Panasonic®

OPERATOR INTERFACE

I.O.P. (Intelligent Operating Panel) M22 Technical Manual (Preliminary)

I.O.P. (Intelligent Operating Panel) M22 Technical Manual
ACG-M0042-3 '93.11

Matsushita Electric Works, Ltd.

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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 Screen Utility. 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 operatior on the screen, so that the operator can control the system just by following the instructions.

The I.O.P. Model 22 can communicate with Matsushita's programmable controllers, the FP1, the FP3 and the FP5. Because no handshaking is required for the data communication, you can easily create programs. In addition, the connection between the I.O.P. and the programmable controller can be done with just one cable. No complicated wiring is needed.

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 FP1 Technical Manual, when necessary.
Refer to the C.C.U. Technical Manual, when necessary.
Refer to the NPST-GR Manual, when necessary.
Refer to the FP3/FP5 Programming Manual, when necessary.

To operate the I.O.P. Model 22, you must first create the screens and store them in the I.O.P. Please reference the I.O.P. 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.

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What's in each Chapter

Outline

Chapter 1 describes the I.O.P. Model 22's general specifications, functional specifications, external dimensions, part names and data communications specifications.

Chapter 2 explains how to use the I.O.P Model 22. You will learn how to operate the I.O.P..

Chapter 3 explains how you can set the DIP switches for your operation. You will also find instructions on how to allocate memory areas in a PC for communication between the I.O.P. and the PC.
You must set the the DIP switches and allocate memory before you can create programs for data communication.

Chapter 4 will give you ideas for creating programs for data communication. All data communication between the I.O.P. and the PC will be done automatically, except data used for highlighting and superimposing characters. So, no handshaking will be required.
You can choose either the Contact Communication Mode or the Data Communication Mode depending on how you create programs for the I.O.P. Model 22.
The programming is introduced according to the I.O.P. function that is being described.

Chapter 5 will give you advanced idea for creating programs for data communication.

Chapter 6 explains how to connect the communication cables.
You will learn how to connect the I.O.P. Model 22 to an FP1, FP3 or FP5.

Chapter 7 explains how to maintain the I.O.P. Model 22.
Precautions for safe handling the I.O.P. Model 22 will be explained.

Appendix
Refer to the appendices as necessary.

Notation used in this manual

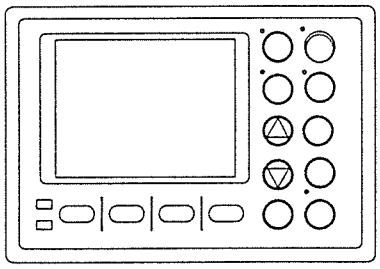
Notes	Indicates limits to be observed.
Caution	Indicates a precaution to be followed.

Abbreviations used in this manual

PC	: programmable controller
I.O.P.	: Intelligent Operating Panel Model 22
Manual Screen	: Manual Key Access Screen
C.C.U.	: Computer Communication Unit
DPU	: Data Processing Unit
JIS	: Japanese Industrial Standards

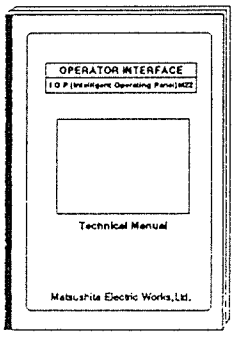
Packing List

I.O.P. Model 22

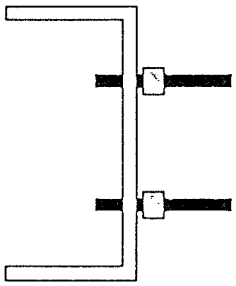


Backup Battery

This manual



Mounting Metal: When you purchased Flange type I.O.P. (AIP223002)

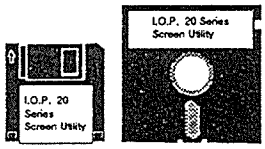


Getting Ready to Use the I.O.P.

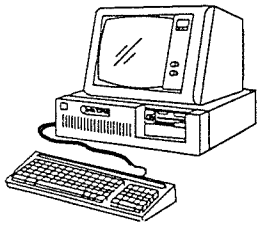
You will need:

For Screen editing

I.O.P. 20 Series Screen Utility



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

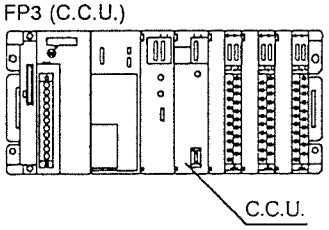


Transmission cable (Model AIP8001 or the "Transmission cable" spedified on page 194.)

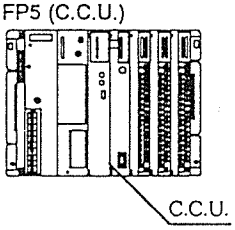
For communicating with a programmable controller

A programmable controller

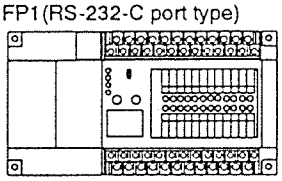
FP3 (C.C.U.)



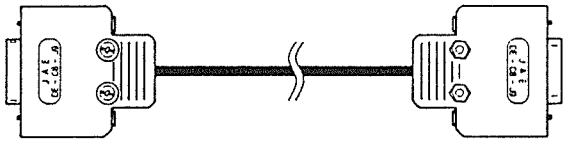
FP5 (C.C.U.)



FP1(RS-232-C port type)

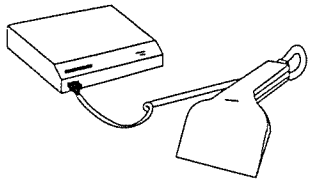


RS-232-C serial cable



System Configurations

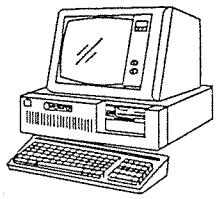
External Device

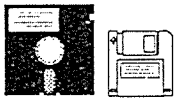


Bar Code Reader etc.

Editing Screens

IBM PC/AT or the compatible



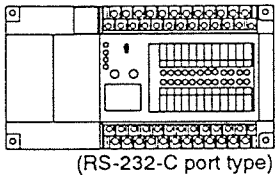


Application software
"I.O.P. 20 Series
Screen Utility"

Transmission Cable
(Appendix A)

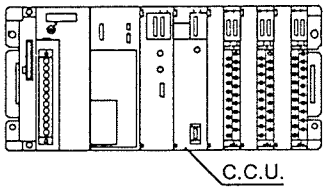
Connecting to an
FP1, FP3 or FP5

FP1



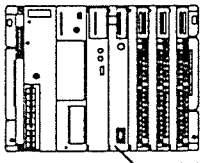
(RS-232-C port type)

FP3



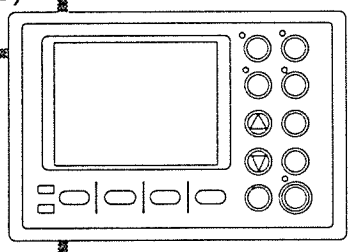
C.C.U.

FP5



C.C.U.

Serial (RS-232-C)
Cable

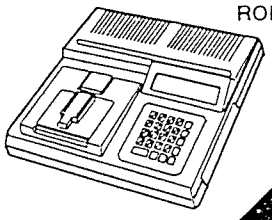


I.O.P. Model 22

RS-232-C Cable
(Appendix B)

Transfering to ROM

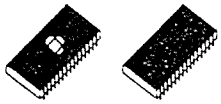
ROM programmer



ROM

I.O.P. parts

Backup battery



ROM RAM

Parts Name	Specifications				Model Number
I.O.P. Model 22	Flange type				AIP223002
	Case type				AIP223102
C.C.U.	For FP3				AFP3462
	For FP5				AFP5462
FP1 RS-232-C port type	24 points type Input : 16 points Output : 8 points	DC	Relay		AFP12212C
			Transistor		AFP12242C
		AC	Relay		AFP12216C
			Transistor		AFP12246C
	40 points type Input : 24 points Output : 16 points	DC	Relay		AFP12412C
			Transistor		AFP12442C
		AC	Relay		AFP12416C
			Transistor		AFP12246C
Double-ended connector cable for serial communications	Connection with the Computer Communication Unit of an FP3 or FP5. Connection with an FP1			2m	AIP81862N
				50cm	AFP15305
Single-ended connector cable for serial communications	9 wires with 9-pin connector * You can 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 communications	9-pin connector for RS-232-C (I.O.P. side)				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 Screen Utility"	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 Installed 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. 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 Screen Utility MANUAL.
2. Create screens with a personal computer.
   Read the I.O.P. 20 Series Screen Utility MANUAL.
3. Transfer created screens and key codes to the I.O.P.. (Transfer operation)
   Read the I.O.P. 20 Series Screen Utility MANUAL.
4. Set the DIP switches for your operation mode.
   Refer to 3-2 "I.O.P. DIP Switches Settings".
5. Set the data communication format for a PC.
   Refer to 3-3 "Setting the Communication Data Format".
6. Allocate memory areas in a PC.
   Refer to 3-4 "Allocating Data Areas in the PC Memory".
7. Create programs.
   Refer to Chapter 4 and 5.
8. Connect an RS-232-C cable for data communication.
   Refer to Chapter 6.
9. 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".

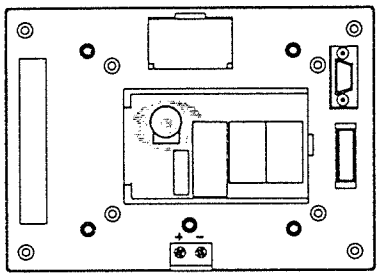
   Acceptable / Not Acceptable (Not Acceptable returns to step 1)

10. Burn the data into a ROM with a ROM programmer, if necessary.
    Read the I.O.P. 20 Series Screen Utility MANUAL.
    Refer to 2-9 "Replacing User Memory".
11. Operate the I.O.P. in Run Mode.
    Refer to 2-8 "Choosing Run Mode and Monitor Mode".
12. Maintenance
    Refer to Chapter 7.

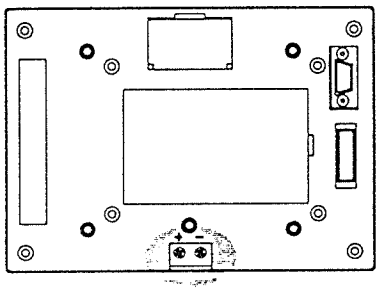
Preparing the I.O.P. Model 22 for Operation

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

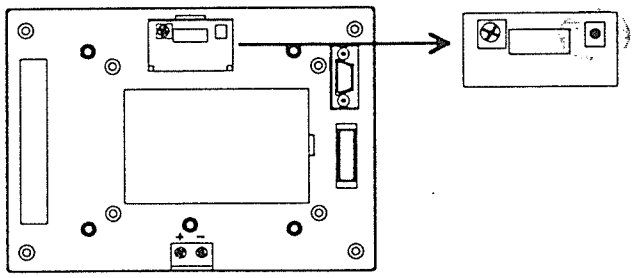
1. Install the backup battery in the I.O.P..
   You can refer to "Replacing the Backup Battery" on page 188 for installation.



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 22's general specifications, functional specifications, external dimensions, part names, and data communications specifications.

Programmable Controller is abbreviated PC.

1-1 Specifications

General Specifications

Items	Specifications
Rated voltage	24V DC +/- 10 %
Power consumption	12W max.
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
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

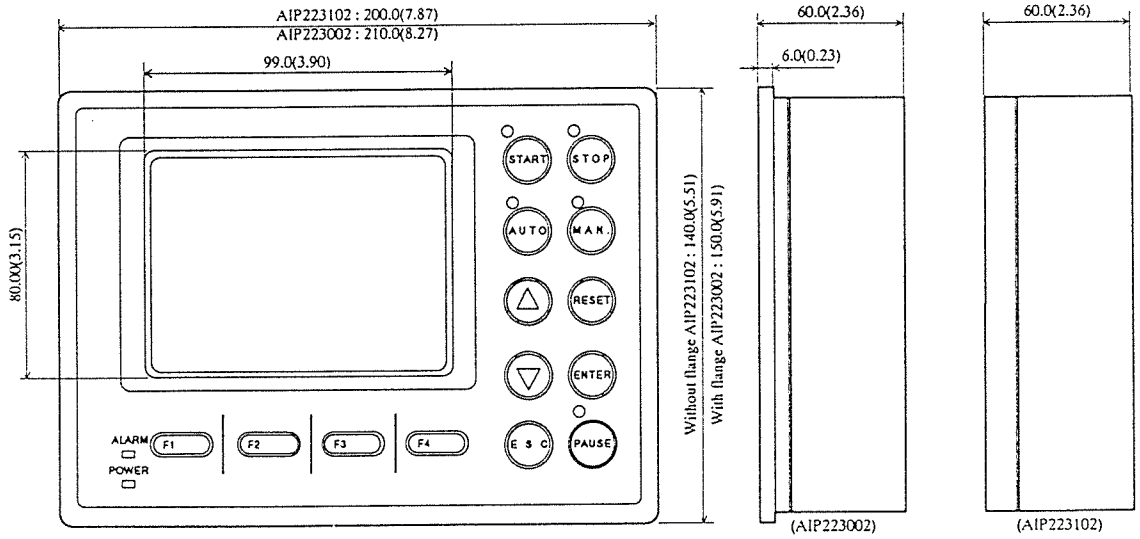
- Back light may darken if the temperature drops below 10 ℃ (50 ℉).

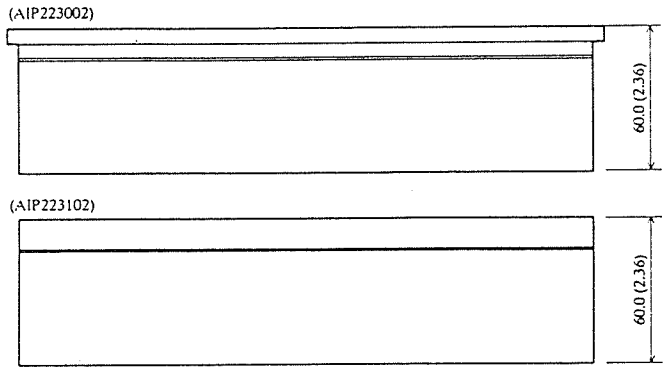
Functional Specifications

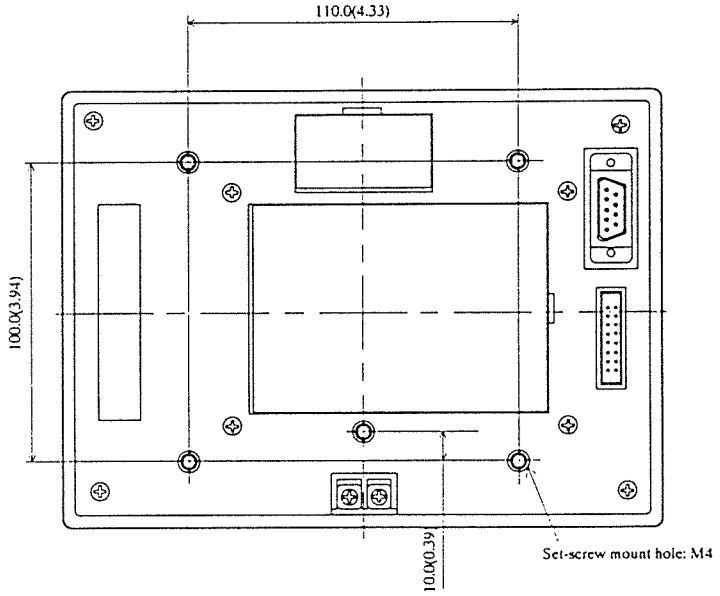
Items	Specifications
Number of screens	Manual Key Access Screen: 1 Primary & Secondary Screens: Total 63 maximum. (Total 255 maximum when User Memory is extended to 1024Kb)
Screen storage method	Personal Computer Software
Characters	All Alphanumeric & ASCII codes except " | " " ~ ".
Character size(H 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 in 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 power is supplied.) ALARM LED: Red (lit when the I.O.P. is hung.) START LED: Green STOP LED: Red AUTO LED: Green MAN. LED: Green PAUSE LED: Red

1-2 External Dimensions

unit : mm(in.)





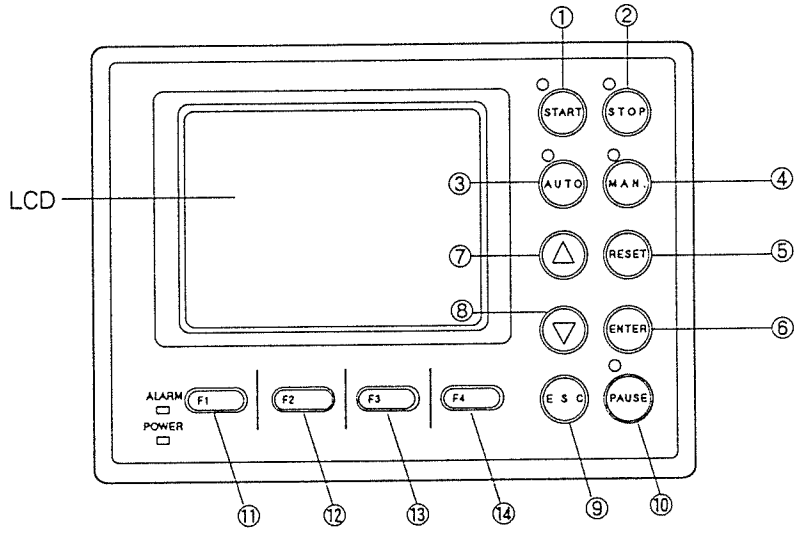


Notes :
AIP223002 has a flange for mounting the I.O.P. on a board.
AIP223102 does not have a flange.

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

1-3 I.O.P. Part Names

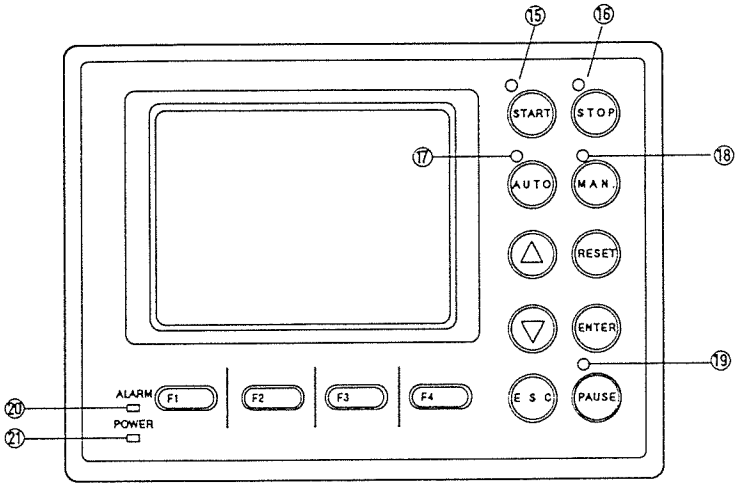
Front Panel



Keys

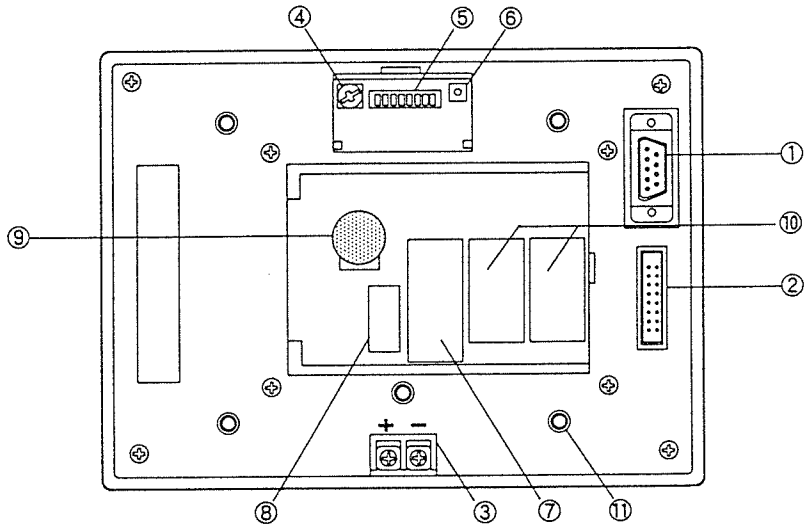
①	START	Fixed Key Outputs key code 03H(initial setting). Momentary Operation.
②	STOP	Fixed Key Outputs key code 04H(initial setting). Momentary Operation.
③	AUTO	Fixed Key Outputs key code 01H(initial setting). Momentary Operation.
④	MAN.	Fixed Key Outputs key code 02H(initial setting). Momentary Operation.
⑤	RESET	Fixed Key Outputs Key Code 05H(initial setting). Momentary Operation. Resets PAUSE exclusive output.
⑥	ENTER	Used to allocate memory area in a PC for communications, and to enter External Data.
⑦ ⑧	▲ ▼	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.
⑨	ESC	Escape key. You can change screens (from Secondary Screen to Primary Screen, from Manual Key Access Screen to Primary Screen).
⑩	PAUSE	Pause key. The I.O.P. sends an exclusive signal to the PC. Latched operation (cancelled with the RESET key)
⑪ ⑫ ⑬ ⑭	F1 F2 F3 F4	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.

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.
⑳	ALARM	Red	Lit when the I.O.P. is hung. 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



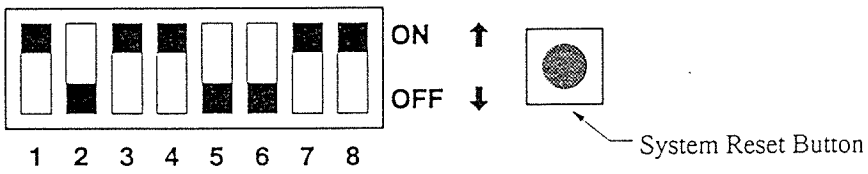
①	RS-232-C connector	RS-232-C port for communication with the C.C.U. of an FP3, FP5, or FP1. Connects to a commercial ROM programmer. You can transfer the data in User Memory to the ROM programmer.
②	Transmission connector	Connects to a personal computer to transfer edited data to the I.O.P.. Use a Transmission 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 switches	Switches for changing modes. Refer to DIP switches table on the next page.
⑥	System Reset Button	Pressed after the mode is changed with the DIP switches.
⑦	RAM/ROM mounting connector	Install User Memory (RAM/ROM) in it. 256Kb RAM installed when shipped.
⑧	RAM/ROM switching Jumper	The connector assigmnents will vary depending on the User Memory you use.
⑨	Backup battery	Battery for I.O.P. User Memory backup.
⑩	System ROM	The I.O.P. System ROM. Do not remove the System ROM.
⑪	Set-screw	Set-screw M4.

Caution

■ Do NOT remove the System ROM.

DIP switches

Layout of the DIP switches



DIP – Switch Setting								Setting
1	2	3	4	5	6	7	8	
OFF	OFF	*	*	*	*	*	*	Data Register Mode/Transfer Mode
ON	ON	*	*	*	*	*	*	Monitor Mode
OFF	ON	*	*	*	*	*	*	PC memory area allocation
ON	OFF	*	*	*	*	*	*	Run Mode
*	*	OFF	*	*	*	*	*	Data Communication Mode
*	*	ON	*	*	*	*	*	Contact Communication Mode
*	*	*	*	OFF	*	*	*	HEX Code (Displayable External Data)
*	*	*	*	ON	*	*	*	ASCII Code (Displayable External Data)
*	*	*	*	*	OFF	OFF	*	Back light ON all the time.
*	*	*	*	*	OFF	ON	*	Back light AUTO OFF in 5 minutes. AUTO ON with a screen change or the ESC key.
*	*	*	*	*	ON	OFF	*	Back light AUTO OFF in 5 minutes. ON with the ESC key.
*	*	*	*	*	ON	ON	*	Back light AUTO OFF in 15 minutes. ON with the ESC key.
*	*	*	*	*	*	*	OFF	When the I.O.P. is turned off, saves the current data entered on the I.O.P..
*	*	*	*	*	*	*	ON	When the I.O.P. is turned off, does not save the current data entered on the I.O.P..

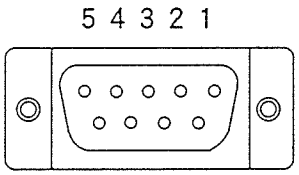
* You can set the DIP switch either ON or OFF.
Choose the one appropriate for your operation.

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.

1-4 Serial (RS-232-C) Interface Specifications

I.O.P. Serial Interface Connector

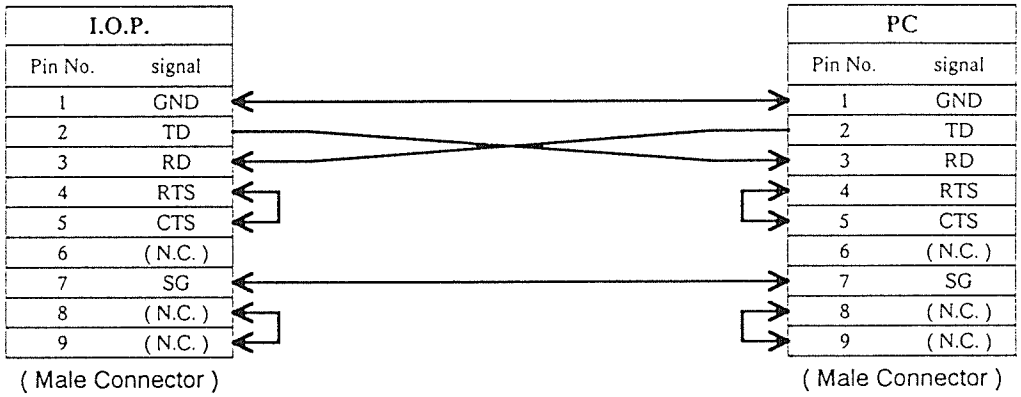


(Female connector installed on the I.O.P.)

Pin Assignments

Pin No.	CCITT	EIA	Description	Abbrev.
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)	–

Example of Cable Wiring (Cable : AIP81862N)



(Male Connector) (Male Connector)

* The above wiring is intended for connecting the I.O.P. to an FP series PC manufactured by Matsushita Electric Works Ltd.
* N.C. : Not Connected

I.O.P. Serial Interface Specifications

Communication standard	EIA RS-232-C	
Mode	Start-stop synchronous system	
	Data	8 bits
	Parity check	Yes
	Parity setting	Odd
	Stop bit	1 bit
	Terminator	CR
Baud rate	9600 baud	
Transmission Style	Half duplex	
Protocol	MEWTOCOL-COM	
Serial port	D subminiature 9-pin connector (female connector)	

Chapter 2

I.O.P. Operation

This chapter explains the features and uses of the I.O.P. Model 22. 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 signals 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 data to control the appearance of the screen with messages or explanations for the operator. The operator can also monitor numeric 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 42 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.

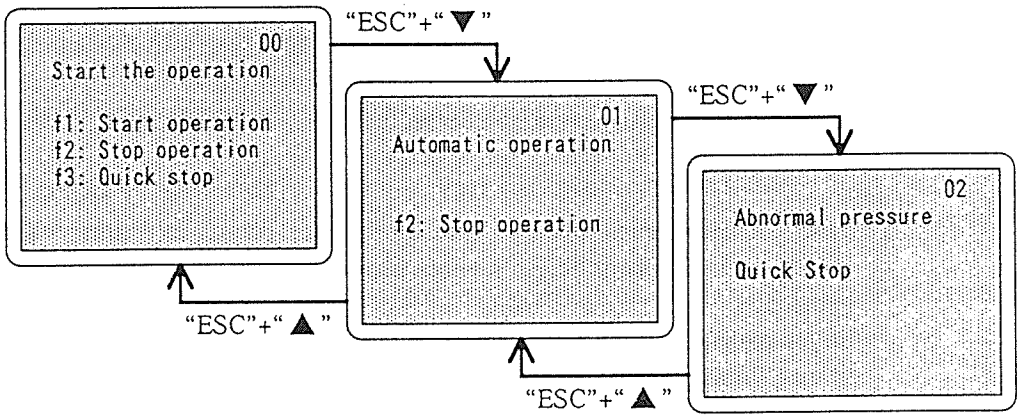
the ESC key and the up arrow key (▲) to display the previous page.

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, the I.O.P. will immediately return to the Primary Screen that was displayed before the manual operation. The I.O.P. can then receive data from the PC.

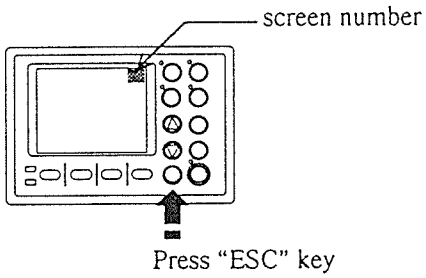
Caution

- 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 on the upper right of the screen. Screen numbers are determined when the screens are created. They start with screen number 00.



Creating Primary Screens

You can create Primary Screens by running the I.O.P. 20 Series Screen Utility. 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

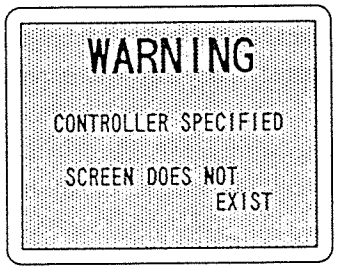
The programming method to display a Primary Screen differs, depending on the Communication Mode you choose.
Refer to the chapter 3 and 4 for details.

Contact Communication Mode : The I.O.P. will display a Primary Screen when the corresponding internal relay in the PC memory is turned ON.
If you assign a starting word number on the I.O.P., it will allocate an internal relay for each Primary Screen.

Data Communication Mode : The I.O.P. will display a Primary Screen when the corresponding Primary Screen number is stored in the data registers of a PC you allocate previously.
If you assign a starting word number on the I.O.P., it will automatically allocate the area for storing Primary Screen numbers.

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

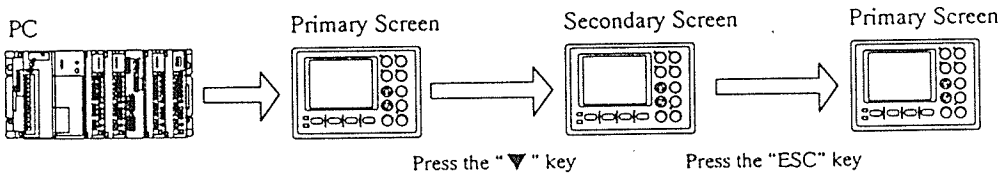
- 256Kb of RAM is installed in the I.O.P. when it is shipped.
  Refer to "Replacing User Memory" on page 42 if you want to add more memory or change to a ROM.

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.

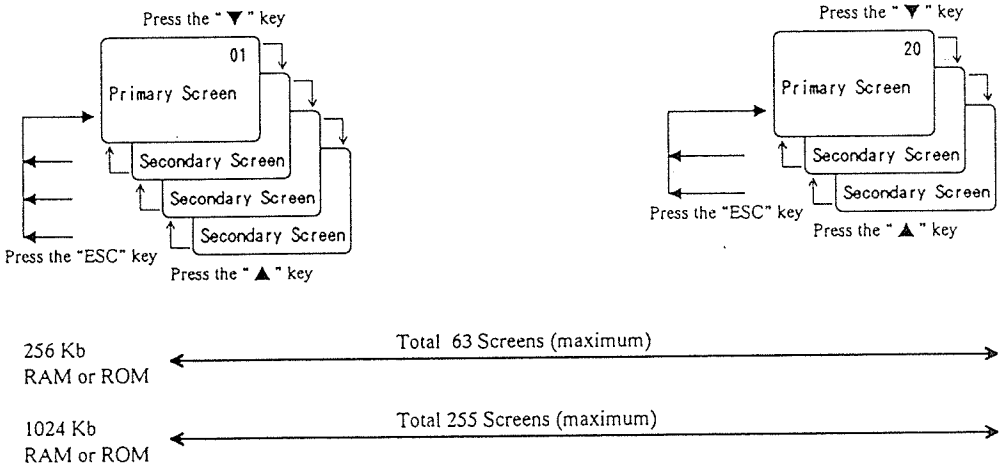
Displaying Secondary Screens



Creating Secondary Screens

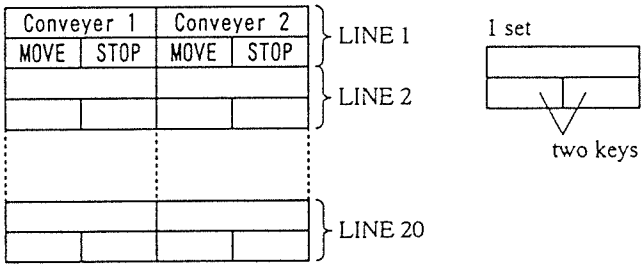
You can create or edit Secondary Screens by running the I.O.P. 20 Series Screen Utility. You can create and edit Secondary Screens in almost the same way as you edit Primary Screens. If you add a Secondary Screen number, the I.O.P. Message Screen can be used for editing the Secondary Screen.
Refer to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

Relationship between Primary Screens and Secondary Screens



Manual Key Access Screen

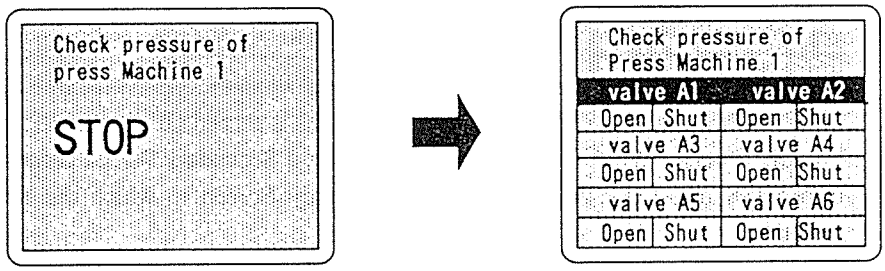
The I.O.P. has one Manual Key Access Screen (Manual Screen) for operating Manual Keys. You can assign a maximum of 80 Manual Keys (40 sets) on this screen.



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 25 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 Screen Utility. 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

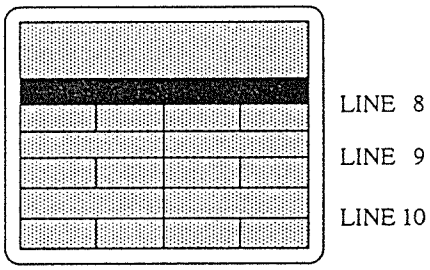
Refer to the chapter 3 and 4 for details.

The Manual Key Access Screen will be displayed when the MS bit is turned ON. MS bit is a bit in the data register of the PC. When the MS bit 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 bit 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 you specify "1"(ON) for bit 8 (ML bit) in the Manual Screen Display Area which is allocated in the data register of the PC. Bits 0 through 7 of the Manual Screen Display Area should contain a number which specifies the LINE for the cursor.

Example

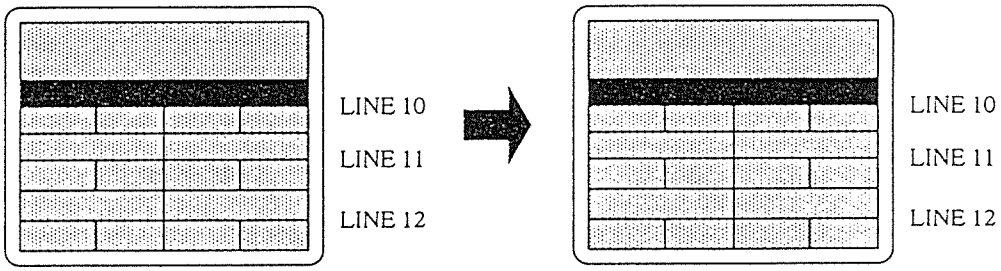
■ Specifying LINE 8 of the Manual Screen



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

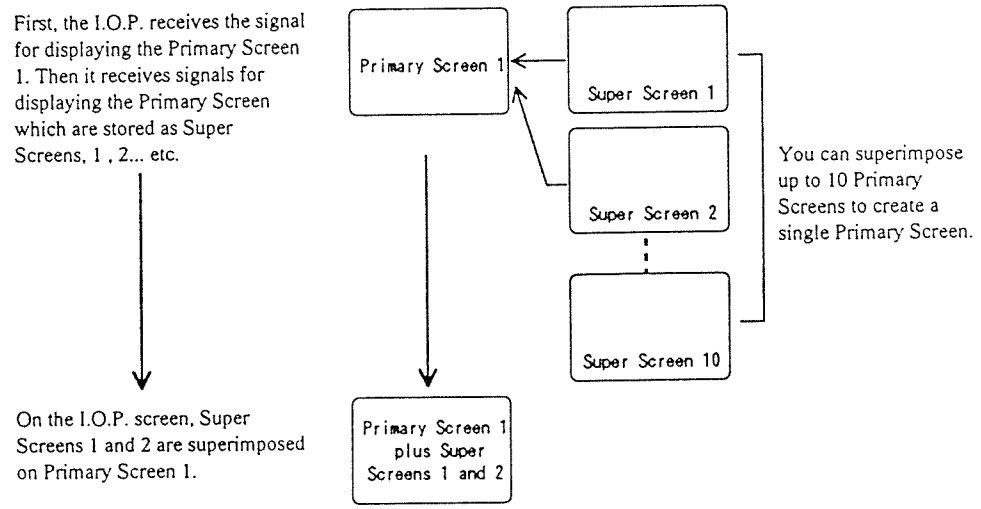
The I.O.P. can display a Primary Screen consisting of several Primary Screens superimposed on a Primary Screen. You can superimpose a maximum of 10 different Primary Screens. Superimposed screens are controlled by the PC.
A Screen can be superimposed repeatedly.

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

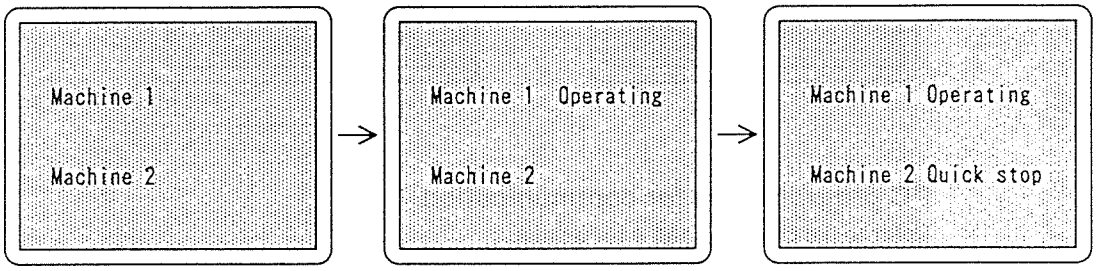
The programming method for superimposing a Primary Screen differs, depending on the Communication Mode you choose.
Refer to the chapter 3 and 4 for details.

Contact Communication Mode : The I.O.P. will superimpose a Primary Screen when the corresponding internal relay in the PC memory is 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 a corresponding Primary Screen number is stored in the previously allocated data registers of the PC 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.

Superimposing Characters

The I.O.P. can superimpose arbitrary 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 in Appendices D and E. When you want to superimpose half width characters, you can specify the character 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 the chapter 3 and 4 for details.

Store the character code you want to superimpose in the data registers you previously allocated for this. The I.O.P. will superimpose the character using two flags, CD and RCC:

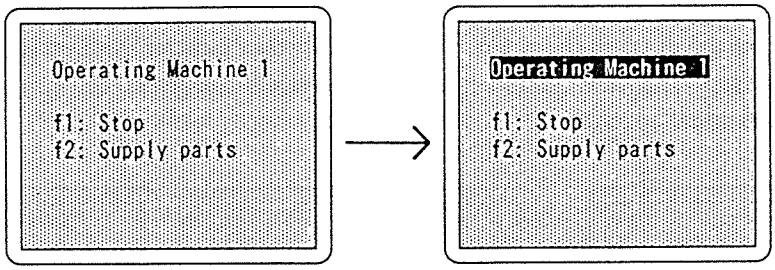
CD : ON when a character code has been stored in the data register.
RCC: ON when the superimposition has been completed.

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 at that 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 the chapter 3 and 4 for details.

Specify the position in the previously assigned where the character you want is located. The I.O.P. will highlight characters using two flags, HD and RCH:

HD : ON when the position data has been stored in the data register.
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.

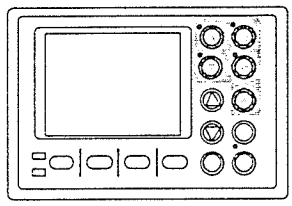
2-2 Operating Keys

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, if 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

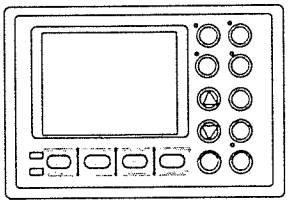
When the I.O.P. Message Screen is displayed on the screen of a personal computer, press the F10 key.

PC programming for communication

Refer to "PC Programming for Receiving Key Codes" on page 28.

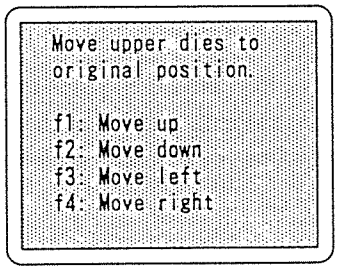
Function Keys

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 28.

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. ⓓ)

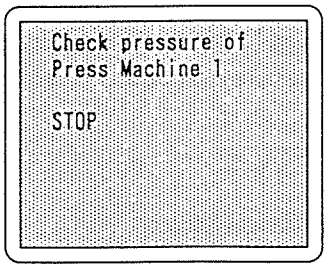
Assigning Key Codes to Manual Keys

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

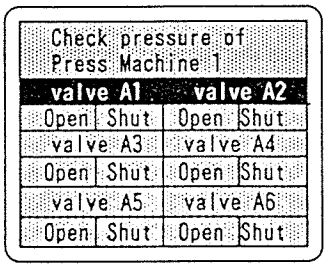
Refer to "PC Programming for Receiving Key Codes" on page 28.

Fig. ⓐ



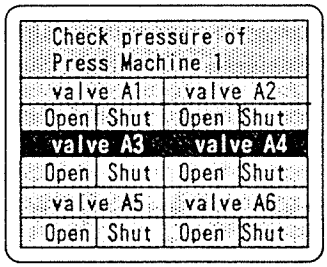
The Manual Access Screen will be displayed.

Fig. ⓑ



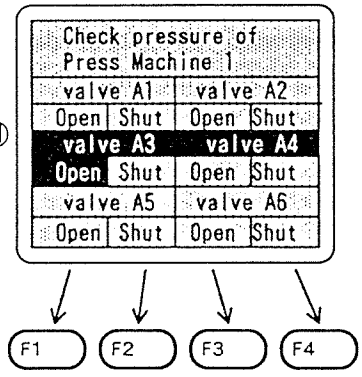
Press the down arrow key (▼).

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

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.
- The status of the PAUSE key is stored separetely in the "PAUSE" bit of the PC.

PC Programming for Receiving Key Codes

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

Contact Communication Mode : An internal relay in the PC memory is assigned to each Key Code. If a key is pressed on the I.O.P., the internal relay corresponding to the Key Code will be turned ON. During the key press, the ON state is maintained.

Data Communication Mode : If a key is pressed on the I.O.P., the corresponding Key Code will be stored in the previously assigned data registers of the PC. While the key is pressed, the KD-STROB will be ON. This line controls an internal bit in the PC allowing the PC to read the Key Data.

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 the 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 the chapter 3 and 4 for details.

The status of the PAUSE key is stored in one bit of the data registers.
Refer to "PC Programming for PAUSE status" for details.

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 allocate a memory area in the PC for communications. It is used to enter External Data.

ESC key

Use the ESC key to check the Primary Screen number, to page through the Primary Screens manually. It is used to display the Secondary Screens, to hide the Manual Screen temporary. Also use the ESC key 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.
It is also used to move the cursor on the Manual Screen.

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 as either HEX code or ASCII code. If you use HEX code, you can display the numeric 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 "7E". For the ASCII code character table, refer the 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 as normal size) 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 the chapter 3 and 4 for details.

If Displayable External Data is stored in the data register allocated for that data, the I.O.P. will display the data on the screen. As the data length is fixed at 10 characters, if you want, you can specify suppression of leading zeroes in the data register.

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 (Descriptive External Data), can be entered from the I.O.P..

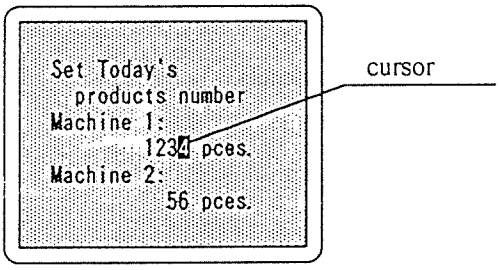
The I.O.P. has 16 Descriptive External Data Buffers to store the External Data entered.
A buffer number is assigned to each piece External Data as a hexadecimal number (0 to F) when you create or edit an I.O.P. Message Screen with a personal computer.

Entering External Data from the I.O.P.

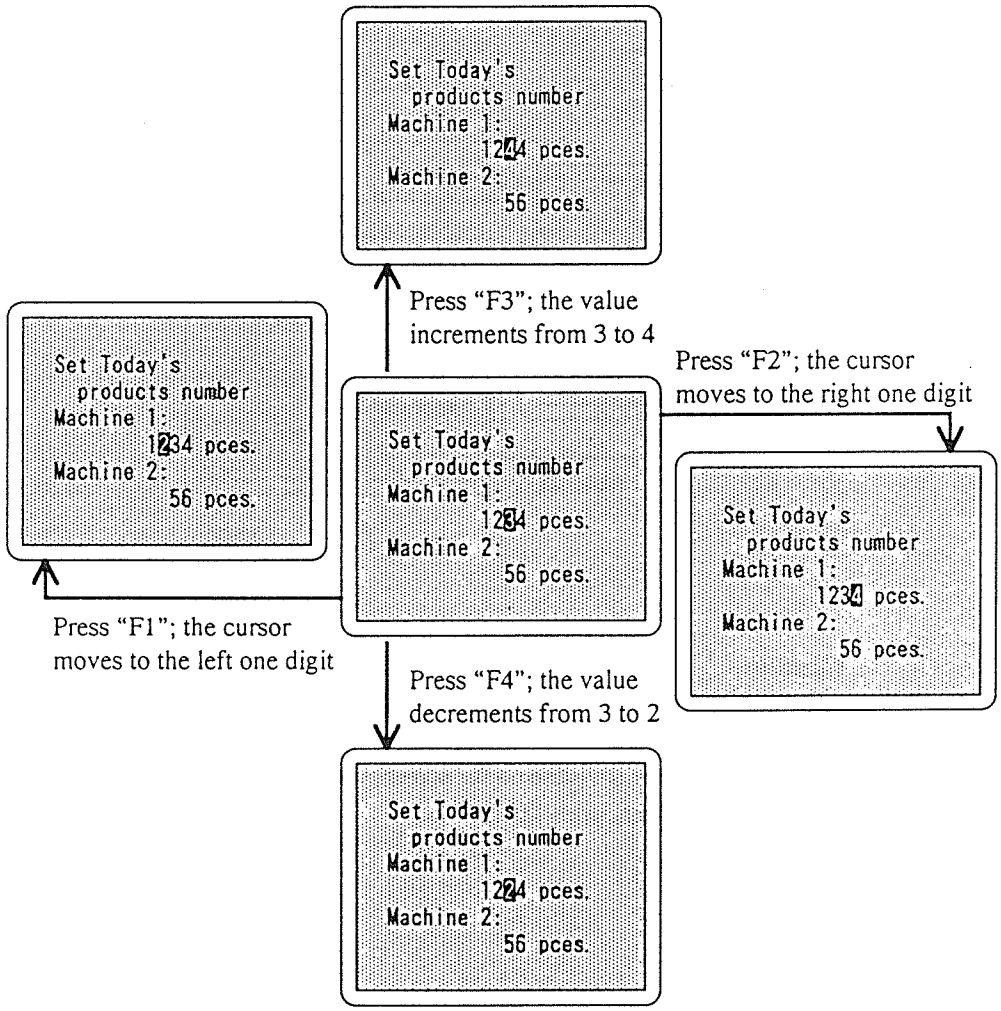
Procedure

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.

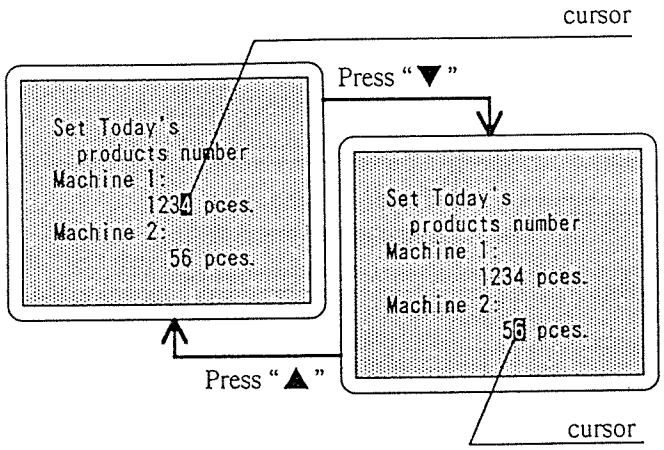


3. After you are through setting the values, press the ENTER key.
   When you press the ENTER key, the I.O.P. stores the value in the corresponding Descriptive External Data Buffer. You must press the ENTER for each by line to send the data from a given line to the buffer.

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 screen, 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 quit the screen, press the ESC key.

Creating a screen for entering External Data

You can create or edit a screen by running the I.O.P. 20 Series Screen Utility.
On the I.O.P. Message Screen, the area where you type a $(normal size) is then assigned as an External Data entry area.
See the I.O.P. 20 series Software MANUAL for details.

PC programming for communication

Refer to the chapter 3 and 4 for details.

The External Data entered on the I.O.P. is automatically stored to the data buffer for the data. At the same time, the Buffer number where the data entered is also stored in the data register allocated for the buffer.

When the ENTER key is pressed after completing data entry, the Descriptive External Data Flag will be turned ON and immediately turned OFF. So, with the flag, read the data on the PC side.

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

Refer to the chapter 3 and 4 for details.

4 bits of data register (LED1 to LED4) are allocated for ON/OFF of 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 the chapter 3 and 4 for details.

PAUSE output is alternated. While the LED is ON, the data register PAUSE keeps 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 the chapter 3 and 4 for details.

BZ, which is the flag to sound a buzzer, is allocated in the data register of a PC.
If BZ is turned ON, the I.O.P. will sound a buzzer. If OFF, stop sounding a buzzer.

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 screen change on the I.O.P. screen.

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 the ESC key and 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, immediately 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

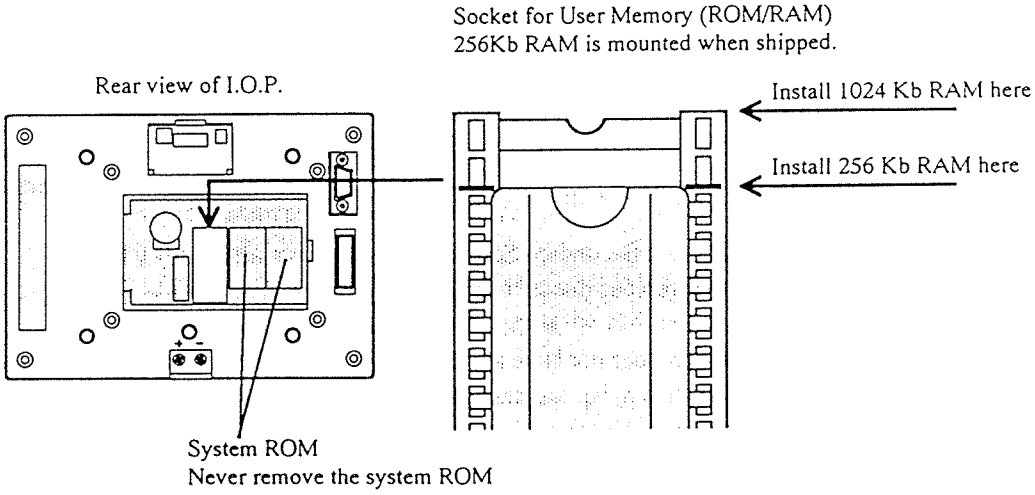
The installation position of the 1024Kb User Memory chip is different from that of the 256Kb chip. See the following drawing for details.

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

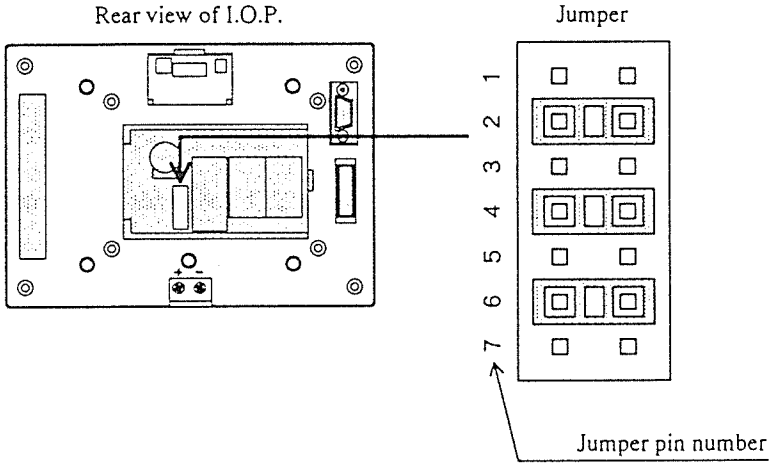
- Be very careful to note the installation for the chip.
  The number of pins will depend on the memory capacity of the chip.

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 "Replacing the Backup Battery" on page 188.



	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 the DIP switches for your operation. You will find instructions on how to allocate memory areas in a PC for communication between the I.O.P. and the PC.
You must set the DIP switches and allocate memory before you can create programs for data communication.

Programmable Controller is abbreviated PC.

3-1 PC Memory Allocations for the I.O.P. Model 22

For communication between the I.O.P. and the programmable controller(PC), you must set the DIP switches on the rear panel of the I.O.P., select a communication format and allocate the data area for communications in the memory of the PC.

Cautions

- If you connect the I.O.P. to a PC that is in use, be sure to check which data registers and internal relays in the PC's memory have been already assigned. Avoid using the same data registers and internal relays in the PC's memory for I.O.P. operations.
- The data registers and internal relays in the PC's memory which are used by the I.O.P. cannot shared with other devices. Make sure the ones assigned to the I.O.P. are exclusively for its use. You can use Appendix G to make notes of the assignments.
- You must allocate the PC's memory area based on the I.O.P. message screens which you creates with the I.O.P. 20 series Software;
  how many pieces of External Data you display and enter on the I.O.P.?
  how many key codes you use? etc.
  So, review these assignments, when necessary.

PC Memory Allocations for the I.O.P. Model 22

Area Name	Processing	Memory Requirements
Basic Area	LED control Buzzer control Manual Screen display control Highlighting characters. Superimposing characters. Specifies LINE No. on the Manual Screen. Specifies Primary Screen number. (in the Data Communication Mode).	DT: Data register The amount of memory used depends on the amount of the Displayable External Data desired. 3 (3) words: None 16 (24) words: 4 Data 28 (44) words: 8 Data 52 (84) words: 16 Data Numbers in parentheses are for ASCII characters.
External Data Display Area (Monitoring)	Stores Displayable External Data. Specifies leading zero suppression.	
	The Displayable External Data Area is allocated automatically starting from the first data register after the Basic Area.	
Control Data 2 & Key Code Area	Monitors the status of the PAUSE key. Monitors the backup battery condition. Monitors the end of character highlighting. Monitors the end of character superimposition. Stores Key Data (in the Data Communication Mode).	DT: Data register 1 word

Area Name	Processing	Memory Requirements
External Data Entry Area	Stores Descriptive External Data. Descriptive External Data Flag control.	DT: Data register 49 words are automatically assigned, starting from the first data register after the Key Code Area. If you don't use all of this area, the unused portion can be assigned to other devices.
	The Descriptive External Data Area is allocated automatically starting from the first data register after the Key Code Area.	
Character Superimposition Area	Stores character codes and line number for superimposed characters. The superimposition is processed one line at a time.	DT: Data register 21 words If you don't need superimposed characters, you can use this area for other devices.
Character Highlight Area	Specifies the locations on the I.O.P. screen for highlighting characters.	DT: Data register 16 words If you don't need to highlight characters, you can use this area for other devices.
Key Code Area	When you choose the Contact Communication Mode, use this area. One bit is assigned to each valid Key Code.	R: Internal relay The memory used depends on the number of Key Codes you want to use. 1 word : 15 Key Codes 2 words : 31 Key Codes 4 words : 63 Key Codes 10 words : 159 Key Codes
Primary Screen Number Area	When you choose the Contact Communication Mode, use this area. One bit is assigned to each valid Primary Screen number.	R: Internal relay The memory used depends on the number of Primary Screens you will use. 1 word : 16 Primary Screen numbers 2 words : 32 Primary Screen numbers 4 words : 64 Primary Screen numbers 10 words : 160 Primary Screen numbers

3-2 I.O.P. DIP Switches Settings

I.O.P. Operation Modes

The I.O.P. has two communication modes: the Data Communication Mode and the Contact Communication Mode. The number of keys and screens that you can use on the I.O.P. and the programming method for communication with the PC will depend on the communication mode chosen. Select the mode best suited for your application. You can set the communication mode with DIP switches on the rear panel of the I.O.P.

I.O.P. operation	Communication Mode	Remarks
Display Primary Screen	Contact	Controlled by ON/OFF condition of an internal relay register corresponding to the Screen Number. Paging of a maximum of 160 screens is possible.
	Data	A Primary Screen is displayed by writing the corresponding screen number in the data register allocated for the screen number. Paging of a maximum of 255 screens is possible.
Send Key Data	Contact	When a key is pressed on the I.O.P., an internal relay registers corresponding to to the key is turned ON. A maximum of 159 keys can be assigned to internal relay registers.
	Data	When a key is pressed on the I.O.P., the Key Code corresponding to the key is stored in the data registers allocated for the code. A maximum of 255 keys can be recognized.
Display External Data Enter External Data Superimpose characters Highlight characters Manual Screen LINE specification Display Manual Screen LED ON/OFF Sound Buzzer PAUSE key	Contact/Data (common)	Data in the data register previously specified for these controls will be automatically communicated between the PC and the I.O.P.. No handshaking is required except for superimposing or highlighting characters. To superimpose or highlight characters, the I.O.P. must set a flag when done.

Displayable External Data

You can use either HEX or ASCII format to specify the External Data to be displayed on the I.O.P.. The HEX format allows you to display the characters '0' through '9', and '.'(decimal), '+', '-', '='. The ASCII format lets you display alphanumeric characters and symbols. You can choose either one with DIP switches on the rear panel of the I.O.P..

Characters to be Superimposed

To superimpose characters, you must specify the character codes using JIS codes or Shift-JIS codes. You can choose either one with the DIP switches on the rear panel of the I.O.P.

I.O.P. DIP switch settings for the operation modes

DIP Switch Setting								Setting
1	2	3	4	5	6	7	8	
*	*	OFF	*	*	*	*	*	Data Communication Mode
*	*	ON	*	*	*	*	*	Contact Communication Mode
*	*	*	OFF	*	*	*	*	JIS Code (Normal size characters to be superimposed)
*	*	*	ON	*	*	*	*	Shift-JIS Code (Normal size characters to be superimposed)
*	*	*	*	OFF	*	*	*	HEX Data (Displayable External Data)
*	*	*	*	ON	*	*	*	ASCII Data (Displayable External Data)

* You can set the DIP switch 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 making the changes.

Example

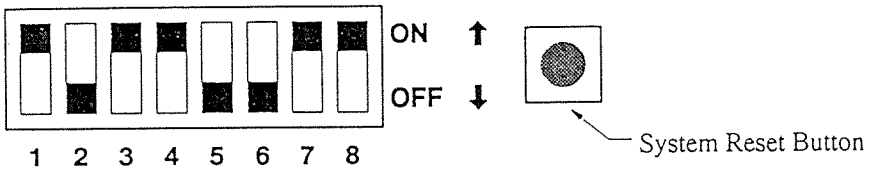
DIP Switches							
1	2	3	4	5	6	7	8
*	*	ON	ON	OFF	*	*	*

Selects the Contact Communication Mode for PC Communication.
Specifies superimposed characters will be sent as Shift-JIS codes for normal size characters.
Specifies Displayable External Data will be sent as HEX codes.

Notes

- Refer to the next page for the details of DIP switch settings.

I.O.P. DIP switches



DIP – Switch Setting								Setting
1	2	3	4	5	6	7	8	
OFF	OFF	*	*	*	*	*	*	Data Register Mode/Transfer Mode
ON	ON	*	*	*	*	*	*	Monitor Mode
OFF	ON	*	*	*	*	*	*	PC memory area allocation
ON	OFF	*	*	*	*	*	*	Run Mode
*	*	OFF	*	*	*	*	*	Data Communication Mode
*	*	ON	*	*	*	*	*	Contact Communication Mode
*	*	*	*	OFF	*	*	*	HEX Code (Displayable External Data)
*	*	*	*	ON	*	*	*	ASCII Code (Displayable External Data)
*	*	*	*	*	OFF	OFF	*	Back light ON all the time.
*	*	*	*	*	OFF	ON	*	Back light AUTO OFF in 5 minutes. AUTO ON with a screen change or the ESC key.
*	*	*	*	*	ON	OFF	*	Back light AUTO OFF in 5 minutes. ON with the ESC key.
*	*	*	*	*	ON	ON	*	Back light AUTO OFF in 15 minutes. ON with the ESC key.
*	*	*	*	*	*	*	OFF	When the I.O.P. is turned off, saves the current data entered on the I.O.P..
*	*	*	*	*	*	*	ON	When the I.O.P. is turned off, does not save the current data entered on the I.O.P..

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

Communication Mode

PC communication can be either the "Contact Communication 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 code" or "ASCII code" as the format for sending Displayable External Data.

Back Light

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

External Data Entry

Choose whether or not the I.O.P. will save the current data entered on the I.O.P. when it is turned OFF.

Example

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

In the example above the switches are set for Run mode, Contact Communication Mode with the PC, HEX code for displaying External Data and Shift-JIS code for superimposing characters in normal size. External Data entered on the I.O.P. won't be saved when the I.O.P. is turned off. The Back light is set for AUTO OFF in 5 minutes and AUTO ON when the screen change.

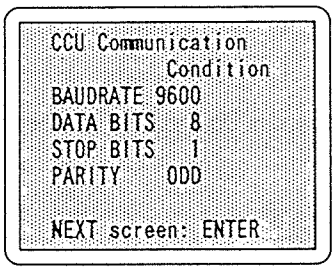
3-3 Setting the Communication Data Format

I.O.P. Setting

You must set the communication data format for your PC to match the setting on the I.O.P. Serial communication (RS-232-C) is used for communication between the I.O.P. and the PC. You can check the format programmed in the I.O.P by setting the DIP switches as follows and then by pressing the System Reset Button.

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

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



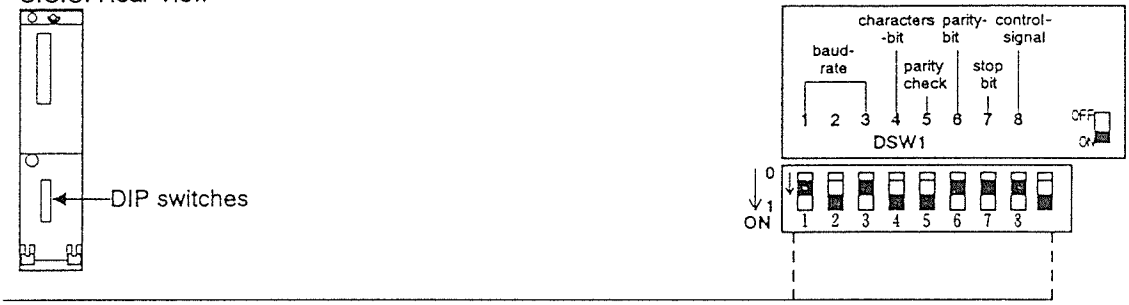
PC Setting

When using an FP3 or FP5

You can set the PC communication data format with the DIP switches on the rear panel of the Computer Communication Unit(C.C.U.).

DIP Switches (Unit Rear Side)

C.C.U. Rear View



Switch No.	Function		Switch position 1 2 3 4 5 6 7 8
1 to 3	Modem control	———	0 0 0
	Baud rate	19,200 bps	1 0 0
		9,600 bps	0 1 0
		4,800 bps	1 1 0
		2,400 bps	0 0 1
		1,200 bps	1 0 1
		600 bps	0 1 1
		300 bps	1 1 1
4	Character bits	7-bit	0
		8-bit	1
5	Parity Check	Invalid	0
		Valid	1
6	Parity	Odd parity	0
		Even parity	1
7	Stop bits	1-bit	0
		2-bit	1
8	Control signal	RTS,CTS disabled	0
		RTS,CTS enabled	1

*OFF is represented as " 0 " and ON is represented as " 1 ".

Notes

- Refer to the "FP3, FP5 C.C.U. Technical Manual" for details.

When using an FP1

When you use an FP programmer, check the system registers by executing "OP-50".
When you use NPST-GR software, check the screen for "SET RS-232-C" in "SET SYSTEM REGISTER".

When you use an FP programmer

With "OP-50", you can change the value of the system registers. Change the settings after you place the FP1 in the PROG. mode.

```
OP- 50
SYSTEM REG.
```

Execute "OP-50".

```
          412
K           1
```

System register address: Input "412".
Computer link setting: Input "K1".

```
          413
K           3
```

System register address: Input "413".
Data length: 8 bits
Terminator: CR
Parity check: ODD
Header: No STX
Stop bits: 1 bit Input "K3".

```
          414
K           1
```

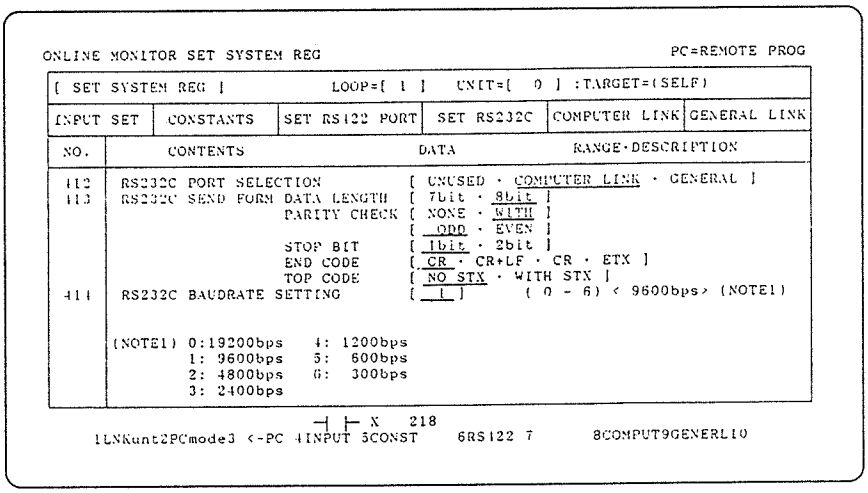
System register address: Input "414".
Baud rate: 9600 bps Input "K1"

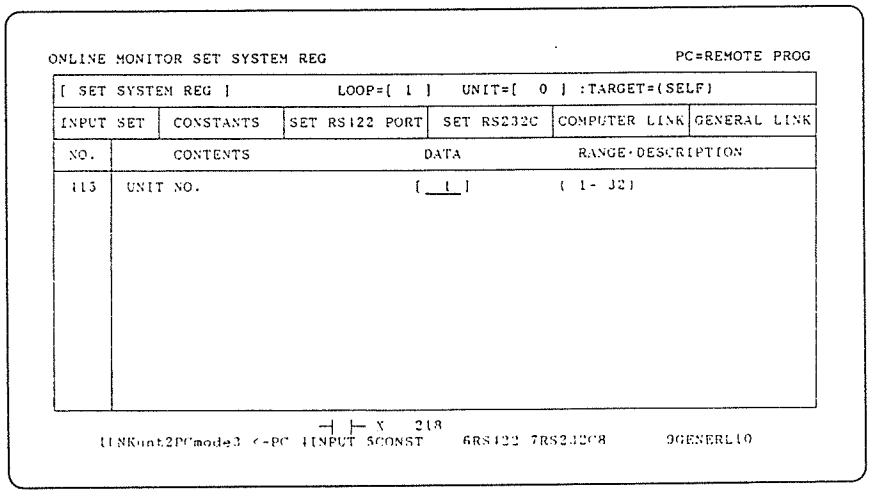
```
          415
K           1
```

System register address: Input "415".
Unit number: 1 Input "K1"

When you are using NPST-GR

Check the contents of "SET RS232C" in the "SET SYSTEM REG" screen.
Configure as shown in the following screen.





Cautions

- To select the RS232C port (No. 412), choose "Computer Link"
  After completing the setting, press the F1 key in the ONLINE mode to save the data.

Notes

- Refer to "Displaying System Register Setting " in the "FP PROGRAMMER Operation Manual" or "Setting RS232C port" in the "NPST-GR Manual" for details.

3-4 Allocating Data Areas in the PC Memory

Before Allocation

For communication with a PC, the I.O.P. will use some of the data registers(DT) and internal relays(R) (when it is set for Contact Communication Mode) in PC's memory. Be sure to check which areas have already been allocated to other devices. Allocate data registers and internal relays for use by the I.O.P. that do not overlap the other areas.

Depending on the PC you use, the number of internal relays and data registers you can specify will differ somewhat. Refer to the following.

PC	Internal relay (R)	Data register(DT)
FP5	0 to 97F (1568 points)	0 to 2047 (2048 points)
FP3	0 to 97F (1568 points)	0 to 2047 (2048 points)
FP1	0 to 62F (1008 points)	0 to 1559 (1660 points)
	* C24C type & C40C type: Internal relay points are the same.	

Notes

- Refer to the manual for your particular PC for details.
  The data registers are addressed in units of 1 word (16 bits).

Overview of I.O.P. Setting Screens

The allocation of PC memory areas for communication with the I.O.P. is done on the I.O.P. screen. The following is an overview of the allocation process. The individual steps will be explained in detail in each section.
The initial setting value will be displayed on the screen when you first allocate the PC memory area. The value shown on the each screen below indicates the initial setting.

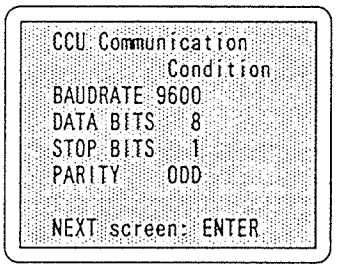
1. DIP switch settings

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

** : ON if you are using Contact Communication Mode.
OFF if you are using Data Communication Mode.
* : You can set these DIP switches either ON or OFF.
Choose the one appropriate for your operation.

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

The RS232C communication data format setting screen will appear on the I.O.P..
Match the settings on the screen to those on the PC.

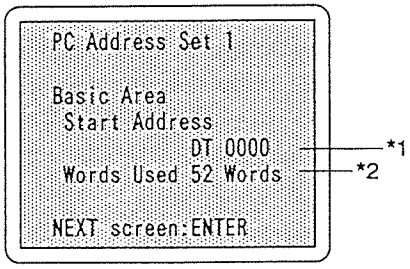


Caution

- Do not press the System Reset Button until the last setting screen is displayed.

3. Press the ENTER key on the front panel of the I.O.P..

The "PC Address Set 1" screen will appear on the I.O.P.



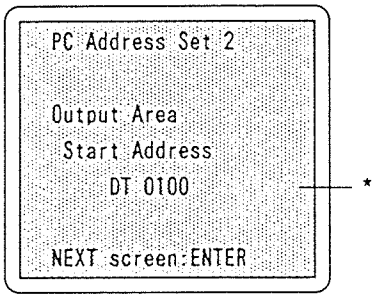
*1 Specify the starting address of the Basic Area in 4 digits number.

*2 Choose how many words to use for Basic Data and Displayable External Data.

The starting address for Displayable External Data will be automatically allocated, starting with the next address after the Basic Data area.

4. Press the ENTER key on the front panel of the I.O.P..

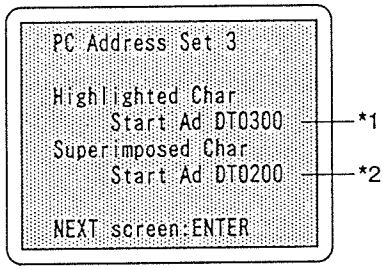
The "PC Address Set 2" screen will appear on the I.O.P..



* Specify the starting address of the Output Area in 4 digits number.
The next 49 words will be automatically allocated.
The Output Area contains space for both Key Codes and Descriptive External Data, in that order. The starting address for Descriptive External Data will be automatically allocated, starting with the next address after the Key Code area.

5. Press the ENTER key on the front panel of the I.O.P.

The "PC Address Set 3" screen will appear on the I.O.P.



*1 Specify the starting address for storing highlighted characters in 4 digits number. 16 words are automatically assigned, starting at the address given.

*2 Specify the start address for storing superimposed characters in 4 digits number. 21 words are automatically assigned, starting at the address given.

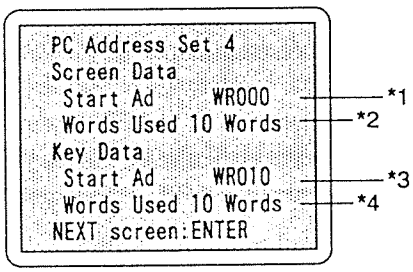
6. Press the ENTER key on the front panel of the I.O.P.

When you choose the Data Communication Mode:

Goes to the screen in the step 7 without displaying "PC Address Set 4" screen.

When you choose the Contact Communication Mode:

The "PC Address Set 4" screen will appear on the I.O.P.



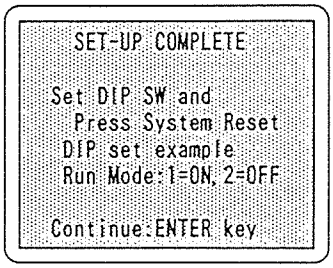
*1 Specify the starting address for displaying Primary Screens in 3 digits number.

*2 Specify how many words you will use (how many Primary Screens) in 2 digits number.

*3 Specify the starting address for receiving Key Codes in 3 digits number.

*4 Specify how many words you will use (how many Key Codes) in 2 digits number.

7. Press the ENTER key on the front panel of the I.O.P.



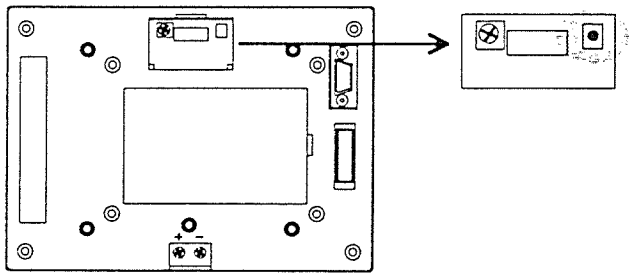
* To return to the first I.O.P. screen in this series, press the ENTER key.

8. Set the DIP switches on the rear panel of the I.O.P. as follows.

DIP Switches settings							
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.

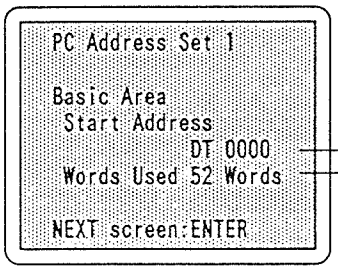
9. Press the System Reset Button on the rear panel of the I.O.P..



Allocating memory for the Basic Area

In the Basic Area, you can specify Basic Data and Displayable External Data.
The Basic Data consists of Control Data, Primary Screen numbers, and the Manual Screen LINE number.

If you specify the Basic Area Starting Address, an area for Displayable External Data is automatically assigned immediately following the Basic Data (3 words, fixed).
Even if you don't display any External Data on the I.O.P., 3 words will be allocated for the Basic Data.



(Initial setting screen)

*1 Specify the starting address for the Basic Area with the function keys on the front panel of the I.O.P.. Specify it in 4 digits number.

*2 Choose the number of words you will need for the Basic Area depending on the amount of External Data you want to display on the I.O.P. screen. You can use the F3 and F4 keys for the selection.

When you use a HEX data format the choices are: → 52 → 28 → 16 → 3 ┐

When you use an ASCII data format the choices are: → 84 → 44 → 24 → 3 ┐

* Press the F1 key to move the cursor to the right.
Press the F2 key to move the cursor to the left.
Press the F3 key to increment the value.
Press the F4 key to decrement the value.
Press the ENTER key to move to the next item.

Basic Area Map

Data Register		Description	Total Size(words)
DT n	DT 0	Control Data 1	
DT n+1	DT 1	Screen number (in the Data Communication Mode)	3 words fixed
DT n+2	DT 2	Manual Screen LINE specification	
DT n+3	DT 3	Leading zero suppression	
DT n+4	DT 4	Displayable External Data	
DT n+5	DT 5		
DT n+6	DT 6		
⋮	⋮		
DT n+15 (DT n+23)	DT 15 (DT 23)	Displays 4 kinds of External Data	16(24) words
DT n+27 (DT n+43)	DT 27 (DT 43)	Displays 8 kinds of External Data	28(44) words
DT n+51 (DT n+83)	DT 51 (DT 83)	Displays 16 kinds of External Data	52(84) words

↑
In case you specify DT0 for the Basic Area Start Address.

Notes

■ Numbers in parentheses are for ASCII characters.

Memory Area for the Basic Data

When you specify the starting address for the Basic Area, the Basic Data addresses are counted from there. The Basic Data consists of the "Control Data 1", the "Primary screen number" and the "Manual Screen Display" LINE specification.
3 words are allocated for the Basic Data.

Basic Data

Data register	Bit contents F E D C B A 9 8	7	6	5	4	3	2	1	0	Data
DT n	(not used) (not used)	LED4	LED3	LED2	LED1	BZ	MS	HD	CD	Control Data 1
DT n+1	(not used) (not used)	Primary Screen number								Primary Screen number
DT n+2	(not used) (not used) ML	Manual Screen LINE spec.								Manual Screen

Control Data 1 (Output to the I.O.P.)

Bit	Name	Description	Remarks
F	(not used)	(not used)	(not used)
E	(not used)	(not used)	(not used)
D	(not used)	(not used)	(not used)
C	(not used)	(not used)	(not used)
B	(not used)	(not used)	(not used)
A	(not used)	(not used)	(not used)
9	(not used)	(not used)	(not used)
8	(not used)	(not used)	(not used)
7	LED4	STOP LED flag	ON: LED ON OFF: LED OFF
6	LED3	START LED flag	ON: LED ON OFF: LED OFF
5	LED2	MAN. LED flag	ON: LED ON OFF: LED OFF
4	LED1	AUTO LED flag	ON: LED ON OFF: LED OFF
3	BZ	Buzzer flag	ON: sound OFF: stop
2	MS	Manual Screen flag	ON: Display OFF: Cancel
1	HD	Flag for highlighting characters	ON: Highlight characters are specified
0	CD	Flag for superimposing characters	ON: Superimpose characters specified

Primary Screen numbers

This specification is valid only in the Data Communication Mode.
Specify the 8 bit pattern of the Primary Screen number you want displayed.
Paging is accomplished by changing the bit pattern.

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 (bit 8), and then MS bit (bit 2) in Control Data1.

The ML bit: Turn ON the ML bit (bit 8) if you want to display the Manual Screen starting from a specific LINE.

Memory Area for Displayable External Data

The area for Displayable External Data begins immediately after the 3 words of Basic Data. Depending on the Data format you will use(HEX data or ASCII data) and the number of pieces of External Data you want to display on the I.O.P., the amount of memory required will vary. Even if you don't display any External Data, 3 words will be assigned for the Basic Data.
If you assign memory for External Data Display, the 4th word address (DT n+3) will be allocated as a flag for leading zero suppression.

Total number of words required

Number of External Data that can be displayed	HEX format	ASCII format
None	3 words	3 words
4 pieces of data	16 words	24 words
8 pieces of data	28 words	44 words
16 pieces of data	52 words	84 words

Leading zero suppression flag

Leading zero suppression for Displayable External Data is specified in the 4th word.
Each bit corresponds to one of the 16 External Data Buffers as follows. The data in the buffer will be subject to leading zero suppression if the corresponding bit is ON.

Leading zero suppression flag

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

The Memory Area Occupied (when data is specified in HEX format)

Basic Area Start Address: DT n (DT0)

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

Digit position

10	9	8	7	6	5	4	3	2	1

Data register		Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0	Data
DT n	DT 0	(not used) (not used)	LED4 LED3 LED2 LED1 BZ MS HD CD	Control Data 1
DT n+1	DT 1	(not used) (not used)	Primary Screen number	Primary Screen number
DT n+2	DT 2	(not used) (not used) ML	Manual Screen LINE spec.	Manual Screen
DT n+3	DT 3	F E D C B A 9 8	7 6 5 4 3 2 1 0	Leading zero suppression (specify the buffer number)
DT n+4	DT 4	Digit 4 Digit 3	Digit 2 Digit 1	Displayable External Data stored in Buffer 0
DT n+5	DT 5	Digit 8 Digit 7	Digit 6 Digit 5	
DT n+6	DT 6	(not used) (not used)	Digit 10 Digit 9	
⋮	⋮	⋮ ⋮	⋮ ⋮	⋮
DT n+13	DT 13	Digit 4 Digit 3	Digit 2 Digit 1	Displayable External Data stored in Buffer 3
DT n+14	DT 14	Digit 8 Digit 7	Digit 6 Digit 5	
DT n+15	DT 15	(not used) (not used)	Digit 10 Digit 9	
⋮	⋮	⋮ ⋮	⋮ ⋮	⋮
DT n+25	DT 25	Digit 4 Digit 3	Digit 2 Digit 1	Displayable External Data stored in Buffer 7
DT n+26	DT 26	Digit 8 Digit 7	Digit 6 Digit 5	
DT n+27	DT 27	(not used) (not used)	Digit 10 Digit 9	
⋮	⋮	⋮ ⋮	⋮ ⋮	⋮
DT n+49	DT 49	Digit 4 Digit 3	Digit 2 Digit 1	Displayable External Data stored in Buffer F
DT n+50	DT 50	Digit 8 Digit 7	Digit 6 Digit 5	
DT n+51	DT 51	(not used) (not used)	Digit 10 Digit 9	

↑ Assumes that the starting address is set to DT0000.

*Buffer : Displayable External Data Buffer.

Displayable External Data Area

Displayable External Data *	Data register	
Displayable External Data 0	DT n+4 to DT n+6	DT 4 to DT 6
Displayable External Data 1	DT n+7 to DT n+9	DT 7 to DT 9
Displayable External Data 2	DT n+10 to DT n+12	DT 10 to DT 12
Displayable External Data 3	DT n+13 to DT n+15	DT 13 to DT 15
Displayable External Data 4	DT n+16 to DT n+18	DT 16 to DT 18
Displayable External Data 5	DT n+19 to DT n+21	DT 19 to DT 21
Displayable External Data 6	DT n+22 to DT n+24	DT 22 to DT 24
Displayable External Data 7	DT n+25 to DT n+27	DT 25 to DT 27
Displayable External Data 8	DT n+28 to DT n+30	DT 28 to DT 30
Displayable External Data 9	DT n+31 to DT n+33	DT 31 to DT 33
Displayable External Data A	DT n+34 to DT n+36	DT 34 to DT 36
Displayable External Data B	DT n+37 to DT n+39	DT 37 to DT 39
Displayable External Data C	DT n+40 to DT n+42	DT 40 to DT 42
Displayable External Data D	DT n+43 to DT n+45	DT 43 to DT 45
Displayable External Data E	DT n+46 to DT n+48	DT 46 to DT 48
Displayable External Data F	DT n+49 to DT n+51	DT 49 to DT 51

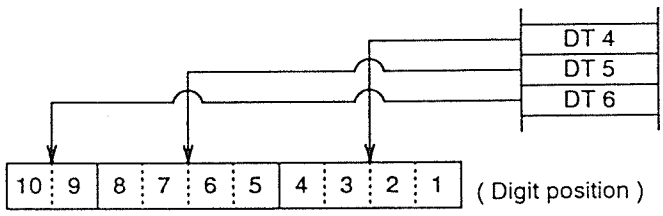
↑

Assumes that the starting address is set to DT0000.

* The suffix indicates the number of the Displayable External Data Buffer where the data is stored.

HEX data you can use as Displayabel External Data

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)



Displayable External Data 0

The Memory Area Occupied (when data is specified in ASCII format)

Basic Area Start Address: DT n (DT00)

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

Digit position

10	9	8	7	6	5	4	3	2	1

Data register		Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0	Data
DT n	DT 0	(not used) (not used)	LED4 LED3 LED2 LED1 BZ MS HD CD	Control Data 1
DT n+1	DT 1	(not used) (not used)	Primary Screen number	Primary Screen number
DT n+2	DT 2	(not used) (not used) ML	Manual Screen LINE spec.	Manual Screen
DT n+3	DT 3	F E D C B A 9 8	7 6 5 4 3 2 1 0	Leading zero suppression (specify the buffer number)
DT n+4	DT 4	Digit 9	Digit 10	
DT n+5	DT 5	Digit 7	Digit 8	
DT n+6	DT 6	Digit 5	Digit 6	
DT n+7	DT 7	Digit 3	Digit 4	Displayable External Data stored in Buffer 0
DT n+8	DT 8	Digit 1	Digit 2	
⋮	⋮	⋮	⋮	⋮
DT n+19	DT 19	Digit 9	Digit 10	
DT n+20	DT 20	Digit 7	Digit 8	
DT n+21	DT 21	Digit 5	Digit 6	
DT n+22	DT 22	Digit 3	Digit 4	Displayable External Data stored in Buffer 3
DT n+23	DT 23	Digit 1	Digit 2	
⋮	⋮	⋮	⋮	⋮
DT n+39	DT 39	Digit 9	Digit 10	
DT n+40	DT 40	Digit 7	Digit 8	
DT n+41	DT 41	Digit 5	Digit 6	
DT n+42	DT 42	Digit 3	Digit 4	Displayable External Data stored in Buffer 7
DT n+43	DT 43	Digit 1	Digit 2	
⋮	⋮	⋮	⋮	⋮
DT n+79	DT 79	Digit 9	Digit 10	
DT n+80	DT 80	Digit 7	Digit 8	
DT n+81	DT 81	Digit 5	Digit 6	
DT n+82	DT 82	Digit 3	Digit 4	Displayable External Data stored in Buffer F
DT n+83	DT 83	Digit 1	Digit 2	

↑

Assumes that the starting address is set to DT0000.

*Buffer : Displayable External Data Buffer.

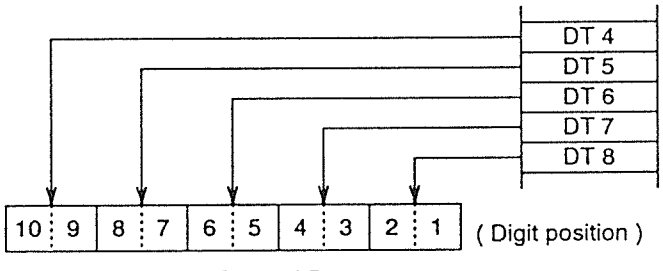
Displayable External Data Area

Displayable External Data *	Data register	
Displayable External Data 0	DT n+4 to DT n+8	DT 4 to DT 8
Displayable External Data 1	DT n+9 to DT n+13	DT 9 to DT 13
Displayable External Data 2	DT n+14 to DT n+18	DT 14 to DT 18
Displayable External Data 3	DT n+19 to DT n+23	DT 19 to DT 23
Displayable External Data 4	DT n+24 to DT n+28	DT 24 to DT 28
Displayable External Data 5	DT n+29 to DT n+33	DT 29 to DT 33
Displayable External Data 6	DT n+34 to DT n+38	DT 34 to DT 38
Displayable External Data 7	DT n+39 to DT n+43	DT 39 to DT 43
Displayable External Data 8	DT n+44 to DT n+48	DT 44 to DT 48
Displayable External Data 9	DT n+49 to DT n+53	DT 49 to DT 53
Displayable External Data A	DT n+54 to DT n+58	DT 54 to DT 58
Displayable External Data B	DT n+59 to DT n+63	DT 59 to DT 63
Displayable External Data C	DT n+64 to DT n+68	DT 64 to DT 68
Displayable External Data D	DT n+69 to DT n+73	DT 69 to DT 73
Displayable External Data E	DT n+74 to DT n+78	DT 74 to DT 78
Displayable External Data F	DT n+79 to DT n+83	DT 79 to DT 83

Assumes that the starting address is set to DT0000.

* The suffix indicates the number of the Displayable External Data Buffer where the data is stored.

The ASCII data you can display on the I.O.P. are any characters from "20" to "7A".

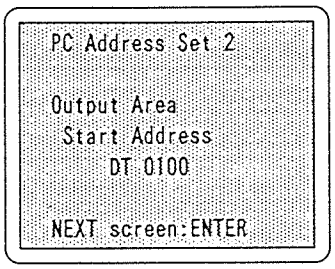


Displayable External Data 0

Allocating Memory for the Output Area

Output Area

In the Output Area, you can specify Key Data and Descriptive External Data.
The Key Data consists of Control Data 2 and Key Data
If you specify the Output Starting Address, the area for the Descriptive External Data is automatically assigned to the memory immediately after the Key Data Memory Area.
50 words (fixed) are automatically assigned as the Output Area: one word for the Key Data Area and 49 words for the Descriptive External Data Area. If there is a portion of the Descriptive External Data Area that you don't use, it can be assigned to other devices.



(Initial setting screen)

Specify the starting address for the Output Area with the function keys on the front panel of the I.O.P.. Specify it in 4 digits number.

* Press the F1 key to move the cursor to the right.
  Press the F2 key to move the cursor to the left.
  Press the F3 key to increment the value.
  Press the F4 key to decrement the value.

Output Area Map

Data Register		Description
DT m	DT 100	Control Data 2, Key Data
DT m+1	DT 101	Descriptive External Data Flag
DT m+2	DT 102	Descriptive External Data
DT m+3	DT 103	
DT m+4	DT 104	Descriptive External Data in Buffer 0
DT m+5	DT 105	
⋮	⋮	
DT m+49	DT 149	Descriptive External Data in Buffer F

↑
In case you specify DT0100 for the Output Area Start Address.

Memory Area for Control Data 2 and Key Data

Control Data 2 and the Key Data use the first word at the starting address specified for the Output Area.

Bits 0 to 7 are assigned for the Key Data (KD).

Bits 8 to F are assigned for the Control Data 2.

Control Data 2 and Key Data Area

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Name			BT	RCH	RCC		PAUSE	KD-STROB	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0
	Control Data 2								Key Data							

Bit	Name	Description	Remarks
F	(not used)	(not used)	(not used)
E	(not used)	(not used)	(not used)
D	BT	Battery flag	ON when the battery gets low.
C	RCH	Superimposition complete flag	ON when completing superimposition of characters.
B	RCC	Highlight complete flag	ON when completing highlighting characters.
A	(not used)	(not used)	(not used)
9	PAUSE	PAUSE flag	ON when the PAUSE key on the front panel of the I.O.P. is pressed. OFF when the RESET key is pressed on the I.O.P..
8	KD STROB	KD STROB flag	ON during a key press. (except the PAUSE key)
7	KD7	Key Data	The Key Code (01 to FF) corresponding to the key pressed on the I.O.P. is stored here as an 8 bit pattern.
6	KD6	Key Data	
5	KD5	Key Data	
4	KD4	Key Data	When a key is pressed on the I.O.P, the KD-STROB turns ON. When the PC sees this strobe, it can read the Key Code here.
3	KD3	Key Data	
2	KD2	Key Data	
1	KD1	Key Data	These 8 bits are only valid if you are in Data Communication Mode.
0	KD0	Key Data	

Memory Area for Descriptive External Data

The Descriptive External Data memory area consists of the 49 words immediately after the word assigned for Key Data and Control Data 2.
If you don't need 16 pieces of Descriptive External Data, the unused data registers can be used freely by other devices.

The first of these 49 words (the word immediately after the Key Data) is used for the Descriptive External Data flag.

Descriptive External Data flag

When you press the ENTER key, after entering External Data on the I.O.P., the Descriptive External Data flag (which corresponds to the buffer whose data has changed) will turn ON for more than one scan. Then the flag will automatically be turned OFF.

Descriptive External Data flag

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

The Organization of the Output Area

Basic Area Start Address: DT n (DT0)

"Digit nn" in the table indicates the position of the Descriptive External Data .

Digit position

10	9	8	7	6	5	4	3	2	1

Data register		Bit contents F E D C B A 9 8 7 6 5 4 3 2 1 0				Data
DT m	DT 100	BT RCH RCC PAUSE KD STROB KD7 KD6 KD5 KD4 KD3 KD2 KD1 KD0				Control Data 2 Key Data
		Control Data 2		Key Data		
DT m+1	DT 101	F E D C B A 9 8 7 6 5 4 3 2 1 0				Descriptive External Data flag
DT m+2	DT 102	Digit 4	Digit 3	Digit 2	Digit 1	Descriptive External Data stored in Buffer 0
DT m+3	DT 103	Digit 8	Digit 7	Digit 6	Digit 5	
DT m+4	DT 104	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮	⋮
DT m+11	DT 111	Digit 4	Digit 3	Digit 2	Digit 1	Descriptive External Data stored in Buffer 3
DT m+12	DT 112	Digit 8	Digit 7	Digit 6	Digit 5	
DT m+13	DT 113	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮	⋮
DT m+23	DT 123	Digit 4	Digit 3	Digit 2	Digit 1	Descriptive External Data stored in Buffer 7
DT m+24	DT 124	Digit 8	Digit 7	Digit 6	Digit 5	
DT m+25	DT 125	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮	⋮
DT m+47	DT 147	Digit 4	Digit 3	Digit 2	Digit 1	Descriptive External Data stored in Buffer F
DT m+48	DT 148	Digit 8	Digit 7	Digit 6	Digit 5	
DT m+49	DT 149	(not used)	(not used)	Digit 10	Digit 9	

↑ Assumes that the starting address is set to DT0100.

*Buffer : Descriptive External Data Buffer.

Descriptive External Data Area

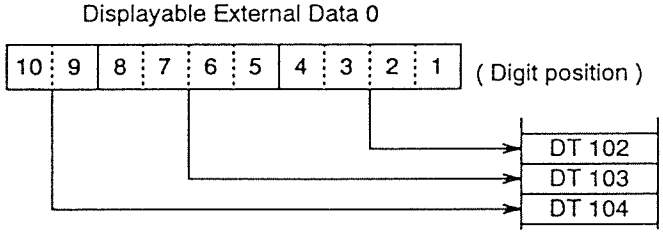
Descriptive External Data *	Data register	
Descriptive External Data 0	DT m+2 to DT m+4	DT 102 to DT 104
Descriptive External Data 1	DT m+5 to DT m+7	DT 105 to DT 107
Descriptive External Data 2	DT m+8 to DT m+10	DT 108 to DT 110
Descriptive External Data 3	DT m+11 to DT m+13	DT 111 to DT 113
Descriptive External Data 4	DT m+14 to DT m+16	DT 114 to DT 116
Descriptive External Data 5	DT m+17 to DT m+19	DT 117 to DT 119
Descriptive External Data 6	DT m+20 to DT m+22	DT 120 to DT 122
Descriptive External Data 7	DT m+23 to DT m+25	DT 123 to DT 125
Descriptive External Data 8	DT m+26 to DT m+28	DT 126 to DT 128
Descriptive External Data 9	DT m+29 to DT m+31	DT 129 to DT 131
Descriptive External Data A	DT m+32 to DT m+34	DT 132 to DT 134
Descriptive External Data B	DT m+35 to DT m+37	DT 135 to DT 137
Descriptive External Data C	DT m+38 to DT m+40	DT 138 to DT 140
Descriptive External Data D	DT m+41 to DT m+43	DT 141 to DT 143
Descriptive External Data E	DT m+44 to DT m+46	DT 144 to DT 146
Descriptive External Data F	DT m+47 to DT m+49	DT 147 to DT 149

↑
Assumes that the starting address is set to DT0100.

* The suffix indicates the number of the Descriptive External Data Buffer where the data is stored.

HEX data you can use as Descriptive External Data

Character entered on I.O.P.	0	1	2	3	4	5	6	7	8	9	.	(space)
HEX data (stored in a PC)	0	1	2	3	4	5	6	7	8	9	A	0



Allocating the Memory Area for Highlighting Characters

Memory Area for highlighting characters

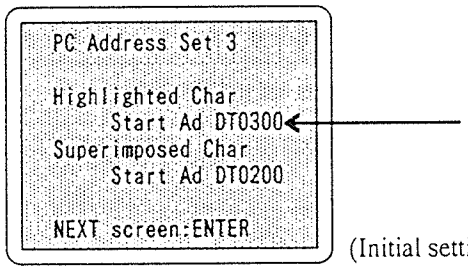
16 data registers (16 words) in the PC are automatically allocated as the area for highlighting characters. You must specify the starting address.
You can highlight characters on a Primary Screen by turning ON the bits in the registers which correspond to the area on the I.O.P. screen.
Even if you don't highlight characters, you must specify the starting address as shown below.

However, if you don't highlight characters, you can assign the area to other devices later. Since the flags for highlighting characters (HD and RCH) will not be used, the data stored here by another device will never be used as highlight information.

Highlighting characters

You can highlight half-width characters by turning ON the corresponding bit. To cause these bit settings to show up on the screen, use the highlight flags (HD and RCH):

HD (bit 1 in Control Data 1): Highlights characters when turned ON.
RCH (bit C in the Control Data 2): This bit goes ON after the highlighted characters have been sent.



(Initial setting screen)

Specify the starting address in 4 digits number for highlighted character information.
16 words are automatically assigned, starting at that address.
You must specify this address even if you don't use highlight characters.

* Press the F1 key to move the cursor to the left.
  Press the F2 key to move the cursor to the right.
  Press the F3 key to increment the value.
  Press the F4 key to decrement the value.
  Press the ENTER key to move to the next item.

The relation between the assigned data registers and the highlighted position on the I.O.P. screen is as follows.
Any character whose bit is ON, will be highlighted.

If you want to highlight a normal size character, you must turn on 2 bits.

	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			DT n+1 (DT301)										DT n+0 (DT300)							
	2			DT n+3 (DT303)										DT n+2 (DT302)							
	3			DT n+5 (DT305)										DT n+4 (DT304)							
	4			DT n+7 (DT307)										DT n+6 (DT306)							
	5			DT n+9 (DT309)										DT n+8 (DT308)							
	6			DT n+11 (DT311)										DT n+10 (DT310)							
	7			DT n+13 (DT313)										DT n+12 (DT312)							
	8			DT n+15 (DT315)										DT n+14 (DT314)							
DT bit position		9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0

(DT nn) : the address when the starting address is set to DT0300.

Allocating the Memory Area for Superimposed Characters

Memory Area for superimposed characters

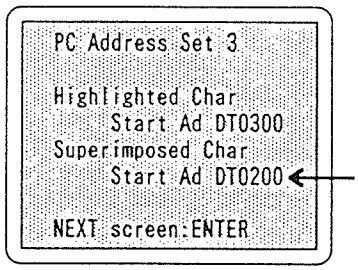
21 data registers (21 words) in the PC are automatically allocated as the area for superimposing characters. You must specify the starting address.
You can superimpose characters on a Primary Screen by storing the characters and the line position in the data registers previously allocated.
Specify the characters in JIS code.
Superimposition is done line by line on the I.O.P. screen.

Even if you don't superimpose characters, you must specify the starting address as shown below. However, if you don't superimpose characters, you can assign the area to other devices later. Since the flags for superimposed characters (CD and RCC) will not be used, the data stored here by another device will never be used as superimposition information.

Superimposing characters

21 words are used to specify the lines, and the characters on those lines, that will be superimposed.

CD (bit 0 in the Control Data 1) : Superimpose characters when turned ON.
RCC (bit B in the Control Data 2) : This bit goes ON after the superimposed characters have been sent.



(Initial setting screen)

Specify the starting address for superimposed characters in 4 digits number.
21 words are automatically assigned, starting at that address.
You must specify this address, even if you don't superimpose characters.

* Press the F1 key to move the cursor to the left.
  Press the F2 key to move the cursor to the right.
  Press the F3 key to increment the value.
  Press the F4 key to decrement the value.
  Press the ENTER key to move to the next item.

The relation between the allocation of the data registers and the line position on the I.O.P. screen and characters to be superimposed are as follows.
Because superimposition is done line by line, if you want to superimpose several lines on a screen, you must change the flags for the corresponding lines.
Superimposed characters are specified as half-width characters. If you want to superimpose normal size characters, The address following the last address used should not be specified.

I.O.P. screen	LINE	DT K (DT 200)																	
	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
DT (Character Specification)		DT k+1	DT k+2	DT k+3	DT k+4	DT k+5	DT k+6	DT k+7	DT k+8	DT k+9	DT k+10	DT k+11	DT k+12	DT k+13	DT k+14	DT k+15	DT k+16	DT k+17	DT k+18	DT k+19	DT k+20
		DT 201	DT 202	DT 203	DT 204	DT 205	DT 206	DT 207	DT 208	DT 209	DT 210	DT 211	DT 212	DT 213	DT 214	DT 215	DT 216	DT 217	DT 218	DT 219	DT 220

The sample DT numbers shown in the bottom line of the table assume that you specified DT0200 as the starting address.

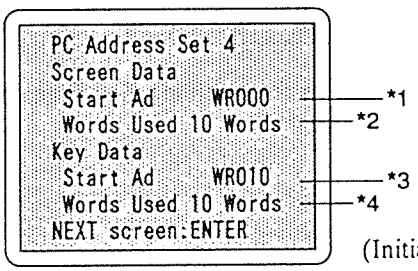
Allocating Internal Relay Addresses - Contact Communication Mode -

If you use the Contact Communication Mode, specify the area for displaying Primary Screens and receiving Key Data from the available internal relays in the PC's memory. If you are using the Data Communication Mode, you don't need to make these assignments.

Depending on the number of screen and the number of keys you want to be functional on the I.O.P., you can assign the number of internal relay words as shown below.

Words used	Number of keys you can use
1	15
2	31
4	63
10	159

Words used	Number of Primary Screen you can display
1	16
2	32
4	64
10	160



(Initial setting screen)

*1 Specify the starting address for displaying Primary Screens in 3 digits number.

*2 Depending on the number of the screens you will need, specify the number of words required in 2 digits number.

*3 Specify the starting address for receiving Key Data in 3 digits number.

*4 Depending on the number of the keys you will use, specify the number of words required in 2 digits number.

* Press the F1 key to move the cursor to the left.
Press the F2 key to move the cursor to the right.
Press the F3 key to increment the value.
Press the F4 key to decrement the value.
Press the ENTER key to move to the next item.

Word address	Bit contents															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
WR 0	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
WR 1	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
WR 8	80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F
WR 9	90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F

If you allocate "WR000" as the starting address for displaying Primary Screens, the internal relay corresponding to the screen number "1F" is "R01F".

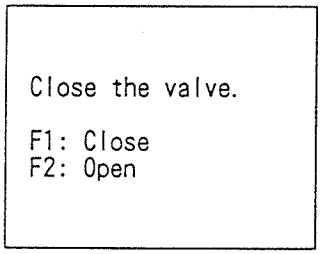
Word address	Bit contents															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
WR 10		01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
WR 11	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
WR 18	80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F
WR 19	90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F

If you allocate "WR010" as the starting address for receiving Key Data, the internal relay corresponding to the screen number "1F" is "R01F".

The relationship between internal relays and Primary Screen numbers

If you allocate "WR000" as the starting address for displaying Primary Screens:
The internal relay corresponding to screen number "05" is "R005".

IOP Message Screen



Prim. No.	05
Sec. No.	
ATB.	1

The relationship between internal relays and Key Codes

If you allocate "WR010" as the starting address for Key Codes:
The internal relay corresponding to the Key Code "5E" is "R15E".
The internal relay corresponding to the Key Code "5F" is "R15F".

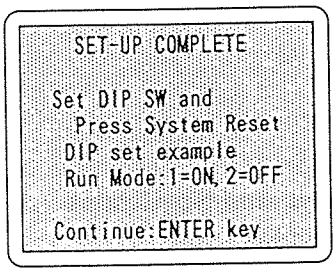
Function Key

F1	F2	F3	F4
5E	5F		

Ending Memory Allocation

If you chose the Data Communication Mode, you will see the screen below when you press the I.O.P. ENTER key after you have allocated the area for superimposing characters.

If you chose the Contact Communication Mode, you will see the screen below when you press the I.O.P. ENTER key after you have allocated the internal relay area.

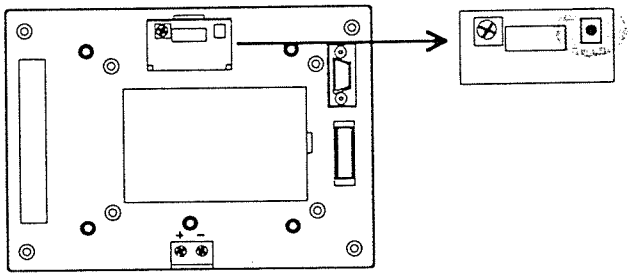


When you see the screen, set the DIP switches as specified below, and then press the System Reset Button on the rear panel of the I.O.P..
If you want to return to the setting screen again, press the ENTER key on the front panel of the I.O.P..

DIP Switches 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.

Press the System Reset Button on the rear panel of the I.O.P. after you set the DIP switches.



Cautions

- If you don't complete the allocation on the screen above, the values you entered won't be saved correctly.
- The settings are maintained by the backup battery. When you replace the backup battery, check the settings.

Chapter 4

Guide to PC Programming

Chapter 4 will give you ideas for creating programs for data communication. All data communication between the I.O.P. and the PC will be done automatically, except data used for highlighting and superimposing characters. So, no handshaking will be required.
You can choose either the Contact Communication Mode or the Data Communication Mode depending on how you create programs for the I.O.P. Model 22.
The programming is introduced according to the I.O.P. function that is being described.

Programmable Controller is abbreviated PC.

4-1 Before Programming the PC

Before the I.O.P. can communicate with the PC, you have to create programs for the PC. There are different programming methods for displaying Primary Screens and for receiving Key Data that depend on whether you choose the Contact Communication Mode or the Data Communication Mode.

You can refer to "Programming Overview" below for details.

The allocation of internal relays and data registers in this chapter assumes that the registers, relays and other requirements are the ones shown in the "PC Programming Conditions". Your assignments and requirements might be different.

For the details of each instruction used in this chapter, refer to the FP3/FP5 Programming Manual or the FP1 Technical Manual.
Programs introduced in this chapter are the ones made by using the NPST-GR software.

PC Programming Overview

I.O.P. function	Communication Mode	PC Programming	Reference
Display Primary Screen (Paging)	Contact	Specify the internal relay register corresponding to the number of the Primary Screen you want to display on the I.O.P..	4-2
	Data	Store the number of Primary Screen you want to display on the I.O.P. in the data registers you allocated for the Primary Screen number (Basic Area).	4-2
Superimpose Primary Screen (the same as above)	Contact / Data	The same programming as above. The I.O.P. will recognize the screen to be superimposed by the attribute "6" which you assigned when you created the screen on your personal computer. When the I.O.P. is displaying a Primary Screen, specify a Primary Screen which has attribute '6'.	4-3
Send Key Data (PC : Receive the Key Data)	Contact	Sets the internal relay register corresponding to the Key Code of the key pressed on the I.O.P..	4-4
	Data	Stores the key data in the data register you allocated for Key Codes (Key Code Area). With the flag "KD STROB", a PC can read fresh data when it is stored in the registers.	4-4
Display External Data	Contact/Data (The programming is the same for contact or data communications.)	Data will be stored automatically in the previously allocated corresponding register.	4-5
Enter External Data (PC: Receive the data entered)			4-6
Superimpose character			4-8
Highlight character			4-9
LED ON/OFF			4-10

I.O.P. function	Communication Mode	PC Programming	Reference
Displays Manual Screen	Contact/Data (The programming is the same for contact or data communications.)	Data will be stored automatically in the previously allocated corresponding register.	4-7
Display Manual Screen with LINE specification			4-7
Buzzer ON/OFF			7-11
PAUSE key (PC: Receive PAUSE state)			4-12

PC Programming Conditions

The programs introduced in this chapter assume that the PC memory areas specified below are allocated for use by the I.O.P..

Data registers

Data Register	Starting Address	Word used	Memory Area	Remark
Basic Area Starting Address	DT0000	16 words (in HEX)	DT0 to DT15	16 words are used in total: 3 words for the Basic Data(DT0 to DT2) 13 words for the Displayable External Data (DT3 to DT15) (Suppression of leading zeros and 4 pieces of Data)
		24 words (in ASCII)	DT0 to DT23	24 words are used in total: 3 words for the Basic Data(DT0 to DT2) 21 words for the Displayable External Data (DT3 to DT23) (A flag and 4 pieces of Data)
Output Area Starting Address	DT0100	50 words (8 words)	DT100 to DT149 (DT100 to DT107)	50 words are automatically assigned as the Output Area. In the examples given, only 8 words are used. (2 pieces of External Data can be entered from the I.O.P..) The rest of the area can be used for other devices. 1 word for Control Data 2 and Key Data (DT100) 7 words for the Descriptive External Data (DT101 to DT107) (A flag and 2 pieces of Data)
Character Superimposition Starting Address	DT0200	21 words	DT200 to DT220	21 words are automatically assigned. Even if you don't use superimposition, 21 words from the starting address you entered on the I.O.P. screen will be automatically assigned. However, you can use the allocated area for other devices.
Character Highlight Starting Address	DT0300	16 words	DT300 to DT315	16 words are automatically assigned. Even if you don't use highlighting, 16 words from the starting address you entered on the I.O.P. screen will automatically assigned. However, you can use the allocated area for other devices.

Internal relays (Contact Communication Mode)

Internal Relay	Starting Address	Word used	Memory Area	Remark
Primary Screen Starting Address	WR000	2 words	WR0 to WR1 (R0 to R1F)	Depending on the number of Primary Screens you want to display or superimpose, specify the number of words to be allocated. In these examples, 2 words are specified to display 32 Primary Screens.
Key Data Starting Address	WR010	4 words	WR10 to WR13 (R100 to R13F)	Depending on the number of keys you want to operate, specify the number of words to be allocated. In these examples, 4 words are specified for recognizing up to 32 keys.

Precautions when Using a Ladder Type CPU

If you are using a Ladder type CPU and choose the Contact Communication Mode, be very careful about setting the HOLD ON/OFF condition of the internal relays(R) used for communication with the I.O.P.

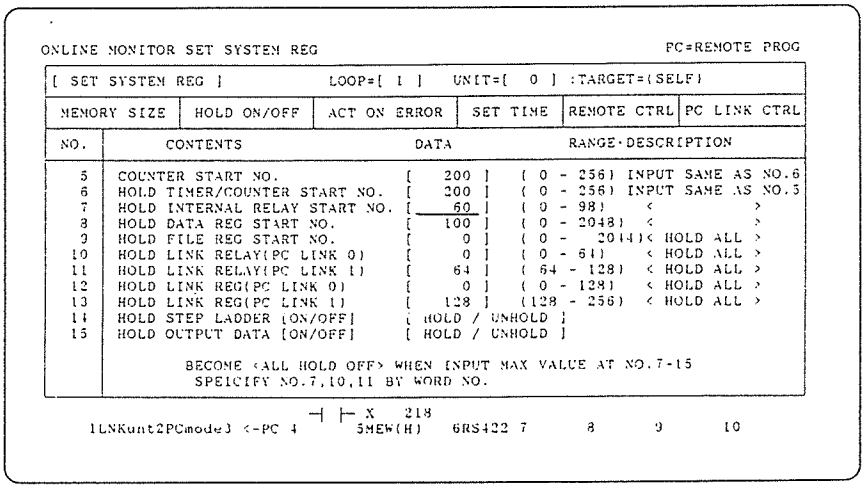
The internal relays assigned to the I.O.P. should be set to "HOLD OFF".

When using an FP5 or FP3

You can set the internal relays used by the I.O.P. to the "HOLD OFF" condition by setting the "HOLD INTERNAL RELAY START NO." to the number followed by the end address of the internal relay. Give some allowance for the setting.

For example, when the end address is "R59F", the number should be at least 60.

Using NPST-GR



Cautions

- After you have set the condition, press the F1 key to save the setting from the ONLINE MONITOR MODE in the NPST-GR or from the PROG. MODE for the PC.

Using the FP PROGRAMMER

```
OP-  50
SYSTEM  REG.
```

OP-50: Modifies the system registers of the PC.

```
                    7
          K        60
```

7 : HOLD INTERNAL RELAY START NO. setting

K 60: in this case "K60" has been entered as the starting number

Caution

- Set the values in the PROG. MODE for the PC.

Notes

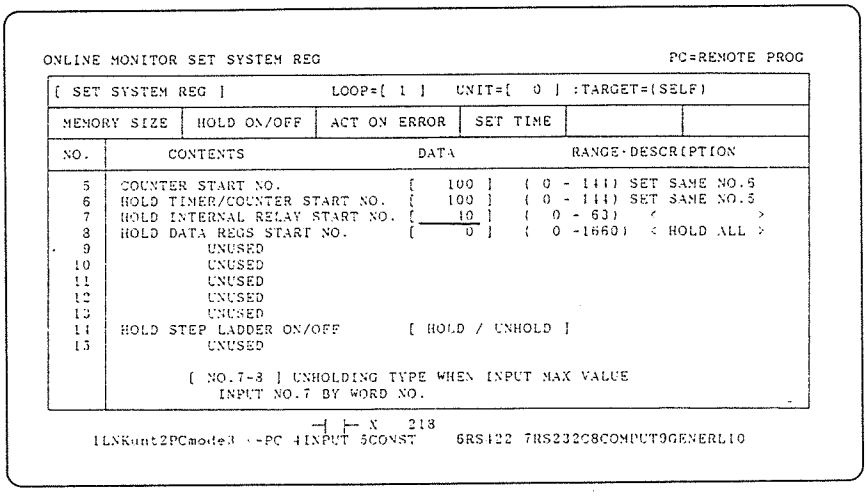
- Refer to "Displaying System Register Setting" in the FP PROGRAMMER Operation Manual or "Setting to Hold ON/OFF and Timer/Counter" in the NPST-GR MANUAL for details.

When using an FP1

You can set the internal relays for the I.O.P. to "HOLD OFF" by setting "HOLD INTERNAL RELAY START NO." to the number followed by the end address of the internal relay. Give some allowance for the setting.

For example, when the end address is "R39F", the number should be at least 40.

Using NPST-GR



Cautions

- After you have set the condition, press the F1 key to save the setting from the ONLINE MONITOR MODE in the NPST-GR or from the PROG. MODE for the PC.

Using the FP PROGRAMMER

```
OP-  50
SYSTEM  REG.
```

OP-50: Modifies the system registers of the PC.

```
                    7
          K        60
```

7 : HOLD INTERNAL RELAY START NO. setting

K 40: in this case "K40" has been entered as the starting number

Caution

- Set the values in the PROG. MODE for the PC.

Notes

- Refer to "Displaying System Register Setting" in the FP PROGRAMMER Operation Manual or "Setting to Hold ON/OFF and Timer/Counter" in the NPST-GR MANUAL for details.

4-2 Displaying Primary Screens

When You Choose the Contact Communication Mode (1) : Ladder CPU

This mode turns ON the internal relay corresponding to the Primary Screen number you want the I.O.P. to display.

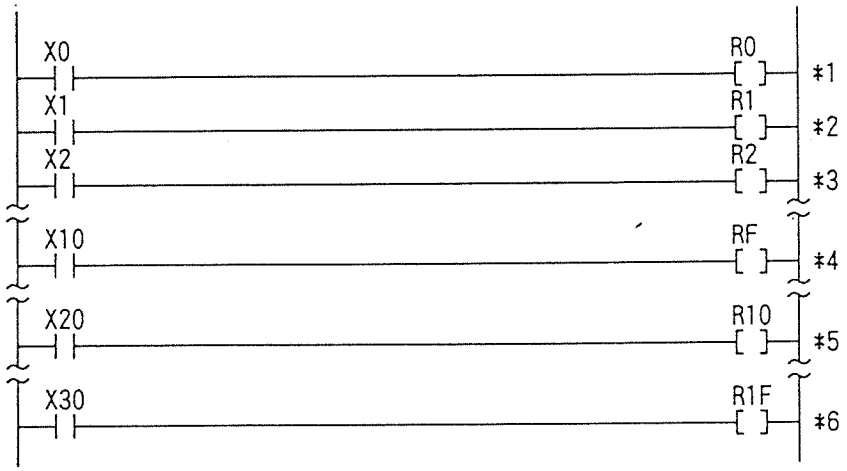
Postulate

Internal relays for displaying Primary Screens:

Two words from WR00 (R00 to R1F)

Primary Screen number "00": R0 "01": R1 "02": R2
"0F": RF "10": R10 "1F": R1F

Programming Example



‡1 When external input relay X0 is ON, Primary Screen number "00", which has been assigned to R00, will be displayed.
‡2 When external input relay X1 is ON, Primary Screen "01" will be displayed.
‡3 When external input relay X2 is ON, the Primary Screen "02" will be displayed.
‡4 When external input relay X10 is ON, Primary Screen number "0F", which has been assigned to R0F, will be displayed.
‡5 Primary Screen number "10", assigned to R10, will be displayed when external input relay X20 is ON.
‡6 Primary Screen number "1F" will be displayed.

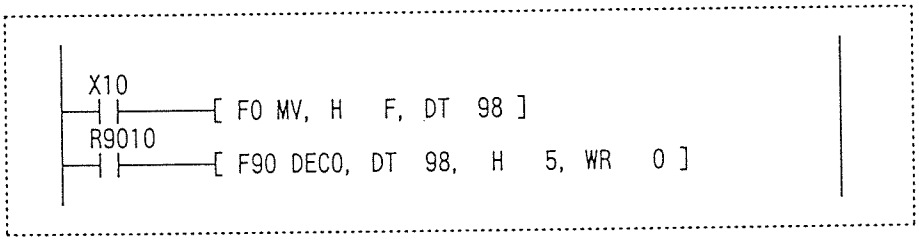
Cautions

- If more than one internal relay (which corresponds to a Primary Screen) is turned ON at the same time, the Primary Screen with the lowest screen number will be the one displayed.
- If the internal relay is turned ON by an external device such as a switch, it must be held ON for at least for 1000 msec.

When You Choose the Contact Communication Mode (2) : Ladder CPU

In this example, the internal relays are tuned ON or OFF with the DECO instruction.
First store the number of the Primary Screen you want to display into a data register with the move instruction, then use the DECO instruction.
By using this instruction, you will avoid turning ON several internal relays at the same time.

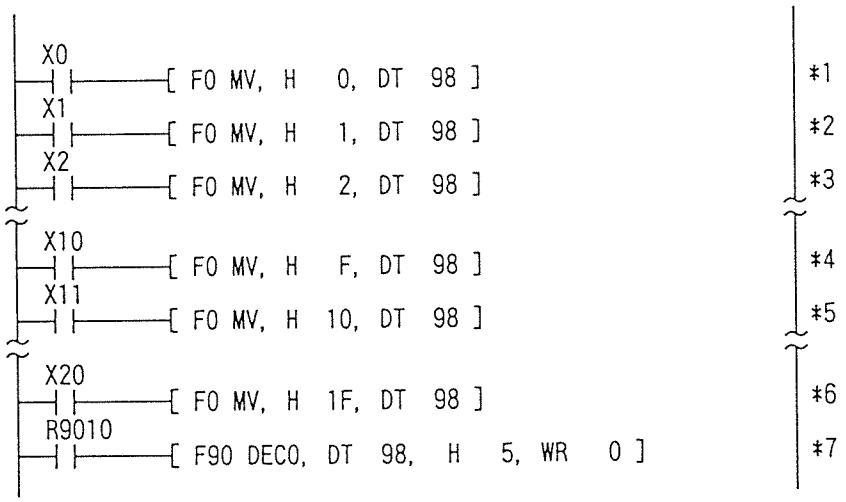
Basic Program



When external input relay X10 is ON, Primary Screen number "0F" will be stored in DT98.

At special internal relay R9010 (normally ON), execute the DECO instruction.
This will convert the Primary Screen number stored in DT98, "0F", to the correct contact data for the internal relay. This will correspond to the number held in the 2 words starting at WR0, "RF". Then, Primary Screen number "0F" will be displayed on the I.O.P..

Programming Example



DT98 is assumed to be the data register where the Primary Screen number is stored.

‡1 When external input relay X0 is ON, Primary Screen number "00" will be stored in DT98.

‡2 When external input relay X1 is ON, Primary Screen number "01" will be stored in DT98.

‡3 When external input relay X2 is ON, Primary Screen number "02" will be stored in DT98.

*4 When external input relay X10 is ON, Primary Screen number "0F" will be stored in DT98.

‡5 When external input relay X11 is ON, Primary Screen number "10" will be stored in DT98.

‡6 When external input relay X20 is ON, Primary Screen number "1F" will be stored in DT98.

‡7 The Primary Screen number stored in DT98 is decoded and then the result is converted to the corresponding internal relay number. Here two words from WR0 (R0 to R1F) are specified.

Screen number	00 is converted to	R0
	01	R1
	0F	RF
	10	R10
	11	R11
	1F	R1F

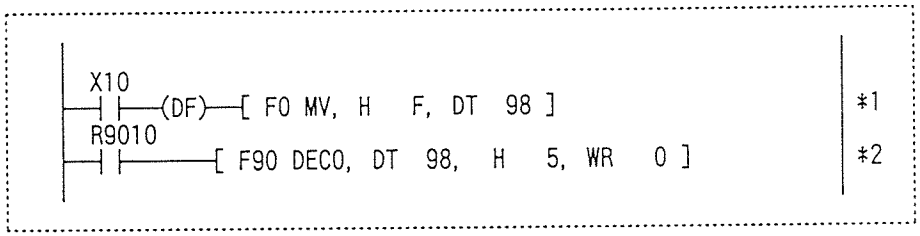
Notes

■ Refer to 4-14 "DECO/ENCO Instruction" for details.

DF instruction (leading edge differential)

With the DF instruction, the I.O.P. will display the Primary Screen corresponding to the internal relay which is turned ON last.
Using this instruction avoids turning several internal relays ON at the same time.

Basic Program

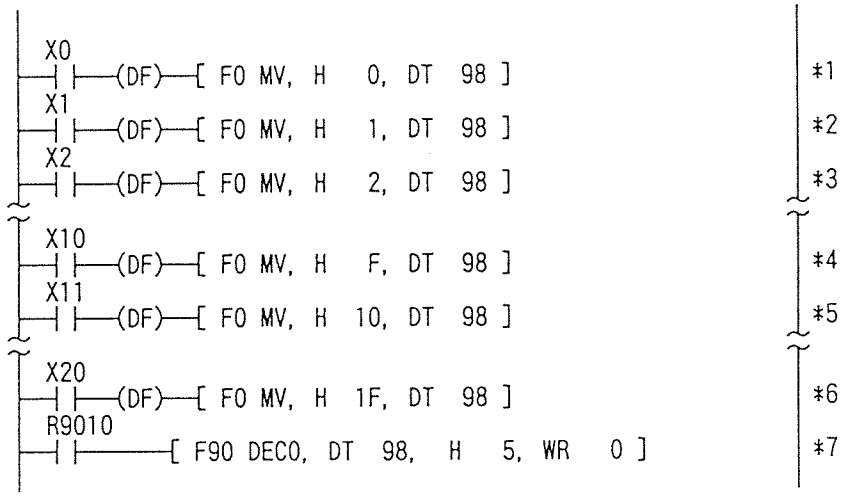


DT98 is assumed to be the data register where the Primary Screen number is stored.

*1 When external input relay X10 is ON, Primary Screen number "0F" will be stored in DT98.

*2 At special internal relay R9010 (Normally ON), execute the DECO instruction.
Then, the screen number stored in DT98, "0F", will be converted to contact data for the internal relay corresponding to the Primary Screen number. This will correspond to the number held in the 2 words starting at WR0, "RF". Then, Primary Screen number "0F" will be displayed on the I.O.P..

Programming Example



DT98 is assumed to be the data register where the Primary Screen number is stored.

‡1 When external input relay X0 is ON, the Primary Screen number "00" will be stored in DT98.
‡2 When external input relay X1 is ON, the Primary Screen number "01" will be stored in DT98.
‡3 When external input relay X2 is ON, the Primary Screen number "02" will be stored in DT98.
‡4 When external input relay X10 is ON, the Primary Screen number "0F" will be stored in DT98.
‡5 When external input relay X11 is ON, the Primary Screen number "10" will be stored in DT98.
‡6 When external input relay X20 is ON, the Primary Screen number "1F" will be stored in DT98.
‡7 The screen number stored in DT98 is decoded and then the result is converted to the corresponding internal relay number. Here two words from WR0 (R0 to R1F) are specified.

Screen number	00 is converted to	R0
	01	R1
	0F	RF
	10	R10
	11	R11
	1F	R1F

At step 3, when X2 is ON, the Primary Screen number "02" will be displayed on the I.O.P.. Then, even if X2 is still ON, if X1 is turned ON (step 2), the I.O.P. will display Primary Screen "01".
So, the page number is updated every time a external input relay is turned ON.

When You Choose the Data Communication Mode : Ladder CPU

Specify the Primary Screen screen number you want displayed at the address of the second word in the Basic Area.

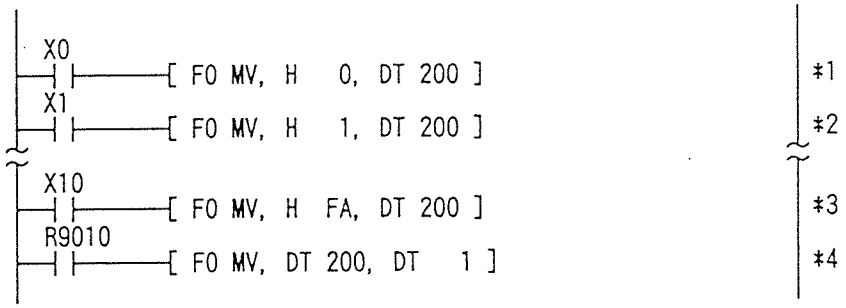
Postulate

Basic Area: DT0 to DT2

* DT1 is the register for the Primary Screen number.

Example: Contents of DT1: 00 Primary Screen number: 00
01 01
0F 0F
1F 1F

Programming Example 1



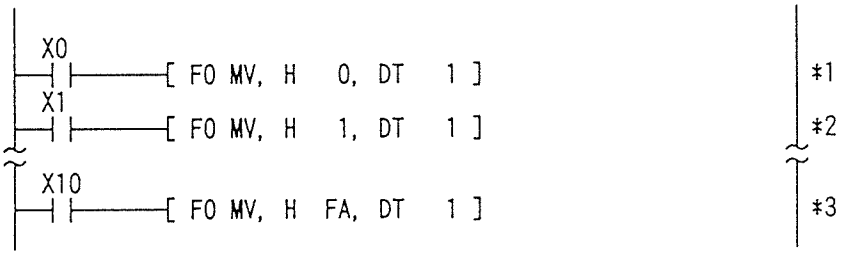
‡1 When external input relay X0 is ON, "00" will be written into DT200.

‡2 When external input relay X1 is ON, "01" will be written into DT200.

‡3 When external input relay X10 is ON, "FA" will be written into DT200.

‡4 Because R9010 is a Normally ON relay, the contents of DT200 are always copied to DT1.
Then the I.O.P. will display the Primary Screen corresponding to the data in DT1.

Programming Example 2



‡1 When external input relay X0 is ON, "00" is copied to DT1 to display Primary Screen "00" on the I.O.P.

‡2 When external input relay X1 is ON, "01" is copied to DT1 to display Primary Screen "01" on the I.O.P.

‡3 When external input relay X10 is ON, "FA" is copied to DT1 to display Primary Screen "FA" on the I.O.P.

Cautions

- In the above programs, if external input relays X0 and X1 are turned ON at the same time, external input relay X1 (the one with the highest address number) has display priority. So, Primary Screen which number "01" will be displayed on the I.O.P.

Notes

- If you use the DF instruction (leading edge differential), the paging of Primary Screen will be done when the leading edge of the trigger is detected.
  Refer to the programming example on page 96.

ENCO instruction

With the ENCO instruction, a maximum of 255 screens can be displayed with the ON/OFF internal relays of the PC. This will be handled the same way as when you operate the I.O.P. in the Contact Communication Mode.

Postulate

Basic Area: DT0 to DT2

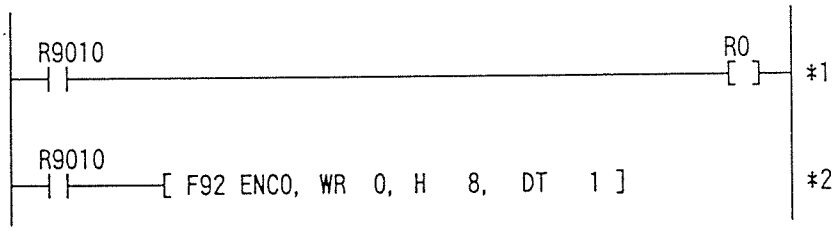
DT1: The Primary Screen number is stored here.

Internal relays to be encoded: WR0 to WR15 (16 words)

(R0 to R15F)

Each internal relay controls the display of the Primary Screen with the corresponding number. For example, R0 corresponds to the Primary Screen number "00".

Programming Example



R0 is always kept ON by R9010 (A Normally ON relay).

*1 When you use the ENCO instruction, one of the internal relays should always be ON.

*2 ENCO instruction is always passed through R9010 (A Normally ON relay).
The number stored in the internal relay (R0 to W15F) which is turned ON is encoded as a hexadecimal number in the range of 00 to FF, and the result is stored in DT1.
The I.O.P. will display the Primary Screen number stored in DT1.

Cautions

- Always use the code in line *1 just before the code in line *2.
- Be sure the program turns OFF R0 after the code in line *2.

Notes

- Refer to 4-14 "DECO/ENCO Instruction" for details.

4-3 Superimposing Primary Screens

If the PC specifies a Primary Screen whose attribute is "6", while the I.O.P. is displaying a Primary Screen whose attribute is "1", 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").

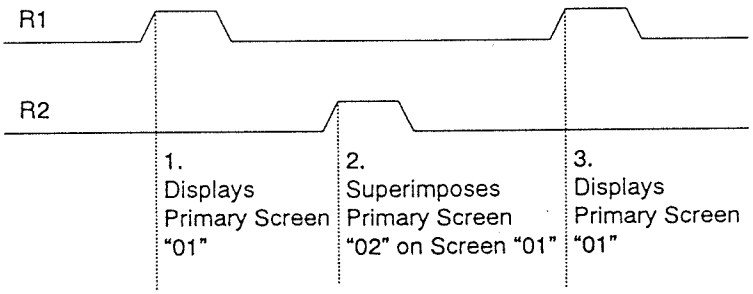
Time chart

Contact Communication Mode

When using internal relays for Primary Screens: R0 to R1F

R1: Primary Screen number "00" (Primary Screen)

R2: Primary Screen number "02" (Primary Screen to be superimposed)



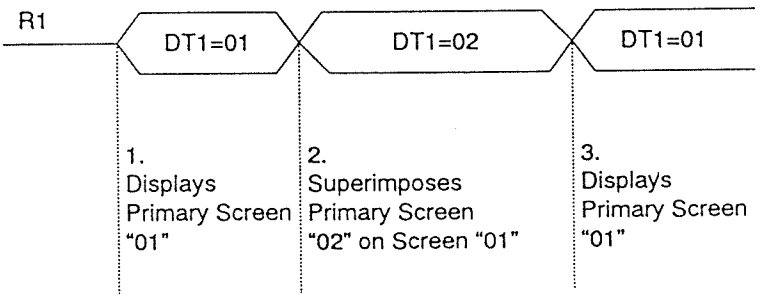
1. Displays Primary Screen "01"
2. Superimposes Primary Screen "02" on Screen "01"
3. Displays Primary Screen "01"

Data Communication Mode

When DT1 is used as the register for specifying the Primary Screen number

DT1: "01" (Primary Screen)

"02" (Primary Screen to be superimposed)



1 Displays Primary Screen "01"

2 Superimposes Primary Screen "02" on Screen "01"

3 Displays Primary Screen "01"

4-4 Receiving Key Codes

When You Choose the Contact Communication Mode: Ladder CPU

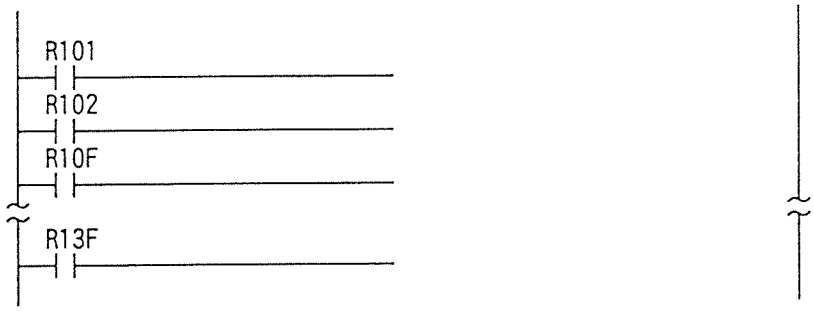
Each key (except the PAUSE key) has an assigned Key Code. The assignment is made when you edit the screens on a personal computer.
If you choose the Contact Communication Mode, you must assign the internal relay's address for the Key Codes from the I.O.P. screen. Each Key Code will have a corresponding bit in an internal relay .
When a key is pressed on the I.O.P., a corresponding bit in an internal relay will be activated.

Postulate

Internal relays for Key Codes: WR10 to WR13 (4 words)
(R100 to R13F)

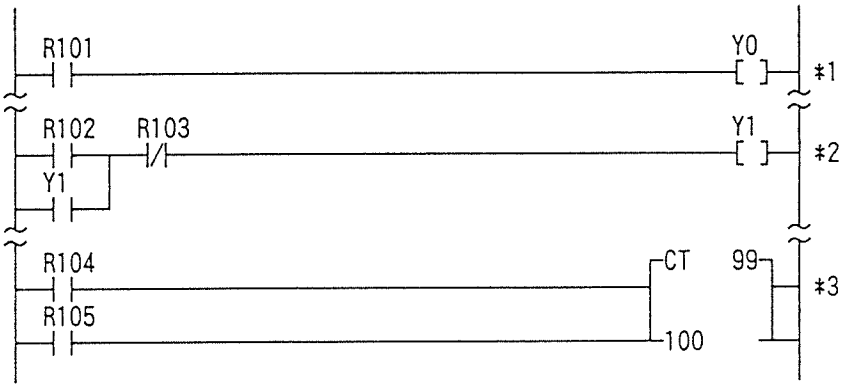
Key Code 01 corresponds to R101
Key Code 0F corresponds to R10F
Key Code 10 corresponds to R110
Key Code 1F corresponds to R11F
Key Code 2F corresponds to R12F
Key Code 3F corresponds to R13F

Programming Example 1



R101: ON when the key whose code is "01" is pressed.
R102: ON when the key whose code is "02" is pressed.
R10F: ON when the key whose code is "0F" is pressed.
R13F: ON when the key whose code is "3F" is pressed.
* The ON state is maintained only while the key is pressed.

Programming Example 2



‡1 When the key, whose code is "01", is pressed on the I.O.P., R101 will be turned ON. Then, Y0 will be ON while R101 is ON.

‡2 When the key, whose code is "02", is pressed on the I.O.P., R102 will be turned ON. Then, Y1 is turned ON. In this program, Y1 will remain ON. When the key, whose code is "03", is pressed on the I.O.P., R103 will be turned OFF. Then, Y1 will be turned OFF.

‡3 When the key, whose code is "04", is pressed on the I.O.P., R104 will be turned ON. Then, the counter "CT0" is counted as one. When the key, whose code is "05", is pressed on the I.O.P., R105 will be turned ON and this clears the counter.

When You Choose the Data Communication Mode: Ladder CPU

In the Data Communication Mode, when a key is pressed on the I.O.P., the corresponding Key Code will be stored in the Key Data Area you previously specified. At the same time the KD-STROB bit will be turned ON. When the KD-STROB bit goes ON, the PC should read the Key Data stored in the PC data register.
KD-STROB will remain ON only while the key is pressed.

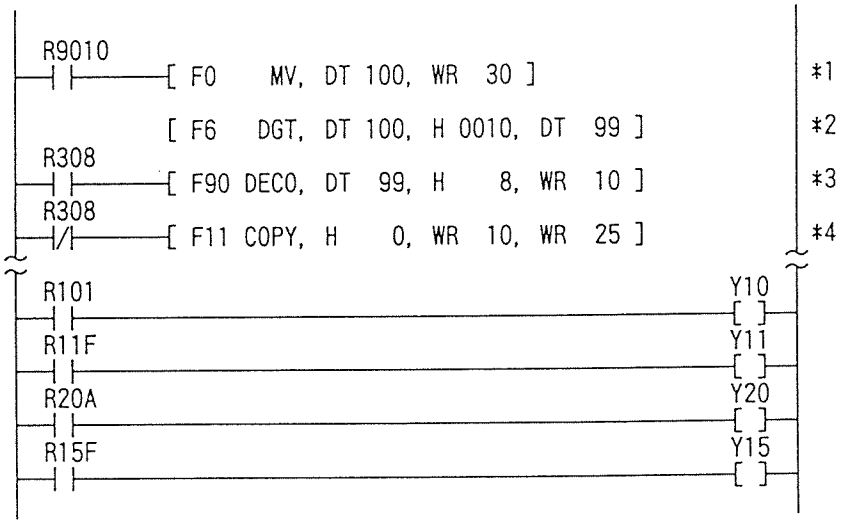
Programming Example

Postulate

Output Area Starting address: DT100
The internal relay area corresponding to the Key Data:
WR10 to WR25 (16 words)
(R100 to R25F) for 255 Key Data

Key Code Area

Data register	Bit contents F E D C B A 9 8 7 6 5 4 3 2 1 0	Data
DT 100	BT RCH RCC PAUSE KD STROB KD7 KD6 KD5 KD4 KD3 KD2 KD1 KD0	Control Data 2
	Control Data 2 / Key Data	Key Data



‡1 Copies the contents of DT100 to WR30 (R300 to R30F).
* KD-STROB is converted to R308.
‡2 Stores Key Data (KD7 to KD0) in DT99.
‡3 While the KD-STROB bit is ON, the DECO instruction is executed.
The resulting Key Data will be reflected in R100 to R15F.
‡4 When the KD-STROB bit is OFF, all of the areas specified in DECO instruction above will be OFF.

R101: ON when the key whose code is "01" is pressed.
R11F: ON when the key whose code is "1F" is pressed.
R20A: ON when the key whose code is "AA" is pressed.
R25F: ON when the key whose code is "FF" is pressed.

Cautions

- If you don't execute the code line ‡4 , once the internal relays are turned ON they will stay ON, even if the KD-STROB turns OFF. With this line of code, you can turn OFF the corresponding internal relays when KD-STROB turns OFF.
The areas to be turned OFF are the internal relays specified in ‡3 and area.

Notes

- Refer to 4-14 "DECO/ENCO Instruction" for details of the DECO instruction.

4-5 Displaying External Data

When You Have Chosen HEX Data: Ladder CPU

The choice of communication mode does not affect the programming.
You must use HEX data for the Displayable External Data if you chose "HEX Data" when setting the DIP switches.
If a piece of Displayable External Data is stored in the PC's allocated data register, it will be sent to the I.O.P.'s Displayable External Buffer automatically and then the I.O.P. will display the data.
No handshaking is need to display External Data.

The characters displayed on the I.O.P. and the HEX data for each

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)

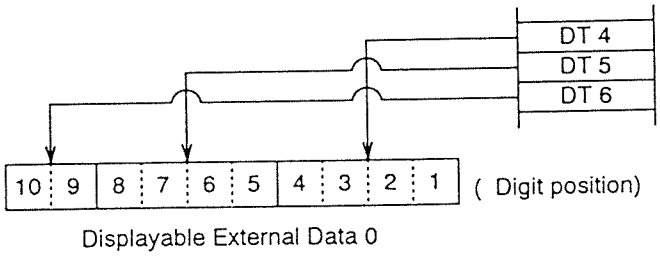
Programming Example 1

Postulate

Basic Area Starting address: DT0
Displayable External Data Area: DT3 to DT15
Leading zero suppression specification: DT3
Displayable External Data stored in Buffer 0: DT 4 to DT 6
Displayable External Data stored in Buffer 1: DT 7 to DT 9
Displayable External Data stored in Buffer 2: DT10 to DT12
Displayable External Data stored in Buffer 3: DT13 to DT15

Data register for Displayable External Data:DT4 to DT15

Data register	Bit contents F E D C B A 9 8		7 6 5 4	3 2 1 0	Data
DT 4	Digit 4	Digit 3	Digit 2	Digit 1	
DT 5	Digit 8	Digit 7	Digit 6	Digit 5	Displayable External Data stored in Buffer 0
DT 6	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮
DT 13	Digit 4	Digit 3	Digit 2	Digit 1	
DT 14	Digit 8	Digit 7	Digit 6	Digit 5	Displayable External Data stored in Buffer 3
DT 15	(not used)	(not used)	Digit 10	Digit 9	



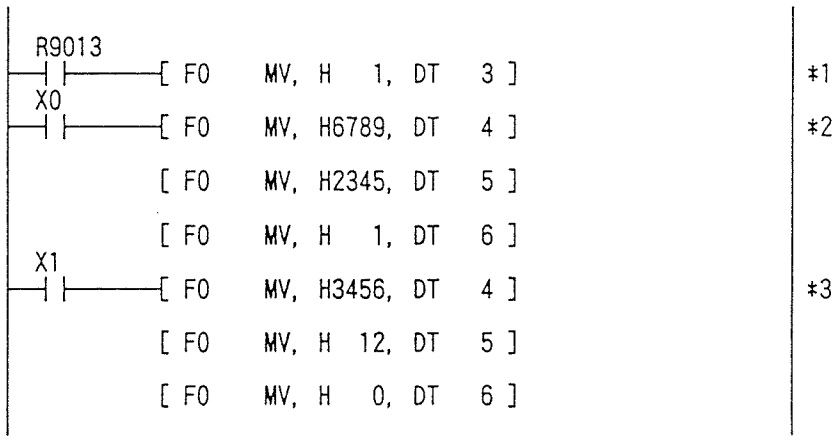
DT3: Leading zero suppression flag

Each character in the Displayable External Data Buffer corresponds to the suppression flag bits as follows.

Suppress a leading zero in this position: 1=yes, 0=no

Leading Zero Suppression Flag:DT3

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Buffer	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0



‡1 R9013 (Initial pulse(ON) relay): Specifies suppression of leading zeroes for one scan.

‡2 When external input relay X0 is ON, the data stored in DT4 thru DT6 is sent to the Displayable External Data Buffer 0 in the I.O.P.. The I.O.P. will display the data on the screen.

In this case, " 123456789" will be displayed by the I.O.P..

‡3 When external input relay X1 is ON, the data stored in DT4 thru DT6 is sent to the Displayable External Data Buffer 0 in the I.O.P.. The I.O.P. will display the data on the screen.

In this case, " 123456" will be displayed by the I.O.P..

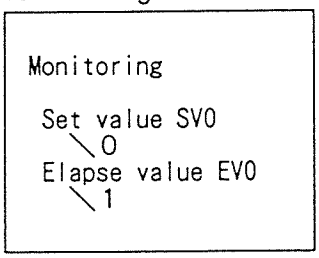
Programming Example 2

Program for displaying the preset value and elapsed value of the PC timer.

Postulate

The timer to be monitored: T0 (set value = SV0, elapsed value = EV0)
Displayable External Data Buffer: No. 0 and No. 1
Basic Area Starting address: DT0
Displayable External Data Area: DT3 to DT15
Leading zero suppression specifications: DT3
Displayable External Data for buffer 0: DT4 to DT6
Displayable External Data for buffer 1: DT7 to DT9

IOP Message Screen



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

Function Key

F1	F2	F3	F4

*1 R9013 (Initial pulse(ON) relay): Specifies the suppression of leading zeroes for one scan. Bits 0 and 1 are turned ON. So, define DT3 = 03(Hex)

*2 While the data which the I.O.P. can display is BCD data, the values for SV0 and EV0 are stored as BIN data. Therefore, the BIN data must first be converted to BCD data. Then store the BCD data in the data registers.
Because SV0 and EV0 contain 4-digit data, the 4 rightmost digits are filled with the data. Therefore, you must also specify leading zero suppression for this data.

Cautions

T0 (No.0) must be previously set-up as the timer by the program.

In the program above, the data in DT5, DT6 and DT8, DT9 won't be overwritten.
If you want to display other data which is larger than 4-digits via Buffer 0 and 1, you must clear DT5, DT6, DT8 and DT9.

Advanced Programming

Add decimal points to the elapsed value displayed on the screen with the Programming Example.

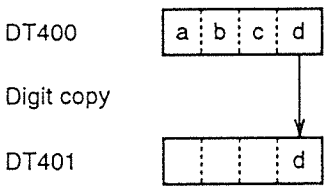
Postulate

Timer: TX0 (0.1 sec. timer)

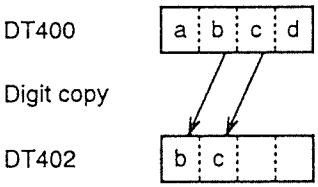
```
R9013
 ┤├──────[ F0    MV, H    2, DT    3 ]
R9010
 ┤├──────[ F80   BCD, EV   0, DT  400 ]                          ‡1
       [ F6    DGT, DT  400, H     0, DT  401 ]                 ‡2
       [ F6    DGT, DT  400, H   211, DT  402 ]                 ‡3
       [ F0     MV, H    A0, DT  403 ]                          ‡4
       [ F66   WOR, DT  401, DT  402, DT  404 ]                 ‡5
       [ F66   WOR, DT  404, DT  403, DT    7 ]                 ‡6
       [ F6    DGT, DT  400, H     3, DT    8 ]                 ‡7
```

‡1 Converts the value of EV0 to BCD data and then stores the results in DT400.
‡2 The data for the 1st digit (the leftmost digit) of DT400 is copied to the 1st digit of DT401.
‡3 The data for the 2nd and 3rd digits of DT400 is copied to the 3rd and 4th digits of DT402.
‡4 Hex "A" is stored in the 2nd digit of DT403 to be used for the decimal point.
‡5 The data in DT401 and DT402 is logically ORed and the result is stored in DT404.
‡6 The data in DT404 and DT403 is logically ORed and the result is stored in DT7.
‡7 The data in 4th digit of DT400 is stored in the 1st digit of DT8.
(See the next page for a diagram of the digit manipulations)

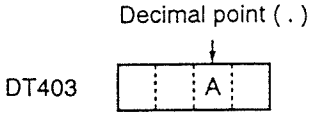
*2[F6 DGT, DT 400, H 0, DT 401]



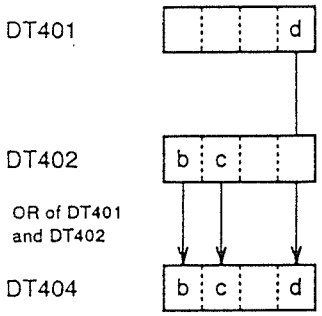
*3[F6 DGT, DT 400, H 211, DT 402]



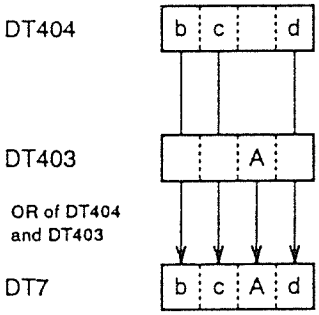
*4[F0 MV, H A0, DT 403]



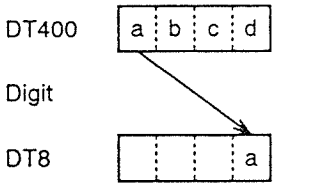
*5[F66 WOR, DT 401, DT 402, DT 404]



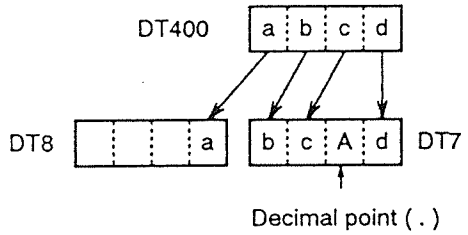
*6[F6 WOR, DT 404, DT 403, DT 7]



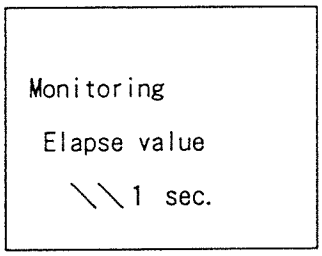
*7[F6 DGT, DT 400, H 3, DT 8]



The results of *2 to *7 are shown below.



IOP Message Screen



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

Function Key

F1	F2	F3	F4

When You Have Chosen ASCII Data : Ladder CPU

The choice of communication mode does not affect the programming.
You must use ASCII data for the Displayable External Data if you chose "ASCII Data" when setting the DIP switches. The range of ASCII codes that the I.O.P. Model 22 can display is limited to the characters with codes from HEX 20 to 7A.
If a piece of Displayable External Data is stored in the PC's allocated data register, it will be sent to the I.O.P.'s Displayable External Buffer automatically and then the I.O.P. will display the data.
No handshaking is need to display External Data.

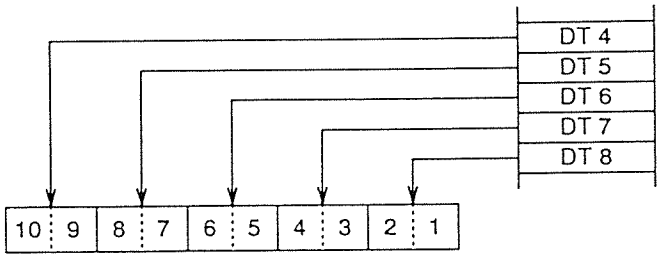
Programming Example

Postulate

Basic Area Starting address: DT0
Displayable External Data Area: DT3 to DT23
- Leading zero suppression specification: DT3
- Displayable External Data stored in Buffer 0: DT4 to DT8
- Displayable External Data stored in Buffer 1: DT9 to DT13
- Displayable External Data stored in Buffer 2: DT14 to DT18
- Displayable External Data stored in Buffer 3: DT19 to DT23

Data register for Displayable External Data:DT4 to DT23

Data register	Bit contents F E D C B A 9 8	Bit contents 7 6 5 4 3 2 1 0	Data
DT 4	Digit 9	Digit 10	
DT 5	Digit 7	Digit 8	
DT 6	Digit 5	Digit 6	
DT 7	Digit 3	Digit 4	Displayable External Data stored in Buffer 0
DT 8	Digit 1	Digit 2	
⋮	⋮	⋮	⋮
DT 19	Digit 9	Digit 10	
DT 20	Digit 7	Digit 8	
DT 21	Digit 5	Digit 6	
DT 22	Digit 3	Digit 4	Displayable External Data stored in the Buffer 3
DT 23	Digit 1	Digit 2	

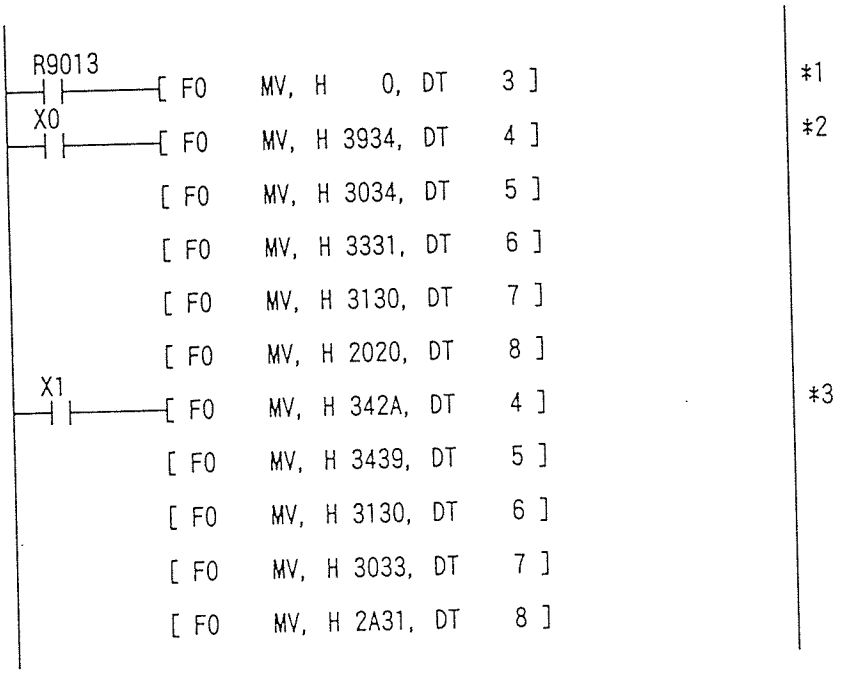


Displayable External Data 0

DT3: Leading zero suppression flag
Each character in the Displayable External Data Buffer corresponds to the suppression flag bits as follows.
Suppress a leading zero in this position: 1=yes, 0=no

Leading Zero Suppression Flag:DT3

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Buffer	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0



‡1 R9013 (Initial pulse(ON) relay): Specifies suppression of leading zeroes for one scan.

‡2 When external input relay X0 is ON, the data stored in DT4 to DT8 is sent to the Displayable External Data Buffer 0 in the I.O.P. Then he I.O.P. will display the data on the screen.
In this case, "49401301 " will be displayed by the I.O.P.

‡3 When external input relay X1 is ON, the data stored in DT4 to DT8 is sent to the Displayable External Data Buffer 0 in the I.O.P. Then the I.O.P. will display the data on the screen.
In this case, "*49401301*" will be displayed by the I.O.P.

Cautions

- The range of ASCII codes that the I.O.P. Model 22 can display is limited to the characters with codes from Hex 20 to 7E.

Advanced Programming

I.O.P. display of ASCII data read with a bar-code reader

1. I.O.P. Environments

Basic Area Starting address: DT0

Displayable External Data Area: DT3 to DT23

Leading zero suppression specification: DT3

Displayable External Data stored in Buffer 0: DT4 to DT8

Displayable External Data stored in Buffer 1: DT9 to DT13

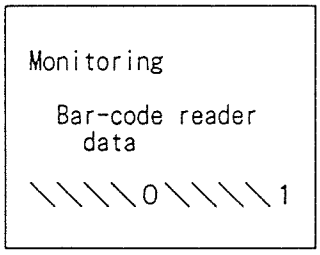
Displayable External Data stored in Buffer 2: DT14 to DT18

Displayable External Data stored in Buffer 3: DT19 to DT23

Displays External Data in ASCII.

2. I.O.P. Message Screen

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 Process Unit

Slot 1 : Input Unit (16 points)

Slot 2 : Computer Communication Unit (C.C.U.)

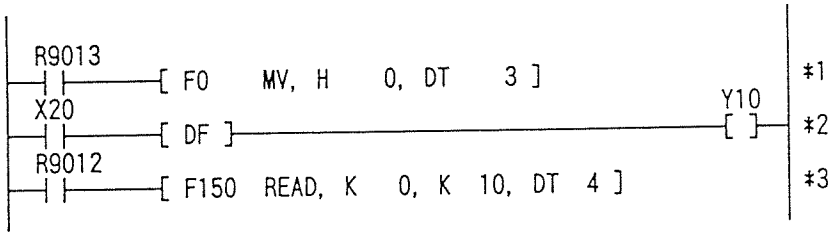
4- I/O Shared Memory

	Y10	DPU	Sends the bar-code reader asynchronous command
I/O	X20	Input	Asynchronous sensor for bar-code reader
Memory Shared	0 to 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

Ladder CPU Programming example



‡1 R9013 (Initial pulse(ON) relay): Specifies the suppression of leading zeroes for one scan.
‡2 When the asynchronous sensor is turned ON, it sends the command to the DPU.
‡3 10 words of ASCII data (20 bytes) from the shared memory will be stored in DT4 to DT13.

DPU Programming 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.

In the above program, the I.O.P. can display a maximum of 20 ASCII characters.

4-6 Receiving Descriptive External Data: Ladder CPU

The choice of communication mode does not affect the programming.
If External Data is entered on the I.O.P., it will be stored in the corresponding Descriptive External Data Buffer, then the data will be automatically sent to the previously allocated data register in the PC. No handshaking is need to receive Descriptive External Data.

When the data is first entered from the I.O.P., the Descriptive External Data Flag allocated for that data register is turned ON. When the flag goes ON, the PC can read the data.

HEX data you can use as Descriptive External Data

Character entered on I.O.P.	0	1	2	3	4	5	6	7	8	9	.	(space)
HEX data (stored in a PC)	0	1	2	3	4	5	6	7	8	9	A	0

Postulate

Output Area Starting address: DT100
Descriptive External Data Area: DT101 to DT149
Descriptive External Data Flag: DT101 (Corresponds to WR31)
Descriptive External Data stored in Buffer 0: DT102 to DT104
Descriptive External Data stored in Buffer 1: DT105 to DT107
Descriptive External Data stored in Buffer 2: DT108 to DT110
Descriptive External Data stored in Buffer F: DT147 to DT149

Cautions

- 50 words area automatically allocated as the Output Area when you specify the starting address. However, any portion of the area you don't use (the area for the buffer which in not assigned for data storage) can be freely assigned to other devices.
- Each bit of DT101 is used as a flag corresponding to a Descriptive External Data Buffer as shown in the table below.
  When the ENTER key is pressed after completing the data entry on the I.O.P., the flag corresponding to the buffer number where the data is stored will be turned ON, then kept ON for more than 1 scan. Therefore, when the flag goes on, the PC can read the data stored in the corresponding data register.

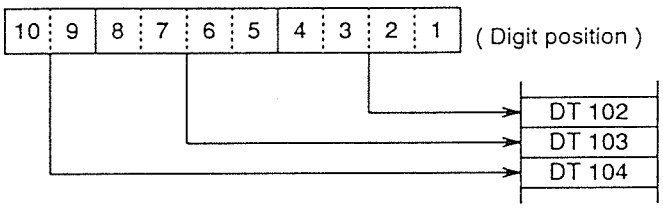
Descriptive External Data Flag: DT101

Bit	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Buffer	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0

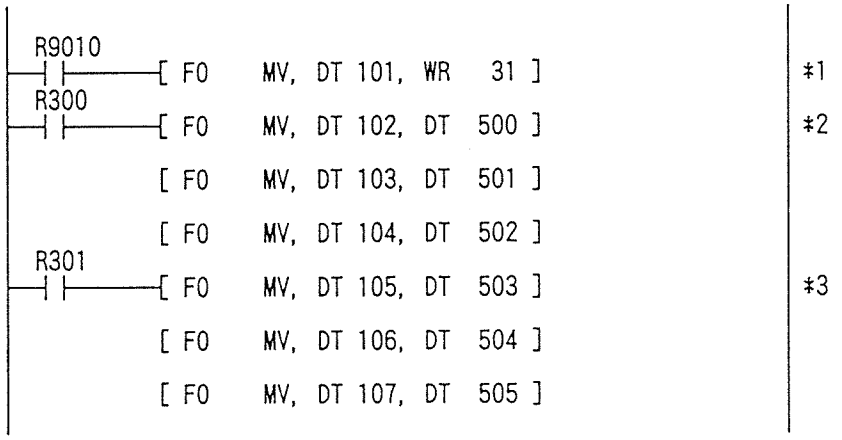
Data register for Descriptive External Data: DT102 to DT149

Data register	Bit contents F E D C B A 9 8 7 6 5 4 3 2 1 0				Data
DT 102	Digit 4	Digit 3	Digit 2	Digit 1	
DT 103	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 0
DT 104	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮
DT 111	Digit 4	Digit 3	Digit 2	Digit 1	
DT 112	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 3
DT 113	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮
DT 123	Digit 4	Digit 3	Digit 2	Digit 1	
DT 124	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer 7
DT 125	(not used)	(not used)	Digit 10	Digit 9	
⋮	⋮	⋮	⋮	⋮	⋮
DT 147	Digit 4	Digit 3	Digit 2	Digit 1	
DT 148	Digit 8	Digit 7	Digit 6	Digit 5	Descriptive External Data stored in Buffer F
DT 149	(not used)	(not used)	Digit 10	Digit 9	

Descriptive External Data 0



Programming Example 1



‡1 R9013 (Initial pulse(ON) relay): Corresponds to the bit contents of DT101 (flags) to WR31 (R310 to R31F) of the internal relays.

‡2 When data is stored in Buffer 0, R310 is turned ON and then the Data in DT102 to DT104 is stored in DT500 to DT502 respectively.

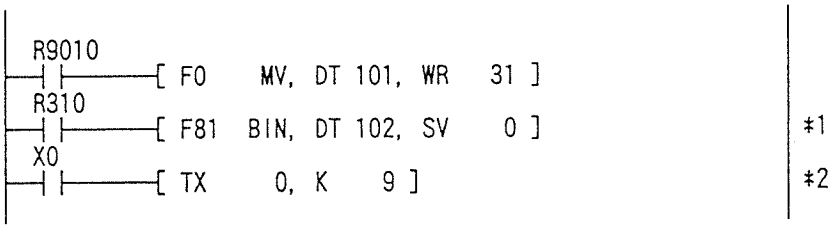
‡3 When data is stored in Buffer 1, R311 is turned ON and then the Data in DT105 to DT107 is stored in DT503 to DT505 respectively.

Programming Example 2

Program to set the timer on the I.O.P. screen.

Postulate

Timer to be set: T0 (set value: SV0)
Descriptive External Data Buffer number 0 is used.
The Output Area Starting address: DT100
Descriptive External Data Flag: DT101 (Corresponds to WR31)
Descriptive External Data Area for "0": DT102 to DT104



*1 Data from the I.O.P. is sent as BCD data.
Because data is processed in the PC as BIN data, you must convert the BCD data to BIN data. The set value for the timer is stored as 4-digit data. So, 4-digits of data must be converted to binary and stored at SV0 (the memory location for T0).

*2 When external input relay X0 is ON, the set value is overwritten by the data entered from the I.O.P..

4-7 Displaying the Manual Screen

Displaying the Manual Screen without LINE Specification

The Manual Screen will be displayed when MS is turned ON, and cancelled when it is truned OFF. MS is the bit 2 of Control Data 1.
The LINE displayed as the first line of the Manual Screen will be the LINE where the cursor last appeared.

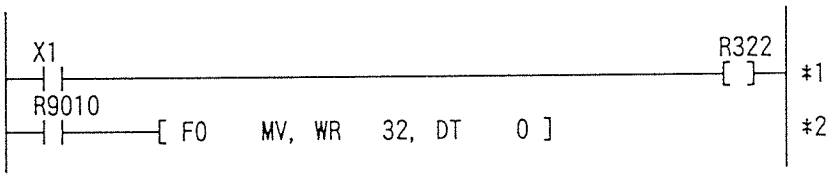
Programming Example

When external input relay X1 is ON, MS will be turned ON.
When external input relay X1 is OFF, MS will be turned OFF.

Postulate

Basic Area Starting address : DT0
Basic Data Area : DT0 to DT2
Control Data 1 : DT0
DT0 corresponds to WR32

Data register	Bit contents F E D C B A 9 8	7	6	5	4	3	2	1	0	Data
DT 0	(not used) (not used)	LED4	LED3	LED2	LED1	BZ	MS	HD	CD	Control Data 1



‡1 Controls the Manual Screen Display ON/OFF.
MS is changed by writing to R322.

‡2 When R9010 (Normally ON relay) is turned on, the contents of WR32 (R320 to R32F) will be stored in DT0. This operation sets the bit positions of data register(DT0) to match those of internal relay(WR32).

Displaying the Manual Screen with the LINE Specification

If you want to display the Manual Screen and specify the LINE number to appear on the first line of the Manual Screen, use the 3rd word above the Basic Data starting address (DT2).

Programming Example

If X2 is ON, display the Manual Screen starting at LINE 1.
If X3 is ON, display the Manual Screen starting at LINE 16.
If X4 is ON, display the Manual Screen without a LINE specification.
When external input relay X2, X3 or X4 is OFF, it will cancel the display of the Manual Screen.

Postulate

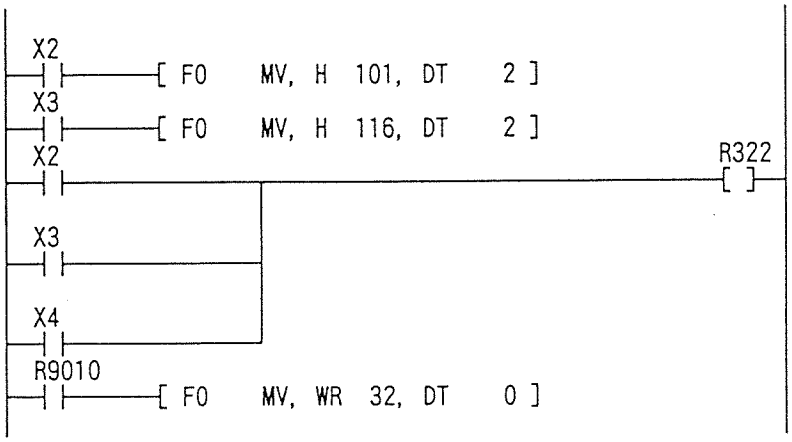
Basic Area Starting address : DT0
Basic Data Area : DT0 to DT2 (3 words)
Control Data 1 : DT0 (corresponds to WR32)

Basic Area: DT0 to DT2

Data register	Bit contents F E D C B A 9 8		7 6 5 4 3 2 1 0	Data
DT 0	(not used)	(not used)	LED4 LED3 LED2 LED1 BZ MS HD CD	Control Data 1
DT 1	(not used)	(not used)	Primary Screen number	Primary Screen number
DT 2	(not used)	(not used) ML	Manual Screen LINE spec.	Manual Screen

Store the line number (Hex 0 to Hex 18) in the Manual Screen Line Spec. shown in the table above. After specifying the LINE number, set "ML" bit ON and then set the "MS" bit to begin the I.O.P. display of the Manual Screen from a specific LINE.

"ML" is the enabling flag for LINE spec.
1: The I.O.P. will display the Manual Screen starting at a specific LINE.
0: The I.O.P. will display the Manual Screen starting with the LINE where the cursor was last left.



When external input relay X2 is ON, H101 will be stored in DT2 to specify LINE 1 and set the enable flag.
When external input relay X3 is ON, H116 will be stored in DT2 to specify LINE 16 and set the enable flag.
When external input relay X2, X3 or X4 is ON, WR32 is turned ON to display the Manual Screen.

4-8 Superimposing Characters

Superimposing characters: Ladder CPU

Arbitrary characters stored in a previously allocated data register can be superimposed at a specified position. The superimposition can be executed with the CD and RCC flags.
You cannot superimpose double-height characters.

Superimposed characters should be specified within the range of character codes listed in Appendix D and E.
The superimposition operation is done in units of one line.

Cautions

- 21 words are automatically assigned in the data registers. If you don't need the superimposition feature, you can assign the area to other devices. In this case, do not use the CD and RCC flags.
- 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 "0000" in that position when you create the program.
- When you superimpose normal size character, the data registers following the last register used for the superimposed characters should be filled with "0000".
- Character Superimposition may not done if you try to superimpose one size of character on top of a different sized character, or when the position a character changes.
- 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.

Programming Example

Program for superimposing "STOP" (half-width)on the first line of the I.O.P. screen.

Postulate

Basic Area Starting address: DT0

DT0 corresponds to WR32. (the CD flag: R320)

Output Area Starting address: DT100

DT100 corresponds to WR30. (the RCC flag: R30B)

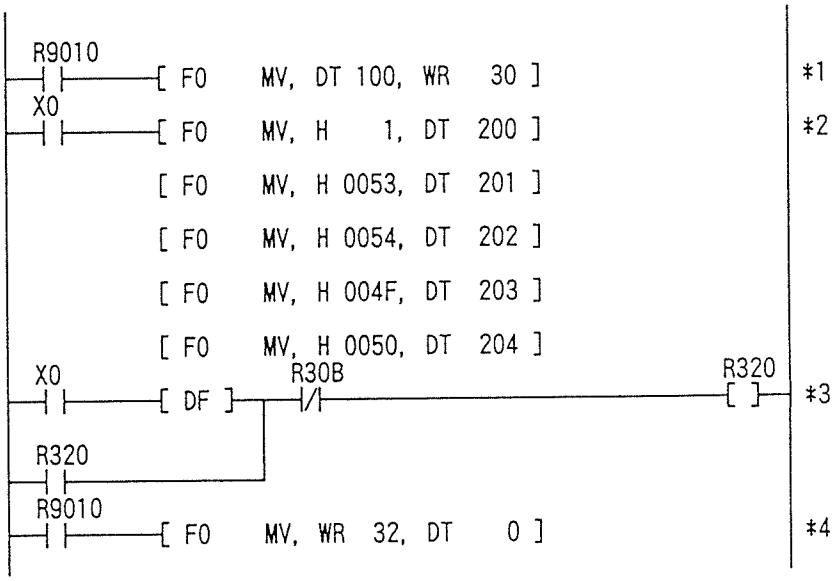
Data register	Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0	Data
DT 0	(not used) (not used)	LED4 LED3 LED2 LED1 BZ MS HD CD	Control Data 1
DT 100	BT RCH RCC PAUSE KD STROB	KD7 KD6 KD5 KD4 KD3 KD2 KD1 KD0	Control Data 2
	Control Data 2	Key Data	Key Data

Superimposed Character Starting address: DT200

Data register for specifying the line number : DT200

Data registers for specifying the character to be superimposed : DT201 to DT220

I.O.P. screen	LINE	DT 200																	
	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
DT (Character Specification)		DT 201	DT 202	DT 203	DT 204	DT 205	DT 206	DT 207	DT 208	DT 209	DT 210	DT 211	DT 212	DT 213	DT 214	DT 215	DT 216	DT 217	DT 218	DT 219	DT 220



‡1 When R9010 (Normally ON relay) is turned ON, the contents of DT100 are always copied to WR30(R300 to R30F). The "RCC" flag corresponds to "R30B".

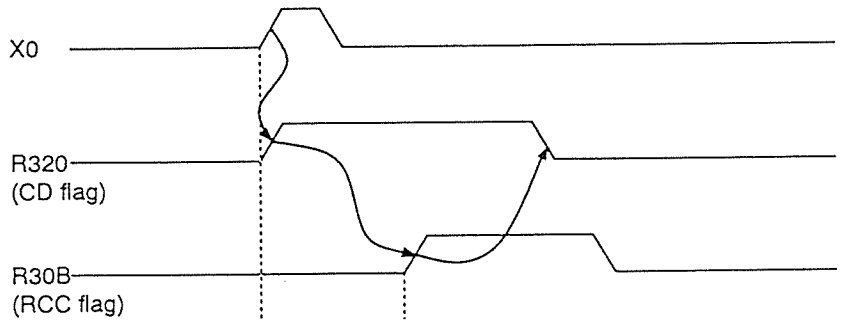
‡2 When external input relay X0 is turned ON, the word "STOP" (in half-width characters) is superimposed on the first line of the I.O.P.:

* Hex 1 is copied to DT200. 1st line is specified.
* Hex 0053 is copied to DT201. "S"
* Hex 0054 is copied to DT202. "T"
* Hex 004F is copied to DT203. "O"
* Hex 0050 is copied to DT201. "P"

These characters are displayed on the first line of the I.O.P. screen starting at the left side.

‡3 When external input relay X0 is turned ON, R320 is turned ON.

‡4 When R9010 (Normally ON relay) is turned ON, the contents of WR32(R320 to R32F) are always copied to DT0. The "CD" flag corresponds to "R320".



With the conditions call for superimposing characters, the CD flag will be turned ON. When this signal is sent to the I.O.P., superimposition will begin.

With CD flag ON, the superimposition will begin according to the data contained in superimposition data registers.

When the superimposition is complete, the RCC flag will be turned ON. When this flag is ON, the program should turn the CD flag OFF.

4-9 Highlighting Characters

Program for highlighting characters: Ladder CPU.

The characters at the position which is specified in the corresponding data register of the PC will be highlighted.

For the operation, HD and RCH flags are used.

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

RCH : When the operation is complete, the RCH flag is turned ON.

Cautions

- 16 words are automatically assigned in the data registers. If you don't need the superimposition feature, you can assign the area to other devices. In this case, do not use the HD and RCH flags.
- 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 Key Access Screen, you cannot highlight characters.
- If there is no character at the position you specify, the space will be highlighted.
- When you highlight a normal size character, both bits corresponding to that character should be specified. If the character position is changed, the highlight may not be performed successfully.
- You cannot highlight double-height character.
- When a new screen is displayed on the I.O.P., the highlight operation will be cleared.

Programming Example

When X3 is ON, the whole of the first line will be highlighted.
When X4 is ON, half of the I.O.P. screen (lines 1 to 4) will be highlighted.

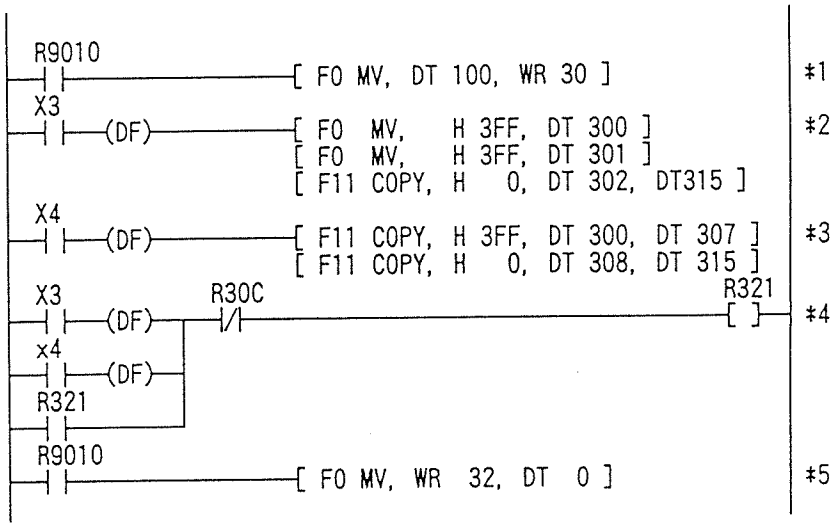
Postulate

Basic Area Starting address: DT0
DT0 corresponds to WR32. (the flag HD: R321)
Output Area Starting address: DT100
DT100 corresponds to WR30. (the flag RCC: R30C)

Data register	Bit contents F E D C B A 9 8	7 6 5 4 3 2 1 0	Data
DT 0	. (not used) (not used)	LED4 LED3 LED2 LED1 BZ MS HD CD	Control Data 1
DT 100	BT RCH RCC PAUSE KD STROB	KD7 KD6 KD5 KD4 KD3 KD2 KD1 KD0	Control Data 2
	Control Data 2	Key Data	Key Data

Superimposed Character Starting address: DT300

	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			DT301					DT300		
	2			DT303					DT302		
	3			DT305					DT304		
	4			DT307					DT306		
	5			DT309					DT308		
	6			DT311					DT310		
	7			DT313					DT312		
	8			DT315					DT314		
DT bit position		9 8	7 6	5 4	3 2	1 0	9 8	7 6	5 4	3 2	1 0



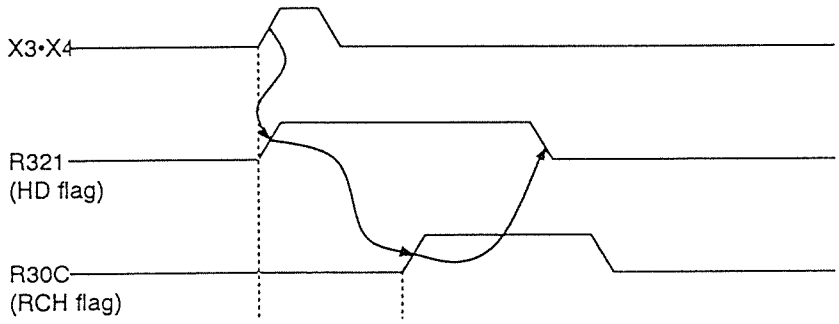
*1 When R9010 (Normally ON relay) is turned ON, the contents of DT100 are always copied to WR30(R300 to R30F). The "RCC" flag corresponds to "R30C".

*2 Specify highlighting for the first line.
Specify a 1 in each bit from bit 0 to bit 9 of DT300 and DT301.
Specify a 0 in each bit from bit 0 to bit 9 of DR302 to DT315.

*3 Specify highlighting for half of the I.O.P. screen (lines 1 to 4).
Specify a 1 in each bit from bit 0 to bit 9 of DT300 to DT307.
Specify a 0 in each bit from bit 0 to bit 9 of DT308 to DT315.

*4 Handshaking for highlighting characters.

*5 When R9010 (Normally ON relay)is turned ON, the contents of WR32(R320 to R32F) are always copied to DT0. The "HD" flag corresponds to "R321".



With the conditions call for highlighting characters, the HD flag will be turned ON. When this signal is sent to the I.O.P., highlighting will begin.
With HD flag ON, the highlighting will begin according to the data contained in highlight data registers.
When the superimposition is complete, the RCH flag will be turned ON. When this flag is ON, the program should turn the HD flag OFF.

4-10 Controlling LEDs

LED control: Ladder CPU

The ON/OFF condition of 4 LEDs (AUTO LED, MAN. LED, START LED and STOP LED) is controlled in the Basic Area of the data registers.
When a bit is turned ON, the corresponding LED will be turned ON.

Programming Example

When Y0 is ON, the LED1 flag will be turned ON.
When Y1 is ON, the LED2 flag will be turned ON.
When Y2 is ON, the LED3 flag will be turned ON.
When Y3 is ON, the LED4 flag will be turned ON.
* When the LED(n) flag is ON, the corresponding I.O.P. LED(n) will be turned ON.

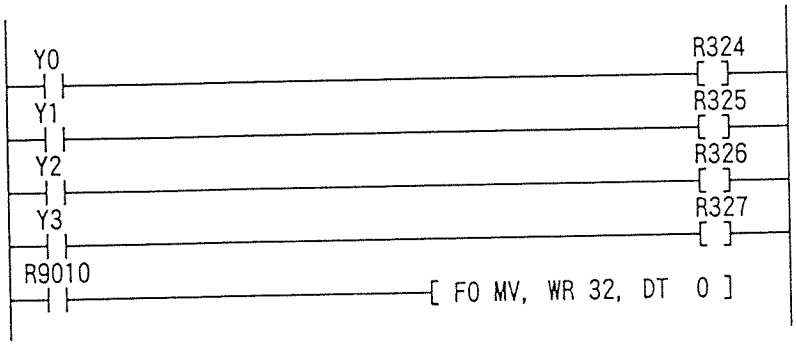
Postulate

Basic Area Starting address: DT0
Basic Data Area: DT0 to DT2 (3 words)
Control Data 1: DT0 (corresponds to WR32)
LED1: R324
LED2: R325
LED3: R326
LED4: R327

Data register	Bit contents F E D C B A 9 8	7	6	5	4	3	2	1	0	Data
DT 0	(not used) (not used)	LED4	LED3	LED2	LED1	BZ	MS	HD	CD	Control Data 1

LED 1 flag : AUTO LED
LED 2 flag : MAN LED
LED 3 flag : START LED
LED 4 flag : STOP LED

Controls the ON/OFF condition of the LED flags to turn ON/OFF the corresponding I.O.P. LED.
The LED1 to LED4 flags are activated by R324 to R327 respectively.



When R9010 (A normally ON relay) is turned ON, the contents of WR32 (R320 to R32F) will be stored in DT0. This operation sets the bit positions of data register(DT0) to match those of internal relay(WR32).

4-11 Sounding the Buzzer

Buzzer Control: Ladder CPU

The ON/OFF condition of the BZ flag is controlled in the Basic Area of the data registers. When BZ is turned ON, the I.O.P. will sound the buzzer.

Programming Example

Postulate

Basic Area Starting address: DT0

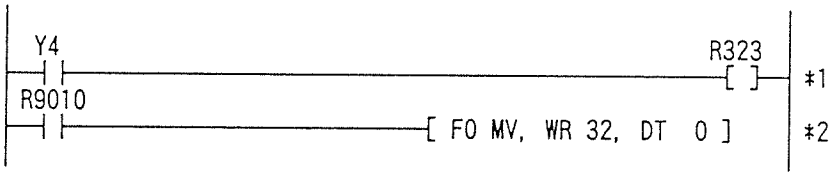
Basic Data Area: DT0 to DT2 (3 words)

Control Data 1: DT0 (corresponds to WR32)

BZ flag: R323

Data register	Bit contents F E D C B A 9 8	7	6	5	4	3	2	1	0	Data
DT 0	(not used) (not used)	LED4	LED3	LED2	LED1	BZ	MS	HD	CD	Control Data 1

When Y4 is ON, the I.O.P. sounds the buzzer. When it is OFF, the buzzer stops sounding.



*1 Controls the ON/OFF condition of BZ to start or stop sounding the buzzer. The BZ flag is activated by R323.

*2 When R9010 (Normally ON relay) is turned ON, the contents of WR32 (R320 to R32F) will be stored in DT0. This operation sets the bit positions of data register(DT0) to match those of internal relay(WR32).

4-12 Receiving the State of the PAUSE Key

Receiving data corresponding to the PAUSE key state : Ladder CPU

The state of the PAUSE key (whether or not the PAUSE key on the I.O.P. is pressed) can be checked in the Basic Area of the data registers.
When the PAUSE key is pressed, the PAUSE flag will be turned ON. With this information, you can control an external device.

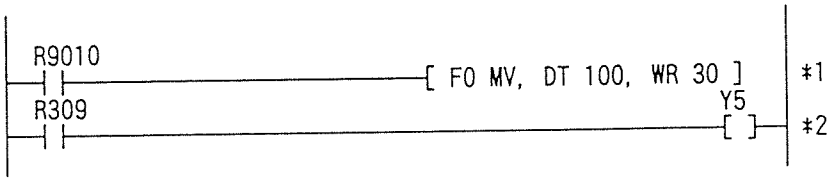
Programming Example

If PAUSE is ON, Output Y5 will be turned on.

Postulate

Output Area Starting address: DT100
Control Data 2 : DT100 (corresponds WR30)
PAUSE flag :R309

Data register	Bit contents F E D C B A 9 8 7 6 5 4 3 2 1 0	Data
DT 100	BT RCH RCC PAUSE KD STROB KD7 KD6 KD5 KD4 KD3 KD2 KD1 KD0	Control Data 2 Key Data
	Control Data 2 / Key Data	



*1 When R9010 (Normally ON relay) is turned ON, the contents of Control Data 2 are copied to WR30 (R300 to R30F).
PAUSE corresponds to R309.

*2 If the PAUSE key is pressed (PAUSE state), R309 will be turned ON. While R309 is ON, Output Y5 will be ON.

To clear the PAUSE state, press the RESET key on the front panel of the I.O.P.

4-13 Detecting a Low Battery Condition

Detecting a Low Battery Condition: Ladder CPU

When the backup battery of the I.O.P. gets low and the weak Backup Battery Indicator is displayed on the I.O.P. screen, the BT flag will be turned ON. This flag can be used to control an external device.
When the operator sees the indicator, they should replace the backup battery with a new one.
The BT flag is located in Control Data 2 in the data registers.

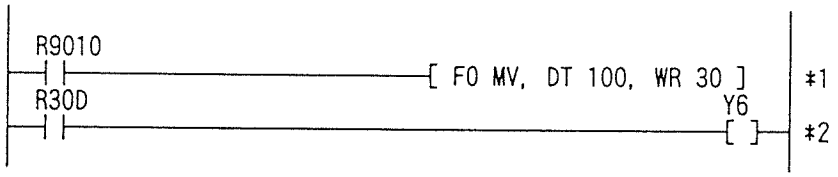
Programming Example

If BT is ON, Output Y6 will be turned ON.

Postulate

Output Area Starting address: DT100
Control Data 2: DT100 (corresponds to WR30)
BT flag : R30D

Data register	Bit contents F E D C B A 9 8 7 6 5 4 3 2 1 0	Data
DT 100	BT RCH RCC PAUSE KD STROB KD7 KD6 KD5 KD4 KD3 KD2 KD1 KD0	Control Data 2
	Control Data 2 / Key Data	Key Data



‡1 When R9010 (Normally ON relay) is turned on, the contents of Control Data 2 are copied to WR30 (R300 to R30F).
The BT flag corresponds to R30D.

‡2 If the backup battery gets low, R30D will be turned ON. While R30D is ON, Output Y6 will be ON.

4-14 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 relay registers.

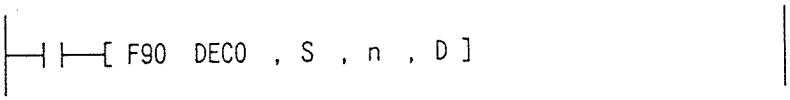
The ENCO instruction (F92/P92) converts bit data (the contact data of internal relay registers) to HEX data (for example Primary Screen numbers).

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 register.

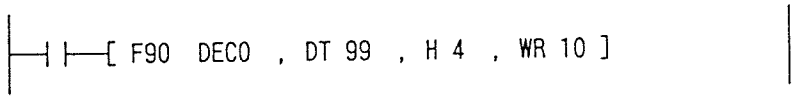
The HEX data is read, and the single bit corresponding to this position is converted to 1. The rest of the bits are set to 0.

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 relay registers (1 word)

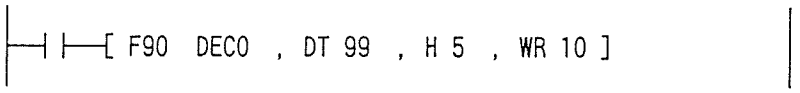


A Key Code, stored in DT99, is converted to the contact data used by the internal relay registers. H4 and WR10 are specified so the 16 internal relay registers (16 bits or 1 word), R100 to R10F, will be accessible.

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 relay registers (2 words)

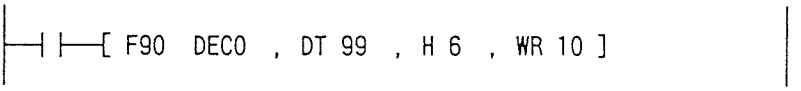


The Key Code stored in DT99 is converted to internal relay register contact data. H5 and WR10 are specified in the program so the 32 internal relay registers (32 bits or 2 words) R100 to R1F will be accessible.

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 relay registers (4 words)

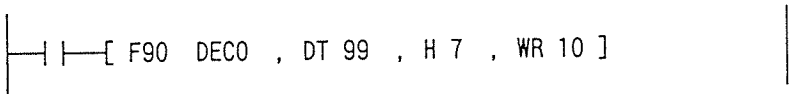


The Key Code stored in DT99 is converted to internal relay register contact data. H6 and WR10 are specified in the program so the 64 internal relay registers (64 bits or 4 words) R100 to R4F will be accessible.

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 relay registers (8 words)

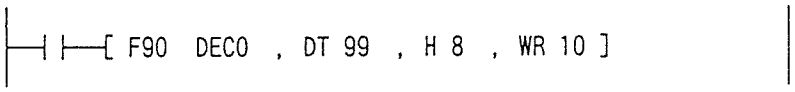


The Key Code stored in DT99 is converted to internal relay register contact data. H7 and WR10 are specified in the program so the 128 internal relay registers (128 bits or 8 words) R100 to R4F will be accessible.

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 relay registers (16 words)



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

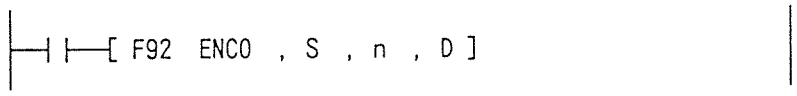
DT99 = 01 R101
DT99 = 0F R10F
DT99 = 1F R11F
DT99 = 2F R12F
DT99 = 3F R13F
DT99 = 4F R14F
DT99 = 5F R15F
DT99 = 6F R16F
DT99 = 7F R17F
DT99 = 8F R18F
DT99 = 9F R19F
DT99 = AF R20F
DT99 = BF R21F
DT99 = CF R22F
DT99 = DF R23F
DT99 = EF R24F
DT99 = FF R25F

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

ENCO Instruction

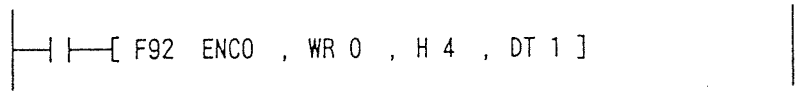
If you include the ENCO instruction (F92/P920) in the code to send Primary Screen Data, the contact data of the internal relay registers can be converted to screen data.
According to the bit information (ON/OFF=1/0) specified, the bit-level contact data is converted to the corresponding HEX data and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

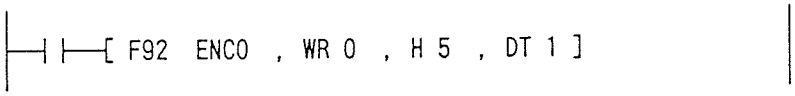


The number of the internal relay register that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 16 bits in WR00, will be stored in DT1.

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 relay registers (2 words)

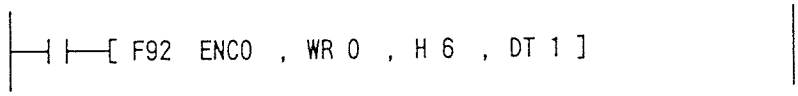


The number of the internal relay register that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 32 bits starting at WR00, will be stored in DT1.

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 relay registers (4 words)

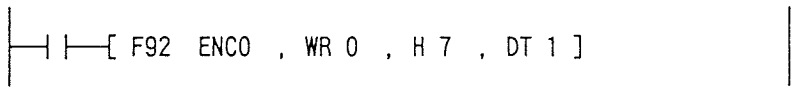


The number of the internal relay register that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 64 bits starting at WR00, will be stored in DT1.

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 relay registers (8 words)

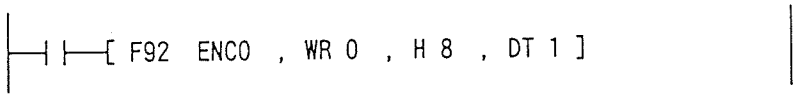


The number of the internal relay register that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 128 bits starting at WR00, will be stored in DT1.

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 relay registers (16 words)



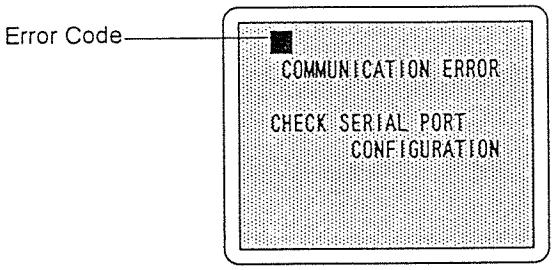
The number of the internal relay register that is on will be stored in the data register specified. In the program, the number of the particular relay which is ON, out of the 256 bits starting at WR00, will be stored in DT1.

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.

4-15 Communication Error

If a communication error occurs, the I.O.P. will display the following screen. The corresponding error code will be displayed in the upper left part of the screen.



Error type	Code (HEX)		Description
Programmable Controller (PC) Application Error	50	Link set error :	A link No. was specified that does not exist.
	51	Simultaneous operating error :	The transmit buffer of the local unit was already full when a command was issued by the other unit.
	52	Transmit disable error :	Cannot transmit to another unit.
	53	Busy error :	Processing for another command when another command was received.
	60	Parameter error:	A code was found without an area specification parameter or a code which cannot be used in the command was found. (X, Y, D, etc.) A code with an illegal function specification parameter (0, 1, 2, etc.) was found.
	61	Data error :	Contact no., Area no., data code format (BCD, hex, etc.), overflow, underflow or range specification error.
	62	Registration error :	Excessive number of registrations or operation in unregistered state. (monitor registration, trace registration, etc.)
	63	Programmable Controller (PC) mode error :	The operating mode of the Programmable Controller (PC) when a command was received does not allow the command to be processed.
	65	Protect error :	A write operation was performed to the program area or to a system register in the memory protect state.
	66	Address error :	Address (program address, absolute address, etc.) data code format (BCD, HEX, etc.), overflow, underflow or range specification error.
	67	Missing data error :	Read data does not exist. (Data was read that was written without a comment registration.)
I.O.P. Application Error	EF	No response error	No response from the PC. (erratic connection)

Notes

- For details of communication error refer to the C.C.U. Tecnical Manual.

Chapter 5

Guide to Advanced PC Programming

Chapter 5 will give you advanced ideas for creating programs for data communiction.

Programmable Controller is abbreviated PC.

5-1 Basic Sample Program

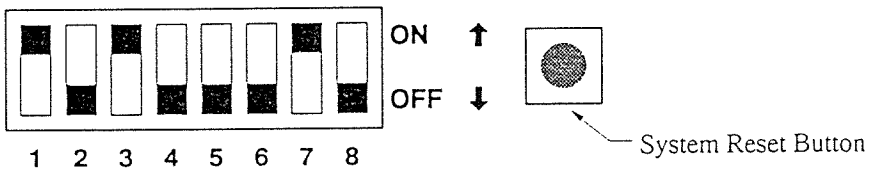
Basic Program Requirements

The sample programs shown in this chapter are all based on the assumption that the PC assignments and I.O.P. options are as follows:

Data Register and Internal Relay Assignments for the I.O.P. 22

	Strating Address	Words Occupied	Area Occupied
Basic Area	DT 0000	16 words	DT 0 to DT 15
Output Area	DT 0100	50 words	DT 100 to DT 149
Character Highlight Area	DT 0300	16 words	DT 300 to DT 315
Character Superimposition Area	DT 0200	21 words	DT 200 to DT 220
Primary Screen Area	WR000	1 words	WR0 to WR0 (R0 to RF)
Key Code Area	WR010	2 words	WR10 to WR11 (R100 to R11F)

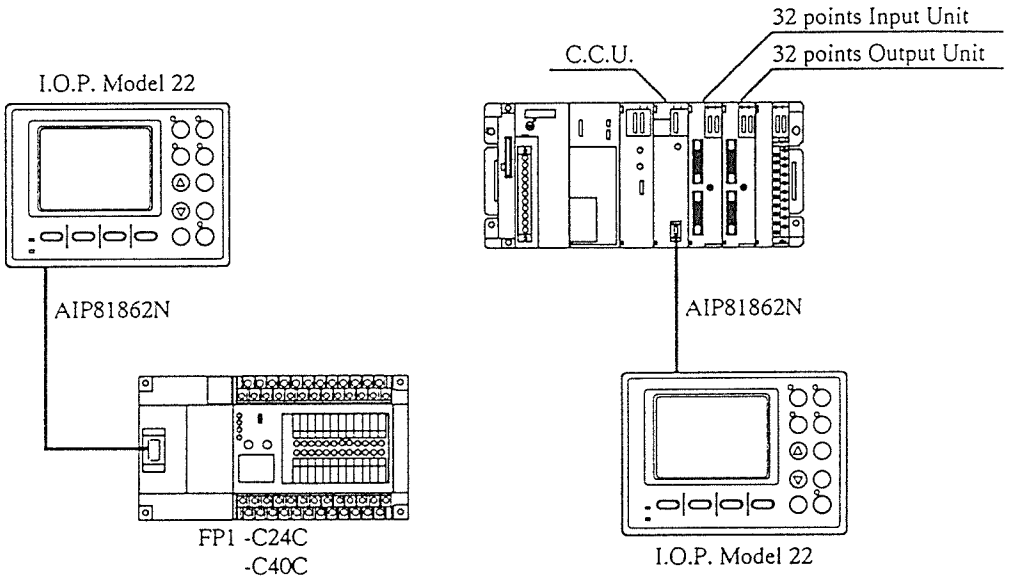
The I.O.P. Model 22 DIP switch settings



* Contact Communication Mode
* Displayable External Data: HEX data.
* I.O.P. data entered during operation will be saved.

FP1, FP3, and FP5 Communication Data Format RS232C settings

The Communication Data Format settings for the FP1, FP3 C.C.U., and FP5 C.C.U. (RS232C settings) must match the settings on the I.O.P. Model 22.



Notes

- The programs in this chapter are for ladder type CPUs.
- Programs for communication with FP1, FP3 or FP5 can all be created in the same manner.

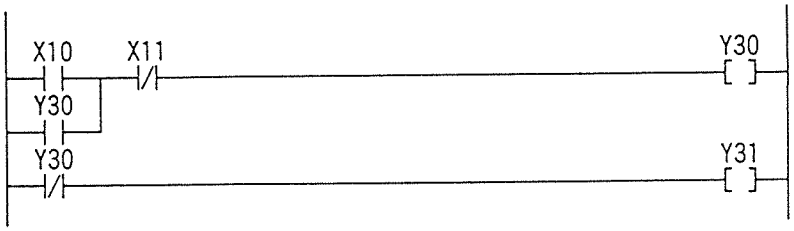
Displaying Primary Screens and Receiving Key Data

The comparison with a sample program is made.

(1) Sample Program

Program for controlling start and stop switches

X10: Start switch
X11: Stop switch
Y30: Start lamp
Y31: Stop lamp



* If the start switch flag is ON (X10:ON), the start lamp will be lit (Y30:ON).
* The start lamp remains lit until the stop switch is pressed (X11).
* If the stop switch flag is ON (X11), the stop lamp will be lit (Y31:ON).

(2) Program for the I.O.P.

Program for displaying Primary Screens by pressing keys.

Fixed key

AUTO	01
MAN.	02
START	03
STOP	04
RESET	05

IOP Message Screen

PAUSING

Press the START key
to start operation

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

Function Key

F1	F2	F3	F4

IOP Message Screen

Operating

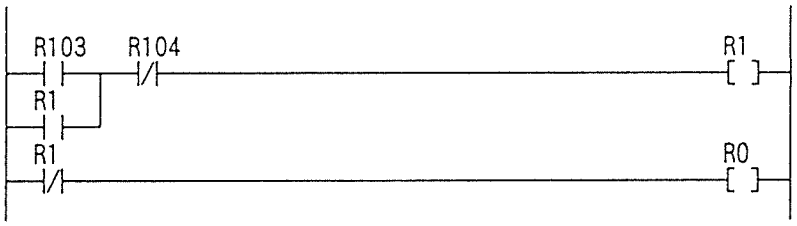
Press the STOP key
to stop operation

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

Function Key

F1	F2	F3	F4

START key: R103
STOP key: R104
Screen "00": R0
Screen "01": R1



Instead of the I/O relays in program (1), internal relays are used.
The basic idea is the same as that above.

1 If the START key is pressed (R103:ON), the I.O.P. will display Primary Screen "01" (R1:ON).
2 Screen "01" is displayed until the STOP key is pressed (R104:ON).
3 If the STOP key is pressed, the I.O.P. will display Primary Screen "00".

Displaying Primary Screens and Receiving Key Data with LED control

(3) This program, for controlling LEDs, can be added to program (2).

Fixed key

AUTO	01
MAN.	02
START	03
STOP	04
RESET	05

IOP Message Screen

PAUSING

Press the START key to start operation

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

Function Key

F1	F2	F3	F4

IOP Message Screen

Operating

Press the STOP key to stop operation

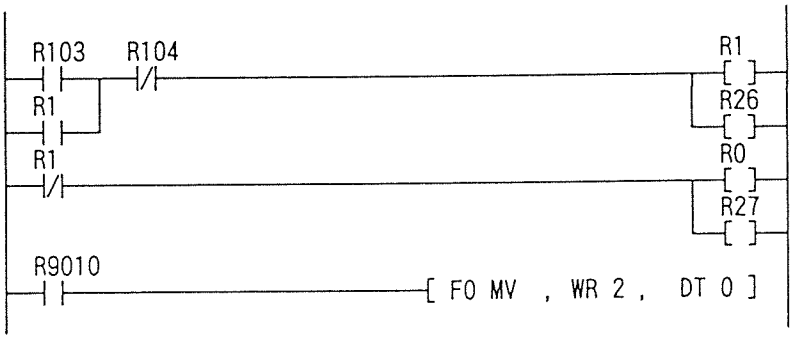
Prim. No.	01
Sec. No.	
ATB.	0

Function Key

F1	F2	F3	F4

Pressing the STOP key while screen "01" is displayed, turns ON the STOP LED.
Pressing the START key while screen "00" is displayed, turns ON the START LED.
ON/OFF control of the LEDs is done via the Basic Address area allocated in the data registers of the PC. WR2 (R20 to R2F) is used in the program. Each bit of WR2 corresponds to a bit in DT0. Then via R9010 (a normally ON relay), the contents of WR2 is always copied to DT0.

* STOP LED: R27
* START LED: R26

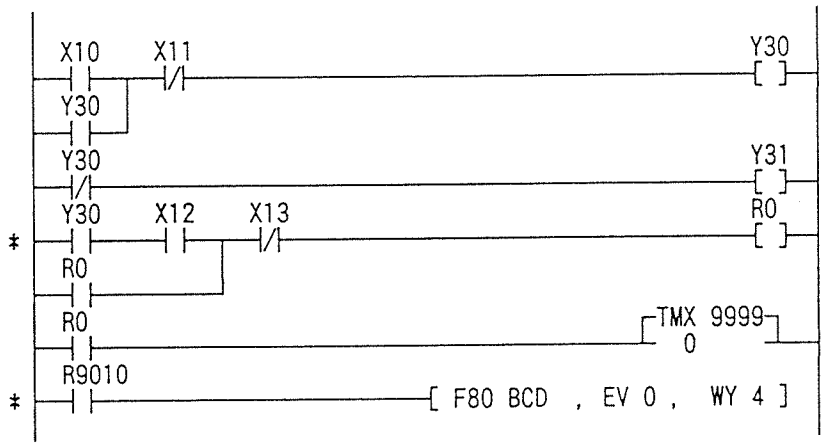


Displaying External Data on the I.O.P.

Program to display the elapsed value of the timer (T0) which is used in the program.

(4) Sample Program

X10 : Start switch
X11 : Stop switch
X12 : Timer start
X13 : Timer reset
Y30 : Start lamp
Y31 : Stop lamp
WY4 : Digital read-out (BCD type: 4-digit)
(Y40 to Y4F)



If the start lamp is turned ON (Y30:ON), the timer will start (X12:ON) and R0 is turned ON. R0 remains ON until the timer is reset (X13:ON).
When R0 comes ON, the timer (T0) starts.
The elapsed value (EV0) is converted to BCD data and the result is stored in WY4 (Y40 to Y4F) to be displayed.

(5) Program for the I.O.P. Model 22

Fixed key

AUTO	01
MAN.	02
START	03
STOP	04
RESET	05

IOP Message Screen

```
PAUSING

Press the START key
 to start operation
```

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

Function Key

F1	F2	F3	F4

IOP Message Screen

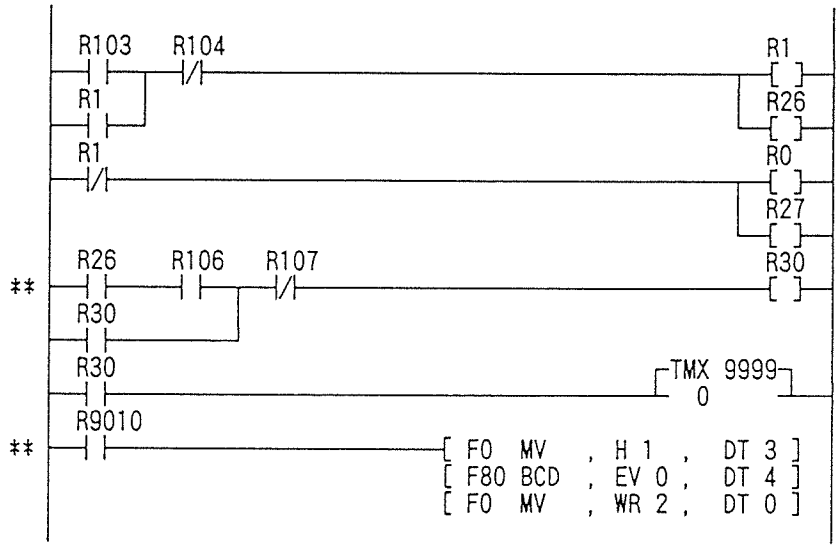
```
Operating

Timer elapsed
value:
   \0
F1: Start timer
F4: Reset timer
      STOP: End
```

Prim. No.	01
Sec. No.	
ATB.	3

Function Key

F1	F2	F3	F4
06			07

* Timer start: R106
* Timer reset: R107



Instead of using I/O relays between the asterisks (✱ ... ✱) in program (4), internal relays are used between ✱✱ and ✱✱ in the program above.

The data registers for Displayable External Data (＼ 0) are DT4 to DT6. Here, the data consists only of 4-digit data and this corresponds to data register DT4 only. Therefore, leading zero suppression is specified in DT3.

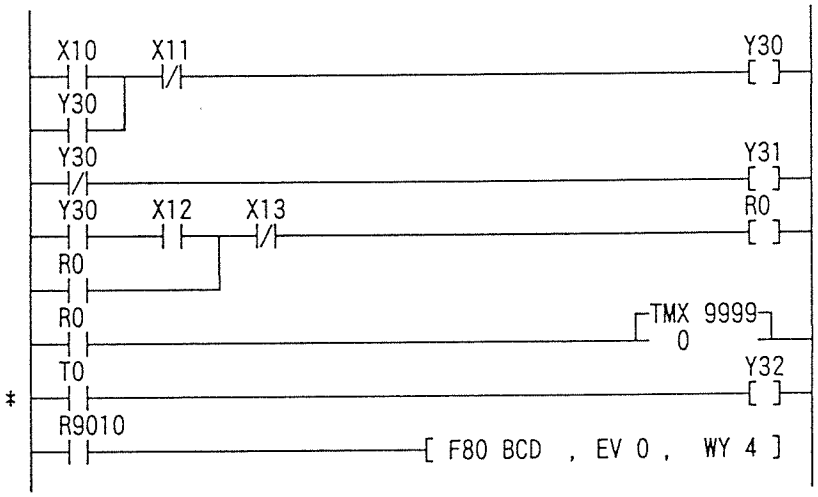
Superimposing a Primary Screen

The program to display "TIME UP" is added.

(6) Sample Program

Time-up display is added to program (4)

X10: Start switch
X11: Stop switch
X12: Timer start
X13: Timer reset
Y30: Start lamp
Y32: Time-up lamp
WY4: Digital read-out (BCD type: 4-digit)
(Y40 to Y4F)



The program line ǂ is added to turn Y32 ON when the time has expired.

(7) Program for the I.O.P. Model 22

Primary Screen "02" is added to program (5).

Fixed key

AUTO	01
MAN.	02
START	03
STOP	04
RESET	05

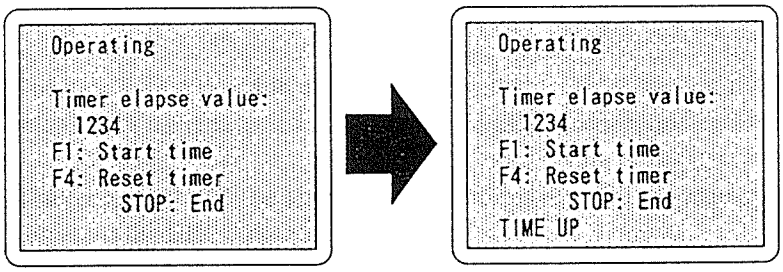
IOP Message Screen

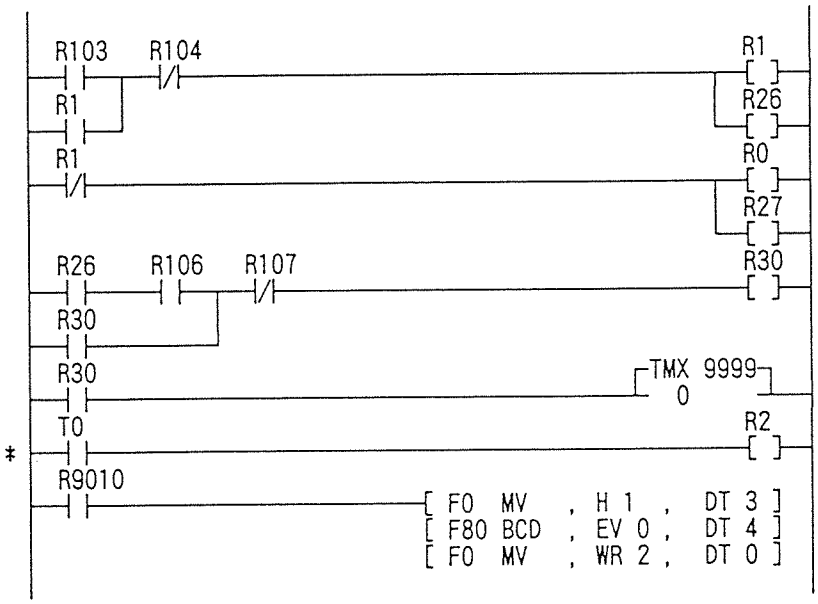
TIME UP

Prim. No.	02
Sec. No.	
ATB.	6

Function Key

F1	F2	F3	F4



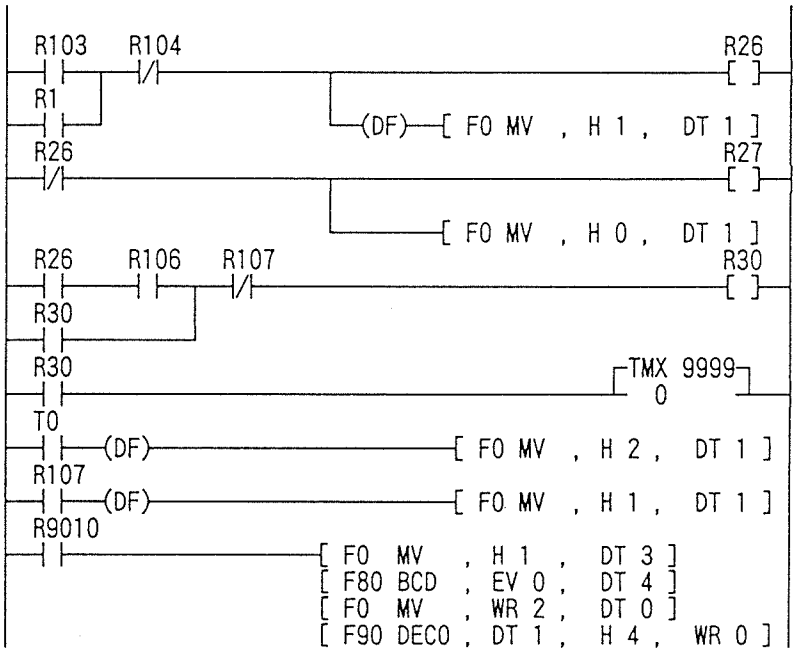


The program line ‡ is added to superimpose primary screen "02" on primary screen "01" when the time has expired.

(8) Program for the I.O.P. Model 22

In program (7), if you press the F4 key on the I.O.P., after "TIME UP" is displayed, timer (T0) will be reset. However, screen "02" will still be superimposed. This is because no new Primary Screen has been specified. The I.O.P. will clear the superimposed screen when it receives a new Primary Screen number from the PC.

You can easily add a program to display the Primary Screen if you use the DECO and DF instructions.



The data is first stored in a data register with the DF instruction and then R9010 (ON relay) will decode the data stored in the register to set the corresponding internal relay.

The contents of DT (the screen number) are converted to the contact data used by the internal relays via the DECO instruction.

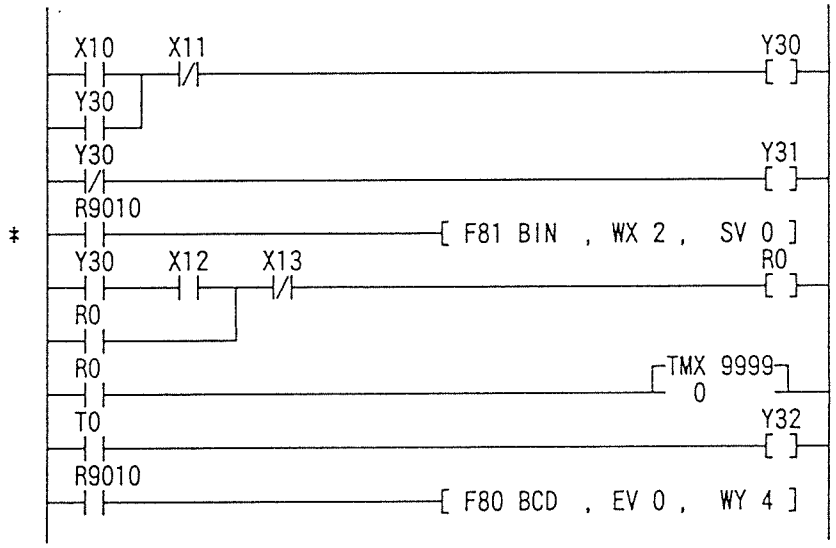
Thus, when the timer is reset, primary screen "01" will be displayed.

Receiving External Data Entered on the I.O.P.

Program to set the set value of the timer from an external device.

(9) Sample Program

X10 : Start switch
X11 : Stop switch
X12 : Timer start
X13 : Timer reset
WX2 : Digital switch (BCD type: 4-digit)
(X20 to X2F)
Y30 : Start lamp
Y32 : Time-up lamp
WY4 : Digital read-out (BCD type: 4-digit)
(Y40 to Y4F)



The program line ‡ is added to program (6).

(10) Program for the I.O.P. Model 22

Primary Screen "01" is changed as follows:

IOP Message Screen

```
Operating

Timer elapsed value:
  \0
F1: Start timer
F4: Reset timer
      STOP: End
▼: Enter T. value
```

Prim. No.	01
Sec. No.	
ATB.	3

IOP Message Screen

```
Operating

Timer set value
 Current: \1
 New:     $0
▲: Monitor elapsed
   value
```

Prim. No.	01
Sec. No.	
ATB.	5

Function Key

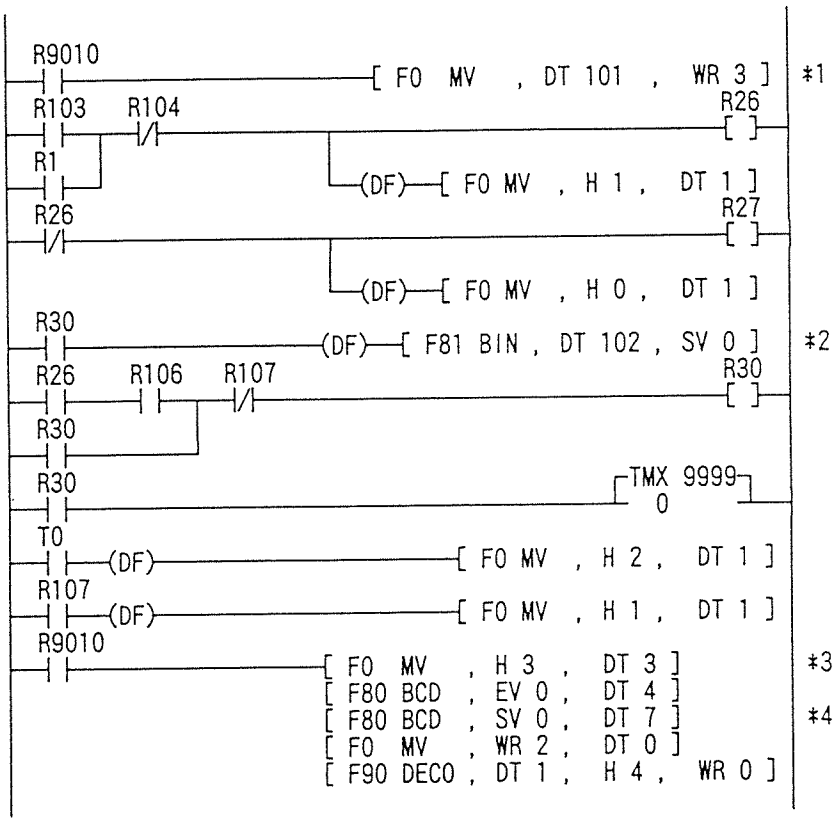
F1	F2	F3	F4
06			07

Function Key

F1	F2	F3	F4

* A Secondary Screen is added to Primary Screen "01".
The Secondary Screen the current timer value is displayed at " \ 1 ", and the new value is entered at " $ 0 ".

The data stored in DT4 is displayed at " \ 0 ".
The data stored in DT7 is displayed at " \ 1 ".
The data entered at " $ 0 " is stored in DT102.



Lines ‡1 , ‡2 and ‡4 are added to program (8):

‡1 The data from Descriptive External Data Buffer (DT101) is copied to WR3 (R30 to R3F).

‡2 If a timer value is entered at " $ 0 " on the I.O.P., flag R30 (bit 0) is turned ON. With this signal, the data stored in DT102 will be converted to BIN data and the result will be stored in SV0.

‡3 "H 3" is stored in DT3 so that the leading zeroes of the data displayed at both " \ 0 " and " \ 1 " are suppressed.

‡4 The set value of the timer (T0), SV0 is converted to BCD data and the result is stored in DT7 for display at " \ 1 ".

5-2 Advanced Sample Program

Monitoring and Setting Values in an Arbitrary Timer/Counter on the I.O.P.

Use the I.O.P. to display and set a timer/counter.

Using the External Data entry function and External Data display function, the I.O.P. can monitor the preset value and the current value of an arbitrary timer or counter.

Postulate

Communication Mode: Contact Communication Mode

Allocation of Data Registers and Internal Relays for the I.O.P. 22

	Strating Address	Words Occupied	Area Occupied
Basic Area	DT 0000	16 words	DT 0 to DT 15
Output Area	DT 0100	50 words	DT 100 to DT 149
Character Highlight Area	DT 0300	16 words	DT 300 to DT 315
Character Superimposition Area	DT 0200	21 words	DT 200 to DT 220
Primary Screen Area	WR000	1 words	WR0 to WR0 (R0 to RF)
Key Code Area	WR010	2 words	WR10 to WR11 (R100 to R11F)

I.O.P. Operation

1. Enter the timer/counter number which contains the set value.
   The range of the timer/counter number is as specified below. Be careful to only use numbers within this range.
2. Check the value which was previously set. (Monitoring)
3. Enter a new value (enter the new value from the I.O.P.)
4. Enter the timer/counter number which contains the elapsed value to be monitored.
   The range of the timer/counter number is as specified below. Be careful to only use numbers within this range.
5. The I.O.P. will display the value in the timer/counter specified above.

The timer/counter number

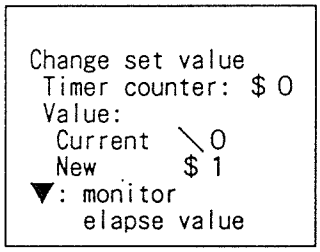
PC	Number
FP1	0 to 143
FP3	0 to 255
FP5	0 to 255

Caution

■ The number of timer/counter must be set within the range specified in the table above. If you enter a number that is out of range, the timer/counter function will not work.

I.O.P. Message Screens

IOP Message Screen

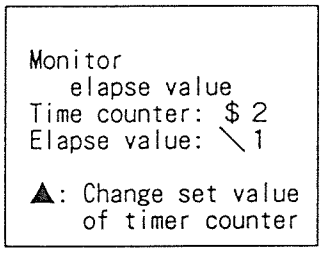


Prim. No.	00
Sec. No.	
ATB.	5

Function Key

F1	F2	F3	F4

IOP Message Screen

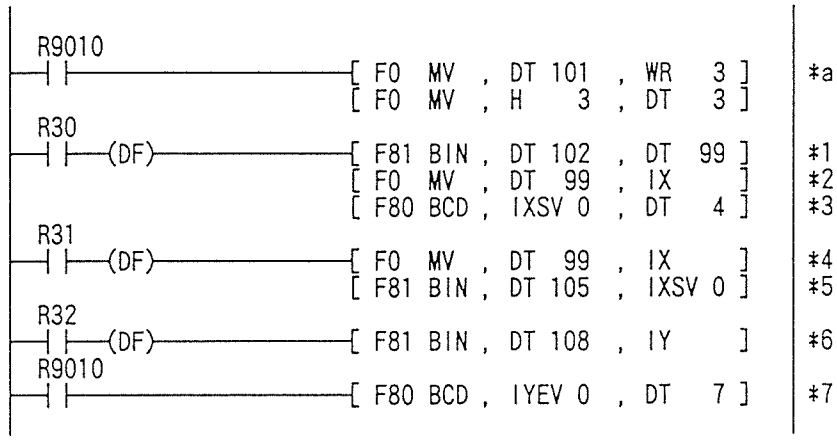


Prim. No.	00
Sec. No.	01
ATB.	5

Function Key

F1	F2	F3	F4

The value entered at " $ 0" will be stored in DT102.
Data stored in DT4 will be displayed at "\0".
The value entered at " $ 1" will be stored in DT105.
The value entered at " $ 2" will be stored in DT108.
Data stored in DT7 will be displayed at "\1".



*a Data in the Descriptive External Data Flag (DT101) is copied to WR3 (R30 to R3F).
If fresh data is entered at " $ 0", " $ 1" or " $ 2" from the I.O.P., R30, R31 or R32 will be turned ON respectively.
Specify the suppression of leading zeroes, for the data displayed at "\0" and "\1", in DT3.

*1 If fresh data is entered at " $ 0", R30 will be turned ON.
Data stored in DT102 is converted to BIN data and the result is stored in DT99.

*2 The contents of DT99 are copied to the IX (Index register).

*3 The value of SV specified in IX is converted to BCD data and the result is stored in DT4.
The I.O.P. will display the data at "\0" on the screen.

*4 The contents of DT99 are copied to the IX (Index register).

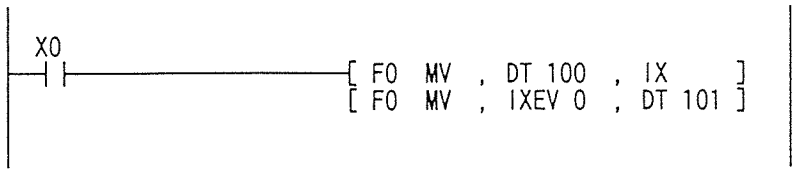
*5 If fresh data is entered at " $ 1" on the I.O.P., R31 will be turned ON. The data stored in DT105 is converted to BIN data and the result is stored at the SV which corresponds to the SV base number plus the value of IX.

*6 If fresh data is entered at " $ 2" on the I.O.P., R32 will be turned ON. The data stored in DT108 is converted to BIN data and the result is stored in IY.

*7 The value of EV is converted to BCD data and the result is stored in DT7. The I.O.P. will display the data at "\1" on the screen.

Notes

Index register



In the program above, the contents of the EV (whose address corresponds to the base EV address plus the value in IX) are stored in DT101.

If DT100=0, the value of timer/counter EV1 is stored in DT101.
If DT100=1, the value of timer/counter EV2 is stored in DT101.
If DT100=F, the value of timer/counter EV15 is stored in DT101.

Refer to "ADDRESS MODIFIER" in the FP1 Technical Manual or "Index registers" in the FP3/5 Programming Manual for details.

Monitoring and Setting Values in an Arbitrary Data Register on the I.O.P.

Program for displaying or setting the contents of an arbitrary data register in the I.O.P.:

Control/monitor the value of an arbitrary data register using the External Data entry and External Data display functions.

Postulate

Communication Mode: Contact Communication Mode

Allocation of Data Registers and Internal Relays for the I.O.P. 22

	Strating Address	Words Occupied	Area Occupied
Basic Area	DT 0000	16 words	DT 0 to DT 15
Output Area	DT 0100	50 words	DT 100 to DT 149
Character Highlight Area	DT 0300	16 words	DT 300 to DT 315
Character Superimposition Area	DT 0200	21 words	DT 200 to DT 220
Primary Screen Area	WR000	1 words	WR0 to WR0 (R0 to RF)
Key Code Area	WR010	2 words	WR10 to WR11 (R100 to R11F)

I.O.P. Operation

1. Enter the number of data register to be changed.
   The range of valid data register numbers is specified below. Be careful not to exceed the range.
2. Monitor the value of data register specified above.
3. Change the value (enter the new value from the I.O.P.)

Caution

- Depending on the PC you use, the number of data registers will vary. If you enter an out of the range value, the program will be aborted.
- In the program example, only Data Registers from DT1000 and up can be changed. Enter a number within the range specified in parentheses. For example if you want to change the value of DT1050, enter "50".

PC Model Name	Number of Data Registers	Range of Data Registers you can specify
FP1	0 to 1659	1000 to 1659 (0 to 659)
FP3	0 to 2047	1000 to 2047 (0 to 1047)
FP5	0 to 2047	1000 to 2047 (0 to 1047)

I.O.P. Message Screen

IOP Message Screen

```
  Data Register
Monitoring/Changing

DT1000 + $ 0

DT:      \0
Current:  \1
New:    $ 1
```

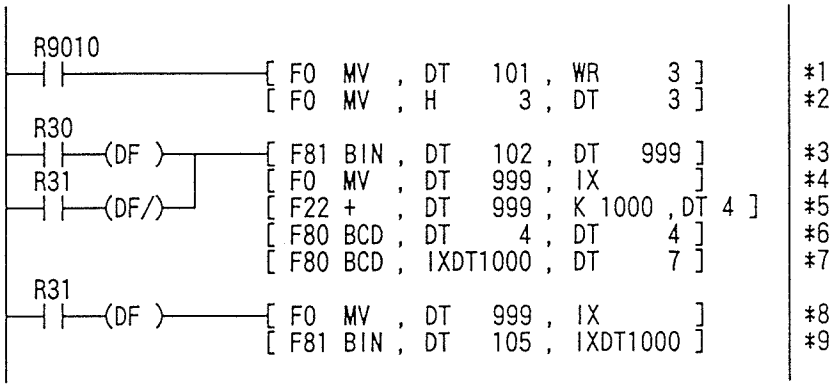
Prim. No.	00
Sec. No.	
ATB.	5

Function Key

F1	F2	F3	F4

The value entered at " $ 0" will be stored in DT102.
(In actual practice, 1000 will be added to the number 102)
Data stored in DT4 will be displayed at "\0".

Data stored in DT7 will be displayed at "\1".
The value entered at " $ 1" will be stored in DT105.



*1 The contents of Descriptive External Data Flag (DT101) are copied to WR3 (R30 to R3F).

*2 Specify the suppression of leading zeroes, for data which will be displayed at "\0" and "\1", in DT3.

If fresh data is entered at " $ 0" on the I.O.P., R30 will be turned ON.

*3 The data stored in DT102 is converted to BIN data and the result is stored in DT999.

*4 The value of DT999 is copied to the IX (Index register).

*5 1000 is added to the value held in DT999 and the result is stored in DT4.

*6 The data in DT4 is converted to BCD data and the result is stored in DT4.
The I.O.P. will display this data as the data register number.

*7 The data stored in the data register just specified is converted to BCD data, and the result is stored in DT7.
The data in DT7 will be displayed at "\1".

If fresh data is entered at " $ 1" on the I.O.P., R31 will be turned ON.

*8 The contents of DT999 are copied to the IX (Index register).

*9 If fresh data is entered at " $ 1", R31 will be turned ON and the data stored in DT105 will be stored in the indexed register pointed at by IXDT1000.

Displaying the Data Read with a Bar-code Reader (Using the DPU) on the I.O.P.

Program for displaying ASCII data read with a bar-code reader via the Data Processing Unit (DPU).

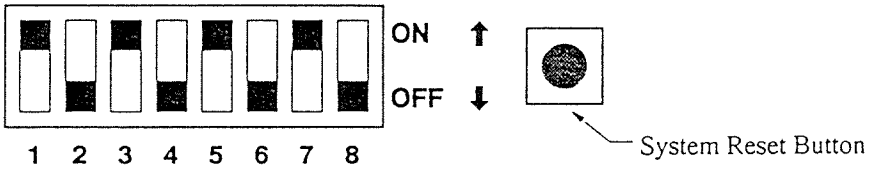
Postulate

Communication Mode: Contact Communication Mode

Allocation of Data Registers and Internal Relays for the I.O.P. 22

	Strating Address	Words Occupied	Area Occupied
Basic Area	DT 0000	24 words	DT 0 to DT 23
Output Area	DT 0100	50 words	DT 100 to DT 149
Character Highlight Area	DT 0300	16 words	DT 300 to DT 315
Character Superimposition Area	DT 0200	21 words	DT 200 to DT 220
Primary Screen Area	WR000	1 words	WR0 to WR0 (R0 to RF)
Key Code Area	WR010	2 words	WR10 to WR11 (R100 to R11F)

The I.O.P. Model 22 DIP switch settings



* Contact Communication Mode
* Displayable External Data is specified in ASCII code.
* Normal size characters to be superimposed are specified in JIS code.
* Data entered is saved.

PC Environments

CPU : FP3 (ladder CPU)
Slot 0 : Data Processing Unit (DPU)
Slot 1 : Computer Communication Unit (C.C.U.)
Slot 2 : Input 16 points
Slot 3 : Output 16 points

I/O Map

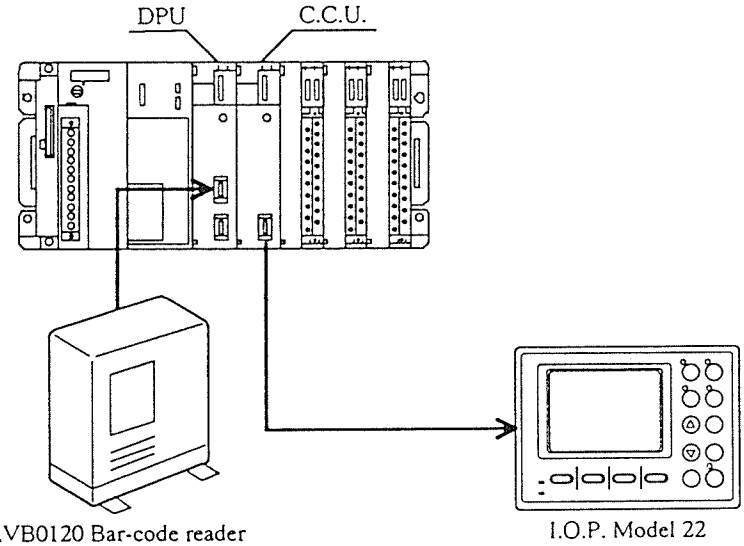
Input	X30	Photo sensor (read Bar-code data)
Output	Y10	DPU (order to sent the command)

Bar-code Reader Environments

Bar-code reader : AVB0120

Baud rate	: 9600 bps
Data length	: 8 bits
Parity	: None
Stop bits	: 1 bit
Terminator	: CR, LF
Synchronous mode	: 2

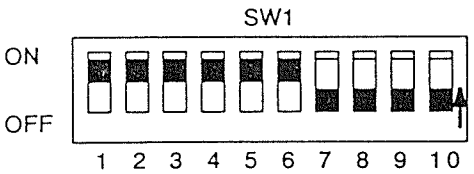
* The data read is JAN code up to 20 digits long.

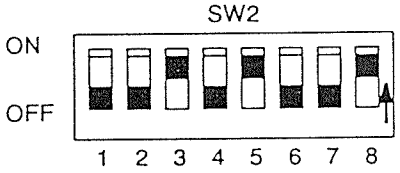


AVB0120 Bar-code reader

I.O.P. Model 22

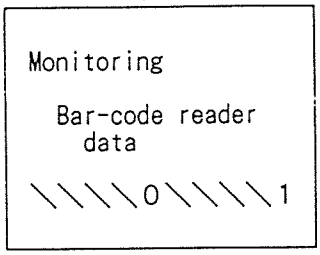
Bar-code Reader DIP Switches setting





I.O.P. Message Screen

IOP Message Screen

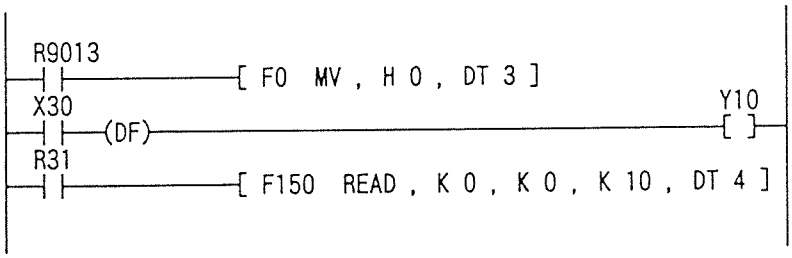


Prim. No.	00
Sec. No.	
ATB.	2

Function Key

F1	F2	F3	F4

Displays the ASCII data from DT4 to DT13 in the "\\\\0\\\\\1" area.
A maximum of 20 digits can be displayed.



* At R9013 (Initial Pulse ON), specify not to suppress leading zeroes.
* If sensor (X30) is turned ON, switch 0 of DPU is turned ON (Y10).
  If the synchronous sensor is ON, a command is sent to DPU.
* 10 words of ASCII data (20 bytes) from the shared memory of the DPU is stored in DT4 to DT13 for display in the "\\\\0\\\\\1" area of the I.O.P..

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.

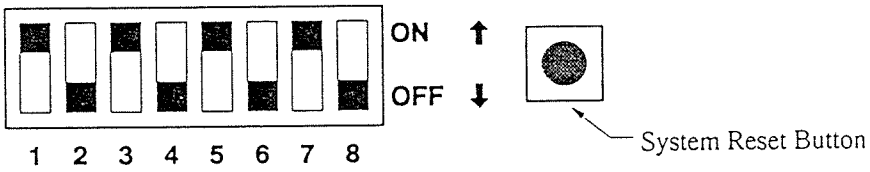
In the above program, the I.O.P. can display a maximum of 20 ASCII characters.

Displaying the Data Read with a Bar-code Reader (Using the Bar-code Interface Unit) on the I.O.P.

Allocation of Data Registers and Internal Relays for the I.O.P. 22

	Strating Address	Words Occupied	Area Occupied
Basic Area	DT 0000	16 words	DT 0 to DT 15
Output Area	DT 0100	50 words	DT 100 to DT 149
Character Highlight Area	DT 0300	16 words	DT 300 to DT 315
Character Superimposition Area	DT 0200	21 words	DT 200 to DT 220
Primary Screen Area	WR000	1 words	WR0 to WR0 (R0 to RF)
Key Code Area	WR010	2 words	WR10 to WR11 (R100 to R11F)

The I.O.P. Model 22 DIP switch settings



* Contact Communication Mode
* Displayable External Data is specified in ASCII code.
* Normal size characters to be superimposed are specified in JIS code.
* Data entered is saved.

PC Environments

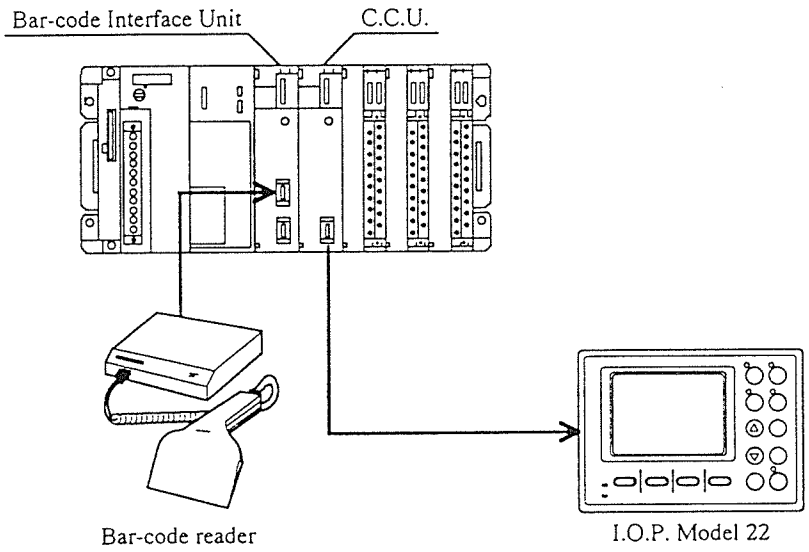
CPU : FP3 (ladder CPU)
Slot 0 : Bar-code Interface Unit
Slot 1 : Computer Communication Unit (C.C.U.)

Bar-code Reader Environments

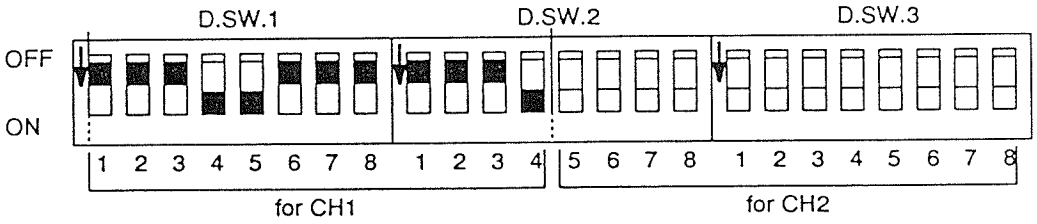
Bar-code reader: AVB2100N
AVB1100

Baud rate	:	9600 bps
Data length	:	7 bits
Parity	:	Odd
Stop bits	:	2 bits
Terminator	:	CR, LF

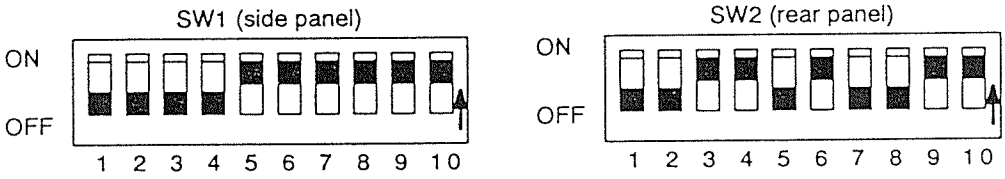
* Up to 20 digits of data can be read at once.



FP3 Bar-code Reader Interface DIP Switches Setting

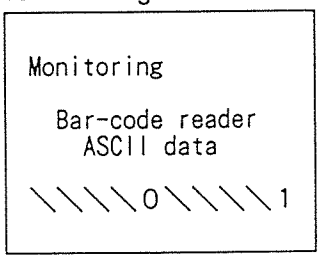


Bar-code Reader (AVB21000N) DIP Switches Setting



I.O.P. Message Screen

IOP Message Screen



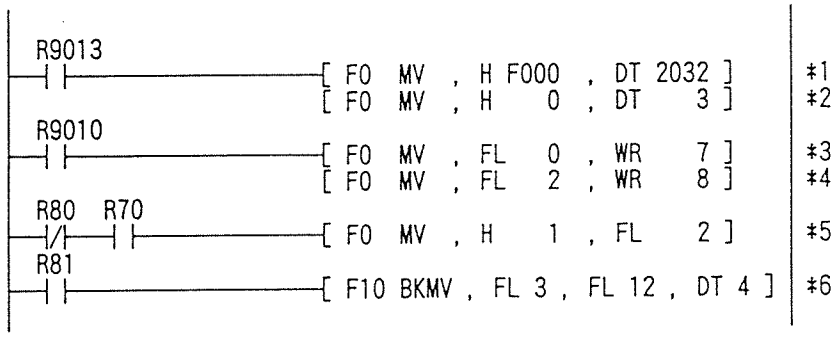
Prim. No.	00
Sec. No.	
ATB.	2

Function Key

F1	F2	F3	F4

Displays the ASCII data stored in DT4 to DT13 in the "\\\\0\\\\1" area.
A maximum of 20 digits can be displayed.

Program Example



*1 Data from the Bar-code Interface Unit Channel 1 is stored in the area starting at FL0 (file register: zero).

*2 "H 0" is stored in DT3 to specify "no suppression of leading zeroes".

*3 to *6 Handshake program for the Bar-code Interface Unit.

*6 Bar-code data is stored in DT4 to DT13 for display in the area "\\\\0\\\\1" area of the I.O.P. screen.

Chapter 6

Connecting the I.O.P. to a PC

This chapter explains how to connect the communication cable.
You will learn how to connect the I.O.P. Model 22 to an FP1, FP3 or FP5.

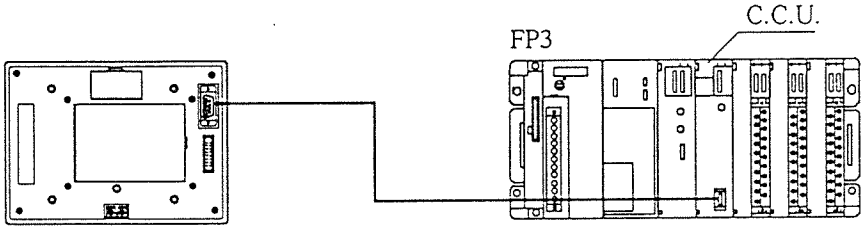
PC is an abbreviation of programmable controller.

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

If you connect the I.O.P. to the FP3, you must use the Computer Communication Unit made for the FP3 (Part number: AFP3462) and an RS-232-C cable (Part number AIP81862N or AFP15305).

If you connect the I.O.P. to the FP5, you must use the Computer Communication Unit made for the FP5 (Part number: AFP5462) and an RS-232-C cable (Part number AIP81862N or AFP15305).

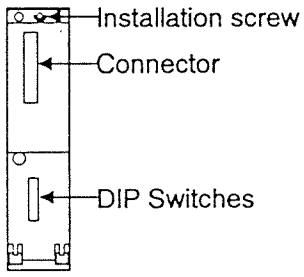
The connection method is the same for the FP3 and the FP5.

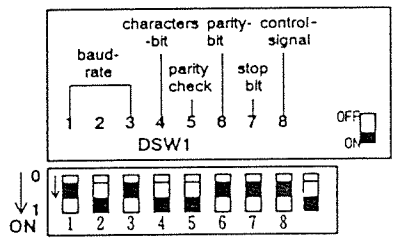


Setting the Communication Data Format

Switch No.	Function		Switch position 1 2 3 4 5 6 7 8
1 to 3	Modem control	———	0 0 0
	Baud rate	19,200 bps	1 0 0
		9,600 bps	0 1 0
		4,800 bps	1 1 0
		2,400 bps	0 0 1
		1,200 bps	1 0 1
		600 bps	0 1 1
		300 bps	1 1 1
4	Character bit	7-bit	0
		8-bit	1
5	Parity Check	Invalid	0
		Valid	1
6	Parity bit	Odd parity	0
		Even parity	1
7	Stop bit	1-bit	0
		2-bit	1
8	Control signal	Invalid CS,CD	0
		Valid CS,CD	1

*OFF is represented as " 0 " and ON is represented as " 1 ".

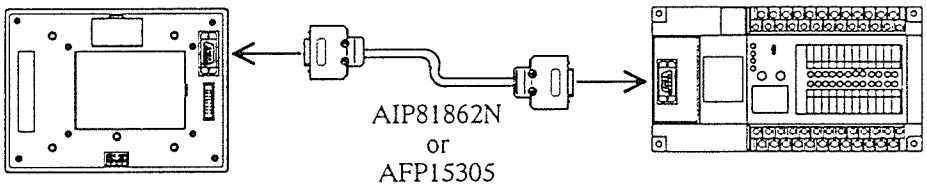




Notes
Refer to the FP3 and FP5 C.C.U. Technical Manual for details.

6-2 Connecting the I.O.P. to FP1

If you connect the I.O.P. to the FP1, you must use the FP1 RS-232-C port. The cable should be an RS-232-C cable (model number: AIP81862N or AFP15305).
RS-232-C port should be "for computer link".



Setting of Communication Data Format

When you use an FP Programmer

With "OP-50", you can change the value of the system registers. Change the settings after you place the FP1 in the PROG. mode.

```
OP- 50
SYSTEM REG.
```

Execute "OP-50".

```
                    412
      K               1
```

System register address : Input "412".
Computer link setting : Input "K1".

```
                    413
      K               3
```

System register address : Input "413".
Data length : 8 bits
Terminator : CR
Parity check: ODD
Header : No STX
Stop bits : 1 bit Input "K3".

```
                    414
      K               1
```

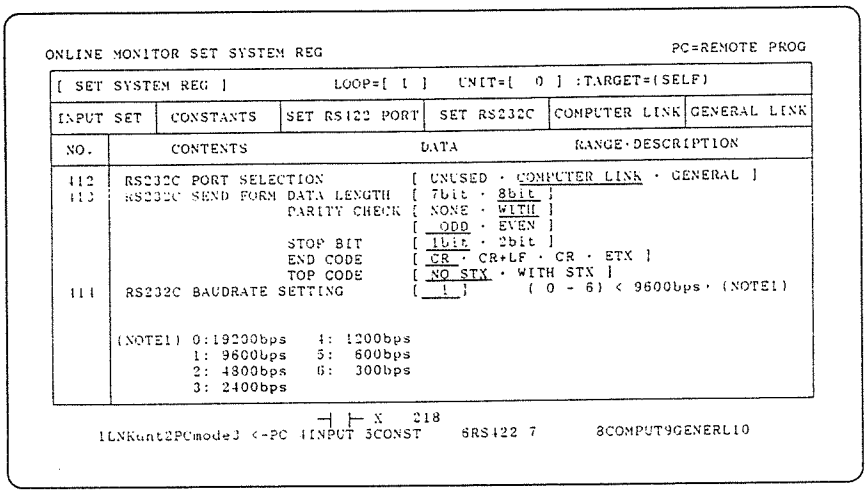
System register address: Input "414".
Baud rate: 9600 bps Input "K1"

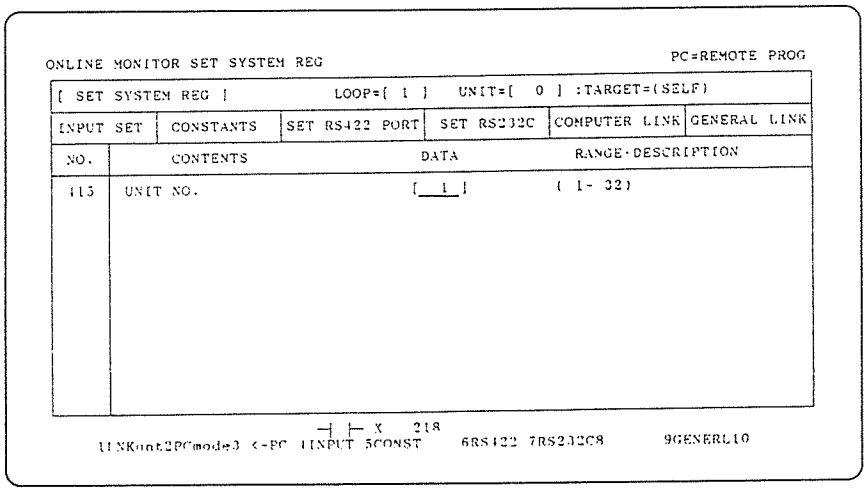
```
                    415
      K               1
```

System register address : Input "415".
Unit number: 1 Input "K1"

When you are using NPST-GR

Check the contents of "SET RS232C" in the "SET SYSTEM REG" screen.
Configure as shown in the following screen.





Cautions

- To select the RS232C port (No. 412), choose "Computer Link"
  After completing the setting, press the F1 key in the ONLINE mode to save the data.

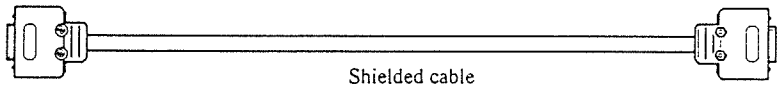
Notes

- Refer to "Display System Register Setting" in the FP PROGRAMMER Operation Manual or "Setting RS232C" in the NPST-GR Manual for details.

6-3 RS-232-C Cable

You can use the RS-232-C cable (part number AIP81862N or AFP15305) for the connection bewteen the I.O.P. and the FP1, FP3 or FP5.
If you make the cable yourself, refer to the following lists for wiring. Pin number 4 and 5 should be shorted.

Cable (Part Number. AIP81862N or AFP15305)



RS-232-C male connector (mated with PC serial port)

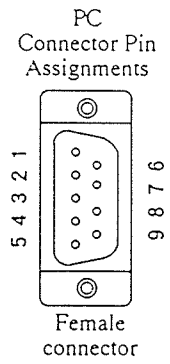
Shielded cable

AIP81862N : 2 m(78.74 in.)
AFP15305 : 50cm(19.68 in.)

RS-232-C male connector (mated with I.O.P. serial port)

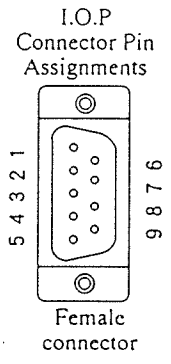
PC side: RS-232-C port

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	109	CF	Received Line Signal Detector	DCD	←
9	108/2	CD	Data Terminal Ready	DTR	→

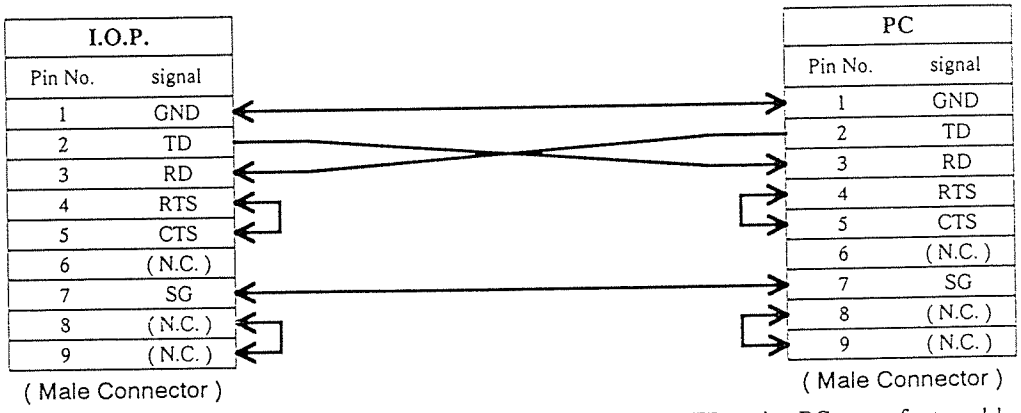


I.O.P. side: RS-232-C Port

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)	–	–



Example of cable wiring (Cable : AIP81862N)

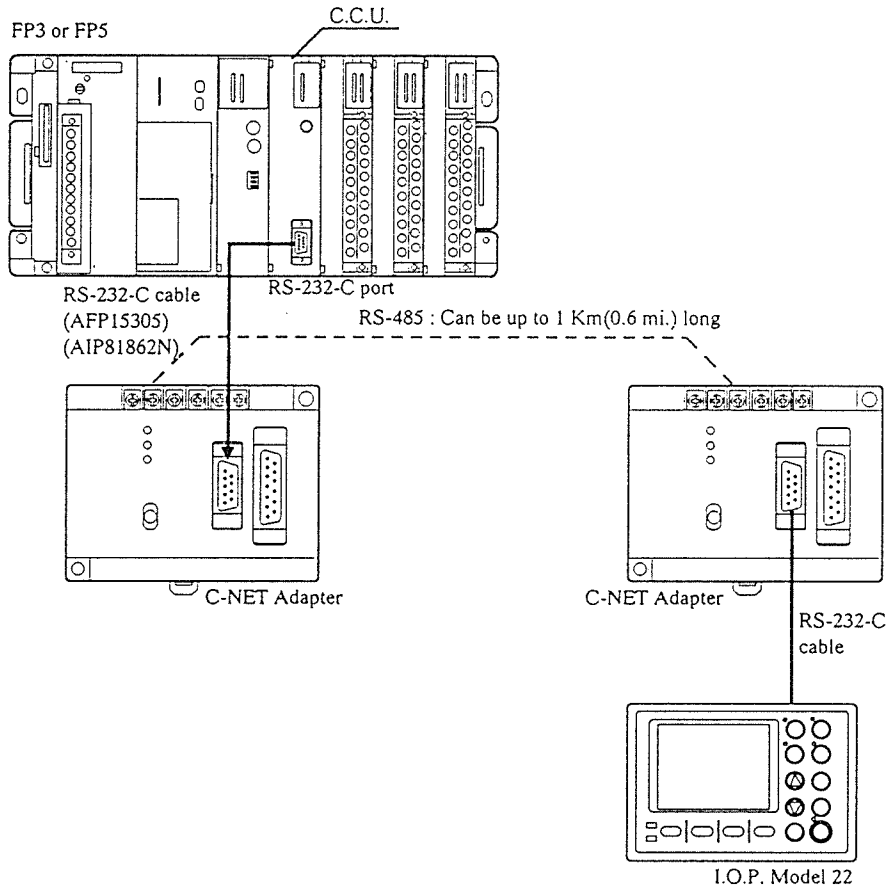


* The above wiring is intended for connecting the I.O.P. to an FP series PC manufactured by Matsushita Electric Works Ltd.
* N.C. : Not Connected

6-4 How to extend the RS-232-C cable

You can use a C-NET Adapter if you want to extend the cable beyond the specifications listed for your PC.
If you use a C-NET Adapter, you can use a cable up to 1 Km (0.6 mi.) long. The following diagram applies :

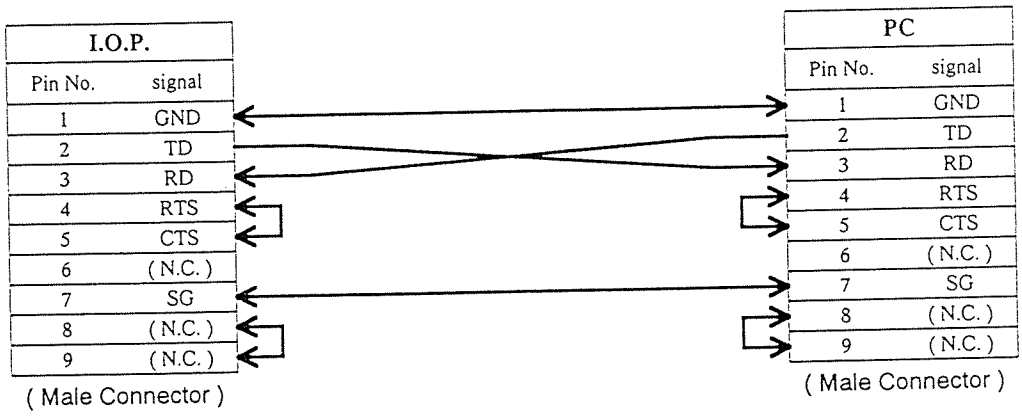
Example:When using an FP3 or FP5



Note

■ For the FP1, you can extend the cable in the same manner.

Cable pin assignments



Reference

Part number

C-NET Adapter	Power source	24VDC	AFP8532
		100VAC to 240VAC	AFP8536
C-NET Adapter Connector Cable	Length	50 cm	AFP15305
		2m	AIP8162N

Chapter 7

Operating Environments

This chapter explains how to maintain the I.O.P. Model 22.

Precautions for safeguarding the I.O.P Model 22 will be explained.

PC stands for Programmable Controller.

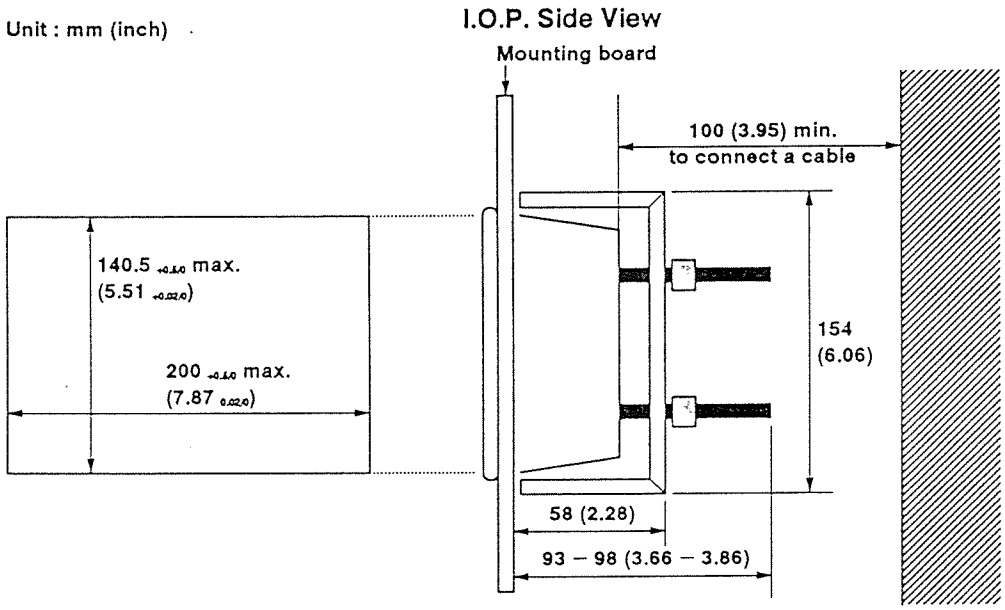
7-1 Mounting the I.O.P. on a Board

The flange type I.O.P.

If you have the I.O.P. part number AIP223002, you can mount the I.O.P. on a board. The mounting dimensions are specified below.

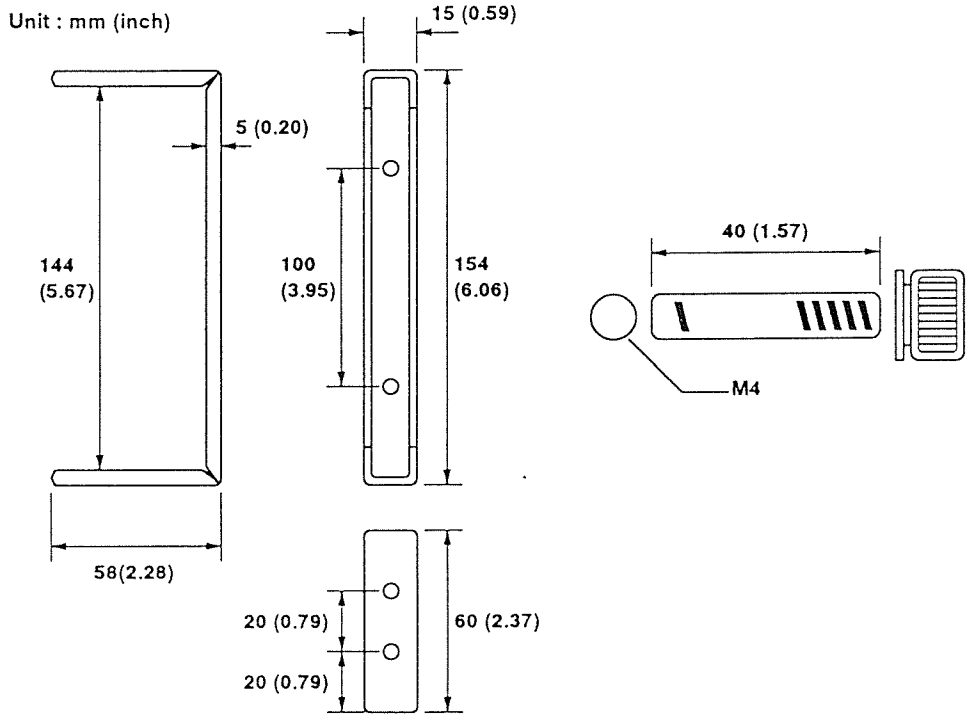
Mounting dimensions

Unit : mm (inch)



Set-screw hole dimensions

Unit : mm (inch)

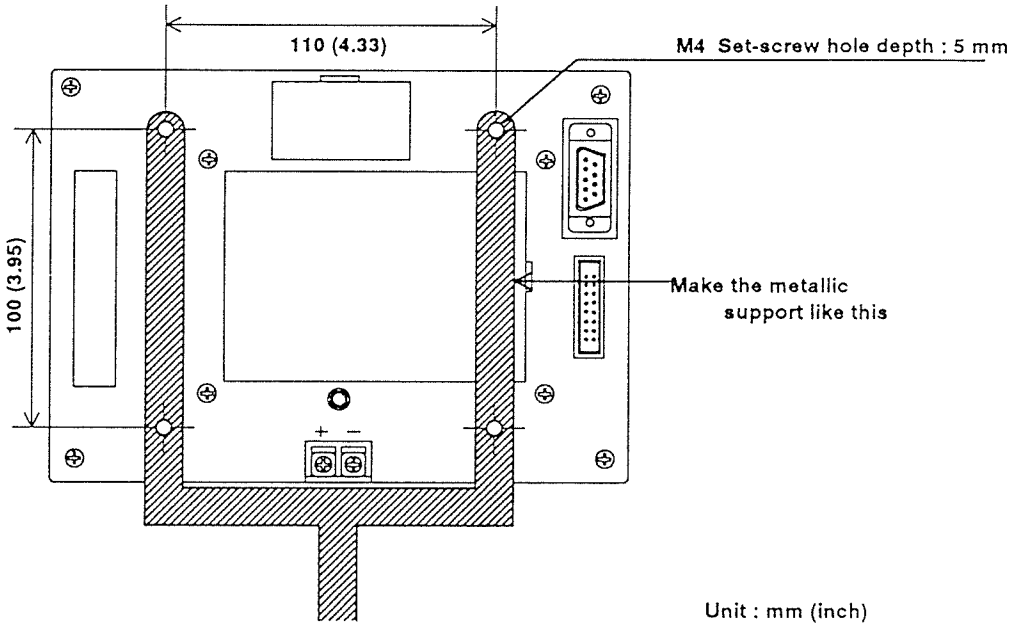


The case type I.O.P.

If you have the I.O.P. part number AIP233102, 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

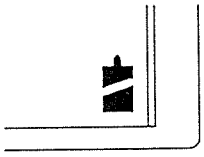
The depth of the set-screw holes is 5mm. Be careful when mounting the I.O.P.
Do not short between the board and the power supply.



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 22. 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(Model No. AFB8801).



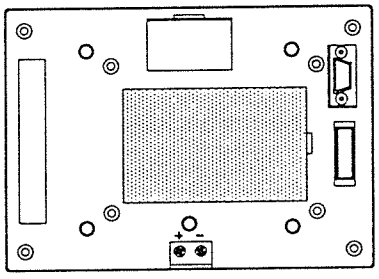
Backup Battery Indicator

Caution

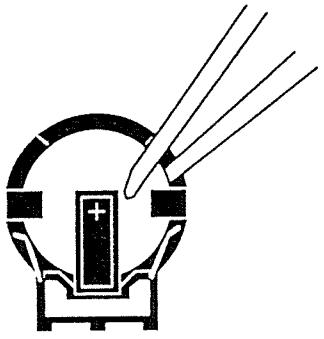
- If the battery dies, data in the memory will not be maintained.
- The shelf life of the battery is at least 10,000 hours in RAM operation.

Procedure

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

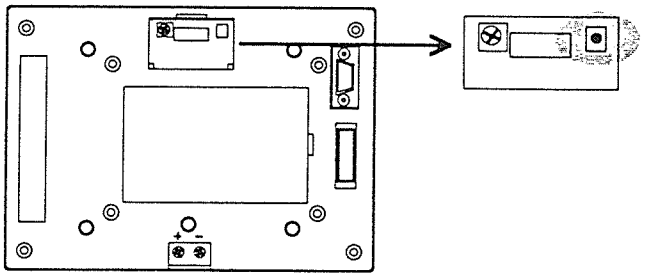


2. Remove the old backup battery with insulated tweezers or a similar tool.



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..



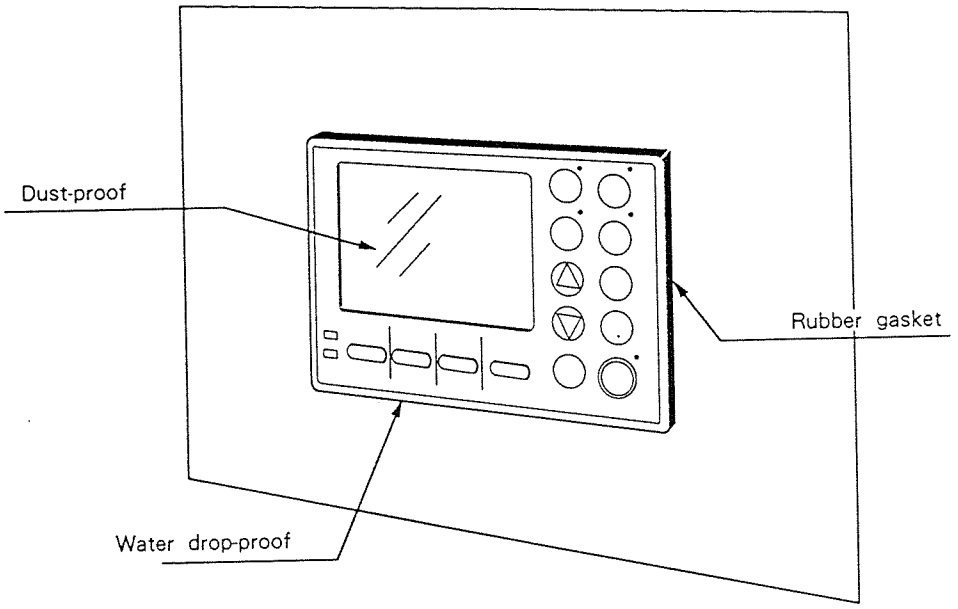
Caution

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

7-3 Dust Protection

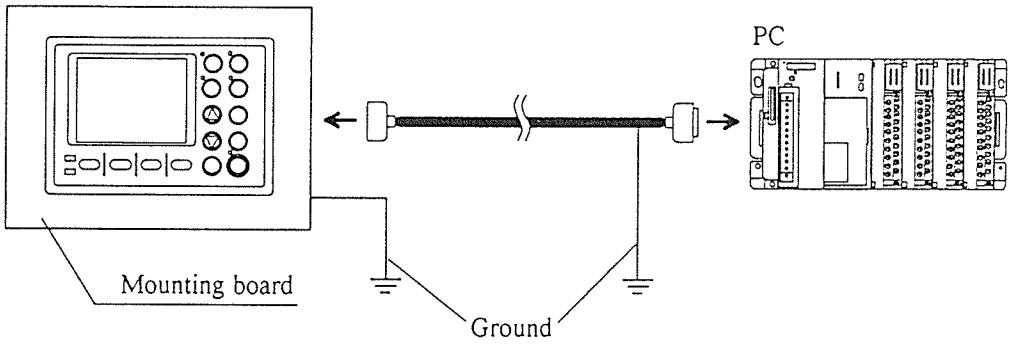
The I.O.P. has a rubber gasket in the area where it contacts the board. This protects it from dust, mist and humidity.

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.



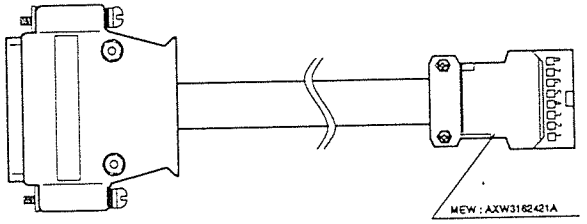
Install the I.O.P., I/O cable and power cord so that they may be placed far enough away from devices which may cause noise, such as welding machines, other power cables and motors. Do not install the I/O cable next to high voltage (100 V or higher) cable, as this can lead to erratic operation.

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 Matsushita Electric Works, Ltd.(part number AIP8001), or make a cable yourself by referring to the following.

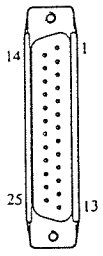
Cable
The connector at the I.O.P. end should be MIL type 16-pin connector(female connector).
The connector to the personal computer end should be a D-sub miniature 25-pin connector(male connector).



D-sub miniature 25-pin connector

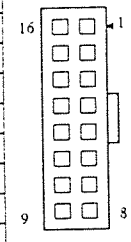
MIL type 16-pin connector

Temporary Specification



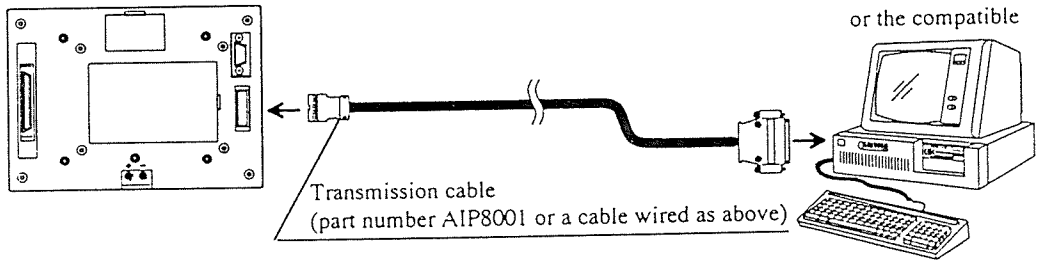
signal	pin No.
STR	1
DB0	2
DB1	3
DB2	4
DB3	5
DB4	6
DB5	7
DB6	8
DB7	9
ACK	10
PE	12
GND	21
BUSY	11
SELECT	13
ERROR	15

pin No.	signal
1	STR
16	DB0
2	DB1
15	DB2
3	DB3
14	DB4
4	DB5
13	DB6
5	DB7
7	GND
6	BUSY
12	+5V



Rear view of the I.O.P.

IBM PC/AT
or the compatible



Transmission cable
(part number AIP8001 or a cable wired as above)

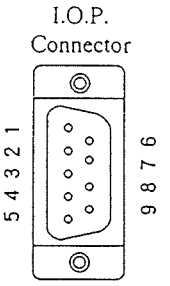
Appendix B ROM Programmer Cable

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:

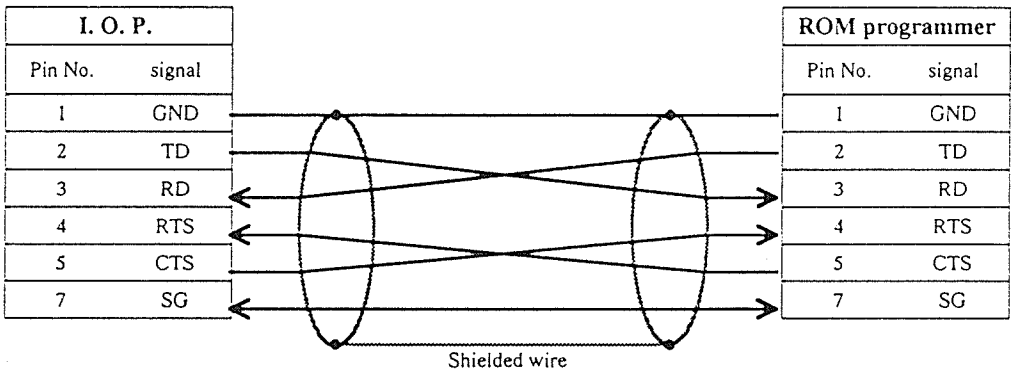
Use the PKW-1100A-E ROM programmer manufactured by AVALDATA CORPORATION. (transfer the data in Intel HEX format.)

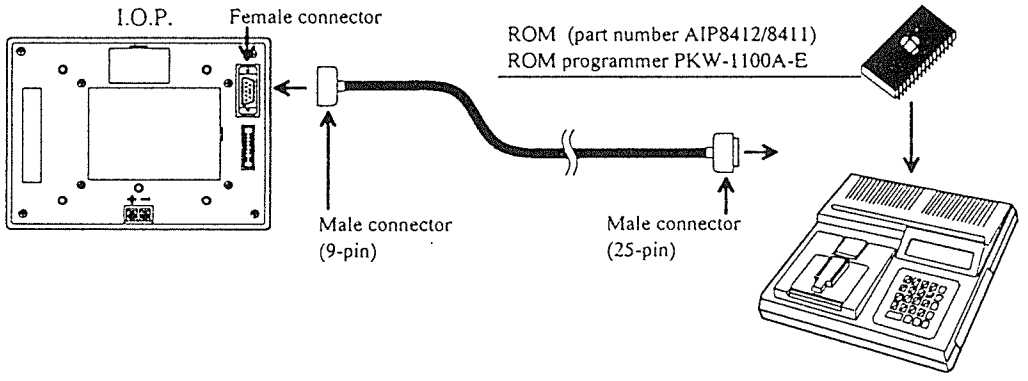
I.O.P. RS-232-C connector

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 JIS Character Code List (Normal Size)

		0 1 2 3	4 5 6 7	8 9 A B	C D E F
Symbol	2120	SP 、 。	, . ・ :	; ? ! ゛	゜ ´ ` ¨
	2130	^ ￣ _ ヽ	ヾ ゝ ゞ 〃	仝 々 〆 〇	― ‐ / ＼
	2140	～ ∥ ｜ … ‥	‘ ’	“ ” ( )	〔 〕 ［ ］
	2150	｛ ｝ 〈 〉	《 》 「 」	『 』 【 】	＋ － ± ×
	2160	÷ ＝ ≠ ＜	＞ ≦ ≧ ∞	∴ ♂ ♀ °	′ ″ ℃ ￥
	2170	＄ ¢ £ ％	＃ ＆ ＊	§ ☆ ★ ○	● ◎ ◇
	2220	◆ □ ■	△ ▲ ▽ ▼	※ 〒 → ←	↑ ↓ ＝
Alphanum	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 2121 is a SPACE.

Appendix E JIS Character Code List (Half-width)

	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 [	¥] ^ SP
0060	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.

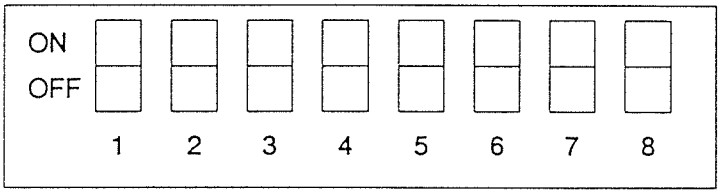
BK: blank

Appendix F I.O.P. Communication Setting Memo

Communication Mode

Communication Mode	☐ Contact Communucation	☐ Data Communication
External Data	☐ HEX data	☐ ASCII data
Character Superimposition	☐ JIS code	☐ Shift-JIS code

DIP switch Settings



RS-232-C Communication Setting

Baud rate	9600 bps	Parity	Odd
Data bits	8 bits	Stop bits	1 bit
Parity check	Yes	Terminator	CR

PC Memory Area Allocation

Area Name	Strat Address	Words Used	Range of Area Used	Remarks
Basic Area	DT _____	___words	DT ____ to DT ____	Displayable External Data: HEX data: Select from 3, 16, 28 or 52
				Displayable External Data: ASCII data: Select from 3, 24, 44 or 84
Output Area	DT _____	50 words	DT ____ to DT ____	50 words are automatically allocated. But you can reassign any area that you don't use for the I.O.P..
Superimposed Character Area	DT _____	21 words	DT ____ to DT ____	21 words are automatically allocated. But you can reassign the area if you don't need character superimposition.
Highlighted Character Area	DT _____	16 words	DT ____ to DT ____	16 words are automatically allocated. But you can reassign the area if you don't need highlighted characters.
Key Code Area	WR _____	___words	WR ____ to WR ____ (R____ to R ____)	Select from 1, 2, 4 or 10 words. Required only for Contact Communication Mode.
Primary Screen Number Area	WR _____	___words	WR ____ to WR ____ (R____ to R ____)	Select from 1, 2, 4 or 10 words. Required only for Contact Communication Mode.

Basic Area

Basic Area Starting Address : DT_____		
Words Used : ____ words		
DT n	DT _____	Control Data 1
DT n+1	DT _____	Primary Screen number
DT n+2	DT _____	Manual Screen LINE
DT n+3	DT _____	Leading zero suppression

Displayable External Data : HEX data		Displayable External Data : ASCII data		
DTn+ 4 to DTn+ 6	DT_____ to DT_____	DTn+ 4 to DTn+ 8	DT_____ to DT_____	Data in Buffer 0
DTn+ 7 to DTn+ 9	DT_____ to DT_____	DTn+ 9 to DTn+13	DT_____ to DT_____	Data in Buffer 1
DTn+10 to DTn+12	DT_____ to DT_____	DTn+14 to DTn+18	DT_____ to DT_____	Data in Buffer 2
DTn+13 to DTn+15	DT_____ to DT_____	DTn+19 to DTn+23	DT_____ to DT_____	Data in Buffer 3
DTn+16 to DTn+18	DT_____ to DT_____	DTn+24 to DTn+28	DT_____ to DT_____	Data in Buffer 4
DTn+19 to DTn+21	DT_____ to DT_____	DTn+29 to DTn+33	DT_____ to DT_____	Data in Buffer 5
DTn+22 to DTn+24	DT_____ to DT_____	DTn+34 to DTn+38	DT_____ to DT_____	Data in Buffer 6
DTn+25 to DTn+27	DT_____ to DT_____	DTn+39 to DTn+43	DT_____ to DT_____	Data in Buffer 7
DTn+28 to DTn+30	DT_____ to DT_____	DTn+44 to DTn+48	DT_____ to DT_____	Data in Buffer 8
DTn+31 to DTn+33	DT_____ to DT_____	DTn+49 to DTn+53	DT_____ to DT_____	Data in Buffer 9
DTn+34 to DTn+36	DT_____ to DT_____	DTn+54 to DTn+58	DT_____ to DT_____	Data in Buffer A
DTn+37 to DTn+39	DT_____ to DT_____	DTn+59 to DTn+63	DT_____ to DT_____	Data in Buffer B
DTn+40 to DTn+42	DT_____ to DT_____	DTn+64 to DTn+68	DT_____ to DT_____	Data in Buffer C
DTn+43 to DTn+45	DT_____ to DT_____	DTn+69 to DTn+73	DT_____ to DT_____	Data in Buffer D
DTn+46 to DTn+48	DT_____ to DT_____	DTn+74 to DTn+78	DT_____ to DT_____	Data in Buffer E
DTn+49 to DTn+51	DT_____ to DT_____	DTn+79 to DTn+83	DT_____ to DT_____	Data in Buffer F

Control Data 1 : DTn DT_____

Bit	7	6	5	4	3	2	1	0
Name	STOP LED	START LED	MAN. LED	AUTO LED	Buzzer	MS	HD	CD

MS : Manual Screen Flag
HD : Character Superimposition Flag
CD : Character Highlight Flag

Leading zero suppression : DTn+3

Bit(Buffer)	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Suppression	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Output Area

Output Area Starting Address : DT_____		
Words Used : 50 words		
DTm	DT _____	Key Data, Control Data 2
DTm+ 1	DT _____	Descriptive External Data Flag
DTm+ 2 to DTm+ 4	DT_____ to DT_____	Descriptive External Data in Buffer 0
DTm+ 5 to DTm+ 7	DT_____ to DT_____	Descriptive External Data in Buffer 1
DTm+ 8 to DTm+10	DT_____ to DT_____	Descriptive External Data in Buffer 2
DTm+11 to DTm+13	DT_____ to DT_____	Descriptive External Data in Buffer 3
DTm+14 to DTm+16	DT_____ to DT_____	Descriptive External Data in Buffer 4
DTm+17 to DTm+19	DT_____ to DT_____	Descriptive External Data in Buffer 5
DTm+20 to DTm+22	DT_____ to DT_____	Descriptive External Data in Buffer 6
DTm+23 to DTm+25	DT_____ to DT_____	Descriptive External Data in Buffer 7
DTm+26 to DTm+28	DT_____ to DT_____	Descriptive External Data in Buffer 8
DTm+29 to DTm+31	DT_____ to DT_____	Descriptive External Data in Buffer 9
DTm+32 to DTm+34	DT_____ to DT_____	Descriptive External Data in Buffer A
DTm+35 to DTm+37	DT_____ to DT_____	Descriptive External Data in Buffer B
DTm+38 to DTm+40	DT_____ to DT_____	Descriptive External Data in Buffer C
DTm+41 to DTm+43	DT_____ to DT_____	Descriptive External Data in Buffer D
DTm+44 to DTm+46	DT_____ to DT_____	Descriptive External Data in Buffer E
DTm+47 to DTm+49	DT_____ to DT_____	Descriptive External Data in Buffer F

Key Data, Control Data 2 : DTm DT_____

BIT	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Name			BT	RCH	RCC		PAUSE	KD-STROB	Key Code (KD)							
	Control data 2								Key Data							

BT : Battery Flag
RCH : Character Highlight completion Flag
RCC : Character Superimposition Completion Flag
PAUSE : PAUSE Flag
KD : Key Data

Superimposed Character Area

I.O.P. screen	LINE	DT K																	
	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
DT Character Specification		DT k+1	DT k+2	DT k+3	DT k+4	DT k+5	DT k+6	DT k+7	DT k+8	DT k+9	DT k+10	DT k+11	DT k+12	DT k+13	DT k+14	DT k+15	DT k+16	DT k+17	DT k+18	DT k+19	DT k+20

Superimposed Character Starting Address : DT_____

Words Used : 21 words

Character : ☐ JIS Code ☐ Shift JIS Code

DTk	DT _____	line : _____
DTk+ 1	DT _____	Character Code : _____
DTk+ 2	DT _____	Character Code : _____
DTk+ 3	DT _____	Character Code : _____
DTk+ 4	DT _____	Character Code : _____
DTk+ 5	DT _____	Character Code : _____
DTk+ 6	DT _____	Character Code : _____
DTk+ 7	DT _____	Character Code : _____
DTk+ 8	DT _____	Character Code : _____
DTk+ 9	DT _____	Character Code : _____
DTk+ 10	DT _____	Character Code : _____
DTk+ 11	DT _____	Character Code : _____
DTk+ 12	DT _____	Character Code : _____
DTk+ 13	DT _____	Character Code : _____
DTk+ 14	DT _____	Character Code : _____
DTk+ 15	DT _____	Character Code : _____
DTk+ 16	DT _____	Character Code : _____
DTk+ 17	DT _____	Character Code : _____
DTk+ 18	DT _____	Character Code : _____
DTk+ 19	DT _____	Character Code : _____
DTk+ 20	DT _____	Character Code : _____

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
	line 1					DT h+1										DT h+0					
	2					DT h+3										DT h+2					
I.O.P.	3					DT h+5										DT h+4					
screen	4					DT h+7										DT h+6					
	5					DT h+9										DT h+8					
	6					DT h+11										DT h+10					
	7					DT h+13										DT h+12					
	8					DT h+15										DT h+14					
DT bit position		9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0

Hightlight Character Area Starting Address : DT_____

Words Used : 16 words

DT bit position	9	8	7	6	5	4	3	2	1	0		9	8	7	6	5	4	3	2	1	0
DTh+ 1 DT_____											DTh DT_____										
DTh+ 3 DT_____											DTh+ 2 DT_____										
DTh+ 5 DT_____											DTh+ 4 DT_____										
DTh+ 7 DT_____											DTh+ 6 DT_____										
DTh+ 9 DT_____											DTh+ 8 DT_____										
DTh+11 DT_____											DTh+10 DT_____										
DTh+13 DT_____											DTh+12 DT_____										
DTh+15 DT_____											DTh+14 DT_____										

Contact Communication Mode

Key Data Starting Address : WR_____			Screen Data Starting Address : WR_____		
Words Used : ____ words			Words Used : ____ words		
Rx	R_____	Key Code : _____	Ry	R_____	Primary Screen No. : _____
Rx+ 1	R_____	Key Code : _____	Ry+ 1	R_____	Primary Screen No. : _____
Rx+ 2	R_____	Key Code : _____	Ry+ 2	R_____	Primary Screen No. : _____
Rx+ 3	R_____	Key Code : _____	Ry+ 3	R_____	Primary Screen No. : _____
Rx+ 4	R_____	Key Code : _____	Ry+ 4	R_____	Primary Screen No. : _____
Rx+ 5	R_____	Key Code : _____	Ry+ 5	R_____	Primary Screen No. : _____
Rx+ 6	R_____	Key Code : _____	Ry+ 6	R_____	Primary Screen No. : _____
Rx+ 7	R_____	Key Code : _____	Ry+ 7	R_____	Primary Screen No. : _____
Rx+ 8	R_____	Key Code : _____	Ry+ 8	R_____	Primary Screen No. : _____
Rx+ 9	R_____	Key Code : _____	Ry+ 9	R_____	Primary Screen No. : _____
Rx+ A	R_____	Key Code : _____	Ry+ A	R_____	Primary Screen No. : _____
Rx+ B	R_____	Key Code : _____	Ry+ B	R_____	Primary Screen No. : _____
Rx+ C	R_____	Key Code : _____	Ry+ C	R_____	Primary Screen No. : _____
Rx+ D	R_____	Key Code : _____	Ry+ D	R_____	Primary Screen No. : _____
Rx+ E	R_____	Key Code : _____	Ry+ E	R_____	Primary Screen No. : _____
Rx+ F	R_____	Key Code : _____	Ry+ F	R_____	Primary Screen No. : _____
Rx+10	R_____	Key Code : _____	Ry+10	R_____	Primary Screen No. : _____
Rx+11	R_____	Key Code : _____	Ry+11	R_____	Primary Screen No. : _____
Rx+12	R_____	Key Code : _____	Ry+12	R_____	Primary Screen No. : _____
Rx+13	R_____	Key Code : _____	Ry+13	R_____	Primary Screen No. : _____
Rx+14	R_____	Key Code : _____	Ry+14	R_____	Primary Screen No. : _____
Rx+15	R_____	Key Code : _____	Ry+15	R_____	Primary Screen No. : _____
Rx+16	R_____	Key Code : _____	Ry+16	R_____	Primary Screen No. : _____
Rx+17	R_____	Key Code : _____	Ry+17	R_____	Primary Screen No. : _____
Rx+18	R_____	Key Code : _____	Ry+18	R_____	Primary Screen No. : _____
Rx+19	R_____	Key Code : _____	Ry+19	R_____	Primary Screen No. : _____
Rx+1A	R_____	Key Code : _____	Ry+1A	R_____	Primary Screen No. : _____
Rx+1B	R_____	Key Code : _____	Ry+1B	R_____	Primary Screen No. : _____
Rx+1C	R_____	Key Code : _____	Ry+1C	R_____	Primary Screen No. : _____
Rx+1D	R_____	Key Code : _____	Ry+1D	R_____	Primary Screen No. : _____
Rx+1E	R_____	Key Code : _____	Ry+1E	R_____	Primary Screen No. : _____
Rx+1F	R_____	Key Code : _____	Ry+1F	R_____	Primary Screen No. : _____
Rx+20	R_____	Key Code : _____	Ry+20	R_____	Primary Screen No. : _____

Rx+21	R_____	Key Code : _____	Ry+21	R_____	Primary Screen No. : _____
Rx+22	R_____	Key Code : _____	Ry+22	R_____	Primary Screen No. : _____
Rx+23	R_____	Key Code : _____	Ry+23	R_____	Primary Screen No. : _____
Rx+24	R_____	Key Code : _____	Ry+24	R_____	Primary Screen No. : _____
Rx+25	R_____	Key Code : _____	Ry+25	R_____	Primary Screen No. : _____
Rx+26	R_____	Key Code : _____	Ry+26	R_____	Primary Screen No. : _____
Rx+27	R_____	Key Code : _____	Ry+27	R_____	Primary Screen No. : _____
Rx+28	R_____	Key Code : _____	Ry+28	R_____	Primary Screen No. : _____
Rx+29	R_____	Key Code : _____	Ry+29	R_____	Primary Screen No. : _____
Rx+2A	R_____	Key Code : _____	Ry+2A	R_____	Primary Screen No. : _____
Rx+2B	R_____	Key Code : _____	Ry+2B	R_____	Primary Screen No. : _____
Rx+2C	R_____	Key Code : _____	Ry+2C	R_____	Primary Screen No. : _____
Rx+2D	R_____	Key Code : _____	Ry+2D	R_____	Primary Screen No. : _____
Rx+2E	R_____	Key Code : _____	Ry+2E	R_____	Primary Screen No. : _____
Rx+2F	R_____	Key Code : _____	Ry+2F	R_____	Primary Screen No. : _____
Rx+30	R_____	Key Code : _____	Ry+30	R_____	Primary Screen No. : _____
Rx+31	R_____	Key Code : _____	Ry+31	R_____	Primary Screen No. : _____
Rx+32	R_____	Key Code : _____	Ry+32	R_____	Primary Screen No. : _____
Rx+33	R_____	Key Code : _____	Ry+33	R_____	Primary Screen No. : _____
Rx+34	R_____	Key Code : _____	Ry+34	R_____	Primary Screen No. : _____
Rx+35	R_____	Key Code : _____	Ry+35	R_____	Primary Screen No. : _____
Rx+36	R_____	Key Code : _____	Ry+36	R_____	Primary Screen No. : _____
Rx+37	R_____	Key Code : _____	Ry+37	R_____	Primary Screen No. : _____
Rx+38	R_____	Key Code : _____	Ry+38	R_____	Primary Screen No. : _____
Rx+39	R_____	Key Code : _____	Ry+39	R_____	Primary Screen No. : _____
Rx+3A	R_____	Key Code : _____	Ry+3A	R_____	Primary Screen No. : _____
Rx+3B	R_____	Key Code : _____	Ry+3B	R_____	Primary Screen No. : _____
Rx+3C	R_____	Key Code : _____	Ry+3C	R_____	Primary Screen No. : _____
Rx+3D	R_____	Key Code : _____	Ry+3D	R_____	Primary Screen No. : _____
Rx+3E	R_____	Key Code : _____	Ry+3E	R_____	Primary Screen No. : _____
Rx+3F	R_____	Key Code : _____	Ry+3F	R_____	Primary Screen No. : _____
Rx+40	R_____	Key Code : _____	Ry+40	R_____	Primary Screen No. : _____
Rx+41	R_____	Key Code : _____	Ry+41	R_____	Primary Screen No. : _____
Rx+42	R_____	Key Code : _____	Ry+42	R_____	Primary Screen No. : _____
Rx+43	R_____	Key Code : _____	Ry+43	R_____	Primary Screen No. : _____
Rx+44	R_____	Key Code : _____	Ry+44	R_____	Primary Screen No. : _____
Rx+45	R_____	Key Code : _____	Ry+45	R_____	Primary Screen No. : _____

Rx+46	R_____	Key Code : _____	Ry+46	R_____	Primary Screen No. : _____
Rx+47	R_____	Key Code : _____	Ry+47	R_____	Primary Screen No. : _____
Rx+48	R_____	Key Code : _____	Ry+48	R_____	Primary Screen No. : _____
Rx+49	R_____	Key Code : _____	Ry+49	R_____	Primary Screen No. : _____
Rx+4A	R_____	Key Code : _____	Ry+4A	R_____	Primary Screen No. : _____
Rx+4B	R_____	Key Code : _____	Ry+4B	R_____	Primary Screen No. : _____
Rx+4C	R_____	Key Code : _____	Ry+4C	R_____	Primary Screen No. : _____
Rx+4D	R_____	Key Code : _____	Ry+4D	R_____	Primary Screen No. : _____
Rx+4E	R_____	Key Code : _____	Ry+4E	R_____	Primary Screen No. : _____
Rx+4F	R_____	Key Code : _____	Ry+4F	R_____	Primary Screen No. : _____
Rx+50	R_____	Key Code : _____	Ry+50	R_____	Primary Screen No. : _____
Rx+51	R_____	Key Code : _____	Ry+51	R_____	Primary Screen No. : _____
Rx+52	R_____	Key Code : _____	Ry+52	R_____	Primary Screen No. : _____
Rx+53	R_____	Key Code : _____	Ry+53	R_____	Primary Screen No. : _____
Rx+54	R_____	Key Code : _____	Ry+54	R_____	Primary Screen No. : _____
Rx+55	R_____	Key Code : _____	Ry+55	R_____	Primary Screen No. : _____
Rx+56	R_____	Key Code : _____	Ry+56	R_____	Primary Screen No. : _____
Rx+57	R_____	Key Code : _____	Ry+57	R_____	Primary Screen No. : _____
Rx+58	R_____	Key Code : _____	Ry+58	R_____	Primary Screen No. : _____
Rx+59	R_____	Key Code : _____	Ry+59	R_____	Primary Screen No. : _____
Rx+5A	R_____	Key Code : _____	Ry+5A	R_____	Primary Screen No. : _____
Rx+5B	R_____	Key Code : _____	Ry+5B	R_____	Primary Screen No. : _____
Rx+5C	R_____	Key Code : _____	Ry+5C	R_____	Primary Screen No. : _____
Rx+5D	R_____	Key Code : _____	Ry+5D	R_____	Primary Screen No. : _____
Rx+5E	R_____	Key Code : _____	Ry+5E	R_____	Primary Screen No. : _____
Rx+5F	R_____	Key Code : _____	Ry+5F	R_____	Primary Screen No. : _____
Rx+60	R_____	Key Code : _____	Ry+60	R_____	Primary Screen No. : _____
Rx+61	R_____	Key Code : _____	Ry+61	R_____	Primary Screen No. : _____
Rx+62	R_____	Key Code : _____	Ry+62	R_____	Primary Screen No. : _____
Rx+63	R_____	Key Code : _____	Ry+63	R_____	Primary Screen No. : _____
Rx+64	R_____	Key Code : _____	Ry+64	R_____	Primary Screen No. : _____
Rx+65	R_____	Key Code : _____	Ry+65	R_____	Primary Screen No. : _____
Rx+66	R_____	Key Code : _____	Ry+66	R_____	Primary Screen No. : _____
Rx+67	R_____	Key Code : _____	Ry+67	R_____	Primary Screen No. : _____
Rx+68	R_____	Key Code : _____	Ry+68	R_____	Primary Screen No. : _____
Rx+69	R_____	Key Code : _____	Ry+69	R_____	Primary Screen No. : _____
Rx+6A	R_____	Key Code : _____	Ry+6A	R_____	Primary Screen No. : _____

Rx+6B	R_____	Key Code : _____	Ry+6B	R_____	Primary Screen No. : _____
Rx+6C	R_____	Key Code : _____	Ry+6C	R_____	Primary Screen No. : _____
Rx+6D	R_____	Key Code : _____	Ry+6D	R_____	Primary Screen No. : _____
Rx+6E	R_____	Key Code : _____	Ry+6E	R_____	Primary Screen No. : _____
Rx+6F	R_____	Key Code : _____	Ry+6F	R_____	Primary Screen No. : _____
Rx+70	R_____	Key Code : _____	Ry+70	R_____	Primary Screen No. : _____
Rx+71	R_____	Key Code : _____	Ry+71	R_____	Primary Screen No. : _____
Rx+72	R_____	Key Code : _____	Ry+72	R_____	Primary Screen No. : _____
Rx+73	R_____	Key Code : _____	Ry+73	R_____	Primary Screen No. : _____
Rx+74	R_____	Key Code : _____	Ry+74	R_____	Primary Screen No. : _____
Rx+75	R_____	Key Code : _____	Ry+75	R_____	Primary Screen No. : _____
Rx+76	R_____	Key Code : _____	Ry+76	R_____	Primary Screen No. : _____
Rx+77	R_____	Key Code : _____	Ry+77	R_____	Primary Screen No. : _____
Rx+78	R_____	Key Code : _____	Ry+78	R_____	Primary Screen No. : _____
Rx+79	R_____	Key Code : _____	Ry+79	R_____	Primary Screen No. : _____
Rx+7A	R_____	Key Code : _____	Ry+7A	R_____	Primary Screen No. : _____
Rx+7B	R_____	Key Code : _____	Ry+7B	R_____	Primary Screen No. : _____
Rx+7C	R_____	Key Code : _____	Ry+7C	R_____	Primary Screen No. : _____
Rx+7D	R_____	Key Code : _____	Ry+7D	R_____	Primary Screen No. : _____
Rx+7E	R_____	Key Code : _____	Ry+7E	R_____	Primary Screen No. : _____
Rx+7F	R_____	Key Code : _____	Ry+7F	R_____	Primary Screen No. : _____
Rx+80	R_____	Key Code : _____	Ry+80	R_____	Primary Screen No. : _____
Rx+81	R_____	Key Code : _____	Ry+81	R_____	Primary Screen No. : _____
Rx+82	R_____	Key Code : _____	Ry+82	R_____	Primary Screen No. : _____
Rx+83	R_____	Key Code : _____	Ry+83	R_____	Primary Screen No. : _____
Rx+84	R_____	Key Code : _____	Ry+84	R_____	Primary Screen No. : _____
Rx+85	R_____	Key Code : _____	Ry+85	R_____	Primary Screen No. : _____
Rx+86	R_____	Key Code : _____	Ry+86	R_____	Primary Screen No. : _____
Rx+87	R_____	Key Code : _____	Ry+87	R_____	Primary Screen No. : _____
Rx+88	R_____	Key Code : _____	Ry+88	R_____	Primary Screen No. : _____
Rx+89	R_____	Key Code : _____	Ry+89	R_____	Primary Screen No. : _____
Rx+8A	R_____	Key Code : _____	Ry+8A	R_____	Primary Screen No. : _____
Rx+8B	R_____	Key Code : _____	Ry+8B	R_____	Primary Screen No. : _____
Rx+8C	R_____	Key Code : _____	Ry+8C	R_____	Primary Screen No. : _____
Rx+8D	R_____	Key Code : _____	Ry+8D	R_____	Primary Screen No. : _____
Rx+8E	R_____	Key Code : _____	Ry+8E	R_____	Primary Screen No. : _____
Rx+8F	R_____	Key Code : _____	Ry+8F	R_____	Primary Screen No. : _____

Rx+90	R_____	Key Code : _____	Ry+90	R_____	Primary Screen No. : _____
Rx+91	R_____	Key Code : _____	Ry+91	R_____	Primary Screen No. : _____
Rx+92	R_____	Key Code : _____	Ry+92	R_____	Primary Screen No. : _____
Rx+93	R_____	Key Code : _____	Ry+93	R_____	Primary Screen No. : _____
Rx+94	R_____	Key Code : _____	Ry+94	R_____	Primary Screen No. : _____
Rx+95	R_____	Key Code : _____	Ry+95	R_____	Primary Screen No. : _____
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Rx+98	R_____	Key Code : _____	Ry+98	R_____	Primary Screen No. : _____
Rx+99	R_____	Key Code : _____	Ry+99	R_____	Primary Screen No. : _____
Rx+9A	R_____	Key Code : _____	Ry+9A	R_____	Primary Screen No. : _____
Rx+9B	R_____	Key Code : _____	Ry+9B	R_____	Primary Screen No. : _____
Rx+9C	R_____	Key Code : _____	Ry+9C	R_____	Primary Screen No. : _____
Rx+9D	R_____	Key Code : _____	Ry+9D	R_____	Primary Screen No. : _____
Rx+9E	R_____	Key Code : _____	Ry+9E	R_____	Primary Screen No. : _____
Rx+9F	R_____	Key Code : _____	Ry+9F	R_____	Primary Screen No. : _____

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