencil or a screwdriver, since doing so can damage the touch panel.
- Do not install the LT where the ambient temperature exceeds the specified range. Doing so may cause a unit malfunction.
- To prevent abnormally high temperatures from occurring inside the LT, do not restrict or block the LT unit's rear-face ventilation slots.
- Do not operate the LT in areas where large, sudden temperature changes can occur. These changes can cause condensation to form inside the LT, possibly causing it to malfunction.
- Do not allow water, liquids, metal fragments to enter inside the LT unit's case, since they can cause either a malfunction or an electrical shock.
- Do not operate or store the LT in locations where it can be exposed to direct sunlight, high temperatures, excessive dust, moisture or vibration.
- Do not operate or store the LT where chemicals evaporate, or where chemicals are present in the air.

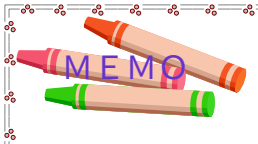
  Corrosive chemicals: acids, alkalines, liquids containing salt
  Flammable chemicals: organic solvents

- Do not use paint thinner or organic solvents to remove dirt or oil from the LT unit's surface. Instead, use a soft cloth moistened with a diluted neutral detergent.
- Do not operate or store the LT in areas with direct sunlight, since the sun's ultraviolet (UV) rays may cause the quality of the LCD to deteriorate.
- Do not store the LT in an area where the temperature is lower than that recommended in the LT unit's specifications. Doing so may cause the LCD display's liquid to congeal, which can damage the LCD. Also, if the storage area's temperature becomes higher than the specified level, the LCD's liquid may become isotropic, causing irreversible damage to the LCD. Therefore, only store the LT in areas where temperatures are within the LT unit's specifications.
- After turning OFF the LT, be sure to wait a few seconds before turning it ON again. The LT may not operate correctly if it is restarted too quickly.
- Be sure to back up the LT screen data and logic programs in case they are lost accidentally.

LCD Panel Usage Precautions

- The LCD panel's liquid contains an irritant. If the panel is damaged and any of this liquid contacts your skin, immediately rinse the area with running water for at least 15 minutes. If the liquid gets in your eyes, immediately rinse your eyes with running water for at least 15 minutes and consult a doctor.
- The LT unit's LCD screen may flicker or show unevenness in the brightness of certain images or at some contrast settings. This is an LCD characteristics and not a product defect.
- There's an individual difference in brightness and tone of LCD screen. Please be aware of this difference before using the lined-up plural units.
- The LT unit's LCD screen pixels may contain minute black and white-colored spots. This is an LCD characteristic and not a product defect.
- Extended shadows, or "Crosstalk" may appear on the sides of screen images. This is an LCD characteristic and not a product defect.
- The color displayed on the LT unit's LCD screen may appear different when seen from outside the specified viewing angle. This is an LCD characteristic and not a product defect.
- When the same image is displayed on the LT unit's screen for a long period, an afterimage may appear when the image is changed. If this happens, turn off the LT, wait 10 seconds and then restart the unit. This is an LCD characteristic and not a product defect.
- To prevent an afterimage:
  * Set the LT unit's display OFF feature when you plan to display the same screen image for a long period of time.
  * Change the screen image periodically and try not to display the same image for a long period of time.

Table of Contents

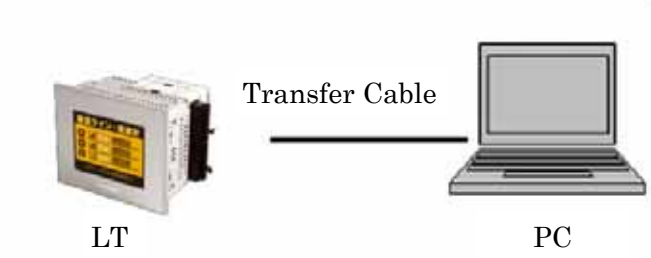

MEMO

Chapter 1 Introduction

1-1. System Environment

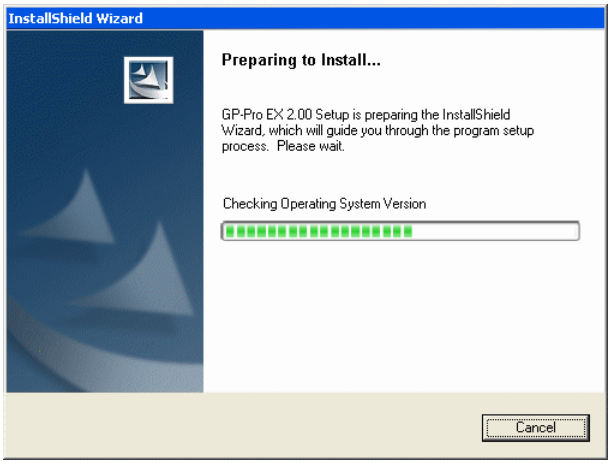
Editing & Logic Program Software	PC	OS
GP-Pro EX	Environment in which Windows® operates normally Pentium®III 800MHz or faster (Pentium®4 1.3GHz or above) Memory: 512MB (1GB or more) Resolution: SVGA (800 × 600) or above is recommended (Display with 256 or more colors is required.)	Windows® 2000 (Service Pack3 or later) Windows® XP (Home Edition or Professional)

Transfer Cable	CA3-USBCB01

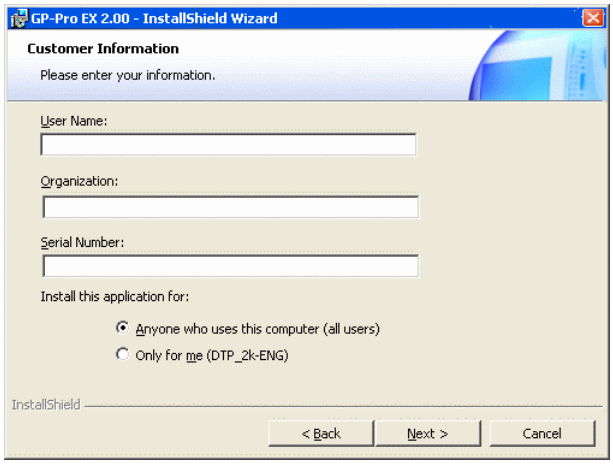


1-2. Installation

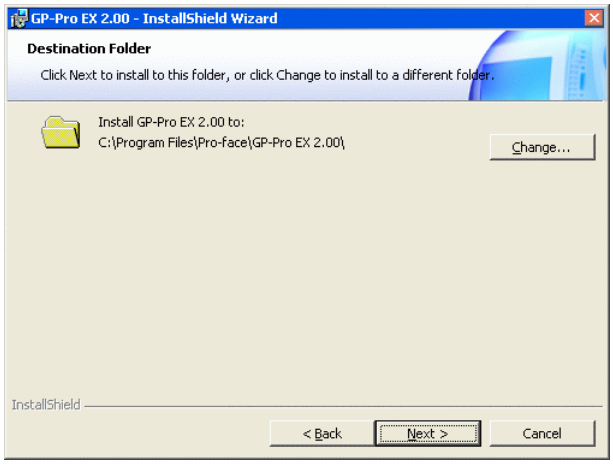
1. Insert a GP-Pro EX CD ROM into the CD-ROM drive of your PC.
   A window as left opens. Select "GP-Pro EX".



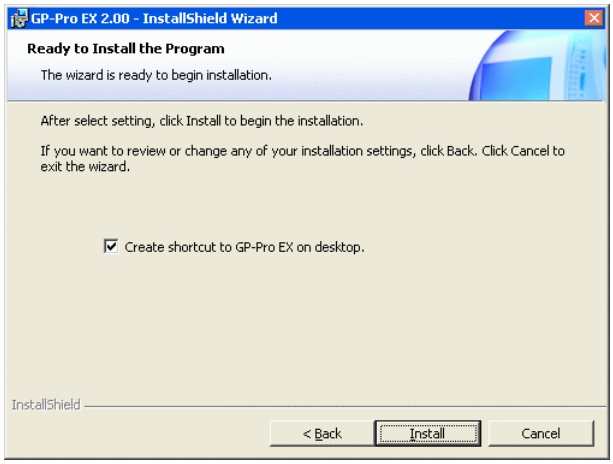
2. Installer starts up automatically.



3. Enter the serial number and the key code which are attached in the CD case.

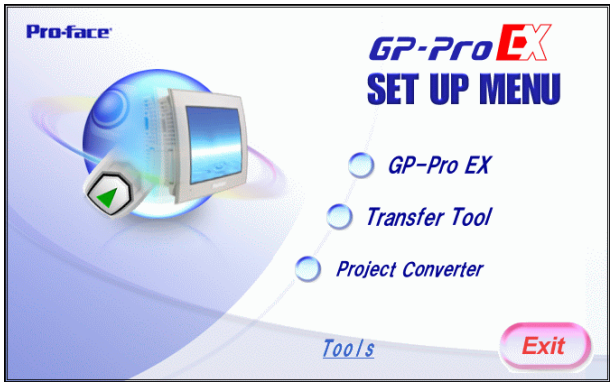


4. Specify the location to install GP-Pro EX to.
   If there is not a specific location, the software is installed in :
   C:\Program Files\Pro-face\GP-Pro EX 2.00\



5. Click [Install] to start installing.

6. Click [Continue] to install Transfer Tool.



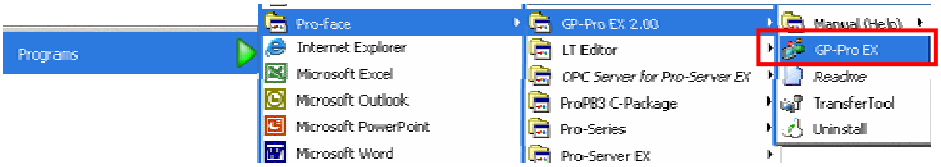
7. Click [Exit] to finish installing.

1-3. Start up GP-Pro EX

Start up the program software.

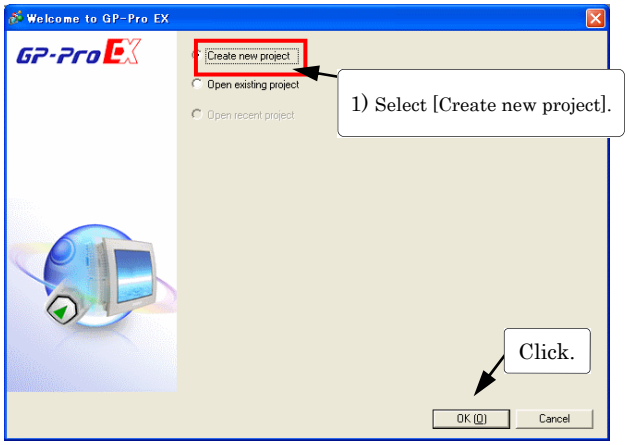
1) Open a GP-Pro EX screen.
Double-click the shortcut icon 

on the desktop or click the Windows "Start" button, and point to "Programs" →"Pro-face"→ "GP-Pro EX 2.00"→"GP-Pro EX".



2) GP-Pro EX starts up and the following screen appears.

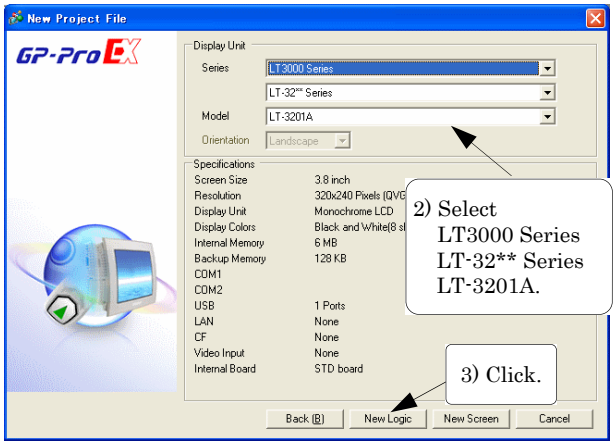
1-4. Create New Project



Create a new project.

After starting up, the "Welcome to GP-Pro EX" dialog box appears with the main window.

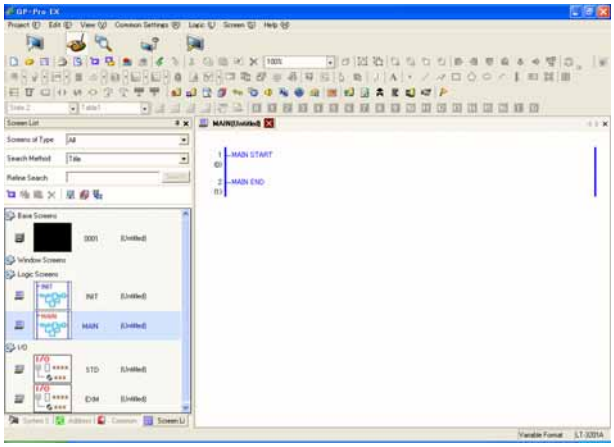
1) Select [Create new project] and click [OK].



Set [Display Unit] in the "New Project File" dialog box.

2) Series: LT3000 Series
LT-32** Series
Model: LT-3201A

3) After setting the above items, click [New Logic].



A logic screen (MAIN) as left opens.

Create a logic program (ladder program) on this screen.

* You can also start a new project by opening with the "Project" → "New" menu or clicking  .

Main Window

Reference

<< Main Window Part Names >>

Menu Bar

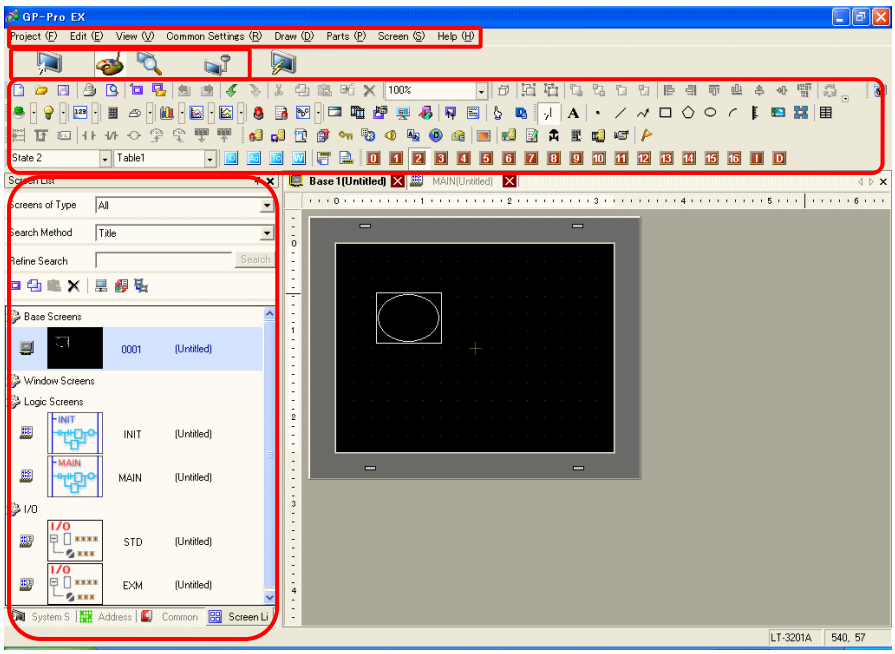
State Bar

Tool Bar

Work Space

- System Setting
- Address
- Common Settings
- Screen List
- Search

etc.



<< State Bar >>

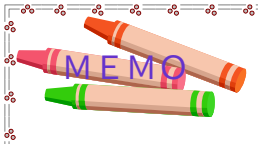
[System Settings]
Displays the System Settings window and in the editing area the previously selected settings.

[Edit]
Displays the preview screen where you can draw graphics and define common settings.

[Preview]
Displays the preview screen where you can check the display state of screens. You can copy previews to the clipboard or save them as JPEG files.

[Transfer Project]
Launches the Transfer Tool.

[Monitor]
When the display unit is connected to the PC, you can view the operation and state of the logic program on the display unit from the PC.


MEMO

Chapter 2 Programming Basics

2-1 Variable

2-2 Allocate I/O (I/O Settings)

2-3 Before Programming

2-1. Variable

2-1-1 What is a variable?

A variable is a “data holder” and equivalent to PLC’s device address. It stores a bit data or word (numeric) data.

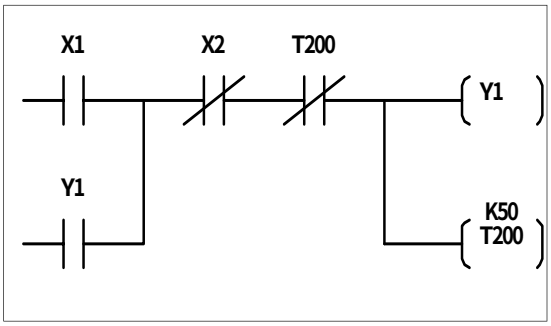
In conventional PLCs, areas used to store data are called device addresses and these addresses are given specific names by each PLC manufacturer.

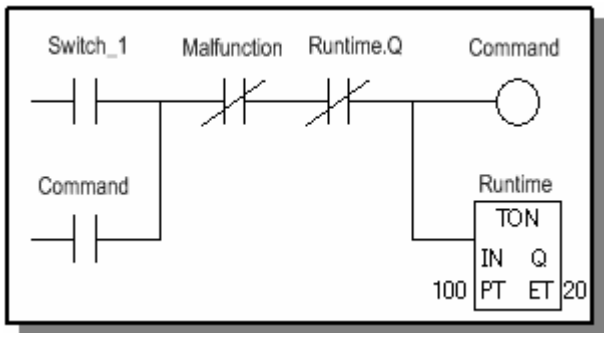
	External I/O	Internal Relay	Timer	Data Register
Mitsubishi Elec.	X001	M100	T200	D00001
OMRON Elec.	0.01	100.01	TIM200	DM0001

With GP-Pro EX, you can assign arbitrary names to these device addresses and use them as **variables** in the logic program.

	External I/O	Internal Relay	Timer	Data Register
GP-Pro EX	Switch_1 Motor_Run :	Start_Timer Trigger_Condition :	Runtime Trafic_Detection_Timer :	Spinning_Times Heater_Temperature :

Comparing GP-Pro EX to a conventional PLC...





Conventional PLC

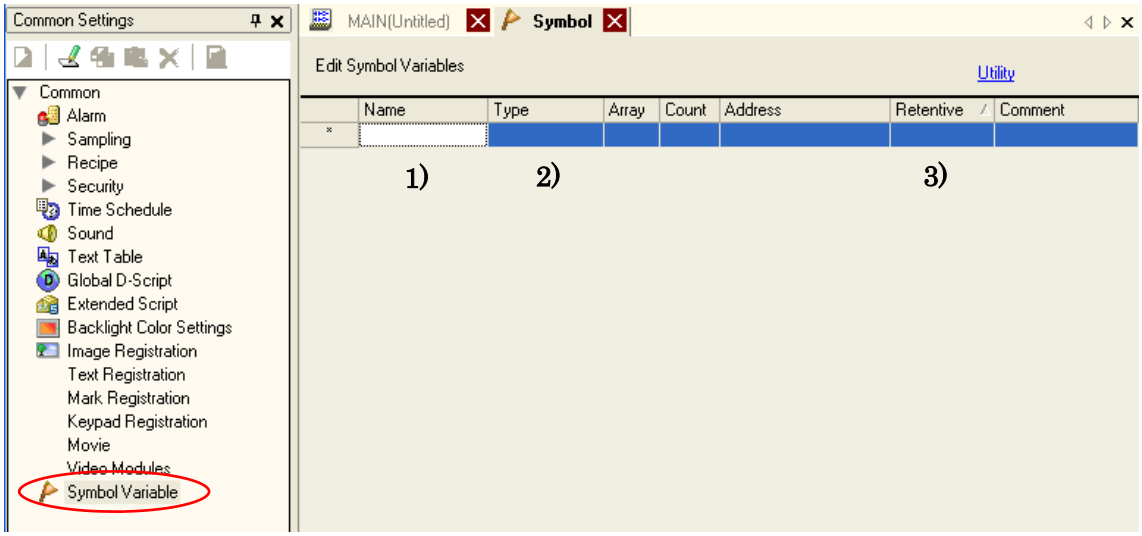
GP-Pro EX

You can see the performance contents of the ladder program at a glance by using variables!

For the ladders of the PLCs, it is common to add a comment, such as I/O part name, on the device address. With GP-Pro EX, since the comment can be a variable name, you can save your time to check addresses and their comments. This is useful for development or maintenance.

2-1-2. How to set variables

To set variables in GP-Pro EX, open " Symbol Variable" in the "Common Settings" window.



1) Variable Name

There are some restrictions as follows.

- The maximum number character is 32 in single-byte.
- You cannot use symbols other than "_ (underbar)".
- You cannot use TAB or DEL.
- You cannot use a name starting with a single-byte number.
- You cannot use a single-byte space.
- You cannot leave the name blank.
- Double-byte characters and single-byte characters are discriminated.

2) Variable Type

(Main Variables)

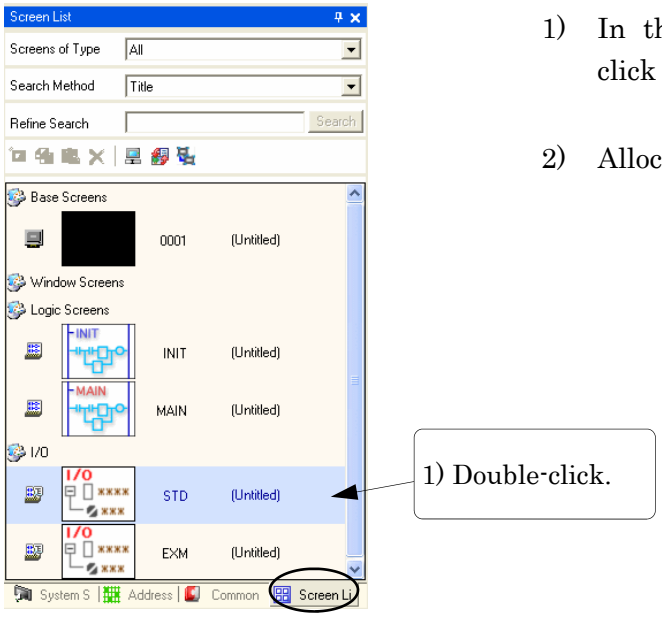
- Bit Variable: **Bit address**. Variable with a value of either on or off.
- Integer Variable: **Word Address (Double-word).** Signed variable with a 32-bit length that has integer values of from -2147483648 to 2147483647.
- Real Variable: **Word Address (Float).** Variable with a 64-bit length that has a floating point value of from ±2.225e-308 to ±1.79e+308 and 0.
- Timer Variable: **Timer Address.** » See page 59.
- Counter Variable: **Counter Address**. » See page 59.

3) Retentive

If you check in Retentive, data are retained when the unit is shut down.

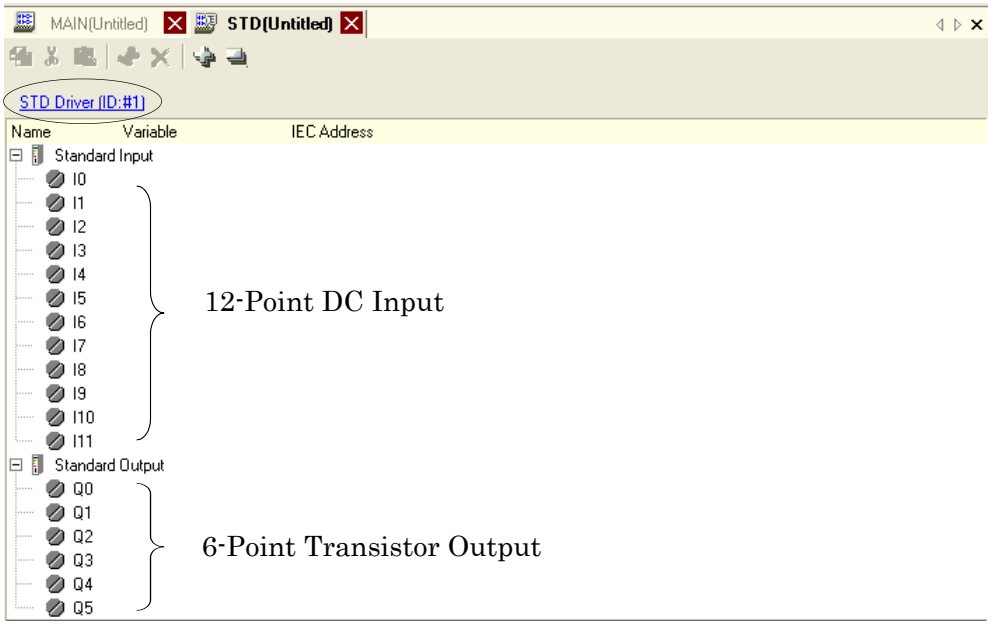
2-2. Allocate I/O (I/O Settings)

Allocate variables used in the logic program to input/output terminals.



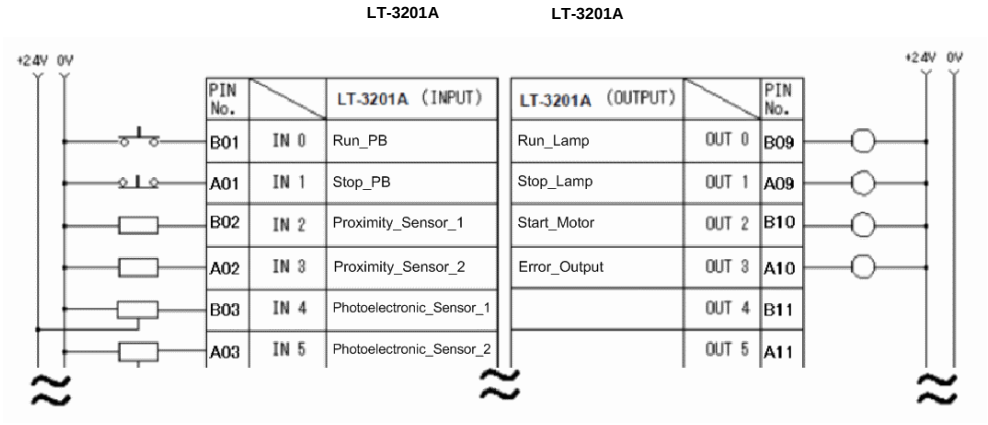
1) In the "Screen List" window, double-click STD, the I/O screen.

2) Allocate variables to each terminal.

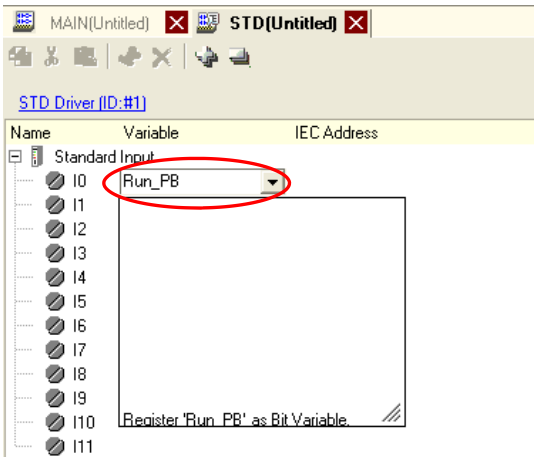


LT-3201A loads 12-point DC input and 6-point transistor output.
I0 through I11 in Standard Input are inputs, and Q0 through Q5 in Standard Output are outputs.
Allocate variable names to each terminal.

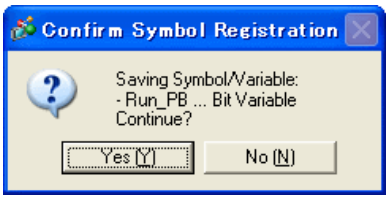
E.g.) Set I/O of the following circuit (External Input: 6 points, External Output: 4 points).



* The above circuit diagram is assumed to be used with the LT-3201A.



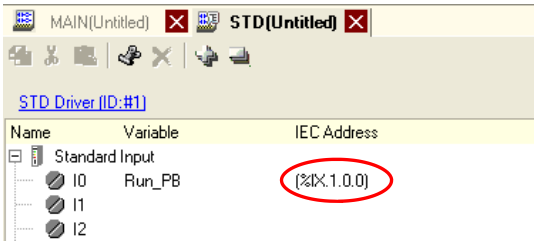
1) Double-click the right of I/O (terminal) on the I/O setting window and enter "Run_PB".



2) The dialog box indicating "Saving Symbol/ Variable:.Run_PB … Bit Variable Continue?" as left appears. Select [Yes].

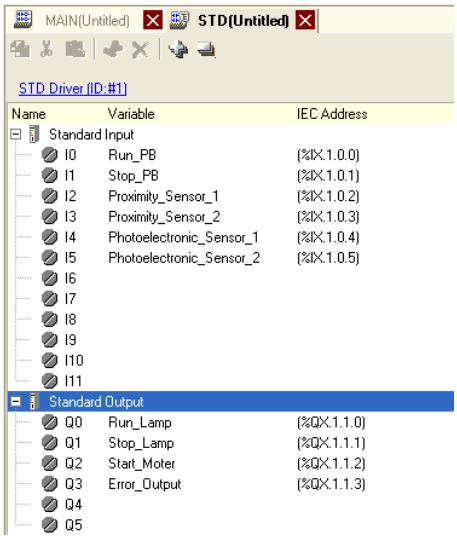
* Variables on the logic program and in the variable list can be dragged and dropped.

» See page 44. Registering Variables

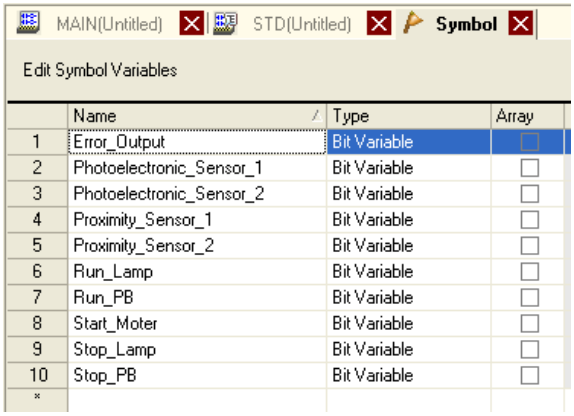


"%IX1.0.0"displayed on the right side of I0 "Run_PB" indicates the location where the variable is allocated.

» See the next page.



3) Set the rest of the inputs and outputs in the same way.



Since inputs and outputs are registered as variables, you can check them in the list of Symbol Variables.
To view the variables in the list, double-click "Symbol Variables" in the "Common Settings" window.
» See page 28. Symbol Variable Settings

Identifying I/O address (location of terminal where I/O is allocated)

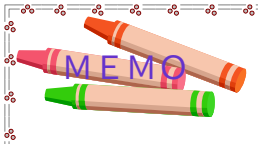
%AB1.C.D The underlined "%" and "1" are fixed.

A • • • Stores a following ID symbol for the input or output terminal.

I/O Terminal	ID Symbol
Input Terminal	I
Output Terminal	Q

B • • • Stores "X" for a bit terminal, "W" for a word terminal.
C • • • Stores the S-No. of the EX module.
D • • • Stores the terminal number of each unit.

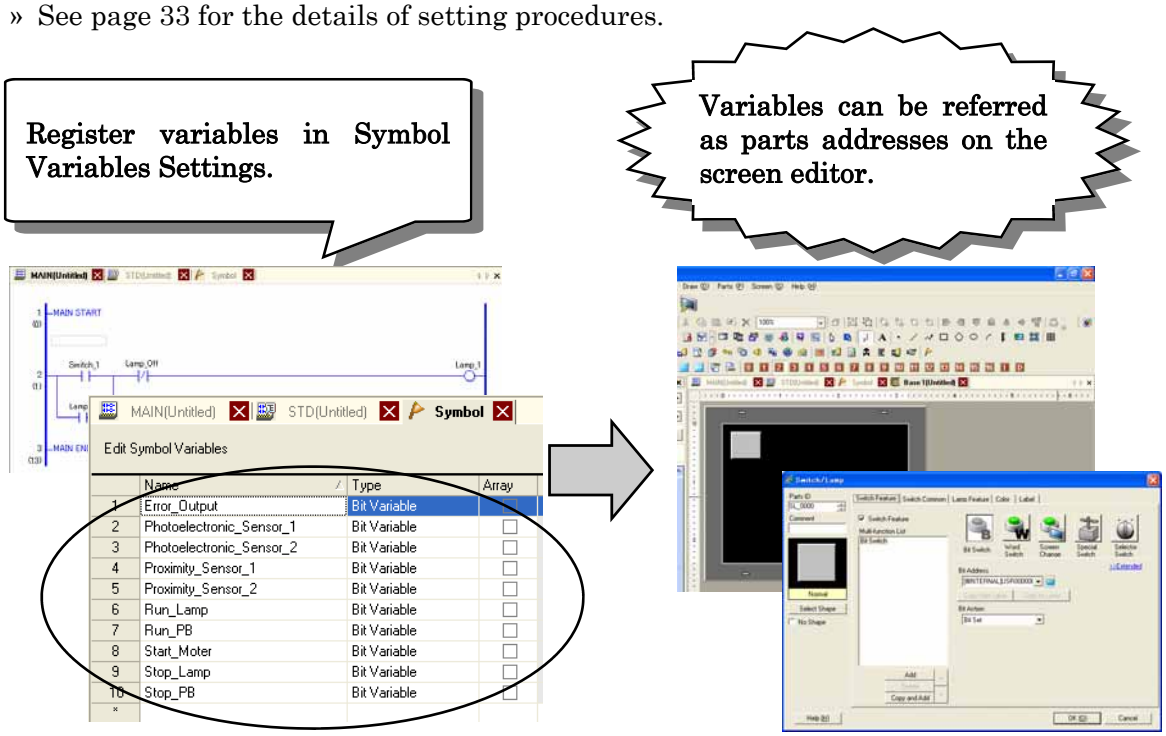
E.g.) %QX1.3.4
The variable is allocated to the fifth terminal of the S-No.3 unit as an output bit.


MEMO

2-3. Before Programming

2-3-1. Symbol Variable Settings

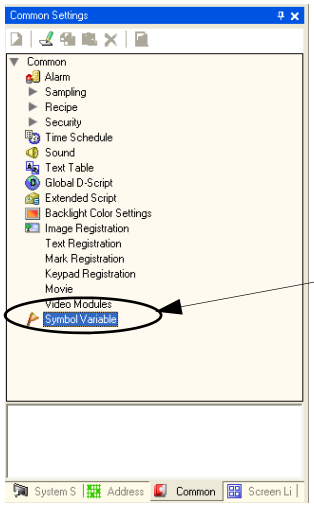
Variables used in GP-Pro EX are all registered in the **Symbol Variable Settings**.
The registered variables can be referred as addresses of parts such as switches or data displays on the screen editor.
» See page 33 for the details of setting procedures.



List of Variables

Open the “Edit Symbol Variable” window in the “Common Settings” window or with the “Common Settings” → “Symbol Variable” menu.

[Common Settings] Window



Or

Click

Menu Bar

» See page 35 for details of setting procedures.

2-3-2. Start with Creating Logic Program

Contacts and coils on the logic program can be operated or displayed by switches or lamps on screens. It is more efficient to create the logic program first.

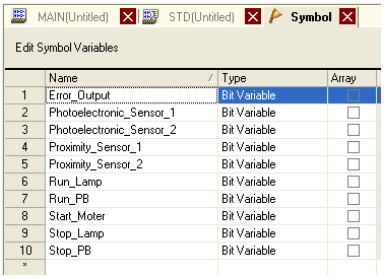
Logic Screen

You can place switches or lamps on the screen by dragging and dropping contacts or coils on the logic program.

Base Screen

Register and refer ⇕ Refer only

Symbol Variables

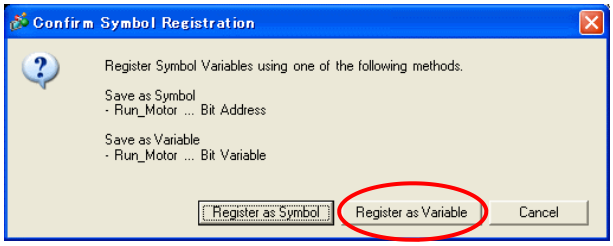


	Name	Type	Array
1	Error_Output	Bit Variable	
2	Photoelectronic_Sensor_1	Bit Variable	
3	Photoelectronic_Sensor_2	Bit Variable	
4	Proximity_Sensor_1	Bit Variable	
5	Proximity_Sensor_2	Bit Variable	
6	Run_Lamp	Bit Variable	
7	Run_PB	Bit Variable	
8	Start_Moter	Bit Variable	
9	Stop_Lamp	Bit Variable	
10	Stop_PB	Bit Variable	

Parts and tags on the screen are **registered in the list of Symbol Variables.** The **saved variables** can be referred in the list of Symbol Variables. You can also register variables newly on the base screen.
» See below.

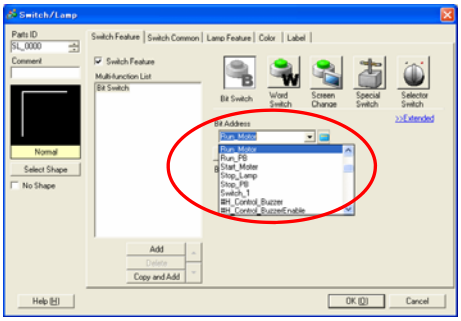
Reference **You can register variables on the screen editor!**

If the following message appears when placing a part on a base screen, the variable has not been registered.
By clicking [Register as Variable], you can create and register the variable on the base screen.

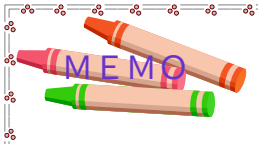


Tips

If the variable has been registered, you can select it from the pull-down menu .



E.g.) Select a saved bit variable.


MEMO

Chapter 3 Exercise

3-1. Automatic Hold Circuit

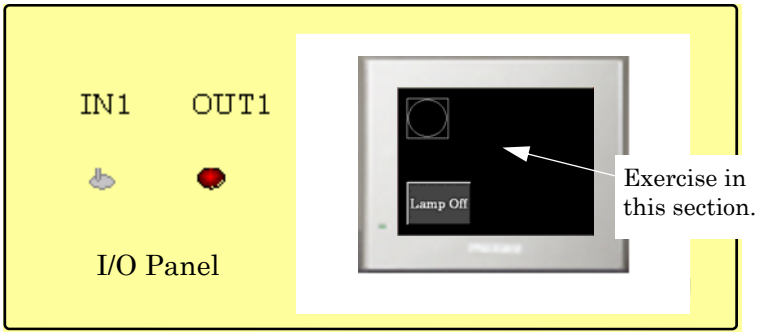
In this section, create an automatic hold circuit. A series of flow, creating a logic program, creating variables, setting I/O, creating a screen, and checking performance, is introduced.

1) When you turn on the external switch (IN1), both of the external lamp (OUT1) and the lamp on the screen light up.

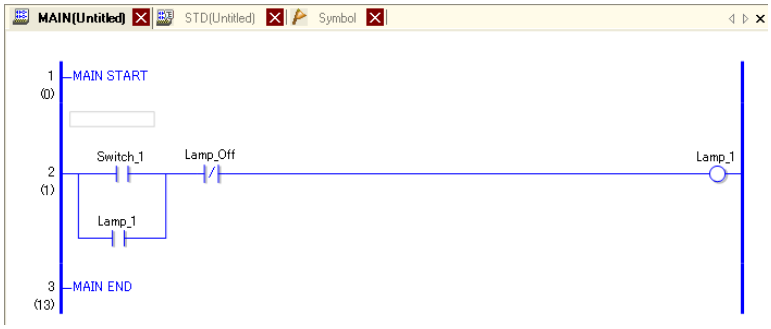
2) Even if you turn off the external switch (IN1), the lamps do not turn off because automatic hold is active.

3) When touch the lamp off switch on the screen is touched, the lamps turn off.

Screen Sample

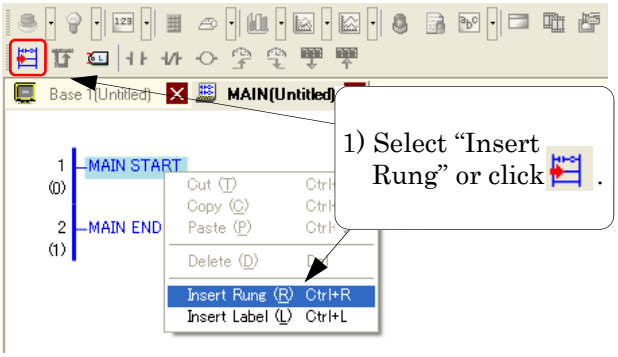


Logic Program Sample

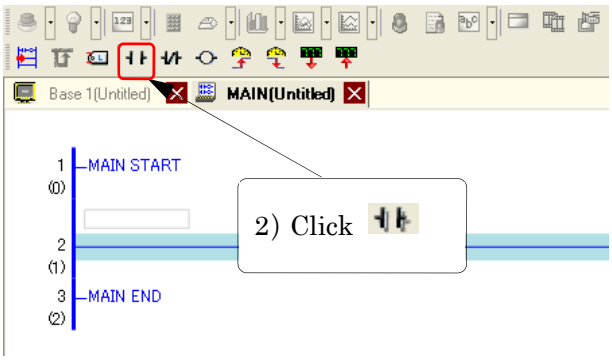


3-1-1. Create Logic Program

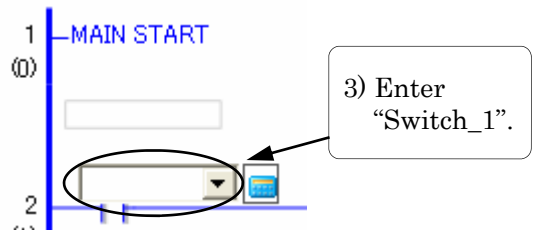
How to insert a contact and a coil, how to create an OR circuit, and "variables" are explained in this section.



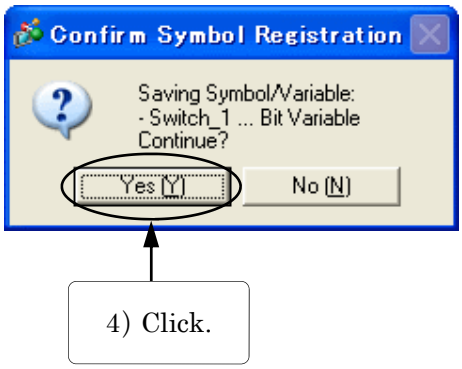
1) Open the logic screen (MAIN) in the "Screen List" window. Select "MAIN START" and right-click it to select "Insert Rung". (Or click .)



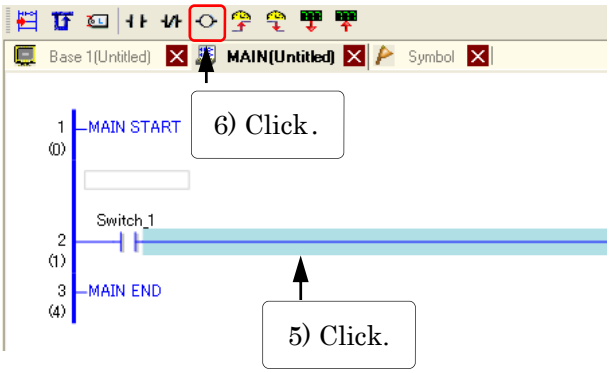
2) A rung is inserted.
Click NO (Normally Open Contact) .



3) An NO is inserted.
Enter a variable name.
(Enter "Switch_1".)

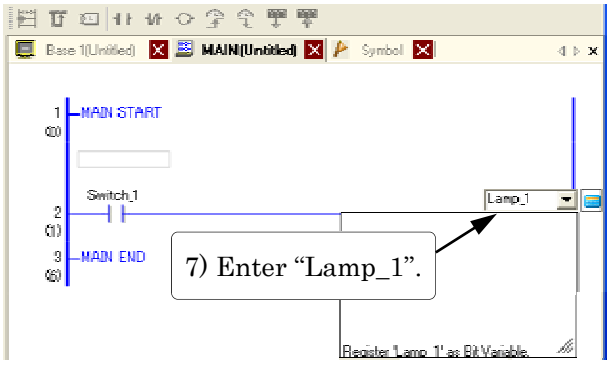


4) When a message box as left appears, click [Yes] to register the variable.

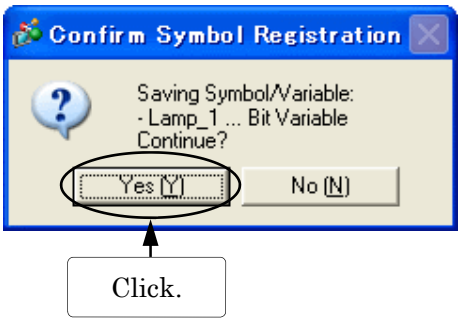


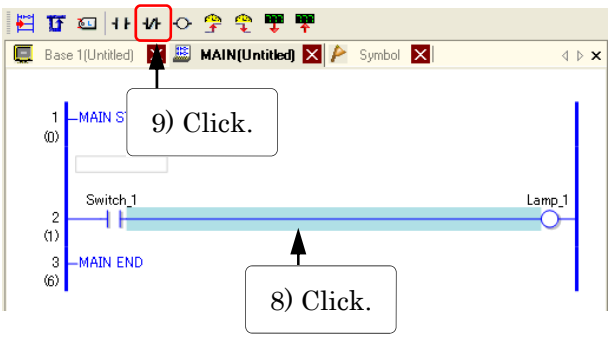
5) Click Rung 2.

6) Click OUT (Output Coil) .



7) A coil is inserted.
Enter “Lamp_1” for its variable name and register it as a variable.

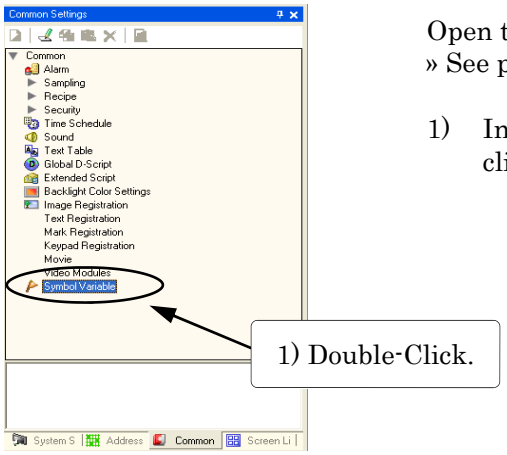




8) Click Rung 2 between “Switch_1” and “Lamp_1”.

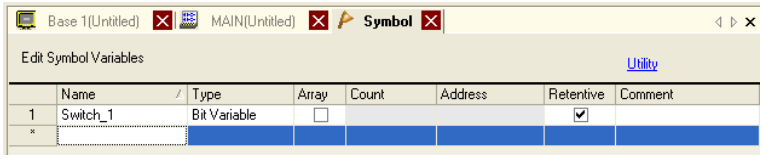
9) The rung is inverted blue.
Click NC (Normally Close Contact) .

Registering variables in the list of Symbol Variables in advance



Open the “Symbol Variables” settings window.
» See page 28

1) In the “Common Settings” window, double-click [Symbol Variables].



2) 3) 4)

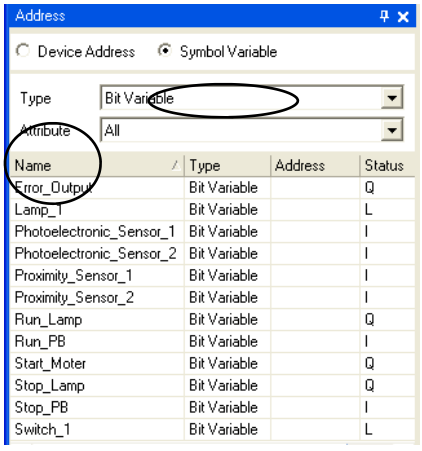
The “Edit Symbol Variable” window opens.

2) Enter a variable name in Name.
E.g.) Switch_1

3) Select its variable type.
E.g.) Bit Variable

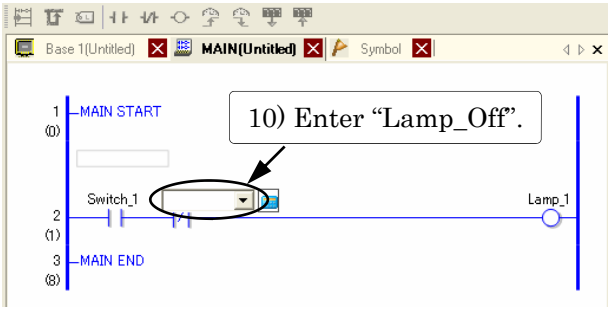
4) Check “Retentive”.

» See page 23 for the details of each setting.

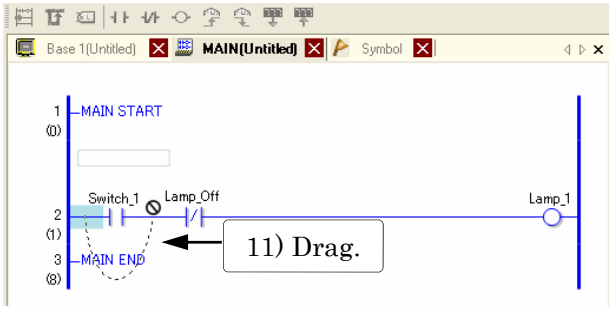


You can check the created variables in the “Address” window.
Variables created on the logic program or in the I/O settings are also added in the lists of Symbol Variables and “Addresses” automatically.

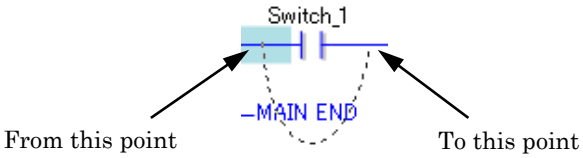
Check “Symbol Variable” in the “Address” window and specify Type and Attribute.



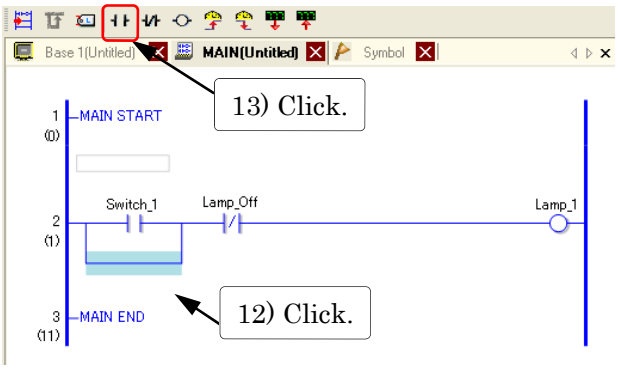
10) Enter the variable name.
When a message box appears, click [Yes] to register the variable.



11) Drag the mouse from the left of the Normally Open Contact and release it on the left of the Normally Close Contact when the mouse pointer turns into an arrow.

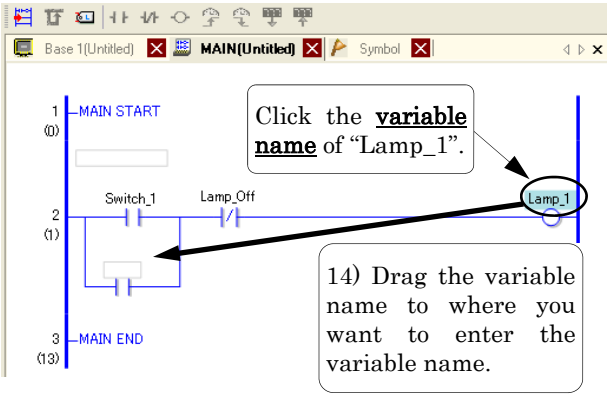


An OR circuit is inserted with the Normally Open Contact put between the branching points.



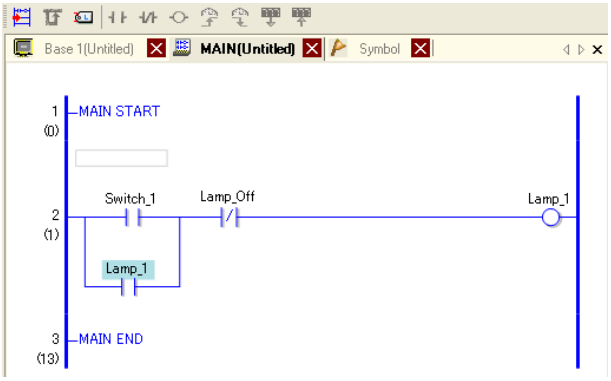
12) Click the bottom of the branched rung.

13) Click the Normally Open Contact .



14) Enter the variable name.

You can enter the variable name not only by entering directly from the keypad, but also by dragging and dropping the variable name, Lamp_1, that already exists on the logic program.

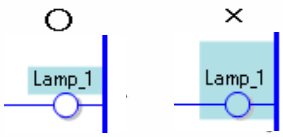


Automatic Hold Circuit is created completely.

Reference!

To drag and drop the variable name, select the **variable name only**.

If you select it with the instruction, you cannot drag it.



Memory Size of Variable

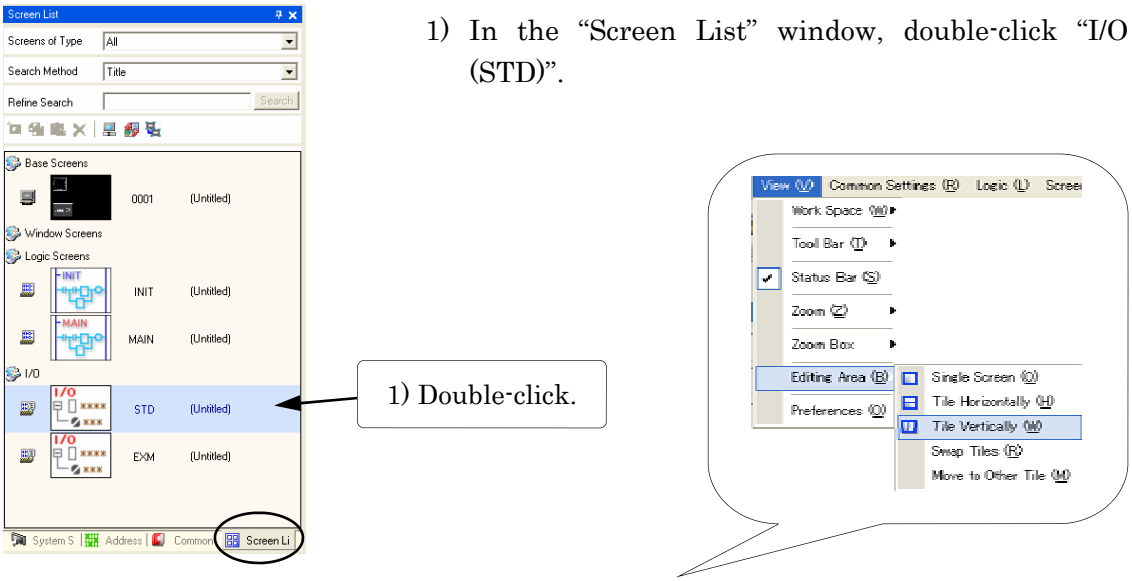
Tips

The amount of memory available to the LT for variables is limited to 32KB. Refer to the following table to find the amount of memory used by each variable.

Variable Type	Memory Used (Unit:Byte)
Bit	12
Bit Array	20 + (No. of elements × 12)
Integer	8
Integer Array	20 + (No. of elements × 8)
Real	16
Real Array	20 + (No. of elements × 16)
Timer	48
Counter	80

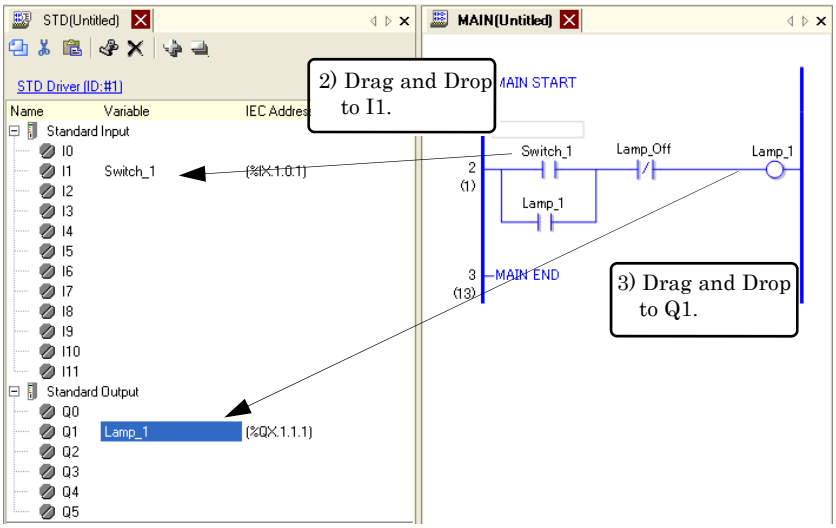
* No. of elements: size of an array » See page 66. Array

Specify destinations for I/O since the variables that you have created earlier have not been allocated to I/O.



1) In the “Screen List” window, double-click “I/O (STD)”.

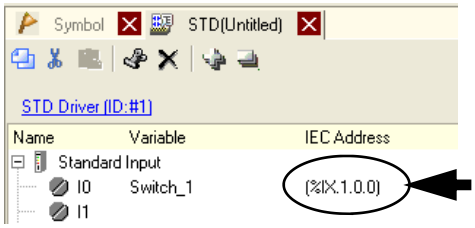
* To work on settings easily, use the “Tile Vertically” feature.

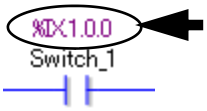


Allocate variables to the terminals which actual inputs and outputs are connected to on the I/O screen.
Drag and drop variable names from the logic program or the “Edit Symbol Variable” window to I/O screen.

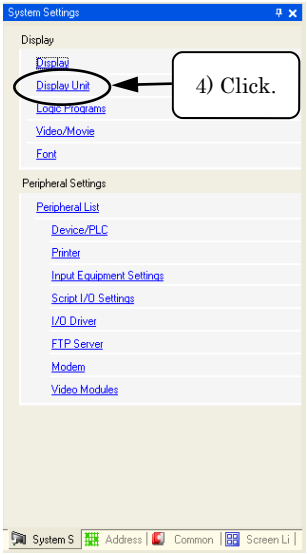
In this exercise, allocate as followings.
2) “Switch_1” to I1.
3) “Lamp_1” to Q1.

When you finish allocating variables, I/O addresses (location of terminal where I/O is allocated) show on the logic program and the I/O screen.
» See page 26 for Identifying I/O address

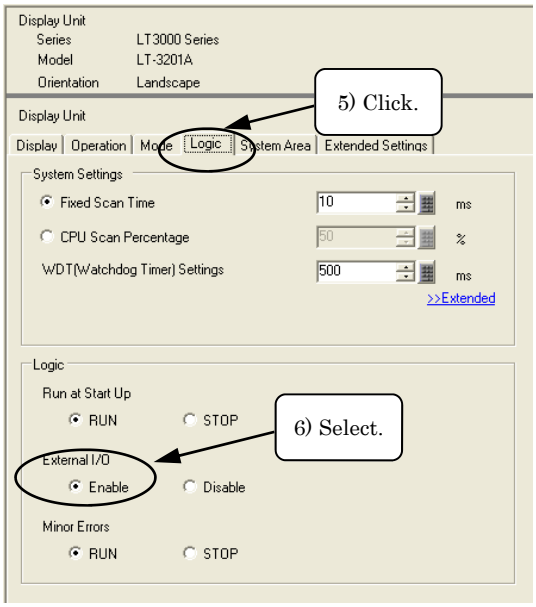




Important! Make a setting to enable I/O.



4) In the [System Settings] window, click [Display Unit].



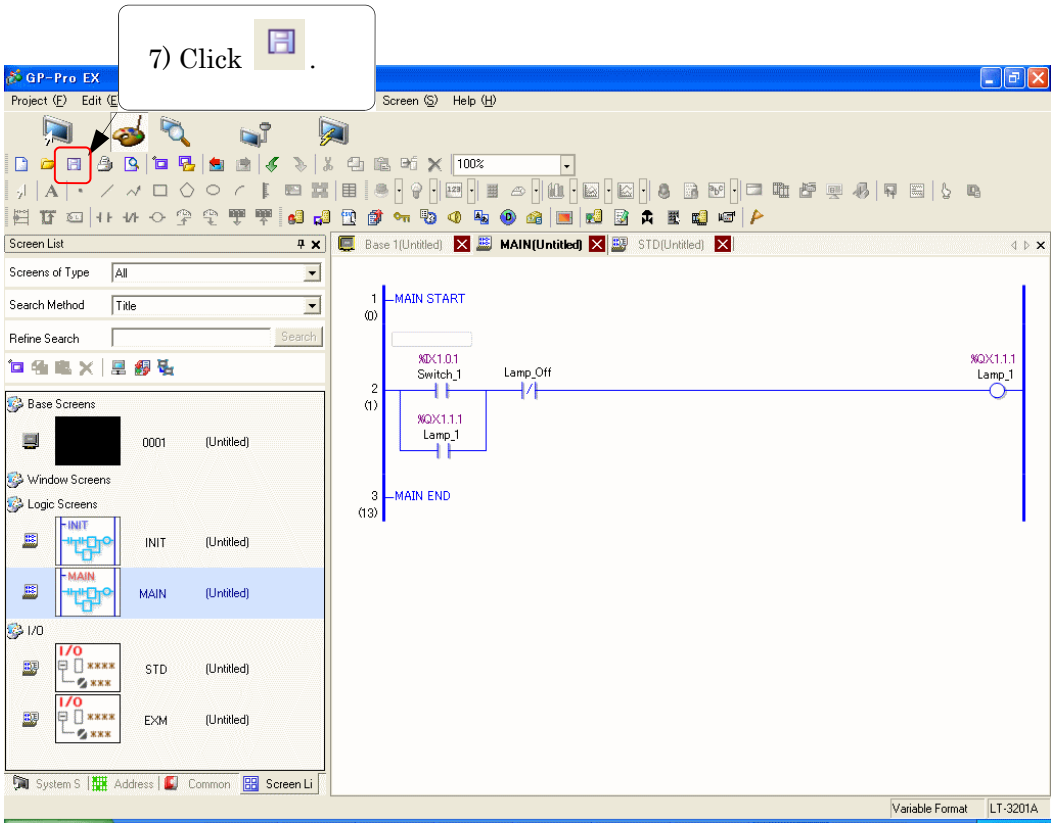
5) Click the [Logic] tab.

6) On the window as left, enable [External I/O] in [Logic].

External I/O is enabled by default.

Important! Save the Logic Program.

7) Save the created logic program.



Enter the location to save the file and the file name.

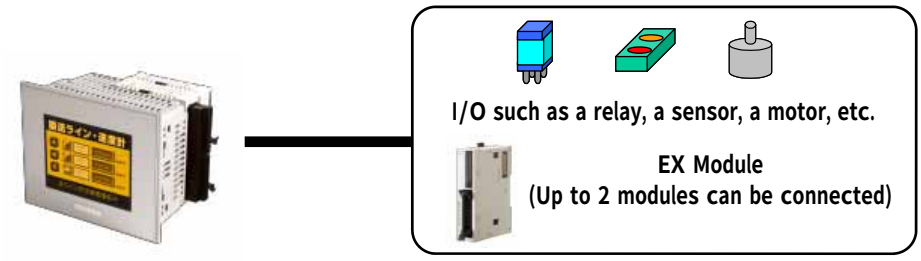
- Save in: Database (Default)
- File name: test

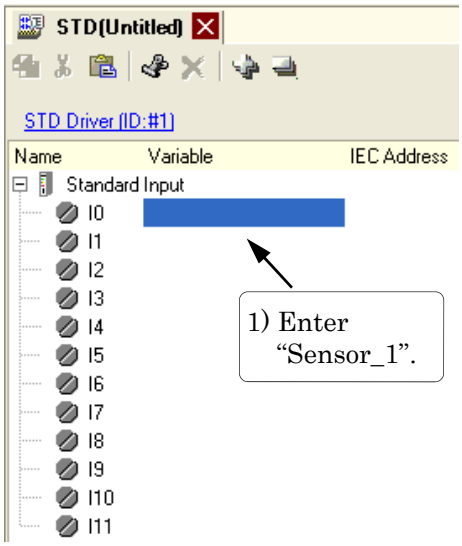
This is the end of the setting procedure to create a logic program.

Allocating variables from external I/O to a logic program

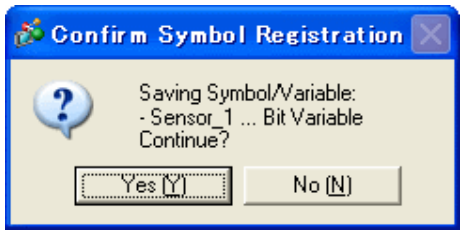
Tips

If you have a certain type or number of the external I/O, you can register variables, which are registered in the list of variables, on the I/O screen first. You can paste them on the logic program afterward.

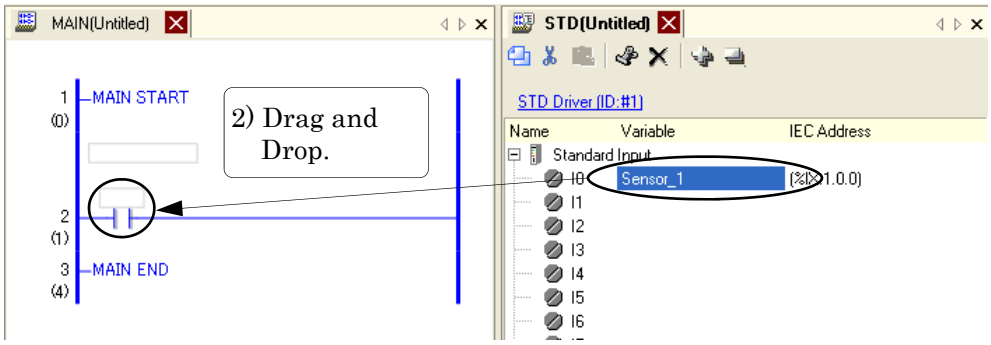




1) Register variables to the external I/O.
Double-click ▬ part of the terminal to allocate the variable to, and enter the variable name.
For example, if you enter "Sensor_1", the following message appears, and the variable name is registered in the list of variables after clicking [OK].

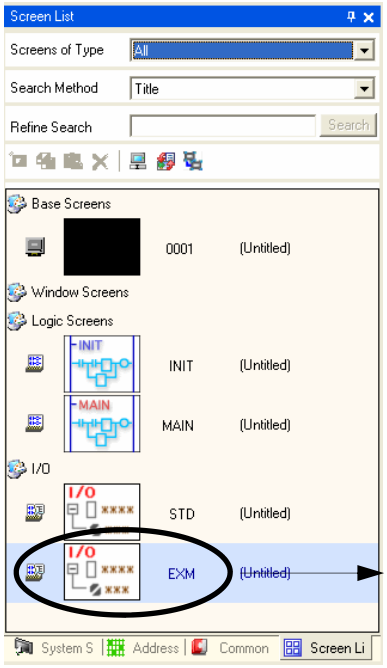


2) Allocate variables to the logic program.
Drag and drop the variable from " Sensor_1" in the I/O screen to the instruction in the logic program.

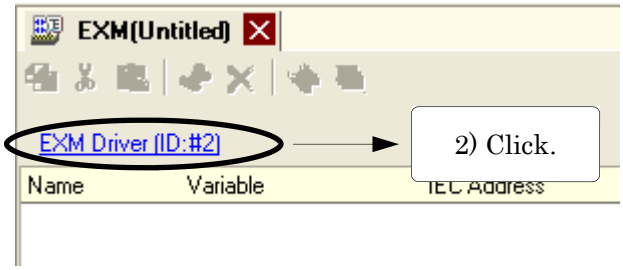


EX Module

Reference Attaching EX Module on the back of the LT enables you to input thermocouple on the I/O other than the standard/analog I/O. Make settings as follows depending on the type of each EX Module.

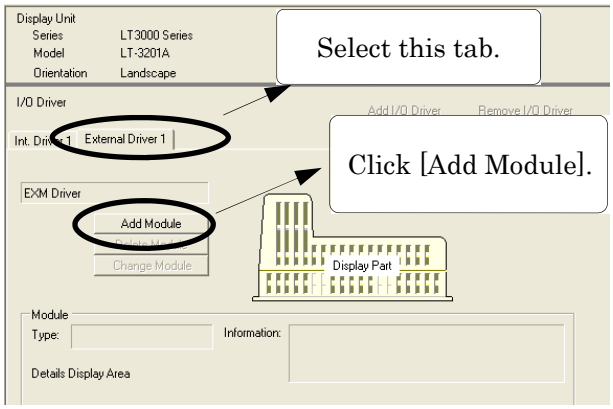


1) Add EX Module.
In the "Screen List" window, double-click "I/O (EXM)".



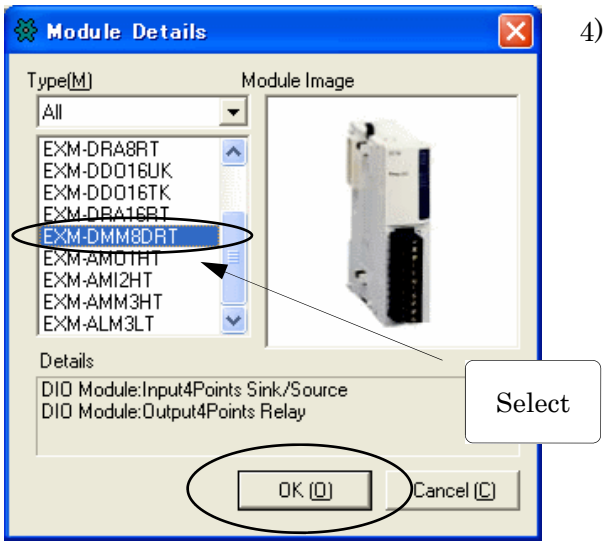
2) Click "EXM Driver (ID:#2)".

Continued on the next page →



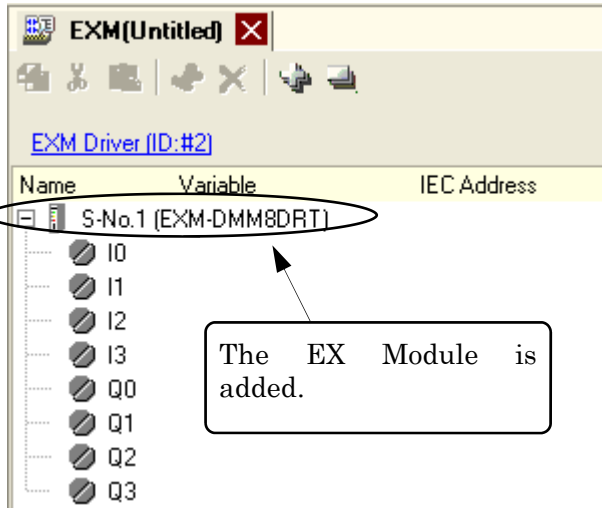
3) Set I/O driver.

Select the [External Driver 1] tab and click [Add Module].



4) Set Module Details.

Select an EX Module to use and click [OK].



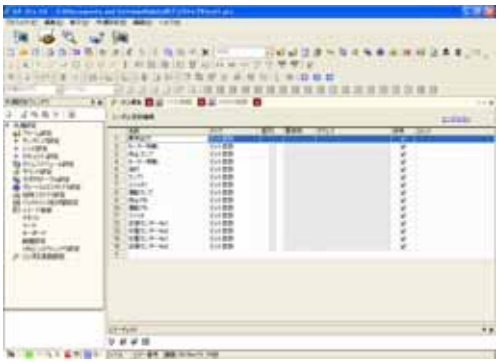
5) The EX Module is added on the I/O screen (EXM).

Set the required I/Os.

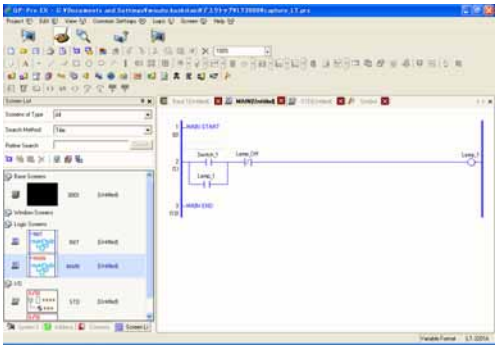
Reference

Registering Variables

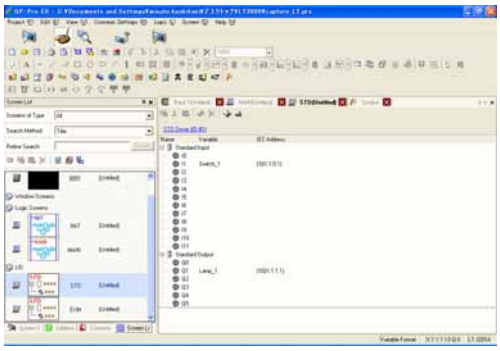
There are three ways to register variables as below.
1) Edit Symbol Variable Window 2) Logic Screen 3) I/O Screen
Variables registered in any way can be referred in **the list of Symbol Variable** or **the "Address" setting window.**



1) Edit Symbol Variable Window



2) Logic Screen



3) I/O Screen

You can start programming on any screen/window, since variables on these screens/windows can be dragged and dropped to each other.
It enables you to create a program efficiently!

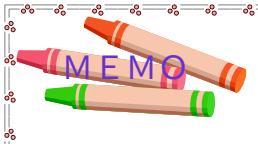
E.g.1: Register required variables in the Edit Symbol Variable window in advance and drag and drop them from the window to the logic screen or the I/O screen.

E.g.2: Enter variables for I/O on the I/O screen in advance, and drag and drop to the logic screen. » See Page 38.

E.g.3: Start with creating the logic program, enter variables on the screen and make I/O settings for variables which require to be allocated to external I/O.

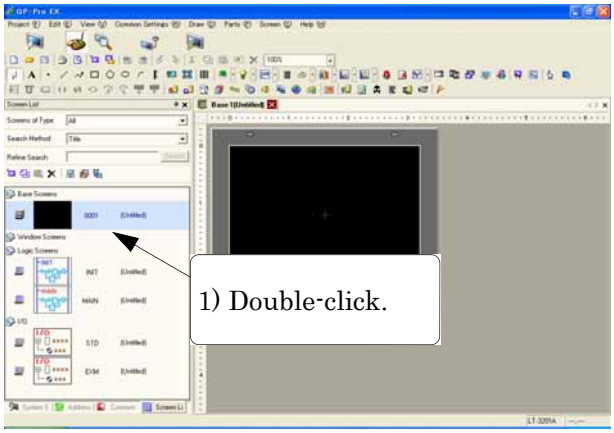
• • • etc.

*** Variables can be also created on the base screen.**


MEMO

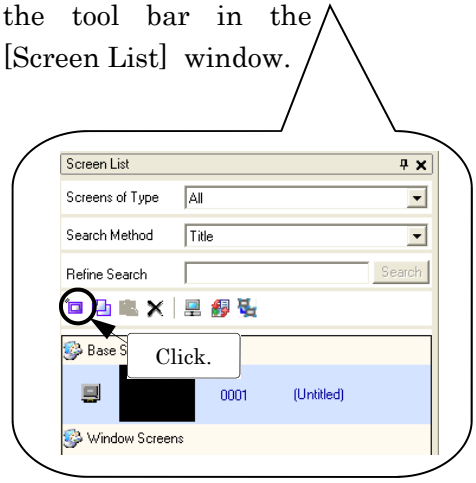
3-1-2. Create Screen

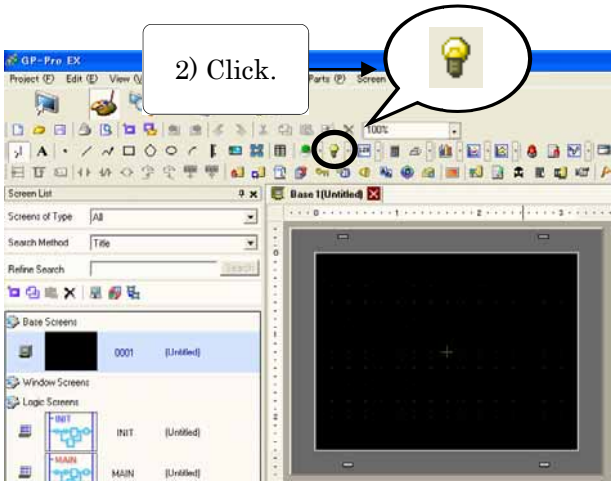
Display contacts and coils on the logic as switches and lamps on the screen.



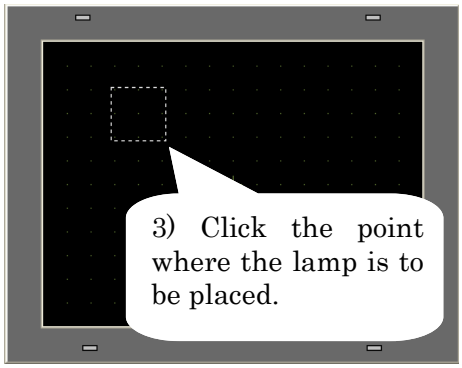
1) In the “Screen List” window, double-click the Base Screen.

To create a new base screen, click “New Screen” on the tool bar in the [Screen List] window.

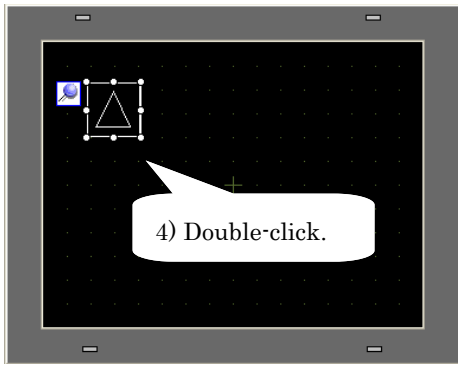




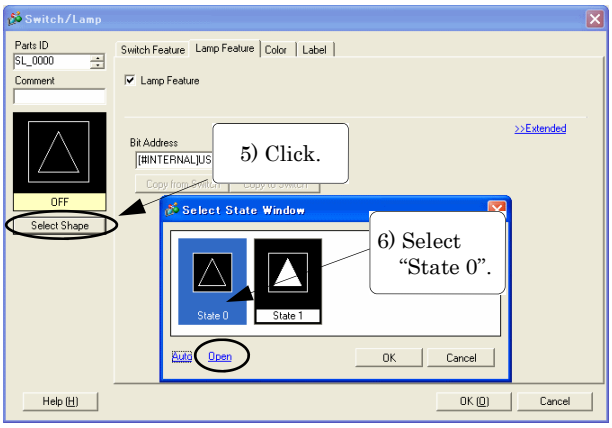
2) Click Lamp on the tool bar.



3) Place the lamp on the base screen.

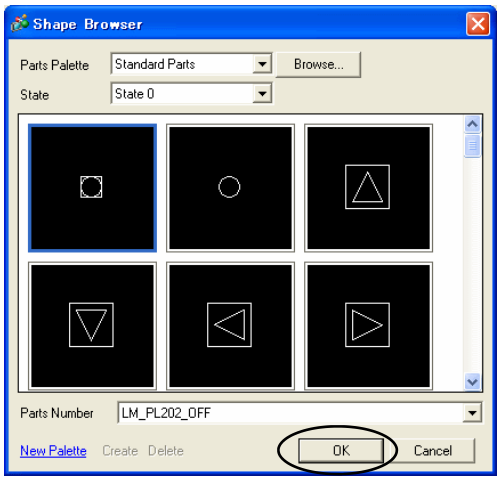


4) Double-click the placed lamp.

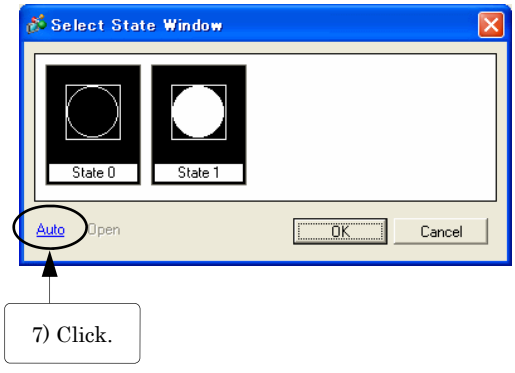


5) The "Switch/Lamp" dialog box appears.
Click [Select Shape].

6) The "Select State Window" opens.
Select "State 0" and click [Open] to open the Shape Browser.

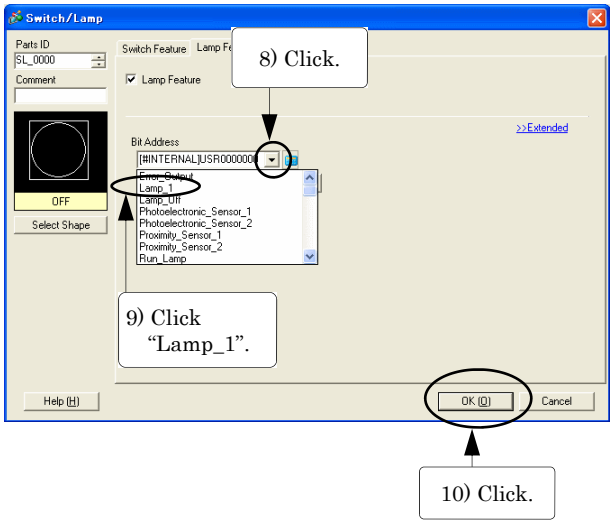


Select "LM_PL202_OFF" and click [OK].



7) Click [Auto], and the shape of "State 1" is selected automatically.

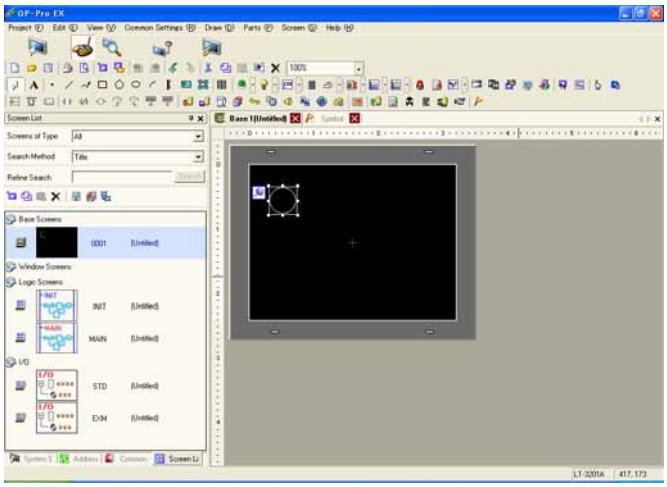
You can also specify the shapes from the Shape Browser by clicking [Open] for both of "State 0" and "State 1".



8) Enter a bit address to light on the lamp.
Click ▼ on the right of the Bit Address input field to show the pull-down menu. The list of variables registered in the logic program.

9) Select "Lamp_1".

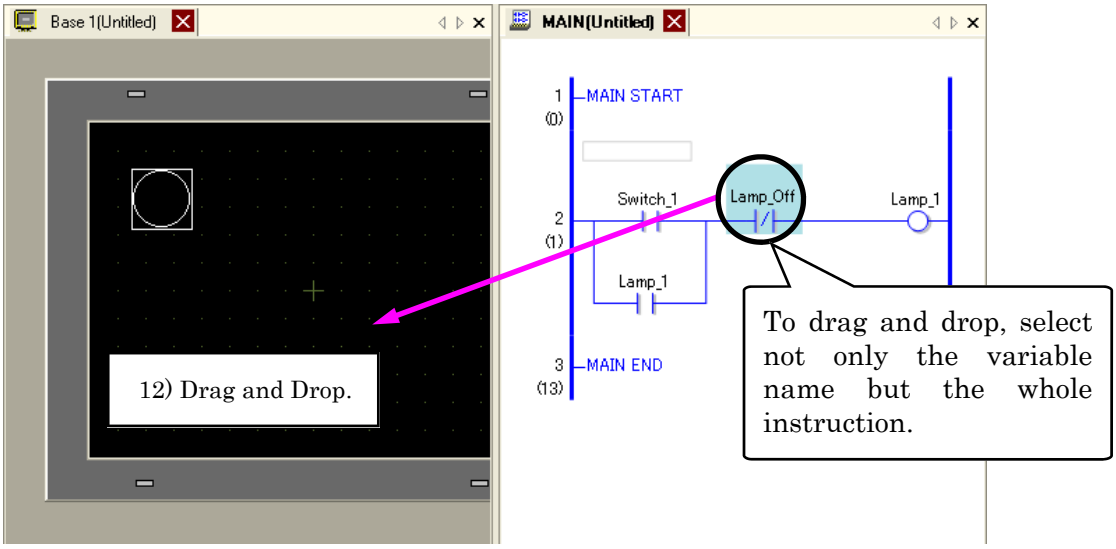
10) Click [OK].



11) The settings for the lamp are completed.

12) Place a switch to turn off the lamp.

Although you can make the switch from the parts icon on the tool bar as well as the way that you have made the lamp, here in this exercise, drag and drop the variable, Lamp_Off, on the logic program to the base screen.

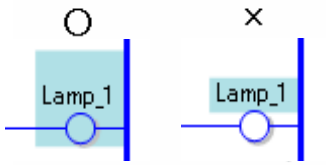


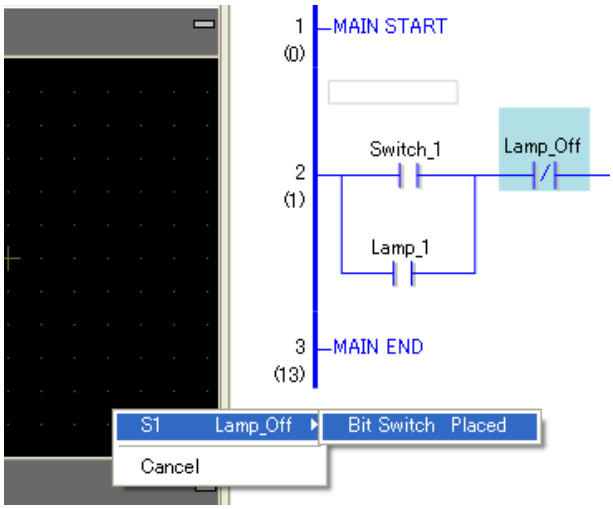
Important!

To make contacts or coils on the logic parts by dragging and dropping them **on the base screen**, select **the whole instruction**.

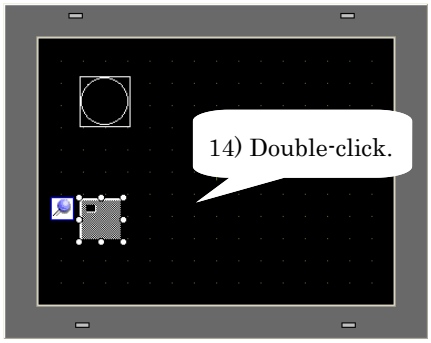
Selecting only the variable name does not enable you to drag and drop it.

(Please note that this differs from the way to allocate variables.)

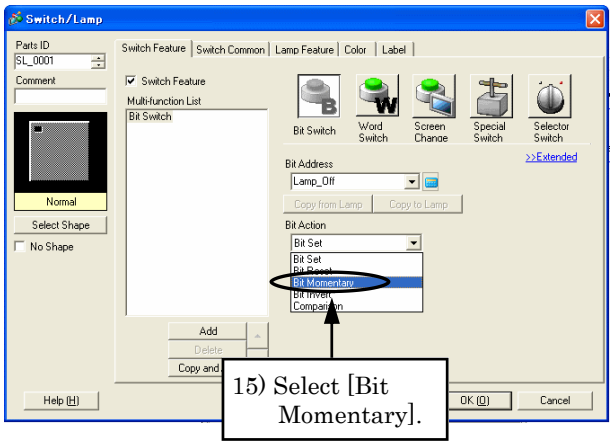




13) Select “S1 Lamp_Off” → “Bit Switch Placed”.

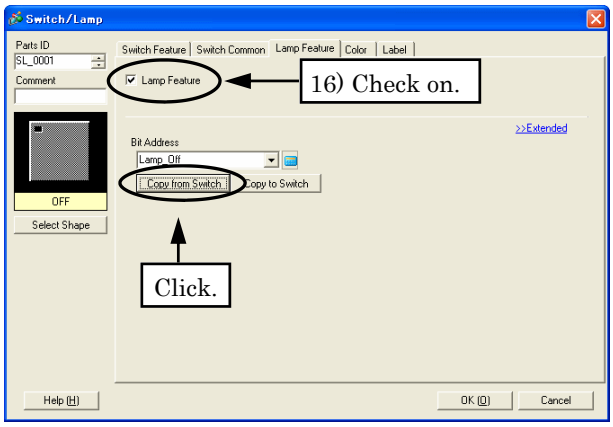


14) Double-click the placed bit switch.

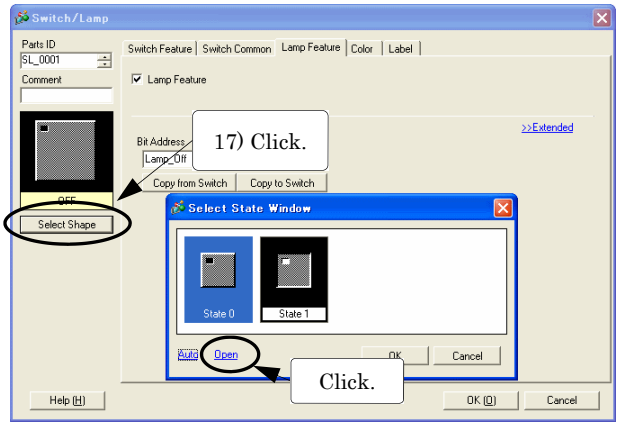


15) The "Switch/Lamp" dialog box appears.
Select [Bit Momentary] for Bit Action.

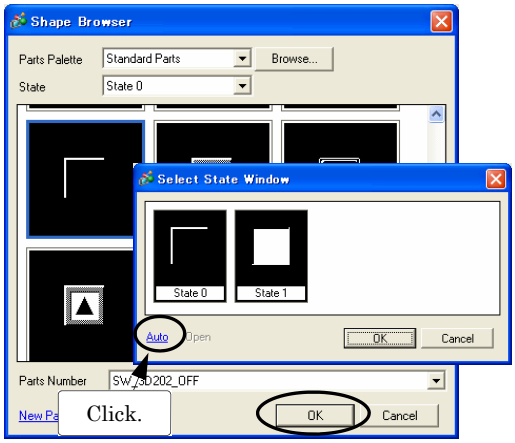
- Bit Set: The bit turns on.
- Bit Reset: The bit turns off.
- Bit Momentary: While the switch is touched, the bit is on.
- Bit Invert: Touch the switch and the bit is alternated (On-Off or Off-On).



16) Select the "Lamp Feature" tab and check [Lamp Feature].
Click [Copy from Switch].



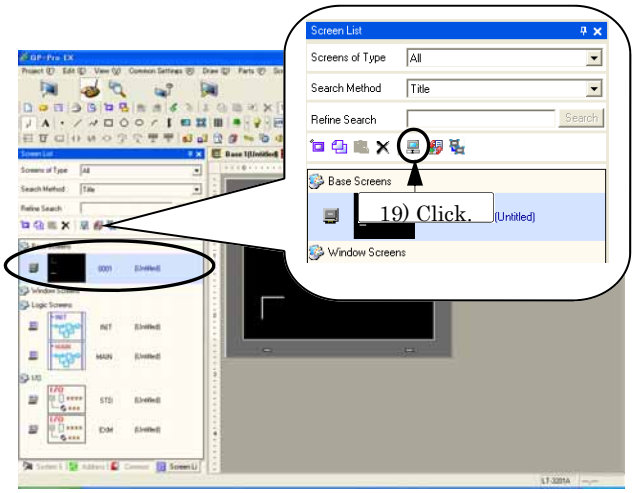
17) Click Select Shape .
Select "State 0" in the "Select State Window", and click [Open].



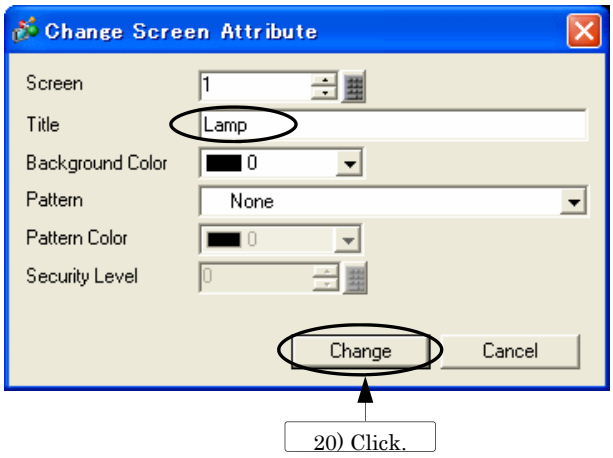
18) Select “SW_3D202_OFF” for the shape of the switch from the “Shape Browser” and click [OK].

Select [Auto] in the “Select State Window”.
Another shape is selected automatically.

Click [OK] to finish the settings of the switch.



19) To title the base screen that you have created, select the screen and click [Change Attributes] in the “Screen List” window.



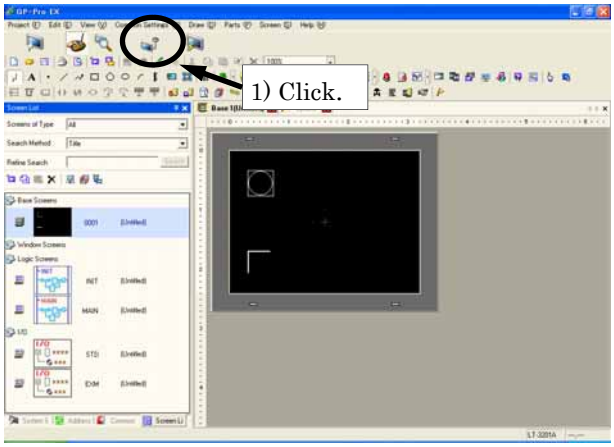
20) The “Change Screen Attribute” window opens.
Change the screen number, title, background color, etc.
Enter “Lamp” for the title and click [Change].

The title for the base screen is changed to “Base 1 (Lamp)”.

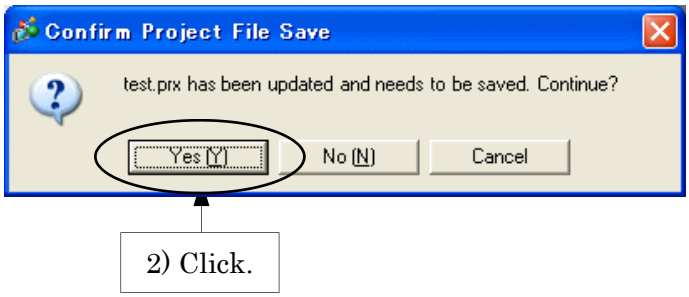
That is all for programming an automatic hold circuit. Next exercise is transferring data to the unit.

3-1-3. Transfer Created Project

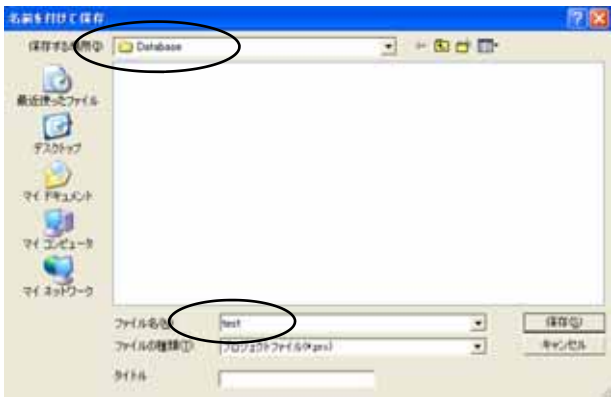
Transfer a project file.



1) Click [Transfer Project]  on the state bar of GP-Pro EX .



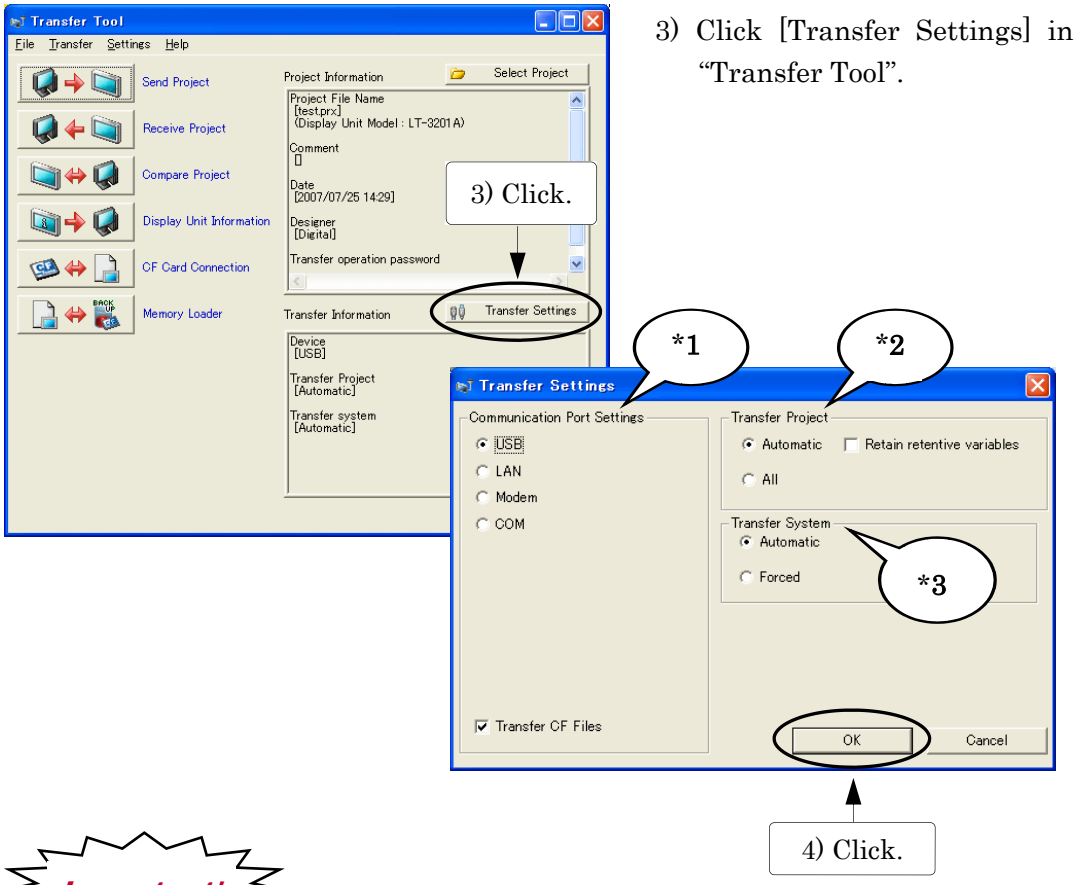
2) When a message box as left appears, click [Yes].



To transfer the project file, you need to save it with a file name in advance.

What is Project File?

A project file is a file which contains data of screens and the logic.
You can transfer it to the LT after combining the created logic and screens and saving it on the PC with a file name. The extension ".prx" is allocated to the end of the file name.



3) Click [Transfer Settings] in the "Transfer Tool".

Important!

***1 Communication Port Settings**

Select "USB" to transfer the data with a USB transfer cable in this exercise.

***2 Transfer Project**

Specify "Automatic" in this exercise.

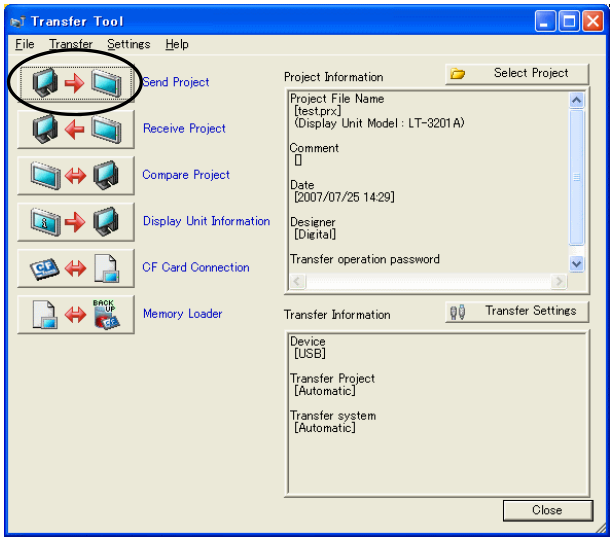
- Automatic — The project to be transferred is compared with the project on the GP. If they are the same project, only updated or added screen data are sent.
- All — The whole project to be transferred is sent. The existing project on the GP is overwritten.
- Retain retentive variables — The project data is transferred with current variable values retained.
  If the check box is not selected, data in the variables will be initialized.

***3 Transfer System**

Specify "Automatic" in this exercise.

- Automatic — When sending the project, the system versions of the GP and GP-Pro EX are compared automatically, and the system program, protocol, and the fonts are downloaded to the GP as necessary.
- Forced — After formatting the GP when sending a project, system programs, protocol programs, and fonts are forced to download to the GP. These are downloaded even if the GP-Pro EX system version of which you are transferring the data is older than the existing system.

4) Click [OK] if the settings are as above.

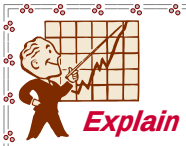


5) In the "Transfer Tool", click [Send Project].

When transfer is completed, confirm that the lamp and the lamp off switch are displayed on the LT screen.

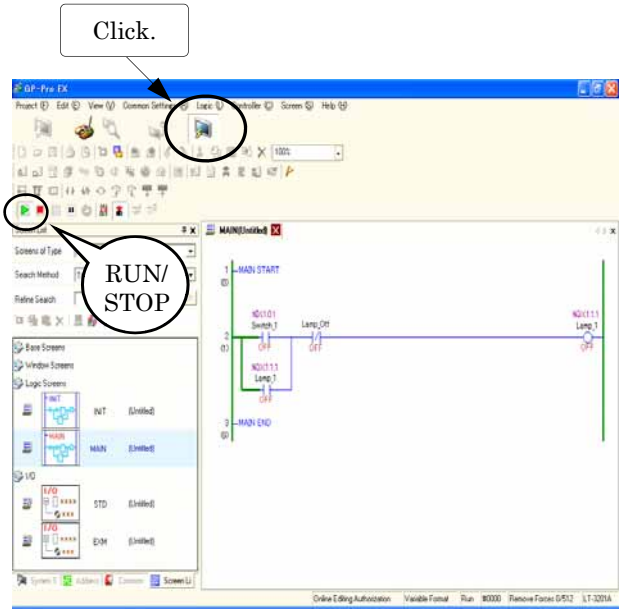
3-1-4. Check Performance

Check the performances on page 32 monitoring the logic program.



Monitor Mode

You can view the performances of each variable on the logic program after transferring data.



Click [Monitor] on the state bar of GP-Pro EX .

In the monitor mode, the lines with signals passing on are displayed in green. You can run or stop the logic program by buttons on the menu bar.

You cannot edit the logic program in the monitor mode, even though you can switch bits on and off or change value data. To edit the logic program, click [Monitor] again and return to the programming mode.

3-2. Counter

In this section, create a program to display a counter. A counter instruction, a positive transition instruction, how to display numeric values on the screen, and how to input numeric value on the keypad are introduced.
(Use the project file that you have created in the previous section and add the program on it.)

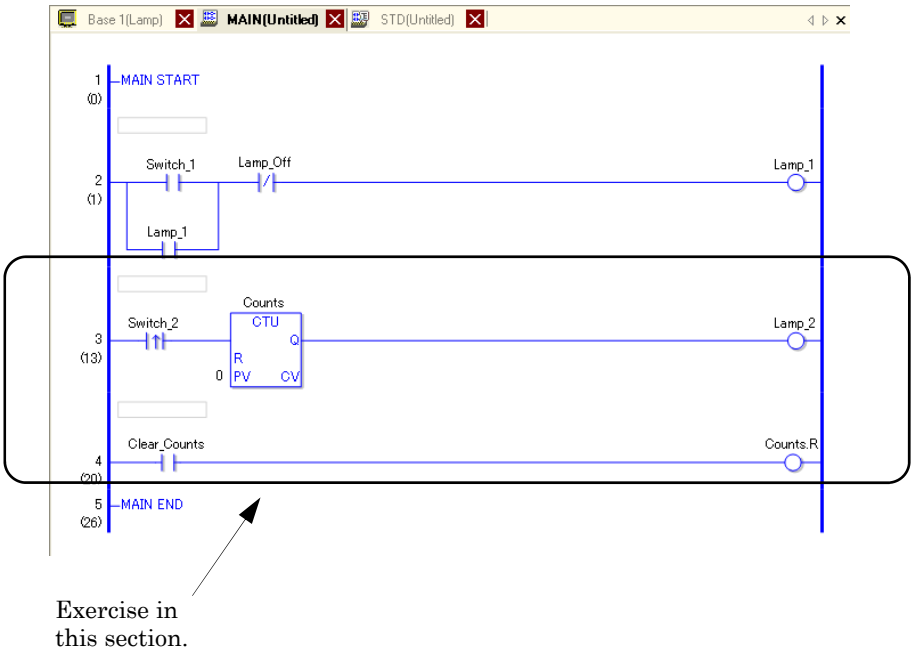
1) Every time the switch (IN2) on the I/O panel turns on, the current value is counted up 1 by 1.

2) When the current value reaches to the preset value, the lamp (OUT2) on the I/O panel turns on.

3) When the “Clear Count” switch on the screen is touched, the current value is cleared.

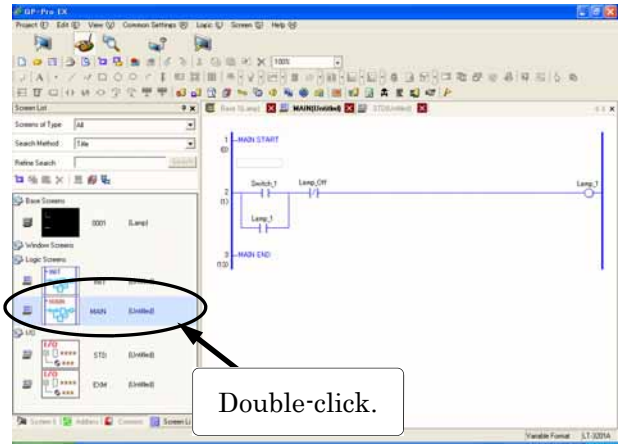
Screen Sample

Logic Program Sample



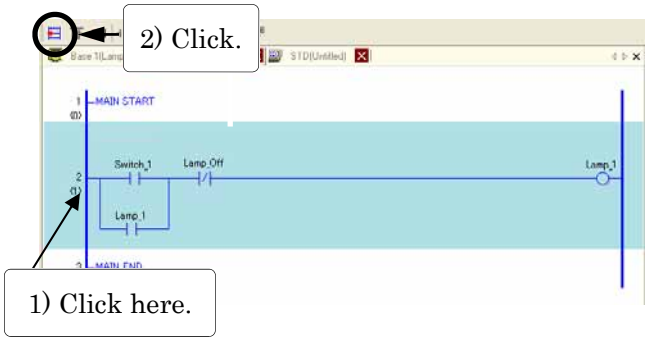
3-2-1. Create Logic Program

How to use a positive transit instruction, “PT”, and an up counter, “CTU” are introduced.



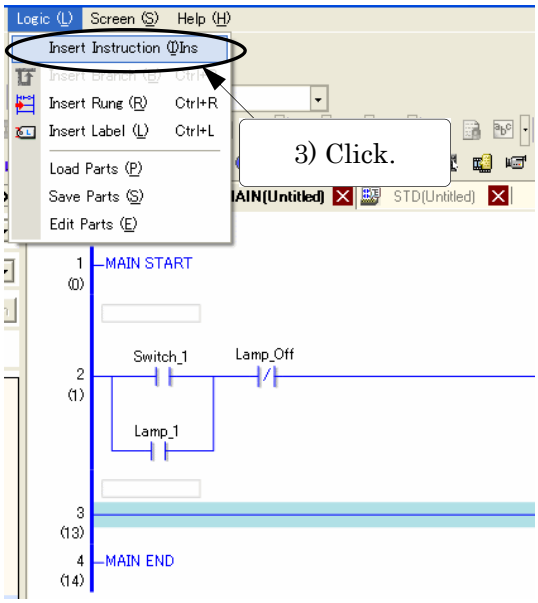
Open the logic screen, MAIN, in the “Screen List” window.

(Continue to use the project file, “test.prx”, that you have created in the previous section.)



1) Click the edge of Rung 2 to invert the whole area of Rung 2.

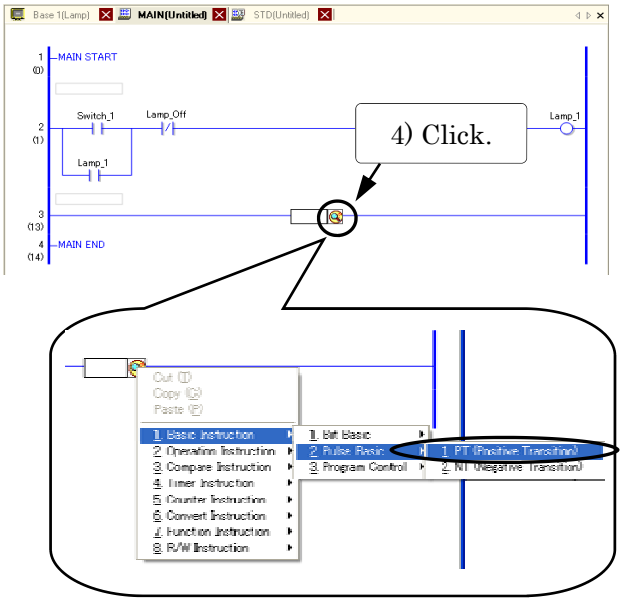
2) Click [Insert Rung] .



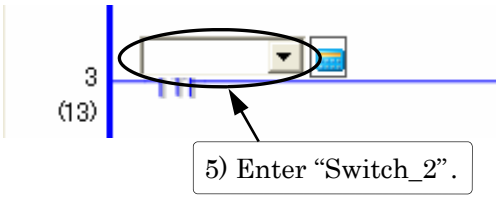
Insert an instruction, Positive Transition, onto Rung 3, which has been inserted.

3) Click the [Logic] menu, and then [Insert Instruction].

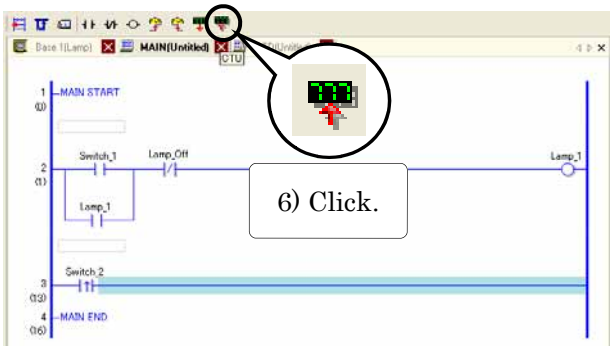
* You can also insert an instruction by double-clicking the rung to insert it on.



4) Click the icon on the right and select “1. Basic Instruction” → “2. Pulse Basic” → “1. PT (Positive Transition”.



5) A PT instruction is inserted.
Enter “Switch_2” for its variable name and register it.

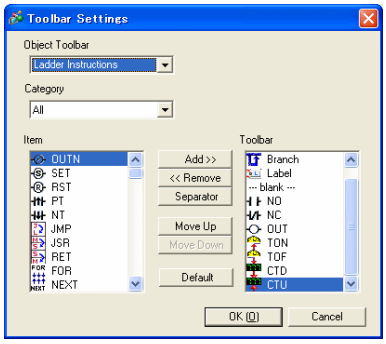


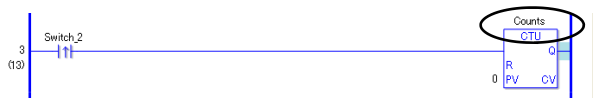
6) Click the right of the PT instruction to invert it blue. Click CTU (Up Counter) to insert.

Reference!

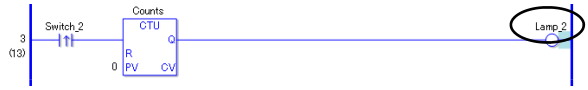
Edit Instruction Toolbar

You can add frequently used instruction icons on the toolbar with the [View] menu → [Preference] → [Toolbar] → [Toolbar Settings].

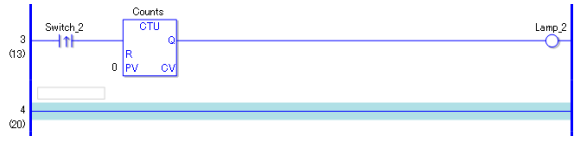




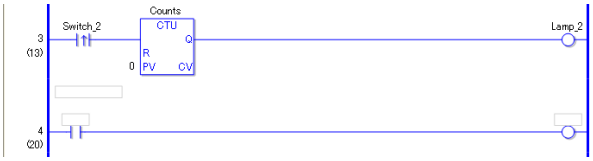
7) Enter “Counts” for its variable name and register it.
Click the right of the instruction and invert the rung blue.



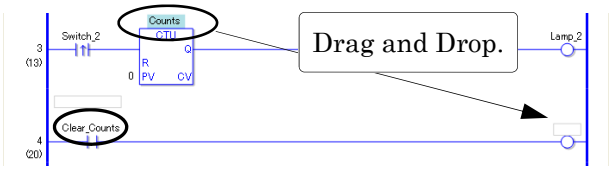
8) Insert OUT (Output Coil) and enter “Lamp_2” for its variable name.



9) Select anywhere on Rung 3 and click “Insert Rung” to add another rung.

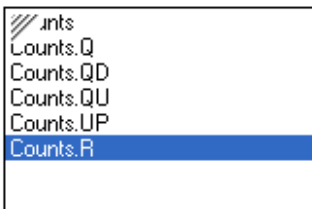


10) Insert an NO (Normally Open Contact) and an OUT (Output Coil) on Rung 4.

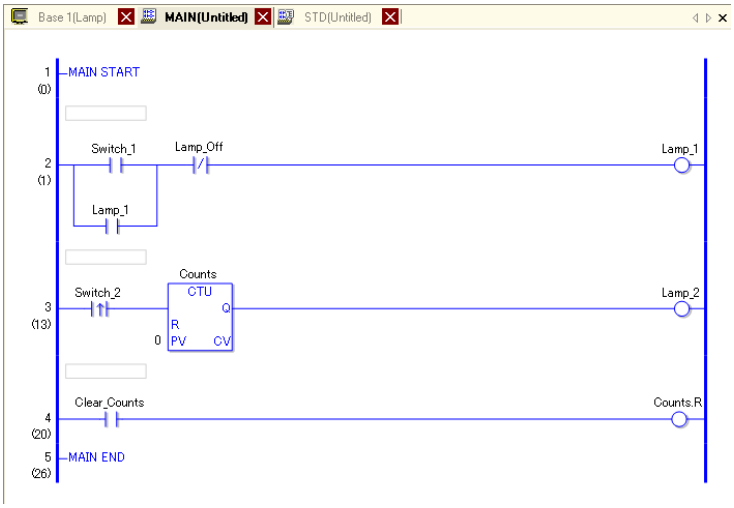


11) Enter “Clear_Counts” for the variable name of the Normally Open Contact.

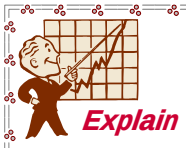
12) Drag and drop the variable name of “Counts” to the coil, and the following list appears on the coil.



Double-click “Counts.R”.



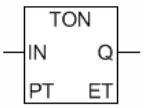
The program is completed.



Useful usage of timers and counters

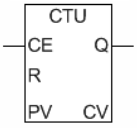
Timer and counter variables are consisted of the combination of multiple bits and of integer variables respectively. By allocating an extension after the variable name, each instruction can have the function as below.

Variable Name



Timer	Function
Variable Name.PT	Preset Time
Variable Name.ET	Elapsed Time
Variable Name.Q	Output Bit

Variable Name

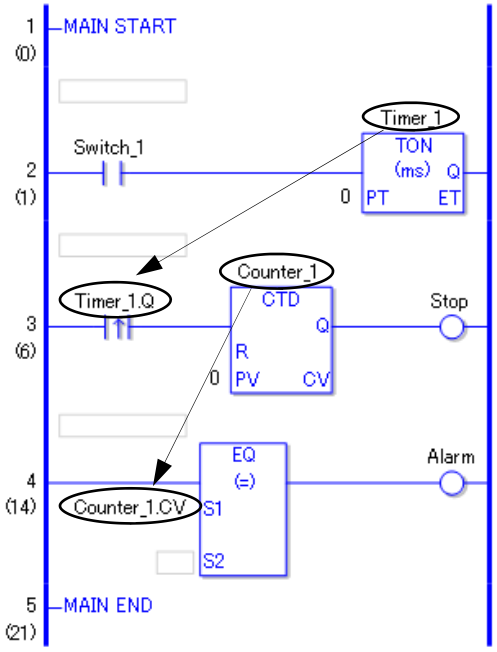


Timer	Function
Variable Name.PV	Preset Value
Variable Name.CV	Current Value
Variable Name.Q	Output Bit
Variable Name.R	Reset Bit

These variables with an extension can be dragged and dropped on the logic as well as other variables.

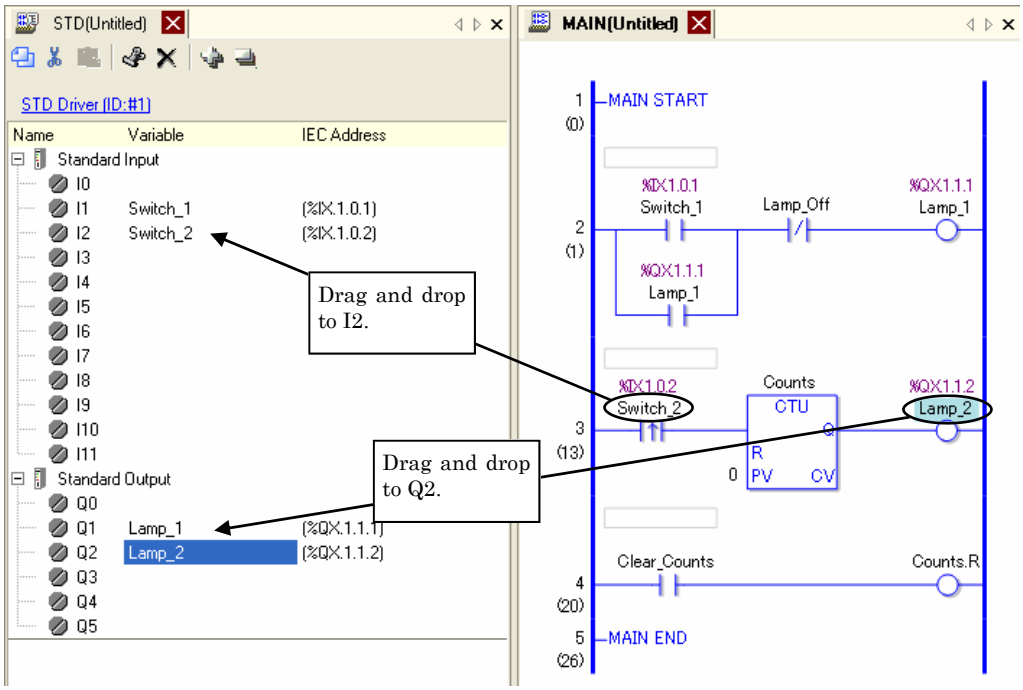
For example, this feature enables to make an output bit of the timer a contact on another rung, or to operate the current value of the counter on another rung….

E.g.



Allocate variables to external I/O.

Allocate “Switch_2” and “Lamp_2” to “I2” and “Q2” respectively in the way described previously.
» See page 38.



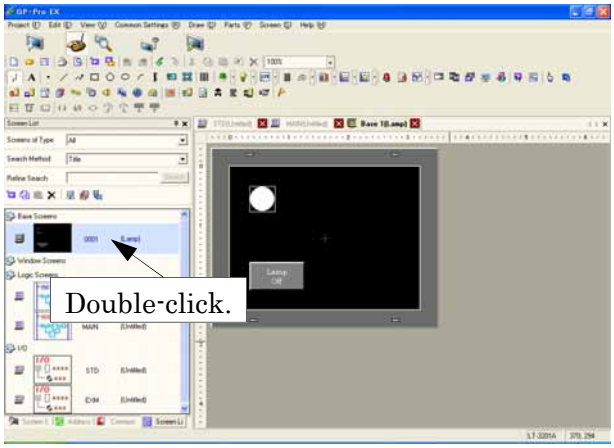
Important!

This is the end of this exercising in logic programming.

Be sure to save the project data.

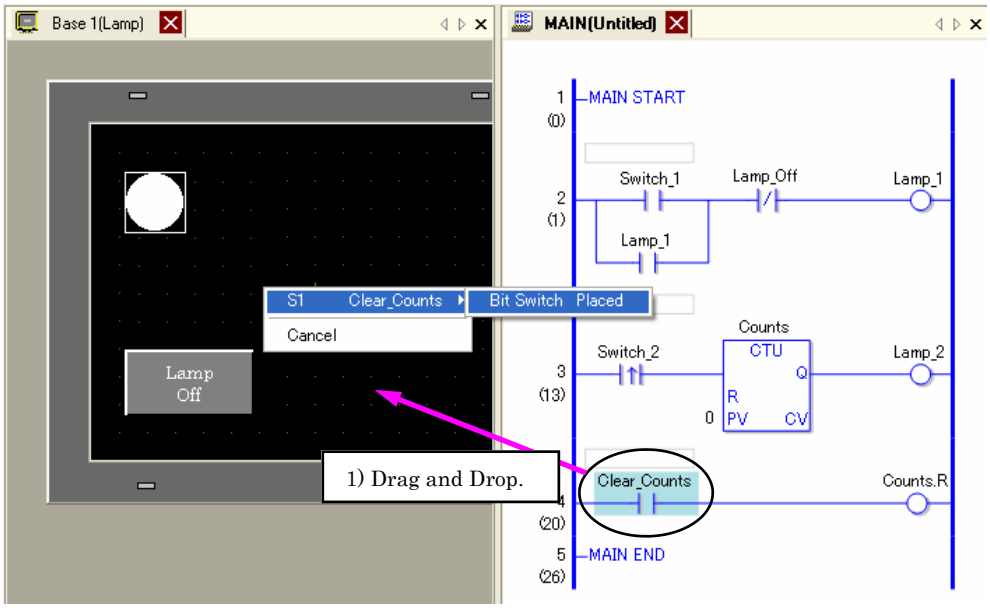
3-2-2. Create Screen

Create a screen with Data Display on it.

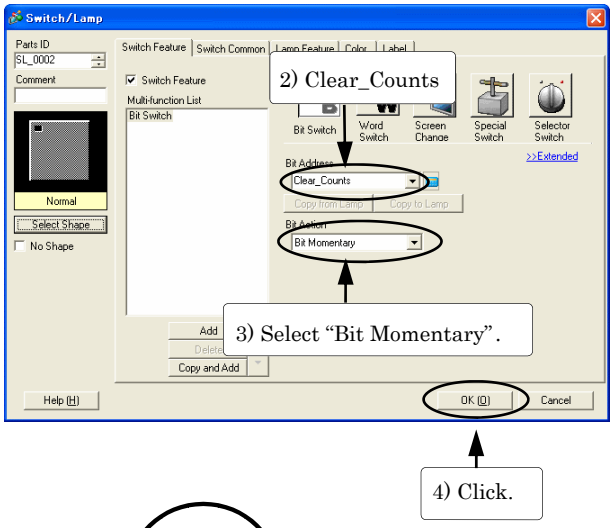


Open the base screen in the “Screen List” window.

The “Base 1 (Lamp)” screen that you have created appears.



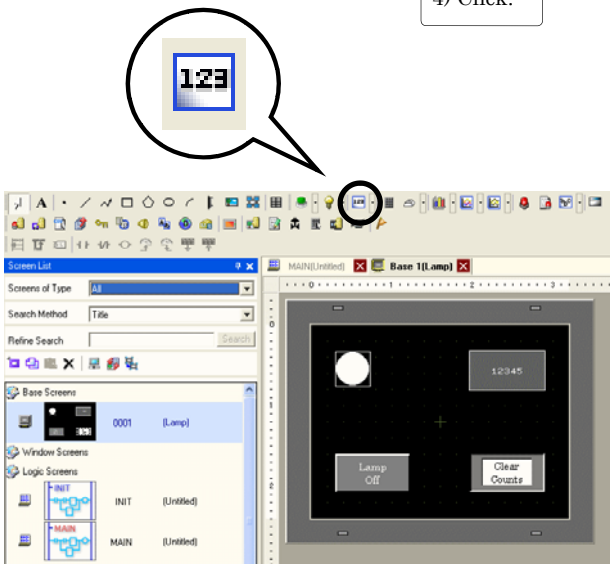
1) Drag and drop the **NO (Normally Open Contact)** symbol for “Clear_Counts” on the logic program to the base screen as above and select “Bit Switch Placed”.
» See page 49: Important.



Double-click the placed switch and the "Switch/Lamp" window will open.

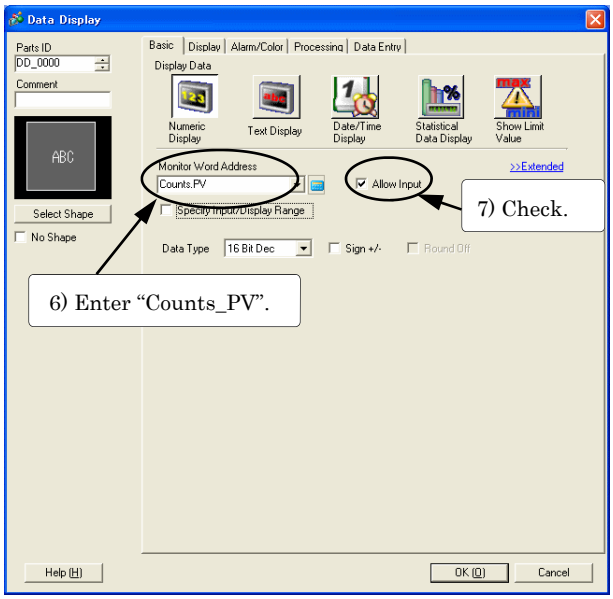
Set as below in this exercise.
2) Bit Address: Clear_Counts
3) Bit Action: Bit Momentary

4) Click [OK] and place the switch on the right bottom of the screen.



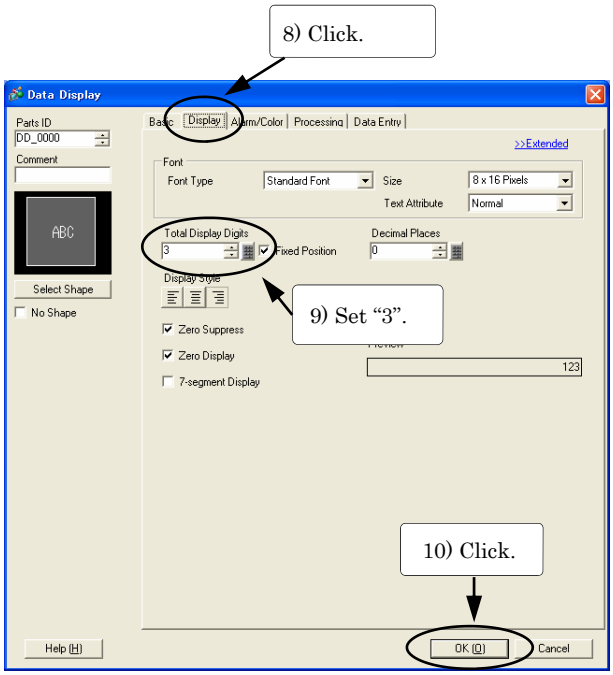
Next, place a part to enter the preset value on the screen.

5) Click Data Display on the parts toolbar and place it on the screen.



Double-click the data display and open the "Data Display" window.

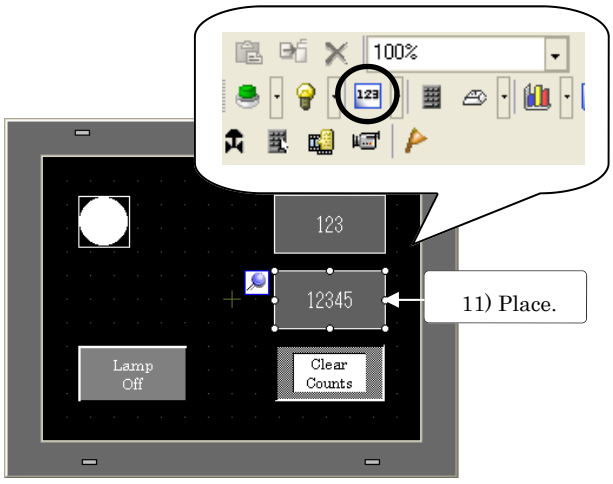
6) On the Basic tab, enter "Counts.PV" for Monitor Word Address.
7) Check [Allow Input].



8) Click the "Display" tab to set the display type.

9) Total Display Digits : 3
Decimal Places: 0
Font Size: 8 × 16 pixels

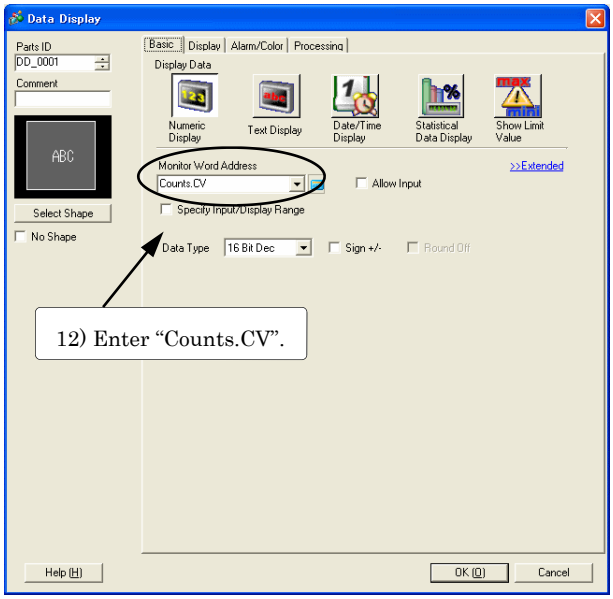
10) Click [OK] after making settings as above.



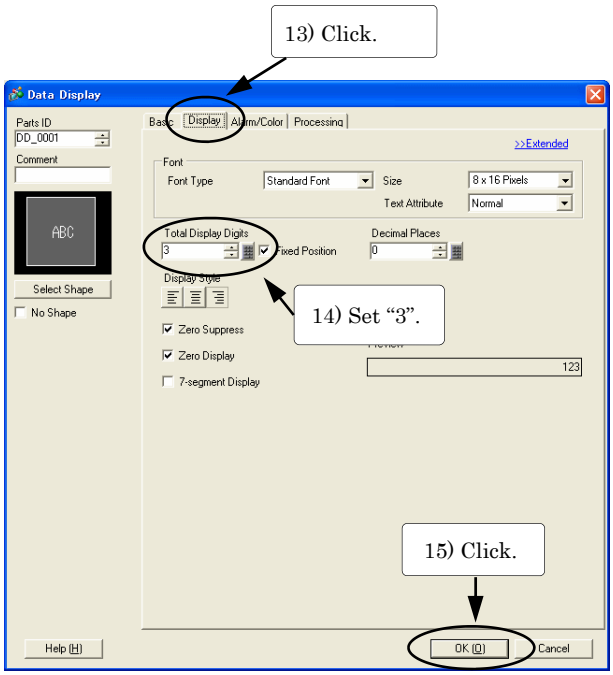
Create another data display.

11) Click [Data Display] on the toolbar and place another data display under the data display that you have placed earlier.

Double-click it to open the Data Display window.



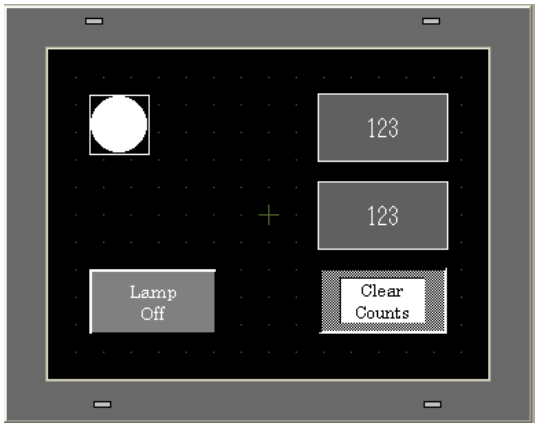
12) Enter "Counts.CV" for Monitor Word Address on the "Basic" tab.



13) Click the "Display" tab to set the display type.

14) Total Display Digits : 3
Decimal Places: 0
Font Size: 8 × 16 pixels

15) Click [OK] after making settings as above.



Two data displays are created on the base screen.

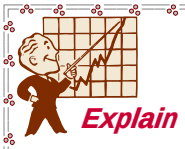
16) Save  the screen.

3-2-3. Transfer Created Project

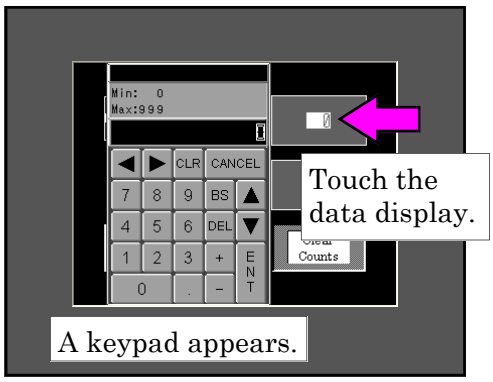
Click [Transfer Project] on the state bar to transfer the project.
» See page 52.

3-2-4. Check Performance

Check the performance after transferring the screens.
» See page 54 Monitor Mode.



Displaying Numeric Keypad



Check [Allow Input] in the "Data Display" setting window and place a data display on the screen, a keypad will appear when the numeric data display is touched during the LT is on.

* You can change the type of keypad or the position to display it by setting.

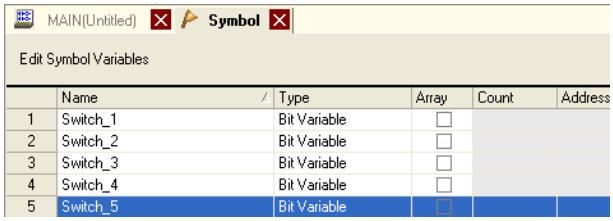
3-3. Advanced Programming

3-3-1. Array

An array is equivalent to consecutive device addresses of a PLC.
On GP-Pro EX, bits and numeric data are stored in the variables. » See page 22.
When a few decades of numeric data are required, for example, it takes a lot of effort to register all of the integer variables one by one, or is difficult to control the program memory.
For PLCs, the number of consecutive device addresses are specified starting from the top address. On the other hand, for GP-Pro EX, the data storage location for the number set in one variable name is specified and kept on the memory by using an array.
Please see the below example.

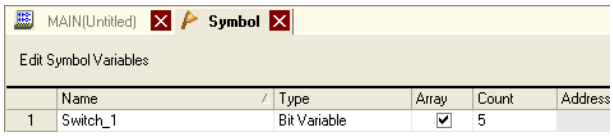
E.g.) A device has 5 switches for input. Create a variable for each switch.

■ Without Array used



It takes extra effort to register 5 bit variables. Also you might make a mistake in registration.

■ With Array used (Bit Array)



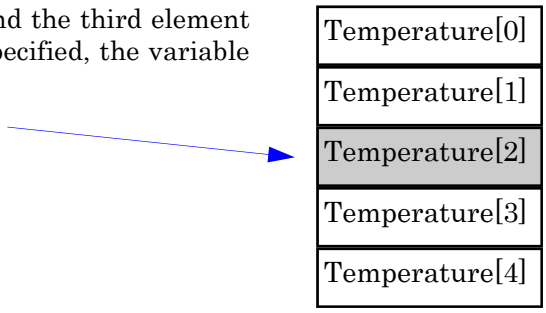
When an array is used, you can register multiple bit variables for one registration. It is useful for categorizing multiple sensors, switches, lamps, etc. by type.

There are 4 types of arrays as below.

- Bit Array
- Integer Array
- Float Array
- Real Array

To specify an element of the array, allocate [number] after the variable name.
For example, when the array size is 5 and the third element of the variable "Temperature" is to be specified, the variable is

Temperature[2]



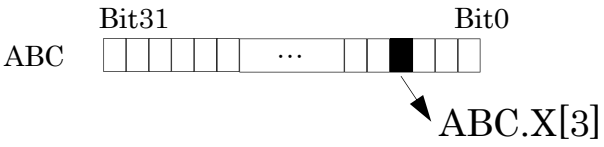
3-3-2. Modifier

An integer variable (32-bit) can be divided by adding a **modifier** after the variable name and used in the logic program as the followings.

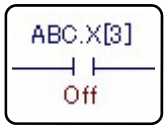
1) 32 bit data for every 1 bit
2) 4 byte data for every 8 bits
3) 2 word data for every 16 bits

1) Data for 1 bit (Modifier .X[n])

An integer variable is divided into 1-bits and handled as 32-bit device address.
Its value is either on or off.
E.g.) Specify the 4th bit of an integer variable, "ABC".



(e.g.)



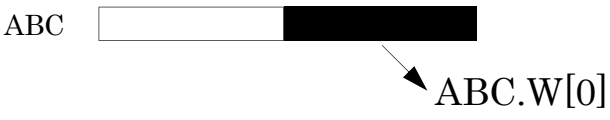
2) Data for 8 bits (Modifier .B[n])

An integer variable is divided into 8-bits and handled as 4-byte device address.
Its value is an unsigned integer from 0 to 256.
E.g.) Specify the 2nd byte of an integer variable, "ABC".

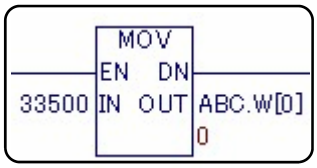
(e.g.)

3) Data for 16 bits (Modifier .W[n])

An integer variable is divide into 16-bits and handled as 2-word device address.
Its value is an unsigned integer from 0 to 65535.
E.g.) Specify the 0th word of an integer variable, "ABC".



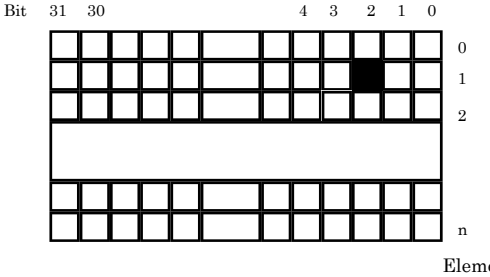
(e.g.)



Reference

Integer Array・・・

E.g.) Specify the 3rd bit of the 2nd element of an integer array "ABC".



ABC[1].X[2]
or
ABC.X[34]

Chapter 4 Troubleshooting

4-1. FAQ

■ Hardware

[General Specifications]

Q. How constant is the scan time of the logic program?

A. The minimum scan time for the logic program is 10ms to keep the minimum time that is required for the screen display, touch panel, and communication. If the number of the parts on the screen or the size of the logic program is increased, the scan time will be longer.

Q. Can I rewrite data while the logic program runs?

A. Yes. It is possible to rewrite data while the logic program runs.

Q. On what occasion, does the lamp on the left bottom of the LT blink in green after power on?

A. The state the green lamp is blinking indicates that the logic program is not running. Please check if the logic program runs or not. The status LED also indicates the run states of the firmware and error status such as burnout lamp.

Q. How accurate is the internal clock of the LT?

A. The degree of error is 65 seconds per month at normal operating temperatures.

[Memory]

Q. How much capacity of the logic program does the LT have?

A. The logic capacity of the LT is 15000 steps.. The capacity of the program depends on the number of variables or the number of logic instructions.

Q. How many words of data can I save?

A. Approximately 6000 words for integer variables only. Timers and counters are regarded as variables. Therefore, if you keep 6000 words with integers only, you cannot use other variables.

Q. Is the data which the LT keeps still saved after changing the logic program?

A. With GP-Pro EX, you can reload the program with the current value of the retentive variable saved.

1. Open [Transfer Settings] in the [Transfer Tool] window.
2. Check [Retain retentive variables] in [Transfer Project].
3. Click [Send Project] in the [Transfer Tool].

Q. How are the counter and timer variable data treated after the LT turns off?

A. If you have checked “Retentive” in the variable settings, both the preset values and the current values are kept. If you have not, the preset values are kept, but the current values are not.

Q. How long is the backup period when the power of the main unit is off?

A. It varies depending on the battery ambient temperature, but it is approximately 100 days with a battery fully charged and approximately 6 days with a half charged battery. The lifetime of a lithium itself is 10 years when the battery ambient temperature is 40 °C or less.

[Timer / Counter]

Q. How many timers or counters can I use on one logic program?

A. Timers and counters are considered as a variables. They are limited as many as variables. The maximum number of the timers that you can use is 512 in case that you create timers only. The maximum number of the counters that you can use is 512 in case that you create counters only.

Q. How can I reset or initialize the counter instruction?

A. You can reset it by turning on "CounterVariableName.R".

Q. Can I input High Speed Counter with the LT?

A. You can input High Speed Counter with the DIO Built0in LT. (100kHz. 50kHz for double phase counter)

[Input / Output]

Q. How do I connect the EX module with the LT3000?

A. Attach the EX module on the rear side of the LT3000. Please make sure to set it with the latch buttons on the EX module.

Q. How many EX modules can I extend?

A. Up to two EX modules can be connected to the rear side of the LT 3201A.

Q. Is a DIO connector attached in the package?

A. It is an attached accessory. Also you can purchase one (DIO Connector CA6-DIOCN4-01).

Q. The sensor or the lamp that is connected to the LT does not respond. What should I do?

A. Check the following points.

1. Have you set "Enable" for [External I/O] on the [Logic] tab in the Display Unit settings with GP-Pro EX?
2. Have you set "RUN" for [Run at Start Up] on the [Logic] tab in the Display Unit settings with GP-Pro EX?
3. Have you set "Enable" for [Logic Program] in the Logic Program settings with GP-Pro EX?
4. Is the logic program proper? Have you checked it with the Error Check feature?
5. Is wiring correct?
6. Have you set the I/O drivers properly with GP-Pro EX?

[Serial Communication]

Q. Can the LT be connected with the PLC?

A. No, it cannot. The GP3000 Series C class can be connected with the PLC instead of the LT.

[Standard]

Q. What standard does the LT conform to?

A. It confirms to UL and C-UL (CAN) other than CE Marking.

■ Software

[Programming Tool]

Q. How do I create screens or logic programs?

A. Use the screen editor GP-Pro EX (Ver. 2.0 or above).

Q. Is a transfer cable attached in the package?

A. No, it is not. Please purchase one separately. USB screen transfer cable: CA3-USBCB-01

Q. Are the created screen data and the logic program data saved in different files?

A. The created screen data and the logic program data are saved in one file.

[Screen Creation]

Q. How can I set to popup a numeric keypad for entering numeric values.

A. Place a Data Display on the screen. Double-click it to make settings and check [Allow Input] on the [Basic] tab. Touch the numeric data display, and a pop-up keypad will show automatically.

Q. Is it possible to label switches in Chinese or Korean characters?

A. With GP-Pro EX, it is possible to display most of the characters such as European, Chinese, Taiwanese, and Korean by adopting Unicode.

Q. Is it possible to paste image data such as pictures on the screen?

A. It is possible to paste image data in BMP and JPG format.

Q. Is it possible to display various graphs?

A. It is possible to display wide variety of graphs such as bar, circle, statistical, and trend graphs.

[Logic Program]

Q. What is a variable?

A. It can be considered as a container for data. For conventional PLCs, I/O and data memories are called device addresses , which are treated in the specific way of each manufacture. For the LT, variables are used instead of these device addresses and you can manage them with arbitrary names.

Q. How can I use data register (e.g. D0100) for the PLC?

A. Create integer variables with GP-Pro EX. You can create them by entering on the "Edit Symbol Variable" window, on the logic program directly, or on the I/O screen.

Q. Can I delete unused variables?

A. You can delete unused variables by specifying symbol variables to delete on the Edit Symbol Variable window and clicking [Delete (D) on the shortcut menu which appears by right-clicking.

Q. How can I create an OR circuit?

A. Drag your mouse from the start point (left or right of the instruction) where the circuit is to be branched and drop it on the end (right or left of the instruction) on the same rung.

Q. How do I backup the created screen and logic program?

A. Both the created screen and logic program are saved in one project file. Please save and manage it in a FD, CD-ROM, etc.

Q. I want to create many of variables quickly. Is there any method to create them easily?

A. Use the **変数の一括コピー機能を使用できます。** You can also make arrays if the variables are bit, integer, or real variables.

[Data Compatibility]

Q. Are data for the LT3000 Series compatible with data for the former LT Series?

A. They are incompatible. The project file created with C-Package (PRW file) can be used on the LT3000 Series. However, create data for the LT3000 Series with GP-Pro EX (Ver.2.0 or above).

Revision History

Revision Date	Ver.	Detail
June, 2007	1.0	Newly issued