TOSHIBA

PROGRAMMABLE CONTROLLER

EX SERIES

HANDY PROGRAMMER

OPERATION MANUAL

Important Information

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Inside this manual This manual is designed to enable operators of the Handy Programmer HP100 in fully understanding its functions and method of operation. The Handy Programmer HP100 (simply called the HP in this manual) is designed for use with the Toshiba Programmable Controller EX series. Unless specifically mentioned, EX is the generic term for the EX100, EX200B, EX250, and EX500. In this manual, EX refers to the EX-series controller.

The contents of this manual are as follows:

Section 1   Introduction
Introduces the functions of the HP, and describes the handling precautions.

Section 2   Names and Functions of Individual Components
Shows the external features of the HP, and describes the display and operations keys.

Section 3   Getting started
Describes the basic procedures for connecting the HP to the EX and for writing a program into the EX.

Section 4   Modes and Functions
Describes the modes of the HP, which are important in understanding the functions of the HP. All the functions are listed.

Section 5   Common Key Input Rules
Describes the common rules for operating the HP keys.

Section 6   Control Commands
Describes the various command functions issued by the HP to the EX, as well as their key operations.

Section 7   The System Information Mode
Describes the functions and their key operations of the system information mode.

Section 8   The Edit Mode
Describes the key operations for writing or modifying a program.

Section 9   The Monitor Mode
Describes the method for monitoring the EX execution status and the various functions.

Section 10   The Block Monitor Mode
Describes the the block monitor (multiple I/O batch monitor) functions and data setting.

Appendices
Contains the specifications of the HP and a list of error messages.

Note and caution symbols

You should pay special attention to the information preceded by the following symbols.

NOTE

△▽

Information preceded by this symbol call the reader's attention to information considered important for full understanding of programming procedures and/or operation of the equipment.

CAUTION

▽△▼

Information preceded by this symbol call the reader's attention to conditions or practices that could damage the equipment or render it temporarily inoperative.

Related publications

The HP is a programming tool for EX controllers. Before reading this manual, you should read the following manuals for the EX controller to ensure you understand its functions.

EX100 User's Manual
EX200B Instruction Manual
EX250/500 User's Manual

Terminology

The following is a list of abbreviations and acronyms used in this manual.

ASCII	American Standard Code for Information Interchange
CMOS	complementary metal oxide semiconductor
CPU	central processing unit
EEPROM	electrically erasable programmable read-only memory
GP	graphic programmer
H	hexadecimal (when it appears in front of an alphanumeric string)
HP	handy programmer
I/O	input/output
LCD	liquid crystal display
LED	light-emitting diode
LSI	large-scale integration (large-scale integrated circuit)
MP	miniprogrammer
NEMA	National Electrical Manufacturers' Association
PC	programmable controller
PROM	programmable read-only memory
RAM	random access memory
UL	Underwriters' Laboratories, Inc.
Vac	ac voltage
Vdc	dc voltage

Contents

Contents

1.1
The Handy
Programmer HP

The HP is a handy programmer for the EX100, EX200B, EX250 and EX500. A program can be input directly in the user-familiar ladder diagram language, allowing easy addition and modification. Despite its size, the HP displays 5 lines by 11 columns of ladder diagram. It has many useful functions, such as the monitoring of the operation state and the forced input and output function, and is powerful in debugging and maintenance applications.

EX250/500   EX100

EX200B

EX

HP100

TOSHIBA

HP100

HP
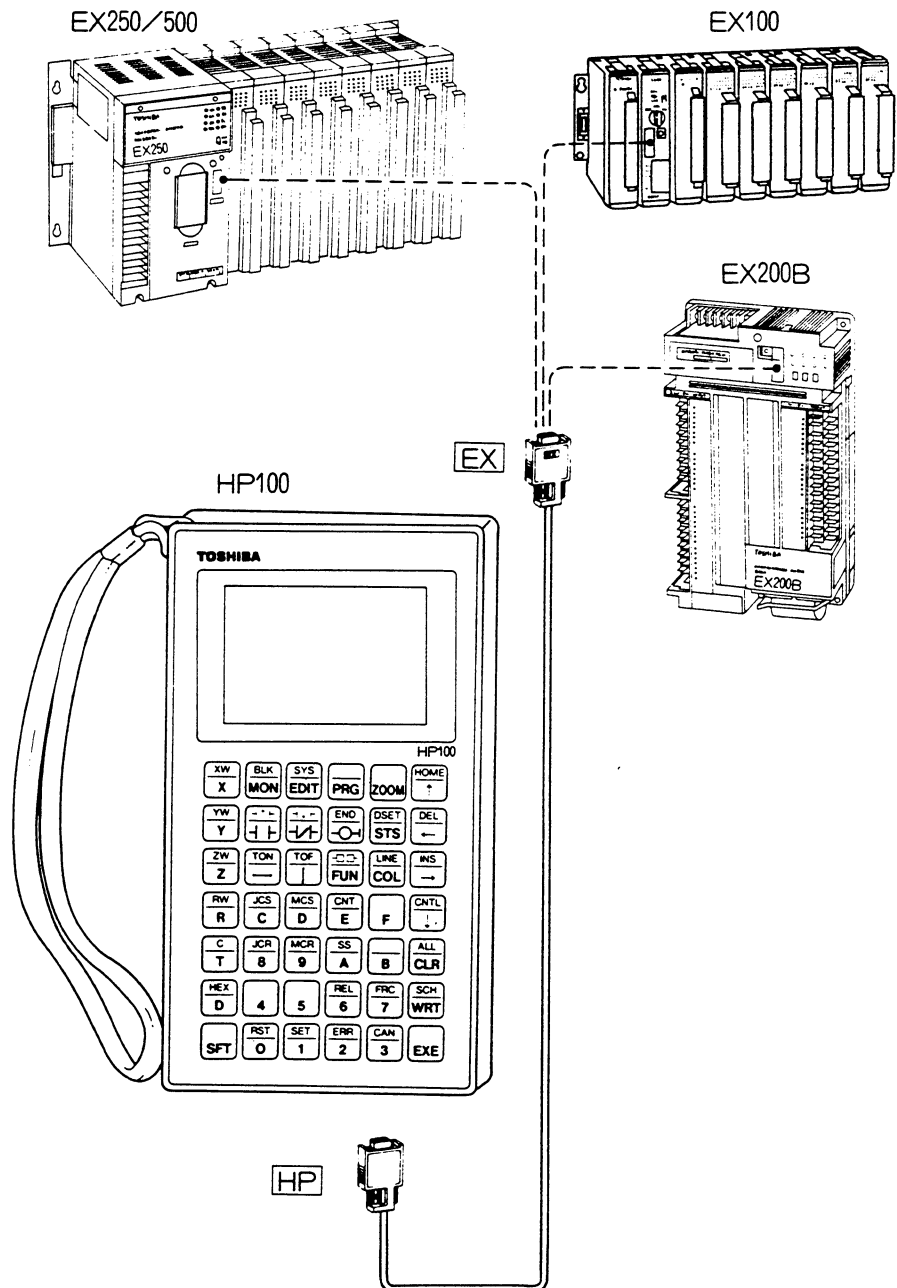
1. Introduction

1.2
Features

The HP has the following features:

- The program can be written directly in the ladder-diagram format. In the normal display mode, 5 lines by 11 columns of program can be displayed. In the zoom display mode, devices and registers can be displayed accurately, enabling the program to be easily checked.
- The program can be changed on-line, i.e., when the EX is in the RUN mode.
- It is possible to write line connectors in the ladder diagram.
- The page monitor function, which monitors the program execution status midway during a scan, enables efficient debugging.
- The force function enables the state of input devices and output coils to be forcibly maintained for free on and off setting.
- Devices, registers, and instructions can be easily searched.
- The block monitor function makes it possible to monitor the on/off status of 32 devices or the current value of 4 registers simultaneously.
- EX operation (RUN/HALT) can be controlled from the HP.
- The tone for confirming key input can be turned on and off.
- It is possible to mount the HP on the panel using a special bracket.

1.3
Handling Precautions

- Do not use the HP in the following locations:
  - where the ambient temperature falls below 0 $^\circ$C or exceeds 40 $^\circ$C
  - in locations exposed to direct sunlight
  - in locations exposed to inflammable or corrosive gases
  - in locations exposed to vibrations or shocks
- Do not apply excessive tension, torsion or other force to the connection cable .
- Provide an adequate distance between the connection cable and high-voltage and/or power cables.
- Do not clean the HP with thinners or other solvents as the exterior may become deformed or discolored.
- Do not subject the LCD screen to excessive shock.

2.1
External features

Hand strap

LCD screen

TOSHIBA

HP100

Stand

LCD contrast control

Operation keys
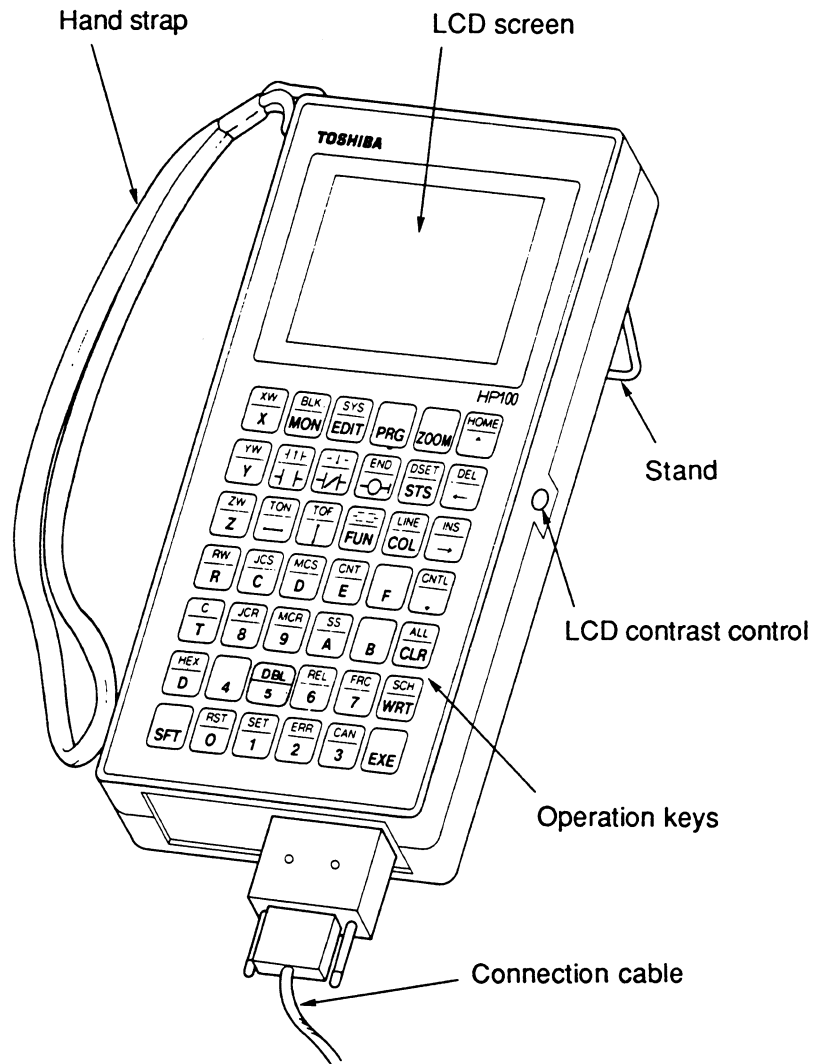
Connection cable

2.2
Connection to the EX

To connect the HP to the EX, use the two-meter cable supplied as an accessory. The connector labeled "EX" on the cable should be connected to the EX.

NOTE

▽▲▽

- This cable is not interchangeable with the cable for the graphic programmer.
- Securely tighten the anchoring screws on the connector.

2. Names and Functions of Individual Components

2.3 LCD screen

HP mode display
[MON]: Monitor mode
[BLK]: Block monitor mode
[SYS]: System information mode

EX operation status display
[R]: RUN (In operation)
[H]: HALT (Not operating)
[E]: Down due to an error

Page No.

Key shift display
[S]: Shift
Blank: No shift

HP status display
● Lit: Ready
●̇: Blinking: Busy

Command display
Acknowledges commands
received, such as [CNTL],
[EDIT], etc.

EX alarm display
Blank: Normal
[BT]: Low battery voltage
[TL]: TOSLINE trouble
[CL]: Computer link trouble
[DG]: Diagnosis instruction
execution
If more than one problem occurs
simultaneously, the priority is:
BT > TL > CL > DG

Data buffer area
Displays the entered data
and the instruction at the
cursor position in a ladder
circuit.

Program display
Displays ladder diagrams
(5 lines x 11 columns), and
displays lists.

Message display
Displays guidances for
the operator to enter
instructions and
confirmation

NOTE
Do not subject the LCD screen to excessive shock.

**2.4
Operation keys
and functions**

The HP has 42 operation keys, 36 of which have duplicate functions. To select the upper function of a key, first press the shift key, then press the required key. The layout of the keyboard is shown below.

XW / X	BLK / MON	SYS / EDIT	PRG	ZOOM	HOME / ↑
YW / Y	⊣↑⊢ / ⊣ ⊢	⊣↓⊢ / ⊣/⊢	END / -O⊣	DSET / STS	DEL / ←
ZW / Z	TON / ⟶	TOF / ↕	-□□- / FUN	LINE / COL	INS / →
RW / R	JCS / C	MCS / D	CNT / E	F	CNTL / ↓
C / T	JCR / 8	MCR / 9	SS / A	B	ALL / CLR
HEX / D	4	DBL / 5	REL / 6	FRC / 7	SCM / WRT
SFT	RST / 0	SET / 1	ERR / 2	CAN / 3	EXE

The functions of the keys are given in the tables below.

The shift key

Key	Name	Function
SFT	SHIFT	Selects the upper function of each key.

HP control keys

Key	Name	Function
BLK / MON	BLOCK MONITOR	Selects the block monitor mode, in which devices and registers are displayed in a block.
	MONITOR	Selects the monitor mode, in which a program is displayed.
SYS / EDIT	SYSTEM INFORMATION	Selects the system information mode, in which system information is displayed.
	EDIT	Used to edit the program or system information.
PRG	ON-LINE PROGRAM	Used to modify a program on-line, i.e., in the RUN state.
	PROGRAM	Used to store a program and information edited by the HP in the EX.
ZOOM	ZOOM	Used to enlarge the display of programs for greater detail. The display changes between the normal mode and the zoom mode each time the key is pressed.
DSET / STS	DATA SET	Used to set data in devices and registers.
	STATUS	Used to register devices and registers in the auxiliary data monitor area.
LINE / COL	LINE	Used to insert and delete lines when editing a program.
	COLUMN	Used to insert or delete columns when editing a program.

2. Names and Functions of Individual Components

Instruction keys

	Transitional contact (rising)	Generates a single pulse of output when the input changes from OFF to ON.
	NO contact	Normally open contact. Closed if the device is ON and open if the device is OFF.
	Transitional contact (falling)	Generates a single pulse of output when the input changes from ON to OFF.
	NC Contact	Normally closed contact. Closed if the device is OFF and open if the device is ON.
	END	Declares the end of program execution.
	COIL	Specifies a coil instruction.
	ON DELAY TIMER	Specifies an on delay timer instruction.
	HORIZONTAL CONNECTION	Inserts a horizontal connection in a circuit.
	OFF DELAY TIMER	Specifies an off delay timer instruction.
	VERTICAL CONNECTION	Inserts a vertical connection in a circuit.
	LINE CONNECTOR	Inserts a line connector in a circuit.
	FUNCTION	Specifies a functional instruction.

2. Names and Functions of Individual Components

Operand keys

XW / **X**	External input register	Specifies the external input register.
	External input device	Specifies the external input device.
YW / **Y**	External output register	Specifies the external output register.
	External output device	Specifies the external output device.
ZW / **Z**	Link register	Specifies the link register.
	Link device	Specifies the link device.
RW / **R**	Auxiliary relay register	Specifies the auxiliary relay register.
	Auxiliary relay device	Specifies the auxiliary relay device.
C / **T**	Counter register	Specifies the counter register.
	Timer register	Specifies the timer register.
HEX / **D**	Hexadecimal	Switches between decimal and hexadecimal for the input of immediate data.
	Data register	Specifies the data register.

2. Names and Functions of Individual Components

Numeric keys

RST **0**	RESET	Used with the data setting function to reset (turn OFF) a device.
	0	Numeric value 0
SET **1**	SET	Used with the data setting function to set (turn ON) a device.
	1	Numeric value 1
ERR **2**	ERROR CANCEL	Cancels an error in key operation.
	2	Numeric value 2
CAN **3**	CANCEL	Cancels a command in response to a prompt issued by the HP.
	3	Numeric value 3
4	4	Numeric value 4
DBL **5**	DOUBLE	Used for double-length (32-bit) display of register.
	5	Numeric value 5
REL **6**	RELEASE FORCE	Releases the forced specification.
	6	Numeric value 6
FRC **7**	FORCE	Sets the forced specification.
	7	Numeric value 7
JCR **8**	JUMP CONTROL RESET	Specifies a jump control reset instruction.
	8	Numeric value 8
MCR **9**	MASTER CONTROL RESET	Specifies a master control reset instruction.
	9	Numeric value 9

SS / **A**	SINGLE-SHOT TIMER	Sets a single-shot timer instruction.
	A	Numeric value A (device No. or hexadecimal value)
B	BEEP	Turns the key tone ON/OFF.
	B	Numeric value B (device No. or hexadecimal value)
JCS / **C**	JUMP CONTROL SET	Specifies a jump control set instruction.
	C	Numeric value C (device No. or hexadecimal value)
MCS / **D**	MASTER CONTROL SET	Specifies a master control set instruction.
	D	Numeric value D (device No. or hexadecimal value)
CNT / **E**	COUNTER	Inserts a counter instruction.
	E	Numeric value E (device No. or hexadecimal value)
F	F	Numeric value F (device No. or hexadecimal value)

Execution keys

ALL / **CLR**	ALL CLEAR	Clears the display when editing a program.
	CLEAR	Clears the last key entry.
SCH / **WRT**	SEARCH	Searches for instructions or operands.
	WRITE	Writes a program or data.
EXE	EXECUTE	Used for final execution of each operation.

2. Names and Functions of Individual Components

HOME ↑	HOME	Returns the cursor to its home position.
	UP ARROW	Moves the cursor upward. (Auto-repeat)
DEL ←	DELETE	Deletes a column, line, or page when editing a program.
	LEFT ARROW	Moves the cursor to the left. (Auto-repeat)
INS →	INSERT	Inserts a column, line, or page during program editing.
	RIGHT ARROW	Moves the cursor to the right. (Auto-repeat)
CNTL ↓	CONTROL	Executes control commands.
	DOWN ARROW	Moves the cursor downward. (Auto-repeat)

This section describes the basic procedures for programming using the HP.

3.1
Preparations

1. Connect the HP to the EX using the dedicated cable.
2. Set the operation control switch on the EX to HALT.
3. Turn on the power to the EX.
4. The LCD display on the HP blinks MEMORY TEST for about three seconds. This is followed by the following display of system information:

```
▣SYS●


SYSTEM
  INFORMATION
1 PROGRAM ID.
     [              ]
```

NOTE

▽▲▽

- If the display is not clear, adjust the contrast control at the right side of the HP.
- The cable connecting the HP and the EX can be connected or disconnected even when the power is on.

3.2
Memory clear

Clear the data in the EX memory to create a new program. Press the [CNTL] key to display the control command menu.

[SFT] [CNTL ↓]
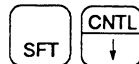
```
▣SYS●CNTL

COMMAND SELECT
05  I/O SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM CHK
```

The HP makes a queue for inputting the command number. Press the cursor key to scroll the command menu. Key in the Memory Clear command (Command 90) after checking the command number, then press the [EXE] key.

[CNTL ↓]

```
▣SYS●CNTL

COMMAND SELECT
90  MEMORY CLEAR
91  FORCE CLEAR
92  ERR. TBL. CLR
93  ERROR RESET
94  PROM WRITE
```

3. Getting Started

```
[MCR]  [RST]
  9      0    [EXE]
```

```
▉SYS●MCLR

CNF. > EXE/S-EXE
9 0  MEMORY CLEAR
9 1  FORCE CLEAR
9 2  ERR. TBL. CLR
9 3  ERROR RESET
9 4  PROM WRITE
```

The HP then makes a queue for the Memory Clear command. If the correct command number is entered, press the [EXE] key once again. If the wrong command number is entered, press the [CAN] key to cancel the command.

```
[EXE]
```

```
▉SYS●MCLR

COMPLETE
9 0  MEMORY CLEAR
9 1  FORCE CLEAR
9 2  ERR. TBL. CLR
9 3  ERROR RESET
9 4  PROM WRITE
```

The HP displays COMPLETE to indicate that the command has been successfully executed.

3.3 Input and output allocation

Next, it is necessary to allocate input and output using the I/O Set-up command (Command 5). This command is entered in the same way as the Memory Clear command.

```
[SFT]  [CNTL ↓]  5  [EXE]  [EXE]
```

```
▉SYS●I/O

COMPLETE
0 5  I/O SETUP
8 0  HALT
8 1  RUN
8 2  RUN-F
8 3  PROGRAM CHK
```

The status of the allocation (I/O set-up) can be checked on the system information display.

```
[SFT]  [SYS EDIT]  [ERR 2]  [EXE]
```

```
▉SYS●

---UNIT #0----
SLOT      I/O
 00   [ X   01W]
 01   [ X   02W]
 02   [ Y   01W]
```
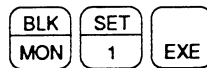
The key operations described above allow programming of the EX. The procedures for inputting a program are described below.
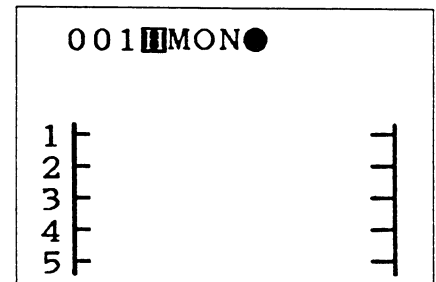
NOTE

Clearing the memory and allocating input and output are necessary only when a program is created for the first time. These operations are not necessary when modifying a program already stored in the EX.

3.4 Programming

First, specify the page number on which the program will be created.

[BLK MON] [SET 1] [EXE]
Page 1

```
001IIMON●

1 ┠                    ┨
2 ┠                    ┨
3 ┠                    ┨
4 ┠                    ┨
5 ┠                    ┨
```

Next, specify the program creation/edit mode.

[SYS EDIT]

```
001IIMON●EDIT

1 ┠■                   ┨
2 ┠                    ┨
3 ┠                    ┨
4 ┠                    ┨
5 ┠                    ┨
```
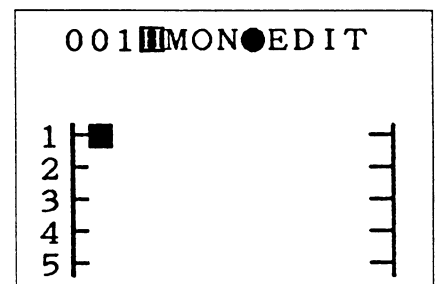
EDIT is displayed at the top of the screen and the cursor is positioned at the start of the program area.
Let's program the following sample circuit.

```
┤├─────────○
R624        Y030

─[END]─
```
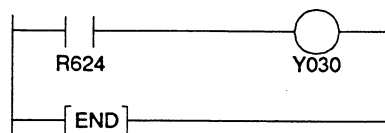
R624 is a special relay that switches on and off every second.

Key in NO contact.

```
┤├
┤ ├
```

```
001IIMON●EDIT
  ┤├
SET DEVICE
1 ┠▪▪                  ┨
2 ┠                    ┨
3 ┠                    ┨
4 ┠                    ┨
5 ┠                    ┨
```
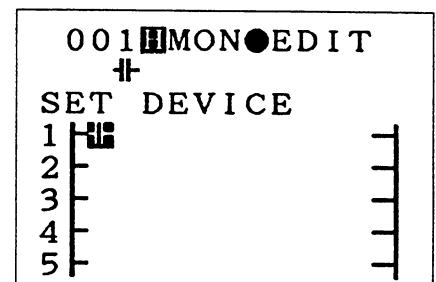
Enter the device R624

RW	REL	ERR	
R	6	2	4

```
001█MON●EDIT
      ┤┝          R624
SET  DEVICE
1 ┤╫
2
3
4
5
```

Register the cursor position.

EXE

```
001█MON●EDIT


1 ┤┝█
2
3
4
5
```

Enter coil Y030.

END	YW	CAN	RST
-O-	Y	3	0

```
001█MON●EDIT
        ◇          Y030
SET  DEVICE
1 ┤┝──────────◈
2
3
4
5
```

NOTE

When the coil symbol is entered, the cursor moves to the column at the extreme right and the horizontal line is automatically connected.

Register the coil in the cursor position

EXE

```
001█MON●EDIT


1 ┤┝──────────○
2 █
3
4
5
```

Enter the END instruction.

SFT	END -O-	EXE

```
001█MON●EDIT


1 ┤┝──────────○
2 ┤□█
3
4
5
```

This completes creating a program. Let's check if the program has been created correctly using the zoom display, then store it in the EX.

Move the cursor to the top of the circuit.

[HOME ↑] [DEL ←]

```
001█MON●EDIT
       ╢╟        R624
SET  DEVICE
1 ╟╫█─────────────○┤
2 ╟─□
3 ╟
4 ╟
5 ╟
```

Select the zoom mode.

[ZOOM]

```
001█MON●EDIT
   ─┤ ├───        R624
SET  DEVICE
        1          2
1 ├ █ █ ─────────────
    R624
2╟ END ╗─
```
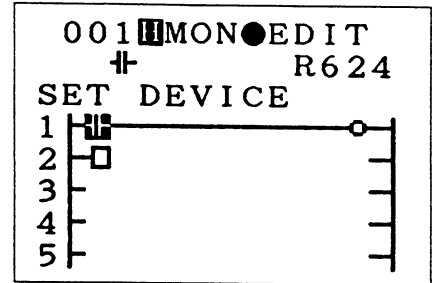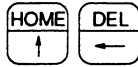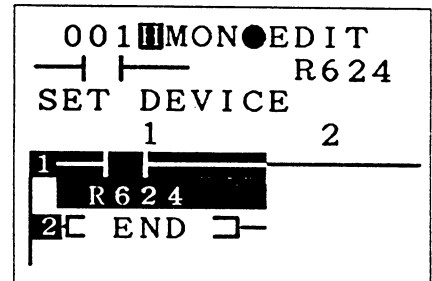
Check the program in this state by moving the cursor.

NOTE
▽▲▽
- Press the [ZOOM] key to change the display from zoom to normal or from normal to zoom.
- The display can be freely changed between normal and zoom during programming.

3.5 Writing the program into the EX

The program edited on the HP has to be written into the memory of the EX in units of one page.

[PRG]

```
001█MON●PRG
      001
SEL. WRT/INS/DEL
1 ╟╫╟─────────────○┤
2 ╟─□
3 ╟
4 ╟
5 ╟
```

[SCH WRT]

```
001█MON●WRT
      001
CONFIRM > EXE
1 ╟╫╟─────────────○┤
2 ╟─□
3 ╟
4 ╟
5 ╟
```

EXE

```
001HMON●EDIT

COMPLETE
1 ┤┤├─────────────○┤
2 ┤┌┐├──────────────┤
3 ┤
4 ┤
5 ┤
```
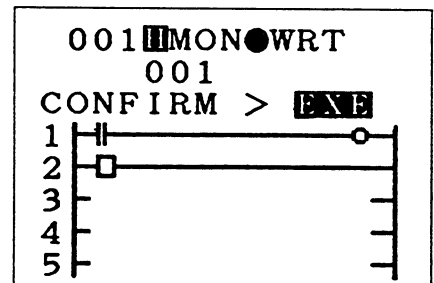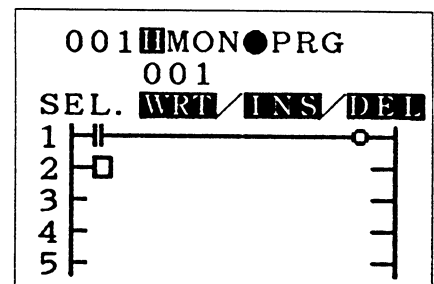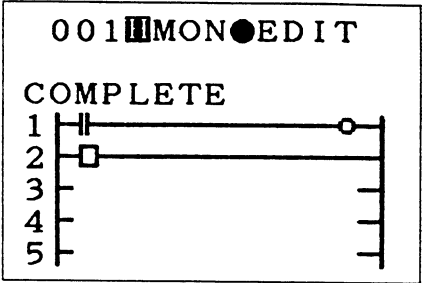
The HP displays COMPLETE to indicate that the program has been written into the EX normally. If an error is found in the program, the cursor moves to error location and blinks. It is then necessary to correct the program and write it into the EX once again.

3.6 Monitoring execution

After successfully completing programming, set the EX operation control switch to RUN to put the EX in the operating state. The area on the HP screen which displays the state of EX operation changes from [H] to [R].

Set the HP to the page monitor mode.

BLK MON   SET 1   EXE

```
001RMON●

1 ┤┤├─────────────○┤
2 ┤┌┐├──────────────┤
3 ┤
4 ┤
5 ┤
```

NOTE
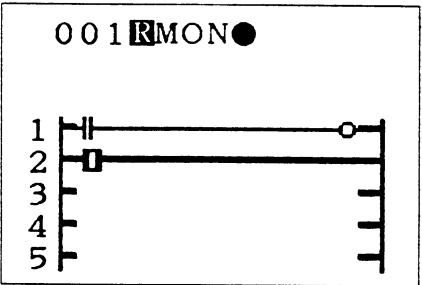
The execution state is displayed by a power flow (hot line).

R624 is ON: ┤█─────────────●┤

R624 is OFF: ┤┤├─────────────○┤
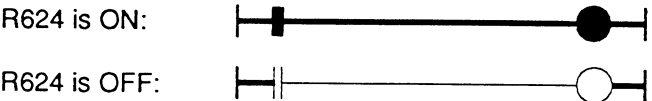
3.7 Terminating operation

Set the EX operation control switch to HALT and turn the power off. If the switch is left at RUN, the system will automatically start program execution when the power is turned on next time.

NOTE

With some models of the EX controller, it is necessary to store the program in the EEPROM. In this case it is necessary to enter the EEPROM write command before turning the power off.

4.1 Modes The HP has three modes:
- the system information mode
- the monitor mode
- the block monitor mode

The control commands are effective in all these modes.

The System Information mode [SYS]

- System 1
  - System information display
  - Display of the retentive memory area
  - Error information display
  - EX scan time dispaly
  - Diagnosis list display
  - Edit
    - Program ID edit
    - Retentive memory area edit
- System 2
  - Display of the input and output allocation
  - Edit
    - Input and output allocation edit

Monitor mode [MON]

- Progarm monitor function
- Search function
- Force function
- Data setting function
- Edit
  - Program editing (in page)
  - Page editing

Block monitor mode [BLK]

- Device/register block monitor
- Edit
  - Data setting function

4. Modes and Functions

Control commands [CNTL]

Command 05	Input and output allocation
Command 80	Operation stop (HALT)
Command 81	Operation start (RUN)
Command 82	Forced operation (RUN-F)
Command 83	Program check
Command 90	Memory clear
Command 91	Forced clear
Command 92	Clear error information
Command 93	Error reset
Command 94	EEPROM write

4.2
List of functions

The System Information mode

Function	Description	EX Mode	Key Entry
System Information display	Displaying program name (ID), type of EX connected, the numbers of pages and steps used, the software version, and other information	Any mode	SFT SYS EDIT SET 1 EXE Scroll using the cursor keys
Display of the retentive memory area	Displaying the range of registers, the data of which is kept in the event of power failure	Any mode	
Error Information display	Displaying the latest EX error history	Any mode	
Diagnosis List display	Displaying the error No. and message when the User Diagnosis command is executed	Any mode	
EX scan time	Displaying the scan time of the EX.	Any mode	
Program ID edit	Registering the program ID (program name)	Any mode	SYS EDIT [Numeral key] EXE
Retentive Memory Area edit	Setting the range of registers whose data is to be kept in the event of power failure	Any mode	
Writing to the EX	Writing edited program ID and the retentive memory area into the EX	HALT	PRG SCH WRT

Function	Description	EX Mode	Key Entry
Display of I/O Allocation	Displaying the input and output allocation states	Any mode	SFT SYS EDIT ERR 2 EXE Scroll using the cursor keys
Edit I/O Allocation Information	Setting the input and output allocation for each slot	Any mode	SYS EDIT [Cursor key] SFT HOME ↑ [Cursor key] EXE
Writing to the EX	Writing the edited input and output allocation information to the EX	HALT	PRG SCH WRT

4. Modes and Functions

The Monitor mode

Function	Description	EX Mode	Key Entry
The program monitor function	Monitoring the specified page.	Any mode	[BLK] [MON] [Page number] [EXE]
	Monitoring the page after the page presently monitored.	Any mode	[BLK] [MON] [CNTL ↓] or [INS →]
	Monitoring the page before the page presently monitored.	Any mode	[BLK] [MON] [HOME ↑] or [DEL ←]
	Monitoring the first page.	Any mode	[BLK] [MON] [SFT] [HOME ↑]
Zoom display	Alternating between normal and zoom display	Any mode	[ZOOM]
The search function	Searching for instructions.	Any mode	[Instruction] [SFT] [SCH WRT]
	Searching for operands (devices or registers)	Any mode	[Operand] [SFT] [SCH WRT]
	Searching for a combination of instructions and operands	Any mode	[Instruction] [Operand] [SFT] [SCH WRT]
	Searching for operands and/or instructions using the cursor	Any mode	[Cursor key] [SFT] [SCH WRT]

The Auxiliary Data Monitor function	Registering devices and registers in the auxiliary data monitor area to monitor their present value. Used in conjunction with the Force and Data Setting functions.	Any mode	Move the cursor to the auxiliary data monitor area. [DSET/STS] [Device/register] [EXE]
The Force function	Maintaining the state of coils in a ladder circuit independently of program execution Forced coils are displayed: —( )—	RUN or HALT	Move the cursor to the desired coil. [SFT] [FRC/7] [EXE]
	Releasing forced coils	RUN or HALT	Move the cursor to the desired coil. [SFT] [REL/6] [EXE]
	Forcibly maintaining the present state of external input devices (X) or link devices (Z). Forced devices are displayed in lower-case letters: X000 → x000	RUN or HALT	Register the desired device in the auxiliary data monitor area. [SFT] [FRC/7] [EXE]
	Releasing forced devices	RUN or HALT	Register the desired device in the auxiliary data monitor area. [SFT] [REL/6] [EXE]
The Data Setting function	Forcibly turning devices on or off. This function, when used with the Force function, is useful for debugging.	RUN or HALT	Register the desired device in the auxiliary data monitor area. [SFT] [DSET/STS] [RST/0] (OFF) or [SET/1] (ON) [EXE]

4. Modes and Functions

The Data Setting function (cont'd)	Setting data in registers	RUN or HALT	Register the desired register in the auxiliary data monitor area. SFT DSET/STS [Numeral key] EXE
	Changing the preset value (immediate) of timers or counters	RUN or HALT	Move the cursor to the desired preset value. SFT DSET/STS [Numeral key] EXE
The Program Edit function	Setting the HP to the program create/edit mode	Any mode	Page monitoring state SYS EDIT
	Clearing an instruction and/or operand in the cursor position	Any mode	Move the cursor. ALL CLR
	Clearing the entire display	Any mode	SFT ALL/CLR
	Writing a single-element instruction (contact, coil, etc.) in the cursor position	Any mode	[Instruction] [Device type] [Device number] EXE
	Writing a multi-element instruction (TON, TOF, SS, CNT, etc.) in the cursor position	Any mode	[Instruction] EXE [First operand] EXE [Second operand] EXE

The Program Edit function (cont'd)	Writing a functional instruction at the cursor position. (The number of operands depends on the instruction.)	Any mode	⊣□□⊢ FUN [Function No.] EXE EXE [First operand] EXE [Second operand] EXE [Third operand] EXE
	Inserting a column in a rung	Any mode	Move the cursor. LINE COL SFT / INS → EXE
	Deleting a column from a rung	Any mode	Move the cursor. LINE COL SFT / DEL ← EXE
	Inserting a line at the cursor position	Any mode	Move the cursor. SFT / LINE COL SFT / INS → EXE
	Deleting a line from the cursor position	Any mode	Move the cursor. SFT / LINE COL SFT / DEL ← EXE

The Program Edit function (cont'd)	Writing one page of an edited program onto a specified page (If no page is specified, the page is written onto the monitored page.)	HALT	PRG [Page No.] SCH/WRT EXE
	Inserting one page of an edited program into a specified page (If no page is specified, the page is inserted onto the monitored page.)	HALT	PRG [Page No.] SFT INS/→ EXE
	Deleting the specified page (If no page is specified, the monitored page is deleted.)	HALT	PRG [Page No.] SFT DEL/← EXE
	Writing a page in the on-line (RUN) state	RUN or HALT	SFT PRG [Page No.] SCH/WRT EXE
	Inserting a page in the on-line (RUN) state	RUN or HALT	SFT PRG [Page No.] SFT INS/→ EXE
	Deleting a page in the on-line (RUN) state	RUN or HALT	SFT PRG [Page No.] SFT DEL/← EXE

NOTE ▽▲▽ Program modifications that change the number or execution sequence of program control instructions, such as Jump, Master control, and END, are prohibited in on-line page editing.

The Block Monitor Mode

Function	Description	EX Mode	Key Entry
The Device Block Monitor function	Monitoring two registers (32 devices) starting from the register which contains the specified device	Any mode	[SFT] [BLK MON] [Device No.] [EXE]
The Register Block Monitor function	Monitoring the present values of four registers starting from the specified register	Any mode	[SFT] [BLK MON] [Register No.] [EXE]
Device ON/OFF setting	Forcibly setting devices on or off	Any mode	Device block monitor state [SYS] [EDIT] Move the cursor to the desired device. [RST 0] OFF or [SET 1] ON
Register setting	Setting data in registers	Any mode	Register block monitor state [SYS] [EDIT] Move the cursor to the desired register. [Numeral key] [EXE]
Writing to the EX	Writing the data set in devices and registers into the EX	RUN or HALT	[PRG] [SCH] [WRT]

4. Modes and Functions

Control Commands

Function	Description	EX Mode	Key Entry
Input and output allocation	Automatically allocating input and output according to the order in which the modules are mounted	HALT	SFT [CNTL ↓] / 5 / EXE / EXE
Operation stop (HALT)	Setting the EX to the HALT mode (Valid only if the operation control switch is set to RUN.)	RUN	SFT [CNTL ↓] / [JCR 8] [RST 0] / EXE / EXE
Operation start (RUN)	Setting the EX to the RUN mode (Valid only if the operation control switch is set to RUN.)	HALT	SFT [CNTL ↓] / [JCR 8] [SET 1] / EXE / EXE
Forced operation (RUN-F)	Setting the EX to the forced operation mode, i.e., operation without checking if the modules are responding (Valid only if the operation control switch is set to RUN.)	HALT	SFT [CNTL ↓] / [JCR 8] [ERR 2] / EXE / EXE
Program check (PROGRAM CHK)	Checking the syntax of the program stored in the EX	HALT	SFT [CNTL ↓] / [JCR 8] [CAN 3] / EXE / EXE

Control Commands

Function	Description	EX Mode	Key Entry
Memory Clear	Erasing all memory areas including the EX program and data memory	HALT	SFT / CNTL ↓; MCR 9 / RST 0; EXE; EXE
Force Clear	Releasing all forced designations	RUN or HALT	SFT / CNTL ↓; MCR 9 / SET 1; EXE; EXE
Error Table Clear	Clearing error information	HALT	SFT / CNTL ↓; MCR 9 / ERR 2; EXE; EXE
Error Reset	Releasing the EX from the error state	ERROR	SFT / CNTL ↓; MCR 9 / CAN 3; EXE; EXE
EEPROM Write	Copying the program from the EX RAM to the EEPROM	HALT	SFT / CNTL ↓; MCR 9 / 4; EXE; EXE

Other functions

Function	Description	EX Mode	Key Entry
Command Cancel	Cancelling various commands and confirmation key queuing	Any mode	SFT / CAN 3
Key Input Tone	Turning the key input tone on and off	Any mode	SFT / B

**5.1
Entering numerals**

Observe the following rules when entering numerals, such as the monitor page, command numbers, numerals when setting data, and the numeric operands of instructions:

1. Negative numbers cannot be input. With two's complement, 32768 (H8000) to 65535 (HFFFF) are handled as -32768 to -1.
2. The effective columns are displayed each time a numeral is input.
3. If the number of numerals entered is less than the number of effective columns, the column(s) on the left, for which no numeral is specified, is regarded as 0.
4. If the number of numerals entered is more than the number of effective columns, the excess numerals are dropped from the left, and only the last digits entered are effective.

For example, when inputting the page number (three effective columns), if the keys [1], [2], [3], [4], and [5] are entered, the effective value is 345.

**5.2
Entering
devices/registers**

Observe the following rules when entering devices and registers:

1. The addresses corresponding to devices and registers are cleared to zero when the device or register key is entered.
2. The effective columns for the address are displayed each time a device or register key is input.
3. If the number of numerals entered is less than the number of effective columns, the column(s) on the left, for which no numeral is specified, is regarded as 0.
4. If the number of numerals entered is more than the number of effective columns, the excess numerals are dropped from the left, and only the last digits entered are effective.

For example, if the following keys are input sequentially, the following is displayed.

Key input	Display
[X]	X000
[4]	X004
[Z]	Z000
[1]	Z001
[2]	Z012
[3]	Z123
[4]	Z234

5. Common Key Input Rules

5.3
Key input tone

The tone for confirming key input sounds as follows:
1. A short beep (approximately 100 ms) when a valid key is pressed
2. A short beep followed by a longer beep (approximately 250 ms) for an alarm.

Alarm states are as follows:
- An invalid key is pressed.
- An attempt is made to input invalid data.
- There is a transmission error between the HP and the EX.
- An attempt is made to execute a command unacceptable to the EX.

NOTE

The key input tone can be turned on and off by pressing [SFT] [B].

6.1

Input and output allocation (I/O set-up)

This command automatically allocates input and output numbers by reading the configuration in which the modules are mounted. Input and output numbers can also be allocated by specifying them for individual slots in the System Information mode.

For information concerning the use of this command, refer to the manual for your EX controller.

[SFT] [CNTL ↓]

(Control command)

```
      ▊SYS●CNTL

COMMAND  SELECT
05  I/O  SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM  CHK
```

[5] [EXE]

(Command 5)

```
      ▊SYS●I/O

CNF. >  EXE/S-EXE
05  I/O  SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM  CHK
```

[EXE]

(Confirmation)

```
      ▊SYS●I/O

COMPLETE
05  I/O  SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM  CHK
```

The HP displays COMPLETE to indicate the successful completion of allocation. An error message is displayed if an error occurs. Check the nature of the error by referring to the list of error messages in the Appendices.

NOTE
▽▲▽

This command is effective only if the EX is in the HALT mode.

6. Control Commands

6.2 Stopping operation (HALT)

The HALT command is entered into the HP to instruct the EX to stop operation.
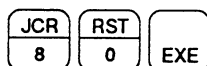
SFT | CNTL ↓
(Control command)

```
⬛SYS●CNTL

COMMAND  SELECT
05  I/O  SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM  CHK
```

JCR 8 | RST 0 | EXE
(Command 80)

```
⬛SYS●HALT

CNF. >  EXE/S-EXE
05  I/O  SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM  CHK
```

EXE
(Confirmation)

```
⬛SYS●HALT

COMPLETE
05  I/O  SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM  CHK
```

The HP displays COMPLETE to indicate that allocation has been successful. An error message is displayed if an error has been detected. In this case, check the nature of the error with the list of error messages in the Appendices.

6.3 Starting operation (RUN)

The RUN command is entered into the HP to instruct the EX to start operation when it is in the HALT mode. This command is effective only if the EX operation control switch is set the RUN position.
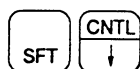
SFT | CNTL ↓
(Control command)

```
001⬛MON●CNTL

COMMAND  SELECT
05  I/O  SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM  CHK
```

```
 JCR   SET
  8     1    EXE
```
(Command 81)

```
001HMON●RUN

CNF.> EXE/S-EXE
05  I/O SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM CHK
```

```
 EXE
```
(Confirmation)

```
001RMON●RUN

COMPLETE
05  I/O SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM CHK
```

The HP displays COMPLETE to indicate that operation has been successfully started. The area on the HP screen which displays the state of EX operation changes from [H] to [R] to indicate that the EX is in the RUN mode. An error message is displayed if an error occurs. Check the nature of the error by referring to the list of error messages in the Appendices.

6.4 Forced operation (RUN-F)

The RUN-F command is entered into the HP to instruct the EX to start operation when it is in the HALT mode. The difference between this command and Command 81 (RUN) is that this command enables operation to be started forcibly even if modules have not yet been mounted, but input and output has been allocated. This command is useful for debugging a program before modules are not yet mounted.

NOTE

This command is for forced operation when modules are not yet mounted. Operation is not possible if registration (i.e., allocation) and the mounting positions do not match.

```
 SFT   CNTL
        ↓
```
(Control command)

```
001HMON●CNTL

COMMAND SELECT
05  I/O SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM CHK
```

6. Control Commands

```
JCR   ERR
 8     2    EXE
```
(Command 82)

```
001HMON●RUNF

CNF. > EXE/S-EXE
05   I/O SETUP
80   HALT
81   RUN
82   RUN-F
83   PROGRAM CHK
```

```
EXE
```
(Confirmation)

```
001RMON●RUNF

COMPLETE
05   I/O SETUP
80   HALT
81   RUN
82   RUN-F
83   PROGRAM CHK
```

The HP displays COMPLETE to indicate that forced operation has been successful. The area on the HP screen which displays the state of EX operation changes from [H] to [R] to indicate that the EX is in the RUN mode. An error message is displayed if an error occurs. Check the nature of the error by referring to the list of error messages in the Appendices.

6.5 Program checking

This command checks a program. The same function is automatically done during operation (i.e., when the EX is in the RUN mode). A program can also be checked individually using the commands shown below.

```
SFT   CNTL
       ↓
```
(Control command)

```
001HMON●CNTL

COMMAND SELECT
05   I/O SETUP
80   HALT
81   RUN
82   RUN-F
83   PROGRAM CHK
```

```
JCR   CAN
 8     3    EXE
```
(Command 83)

```
001HMON●PCHK

CNF. > EXE/S-EXE
05   I/O SETUP
80   HALT
81   RUN
82   RUN-F
83   PROGRAM CHK
```

`EXE`
(Confirmation)
	``
	0 0 1█MON●PCHK
	
	CNF. > EXE/S-EXE
	       PAGE 0 0 1
	       RUNG 1
	       STEP 0 0
	 ! NO END ERROR
	``

The HP displays COMPLETE to indicate that no errors have been found in the program. An error message is displayed if an error is found. Check the nature of the error by referring to the list of error messages in the Appendices.

Example:

|			
PAGE	001	◄──	On page 1
RUNG	1	◄──	In first rung
STEP	00	◄──	First step
! NO END ERROR		◄──	Indicates the error resulting from there being no END instruction.

NOTE ▽▲▽ This command is only effective when the EX is in the HALT mode.

6.6
Clearing the memory

This command clears all information related to a program in the EX. The following information is cleared:
- Program
- Input and output allocation information
- Forced specification
- The states of devices (cleared to off)
- The values of registers (cleared to zero)
- Retentive memory area specification
- History of error information
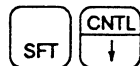
`SFT` `CNTL↓`
(Control command)
	``
	0 0 1█MON●CNTL
	
	COMMAND SELECT
	  05 I/O SETUP
	  80 HALT
	  81 RUN
	  82 RUN-F
	  83 PROGRAM CHK
	``

6. Control Commands

`CNTL` `↓`

To check the command numbers, use the cursor keys to scroll the command menu forward and backward.

```
001▥MON●CNTL

COMMAND SELECT
90 MEMORY CLEAR
91 FORCE CLEAR
92 ERR. TBL. CLR
93 ERROR RESET
94 PROM WRITE
```

`MCR` `9` `RST` `0` `EXE`

(Command 90)

```
001▥MON●MCLR

CNF. > EXE/S-EXE
90 MEMORY CLEAR
91 FORCE CLEAR
92 ERR. TBL. CLR
93 ERROR RESET
94 PROM WRITE
```

`EXE`

(Confirmation)

```
001▥MON●MCLR

COMPLETE
90 MEMORY CLEAR
91 FORCE CLEAR
92 ERR. TBL. CLR
93 ERROR RESET
94 PROM WRITE
```

The HP displays COMPLETE to indicate that the memory has been successfully cleared.

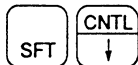**NOTE** ▽▲▽ This command is only effective when the EX is in the HALT mode.

6.7 Forced clear

This command releases the forced designations of devices in blocks. The command is useful for completely releasing forced designations at the end of debugging. See Section 9.5 for forced functions.

`SFT` `CNTL` `↓`

(Control command)

```
001▥MON●CNTL

COMMAND SELECT
05 I/O SETUP
80 HALT
81 RUN
82 RUN-F
83 PROGRAM CHK
```

```
┌────┐┌────┐
│MCR ││SET │ ┌───┐
│ 9  ││ 1  │ │EXE│
└────┘└────┘ └───┘
```
(Command 91)

```
┌─────────────────────────┐
│ 001█MON●REL             │
│                         │
│ CNF. > ███/S-███        │
│ ▐05▌ I/O  SETUP         │
│ ▐80▌ HALT               │
│ ▐81▌ RUN                │
│ ▐82▌ RUN-F              │
│ ▐83▌ PROGRAM  CHK       │
└─────────────────────────┘
```

```
┌───┐
│EXE│
└───┘
```
(Confirmation)

```
┌─────────────────────────┐
│ 001█MON●REL             │
│                         │
│ COMPLETE                │
│ ▐05▌ I/O  SETUP         │
│ ▐80▌ HALT               │
│ ▐81▌ RUN                │
│ ▐82▌ RUN-F              │
│ ▐83▌ PROGRAM  CHK       │
└─────────────────────────┘
```

The HP displays COMPLETE to indicate that the forced clear operation has been successful.

NOTE

- This command can be executed when the EX is in either the HALT or RUN mode.
- The Force Clear command releases the forced designations of devices but does not change their status.

6.8 Clearing error information

The EX stores the latest error information, which can be checked in the System Information mode. The Error Table Clear command clears the error information.

```
┌────┐┌────┐
│SFT ││CNTL│
│    ││ ↓  │
└────┘└────┘
```
(Control command)

```
┌─────────────────────────┐
│ 001█MON●CNTL            │
│                         │
│ COMMAND  SELECT         │
│ ▐05▌ I/O  SETUP         │
│ ▐80▌ HALT               │
│ ▐81▌ RUN                │
│ ▐82▌ RUN-F              │
│ ▐83▌ PROGRAM  CHK       │
└─────────────────────────┘
```

```
┌────┐┌────┐
│MCR ││ERR │ ┌───┐
│ 9  ││ 2  │ │EXE│
└────┘└────┘ └───┘
```
(Command 92)

```
┌─────────────────────────┐
│ 001█MON●ECLR            │
│                         │
│ CNF. > ███/S-███        │
│ ▐05▌ I/O  SETUP         │
│ ▐80▌ HALT               │
│ ▐81▌ RUN                │
│ ▐82▌ RUN-F              │
│ ▐83▌ PROGRAM  CHK       │
└─────────────────────────┘
```

6. Control Commands

[EXE]
(Confirmation)

```
001圓MON●ECLR

COMPLETE
05 I/O SETUP
80 HALT
81 RUN
82 RUN-F
83 PROGRAM CHK
```

The HP displays COMPLETE to indicate that the error information has been successfully cleared.
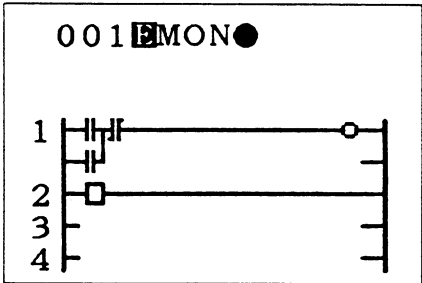
NOTE
▽▲▽

This command is only effective when the EX is in the HALT mode.

6.9 Resetting errors

When an error occurs in the EX, operation stops and error information is registered, and all operations for writing into the EX are inhibited.The Error Reset command resets the EX from the error state to the HALT mode.

(Error state)

```
001圓MON●

1 ├┤├┤├─────────────○┤
  ├┤├
2 ├□────────────────┤
3 ├                 ┤
4 ├                 ┤
```

If an error occurs in the EX, [E] blinks in the EX operation status display area of the HP screen.
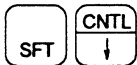
[SFT] [CNTL ↓]
(Control command)

```
001圓MON●CNTL

COMMAND SELECT
05 I/O SETUP
80 HALT
81 RUN
82 RUN-F
83 PROGRAM CHK
```

[MCR 9] [CAN 3] [EXE]
(Command 93)

```
001圓MON●ERST

CNF.> EXE/S-EXE
05 I/O SETUP
80 HALT
81 RUN
82 RUN-F
83 PROGRAM CHK
```

EXE
(Confirmation)

```
001⊞MON●ERST

COMPLETE
05  I/O SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM CHK
```

The HP displays COMPLETE to indicate that the error reset operation has been successfully completed. The area on the HP screen which displays the state of EX operation changes from [E] to [H] to indicate that the EX is in the HALT mode.

NOTE

• This command is only effective when the EX is in the ERROR state.
• After resetting the error, check the error information in the System information mode.

6.10
Writing in EEPROM

This command instructs the EX to write the RAM program into the EEPROM.

SFT CNTL↓
(Control command)

```
001⊞MON●CNTL

COMMAND SELECT
05  I/O SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM CHK
```

MCR 9   4   EXE
(Command 94)

```
001⊞MON●PROM

CNF. > EXE/S-EXE
05  I/O SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM CHK
```

EXE
(Confirmation)

```
001⊞MON●PROM

COMPLETE
05  I/O SETUP
80  HALT
81  RUN
82  RUN-F
83  PROGRAM CHK
```

The HP displays EXECUTING when writing is being performed. COMPLETE is displayed to indicate that the data has been successfully written into the EEPROM.

NOTE This command is only effective when the EX is in the HALT mode.
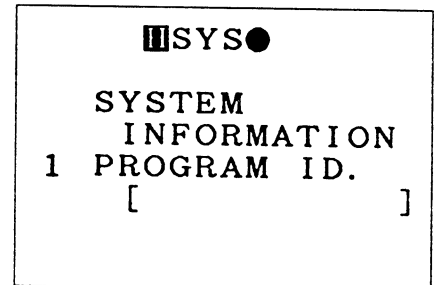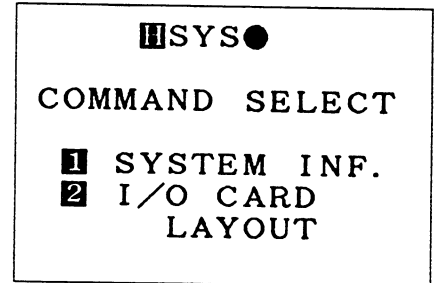
7.1
Displaying system information

The system information, the retentive memory area , EX error information, and the diagnosis list are displayed in the system information mode (system 1).

[SFT] [SYS EDIT]

(The System Information mode)

```
 ▮SYS●

COMMAND  SELECT

 ❶  SYSTEM  INF.
 ❷  I/O  CARD
         LAYOUT
```

[SET 1] [EXE]

(System 1)

```
 ▮SYS●

   SYSTEM
      INFORMATION
 1  PROGRAM  ID.
    [              ]
```

The system information screen (System 1) contains the following information. The HP screen displays five lines. The information can be scrolled vertically using the up and down cursor keys.

Displayed portion

```
     SYSTEM
        INFORMATION
   1  PROGRAM ID.
      [                 ]

   2  KEEP AREA TOP
      RW [        ] ~ RW63
      D  [        ] ~ D1535
      C  [        ] ~ C095
      T  [        ] ~ T127
   3  CAPACITY
         4.0 K        STEPS
   4  USED PAGE        000
   5  USED STEP
                      0000
   6  EX TYPE
            EX100
   7  SYSTEM ID.
            EX - V 1.0
   8  HP VERSION
            HP - V 1.0
   9  ERROR STATUS
```

```
   10    DIAGNOSTIC
         SLOT           1
         DIAG. NO.
         EVENT

   10    DIAGNOSTIC
         SLOT           2
         DIAG. NO.
         EVENT

   10    DIAGNOSTIC
         SLOT           3
         DIAG. NO.
         EVENT

   10    DIAGNOSTIC
         SLOT           4
         DIAG. NO.
         EVENT

   11    EX SCAN TIME
                      ms
```

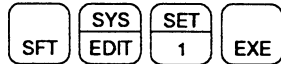# 7. The System Information Mode

Each item of system information has the following meaning.

1. PROGRAM ID (Program name)
   User-specified program name. Up to ten alphanumeric characters can be assigned. This name is useful for managing programs.

2. KEEP AREA TOP (Retentive memory area)
   Displays the first register address of the retentive area. It is left blank if no retentive area is specified.

3. CAPACITY (Memory capacity)
   Displays the memory capacity of the EX currently connected.

4. USED PAGE (Number of pages used)
   Displays the number of pages used in the program (1 to 999 pages).

5. USED STEP (Number of steps used)
   Displays the total number of steps used in the program.

6. EX TYPE (Type of EX)
   Displays the type of EX currently connected.

7. SYSTEM ID (EX version)
   Displays the software version of the EX currently connected.

8. HP VERSION (HP version)
   Displays the software version of the HP.

9. ERROR STATUS (Error information)
   Displays the latest error information of the EX currently connected.

10. DIAGNOSTIC (Diagnosis list)
    When the user diagnosis instruction (DDSP or DDSM) is executed, displays the designated diagnostic numbers and messages in the order of execution. A maximum of four diagnostic numbers and messages are displayed. If more have been executed, the earlier ones are discarded. These instructions use data registers D0000 to D0004. If data in D0000 is more than 4, 9999 DIAG. ERR is displayed.

11. EX SCAN TIME (Scan time)
    Displays the actual scan time of the EX.

**7.2
Setting system
information**

Setting system information sets the program name (PROGRAM ID) and the retentive memory (KEEP AREA TOP).

| SFT | SYS EDIT | SET 1 | EXE |

Display system information.

```
        ⊞SYS●


        SYSTEM
          INFORMATION
     1  PROGRAM  ID.
        [              ]
```

| SYS EDIT |

Enter the Edit mode.

```
        ⊞SYS●EDIT


        SYSTEM
          INFORMATION
     1  PROGRAM  ID.
        [■            ]
```

The cursor appears in the top column of the program ID ready for setting. (Max. 10 characters)

- Use the numeric keys [0 to F] to enter an optional program ID.
- Use the clear key [CLR] to enter a blank space.

```
        ⊞SYS●EDIT


        SYSTEM
          INFORMATION
     1  PROGRAM  ID.
        [BED■         ]
```

After setting the program ID, press the execute key [EXE]. The cursor automatically moves to the next setting position, the retentive memory area.

| EXE |

The end of setting the program ID

```
        ⊞SYS●EDIT


     2  KEEP  AREA  TOP
        RW [■■■■■] ~RW63
        D  [     ] ~D1535
        C  [     ] ~C095
        T  [     ] ~T127
```

7. The System Information Mode

To set retentive memory area for power failure, set the first register address. For example, specifying RW20 reserves the registers RW20 to RW63.
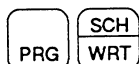
```
┌ERR┐┌RST┐┌───┐
│ 2 ││ 0 ││EXE│
└───┘└───┘└───┘
```

```
┌─────────────────────────┐
│      ▣SYS●EDIT          │
│                         │
│                         │
│  2 KEEP  AREA  TOP      │
│  RW[0020]~RW63          │
│  D  [████]~D1535        │
│  C  [    ]~C095         │
│  T  [    ]~T127         │
└─────────────────────────┘
```
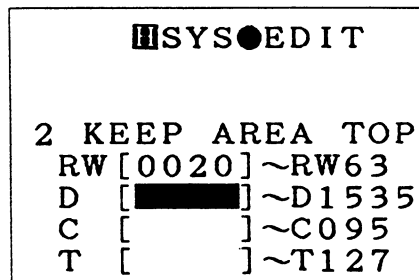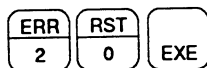
Set in the sequence of registers RW, D, C, and T. Move the cursor using the up and down cursor keys, and press the execute key. Press the clear key [CLR] to cancel a register address after setting it.

(Sample setting)

```
┌─────────────────────────┐
│      ▣SYS●EDIT          │
│                         │
│                         │
│  2 KEEP  AREA  TOP      │
│  RW[0020]~RW63          │
│  D  [0000]~D1535        │
│  C  [0000]~C095         │
│  T  [    ]~T127         │
└─────────────────────────┘
```
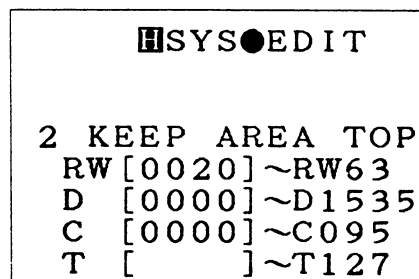
This completes editing. It is now necessary to write this information into the EX.

```
┌───┐┌SCH┐
│PRG││WRT│
└───┘└───┘
```
Write to the EX.

```
┌─────────────────────────┐
│      ▣SYS●EDIT          │
│                         │
│ COMPLETE                │
│  2 KEEP  AREA  TOP      │
│  RW[▓0▓0▓2▓0▓]~RW63     │
│  D  [0000]~D1535        │
│  C  [0000]~C095         │
│  T  [    ]~T127         │
└─────────────────────────┘
```
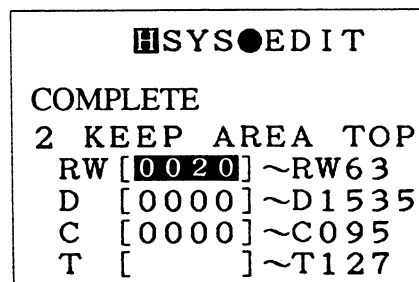
The HP displays COMPLETE to indicate that setting of the program ID and the retentive memory area have been successfully written into the EX.

NOTE ▽▲▽   This is only effective when the EX is in the HALT mode.

**7.3
Displaying input and
output allocation
information**

Information concerning the allocation of input and output modules is displayed for each slot.

[SFT] [SYS EDIT]

(The System Information mode)

```
    ▉SYS●

 COMMAND  SELECT

 ❶ SYSTEM  INF.
 ❷ I/O  CARD
         LAYOUT
```

[ERR 2] [EXE]

(System 2)

```
    ▉SYS●


 ---UNIT  #0----
 SLOT        I/O
   00    [ X    01W]
   01    [ X    02W]
   02    [ Y    01W]
```
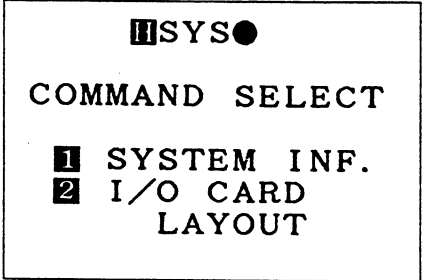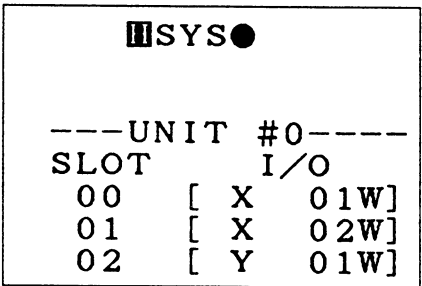
Press the up or down cursor key to display the cursor. Repeat pressing the keys or simply hold them down to scroll through the displayed slots.

[CNTL ↓]

```
    ▉SYS●


 ---UNIT  #0----
 SLOT        I/O
   00    [ X    01W]
   01    [ X    02W]
   02    [ Y    01W]
```

[CNTL ↓] [CNTL ↓] [CNTL ↓] [CNTL ↓]

```
    ▉SYS●


 ---UNIT  #0----
 SLOT        I/O
   02    [ Y    01W]
   03    [          ]
   04    [          ]
```

NOTE

▽▲▽
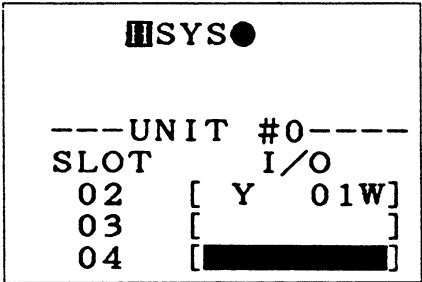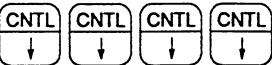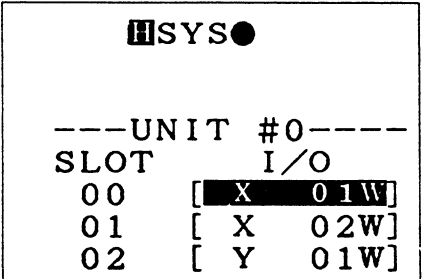
The number of slots in which modules can be mounted and the number of units that can be connected vary according to the EX model. Refer to the reference manual for your EX for the exact number.

7.4
Manually allocating slots for input and output modules

Input and output modules are allocated for each slot. The I/O Set-up command is used to automatically allocate slots according to the way the modules are actually mounted. To allocate the slots manually, follow the procedures described below. This function is useful when a program has to be created without the modules being mounted.

[SFT] [SYS EDIT] [ERR 2] [EXE]
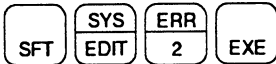
Display the input and output allocation information.

```
 ⊞SYS●


 ---UNIT #0----
 SLOT       I/O
   00   [ X    01W]
   01   [ X    02W]
   02   [ Y    01W]
```

[SYS EDIT]

Enter the Edit mode.

```
 ⊞SYS●EDIT

 SEL.  CARD  TYPE
   ---UNIT #0----
 SLOT       I/O
   00   [  X    01W]
   01   [ X    02W]
   02   [ Y    01W]
```
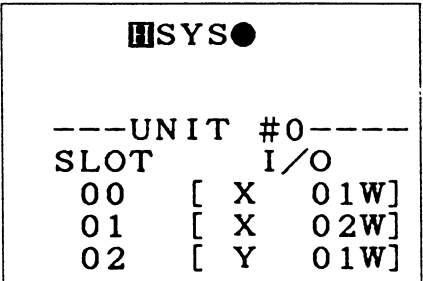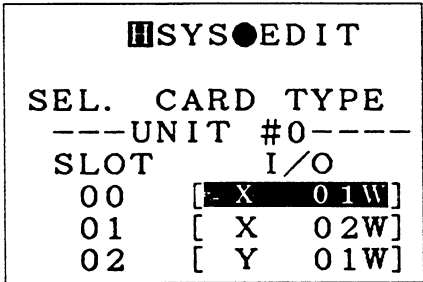
The cursor appears in the first slot. Move the cursor to the desired slot.

Move the cursor using the cursor keys.

```
 ⊞SYS●EDIT

 SEL.  CARD  TYPE
   ---UNIT #0----
 SLOT       I/O
   02   [ Y    01W]
   03   [          ]
   04   [█████████]
```
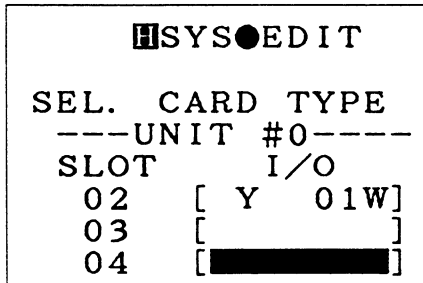
Press the [HOME] key to enter the I/O Allocation Setting mode.

[SFT] [HOME ↑]

```
 ⊞SYS●EDIT
 ███

 SEL.  CARD  TYPE
   ---UNIT #0----
 SLOT       I/O
   02   [ Y    01W]
   03   [          ]
   04   [█████████]
```
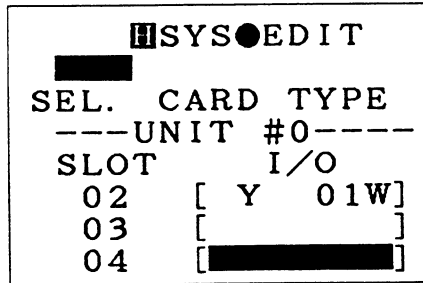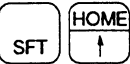
After entering the setting mode, the cursor is positioned on the second line of the HP screen.

NOTE
▽▲▽

The setting mode is possible only for one slot at a time.

Module (card) type

Operate the left and right cursor keys to move the cursor to the required item.

Card size
[blank]
[01W]
[02W]
[04W]
[08W]
[16W]
[32W]

Select by operating the up and down cursor keys.

Card type
[blank]
[Y   ]
[X   ]
[X + Y]
[Z   ]
[SP   ]
[OPT]

Select by operating the up and down cursor keys.

Indication of batch I/O update inhibit
[blank]   Select by operating the up
[i]   and down cursor keys.
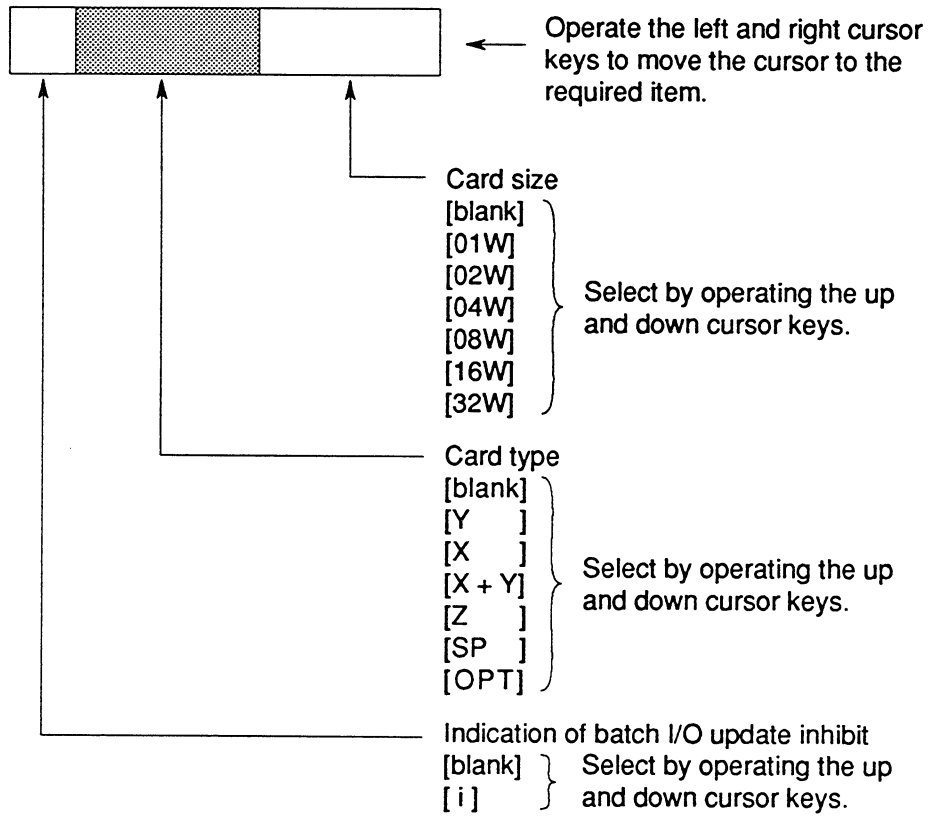
NOTE

For the meaning of each module symbol, refer to the EX reference manual.

(Example of setting)

CNTL
↓

Select the card type.

```
         ⊞SYS●EDIT
    Y
  SEL.  CARD  TYPE
  ---UNIT #0----
  SLOT       I/O
   02    [ Y    01W]
   03    [         ]
   04    [         ]
```

CNTL ↓

Select the card type.

```
      ⊞SYS●EDIT
█X█████
SEL.  CARD  TYPE
---UNIT  #0----
SLOT      I/O
 02    [  Y    01W]
 03    [          ]
 04    [██████████]
```

INS →

Move the set item.

```
      ⊞SYS●EDIT
 X  ██████
SEL.  CARD  TYPE
---UNIT  #0----
SLOT      I/O
 02    [  Y    01W]
 03    [          ]
 04    [██████████]
```

CNTL ↓

Select the card size.

```
      ⊞SYS●EDIT
 X  █01W█
SEL.  CARD  TYPE
---UNIT  #0----
SLOT      I/O
 02    [  Y    01W]
 03    [          ]
 04    [██████████]
```

INS →

Move the set item.

```
      ⊞SYS●EDIT
██X   01W
SEL.  CARD  TYPE
---UNIT  #0----
SLOT      I/O
 02    [  Y    01W]
 03    [          ]
 04    [██████████]
```

CNTL ↓

Inhibit batch I/O update.

```
      ⊞SYS●EDIT
██X   01W
SEL.  CARD  TYPE
---UNIT  #0----
SLOT      I/O
 02    [  Y    01W]
 03    [          ]
 04    [██████████]
```

```
EXE
```
(Register in slot)

```
 ▣SYS●EDIT

SEL.  CARD  TYPE
 ———UNIT #0————
SLOT      I/O
  03    [        ]
  04    [iX   01W]
  05    [████████]
```

Move the cursor to the desired slot and repeat by pressing the [HOME] key to set the other slots.

NOTE
▽▲▽

The HP displays !COMBINATION and does not perform registration if the set items are not in the correct combination.

It is necessary to write the I/O allocation data into the EX after setting it.

```
PRG  SCH
     WRT
```
Write in the EX.
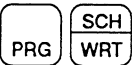
```
 ▣SYS●EDIT

COMPLETE
 ———UNIT #0————
SLOT      I/O
  03    [████████]
  04    [iX   01W]
  05    [        ]
```

The HP displays COMPLETE to indicate that setting has been successful.

NOTE
▽▲▽

Writing into the EX is only effective when the EX is in the HALT mode.

8.1
Programming rules

The EDIT mode is for editing and creating a program. The following rules apply to programming.

- Programming is made in units of a page. The page numbers are from 001 to 999. When creating a new program, the program is produced sequentially beginning with page 001, then pages 002 and 003.
- One page consists of 11 columns and 14 lines. This limit can be exceeded if the miniprogrammer (MP) is used. However, such a program cannot be monitored or edited correctly if they are monitored by the HP.
- The maximum number of instruction steps per page is 154.
- The maximum number of instruction steps per rung is 32.
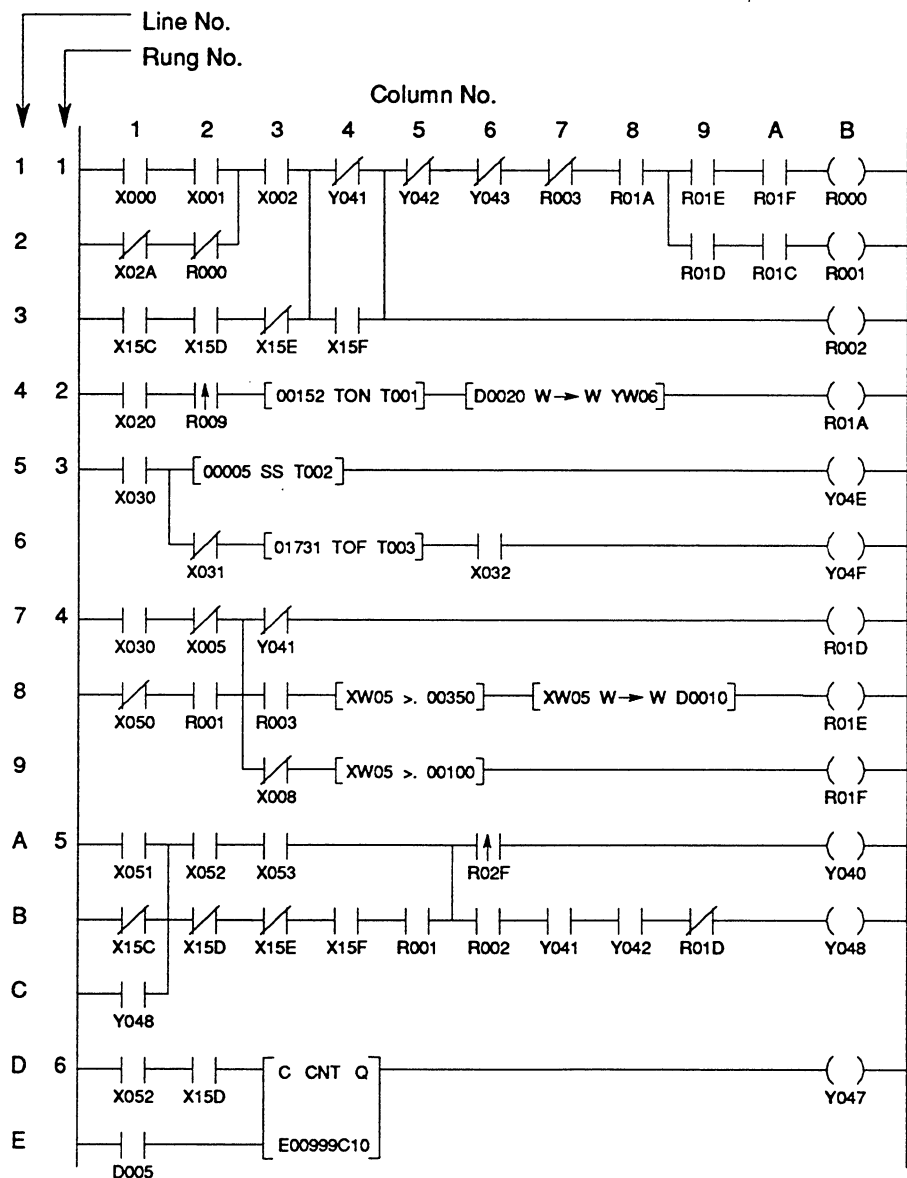
8. The Edit Mode

- Programming is possible when the program is displayed either the normal or zoom modes. In the normal mode, the HP displays 5 lines and 11 columns. In the zoom mode it displays 2 lines and 2 columns.

Cursor

Display area during zoom display

Display area during normal display

Move the cursor to scroll the display area.
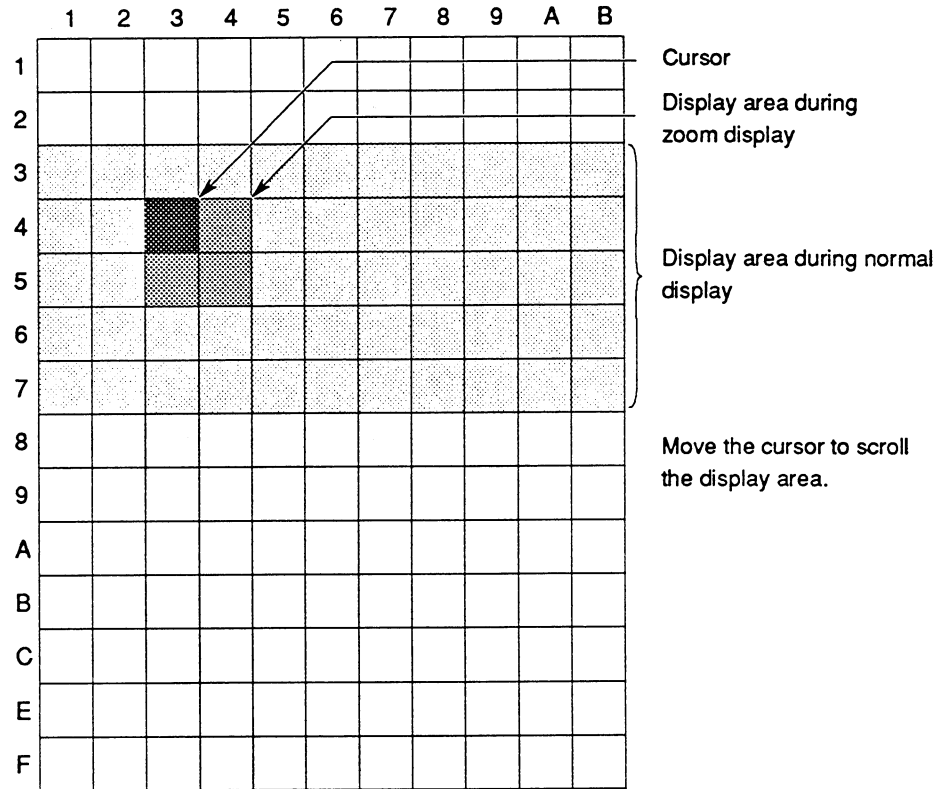
Example of the edit screen in the normal display mode.
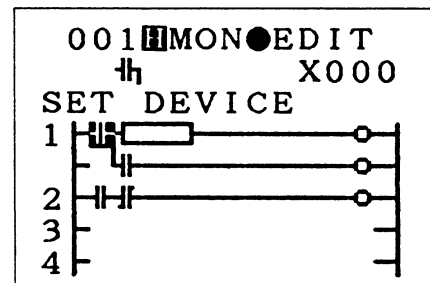
Example of the edit screen in the zoom display mode.
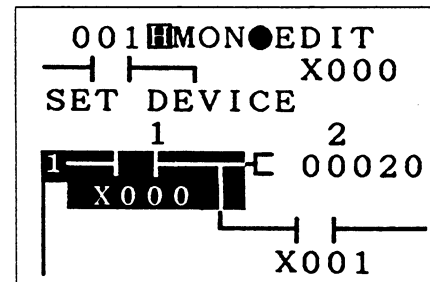
NOTE ▽▲▽   This manual explains programming using examples displayed in the normal mode.

8.2
Writing a program

The program is written in units of a page. To write or edit a program, monitor the required page, then press the [EDIT] key to enter the Edit mode.

[BLK/MON] [Page No.] [EXE]
Enter the Monitor mode.
(Example of page 001)

```
0 0 1 ▤ M O N ●

1 ├                    ┐
2 ├                    ┤
3 ├                    ┤
4 ├                    ┤
5 ├                    ┘
```

[SYS/EDIT]
Enter the Edit mode.

```
0 0 1 ▤ M O N ● E D I T

1 ├ ■                  ┐
2 ├                    ┤
3 ├                    ┤
4 ├                    ┤
5 ├                    ┘
```
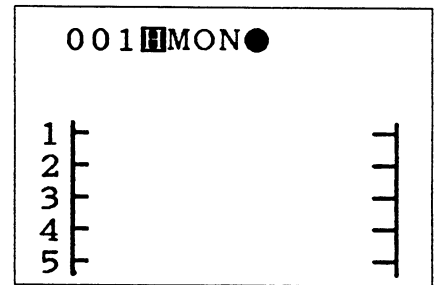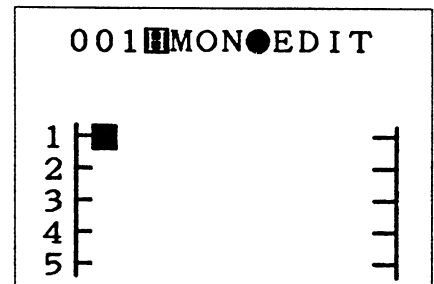
The HP displays EDIT to indicate that the Edit mode has been set up. The cursor is positioned at the top of the screen.

NOTE The cursor keys cannot be operated if an error has occurred during program creation. In this case, restart operation after removing the error by pressing the [ERR] key.

8.2.1
Writing contacts and coils

The method for writing contacts and coils is described using the following circuit as an example.
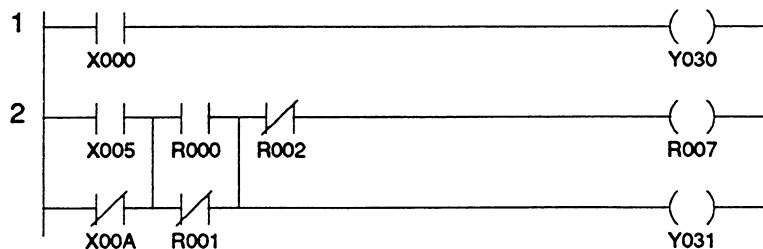
Programming is made by placing instructions at the position of the cursor. Instructions are written in the following sequence:
[INSTRUCTION SYMBOL] [DEVICE TYPE] [DEVICE NUMBER] ([VERTICAL CONNECTION]) [EXE] or [WRT]
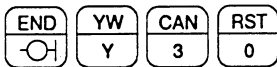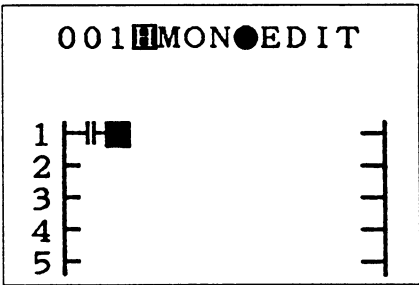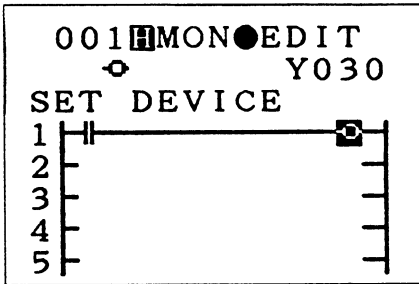
8. The Edit Mode
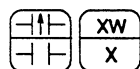
It is not necessary to input the device No. if the device No. is 0.
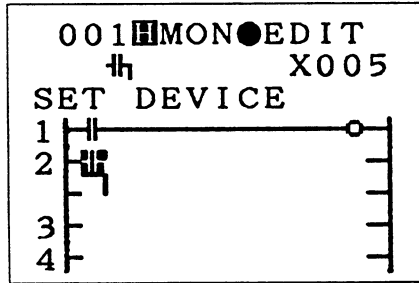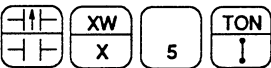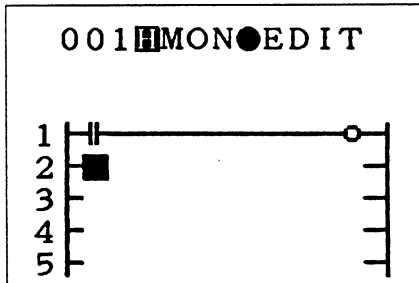
```
001圓MON●EDIT
  ╢┝         X000
SET  DEVICE
1 ├╫╏
2 ├
3 ├
4 ├
5 ├
```

EXE

Register the cursor position.

```
001圓MON●EDIT


1 ├╢╫■
2 ├
3 ├
4 ├
5 ├
```
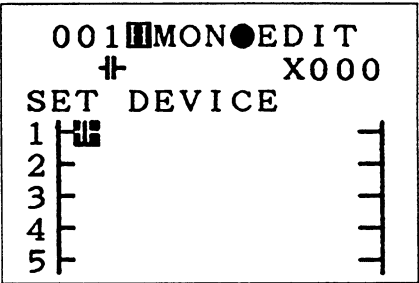
If the coil symbol is input, it is automatically connected to the right power rail.

```
001圓MON●EDIT
   ◇          Y030
SET  DEVICE
1 ├╢━━━━━━━━━━◇┤
2 ├
3 ├
4 ├
5 ├
```

EXE

Register the cursor position.

```
001圓MON●EDIT


1 ├╢━━━━━━━━━○┤
2 ■
3 ├
4 ├
5 ├
```

```
001圓MON●EDIT
  ╢╖         X005
SET  DEVICE
1 ├╢━━━━━━━━━○┤
2 ├╫╏
3 ├
4 ├
```

NOTE

A vertical connection is placed at the lower right of the cursor. Displaying or erasing of the connection is repeated each time the vertical connection key is pressed.

[EXE]

Register the cursor position.

```
┌─────────────────────┐
│   001⊞MON●EDIT      │
│                     │
│  1 ┤├──────────○    │
│  2 ┤├■              │
│  3                  │
│  4                  │
└─────────────────────┘
```
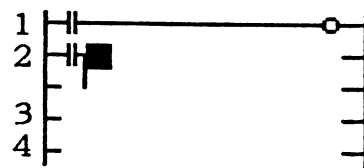
[⊣↑⊢/⊣⊢] [RW/R] [TON/↓] [EXE]

```
┌─────────────────────┐
│   001⊞MON●EDIT      │
│                     │
│  1 ┤├──────────○    │
│  2 ┤├┤├■            │
│  3                  │
│  4                  │
└─────────────────────┘
```

[⊣↑⊢/⊣/⊢] [RW/R] [ERR/2] [EXE]

```
┌─────────────────────┐
│   001⊞MON●EDIT      │
│                     │
│  1 ┤├──────────○    │
│  2 ┤├┤/├┤├■         │
│  3                  │
│  4                  │
└─────────────────────┘
```

[END/-○⊢] [RW/R] [FRC/7] [EXE]

```
┌─────────────────────┐
│   001⊞MON●EDIT      │
│        |            │
│  1 ┤├──────────○    │
│  2 ┤├┤/├┤/├─────○   │
│  3 ■                │
│  4                  │
└─────────────────────┘
```

[⊣↑⊢/⊣/⊢] [XW/X] [SS/A] [EXE]
[⊣↑⊢/⊣/⊢] [RW/R] [SET/1] [EXE]
[END/-○⊢] [YW/Y] [CAN/3] [SET/1] [EXE]

```
┌─────────────────────┐
│   001⊞MON●EDIT      │
│                     │
│  1 ┤├──────────○    │
│  2 ┤├┤/├┤/├─────○   │
│      ┤├┤/├──────○   │
│  3 ■                │
│  4                  │
└─────────────────────┘
```
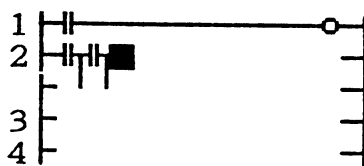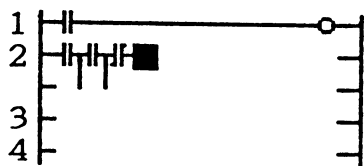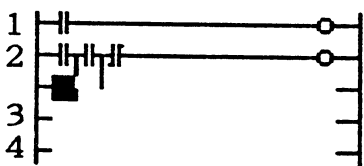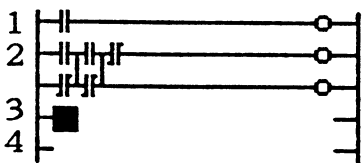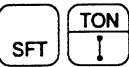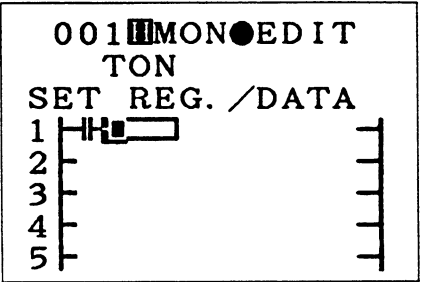
8. The Edit Mode

**8.2.2
Writing timer
instructions**

There are three types of timer instructions, the on delay timer (TON), the off delay timer (TOF), and the single-shot timer (SS). Unlike writing contacts and coils, timer instructions are written after securing an area.
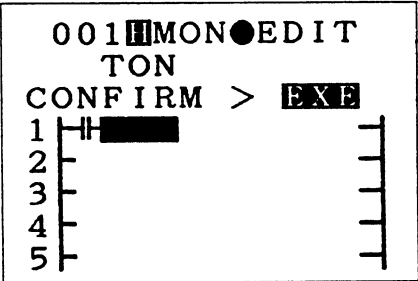
[SFT] [TON]

(On Delay Timer instruction)

```
001 MON●EDIT
      TON
SET REG. /DATA
1 ┤├┤├■☐──┐
2 ┤                ┤
3 ┤                ┤
4 ┤                ┤
5 ┤                ┤
```

The cursor secures the instruction area and the system queues for the confirmation key to be entered.

[EXE]

(Confirmation)

```
001 MON●EDIT
      TON
CONFIRM > EXE
1 ┤├┤█████─┐
2 ┤                ┤
3 ┤                ┤
4 ┤                ┤
5 ┤                ┤
```

The instruction is defined at this time. The cursor moves to the position of the set value ready for input.

[SET 1] [RST 0] [EXE]

Enter the preset value.

```
001 MON●EDIT
      TON
SET T REGISTER
1 ┤├┤├─☐─■─┐
2 ┤                ┤
3 ┤                ┤
4 ┤                ┤
5 ┤                ┤
```

NOTE
▽▲▽
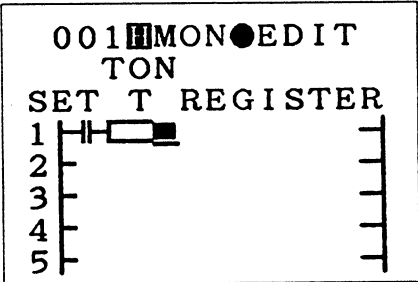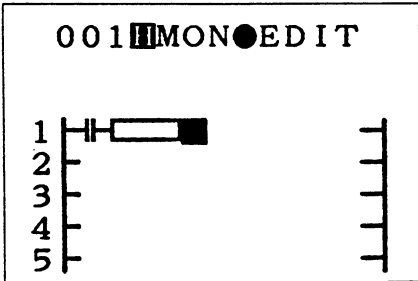
An immediate or register can be used as a preset value. The cursor moves to the position for inputting a timer register after the preset value is input.
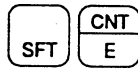
[C T] [5] [EXE]

Enter the timer register.

```
001 MON●EDIT


1 ┤├┤├──☐─■─┐
2 ┤                ┤
3 ┤                ┤
4 ┤                ┤
5 ┤                ┤
```
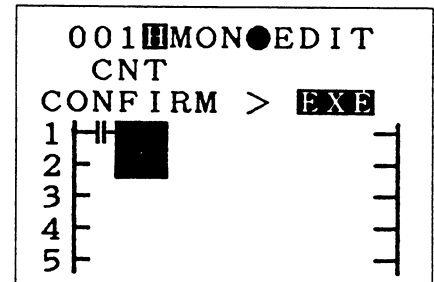
8.2.3
Writing counter instructions

The counter instruction has two inputs, Count and Enable. Otherwise, the counter instruction can be written the same way as writing the timer instruction.
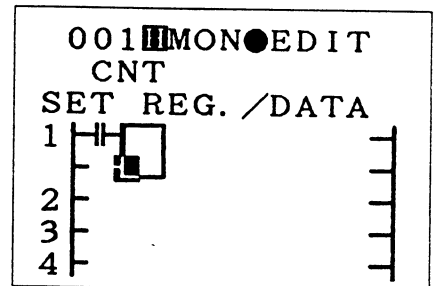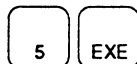
[SFT] [CNT/E]

(The Counter instruction)

```
001█MON●EDIT
    CNT
CONFIRM > ███
1├┤├█
2├  █
3├
4├
5├
```

The cursor secures the instruction area and the system queues for the confirmation key to be entered.

[EXE]

(Confirmation)

```
001█MON●EDIT
    CNT
SET REG./DATA
1├┤├┌─┐
  │ └■┘
2├
3├
4├
```
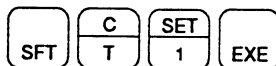
The cursor moves to the position of the preset value ready for input.

[5] [EXE]

Enter the preset value.

```
001█MON●EDIT
    CNT
SET C REGISTER
1├┤├┌──┐
  │  └■┘
2├
3├
4├
```
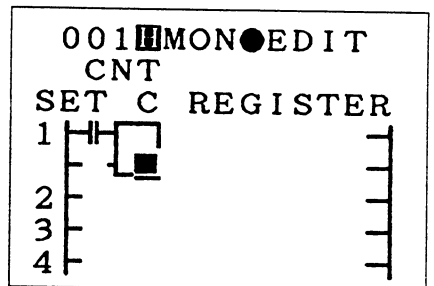
An immediate or register can be used as a preset value.

[SFT] [C/T] [SET/1] [EXE]

Enter the counter register.

```
001█MON●EDIT

1├┤├┌─█┐
  │  └─┘
2├
3├
4├
```
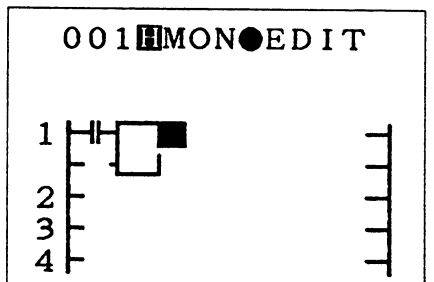
This completes writing the counter instruction. Move the cursor and write the contact for the enable input.

8. The Edit Mode

8.2.4
Writing functional
instructions

There are two types of functional instructions. The first type has a single input (the horizontal-box instruction), and the second has several inputs (the vertical-box instruction). Basically, the timer instruction is used for single input, and the counter instruction is used for multiple inputs. The functional instructions are written in nearly the same way as these two instructions.

Move the cursor to the position where the functional instruction is to be written.

```
001▣MON●EDIT

1 ⊢IH■                    ⊣
2 ⊢                       ⊣
3 ⊢                       ⊣
4 ⊢                       ⊣
5 ⊢                       ⊣
```

```
┌─□□─┐
│ FUN │
└─────┘
```
(Functional instruction)

```
   001▣MON●EDIT
     W→W         000
 SELECT  FUN  NO.
 ▌0 0 0  W→W
 ▌0 0 1  K→W
 ▌0 0 2  TINZ
 ▌0 0 3  T→W
 ▌0 0 4  W→T
```

The display changes to the functional instruction menu. Use the cursors keys to scroll the menu.

```
┌─────┐ ┌─────┐
│ ERR │ │ RST │
│  2  │ │  0  │
└─────┘ └─────┘
```
Example: FUN 20 = immediate addition

```
   001▣MON●EDIT
     +.          020
 SELECT  FUN  NO.
 ▌0 0 0  W→W
 ▌0 0 1  K→W
 ▌0 0 2  TINZ
 ▌0 0 3  T→W
 ▌0 0 4  W→T
```

```
┌─────┐
│ EXE │
└─────┘
```
Input function instruction
(FUN 20)

```
   001▣MON●EDIT
     +.
 CONFIRM  >  ▛EXE▜
 1 ⊢IH██████      ⊣
 2 ⊢             ⊣
 3 ⊢             ⊣
 4 ⊢             ⊣
 5 ⊢             ⊣
```

The cursor secures the instruction area and the system queues for the confirmation key to be entered.
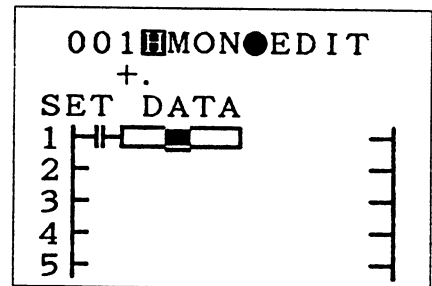
| EXE |

(Confirmation)

```
001▦MON●EDIT
   +.
SET REGISTER
1 ┤├─┤├─■══════╕     ┤
2 ┤─                 ├
3 ┤─                 ├
4 ┤─                 ├
5 ┤─                 ├
```
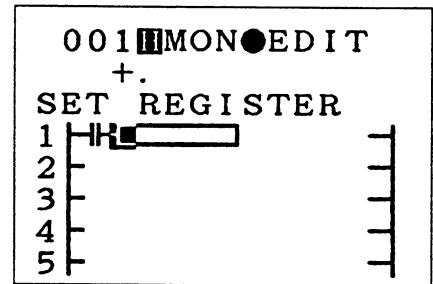
The cursor moves to the first operand ready for input.

| HEX D | SET 1 | RST 0 | EXE |

Write the first operand, D0010 in this example.

```
001▦MON●EDIT
   +.
SET DATA
1 ┤├─┤├─══■═══╕     ┤
2 ┤─                ├
3 ┤─                ├
4 ┤─                ├
5 ┤─                ├
```

| SET 1 | EXE |

Write the second operand, the number to be added. In this example, 1.

```
001▦MON●EDIT
   +.
SET REGISTER
1 ┤├─┤├─══════■╕     ┤
2 ┤─                 ├
3 ┤─                 ├
4 ┤─                 ├
5 ┤─                 ├
```
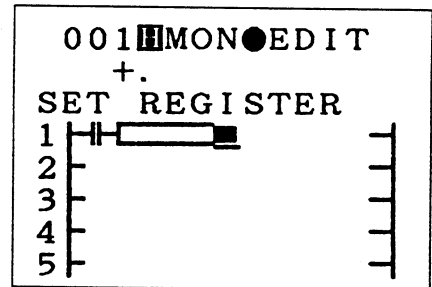
NOTE ▽▲▽ The operands that can be used differ depending on the type of functional instruction. Check the operands that can be input by referring to the manual of instruction sets.

| HEX D | SET 1 | SET 1 | EXE |

Write the third operand, the register in which the result is to be stored. D0011 in this example.

```
001▦MON●EDIT

1 ┤├─══════■╕      ┤
2 ┤─               ├
3 ┤─               ├
4 ┤─               ├
5 ┤─               ├
```
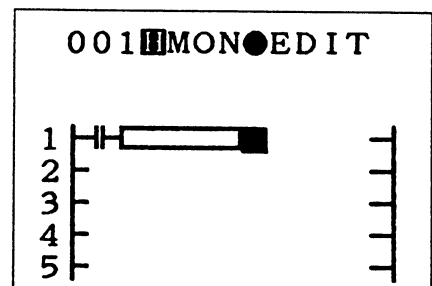
This completes writing the functional instruction.

NOTE ▽▲▽ The coil instruction is not always needed on the output side of the functional instruction.

8.2.5

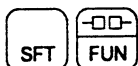**Writing line connectors**

The size of a one-page program for the HP is 11 columns by 14 lines. The line connector function makes it possible to write circuits that have more than 11 columns.
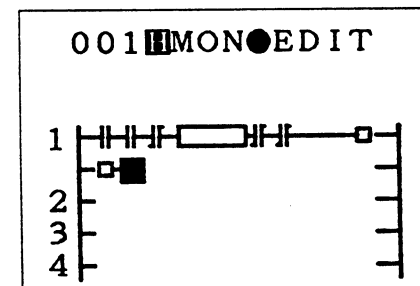
[SFT] [FUN]
(Line connector outlet)

001█MON●EDIT

[EXE]
(Write)

001█MON●EDIT

[SFT] [FUN]
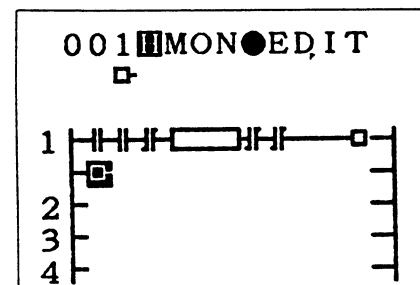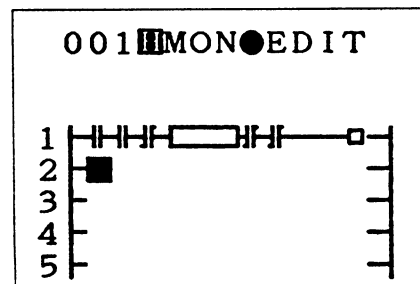(Line connector inlet)

001█MON●EDIT

[EXE]
(Write)

001█MON●EDIT

NOTE
▽▲▽
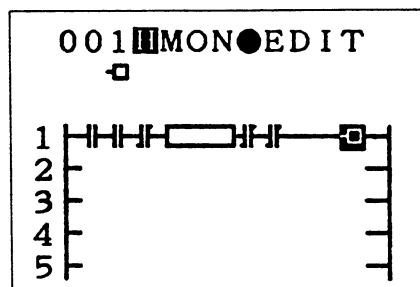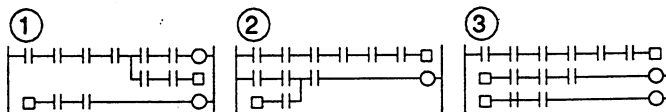
An error results if the rung of the line connector outlet is connected to the right power rail ①, if the line connector inlet is not located on the next line of the outlet ②, or if the outlets and inlets do not correspond one to one ③.

① ② ③

8.3
Modifying programs

Part of a page in a program already written is modified as follows. Display the page requiring modification, press the edit key to enter the edit mode, and then modify the page.

8.3.1
Changing instructions

The method for modifying contact and coil instructions differs slightly from the method for modifying timer, counter and functional instructions, as follows.
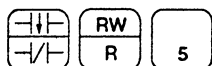
Changing contacts and coils
To change a contact or coil instruction, move the cursor to the position of the instruction and overwrite the new instruction on the old instruction.
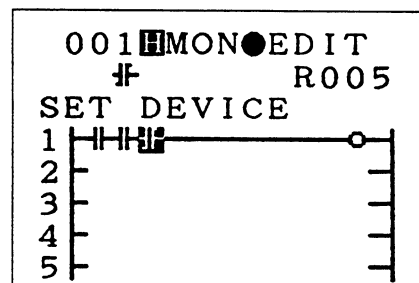
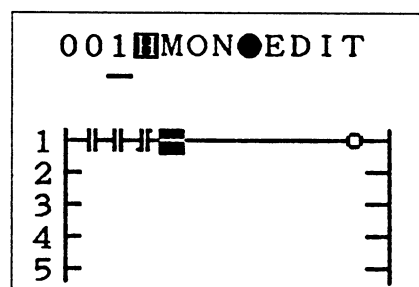Move the cursor to the desired position.

```
001 MON●EDIT
     ⊩          R001
SET DEVICE
1 ⊩⊩⊩⊩──────────○
2 ⊢
3 ⊢
4 ⊢
5 ⊢
```
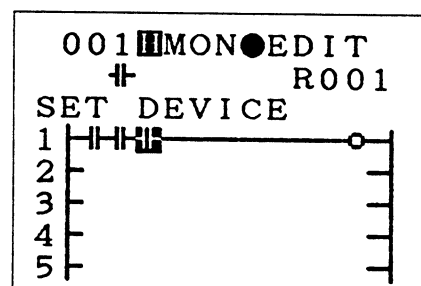
Rewrite the instruction at the cursor position. (Change NO contact of R001 to NC contact of R005.

[⊣⊩⊢] [RW]
[⊣/⊢] [R] [5]
(NC contact of R005)

```
001 MON●EDIT
     ⊩          R005
SET DEVICE
1 ⊩⊩⊩⊩──────────○
2 ⊢
3 ⊢
4 ⊢
5 ⊢
```

[EXE]
(Rewriting)

```
001 MON●EDIT
  ─
1 ⊩⊩⊩⊩──────────○
2 ⊢
3 ⊢
4 ⊢
5 ⊢
```
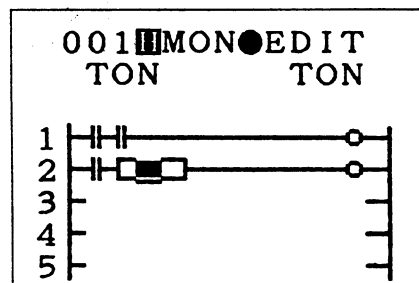
8. The Edit Mode

Changing timer, counter, and functional instructions
To change a timer, counter, or functional instruction, move the cursor to the position of the instruction, delete the old instruction by pressing the [CLR] key and write the new instruction.
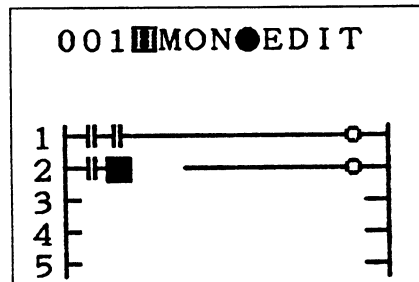
Move the cursor to the instruction to be changed.

```
001█MON●EDIT
  TON        TON

1├┤├┤├─────────────○
2├─┤├─■■■──────────○
3├
4├
5├
```
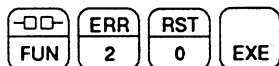
NOTE
▽▲▽

Position the cursor at the instruction symbol. When the cursor is positioned at the instruction symbol, two identical symbols are displayed in the data buffer area (TON in the example above). Then press the [CLR] key to delete the instruction.
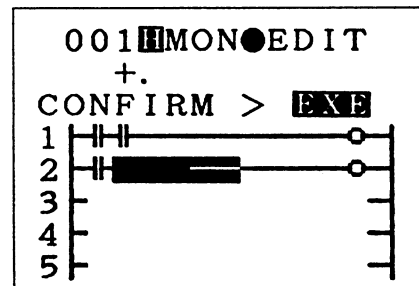
[ALL] [CLR]

Delete the instruction.

```
001█MON●EDIT

1├┤├┤├─────────────○
2├─┤├■■────────────○
3├
4├
5├
```

Write the new instruction. (Change to FUN 20, the immediate addition instruction.)

[FUN] [ERR 2] [RST 0] [EXE]

(FUN 20, numeric addition)

```
001█MON●EDIT
     +.
CONFIRM > █X█
1├┤├┤├─────────────○
2├─┤├■■■■■■────────○
3├
4├
5├
```

[EXE]

Define the instruction.

```
001█MON●EDIT
     +.
SET  REGISTER
1├┤├┤├─────────────○
2├─┤├■■■■■─────────○
3├
4├
5├
```

| HEX D | SET 1 | RST 0 | EXE |

| SET 1 | EXE |

| HEX D | SET 1 | RST 0 | EXE |

Write the operand.

```
001█MON●EDIT
 ‾
1  ┤├┤├                              ○┤
2  ┤├┤  █                            ○┤
3
4
5  ┡
```
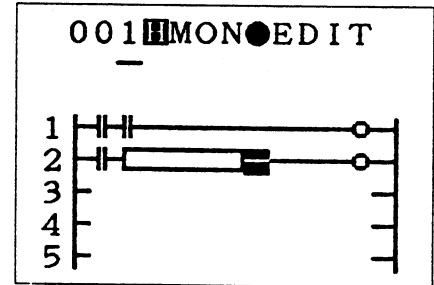
NOTE

△▲▽

If a horizontal connection becomes disconnected after changing an instruction, reconnect it by entering a horizontal connection. (This happens, for example, when an instruction consisting of 5 columns is replaced with an instruction consisting of 3 columns.)

8.3.2
Inserting columns

To insert a instruction, insert a column of spaces using column insertion, then write the instruction.

Move the cursor to the position for column insertion.

```
001⊞MON●EDIT
   TON      00005
SET REG. /DATA
1 ┤├┤├┤█──────o
        ├──────o
2 ┤├┤├┤├──────o
3
4
```

【LINE】
【COL】

(Column edit)

```
001⊞MON●COL
   TON      00005
SELECT INS/DEL
1 ┤├┤├┤█──────o
        ├──────o
2 ┤├┤├┤├──────o
3
4
```

【SFT】【INS →】

Instruct insertion.

```
001⊞MON●CINS
 ─
CONFIRM > EXE
1 ┤├┤├█──────o
       ├──────o
2 ┤├┤├┤├──────o
3
4
```

【EXE】

(Definition)

```
001⊞MON●EDIT
 ─
1 ┤├┤├█──────o
       ├──────o
2 ┤├┤├┤├──────o
3
4
```

NOTE
▽▲▽

- It is not possible to insert a column if the tenth column contains a contact instruction or a vertical connection line, or if the cursor is positioned in the eleventh column.
- It is not possible to insert a column if the number of columns exceeds eleven after column insertion.
- If half of a box instruction is located on the cursor column in the same rung, the new column is inserted after the box instruction, on the right-hand side.
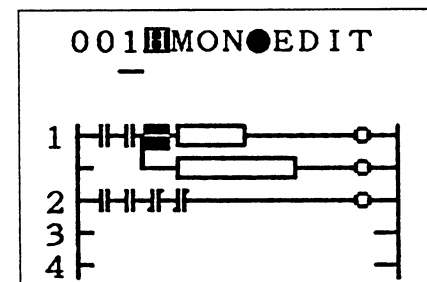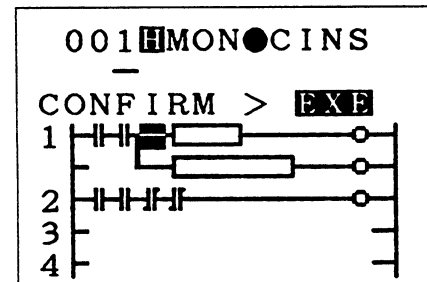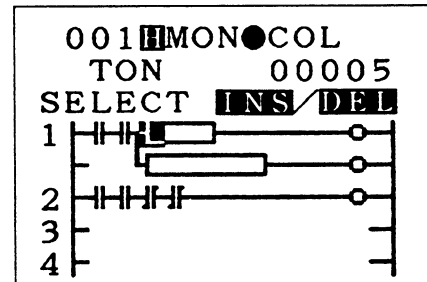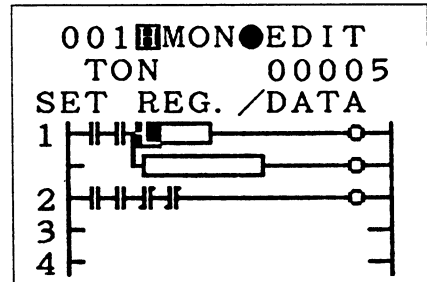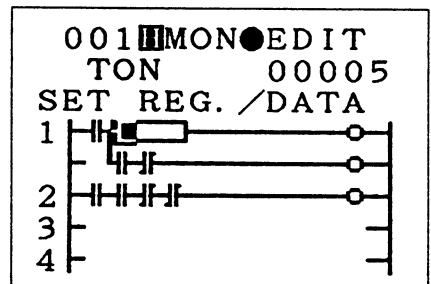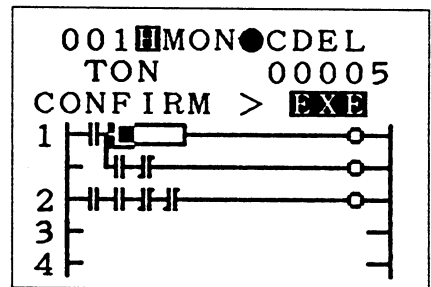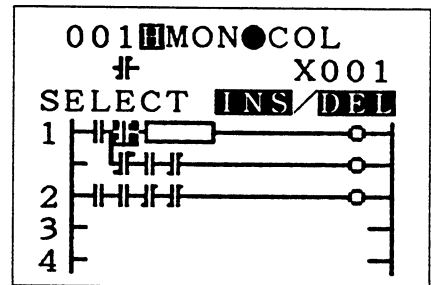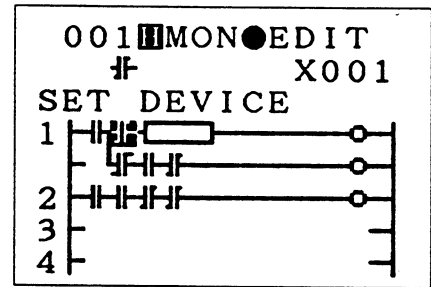
8.3.3
Deleting columns

Any single column can be deleted from a rung.

Move the cursor to the column to be deleted.

```
001█MON●EDIT
     ╢╟        X001
SET DEVICE
1 ╟╢╟╠    [    ]─────o
  ╟   ╙╟╟╟╟──────────o
2 ╟╢╟╢╟╢──────────────o
3 ╟
4 ╟
```

[LINE / COL]
(Column edit)

```
001█MON●COL
     ╢╟        X001
SELECT ▮NS/DEL▮
1 ╟╢╟╠    [    ]─────o
  ╟   ╙╟╟╟╟──────────o
2 ╟╢╟╢╟╢──────────────o
3 ╟
4 ╟
```

[SFT] [DEL / ←]
Instruct deletion

```
001█MON●CDEL
   TON      00005
CONFIRM > ▮XE▮
1 ╟╢╟■[    ]───────o
  ╟   ╙╟╟╟─────────o
2 ╟╢╟╢╟╢────────────o
3 ╟
4 ╟
```

[EXE]
(Definition)

```
001█MON●EDIT
   TON      00005
SET REG. /DATA
1 ╟╢╟■[    ]───────o
  ╟   ╙╟╟───────────o
2 ╟╢╟╢╟╢────────────o
3 ╟
4 ╟
```

NOTE

- If the column of the cursor is at the left edge of a box instruction, the entire box is deleted.
- If the column of the cursor is halfway over a box instruction, the instruction immediately to the right of the box is deleted.

8.3.4
Inserting lines

To insert a line in any page of program, insert a one-line space.

Move the cursor to the line to be inserted.

```
001HMON●EDIT
  ⊣⊢        X005
SET DEVICE
1 ⊣⊢⊢⊢⊏━━┓    ○
2 ⊣⊢┌──┐⊣⊦⊣⊦   ○
  ⊣⊦ │  │
3 ⊢
4 ⊢
```

⌈SFT⌉ ⌈LINE/COL⌉
(Line edit)

```
001HMON●LINE
  ⊣⊢        X005
SELECT ▮INS/DEL▮
1 ⊣⊢⊢⊢⊏━━┓    ○
2 ⊣⊢┌──┐⊣⊦⊣⊦   ○
  ⊣⊦ │  │
3 ⊢
4 ⊢
```

⌈SFT⌉ ⌈INS/→⌉
Instruct insertion.

```
001HMON●LINS
CONFIRM > ▮EXE▮
1 ⊣⊢⊢⊢⊏━━┓    ○
2 ⊢      ■
3 ⊣⊢┌──┐⊣⊦⊣⊦   ○
  ⊣⊦ │  │
4 ⊢
```

⌈EXE⌉
(Definition)

```
001HMON●EDIT

1 ⊣⊢⊢⊢⊏━━┓    ○
2 ⊢      ■
3 ⊣⊢┌──┐⊣⊦⊣⊦   ○
  ⊣⊦ │  │
4 ⊢
```

NOTE
▽▲▽

- A line cannot be inserted if the page already contains fourteen lines or if the cursor is positioned on the fourteenth line.
- A line cannot be inserted if the line the cursor is half-way over contains a vertical-box instruction.
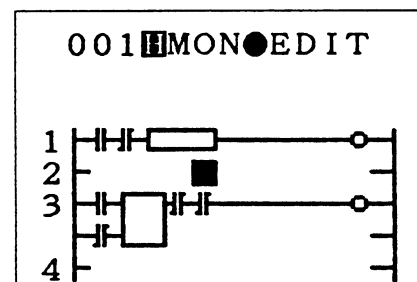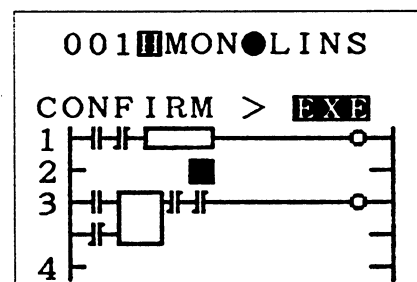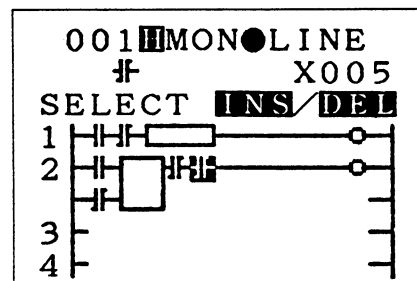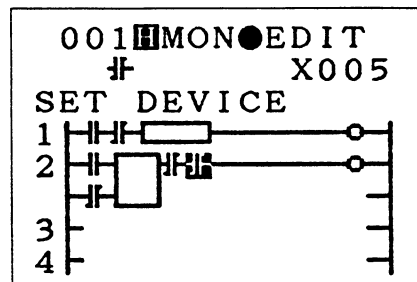
8.3.5
Deleting lines

When a line is deleted from a page of program, all the subsequent lines are shifted up by one line.

Move the cursor to the line to be deleted.

```
001 MON●EDIT
  —
1
2
3
```

[SFT] [LINE/COL]
(Line edit)

```
001 MON●LINE
SELECT  INS/DEL
1
2
3
```

[SFT] [DEL/←]
Instruct deletion.

```
001 MON●LDEL
  —
CONFIRM > EXE
1
2
3
4
```

[EXE]
(Definition)

```
001 MON●EDIT
  —
1
2
3
4
```

NOTE

- If the line to be deleted contains a vertical connection, this connection is also deleted. However, if the positional relationship of the vertical connection does not change when the line is deleted, the vertical connection remains.
- If the line to be deleted contains the first line of a vertical box instruction, the entire vertical box instruction is deleted.
- A line cannot be deleted if a vertical box instruction lies halfway across it.
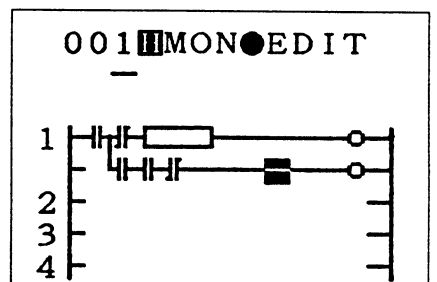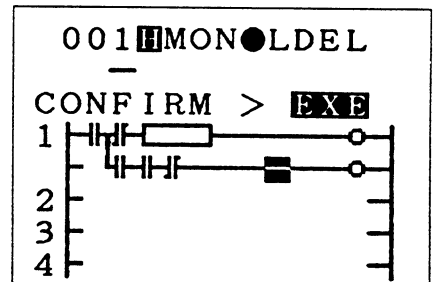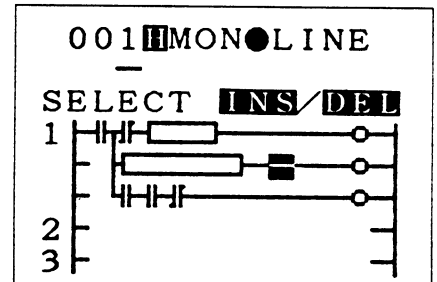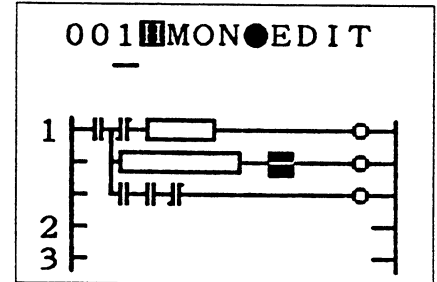
8. The Edit Mode

The examples used in explaining the program edit (write and modify) operations were in the normal display mode. Needless to say, it is also possible to edit the program in the zoom display mode. Selecting the normal or zoom display mode is possible anytime during editing. The zoom display mode is explained below.

(When editing in the normal mode)

```
001█MON●EDIT
  ╢╟        X003
SET DEVICE
1├┤╢╟┤─────────○┤
2├
3├
4├
5├
```
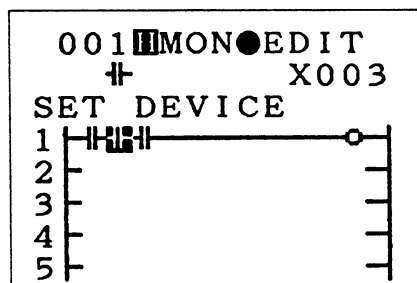
ZOOM

Select the zoom display mode.
The column numbers are shown on the zoom display screen.

```
001█MON●EDIT
 ─┤ ├─       X003
SET DEVICE
      2        3
 ━━┨┃┠━━━━━┨ ├━
   X003    X004
```

─┤↓├─ / ─┤/├─ **EXE**
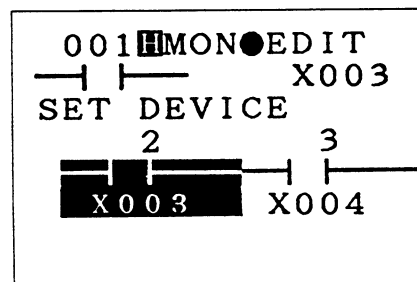
(Example of changing an instruction)

```
001█MON●EDIT
 ─┤ ├─       X004
SET DEVICE
      2        3
 ─┤/├─     ━┨ ┠━━
   X003    X004
```
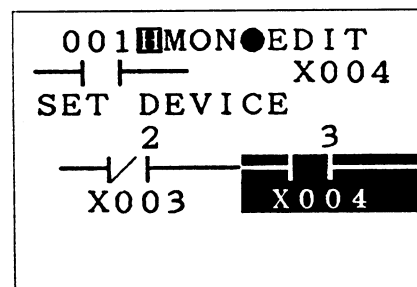
ZOOM

Return to the normal display mode.

```
001█MON●EDIT
   ╢╟        X004
SET DEVICE
1├┤╟┤╟╢█──────○┤
2├
3├
4├
5├
```
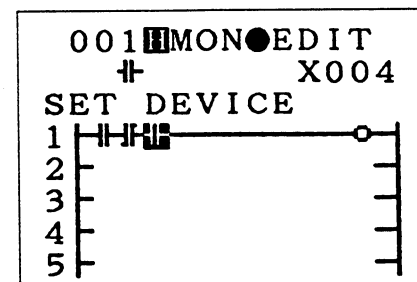
You can check the program easily using the zoom display mode.

8.4
Writing into the
EX memory

The editing operations described in sections 8.2 and 8.3 above are performed in the HP. These operations do not change the contents of the memory in the EX. Therefore, after editing a program, it must be written into the EX controller, as follows.

8.4.1
Writing/replacing a
page

A page of program created or edited on the HP is written onto the specified page in the memory of the EX. If the specified page already exists in the EX, the data on this page is replaced by the data on the new page.

[PRG]

Instruct the EX to commence operation.

```
001■MON●PRG
      001
SEL. WRT/INS/DEL
1
2
3
4
```

The HP displays SEL. [WRT]/[INS]/[DEL] and waits for one of the keys to be entered.

[SCH]
[WRT]
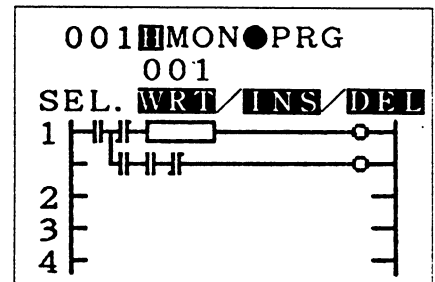
Instruct writing (replace).

```
001■MON●WRT
      001
CONFIRM > EXE
1
2
3
4
```
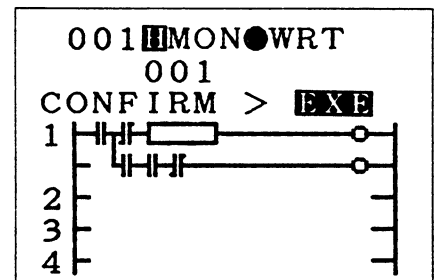
Compile the program edited on the HP, and wait for confirmation to write the program into the EX. If a compilation error occurs, the relevant details are displayed.

NOTE

▽▲▽

Specify the page number before pressing the WRITE key. If no page is specified, the page initially monitored is automatically assumed.

EXE
(Confirmation)

```
001▉MON●EDIT

COMPLETE
1 ┤├┤├─┤  ┠────────○
     ┤├┤├┤├─────────○
2 ┤
3 ┤
4 ┤
```

The HP displays COMPLETE to indicate that the pages have been successfully written into the EX.

NOTE The page number specified for writing a program must be less than or equal to the number of the page after the last page of program in the EX. It is not possible to skip pages when writing a program into the EX.

8.4.2
Inserting a page

It is possible to insert a page of program created or edited on the HP onto a specified page in the EX. The pages after the page specified in the EX are all shifted along one page.
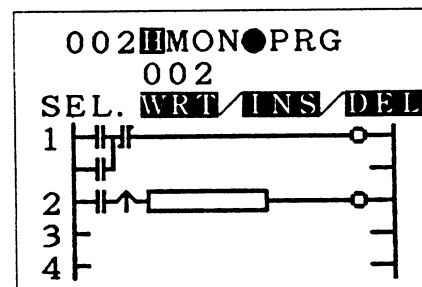
PRG

Instruct the EX to commence operation.

```
002▉MON●PRG
     002
SEL. WRT/INS/DEL
1 ┤├┤├          ○
    ┤├┤├
2 ┤├╱┤ ┤  ┠──────○
3 ┤
4 ┤
```
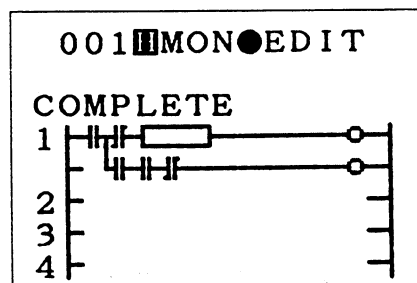
The HP displays SEL. [WRT]/[INS]/[DEL] and waits for one of the keys to be entered.

SFT INS →

Instruct insertion.

```
002▉MON●INS
     002
CONFIRM > EXE
1 ┤├┤├          ○
    ┤├
2 ┤├╱┤ ┤    ┠─────○
3 ┤
4 ┤
```
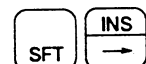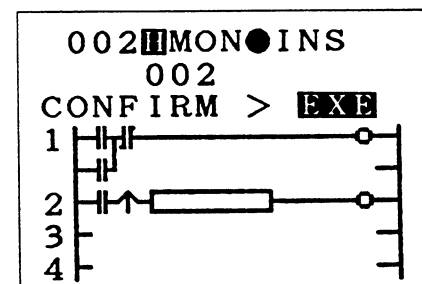
As in the case of writing pages, compile the the program and wait for confirmation before transferring it to the EX.

NOTE Specify the number of the page before pressing the INSERT key. If no page is specified, the page initially monitored is automatically assumed. The new page is inserted immediately before the page specified.

EXE

(Confirmation)

```
002█MON●EDIT

COMPLETE
1 ├┤├┤├──────────────○┤
  ├┤├
2 ├┤├◄─[────────]──────○┤
3 ├
4 ├
```

The HP displays COMPLETE to indicate that the pages have been successfully inserted in the EX.

NOTE ▽▲▽   The page number specified for inserting a program must be a page on which a program already exists.

8.4.3
Deleting a page

To delete a page from the EX, simply specify the page to be deleted. The subsequent pages are all moved forward by the corresponding number of pages.
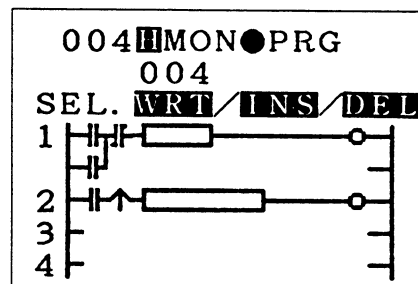
PRG

Instruct the EX to commence operation.

```
004█MON●PRG
      004
SEL. █WRT█/█INS█/█DEL█
1 ├┤├┤├─[────]────────○┤
  ├┤├
2 ├┤├◄─[────────]──────○┤
3 ├
4 ├
```

The HP displays SEL. [WRT]/[INS]/[DEL] and waits for one of the keys to be entered.

SFT DEL ←

Instruct deletion.

```
004█MON●DEL
      004
CONFIRM > █EXE█
1 ├┤├┤├─[────]────────○┤
  ├┤├
2 ├┤├◄─[────────]──────○┤
3 ├
,4 ├
```
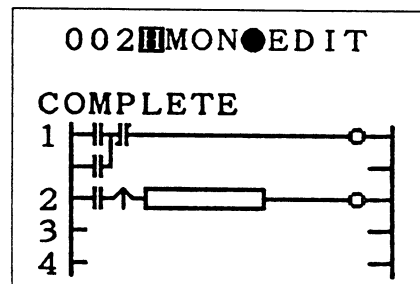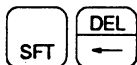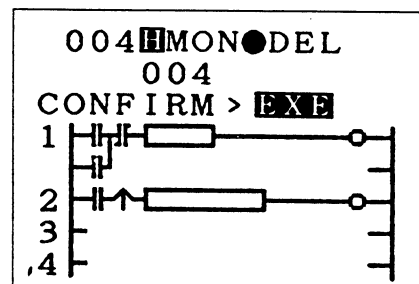
NOTE ▽▲▽   Specify the number of the page before pressing the DELETE key. If no page is specified, the page initially monitored is automatically assumed. The page number specified must be a page which already exists.

EXE

(Confirmation)

```
004█MON●EDIT

COMPLETE
1
2
3
4
```
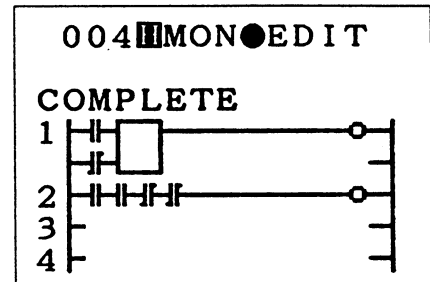
The HP displays COMPLETE to indicate that the page has been successfully deleted from the EX.

8.4.4
On-line programming

The editing operations for the EX memory described in sections 8.4.1 to 8.4.3 can only be executed when the EX is in the HALT mode. The following operations enable page editing when the EX is in the RUN state. The operations that can be performed on-line are page writing, insertion, and deletion.

SFT PRG

Instruct on-line page editing.

```
003█MON●OPRG
       003
SEL. WRT/INS/DEL
1
2
3
4
```
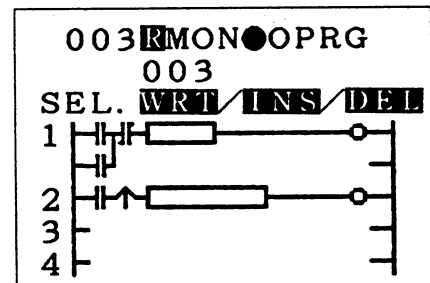
The HP displays SEL. [WRT]/[INS]/[DEL] and waits for one of the keys to be entered. Operations after this are the same as those for normal programming.

SCH/WRT EXE

Example of page replacing on-line

NOTE

▽▲▽

- On-line editing is not possible in the following cases:
  1. If on-line editing changes the number of program control instructions, i.e., END, MCS, MCR, JCS, and JCR.
  2. If on-line editing changes the execution sequence of program control instructions.

CAUTION

▼△▼

- On-line programming rewrites a program while the EX is in operation. Sufficient care must be taken so that the machines and systems controlled by the EX are not exposed to danger.

**9.1
General rules**

The monitor mode is used for displaying the program stored in the EX on the HP screen. If the EX is in the RUN mode, i.e., executing a program, the program execution status is displayed in a power-flow, in which the present register values and the active connections are also displayed.

The following rules apply to the monitor mode:

1. The program is displayed one page at a time.

BLK MON	[Page No.] EXE	(Monitoring the designated page)
	HOME ↑ or DEL ←	(Monitoring the previous page)
	CNTL ↓ or INS →	(Monitoring the next page)
	SFT HOME ↑	(Monitoring the first page)
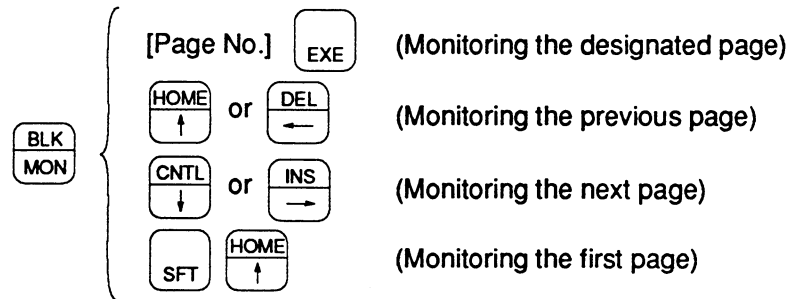
Entering these keys sets up the page-monitoring mode. See section 8.1, Programming rules, for the construction of each page.

2. The display mode can be switched freely between normal and zoom. However, changing the display mode when the EX is performing an operation, such as searching or forcing, cancels the operations performed prior to that point.

Auxiliary data monitor area

Cursor

Display area during zoom display

Display area during normal display

Move the cursor to scroll the display area.
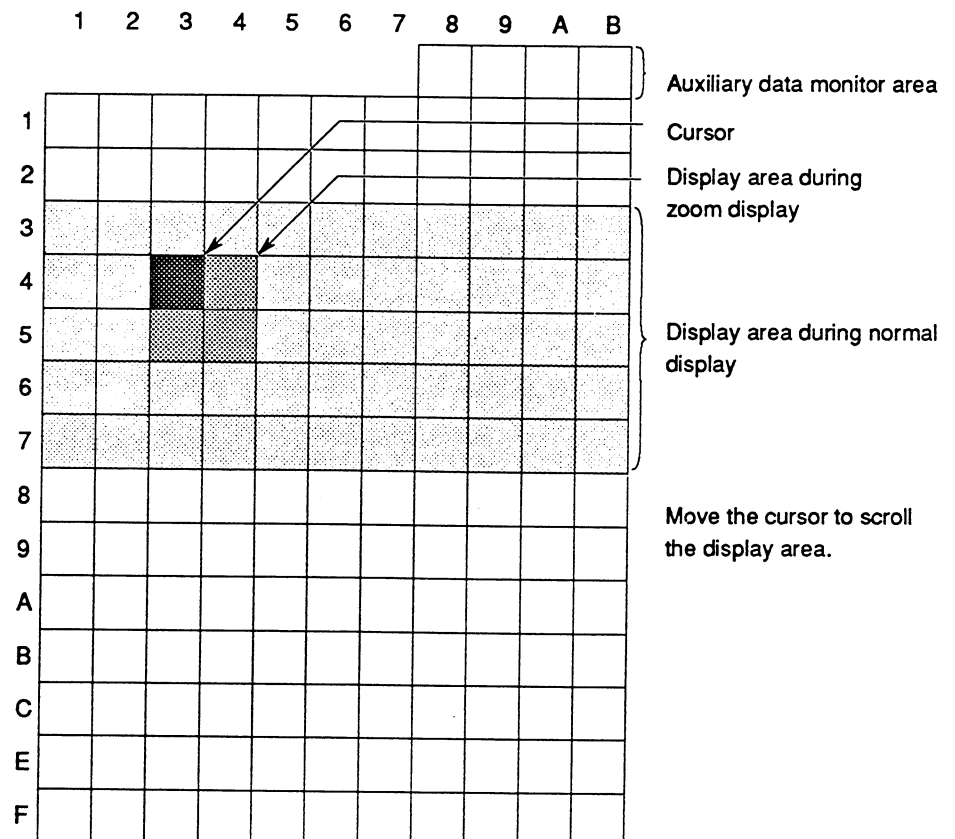
9. The Monitor Mode

9.2
Monitoring a page
on-line

This mode displays the designated page of the program. If the EX is in the RUN state, the execution status of the program is displayed in a power-flow. Instead of data decided after each scan, the data which is decided at the point of execution of each instruction is displayed. In this way, the on-line page monitor greatly simplifies debugging.

| BLK |
| MON |

Specify the Monitor mode.

```
┌─────────────────────────┐
│  0 0 1 ▨MON●            │
│      0 0 1              │
│                        │
│                        │
│                        │
│                        │
└─────────────────────────┘
```

| ERR |
| 2 |

Specify the page No.

```
┌─────────────────────────┐
│  0 0 1 ▨MON●            │
│      0 0 2              │
│                        │
│                        │
│                        │
│                        │
└─────────────────────────┘
```

| EXE |

(Definition)

```
┌─────────────────────────┐
│  0 0 2 ▨MON●            │
│                        │
│ 1  ┤├┤├─┤ ┌──┐────●    │
│ 2  ├■                  │
│ 3  ├                   │
│ 4  ├                   │
└─────────────────────────┘
```
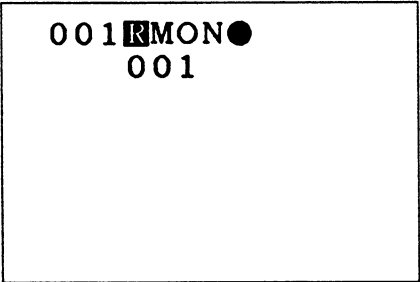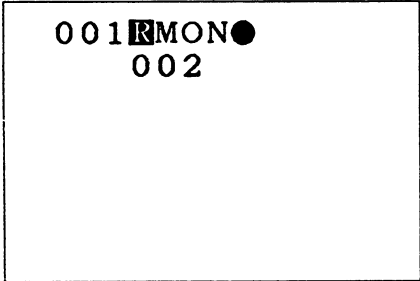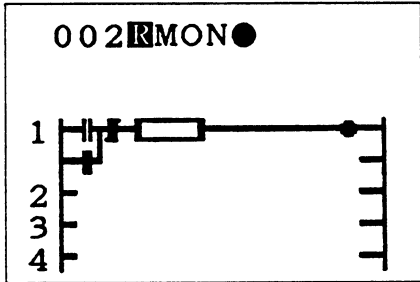
In addition to the method for specifying page numbers shown above, the cursor keys can be used.
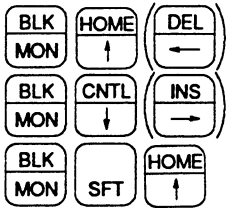
| BLK | HOME | DEL |
| MON | ↑ | ← | Monitor the previous page.

| BLK | CNTL | INS |
| MON | ↓ | → | Monitor the next page.

| BLK | | HOME |
| MON | SFT | ↑ | Monitor the first page.

[ZOOM]

Enter the zoom mode.

```
002RMON●

      1        2
   ┌─┤ ├──┬──┤/├────┐
  1│  X000 │  X001  │
   │       │        │
   └─┤ ├───┘        │
      Y040
```

[ZOOM]
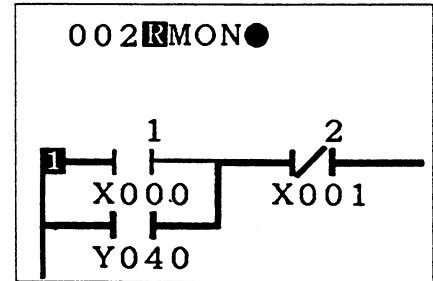
Return to the normal mode.

```
002RMON●

1 ├┤├─■─▭──────●
2 ├
3 ├
4 ├
```
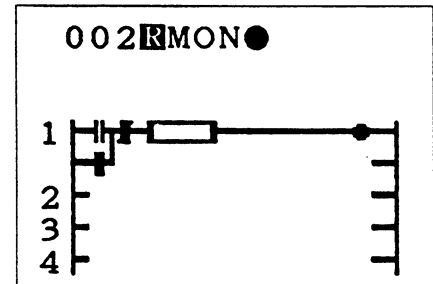
• Monitoring the execution state is valid from the start of a program to the END instruction.

• Vertical connections are not displayed in a power-flow in the normal display mode.

9.3
Using the auxiliary data monitor area

Up to four devices or registers can be registered in the auxiliary data monitor area to monitor their ON/OFF state or their present value. Data can also be set directly in the registered devices and registers.

NOTE ▽▲▽   The values displayed in the auxiliary monitor area show the data after each scan.

9.3.1
Registering devices and registers

To register a device or register, enter the page monitor mode and position the cursor in the auxiliary data monitor area.

```
                              ┌─┬─┬─┬─┐
                              └─┴─┴─┴─┘ ←┐
1 ┤├┤├┤├┤├─┬┤├┤├┤├┤├┤├      ○   │
          │                         │
  ┤├┤├─────┘                         │
2 ┤├┤├──┤  ▭  ├──────────────────────┘
  ∼                           ∼
```

Auxiliary data monitor area (It is possible to register up to 4 devices and/or registers.)

Move the cursor to the auxiliary data monitor area.

```
001RMON●

         ■
1 ┤├┤├┤├┼┤├           ─○┤
  ┤├┤├┤├
2 ┤├┤ ┌──┐              ○┤
3 ┤  ┤├┌──┐            ○┤
```

DSET / STS

Press the Status key.

```
001RMON●STS

         ■
1 ┤├┤├┤├┼┤├           ─○┤
  ┤├┤├┤├
2 ┤├┤ ┌──┐              ○┤
3 ┤  ┤├┌──┐            ○┤
```

RW / R **SET / 1** **RST / 0**

Specify the device. (R010 in this example)

```
001RMON●STS
        R010

         ■
1 ┤├┤├┤├┼┤├           ─○┤
  ┤├┤├┤├
2 ┤├┤ ┌──┐              ○┤
3 ┤  ┤├┌──┐            ○┤
```

EXE

Registration

```
001RMON●
        R010
          ○
         ■
1 ┤├┤├┤├┼┤├           ─○┤
  ┤├┤├┤├
2 ┤├┤ ┌──┐              ○┤
3 ┤  ┤├┌──┐            ○┤
```
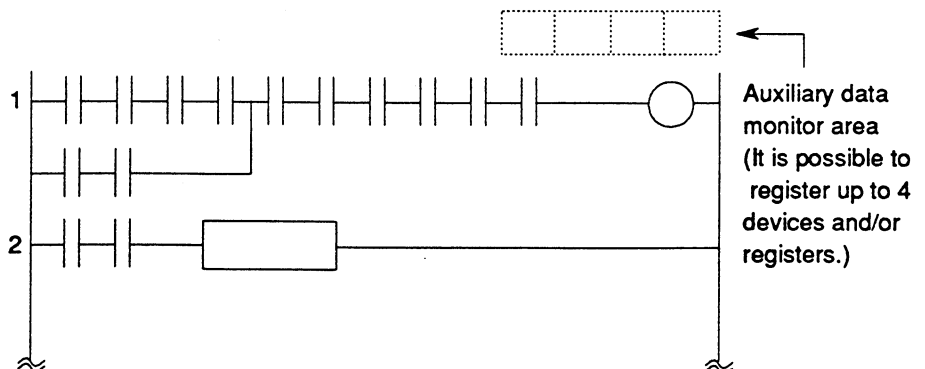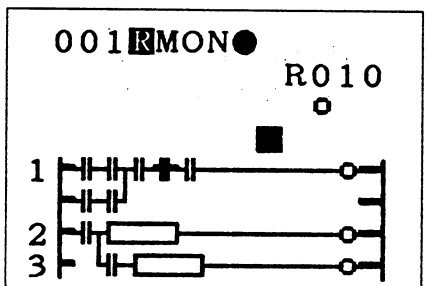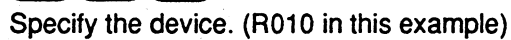
The ON/OFF states of registers are displayed on the screen.

● : ON, ○ : OFF

The registers are registered in the auxiliary data monitor area in the same way as devices.

INS / → Move to the next area.

DSET / STS Press the status key.

SFT **C / T** **SET / 1** **EXE**

In this example, register C01 is registered.

```
001RMON●
            C01
          00000
         ■
1 ┤├┤├┤├┼┤├           ─○┤
  ┤├┤├┤├
2 ┤├┤ ┌──┐              ○┤
3 ┤  ┤├┌──┐            ○┤
```
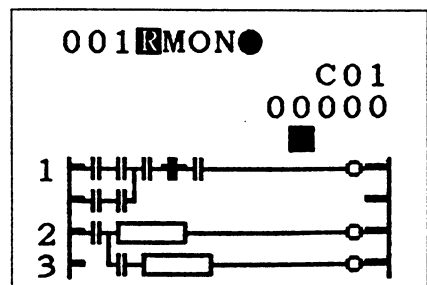
When a register is registered, its present value is displayed on the screen. The value can be displayed in hexadecimal by pressing the [HEX] key.
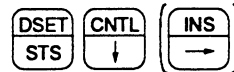
NOTE
▽▲▽

- The registration of devices and registers can be cleared by turning off the power to the EX or by disconnecting the cable connecting the HP to the EX.
- The devices and registers already registered can be stepped forward or backward using the cursor keys.

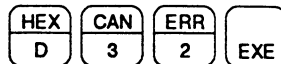| DSET / STS | CNTL / ↓ | INS / → | Register the next device/register. |
| DSET / STS | HOME / ↑ | DEL / ← | Register the previous device/register. |

The double-length registers can be registered and monitored as follows.

Move the cursor to the auxiliary data monitor area

| DSET / STS | SFT | DBL / 5 |

Press the Status and Double keys.

| HEX / D | CAN / 3 | ERR / 2 | EXE |

Specify the double-length register.
(D0032· D0033 in this example)

NOTE
▽▲▽
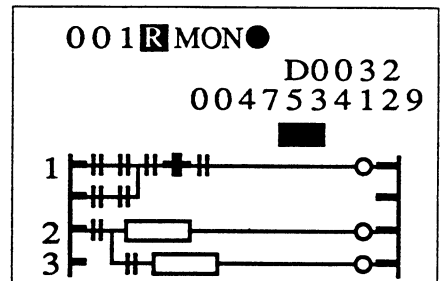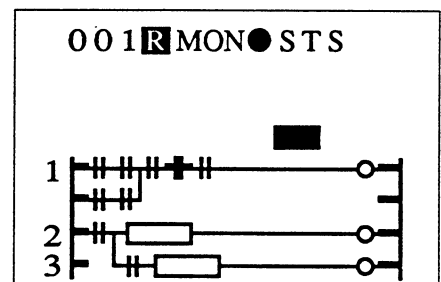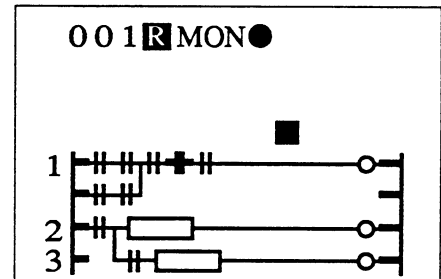
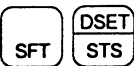When the cursor is on the right-end column of the auxiliary data monitor area, the double-length register cannot be registered.
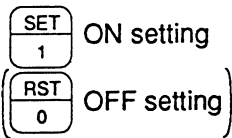
9.3.2
Setting data

Data can be set in the devices and registers registered in the auxiliary data monitor area. This is possible even if the EX is in the RUN mode. Changing the preset value of the timer and counter is explained here. Below is a description of 1) setting devices ON/OFF, 2) setting the values of registers, and 3) changing the preset values of timers and counters.

Setting devices ON/OFF

Position the cursor on the device registered in the auxiliary data monitor area.

```
001RMON●
            R010
             ○
            ■
1  ├┤┤─┤┤┤┤─┼─┤┤────────○ ┤
   ├┤┤─┤┤┘
2  ├┤┤─┤   ▭────────────○ ┤
3  ├─ └┤┤── ▭──────────○ ┤
```

[SFT] [DSET/STS]

Instruct data setting.

```
001RMON●DSET
    ○       R010
            ■
1  ├┤┤─┤┤┤┤─┼─┤┤────────○ ┤
   ├┤┤─┤┤┘
2  ├┤┤─┤   ▭────────────○ ┤
3  ├─ └┤┤── ▭──────────○ ┤
```

[SET/1] ON setting

([RST/0] OFF setting)

```
001RMON●DSET
        ●       R010
            ■
1  ├┤┤─┤┤┤┤─┼─┤┤────────○ ┤
   ├┤┤─┤┤┘
2  ├┤┤─┤   ▭────────────○ ┤
3  ├─ └┤┤── ▭──────────○ ┤
```

[EXE]

Write into the EX.

```
001RMON●
            R010
             ●
            ■
1  ├┤┤─┤┤┤┤─┼─┤┤────────○ ┤
   ├┤┤─┤┤┘
2  ├┤┤─┤   ▭────────────○ ┤
3  ├─ └┤┤── ▭──────────○ ┤
```

NOTE
▽▲▽

Devices can be set ON/OFF even if the EX is in the RUN mode. Program execution results are given priority for the device state. The input state is given priority for external input devices. It is useful to combine setting the device state with the force function, described below.
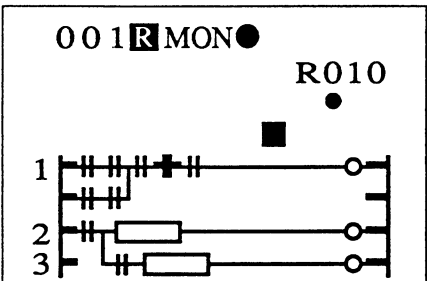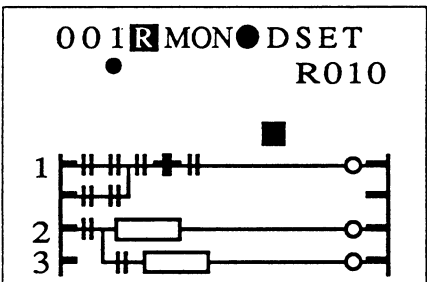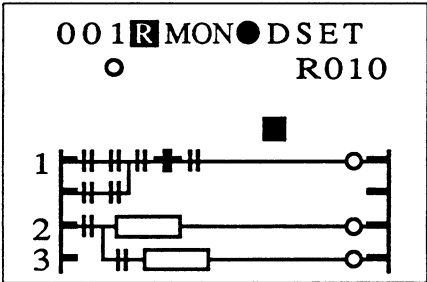
Setting the values of registers

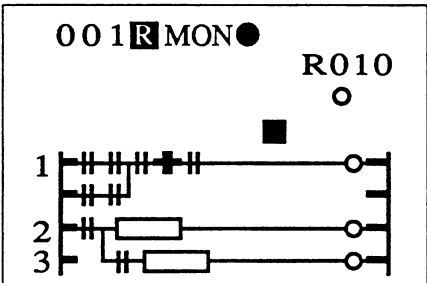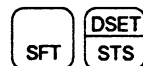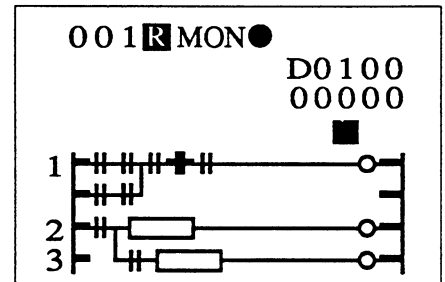Position the cursor on the registered register in the auxiliary data monitor area.

```
001 Ⓡ MON●
              D0100
              00000
              ■
1 ┤├─┤├─┤├─╋─┤├────────○
  ┤├─┤├
2 ─┤├──▭────────────○
3 ─┤├──┤├──▭─────────○
```

[SFT] [DSET/STS]

Instruct data setting.

```
001 Ⓡ MON●DSET
00000       D0100
              ■
1 ┤├─┤├─┤├─╋─┤├────────○
  ┤├─┤├
2 ─┤├──▭────────────○
3 ─┤├──┤├──▭─────────○
```

[ALL/CLR] [SET/1] [ERR/2] [CAN/3]
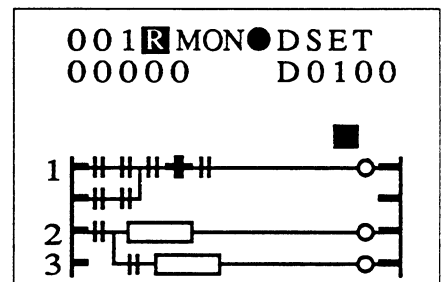
Set the value, 123 in this example.

```
001 Ⓡ MON●DESET
00123       D0100
              ■
1 ┤├─┤├─┤├─╋─┤├────────○
  ┤├─┤├
2 ─┤├──▭────────────○
3 ─┤├──┤├──▭─────────○
```

[EXE]

Write into the EX.

```
001 Ⓡ MON●
              D0100
              00123
              ■
1 ┤├─┤├─┤├─╋─┤├────────○
  ┤├─┤├
2 ─┤├──▭────────────○
3 ─┤├──┤├──▭─────────○
```

NOTE

▽▲▽
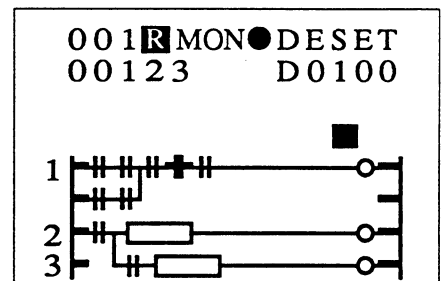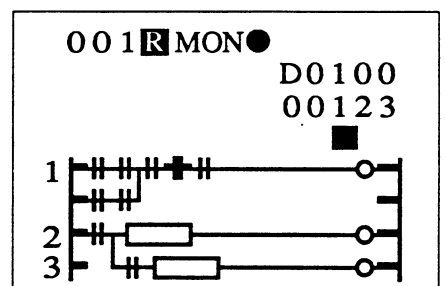
- To set hexadecimal values, press the [HEX] key before entering the values.
- The values of the registers can be set even if the EX is in the RUN mode. Note, however, that execution results are given priority.

Setting the values of double-length registers

Position the cursor on the registered double-length register in the auxiliary data monitor area.

```
001 R MON●
              D0032
     0047534129
        ■
1
2
3
```

SFT DSET/STS

Instruct data setting.

```
001 R MON●DSET
00475      D0032
34129
        ■
1
2
3
```

ALL/CLR ERR/2 FRC/7 4 MCR/9
JCR/8 CAN/3 REL/6
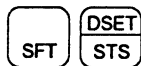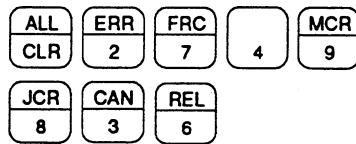
Set the value, 2749836 in this example.

```
001 R MON●DESET
00027      D0032
49836
        ■
1
2
3
```

EXE

Write into the EX.

```
001 R MON●
              D0032
     0002749836
        ■
1
2
3
```
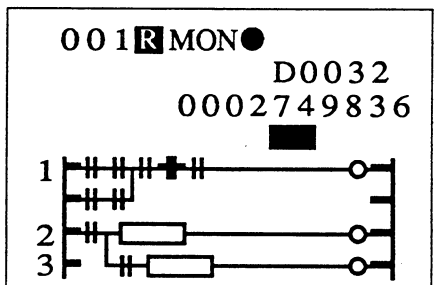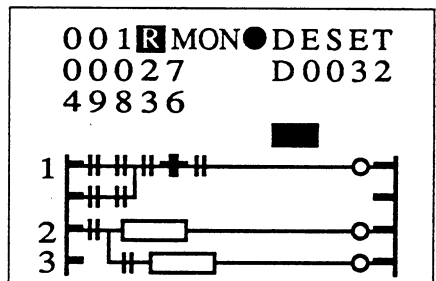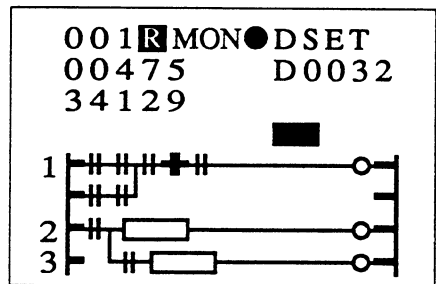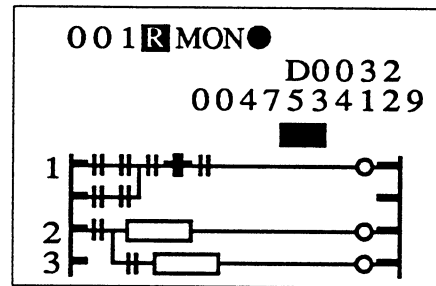
Changing the preset values of timers and counters

The preset values of timers and counters can be changed while the EX is in RUN, even if the preset values are used immediates. This function does not use the auxiliary data monitor area.

Position the cursor on the preset value to be changed.
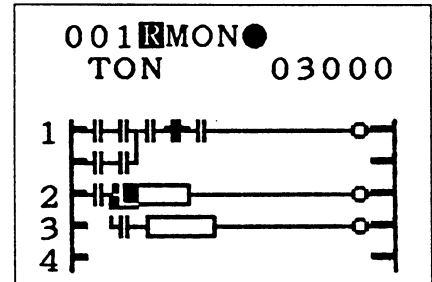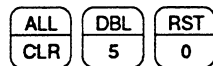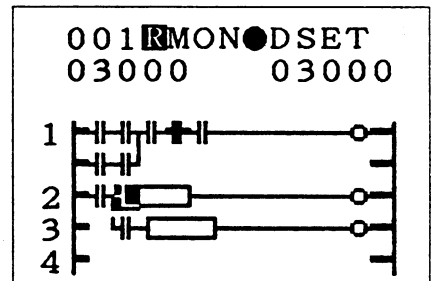
```
001█MON●
   TON      03000
```

[SFT] [DSET/STS]

Instruct data setting.

```
001█MON●DSET
 03000      03000
```

[ALL/CLR] [DBL/5] [RST/0]

Enter the preset value.

```
001█MON●DSET
 00050      03000
```

[EXE]

Write into the EX.

```
001█MON●
   TON      00050
```
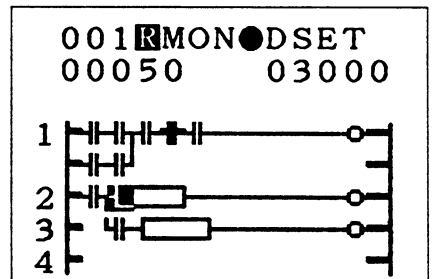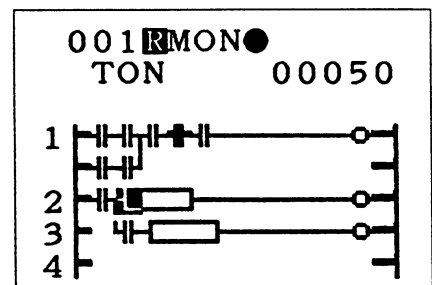
9. The Monitor Mode

The programmed elements stored in the EX can be searched for specified instructions, operands, or combinations of both. The search is performed as follows:

- The search is performed from where the cursor is positioned to the end of the program.
- When the specified object is found, the cursor is positioned at the object. The HP displays CONTINUE > [SCH].
- To continue searching, press the [SCH] key again. The search then continues in the subsequent program.
- If the end of the program is reached and the object is not found, the HP displays SEARCH END. To restart the search from the top of the program, press the [SCH] key again.

9.4.1
Searching instructions

The instruction search is performed by specifying only instruction symbols.
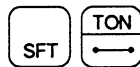
Enter the instruction, ON delay timer in this example.
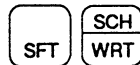
Execute search.
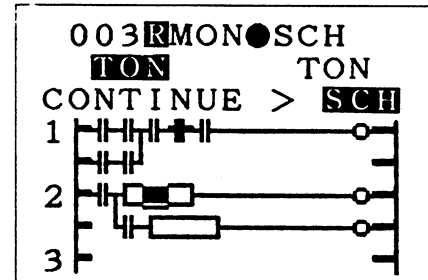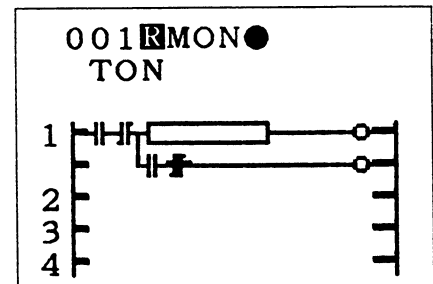
The object being searched is displayed in reverse in the data buffer area, and the search is executed. The HP displays EXECUTING during the search.

```
[FUN] [SET 1] [EXE]
```
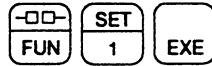
Enter the instruction, FUN 1 in this
example.

```
001RMON●SCH
  K→W

1
2
3
4
```

```
[SFT] [SCH WRT]
```

Execute search.

```
005RMON●
   K→W      K→W
CONTINUE > SCH
1
2
3
4
```
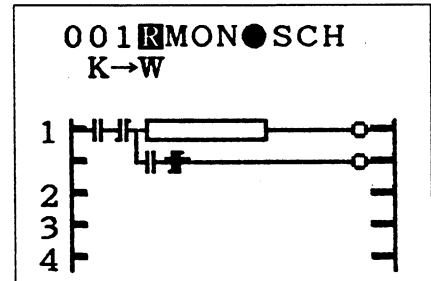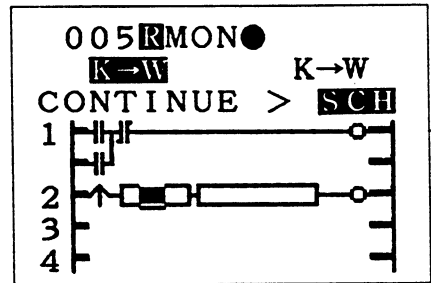
**9.4.2
Searching operands**

The operand search is performed by specifying operands (devices and
registers).

```
[RW R] [SS A]
```
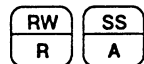
Enter the operand, device R00A in
this example.

```
001RMON●
          R00A

1
2
3
4
```

```
[SFT] [SCH WRT]
```

Execute search.

```
003RMON●SCH
  ◆        R00A
CONTINUE > SCH
1
2
3
```

The object being searched is displayed in reverse in the data buffer area, and
the search is executed. The HP displays EXECUTING during the search.

9.4.3
Searching instructions with operands

The search is performed by specifying a combination of instruction and operand.

END YW ERR RST
-O- Y 2 0

(Example of coil Y020)
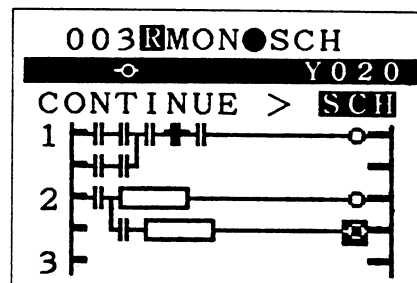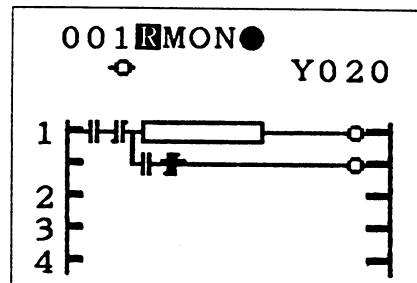
```
┌──────────────────────┐
│ 0 0 1 RMON●          │
│        -O-      Y 0 2 0 │
│                       │
│ 1 ┤├┤├┤ ▭        ○    │
│    ┤├▪                ○ │
│ 2 ┤                   │
│ 3 ┤                   │
│ 4 ┤                   │
└──────────────────────┘
```

SFT SCH/WRT

Execute search.

```
┌──────────────────────┐
│ 0 0 3 RMON●SCH       │
│    -O-         Y 0 2 0 │
│ CONTINUE > SCH        │
│ 1 ┤├┤├┤├┤▪┤├     ○    │
│    ┤├┤├               │
│ 2 ┤├ ▭          ○    │
│    ┤├ ▭         ▣    │
│ 3 ┤                   │
└──────────────────────┘
```

The object being searched is displayed in reverse in the data buffer area, and the search is executed. The HP displays EXECUTING during the search.

9.4.4
Searching using the cursor

The search is performed by positioning the cursor on the object to be searched.

Move the cursor to the object to be searched for.

```
┌──────────────────────┐
│ 0 0 1 RMON●          │
│     ┤├          X 0 2 4 │
│                       │
│ 1 ┤├┤├┤ ▭        ○    │
│    ▪▪▪                ○ │
│ 2 ┤                   │
│ 3 ┤                   │
│ 4 ┤                   │
└──────────────────────┘
```

SFT SCH/WRT

Execute search.

```
┌──────────────────────┐
│ 0 0 7 RMON●SCH       │
│     ┤├          X 0 2 4 │
│ CONTINUE > SCH        │
│ 1 ┤├┤├┤├▪┤├     ○    │
│       ┤├┤├┤├     ○    │
│ 2 ┤├┤├┤├┤├      ○    │
│       ┤├┤├             │
│ 3 ┤□                  │
└──────────────────────┘
```
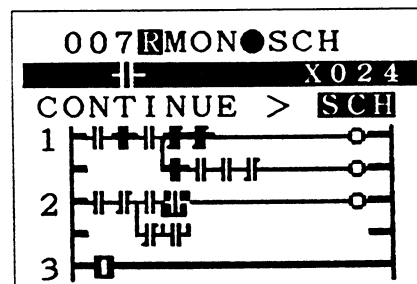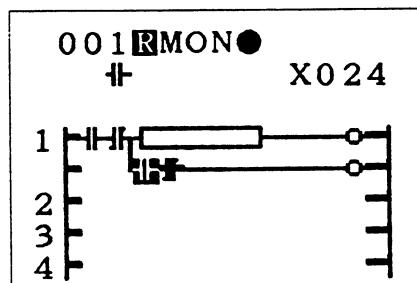
9.5
The force functions

The force functions maintain the state of the designated device independently of the external input or the state of program execution. This function enables the program to be debugged efficiently and the system to be checked easily. The following force functions are available:

1. Forced coil

   The state of the coil is maintained independently of the state of the program containing the coil.

2. Forced input device

   The state of the input device is maintained independently of the external input.

NOTE

$\bigtriangledown\blacktriangle\bigtriangledown$

- The force functions forcibly maintain the present state of the devices. The data setting function is used to freely set the device ON/OFF states. See Section 9.3.2, Data setting, and Section 10.2, The data setting function.
- The force specifications and the states of the forced devices are maintained even after turning the power to the EX off and on again.
- It is possible to force a register by forcing all 16 devices in the register.
- The FORCE CLEAR command is used to release the forced designation for all forced devices and registers simultaneously. See Section 6.7, Force clear, for details.

9.5.1
Forcing coils

To force a coil, move the cursor to the required coil, and perform the following operations:

Move the cursor to the coil, then enter

[SFT] [FRC 7]

to specify the coil as forced.

```
┌─────────────────────┐
│ 004▨MON●FRC         │
│  ⼗O          R03E   │
│                     │
│ 1 ┤┤┤├──────────█─┤ │
│   ┤┤├                │
│ 2 ┤┤┤┤┤├────────○─┤ │
│ 3 ┤                 │
│ 4 ┤                 │
└─────────────────────┘
```
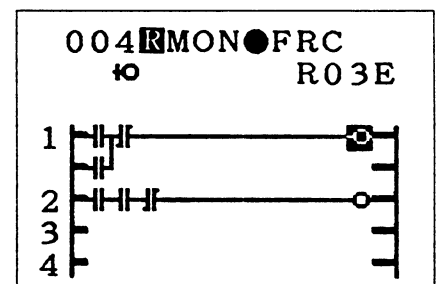
The force coil symbol is displayed in the data buffer area.

[EXE]

(Definition)

```
┌─────────────────────┐
│ 004▨MON●            │
│  ⼗O          R03E   │
│                     │
│ 1 ┤┤┤├──────────▣─┤ │
│   ┤┤├                │
│ 2 ┤┤┤┤┤├────────○─┤ │
│ 3 ┤                 │
│ 4 ┤                 │
└─────────────────────┘
```
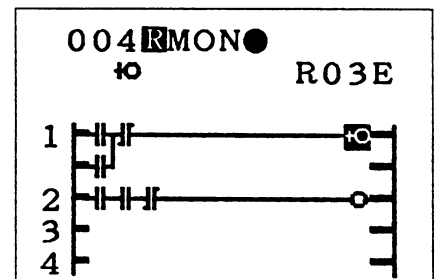
The symbol for the coil in the ladder circuit changes to that of a forced coil. Press the force release key [REL] to release the force designation.

Move the cursor to the coil, then enter

[SFT] [REL / 6]

to release the force designation.

```
004RMON●REL
        ◦        R03E
1 ├┤├┤├──────────────◉├
  ├┤├┤
2 ├┤├┤├┤├───────────○├
3 ├
4 ├
```

[EXE]

(Definition)

```
004RMON●
        ◦        R03E
1 ├┤├┤├──────────────◙├
  ├┤├┤
2 ├┤├┤├┤├───────────○├
3 ├
4 ├
```
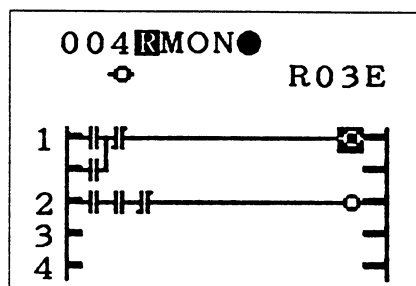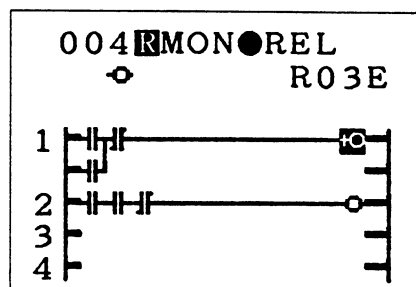
9.5.2 Forcing external input devices

To force an external input device, it is first necessary to register it in the auxiliary data monitor area. (See section 9.3.1, Registering devices and registers, for details.)

Move the cursor to the registered device in the auxiliary data monitor area.

```
004RMON●FRC
              X00B
                ○
               ■
1 ├┤├┤├─────────────○├
  ├┤├┤
2 ├┤├┤├┤├───────────○├
4 ├
```

[SFT] [FRC / 7]

Specify Force.

```
004RMON●
              X00B
                ○
               ■
1 ├┤├┤├─────────────○├
  ├┤├┤
2 ├┤├┤├┤├───────────○├
3 ├
```

[EXE]
(Definition)

```
┌─────────────────────────┐
│  004⊠MON●               │
│              x00B       │
│                 ○       │
│                 ■       │
│  1 ╢╟╢╟─────────────○┤  │
│    ╢╟                   │
│  2 ╢╟╢╟─────────────○┤  │
│  3 ╟                    │
└─────────────────────────┘
```
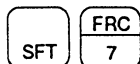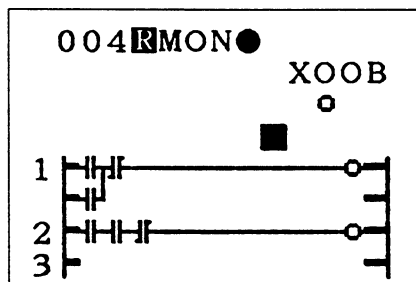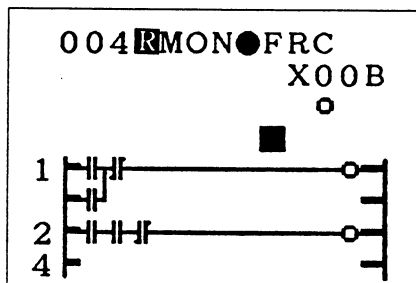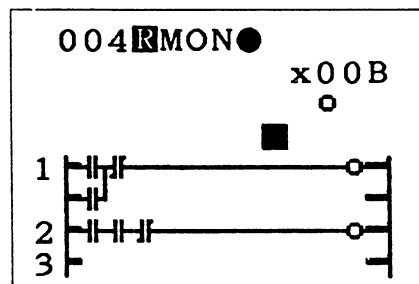
To indicate that a device is forced, its symbol is changed from an upper-case letter, **X**, to a lower-case letter, **x**.

NOTE

▽▲▽

If a register contains any forced external input devices, its symbol is also changed from upper-case, **XW**, to lower-case, **xW**. All the register symbols are changed to lower-case if all the devices in the register are forced.

The forced designation is released as follows.

Move the cursor to the device in the auxiliary data monitor area then enter

[SFT] [REL 6]

to release the force designation.

```
┌─────────────────────────┐
│  004⊠MON●REL            │
│              x00B       │
│                 ○       │
│                 ■       │
│  1 ╢╟╢╟─────────────○┤  │
│    ╢╟                   │
│  2 ╢╟╢╟─────────────○┤  │
│  3 ╟                    │
└─────────────────────────┘
```

[EXE]
(Definition)

```
┌─────────────────────────┐
│  004⊠MON●               │
│              X00B       │
│                 ○       │
│                 ■       │
│  1 ╢╟╢╟─────────────○┤  │
│    ╢╟                   │
│  2 ╢╟╢╟─────────────○┤  │
│  3 ╟                    │
└─────────────────────────┘
```
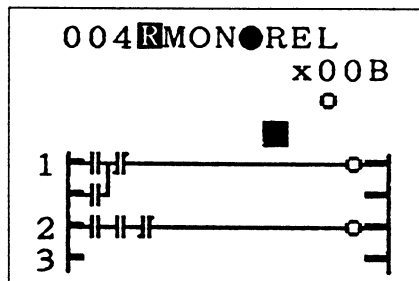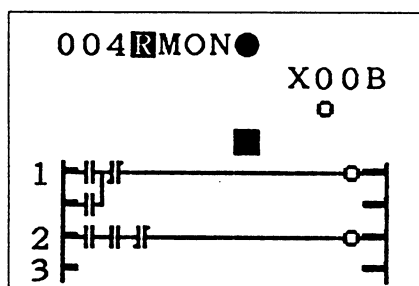
When a device is released from the forced designation, its symbol is restored to an upper-case letter.

9.5.3
Forcing link devices

The method for forcing link devices (Z) differs depending on the setting of the TOSLINE-30 data link system. The devices set to TALKER (i.e., output) are forced using the method for forcing coils. The devices set to LISTENER (i.e., input) are forced using the method for forcing external input devices.

10.1 Displaying registers or devices in a block

In the block monitor mode, information of several registers or devices is monitored simultaneously. This mode displays the present value of 4 registers in succession or the ON/OFF state of 32 devices in succession.

To display registers or devices in a block, first select the block monitor mode.

| SFT | BLK MON |

Enter the Block Monitor mode.

```
        ®BLK●
XW00
KEY  IN  ST.  NO.
  REG.      VALUE
  XW00     04434
  XW01     11450
  XW02     00000
  XW03     00000
```

This displays the present values of addresses 00 to 03 of the external input and output registers (XW/YW). Enter the registers or devices to be monitored from the keypad.

| HEX D | 5 | RST 0 |

Enter the first register to be monitored, data register D0050 in this example.

```
        ®BLK●
D0050
KEY  IN  ST.  NO.
  REG.      VALUE
  XW00     04434
  XW01     11450
  XW02     00000
  XW03     00000
```

| EXE |

(Definition)

```
        ®BLK●
D0050
KEY  IN  ST.  NO.
  REG.      VALUE
  D0050    00128
  D0051    02048
  D0052    00064
  D0053    08192
```

This displays the data for the four registers, starting from the designated register. Press the up and down cursor keys to scroll the data for the previous and subsequent registers.

NOTE To change the display of the present register values from decimal to hexadecimal or vice versa, press the [HEX] key.

10. The Block Monitor Mode

To display the values of double-length registers, press the [DBL] key.

[SFT] [DBL 5]

Set the double-length display.

```
      Ⓡ B L K ●
   D 0 0 5 0
KEY  IN  ST.   NO.
    REG.     VALUE
   D 0 0 5 0 · D 0 0 5 1
            0 0 0 8 3 9 0 6 5 6
   D 0 0 5 2 · D 0 0 5 3
            0 0 0 4 2 1 2 4 9 6
```

[SFT] [DBL 5]

Return the normal display.

```
      Ⓡ B L K ●
   D 0 0 5 0
KEY  IN  ST.   NO.
    REG.     VALUE
   D 0 0 5 0     0 0 1 2 8
   D 0 0 5 1     0 2 0 4 8
   D 0 0 5 2     0 0 0 6 4
   D 0 0 5 3     0 8 1 9 2
```

Let's input the device to be monitored with the following key operations.

[XW X] [CAN 3]
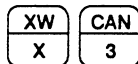
```
      Ⓡ B L K ●
   X W 0 0        X 0 0 3
KEY  IN  ST.   NO.
    REG.     VALUE
   X W 0 0   ○ ○ ○ ● ○ ○ ○ ●
             ○ ● ○ ● ▣ ○ ● ●
   X W 0 1   ○ ○ ● ○ ● ● ○ ○
             ● ○ ● ● ● ○ ● ○
```

The register containing the specified device and the next register will be displayed as bits in the device display mode.

●: ON   ○: OFF

The device address at the cursor position is displayed on the screen. (X003 in the above example.) Press the cursor keys to check the other devices positioned to the left, right, above, and below. The display automatically scrolls, and the data for the registers before and after are displayed if the cursor moves beyond the the range of the screen.

NOTE
▽▲▽

The layout of the device display is as follows:

XW00 F E D C B A 9 8
       7 6 5 4 3 2 1 0

10.2
The data setting
function

Data can be set in registers or in devices in the block monitor mode. This is possible even when the EX is in the RUN mode.

Display the devices and registers in which data is to be set, then press the [EDIT] key to set up the data setting mode.

| SFT |

Enter the Edit mode.

```
        🅡BLK●EDIT

   KEY  IN  DATA
        REG.    VALUE
        D0030   ▐06472▌
        D0031   00378
        D0032   00005
        D0033   03003
```

The HP displays EDIT to indicate that the data setting mode has been set up.

Set the value in the register.

| ALL/CLR | SET/1 | ERR/2 | CAN/3 | 4 | EXE |
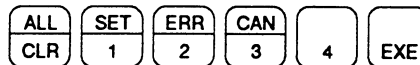
```
        🅡BLK●EDIT

   KEY  IN  DATA
        REG.    VALUE
        D0030   01234
        D0031   ▐00378▌
        D0032   00005
        D0033   03003
```

The cursor moves to the next register position. It is possible to set the data for 16 registers in succession as a block.

NOTE
▽▲▽   To set hexadecimal data, press the [HEX] key,

Write the set data into the EX.
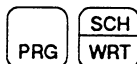
| PRG | SCH/WRT |

Write into the EX.

```
        🅡BLK●EDIT

   KEY  IN  DATA
        REG.    VALUE
        D0030   ▐01234▌
        D0031   00378
        D0032   00005
        D0033   03003
```

NOTE
▽▲▽
• The data setting function can be used even if the EX is in the RUN state. Note, however, that the program execution results have priority.
• To set the data into the double-length registers, first set the double-length display, then press the [EDIT] key.

10. The Block Monitor Mode

An example of setting the ON/OFF state of a device is given below.
Display the device whose data is to be set, then press the [EDIT] key.

[SYS / EDIT]

Enter the Edit mode.

```
       RBLK●EDIT
               R10B
KEY IN DATA
   REG.    VALUE
   RW10  ●●○●▣○○●
         ○●○●○●○○
   RW11  ○○●●○●○●
         ●○○●●○●○
```

The HP displays EDIT to indicate that the data setting mode is set up.

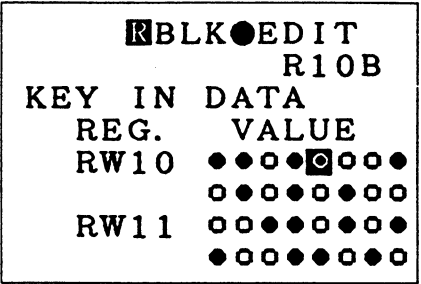Move the cursor to the device whose ON/OFF state is to be set, and enter the data using the numeric keys [0] and [1].

[RST / 0]   (OFF setting)

[SET / 1]   (ON setting)

```
       RBLK●EDIT
               R10A
KEY IN DATA
   REG.    VALUE
   RW10  ●●○●●▣○●
         ○●○●○●○○
   RW11  ○○●●○●○●
         ●○○●●○●○
```
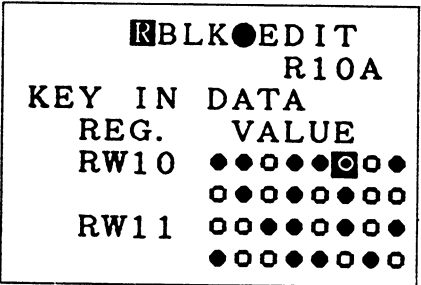
It is possible to set 16 registers in succession as a block.
Next, write the data into the EX.

[PRG] [SCH / WRT]

```
       RBLK●EDIT
               R10F
KEY IN DATA
   REG.    VALUE
   RW10  ▣●○●●○○●
         ○●○●○●○○
   RW11  ○○●●○●○●
         ●○○●●○●○
```
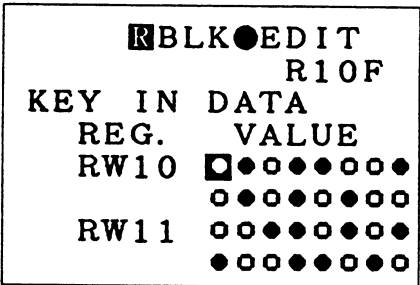
NOTE

The data setting function can be used even if the EX is in the RUN mode. Note, however, that the input state and program execution results are given priority.

**A.
Specifications**

| Item	Specifications
Power supply	Supplied by the EX 0.2 A (5 V ± 5%) or less
Operating temperature	0 to 40 °C
Storage temperature	-20 to 60 °C
Ambient humidity	20 to 90 %RH (No condensation)
Resistence to vibration	16.7 Hz - 3 mm p-p, 30 minutes in the X, Y, and Z directions
Resistence to shock	10 G, 3 times each in the X, Y, and Z directions
Processor	Built-in microprocessor
Display	Full-dot liquid crystal display (LCD)
Keyboard	Membrane keyboard with click action 42 keys, 7 rows by 6 columns
Data communication with EX	Serial transmission (current loop) Baud rate: 4800 bps Two-meter cable supplied as an accessory
Ladder diagram display (Monitor mode)	Normal mode: 5 lines x 11 columns Zoom mode: 2 lines x 2 columns
Functions — Program edit	On-page editing: Element change Column insertion/deletion Line insertion/deletion Page-unit editing: Page writing/insertion/deletion On-line editing is possible.
Functions — Monitor	Ladder circuit on-line monitor (power flow) Block monitor (4 registers/32 devices)
Functions — Debugging, simulation	Force, data setting, and search functions
Functions — Control commands	Input and output allocation, HALT, RUN, forced RUN, program check, memory clear, force clear, error information clear, error reset, and EEPROM write
Buzzer	Key entry tone, with ON/OFF control

**B.
Dimensions**

95 mm

28 mm

170 mm
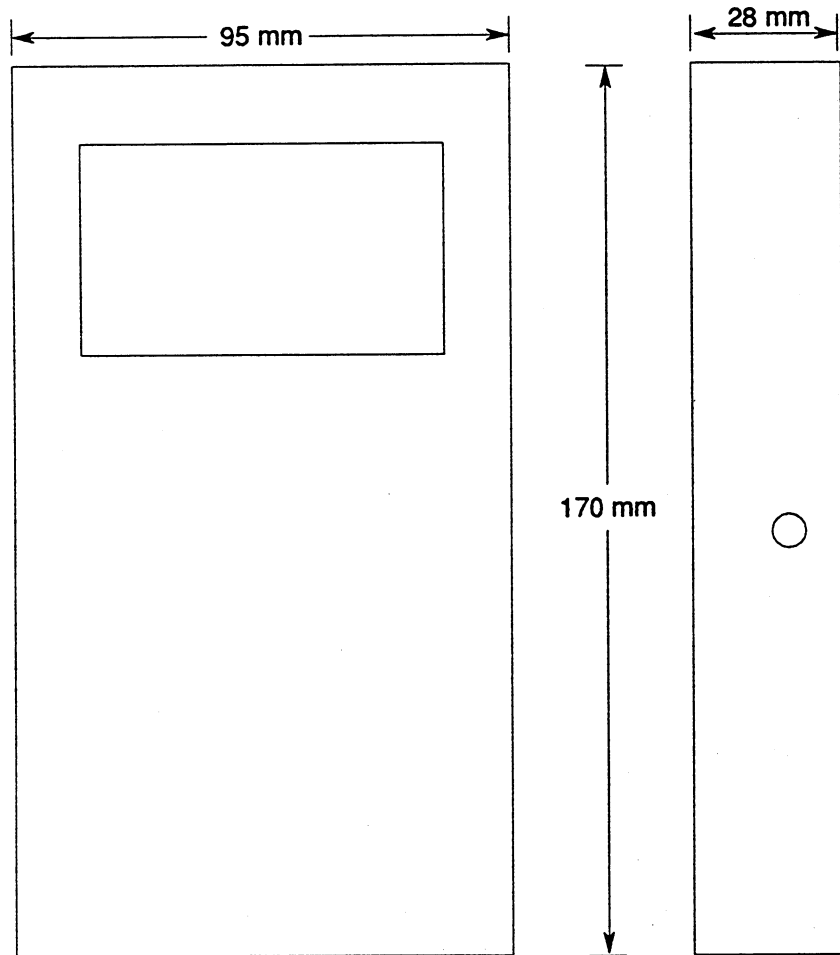
C.
Error messages

Key operation errors

Message	Meaning
! COMBINATION	The card type specified when editing the I/O card allocation table was illegal.
! I/O UNMATCH	The I/O registration status does not correspond to the modules mounted.
! I/P IMPOSSIBLE	The specified instruction cannot be written at the present position.
! ILLEGAL CMD	An illegal command key was entered.
! ILLEGAL CMD NO.	The control command No. is illegal.
! ILLEGAL FUN NO.	An illegal function number was entered.
! ILLEGAL KEY	A key that cannot be accepted at present was entered.
! ILLEGAL PAGE	An attempt was made to set an illegal page No.
! ILL. POSITION	The item specified is invalid when the cursor is at its present position.
! IMPOSSIBLE FRC	An attempt was made to force a device while the display is abnormal.
! LIMIT OVER	The set value or register/device No. exceeds the limit.
! PAGE OVER	The page range 1 to 999 was exceeded when scrolling through the pages.
! TARGET NG	The target specified for a search is illegal.
! V - LINE IMPOS.	The vertical connection key cannot be entered at the present position.

Communication errors

Message	Meaning
! COMM. TIMEOUT	No response is received during communication.
! HP COMM. ERROR	A communication error was detected by the HP. (Parity, BCC, etc.)

HP hardware error

Message	Meaning
! ROM BCC ERROR	The ROM in the HP is faulty.
! RAM ERROR	The RAM in the HP is faulty.

Appendices

Compilation errors

Message	Meaning
! BACK CURRENT	A back current error exists in the ladder diagram.
! BRANCH STACK	Divergence connection trouble
! COLUMN OVER	The number of columns exceeds 11.
! CONTACT/PULSE	There is an error in the contact instruction connecting the right bus bar.
! ILLEGAL INST	An illegal instruction was detected by the EX.
! ILL. OPERAND	Operand specification error
! JOIN STACK	Convergence connection trouble
! L-BUS CONN. ERR	There is an error in the step sequence output (STOP) connecting the left power rail.
! LEFT-CONN. ERR.	There is an error in the left connection of the instruction.
! LINE OVER	The number of lines exceed 14.
! MCR / JCR / END	The MCR/JCR/END instructions are not connected to the left power rail.
! MCS / JCS / ERROR	The MCS/JCS instructions are not located on the last line of a rung.
! NO OPERAND	No operand is specified.
! OPEN CIRCUIT	Open connection line error
! OPR LIMIT OVER	A specified constant, such as a register No., exceeds the limit.
! OVER 32 STEP	The number of instructions in a rung exceeds 32 steps.
! PAGE FULL	The number of instructions in a page exceeds 154 steps.
! SHORT CIRCUIT	A circuit contains a short circuit.
! TURN UP SYMBOL	Line connector error

Error responses from the EX

Message	Meaning
! CMT/RAM TYPE	The EX received an unacceptable command.
! CNTL INST.	On-line program changes are not valid because the number or order of control instructions is changed.
! ERROR DOWN	The EX is in the error state, and cannot accept commands.
! ERROR (PROM)	An attempt was made to write a program while the EEPROM was mounted or in the protect state.
! EX COMM ERROR	A communication error was detected by the EX.
PAGE nnn RUNG n STEP nn ! ILLEGAL PAGE	The required page does not exist.
I / O nnnnn (nn) ! I/O NO. ERROR	Either the register No., the size of the specified data, or the register information is incorrect.
I / O nnnnn (nn) ! I/O NO SYNC	An I/O module did not respond.
I / O nnnnn (nn) ! I/O UNMATCH	A mismatch was found between I/O allocation and the module mounted.
PAGE nnn RUNG n STEP nn ! MC/JC ERROR	The Master Control and/or Jump instruction were not programmed correctly.
! MEMORY ERROR	There is trouble in the program.
! MEMORY FULL	The memory was found to be full immediately before a page was written or inserted.
! MODE ERROR	The received command is invalid when the EX is in the current mode.
PAGE nnn RUNG n STEP nn ! NO END ERROR	The END instruction could not be found when the program was checked at the start of execution.
PAGE nnn RUNG n STEP nn ! OPERAND ERROR	The I/O allocation table does not correspond to the operands used in the program.

EX errors registered as error history

Message (Displayed on the System Information screen)	Semantics
STATUS : ! BATTERY FAIL	A low battery voltage was detected during initialization.
STATUS : ! CPU ERROR	A status error of a bit processor or peripheral LSI was detected.
STATUS : ! DC POWER FAIL	The DC power voltage for the EX dropped.
STATUS : ! E - POWER FAIL	The power supply voltage of the expansion unit dropped.
PAGE : nnn - n STEP : nn STATUS : ! ILLEGAL INST.	An illegal instruction was detected during execution.
STATUS : ! I/O BUS ERROR	I/O bus trouble was detected during initialization or immediately before block input or output.
I / O : nnnnn REG. NO. : nn STATUS : ! I/O NO SYNC	An I/O module did not respond.
I / O : nnnnn REG. NO. : nn STATUS : ! I/O UNMATCH	A mismatch was found between I/O allocation and the module mounted.
PAGE : nnn - n STEP : nn STATUS : ! MC/JC ERROR	A Master Control and/or Jump instruction were not programmed correctly.
STATUS : ! MEMORY ERROR	An error was detected in the program.
PAGE : nnn - n STEP : nn STATUS : ! NO END ERROR	An END instruction could not be found when the program was checked at initialization.
PAGE : nnn - n STEP : nn STATUS : ! OPERAND ERROR	The I/O card allocation table does not correspond to the operand used in the program.
STATUS : ! ROM ERROR	ROM check sum error
STATUS : ! ROM TYP ERROR	ROM cassette size error
STATUS : ! SCAN OVER	The scan time exceeded 200 ms.
STATUS : ! WD - TIMER	The W/D timer could not be reset within the required time (approximately 350 ms).

D.
Guidance messages

Message	Meaning
CNF. > [EXE]/S-[EXE]	Request to enter [EXE] or [SFT][EXE] after confirmation
COMMAND SELECT	Request to select a command No.
COMPLETE	Processing is finished.
CONFIRM > [EXE]	Request to enter [EXE] after confirmation
CONFIRM > [WRT]	Request to enter [WRT] after confirmation
CONTINUE > [SCH]	Request to confirm whether to perform a continuous search
EX CONNECT	Transmission with the EX has been restored to normal.
EXECUTING	An operation is being performed.
KEY IN DATA	Request to set register data when editing in the Block Monitor mode
KEY IN ST. NO.	Request to enter the first register No. to be monitored in the Block Monitor mode
PLEASE [HOME] KEY	Request to enter [HOME]
SEARCH END	The search has reached the end of the program.
SEL. CARD TYPE	Request to select the size and type of the card when editing the I/O card allocation
SELECT FUN NO.	Request to select the function No.
SELECT [INS]/[DEL]	Request to select insert or delete
SEL. [WRT]/[INS]/[DEL]	Request to select write/insert/delete
SET C REGISTER	Request to enter the counter register when editing a program
SET DATA	Request to enter an immediate operand when editing a program
SET DEVICE	Request to enter a device operand when editing a program
SET REG./DATA	Request to enter a register or immediate operand when editing a program
SET REGISTER	Request to enter a register operand when editing a program
SET T REGISTER	Request to enter a timer register when editing a program
SET TABLE SIZE	Request to enter a table size when editing a program

Appendices

E.
Functional differences between EX types

EX250/500 (V2.0 or later)
All functions described in this manual can be performed.

EX250/500 (earlier than V2.0)
The following functions cannot be performed.
*   On-line programming
*   Immediate IN/OUT instructions (FUN96/97)
*   ASCII read/write instructions (FUN98/99)
*   EEPROM write command

The preset value (immediate) of timers/counters can be changed in the RUN mode only when the value is 255 or less.

EX200B
The following functions cannot be performed.
*   On-line programming
*   Immediate IN/OUT instructions (FUN96/97)
*   ASCII read/write instructions (FUN98/99)
*   Changing timer/counter preset value (immediate) in the RUN mode.

EX100
The ASCII read/write instructions (FUN98/99) cannot be performed. All other functions issued by the HP are available.

TOSHIBA