Panasonic®

OPERATOR INTERFACE

I.O.P. (Intelligent Operating Panel) M21 Technical Manual (Preliminary)

I.O.P. (Intelligent Operating Panel) M21 Technical Manual
ACG-M0041-1 '92.5

Matsushita Electric Works, Ltd.

BEFORE BEGINNING

MATSUSHITA ELECTRIC WORKS, Ltd. pursues a policy of continuously improving of the design and performance of its products. Therefore, we reserve the right to change the manual or software without notice. In no event will MATSUSHITA ELECTRIC WORKS, Ltd. be liable for direct, indirect, special, incidental, or consequential damage resulting from any defect in the product or its documentation, even if advised of the possibility of such damages.

LIMITED WARRANTY

All implied warranties on the product, including merchantability and fitness, are limited to one year from the date of purchase.

If physical defects caused by distribution are found, MATSUSHITA ELECTRIC WORKS, Ltd. will replace or repair the product free of charge. Exceptions include:

1. Physical defects due to a different usage or treatment of the product than that presented in the manual.
2. Physical defects due to defective equipment other than the distributed product.
3. Physical defects due to modification or repair by someone other than MATSUSHITA ELECTRIC WORKS, Ltd.
4. Physical defects due to natural disasters.

Introduction

The Intelligent Operating Panel is designed to allow you to configure the console panel to match your specific needs, thereby making the I.O.P. much easier to operate.

You can create the screens displayed on the I.O.P. with a personal computer (IBM PC/AT or a compatible) and I.O.P. 20 series Software. You can make a "console panel" that is matched to the needs of your system and to the needs of the operators. When you change the machines or the design of your system, you don't have to rewire the control panel. You just redesign the control screens.

You can store a maximum of 256 screens in the I.O.P. with extended User Memory (1024 Kb). With this large number of screens, you can include instructions for the operator on the screen, so that the operator can control the system just by following the instructions.

The I.O.P. Model 21 can be connected to Matsushita's FP3/FP5 remote I/O system. A maximum of 32 I.O.P.s within 200 meters can be simultaneously connected to a Master Unit. With a two-conductor cable, you can easily connect the I.O.P. to a Master Unit installed on a FP3 or FP5 programmable controller.

We assume that you are familiar with designing and operating a console panel, and also with the programming required for your controller.
Refer to the Remote I/O System Unit Manual for details about Remote I/O systems.
Refer to the FP3/FP5 Programming Manual for details about PC Programming.

To operate the I.O.P. Model 21, you must first create the screens and store them in the I.O.P. Please reference the I.O.P. 20 series software manual.

Warning

Be certain to always use one or more hard-wired, electromechanical Emergency Stop Switches to cut power to potential dangerous machines and processes. The I.O.P. is not a substitute for this.

Contents

Chapter 1 Specifications

Chapter 2 I.O.P. Operation

Chapter 3 Preparing for PC Programming

Chapter 4 Guiding to PC Programming

Chapter 5 Sample Programs

Chapter 6 Connecting the I.O.P. to a PC

Chapter 7 Operating Environments

Chapter 8 Appendix

What's in each Chapter

Outline

Chapter 1 describes the I.O.P. Model 21's general specifications, functional specifications, communication specifications, external dimensions and part names.

Chapter 2 explains how to use the I.O.P Model 21. You will learn how to operate the I.O.P..

Chapter 3 explains how you can set up the PC and the I.O.P. to build your remote I/O system. You will also find out how to use the PC to control the I.O.P.. The I.O.P. operation modes are also explained in this chapter.

Chapter 4 will give you ideas for creating programs for data communication.
The I.O.P. Model 21 has Shared Memory to store data for communications. The PC can access this Memory via the remote memory read/write instructions. The PC also controls the I.O.P. Model 21 using input relays (X) and output relays (Y) in the PC's memory. You will find how to create programs according to the I.O.P. function that is being described.

Chapter 5 will show you sample programs for data communication.

Chapter 6 explains how to connect the communication cable.
You will learn how to connect the I.O.P. Model 21 to an FP3 or FP5.

Chapter 7 explains how to maintain the I.O.P. Model 21.
Precautions for safe handling of the I.O.P. Model 21 will be explained.

Appendix
Refer to the appendices as necessary.

Notation used in this manual

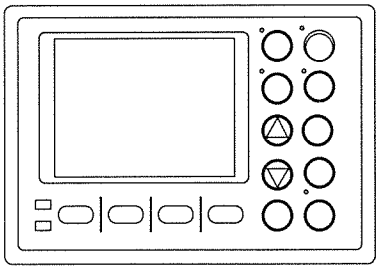
Notes	Indicates limits to be observed.
Caution	Indicates a precaution to be followed.

Abbreviations used in this manual

PC	: programmable controller
I.O.P.	: Intelligent Operating Panel Model 21
Manual Screen	: Manual Key Access Screen
DPU	: Data Processing Unit
JIS	: Japanese Industrial Standards

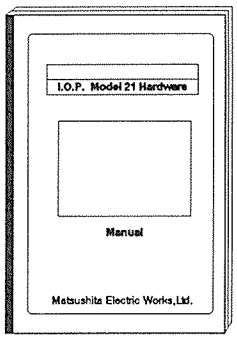
Packing List

I.O.P. Model 21

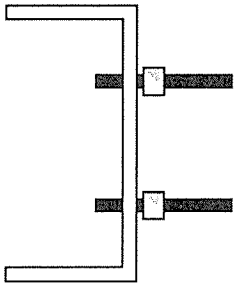


Backup Battery

This manual



Mounting Metal: When you purchased Flange type I.O.P.

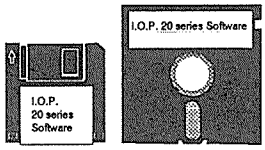


Getting Ready to Use the I.O.P. Model 21

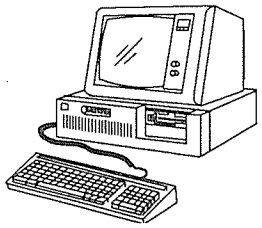
You will need:

For Screen editing

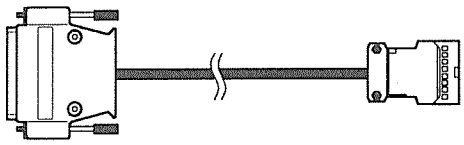
I.O.P. 20 series Software



A personal Computer (IBM PC/AT or a compatible)

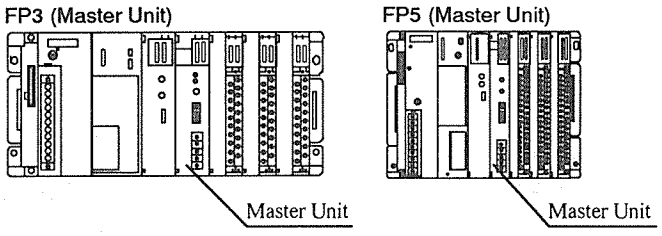


Transmission cable (Model AIP8001 or the "Transmission cable" specified on page 174.)



For communicating with a programmable controller

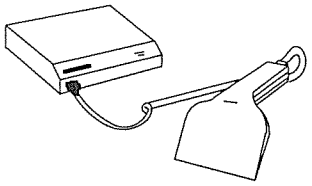
A programmable controller



A two-core wire cable (VCTF 0.75 mm^2 × 2 C equivalent)

System Configurations

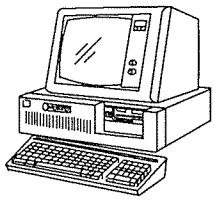
External Device

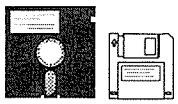


Bar Code Reader etc.

Editing Screens

IBM PC/AT or the compatible



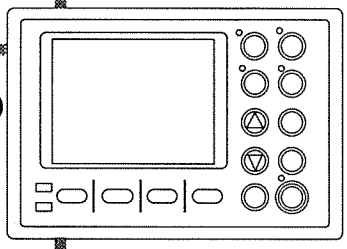


Application software
"I.O.P. 20 series
Software"

Transmission Cable (Appendix A)

Two-conductor Cable

(VCTF 0.75mm² × 2C equivalent)

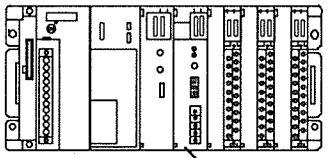


I.O.P. Model 21

RS-232-C Cable (Appendix B)

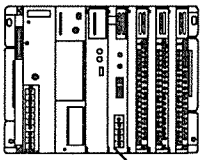
Connecting with the FP3 or FP5

FP3



Master Unit

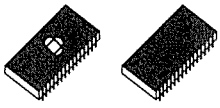
FP5



Master Unit

I.O.P. parts

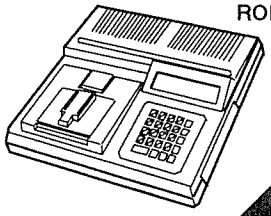
Backup battery

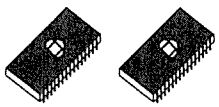


ROM RAM

Transfering to ROM

ROM programmer





ROM

Parts Name	Specifications		Part Number
I.O.P. Model 21	Flange type		AIP211002
	Case type		AIP211102
Master Unit	For FP3		AFP3740
	For FP5		AFP5740
Single-ended connector cable for serial connection	9 wires with 9-pin connector * Use this cable for making the connection between the I.O.P. and a ROM programmer.	1m	AIP81841
		2m	AIP81842
		3m	AIP81843
		4m	AIP81844
		5m	AIP81845
9-pin serial connector for serial connection	9-pin Dsubminiature connector for RS-232-C (I.O.P. side) * Use this cable for making the connection between the I.O.P. and a ROM programmer.		AIP8129
Transmission cable	Used when data edited with a personal computer is transferred to the I.O.P. * You can make this cable yourself. See Appendix A.	1.5m	AIP8001
Application Software "I.O.P. 20 series Software"	Used to create and edit screens		AIP8304
ROM	User Memory 256Kb: Screen storage, max. 64 screens		AIP8412
	User Memory 1024Kb: Screen storage, max. 256 screens		AIP8411
RAM	User Memory 256Kb: Screen storage, max. 64 screens Mounted when shipped.		AIP8402
	User Memory 1024Kb: Screen storage, max. 256 screens		AIP8401
Backup battery	To maintain User Memory (supplied when shipped)		AFB8801

I.O.P. Model 21 Installation Procedure

1. Design the screens for the PC that you will use with the I.O.P..
   Assign Key Codes.
   Read the I.O.P. 20 series Software MANUAL.

2. Create screenswith a personal computer.
   Read the I.O.P. 20 series Software MANUAL.

3. Transfer created screens and key codes to the I.O.P.. (Transfer operation)
   Read the I.O.P. 20 series Software MANUAL.

4. Locate the I.O.P. Model 21 in the FP3/FP5 remote I/O system.
   * Set the I.O.P. DIP switch bank 2.
   * Assign a slave station number to the I.O.P..
   * Set the Mode Selector Switches on the master Unit.
   * Assign I/O numbers to the PC Memory Area for controlling the I.O.P..
   Refer to 3-1 "Setting the I.O.P. and a PC".

5. Set the I.O.P. DIP switch bank 1 for the operation mode you need.
   Refer to 3-3 "I.O.P. DIP Switch Bank 1 Setting".

6. Create programs for data communication.
   Refer to Chapter 3, 4 and 5.

7. Connect the I.O.P. Model 21 to the Master Unit
   Refer to 6-1 "Connecting the I.O.P. to FP3/FP5 Master Unit".

8. Adjust the I.O.P., the PC, and the external devices for complete control.
   In order to check screens that you create with a personal computer, you can use the Monitor Mode.
   Refer to 2-8 "Choosing Run Mode and Monitor Mode".

   Acceptable / Not Acceptable (Not Acceptable → back to step 1)

9. Burn the data into a ROM with a ROM programmer, when necessary.
   Read the I.O.P. 20 series Software MANUAL.
   You can also refer to 2-9 "Replacing User Memory".

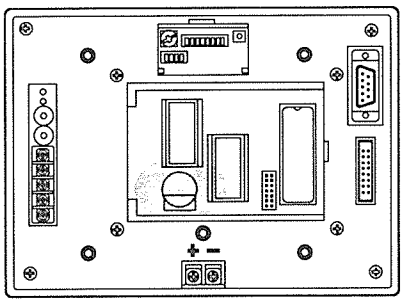
10. Operate the I.O.P. in Run Mode.
    Refer to 2-8 "Choosing Run Mode and Monitor Mode".
    Refer to 6-2 "Power Up Sequence".

11. Maintenance
    Refer to Chapter 7.

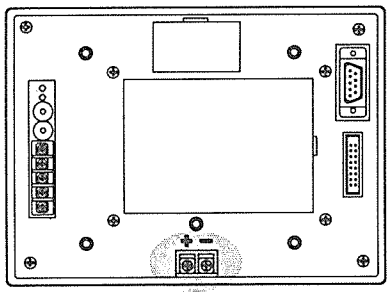
Preparing the I.O.P. Model 21 for Operation

You must set up the I.O.P. so that it will operate correctly when you first turn it on. Follow the procedures below.

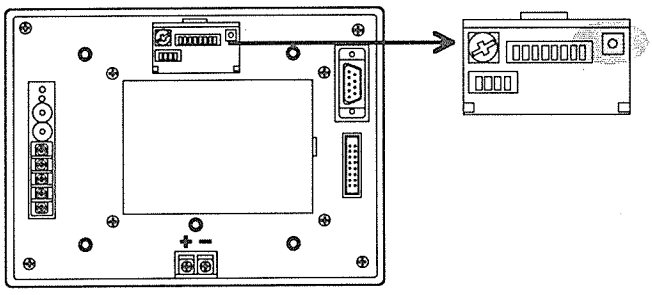
1. Install the backup battery in the I.O.P..
   You can refer to 7-2 "Replacing the Backup Battery" on page 168 for installation.



2. Connect the power cable to the 24VDC power terminal on the rear panel of the I.O.P..



3. Press the System Reset Button on the rear panel of the I.O.P..



Caution

After you turn on the power for the first time, be sure you press the System Reset Button on the rear panel of the I.O.P..

Chapter 1

Specifications

This chapter describes the I.O.P. Model 21's general specifications, functional specifications, communication specifications, external dimensions and part names.

Programmable Controller is abbreviated PC.

1-1 Specifications

General Specifications

Items	Specifications
Rated voltage	24V DC +/- 10 %
Power consumption	12W max.
Current Consumption	150 mA (for a I.O.P.)
User memory	256Kb (1024Kb available)
Backup battery	Lithium battery Continuous no-voltage life time: 10,000 hours
Ambient operating temperature	0 ℃ to 40 ℃ (32 ℉ to 104 ℉)
Ambient operating humidity	45% to 90% RH (no dew-condensing)
Vibration	10Hz to 55Hz 0.75 mm
Shock	10G X,Y,Z axis, 5 times each
Insulation resistance	100MΩ min. at 500V DC
Liquid-crystal display (LCD)	Dot matrix black/white mode LCD panel Dot number: 160 × 128 Effective display area: 96 mm × 76 mm
Contrast	Adjustable
Back Light life	20,000 hours (under normal temperature and humidity)
Buzzer	Internal buzzer (ON/OFF controllable)
External dimensions	With flange: 150(H) × 210(W) ×60(D) mm Without flange: 140(H) × 200(W) ×60(D) mm
Environment protection	Dust-proof and water drop-proof on the front panel.

Note

■ Back light may darken if the temperature drops below 10 ℃ (50 ℉).

Functional Specifications

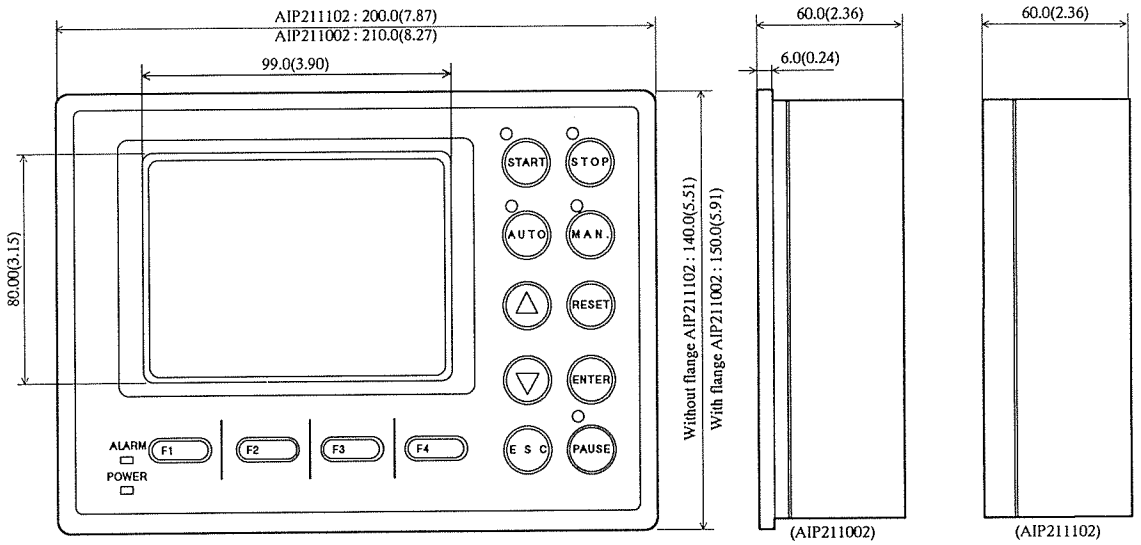
Items	Specifications
Number of screens	Manual Key Access Screen: 1 Primary & Secondary Screens: Total 63 maximum. (Total 255 maximum when User Memory is extended to 1024Kb)
Screen storage method	Personal Computer Software
Characters	All Alphanumeric & ASCII codes except " | " " ~ ".
Character size(H x W)	Half width (16x8 dots): alphanumeric Normal (16x16 dots): alphanumeric Double height (32x16 dots): alphanumeric
Number of characters	Half width : 20 letters, 8 lines Normal : 10 letters, 8 lines Double height : 10 letters, 4 lines
Superimposed screens	A maximum of 10 screens can be superimposed on one screen.
Superimposed characters	Specify the characters listed in Appendices D, E and F.
Keys	Manual Keys: 40 sets (80 Keys) max. Function Keys: 4 keys per screen max. (Total 170 Keys)
Indicators	POWER LED: Green (lit when the power is supplied.) ALARM LED: Red (lit when there is a system problem.) START LED: Green STOP LED: Red AUTO LED: Green MAN. LED: Green PAUSE LED: Red

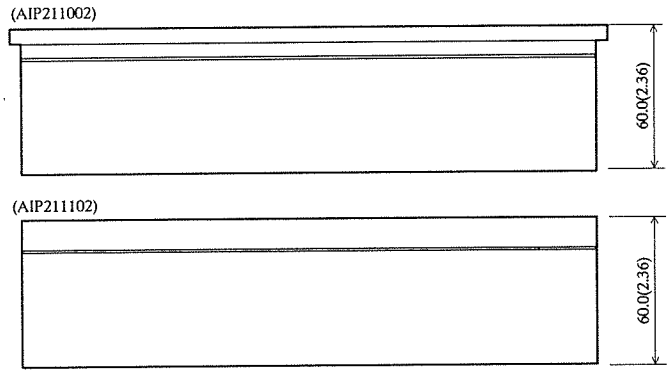
Communication Specifications

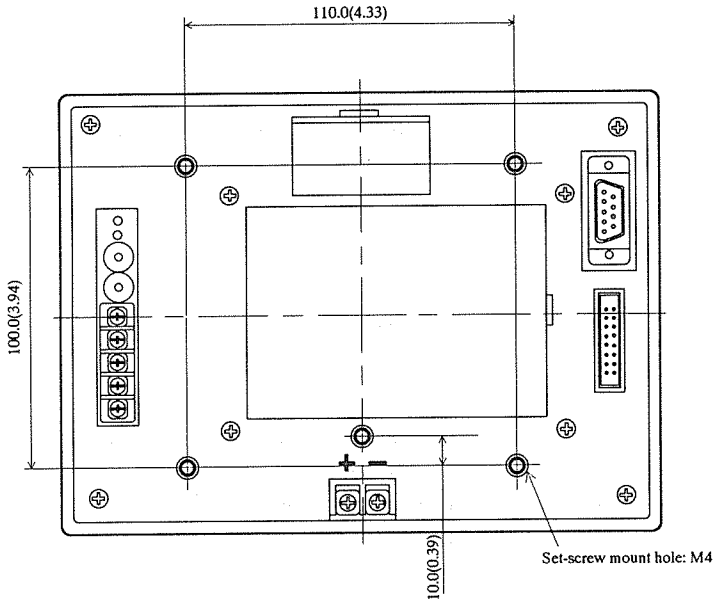
Items	Specifications
Baud rate	0.5 Mbps
Communication method	Half duplex
Synchronous method	Start-stop synchronous system
Transmission distance	Total 200 m/218.733 yd. per port.
Transmission line	Two-conductor cable (VCTF 0.75 mm^2 x 2C or the equivalent)
Interface	RS-485 interface
Transmission error check	CRC(Cyclic Redundancy Check) method
I/O numbers	Input relay(X) registers: 1 words (16 bits) Input relay(Y) registers: 1 words (16 bits)
PC memory access	F152 (RMRD instruction) F153 (RMWT instruction)

1-2 External Dimensions

unit : mm(in.)





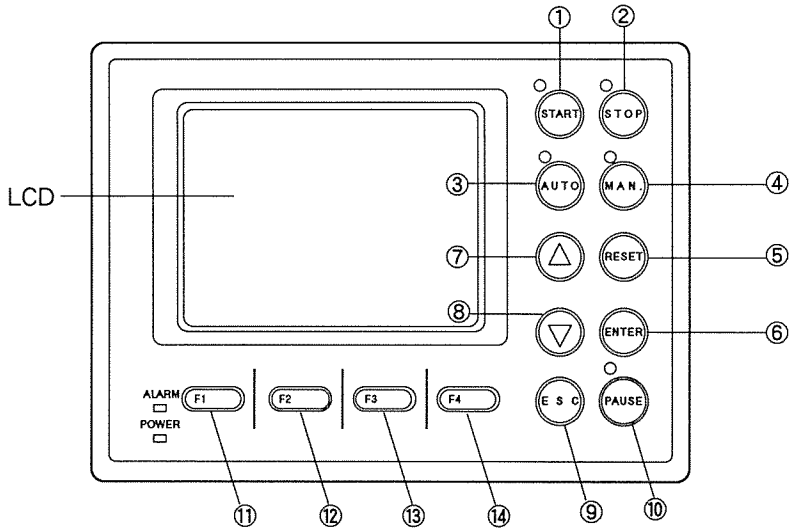


Notes :
AIP211002 has a flange for mounting the I.O.P. on a board.
AIP211102 does not have a flange.

Refer to 7-1. "Mounting the I.O.P. on a board" for mounting dimensions.

1-3 I.O.P. Model 21 Part Names

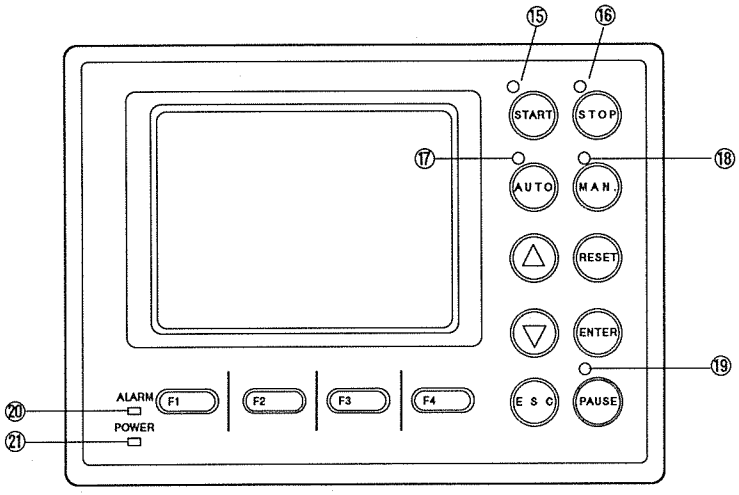
Front Panel



Keys

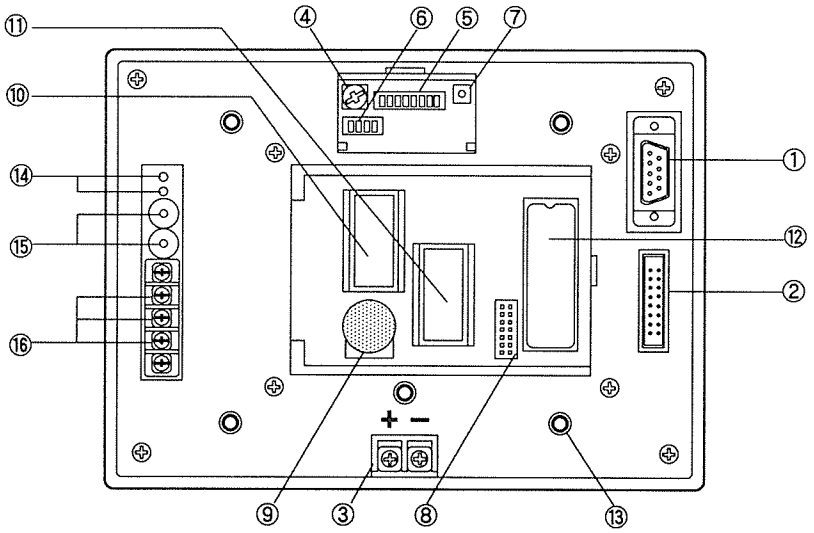
①	START	Fixed Key Outputs key code 03H(initial setting). Momentary Operation.
②	STOP	Fixed Key Outputs key code 04H(initial setting). Momentary Operation.
③	AUTO	Fixed Key Outputs key code 01H(initial setting). Momentary Operation.
④	MAN.	Fixed Key Outputs key code 02H(initial setting). Momentary Operation.
⑤	RESET	Fixed Key Outputs Key Code 05H(initial setting). Momentary Operation. Resets PAUSE exclusive output.
⑥	ENTER	Used to enter External Data.
⑦	▲	Arrow keys Using arrow keys, you can change to a Secondary Screen from a Primary Screen, or you can move to the LINE you want on the Manual Key Access Screen.
⑧	▼	
⑨	ESC	Escape key. You can change screens (from Primary Screen to Secondary Screen, from Primary Screen to Manual Key Access Screen).
⑩	PAUSE	Pause key. The I.O.P. sends an exclusive signal to the PC. Latched operation (cancelled with the RESET key)
⑪	F1	Function keys These four keys function as Manual Keys on the Manual Key Access Screen and as Function Keys on Primary and Secondary Screens. They send a Key Code corresponding to the key you pressed. You can enter External Data with these keys.
⑫	F2	
⑬	F3	
⑭	F4	

LEDs



⑮	START	Green	Lit/unlit controlled by the PC.
⑯	STOP	Red	
⑰	AUTO	Green	
⑱	MAN.	Green	
⑲	PAUSE	Red	Lit when the PAUSE key is pressed. To turn it off, press the RESET key.
⑳	ALARM	Red	Lit when there is a system problem. To turn it off, press the System Reset Button on the rear panel of the I.O.P..
㉑	POWER	Green	Lit when the I.O.P. is turned ON.

Rear Panel



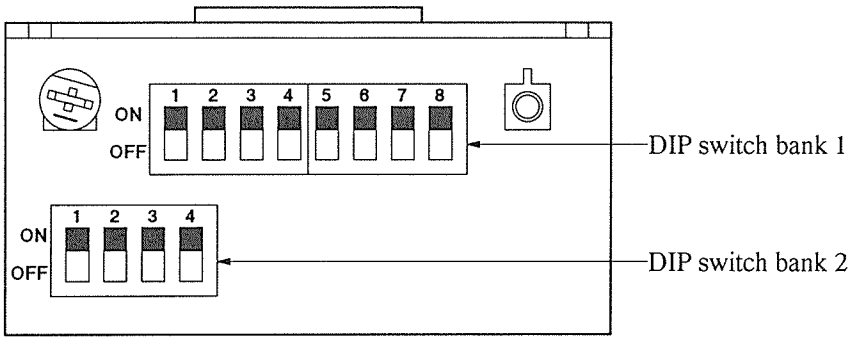
①	RS-232-C connector	Connects to a commercial ROM programmer. You can transfer the data in User Memory to the ROM programmer.
②	Transmission connector	Connects to a personal computer to transfer edited data to the I.O.P.. Use a Transmission Cable (e. g. Model No. AIP8001) for the connection.
③	Power supply terminal	Power terminal for I.O.P. operation. 24V DC.
④	Contrast adjustment	Adjusts the contrast of the liquid-crystal display.
⑤	DIP switch bank1	Switches for changing modes. Refer to DIP switch bank 1 table on the next page.
⑥	DIP switch bank 2	Switches for setting the RS-485 communication format. Refer to DIP switch bank 2 table on the page 10.
⑦	System Reset Button	Pressed after the mode is changed with the DIP switches.
⑧	RAM/ROM Switching Jumper	The connector assignments will vary depending on the User Memory you use.
⑨	Backup battery	Battery for I.O.P. User Memory backup.
⑩	I.O.P. System ROM	The I.O.P. System ROM. Do not remove the System ROM.
⑪	Remote I/O System ROM	System ROM for remote I/O system. Do not remove the System ROM.
⑫	RAM/ROM mounting connector	Install User Memory (RAM/ROM) in it. 256Kb RAM installed when shipped.
⑬	Set-screw	Set-screw M4.
⑭	Operation Indicator LED	LEDs indicating the communication status and error status.
⑮	Slave Station number selector switch	Assigns a slave station number for the I.O.P..
⑯	Transmission terminals	Terminals for connecting to the Master Unit.

Caution

■ Do NOT remove the System ROMs.

DIP switches

Layout of the DIP switches



DIP switch 1 bank setting

DIP-Switch bank 1 Setting								Setting
1	2	3	4	5	6	7	8	
OFF	OFF	*	*	*	*	*	*	Data Register Mode/Transfer Mode
ON	ON	*	*	*	*	*	*	Monitor Mode
ON	OFF	*	*	*	*	*	*	Run Mode
ON	*	OFF	*	*	*	*	*	JIS Code (Normal size characters to be superimposed)
ON	*	ON	*	*	*	*	*	Shift-JIS Code (Normal size characters to be superimposed)
ON	*	*	OFF	*	*	*	*	HEX Code (Displayable External Data)
ON	*	*	ON	*	*	*	*	ASCII Code (Displayable External Data)
ON	*	*	*	OFF	*	*	*	I/O Mode
ON	*	*	*	ON	*	*	*	Shared Memory R/W Mode
ON	*	*	*	*	OFF	OFF	*	Back light ON all the time.
ON	*	*	*	*	OFF	ON	*	Back light AUTO OFF in 5 minutes. AUTO ON with a screen change or the ESC key.
ON	*	*	*	*	ON	OFF	*	Back light AUTO OFF in 5 minutes. ON with the ESC key.
ON	*	*	*	*	ON	ON	*	Back light AUTO OFF in 15 minutes. ON with the ESC key.

* You can set the DIP switch to either ON or OFF.
Choose the one appropriate for your operation.

DIP switch bank 2 setting

DIP Switch Setting				Setting
1	2	3	4	
ON	ON	*	*	A terminal station (there is a terminal registor)
OFF	OFF	*	*	Not a terminal station (there is no terminal registor)
*	*	ON	*	Condition during a communication error: Continuous operation
*	*	OFF	*	Condition during a communication error: Stop operation

* You can set the DIP switches to either ON or OFF.
Choose the one appropriate for your operation.

Caution

- When you change the DIP switch settings, be sure you press the System Reset Button on the rear panel of the I.O.P. after the change.

Chapter 2

I.O.P. Operation

This chapter explains the features and uses of the I.O.P. Model 21. You will learn how to operate the I.O.P..

"Programmable Controller" is abbreviated "PC" in this chapter.

2-1 Displaying Screens

The I.O.P. has three kinds of screens: Primary Screens, Secondary Screens and a Manual Key Access Screen(Manual Screen).
You can store a maximum of 64 screens (or 256 screens with 1024Kb User Memory). One screen is permanently assigned as a Manual Screen.
This section of the manual provides explanations of what you can do with each kind of screen and how you can manage these three screen types.

Primary Screen

A Primary Screen is displayed on the I.O.P. when it receives from the PC.
On a Primary Screen, you may present instructions for the operator to allow him to control an external device via the PC. You assign keys and enter numeric data to control the appearance of the screen with messages or explanations for the operator. The operator can also monitor data from the devices such as the current number of finished products.

Number of Primary Screens you can store in the I.O.P.

When you use a 256Kb RAM or ROM, you can store a maximum of 63 screens in the I.O.P..
When you use a 1024Kb RAM or ROM, you can store a maximum of 255 screens in the I.O.P..

Notes

- 256Kb of RAM is installed in the I.O.P. when it is shipped.
  Refer to "Replacing User Memory" on page 43 if you want to add more memory or change to a ROM.

Displaying Primary Screens manually

A Primary Screen is displayed on the I.O.P. under the control of a PC. Paging of the Primary Screen can be also done by the PC.

However, when necessary, you can turn the pages manually. When the I.O.P. is displaying a Primary Screen, press

the ESC key and the down arrow key (▼) to display the page following the current Primary Screen.

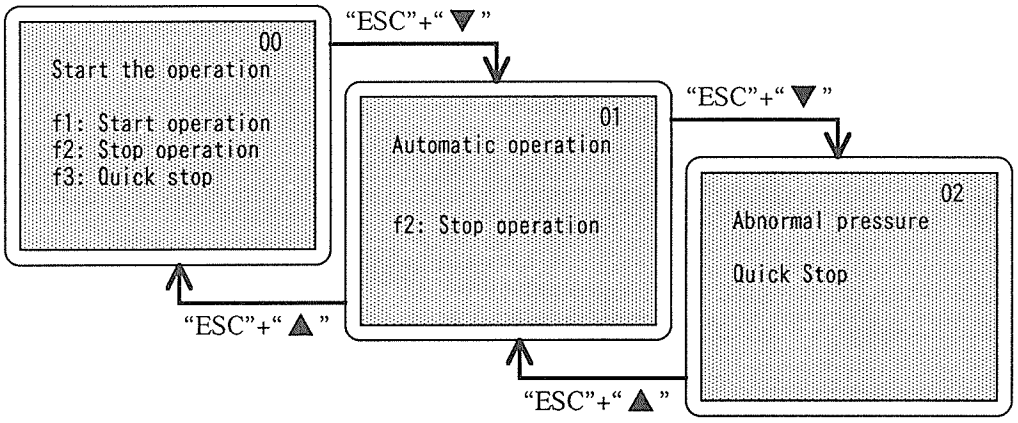
the ESC key and the up arrow key (▲) to display the previous page.

If you press the ESC key and the up arrow key (▲) on the Primary Screen page 00, the screen won't show any change.

When you turn pages manually, after 5 seconds without detecting a key press, the I.O.P. will return to the Primary Screen that was displayed before the manual operation. The I.O.P. can then receive data from the PC.

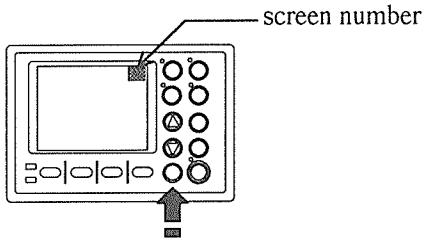
Caution

- On manually displayed screens, you cannot operate the Function Keys, the Fixed Keys, the PAUSE key or the ENTER key.



Displaying the Primary Screen numbers

You can display the Primary Screen number by pressing the ESC key.
The screen number will be displayed in hexadecimal for 5 seconds on the upper right of the screen. Screen numbers are determined when the screens are created. They start with screen number 00. While the screen number is being displayed, the I.O.P. will not be able to receive instructions from the PC.



Creating Primary Screens

You can create Primary Screens by running the I.O.P. 20 series program. With this program, you can assign screen numbers, messages, Key Codes and generally design or edit screens to meet your needs.
Refer to the I.O.P. 20 series Software MANUAL for details.

PC programming for communication

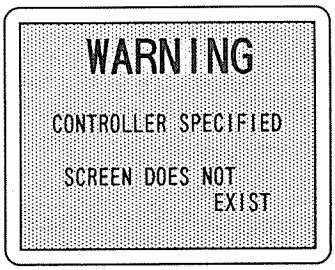
The programming method for displaying a Primary Screen depends on the Communication Mode you use.
Refer to Chapter 3 and 4 for details.

I/O Mode: The I.O.P. will display a Primary Screen when the corresponding GD bits, allocated in the PC memory, turn ON.

Shared Memory R/W Mode: The I.O.P. will display a Primary Screen when the corresponding Primary Screen number is written in the previously allocated I.O.P. Shared Memory area by the PC.

Caution

- If the PC specifies a Primary Screen number which does not exist in the I.O.P., the following warning message will appear on the screen.



Secondary Screen

Each Primary Screen can have Secondary Screens. By pressing the down arrow key (▼) when a Primary Screen is being displayed, you can display any Secondary Screen that belongs to that Primary Screen. Secondary Screens cannot be displayed by the PC.
Secondary Screens can be useful when the Primary Screen does not have enough space for a series of messages or instructions.

Number of Secondary Screens you can store in the I.O.P.

When you use a 256Kb RAM or ROM, you can store a maximum of 62 Secondary Screens in the I.O.P..
When you use a 1024Kb RAM or ROM, you can store a maximum of 254 Secondary Screens in the I.O.P..

Notes

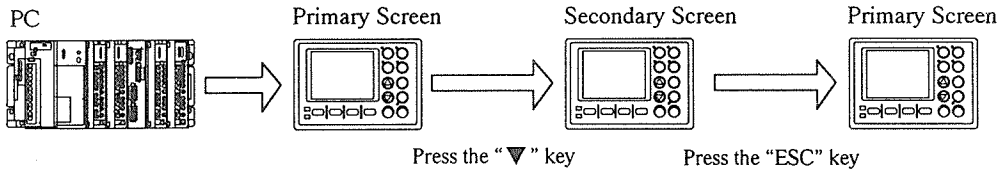
- 256Kb of RAM is installed in the I.O.P. when it is shipped.
  Refer to "Replacing User Memory" on page 43 if you want to add more memory or change to a ROM.

Displaying Secondary Screens

When the I.O.P. is displaying a Primary Screen, press the down arrow key (▼). The I.O.P. will display any Secondary Screen which belongs to the Primary Screen. Paging of Secondary Screens is done by pressing the arrow keys as follows.
If the Primary Screen does not have any Secondary Screens, the screen won't change.
If the I.O.P. is displaying the last Secondary Screen that belongs to a Primary Screen, the I.O.P. will display the Primary Screen the next time you press the down arrow key (▼).

Press the up arrow key (▲) to go to the previous screen.
Press the down arrow key (▼) to go to the next screen.
Press the ESC key to return directly to the Primary Screen.

Displaying Secondary Screens

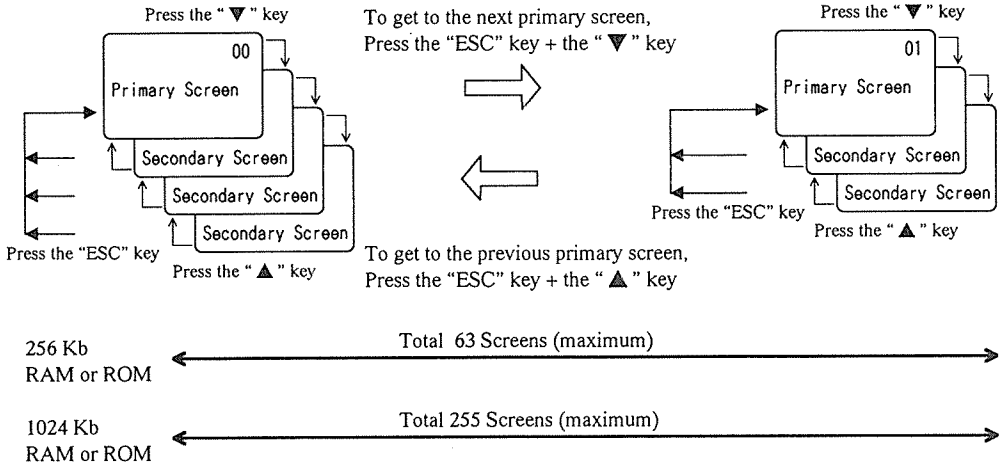


Creating Secondary Screens

You can create or edit Secondary Screens by running the I.O.P. 20 series program. You can create and edit Secondary Screens in almost the same way as you edit Primary Screens. If you add a Secondary Screen number, the I.O.P. Message Screen can be used for editing the Secondary Screen.

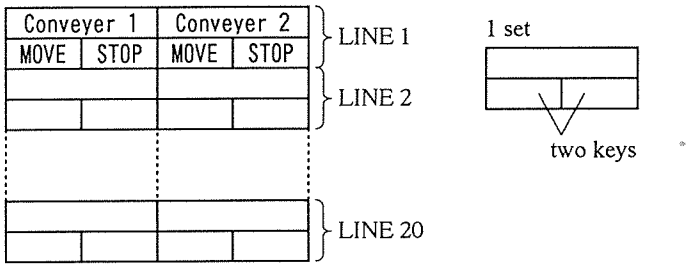
Refer to the I.O.P. 20 series Software MANUAL for details.

Relationship between Primary Screens and Secondary Screens



Manual Key Access Screen

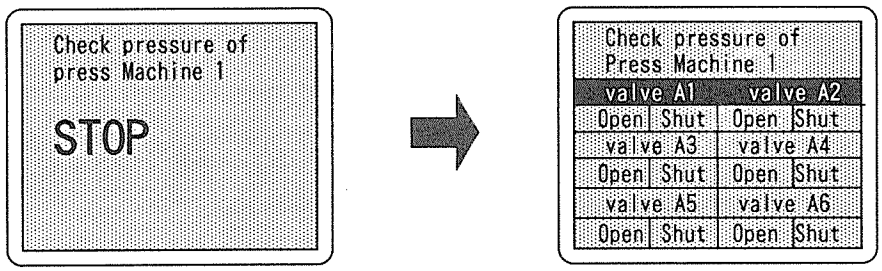
The I.O.P. has one Manual Key Access Screen (Manual Screen) for operating Manual Keys. You can assign a maximum of 80 Manual Keys (40 sets) on this screen.



The Manual Screen will be displayed on the I.O.P. when it receives the correct signal(s) from the PC. It will be superimposed on the lower 3/4 of the Primary Screen. If the I.O.P. is displaying a Secondary Screen when it receives the instructions to show the Manual Screen, the I.O.P. screen will return to the Primary Screen automatically and display the Manual Screen.

In the Manual Screen, only 3 of the 20 possible line pairs are displayed. If you want to see other LINEs, you can use the arrow keys. Along with the movement of the cursor, the Manual Screen will be scrolled.

Refer to "Manual Keys" on page 26 to learn how to operate the Manual Keys.



Number of Manual Key Access Screens in the I.O.P.

The I.O.P. has one Manual Screen.

Notes

- Even if you are using extra memory, you cannot increase the number of Manual Screens. Only one Manual Screen is available.

LINE specification on a Manual Key Access Screen

When the Manual Screen is first displayed, the cursor appears automatically on the first line. You have two options to specify the LINE which is displayed as the first line of the Manual Screen: You can display the Manual Screen LINE starting from where the cursor was left the last time the Manual Screen was displayed or you can have the cursor appears on a specific LINE. Refer to Example on the next page.

Hiding the Manual Key Access Screen temporarily

You can hide the Manual Key Access Screen temporarily. Press the ESC key to see the original Primary Screen.
Press the ESC key again to return to the Manual Screen.

Creating a Manual Key Access Screen

You can create or edit a Manual Screen by running the I.O.P. 20 series program. With it you can assign 40 sets of Manual Keys.
Refer to the I.O.P. 20 series Software MANUAL for details.

PC programming for communication

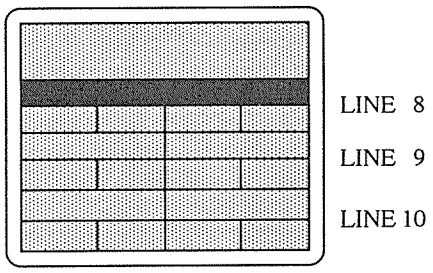
Refer to Chapter 3 and 4 for details.

The Manual Key Access Screen will be displayed when the MS flag is turned ON. When the MS flag is turned OFF, the I.O.P. will return to the Primary Screen. When the I.O.P. was displaying a Secondary Screen before the MS flag was turned ON, the I.O.P. will return to the Primary Screen to which the Secondary Screen belongs.

The LINE to be displayed as the first line can be specified when ML bit is turned ON. The ML bit is in the "K 1" register of the I.O.P. Shared Memory. Bits 0 through 7 of K 1 should contain a number which specifies the LINE for the cursor.

Example

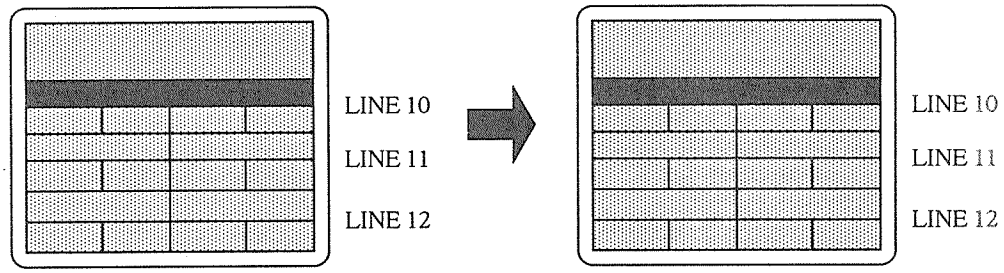
■ Specifying LINE 8 of the Manual Screen



If the MS bit is turned ON and the ML bit remains OFF, the I.O.P. will display the the cursor on the LINE where it last appeared.

The screen displayed as it appeared at the end of the last manual operation.

The screen as it will appear the next time if the cursor LINE is not specified.



Superimposing Primary Screens

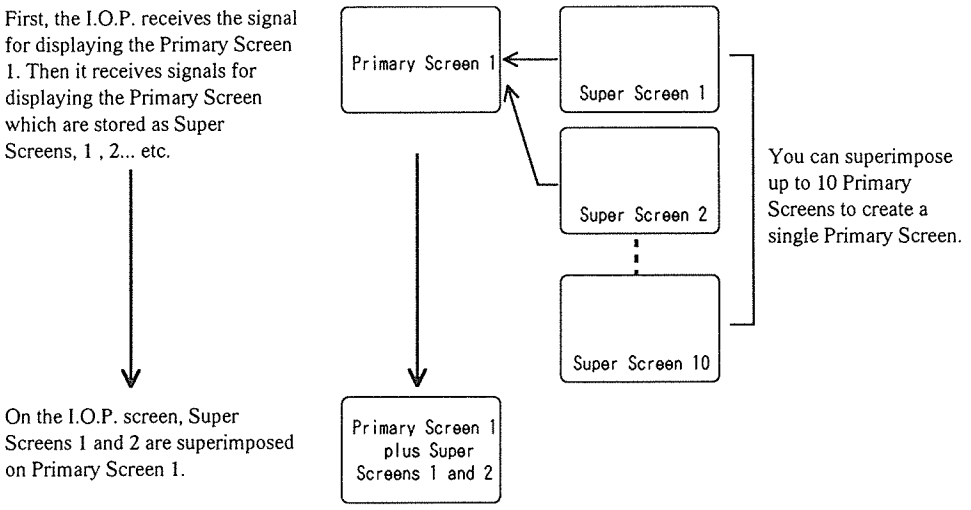
The I.O.P. can display a Primary Screen consisting of several Primary Screens superimposed on a Primary Screen. You can superimpose a maximum of 10 different Primary Screens. Superimposed screens are controlled by the PC.
A Screen can be superimposed repeatedly.

Caution

- The I.O.P. cannot superimpose screens that contain double height characters.
  The I.O.P. cannot superimpose information or messages in the area where External Data is displayed or where External Data is entered.

Creating Primary Screens for superimposition

You can create and edit screens for superimposition on the I.O.P. by assigning attribute "6" to a screen.



PC programming for communication

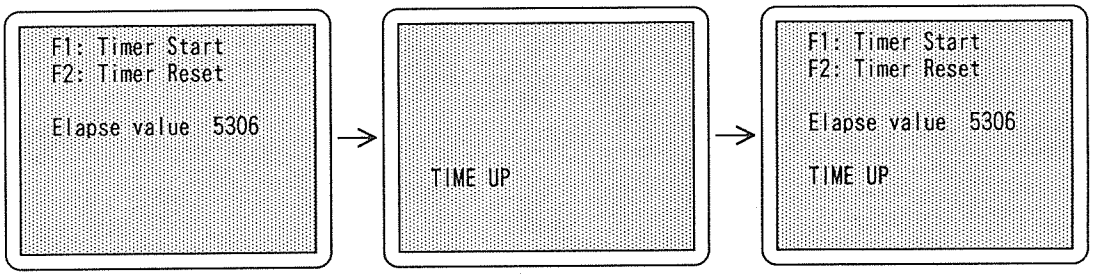
The programming method for superimposing a Primary Screen depends on the Communication Mode you use.
Refer to Chapter 3 and 4 for details.

I/O Mode: The I.O.P. will superimpose a Primary Screen when the corresponding GD bits are turned ON while the I.O.P. is displaying a Primary Screen.
The Primary Screen to be superimposed should have the attribute "6". Otherwise the I.O.P. cannot recognize the screen as a Super Screen.

Data Communication Mode: The I.O.P. will superimpose a Primary Screen when the corresponding Primary Screen number is written in the previously allocated I.O.P. Shared Memory of the I.O.P. by the PC. The Primary Screen to be superimposed should have the attribute "6". Otherwise the I.O.P. cannot recognize the screen as a Super Screen.

Notes

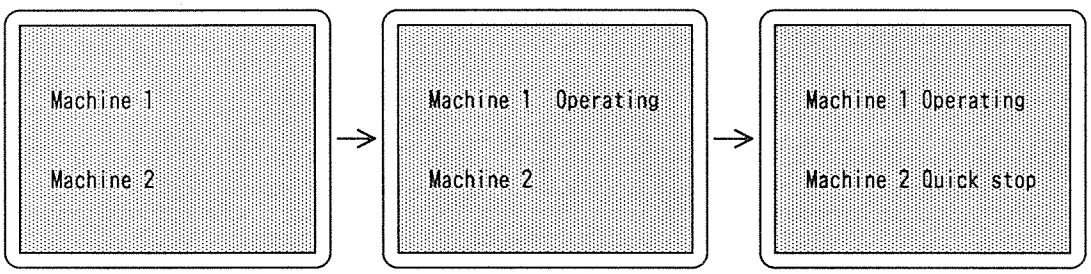
- On an I.O.P. Message Screen, which has attribute "6", you cannot place characters in the area used for displaying and entering External Data, and assigning keys. However, if the Primary Screen previously displayed on the I.O.P. has an area for displaying and entering External Data, or a key entry area, you can operate these functions on the superimposed screen.



Primary Screen Super Screen Superimposed Screen

Superimposing Characters

The I.O.P. can superimpose arbitrary first level JIS characters (normal size and half width) on a Primary Screen. This is controlled by the PC.
When you want to superimpose normal size characters, you can specify the characters as either JIS code or Shift-JIS code listed Appendices D and E. When you want to superimpose half width characters, You can specify the characters listed in Appendix F.
You can superimpose characters in units of half-width characters, and you can superimpose up to one line at a time.



Superimposes "Operating" first

Then superimposes "Quick stop"

PC programming for communication

Refer to Chapter 3 and 4 for details.

When the PC writes the character codes and location of the characters you want to superimpose in the I.O.P. Shared Memory, the I.O.P. will superimpose the character using two flags, CD and RCC.

CD: The PC turns CD ON when a character code has been written in the I.O.P. Shared Memory.

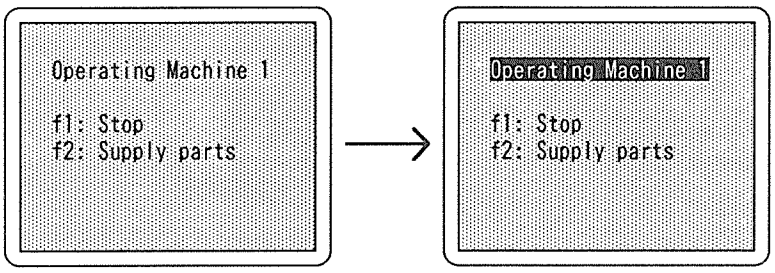
RCC: The I.O.P. turns RCC ON when the superimposition operation has been completed.

Cautions

- When the I.O.P. is displaying the Manual Screen or a Secondary Screen, You cannot superimpose characters.
- If you specify a position on the screen where characters are already being displayed, the superimposed characters will have priority over the characters that at location.
- You cannot display double size JIS characters.
- You cannot superimpose a character where External Data is displayed or entered.
- When a new screen is displayed on the I.O.P., the superimposed characters will be cleared.

Highlighting Characters

The I.O.P. can highlight any characters on a Primary Screen except double height characters and the area for displaying or entering External Data. This function is controlled by the PC.



PC programming for communication

Refer to Chapter 3 and 4 for details.

Specify the position for the character you want in the I.O.P. Shared Memory. The I.O.P. will highlight characters using two flags, HD and RCH:

HD: The PC turns HD ON when position data has been written in the I.O.P. Shared Memory.

RCH: The I.O.P. turns RCH ON when the highlight operation has been completed.

Cautions

- You cannot highlight character positions where external data is displayed or entered.
- If there is no character at the position you specify in the command, the space will be highlighted.
- When the I.O.P. is displaying a secondary screen or the Manual Key Access Screen, you cannot highlight characters.
- When a new Primary Screen is displayed on the I.O.P., the highlight operation will be cleared.
- You can highlight superimposed characters.

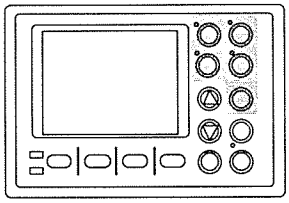
2-2 Operating Keys

The I.O.P. has several kinds of keys; Fixed Keys, Function Keys, Manual Keys, the PAUSE key and others.
With these keys, you can control external devices through the PC.

Fixed Keys

The AUTO, MAN., START, STOP, and RESET keys on the front panel of the I.O.P. belong to the Fixed Key group.
When you press a key, the I.O.P. sends the corresponding Key Code to the PC. Key Codes are assigned a hexadecimal number as shown below for their initial settings. You can change the assignments when you edit screens, when necessary.

Fixed keys



Fixed Key Code initial assignments

Fixed key	AUTO	MAN.	START	STOP	RESET
Key Code	HEX 01	HEX 02	HEX 03	HEX 04	HEX 05

Changing Fixed Key Code assignments

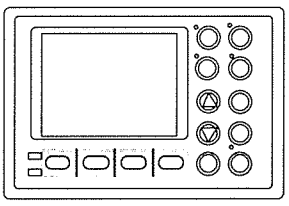
When the I.O.P. Message Screen is displayed on the screen of a personal computer, press the F10 key. The screen where Key Codes for Fixed keys are assigned will appear.

PC programming for communication

Refer to "PC Programming for Receiving Key Codes" on page 29.

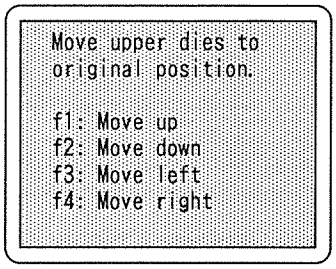
Function Keys

On Primary Screens and Secondary Screens, you can assign 4 keys for each screen. These keys correspond to the function keys, F1, F2, F3 and F4 on the front panel of the I.O.P..



Function keys
To execute a function shown on the screen, press the corresponding function key at the bottom of the I.O.P..

Function Keys



Using the Function Keys

Press the function key on the I.O.P. that corresponds to the function you want to execute.

Assigning Key Codes to Function Keys

You can assign Key Codes to Function Keys on the same screen where you edit messages for Primary Screens or Secondary Screens. Any Key Codes ("01" through "FF") can be arbitrarily assigned to the 4 Function Keys on each screen.

PC programming for communication

Refer to "PC Programming for Receiving Key Codes" on page 29.

Manual Keys

On the Manual Key Access Screen, you can operate a maximum of 80 kinds of Manual Keys (40 sets). The function keys (F1, F2, F3 and F4) on the front panel of the I.O.P. are linked to the Manual Key functions selected with the cursor on the I.O.P. screen.

Using the Manual Keys

Procedure: When the I.O.P. displays the Manual Screen;

1. Move the cursor on the Manual Screen to the LINE containing the function you want to execute. The cursor is moved by pressing the arrow keys.

2. Press the function key that corresponds to the Manual Key function you want to execute. By pressing the key, the I.O.P. will send the Key Code assigned to that Manual Key function.

Example: When you want to open valve 3.

Refer to the illustration on the next page.
The Manual Screen will be displayed on the lower 3/4 of the Primary Screen. (Fig. ⓐ→ⓑ)

1. Move the cursor to the valve 3 position by pressing the down arrow key.
   Once you press the down arrow key, the screen will look like Fig. ⓒ will appear.

2. At Fig ⓒ, the key corresponding to "open valve 3" is the F1 key. Press the F1 key.

3. When you press the F1 key, the I.O.P. will highlight the screen as shown in ⓓ and it will send the Key Code assigned to that Manual Key. (Fig. ⓓ)

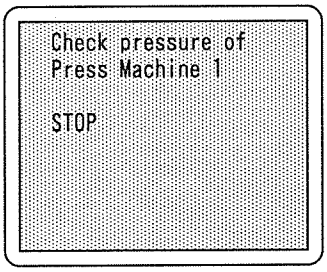
Assigning Key Codes to Manual Keys

You can assign Key Codes to Manual Keys when you create or edit the Manual Screen with a personal computer. A maximum of 80 keys can be assigned any Key Code from 01 through FF.
You cannot assign "00" as a Key Code.

PC programming for communication

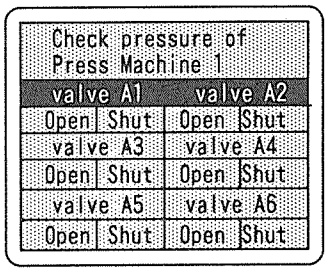
Refer to "PC Programming for Receiving Key Codes" on page 29.

Fig. ⓐ



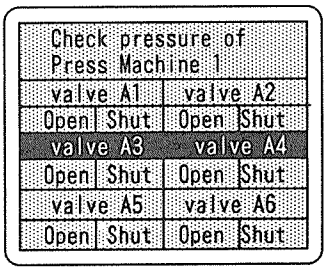
The Manual Access Screen will be displayed.

Fig. ⓑ



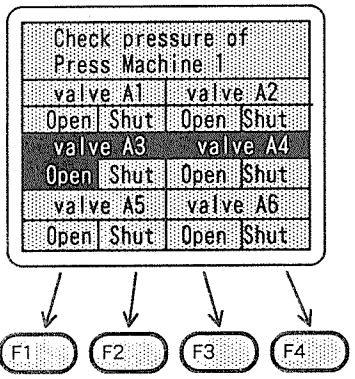
Press the down arrow key (▼).

Fig. ⓒ



Press the F1 key.

Fig. ⓓ



Key Code Assignments

A Key Code is assigned to each of the Fixed keys (START, STOP, MAN., AUTO, RESET keys), Manual Keys and Function Keys. The assignments can be made when you edit the screens with a personal computer. You can assign any of 255 Key Codes from 01 to FF. You can assign any Key Code to any number of keys repeatedly. Fixed Keys are assigned initial Key Codes as follows. You can change the assignments, when necessary.

The I.O.P. sends Key Codes as Key Data to the PC. The following table shows the relationship between Key Codes and Keys.

Key Name		Key Code	
Fixed Key	AUTO	01	You can change these assignments, when necessary.
	MAN.	02	
	START	03	
	STOP	04	
	RESET	05	
Manual Key	Manual Key Access Screen	01 through FF Set as you wish.	
	LINE 1 to LINE 20	4 Keys can be assigned on each LINE. (A total of 80 keys)	
Function Key	Primary Screen Secondary Screen	01 through FF Set as you wish.	
	Total 63 screens (255 screens)	4 keys can be assigned on each screen.	

Notes

- You can assign the same Key Codes to different keys according to your needs.
- When you press a Key, the I.O.P. sends the Key Code assigned to that Key.
- When the "PAUSE" key is pressed on the I.O.P., it turns the PAUSE flag ON.

PC Programming for Receiving Key Codes

The Programming method for receiving Key Data will depend on the Communication Mode you choose.
Refer to Chapter 3 and 4 for details.

I/O Mode: If a key is pressed on the I.O.P., the corresponding KD bits in the PC memory turn ON.

Data Communication Mode: If a key is pressed on the I.O.P., the corresponding Key Code will be stored in I.O.P. Shared Memory.

While a key is pressed, the I.O.P. turns ON the KD STROB allowing the PC to read the Key Data.

Cautions

- The assertion of the Key Code is maintained until the I.O.P. sends another Key Code. However, the I.O.P. will send the KD STROB signal only while the key is held down. However, you can create a program so that the key code assertion won't be maintained.

- The I.O.P. gives priority to the output of Key Data over input of Screen Data from the PC. So, while the I.O.P. is sending a KD STROB signal, it cannot receive Screen Data from the PC.

- Do not use "00" as a Key Code. The I.O.P. won't do anything with this number.

PAUSE Key

Using the PAUSE key

When the PAUSE key is pressed, the I.O.P. will change and hold the PAUSE status at ON until the RESET key is pressed. When the RESET key is pressed, the I.O.P. will reset the PAUSE status to OFF and output the Key Data for the RESET key to the PC.

Notes

- While PAUSE is asserted (status held ON), the I.O.P. will send other Key Codes normally.
- PAUSE LED will be turned ON while the pause status is ON.

PC programming for communication

Refer to Chapter 3 and 4 for details.

The PAUSE flag is assigned to the PAUSE key. If the PAUSE key is pressed on the I.O.P., the I.O.P. turns ON the PAUSE flag.

Other Keys

The I.O.P. also has an ENTER key, an ESC key and arrow keys (▼)(▲) on the front panel. The following is a brief description of their use.

ENTER key

Use the ENTER key to complete the entry of External Data.

ESC key

Use the ESC key to check the Primary Screen number, to page through the Primary Screens manually, and to transfer screens from a personal computer.

Arrow keys (▼)(▲)

Use the arrow keys to switch to a Secondary Screen from a Primary Screen, to page through Primary Screens (when the ESC key is also pressed.) , and to enter External Data.

2-3 Displaying External Data on the I.O.P.

The I.O.P. can display data from an external device (External Data) that is transmitted by the PC. A maximum of 16 different pieces of data (consisting of a maximum of 10 digits each) can be displayed on the I.O.P.(Displayable External Data).
The I.O.P. has 16 buffers for displaying External Data (Displayable External Data Buffer). A buffer number is assigned to each piece of External Data as hexadecimal number (0 to F) when you create or edit the screen with a personal computer.

You can specify Displayable External Data to be sent as either HEX code or ASCII code. If you use HEX code, you can display the numbers 0 through 9, decimal point, +, -, and = on the I.O.P. screen. If you use ASCII code, you can display characters with ASCII codes in the range of "20" and "5E". For the ASCII code character table, refer Appendix C.

Example: Displaying the number of products produced so far.

Parts A	123456	
Parts B	98765432	
⋮		
Parts P	3456789	up to 16 pieces of information (Max. 10 digits each)

Creating screens for displaying External Data

You can create or edit this type of screen on the I.O.P. Message Screen.
The area typed "\"(back slash) on the I.O.P. Message Screen is assigned as an External Data display area.
See the I.O.P. 20 series Software MANUAL for details.

PC programming for communication

Refer to Chapter 3 and 4 for details.

When the PC writes Displayable External Data in the I.O.P. Shared Memory, the I.O.P. will display the data on the I.O.P. screen. The data length is fixed at 10 characters, so, if you want you can specify the suppression of leading zeroes.

Notes

- Leading zero suppression: when you specify zero suppression, the External Data will be displayed by the I.O.P. without leading zeroes.
  For example, when you want the I.O.P. to display the data "0007654321" as "7654321", you should use leading zero suppression. If you want the leading zeroes displayed as "0007654321", you don't need to use leading zero suppression.

2-4 Entering External Data from the I.O.P.

On the I.O.P. you can enter numeric data to be sent via the PC to an external device (External Data).
You can enter External Data on either Primary Screens or Secondary Screens by using the function keys on the front panel of the I.O.P..
A maximum of 16 different pieces of External Data, each with a maximum of 10 digits, can be entered from the I.O.P.(Displayable External Data).

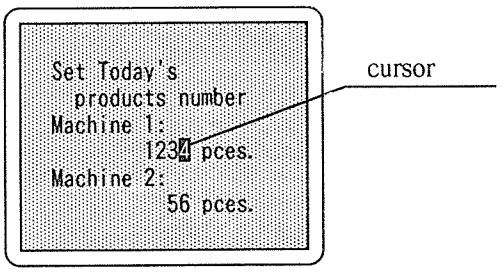
The I.O.P. has 16 Descriptive External Data Buffers to store the External Data entered.
A buffer number is assigned to each piece External Data as a hexadecimal number (0 to F) when you create or edit an I.O.P. Message Screen with a personal computer.

Entering External Data from the I.O.P.

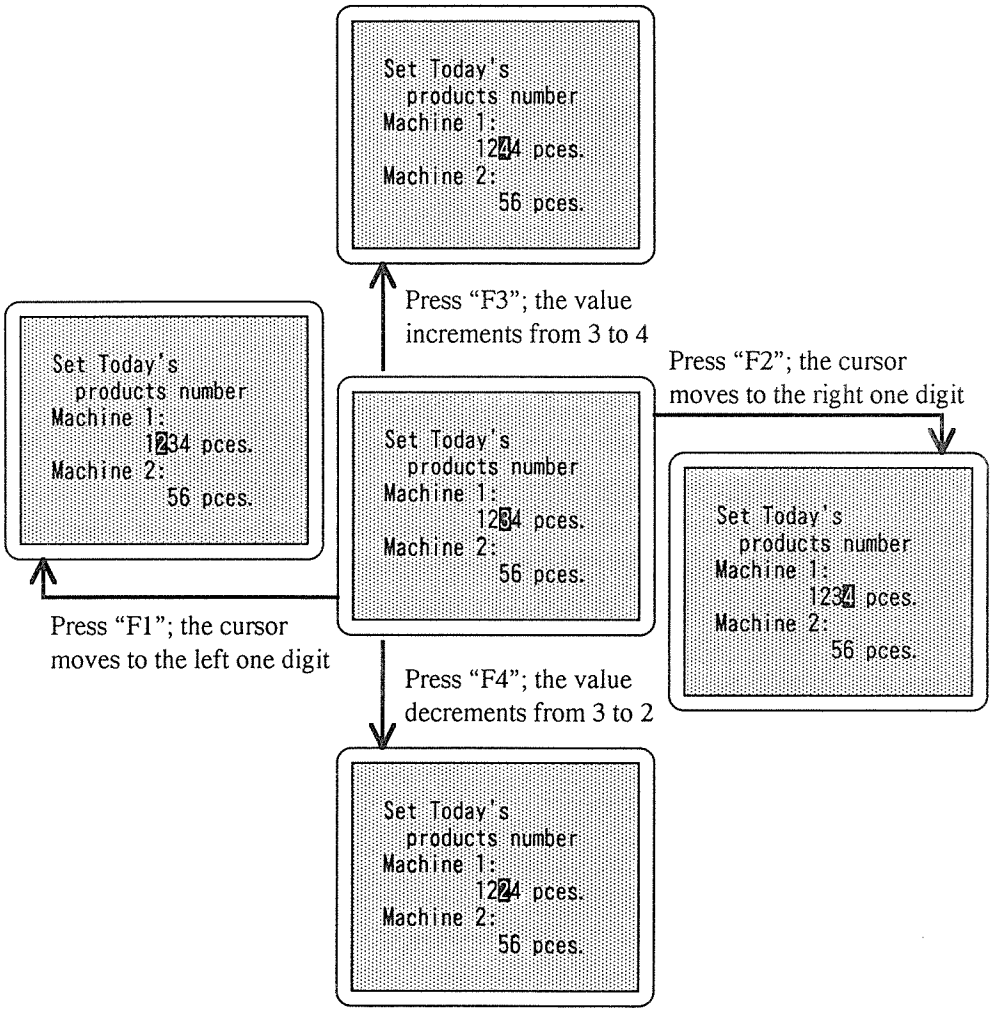
Procedure

When the screen for entering External Data appears on the I.O.P..

1. Press the ENTER key to make the cursor visible.
   The cursor will appear on the uppermost line for data entry.
   You can change the value under the cursor.



2. Enter the value you want.
   Use the F3 key to increment the value.
   Use the F4 key to decrement the value.
   Use the F1 key to move the cursor one digit to the left. When the cursor is at the leftmost digit, it will not go any further left.
   Use the F2 key to move the cursor one digit to the right. When the cursor is at the rightmost digit, it will not go any further right.

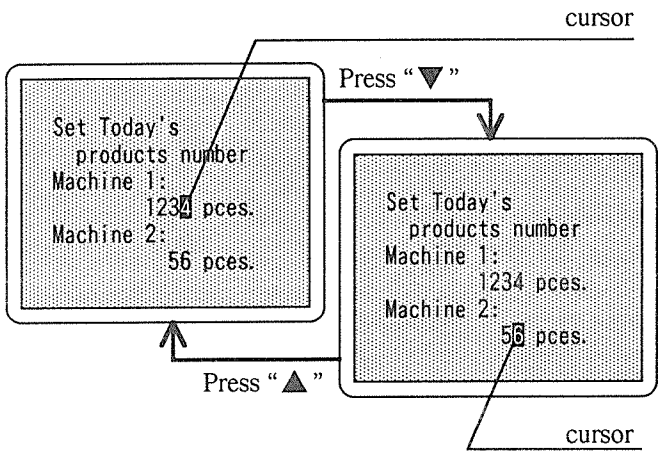


3. After you are through setting the values, press the ENTER key.
   The External Data entered on the I.O.P. is stored in the I.O.P. Shared Memory. You must press the ENTER key for the I.O.P. to store the data in memory.

When you want to enter data on another line, press the ENTER key to make the cursor visible again, then press an arrow key to move the cursor to the line you want.

With the down arrow key (▼), the cursor will move one line down.

With the up arrow key (▲), the cursor will move one line up.



Caution

- In this mode, the function keys on the front panel of the I.O.P. can only be used for entering External Data.
- While the cursor is visible on the screen, you cannot operate the Fixed keys.
  To make the cursor disappear, press the ESC key.
- Even if the I.O.P. power is turned OFF, the values in the buffer will be saved. However, the values stored in the I.O.P. Shared Memory won't be saved when the power is turned OFF. The data in the Shared Memory is not maintained by the backup battery. Once you turn OFF the I.O.P.'s power, you must send the data to the Shared Memory, even if you are entering the same data.

Creating a screen for entering External Data

You can create or edit a screen by running the I.O.P. 20 series program.
On the I.O.P. Message Screen, the area where you type a $ is then assigned as an External Data entry area.
Refer to the I.O.P. 20 series Software MANUAL for details.

PC programming for communication

Refer to Chapter 3 and 4 for details.

When the ENTER key is pressed, after completing the entry of data, the External Data that was entered will be stored in the I.O.P. Shared Memory. At the same time, the SD flag and the corresponding Descriptive External Data Buffer Flag will turn ON. The PC uses these flags to read the data.

2-5 Lighting LEDs

On the front panel of the I.O.P. are LEDs for 4 of the Fixed keys (AUTO, MAN., START, STOP). They are controlled by the PC.

LEDs for the Fixed Keys

Of the LEDs for 5 Fixed Keys, the LEDs, the AUTO LED, MAN. LED, START LED and STOP LED are controlled by the PC.

PC programming for communication

The Programming method for controlling the LED's status depends on the Communication Mode you choose.
Refer to Chapter 3 and 4 for details.

I/O Mode: 4 bits of output relay registers (in the PC) are used for the ON/OFF status of these LEDs. If a bit is ON, the corresponding LED will be turned ON, if the bit is OFF, the LED is turned OFF.

Shared Memory R/W Mode: 4 bits of the I.O.P. Shared Memory in the I.O.P. is allocated for the ON/OFF status of these LEDs. According to the bit pattern, the I.O.P. will turn ON the corresponding LEDs.

PAUSE LED

The PAUSE LED will turn ON if you press the PAUSE key. The PAUSE LED will be turned OFF if you press the RESET key.

PC programming for communication

Refer to Chapter 3 and 4 for details.

The PAUSE output is toggled. While the LED is ON, the PAUSE flag will be held in the ON state.

ALARM LED

When there is a problem in the I.O.P. system , the ALARM LED is automatically turned ON. To cancel the ALARM LED, press the System Reset Button on the rear panel of the I.O.P..

POWER LED

When the I.O.P. is ON, the POWER LED will be ON.

2-6 Sounding the Buzzer

The I.O.P. can sound a buzzer under the control of the PC.

PC programming for communication

Refer to Chapter 3 and 4 for details.

When the PC turns ON the BZ flag, the I.O.P. will sound a buzzer. If the flag gose OFF, the buzzer stops sounding.

2-7 Lighting the Back Light

You can specify the length of time the Back Light will remain lit with DIP switches No.6 and No.7 on the rear panel of the I.O.P..
You can set the DIP switches with the following table.

Backlight Lit	DIP switch No. 6	DIP switch No. 7
ON all the time	OFF	OFF
AUTO OFF (in 5 minutes) AUTO ON	OFF	ON
AUTO OFF (in 5 minutes) ON when ESC key is pressed.	ON	OFF
AUTO OFF (in 15 minutes) ON when ESC key is pressed.	ON	ON

AUTO OFF : The I.O.P. automatically turns OFF the back light when no signal is sent from the PC and no key is pressed for more than a certain period of time.

AUTO ON : The I.O.P. turns ON the back light automatically when there is any change on the I.O.P. screen or when the ESC key is pressed.

Note

- The back light will last longer if OFF is selected.

2-8 Choosing Run Mode or Monitor Mode

The I.O.P. has two modes: Run mode and Monitor mode.
In the Run mode, the I.O.P. will communicate with the PC. In the Monitor mode, you can check the screens before beginning communication with the PC (in the Run mode).
You can set the mode with the DIP switches on the rear panel of the I.O.P..

Run Mode

Usually you will operate the I.O.P. in the Run mode: The I.O.P. works according to the data exchanged with the PC when in the Run mode. However, you can check the Primary Screen briefly by pressing the ESC key and an arrow key at the same time.

Setting the DIP switches for the Run mode

DIP switch							
1	2	3	4	5	6	7	8
ON	OFF	*	*	*	*	*	*

* You can set either ON or OFF.
Choose the one appropriate for your operation.

When you set the DIP switches to the Run mode, you have to set the rest of the DIP switches according to your communication mode. You may refer to "DIP switches" on page 53.

After completing the DIP switch setting, press the System Reset Button on the rear panel of the I.O.P..

Viewing Primary Screens manually

In the Run mode, the Primary Screen is normally displayed under the control of the PC. But, you can view the Primary Screens manually:

To check the next Primary Screen, press the ESC key and the down arrow key(▼).
To check the previous Primary Screen, press the ESC key and the up arrow key(▲).

Caution

- On a Screen displayed by pressing an arrow key, you cannot operate the Fixed Keys, Function Keys, the PAUSE key or the ENTER key. The Key Codes won't be sent to the PC.

When you turn pages manually, after 5 seconds the I.O.P. will return to the Primary Screen that was displayed before the manual operation. The I.O.P. can then receive data from the PC.

Monitor Mode

In the Monitor mode, You can check the screens that have been transferred from a personal computer before you connect the I.O.P. to the PC. You can review the Primary Screens, Secondary Screens and the Manual Screen with the following operations.
In Monitor mode, the type of communication with the PC does not affect the operations.

Setting the DIP switches to the Monitor mode

DIP switch							
1	2	3	4	5	6	7	8
ON	ON	*	*	*	*	*	*

* You can set either ON or OFF.
Choose the one appropriate for your operation.

After completing the DIP switch settings, press the System Reset Button on the rear panel of the I.O.P..

When you set the DIP switches to the Monitor mode, the I.O.P. will first display the Primary Screen 00.

Checking the Primary Screens

To check the next Primary Screen, press the ESC key and the down arrow key(▼).
To check the previous Primary Screen, press the ESC key and the up arrow key(▲).

Checking the Secondary Screens

To see a Secondary Screen, first you must display the Primary Screen that the Secondary Screen belongs to. Then press the down arrow key (▼) to display a Secondary Screen.

To check the next Secondary Screen, press the down arrow key (▼).
To check the previous Secondary Screen, press the up arrow key (▲).

If a Primary Screen does not have any Secondary Screens, the Screen won't change.
If the I.O.P. was displaying the last Secondary Screen, the next screen displayed will be the Primary Screen.

Checking the Manual Key Access Screen

When the I.O.P. is displaying a Primary Screen or a Secondary Screen, you can see the Manual Screen by pressing MAN. key. If you press the MAN. key again , you will return to the Primary Screen. If the I.O.P. had been displaying a Secondary Screen, the I.O.P. will return to the Primary Screen to which the Secondary Screen belongs.

2-9 Replacing User Memory

The I.O.P. is shipped with a 256Kb RAM for User Memory.
You can replace the User Memory with a 256Kb ROM.
If you want to increase the number of screens that can be stored, install a 1024Kb RAM or ROM for User Memory.
When you replace the User Memory, you will have to change the Jumper settings depending on the User Memory you want to use.

Replacing User Memory

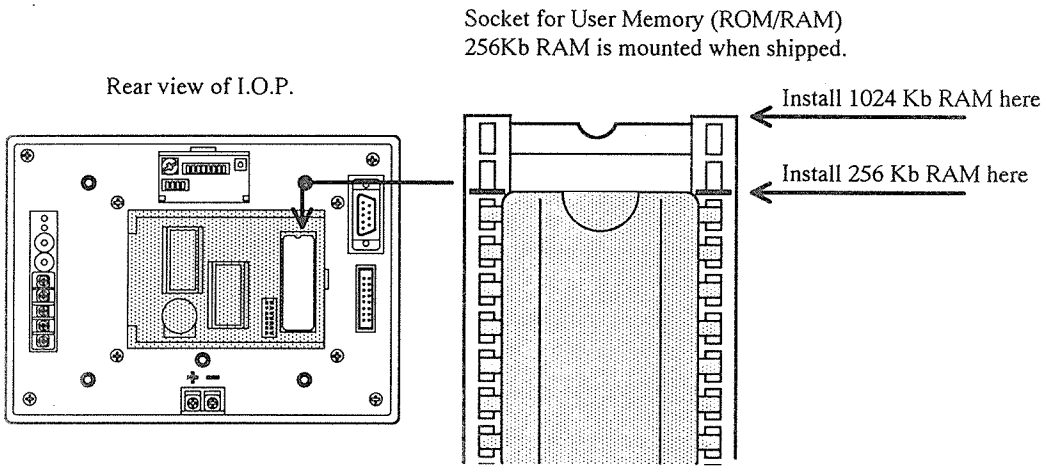
The installation position of the 1024Kb User Memory chip is different from that of the 256Kb chip. See the following drawing for details.

Caution

- Do not confuse User ROM or RAM with the System ROM. If you remove the System ROM, it will cause the I.O.P. to become defective.

No. of pin

	256Kb	1024Kb
RAM	28-pin	32-pin
ROM	28-pin	32-pin



Caution

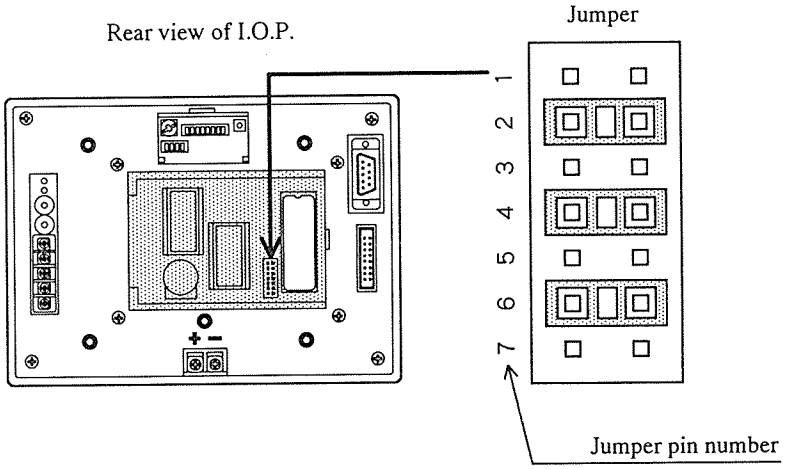
- Be very careful to note the installation for the chip.
  The number of pins will depend on the memory capacity of the chip.

Changing Jumper Settings

Depending on the User Memory you use, change the Jumper settings. Refer to the table below for details.

Caution

- Even when you use ROM, you must install a Backup Battery. In this case the battery life may be shorter than usual.
  Refer to 7-2 "Replacing the Backup Battery" on page 168.



	Jumper positions	
	256Kb	1024Kb
RAM	2,4,6	2,4,6
ROM	3,5,7	1,5,7

Example: Using 256Kb RAM

- Install jumpers on 2,4,6 as shown in the drawing above.
  When you use a 1024Kb ROM, use a 32-pin DIP type ROM conforming to the JEDEC standard(AIP8411).

Chapter 3

Preparing for PC Programming

Chapter 3 explains how you can set up the PC and the I.O.P. to build your remote I/O system. You will also find out how to use the PC to control the I.O.P.. The I.O.P. operation modes are also explained in this chapter.

Programmablr Contoroller is abbreviated PC.

3-1 Setting Up the I.O.P. and a PC

The I.O.P. Model 21 is connected to an FP3 or FP5 remote I/O system, and treated as a slave station. The relationship with the master station (the Master PC Unit) and with other slave stations must be considered when installing the I.O.P.. In this chapter you will learn how you can set up the I.O.P. as a slave station in a remote I/O system.

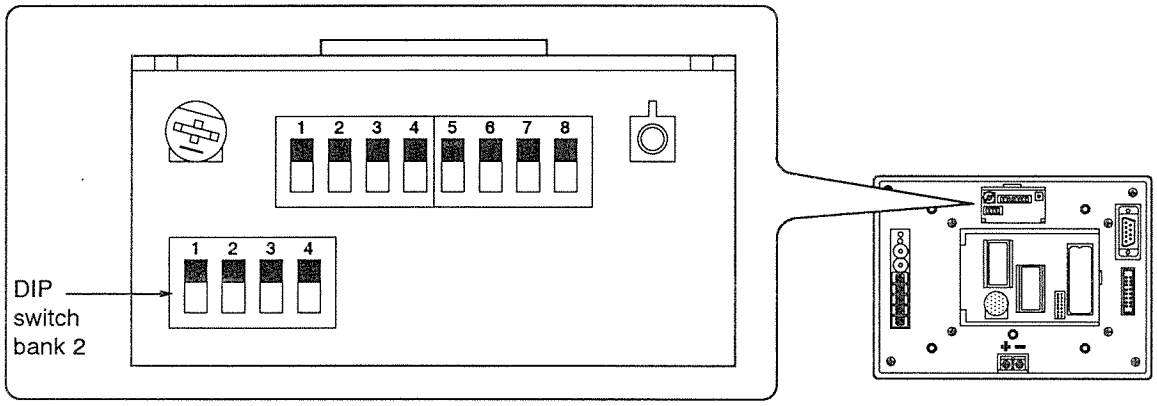
Refer to the Remote I/O System manual for details, when necessary.

I.O.P. DIP Switch Bank 2 Setting

Whether or not the I.O.P. will be the terminal (last) station on a line, and how the I.O.P. is treated when a communication error occurrs, are both set with the DIP switch bank 2 on the rear panel of the I.O.P.

Turn OFF the power to the I.O.P. to set the DIP switch bank 2.

I.O.P. DIP switch bank 2 settings



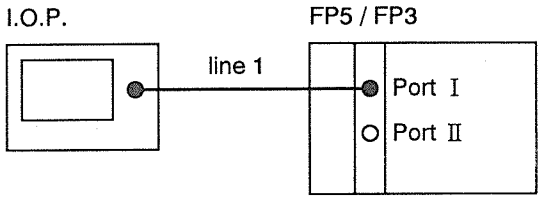
DIP Switch Bank 2 Setting				I.O.P. status
1	2	3	4	
ON	ON	*	*	Terminal station (a terminating resistor is present)
OFF	OFF	*	*	Not a terminal station (no terminating resistor)
*	*	ON	*	Continuous operation during a communication error
*	*	OFF	*	Stop operation when a communication error occurs

* You can set the DIP switch either ON or OFF.
Choose the one appropriate for your operation.

Terminal station

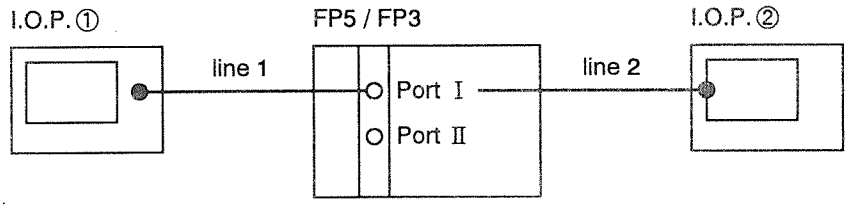
The Master Unit has two ports; Port I and Port II . For each port there must be a terminal station.

The following examples shows an I.O.P. configured as a terminal station.



● : terminal station

In the configuration above, the I.O.P. is one terminal station and Port I it I self is the other.



● : terminal station

In the configuration above, I.O.P. ① and I.O.P. ② are the terminal stations.

Note

- Refer to 3-1 "Connection" in the Remote I/O system Manual for the details about terminal stations.

Condition during a communication error

With DIP switch bank 2, you can set the status of the I.O.P. when a communication error occurrs between the I.O.P. and the PC (the Master Unit):

Continuous operation : The I.O.P. continues to output data to the PC during a communication error.

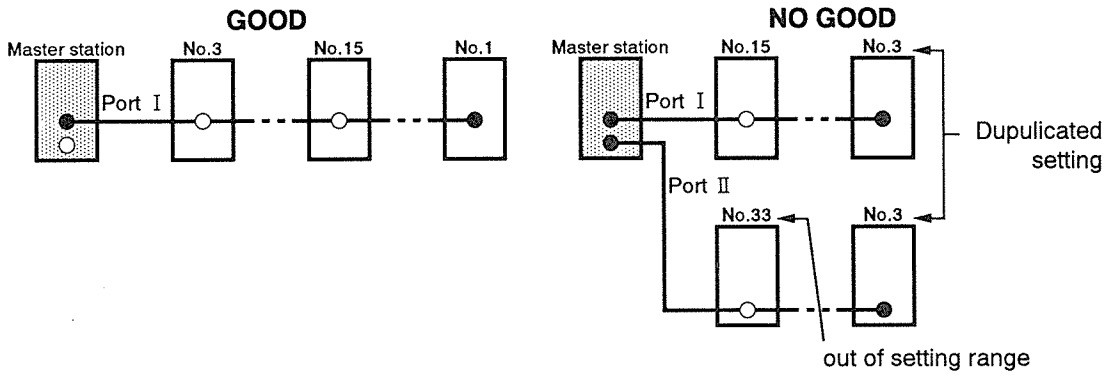
Stop operation : The I.O.P. will stop outputting data to the PC during communication error.

Note

- Refer to 5-2 "Operating mode during errors" in the Remote I/O System Manual for details.

I.O.P. Slave Station No. Selector Switches Setting

A slave station number must be assigned to each slave station. A maximum of 32 slave stations can be connected to a master station. You can assign the I.O.P. any number in the range from 1 to 32. Do not duplicate station numbers. If you assign duplicate numbers, or a number that is out of range, remote I/O control cannot be correctly accomplished. The I.O.P. slave station number is set with the Slave Station No. Selector Switches on the rear panel of the I.O.P..

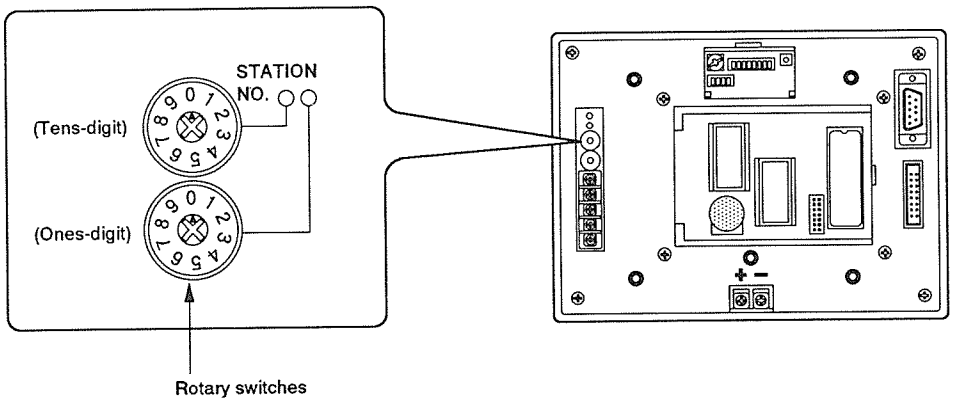


○ : connection port
● : terminal station

: Master station
(Master Unit)

: Slave station
(Slave Unit or I/O Terminal Board)

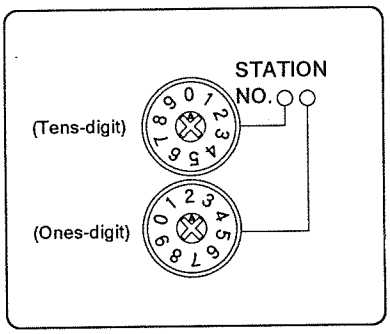
Slave Station No. Selector Switches



Set the switches to the station number you want to assign the I.O.P..

Example

Assign station number 02.



Notes

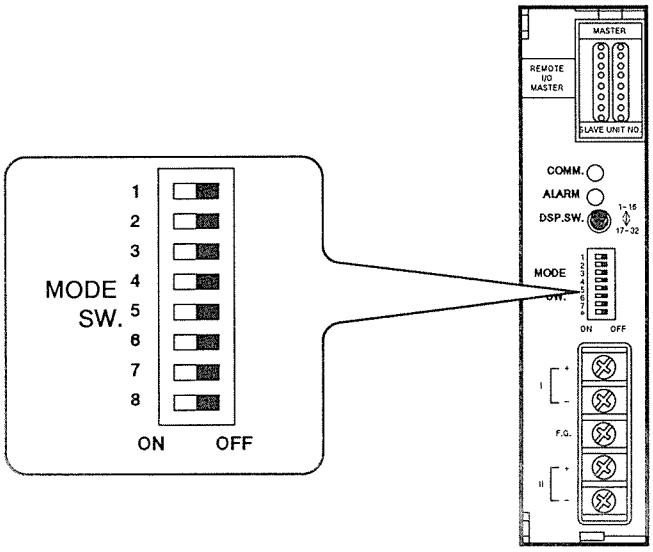
- Do not assign the same slave station number to two different I.O.P.s.
- You can assign slave station numbers without regard to the order in which they are physically connected, and the numbers do not have to be consecutive (unused slave station numbers are O.K.).

Master Unit Mode Selector Switches Setting

The Master Unit must be set for your remote I/O system configuration, including the I.O.P. settings.
The system ports used and the status during a communication error must be set with the Mode Selector Switches on the front panel of the Master Unit.

Turn OFF the power to the system (including to the I.O.P.s) when you set the DIP switches.

Master Unit Mode Selector Switches



Mode selector switch No.								Description
1	2	3	4	5	6	7	8	
OFF	OFF							Use only Port I
ON	ON							Use Port I and Port II
		OFF	OFF					Port I is a Terminal Station
		ON	ON					Port I is NOT a Terminal Station
				OFF	OFF			Port I II is a Terminal Station
				ON	ON			Port II NOT a Terminal Station
						OFF		Stop during transmission error
						ON		Continue during transmission error

* You can set the DIP switch either ON or OFF.
Chose the one appropriate for your operation.

Switch 1 and 2

Sets the ports used.
The Master Unit has two ports. If you only use one port, you must use Port I . You cannot use Port II by itself.

Switches 3 to 6

Sets the terminal station condition of the port.
Whether or not the port is itself a terminal station is set with these switches.
Switch 3 and 4 are for Port I .
Switch 5 and 6 are for Port II .

Switch 7

Sets of the status of the Master Unit during a communication error.

ON: Stop the Master Unit system.
OFF: Continue operation when a communication error occurs with a slave station.

Caution

- If you choose the continuous operation mode, the relationship with the CPU must be considered. Refer to 5-2 "Operation Mode during errors" in the Remote I/O system Manual for details.

Note

- Refer to 3-2 "Settings" in the Remote I/O system Manual for details.

Assigning an I/0 number for controlling the I.O.P.

In the PC memory area used for input and external output relays, the Master Unit assigns 2 words (32 bits, a 16 bit external input relay and a 16 bit external output relay) for controlling the I.O.P. Model 21. The addresses (I/O numbers) for the I.O.P. are determined by the location of the I.O.P.. You have to determine which number is assigned for the I.O.P..
You can check the number as described below.

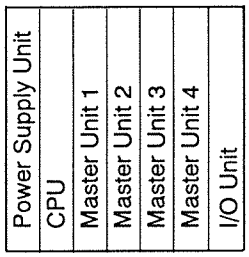
Remote I/O Map

The range of I/O numbers assigned for each slave station (the I.O.P. is a slave station) are called the "Remote I/O Map". These assignments are allocated according to the location of the I.O.P. in the Master Unit communication link. The creation of the remote I/O map is described below.

Master Unit Number

In the FP3/FP5 system, a maximum of 4 Master Units can be installed. If you install more than one Master Unit, a Unit number is assigned in sequence, starting with number "1" being assigned to the Unit which is in the slot closest to the CPU.

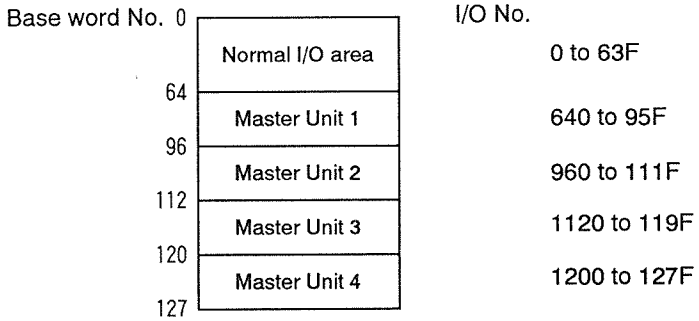
To connect 4 Master Units,



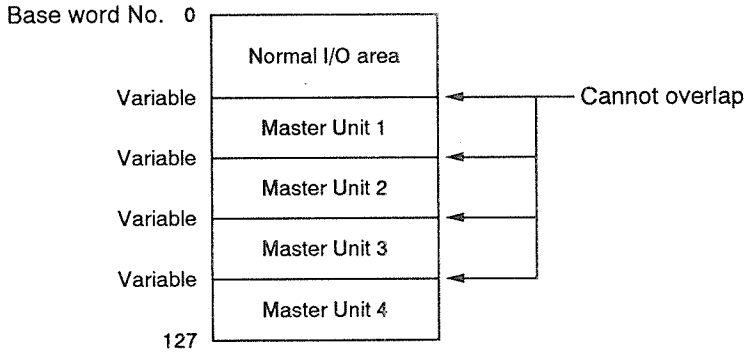
Base Word Number

The number of input and external output relays in the PC memory (I/O numbers) that a Master Unit can control depends on the Master Unit Number. A maximum of 64 words (16 bits/word) can be assigned to a Master Unit. The first number assigned is called the "base word number".

Initial settings are shown below. The value can be changed within the restrictions also described below.



Restrictions: Maximum of 128 words (16 I/O points per word) per CPU.
Maximum of 64 words per Master Unit.
No duplication or overlapping of I/O numbers.

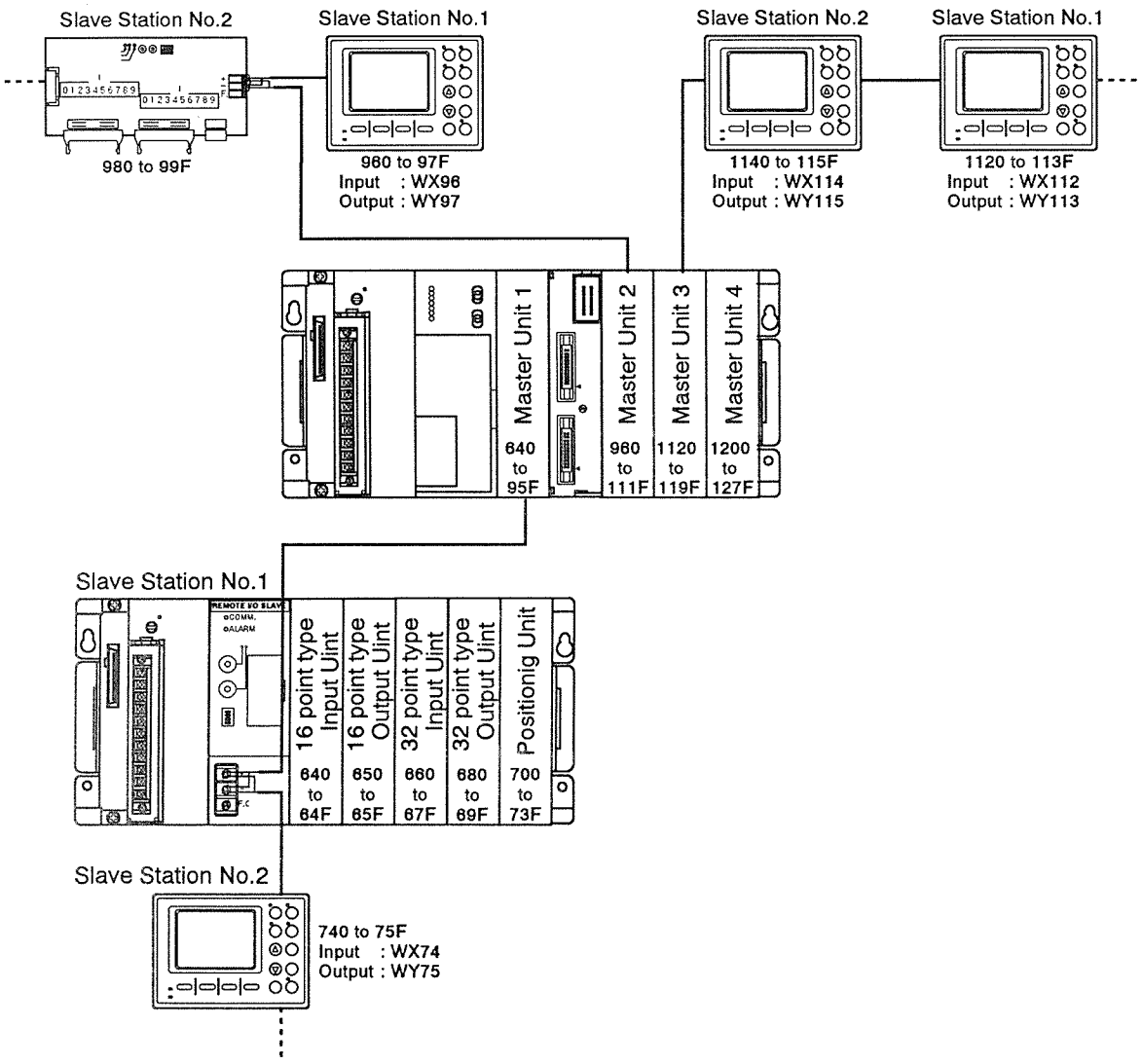


For example, if the base word number for Master Unit 1 is 64, the slave units connected to Master Unit 1 are controlled via external input/output relays "640" to "95F".

I/O numbers for the I.O.P.

The I.O.P. uses 2 words of I/O in the Master Unit. After the base word for the Master Unit is determined, the I/O numbers for the I.O.P. can be checked. The I/O numbers allocated for the I.O.P. will depend on the other kinds of Slave Units controlled by the same Master Unit.

Remote I/O Map



Note

- Refer to 4-1 "Remote I/O Map" in the Remote I/O system manual for details about the base word number.

3-2 How the Master Unit Communicates with the I.O.P.

The Master Unit uses 2 words worth of input/output relays (one word for input and one word for output) to control the I.O.P. Model 21. Each bit has been already assigned a specific use as shown in the table "I/O Numbers Assignments for Controlling the I.O.P." You can't change these assignments.

The I.O.P. Model 21 dose not have I/O terminals corresponding to the external input/output relays assigned for the I.O.P.. But, instead of them, it communicates with the PC via 2-conductor communication cable.

In addition, the I.O.P. Shared Memory has been allocated to store various data which are read or written by the Master Unit. The Maser Unit will read and write the data in the shared memory via Remote Memory Read/Write instructions (RMRD/RMWT instructions). Refer to "RMRD/RMWT instructions" in 4-1 "Before Programming the PC" for details about RMRD/RMWT instructions.

I/O Numbers Assignments for Controlling the I.O.P.

Notes

- The input relay(X) and output relay(Y) registers described in this manual are shown in "MEW" representation. In MEW, the rightmost digit is a hexadecimal number and the rest of the digits are decimal. Refer to the following to determine input and output relay addresses.

  How to look up addresses in the table :

  X *** +
  - Bit position
  - Word number ---------- For the I.O.P., it is the base word number.
  - "X" is an input relay

  Y *** +
  - Bit position
  - Word numer ---------- For the I.O.P., it is the base word number plus "1".
  - "Y" is an output relay

- A PC input corresponds to an I.O.P. output.
  A PC output corresponds to an I.O.P. input.

PC memory (external input relay)		Description	Remarks
Address	Name		
X✱0	KD 0	Key Data	The Key Code (01 to FF) corresponding to the key pressed on the I.O.P. is received as an 8 bit contact pattern. These 8 contacts (bits) are activated even if you are in Shared Memory R/W mode.
X✱1	KD 1		
X✱2	KD 2		
X✱3	KD 3		
X✱4	KD 4		
X✱5	KD 5		
X✱6	KD 6		
X✱7	KD 7		
X✱8	KD STROB	KD STROB flag	ON, during any key press. (except the PAUSE key)
X✱9	(not used)		
X✱A	SD	Descriptive External Data Completion Flag	ON, when new Descriptive External Data is entered on the I.O.P..
X✱B	PAUSE	PAUSE flag	ON, when the PAUSE key on the front panel of the I.O.P. is pressed.
X✱C	(not used)		
X✱D	RCC	Character Superimposition Complete Flag	ON, when superimposed characters have been sent.
X✱E	RCH	Character Highlight Complete Flag	ON, when highlighted positions have been sent.
X✱F	BT	Backup Battery Flag	ON, when the battery gets low.

✱ : Insert the base word number assigned for the I.O.P..

PC memory (external output relay)		Description	Remarks
Address	Name		
Y**0	GD 0	Primary Screen Data	The screen number is sent to the I.O.P. as ia 8 bit contact pattern. These contacts are only valid if you are in I/O Mode.
Y**1	GD 1		
Y**2	GD 2		
Y**3	GD 3		
Y**4	GD 4		
Y**5	GD 5		
Y**6	GD 6		
Y**7	GD 7		
Y**8	CD	Character Superimposition Flag	ON when superimposed character, are specified.
Y**9	HD	Character Highlight Flag	ON when highlighted position, are specified.
Y**A	MS	Manual Screen Flag	ON when displaying the Manual Screen.
Y**B	BZ	BUZZER Flag	ON when the buzzer is sounding.
Y**C	STOP LED	LED control	ON : LED ON OFF: LED OFF
Y**D	START LED		
Y**E	MAN. LED		
Y**F	AUTO LED		

**: Insert the base word number plus 1.

I.O.P. Shared Memory Allocation

The allocation will depend on whether you use HEX data or ASCII data for Displayable External Data.
The addresses are assigned and areas for storing data have been allocated for this specific use.

When you have chosen HEX data for Displayable External Data

"Digit nn" in the table below indicates the position of the Displayable External Data Digit

10	9	8	7	6	5	4	3	2	1

(Data position on the I.O.P. screen)

"Position nn" in the Table below indicates the horizontal digit position on the I.O.P. screen.
Position

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

(I.O.P. screen)

Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0	Data
K 0	(not used)	(not used)	Primary Screen number		Primary Screen number
K 1	(not used)	(not used) ML	Manual Screen LINE spec.		Manual Screen
K 2	(not used)	(not used)	(not used)	AUTO LED, MAN. LED, START LED, STOP LED	LED Control
K 3	(not used)	(not used)	Key Code		Key Code
(not used)					
K 99	F E D C	B A 9 8	7 6 5 4	3 2 1 0	Leading zero suppression flag (specify the buffer number)
K 100	Digit 4	Digit 3	Digit 2	Digit 1	Displayable External Data stored in Buffer 0
K 101	Digit 8	Digit 7	Digit 6	Digit 5	
K 102	(not used)	(not used)	Digit 10	Digit 9	
K 103	Digit 4	Digit 3	Digit 2	Digit 1	Displayable External Data stored in Buffer 1
K 104	Digit 8	Digit 7	Digit 6	Digit 5	
K 105	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮

Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0	Data
K 145	Digit 4	Digit 3	Digit 2	Digit 1	
K 146	Digit 8	Digit 7	Digit 6	Digit 5	Displayable External Data stored in Buffer F
K 147	(not used)	(not used)	Digit 10	Digit 9	
(not used)					
K 199	F E D C	B A 9 8	7 6 5 4	3 2 1 0	Descriptive External Data Buffer flag
K 200	Digit 4	Digit 3	Digit 2	Digit 1	
K 201	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 0
K 202	not used	not used	Digit 10	Digit 9	
K 203	Digit 4	Digit 3	Digit 2	Digit 1	
K 204	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 1
K 205	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮
K 245	Digit 4	Digit 3	Digit 2	Digit 1	
K 246	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer F
K 247	(not used)	(not used)	Digit 10	Digit 9	
(not used)					
K 300	character superimposition line specification				
K 301	position 1				
K 302	position 2				
⋮	⋮	⋮	⋮	⋮	
K 320	position 20				Character Superimposition operation data storage area
(not used)					
K 350	(not used : bit A to F)		line 1	position 11 – 20	
K 351	(not used : bit A to F)		line 1	position 1 – 10	
K 352	(not used : bit A to F)		line 2	position 11 – 20	
K 353	(not used : bit A to F)		line 2	position 1 – 10	
⋮	⋮	⋮	⋮	⋮	
K 364	(not used : bit A to F)		line 8	position 11 – 20	Character Highright operation data storage area
K 365	(not used : bit A to F)		line 8	position 1 – 10	

When you have chosen ASCII data for Displayable External Data

"Digit nn" in the table below indicates the position of the Displayable External Data Digit

10	9	8	7	6	5	4	3	2	1

(Data position on the I.O.P. screen)

"Position nn" in the table below indicates the horizontal digit position on the I.O.P. screen. Position

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

(I.O.P. screen)

Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0	Data
K 0	(not used)	(not used)	Primary Screen number		Primary Screen number
K 1	(not used)	(not used) ML	Manual Screen LINE spec.		Manual Screen
K 2	(not used)	(not used)	(not used)	AUTO LED, MAN. LED, START LED, STOP LED	LED Control
K 3	(not used)	(not used)	Key Code		Key Code
(not used)					
K 99	F E D C	B A 9 8	7 6 5 4	3 2 1 0	Leading zero suppression flag (specify the buffer number)
K 100	Digit 9		Digit 10		
K 101	Digit 7		Digit 8		
K 102	Digit 5		Digit 6		
K 103	Digit 3		Digit 4		Displayable External Data stored in Buffer 0
K 104	Digit 1		Digit 2		
K 105	Digit 9		Digit 10		
K 106	Digit 7		Digit 8		
K 107	Digit 5		Digit 6		
K 108	Digit 3		Digit 4		Displayable External Data stored in Buffer 1
K 109	Digit 1		Digit 2		
⋮	⋮		⋮		⋮

Word Address	Bit contents F E D C B A 9 8		7 6 5 4	3 2 1 0	Data
K 175	Digit 9		Digit 10		
K 176	Digit 7		Digit 8		
K 177	Digit 5		Digit 6		
K 178	Digit 3		Digit 4		Displayable External Data stored in Buffer F
K 179	Digit 1		Digit 2		
(not used)					
K 199	F E D C B A 9 8		7 6 5 4	3 2 1 0	Descriptive External Data Buffer Flag
K 200	Digit 4	Digit 3	Digit 2	Digit 1	
K 201	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 0
K 202	(not used)	(not used)	Digit 10	Digit 9	
K 203	Digit 4	Digit 3	Digit 2	Digit 1	
K 204	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 1
K 205	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮
K 245	Digit 4	Digit 3	Digit 2	Digit 1	
K 246	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer F
K 247	(not used)	(not used)	Digit 10	Digit 9	
(not used)					
K 300	character superimposition line specification				
K 301	position 1				
K 302	position 2				
⋮	⋮	⋮	⋮	⋮	Character Superimposition operation data storage area
K 320	position 20				
(not used)					
K 350	(not used : bit A to F)		line 1	position 11 – 20	
K 351	(not used : bit A to F)		line 1	position 1 – 10	
K 352	(not used : bit A to F)		line 2	position 11 – 20	
K 353	(not used : bit A to F)		line 2	position 1 – 10	
⋮	⋮	⋮	⋮	⋮	
K 364	(not used : bit A to F)		line 8	position 11 – 20	Character Highright operation data storage area
K 365	(not used : bit A to F)		line 8	position 1 – 10	

Note

- In the I.O.P. Shared Memory, there are areas for Primary Screen display, Key Code storage and LED control. These can be also controlled by I/Os. You can choose either one by setting the Communication Mode for either the I/O mode or the shared memory R/W mode with DIP switch 1 on the rear panel of the I.O.P.

Communication Mode

I/O Mode: Primary Screen display, LEDs control and Key Code sending are done via I/O contacts.

Shared Memory R/W Mode: Primary Screen display, LED control and Key Code sending are done via the shared memory of the I.O.P.

Primary Screen numbers

This specification is valid only in the Shared Memory R/W Mode. Specify the 8 bit pattern (Bits 0 to 7) corresponding to the Primary Screen number you want displayed. Paging is accomplished by changing the bit pattern. For PC programming use the RMWT instruction to store Primary Screen numbers in the memory.

Manual Screen LINE specification

The LINE number you want displayed as the first line on the Manual Screen is specified as an 8 bit pattern (Bits 0 to 7). To actually display the Manual Screen starting with the LINE you specify, you have to turn ON the ML bit (8th bit) and then the MS bit. For PC programming, use the RMWT instruction to store the LINE number in memory.

LED control

This area is valid in the Shared Memory R/W Mode only.
Turn ON the bit corresponding to the LED you want to turn ON. For PC programming, use the RMWT instruction to store the data in memory.

Key Code

This area is valid in the Shared Memory R/W Mode only.
The Key Code (01 to FF) corresponding to the I.O.P. key that is pressed is stored here as an 8 bit pattern. For PC programming, use the RMRD instruction to retreive the Key Data from memory.

Memory Area for Displayable External Data

Depending on the Data Format you use (HEX or ASCII data), the amount of memory required will vary. In HEX data format, 3 words are used to store one piece of Displayable External Data. So, 48 words (K100 to K147) are allocated for storing 16 pieces of Displayable External Data. In ASCII data format, 5 words are used to store one piece of Displayable External Data. So, 80 words (K100 to K179) are allocated for storing 16 pieces of Displayable External Data.
For PC programming, use the RMWT instruction to store Displayable External Data in memory.

K99 is commonly used to specify suppression of leading zeroes.
For PC programming, use the RMRD instruction to specify suppression of leading zeroes.

Leading zero suppression flag

Leading zero suppression can be specified for Displayable External Data. Each bit corresponds to one of the 16 External Data Buffers as follows. The data in the buffer will be subjected to leading zero suppression if the corresponding bit is ON.

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Buffer No.	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0

Memory Area for Descriptive External Data

3 words are used to store a piece of Descriptive External Data.
48 words (K200 to K247) are allocated for the 16 pieces of Descriptive External Data. For PC programming, use the RMRD instructions to receive Descriptive External Data.

K199 is used as the Descriptive External Data flag.
For PC programming, use the RMRD instructions to receive the flag's condition.

Descriptive External Data Buffer flag

When you press the enter key, after entering External Data on the I.O.P., the Descriptive External Data Buffer flag (which corresponds to the buffer whose data has changed) will turn ON for at least 640 msec.

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Buffer No.	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0

Memory Area for Superimposed Characters

I.O.P. screen	LINE	K 300																			
	Half-width	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I.O.P. Shared Memory (Character Specification)		k301	k302	k303	k304	k305	k306	k307	k308	k309	k310	k311	k312	k313	k314	k315	k316	k317	k318	k319	k320

I.O.P. screen	LINE	K 300									
	Normal size	1	2	3	4	5	6	7	8	9	10
I.O.P. Shared Memory (Character Specification)		k301	k303	k305	k307	k309	k311	k313	k315	k317	k319

For PC programming, use the RMWT instructions to store superimposed character codes in the memory. The I.O.P. will superimpose characters corresponding to the code stored in memory when the CD flag turns ON. After the superimposition has been completed, the I.O.P. will turn RCC flag ON.

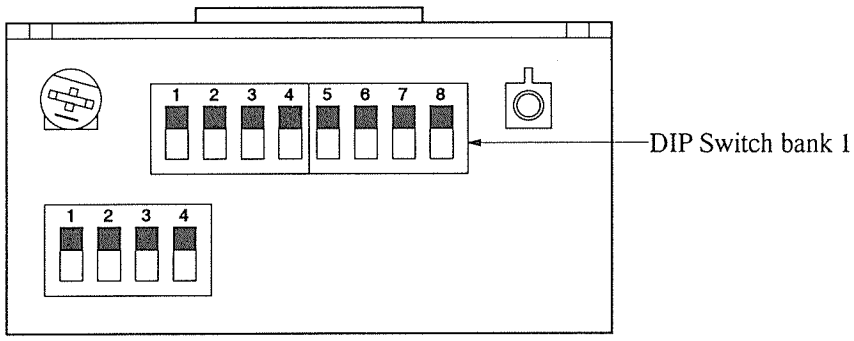
Memory Area for Highlighted Characters

	Normal size	1		2		3		4		5		6		7		8		9		10	
	Half-width	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I.O.P. screen	line 1					K 351										K 350					
	2					K 353										K 352					
	3					K 355										K 354					
	4					K 357										K 356					
	5					K 359										K 358					
	6					K 361										K 360					
	7					K 363										K 362					
	8					K 365										K 364					
Bit position		9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0

For PC programming, use the RMWT instructions to store highlighted position data in the memory. The I.O.P. will highlight the specified character's position when the HD flag turns ON. After the superimposition has been completed, the I.O.P. will turn RCH flag ON.

3-3 I.O.P. Setting DIP Switch Bank 1 Setting

The I.O.P. Model 21 system settings (operation mode settings) are done with the DIP switch bank 1 on the rear panel of the I.O.P..
These settings will determine the kind of programming used for data communication.



DIP-Switch Bank 1 Setting								Setting
1	2	3	4	5	6	7	8	
OFF	OFF	*	*	*	*	*	*	Data Register Mode/Transfer Mode
ON	ON	*	*	*	*	*	*	Monitor Mode
ON	OFF	*	*	*	*	*	*	Run Mode
ON	*	OFF	*	*	*	*	*	JIS Code (Normal size characters to be superimposed)
ON	*	ON	*	*	*	*	*	Shift-JIS Code (Normal size characters to be superimposed)
ON	*	*	OFF	*	*	*	*	HEX Code (Displayable External Data)
ON	*	*	ON	*	*	*	*	ASCII Code (Displayable External Data)
ON	*	*	*	OFF	*	*	*	I/O Mode
ON	*	*	*	ON	*	*	*	Shared Memory R/W Mode
ON	*	*	*	*	OFF	OFF	*	Back light ON all the time.
ON	*	*	*	*	OFF	ON	*	Back light AUTO OFF in 5 minutes. AUTO ON with a screen change or the ESC key.
ON	*	*	*	*	ON	OFF	*	Back light AUTO OFF in 5 minutes. ON with the ESC key.
ON	*	*	*	*	ON	ON	*	Back light AUTO OFF in 15 minutes. ON with the ESC key.

* You can set the DIP switch to either ON or OFF.
Choose the one appropriate for you operation.

Communication Mode

PC communication can be in either the I/O Mode or the Data Communication Mode.

Character Superimposition

Choose from "JIS code" or "Shift-JIS code" as the format for sending superimposed characters. (Normal Size Characters)

External Data Display

Choose from "HEX data" or "ASCII data" as the format for sending Displayable External Data.

Back Light

Select the control method for the back light.
The back light will last longer if OFF is selected.

Caution

- Press the System Reset Button after changing the DIP setting.

Chapter 4

Guide to PC Programming

Chapter 4 will give you ideas for creating programs for data communication.
The I.O.P. Model 21 has Shared Memory to store data for communications. The PC can access this Memory via the remote memory read/write instructions. The PC also controls the I.O.P. Model 21 using input relays(X) and output relays(Y) in the PC's memory.
You will find how to create programs according to the I.O.P. function that is being described.

Programmable Controller is abbreviated PC.

4-1 Before Programming the PC

PC Programming Overview

Before the I.O.P. can communicate with the PC, you must create programs for the PC. There are different programming methods for displaying Primary Screens, for receiving Key Data and for controlling LEDs that depend on whether you choose the I/O Mode or the Shared Memory R/W Mode.
You can refer to the "PC Programming Overview" below for details.

I.O.P. Operation	Communication Mode	I.O.P. Status
Display Primary Screens	I/O Mode	A Primary Screen is displayed when the PC turns ON the GD bits corresponding to the Primary Screen number you want the I.O.P. to display.
	Shared Memory R/W Mode	A Primary Screen is displayed when the PC writes the Primary Screen number in the corresponding I.O.P. Shared Memory area.
Superimpose Primary Screens	I/O Mode Shared Memory R/W Mode	The same as the Primary Screen. Display a Primary Screen and then a Primary Screen which has the attribute "6". The I.O.P. will superimpose the new screen on a Primary Screen that is already being displayed.
Send Key Data	I/O Mode	When any key (except the PAUSE key) is pressed on the I.O.P., the corresponding KD bits in the PC memory will turn ON.
	Shared Memory R/W Mode	When any key (except the PAUSE key) is pressed on the I.O.P., its Key Code is stored in the I.O.P. Shared Memory area.
	Use KD STROB to receive Key Data from the I.O.P.. If a key is pressed on the I.O.P., KD STROB will be turned ON. When the PC sees this signal, it can retreive the Key Data.	
Display External Data	I/O Mode/ Shared Memory R/W Mode (common)	The I.O.P. will display External Data when the PC writes the Displayable External Data in the corresponding I.O.P. Shared Memory area. You can specify leading zero suppression.

I.O.P. operation	Communication Mode	I.O.P. Status
Enter External Data	I/O Mode/ Shared Memory R/W Mode (common)	When External Data is entered on the I.O.P., the data is stored in the corresponding the I.O.P. Shared Memory area. If the External Data is freshly entered (when the ENTER key is pressed after a value is entered), the SD Flag in the PC's Memory will turn ON. When the flag is ON, the PC can read the data from the I.O.P. The I.O.P. also turns ON the corresponding Descriptive External Data Buffer Flag in the I.O.P. Shared Memory area. When the flag is ON, the PC can read the data in the specified buffer.
Superimpose characters	I/O Mode/ Shared Memory R/W Mode (common)	The I.O.P. superimposes characters according to the data written in the I.O.P. Shared Memory area by the PC. This happens when the Character Superimposition Flag (CD flag) is ON. After superimposition is complete, the I.O.P. will turn ON the Character Superimposition Completion Flag(RCC flag). Then, the PC can turn OFF the Character Superimposition Flag.
Highlight characters	I/O Mode/ Shared Memory R/W Mode (common)	The I.O.P. highlights characters at the locations specified in the I.O.P. Shared Memory area by the PC. This happens when the Character Highlight Flag (HD flag) is ON. After completion, the I.O.P. will turn ON the Character Highlight Completion Flag(RCH flag). Then, the PC can turn OFF the Character Highlight Flag.
LEDs ON/OFF	I/O Mode	The I.O.P. turns ON an LED when the corresponding LED flag is ON.
	Shared Memory R/W Mode	The I.O.P. turns ON LEDs according to the bit patterns written in the I.O.P. Shared Memory area by the PC.
Display the Manual Screen	I/O Mode/ Shared Memory R/W Mode (common)	The I.O.P. will display the Manual Screen when the MS flag in the PC memory is turned ON.
Manual Screen LINE specification	I/O Mode/ Shared Memory R/W Mode (common)	The I.O.P. will display the Manual Screen, starting with the LINE specified, if the PC writes the LINE number in the I.O.P. Shared Memory allocated for LINE specification, and turns ON the ML flag.
Sound Buzzer	I/O Mode/ Shared Memory R/W Mode (common)	The I.O.P. will sound the buzzer when the BZ flag in the PC memory is turned ON.
PAUSE key	I/O Mode/ Shared Memory R/W Mode (common)	When the PAUSE key is pressed on the I.O.P., the PAUSE flag in the PC memory will be turned ON. OFF when the RESET key is pressed on the I.O.P..

RMRD/RMWT instructions

Refer to the FP3/FP5 Programming Manual for details of the RMRD/RMWT instructions.

The Remote Memory Read instruction (RMRD instruction) and Remote Memory Write instruction (RMWT instruction) must be used to access the I.O.P. Shared Memory from a PC.

I.O.P. Shared Memory read from the PC: F152(RMRD), P152(PRMRD)
I.O.P. Shared Memory write from the PC: F153(RMWT), P153(PPMWT)

Control Data for the I.O.P. Model 21

To use these instructions, you must specify the control data.
The control data is used to specify the address where the PC can read and write data. For the I.O.P. Shared Memory, you can calculate the control data as described below.

To calculate the control data, use a two-word data register.

	High order (Upper 8 bits)	Low order (Lower 8 bits)
1st word	Master Unit number	Slave station number
2nd word	Bank number	Slot number

Master Unit number

Must be in the range of 1 to 4.
This is the address of the Master Unit to which the I.O.P. is connected.
Refer to page 52 for details.

Slave station number

Must be in the range of 01 to 32.
This is the station number you set with the selector switches on the rear panel of the I.O.P..
Refer to page 48 for details.

Bank number

Must be "0" for the I.O.P.

Slot number

Must be "0" for the I.O.P.

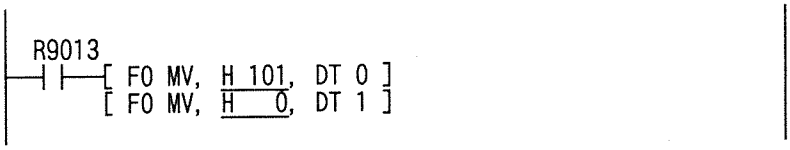
Note

- Refer to 7-2 "Memory Access Function" of the Remote I/O system manual for details about control data.

Setting Example

Assumptions

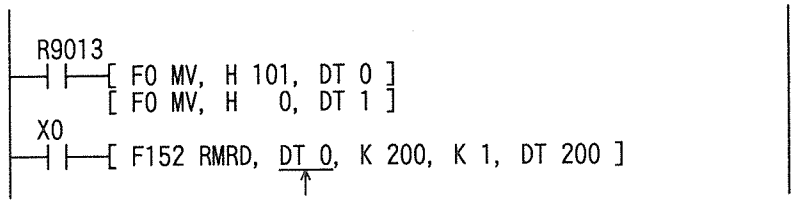
Master Unit number connected to the I.O.P. : number 1
I.O.P. Slave station number : number 1
* Bank number and slot number : must be 0
Data registers used for the control data : DT0 and DT1



H101: H 101
- 1 — slave station number
- 01 — master slot number
- H — always set in HEX.

H 0: H 0
- 0 — always set to H 0 for the I.O.P.

In the F152/F153 instructions, the control data is written as shown below. For details you can refer to the next section.



If you connect more than one I.O.P., the slave station number must be changed.
The same data registers in the PC must not be assigned to different I.O.P.s.

Example

* DT0 and DT1 are used to stored the control data for the I.O.P. assigned as station number 01.
* DT2 and DT3 are used to stored the control data for the I.O.P. assigned as station number 02.

```
R9013
─┤ ├─[ F0 MV, H 101, DT 0 ]
      [ F0 MV, H   0, DT 1 ]
      [ F0 MV, H 102, DT 2 ]
      [ F0 MV, H   0, DT 3 ]
X0
─┤ ├─[ F152 RMRD, DT 0, K 200, K 1, DT 200 ]
X1
─┤ ├─[ F152 RMRD, DT 2, K 200, K 1, DT 201 ]
```

RMRD instruction (F152)

Basic Program

```
─┤ ├─[ F152 RMRD, S1, S2, n, D ]
```

S1: Control data
The 1st word's address must be specified.
(Specify as a double word)

S2: Starting address of the remote I/O memory to be read.
For the I.O.P., the remote I/O memory corresponds to the Shared Memory.

n: The number of words to be read.

D: Starting address of the area where the data that is read will be stored.

Operands

Preset (Set) value	Word unit											Constant		Index modifier	Steps
	WX	WY	WR	WL	SV	EV	DT	LD	FL	IX	IY	K	H		
S1	A	A	A	A	A	A	A	A	A	N/A	N/A	N/A	N/A	A	9
S2	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
n	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
D	N/A	A	A	A	A	A	A	A	A	N/A	N/A	N/A	N/A	A	

A : Available
N/A : Not Available

Cautions

- The PC can write a maximum of 32 words of data with one instruction.
  If you specify more than 32 words, the CPU will declare an error.

```
|--| |--[ F152 RMRD, DT 0, K 200, K 33, DT 100 ]
                                   ↑
                                 Error
```

- The PC can execute only one RMRD instruction per scan. If the PC trys to execute more than one, the CPU will declare an error. To prevent this kind of error, use the special relays discussed below.

R9035: Memory access instruction executable flag
- 0: Non-executable (already executing an instruction)
- 1: Executable

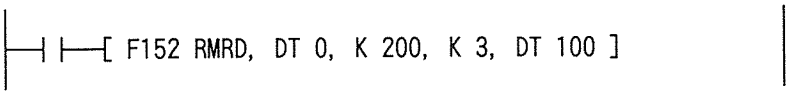
R9036: Memory access instruction completion flag
- 0: Normal termination
- 1: Error termination

DT9036: Memory access instruction completion error code
- 0: Normal termination
- 1: Stores the error code (valid only when R9036 is 1)

Program examples using special relays and special data registers are introduced in Chapter 5.

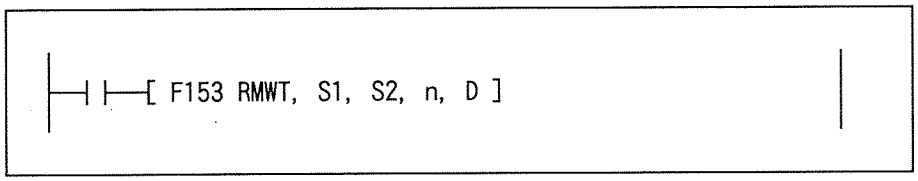
Programming Example

Read 3 words of data, starting from K200, in the remote I/O memory of the slave station specified in DT0 and DT1.



RMWT instruction (F153)

Basic Program



S1: Control data
The 1st word's address must be specified.
(Specify as a double word)

S2: Starting address of the area to be read.

n: The number of words to be read.

D: Start address of the remote I/O memory where the data that is read will be stored.
For the I.O.P., the remote I/O memory corresponds to the Shared Memory.

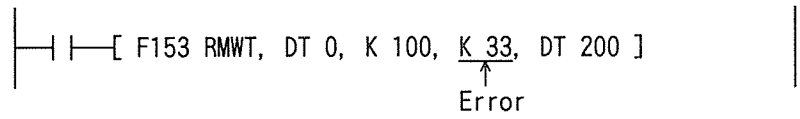
Operands

Preset (Set) value	Word unit											Constant		Index modifier	Steps
	WX	WY	WR	WL	SV	EV	DT	LD	FL	IX	IY	K	H		
S1	A	A	A	A	A	A	A	A	A	N/A	N/A	N/A	N/A	A	9
S2	A	A	A	A	A	A	A	A	A	N/A	N/A	N/A	N/A	A	
n	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
D	A	A	A	A	A	A	A	A	A	A	A	A	A	A	

A : Available
N/A : Not Available

Caution

- The PC can write a maximum of 32 words of data with one instruction. If you specify more than 32 words, the CPU will declare an error.



- The PC can execute only one RMRD instruction per scan. If the PC trys to execute more than one, the CPU will declare an error. To prevent this kind of error, use the special relays discussed below.

R9035: Memory access instruction executable flag
- 0: Non-executable (already executing an instruction)
- 1: Executable

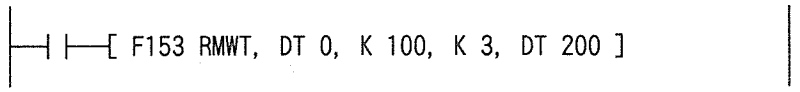
R9036: Memory access instruction completion flag
- 0: Normal termination
- 1: Error termination

DT9036: Memory access instruction completion error code
- 0: Normal termination
- 1: Stores the error code (valid only when R9036 is 1)

Program examples using special relays and special data registers are introduced in Chapter 5.

Program example

Read 3 words data starting from DT100 in the remote I/O memory of the slave station specified in DT0 and DT1.



4-2 PC Programming in the I/O Mode

When you choose the I/O Mode as your communication mode, you must set DIP switch bank 1 as follows.

DIP Switches							
1	2	3	4	5	6	7	8
ON	*	*	*	OFF	*	*	*

* You can set the DIP switch to either ON or OFF.
Choose the one appropriate for your operation.

For the details of each instruction, please refer to the FP3/5 Programming Manual.

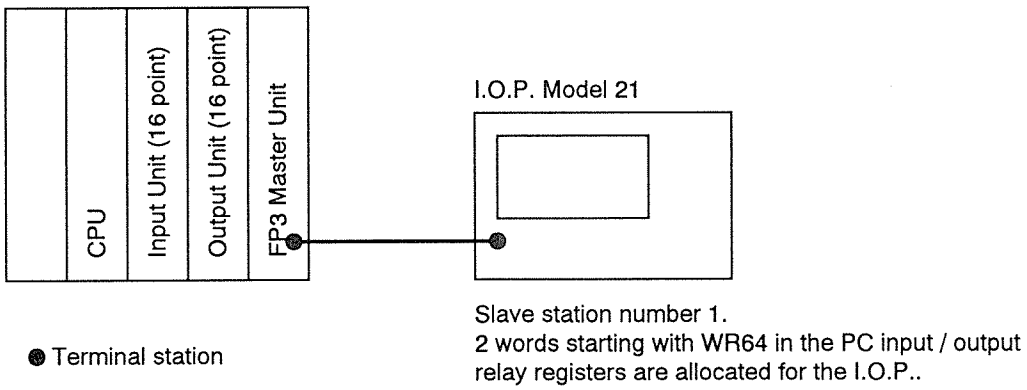
Postulate

Programs introduced in this chapter are all based on the assumption that the PC assignments and the I.O.P. options are as follows.

The I.O.P. is connected to the FP3 Master Unit via line 1.
Master Unit number: 1
I.O.P. station number: 1
Base word number: 64
Control data: "0101" in DT0
"0000" in DT1

System configuration

PC : FP3 System



Cautions

- In the programs introduced in this section, the PC is assumed to be the subject of the programming.
- Ladder diagrams are based on the NPST-GR format.

PC Memory Area used in the I/O Mode

PC ← I.O.P. (Input) (Output)			PC → I.O.P. (Output) (Input)		
PC memory address			PC memory address		
Word	Bit	Name	Word	Bit	Name
WX64	X640	KD0	WY64	Y650	GD0
	X641	KD1		Y651	GD1
	X642	KD2		Y652	GD2
	X643	KD3		Y653	GD3
	X644	KD4		Y654	GD4
	X645	KD5		Y655	GD5
	X646	KD6		Y656	GD6
	X647	KD7		Y657	GD7
	X648	KD STROB		Y658	CD flag
	X649	(not used)		Y659	HD flag
	X64A	SD flag		Y65A	MS flag
	X64B	PAUSE flag		Y65B	BZ flag
	X64C	(not used)		Y65C	STOP LED flag
	X64D	RCC flag		Y65D	START LED flag
	X64E	RCH flag		Y65E	MAN. LED flag
	X64F	BT flag		Y65F	AUTO LED flag

I.O.P. Shared Memory used in the I/O Mode

Caution

■ The darkened memory areas are NOT used in I/O Mode.

When you have chosen the HEX data format for Displayable External Data

"Digit nn" in the table below indicates the position of the Displayable External Data Digit

10	9	8	7	6	5	4	3	2	1

(Data position on the I.O.P. screen)

"Position nn" in the table below indicates the horizontal digit position on the I.O.P. screen. Position

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

(I.O.P. screen)

Word Address	Bit contents F E D C B A 9 8		7 6 5 4	3 2 1 0	Data
K 0	(not used)	(not used)	Primary Screen number		Primary Screen number
K 1	(not used)	(not used) ML	Manual Screen LINE spec.		Manual Screen
K 2	(not used)	(not used)	(not used)	AUTO LED, MAN. LED, START LED, STOP LED	LED Control
K 3	(not used)	(not used)	Key Code		Key Code
(not used)					
K 99	F E D C	B A 9 8	7 6 5 4	3 2 1 0	Leading zero suppression flag (specify the buffer number)
K 100	Digit 4	Digit 3	Digit 2	Digit 1	Displayable External Data stored in Buffer 0
K 101	Digit 8	Digit 7	Digit 6	Digit 5	
K 102	(not used)	(not used)	Digit 10	Digit 9	

Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0	Data
K 103	Digit 4	Digit 3	Digit 2	Digit 1	
K 104	Digit 8	Digit 7	Digit 6	Digit 5	Displayable External Data stored in Buffer 1
K 105	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮
K 145	Digit 4	Digit 3	Digit 2	Digit 1	
K 146	Digit 8	Digit 7	Digit 6	Digit 5	Displayable External Data stored in Buffer F
K 147	(not used)	(not used)	Digit 10	Digit 9	
(not used)					
K 199	F E D C	B A 9 8	7 6 5 4	3 2 1 0	Descriptive External Data Buffer flag
K 200	Digit 4	Digit 3	Digit 2	Digit 1	
K 201	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 0
K 202	(not used)	(not used)	Digit 10	Digit 9	
K 203	Digit 4	Digit 3	Digit 2	Digit 1	
K 204	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 1
K 205	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮
K 245	Digit 4	Digit 3	Digit 2	Digit 1	
K 246	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer F
K 247	(not used)	(not used)	Digit 10	Digit 9	
(not used)					
K 300	character superimposition line specification				
K 301	position 1				
K 302	position 2				
⋮	⋮	⋮	⋮	⋮	Character Superimposition operation data storage area
K 320	position 20				
(not used)					
K 350	(not used : bit A to F)		line 1	position 11 – 20	
K 351	(not used : bit A to F)		line 1	position 1 – 10	
K 352	(not used : bit A to F)		line 2	position 11 – 20	
K 353	(not used : bit A to F)		line 2	position 1 – 10	
⋮	⋮	⋮	⋮	⋮	
K 364	(not used : bit A to F)		line 8	position 11 – 20	Character Highright operation data storage area
K 365	(not used : bit A to F)		line 8	position 1 – 10	

When you have chosen ASCII data for Displayable External Data

"Digit nn" in the table below indicates the position of the Displayable External Data Digit

10	9	8	7	6	5	4	3	2	1

(Data position on the I.O.P. screen)

"Position nn" in the table below indicates the horizontal digit position on the I.O.P. screen. Position

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

(I.O.P. screen)

Word Address	Bit contents F E D C B A 9 8	7 6 5 4	3 2 1 0	Data
K 0	(not used) (not used)	Primary Screen number		Primary Screen number
K 1	(not used) (not used) ML	Manual Screen LINE spec.		Manual Screen
K 2	(not used) (not used)	(not used)	AUTO LED, MAN LED, START LED, STOP LED	LED Control
K 3	(not used) (not used)	Key Code		Key Code
(not used)				
K 99	F E D C B A 9 8	7 6 5 4	3 2 1 0	Leading zero suppression flag (specify the buffer number)
K 100	Digit 9	Digit 10		
K 101	Digit 7	Digit 8		
K 102	Digit 5	Digit 6		
K 103	Digit 3	Digit 4		Displayable External Data stored in Buffer 0
K 104	Digit 1	Digit 2		
K 105	Digit 9	Digit 10		
K 106	Digit 7	Digit 8		
K 107	Digit 5	Digit 6		
K 108	Digit 3	Digit 4		Displayable External Data stored in Buffer 1
K 109	Digit 1	Digit 2		
⋮	⋮	⋮		⋮

Word Address	Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0	Data
K 175	Digit 9	Digit 10	
K 176	Digit 7	Digit 8	
K 177	Digit 5	Digit 6	
K 178	Digit 3	Digit 4	Displayable External Data stored in Buffer F
K 179	Digit 1	Digit 2	
(not used)			
K 199	F E D C B A 9 8	7 6 5 4 3 2 1 0	Descriptive External Data Buffer Flag
K 200	Digit 4 Digit 3	Digit 2 Digit 1	
K 201	Digit 8 Digit 7	Digit 6 Digit 5	Descriptive External Data stored in Buffer 0
K 202	(not used) (not used)	Digit 10 Digit 9	
K 203	Digit 4 Digit 3	Digit 2 Digit 1	
K 204	Digit 8 Digit 7	Digit 6 Digit 5	Descriptive External Data stored in Buffer 1
K 205	(not used) (not used)	Digit 10 Digit 9	
⋮	⋮ ⋮	⋮ ⋮	⋮
K 245	Digit 4 Digit 3	Digit 2 Digit 1	
K 246	Digit 8 Digit 7	Digit 6 Digit 5	Descriptive External Data stored in Buffer F
K 247	(not used) (not used)	Digit 10 Digit 9	
(not used)			
K 300	character superimposition line specification		
K 301	position 1		
K 302	position 2		
⋮	⋮ ⋮	⋮ ⋮	Character Superimposition operation data storage area
K 320	position 20		
(not used)			
K 350	(not used : bit A to F)	line 1 position 11 – 20	
K 351	(not used : bit A to F)	line 1 position 1 – 10	
K 352	(not used : bit A to F)	line 2 position 11 – 20	
K 353	(not used : bit A to F)	line 2 position 1 – 10	
⋮	⋮ ⋮	⋮ ⋮	
K 364	(not used : bit A to F)	line 8 position 11 – 20	Character Highright operation data storage area
K 365	(not used : bit A to F)	line 8 position 1 – 10	

Displaying the Primary Screen

The programming method for displaying the Primary Screen depends on the Communication Method you choose. When you use the Shared Memory R/W Mode, refer to 4-3 "PC Programming in the Shared Memory R/W Mode".

The I/O Mode turns ON GD bits corresponding to the Primary Screen number you want the I.O.P. to display. The PC will automatically send the data to I.O.P., and the I.O.P. will display the Primary Screen according to the data received.

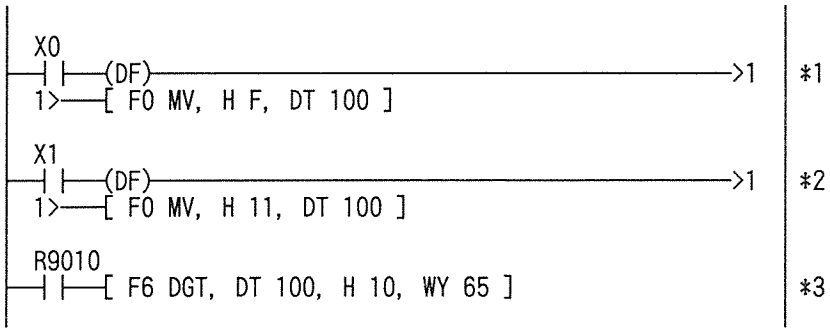
GD bits

Y65F	Y65E	Y65D	Y65C	Y65B	Y65A	Y659	Y658	Y657	Y656	Y655	Y654	Y653	Y652	Y651	Y650
AUTO	MAN.	START	STOP	BZ	MS	HD	CD	GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0

Programming Example 1

Using the MOVE instruction (F0) and DIGIT instruction (F6)

For details about the F0 and F6 instructions, refer to the FP3/FP5 Programming Manual.
To use the DIGIT instruction, the Primary Screen number is stored in DT100 as in the example below.



*1 When external input relay X0 is ON, "H F" will be copied to DT100.
*2 When external input relay X1 is ON, "H 11" will be copied to DT100.
*3 In R9010 (normally ON), the lower 8 bits of data in DT100 will always be stored at the external output relay WY65 (bit 0 to bit 7) to display the Primary Screen corresponding to the data in WY65 (bit 0 to bit 7).

Note

- If you use a DIGIT instruction, the PC will copy only the necessary bits of data to another memory area. So, to get only the GD bits (bit 0 to bit 7) of WY65, you should use the DIGIT instruction.

Programming Example 2

Using the ENCO instruction (F92)

For details of the F92 instruction, refer to the FP3/FP5 Programming Manual and also 4-4 "DECO/ENCO instructions".
With the ENCO instruction, a maximum of 256 screens can be displayed using the ON/OFF internal relay(R)s of the PC.
To use the ENCO instruction, you must first allocate internal relay registers for the Primary Screen numbers. If you use internal relay registers starting with "R100", Primary Screen "00" will correspond to "R100", and Primary Screen "0A" will correspond to "R10A".

Caution

- Internal relay registers are represented in "MEW". In MEW, the rightmost digit is represented in HEX, and the rest of the digits are represented in decimal. The rightmost digit indicates the bit position at the address in memory.
  On the other hand, Primary Screen numbers are represented in HEX. So, be very careful to look up the corresponding internal relay register number for the Primary Screen number you want to display.

  How to get an internal relay register number from Primary Screen number:

  If you want to display Primary Screen "0A"

  0A A
  ↑
  Change the left hex digit to a decimal number : 0
  Then add the base address. So,if your Primary Screens start at WR10, add 10 to the leftmostdigit of decimal number above : 10
  Internal relay register number : 10A

If you want to display Primary Screen "0A"

FF F
↑

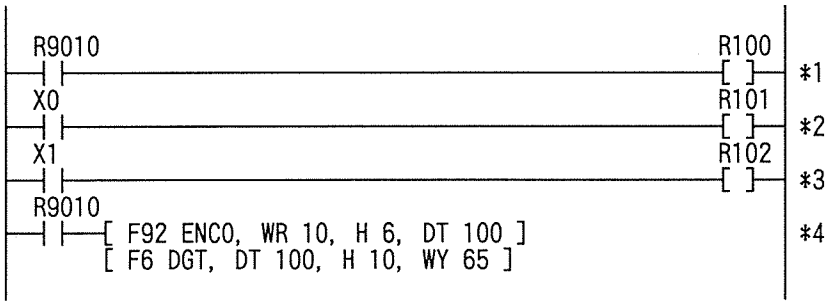
Change the left hex digit to a decimal number : 15

Then add the base address. So,if your Primary Screens start at WR10,
add 10 to the leftmostdigit of decimal number above : 10

Internal relay number : 25F

In the example below, the internal relays, starting with WR10, are allocated for the Primary Screen numbers.

To use the DIGIT instruction, the Primary Screen number is stored in DT100 in the example below.



*1 R100 is always kept ON by R9010 (a normally ON register).
When you use the ENCO instruction, one of the internal relays should always be ON.

*2 When external input relay X0 is ON, the internal relay R101 is ON.

*3 When external intput relay X1 is ON, the internal relay R102 is ON.

*4 The ENCO instruction is always passed through R9010 (a normally ON register). The number stored in the internal relays (R100 to R102) which are turned ON are encoded as a hexadecimal number in the range of 00 to 3F, and the result is stored in DT100. With the DGIT instruction, data from the lower 8 bits of DT100 is copied to WY65.

Caution

- If you allocate internal relays for Primary Screen numbers and use ENCO instruction to display the Primary Screen, the internal relay turned ON will stay ON. So be sure that the program turns it OFF.

- Code the ENCO instruction in the last line of the program.

Superimposing Primary Screens

If the PC specifies a Primary Screen whose attribute is "6", while the I.O.P. is displaying a Primary Screen, the new screen will be superimposed on the Primary Screen already being displayed on the I.O.P. The screen's attribute is assigned when the screen is first created on a personal computer.

When programming the PC, code the program to display duplicate Primary Screens. The I.O.P. will automatically recognize the superimposed Screen by its attribute ("6").

Receiving Key Codes

The programming method for receiving Key Codes depends on the Communication Method you choose. When you are in the Shared Memory R/W Mode, refer to 4-3 "PC Programming in the Shared Memory R/W Mode".

Each key (except the PAUSE key) has an assigned Key Code. The assignment is made when you edit the screens on a personal computer.

In the I/O Mode, when a key is pressed on the I.O.P., the corresponding bits in KD0 thru KD7 (allocated in external output relays) will turn ON. At the same time, the KD STROB signal will turn ON. When the KD STROB goes ON, the PC should read the Key Data stored in KD0 thru KD7. The KD STROB will remain ON only while the key is pressed.

KD bits and KD STROB

X64F	X64E	X64D	X64C	X64B	X64A	X649	X648	X647	X646	X645	X644	X643	X642	X641	X640
BT	RCH	RCC		PAUSE	SD		KDSTB	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0

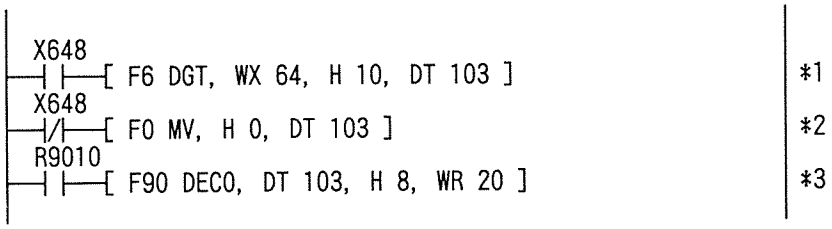
Programming Example

Using the DIGIT and DECO instruction.

For details of the F90 instruction, refer to the FP3/FP5 Programming Manual and also 4-4 "DECO/ENCO instructions".
To use the DECO instruction, you first assign the internal relay addresses for the Key Codes. Refer to the Caution in "Displaying Primary Screens" on page 83.

In the example below, the internal relays, starting with WR20, are allocated for the Key Codes.

To use the DIGIT instruction, Key Codes are stored in DT103 in the example below.



*1 When a key is pressed, the external input relay X648 (KD STROB) will turn ON, and a DGT instruction will be executed. With the DGT instruction, data in the lower 8 bits of WX64 will be copied to DT103 (bit 0 thru bit 7).

*2 When KD STROB is OFF, a MOVE instruction is executed.
With the MOVE instruction, "H 0" is stored in DT103 to clear the bits in KD0 thru KD7.

*3 The DECO instruction is always passed through R9010 (a Normally ON relay). The resulting Key Data will be reflected in R200 to R35F (16 words).
(H8: 256 bits)

Displaying External Data

The choice of communication mode does not affect the programming.

When the PC writes a piece of Displayable External Data to the corresponding I.O.P. Shared Memory using a RMWT instruction, the I.O.P. will store the data in the corresponding buffer. This value will be displayed in the area on the screen that was previously assigned when you created I.O.P. screen.

When the I.O.P. displays a piece of Displayable External Data, the I.O.P. references the I.O.P. Shared Memory K99 to perform the suppression of leading zeroes.

You must use either HEX data or ASCII data for the Displayable External Data.
The choice is made with DIP switch bank 1 on the rear panel of the I.O.P..
The size of the I.O.P. Shared Memory area depends on whether you choose the HEX or ASCII data format. Refer to "Postulate" in the section for details.

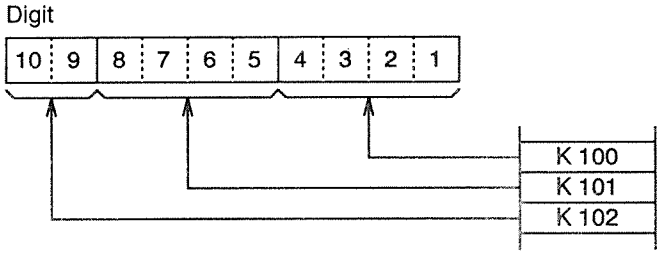
With the RMWT instruction, the PC can read up to 32 words of data at one time. So, if you want the PC to write more than 32 words of data at one time, you have to use more than one RMWT instruction. In HEX data format, the PC can write up to 10 pieces of Displayable External Data, and in ASCII data format, up to 6 pieces of Displayable External Data at one time.

When You Have Chosen HEX Data

I.O.P. Shared Memory Area used for Displayable External Data

Address	Data type
K99	Leading zero suppression data
K100 K101 K102	Displayable External Data stored in Buffer 0
K103 K104 K105	Displayable External Data stored in Buffer 1
K106 K107 K108	Displayable External Data stored in Buffer 2
K109 K110 K111	Displayable External Data stored in Buffer 3
K112 K113 K114	Displayable External Data stored in Buffer 4
K115 K116 K117	Displayable External Data stored in Buffer 5
K118 K119 K120	Displayable External Data stored in Buffer 6
K121 K122 K123	Displayable External Data stored in Buffer 7
K124 K125 K126	Displayable External Data stored in Buffer 8
K127 K128 K129	Displayable External Data stored in Buffer 9
K130 K131 K132	Displayable External Data stored in Buffer A
K133 K134 K135	Displayable External Data stored in Buffer B
K136 K137 K138	Displayable External Data stored in Buffer C
K139 K140 K141	Displayable External Data stored in Buffer D
K142 K143 K144	Displayable External Data stored in Buffer E
K145 K146 K147	Displayable External Data stored in Buffer F

Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0	Data
K 100	Digit 4	Digit 3	Digit 2	Digit 1	
K 101	Digit 8	Digit 7	Digit 6	Digit 5	Displayable External Data stored in Buffer 0
K 102	(not used)	(not used)	Digit 10	Digit 9	



HEX codes and the characters displayed on the I.O.P.

HEX data (stored in the PC)	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
I.O.P. display	0	1	2	3	4	5	6	7	8	9	.	+	−	=	(space)	(space)

Programming Example 1

```
R9013
─┤ ├─[ F0 MV, H 101, DT 0 ]                          *1
      [ F0 MV, H   0, DT 1 ]
X0
─┤ ├─[ F0 MV, H 6789, DT 200 ]                       *2
      [ F0 MV, H 2345, DT 201 ]
      [ F0 MV, H    1, DT 202 ]
      [ F153 RMWT, DT 0, DT 200, K 3, K 100 ]       *3
```

*1 Control Data
Refer to "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 When external input relay X0 is ON, "H6789", "H2345" and "H 1" will be copied to DT200, DT201, DT202 respectively.

*3 With a RMWT instruction, 3 words of data starting with DT200 (DT200 thru DT202) will be copied to the I.O.P. Shared Memory starting at K100.

In the example above, leading zero suppression is not specified. So, "0123456789" will be displayed by the I.O.P..

Programming Example 2

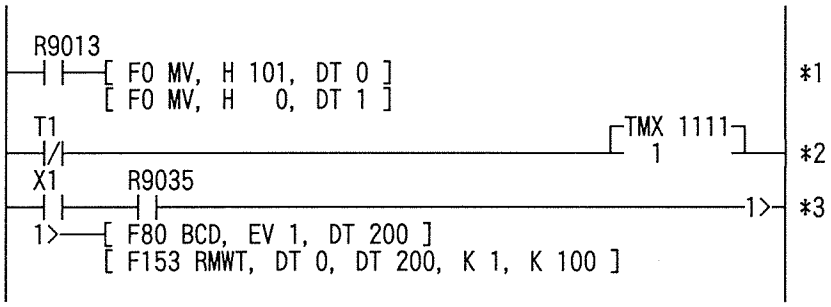
Displaying the elapsed value of the PC timer.

Postulate

The timer to be monitored: T1 (elapsed value = EV1)
Displayable External Data Buffer: No.1
* The I.O.P. Shared Memory area = K100

While the data which the I.O.P. can display is BCD data, the value of EV is stored as BIN data. Therefore, the BIN data must be converted to BCD data. You can use the BCD instruction for this.

Because the value of EV is expressed as 4 digits (16 bits), the PC will need only one data register to store the value, and also only one address in the I.O.P. Shared Memory will be needed to display the data on the I.O.P.

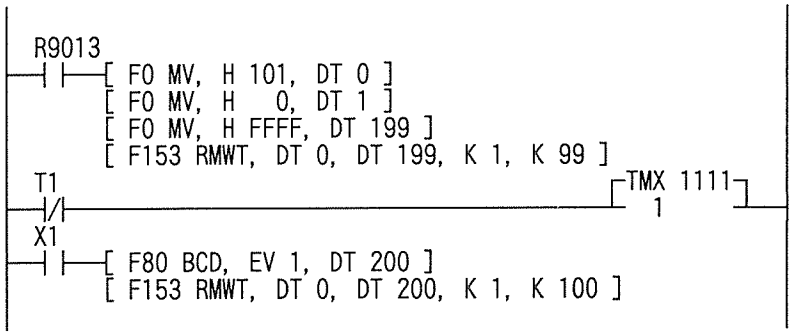


*1 Control Data
Refer to "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 The elapsed value of timer, stored in the timer register EV1, is converted to BCD data and the result will be stored in DT200.

*3 With a RMWT instruction, 3 words of data, starting with DT200 (DT200 thru DT202), will be copied to the I.O.P. Shared Memory starting at K100.

In the example above, the suppression of leading zeroes is not specified. When you want the PC to specify suppression of leading zeroes, add the lines of code as shown on the next page.



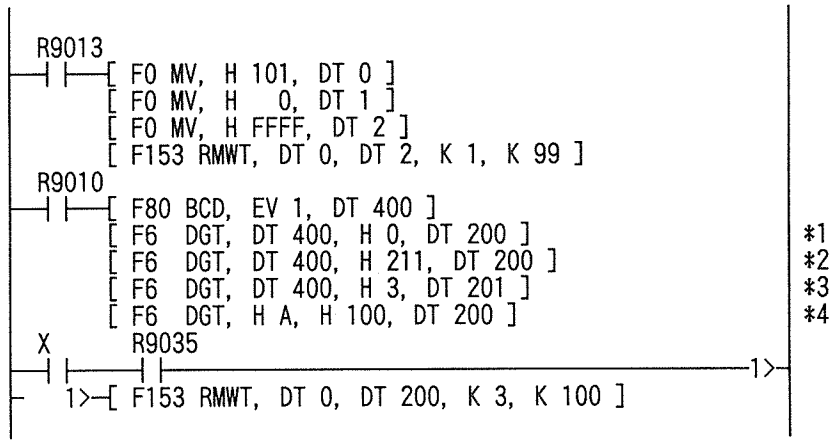
"H FFFF" is copied to DT199. So, all of the bits in DT199 will turn ON. Then with the RMWT instruction, the data in DT199 will be written to K99 in the I.O.P. Shared Memory. So, all of the buffers are specified for suppression of leading zeroes.

Advanced Programming Example

Add decimal points to the elapsed value displayed on the I.O.P. in the program mentioned above.

Postulate

Timer: TX1 (0.1 sec. timer)



*1 The data for the 1st digit (the rightmost digit) is copied to the 1st digit of DT200.

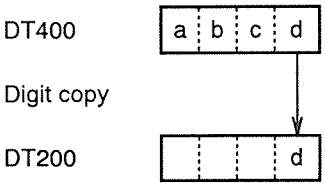
*2 The data for the 2nd and 3rd digits is copied to the 3rd and 4th digits of DT200.

*3 The data for the 4th digit is copied to the 1st digit of DT201.

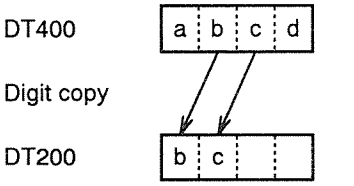
*4 Hex "A" is stored in the 2nd digit of DT200 to be used for the decimal point.

The diagram of the digit manipulations

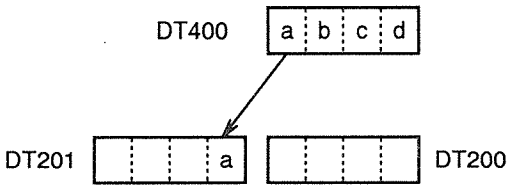
*1[F6 DGT, DT 400, H 0, DT 200]



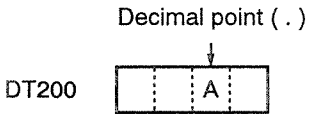
*2[F6 DGT, DT 400, H 0, DT 200]



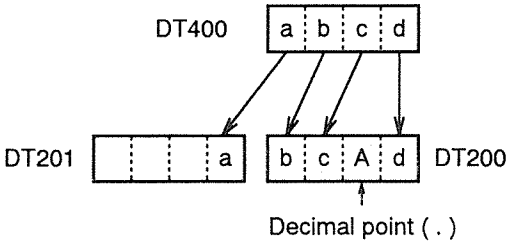
*3[F6 DGT, DT 400, H 3, DT 200]



*4[F6 DGT, H A, H 100, DT200]



*1～*4

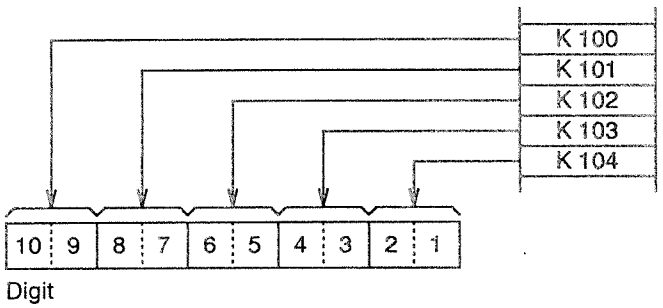


When You Have Chosen ASCII Data

I.O.P. Shared Memory Area used for Displayable External Data

Address	Data type
K99	Leading zero suppression data
K100 thru K104	Displayable External Data stored in Buffer 0
K105 thru K109	Displayable External Data stored in Buffer 1
K110 thru K114	Displayable External Data stored in Buffer 2
K115 thru K119	Displayable External Data stored in Buffer 3
K120 thru K124	Displayable External Data stored in Buffer 4
K125 thru K129	Displayable External Data stored in Buffer 5
K130 thru K134	Displayable External Data stored in Buffer 6
K135 thru K139	Displayable External Data stored in Buffer 7
K140 thru K144	Displayable External Data stored in Buffer 8
K145 thru K149	Displayable External Data stored in Buffer 9
K150 thru K154	Displayable External Data stored in Buffer A
K155 thru K159	Displayable External Data stored in Buffer B
K160 thru K164	Displayable External Data stored in Buffer C
K165 thru K169	Displayable External Data stored in Buffer D
K170 thru K174	Displayable External Data stored in Buffer E
K175 thru K179	Displayable External Data stored in Buffer F

Word Address	Bit contents F E D C B A 9 8	Bit contents 7 6 5 4 3 2 1 0	Data
K 100	Digit 9	Digit 10	
K 101	Digit 7	Digit 8	
K 102	Digit 5	Digit 6	
K 103	Digit 3	Digit 4	Displayable External Data
K 104	Digit 1	Digit 2	stored in the Buffer 0



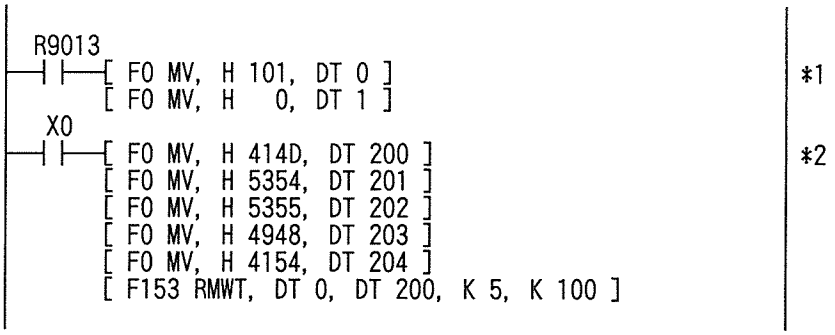
ASCII Characters displayable on the I.O.P.

		High bits (4 bits)							
		0	1	2	3	4	5	6	7
Low bits (4 bits)	0			SP	0	@	P		
	1			!	1	A	Q		
	2			"	2	B	R		
	3			#	3	C	S		
	4			$	4	D	T		
	5			%	5	E	U		
	6			&	6	F	V		
	7			'	7	G	W		
	8			(	8	H	X		
	9			)	9	I	Y		
	A			*	:	J	Z		
	B			+	;	K	[		
	C			,	<	L	\		
	D			−	=	M	]		
	E			.	>	N	^		
	F			/	?	O	SP		

Notes

- SP: space
  For example, specify "4D" to display letter "M".
- If you specify a "space", that digit won't be subject to the suppression of leading zeroes.

Programming Example



*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 When external input relay X0 is ON, the PC will write the data stored in DT200 thru DT204 to the I.O.P. Shared Memory area starting at K100 (K100 thru K104).

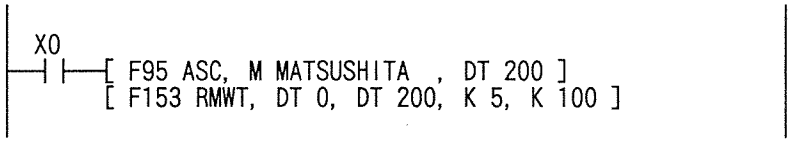
ASCII Data	Character
41	A
4D	M
53	S
54	T
53	S
55	U
49	I
48	H
41	A
54	T

	F E D C B A 9 8	7 6 5 4 3 2 1 0
K100	H 41 (A)	H 4D (M)
K101	H 53 (S)	H 54 (T)
K102	H 53 (S)	H 55 (U)
K103	H 49 (I)	H 48 (H)
K104	H 41 (A)	H 54 (T)

Read this right to left, top to bottom.

MATSUSHITA

If you use an ASCII code conversion instruction (ASC instruction, F95), the PC converts the characters to ASCII code. For details of the F95 instruction, refer to the FP3/FP5 Programming Manual.



Caution

- Because you must specify 12 characters for conversion by the ASC instruction, place two spaces after the character string "MATSUSHITA".

Receiving Descriptive External Data

The choice of communication mode does not affect the programming.

If External Data is entered from the I.O.P.(when the ENTER key is pressed after the data entry has been completed), it will be stored in the corresponding Descriptive External Data Buffer, then the data will be stored in the corresponding I.O.P. Shared Memory area. At the same time, the corresponding Descriptive External Data Buffer flag in the I.O.P. Shared Memory (K199) will go ON.

When the data is entered from the I.O.P., the SD flag in the PC memory area (X64A) will also go ON. So, when the flag goes ON, the PC can read the data stored in the previously allocated I.O.P. Shared Memory using the RMRD instruction. The SD flag will remain ON at least 640 msec..

If you want the PC to read only freshly entered data, code the program so that the PC reads the buffer flag data in K199 first, then reads the data stored in the corresponding I.O.P. Shared Memory area. Refer to the Programming Example 3 shown below.

Caution

- When the power of the I.O.P. is turned OFF, the data in buffer area of the I.O.P. is maintained by the backup battery, but the data in the I.O.P. Shared Memory is NOT saved. So, after start-up, if the PC reads the data in the I.O.P. Shared Memory before the SD flag turns ON, the PC may read invalid data. Use the SD flag to receive the valid data.

- With the RMRD instruction, the PC can read up to 32 words of data at one time. So, if you want the PC to read more than 10 pieces of Descriptive External Data (30 words) at a one time, you have to use more than one RMRD instruction.
  (3 words are used for a piece of Descriptive External Data.)

- You must use the HEX data format for Displayable External Data.

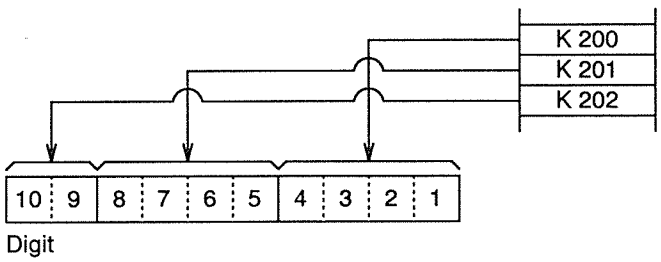
SD flag

X64F	X64E	X64D	X64C	X64B	X64A	X649	X648	X647	X646	X645	X644	X643	X642	X641	X640
BT	RCH	RCC		PAUSE	SD		KDSTB	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0

I.O.P. Shared Memory Area for Descriptive External Data

Address	Data type
K199	Descriptive External Data Buffer Flag
K200 K201 K202	Descriptive External Data stored in Buffer 0
K203 K204 K205	Descriptive External Data stored in Buffer 1
K206 K207 K208	Descriptive External Data stored in Buffer 2
K209 K210 K211	Descriptive External Data stored in Buffer 3
K212 K213 K214	Descriptive External Data stored in Buffer 4
K215 K216 K217	Descriptive External Data stored in Buffer 5
K218 K219 K220	Descriptive External Data stored in Buffer 6
K221 K222 K223	Descriptive External Data stored in Buffer 7
K224 K225 K226	Descriptive External Data stored in Buffer 8
K227 K228 K229	Descriptive External Data stored in Buffer 9
K230 K231 K232	Descriptive External Data stored in Buffer A
K233 K234 K235	Descriptive External Data stored in Buffer B
K236 K237 K238	Descriptive External Data stored in Buffer C
K239 K240 K241	Descriptive External Data stored in Buffer D
K242 K243 K244	Descriptive External Data stored in Buffer E
K245 K246 K247	Descriptive External Data stored in Buffer F

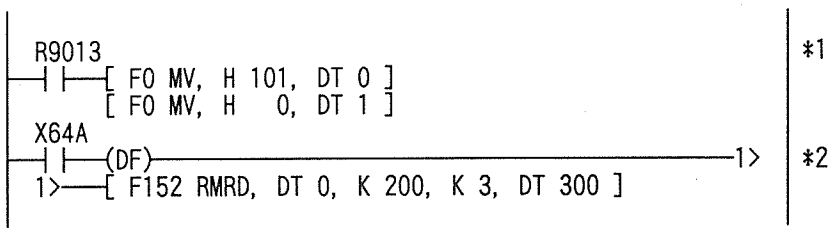
Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0	Data
K 200	Digit 4	Digit 3	Digit 2	Digit 1	Descriptive External Data stored in Buffer 0
K 201	Digit 8	Digit 7	Digit 6	Digit 5	
K 202	(not used)	(not used)	Digit 10	Digit 9	



Characters entered on the I.O.P. and HEX data sent to the PC.

Character	0	1	2	3	4	5	6	7	8	9	.(decimal)	(space)
HEX data	0	1	2	3	4	5	6	7	8	9	A	0

Programming Example 1



*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 When X64A (SD flag) is ON, the PC will read 3 words of data starting with K200(K200 to K202) into the data registers starting at DT300.

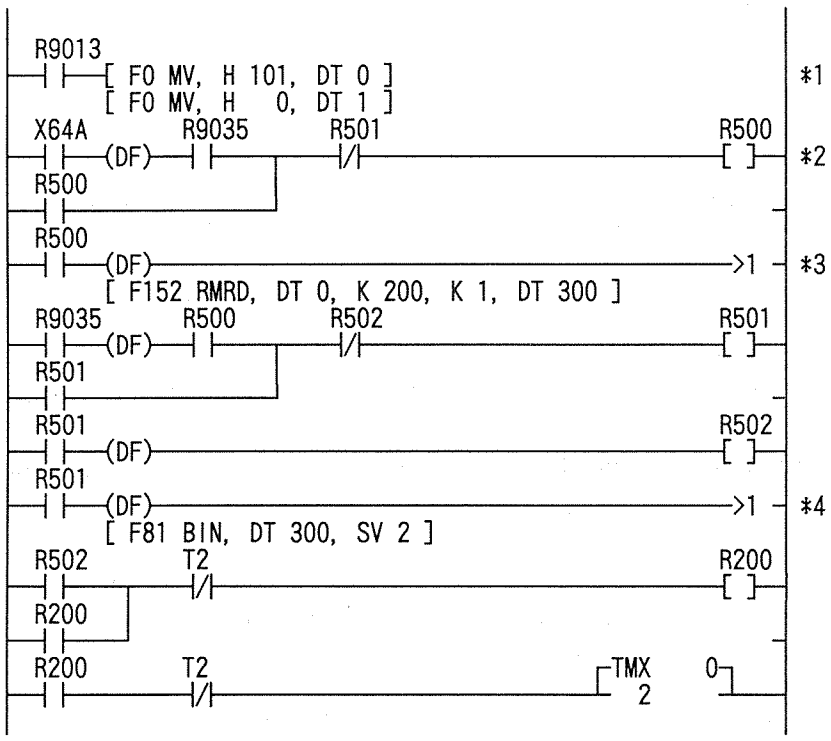
If "1234567890" had been entered on the I.O.P. and stored in Descriptive External Data Buffer 0, the data was stored in the I.O.P. Shared Memory as shown below and stored in PC's data registers as shown also below.

I.O.P. Shared Memory			PC Data Register	
K200:	7890	→	DT300:	7890
K201:	3456	→	DT301:	3456
K202:	0012	→	DT302:	0012

Programming Example 2

Reading the set value of PC timer(T2) entered from the I.O.P.

Set value: 4 digits data (SV2)
Buffer number where the data is stored: Buffer 0



*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 When the ENTER key is pressed after External Data is entered at the I.O.P., X64A (SD flag) goes ON.

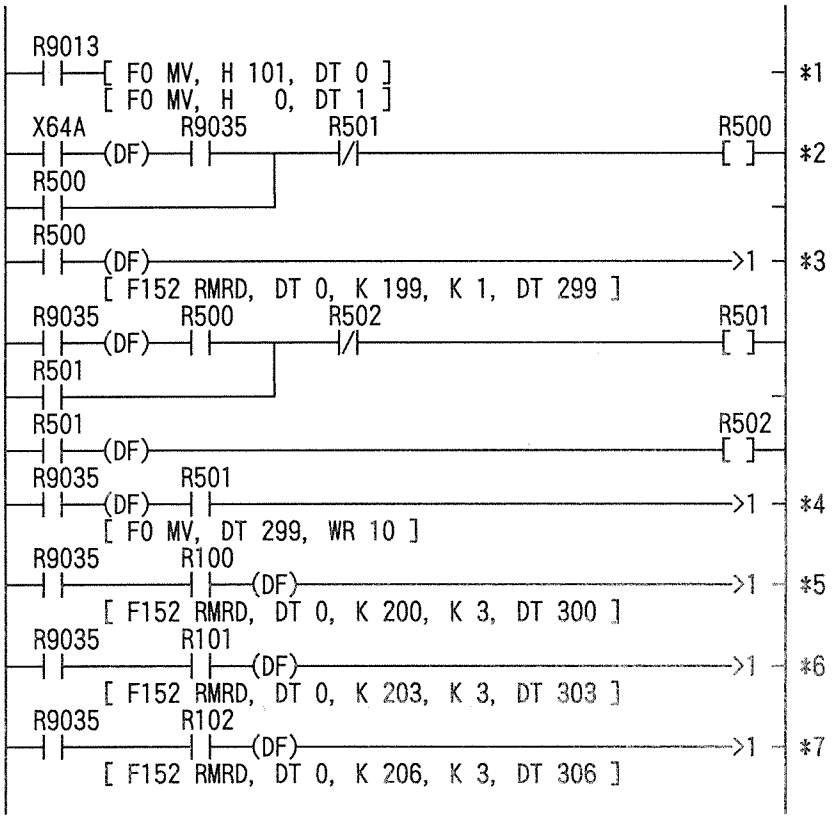
*3 When internal relay R500 is ON, the PC reads the data from K200 into DT300.

*4 When internal relay R501 is ON, the contents of DT300 is converted to BIN data and the result is stored in SV2.

When internal relay R200 is ON, the timer T2 begins to count the time according to the contents of DT300.

Programming Example 3

Using the Descriptive External Data Buffer Flag.



*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 When the ENTER key is pressed after External Data is entered from the I.O.P., X64A (SD flag) goes ON.

*3 When internal relay R500 is ON, the PC reads the data in K199 (buffer flag data) and it is stored in DT299.

*4 Buffer flag data stored in DT299 is copied to WR10 (R100 to R10F).

*5 When R100 is ON (when Descriptive External Data is stored in buffer 0), the PC reads 3 words of data, starting with K200 (K200 to K202), into the data registers of the PC starting at DT300.

*6 When R101 is ON (when Descriptive External Data is stored in buffer 1), the PC reads 3 words of data, starting with K203 (K203 to K205), into the data registers of the PC starting at DT303.

*7 When R102 is ON (when Descriptive External Data is stored in buffer 2), the PC reads 3 words of data, starting with K206 (K206 to K208), to the data registers of the PC starting at DT306.

Displaying the Manual Screen

The choice of communication mode does not affect the programming.

Displaying the Manual Screen without LINE Specification

The Manual Screen will be displayed when the MS flag (Y65A) in the external output relay is turned ON. It will be cancelled when the flag is turned OFF. The LINE displayed as the first line of the Manual Screen will be the LINE where the cursor last appeared.
For details of the LINE on the Manual Screen, refer to Chapter 2 "Displaying the Manual Screen".

MS flag

Y65F	Y65E	Y65D	Y65C	Y65B	Y65A	Y659	Y658	Y657	Y656	Y655	Y654	Y653	Y652	Y651	Y650
AUTO	MAN.	START	STOP	BZ	MS	HD	CD	GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0

Programming Example

When external input relay X0 is ON, Y65A goes ON to cause the I.O.P. to display the Manual Screen.

Displaying the Manual Screen with LINE Specification

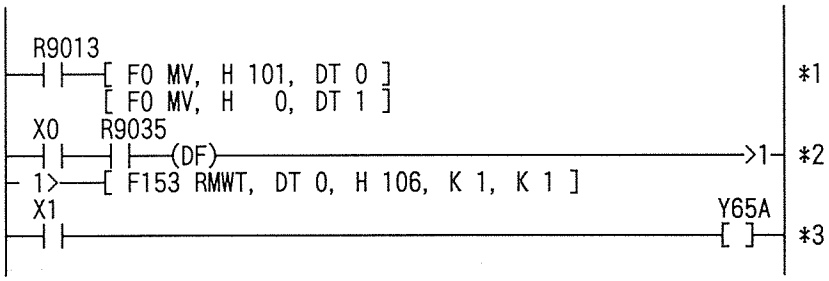
If you want to display the Manual Screen and specify the LINE number to appear as the first line of the Manual Screen, use the ML flag in I.O.P. Shared Memory (K1, Bit 8). The LINE number must be specified in the bit 0 thru bit 7 of K1 in I.O.P. Shared Memory.

I.O.P. Shared Memory Area for LINE Specification

Word Address	Bit contents F E D C B A 9 8 7 6 5 4 3 2 1 0				Data
K 1	(not used)	(not used)	ML	Manual Screen LINE spec.	Manual Screen

LINE number	HEX code specified in K1 (bit 0-7)
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F
16	10
17	11
18	12
19	13
20	14

Programming Example



*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 "H106" is written to K1 to specify LINE number "06" and turn the ML flag ON.

*3 When external input relay X1 is ON, Y65A(MS flag) goes ON to display the Manual Screen. Because the ML flag has been turned ON, the I.O.P. will display the Manual Screen starting from the 6th LINE.

Caution

■ If ML flag is not ON, the I.O.P. will not display the Manual Screen even though you specified the LINE number.
So, if you were to specify "H006" in the example above, the I.O.P. would display the Manual Screen starting with the LINE where the cursor was last left.

Superimposing Characters

The choice of communication mode does not affect the programming.

Arbitrary characters, stored in K301 to K320 of the I.O.P. Shared Memory, can be superimposed in a position specified in K300. The superimposition can be executed with the CD and RCC flags (Y658 and X65D).
You cannot superimpose double-height characters.

CD: When the CD flag is ON, the I.O.P. begins to superimpose characters.
RCC: When the operation is complete, the RCC flag is turned ON.

Superimposed characters should be specified within the range of characters code listed in Appendices D, E and F.
The superimposition operation is performed in units of one line.

Caution

- If you specify a position on the screen where characters are already being displayed, the JIS characters will have priority over the characters at that location. If you have existing characters that you don't want covered up by superimposed characters, specify "00 HEX" for those positions when you create the program.

- When you superimpose normal size character, the address following the last address used should not be specified.

- Character Superimposition may not be done if you try to superimpose one size of character on top of a different sized character, or when the position a character is different from the character already displayed on the screen.

- You cannot superimpose characters at the position where External Data is displayed or entered.

- When a new screen is displayed on the I.O.P., superimposed characters will be cleared.

I.O.P. Shared Memory for Superimposed Characters

I.O.P. screen	LINE / Half-width	K 300																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I.O.P. shared memory (JIS Character Specification)		k301	k302	k303	k304	k305	k306	k307	k308	k309	k310	k311	k312	k313	k314	k315	k316	k317	k318	k319	k320

I.O.P. screen	LINE / Normal size	K 300									
		1	2	3	4	5	6	7	8	9	10
I.O.P. shared memory (JIS Character Specification)		k301	k303	k305	k307	k309	k311	k313	k315	k317	k319

CD flag

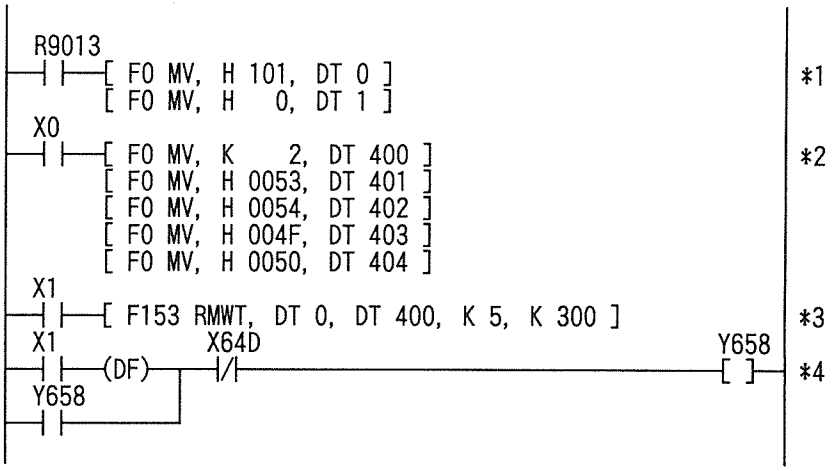
Y65F	Y65E	Y65D	Y65C	Y65B	Y65A	Y659	Y658	Y657	Y656	Y655	Y654	Y653	Y652	Y651	Y650
AUTO	MAN.	START	STOP	BZ	MS	HD	CD	GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0

RCC flag

X64F	X64E	X64D	X64C	X64B	X64A	X649	X648	X647	X646	X645	X644	X643	X642	X641	X640
BT	RCH	RCC		PAUSE	SD		KDSTB	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0

Programming Example

Superimposing "STOP" (Half-width) on the second line of the I.O.P. screen.



*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 When external input relay X0 is turned ON,

Decimal	2 is copied to DT400	2nd line is specified
Hex	0053 is copied to DT401	"S"
Hex	0054 is copied to DT402	"T"
Hex	0054F is copied to DT403	"O"
Hex	0050 is copied to DT404	"P"

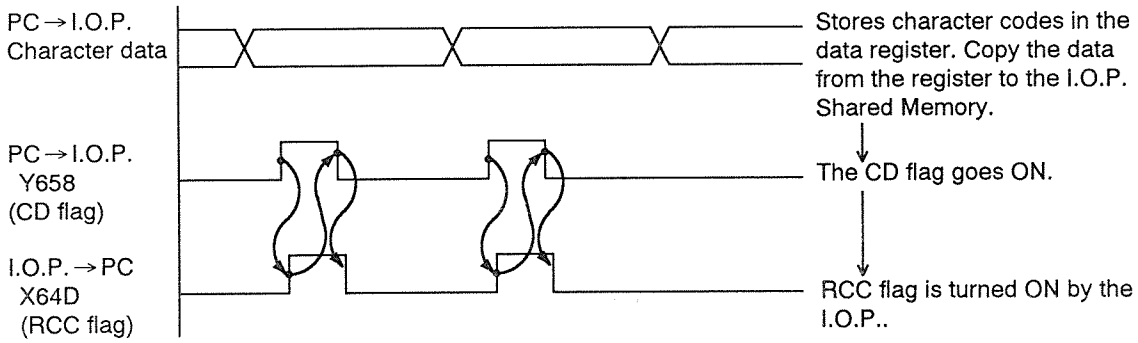
*3 When external input relay X1 is ON, the RMWT instruction causes the PC to write line data and the 4 words of data, starting at DT400, to the I.O.P. Shared Memory starting at K300.

*4 When external input relay X1 is ON, the PC turns ON the CD flag (Y658).
When the I.O.P. turns ON the RCC flag (X64D), the PC turns the CD flag OFF.

Caution

- You must code the DF instruction as shown in the example above.

Time Chart


PC→I.O.P.
Character data
PC→I.O.P.
Y658
(CD flag)
I.O.P.→PC
X64D
(RCC flag)
Stores character codes in the data register. Copy the data from the register to the I.O.P. Shared Memory.
The CD flag goes ON.
RCC flag is turned ON by the I.O.P..

Highlighting Characters

The choice of communication mode does not affect the programming.

The characters at the position which is specified in the corresponding data register of the PC will be highlighted.
For this operation, the HD and RCH flags are used (Y659 and X64E).

HD: When the HD flag is turned ON, the I.O.P. begins to highlight characters.
RCH: When the operation is complete, the RCH flag is turned ON.

To cancel the operation, code the program so that the PC writes the same data, again, to the same I.O.P. Shared Memory area.

16 words in the I.O.P. Shared Memory (K350 thru K365) are allocated for highlighting characters as shown below.
To highlight one line, you must use 2 words of the I.O.P. Shared Memory.

Caution

- You cannot highlight positions on a screen where External Data is entered or displayed.
- When the I.O.P. is displaying a Secondary Screen or the Manual Screen, you cannot highlight characters.
- If there is no character at the position you specify, the space will be highlighted.
- When a new screen is displayed on the I.O.P., the highlight operation will be cleared.

I.O.P. Shared Memory for Highlighted Characters

	Normal size	1		2		3		4		5		6		7		8		9		10	
	Half-width	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I.O.P. screen	line 1					K 351										K 350					
	2					K 353										K 352					
	3					K 355										K 354					
	4					K 357										K 356					
	5					K 359										K 358					
	6					K 361										K 360					
	7					K 363										K 362					
	8					K 365										K 364					
Bit position		9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0

HD flag

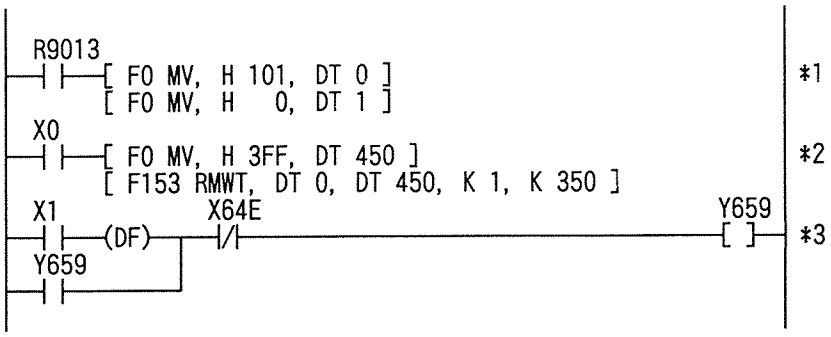
Y65F	Y65E	Y65D	Y65C	Y65B	Y65A	Y659	Y658	Y657	Y656	Y655	Y654	Y653	Y652	Y651	Y650
AUTO	MAN.	START	STOP	BZ	MS	HD	CD	GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0

RCH flag

X64F	X64E	X64D	X64C	X64B	X64A	X649	X648	X647	X646	X645	X644	X643	X642	X641	X640
BT	RCH	RCC		PAUSE	SD		KDSTB	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0

Programming Example

Highlighting the right half of the first line.



*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

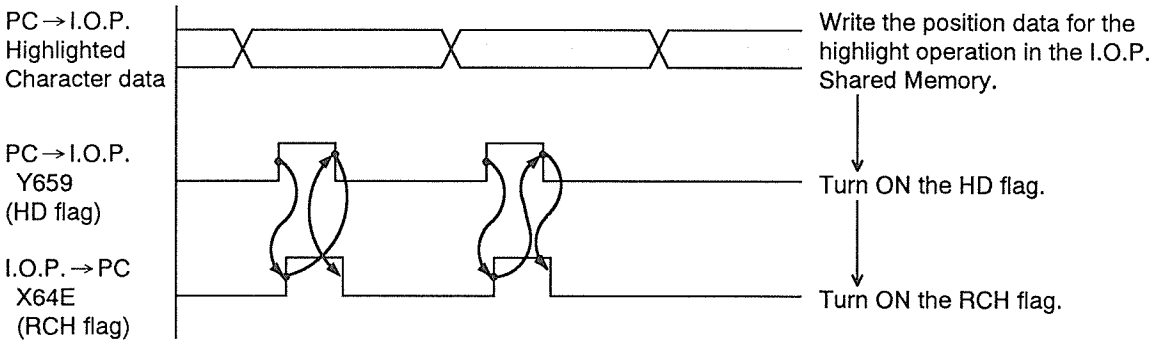
*2 When external input relay X0 is ON, "H3FF" is copied to DT450.
With the RMWT instruction, the PC writes the data in DT450 to I.O.P. Shared Memory location K350 to highlight the corresponding area of the I.O.P. screen.

*3 When external input relay X1 is ON, the PC turns the HD flag (Y659) ON.
When RCH flag (X64E) is turned ON by the I.O.P., the PC turns the HD flag OFF.

Caution

■ You must code the DF instruction as shown in the example above.

Time Chart


PC→I.O.P.
Highlighted
Character data
PC→I.O.P.
Y659
(HD flag)
I.O.P.→PC
X64E
(RCH flag)
Write the position data for the highlight operation in the I.O.P. Shared Memory.
Turn ON the HD flag.
Turn ON the RCH flag.

Controlling the LEDs

The LED control method depends on the communication mode you choose. When you are in Shared Memory R/W Mode, refer to 4-3 "PC Programming in I/O Mode".

The ON/OFF conditions of 4 of the LEDs (AUTO LED, MAN. LED, START LED, and STOP LED) are controlled by external output relays in the PC (Y65C to Y65F) when you are in I/O mode.
When a bit is ON, the corresponding LED will be turned ON.

LED flags

Y65F	Y65E	Y65D	Y65C	Y65B	Y65A	Y659	Y658	Y657	Y656	Y655	Y654	Y653	Y652	Y651	Y650
AUTO	MAN.	START	STOP	BZ	MS	HD	CD	GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0

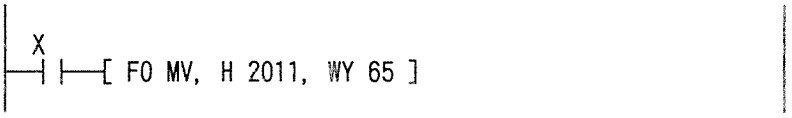
Programming Example

When external input relay X0 is ON, AUTO LED flag (Y65F) will go ON.

Caution

- Do not write code for programs as shown below.
  Do not control the LEDs with other types of operations. Each bit must be controlled independently.

Controlling LEDs with the Primary Screen display operation



Sounding the Buzzer

The choice of communication mode does not affect the programming.

The ON/OFF condition of the BZ flag is controlled by external output relay (Y65B).
When the BZ flag is turned ON, the I.O.P. will sound the buzzer.

BZ flag

Y65F	Y65E	Y65D	Y65C	Y65B	Y65A	Y659	Y658	Y657	Y656	Y655	Y654	Y653	Y652	Y651	Y650
AUTO	MAN.	START	STOP	BZ	MS	HD	CD	GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0

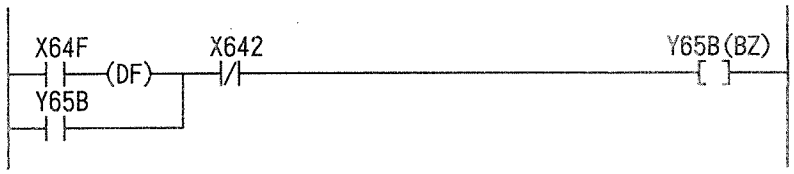
Programming Example 1

When the external input relay X0 is ON, the external output relay Y65B (BZ flag) will be turned ON.

Programming Example 2

When the backup battery of the I.O.P. gets low, the I.O.P. will sound the buzzer. When the STOP key is pressed on the I.O.P., the I.O.P. will stop sounding the buzzer.

Postulate
Key Code of the STOP key: "HEX 04".
The PC external input relays PC X640 thru X647 are set to: 00000100. So, when the STOP key is pressed on the I.O.P., X642 will go ON.



When external input relay X64F (BT flag) is ON, the external output relay Y65B (BZ flag) will go ON. When external input relay X642 is ON, Y65B will go OFF.

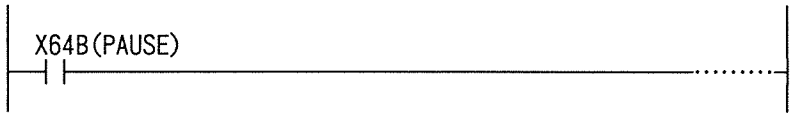
Receiving the State of the Pause Key

When the PAUSE key is pressed on the I.O.P., the PAUSE flag(external input relay X64B) will go ON.

PAUSE flag

X64F	X64E	X64D	X64C	X64B	X64A	X649	X648	X647	X646	X645	X644	X643	X642	X641	X640
BT	RCH	RCC		PAUSE	SD		KDSTB	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0

Programming Example



When X64B is ON, ...

4-3 PC Programming in the Shared Memory R/W Mode

The programming methods for displaying Primary Screens, for receiving Key Data and for controlling LEDs are different from the ones in the I/O Mode.
In this section, the specific programming methods are introduced. For details of the other mode, refer to 4-2 "PC Programing in the I/O Mode.

When you choose the Shared Memory R/W Mode as your communication mode, you must set DIP switch bank 1 as follows.

DIP Switches							
1	2	3	4	5	6	7	8
ON	*	*	*	ON	*	*	*

* You can set the DIP switch to either ON or OFF.
Choose the one appropriate for your operation.

For the details of each instruction, please refer to the FP3/5 Programming Manual.

Note

- When you are in the Shared Memory R/W Mode, all control of the I.O.P. is accomplished with the RMWT and RMRD instructions. These instructions can only be issued once in each scan. So, if you want to use many Primary Screens and Keys on the I.O.P., you may choose to communicate with the I.O.P. in the I/O Mode.

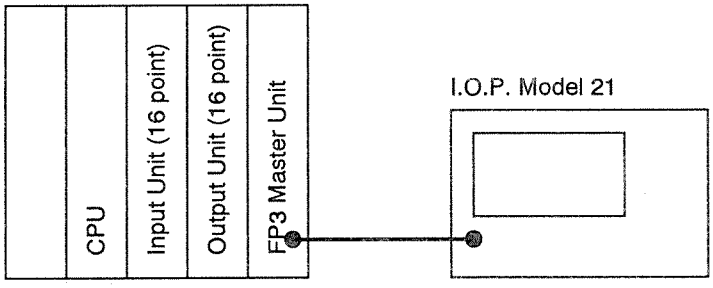
Postulate

Programs introduced in this chapter are based on the assumption that the PC assignments and the I.O.P. options are as follows.

The I.O.P. is connected to the FP3 Master Unit via line I.
Master Unit number : 1
I.O.P. station number : 1
Base word number : 64
Control data : "0101" in DT0
"0000" in DT1

System configuration

PC : FP3 System



● Terminal station

Slave station number 1.
2 words starting with WR64 in the PC input / output relay registers are allocated for the I.O.P..

Caution

- In the programs introduced in this chapter, the PC is assumed to be the subject of the programming.

- Ladder diagrams are based on the NPST-GR format.

I.O.P. Shared Memory used in the Shared Memory R/W Mode

When you have chosen to use HEX data for Displayable External Data

"Digit nn" in the table below indicates the position of the Displayable External Data Digit

10	9	8	7	6	5	4	3	2	1

(Data position on the I.O.P. screen)

"Position nn" in the table below indicates the horizontal digit position on the I.O.P. screen. Position

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

(I.O.P. screen)

Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0	Data
K 0	(not used)	(not used)	Primary Screen number		Primary Screen number
K 1	(not used)	(not used) ML	Manual Screen LINE spec.		Manual Screen
K 2	(not used)	(not used)	(not used)	AUTO LED, MAN. LED, START LED, STOP LED	LED Control
K 3	(not used)	(not used)	Key Code		Key Code
(not used)					
K 99	F E D C	B A 9 8	7 6 5 4	3 2 1 0	Leading zero suppression flag (specify the buffer number)
K 100	Digit 4	Digit 3	Digit 2	Digit 1	Displayable External Data stored in Buffer 0
K 101	Digit 8	Digit 7	Digit 6	Digit 5	
K 102	(not used)	(not used)	Digit 10	Digit 9	
K 103	Digit 4	Digit 3	Digit 2	Digit 1	Displayable External Data stored in Buffer 1
K 104	Digit 8	Digit 7	Digit 6	Digit 5	
K 105	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮

Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0	Data
K 145	Digit 4	Digit 3	Digit 2	Digit 1	
K 146	Digit 8	Digit 7	Digit 6	Digit 5	Displayable External Data stored in Buffer F
K 147	(not used)	(not used)	Digit 10	Digit 9	
(not used)					
K 199	F E D C	B A 9 8	7 6 5 4	3 2 1 0	Descriptive External Data Buffer flag
K 200	Digit 4	Digit 3	Digit 2	Digit 1	
K 201	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 0
K 202	not used	not used	Digit 10	Digit 9	
K 203	Digit 4	Digit 3	Digit 2	Digit 1	
K 204	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 1
K 205	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮
K 245	Digit 4	Digit 3	Digit 2	Digit 1	
K 246	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer F
K 247	(not used)	(not used)	Digit 10	Digit 9	
(not used)					
K 300	character superimposition line specification				
K 301	position 1				
K 302	position 2				
⋮	⋮	⋮	⋮	⋮	
K 320	position 20				Character Superimposition operation data storage area
(not used)					
K 350	(not used : bit A to F)		line 1	position 11 – 20	
K 351	(not used : bit A to F)		line 1	position 1 – 10	
K 352	(not used : bit A to F)		line 2	position 11 – 20	
K 353	(not used : bit A to F)		line 2	position 1 – 10	
⋮	⋮	⋮	⋮	⋮	
K 364	(not used : bit A to F)		line 8	position 11 – 20	Character Highright operation data storage area
K 365	(not used : bit A to F)		line 8	position 1 – 10	

When you have chosen ASCII data for Displayable External Data

"Digit nn" in the table below indicates the position of the Displayable External Data Digit

10	9	8	7	6	5	4	3	2	1

(Data position on the I.O.P. screen)

"Position nn" in the table below indicates the horizontal digit position on the I.O.P. screen. Position

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

(I.O.P. screen)

Word Address	Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0	Data
K 0	(not used) (not used)	Primary Screen number	Primary Screen number
K 1	(not used) (not used) ML	Manual Screen LINE spec.	Manual Screen
K 2	(not used) (not used)	(not used) AUTO LED, MAN. LED, START LED, STOP LED	LED Control
K 3	(not used) (not used)	Key Code	Key Code
(not used)			
K 99	F E D C B A 9 8	7 6 5 4 3 2 1 0	Leading zero suppression flag (specify the buffer number)
K 100	Digit 9	Digit 10	
K 101	Digit 7	Digit 8	
K 102	Digit 5	Digit 6	
K 103	Digit 3	Digit 4	Displayable External Data stored in Buffer 0
K 104	Digit 1	Digit 2	
K 105	Digit 9	Digit 10	
K 106	Digit 7	Digit 8	
K 107	Digit 5	Digit 6	
K 108	Digit 3	Digit 4	Displayable External Data stored in Buffer 1
K 109	Digit 1	Digit 2	
⋮	⋮	⋮	⋮

Word Address	Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0	Data
K 175	Digit 9	Digit 10	
K 176	Digit 7	Digit 8	
K 177	Digit 5	Digit 6	
K 178	Digit 3	Digit 4	Displayable External Data stored in Buffer F
K 179	Digit 1	Digit 2	
(not used)			
K 199	F E D C B A 9 8	7 6 5 4 3 2 1 0	Descriptive External Data Buffer Flag
K 200	Digit 4 Digit 3	Digit 2 Digit 1	
K 201	Digit 8 Digit 7	Digit 6 Digit 5	Descriptive External Data stored in Buffer 0
K 202	(not used) (not used)	Digit 10 Digit 9	
K 203	Digit 4 Digit 3	Digit 2 Digit 1	
K 204	Digit 8 Digit 7	Digit 6 Digit 5	Descriptive External Data stored in Buffer 1
K 205	(not used) (not used)	Digit 10 Digit 9	
⋮	⋮ ⋮	⋮ ⋮	⋮
K 245	Digit 4 Digit 3	Digit 2 Digit 1	
K 246	Digit 8 Digit 7	Digit 6 Digit 5	Descriptive External Data stored in Buffer F
K 247	(not used) (not used)	Digit 10 Digit 9	
(not used)			
K 300	character superimposition line specification		
K 301	position 1		
K 302	position 2		
⋮	⋮ ⋮	⋮ ⋮	Character Superimposition operation data storage area
K 320	position 20		
(not used)			
K 350	(not used : bit A to F)	line 1 position 11 – 20	
K 351	(not used : bit A to F)	line 1 position 1 – 10	
K 352	(not used : bit A to F)	line 2 position 11 – 20	
K 353	(not used : bit A to F)	line 2 position 1 – 10	
⋮	⋮ ⋮	⋮ ⋮	
K 364	(not used : bit A to F)	line 8 position 11 – 20	Character Highright operation data storage area
K 365	(not used : bit A to F)	line 8 position 1 – 10	

PC Memory Area used in the Shared Memory R/W Mode

PC ← I.O.P.
(Input) (Output)

PC memory address

Word	Bit	Name
WX64	X640	KD0
	X641	KD1
	X642	KD2
	X643	KD3
	X644	KD4
	X645	KD5
	X646	KD6
	X647	KD7
	X648	KD STROB
	X649	(not used)
	X64A	SD flag
	X64B	PAUSE flag
	X64C	(not used)
	X64D	RCC flag
	X64E	RCH flag
	X64F	BT flag

PC → I.O.P.
(Output) (Input)

PC memory address

Word	Bit	Name
WY64	Y650	GD0
	Y651	GD1
	Y652	GD2
	Y653	GD3
	Y654	GD4
	Y655	GD5
	Y656	GD6
	Y657	GD7
	Y658	CD flag
	Y659	HD flag
	Y65A	MS flag
	Y65B	BZ flag
	Y65C	STOP LED flag
	Y65D	START LED flag
	Y65E	MAN. LED flag
	Y65F	AUTO LED flag

The darkened memory areas are NOT used in the Shared Memory R/W Mode.
KD0 thru KD7 will be active in the same way as when you are in the I/O Mode.

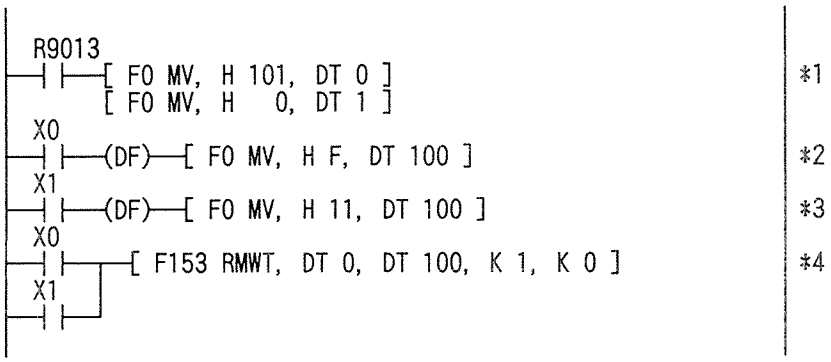
Displaying Primary Screens

The I.O.P. will display a Primary Screen when the PC writes the corresponding Primary Screen number in the I.O.P. Shared Memory location K0 (bit 0 to bit 7).

I.O.P. Shared Memory for displaying the Primary Screen

Word Address	Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0	Data
K 0	(not used) (not used)	Primary Screen number	Primary Screen number

Programming Example 1



*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 "H F" is copied to DT100 to specify the Primary Screen number "0F" (HEX).

*3 "H 11" is copied to DT100 to specify the Primary Screen number "11" (HEX).

*4 With the RMWT instruction, the data in DT100 is written to the I.O.P. Shared Memory location K0.

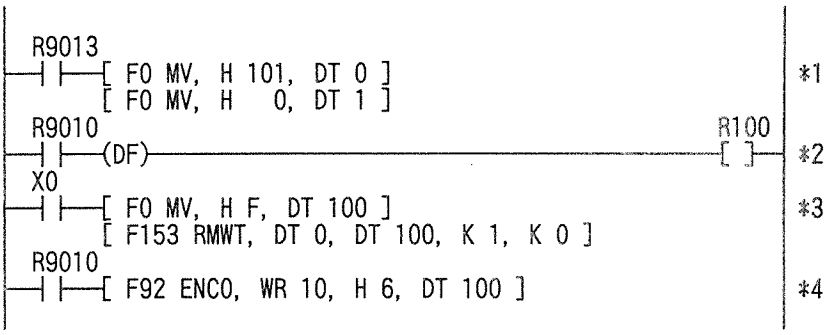
Programming Example 2

Using the ENCO instruction

If you assign each Primary Screen number to an internal relay, use the ENCO instruction(F92 instruction).
For details of the F92 instruction, refer to the FP3/FP5 Programming Manual and also to 4-4 "DECO/ENCO instructions".

Postulate

Primary Screen number "00" corresponds to R100
"0F" R10F



*1 Control Data
Refer to the "RMRD/RMWT instructions" in 4-1 "Before Programming the PC" for details.

*2 When you use the ENCO instruction, one of the internal relays should always be ON.
Here R00, corresponding to the Primary Screen number "00", is always ON.

*3 When external input relay X0 is ON, "H F" is copied to DT100 to display Primary Screen "0F".
With the RMWR instruction, the PC writes the data stored in DT100("H F") to the I.O.P. Shared Memory location K0.

*4 With the ENCO instruction, the bit stored in internal relays (R100 to R15F) which is turned ON is encoded as a hexadecimal number in the range of "00" to "3F", and the result is stored in DT100.
With the RMWT instruction, the PC writes the data stored in DT100 to the I.O.P. Shared Memory location K0.

Receiving Key Codes

When any key (except the PAUSE key) is pressed on the I.O.P., the corresponding Key Code will be stored in the I.O.P. Shared Memory location K3 (bit 0 thru bit 7). At the same time, the KD STROB (Y648 in the PC memory) will go ON. When the KD STROB is ON, the PC should read the Key Data in the K3 register with the RMRD instruction.

KD STROB will remain ON only while the key is pressed. (However it will remain ON for at least 50 msec.)

I.O.P. Shared Memory for receiving Key Codes

Word Address	Bit contents F E D C B A 9 8	7 6 5 4	3 2 1 0	Data
K 3	(not used)	(not used)	Key Code	Key Code

KD STROB

X64F	X64E	X64D	X64C	X64B	X64A	X649	X648	X647	X646	X645	X644	X643	X642	X641	X640
BT	RCH	RCC		PAUSE	SD		KDSTB	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0

Programming Example 1

```
  R9013
──┤ ├──[ F0 MV, H 101, DT 0 ]                    *1
       [ F0 MV, H   0, DT 1 ]
  X648
──┤ ├──[ F152 RMRD, DT 0, K 3, K 1, DT 103 ]     *2
```

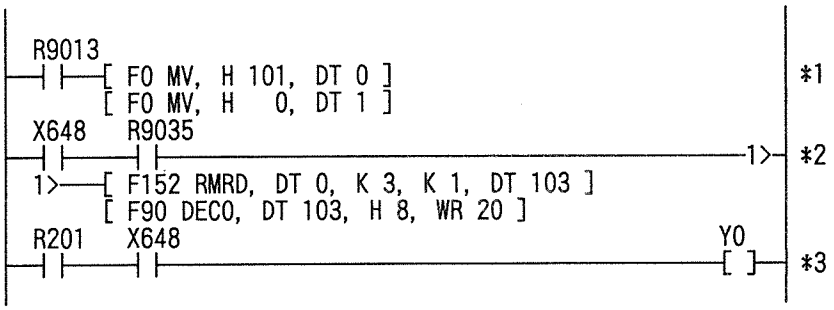
*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 When X648 (KD STROB) is ON, the data stored in K3 is read and stored in DT103.

Programming Example 2

Using the DECO instruction

For details of the F90 instruction, refer to the FP3/FP5 Programming Manual and also to 4-4 "DECO/ENCO instructions".



*1 Control Data
Refer to the "RMRD/RMWT Instructions" in 4-1 "Before Programming the PC" for details.

*2 When X648 (KD STROB) is ON, the PC reads the data in K 3 and stores it in DT103. Via the DECO instruction, the data stored in DT103 is decoded and the result will be reflected in the internal relays WR20 to WR3F.

*3 When R201 (key code "01") is ON, output Y0 will go ON.

Controlling the LEDs

When the PC writes the LED bit pattern as a hexadecimal number to the I.O.P. Shared Memory location K2 (bit 0 thru bit 3), the I.O.P. will turn ON the corresponding LED.
Refer to the table below for the bit patterns.

I.O.P. Shared Memory for LED control

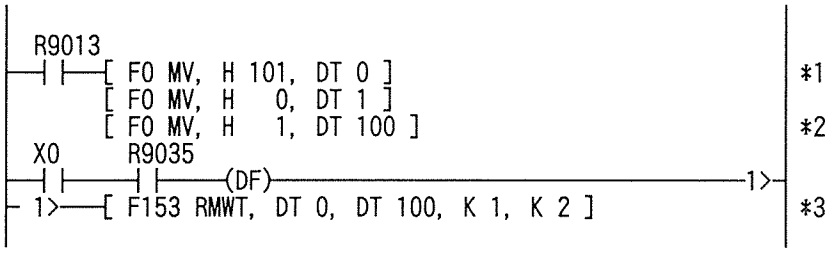
Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3	2	1	0	Data
K 2	(not used)	(not used)	(not used)	AUTO LED	MAN. LED	START LED	STOP LED	

LED patterns

LED	Bit 0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
STOP	–	○	–	○	–	○	–	○	–	○	–	○	–	○	–	○
START	–	–	○	○	–	–	○	○	–	–	○	○	–	–	○	○
MAN	–	–	–	–	–	○	○	○	○	–	–	–	○	○	○	○
AUTO	–	–	–	–	–	–	–	–	○	○	○	○	○	○	○	○

○ : Lit – : Unlit

Programming Example



*1 Control Data
Refer to the "RMRD/RMWT instructions" in 4-1 "Before Programming the PC" for details.

*2 The data for the LED bit pattern "H 1" is stored in DT100.

*3 When external input relay X0 is ON, the PC writes the data in DT100 ("H 1") to the I.O.P. Shared Memory location K2.

4-4 The DECO/ENCO Instructions

For the details of DECO/ENCO instructions, refer to the FP3/FP5 Programming Manual.
The DECO instruction (F90/P90) converts HEX data (for example Key Data) to bit data which corresponds to the contact data used by the internal relays.

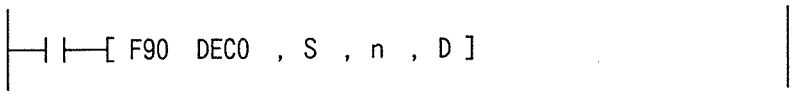
The ENCO instruction (F92/P92) converts bit data (the contact data of internal relays) to HEX data (for example Primary Screen numbers).

DECO Instruction

If you include the DECO instruction (F90/P90) in the code for receiving Key Data, the Key Code will be converted to the bit-level contact data needed by the internal relay.

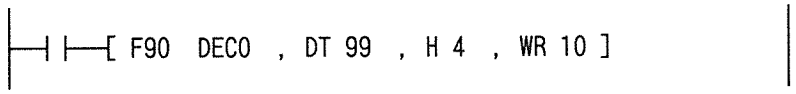
The HEX data is read, and the single bit corresponding to this position is converted to 1. The rest of the bits are set to 0.

Basic Program



S : Area storing data or conversion data (constant)
n : Area storing data or conversion control data
(High-order byte : nH, Low-order byte : nL)
D : Start number of the area storing the converted result

Converts HEX to bit-level for 16 internal relays (1 word)

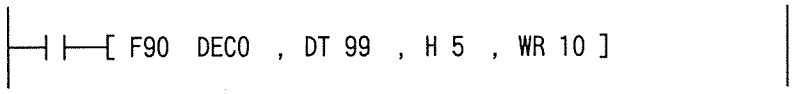


A Key Code, stored in DT99, is converted to the contact data used by the internal relays. H4 and WR10 are specified so the 16 internal relays (16 bits or 1 word), R100 to R10F, will be accessible.

DT99 = 01 R101
DT99 = 0A R10A
DT99 = 0F R10F

Key Codes "01" thru "0F" are valid in the program above.

Converts HEX to bit-level for 32 internal relays (2 words)

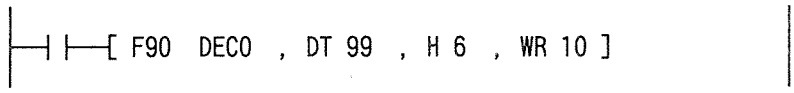


The Key Code stored in DT99 is converted to internal relay contact data. H5 and WR10 are specified in the program so the 32 internal relays (32 bits or 2 words) R100 to R1F will be accessible.

DT99 = 01 R101
DT99 = 0F R10F
DT99 = 1F R11F

The Key Codes "01" thru "1F" are valid in the program above.

Converts HEX to bit-level for 64 internal relays (4 words)

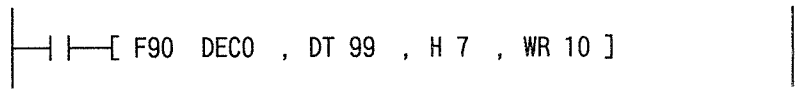


The Key Code stored in DT99 is converted to internal relay contact data. H6 and WR10 are specified in the program so the 64 internal relays (64 bits or 4 words) R100 to R4F will be accessible.

DT99 = 01 R101
DT99 = 0F R10F
DT99 = 1F R11F
DT99 = 2F R12F
DT99 = 3F R13F

The Key Codes "01" thru "3F" are valid in the program above.

Converts HEX to bit-level for 128 internal relays (8 words)

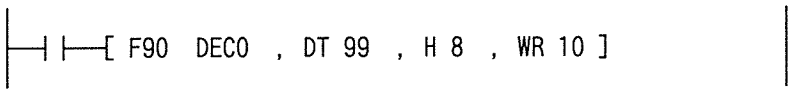


The Key Code stored in DT99 is converted to internal relay contact data. H7 and WR10 are specified in the program so the 128 internal relays (128 bits or 8 words) R100 to R4F will be accessible.

DT99 = 01 R101
DT99 = 0F R10F
DT99 = 1F R11F
DT99 = 2F R12F
DT99 = 3F R13F
DT99 = 4F R14F
DT99 = 5F R15F
DT99 = 6F R16F
DT99 = 7F R17F

The Key Codes "01" thru "7F" are valid in the program above.

Converts HEX to bit-level for 256 internal relays (16 words)



The Key Code stored in DT99 is converted to internal relay contact data. H7 and WR10 are specified in the program so the 256 internal relays (256 bits or 16 words) R100 to RFF will be accessible.

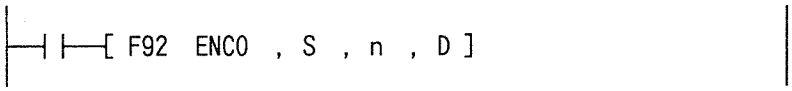
DT99 = 01 R101
DT99 = 0F R10F
DT99 = 1F R11F
DT99 = 2F R12F
DT99 = 3F R13F
DT99 = 4F R14F
DT99 = 5F R15F
DT99 = 6F R16F
DT99 = 7F R17F
DT99 = 8F R18F
DT99 = 9F R19F
DT99 = AF R20F
DT99 = BF R21F
DT99 = CF R22F
DT99 = DF R23F
DT99 = EF R24F
DT99 = FF R25F

The Key Codes "01" thru "FF" are valid in the program above.

ENCO Instruction

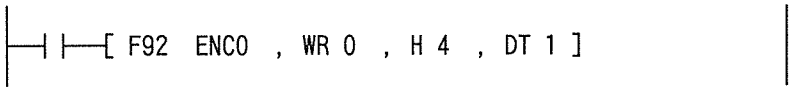
If you include the ENCO instruction (F92/P920) in the code to send Primary Screen Data, the contact data of the internal relays can be converted to screen data.
According to the bit information (ON/OFF=1/0) specified, the bit-level contact data is converted to the corresponding HEX data and the result is stored in the screen data area.

Basic Program



S : Start number of the area storing conversion data
n : Area storing data or conversion control data (constant)
(High-order byte : nH, Low-order byte : nL)
D : Area storing the converted result

Converts the contact data of 16 internal relays (1 word)

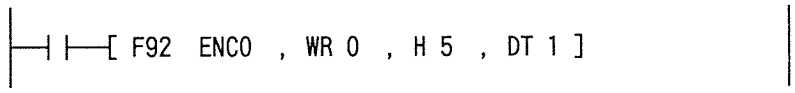


The number of the internal relay that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 16 bits in WR00, will be stored in DT1.

R0=ON ····· DT1=00
R1=ON ····· DT1=01
RF=ON ····· DT1=0F

Primary Screen numbers "01" to "0F" are valid in the program above.

Converts the contact data of 32 internal relays (2 words)

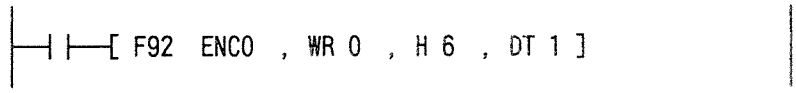


The number of the internal relay that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 32 bits starting at WR00, will be stored in DT1.

R0=ON ····· DT1=00
RF=ON ····· DT1=0F
R1F=ON····· DT1=1F

Primary Screen numbers "01" thru "1F" are valid in the program above.

Converts the contact data of 64 internal relays (4 words)

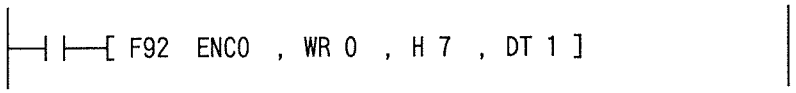


The number of the internal relay that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 64 bits starting at WR00, will be stored in DT1.

R0=ON ····· DT1=00
RF=ON ····· DT1=0F
R1F=ON····· DT1=1F
R2F=ON····· DT1=2F
R3F=ON····· DT1=3F

Primary Screen numbers "01" thru "3F" are valid in the program above.

Converts the contact data of 128 internal relays (8 words)

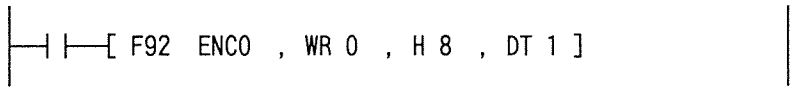


The number of the internal relay that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 128 bits starting at WR00, will be stored in DT1.

R0=ON ····· DT1=00
RF=ON ····· DT1=0F
R1F=ON····· DT1=1F
R2F=ON····· DT1=2F
R3F=ON····· DT1=3F
R4F=ON····· DT1=4F
R5F=ON····· DT1=5F
R6F=ON····· DT1=6F
R7F=ON····· DT1=7F

Primary Screen numbers "01" thru "7F" are valid in the program above.

Converts the contact data of 256 internal relays (16 words)



The number of the internal relay that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 256 bits starting at WR00, will be stored in DT1.

R0=ON ····· DT1=00
RF=ON ····· DT1=0F
R1F=ON····· DT1=1F
R2F=ON····· DT1=2F
R3F=ON····· DT1=3F
R4F=ON····· DT1=4F
R5F=ON····· DT1=5F
R6F=ON····· DT1=6F
R7F=ON····· DT1=7F
R8F=ON····· DT1=8F
R9F=ON····· DT1=9F
R10F=ON ···· DT1=AF
R11F=ON ···· DT1=BF
R12F=ON ···· DT1=CF
R13F=ON ···· DT1=DF
R14F=ON ···· DT1=EF
R25F=ON ···· DT1=FF

Primary Screen numbers "01" thru "FF" are valid in the program above.

4-5 Communication Errors

For details about communication errors, refer to Chapter 8 and 9 in the Remote I/O system manual.

When the FP3/FP5 CPU's ERROR LED is turned ON, first check the following. In many cases, the PC programming was not done correctly.

Cause: The Master Unit tried to perform more than one F152/F153 instruction during a single scan.

Action: The F152 and F153 instructions can be used only once each scan. Using special relays R9035/R9036, code the program so that the PC performs only one F152 or F153 instruction during each scan.

Cause: The number of words requested for reading or writing in a F152/F153 instruction exceeded 32 words.

Action: A maximum of 32 words can be read or written with one F152/F153 instruction. Check and correct the program if more than 32 words are specified in one of these instructions.

Cause: The wiring is not done correctly or the power supply has encounterd a procedure error.

Action: First turn ON the power to the slave stations and then turn ON the power at the master station.

Finding the cause of an error when the CPU ERROR LED is ON

You can check the cause of errors with the special data registers or internal relays in the PC memory.

Error flag R9007 or R9008 is ON

Error flags R9007 and R9008 turn ON in the following cases :

1) When the control data exceeds the specifiable range
2) When the Master Unit is missing
3) When an address modifier error occurs
4) When the range of the read data exceeds the area specified

Error flag R9036 is ON

Code (HEX)	Description
58H	Time out : Remote unit does not exist and the not-ready-to-send state continues.
68H	Access area missing error : Specified memory access area does not exist in the Slave Unit.
71H	Send answer wait time-out error
72H	Send buffer empty wait time-out error
73H	Response wait time-out error

Chapter 5

Sample Program

Chapter 5 will shows you some sample programs for data communication.

Programmable Controller is abbreviated PC.

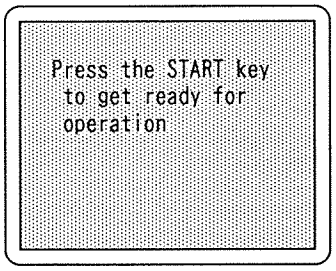
5-1 Sample Program 1

Create the I.O.P. message screens in an order so that the I.O.P. flow of operations will be similar to that shown below.

Flow of Operations on the I.O.P.

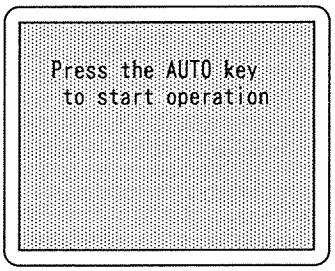
Step 1

When the I.O.P. power is turned ON, the following screen should appear on the I.O.P. display.



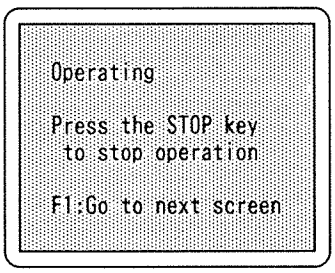
Step 2

When the START key is pressed, the following screen will appear on the I.O.P.. At the same time, the START LED will turn ON.



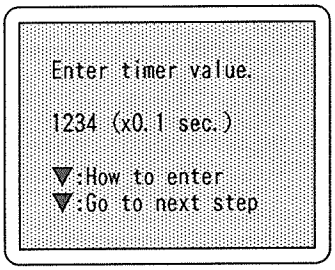
Step 3

When the AUTO key is pressed, the I.O.P. screen will change to the following screen. At the same time, the AUTO LED will turn ON.



Step 4

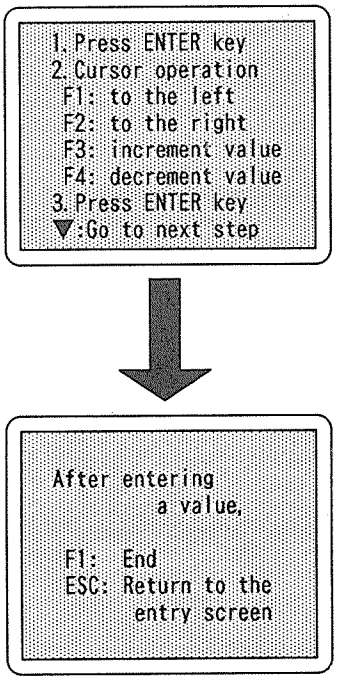
When the F1 key is pressed, the I.O.P. will change to the following screen.
When the STOP key is pressed, the I.O.P. will return to the screen shown in the step 1.



Step 5

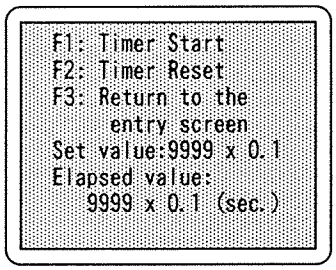
A timer value for the PC is entered.

a. For instructions on how to enter a value, press the down arrow key.
b. To go to the next step after entering the value, press the down arrow key twice.



Step 6

When the F1 key is pressed, the I.O.P. will change to the following screen.
When the ESC key is pressed, the I.O.P. will return to the screen for entering a timer value.

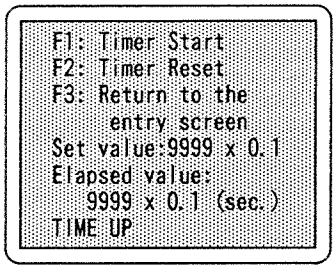


Step 7

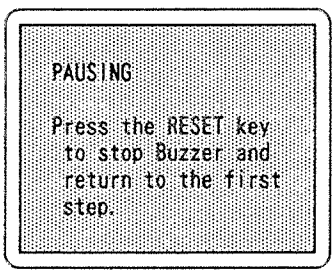
When the F1 key is pressed, the PC timer starts counting.
When the F2 key is pressed, the PC timer is reset. (The timer count returns to "0").
When the F3 key is pressed, the I.O.P. will return to the screen for entering a timer value.

Step 8

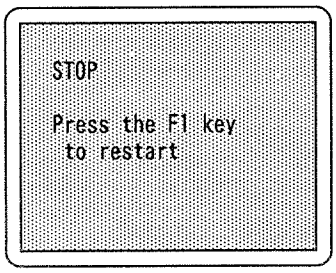
When the timer times out, the following screen will appear.



When the PAUSE key is pressed on any screen, the following screen will appear.
At the same time, the I.O.P. will sound the buzzer.
When the RESET key is pressed, the I.O.P. will stop sounding the buzzer and return to the first step.



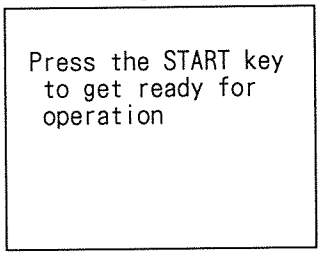
When the STOP key is pressed on any screen, the following screen will appear.
When the F1 key is pressed, the screen shown in step 1 will appear.



I.O.P. Message Screens

Primary Screen number 00: R300

IOP Message Screen



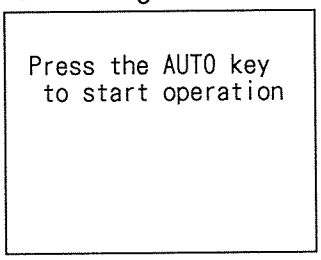
Prim. No.	00
Sec. No.	
ATB.	0

Function Key

F1	F2	F3	F4

Primary Screen number 01: R301

IOP Message Screen



Prim. No.	01
Sec. No.	
ATB.	0

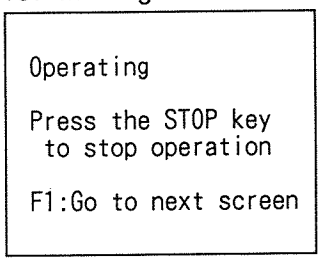
Function Key

F1	F2	F3	F4

Primary Screen number 02: R302

Key Code 10 : R110

IOP Message Screen



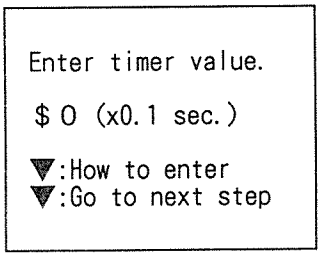
Prim. No.	02
Sec. No.	
ATB.	1

Function Key

F1	F2	F3	F4
10			

Primary Screen number 03: R303

IOP Message Screen



Prim. No.	03
Sec. No.	
ATB.	4

Function Key

F1	F2	F3	F4

Primary Screen number: 03
Secondary Screen: 01

IOP Message Screen

```
1. Press ENTER key
2. Cursor operation
  F1: to the left
  F2: to the right
  F3: increment value
  F4: decrement value
3. Press ENTER key
▼:Go to next step
```

Prim. No.	03
Sec. No.	01
ATB.	0

Function Key

F1	F2	F3	F4

Primary Screen number: 03
Secondary Screen: 02
Key Code 11 : R111

IOP Message Screen

```
After entering
        a value,

 F1:  End
 ESC: Return to the
       entry screen
```

Prim. No.	03
Sec. No.	02
ATB.	3

Function Key

F1	F2	F3	F4
11			

Primary Screen number 04: R304
Key Code 12 : R112
Key Code 20 : R120
Key Code 21 : R121

IOP Message Screen

```
F1: Timer Start
F2: Timer Reset
F3: Return to the
     entry screen
Set value:＼0 x 0.1
Elapsed value:
    ＼1 x 0.1 (sec.)
```

Prim. No.	04
Sec. No.	
ATB.	3

Function Key

F1	F2	F3	F4
12	20	21	

Primary Screen number 05: R305

IOP Message Screen

```
PAUSING

Press the RESET key
 to stop Buzzer and
 return to the first
 step.
```

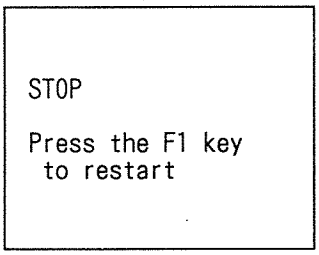
Prim. No.	05
Sec. No.	
ATB.	0

Function Key

F1	F2	F3	F4

Primary Screen number 06: R306
Key Code 13 : R113

IOP Message Screen



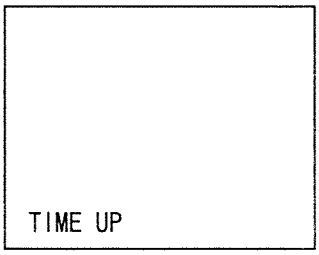
Prim. No.	06
Sec. No.	
ATB.	1

Function Key

F1	F2	F3	F4
13			

Primary Screen number 07: R307
Key Code 13 : R113

IOP Message Screen



Prim. No.	07
Sec. No.	
ATB.	6

Function Key

F1	F2	F3	F4
13			

Fixed key

AUTO	01	Key Code 01 : R101
MAN.	02	Key Code 02 : R102
START	03	Key Code 03 : R103
STOP	04	Key Code 04 : R104
RESET	05	Key Code 05 : R105

Note

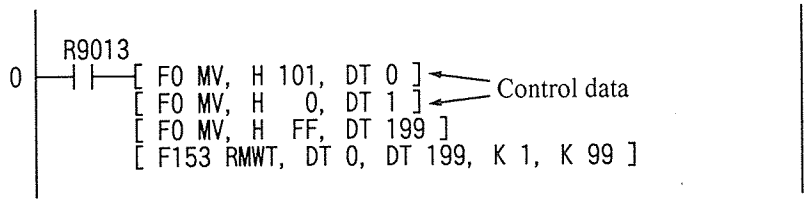
- Refer to the I.O.P. 20 series Software Manual for details about creating I.O.P. Message Screens.

Programming with the NPST-GR

Communication Mode : the I/O Mode
Master Unit number : 1
I.O.P. station number : 1
Base word number : 64
External input relay WX64 (X640 - X64F)
External output relay WY65 (Y650 - Y65F)
Control data : "0101" in DT0
"0000" in DT1

Program for the Control Data
Program for specifying suppression of leading zeroes

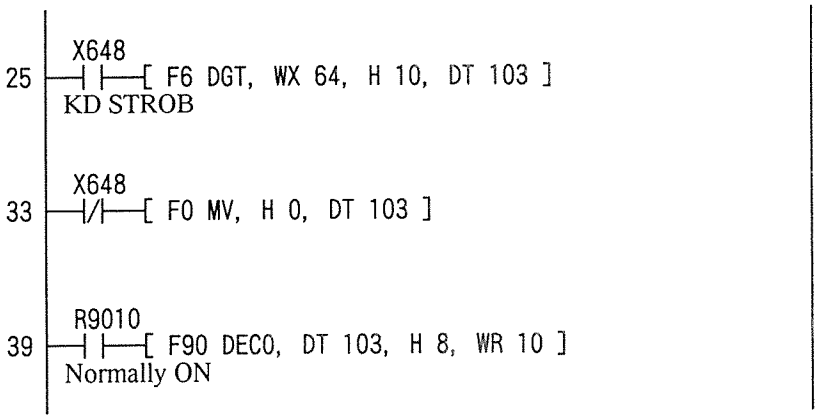
Specifying suppression of leading zeroes
"H FF" is specified to suppress leading zeroes for all pieces of Displayable External Data.
With the RMWT instruction, the PC writes the data stored in DT199 ("H FF") to the I.O.P. Shared Memory K99.



Program for receiving Key Data

When a key is pressed, the lower 8 bits of data in WX64 are stored in DT103 with the DGT instruction.
When no key is pressed, "H 00" is stored in DT103.

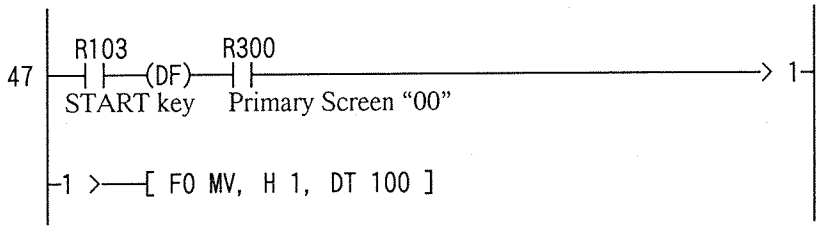
With the DECO instruction, the data in DT103 is reflected in the internal relays starting at WR10.



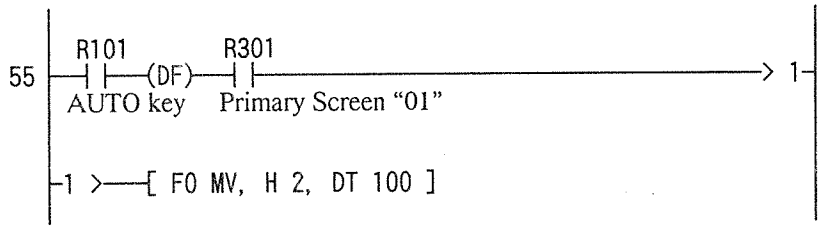
Program for displaying Primary Screens

Primary Screen numbers are stored in DT100 when the corresponding condition is ON.
The processing of the data in DT100 is written at the end of the program.

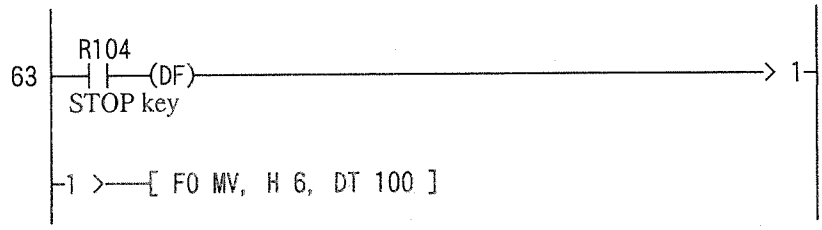
While Primary Screen "00" is being displayed, if the START key is pressed, Primary Screen "01" will be displayed.



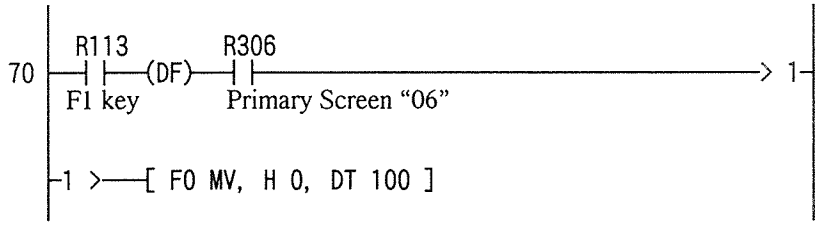
While Primary Screen "01" is being displayed, and if the AUTO key is pressed, Primary Screen "02" will be displayed.



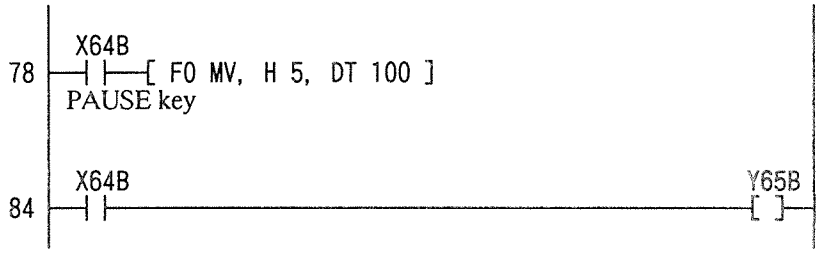
If the STOP key is pressed, Primary Screen "06" will be displayed.



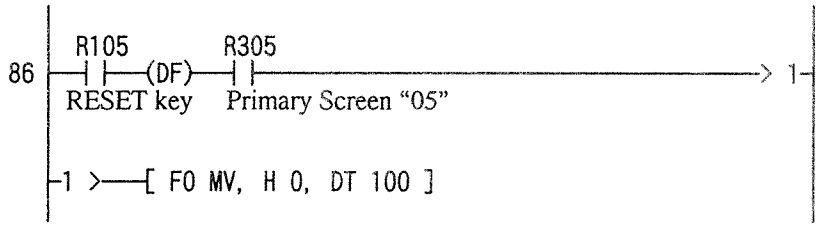
While Primary Screen "06" is being displayed, if the F1 key (Key Code 13) is pressed, Primary Screen "00" will be displayed.



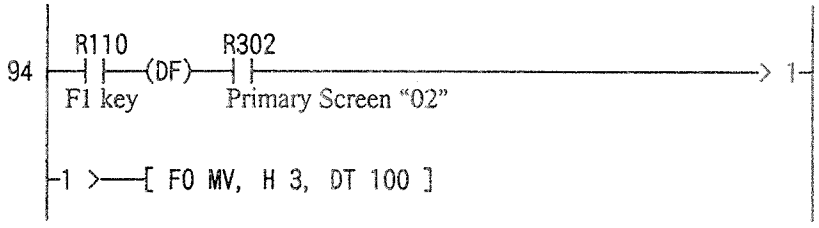
When the PAUSE key is pressed on the I.O.P. (X64B ON), Primary Screen "05" is displayed. At the same time, the I.O.P. sounds the buzzer (Y65B ON).



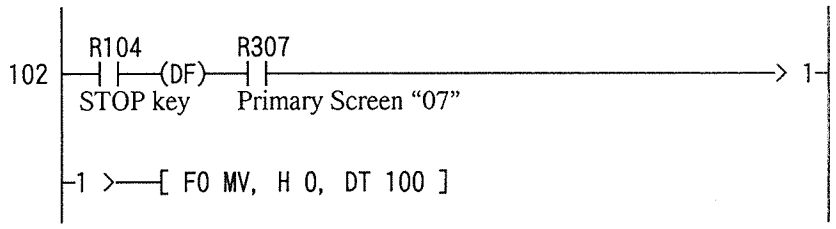
While Primary Screen "05" is being displayed, if the RESET key is pressed, Primary Screen "00" will be displayed.



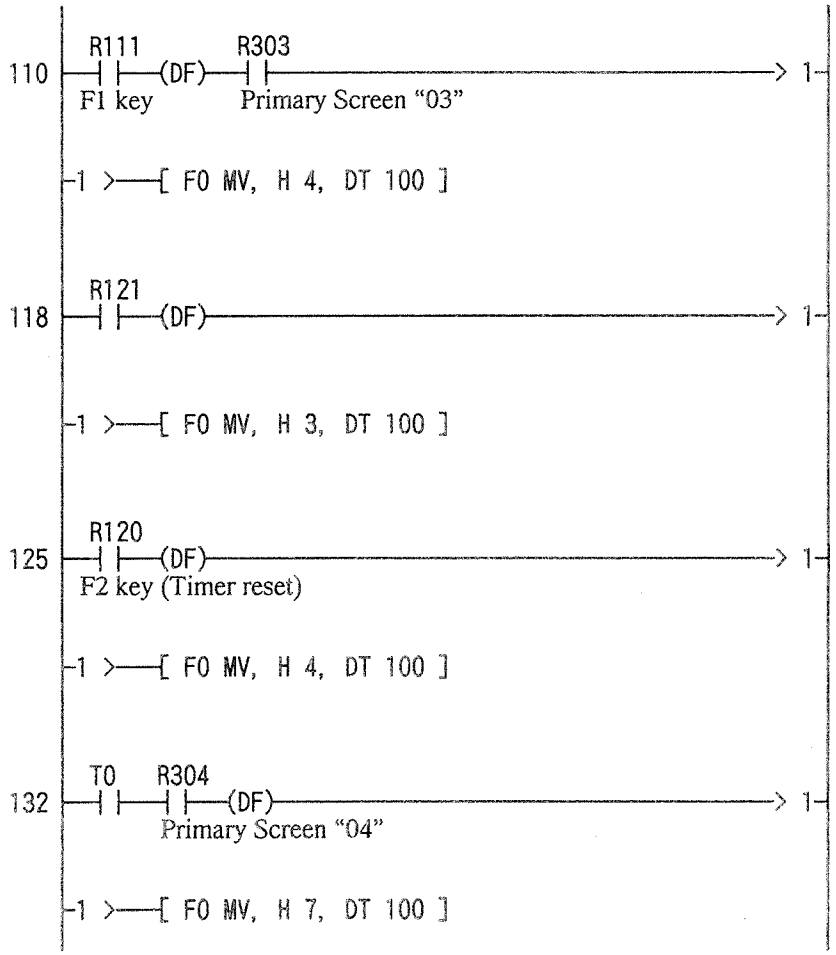
While Primary Screen "02" is being displayed, if the F1 key (Key Code 10) is pressed, Primary Screen "03" will be displayed.



While Primary Screen "07" is being displayed, if the STOP key is pressed, Primary Screen "00" will be displayed.



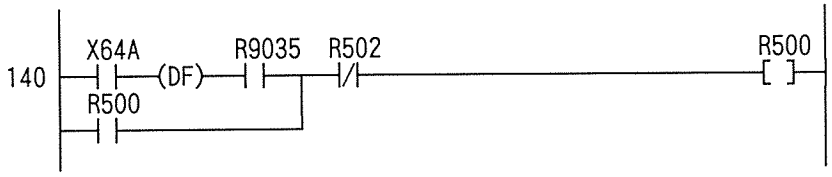
While Primary Screen "03" is being displayed, if the F1 key (Key Code 11) is pressed, Primary Screen "04" will be displayed.



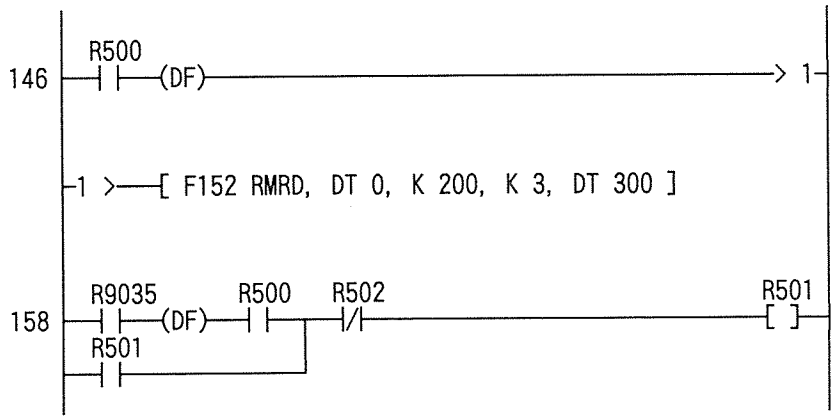
Program for receiving External Data entered on the I.O.P.

X64A : SD flag

When data is entered on the I.O.P., the SD flag turns ON.

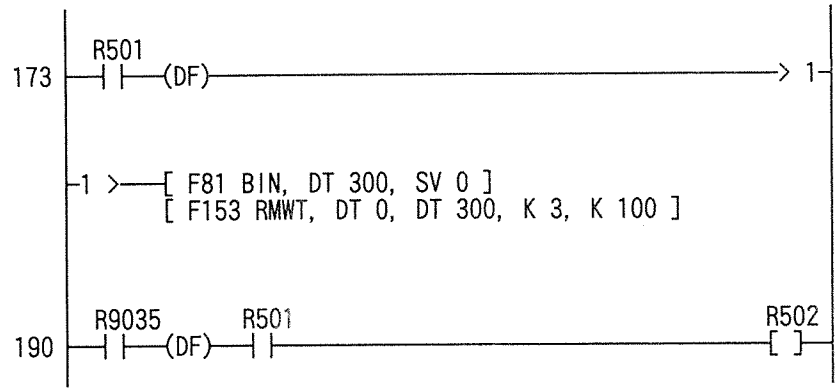


When R500 is ON, the 3 words of data stored in K200 to K202 will be stored in the data registers starting at DT300.

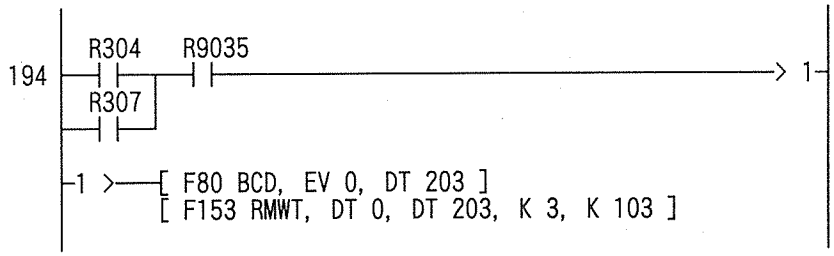


When R501 is ON, the data in DT300 will be converted to BIN data and the result is stored in SV0 (set value of PC timer 0).

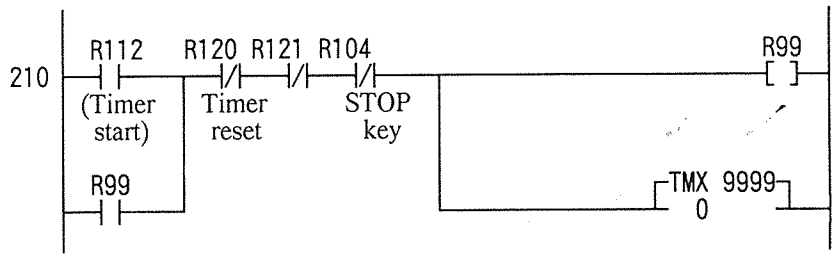
The data in DT300 is also written in the I.O.P. Shared Memory area K100 for display on the I.O.P..



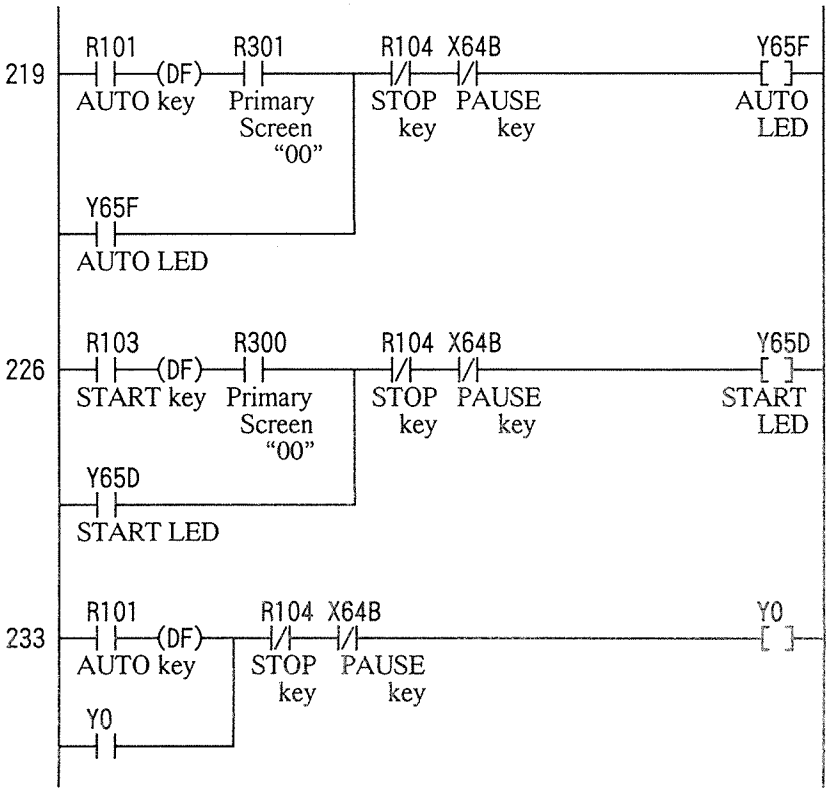
The value of EV0 is converted to BCD data and the result will be stored in DT203. The data in DT203 is written to the I.O.P. Shared Memory area K103.



Programming to start the PC timer (T0)

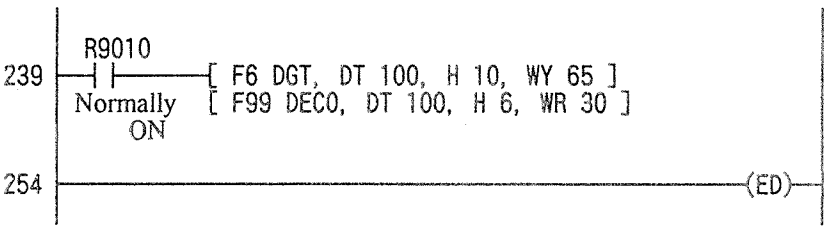


Programming for LED control



Programming to page the Primary Screen

The primary Screen number stored in DT100 is written to WY65 with the DGT instruction. Only the data from bit 0 to bit 7 in DT100 is written to Y650 to Y657.
At the same time, the data in DT100 (Primary Screen number) is decoded and the result is reflected in the internal relays starting at WR30.



5-2 Sample Program 2

Displaying ASCII data, read with a bar-code reader, on the I.O.P.

1. I.O.P. Environment

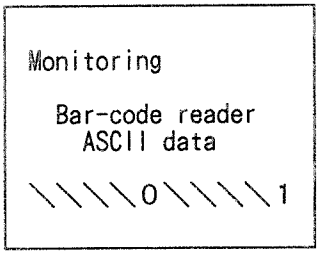
Leading zero suppression specification: K99
Displayable External Data stored in Buffer 0: K100 to K104
Displayable External Data stored in Buffer 1: K105 to K109
Displayable External Data stored in Buffer 2: K110 to K114
Displayable External Data stored in Buffer 3: K115 to K119

Displays External Data in ASCII.

Communication Mode : the I/O Mode
Master Unit number : 1
I.O.P. station number : 1
Base word number : 64
External input relay WX64 (X640 - X64F)
External output relay WY65 (Y650 - Y65F)
Control data : "0101" in DT0
"0000" in DT1

2.

IOP Message Screen



Prim. No.	00
Sec. No.	
ATB.	2

Function Key

F1	F2	F3	F4

3. PC Environments

CPU: FP3 (Ladder type CPU)
Slot 0: Data Processing Unit
Slot 1: Input Unit (16 points)
Slot 2: The FP3 Master Unit

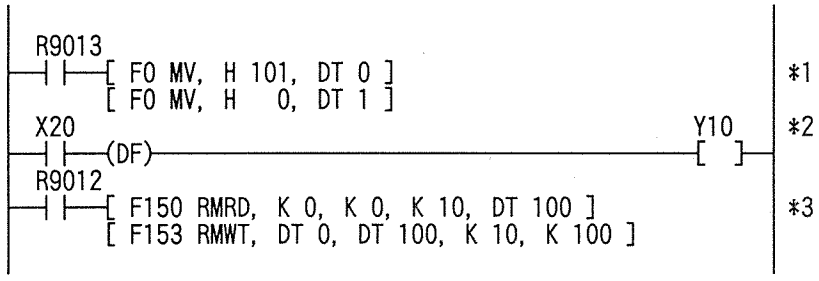
4. PC I/O Shared Memory

I/O	Y10	DPU	Sends bar-code reader asynchronous command
	X20	Input	Asynchronous sensor for bar-code reader
Shared Memory	0-10	DPU	Bar-code reader receiving data (ASCII)

5. Bar-code Reader

Bar-code reader : AVB0120
Baud rate : 9600 bps
Data length : 8 bits
Parity : None
Stop bits : 1 bit
Terminator : CR, LF
Asynchronous Mode : 2
Connection to DPU : COM.1

6. Ladder CPU Program Example



*1 R9013 (Initial pulse (ON) relay): Specifies control data for one scan.

*2 When the asynchronous sensor is turned ON, this line sends the command to the DPU.

*3 10 words of ASCII data (20 bytes), received from shared memory will be stored in data registers starting at DT100.
10 words of data starting with DT100 are written in the I.O.P. Shared Memory area starting with K100.

7. DPU Program Example

Program Example

```
10  REM BARCODE-DATE-READ BAR2.BAS
20  OPEN "COM1:9600,N,8,1" AS #1        ----- *1
30  RK$=CHR$(&H1B)+"A0,5"               ----- *2
40  CL$="                        "      ----- *3
50  IF SW(0)=1 THEN GOTO 70             ----- *4
60  IF SW(0)=0 THEN GOTO 50             ----- *5
70  PWRITE 0,CL$                        ----- *6
80  PRINT #1,PK$                        ----- *7
90  INPUT #1,RES$                       ----- *8
100 PWRITE 0,RES$                       ----- *9
110 GOTO 50                             -----*10
120 END
```

*1 9600 bps, parity: none, character bits: 8 bits, stop bits: 1
*2 RK$= specifies the bar-code reader asynchronous command.
*3 CL$= for clearing the shared memory of 20 bytes
*4 If Y10 is ON, goes to step 70.
*5 If Y10 is OFF, goes to step 50.
*6 Clears the shared memory area for receiving.
*7 Asynchronous command=RK$ is sent to the bar-code reader.
*8 The response is stored in RES$.
*9 RES$ is stored in the shared memory starting with 0.
*10 Returns to step 50.

Chapter 6

Connecting the I.O.P. to a PC

Chpater 6 explains how to connect the communication cable.
You will learn how to connect the I.O.P. Model 21 to an FP3 and FP5.

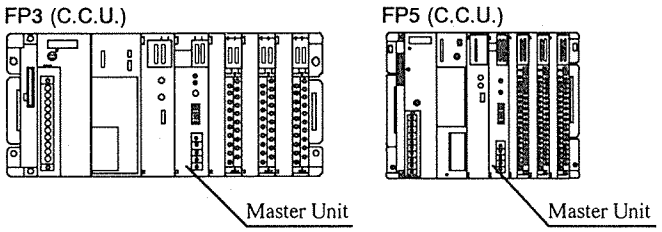
Programmable Controller is abbreviated PC.

6-1 Connecting the I.O.P. to the FP3/FP5 Master Unit

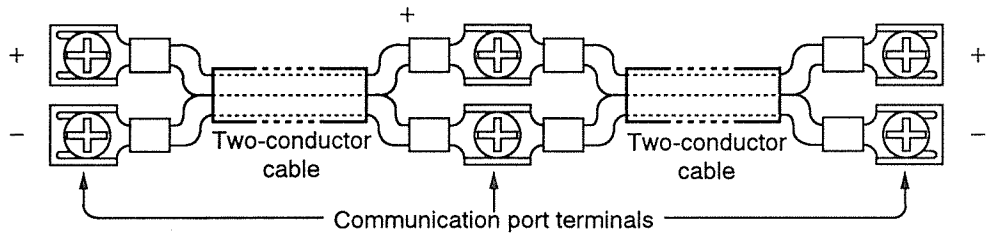
The I.O.P. is connected to the Master Unit with a two-conductor cable (VCTF0.75 mm 2 x 2 (specified in Japanese Industrial Standard) or the equivalent).

What You Need

An FP3 system with a Master Unit installed (model number AFP3740) or
An FP5 system with a Master Unit installed (model number AFP5740)



2-conductor Cable



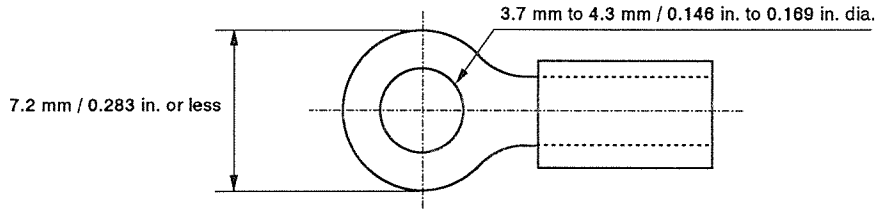
Connect the "+" sides to the "+" sides and "-" sides to the "-" sides as shown above.

Limit the length of the transmission cable between ports to a total of 500 m or less (all cables added together).

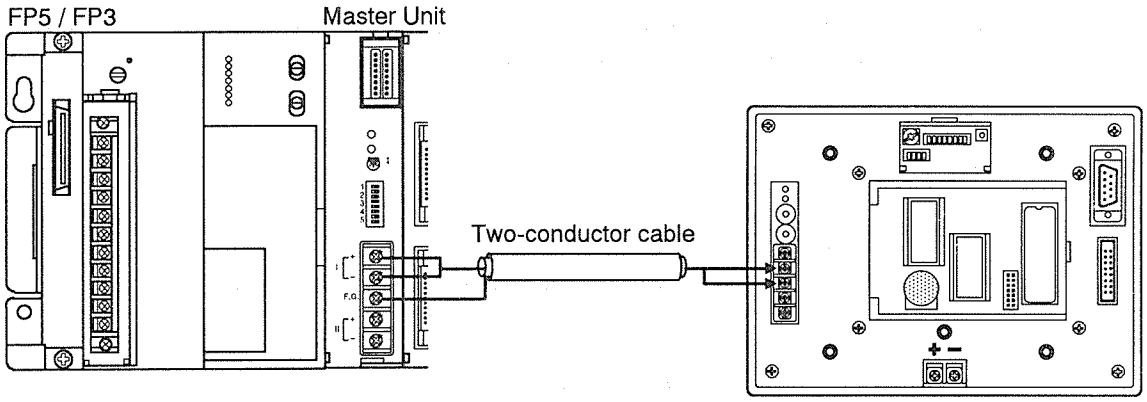
Preparing both ends of the communication cables

Use crimp terminals at the both ends of each transmission cable. If the cable is directly connected to the terminal block without using crimp terminals, a contact failure may occur which can cause erratic data communications.

Crimp terminal specification: J.S.T. number "1.25-YS35" or equivalent



How to Connect the I.O.P. to the Master Unit



6-2 Power Up Sequence

Before turning ON power to the I.O.P. and the PC, be sure the PC and I.O.P. settings have been made correctly. Refer to Chapter 3 for details.

Caution

Be sure that you turn ON the I.O.P. first and then the PC. If you turn ON the PC before you turn ON the I.O.P., the memory I/O map in the PC will be not be correct.

Procedure

1 Check the wiring

Is the I.O.P. Model 21 connected to the Master Unit with the appropriate two-conductor wire.

2 Set DIP switch bank 1 to the RUN Mode

DIP switch bank 1 setting

1	2	3	4	5	6	7	8
ON	OFF	*	*	*	*	*	*

* You can set these DIP switches either ON or OFF.
Choose the one appropriate for your operation.
Refer to 3-3, "DIP Switch bank 2 setting".

3 Turn ON the power to the I.O.P..

It must be supplied with 24 V DC.

4 Turn ON the power to the PC.

6-3 Checking the Operating Status for Data Communications

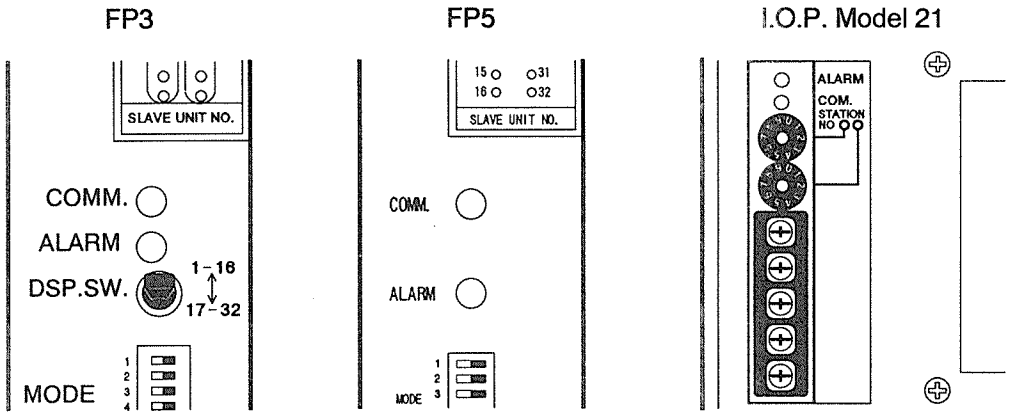
While watching the operating mode indicator LEDs on the Master Unit and the operating mode indicator LEDs on the rear panel of the I.O.P., check the operating status.
Refer to the following table for the patterns of these LEDs.

LED pattern

Indicator name	Description
COMM.	Indicates the current communication mode : ON (Standby) : Fast flashing (Normal transmission) : Slow flashing (Stop mode transmission) : OFF (Transmission error)
ALARM	Indicates unit's error states : ON (Unit error) : Flashing (Setting error) : OFF (Normal)

Stop mode transmission: Error on one of the slave stations on the same line.

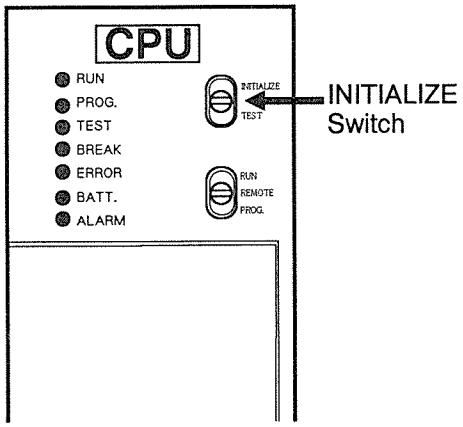
LEDs



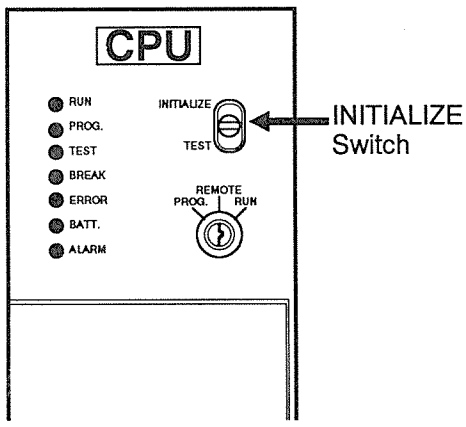
Cautions

If the System Reset Buttom is pressed on the rear panel of the I.O.P. during transmission, the ERROR LED on the CPU will turn ON. When this LED is ON, the data communication with the I.O.P. won't be performed. Clear the error state, set the CPU to PROG. mode and turn the initialize switch to INITIALIZE.

FP 3



FP 5



Chapter 7

Operating Environments

This chapter explains how to maintain the I.O.P. Model 21.
Precautions for safeguarding the I.O.P Model 22 will be explained.

PC stands for Programmable Controller.

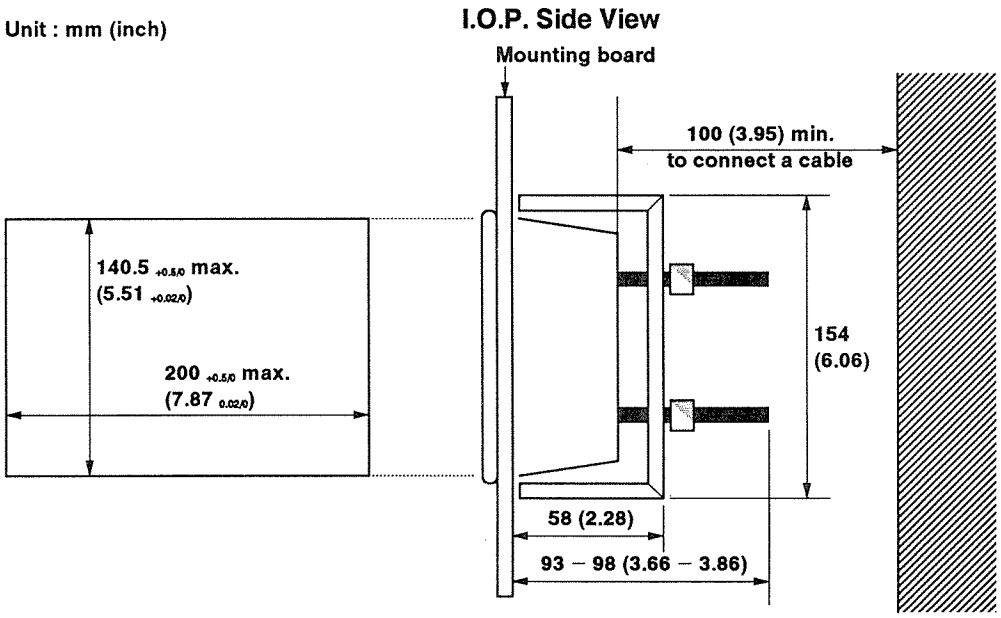
7-1 Mounting the I.O.P. on a Board

The flange type I.O.P.

If you have the I.O.P. part number AIP211002, you can mount the I.O.P. on a board. The mounting dimensions are specified below.

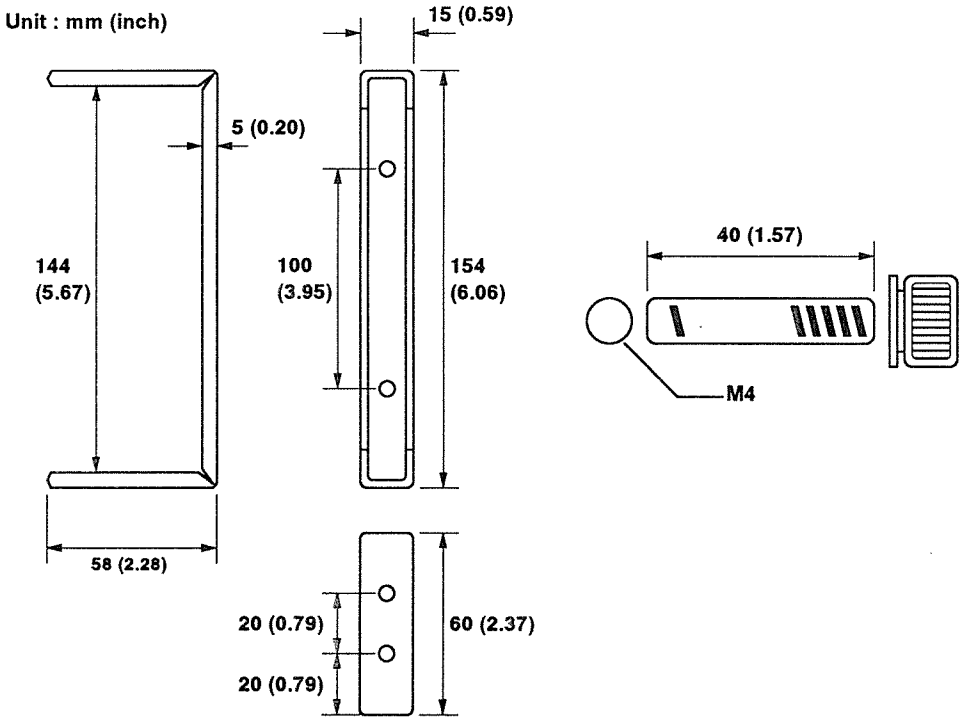
Mounting dimensions

Unit : mm (inch)



Set-screw hole dimensions

Unit : mm (inch)

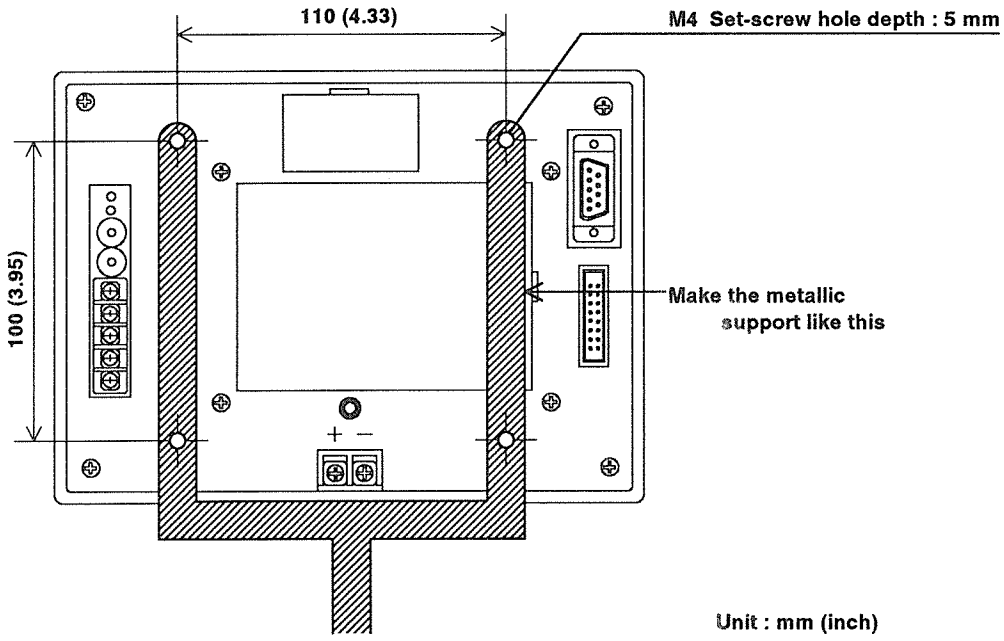


The case type I.O.P.

If you have the I.O.P. part number AIP211102, make a board and a metallic support as shown in the illustration below if you want to mount the I.O.P. on a board.

Cautions

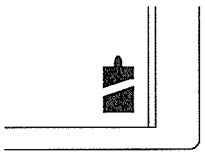
The depth of the set-screw holes is 5mm. Be careful when mounting the I.O.P..
Do not short between the board and the power supply.



7-2 Replacing the Backup Battery

The I.O.P. should have a Backup Battery installed in the rear panel to back up User Memory. A Backup Battery is supplied with the I.O.P. Model 21. Before you use the I.O.P., install the battery.

When the backup battery gets low, the weak Battery Indicator will appear on the screen. When you see this indicator, replace the battery with a new one(Part No. AFB8801).



Backup Battery Indicator

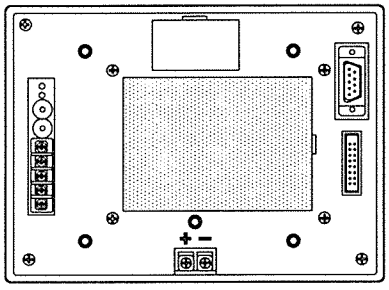
Caution

- Replace the backup battery with a new one within ONE WEEK after you see the low battery indicator on the I.O.P.. If the battery dies, data in the memory will not be maintained.
  The data maintained by the backup battery is the screen data you create on a personal computer (when you install the RAM) and the data stored in buffer.

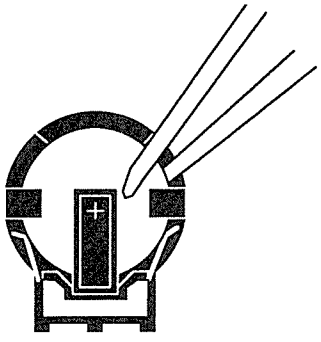
- The shelf life of the battery is about 10,000 hours in RAM operation.

Procedure

1. Open the large cover on the rear panel of the I.O.P.

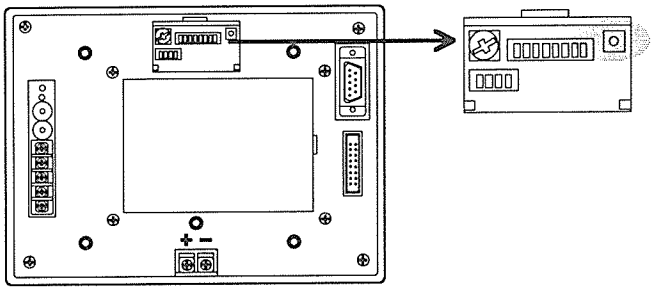


2. Remove the old backup battery with insulated tweezers or a similar tool.



3. Install a new backup battery in the same orientation.

4. Press the System Reset Button on the rear panel of the I.O.P..



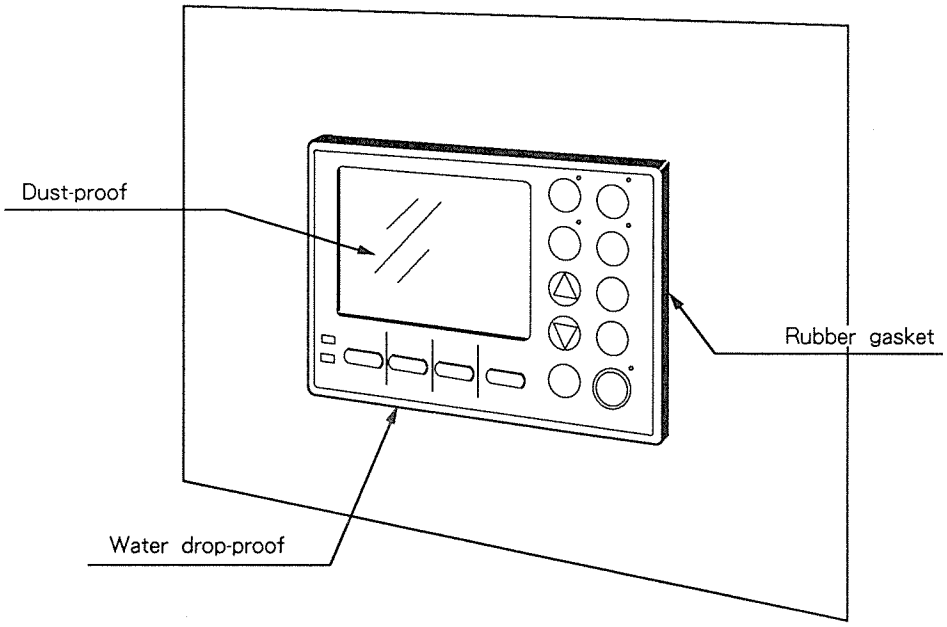
Caution

- If you fail to use insulated tools, they may cause a short-circuit between the battery and the equipment.

7-3 Dust Protection

The I.O.P. has a rubber gasket in the area where it contacts the board. This protects it from dust, mist and humidity.

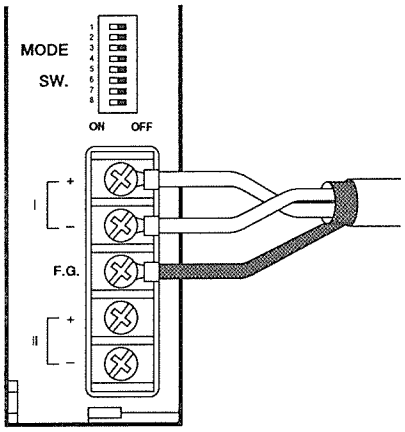
The LCD used is dust-proof, and the rest of the front panel has been water-drop proofed.



7-4 Preventing Noise Interference

If you use the I.O.P. in an electrically noisy environment, ground the shield of the cable between the I.O.P. and a PC as shown below.

If you use the I.O.P. in an electrically noisy environment, noise may occur inside of the communication cable. You must connect the shield of the cable to the frame ground of the FP3/FP5 Master Unit as shown below. The shield must be stranded for the connection.



Install the I.O.P., I/O cable and power cord so that they may be placed far enough away from devices which may cause noise, such as welding machines, other power cables and motors. Do not install the I/O cable next to high voltage (100 V or higher) cable, as this can lead to erratic operation.

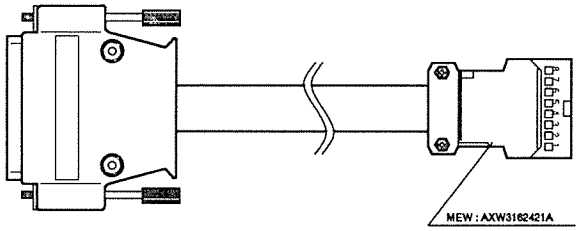
Appendix

Appendix A Transmission Cable

When you want to transfer the data edited with a personal computer to the I.O.P., use a transmission cable. You may use one manufactured by Matushita Electric Works, Ltd.(part number AIP8001), or make a cable yourself by referring to the following.

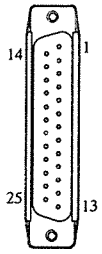
Cable

The connector at the I.O.P. end should be MIL type 16-pin connector(female connector).
The connector to the personal computer end should be a D-sub miniature 25-pin connector(male connector).

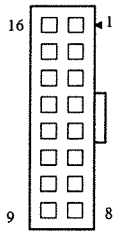


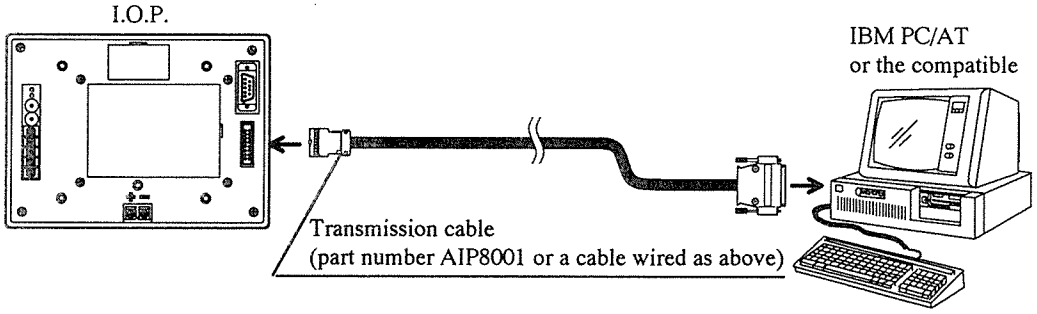
D-sub miniature 25-pin connector MIL type 16-pin connector

Temporary Specification



signal	pin No.		pin No.	signal
STR	1		1	STR
DB0	2		16	DB0
DB1	3		2	DB1
DB2	4		15	DB2
DB3	5		3	DB3
DB4	6		14	DB4
DB5	7		4	DB5
DB6	8		13	DB6
DB7	9		5	DB7
ACK	10		7	GND
PE	12			
ACK	21			
BUSY	11		6	BUSY





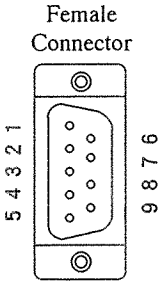
Appendix B ROM Programmer Cable

When you want to transfer the contents of RAM(the screen data previously transferred from a personal computer) to ROM, make a ROM programmer cable using a single-ended connector cable(Part number AIP81841 to AIP81845). The connector with the cable is mated to the I.O.P. RS-232-C port and the other connector which you have to connect by yourself is mated to the ROM programmer.
You can also make the ROM programmer cable referring to the following:

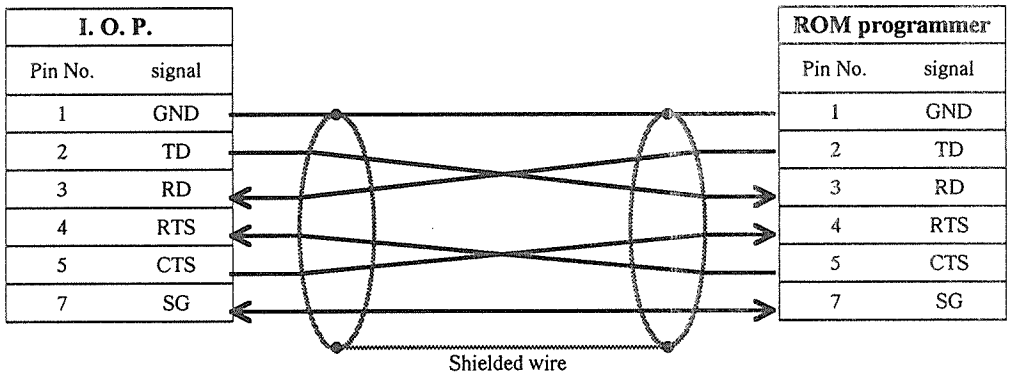
Use the PKW-1100A-E ROM programmer manufactured by AVALDATA CORPORATION.
(transfer the data in Intel HEX format.)

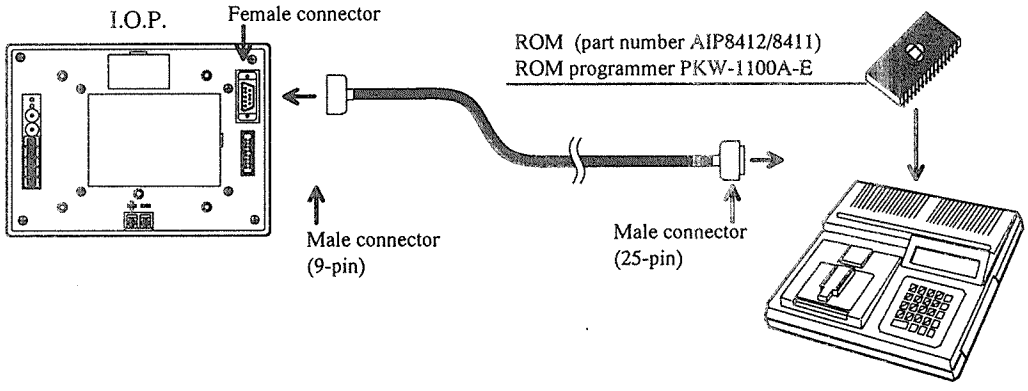
I.O.P. RS-232-C port

Pin No.	CCITT	EIA	Description	Abbrev.	DTC DCE
1	101	AA	Protective Ground (Shield)	GND	–
2	103	BA	Transmitted Data	TD	→
3	104	BB	Received Data	RD	←
4	105	CA	Request to Send	RTS	→
5	106	CB	Clear to Send	CTS	←
6	–	–	(Not used)	–	–
7	102	AB	Signal Ground	SG	
8	–	–	(Not used)	–	–
9	–	–	(Not used)	–	–



Wiring





Appendix. C ASCII Character Code List

		High bits							
		0	1	2	3	4	5	6	7
Low bits	0	Null	DLE	SP	0	@	P		p
	1	SOH	DC1	!	1	A	Q	a	q
	2	STX	DC2	"	2	B	R	b	r
	3	ETX	DC3	#	3	C	S	c	s
	4	EOT	DC4	$	4	D	T	d	t
	5	ENQ	NAK	%	5	E	U	e	u
	6	ACK	SYN	&	6	F	V	f	v
	7	BEL	ETB	'	7	G	W	g	w
	8	BS	CAN	(	8	H	X	h	x
	9	HT	EM	)	9	I	Y	i	y
	A	LF	SUB	*	:	J	Z	j	z
	B	VT	ESC	+	;	K	[	k	{
	C	FF	FS	,	<	L	\	l	¦
	D	CR	GS	−	=	M	]	m	}
	E	SO	RS	.	>	N	^	n	~
	F	SI	VS	/	?	O	SP	o	DEL

ASCII characters which can be displayed on the I.O.P. screen are from "20" to "7A".

Null : space
SP : space
"5F" : space

Appendix D Normal Size Character Code List (JIS Code)

		0 1 2 3	4 5 6 7	8 9 A B	C D E F
Symbol	2120	SP 、 。	, . • :	; ? ! ゛	° ´ ˋ ¨
	2130	^ ￣ _ ヽ	ヾ ゝ ゞ 〃	仝 々 〆 〇	― ‐ - ／
	2140	＼ ～ ‖ ｜	… ‥ ‘ ’	“ ” （ ）	〔 〕 ［ ］
	2150	｛ ｝ 〈 〉	《 》 「 」	『 』 【 】	＋ － ± ×
	2160	÷ ＝ ≠ ＜	＞ ≦ ≧ ∞	∴ ♂ ♀ °	′ ″ ℃ ￥
	2170	$ ¢ £ %	# & *	§ ☆ ★ ○	● ◎ ◇
	2220	◆ □ ■	△ ▲ ▽ ▼	※ 〒 → ←	↑ ↓ ＝
Alphanumeric	2330	0 1 2 3	4 5 6 7	8 9	
	2340	A B C	D E F G	H I J K	L M N O
	2350	P Q R S	T U V W	X Y Z	
	2360	a b c	d e f g	h i j k	l m n o
	2370	p q r s	t u v w	x y z	
Greek	2620	Α Β Γ	Δ Ε Ζ Η	Θ Ι Κ Λ	Μ Ν Ξ Ο
	2630	Π Ρ Σ Τ	Υ Φ Χ Ψ	Ω	
	2640	α β γ	δ ε ζ η	θ ι κ λ	μ ν ξ ο
	2650	π ρ σ τ	υ φ χ ψ	ω	
Russian	2720	А Б В	Г Д Е Ё	Ж З И Й	К Л М Н
	2730	О П Р С	Т У Ф Х	Ц Ч Ш Щ	Ъ Ы Ь Э
	2740	Ю Я			
	2750	а б в	г д е ё	ж з и й	к л м н
	2760	о п р с	т у ф х	ц ч ш щ	ъ ы ь э
	2770	ю я			
		0 1 2 3	4 5 6 7	8 9 A B	C D E F

Example

When you want display A, use code 2341.
When you want display z, use code 237A.

The code 2120 is a SPACE.

Appendix E Normal Size Character Code List (Shift-JIS Code)

		0 1 2 3	4 5 6 7	8 9 A B	C D E F
Symbol	813F	SP 、 。	, . ・ :	; ? ! ゛	° ´ ` ¨
	814F	^ ￣ _ ヽ	ヾ ゝ ゞ 〃	仝 々 〆 〇	― — ‐ ／
	815F	＼ ～ ∥ ｜	… ‥ ‘ ’	“ ” （ ）	〔 〕 ［ ］
	816F	｛ ｝ 〈 〉	《 》 「 」	『 』 【 】	＋ － ± ×
	8180	÷ ＝ ≠ ＜	＞ ≦ ≧ ∞	∴ ♂ ♀ °	′ ″ ℃ ￥
	8190	＄ ¢ £ ％	＃ ＆ ＊	§ ☆ ★ ○	● ◎ ◇
	819E	◆ □ ■	△ ▲ ▽ ▼	※ 〒 → ←	↑ ↓ ＝
Alphanumeric	824F	０ １ ２ ３	４ ５ ６ ７	８ ９	
	825F	Ａ Ｂ Ｃ	Ｄ Ｅ Ｆ Ｇ	Ｈ Ｉ Ｊ Ｋ	Ｌ Ｍ Ｎ Ｏ
	826F	Ｐ Ｑ Ｒ Ｓ	Ｔ Ｕ Ｖ Ｗ	Ｘ Ｙ Ｚ	
	8280	ａ ｂ ｃ	ｄ ｅ ｆ ｇ	ｈ ｉ ｊ ｋ	ｌ ｍ ｎ ｏ
	8290	ｐ ｑ ｒ ｓ	ｔ ｕ ｖ ｗ	ｘ ｙ ｚ	
Greek	839E	Α Β Γ	Δ Ε Ζ Η	Θ Ι Κ Λ	Μ Ν Ξ Ο
	83AE	Π Ρ Σ Τ	Υ Φ Χ Ψ	Ω	
	83BE	α β γ	δ ε ζ η	θ ι κ λ	μ ν ξ ο
	83CE	π ρ σ τ	υ φ χ φ	ω	
Russian	843F	А Б В	Г Д Е Ё	Ж З И Й	К Л М Н
	844F	О П Р С	Т У Ф Х	Ц Ч Ш Щ	Ъ Ы Ь Э
	845F	Ю Я			
	846F	а б в	г д е ё	ж з и й	к л м н
	8480	о п р с	т у ф х	ц ч ш щ	ъ ы ь э
	8490	ю я			
		0 1 2 3	4 5 6 7	8 9 A B	C D E F

Example

When you want display A, use code 8260.
When you want display z, use code 829A.

The code 813F is a SPACE.

Appendix F Half Width Character Code List

	0 1 2 3	4 5 6 7	8 9 A B	C D E F
0020	SP ! " #	$ % & '	( ) * +	, − . /
0030	0 1 2 3	4 5 6 7	8 9 : ;	< = > ?
0040	@ A B C	D E F G	H I J K	L M N O
0050	P Q R S	T U V W	X Y Z [	¥] ^ BK
0060	SP a b c	d e f g	h i j k	l m n o
0070	p q r s	t u v w	x y z {	| } ¯

Example

When you want to display Q, use code 0051.
When you want to display o, use code 006F.

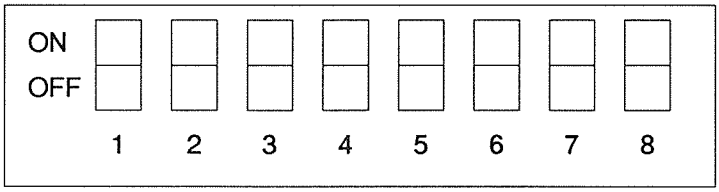
BK: blank

Appendix G I.O.P. Communication Setting Memo

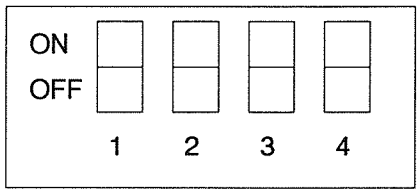
Communication Mode

Communication Mode	☐ I/O Mode	☐ Shared Memory R/W Mode
External Data	☐ HEX data	☐ ASCII data
Character Superimposition	☐ JIS code	☐ Shift-JIS code

DIP Switch Bank 1 Settings



DIP Switch Bank 2 Settings



PC Memory Area for the I.O.P. Model 21

Address		name	Description
word	bit		
WX___	X___0	KD 0	Key Data
	X___1	KD 1	
	X___2	KD 2	
	X___3	KD 3	
	X___4	KD 4	
	X___5	KD 5	
	X___6	KD 6	
	X___7	KD 7	
	X___8	KD STROB	
	X___9	(not used)	
	X___A	SD	Descriptive External Data Completion Flag
	X___B	PAUSE	Flag for PAUSE key.
	X___C	(not used)	
	X___D	RCC	Character Superimposition Complete Flag
	X___E	RCH	Character Highlight Complete Flag
	X___F	BT	Backup Battery Flag. ON when the battery gets low.

Address		name	Description
word	bit		
WY___	Y___0	GD 0	Primary Screen Data
	Y___1	GD 1	
	Y___2	GD 2	
	Y___3	GD 3	
	Y___4	GD 4	
	Y___5	GD 5	
	Y___6	GD 6	
	Y___7	GD 7	
	Y___8	CD	Character Superimposition Flag
	Y___9	HD	Character Highlight Flag
	Y___A	MS	Manual Screen Flag
	Y___B	BZ	BUZZER Flag
	Y___C	STOP LED	LED control
	Y___D	START LED	
	Y___E	MAN. LED	
	Y___F	AUTO LED	

I.O.P. Shared Memory Map

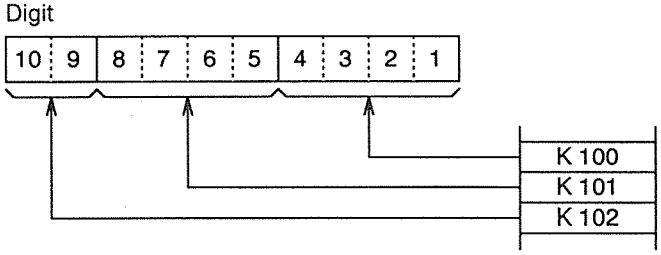
Word Address	Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0	Data
K 0	(not used)	(not used)	Primary Screen number		Primary Screen number
K 1	(not used)	(not used) ML	Manual Screen LINE spec.		Manual Screen
K 2	(not used)	(not used)	(not used)	AUTO LED, MAN. LED, START LED, STOP LED	LED Control
K 3	(not used)	(not used)	Key code		Key code

Displayable External Data Area for HEX data format

Address	Bit contents F E D C B A 9 8 7 6 5 4 3 2 1 0
K 99	Leading Zero Suppression Specification

Address		Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0
K 100	Displayable External Data in Buffer 0	Digit 4	Digit 3	Digit 2	Digit 1
K 101		Digit 8	Digit 7	Digit 6	Digit 5
K 102		(not used)	(not used)	Digit 10	Digit 9
K 103	Displayable External Data in Buffer 1	Digit 4	Digit 3	Digit 2	Digit 1
K 104		Digit 8	Digit 7	Digit 6	Digit 5
K 105		(not used)	(not used)	Digit 10	Digit 9
K 106	Displayable External Data in Buffer 2	Digit 4	Digit 3	Digit 2	Digit 1
K 107		Digit 8	Digit 7	Digit 6	Digit 5
K 108		(not used)	(not used)	Digit 10	Digit 9
K 109	Displayable External Data in Buffer 3	Digit 4	Digit 3	Digit 2	Digit 1
K 110		Digit 8	Digit 7	Digit 6	Digit 5
K 111		(not used)	(not used)	Digit 10	Digit 9
K 112	Displayable External Data in Buffer 4	Digit 4	Digit 3	Digit 2	Digit 1
K 113		Digit 8	Digit 7	Digit 6	Digit 5
K 114		(not used)	(not used)	Digit 10	Digit 9
K 115	Displayable External Data in Buffer 5	Digit 4	Digit 3	Digit 2	Digit 1
K 116		Digit 8	Digit 7	Digit 6	Digit 5
K 117		(not used)	(not used)	Digit 10	Digit 9
K 118	Displayable External Data in Buffer 6	Digit 4	Digit 3	Digit 2	Digit 1
K 119		Digit 8	Digit 7	Digit 6	Digit 5
K 120		(not used)	(not used)	Digit 10	Digit 9
K 121	Displayable External Data in Buffer 7	Digit 4	Digit 3	Digit 2	Digit 1
K 122		Digit 8	Digit 7	Digit 6	Digit 5
K 123		(not used)	(not used)	Digit 10	Digit 9

Address		Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0
K 124		Digit 4	Digit 3	Digit 2	Digit 1
K 125	Displayable External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 126	in Buffer 8	(not used)	(not used)	Digit 10	Digit 9
K 127		Digit 4	Digit 3	Digit 2	Digit 1
K 128	Displayable External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 129	in Buffer 9	(not used)	(not used)	Digit 10	Digit 9
K 130		Digit 4	Digit 3	Digit 2	Digit 1
K 131	Displayable External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 132	in Buffer A	(not used)	(not used)	Digit 10	Digit 9
K 133		Digit 4	Digit 3	Digit 2	Digit 1
K 134	Displayable External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 135	in Buffer B	(not used)	(not used)	Digit 10	Digit 9
K 136		Digit 4	Digit 3	Digit 2	Digit 1
K 137	Displayable External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 138	in Buffer C	(not used)	(not used)	Digit 10	Digit 9
K 139		Digit 4	Digit 3	Digit 2	Digit 1
K 140	Displayable External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 141	in Buffer D	(not used)	(not used)	Digit 10	Digit 9
K 142		Digit 4	Digit 3	Digit 2	Digit 1
K 143	Displayable External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 144	in Buffer E	(not used)	(not used)	Digit 10	Digit 9
K 145		Digit 4	Digit 3	Digit 2	Digit 1
K 146	Displayable External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 147	in Buffer F	(not used)	(not used)	Digit 10	Digit 9



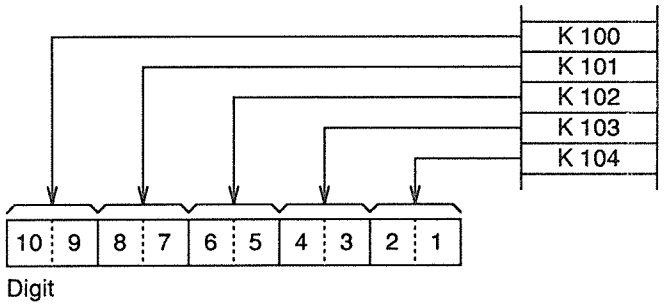
Displayable External Data Area for ASCII data format

Address	Bit contents F E D C B A 9 8 7 6 5 4 3 2 1 0
K 99	Leading Zero Suppression Specification

Address		Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0
K 100		Digit 9	Digit 10
K 101		Digit 7	Digit 8
K 102	Displayable	Digit 5	Digit 6
K 103	External Data	Digit 3	Digit 4
K 104	in Buffer 0	Digit 1	Digit 2
K 105		Digit 9	Digit 10
K 106		Digit 7	Digit 8
K 107	Displayable	Digit 5	Digit 6
K 108	External Data	Digit 3	Digit 4
K 109	in Buffer 1	Digit 1	Digit 2
K 110		Digit 9	Digit 10
K 111		Digit 7	Digit 8
K 112	Displayable	Digit 5	Digit 6
K 113	External Data	Digit 3	Digit 4
K 114	in Buffer 2	Digit 1	Digit 2
K 115		Digit 9	Digit 10
K 116		Digit 7	Digit 8
K 117	Displayable	Digit 5	Digit 6
K 118	External Data	Digit 3	Digit 4
K 119	in Buffer 3	Digit 1	Digit 2
K 120		Digit 9	Digit 10
K 121		Digit 7	Digit 8
K 122	Displayable	Digit 5	Digit 6
K 123	External Data	Digit 3	Digit 4
K 124	in Buffer 4	Digit 1	Digit 2
K 125		Digit 9	Digit 10
K 126		Digit 7	Digit 8
K 127	Displayable	Digit 5	Digit 6
K 128	External Data	Digit 3	Digit 4
K 129	in Buffer 5	Digit 1	Digit 2
K 130		Digit 9	Digit 10
K 131		Digit 7	Digit 8
K 132	Displayable	Digit 5	Digit 6
K 133	External Data	Digit 3	Digit 4
K 134	in Buffer 6	Digit 1	Digit 2

Address		Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0
K 135		Digit 9	Digit 10
K 136		Digit 7	Digit 8
K 137	Displayable	Digit 5	Digit 6
K 138	External Data	Digit 3	Digit 4
K 139	in Buffer 7	Digit 1	Digit 2
K 140		Digit 9	Digit 10
K 141		Digit 7	Digit 8
K 142	Displayable	Digit 5	Digit 6
K 143	External Data	Digit 3	Digit 4
K 144	in Buffer 8	Digit 1	Digit 2
K 145		Digit 9	Digit 10
K 146		Digit 7	Digit 8
K 147	Displayable	Digit 5	Digit 6
K 148	External Data	Digit 3	Digit 4
K 149	in Buffer 9	Digit 1	Digit 2
K 150		Digit 9	Digit 10
K 151		Digit 7	Digit 8
K 152	Displayable	Digit 5	Digit 6
K 153	External Data	Digit 3	Digit 4
K 154	in Buffer A	Digit 1	Digit 2
K 155		Digit 9	Digit 10
K 156		Digit 7	Digit 8
K 157	Displayable	Digit 5	Digit 6
K 158	External Data	Digit 3	Digit 4
K 159	in Buffer B	Digit 1	Digit 2
K 160		Digit 9	Digit 10
K 161		Digit 7	Digit 8
K 162	Displayable	Digit 5	Digit 6
K 163	External Data	Digit 3	Digit 4
K 164	in Buffer C	Digit 1	Digit 2
K 165		Digit 9	Digit 10
K 166		Digit 7	Digit 8
K 167	Displayable	Digit 5	Digit 6
K 168	External Data	Digit 3	Digit 4
K 169	in Buffer D	Digit 1	Digit 2
K 170		Digit 9	Digit 10
K 171		Digit 7	Digit 8
K 172	Displayable	Digit 5	Digit 6
K 173	External Data	Digit 3	Digit 4
K 174	in Buffer E	Digit 1	Digit 2

Address		Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0
K 175		Digit 9	Digit 10
K 176		Digit 7	Digit 8
K 177	Displayable	Digit 5	Digit 6
K 178	External Data	Digit 3	Digit 4
K 179	in Buffer F	Digit 1	Digit 2

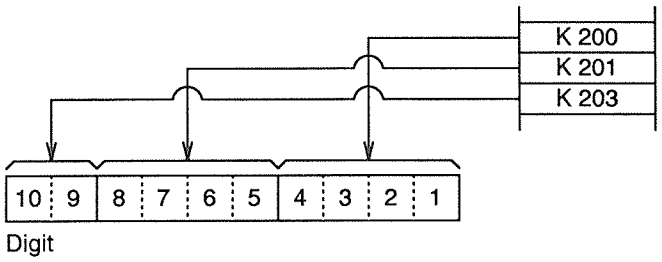


Descriptive External Data Area

Word address	Bit contents															
	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
K 199	Descriptive External Data flag															

Word address		Bit contents			
		F E D C	B A 9 8	7 6 5 4	3 2 1 0
K 200	Descriptive External Data in Buffer 0	Digit 4	Digit 3	Digit 2	Digit 1
K 201		Digit 8	Digit 7	Digit 6	Digit 5
K 202		(not used)	(not used)	Digit 10	Digit 9
K 203	Descriptive External Data in Buffer 1	Digit 4	Digit 3	Digit 2	Digit 1
K 204		Digit 8	Digit 7	Digit 6	Digit 5
K 205		(not used)	(not used)	Digit 10	Digit 9
K 206	Descriptive External Data in Buffer 2	Digit 4	Digit 3	Digit 2	Digit 1
K 207		Digit 8	Digit 7	Digit 6	Digit 5
K 208		(not used)	(not used)	Digit 10	Digit 9
K 209	Descriptive External Data in Buffer 3	Digit 4	Digit 3	Digit 2	Digit 1
K 210		Digit 8	Digit 7	Digit 6	Digit 5
K 211		(not used)	(not used)	Digit 10	Digit 9
K 212	Descriptive External Data in Buffer 4	Digit 4	Digit 3	Digit 2	Digit 1
K 213		Digit 8	Digit 7	Digit 6	Digit 5
K 214		(not used)	(not used)	Digit 10	Digit 9
K 215	Descriptive External Data in Buffer 5	Digit 4	Digit 3	Digit 2	Digit 1
K 216		Digit 8	Digit 7	Digit 6	Digit 5
K 217		(not used)	(not used)	Digit 10	Digit 9
K 218	Descriptive External Data in Buffer 6	Digit 4	Digit 3	Digit 2	Digit 1
K 219		Digit 8	Digit 7	Digit 6	Digit 5
K 220		(not used)	(not used)	Digit 10	Digit 9
K 221	Descriptive External Data in Buffer 7	Digit 4	Digit 3	Digit 2	Digit 1
K 222		Digit 8	Digit 7	Digit 6	Digit 5
K 223		(not used)	(not used)	Digit 10	Digit 9

Address		Bit contents F E D C	B A 9 8	7 6 5 4	3 2 1 0
K 224		Digit 4	Digit 3	Digit 2	Digit 1
K 225	Descriptive External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 226	in Buffer 8	(not used)	not used	Digit 10	Digit 9
K 227		Digit 4	Digit 3	Digit 2	Digit 1
K 228	Descriptive External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 229	in Buffer 9	(not used)	(not used)	Digit 10	Digit 9
K 230		Digit 4	Digit 3	Digit 2	Digit 1
K 231	Descriptive External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 232	in Buffer A	(not used)	(not used)	Digit 10	Digit 9
K 233		Digit 4	Digit 3	Digit 2	Digit 1
K 234	Descriptive External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 235	in Buffer B	(not used)	(not used)	Digit 10	Digit 9
K 236		Digit 4	Digit 3	Digit 2	Digit 1
K 237	Descriptive External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 238	in Buffer C	(not used)	(not used)	Digit 10	Digit 9
K 239		Digit 4	Digit 3	Digit 2	Digit 1
K 240	Descriptive External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 241	in Buffer D	(not used)	(not used)	Digit 10	Digit 9
K 242		Digit 4	Digit 3	Digit 2	Digit 1
K 243	Descriptive External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 244	in Buffer E	(not used)	(not used)	Digit 10	Digit 9
K 245		Digit 4	Digit 3	Digit 2	Digit 1
K 246	Descriptive External Data	Digit 8	Digit 7	Digit 6	Digit 5
K 247	in Buffer F	(not used)	(not used)	Digit 10	Digit 9



Superimpose Character Area

I.O.P. screen	LINE	K 300																			
	Half-width	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I.O.P. Shared Memory (Character Specification)		k301	k302	k303	k304	k305	k306	k307	k308	k309	k310	k311	k312	k313	k314	k315	k316	k317	k318	k319	k320

I.O.P. screen	LINE	K 300									
	Normal size	1	2	3	4	5	6	7	8	9	10
I.O.P. Shared Memory (Character Specification)		k301	k303	k305	k307	k309	k311	k313	k315	k317	k319

Highlighted Character Area

	Normal size	1		2		3		4		5		6		7		8		9		10	
	Half-width	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I.O.P. screen	line 1					K 351										K 350					
	2					K 353										K 352					
	3					K 355										K 354					
	4					K 357										K 356					
	5					K 359										K 358					
	6					K 361										K 360					
	7					K 363										K 362					
	8					K 365										K 364					
Bit position		9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0

Appendix H Index

I

J

K

L

M

N

O

P

R

S

T

U

W

These materials are printed on ECF pulp.
These materials are printed with earth-friendly vegetable-based (soybean oil) ink.

Please contact .....

Matsushita Electric Works, Ltd.

Automation Controls Company

■ Head Office: 1048, Kadoma, Kadoma-shi, Osaka 571-8686, Japan
■ Telephone: +81-6-6908-1050
■ Facsimile: +81-6-6908-5781

ACG-M0041-1 MAY. 92 1ZHo

Printed in Japan.