Panasonic®

OPERATOR INTERFACE

I.O.P. (Intelligent Operating Panel) M20 Technical Manual (Preliminary)

I.O.P. (Intelligent Operating Panel) M20 Technical Manual
ACG-M0040-1 '92.5

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 Software. You can make a "console panel" that is matched to the needs of your system and to the needs of the operators. When you change the machines or the design of your system, you don't have to rewire the control panel. You just redesign the control screens.

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

The I.O.P. has two ports for data communication with a programmable controller. You can use either a parallel or serial cable, depending on your controller. The connection between them 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.

To operate the I.O.P. Model 20, 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.

Contents

Chapter 1 Specifications

Chapter 2 I.O.P. Operation

Chapter 3 Guiding to PC Programming

Chapter 4 Connecting the I.O.P. to a PC

Chapter 5 Operating Environments

Appendix

What's in each Chapter

Outline

Chapter 1 describes the I.O.P. Model 20's general specifications, functional specifications, external dimensions, part names and data communications specifications.

Chapter 2 explains how to use the I.O.P Model 20. You will learn how to operate the I.O.P..

Chapter 3 explains how the I.O.P. Model 20 communicates with a programmable controller. You can choose either parallel or serial communication depending on the programmable controller you use.
According to the explanations given for each communication mode, you may create suitable programs for your PC and its communication mode.

Chapter 4 explains how to connect the communication cables.
You will learn how to connect the I.O.P. Model 20 to FP series programmable controllers, and also to other manufacturers' programmable controllers.

Chapter 5 explains how to maintain the I.O.P..
Precautions for safe handling the I.O.P. Model 20 will be explained.

Appendix
Refer to the appendices as necessary.

Notation used in this manual

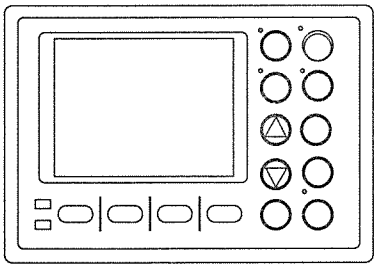
Notes	Indicates limits to be observed.
Caution	Indicates a precaution to be followed.

Abbreviations used in this manual

PC	: programmable controller
I.O.P.	: Intelligent Operating Panel Model 20
Manual Screen	: Manual Key Access Screen
JIS	: Japanese Industrial Standards
BCC	: Block Check Code

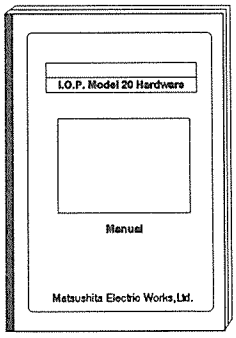
Packing List

I.O.P. Model 20

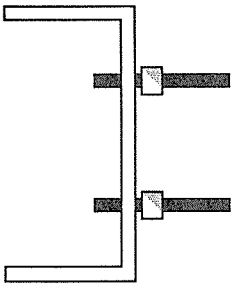


Backup Battery

This manual



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

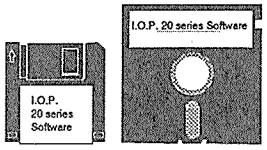


Getting Ready to Use the I.O.P.

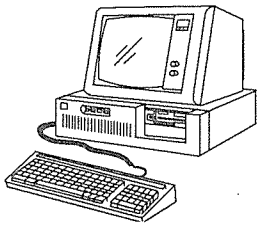
You will need:

For Screen editing

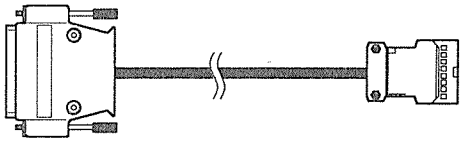
I.O.P. 20 series Software



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

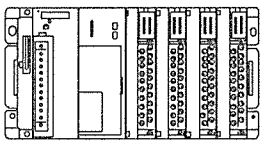


Transmission cable (Part number AIP8001 or the "Transmission cable" spedified on page 148.)

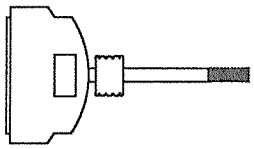


For communicating with a programmable controller

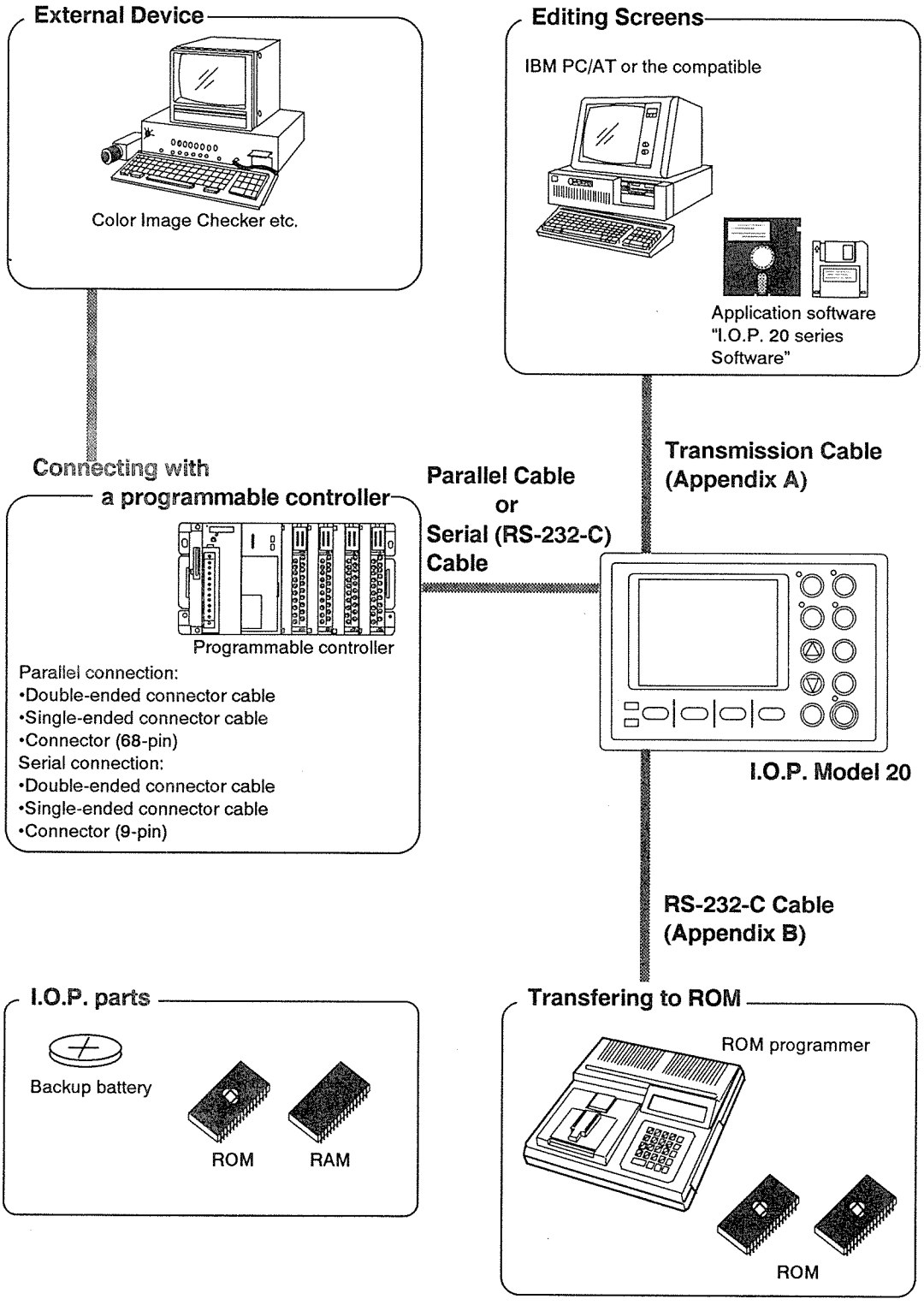
A programmable controller



A cable



System Configurations



Parts Name	Specifications		Part Number
I.O.P. Model 20	Flange type		AIP201002
	Case type		AIP201102
Double-ended connector cable for parallel I/O connection	Connection to FP3(input 32/output 32) (1:4 connection)	2m	AIP81232
	Connection to FP5(input 64/output 64) (1:2 connection)	2m	AIP81252
	Connection to M1T (1:3 connection)	2m	AIP81222
	Connection to M2T (1:3 connection)	2m	AIP81222
Single-ended connector cable for parallel I/O connection	68 wires with 68-pin connector	1m	AIP81241
		2m	AIP81242
		3m	AIP81243
		4m	AIP81244
		5m	AIP81245
68-pin parallel I/O connector	68-pin connector (I.O.P. side)		AIP8126
Double-ended connector cable for serial communication	Connection with the Data Process Unit of FP3 or FP5. Connection with Serial Data Unit Connection with an FP1	2m	AIP81862N
Single-ended connector cable for serial communication	9 wires with 9-pin connector * You can use this cable for marking 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 communication	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.	1.5 m	AIP8001
Application Software "I.O.P. 20 series Software"	Used to create and edit screens		AIP8304
ROM	User Memory 256Kb: Screen storage, max. 64 screens		AIP8412
	User Memory 1024Kb: Screen storage, max. 256 screens		AIP8411
RAM	User Memory 256Kb: Screen storage, max. 64 screens Mounted when shipped.		AIP8402
	User Memory 1024Kb: Screen storage, max. 256 screens		AIP8401
Backup battery	To maintain User Memory (supplied when shipped)		AFB8801

I.O.P. Installation Procedure

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

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

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

4. Determine the communication mode suitable for the PC you will use with the I.O.P..
   Parallel communication or serial communication?

Parallel communication	Serial communication
Choose the mode; Custom mode or Handshake mode? Refer to page 57.	Set the data communication format. Refer to page 89.
Create programs Refer to 3-2 "Guide to Programming for Parallel Communication".	Create programs. Refer to 3-3 "Guide to Programming to Serial Communication".
Connect a cable for parallel communication. Refer to Chapter 4.	Connect a cable for serial communication. Refer to Chapter 4.

5. 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 or Monitor Mode".

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

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

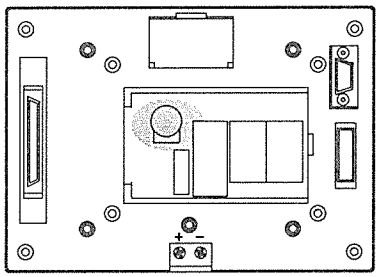
7. Operate the I.O.P. in Run Mode.
   Refer to 2-8 "Choosing Run Mode or Monitor Mode"

8. Maintenance
   Refer to Chapter 5.

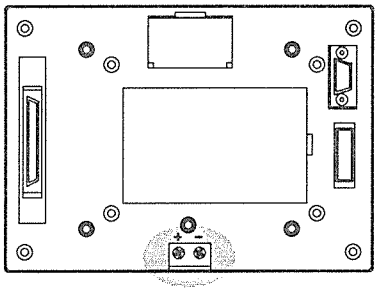
Preparing I.O.P. for Operation

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

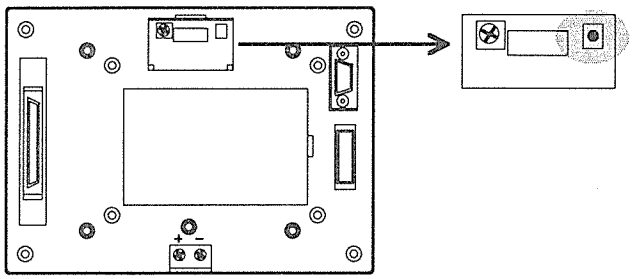
1. Install the backup battery in the I.O.P..
   You can refer to "Replacing the Backup Battery" on page 142 for installation.



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..



Cautions

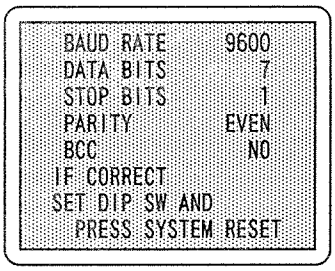
Caution 1

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..

Caution 2

When you want to perform serial communication, you have to confirm that the I.O.P. is ready for serial communication. By setting the I.O.P. DIP switches for serial communication, the serial communication data format can be checked and modified on the I.O.P. screen.
The details can be found in "Setting Serial Communication Data Format" on page 89.

Serial Communication Data Format Screen



Chapter 1

Specifications

This chapter describes the I.O.P. Model 20'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, max. 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	Available with serial communication. Specify the characters listed in Appendices D and E.
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 there is a system problem.) START LED: Green STOP LED: Red AUTO LED: Green MAN. LED: Green PAUSE LED: Red

Communication Specifications

Parallel I/O specifications

Input (I)		Output (O)	
DATA		DATA	
GD0-GD7 (Screen Data)	8 bit	KD0-KD7 (Key Data)	8 bit
SCREEN CONTROL		DATA CONTROL	
KD READY (Key Data ready)	1 bit	GD READY (Screen Data ready)	1 bit
GD STROB (Screen Data strobe)	1 bit	KD STROB (Key Data strobe)	1 bit
I.O.P. CONTROL		I.O.P. CONTROL	
AD0-AD3 (Buffer address for Displayable External Data)	4 bit	SC0-SC3 (Buffer address for Descriptive External Data)	4 bit
KK0-KK3 (Digits position for Displayable External Data)	3 bit	SK0-SK2 (Digits position for Descriptive External Data)	3 bit
C/D (Screen Data / Displayable External Data flag)	1 bit	S/K (Key Data/Descriptive External Data flag)	1 bit
ML (Manual Screen LINE spec.)	1 bit		
MS (Manual Screen control)	1 bit	PAUSE	
FF.REQ (Requesting FF)	1 bit	PAUSE	1 bit
BUZZER (Buzzer control)	1 bit	ALARM OUTPUT.	
LED 1 (AUTO LED)	1 bit	ALARM	1bit.
LED 2 (MAN. LED)	1 bit		
LED 3 (START LED)	1 bit		
LED 4 (STOP LED)	1 bit		

Parallel Port
68-pin Female Connector (JAE D05-36ST-1L1 or equivalent)

Serial specifications

Start-stop ←?

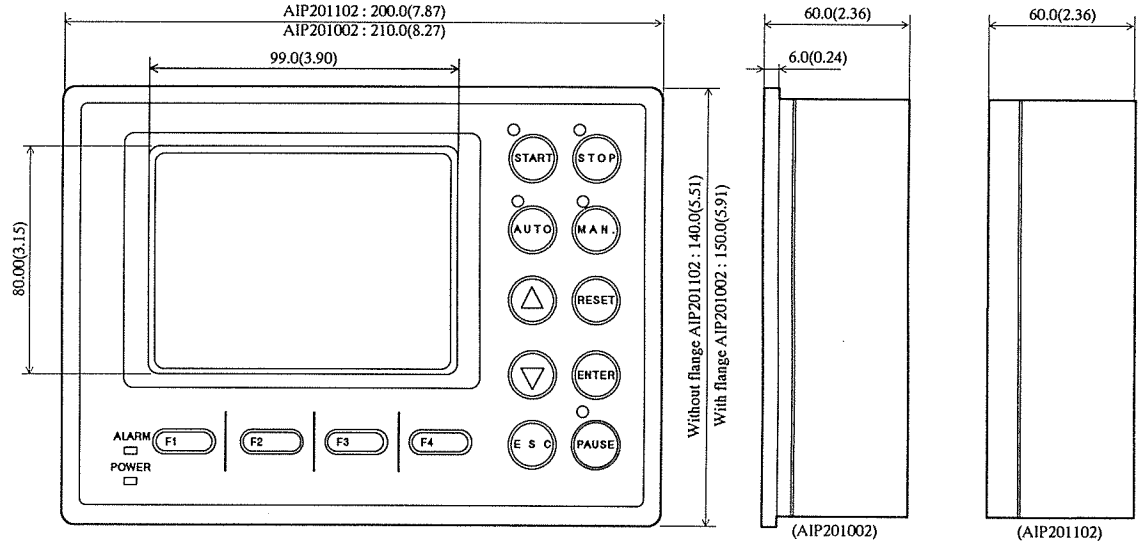
Asynchronous communications	
Start bits	1
Data bits	7/8
Parity check	Yes/No
Parity	Even/Odd
Stop bits	1/2
Baud rate	300/600/1200/2400/4800/9600 baud
Half duplex	
Proprietary protocol	

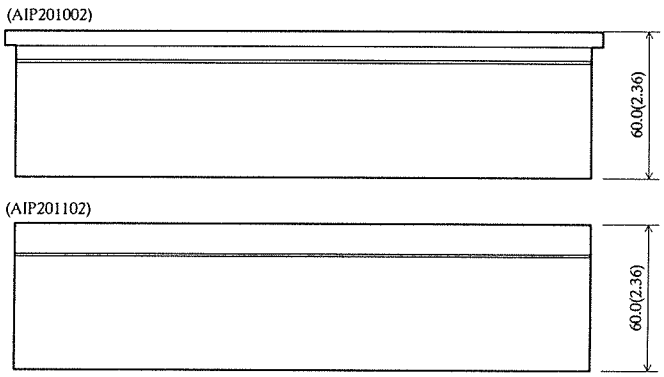
The initial values for data bit, parity check, parity setting, stop bit and baud rate are set to 7/Yes/Even/1/9600.

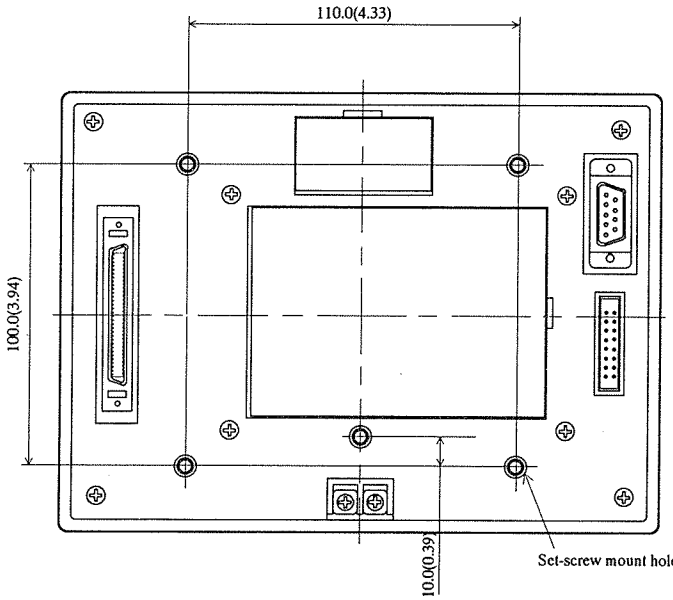
Serial Port
9-pin Female Connector (D Subminiature 9-pin Connector)

1-2 External Dimensions

unit : mm(in.)





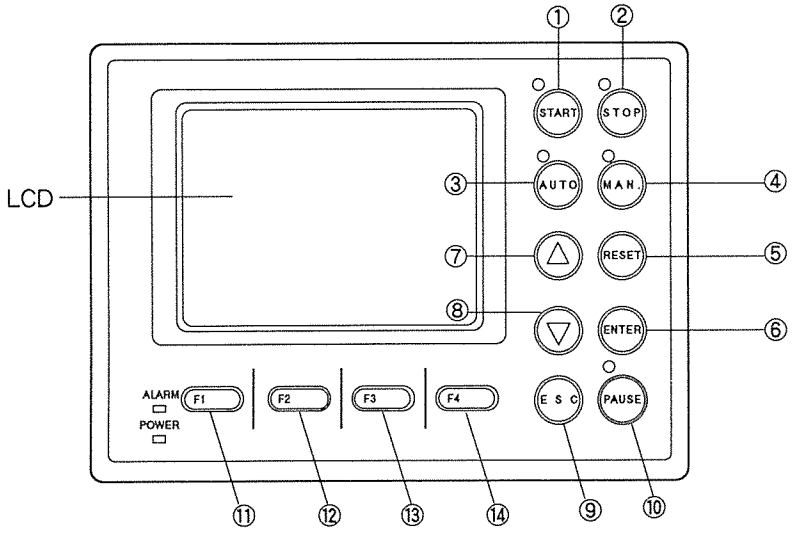


Notes :
AIP201002 has a flange for mounting the I.O.P. on a board.
AIP201102 does not have a flange.

Refer to 5-1. "Mounting the I.O.P. on a board" for mounting dimensions.

1-3 I.O.P. Part Names

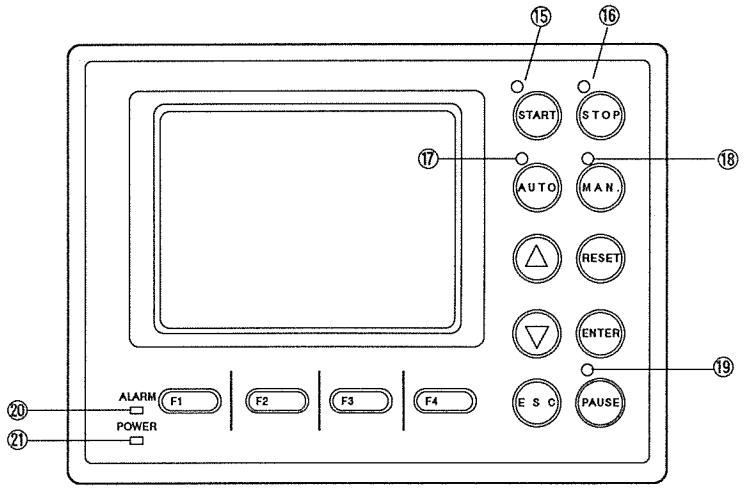
Front Panel



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.
⑥	ENTER	Used to modify the serial communication data format, 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 Primary Screen to Secondary Screen, from Primary Screen to Manual Key Access Screen).
⑩	PAUSE	Pause key. The I.O.P. sends an exclusive signal to the PC. Latched operation (cancelled with the RESET key)
⑪ 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.

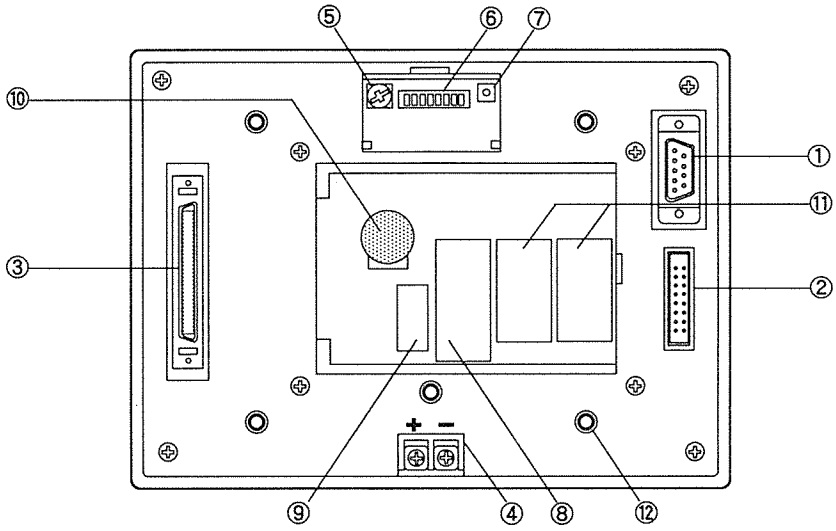
LEDs



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 there is a system problem. To turn it off, press the System Reset Button on the rear panel of the I.O.P..
㉑	POWER	Green	Lit when the I.O.P. is turned ON.

system has a problem

Rear Panel



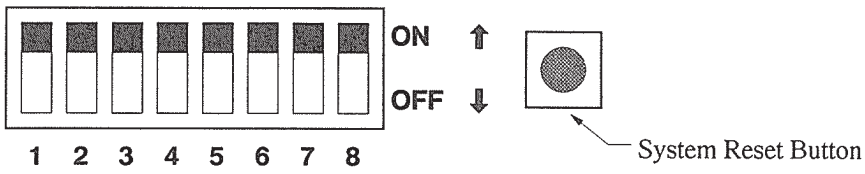
①	RS-232-C connector	RS-232-C port for serial communication. Connects to a commercial ROM programmer. You can transfer the data in User Memory to the ROM programmer.
②	Transmission connector	Connects to a personal computer to transfer edited data to the I.O.P.. Use a Transmission Cable (e. g. Model No. AIP8001) for the connection.
③	Parallel interface connector	Parallel I/O port for parallel communication.
④	Power supply terminal	Power terminal for I.O.P. operation. 24V DC.
⑤	Contrast adjustment	Adjusts the contrast of the liquid-crystal display.
⑥	DIP switch	Switches for changing modes. Refer to DIP switches table on the next page.
⑦	System Reset Button	Pressed after the mode is changed with the DIP switches.
⑧	RAM/ROM mounting connector	Install User Memory (RAM/ROM) in it. 256Kb RAM installed when shipped.
⑨	RAM/ROM switching Jumper	The connector assignments will vary depending on the User Memory you use.
⑩	Backup battery	Battery for I.O.P. User Memory backup.
⑪	System ROM	The I.O.P. System ROM. Do not remove the System ROM.
⑫	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	*	*	*	*	*	*	*	Data Register Mode/Transfer Mode
ON	OFF	*	*	*	*	*	*	Run Mode
ON	ON	*	*	*	*	*	*	Monitor Mode
ON	OFF	OFF	OFF	*	*	*	*	Parallel Custom Mode
ON	OFF	ON	OFF	*	*	*	*	Parallel Handshake Mode
ON	OFF	*	ON	OFF	*	*	*	Serial Communication Mode
ON	OFF	*	ON	ON	*	*	*	Serial Communication Data Format Change Mode
*	*	*	*	*	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..

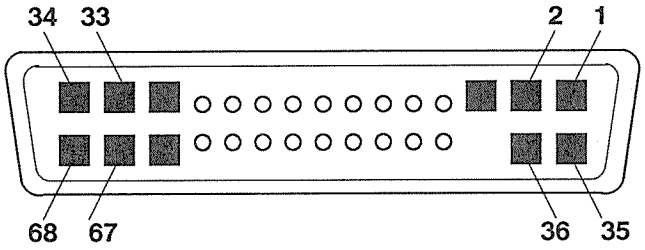
* You can set the DIP switch to either ON or OFF.
Choose the one appropriate for your operation.

Caution

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

1-4 Parallel Interface Specifications

I.O.P. Parallel Interface Connector



(Female connector)

Connector Pin Assignments

The pins of the I.O.P. parallel connector are assigned as follows.

Pin No.	I.O.P. I/O	Name	Description	Pin No.	I.O.P. I/O	Name	Description
1	×	+24VDC	I/O power supply	35	×	+24VDC	I/O power supply
2	I	GD0	Screen Data	36	I	GD1	Screen Data
3	I	GD2		37	I	GD3	
4	I	GD4		38	I	GD5	
5	I	GD6		39	I	GD7	
6	I	LED1	AUTO LED	40	I	LED2	MAN. LED
7	I	LED3	START LED	41	I	LED4	STOP LED
8	I	C/D	Screen Data/ Displayable External Data flag	42	I	$\overline{\text{GD STROB}}$	Screen Data stobe
9	I	FF.REQ	Requesting FF	43	I	KD READY	Key Data ready
10	×	(OV)	(GND)	44	×	(OV)	(GND)
11	×	+24VDC	I/O power supply	45	×	+24VDC	I/O power supply
12	I	AD0	Displayable External Data Buffer Address	46	I	AD1	Displayable External Data Buffer Address
13	I	AD2		47	I	AD3	
14	I	BUZZER	Buzzer control	48	I	ML	Manual Screen LINE spec.
15	I	MS	Manual Screen control	49	I	KK0	Digits position for Displayable External Data
16	I	KK1	Digits position for Displayable External Data	50	I	KK2	
17		N.C.		51		N.C.	
18	×	(OV)	(GND)	52	×	(OV)	(GND)

Pin No.	I.O.P. I/O	Name	Description	Pin No.	I.O.P. I/O	Name	Description
19	×	+24VDC	I/O power supply	53	×	+24VDC	I/O power supply
20	O	KD0	Key Data	54	O	KD1	Key Data
21	O	KD2		55	O	KD3	
22	O	KD4		56	O	KD5	
23	O	KD6		57	O	KD7	
24	O	$\overline{\text{KD STROB}}$	Key Data strobe	58	O	S/K	Key Data/ Descriptive External Data flag
25	O	PAUSE	Pause	59	O	GD READY	Screen Data ready
26	O	SC0	Descriptive External Data Buffer Address	60	O	SC1	Descriptive External Data Buffer Address
27	O	SC2		61	O	SC3	
28	×	0V	GND	62	×	0V	GND
29	×	+24VDC	I/O power supply	63	×	+24VDC	I/O power supply
30	O	SK0	Digits position for Descriptive External Data	64	O	SK1	Digits position for Descriptive External Data
31	O	SK2		65		N.C.	
32		N.C.		66		N.C.	
33		N.C.		67		ALARM	Output I.O.P. alarm
34	×	0V	GND	68	×	0V	GND

N.C. : Not connected

Notes

- Pin No. 1, 11, 35, 45 are internally connected.
  Pin No. 10, 18, 44, 52 are internally connected.
  Pin No. 19, 29, 53, 63 are internally connected.
  Pin No. 28, 34, 62, 68 are internally connected.

- I/O power supply : To keep signal lines pulled high.

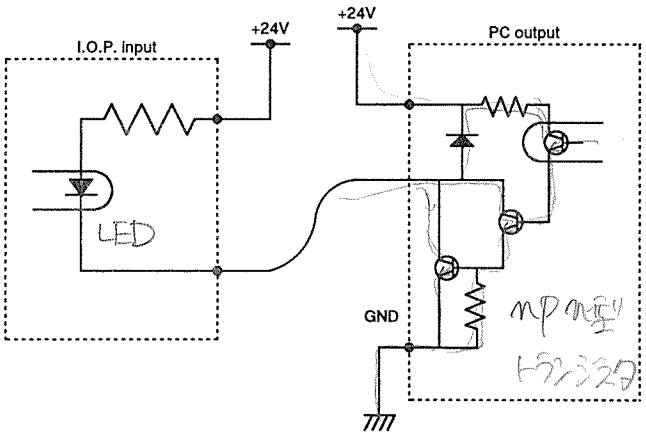
Parallel Interface I/O Specifications

Input specifications

Rated voltage	24V DC(+/- 10%)
Isolation	Photo coupler
Input impedance	Approx. 4.4 KΩ
Input delay time	From OFF to ON: less than 1 msec. From ON to OFF: less than 1 msec.
Applied voltage (Max.)	26.4V DC
ON voltage	19.2V DC
OFF voltage	2.4V DC

Common terminal character +

Input circuit drawing

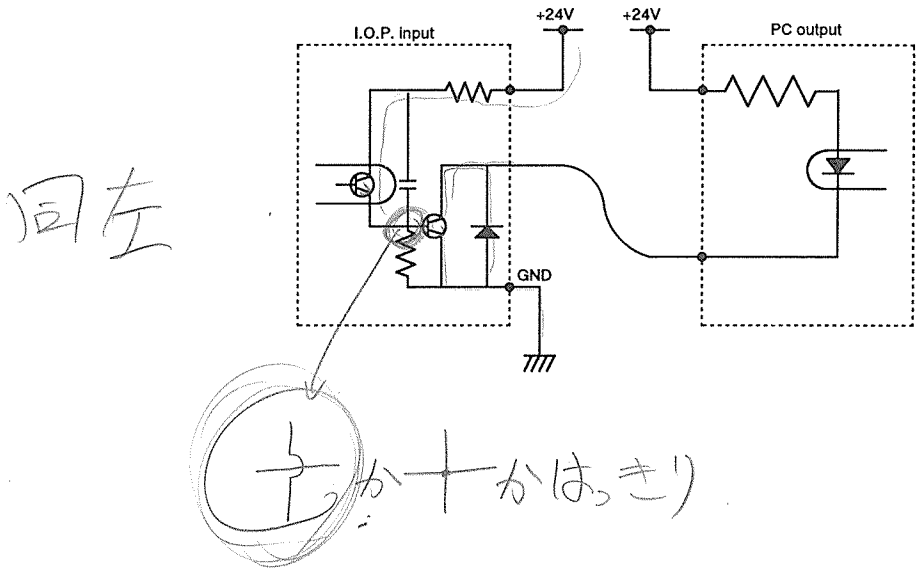


Output Specifications

Output	Transistor/open collector output
Rated voltage	24V DC(+/- 10%)
Isolation	Photo coupler
Maximum capacity Leakage current	10mA 100μA max.
Residual voltage	1.5V max.
Regulation	20.4 V DC to 26.4 V DC
Output delay time	From OFF to ON: less than 1 msec. From ON to OFF: less than 1 msec.

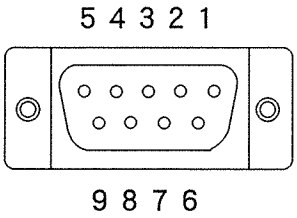
Common terminal character −, +, ×
* There is a common of +24V or 0V in output.

Output circuit drawing



1-5 Serial (RS-232-C) interface specifications

I.O.P. Serial Interface Connector



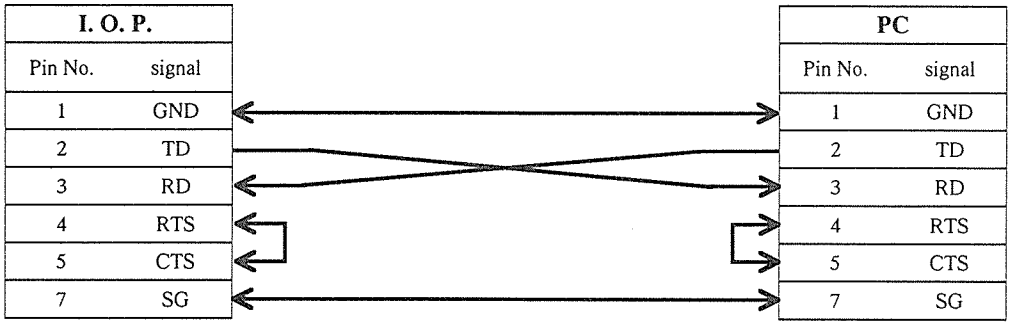
(Female connector installed on the I.O.P.)

Connector 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)	–

RTS and CTS is not effective on the I.O.P. side

Example of wiring



* The above wiring is intended for connecting the I.O.P. to an FP series PC manufactured by Matsushita Electric Works Ltd.

I.O.P. Serial Interface Specifications

Communication standard	EIA RS-232-C	
Mode	Start-stop synchronous system	
	Start bit	1 bit
	Data	7/8 bit
	Parity check	Yes/No
	Parity setting	Even/Odd
	Stop bit	1/2 bits
Baud rate	300/600/1200/2400/4800/9600 baud	
Transmission Style	Half duplex	
Protocol	Proprietary protocol	
Serial port	D subminiature 9-pin connector	

Chapter 2

I.O.P. Operation

This chapter explains the features and uses of the I.O.P. Model 20. 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 numeric 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 49 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. when it receives Screen Code signals from the PC. Paging of the Primary Screens can also done automatically by the PC.

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

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

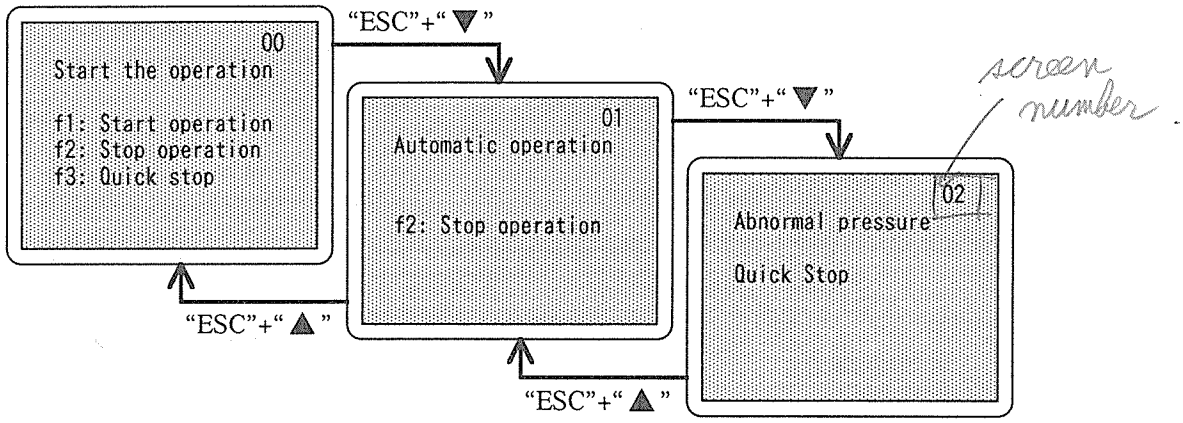
the ESC key and the up arrow key (▲) to display the previous page.

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

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

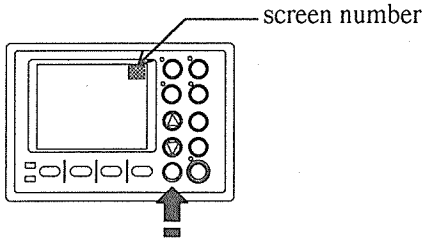
Caution

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



Displaying the Primary Screen number

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



Creating Primary Screens

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

PC programming for communication

Parallel Communication: See 3-2"Guide to Programming for Parallel Communication" for details.

The I.O.P. will display a Primary Screen when it receives a Screen Code from the PC. The Screen Code is sent as on 8 bit number on lines GD0 through GD7.

Example

GD No.	7	6	5	4	3	2	1	0
Specifying screen No. 03	0	0	0	0	0	0	1	1
Specifying screen No. 0A	0	0	0	0	1	0	1	0

* The communication lines on the parallel port use inverted signals. (0 : ~~HIGH~~ 1 : ~~LOW~~) OFF ON

Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.

When the I.O.P. receives the command "G" in ASCII HEX code from the PC, it displays a Primary Screen.

Example

Screen Number HEX 03 → HEX 3033(in ASCII)

Command "G" protocol specification (in ASCII)

1B	30	31	47	30	33					0D
HDR	Machine #		G	Screen #						Terminator

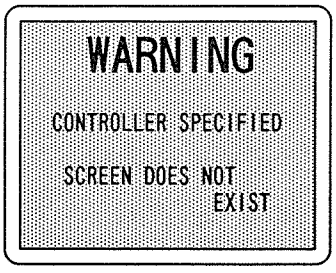
Screen Number HEX 0A → HEX 3041(in ASCII)

Command "G" protocol specification (in ASCII)

1B	30	31	47	30	41					0D
HDR	Machine #		G	Screen #						Terminator

Caution

- If the PC sends a Screen number for a screen 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

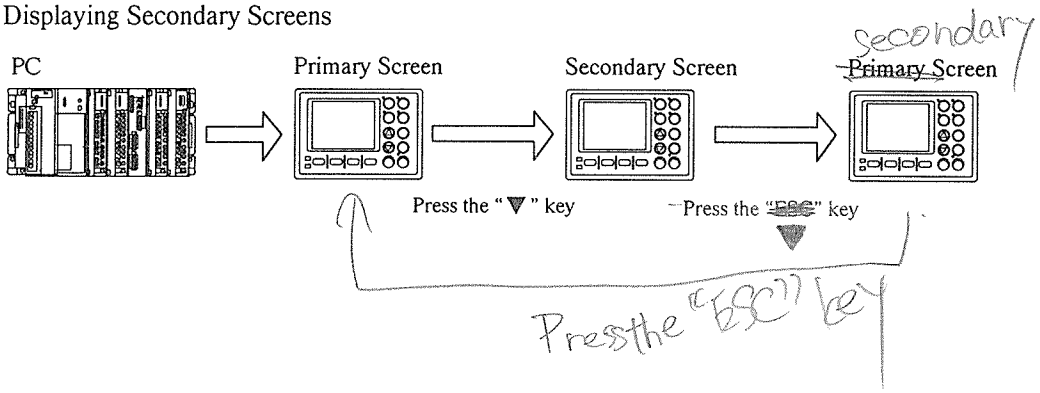
- 256Kb of RAM is installed in the I.O.P. when it is shipped.
  Refer to "Replacing User Memory" on page 49 if you want to add more memory or change to a ROM.

Displaying Secondary Screens

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

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

Displaying Secondary Screens

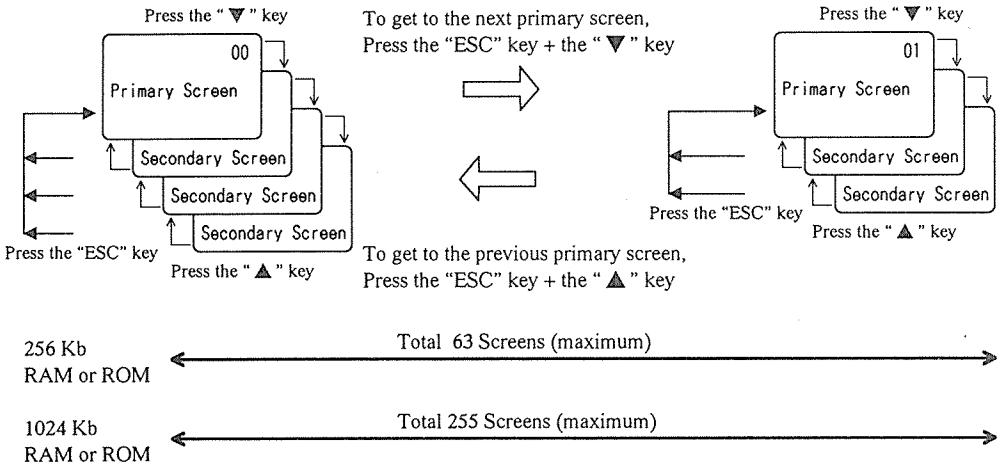


Creating Secondary Screens

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

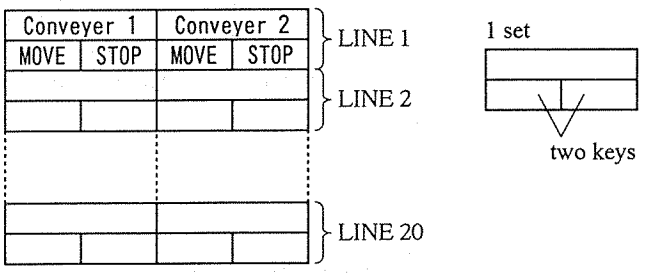
Refer to the I.O.P. 20 series Software MANUAL for details.

Relationship between Primary Screens and Secondary Screens



Manual Key Access Screen

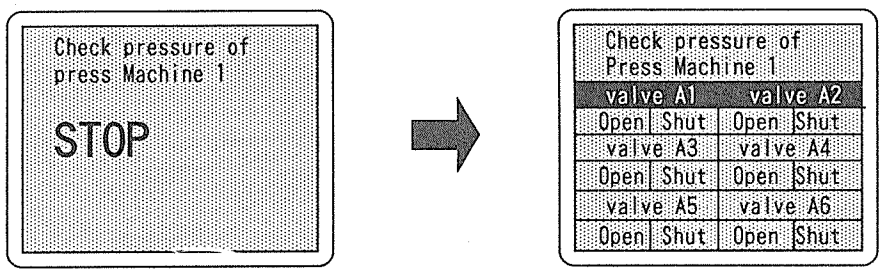
The I.O.P. has one Manual Key Access Screen (Manual Screen) for operating Manual Keys. You can assign a maximum of 80 Manual Keys (40 sets) on this screen.



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

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

Refer to "Manual Keys" on page 31 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.

Note

- 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. The LINE which is displayed as the first line of the Manual Screen will depend on the communication mode you use. In parallel communication, you have two options; 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 the specific LINE. In serial communication, the PC must specify the LINE to display the cursor on in the command sent to display the Manual Screen.

Hiding the Manual Key Access Screen temporarily

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

Creating a Manual Key Access Screen

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

PC programming for communication

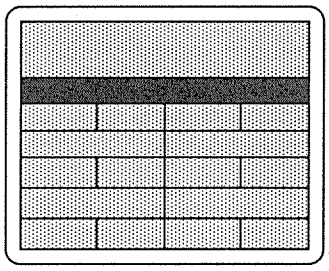
Parallel Communication: See 3-2"Guide to Programming for Parallel Communication" for details.

The Manual Key Access Screen will be displayed when the MS line ~~goes to LOW.~~ When the MS signal ~~goes HIGH,~~ the I.O.P. will return to the Primary Screen. When the I.O.P. was displaying a Secondary Screen before the MS line ~~went LOW~~, 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 the ML line is ~~LOW~~ ON. GD0 through GD7 should contain the number which specifies the LINE for the cursor.

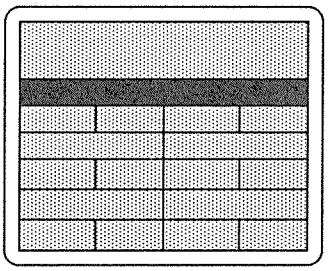
Example

■ Specifying LINE 8 of the Manual Screen

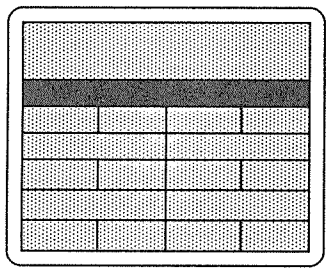


If the MS line ~~goes LOW~~ turns ON and the ML line remains ~~HIGH~~ OFF, the I.O.P. will display the the cursor on the LINE where it last appeared.

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.



Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.

The Manual Screen will be displayed when the PC sends command "M".

Example

Command "M" protocol specification (in ASCII)

1B	30	31	4D	31	31	30			0D
HDR	Machine #		M	①	LINE spec.				Terminator

① Manual Screen display

Superimposing Primary Screens

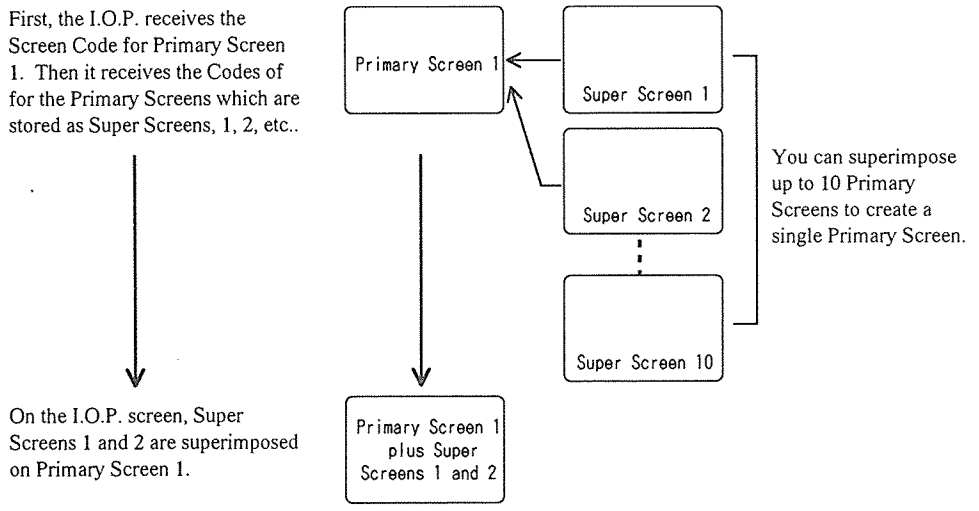
The I.O.P. can display a Primary Screen consisting of several Primary Screens superimposed on a Primary Screen. You can superimpose a maximum of 10 different Primary Screens. Superimposed screens are controlled by the PC.
A Screen can be superimposed repeatedly.

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

Parallel Communication: Refer 3-2"Guide to Programming for Parallel Communication" for details.

First, the I.O.P. receives the Screen number for the Primary Screen. Then it receives the Screen number for a Primary Screen to be superimposed. The I.O.P. will recognize the screen as a Super Screen when it has been assigned attribute "6".

Serial Communication: Refer 3-3"Guide to Programming for Serial Communication" for details.

First, the I.O.P. receives the Screen number for the Primary Screen. Then it receives the Screen number for a Primary Screen to be superimposed. The I.O.P. will recognize the screen as a Super Screen when it has been assigned attribute "6".

Superimposing Characters

This is available only with Serial Communication.

The I.O.P. can superimpose arbitrary characters on a Primary Screen. This is controlled by the PC.
You can specify the characters and assign the position with the command. You must choose the characters from JIS first level characters (Normal Size) or half width characters listed on "Half Width Character Code List".
You can refer to the codes in Appendices D and E.

PC programming for communication

Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.

The I.O.P. superimposes characters when it receives the command "P". The characters and the left-right and up-down position for superimposing must be specified.

Example

Command "P" protocol specification (in ASCII)

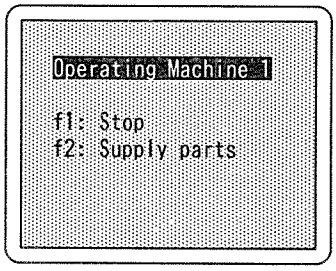
1B	30	31	50	41	34	30	30	32	31			0D
HDR	Machine #		P	①	②	Character code						Terminator

①Left-right position
②Up-down position

Highlighting Characters

This is available only with Serial Communication.

The I.O.P. can highlight any characters on Primary and Secondary Screens except the area for displaying or entering External Data. This function is controlled by the PC.
You must specify the characters and the position in the command.



caution
CP26.

PC programming for communication

Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.

The I.O.P. highlights characters when it receives the command "H". The position(up-down and left-right) and the number of characters to be highlighted must be specified.

Example

Command "H" protocol specification (in ASCII)

1B	30	31	48	41	34	30	34		0D
HDR	Machine #		H	①	②	③			Terminator

①Left-right position
②Up-down position
③Number of characters to be superimposed

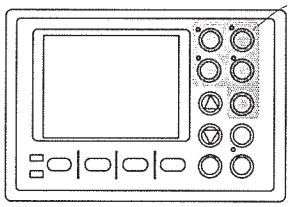
2-2 Operating Keys

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

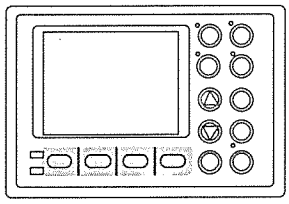
When the I.O.P. Message Screen is displayed on the screen of a personal computer, press the F10 key. The screen where Key Codes for Fixed keys are assigned will appear.

PC programming for communication

Refer to "PC Programming for Receiving Key Codes" on page 34.

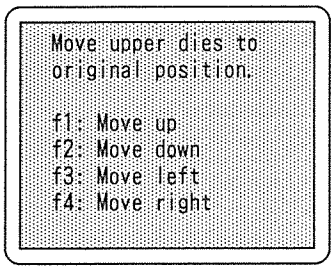
Function Keys

On Primary Screens and Secondary Screens, you can assign 4 keys for each screen. These keys correspond to 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 Code ("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 34.

Caution
manual keys has priority rather than function keys for primary and secondary screen.

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. (Fig. ⓒ)

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. ⓓ)

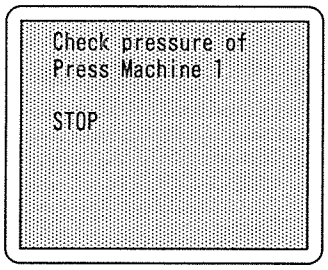
Assigning Key Codes to Manual Keys

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

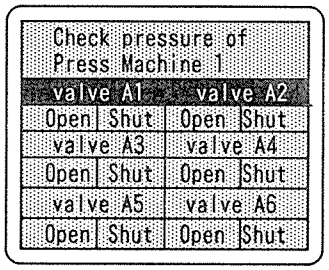
Refer to "PC Programming for Receiving Key Codes" on page 34.

Fig. ⓐ



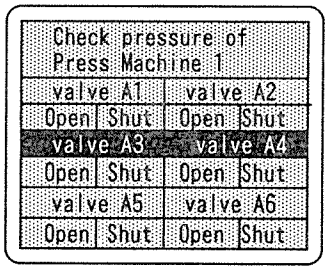
The Manual Access Screen will be displayed.

Fig. ⓑ



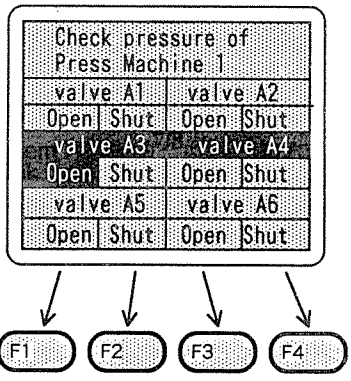
Press the down arrow key (▼).

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 LINE 1 to LINE 20	01 through FF Set as you wish. 4 Keys can be assigned on each LINE. (A total of 80 keys)	
Function Key	Primary Screen Secondary Screen Total 63 screens (255 screens)	01 through FF Set as you wish. 4 keys can be assigned on each screen.	

Notes

- You can assign the same Key Codes to different keys according to your needs.
- When you press a Key, the I.O.P. sends the Key Code assigned to that Key.
- PAUSE key has an exclusive PAUSE line when you are using parallel communication. In serial communication, the status of the PAUSE key is sent to the PC in response to the command "G".

PC Programming for Receiving Key Codes

Parallel Communication: See 3-2"Guide to Programming for Parallel Communication" for details.

The I.O.P. outputs Key Data to the PC as an 8 bit pattern via parallel lines KD0 through KD7.

Example

KD No.	7	6	5	4	3	2	1	0
Key Code 07	0	0	0	0	0	1	1	1
Key Code 0B	0	0	0	0	1	0	1	1

* The communication lines on parallel port use inverted signals. (~~0: HIGH 1: LOW~~)

0 1 2 3 4 5 6 7 OFF ON
07 1 1 1 0 0 0 0 0
0B 1 1 0 1 0 0 0 0

Caution

- In Parallel Custom Mode:

  The assertion of the Key Code on the parallel lines is maintained until the I.O.P. sends another Key Code. However, the I.O.P. will sends the $\overline{\text{KD STROB}}$ signal only while the key is held down. (The $\overline{\text{KD STROB}}$ signal will be valid for at least 50 msec. even if the key is pressed for less than 50 msec.).

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

Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.

When the I.O.P. receives a command "K", it will send the Key Code, stored in a Key Code Transmission Buffer, to the PC as its response. The I.O.P. has 6 Key Code Transmission Buffers.

Example

Command "K" protocol specification (in ASCII)

1B	30	31	4B			0D
HDR	Machine #		K			Terminator

Response (in ASCII)

1B	30	31	4B	41	32			0D
HDR	Machine #		①	Key Code				Terminator

①Command "K" is echoed, together with the Key Code.

PAUSE Key

Using the PAUSE key

When the PAUSE key is pressed, the I.O.P. will change and hold the PAUSE status ~~LOW~~ until the RESET key is pressed. When the RESET key is pressed, the I.O.P. will reset the PAUSE status to ~~HIGH~~ and send the Key Code for the RESET key.

Notes

- While PAUSE is asserted (status held ~~LOW~~), the I.O.P. will send other Key Codes normally.

PC programming for communication

Parallel Communication: See 3-2"Guide to Programming for Parallel Communication" for details.

The I.O.P. sends the status of the PAUSE key via PAUSE line (No.25).

The I.O.P. does not output a STROB signal for the PAUSE key.

Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.

The I.O.P. sends the status of the PAUSE output in the response of to a K command.

Response (in ASCII) to command "K" protocol specification

1B	30	31	4B	41	32	31			0D
HDR	Machine #		K	Key Code		①			Terminator

①PAUSE status ON : 31
OFF : 30

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 modify the serial communication data format, and to enter External Data.

ESC key

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

Arrow keys (▼)(▲)

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

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

The I.O.P. can display numeric 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..
The I.O.P. has 16 buffers for displaying External Data. (Displayable External Data Buffer)

Example: Displaying the number of products produced so far.

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

Creating screens for displaying External Data

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

PC programming for communication

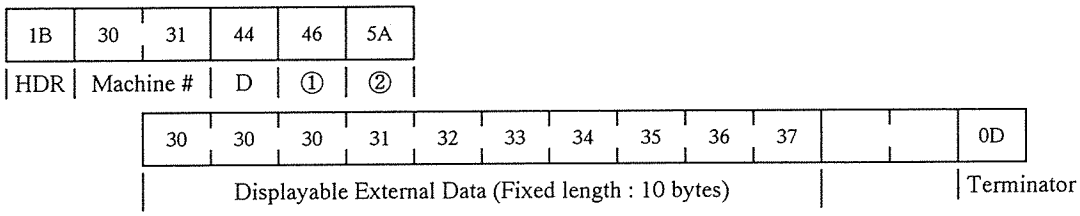
Parallel Communication: See 3-2"Guide to Programming for Parallel Communication" for details.
When the status of the C/D line is ~~LOW~~ turns ON, lines GD0 through GD7 are used to receive External Data for display(Displayable External Data).

Address lines AD0 through AD4 are used to tell the I.O.P. where the External Data will be stored (buffer No.). Data lines GD0 through GD7 are used to receive the 8 bits of External Data. Lines KK0 through KK2 indicate the number of digits that are being sent for display.

Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.
When the PC sends command "D", the buffer No., suppression of leading zeroes and External Data are specified in ASCII.

Example

Command "D" protocol specification (in ASCII)



①Buffer #
②Leading zero suppression: apply : 5A
do not apply : 4E

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.

The same buffer number is not set plural pieces on the one screen

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) through the PC.
You can enter External Data on either Primary Screens or Secondary Screens by using the function keys on the front panel of the I.O.P..
A maximum of 16 different pieces of External Data, each with a maximum of 10 digits, can be entered from the I.O.P.. The I.O.P. has 16 Descriptive External Data Buffers and 1 Descriptive External Data Transmission Buffer.

Caution

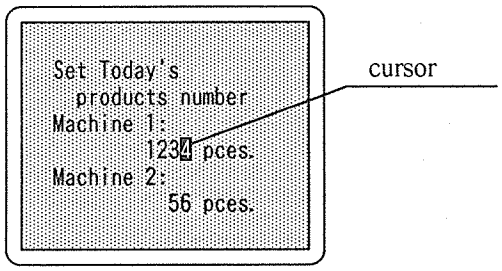
- You cannot enter External Data if you are using a custom mode of parallel communication. The cursor won't appear on the screen in the custom mode.

Entering External Data from the I.O.P.

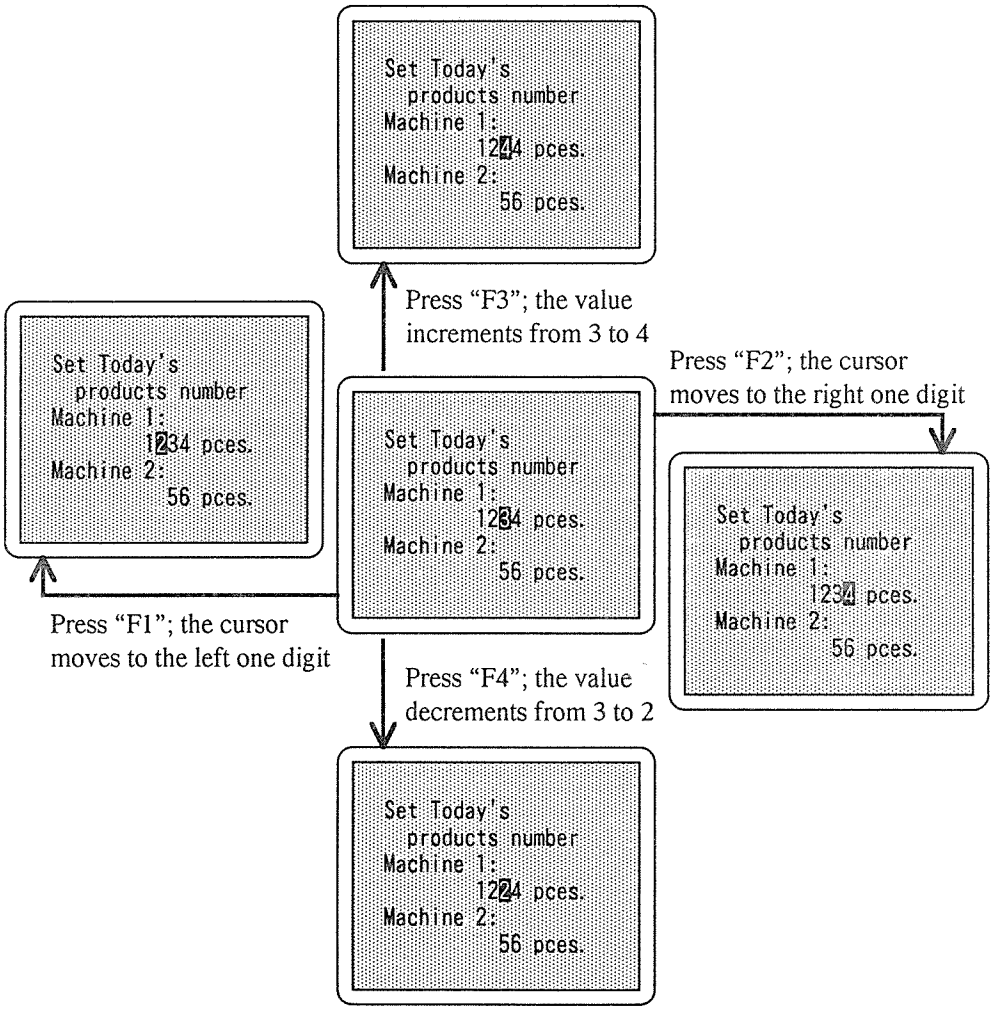
Procedure

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 transmission buffer.
   You must press the ENTER key for each line to send the data from each line to the buffer.

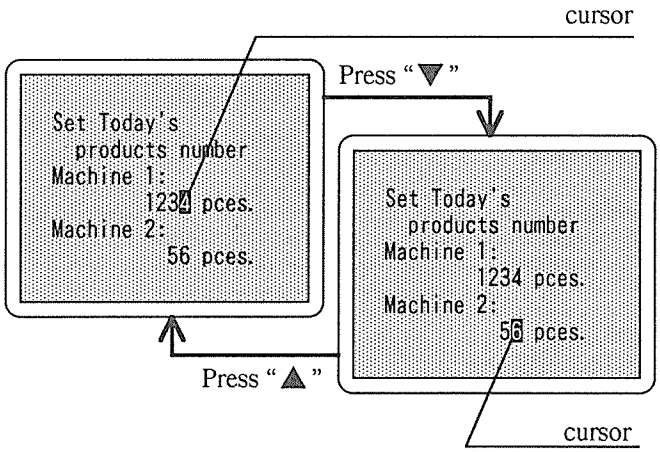
Notes:

- If you use command "T" in serial communication with the PC, the operator doesn't have to press the ENTER key. The data that is entered is stored directly in each Descriptive External Data Buffer as the operator presses the keys.
  If you use command "S" in serial communication with the PC, the operator must press the ENTER key to send the data to the Descriptive External Transmission Buffer.
  For details, refer to page 110.

  In parallel communication, by pressing the ENTER key, the data that is entered is transmitted to the PC.

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

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



Caution

- In this mode, the function keys on the front panel of the I.O.P. can only be used for entering External Data.
- While the cursor is visible on the screen, you cannot operate the Fixed keys.
  To make the cursor disappear, press the ESC key.

Creating a screen for entering External Data

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

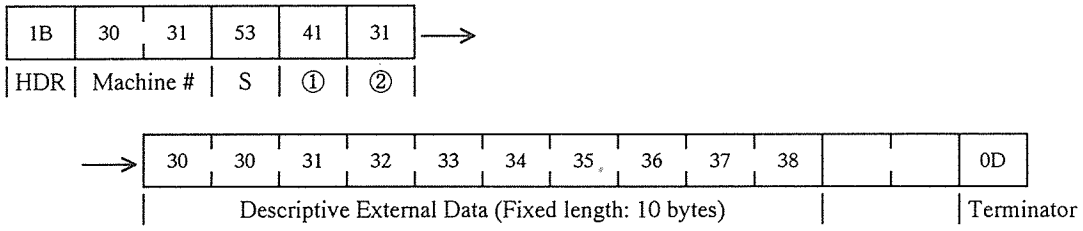
PC programming for communication

Parallel Communication: See 3-2"Guide to Programming for Parallel Communication" for details.
You cannot enter External Data when using a custom parallel communication mode.

When you press the ENTER key after you are through entering External Data on the I.O.P., the I.O.P. uses the S/K line to request that the PC receive the data. The I.O.P. sends the data identifying buffer No. through lines SC0 – SC3. The number of characters is sent on lines SK0 – SK2. The External Data you entered is sent on lines KD0 – KD7.

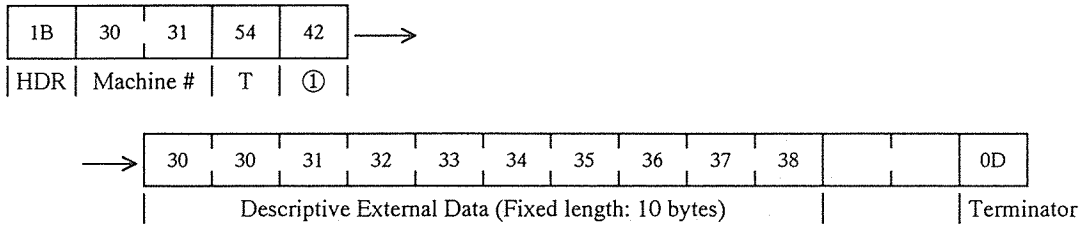
Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.
When the I.O.P. receives a command "S" or "T" from the PC, it sends the data as ASCII to the PC as shown in the following example.

Response to command "S" protocol specification (in ASCII)



① Descriptive External Data Buffer number
② Descriptive External Data transmission flag

Response to command "T" protocol specification (in ASCII)



① Descriptive External Data Buffer number

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 for the AUTO LED, MAN. LED, START LED and STOP LED are controlled by a PC.

PC programming for communication

Parallel Communication: See 3-2"Guide to Programming for Parallel Communication" for details.

The lines LED1, LED2, LED3 and LED4 are dedicated for controlling the Fixed key LEDs. The I.O.P. receives the data for each LED from the PC on a separate line. When an LED line is LOW, the I.O.P. will turn on the corresponding LED. When the LED line is HIGH, the I.O.P. will turn off the corresponding LED.

Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.

The I.O.P. receives the information specifying the condition of the 4 LEDs with the data specifying the Screen Code.
It also can receive LED information independently from the PC.

Example

Controlling LEDs with the Screen Data

Command "G" protocol specification (in ASCII)

1B	30	31	47	30	33	41			0D
HDR	Machine #		G	Screen Data		①			Terminator

①LED pattern

Controlling LEDs independently

Command "L" protocol specification (in ASCII)

1B	30	31	4C	36		0D
HDR	Machine #		L	①		Terminator

①LED pattern

PAUSE LED

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

PC programming for communication

Parallel Communication: See 3-2"Guide to Programming for Parallel Communication" for details.

PAUSE output is toggled. While the LED is ON, the I.O.P. will output the condition of the PAUSE key on the PAUSE line.

Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.

I.O.P. sends the information of PAUSE condition with the data specifying the Key Code data.

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

Parallel Communication: See 3-2"Guide to Programming for Parallel Communication" for details.

When the BUZZER line is HIGH, the I.O.P. buzzer will sound.

Serial Communication: See 3-3"Guide to Programming for Serial Communication" for details.

The I.O.P. receives information specifying the condition of the buzzer along with the data of the Screen number.

It also can receive a command from the PC.

Example

Controlling the buzzer with the Screen Data

Command "G" protocol specification (in ASCII)

1B	30	31	47	30	34		31			0D
HDR	Machine #		G	Screen Data			①			Terminator

①Buzzer control OFF : 30
ON : 31

Controlling the buzzer with a separate command.

Command "B" protocol specification (in ASCII)

1B	30	31	42	31			0D
HDR	Machine #		B	①			Terminator

①Buzzer control OFF : 30
ON : 31

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 or any key is pressed for more than a certain period of time.

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

Note

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

2-8 Choosing Run Mode or Monitor Mode

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

Run Mode

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

Setting the DIP switches for the Run mode

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

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

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

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

Viewing Primary Screens manually

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

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

Caution

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

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

Monitor Mode

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

Setting the DIP switches to the Monitor mode

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

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

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

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

Checking the Primary Screens

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

Checking the Secondary Screens

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

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

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

Checking the Manual Key Access Screen

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

2-9 Replacing User Memory

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

Replacing User Memory

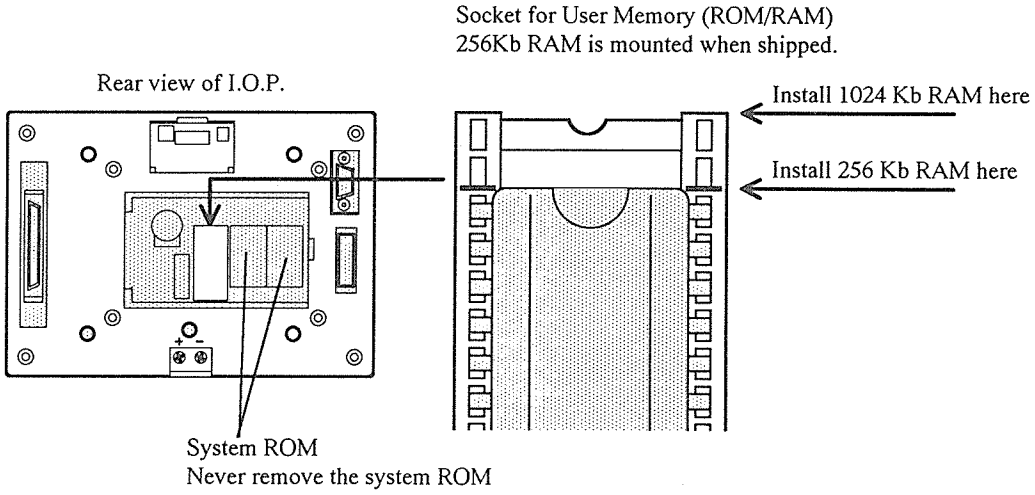
The installation position of the 1024Kb User Memory chip is different from that of the 256Kb chip. See the following drawing for details.

Caution

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

No. of pin

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



Caution

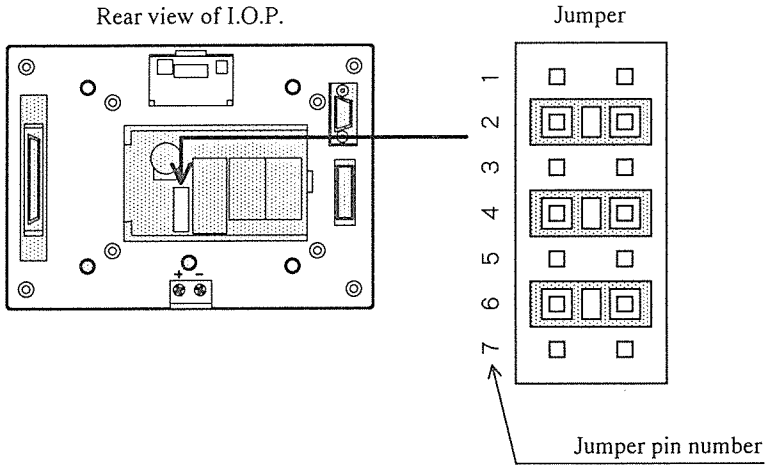
- Be very careful to note the installation for the chip.
  The number of pins will depend on the memory capacity of the chip.

Changing Jumper Settings

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

Caution

- Even when you use ROM, you must install a Backup Battery. In this case the battery life may be shorter than usual.
  Refer to "Replacing the Backup Battery" on page 142.



	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

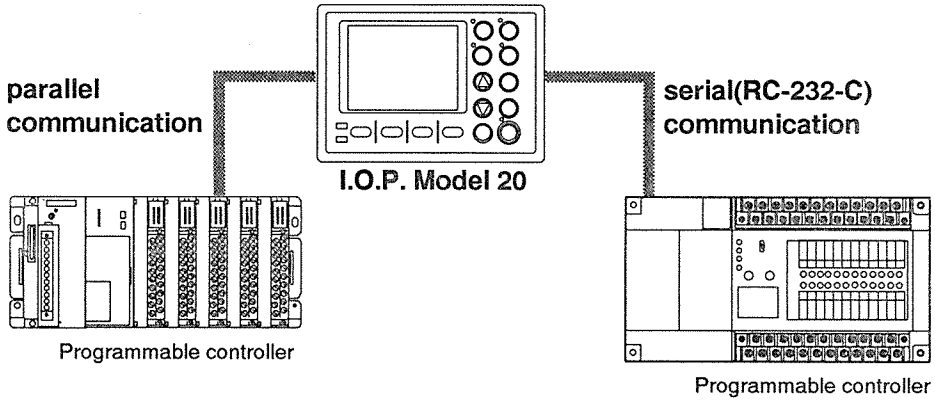
Guiding to PC Programming

This chapter explains how the I.O.P. Model 20 communicates with a programmable controller. You can choose either parallel communication or serial communication modes depending on the controller you use.

PC stands for programmable controller.

3-1 Communication between the I.O.P. and the PC

The I.O.P. has two ports for the communication with a PC: One is for parallel communication and the other is for serial(RC-232-C) communication. You can use either parallel communication or serial communication depending on the specifications of the PC you use. With these ports, the I.O.P. can receive and sends various kinds of data to or from the PC. The I.O.P. communication mode can be set with DIP switches on the rear panel of the I.O.P.. The PC also must be set ready so that the I.O.P. can communicate with the PC. You must create the programs for your communication. This chapter explains about the I.O.P. design for the both parallel communication and serial communication as a guide for to help you create programs.



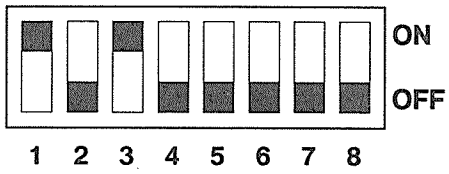
I.O.P. Capabilities with Parallel or Serial Communication

	Parallel Communication		Serial
	Custom Mode	Handshake Mode	Communication
Display Primary Screens	Yes	Yes	Yes
Send Key Data	Yes	Yes	Yes
Keep sending Key Data	Yes	Yes	No
Enter External Data	No	Yes	Yes
Display External Data (monitoring)	Yes	Yes	Yes
Superimpose Primary Screens	Yes	Yes	Yes
Superimpose characters	No	No	Yes
Highlight characters	No	No	Yes

Setting the Communication Mode

You can select either parallel communication mode or serial communication mode with the DIP switches on the rear panel of the I.O.P..

DIP switch



DIP switch Setting								Mode
1	2	3	4	5	6	7	8	
OFF	*	*	*	*	*	*	*	Data Transfer Mode/Writing Mode
ON	OFF	*	*	*	*	*	*	Run Mode
ON	ON	*	*	*	*	*	*	Monitor Mode
ON	OFF	OFF	OFF	*	*	*	*	Parallel Custom Mode
ON	OFF	ON	OFF	*	*	*	*	Parallel Handshake Mode
ON	OFF	*	ON	OFF	*	*	*	Serial Communication Mode
ON	OFF	*	ON	ON	*	*	*	Serial Communication Data Format Change Mode

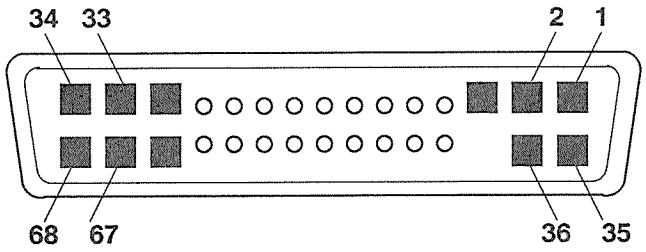
* You can set to either ON or OFF.
Choose the one appropriate for your operation.

Caution

- When you change the DIP switch settings, be sure to press the System Reset Button after the change.

3-2 Guide to Programming for Parallel Communication

I.O.P. Parallel Interface Connector



(Female connector)

Connector Pin Assignments

The pins of the I.O.P. parallel connector are assigned as follows.

Pin No.	I.O.P. I/O	Name	Description	Pin No.	I.O.P. I/O	Name	Description
1	×	+24VDC	I/O power supply	35	×	+24VDC	I/O power supply
2	I	GD0	Screen Data	36	I	GD1	Screen Data
3	I	GD2		37	I	GD3	
4	I	GD4		38	I	GD5	
5	I	GD6		39	I	GD7	
6	I	LED1	AUTO LED	40	I	LED2	MAN. LED
7	I	LED3	START LED	41	I	LED4	STOP LED
8	I	C/D	Screen Data/ Displayable External Data flag	42	I	$\overline{\text{GD STROB}}$	Screen Data stobe
9	I	FF.REQ	Requesting FF	43	I	KD READY	Key Data ready
10	×	(OV)	(GND)	44	×	(OV)	(GND)
11	×	+24VDC	I/O power supply	45	×	+24VDC	I/O power supply
12	I	AD0	Displayable External Data	46	I	AD1	Displayable External Data
13	I	AD2	Buffer Address	47	I	AD3	Buffer Address
14	I	BUZZER	Buzzer control	48	I	ML	Manual Screen LINE spec.
15	I	MS	Manual Screen control	49	I	KK0	Digits position for Displayable External Data
16	I	KK1	Digits position for Displayable External Data	50	I	KK2	
17		N.C.		51		N.C.	
18	×	(OV)	(GND)	52	×	(OV)	(GND)

Pin No.	I.O.P. I/O	Name	Description	Pin No.	I.O.P. I/O	Name	Description
19	×	+24VDC	I/O power supply	53	×	+24VDC	I/O power supply
20	O	KD0	Key Data	54	O	KD1	Key Data
21	O	KD2		55	O	KD3	
22	O	KD4		56	O	KD5	
23	O	KD6		57	O	KD7	
24	O	$\overline{\text{KD STROB}}$	Key Data strobe	58	O	S/K	Key Data/ Descriptive External Data flag
25	O	PAUSE	Pause	59	O	GD READY	Screen Data ready
26	O	SC0	Descriptive External Data	60	O	SC1	Descriptive External Data
27	O	SC2	Buffer Address	61	O	SC3	Buffer Address
28	×	0V	GND	62	×	0V	GND
29	×	+24VDC	I/O power supply	63	×	+24VDC	I/O power supply
30	O	SK0	Digits position for Descriptive External Data	64	O	SK1	Digits position for Descriptive External Data
31	O	SK2		65		N.C.	
32		N.C.		66		N.C.	
33		N.C.		67		ALARM	Output I.O.P. alarm
34	×	0V	GND	68	×	0V	GND

N.C. : Not connected

Notes

- Pin No. 1, 11, 35, 45 are internally connected.
  Pin No. 10, 18, 44, 52 are internally connected.
  Pin No. 19, 29, 53, 63 are internally connected.
  Pin No. 28, 34, 62, 68 are internally connected.

- I/O power supply : To keep signal lines pulled high.

I.O.P. input line assignments

GD0 – GD7 (Pin No.2,3,4,5, 36,37,38,39)	Used to receive Screen Data specifying the Primary Screen number to display and Displayable External Data for displaying External Data on the I.O.P.. These lines are also used for specifying the LINE position of Manual Key Access Screen. 8 bit pattern.
LED1 (Pin No.6)	AUTO LED status, input from the PC.
LED2 (Pin No.40)	MAN. LED status, input from the PC.
LED3 (Pin No.7)	START LED status, input from the PC.
LED4 (Pin No.41)	STOP LED status, input from the PC.
C/D (Pin No.8)	Held LOW when GD0 – GD7 are used for Displayable External Data.
$\overline{\text{GD STROB}}$ (Pin No.42)	Used as a flag to indicate that the data on GD0 through GD7 are valid.
FF REQ (Pin No.9)	Used for checking wiring. When the line is LOW, the I.O.P. returns the values of GD0 – GD7 to KD0 – KD7 respectively. This operation has priority over any other operations.
KD READY (Pin No. 43)	Held HIGH when the PC is ready to receive Key Data from the I.O.P..
AD0 – AD3 (No.12,13,46,47)	Address of the buffer where Displayable External Data will be stored. 4 bit pattern.
BUZZER (Pin No.14)	Buzzer ON/OFF status, input from the PC.
ML (Pin No.48)	Held LOW when GD0 through GD7 are used for the Manual Screen LINE specificaction.
MS (Pin No.15)	When LOW, the PC requests Manual Key Access Screen display without specification of the LINE position.
KK0 – KK2 (Pin. No.16,49,50)	Address specifying the digits position for displaying External Data. 3 bit pattern.

I.O.P. output line assignments

KD0 – KD7 (Pin No.20,21,22, 23,54,55,56,57)	When S/K is HIGH, lines KD0 – KD7 are used for sending Key Code to the PC. When S/K is LOW, these lines are used for sending Descriptive External Data which is enterd on the I.O.P. to the PC. 8 bit pattern.
$\overline{\text{KD STROB}}$ (Pin No.24)	Used as a flag to indicate that the data on KD0 – KD7 are valid.
S/K (Pin No.58)	Held LOW when Descriptive External Data values are sent to the PC on KD0 – KD7.
PAUSE (Pin No.25)	Sends the signal data for pause. When the PAUSE key is pressed, the I.O.P. signals the PC with this line.
GD READY (Pin No.59)	Turned HIGH when the I.O.P. is ready to receive Screen Data from the PC.
SC0 – SC3 (Pin No.26,27,60,61)	Address of the buffer where the I.O.P. stores Descriptive External Data. 4 bit pattern.
SK0 – SK2 (Pin No.30,31,64)	Sends the digits position when Descriptive External Data values are being entered.

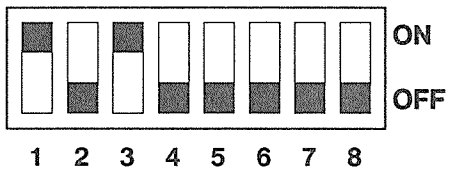
Setting the Parallel Communication Mode

If you want to use parallel communication, you must set the DIP switches as follows. The I.O.P. has two parallel modes: A custom mode and a handshake mode. However, it is recommended that you use the handshake mode for parallel communication, even if you don't need to enter External Data into the I.O.P.. The handshake mode assures a more secure data communication.

Mode	DIP-Switch Setting							
	1	2	3	4	5	6	7	8
Custom Mode	ON	OFF	OFF	OFF	*	*	*	*
Handshake Mode	ON	OFF	ON	OFF	*	*	*	*

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

The DIP switches: To select the handshake mode



Caution

- When you change the DIP switches setting, press the System Reset Button after completing the change.

Before programming

For the programming, you can use HEX codes.

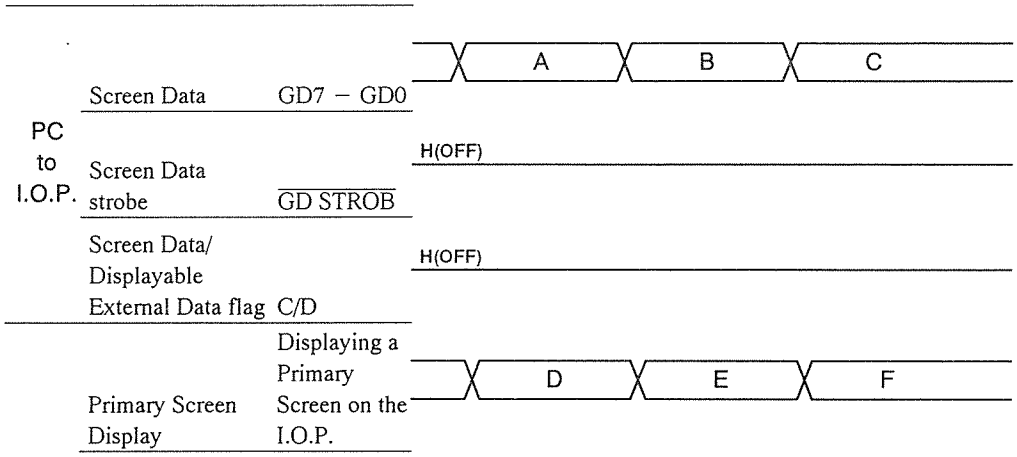
If you want to send a specific bit pattern, just look up the HEX code corresponding to that bit pattern.

If you want to control communications using a specific I/O line like BUZZER, the Hex code will be "0" for HIGH, and "1" for LOW.

The communication lines on the parallel port use inverted signals. (0 : HIGH, 1 : LOW)

Programming for Communications in Custom Mode

Displaying Primary Screens



Screen Data and Displayable External Data

When the C/D is HIGH, GD0 – GD7 are used for sending Screen Data identifying the Primary Screen to be displayed on the I.O.P.. They can also specify subsequent primary screens for superimposing.

Time chart

When the C/D line and $\overline{\text{GD STROB}}$ line are held HIGH by the PC, the PC will send Screen Data on GD0 – GD7.

The I.O.P. will display Screens according to changes in the Screen Data on lines GD0 – GD7.

Notes

- When the PC specifies a Primary Screen number at A, an Superimposed Screen at B and a Primary Screen at C on the time chart above, the I.O.P. will display screen A during the time period D, superimposed screens A and B during the time period E, and screen C during time period F.

Specifying a Primary Screen number

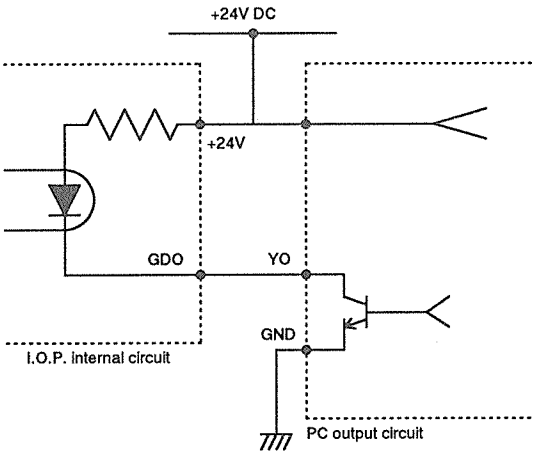
To specify a Screen number, the PC puts the Screen number on lines GD0 – GD7 as shown below.

Example

Screen No.	Screen data: GD0 – GD7							
	GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0
05	0	0	0	0	0	1	0	1
A1	1	0	1	0	0	0	0	1

Circuit drawing

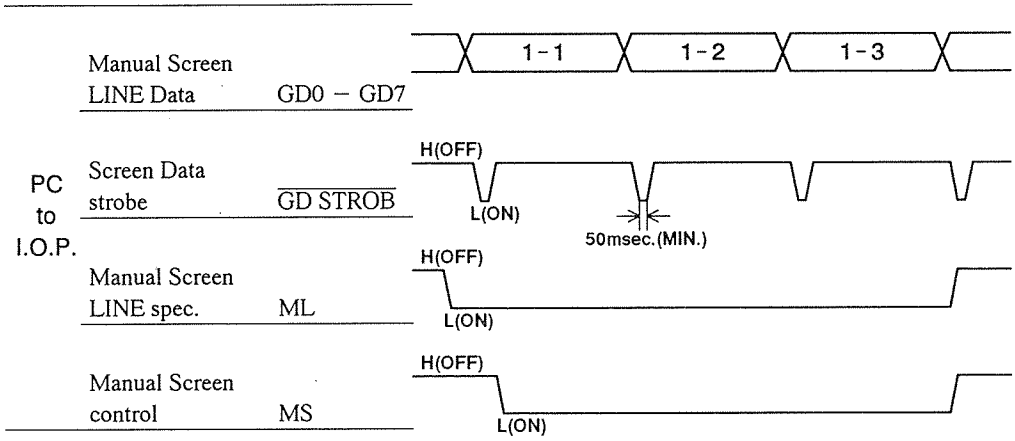
The circuit drawing below shows the circuit when connecting PC output YO to the I.O.P. GD0.



(NPN, Open Collector, Sinking)

Displaying Manual Key Access Screen

The Manual Access Screen will be displayed when MS is pulled LOW. When controlled by the MS line, the screen will be displayed starting with the LINE which was last displayed. If you want to display the screen starting with a specific LINE, you should use ML line together with MS line.



Time chart

1. When the PC pulls the ML LOW, GD0 – GD7 will contain the LINE specification for the Manual Key Access Screen.

2. The PC places the 8 bit line number on GD0 – GD7.
   You can specify any LINE from LINE1 to LINE18.

3. After the LINE number has been put on the GD lines, the PC pulls $\overline{\text{GD STROB}}$ LOW to send the data to the I.O.P..

When the PC pulls MS LOW, the I.O.P. will display the Manual Key Access Screen. If the PC pulls MS LOW after $\overline{\text{GD STROB}}$ is pulled LOW as shown on the time chart above, the I.O.P. will immediately display the Manual Screen starting with the specific LINE. If the PC pulls MS LOW before $\overline{\text{GD STROB}}$ is pulled LOW, the I.O.P. will display the initial Manual Screen briefly and then switch the screen to the specific LINE.

Note

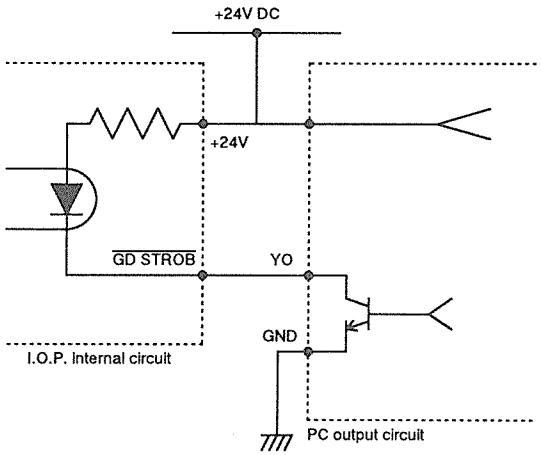
- ML has priority over C/D signal.

Specifying LINE

GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0	HEX	LINE
0	0	0	0	0	0	0	0	00	1
0	0	0	0	0	0	0	1	01	2
0	0	0	0	0	0	1	0	02	3
0	0	0	0	0	0	1	1	03	4
0	0	0	0	0	1	0	0	04	5
0	0	0	0	0	1	0	1	05	6
0	0	0	0	0	1	1	0	06	7
0	0	0	0	0	1	1	1	07	8
0	0	0	0	1	0	0	0	08	9
0	0	0	0	1	0	0	1	09	10
0	0	0	0	1	0	1	0	0A	11
0	0	0	0	1	0	1	1	0B	12
0	0	0	0	1	1	0	0	0C	13
0	0	0	0	1	1	0	1	0D	14
0	0	0	0	1	1	1	0	0E	15
0	0	0	0	1	1	1	1	0F	16
0	0	0	1	0	0	0	0	10	17
0	0	0	1	0	0	0	1	11	18

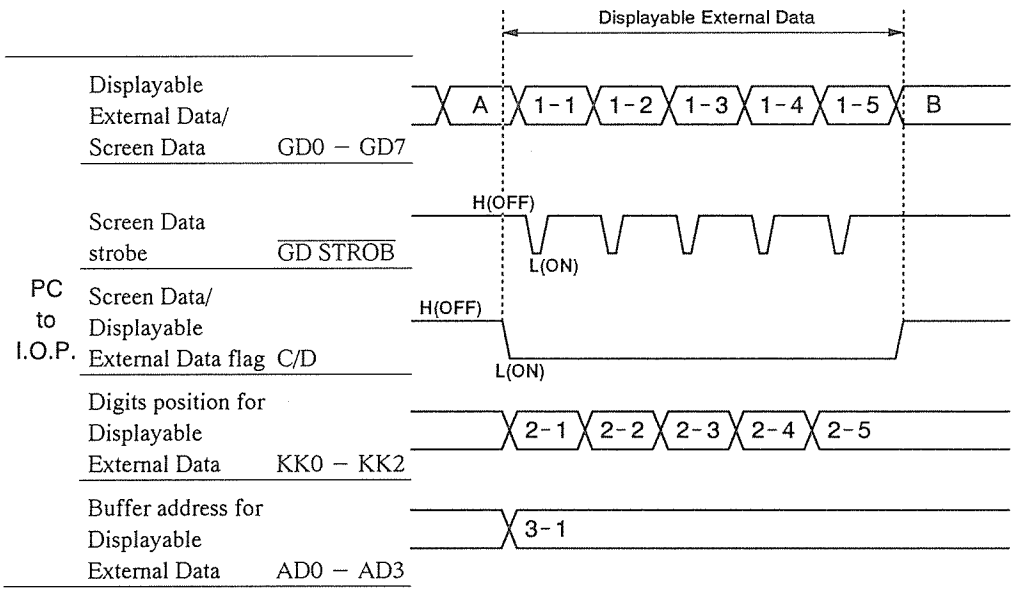
Circuit drawing

The drawing below shows the circuit for connecting PC output YO to the I.O.P. $\overline{\text{GD STROB}}$.



(NPN, Open Collector, Sinking)

Displaying External Data



Screen Data and Displayable External Data

When the C/D is HIGH, GD0 – GD7 are used for sending Screen Data identifying the Primary Screen to be displayed on the I.O.P.. They can also specify subsequent primary screens for superimposing.

When C/D signal is held LOW by the PC, GD0 – GD7 are used for sending Displayable External Data to be displayed on the I.O.P..

At point A and B on the time chart above, C/D is HIGH and lines GD0 through GD7 are used for sending Screen Data.

Time chart

1. The PC pulls C/D LOW to send Displayable External Data for display.
2. The buffer number where the External Data will be stored is specified on address lines AD0 – AD3.
3. The External Data of two numbers is specified on data lines GD0 – GD7.
4. Digits position for the two numbers is specified on lines KK0 – KK2.
5. After completing the specifications above, the PC pulls the $\overline{\text{GD STROB}}$ LOW for 50 msec., which tells the I.O.P. that the data are valid.

To send the data for 10 numbers, the PC must go through these steps 5 times.

Notes

- You can send as few as 2 numbers if you only want to change one or two digits of numeric data.
  While C/D is LOW, the PC places the buffer number on address lines AD0 – AD3, the numeric data on data lines GD0 – GD7, and the digits position is placed on lines KK0 – KK3.

- Data sent to the I.O.P. is held in the specified buffer of the I.O.P. until new data is received to replace it.

Specifying the buffer No., digits position and Displayable External Data

When you create programs, you can specify the following data as HEX numbers.

Displayabe External Data Buffer

AD0 – AD3					Buffer No.
AD3	AD2	AD1	AD0	HEX	
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	2	2
0	0	1	1	3	3
0	1	0	0	4	4
0	1	0	1	5	5
0	1	1	0	6	6
0	1	1	1	7	7
1	0	0	0	8	8
1	0	0	1	9	9
1	0	1	0	A	A
1	0	1	1	B	B
1	1	0	0	C	C
1	1	0	1	D	D
1	1	1	0	E	E
1	1	1	1	F	F

Displayable External Data

GD0 – GD7					Number to be displayed on the I.O.P.
GD7	GD6	GD5	GD4		
GD3	GD2	GD1	GD0	HEX	
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	2	2
0	0	1	1	3	3
0	1	0	0	4	4
0	1	0	1	5	5
0	1	1	0	6	6
0	1	1	1	7	7
1	0	0	0	8	8
1	0	0	1	9	9
1	0	1	0	A	.
1	0	1	1	B	+
1	1	0	0	C	–
1	1	0	1	D	=
1	1	1	0	E	(space)
1	1	1	1	F	(space)

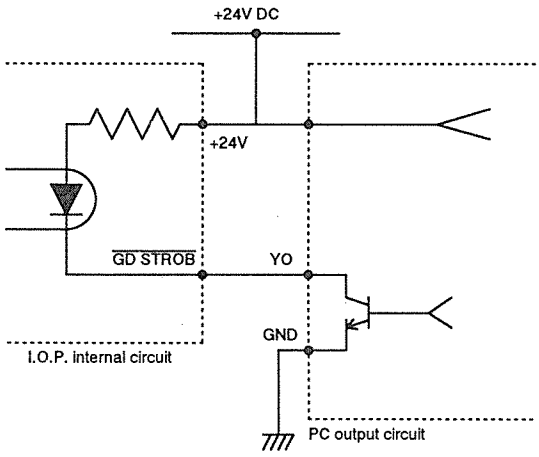
Digits Position/Data

KK2 – KK0				GD7 – GD0	
KK2	KK1	KK0	HEX	GD7 – GD4	GD3 – GD0
0	0	0	0	P^1	P^0
0	0	1	1	P^3	P^2
0	1	0	2	P^5	P^4
0	1	1	3	P^7	P^6
1	0	0	4	P^9	P^8

* P=position counted from the right most digit

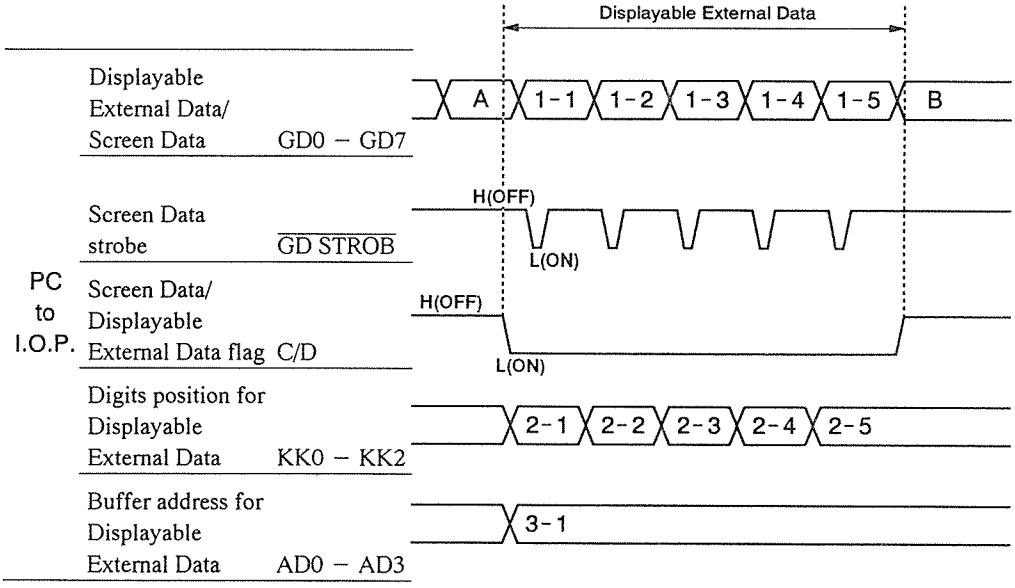
Circuit drawing

The drawing below shows the circuit for connecting PC output YO to the I.O.P. $\overline{\text{GD STROB}}$.



Communication Example

A PC sends the Displayable External Data "1 2 3 4 5 6 7 8 9 0" to I.O.P. buffer 5.:



Address for Displayable External Data					Digits position for Displayable External Data			
AD0 – AD3					KK0 – KK2			
	AD3	AD2	AD1	AD0		KK2	KK1	KK0
3 – 1	0	1	0	1	2 – 1	0	0	0
					2 – 2	0	0	1
					2 – 3	0	1	0
					2 – 4	0	1	1
					2 – 5	1	0	0

Displayable External Data										
GD0 – GD7										
	GD7	GD6	GD5	GD4	number	GD3	GD2	GD1	GD0	number
1 – 1	1	0	0	1	9	0	0	0	0	0
1 – 2	0	1	1	1	7	1	0	0	0	8
1 – 3	0	1	0	1	5	0	1	1	0	6
1 – 4	0	0	1	1	3	0	1	0	0	4
1 – 5	0	0	0	1	1	0	0	1	0	2

1. The PC pulls C/D LOW to send Displayable External Data to the I.O.P.

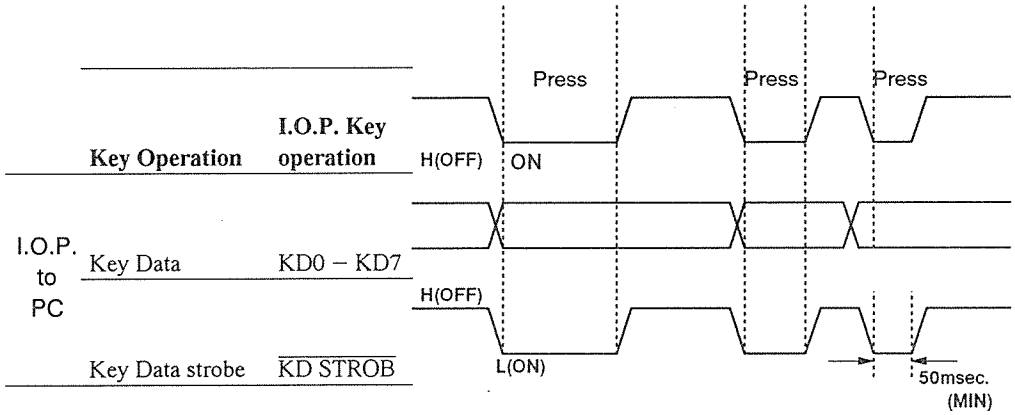
2. The data is intended for buffer "5". So, the PC asserts "0 1 0 1" on "AD3 AD2 AD1 AD0" respectively. (3-1)
   The data address must not be changed while the data is being sent.

3. The two righthand digits "9 0" are sent first. So, the PC asserts "1 0 0 1 0 0 0 0" on "GD7 GD6 GD5 GD4 GD3 GD2 GD1 GD0" respectively. (3-3)
   Simultaneously, the PC asserts the digits position for the data "9 0" on "KK2 KK1 KK0". In this case, the data should go in position P^1 and P^0. So, the PC asserts "0 0 0"(2-1).

4. When the PC is ready to send the data, the $\overline{\text{GD STROB}}$ is pulled LOW. When the $\overline{\text{GD STROB}}$ goes LOW, the I.O.P. will read the data. The $\overline{\text{GD STROB}}$ is asserted for 50 msec..

5. Steps 3 and 4 is repeated another 4 times to send all of the data to the I.O.P..
   The data address must not be changed while the data is being sent.

Receiving Key Codes



Time chart

1. When a Key is pressed on the I.O.P., the I.O.P. sends the corresponding Key Code on lines KD0 – KD7.

2. While the key is being pressed, $\overline{\text{KD STROB}}$ is pulled LOW.

Notes

- The lines containing Key Data will not change until the next time a key is pressed. To send Key Data to the PC, $\overline{\text{KD STROB}}$ must be pulled LOW.

Key Data

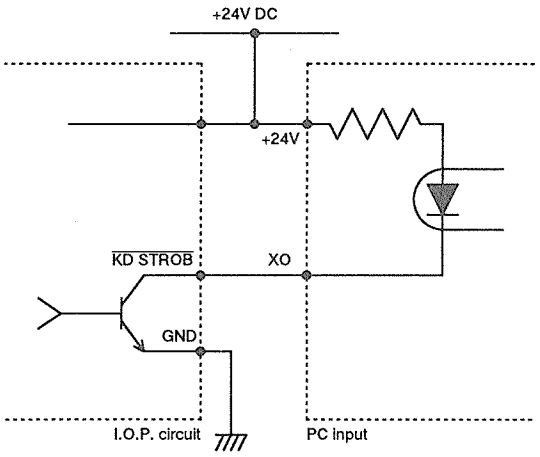
The I.O.P. sends Key Data on lines KD0 – KD7 as an 8 bit Key Code.

Example

	Key data: KD0 – KD7							
Key Code	**KD7**	**KD6**	**KD5**	**KD4**	**KD3**	**KD2**	**KD1**	**KD0**
08	0	0	0	0	1	0	0	0
FA	1	1	1	1	1	0	1	0

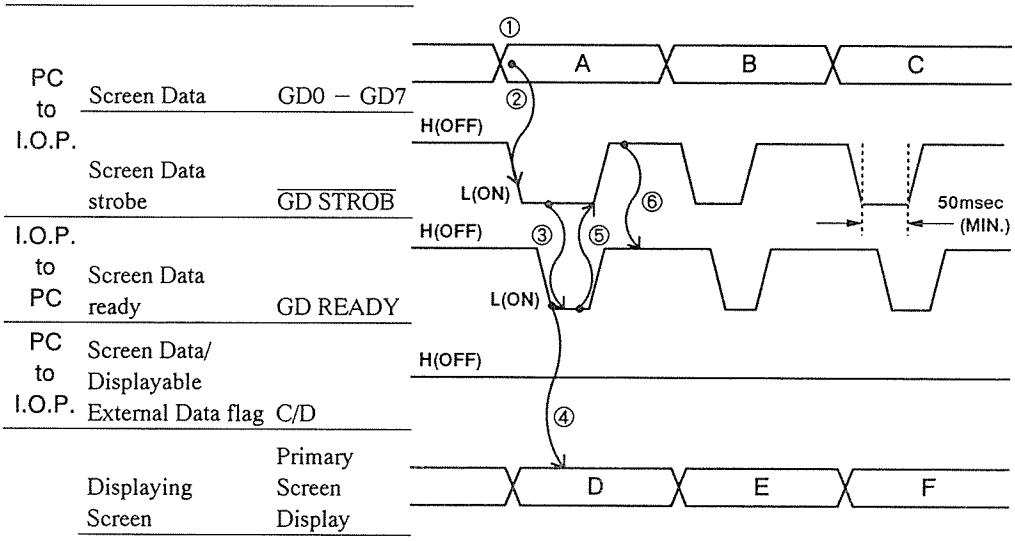
Circuit drawing

The drawing below shows the circuit for connecting the PC input XO to the I.O.P. $\overline{\text{GD STROB}}$.



Programming for Communications in Handshake Mode

Displaying Primary Screens



Screen Data and Displayable External Data

When the C/D is HIGH, GD0 – GD7 are used for sending Screen Data identifying the Primary Screen to be displayed on the I.O.P.. They can also specify subsequent primary screens for superimposing.

Time chart

1. When C/D is HIGH, and GD READY is HIGH, the PC places the Screen Data containing the screen number on data lines GD0 – GD7.

2. When the PC pulls $\overline{\text{GD STROB}}$ LOW, the I.O.P. will read the Screen Data and then pull GD READY LOW.
   $\overline{\text{GD STROB}}$ must be held LOW for at least 50 msec.
   The Screen Data must not change while the $\overline{\text{GD STROB}}$ is held LOW.

3. When GD READY goes LOW, the PC will return $\overline{\text{GD STROB}}$ to its HIGH state.

4. When $\overline{\text{GD STROB}}$ returns HIGH, the I.O.P. restores GD READY to HIGH.

The I.O.P. displays screens according to the changes in the Screen Data received on lines GD0 – GD7.

Caution

- When GD READY is HIGH, the PC can send screen data to the I.O.P. on lines GD0 – GD7.

Specifying a Primary Screen number

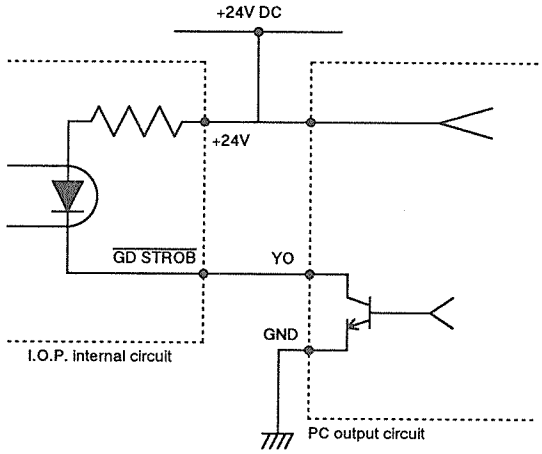
To specify a screen number, the Screen number is placed on lines GD0 – GD7.

Example

Screen No. (Screen Code)	Screen data: GD0 – GD7							
	GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0
screen 05	0	0	0	0	0	1	0	1
screen A1	1	0	1	0	0	0	0	1

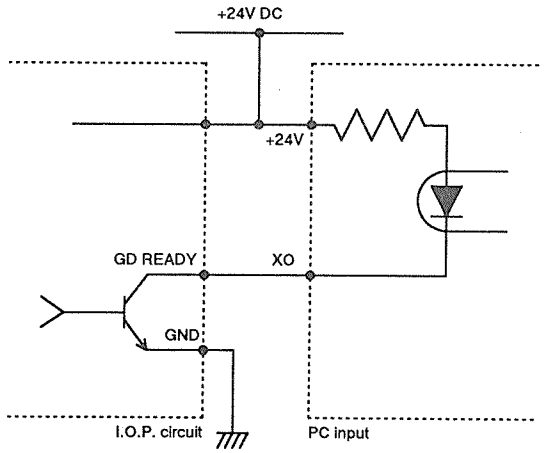
Circuit drawing

The drawing below shows the circuit for connecting the PC output YO to the I.O.P. $\overline{\text{GD STROB}}$.



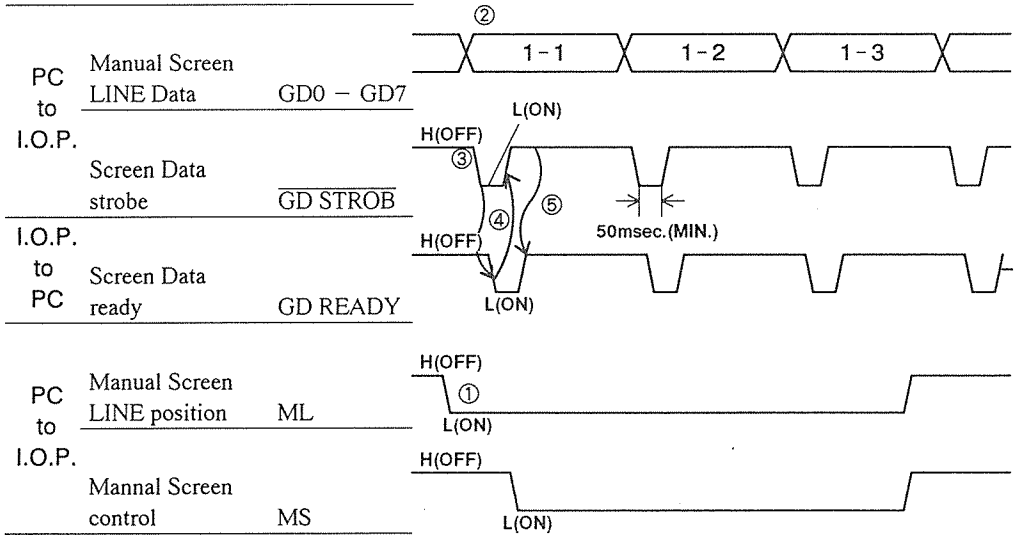
(NPN, Open Collector, Sinking)

The drawing below shows the circuit for connecting the PC input XO to the I.O.P. GD READY.



Displaying Manual Key Access Screen

The Manual Access Screen will be displayed when MS is pulled LOW. When controlled by the MS line, the screen will be displayed starting with the LINE which was last displayed. If you want to display the screen starting with a specific LINE, you should use the ML line together with the MS line.



Time chart

1. When the PC pulls the ML LOW, GD0 – GD7 will contain the LINE specification for the Manual Key Access Screen.

2. The PC places the 8 bit line number on GD0 – GD7.
   You can specify any LINE from LINE1 to LINE18.

3. After the LINE number has been put on the GD lines, the PC pulls $\overline{\text{GD STROB}}$ LOW to send the data to the I.O.P..

4. When $\overline{\text{GD STROB}}$ is pulled LOW, the I.O.P. receives the data and pulls GD READY LOW.

5. When GD READY is pulled LOW, the PC restores $\overline{\text{GD STROB}}$ to HIGH.

6. When $\overline{\text{GD STROB}}$ is pulled LOW, the I.O.P. restores GD READY to HIGH.

When the PC pulls MS LOW, the I.O.P. will display the Manual Key Access Screen. If the PC pulls MS LOW after GD STROB is pulled LOW as shown on the time chart above, the I.O.P. will immediately display the Manual Screen starting with the specific LINE. If the PC pulls MS LOW before $\overline{\text{GD STROB}}$ is pulled LOW, the I.O.P. will display the initial Manual Screen briefly and then switch the screen to the specific LINE.

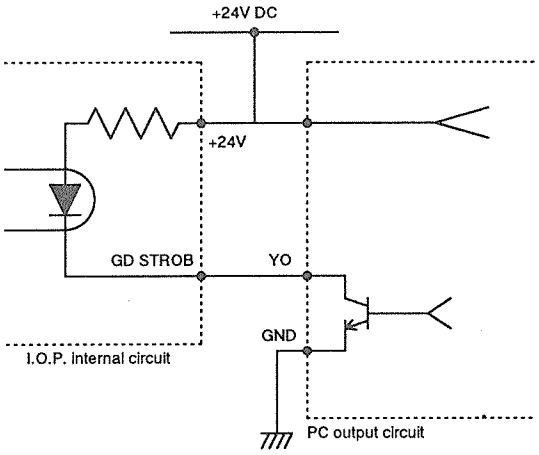
Note
ML has priority over the C/D signal.

Specifying LINE

GD7	GD6	GD5	GD4	GD3	GD2	GD1	GD0	HEX	LINE
0	0	0	0	0	0	0	0	00	1
0	0	0	0	0	0	0	1	01	2
0	0	0	0	0	0	1	0	02	3
0	0	0	0	0	0	1	1	03	4
0	0	0	0	0	1	0	0	04	5
0	0	0	0	0	1	0	1	05	6
0	0	0	0	0	1	1	0	06	7
0	0	0	0	0	1	1	1	07	8
0	0	0	0	1	0	0	0	08	9
0	0	0	0	1	0	0	1	09	10
0	0	0	0	1	0	1	0	0A	11
0	0	0	0	1	0	1	1	0B	12
0	0	0	0	1	1	0	0	0C	13
0	0	0	0	1	1	0	1	0D	14
0	0	0	0	1	1	1	0	0E	15
0	0	0	0	1	1	1	1	0F	16
0	0	0	1	0	0	0	0	10	17
0	0	0	1	0	0	0	1	11	18

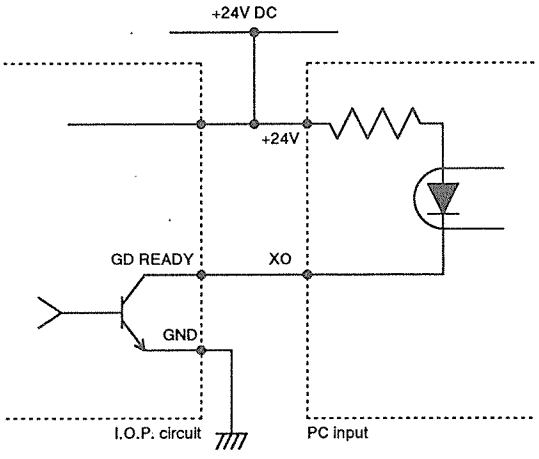
Circuit drawing

The drawing below shows the circuit for connecting the PC output YO to the I.O.P. $\overline{\text{GD STROB}}$.

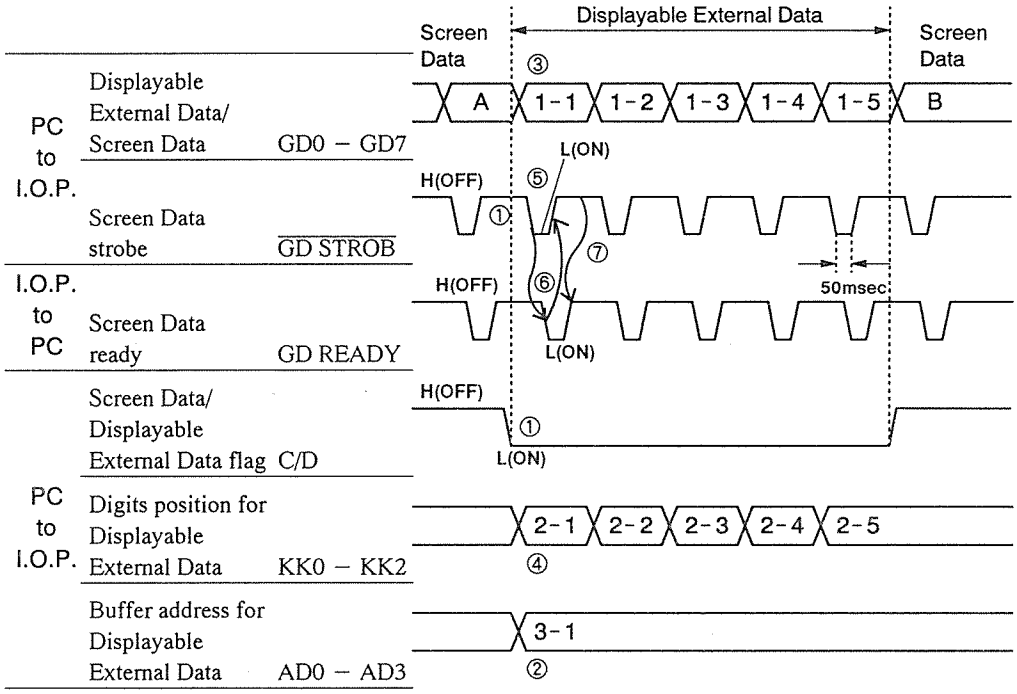


(NPN, Open Collector, Sinking)

The drawing below shows the circuit for connecting the PC input XO to the I.O.P. GD READY.



Displaying External Data



Screen Data and Displayable External Data

When the C/D is HIGH, GD0 – GD7 are used for sending Screen Data identifying the Primary Screen to be displayed on the I.O.P.. They can also specify subsequent primary screens for superimposing.

When C/D signal is held LOW by the PC, GD0 – GD7 are used for sending Displayable External Data to be displayed on the I.O.P..

At point A and B on the time chart above, C/D is HIGH and lines GD0 through GD7 are used for sending Screen Data.

Time chart

1. When C/D is LOW, and GD READY is HIGH, the PC can send Displayable External Data to the I.O.P..

2. The PC places buffer number where the data will be stored on lines AD0 – AD3.

3. The PC places the data for two numbers on lines GD0 – GD7.

4. The PC places the digits position for the two numbers on lines KK0 – KK3.

5. When the PC pulls the $\overline{\text{GD STROB}}$ LOW, the I.O.P. will read the Screen Data and then the I.O.P. will pull GD READY LOW.
   The $\overline{\text{GD STROB}}$ must be held LOW for at least 50 msec..
   Screen Data must not change while $\overline{\text{GD STROB}}$ is LOW.

6. When GD READY goes LOW, the PC will restore $\overline{\text{GD STROB}}$ to HIGH.

7. When $\overline{\text{GD STROB}}$ returns to HIGH, the I.O.P. will restore GD READY to HIGH.

To send the data for 10 numbers, the PC must go through these steps 5 times.

Notes

- You can send as few as 2 numbers if you only want to change one or two digits of numeric data.
  While the C/D is LOW, the PC places the buffer number on address lines AD0 – AD3, the numeric data on data lines GD0 – GD7, and the digits position is placed on lines KK0 – KK3.

- Data sent to the I.O.P. is held in the specified buffer of the I.O.P. until new data is received to replace it.

Specifying the buffer No., digits position and Displayable External Data

When you create programs, you can specify the following data as HEX numbers.

Displayable External Data Buffer

AD3 – AD0					Buffer No.
AD3	AD2	AD1	AD0	HEX	
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	2	2
0	0	1	1	3	3
0	1	0	0	4	4
0	1	0	1	5	5
0	1	1	0	6	6
0	1	1	1	7	7
1	0	0	0	8	8
1	0	0	1	9	9
1	0	1	0	A	A
1	0	1	1	B	B
1	1	0	0	C	C
1	1	0	1	D	D
1	1	1	0	E	E
1	1	1	1	F	F

Displayable External Data

GD7 – GD0					Number to be displayed on the I.O.P.
GD7	GD6	GD5	GD4		
GD3	GD2	GD1	GD0	HEX	
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	2	2
0	0	1	1	3	3
0	1	0	0	4	4
0	1	0	1	5	5
0	1	1	0	6	6
0	1	1	1	7	7
1	0	0	0	8	8
1	0	0	1	9	9
1	0	1	0	A	.
1	0	1	1	B	+
1	1	0	0	C	–
1	1	0	1	D	=
1	1	1	0	E	(space)
1	1	1	1	F	(space)

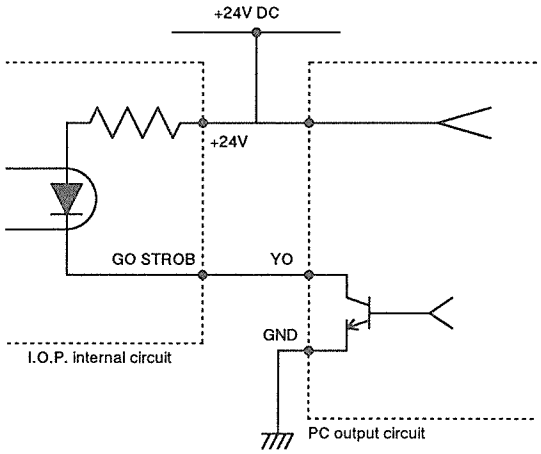
Digits Position/Data

KK2 – KK0				GD7 – GD0	
KK2	KK1	KK0	HEX	GD7 – GD4	GD3 – GD0
0	0	0	0	P^1	P^0
0	0	1	1	P^3	P^2
0	1	0	2	P^5	P^4
0	1	1	3	P^7	P^6
1	0	0	4	P^9	P^8

* P = position counted from the right most digit

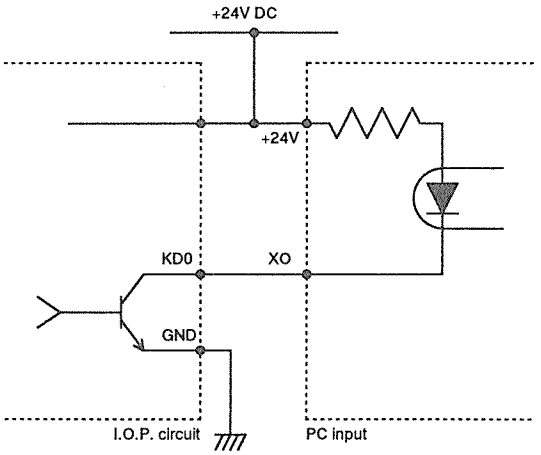
Circuit drawing

The drawing below shows the circuit for connecting the PC output YO to the I.O.P. $\overline{\text{GD STROB}}$.



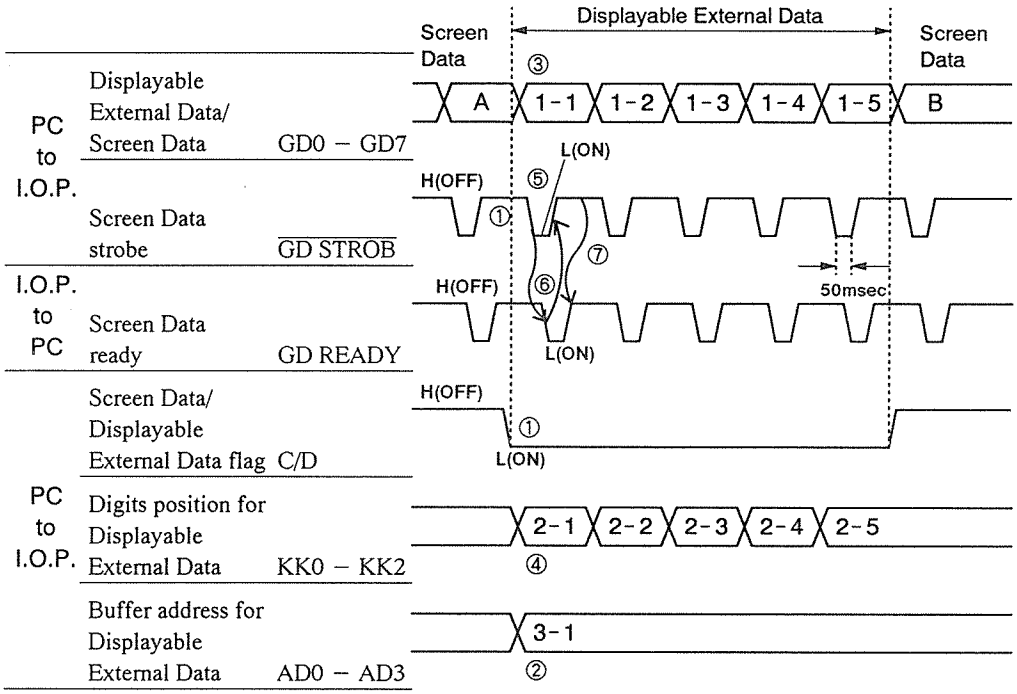
(NPN, Open Collector, Sinking)

The drawing below shows the circuit for connecting the PC input XO to the I.O.P. GD READY.



Communication Example

The PC sends the Displayable External Data "1 2 3 4 5 6 7 8 9 0" to the I.O.P. to be stored in buffer 5.



Address for Displayable External Data					Digits position for Displayable External Data			
AD0 – AD3					KK0 – KK2			
	AD3	AD2	AD1	AD0		KK2	KK1	KK0
3 – 1	0	1	0	1	2 – 1	0	0	0
					2 – 2	0	0	1
					2 – 3	0	1	0
					2 – 4	0	1	1
					2 – 5	1	0	0

Displayable External Data										
GD0 – GD7										
	GD7	GD6	GD5	GD4	number	GD3	GD2	GD1	GD0	number
1 – 1	1	0	0	1	9	0	0	0	0	0
1 – 2	0	1	1	1	7	1	0	0	0	8
1 – 3	0	1	0	1	5	0	1	1	0	6
1 – 4	0	0	1	1	3	0	1	0	0	4
1 – 5	0	0	0	1	1	0	0	1	0	2

1. The PC pulls C/D LOW, to indicate the Displayable External Data is being sent.

2. The data is sent to buffer "5". So, the PC places "0,1,0,1" on lines "AD3 AD2 AD1 AD0" respectively. (3-1)
   The data address must not change while the data is being sent.

3. The PC makes sure that GD READY is HIGH.
   The data "9 0" is sent first. The PC places "1 0 0 1 0 0 0 0" on lines "GD7 GD6 GD5 GD4 GD3 GD2 GD1 GD0" respectively. (1-1)
   Simultaneously, the PC specifies digits position for the data "9 0" on lines "KK2 KD1 KK0". In this case, the data is for P^1 and P^0. So, the PC places "0 0 0".(2-1)

4. When the PC is ready to send the data, the PC pulls $\overline{\text{GD STROB}}$ LOW. When $\overline{\text{GD STROB}}$ is pulled LOW, the I.O.P. can read the data.
   $\overline{\text{GD STROB}}$ must be maintained LOW for at least 50 msec..
   When the data has been read by the I.O.P., the I.O.P. will pull GD READY LOW.

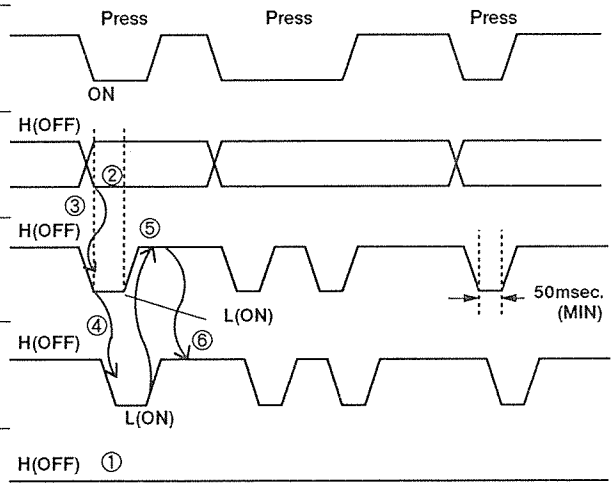
5. When GD READY goes LOW, the PC will restore $\overline{\text{GD STROB}}$ to HIGH.

6. When $\overline{\text{GD STROB}}$ returns to HIGH, the I.O.P. will restore GD READY to HIGH.

7. Steps 3 through 5 are repeated 4 more times to send all of the data to I.O.P..
   The data address must not change while the data is being sent.

Receiving Key Codes

	Key Operation	I.O.P. Key operation
I.O.P. to PC	Key Data	KD0 - KD7
	Key Data strobe	$\overline{\text{KD STROB}}$
PC to I.O.P.	Key Data ready	KD READY
I.O.P. to PC	Key Data/ Descriptive External Data flag	S/K



Time chart

1. When S/K is HIGH, the I.O.P. can send Key Data to a PC.

2. When a key is pressed on the I.O.P., the I.O.P. sends the corresponding Key Code to the PC on lines KD0 – KD7. To do this it pulls $\overline{\text{KD STROB}}$ LOW.

3. When $\overline{\text{KD STROB}}$ is LOW, the PC will read the Key Data and then pull KD READY LOW.

4. When KD READY goes LOW, the I.O.P. will restore $\overline{\text{KD STROB}}$ to HIGH.

5. When $\overline{\text{KD STROB}}$ is returned to HIGH, the PC will restore KD READY to HIGH.

Notes

- If the key is held down, $\overline{\text{KD STROB}}$ will go LOW again even if KD READY has been pulled LOW.
  In this case, KD READY should be toggled HIGH and then LOW again to let the I.O.P. know that the key press has been received.

Key Data

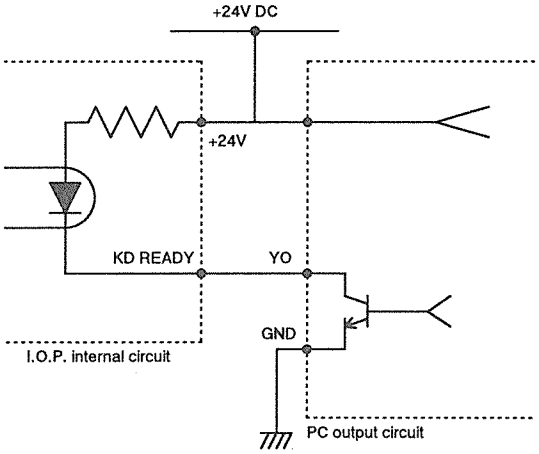
I.O.P. places Key Data on lines KD0 – KD7 as an 8 bit Key Code.

Example

	Key data: KD0 – KD7							
Key Code	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0
08	0	0	0	0	1	0	0	0
FA	1	1	1	1	1	0	1	0

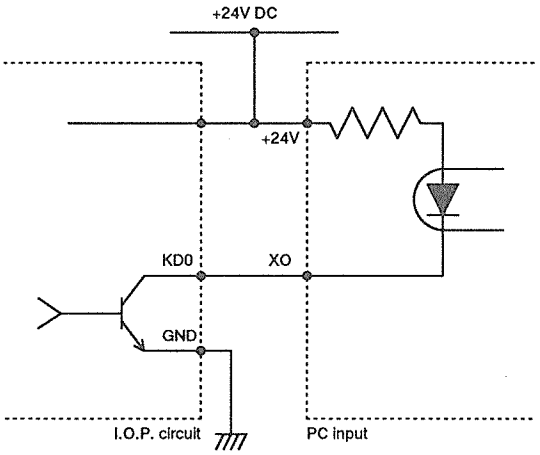
Circuit drawing

The drawing below shows the circuit for connecting the PC output YO to the I.O.P. KD READY.

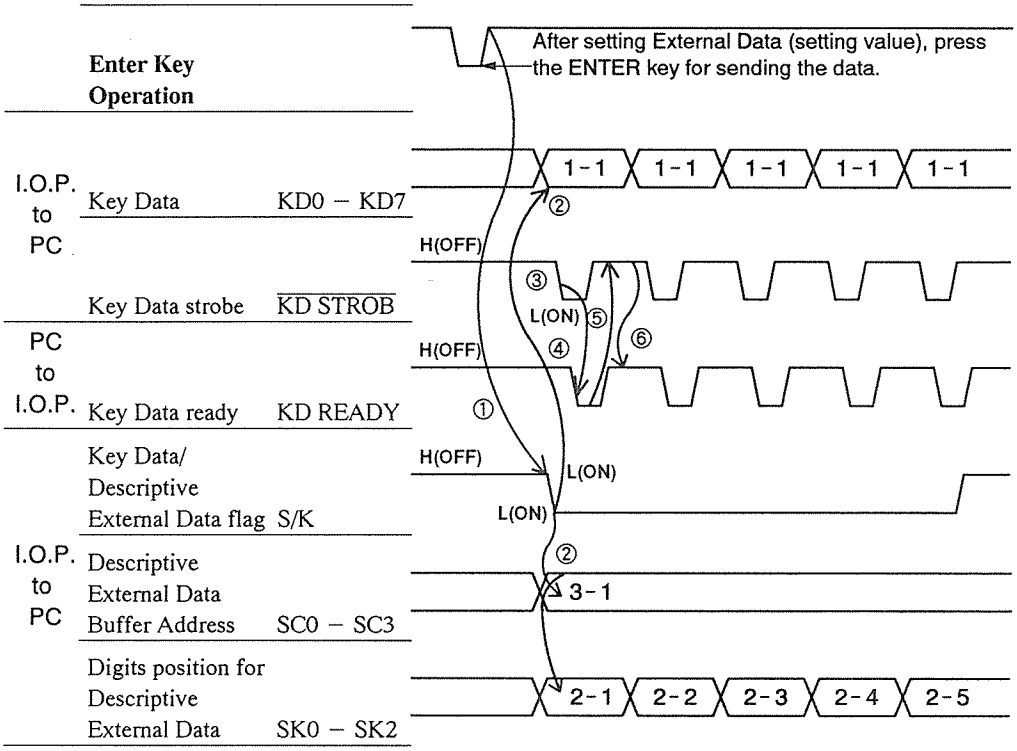


(NPN, Open Collector, Sinking)

The drawing below shows the circuit for connecting the PC input XO to the I.O.P. KD0.



Receiving External Data



Time chart

1. When the ENTER key on the I.O.P. is pressed after entering External Data on the I.O.P. S/K is pulled LOW.

2. At the same time, the first buffer number is sent to the PC on lines SC0 – SC3. Two digits of External Data (starting with the lowest position) are sent to the PC on lines KD0 – KD7. Along with the data, the digit's position is specified on lines SK0 – SK2.

3. When the I.O.P. pulls $\overline{\text{KD STROB}}$ LOW, the PC will read the data placed on the lines in step 2, and the PC will pull KD READY LOW.

4. When KD READY goes LOW, the I.O.P. will restore $\overline{\text{KD STROB}}$ to HIGH.

5. When $\overline{\text{KD STROB}}$ returns to HIGH, the PC will restore KD READY to HIGH.

6. Regardless of the number of characters in the data being sent, the complete 10 digit External Data value is sent as 2 digit chunks, starting with the lowest digits. Steps 2 through 5 are repeated 4 more times.

7. After sending all of the data, the I.O.P. will restore S/K to HIGH.

Caution

- The data (sent on KD0 through KD7) is sent together with the digit's position (lines SK0 through SK2) in 2 digit chunks, starting with the lowest digits.
  The data is sent as 10 digits. So, even if you have entered less than 10 digits of data, the I.O.P. will send all 10 digits for that buffer. A digit position that has not had a value put in it will be sent as "OO" (two zeroes) to the PC.

- 5 handshakes are required.

Specifying the Buffer No., digits position and Descriptive External Data

Descriptive External Data Buffer

SC3 – SC0					Buffer No.
SC3	SC2	SC1	SC0	HEX	
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	2	2
0	0	1	1	3	3
0	1	0	0	4	4
0	1	0	1	5	5
0	1	1	0	6	6
0	1	1	1	7	7
1	0	0	0	8	8
1	0	0	1	9	9
1	0	1	0	A	A
1	0	1	1	B	B
1	1	0	0	C	C
1	1	0	1	D	D
1	1	1	0	E	E
1	1	1	1	F	F

Digits Position/Data

SK2 – SK0				KD7 – KD0	
SK2	SK1	SK0	HEX	KD7 – KD4	KD3 – KD0
0	0	0	0	P^1	P^0
0	0	1	1	P^3	P^2
0	1	0	2	P^5	P^4
0	1	1	3	P^7	P^6
1	0	0	4	P^9	P^8

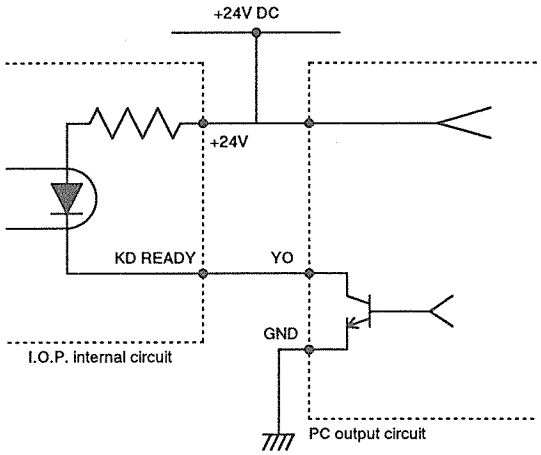
* P = position counted from the right most digit

Descriptive External Data on the I.O.P.

KD0 – KD0					Number to be displayed on the I.O.P.
KD7	KD6	KD5	KD4		
KD3	KD2	KD1	KD0	HEX	
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	2	2
0	0	1	1	3	3
0	1	0	0	4	4
0	1	0	1	5	5
0	1	1	0	6	6
0	1	1	1	7	7
1	0	0	0	8	8
1	0	0	1	9	9
1	0	1	0	A	.

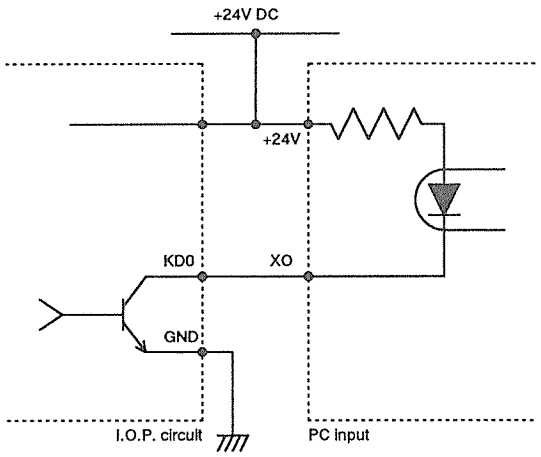
Circuit drawing

The drawing below shows the circuit for connecting the PC output YO to the I.O.P. KD READY.



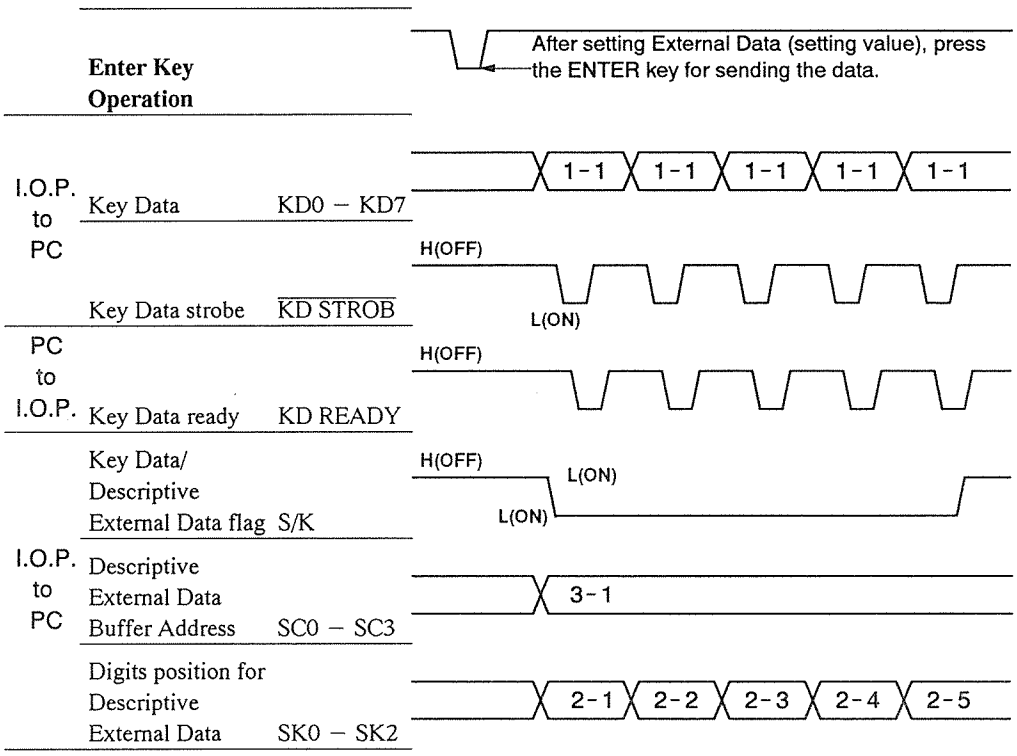
(NPN, Open Collector, Sinking)

The drawing below shows the circuit for connecting the PC input XO to the I.O.P. KD0.



Communication Example

The I.O.P. will send the External Data "1 2 3 4 . 5 6 7 8 9" to the PC from buffer 7:



Address for Descriptive External Data					Digits position for Descriptive External Data			
SC0 – SC3					SK0 – SK2			
	SC3	SC2	SC1	SC0		SK2	SK1	SK0
3 – 1	0	1	1	1	2 – 1	0	0	0
					2 – 2	0	0	1
					2 – 3	0	1	0
					2 – 4	0	1	1
					2 – 5	1	0	0

Descriptive External Data

KD0 – KD7

	KD7	KD6	KD5	KD4	number	KD3	KD2	KD1	KD0	number
1 – 1	1	0	0	0	8	1	0	0	1	9
1 – 2	0	1	1	0	6	0	1	1	1	7
1 – 3	1	0	1	0	.	0	1	0	1	5
1 – 4	0	0	1	1	3	0	1	0	0	4
1 – 5	0	0	0	1	1	0	0	1	0	2

1. When the ENTER key on the I.O.P. is pressed after a value has been entered on the I.O.P. screen, the I.O.P. will pull S/K LOW.

2. The I.O.P. places the buffer number on lines SC0 – SC3. In this example, the buffer number where the data is stored is 7. The I.O.P. places "0 1 1 1" on lines "SC3 SC2 SC1 SC0" respectively.

3. The I.O.P. places 2 characters of the data on lines KD7 – KD0 and it puts the character position on lines SK2 – SK0. In this example, the data which will be sent first is "8 9". So, the I.O.P. places "1 0 0 0 1 0 0 1" on lines "KD7 KD6 KD5 KD4 KD3 KD2 KD1 KD0" respectively.

4. When the I.O.P. is ready to send the above data to the PC, it pulls $\overline{\text{KD STROB}}$ LOW. When $\overline{\text{KD STROB}}$ goes LOW, th PC will read the data and then pull KD READY LOW.

5. When KD READY goes LOW, the I.O.P. will restore $\overline{\text{KD STROB}}$ to HIGH.

6. When $\overline{\text{KD STROB}}$ goes HIGH, the PC will restore KD READY to HIGH.

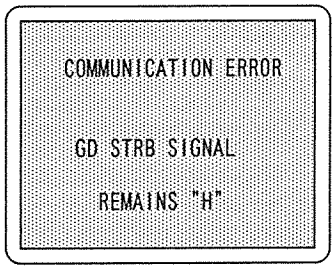
7. Steps 3 through 6 are repeated 4 more times to send all of the data to the PC.

8. When all of the data has been received by PC, the I.O.P. pulls S/K HIGH.

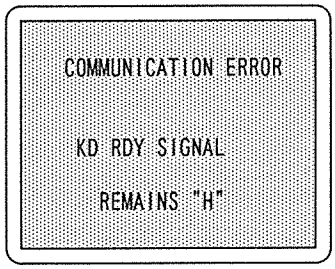
Communication Error

Communication errors can occur when the I.O.P. communicates in handshake mode.
In custom mode, these errors will not occur.

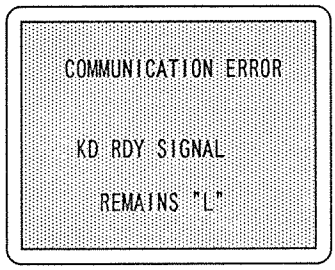
Case 1
When more than 5 seconds has gone by with $\overline{\text{GD STROB}}$ pulled HIGH, the I.O.P. will display the screen shown below and sound the buzzer. Then the I.O.P. will halt the operation.



Case 2
When more than 5 seconds has gone by with $\overline{\text{KD STROB}}$ pulled LOW and KD READY HIGH, the I.O.P. will display the screen shown below and the sound the buzzer. Then the I.O.P. will halt the operation.



Case 3
When more than 5 seconds has gone by with $\overline{\text{KD STROB}}$ pulled HIGH and KD READY LOW, the I.O.P. will display the screen shown below and sound the buzzer. Then the I.O.P. will halt the operation.



Note

- To restart the I.O.P., press the System Reset Button on the rear panel of the I.O.P.. The buzzer sound is cancelled when this button is pressed.

Communication Error with Manual Key

When a Manual Key is pressed, if the I.O.P. did not complete a handshake with the PC, the I.O.P. will halt the operation and highlight the key that was pressed. In this case, an error message will not appear.
When the handshake is conducted normally or the System Reset Button is pressed, the error condition will be corrected.

3-3 Guide to Programming for Serial Communication

In serial communication, the PC always has the token. The I.O.P. will transmit a response to a command from the PC.

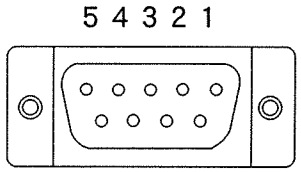
So, to allow the PC receive Key Data or Descriptive External Data from the I.O.P., you may use polling. You can also connect pin number 24 and number 58 on the parallel interface connector to the parallel port of the PC. $\overline{\text{KD STROB}}$ (pin No. 24) will go LOW when a key is pressed. S/K (pin No. 58) will go LOW when the ENTER key is pressed at the end of entering external data on the I.O.P. screen.

If the PC is provided with this information, the command requesting Key Data and the command requesting Descriptive External Data can be sent to the I.O.P. only when the I.O.P. has something to send. This application can make for easier programming and shorter computing time.
If you use the command "T" for Descriptive External Data, you don't have to apply polling. The I.O.P. can receive the data when necessary.
You will find the details in the following sections.

The amount of data that the I.O.P. can receive at one time is 250 bytes.

I.O.P. Serial Communication Port

Serial interface connector



(Female connector)

Serial port specifications

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

Setting the Serial Communication Mode

If you want to use serial communication, you must set the DIP switches as follows.

DIP-Switch Setting								Setting Mode
1	2	3	4	5	6	7	8	
ON	OFF	*	ON	OFF	*	*	*	Serial Communication Mode
ON	OFF	*	ON	ON	*	*	*	Serial Communication Data Format Change Mode

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

Caution

- When you change the DIP switch settings, press the System Reset Button after completing the changes.

How to change the serial communication format is detailed on the next page.

Setting the Serial Communication Data Format

Procedure

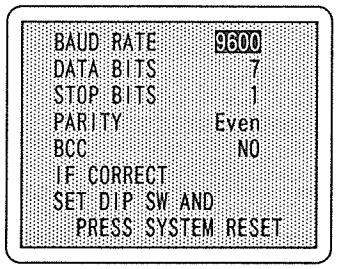
① Set DIP switches 1,2,4,5 as specified below. The rest of the switches can be either ON or OFF.

DIP switch settings

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

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

② Press the System Reset Button.
The I.O.P. will display the screen shown below.
(Default setting)



③ The cursor will be on the baud rate setting. The settings shown on the screen are the ones that will be used for serial communication. You can change the settings from the "Data format options" listed below.

Move the cursor with the I.O.P. arrow keys to the item you want to change.

Data format options

BAUD RATE	300	**DATA BITS**	7	**STOP BITS**	1
	600		8		2
	1200				
	2400	**PARITY**	NONE	**BCC**	NO
	4800		EVEN		YES
	9600		ODD		

9600 baud, 7 bits, 1 bit, EVEN and NO are set at initialization.

④ Press ENTER key on the I.O.P. to change the setting to the one you want.

⑤ Set the DIP switches to Serial Communication Mode

DIP switch setting

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

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

⑥ Press the System Reset Button.

Caution

- If you select 7 data bits and NO or ODD parity check, the I.O.P. will not operate properly.

- When a command is sent from the PC while I.O.P. is switching to a new screen, the I.O.P. may send back an error response.

Before Programming

- All of the data are transmitted in ASCII HEX code. You must change ASCII characters into ASCII HEX code to do the programming shown in the below. Refer to Appendix. C 'ASCII Character Code List' on page 148.

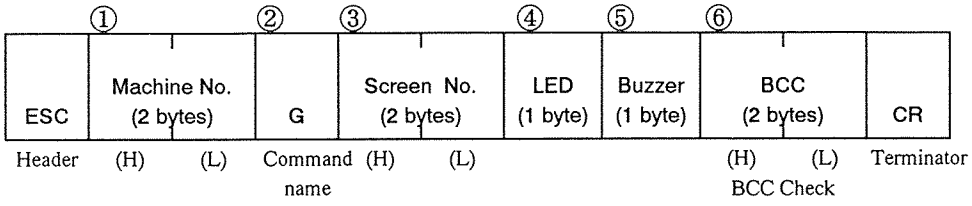
Example

Name	Character	ASCII (HEX)
Header	ESC	1B
Terminator	CR	0D

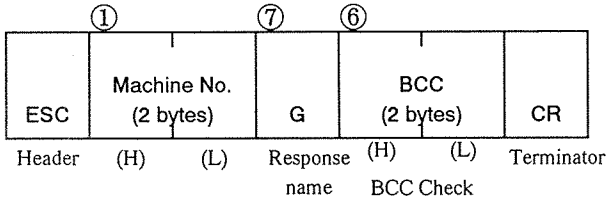
- The machine number must be "01" for the I.O.P. Model 20.
- Data consisting of more than 1 byte is transmitted in order of high(H) byte and low(L) byte.
- Data length is fixed. So, use character 'O' (zero)(HEX 30 in ASCII) to fill blanks in the format.
- When the PC sends Displayable External Data, the frame length is variable depending on the number of bytes. The I.O.P. will confirm receiving the end of a command with a CR (HEX 0D in ASCII).
- When the I.O.P. receives data from the PC normally, it sends the corresponding response back to the PC.
  When the I.O.P. had a problem with reception, it will send an error response to the PC. Refer to "Response at Communication Error" on page 115 for details.
- Block Check Cord is abbreviated BCC.

Displaying Primary Screens

Command "G"



Command "G" Response



① Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

② Give the command name
For command "G", HEX 47 in ASCII.

③ Specify the Primary Screen number as 2 characters
Specify a Primary Screen number for the screen you want to display on the I.O.P. , then change the characters to the corresponding ASCII HEX code.
Example: Screen 05 : "05" , HEX 3035 in ASCII
Screen 1F : "1F" , HEX 3146 in ASCII
Screen 2A : "2A" , HEX 3241 in ASCII

④ Specify the LED status with 1 character
Each of the 4 LEDs has been assigned a bit position. A 1 in that LED's position will turn it ON and a 0 will turn it OFF. Convert the binary 4 bit number to HEX. Consider the result an ASCII character. Look up the ASCII code for that charcter and put it in the LED position in the command "G" frame.
Each bit of 4 bits indicates ON/OFF conditions of 4 kinds of LEDs as shown below.

Example

2^3	2^2	2^1	2^0					
AUTO	MAN.	START	STOP	1	0	1	0 →	A
								(HEX 41 in ASCII)

Quick reference

LED ON/OFF patterns

AUTO	MAN.	START	STOP	CHARACTER	ASCII (HEX)
OFF	OFF	OFF	OFF	0	30
OFF	OFF	OFF	ON	1	31
OFF	OFF	ON	OFF	2	32
OFF	OFF	ON	ON	3	33
OFF	ON	OFF	OFF	4	34
OFF	ON	OFF	ON	5	35
OFF	ON	ON	OFF	6	36
OFF	ON	ON	ON	7	37
ON	OFF	OFF	OFF	8	38
ON	OFF	OFF	ON	9	39
ON	OFF	ON	OFF	A	41
ON	OFF	ON	ON	B	42
ON	ON	OFF	OFF	C	43
ON	ON	OFF	ON	D	44
ON	ON	ON	OFF	E	45
ON	ON	ON	ON	F	46

⑤ Specify the buzzer status with 1 character

If you want the I.O.P. to sound the buzzer, use the character "1". Then change the character to ASCII; HEX 31 and place it in the command.

If you want the I.O.P. to stop sounding the buzzer, use the chacracter "0". Then change the character to ASCII; HEX 30 and place it in the command.

⑥ BCC Check

All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.

If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

⑦ Response name

A "G" is returned to indicate the I.O.P. is responding to command "G".

Example: Requesting screen 03 with the AUTO LED and START LED ON and requests the buzzer to be sounded. No BCC Check.

Command

Character	ESC	0	1	G	0	3	A	1	0	0	CR
ASCII	1B	30	31	47	30	33	41	31	30	30	0D

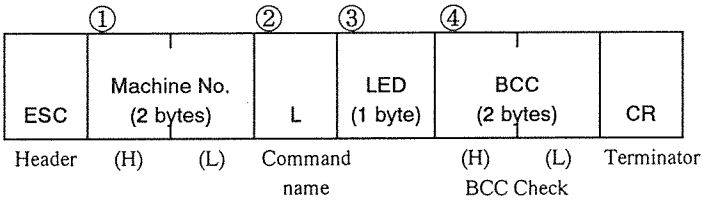
Response

Character	ESC	0	1	G	0	0	CR
ASCII	1B	30	31	47	30	30	0D

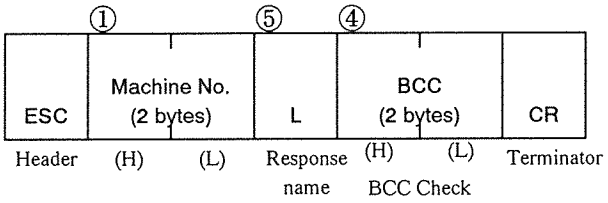
Controlling the LEDs Independently

While you can specify the LED status in a Screen Data command, as already mentioned, you can also control the LEDs independently with the command shown below. This command is useful when you only want to change the LED status.

Command "L"



Command "L" Response



① Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

② Give the command name
For command "L", HEX 4C in ASCII.

③ Specify the LED status with 1 character
Each of the 4 LEDs has been assigned a bit position. A 1 in that LED's position will turn it ON and a 0 will turn it OFF. Convert the binary 4 bit number to HEX. Consider the result an ASCII character. Look up the ASCII code for that charcter and put it in the LED position in the command 'G' frame.
Each bit of 4 bits indicates ON/OFF conditions of 4 kinds of LEDs as shown below.

2^3	2^2	2^1	2^0
AUTO	MAN.	START	STOP

Example

1 0 1 0 → A
(HEX 41 in ASCII)

Quick reference

LED ON/OFF patterns

AUTO	MAN.	START	STOP	CHARACTER	ASCII (HEX)
OFF	OFF	OFF	OFF	0	30
OFF	OFF	OFF	ON	1	31
OFF	OFF	ON	OFF	2	32
OFF	OFF	ON	ON	3	33
OFF	ON	OFF	OFF	4	34
OFF	ON	OFF	ON	5	35
OFF	ON	ON	OFF	6	36
OFF	ON	ON	ON	7	37
ON	OFF	OFF	OFF	8	38
ON	OFF	OFF	ON	9	39
ON	OFF	ON	OFF	A	41
ON	OFF	ON	ON	B	42
ON	ON	OFF	OFF	C	43
ON	ON	OFF	ON	D	44
ON	ON	ON	OFF	E	45
ON	ON	ON	ON	F	46

④ BCC Check

All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.
If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

⑤ Response name

An "L" is returned to indicate the I.O.P. is responding to command "L".

Example: Requesting that the START LED and MAN. LED be turned ON. No BCC Check.

Command

Character	ESC	0	1	L	0	6	0	0	CR
ASCII	1B	30	31	4C	30	33	30	30	0D

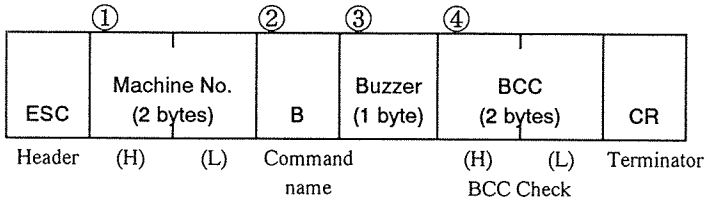
Response

Character	ESC	0	1	L	0	0	CR
ASCII	1B	30	31	4C	30	30	0D

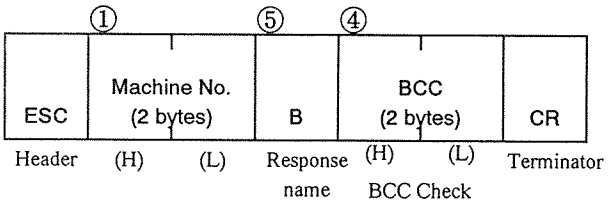
Controlling the Buzzer Independently

While you can specify the buzzer status in a Screen Data command, as already mentioned, you can also control the buzzer independently with the command shown below. This command may be useful when you want to control the buzzer without changing the Primary Screen.

Command "B"



Command "B" Response



① Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

② Give the command name
For command "B", HEX 42 in ASCII.

③ Specify the buzzer status with 1 character
If you want the I.O.P. sound the buzzer, use the character "1". Then change the character to ASCII; HEX 31 and place it in the command.
If you want the I.O.P. to stop sounding the buzzer, use the character "0". Then change the character to ASCII; HEX 30 and place it in the command.

④ BCC Check
All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.
If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

⑤ Response name

A "B" is returned to indicate the I.O.P. is responding to command "B".

Example: Sending the command to sound the buzzer. No BCC Check.

Command

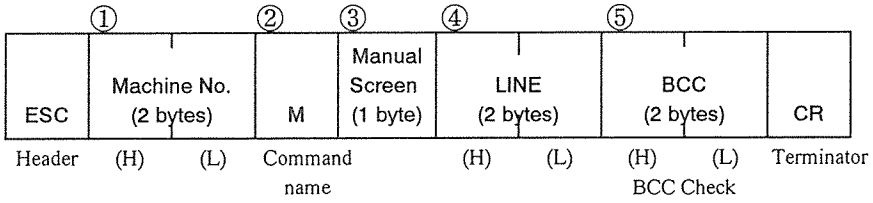
Character	ESC	0	1	B	1	0	0	CR
ASCII	1B	30	31	42	31	30	30	0D

Response

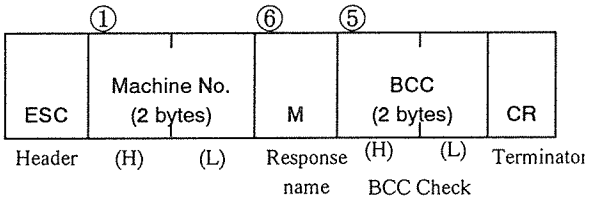
Character	ESC	0	1	B	0	0	CR
ASCII	1B	30	31	42	30	30	0D

Displaying the Manual Key Access Screen

Command "M"



Command "M" Response



① Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

② Give the command name
For command "M", HEX 4D in ASCII.

③ Specify Manual Screen display
If you want the I.O.P. to display the Manual Screen, use the character "1", HEX 31 in ASCII.
To cancel the screen, use the character "0", HEX 30 in ASCII.

④ Specifying the LINE
You can specify which LINE will be displayed as the first line of the Manual Screen. The range for the first line is 1 to 18.
Specify the LINE number using 2 characters in the command.

Example
Display the cursor on 7th line "07": HEX 3037 in ASCII
Display the cursor on 12th line "12": HEX 3132 in ASCII

⑤ BCC Check

All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC. If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

⑥ Response name

An "M" is returned to indicate the I.O.P. is responding to command "M".

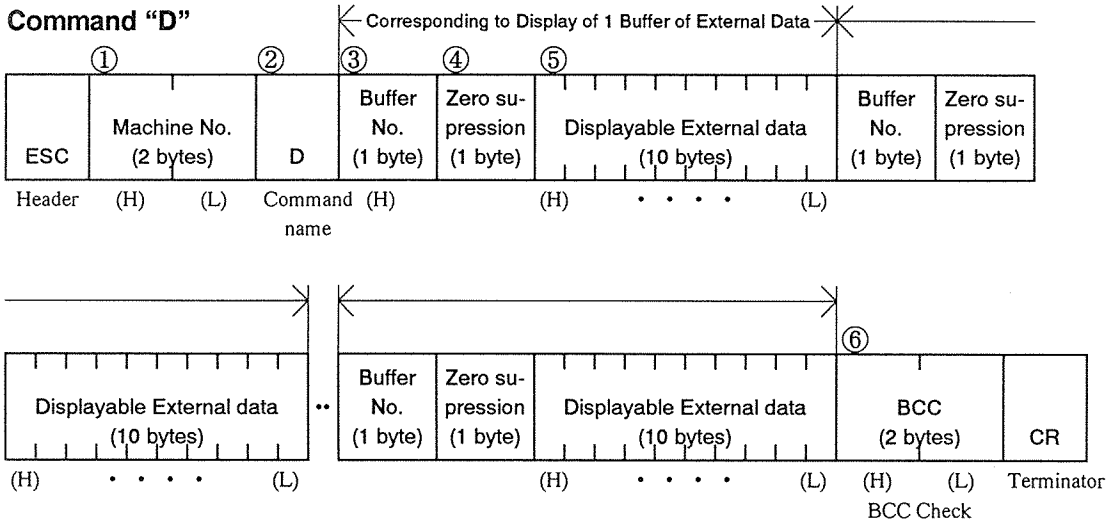
Example: Sending the command to display the Manual Key Access Screen with the cursor on the LINE 10. No BCC Check.

Command	Character	ESC	0	1	M	1	1	0	0	0	CR
	ASCII	1B	30	31	4D	31	31	30	30	30	0D

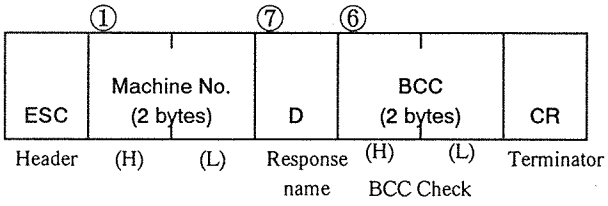
Response	Character	ESC	0	1	M	0	0	CR
	ASCII	1B	30	31	4D	30	30	0D

Displaying External Data

Command "D"



Command "D" Response



①Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

②Give the command name
For command "D", HEX 44 in ASCII.

③Specify the Displayable External Data Buffer number
Specify the buffer number where a Displayable External Data will be stored.
The same buffer number for the data should be used when editing screens with a personal computer. The range is 0 through F. Specify the number according to the use in your situation.

④ Specify zero suppression

If you want to suppress leading zeroes when displaying the data on the I.O.P., use the character "Z", HEX 5A in ASCII.

If not, use the character "N", HEX 4E in ASCII.

⑤ Specify the Displayable External Data

The I.O.P. receives a fixed length of 10 characters of External Data to be displayed on the I.O.P. screen.

If you have specified a value of less than 8 characters in creating the screen, the valid data will be the first 8 characters. However, the I.O.P. receives the data from the PC as 10 data characters with 0 in the invalid digit locations.

For example, to display "12345" on the I.O.P., the PC will send the data to the I.O.P. as "0 0 0 0 0 1 2 3 4 5".

⑥ BCC Check

All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.

If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

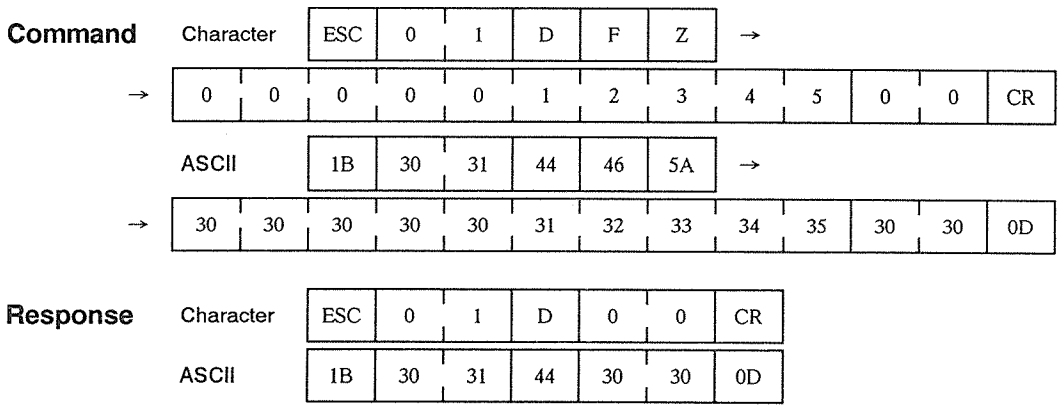
⑦ Response name

A "D" is returned to indicate the I.O.P. is responding to command "D".

Notes

- The frame length depends on the number of Displayable External Data that are transmitted.

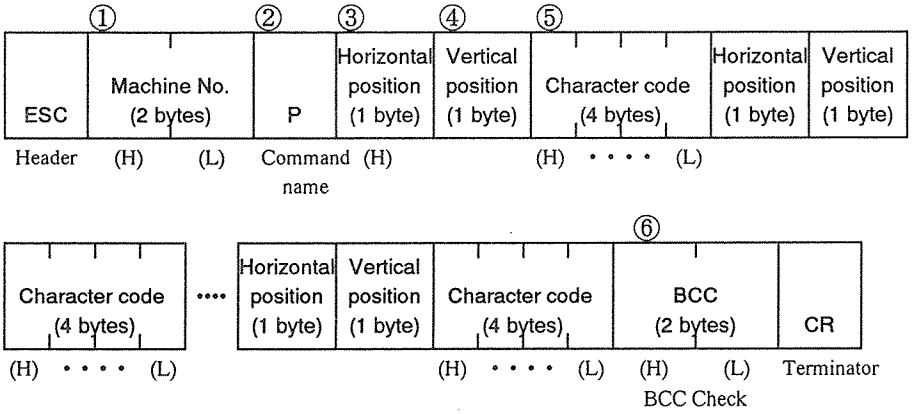
Example: Sending the data "12345" to Displayable External Data Buffer "F" of I.O.P. with zero surpression. No BCC Check.



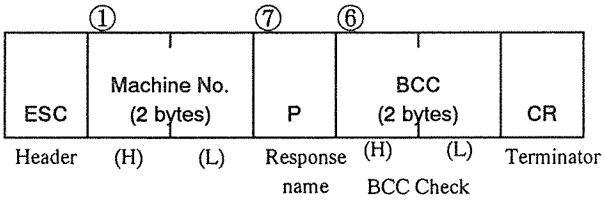
Superimposing Characters

Characters (normal size and half width characters) can be displayed on Primary Screens on the I.O.P.. You can specify the characters arbitrarily in the PC program.
See Appendices D and E for the lists of characters and their character code.

Command "P"



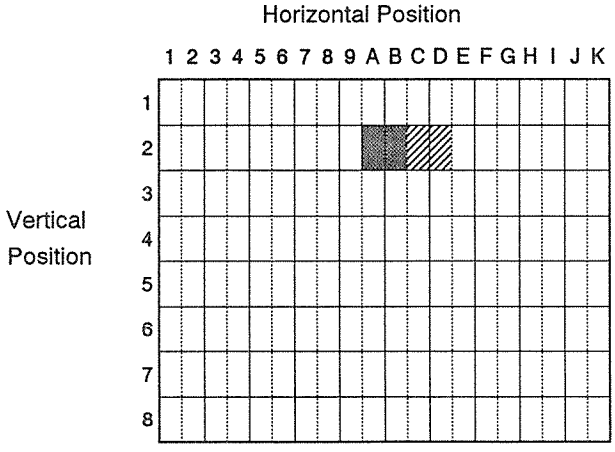
Command "P" Response



① Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

② Give the command name
For command "P", HEX 50 in ASCII.

③ Specify the horizontal position ("1" – "K")
④ Specify the vertical position ("1" – "8")
Specify the position on I.O.P. screen where JIS character will be superimposed.
The position is defined as follows.



Example
When superimposing two nomal size characters (JIS code) in the shaded area
The horizontal position is "A"
(HEX 41 in ASCII)
The vertical position is "2"
(HEX 32 in ASCII)
and
The horizontal position is "C"
(HEX 41 in ASCII)
The vertical position is "2"
(HEX 32 in ASCII)

⑤ Specify the characters

You must specify the characters as (half width or normal size characters).
When the superimposed character is normal size, you can refer to Appendix. D on page 151.
When the superimposed character is half width, you can refer to Appendix. E on page 152.

⑥ BCC Check

All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.
If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

⑦ Response name

A "P" is returned to indicate the I.O.P. is responding to command "P".

Cautions

- If the ESC key is pressed on the I.O.P., superimposed characters will be cleared. (See chapter 2 for more details of the ESC key.)
- To erase a character, use command "P" to send a space "2121" to the same location.
- 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 JIS characters will have priority over the characters at the location.
- You cannot display JIS characters in double size.
- You cannot display JIS 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.

Example: ending the data to the display "STOP" (half width) on the I.O.P. screen at the position from (A 2). No BCC Check.

Command

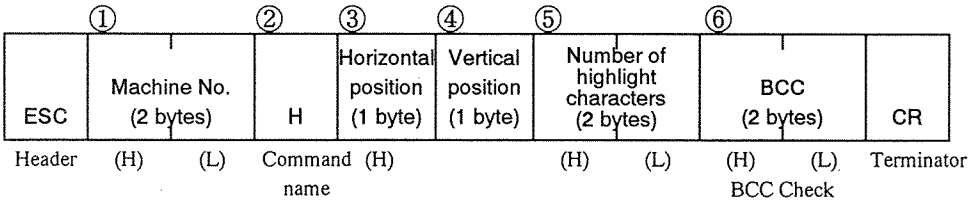
	Character	ESC	0	1	P	A	2	0	0	5	3	→
→	B	2	0	0	5	4	C	2	0	0	4	F →
→	D	2	0	0	5	0	0	0	CR			
	ASCII	1B	30	31	50	41	32	30	30	35	33	→
→	42	32	30	30	35	34	43	32	30	30	34	46 →
→	44	32	30	30	35	30	30	30	0D			

Response

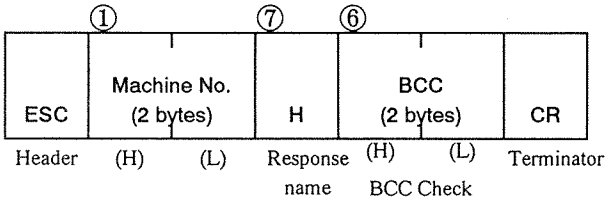
Character	ESC	0	1	P	0	0	CR
ASCII	1B	30	31	50	30	30	0D

Highlighting Characters

Command "H"



Command "H" Response



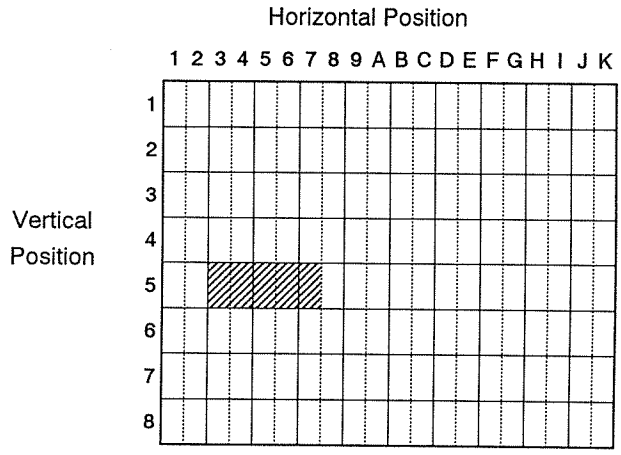
① Specifying machine No. in 2 characters
This time you specify "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code "3031" for the programming.
"01" is also returned in the response.

② Give the command name
For command "H", HEX 48 in ASCII.

③ Specify the horizontal position
④ Specify the vertical position
Specify the position of the character to be highlighted.
The position is defined as shown below.

⑤ Specify the number of characters to be highlighted in two characters
A half width character counts as 1 character.
Normal size character counts as 2 characters.
Specify the number in two characters.

Example: Highlight 4 half width characters: "04", HEX 3034 in ASCII
Highlight 4 normal size characters: "08", HEX 3038 in ASCII



Example

Highlighting characters at the shaded area

The horizontal position begins at '3'(HEX 33 in ASCII), and the vertical position begins at '5'(HEX 35 in ASCII).

Number of characters to be highlighted is '05'(HEX 3035 in ASCII).

⑥ BCC Check

All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC. If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

⑦ Response name

An "H" is returned to indicate the I.O.P. is responding to command "H".

Cautions

- You cannot highlight positions where external data is displayed or entered.
- If there is no character at the position you specify in the command, the location will be darkened.
- If the ESC key is pressed, the highlighting will be cleared.
  (See chapter 2 for more datails of the ESC key.)
- To cancel the highlighting, send the same command again.
- When the I.O.P. is displaying a secondary screen and the Manual Key Access Screen, you cannot highlight characters.
- When a new screen is displayed on the I.O.P., the highlight operation will be cleared.

Example: Sending a command to highlight 4 half width characters starting at position "A","4" (horizontal and vertical). No BCC Check.

Command

Character	ESC	0	1	H	A	4	0	4	0	0	CR
ASCII	1B	30	31	48	41	34	30	34	30	30	0D

Response

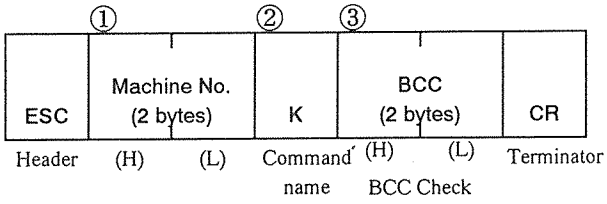
Character	ESC	0	1	H	0	0	CR
ASCII	1B	30	31	48	30	30	0D

Receiving Key Codes

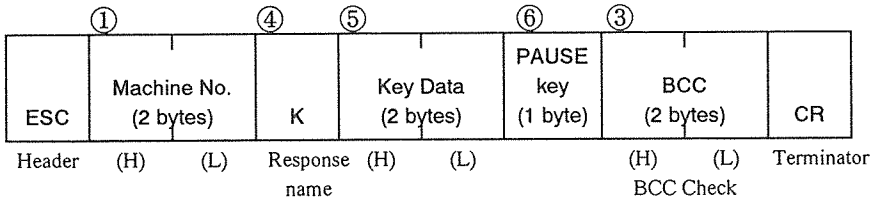
The I.O.P. has 6 Key Data Transmission Buffers, and can store the data for up to 6 keys in the buffers. When all the buffers are in use, the I.O.P. can't store any additional key presses.

When a key on a Screen or a Fixed key is pressed, the corresponding Key Code is stored as Key Data in a buffer. When the I.O.P. receives a command "K" from the PC, it will send the data in the buffer to the PC as the command "K" response. If there is no Key Data in the buffers, the I.O.P. will return "00" as the response.

Command "K"



Command "K" Response



① Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

② Give the command name
For command "K", HEX 4B in ASCII.

③ BCC Check
All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.
If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

④ Response name

A "K" is returned to indicate the I.O.P. is responding to command "K".

⑤ Key data

A Key Code is sent as 2 bytes of the Key Data. Refer to details in "Key Code Output" on the next page.

Start with the Key Code and change it to an ASCII HEX code.

Example: If the START key is pressed, Key Code HEX 03 (at initial setting) is stored in a transmission buffer. The I.O.P. sends HEX 3033 in ASCII as the response.

⑥ PAUSE key data

In command "K", the state of the PAUSE key is transmitted as 1 byte.

When the PAUSE key has been pressed, the I.O.P. will return "1", HEX 31 in ASCII as the response.

When the PAUSE key has not been pressed, it will return "0", HEX 30 in ASCII.

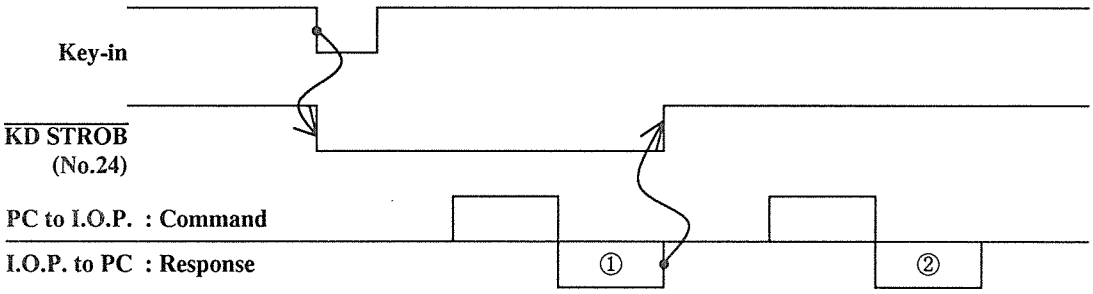
To cancel the ON state of the PAUSE key, press the RESET key.

Example: Requesting key data from the I.O.P.. No BCC Check.
The I.O.P. responds key code "A2" and with PAUSE ON state.

Command	Character	ESC	0	1	K	0	0	CR		
	ASCII	1B	30	31	4B	30	30	0D		
Response	Character	ESC	0	1	K	A	2	1	0	0	CR
	ASCII	1B	30	31	4B	41	32	31	30	30	0D

Key Data Output

To allow the PC to receive Key Data, you can use a polling technique.
You can also connect No. 24 ($\overline{\text{KD STROB}}$) of parallel interface connector to a parallel port of the PC. $\overline{\text{KD STROB}}$ will go LOW when a key is pressed on the I.O.P. and pulls it HIGH when the I.O.P. returns all the Key Data in Key Data Transmission Buffers as the response to command "K". During the $\overline{\text{KD STROB}}$ is HIGH, the I.O.P. will return the response "00".



Example

Command

ESC	0	1	K	0	0	CR

Response ①

ESC	0	1	K	0	4	0	0	0	CR

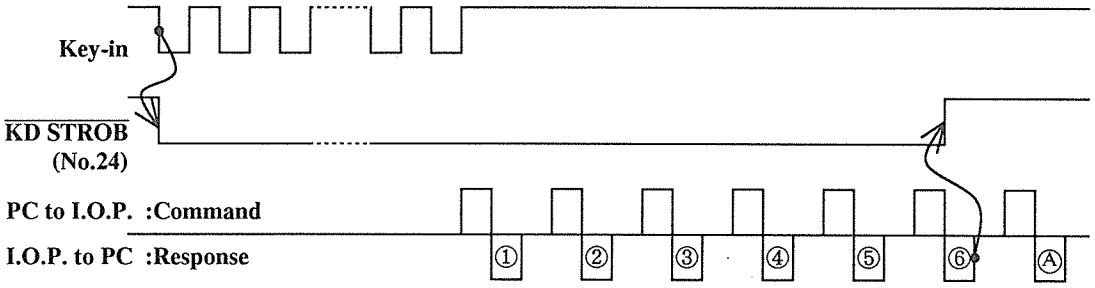
Key Data "04" (a Key of the Key Code 04 is pressed) is sent to a PC as a response.

Response ②

ESC	0	1	K	0	0	0	0	0	CR

When the I.O.P. has sent all the Key Datas held in buffers, the I.O.P. sends Key Data "00".

As the I.O.P. has 6 Key Data Transmission Buffers, the I.O.P. can store up to 6 Key Codes in case it does not receive command "K" for a long time. While any buffer has valid Key Data in it, $\overline{\text{KD STROB}}$ will be held LOW.



Example

Command

ESC	0	1	K	0	0	CR

Response ①

ESC	0	1	K	0	1	0	0	0	CR

Response ②

ESC	0	1	K	0	2	0	0	0	CR

Response ③

ESC	0	1	K	0	3	0	0	0	CR

Response ④

ESC	0	1	K	0	4	0	0	0	CR

Response ⑤

ESC	0	1	K	0	5	0	0	0	CR

Response ⑥

ESC	0	1	K	0	6	0	0	0	CR

Response Ⓐ

ESC	0	1	K	0	0	0	0	0	CR

If 7 Keys with the Key Codes 01 through 07 are pressed, the Key Data "01" through "06" will be sent in the sequence shown above. However, the 7th Key pressed will not be sent because the buffers will have become full after the 6th Key. (If the I.O.P. does not receive a command "K" before the 7th Key is pressed.). So, even if the I.O.P. receives command "K" 7 times, it will return "00" as the 7th response.

Receiving External Data

Command "S"and Command "T"

The I.O.P. has 16 Descriptive External Data Buffers and 1 Descriptive External Data Transmission Buffer for External Data which is entered on on the I.O.P..
Each Descriptive External Data Buffer should be assigned to only one kind of External Data destination when editing screens with a personal computer.

When you use the I.O.P. keys to enter External Data, the data in the corresponding Descriptive External Data Buffer will be overwritten. When the ENTER key is pressed after entering values, the data will be stored in the transmission buffer as new data along with its Descriptive External Data Buffer number.

If you press the ENTER key after entering the data, the data in the transmission buffer is overwritten.

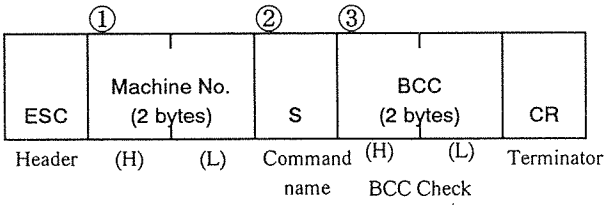
If the PC uses command "S" to receive new data, the I.O.P. will send the data in the Descriptive External Data Transmission Buffer. and if command "T" is used, the data sent by the I.O.P. will come from the Descriptive External Data Buffer.

You may use the command "S" when you want the PC to receive fresh External Data that has been entered on the I.O.P. screen. However, as mentioned, the PC may fail to receive the new data if it does not send a command "S" before different data is stored in the transmission buffer. So, you might want to use command "T" if you want to receive updated data from the I.O.P. on a regular basis.

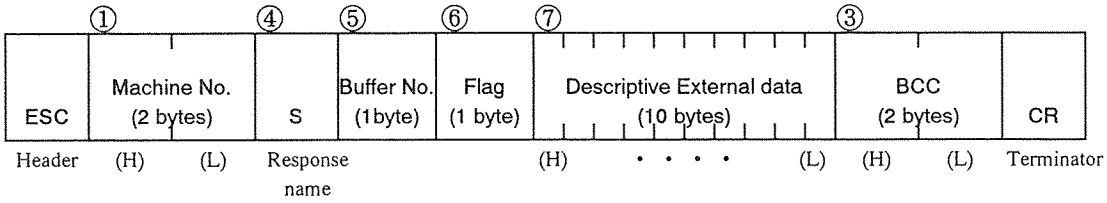
Use command "T" when you want the PC to receive External Data entered from a specific buffer. If you set DIP switch No.8 on the rear panel of the I.O.P. OFF, External Data stored in the I.O.P. is maintained even if you turn off the I.O.P.. With this DIP switch setting, if you use command "T", the PC can request the data from the I.O.P. when necessary, by specifying the Descriptive External Data Buffer number where the data is stored. In the response to command "T", the transmission flag for the data is not set.

Receiving Setting Data with Command "S"

Command "S"



Command "S" Response



① Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

② Give the command name
For command "S", HEX 53 in ASCII.

③ BCC Check
All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.
If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

④ Response name
An "S" is returned to indicate the I.O.P. is responding to command "S".

⑤ Specify Descriptive External Data Buffer number as 1 character
The I.O.P. will return the buffer number (0 to F) where the data is assigned.
You may refer 'External Data Output' for details.

Example
Buffer number 0: "0", HEX 30 in ASCII
Buffer number F: "F", HEX 46 in ASCII

⑥ Transmission flag for new data value
When the ENTER key is pressed after entering External Data on the I.O.P. secreen, the new value is stored in the transmission buffer for Descriptive External Data and the transmission flag is turned ON ("1" = HEX 31 in ASCII).
Once the data in the transmission buffer has been transmitted to the PC, the transmission flag will be turned OFF ("O" = HEX 30 in ASCII).

⑦ Descriptive External Data
When the I.O.P. receives command "S", it responds by sending the External Data in the transmission buffer along with its Descriptive External Data Buffer number to the PC.
The data length is fixed at 10 characters.
If the value entered is less than 10 characters, the I.O.P. will use "0" to fill in the rest of the digits.
The data in the transmission buffer is maintained until it receives new data followed by pressing the ENTER key.

Example
The External Data value entered on the I.O.P. is '12345678'.
The I.O.P. will send the value as '0012345678' (10 characters): HEX 30303132333435363738 in ASCII.

Example: Requesting the data of a newly entered value from the I.O.P. transmission buffer. No BCC Check. The I.O.P. will respond with the data "0012345678" stored in Descriptive External Data Buffer A and will set the transmission flag ON.

Command

Character	ESC	0	1	S	0	0	CR
ASCII	1B	30	31	53	30	30	0D

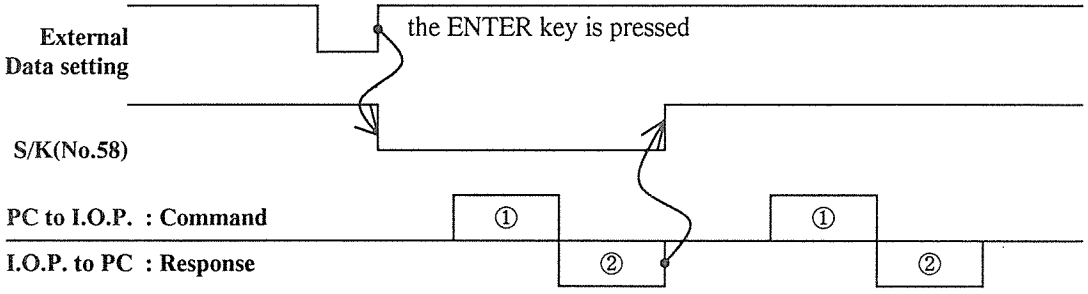
Response

Character	ESC	0	1	S	A	1	→					
→	0	0	1	2	3	4	5	6	7	8	0	0	CR
ASCII	1B	30	31	53	41	31	→					
→	30	30	31	32	33	34	35	36	37	38	30	30	0D

External Data Output

To allow the PC receive External Data which is entered on the I.O.P. screen with command "S", you may use a polling technique.

If you connect terminal No. 58 (S/K) of parallel interface connector to the parallel port of the PC, the I.O.P. will pull S/K LOW when the ENTER key is pressed at the end of entering External Data. It will pull S/K HIGH when the I.O.P. sends the response to command "S".
With this information, the PC can determine when to send command "S" to receive the new data. In the I.O.P., the external data transmission flag will be turned ON whenever new data is stored in the transmission buffer and it will be turned OFF when the data is sent to the PC.
So, if the PC sends command "S" when it receives an S/K signal from the I.O.P., the I.O.P. will send the new data in the buffer with the transmission "1" as the response. If the I.O.P. receives command "S" while the transmission flag is OFF, it will sent the data that was last transmitted again, with the transmission flag "O".



Example

Command ①

ESC	0	1	S	0	0	CR

Response ②

ESC	0	1	S	A	1	0	0	1	2	3	4	5	6	7	8	0	0	CR

IF the I.O.P. has new data to send, the flag will be set to "1". In this example, the data "13245678" is stored in buffer A.

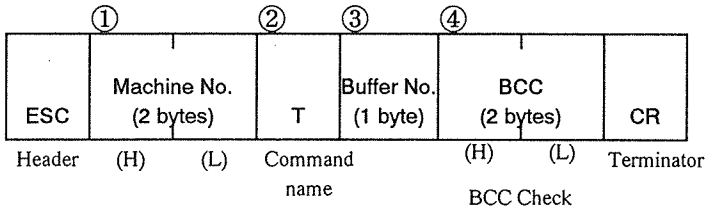
Response ③

ESC	0	1	S	A	0	0	0	1	2	3	4	5	6	7	8	0	0	CR

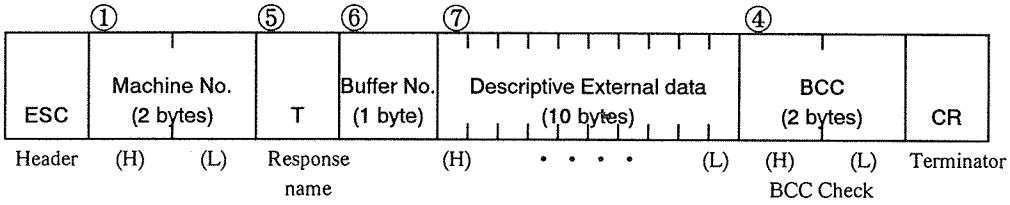
If the I.O.P. is sening data that was already transmitted, the flag will be set to "0"(zero).

Receiving External Data with Command "T"

Command "T"



Command "T" Response



①Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

②Give the command name
For command "T", HEX 54 in ASCII.

③Specify Descriptive External Data Buffer number as 1 character
The I.O.P. will return the buffer number (0 to F) where the data is assigned.
You may refer to 'External Data Output' for details.

④BCC Check
All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.
If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

⑤Response name
A "T" is returned to indicate the I.O.P. is responding to command "T".

⑥ Buffer number

The buffer number where the data is stored.

⑦ Descriptive External Data

When the I.O.P. receives command "T", it responds by sending the External Data from the buffer specified by the PC.

The data length is fixed at 10 characters.

If the value entered is less than 10 characters, the I.O.P. will use "0" to fill in the rest of the digits.

Example: Requesting the data stored in Descriptive External Data Buffer B. No BCC Check.
The I.O.P. sends the data "0012345678" from buffer B.

Command

Character	ESC	0	1	T	B	0	0	CR
ASCII	1B	30	31	54	42	30	30	0D

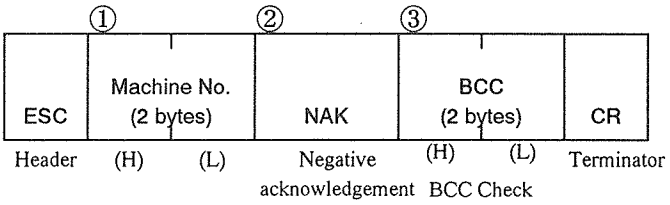
Response

Character	ESC	0	1	T	B	→						
→	0	0	1	2	3	4	5	6	7	8	0	0	CR
ASCII	1B	30	31	54	42	→						
→	30	30	31	32	33	34	35	36	37	38	30	30	0D

Response at Communication Error

If the I.O.P. fails to receive a command correctly, it will return the following response. This will be happen, for example, when a BCC error is detected, or when the I.O.P. receives an undefined command.

Response



① Specify machine No. using 2 characters
Place "01" in the command.
Change the characters "01" to the corresponding ASCII HEX code 3031.
"01" is also returned in the response.

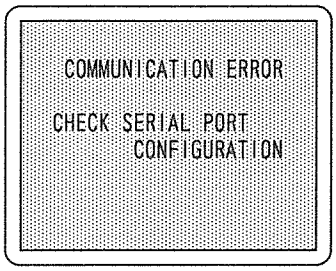
② Negative acknowledgement character NAK (HEX 15 in ASCII)

③ BCC Check
All the bytes in a frame, that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.
If you have chosen "NO" for BCC when you set the serial communication data format, place "0 0" in the block for the BCC check. In this case, the I.O.P. will send "0 0" in the block for the BCC check as the response.

Example: Response to communication error. No BCC check

Response	Character	ESC	0	1	NAK	0	0	CR
	ASCII	1B	30	31	15	30	30	0D

If an error occurs three times in a row, the I.O.P. will display the following message.



The I.O.P. will recover and return to the Run mode when it receives a valid command correctly transmitted. However, the command which caused the error message to be displayed may not have been received by the I.O.P..

When the I.O.P. receives a command while it is processing a Primary Screen display, it might return an error response to the PC.

How to Construct a BCC (Block Check Code)

You may use BCC when you want to increase the reliability of data communication.
The BCC on the I.O.P. is used for checking error with horizontal parity.

You can construct a BCC as follows:

All the bytes in frames that are received prior to the BCC, are exclusive-ORed in the order in which they are received. This number is converted to ASCII HEX and is used for the BCC.
BCC consists of 2 characters.

Example: BCC check when transmitting Screen Data

* The PC sends Screen Data of Screen Code "07" with the data for turning AUTO and START LEDs ON and with the data for sounding Buzzer.

Command	Character	ESC	0	1	G	0	7	A	1	2	A	CR
	ASCII	1B	30	31	47	30	37	41	31	32	41	0D

	Code	ASCII (HEX)
	ESC	1B
	0	30
	1	31
	G	47
	0	30
	7	37
	A	41
	1	31
Exclusive-OR	**2A**	**3241**

Chapter 4

Connecting the I.O.P. to a PC

This chapter explains how to connect cables for data communication.
You will learn how to connect the I.O.P. Model 20 to the FP series programmable controller, and also how it can be connected to other manufacturers' programmable controllers.

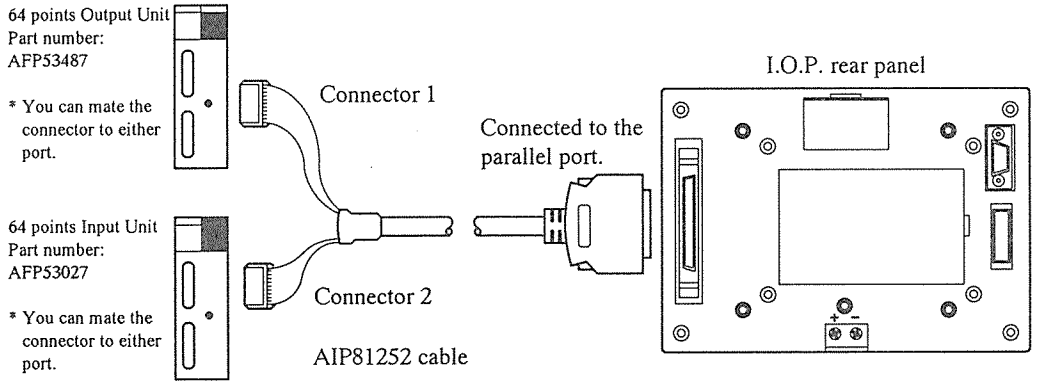
PC is an abbreviation of programmable controller.

4-1 Connecting the I.O.P. to the FP5 (Parallel Connection)

If you connect the I.O.P. to the FP5 (a programmable controller manufactured by Matsushita Electric Works, Ltd.), you can use the cable part number AIP81252.
To use the cable, you must prepare a input unit (64 points) and a output unit (64 points) on the board of FP5.

Connecting the I.O.P. to the FP5 Parallel I/O Ports

You can check which connector number you have by comparing it with the colored discrete wires list on the next page.

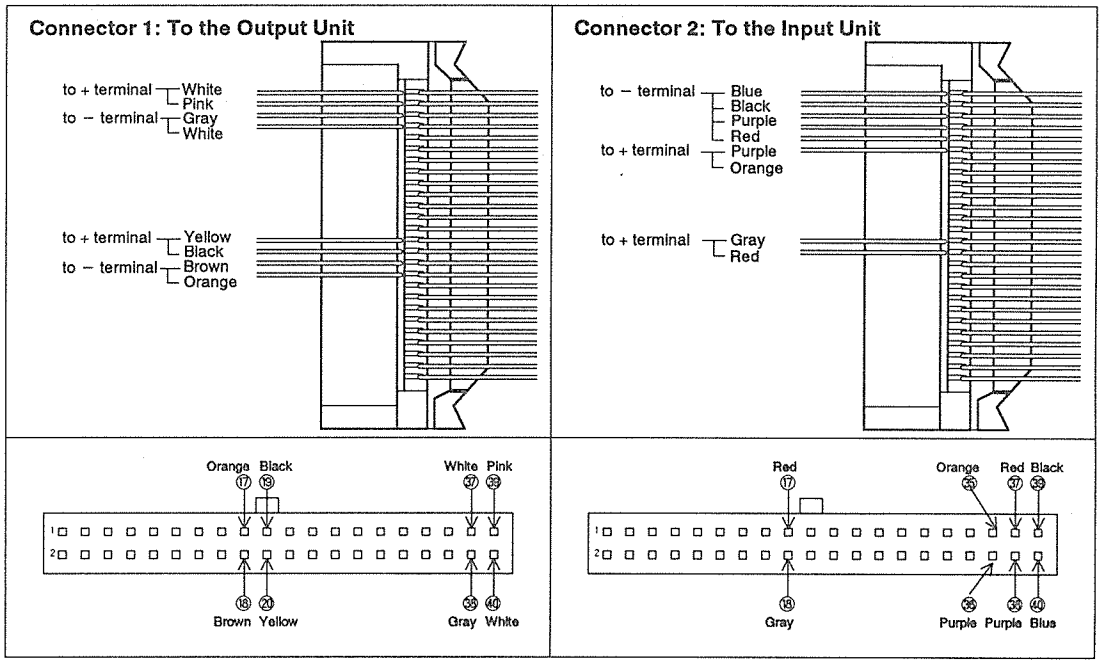


Total length: 2 m (78.7 in.)
Cable wire length: 0.20 m (7.9 in.)

Connecting Colored Discrete Wires to the 24VDC Power Terminals

On connector 1 and connector 2, 200mm (7.9 inches) of colored discrete wires are provided for supplying 24VDC from the power terminals.
After mating each connector into the specified unit, connect the wires to either the positive or negative power terminals as shown on the next page. A minimum 0.5A is required.
The power can be supplied from any power source or you can connect the wires to 24VDC output terminals on the FP5 Power Unit.

Discrete Wires (AIP81252)



Connector Pin Assignments

I/O No.	PC Pin No.		Signal Name	I.O.P. Pin No.
Y0	Connector	1	GD0	2
Y1	1	3	GD1	36
Y2		5	GD2	3
Y3		7	GD3	37
Y4		9	GD4	4
Y5		11	GD5	38
Y6		13	GD6	5
Y7		15	GD7	39
Y8		21	$\overline{\text{GD STROB}}$	42
Y9		23	KK0	49
YA		25	KKI	16
YB		27	KK2	50
YC		29	AD0	12
YD		31	AD1	46
YE		33	AD2	13
YF		35	AD3	47
Y10		2	KD READY	43
Y11		4	C/D	8
Y12		6	MS	15
Y13		8	ML	48
Y14		10	LED1	6
Y15		12	LED2	40
Y16		14	LED3	7
Y17		16	LED4	41
Y18		22	BUZZER	14
Y19		24	FF REQ	9
Y1A		26	unspecified	17
Y1B		28	unspecified	51
Y1C			N.C.	
Y1D			N.C.	
Y1E			N.C.	
Y1F			N.C.	

I/O No.	PC Pin No.		Signal Name	I.O.P. Pin No.
X0	Connector	1	KD0	20
X1	2	3	KD1	54
X2		5	KD2	21
X3		7	KD3	55
X4		9	KD4	22
X5		11	KD5	56
X6		13	KD6	23
X7		15	KD7	57
X8		19	$\overline{\text{KD STROB}}$	24
X9		21	SK0	30
XA		23	SK1	64
XB		25	SK2	31
XC		27	SC0	26
XD		29	SC1	60
XE		31	SC2	27
XF		33	SC3	61
X10		2	GD READY	59
X11		4	S/K	58
X12		6	PAUSE	25
X13		10	unspecified	32
X14		14	unspecified	33
X15		8	unspecified	65
X16		12	unspecified	66
X17		16	ALARM	67
X18			N.C.	
X19			N.C.	
X1A			N.C.	
X1B			N.C.	
X1C			N.C.	
X1D			N.C.	
X1E			N.C.	
X1F			N.C.	

N.C.: Not Connected

Pin assignments for discrete wires (Connector 1)

24VDC power terminal		PC Pin No.	I.O.P. Pin No.	color
+24VDC	Connector 1	19	1	Black
		20	11	Yellow
		39	35	Pink
		45	45	White
GND	Connector 1	17	10	Orange
		18	18	Brown
		37	44	White
		38	52	Gray

Pin assignments for discrete wires (Connector 2)

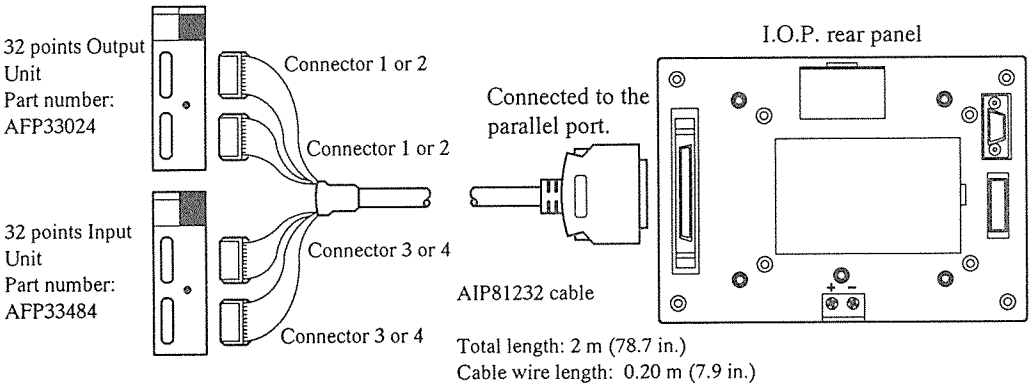
24VDC power terminal		PC Pin No.	I.O.P. Pin No.	color
+24VDC	Connector 2	17	19	Red
		18	53	Gray
		35	29	Orange
		36	63	Purple
GND	Connector 2	37	28	Red
		38	62	Purple
		39	34	Black
		40	68	Blue

4-2 Connecting the I.O.P. to the FP3 (Parallel Connection)

If you connect the I.O.P. to the FP3, you can use the cable part number AIP81232.
To use the cable, you must prepare a input unit (32 points) and a output unit (32 points) on the board of FP3.

Connecting the I.O.P. to the FP3 Parallel I/O Ports

You can check which connector number you have by comparing it with the colored discrete wires list on the next page.

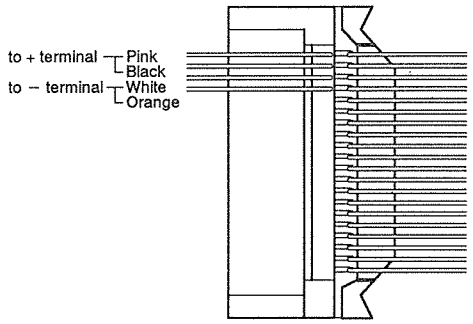


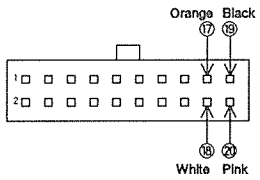
Connecting Colored Discrete Wires to the 24VDC Power Terminals

On connector 1,2,3 and connector 4, 200mm (7.9 inches) of colored discrete wires are provided for supplying 24VDC from the power terminals.
After mating each connector into the specified unit, connect the wires to either the positive or negative power terminals as shown on the next page. A minimum 0.5A is required.
The power can be supplied from any power source or you can connect the wires to 24VDC output terminals on the FP3 Power Unit.

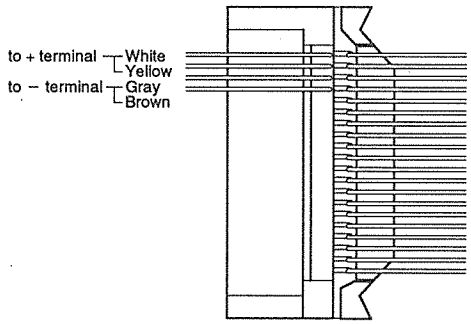
Discrete Wires (AIP81232)

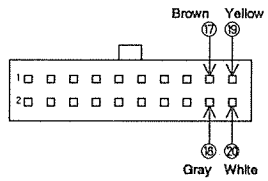
Connector 1: To the Output Unit



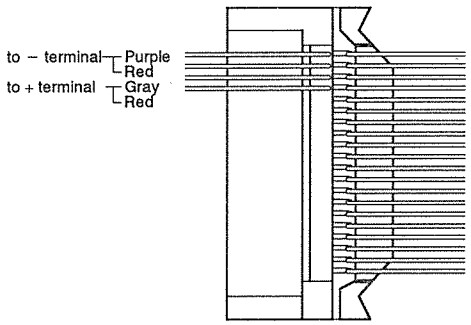


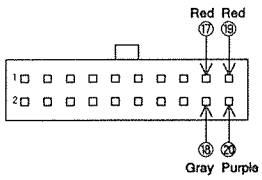
Connector 2: To the Output Unit



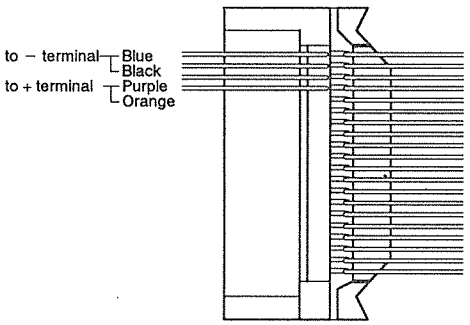


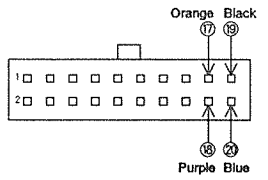
Connector 3: To the Input Unit





Connector 4: To the Input Unit





Connector Pin Assignments

I/O No.	PC Pin No.		Signal Name	I.O.P. Pin No.
Y0	Connector	1	GD0	2
Y1	1	3	GD1	36
Y2		5	GD2	3
Y3		7	GD3	37
Y4		9	GD4	4
Y5		11	GD5	38
Y6		13	GD6	5
Y7		15	GD7	39
Y8		2	$\overline{\text{GD STROB}}$	42
Y9		4	KK0	49
YA		6	KKI	16
YB		8	KK2	50
YC		10	AD0	12
YD		12	AD1	46
YE		14	AD2	13
YF		16	AD3	47
Y10	Connector	1	KD READY	43
Y11	2	3	C/D	8
Y12		5	MS	15
Y13		7	ML	48
Y14		9	LED1	6
Y15		11	LED2	40
Y16		13	LED3	7
Y17		15	LED4	41
Y18		2	BUZZER	14
Y19		4	FF REQ	9
Y1A		6	unspecified	17
Y1B		8	unspecified	51
Y1C			N.C.	
Y1D			N.C.	
Y1E			N.C.	
Y1F			N.C.	

I/O No.	PC Pin No.		Signal Name	I.O.P. Pin No.
X0	Connector	1	KD0	20
X1	3	3	KD1	54
X2		5	KD2	21
X3		7	KD3	55
X4		9	KD4	22
X5		11	KD5	56
X6		13	KD6	23
X7		15	KD7	57
X8		2	$\overline{\text{KD STROB}}$	24
X9		4	SK0	30
XA		6	SK1	64
XB		8	SK2	31
XC		10	SC0	26
XD		12	SC1	60
XE		14	SC2	27
XF		16	SC3	61
X10	Connector	1	GD READY	59
X11	4	3	S/K	58
X12		5	PAUSE	25
X13		9	unspecified	32
X14		13	unspecified	33
X15		7	unspecified	65
X16		11	unspecified	66
X17		15	ALARM	67
X18			N.C.	
X19			N.C.	
X1A			N.C.	
X1B			N.C.	
X1C			N.C.	
X1D			N.C.	
X1E			N.C.	
X1F			N.C.	

N.C. : Not Conneced

Pin Assignments for discrete wires (connector 1 and 2)

24VDC power terminal	PC Pin No.		I.O.P. Pin No.	color
+24VDC	Connector 1	19	1	Black
		20	35	Pink
	Connector 2	19	11	Yellow
		20	45	White
GND	Connector 1	17	10	Orange
		18	44	White
	Connector 2	17	18	Brown
		18	52	Gray

Pin assignments for discrete wires (Connector 3 and 4)

24VDC power terminal	PC Pin No.		I.O.P. Pin No.	color
+24VDC	Connector 3	17	19	Red
		18	53	Gray
	Connector 4	17	29	Orange
		18	63	Purple
GND	Connector 3	19	28	Red
		20	62	Purple
	Connector 4	19	34	Black
		20	68	Blue

4-3 Connecting the I.O.P. to an M1T or M2T (Parallel Connection)

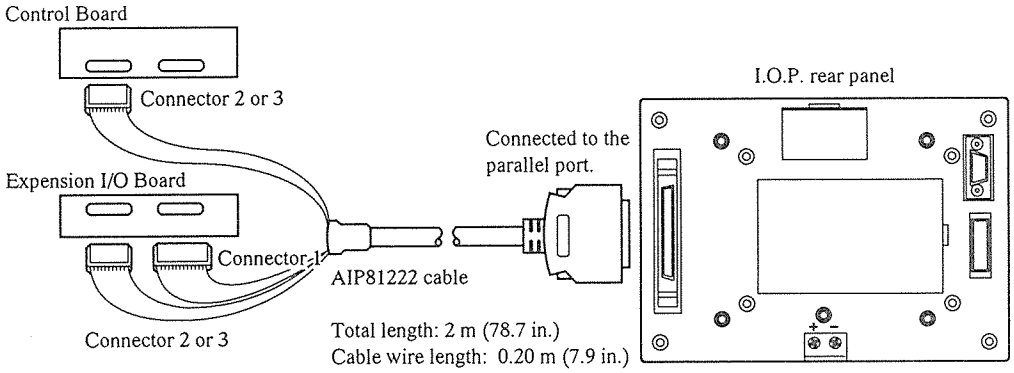
If you connect the I.O.P. with an M1T or M2T (a programmable controller manufactured by Matsushita Electric Works, Ltd.), you can use the cable part number AIP81222.
To use the cable, you have to prepare Expansion I/O board(s).

Connecting the I.O.P. to an M1T or M2T

You can check which connector number you have by comparing it with the colored discrete wires list on the next page.

M1T, M2T

Example



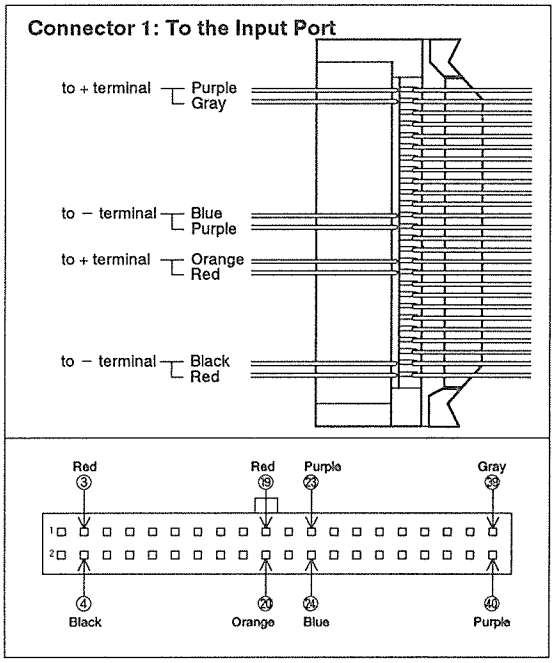
Connecting Colored Discrete Wires to the 24VDC Power Terminals

On connector 1,2 and connector 3, 200mm (7.9 inches) of colored discrete wires are provided for supplying 24V DC from the power terminals.
After mating each connector into the specified unit, connect each of the wires to either the positive or negative power terminals as shown on the next page. A minimum 0.5A is required.
The power can be supplied from any power source.

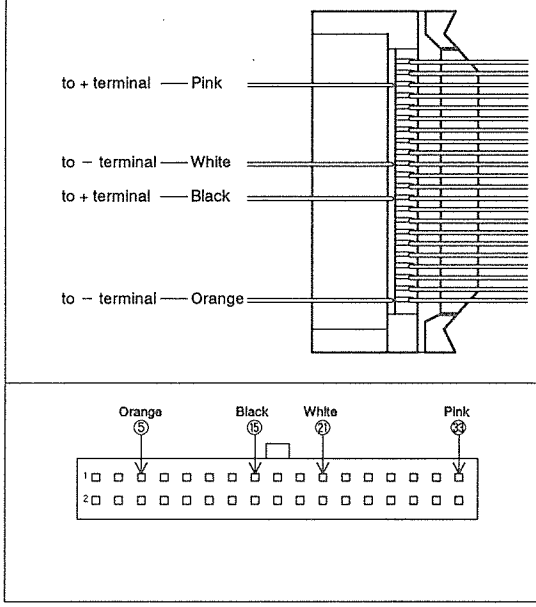
If you use an M1T type PC, you can disregard the discrete wires because this type of PC has internal power source for input and output.

Discrete Wires (AIP81222)

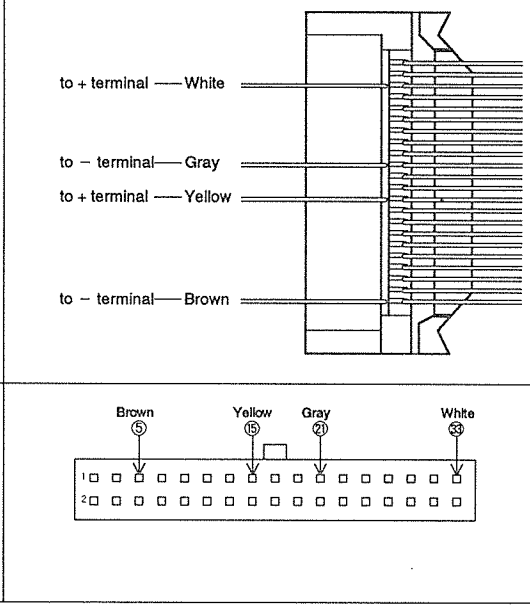
Connector 1: To the Input Port



Connector 2: To the Output Port



Connector 3: To the Output Port



Connector Pin Assignments

I/O No.	PC Pin No.		Signal Name	I.O.P. Pin No.
X32	Connector	36	KD0	20
X33	1	35	KD1	54
X34		34	KD2	21
X35		33	KD3	55
X36		32	KD4	22
X37		31	KD5	56
X38		30	KD6	23
X39		29	KD7	57
X40		28	SC0	26
X41		27	SC1	60
X42		26	SC2	27
X43		25	SC3	61
X44		16	S/K	58
X45		15	PAUSE	25
X46		14	$\overline{\text{KD STROB}}$	24
X47		13	GD READY	59
X48		12	SK0	30
X49		11	SK1	64
X50		10	SK2	31
X51		9	unspecified	65
X52		8	ALARM	67
X53		7	unspecified	33
X54		6	unspecified	66
X55		5	unspecified	32
		17	N.C.	
		19	N.C.	
		37	N.C.	
		38	N.C.	

I/O No.	PC Pin No.		Signal Name	I.O.P. Pin No.
YO	Connector	30	GD0	2
Y1	2	29	GD1	36
Y2		28	GD2	3
Y3		27	GD3	37
Y4		26	GD4	4
Y5		25	GD5	38
Y6		24	GD6	5
Y7		23	GD7	39
Y8		14	LED1	6
Y9		13	LED2	40
Y10		12	LED3	7
Y11		11	LED4	41
Y12		10	BUZZER	14
Y13		9	MS	12
Y14		8	KD READY	43
Y15		7	$\overline{\text{GD STROB}}$	42
Y32	Connector	30	AD0	12
Y33	3	29	AD1	46
Y34		28	AD2	13
Y35		27	AD3	47
Y36		26	KK0	49
Y37		25	KK1	16
Y38		24	KK2	50
Y39		23	C/D	8
Y40		14	ML	48
Y41		13	FF REQ	9
Y42		12	unspecified	51
Y43		11	unspecified	17
Y44		10	N.C.	
Y45		9	N.C.	
Y46		8	N.C.	
Y47		7	N.C.	

N.C. : Not Connected

Pin assignments for discrete wires (Connector 1)

24VDC power terminal		PC Pin No.	I.O.P. Pin No.	color
+24VDC	Connector 1	19	19	Red
		20	29	Orange
		39	53	Gray
		40	63	Purple
GND	Connector 1	3	28	Red
		4	34	Black
		23	62	Purple
		24	68	Blue

Pin assignments for discrete wires (Connector 2 and Connector 3)

24VDC power terminal		PC Pin No.	I.O.P. Pin No.	color
+24VDC	Connector 2	15	1	Black
		33	35	Pink
	Connector 3	15	11	Yellow
		33	45	White
GND	Connector 2	5	10	Orange
		21	44	White
	Connector 3	5	18	Brown
		21	52	Gray

4-4 Connecting the I.O.P. to a PC (Parallel Connection)

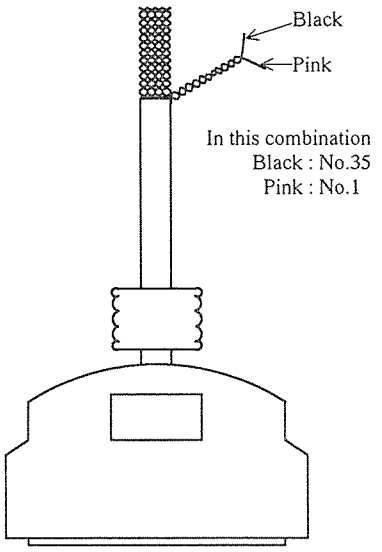
If you connect the I.O.P. to a PC other than the FP5, FP3, M1T or M2T with a parallel cable, you can use one of the cables listed below.

Part number AIP81241 (1m)
AIP81242 (2m)
AIP81243 (3m)
AIP81244 (4m)
AIP81245 (5m)

Connector Pin Assignments

The cables consist of twisted pairs of wires and a connector which is plugged into the I.O.P. parallel port.
The pin number corresponding to a wire can be identified by the wire color, as shown in the list below.

I.O.P. side connector Pin No.	Color of wire pair (twisted)		I.O.P. side connector Pin No.
1	Black	Pink	35
2	Brown		36
3	Red		37
4	Orange		38
5	Yellow		39
6	Green		40
7	Black	White	41
8	Brown		42
9	Red		43
10	Orange		44
11	Yellow		45
12	Green		46
13	Blue		47
14	Purple		48
15	Gray		49
16	Pink		50
17	Black	Gray	51
18	Brown		52
19	Red		53
20	Orange		54
21	Yellow		55
22	Green		56
23	Blue		57
24	Purple		58
25	Pink		59
26	Black	Purple	60
27	Brown		61
28	Red		62
29	Orange		63
30	Yellow		64
31	Green		65
32	Blue		66
33	Pink		67
34	Black	Blue	68



Mated with
I.O.P. Parallel port

Connection example

Depending on what you plan to do with the I.O.P., you can connect only the wires you need.

Parallel port on the I.O.P.

Pin No.	I.O.P. I/O	Name	Description	Pin No.	I.O.P. I/O	Name	Description
1	×	+24VDC	I/O power supply	35	×	+24VDC	I/O power supply
2	I	GD0	Screen Data	36	I	GD1	Screen Data
3	I	GD2		37	I	GD3	
4	I	GD4		38	I	GD5	
5	I	GD6		39	I	GD7	
6	I	LED1	AUTO LED	40	I	LED2	MAN. LED
7	I	LED3	START LED	41	I	LED4	STOP LED
8	I	C/D	Screen Data/ Displayable External Data flag	42	I	$\overline{\text{GD STROB}}$	Screen Data stobe
9	I	FF.REQ	Requesting FF	43	I	KD READY	Key Data ready
10	×	(OV)	(GND)	44	×	(OV)	(GND)
11	×	+24VDC	I/O power supply	45	×	+24VDC	I/O power supply
12	I	AD0	Displayable External Data Buffer Address	46	I	AD1	Displayable External Data Buffer Address
13	I	AD2		47	I	AD3	
14	I	BUZZER	Buzzer control	48	I	ML	Manual screen LINE spec.
15	I	MS	Manual screen control	49	I	KK0	Digits position for Displayable External Data
16	I	KK1	Digits position for Displayable External Data	50	I	KK2	
17		N.C.		51		N.C.	
18	×	(OV)	(GND)	52	×	(OV)	(GND)

Pin No.	I.O.P. I/O	Name	Description	Pin No.	I.O.P. I/O	Name	Description
19	×	+24VDC	I/O power supply	53	×	+24VDC	I/O power supply
20	O	KD0	Key Data	54	O	KD1	Key Data
21	O	KD2		55	O	KD3	
22	O	KD4		56	O	KD5	
23	O	KD6		57	O	KD7	
24	O	$\overline{\text{KD STROB}}$	Key Data strobe	58	O	S/K	Key Data/ Descriptive External Data flag
25	O	PAUSE	Pause	59	O	GD READY	Screen Data ready
26	O	SC0	Descriptive External Data Buffer Address	60	O	SC1	Descriptive External Data Buffer Address
27	O	SC2		61	O	SC3	
28	×	0V	GND	62	×	0V	GND
29	×	+24VDC	I/O power supply	63	×	+24VDC	I/O power supply
30	O	SK0	Digits position for Descriptive External Data	64	O	SK1	Digits position for Descriptive External Data
31	O	SK2		65		N.C.	
32		N.C.		66		N.C.	
33		N.C.		67		ALARM	Output I.O.P. alarm
34	×	0V	GND	68	×	0V	GND

N.C. : Not connected

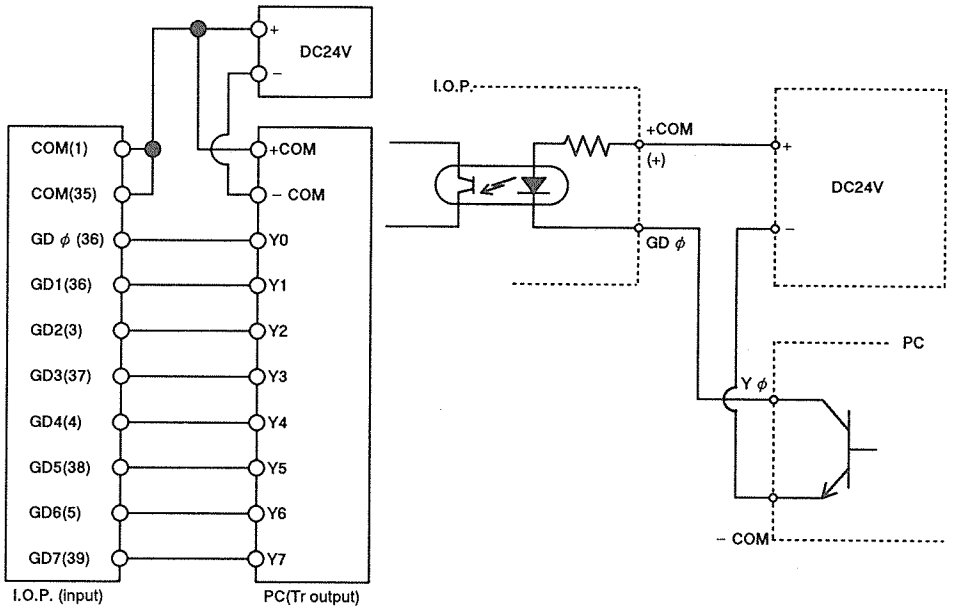
Notes

- Pin No. 1, 11, 35, 45 are internally connected.
  Pin No. 10, 18, 44, 52 are internally connected.
  Pin No. 19, 29, 53, 63 are internally connected.
  Pin No. 28, 34, 62, 68 are internally connected.

- I/O power supply : To keep signal lines pulled high.

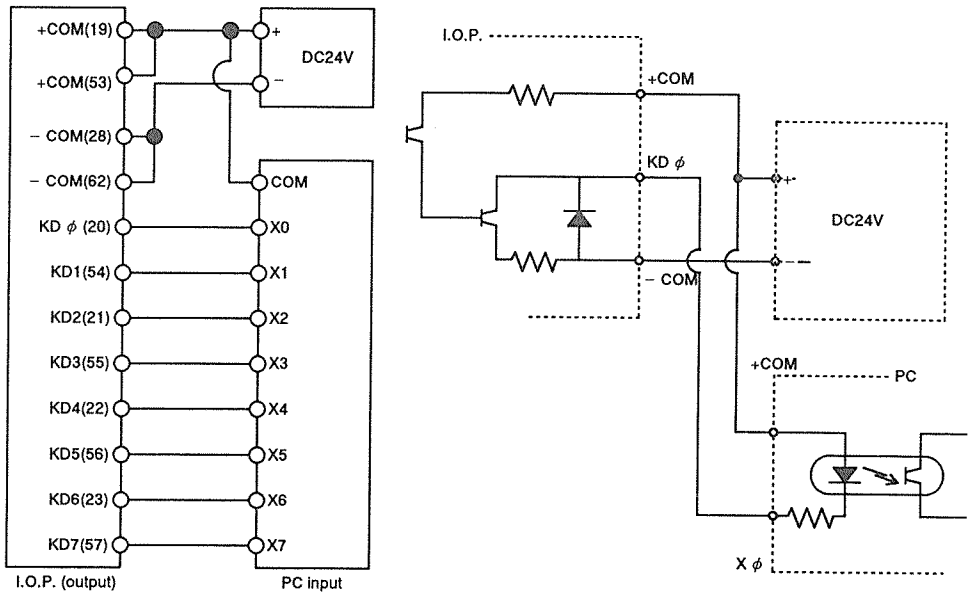
An example of connections for GD data (in parallel custom mode)

I.O.P. internal circuit and PC internal circuit



An example of connections for KD data (in parallel custom mode)

I.O.P. internal circuit and PC internal circuit



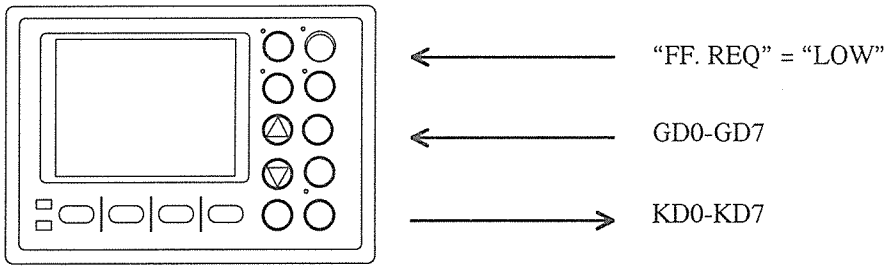
4-5 Checking the Wiring in a Parallel Connection

The I.O.P. has an "FF REQ" terminal to check the parallel wiring between the I.O.P. and the PC.
When FF REQ input is pulled LOW, the data received on lines GD0 through GD7 (screen data) will be sent back to PC on lines KD0 through KD7. The rest of the output lines on the I.O.P. will maintain their previous state prior to FF REQ going LOW.

Caution

- While FF REQ is LOW, the I.O.P. will only operate in the above mentioned mode. The I.O.P. will not respond input or output such as screen codes or key codes.

When FF REQ is LOW

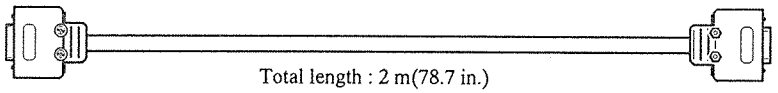


The same data which was received on lines GD0 through GD7 (Screen Data) is sent back to PC on lines KD0 through KD7.

4-6 Connecting Serial (RS-232-C) Cable

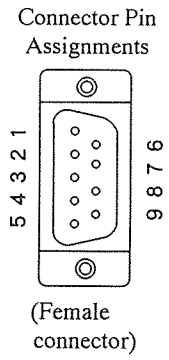
If you connect the I.O.P. RS-232-C port to the serial port of an FP1, FP3 or FP5 programmable controllers manufactured by Matsushita Electric Works, Ltd. or to another serial port (RS-232-C), you can use the cable manufactured by Matsushita Electric Works, Ltd. (Part number AIP81862N)

Cable (Part number AIP81862N)



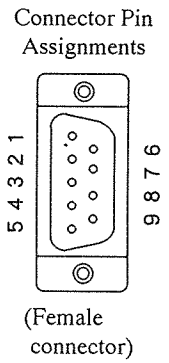
PC side: RS-232-C port

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	→

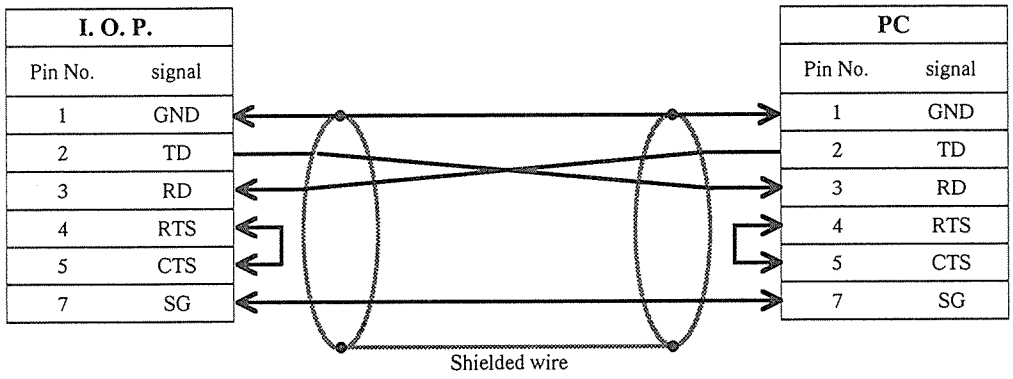


I.O.P. side: RS-232-C Port

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)	–	–



Wiring (AIP81862N)

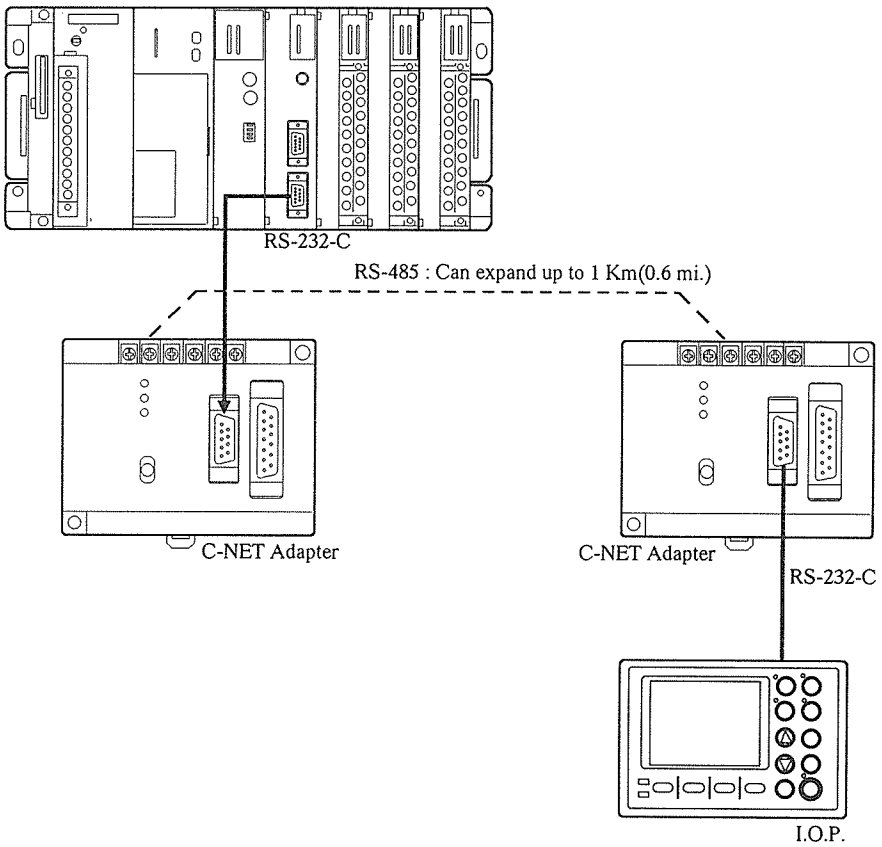


How to extend the RS-232-C cable

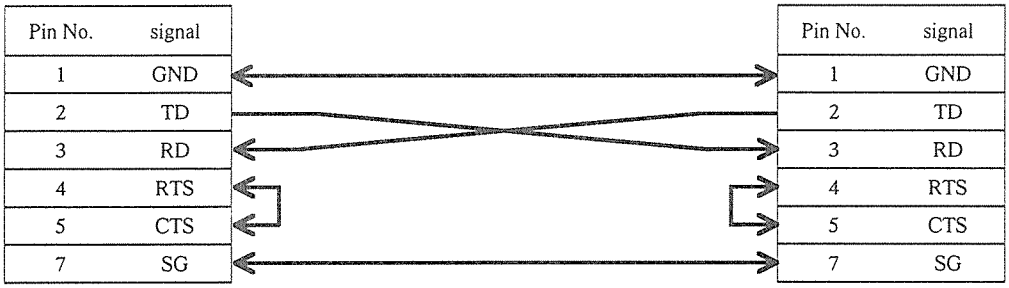
If you connect the I.O.P. to a PC with a serial cable, choose a suitable cable length for the location of the PC you will use.

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 :



Cable pin assignments



Reference

Part number

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

Chapter 5

Operating Environments

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

PC stands for Programmable Controller.

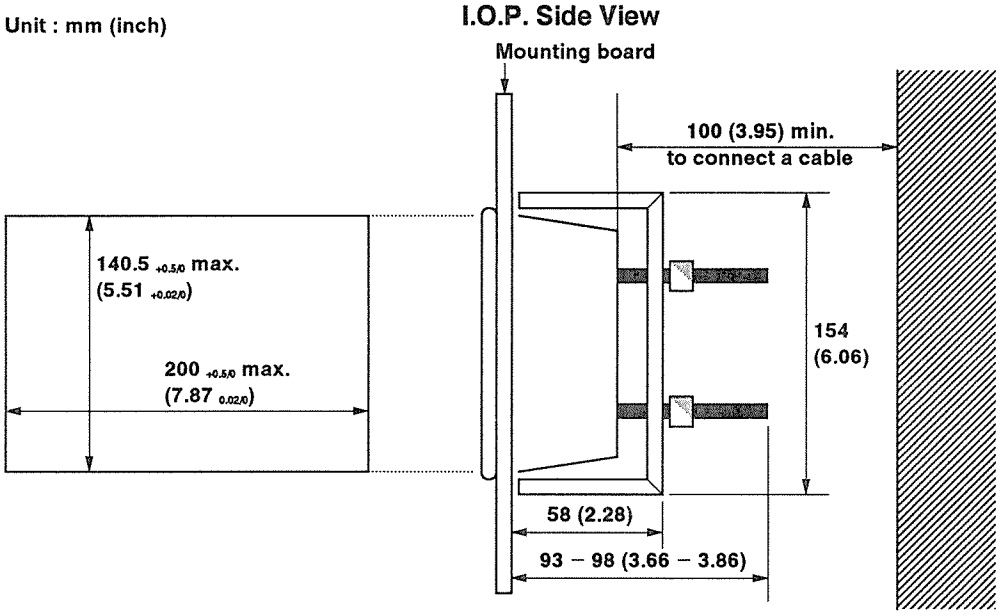
5-1 Mounting the I.O.P. on a Board

The flange type I.O.P.

If you have the I.O.P. part number AIP201002, you can mount the I.O.P. on a board. The mounting dimensions are specified below.

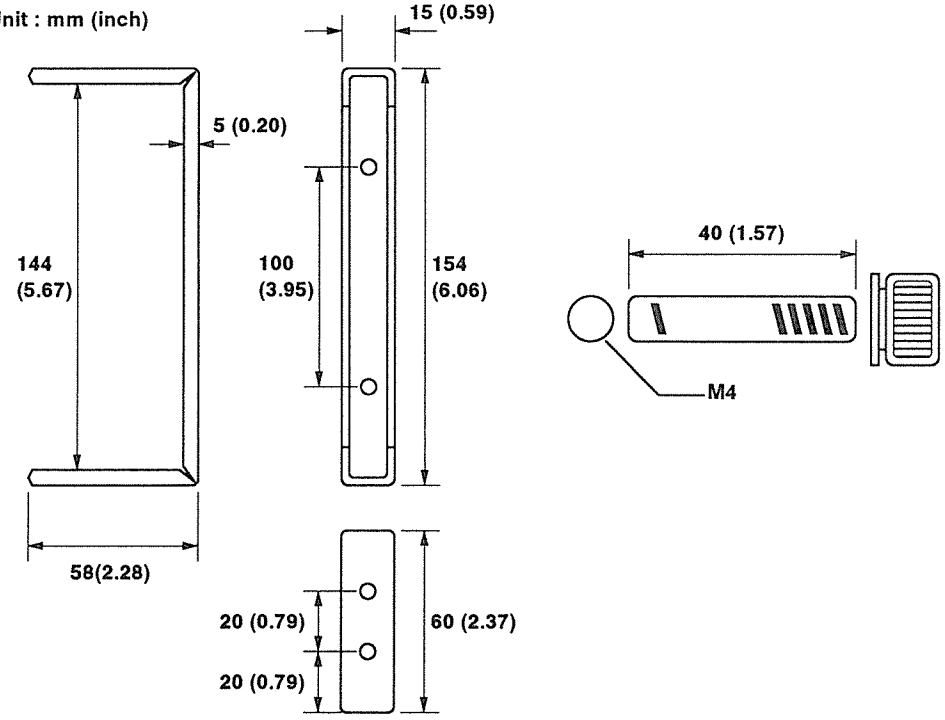
Mounting dimensions

Unit : mm (inch)



Set-screw hole dimensions

Unit : mm (inch)

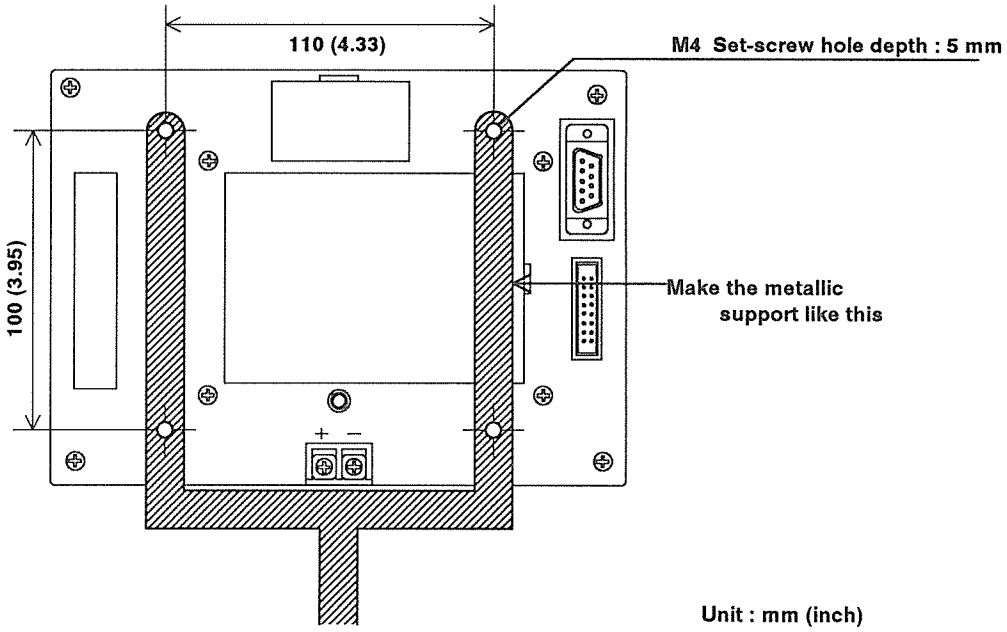


The case type I.O.P.

If you have the I.O.P. part number AIP201102, 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

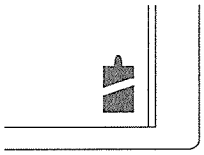
The depth of the set-screw holes is 5mm. Be careful when mounting the I.O.P.
Do not short between the board and the power supply.



5-2 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 20. Before you use the I.O.P., install the battery.

When the backup battery gets low, the weak Battery Indicator will appear on the screen. When you see this indicator, replace the battery with a new one (Part number AFB8801).



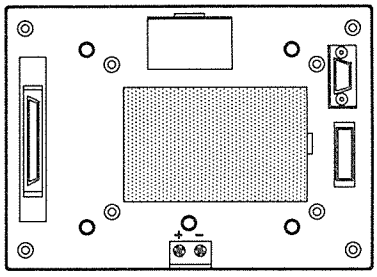
Backup Battery Indicator

Caution

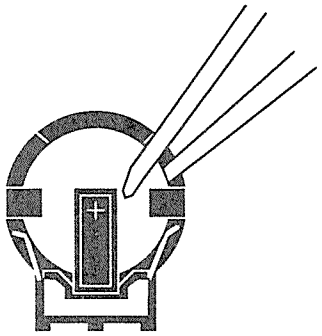
- If the battery dies, data in the memory will not be maintained.
- The shelf life of the battery is at least 10,000 hours.

Procedure

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

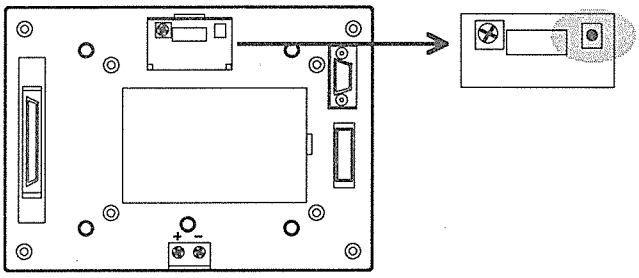


2. Remove the old backup battery with insulated tweezers or a similar tool.



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..



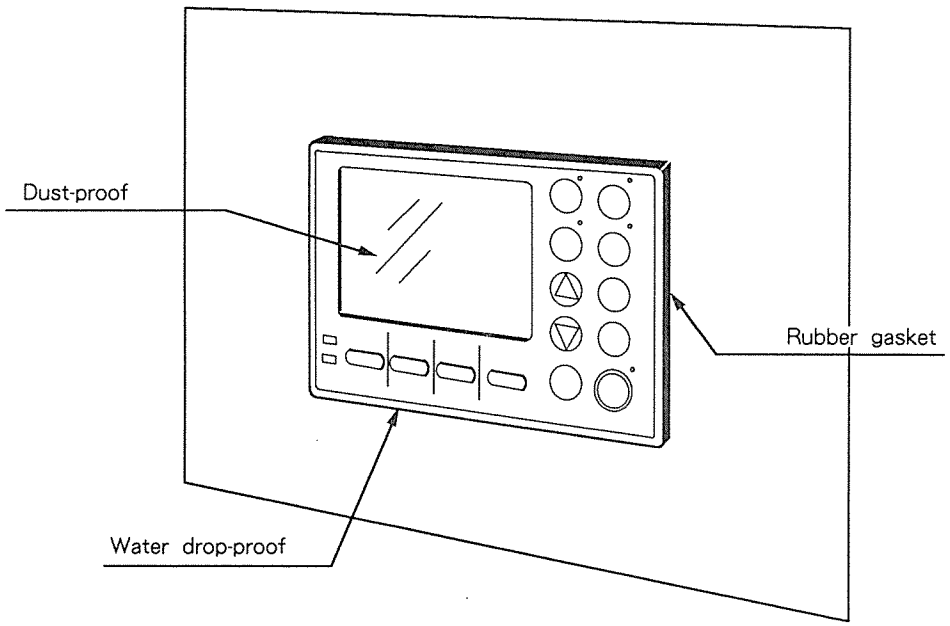
Caution

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

5-3 Dust Protection

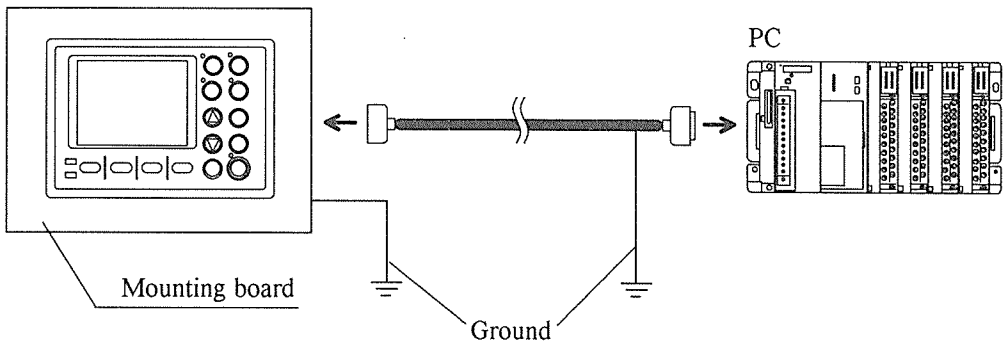
The I.O.P. has a rubber gasket in the area where it contacts the board. This protects it from dust, mist and humidity.

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



5-4 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.



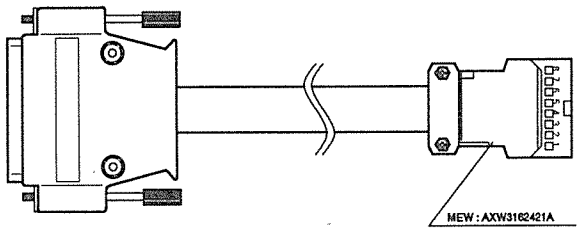
Install the I.O.P., I/O cable and power cord so that they may be placed far enough away from devices which may cause noise, such as welding machines, other power cables and motors. Do not install the I/O cable next to high voltage (100 V or higher) cable, as this can lead to erratic operation.

Appendix

Appendix A Transmission Cable

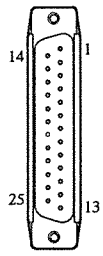
When you want to transfer the data edited with a personal computer to the I.O.P., use a transmission cable. You may use one manufactured by Matushita Electric Works, Ltd.(part number AIP8001), or make a cable yourself by referring to the following.

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

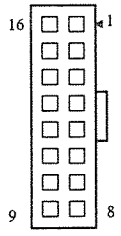


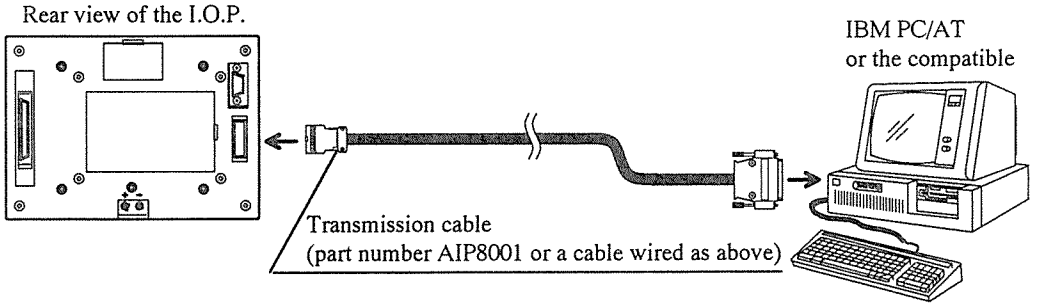
D-sub miniature 25-pin connector MIL type 16-pin connector

Temporary Specification



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





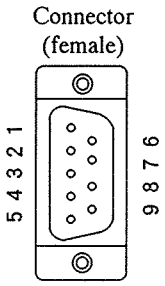
Appendix B ROM Programmer Cable

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

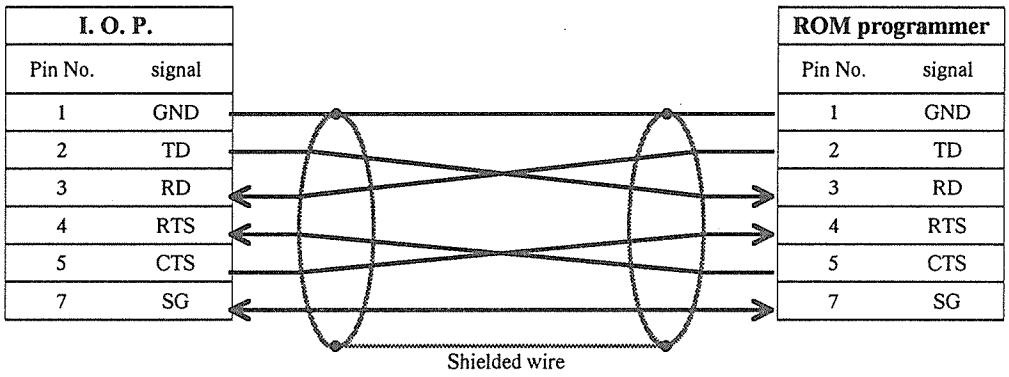
Use the PKW-1100A-E ROM programmer manufactured by AVALDATA CORPORATION. (transferring data in Intel HEX format.)

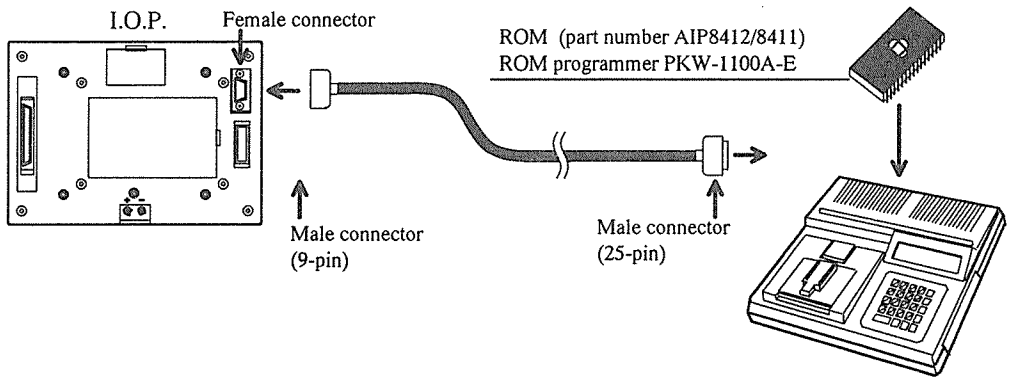
I.O.P. RS-232-C port

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



Wiring





Appendix. C ASCII Character Code List

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

ASCII characters which can be displayed on the I.O.P. screen are from "20" to "7F".
"00" to "1F" are reserved for I.O.P. control.

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

Appendix D Normal Size Character Code List (JIS Code)

		0 1 2 3	4 5 6 7	8 9 A B	C D E F
Symbol	2120	SP 、 。	, . ・ :	; ? ! ゛	゜ ´ ` ¨
	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 φ	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 Half Width Character Code List

	0 1 2 3	4 5 6 7	8 9 A B	C D E F
0020	SP ! " #	$ % & '	( ) * +	, − . /
0030	0 1 2 3	4 5 6 7	8 9 : ;	< = > ?
0040	@ A B C	D E F G	H I J K	L M N O
0050	P Q R S	T U V W	X Y Z [	¥] ^ BK
0060	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 Index

These materials are printed on ECF pulp.
These materials are printed with earth-friendly vegetable-based (soybean oil) ink.

Please contact .....

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■ Telephone: +81-6-6908-1050
■ Facsimile: +81-6-6908-5781

ACG-M0040-1 MAY. 92 1ZHo