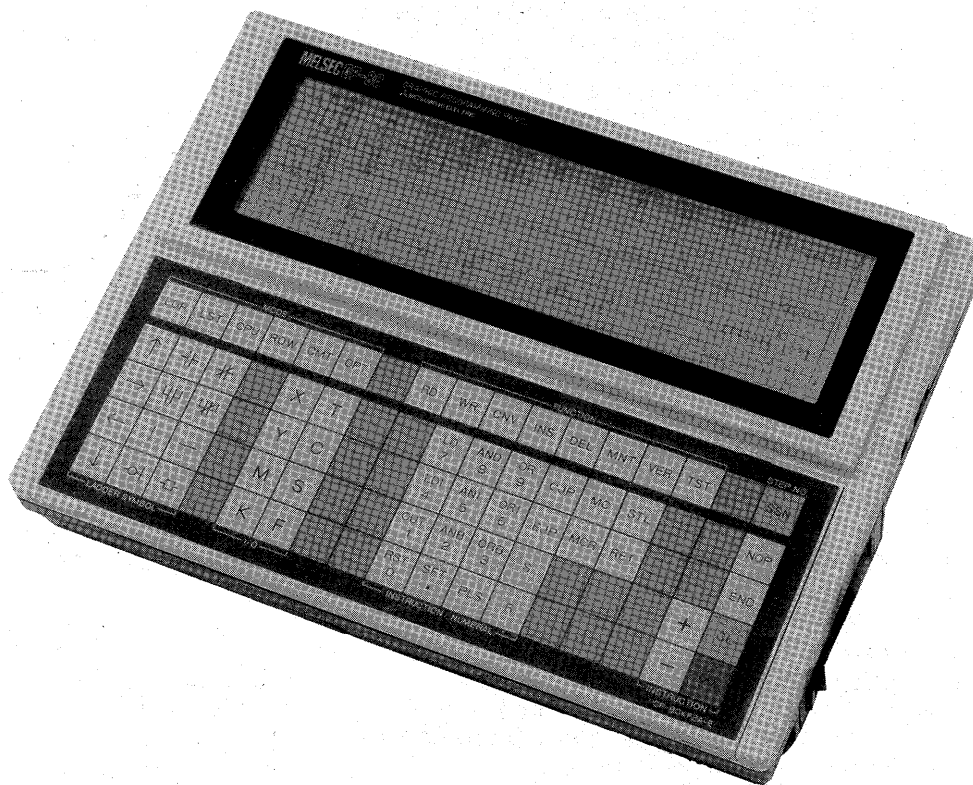# MITSUBISHI

MELSEC F, F₂ Programmable Controller

INSTRUCTION MANUAL

GP-80F₂ HGP (HANDY GRAPHIC PROGRAMMING UNIT)

- This manual provides technical information and guidance on the use of the Mitsubishi GP-80F₂ HGP (Handy Graphic Programming Unit).
- Users should ensure that the detail of this manual is studied and understood before attempting to use the unit.
- Information concerning the programming of the system is covered in a separate manual.

MITSUBISHI ELECTRIC CORPORATION

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1. GENERAL DESCRIPTION

1-1 INTRODUCTION

The GP-80F₂ HGP (Handy Graphic Programming Unit) is the answer to demands for a low-cost, compact, multi-functional graphic programmer.

Utilizing the world largest full-dots matrix LCD (Liquid Cristal Display), never before have so many CRT type functions been integrated in such a small package.

FUNCTIONS AND FEATURES

MULTI-FUNCTIONAL (Previously available only on more expensive CRT programmers)

- OFF-LINE PROGRAMMING ······Program can be stored in the HGP RAM by either instruction code or relay ladder diagram programming.
- PROGRAM TRANSFER ···········Program can be transferred to and from the PC.
- ON-LINE MONITORING···········The PC operation can be monitored on the display.
- CMT RECORDER INTERFACE···CMT(Cassette Magnetic Tape)recorder can be connected for the purpose of program storage or retrieval.
- ROM WRITER INTERFACE ·····ROM Writer Unit (Exclusive model) can be connected to write, read, verify the ROM Cassette.
- HARD-COPY PRINTING ··········Standard printer can be connected for printing of ladder diagram, Input/Output list and program list.

MOST ADVANCED LARGEST LCD DISPLAY (480 × 128 DOTS)

- DISPLAY TYPE ·····················Dynamic Drive Full-Dots Matrix LCD (Liquid Cristal Display).
- RELAY DIAGRAM DISPLAY····· 11 Contacts plus one coil wide × 7 lines high plus two message lines in a screen. One circuit can extend over three screens.
- SCREEN SCROLLING···············Screen can be scrolled up and down.
- ADJUSTABLE VISIBILITY ········Contrast and view angle can be adjusted.

COMPACT, LIGHT WEIGHT, LOW COST

- SIZE & WEIGHT ·····················W 300 × L 215 × H 70 (mm) 2 kg: [W 11.8×L 8.5×H 2.8 (inch) 4.4 lbs]. Handy for factory use

FUTURE EXPANSION FLEXIBILITY

- REPLACEABLE MEMORY·········The memory is installed in a replaceable cassette, key board is also replaceable.

EXTRA FEATURES

- VOLUME ADJUSTABLE SOUND ON KEY OPERATION
- POWER RESET SWITCH AVAILABLE
- POWER CONSUMPTION: LESS THAN 15VA

1-2 SYSTEM FORMATION

The HGP has a off-line programming function by itself but also has many other functions in conjunction with the external devices.

The system formation is illustrated below.

PROGRAMMABLE CONTROLLER

F-20M, F-40M

F₂-40M, F₂-60M

HARD COPYING
● RELAY DIAGRAM
● I/O LIST
● PROGRAM LIST

● PROGRAM LOADING AND UNLOADING
● PROGRAM VERIFICATION
● MONITORING

F₂-20GF
INTERFACE UNIT

● CMT RECORDING
● PLAYBACK
● VERIFICATION

CONTROL ROM CASSETTE

PRINTER CABLE
GP-80PRC

TRANSMIT CABLE
GP-80TCB

CMT CABLE GP-80CCB

HGP UNIT

PRINTER (STANDARD)

ROM WRITER
GP-80ROW-E
/GP-80ROW

AUDIO CASSETTE
RECORDER
(STANDARD)

GP-80ROW-E : AC220/240V
GP-80ROW   : AC110/120V

ROM CASSETTE
● WRITING
● READING
● VERIFICATION

POWER SUPPLY CABLE
GP-80PCB

MEMORY CASSETTE GP-80MF₂A-E

KEY-BOARD SHEET GP-80KF₂A-E

(More than one function can not be utilized at the same time)

ATTACHMENTS

The model GP-80F₂ HGP encloses following attachments in the unit;

GP-80F₂-E
(GP-80F₂-U)

HGP BASE UNIT ——————————————————— GP-80C (FOR GP-80F₂-U) AC110/120V
— GP-80B (FOR GP-80F₂-E) AC220/240V
MEMORY CASSETTE ————————————————— GP-80MF₂A-E
KEY BOARD SHEET ————————————————— GP-80KF₂A-E
LITHIUM BATTERY ——————————————————— GP-80BAT
POWER SUPPLY CABLE ——————————————— GP-80PCB

CMT CABLE ——————————————————————— GP-80CCB
PRINTER CABLE ——————————————————— GP-80PRC
TRANSMIT CABLE ——————————————————— GP-80TCB
INTERFACE UNIT ——————————————————— F₂ -20GF
    WITH CONTROL ROM CASSETTES
SOFT CASE ————————————————————————— GP-80BAG
    WITH SHOLDERING RIBBON
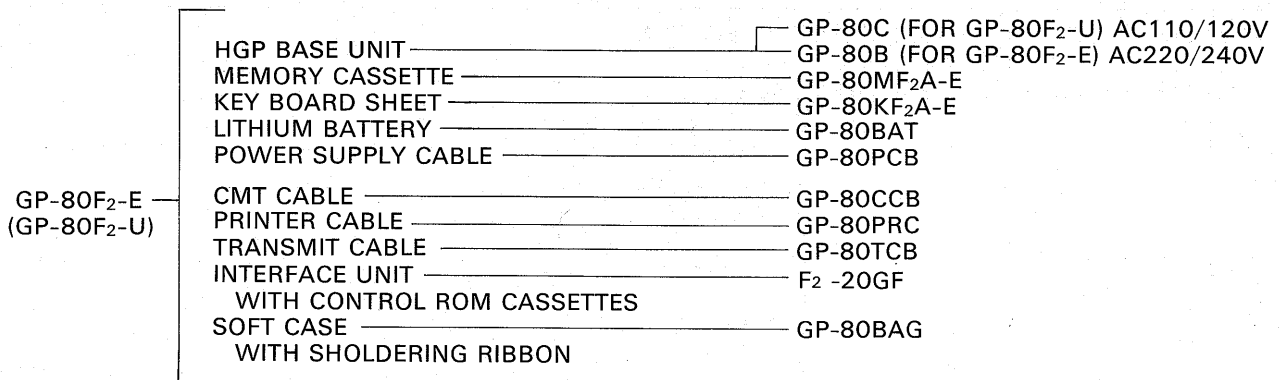
The connectors and switches on the HGP unit are illustrated below.

Connector for PC Interface

Connector for Printer Interface

Connector for CMT Interface

Power Reset Switch

PC Program Protection Switch

Thumbwheel to adjust the contrasts and view angle

Pot to adjust the key sound

LCD SCREEN

Power Supply Connector

Power Switch

Connector for
ROM Writer Interface

Keyboard Sheet

MEMORY
CASSETTE

Battery Case Cover
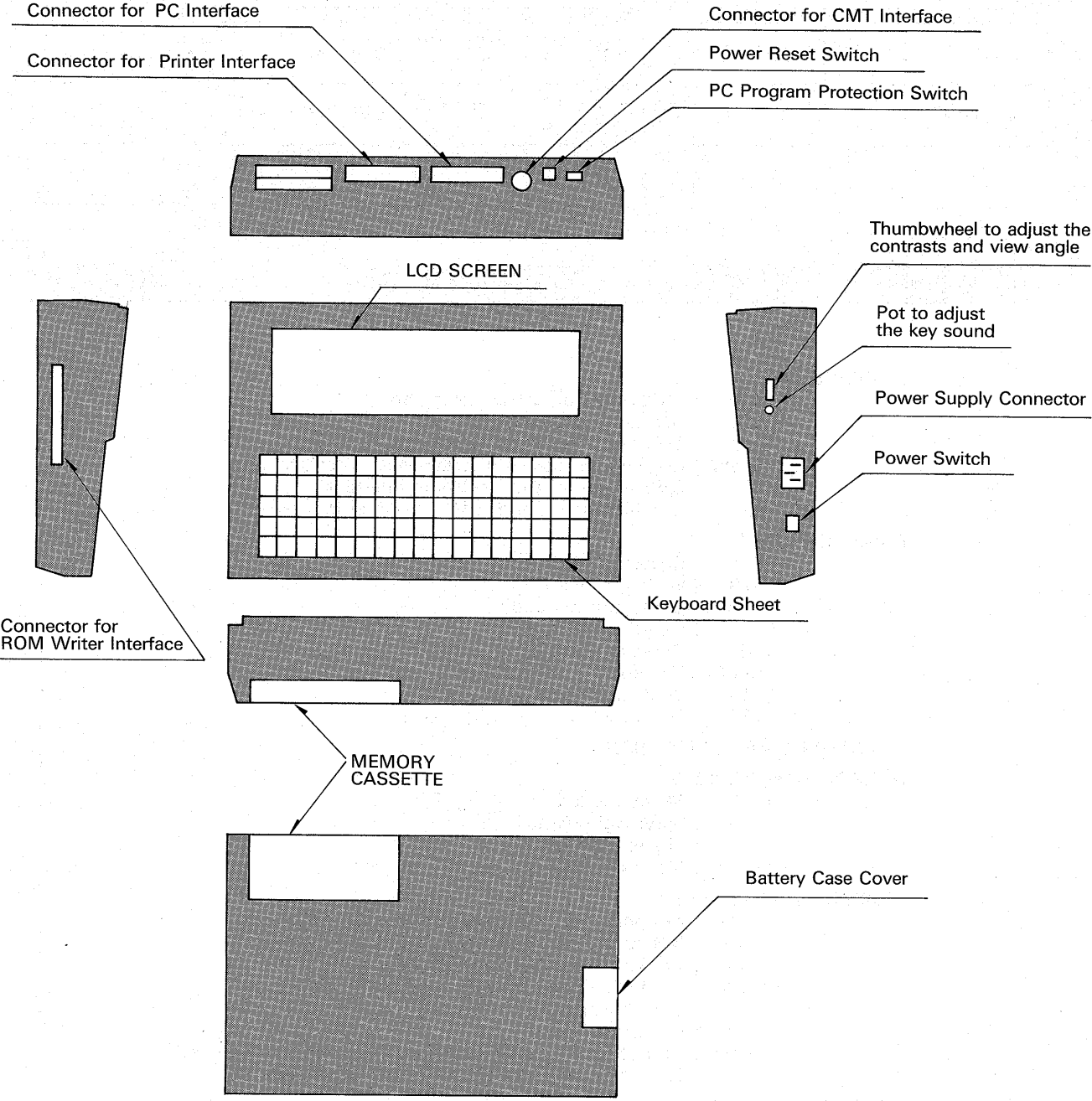
The keyboard is consist of the following keys;

MODE						FUNCTION								STEP NO.
LDR	LST	CPU	RMW	CMT	GPT	RD	WR	CNV	INS	DEL	MNT	VER	TST	SSN
↑	⊣⊢	⊣≠		X	T	LD 7	AND 8	OR 9	CJP	MC ※	STL ※			NOP
→	⊔⊔	⊔≠⊔		Y	C	LDI 4	ANI 5	ORI 6	EJP	MCR ※	RET ※			END
←	|	—		M	S ※	OUT 1	ANB 2	ORB 3	S				+	CL
↓	–○⊣	–□–		K	F ※	RST 0	SFT ·	PLS	R				—	GO
LADDER SYMBOL				I/O		INSTRUCTION/NUMERAL							INSTRUCTION	
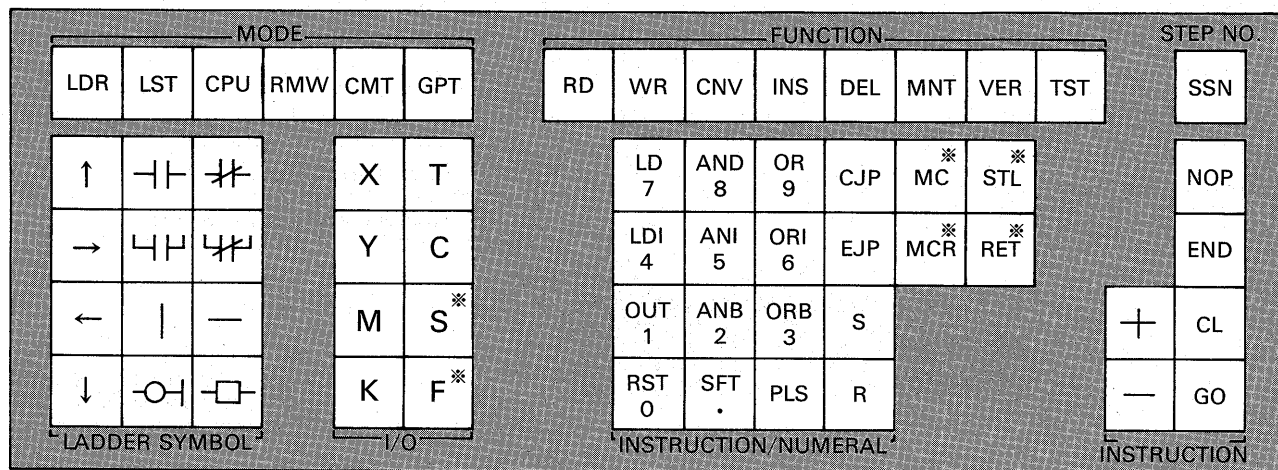
※ Only for GP-80F₂ type.

MODE KEYS :
- LDR : Ladder mode for ladder diagram
- LST : List mode for instruction list
- CPU : CPU mode for PC interfacing
- RMW : ROM writer mode for ROM-writer interfacing
- CMT : CMT mode for CMT recorder interfacing
- GPT : Graphic printer mode for the printer interfacing

FUNCTION KEYS :
- RD : Reading function
- WR : Writing function
- CNV : Converting function
- INS : Inserting function
- DEL : Deleting function
- MNT : Monitoring function
- VER : Verification function
- TST : Test function

SET STEP NUMBER KEY : SSN

CURSOR MOVING KEYS :
- ↑ : Move upward
- → : Move rightward
- ← : Move leftward
- ↓ : Move downward

LADDER SYMBOL KEYS :
- ⊣⊢ : Normally open contact in series (LD, AND)
- ⊣≠ : Normally closed contact in series (LDI, ANI)
- ⊔⊔ : Normally open contact in parallel (OR)
- ⊔≠⊔ : Normally closed contact in parallel (ORI)
- \| : Vertical line
- — : Horizontal line
- –○⊣ : Output (Output relay, auxiliary relay, timer or counter)
- –□– : Timer or counter constant, special instructions.

I/O KEYS :
- X : Input assignment
- Y : Output assignment
- M : Auxiliary relay assignment
- T : Timer assignment
- C : Counter assignment
- K : Constant value assignment
- S : State for step ladder.
- F : Coil for special instruction.

INSTRUCTION/NUMERAL KEYS :
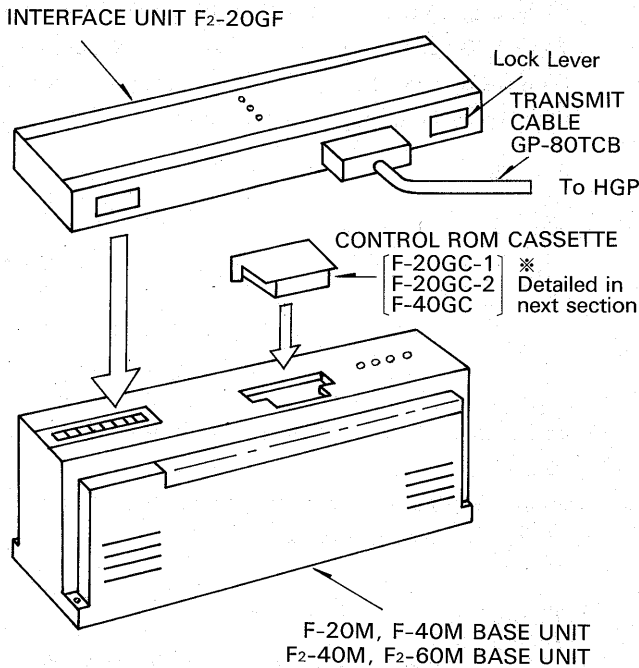
INSTRUCTION/OPERATION KEYS :

— 4 —

2. PREPARATIONS

2-1 CONNECTION WITH THE PC

When the HGP is connected with the PC for the purpose of monitoring, install a control ROM cassette and interface unit on the PC base unit, then connect between the interface unit and HGP using a transmit cable as follows;

But it is not necessary to install a control ROM cassette for following PCs.

① F₂-40M, F₂-60M

② F-40M (Manufactured since JUL. 1984)

INTERFACE UNIT F₂-20GF

Lock Lever

TRANSMIT CABLE GP-80TCB

To HGP

CONTROL ROM CASSETTE
[F-20GC-1] ※ Detailed in
[F-20GC-2] next section
[F-40GC]

F-20M, F-40M BASE UNIT
F₂-40M, F₂-60M BASE UNIT

Before the interface unit, control ROM cassette or transmit cable is installed or removed, ensure that the power of the PC and HGP is off.

To transfer a program between the PC and HGP, it is not necessary to install the control ROM cassette.
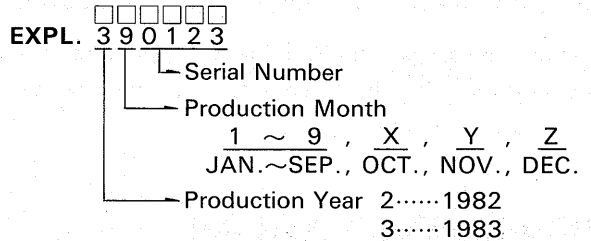
2-2 CONTROL ROM CASSETTE

Three control ROM cassettes are provided as attachments. Use appropriate cassette according to the model of the PC base unit as follows;

Model of Control ROM Cassette	Applicable PC Model
F-20GC-1	F-20M□ (Manufactured before AUG. 1983※) F-20M□-ES, F-20M□-U
F-20GC-2	F-20M□ (Manufactured since AUG. 1983※) F-20M□-ES1, -ESS, F-20M□-U1 F-20M□-DS, F-20M□-D
F-40GC	F-40M□, F-40M□-ES, -ESS, F-40M□-U (Manufactured before JUN. 1984)

※Production Number on the Name Plate Label:

EXPL. 3 9 0 1 2 3

Serial Number

Production Month
1 ~ 9 , X , Y , Z
JAN.~SEP., OCT., NOV., DEC.

Production Year 2······1982
3······1983

2-3 CONNECTION WITH EXTERNAL DEVICES

For connecting the printer and CMT Recorder, the printer cable GP-80PRC and CMT cable GP-80CCB are provided as attachments. The ROM writer unit GP-80ROW can be connected to the HGP by using exclusive cable.

When these external devices are connected to the HGP, ensure that the power of the external devices and HGP is switched off.

2-4 POWER SUPPLY

(1) Connect the power supply cable with the HGP and plug in, then turn the power switch of the HGP "ON".

(2) When the external device such as the printer or CMT recorder is used in conjunction with the HGP, switch the power of the external device ON or OFF before the switch operation of the HGP as follows;

External Device Power OFF | ON | OFF

HGP Power OFF | ON | OFF
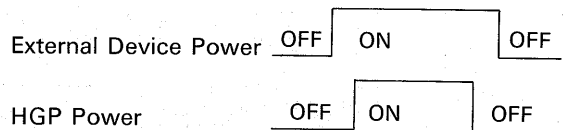
(3) When momentary power interruption is required for the purpose of resetting of the HGP, the RESET button is available.

The HGP unit has self-checking functions for the display and key-board.

Depressing the $\boxed{\downarrow}$ key at the same time to switch power ON, a test pattern is displayed on the screen. By depressing the $\boxed{\text{GO}}$ key, the test pattern is changed. If no fault is found, depress the $\boxed{\text{GO}}$ key over again until a message "KEY-BOARD CHECK" is displayed.

To check all key functions on the key-board, depress all keys including no marked keys in turn as follows;
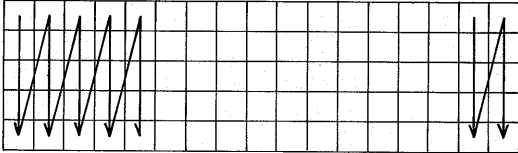
After completed all key-strokes, a message "SELF-CHECK OK" is displayed if there is no function fault. If a problem exists, a message "FAULT" is displayed.

When a message "OPERATION ERROR" is displayed, depress the $\boxed{-}$ and $\boxed{\text{GO}}$ keys to restart the key-stroke from the beginning.

When the power is switched ON, the preliminary messages are displayed. If all preparations are ready to proceed to further operations, depress the $\boxed{1}$, $\boxed{2}$ or $\boxed{3}$ key to select the PC type according to the

(1) Contrast and View-Angle
The suitable contrast of the display depends upon the view-angle and these are adjustable by using a thumbwheel provided on the right side of the HGP.

(2) Volume
When the effective key is depressed, confirmation sound for the key-stroke is heard. The volume is adjustable by using a volume-adjusting potentionmeter provided on the right side of the HGP.

(3) Protection Switch
A slide switch is provided on the back of the HGP to prohibit transfer of the program to the PC. Keep the switch off except the cases of interface with the PC such as program transferring, monitoring or test functions.

PC to be used, then proceed to key-in the mode and functions.

If the preparations are not ready, check the conditions according to the error messages.
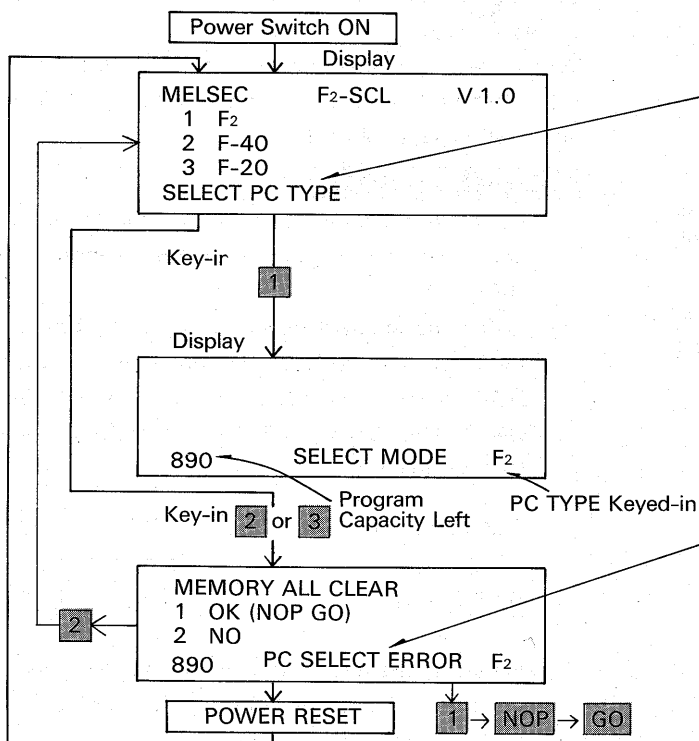
If all preparations are not ready, following messages are displayed;

BATTERY NG ······
   Battery voltage is low.
   Check the battery.
NO MEMORY CASSETTE ······
   Ensure that the memory cassette is installed correctly.
MEMORY CASSETTE NG ······
SYSTEM RAM NG ······
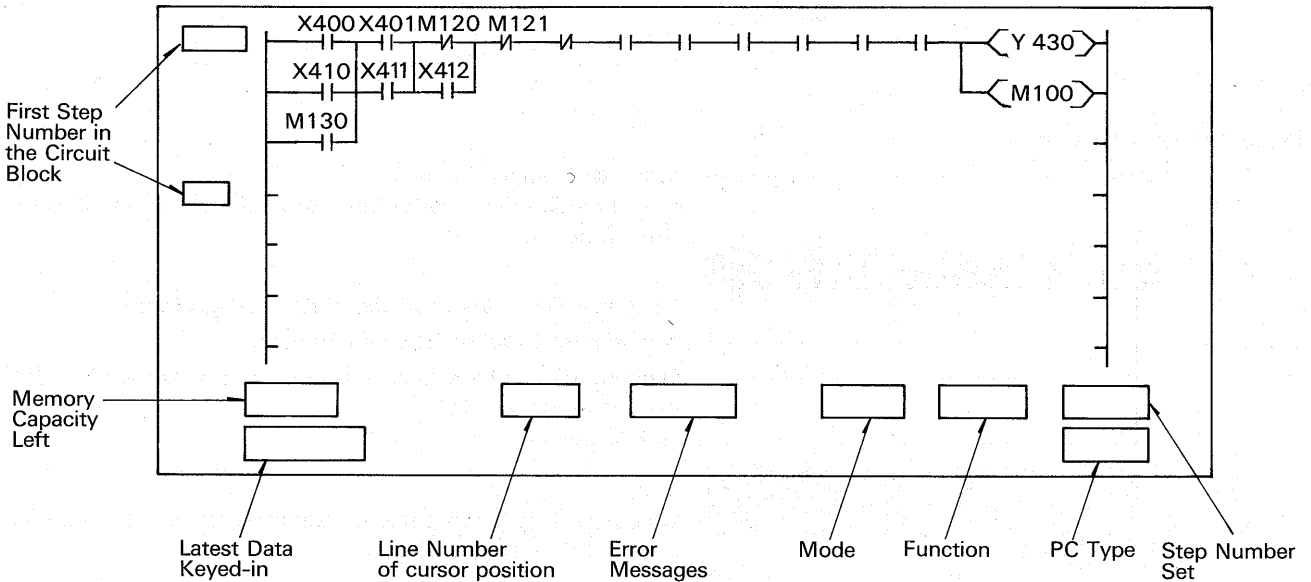   Contact with Mitsubishi agent.

If any previous program was left in the HGP and different PC type is selected, the error message is displayed.

In case of mis-selection, depress the $\boxed{2}$ key to select again.

Otherwise delete all program left in the HGP by depressing $\boxed{1}$ $\boxed{\text{NOP}}$ $\boxed{\text{GO}}$ key.

3. LADDER MODE PROGRAMMING

3-1 MESSAGES ON A SCREEN

This section gives preliminary information of the messages on a screen before programming is started.

```
          X400 X401 M120 M121
           ┤├──┤├──┤/├──┤/├──┤├──┤├──┤├──┤├──┤├──       ⟨Y 430⟩
          X410│X411│X412                                └─────────
           ┤├──┤├──┤├                                    ⟨M100⟩
          M130
           ┤├
```

First Step Number in the Circuit Block

Memory Capacity Left

Latest Data Keyed-in   Line Number of cursor position   Error Messages   Mode   Function   PC Type   Step Number Set
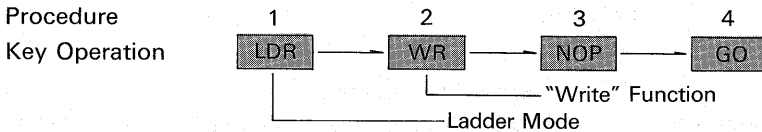
3-2 CLEARING THE RAM READY TO RECEIVE A NEW PROGRAM

The RAM (Random Access Memory) in the HGP is cleared ready to receive a new program by following procedure;

The procedure illustrated below completely clears the program and displays ladder lines to start writing a new program.

The mode "Ladder" and function "Write" remains active until new mode or function is selected.

Procedure   1   2   3   4
Key Operation LDR   →   WR   →   NOP   →   GO
                          └──────── "Write" Function
               └─────────────── Ladder Mode

3-3 WRITING A NEW PROGRAM

After the above procedure is completed, following ladder lines are displayed on the screen ready to write new program starting from step 0.

Cursor

Display

```
0 ┌─■
  ├
  ├
  ├
890      0                          LDR  WR
                                              F-40
```
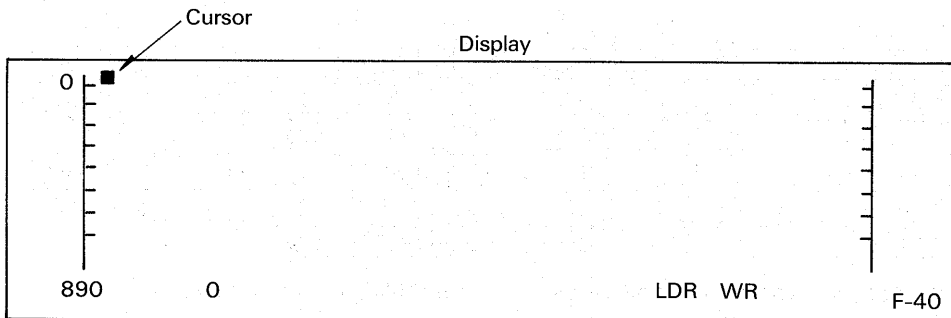
After writing a new program into the HGP, depress the [CNV] [GO] keys to change the format of the program from HGP language to PC language. If a new mode or function key is depressed before [CNV] [GO], the diagram will be erased.

(1) Simple Example

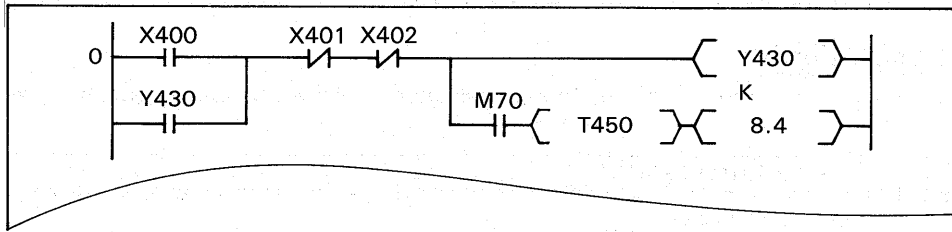| Procedure	Key Operations						
1	LDR	WR					······Mode and function key. (This function need not be re-entered if the user remains in This function.)
2	⊣├	X	4	0	0	GO	

- Execution (The cursor moves in the next position)
- Assignment Number (Element Number)
- Element Mark (Key-stroke is not required because the HGP assigns automatically)
- Ladder Symbol

3	⊣├	X	4	0	1	GO
4	⊣/├	X	4	0	2	GO ··· When the ladder symbol is the same as the one before the symbol key is not required.
5	│	GO				
6	⊸├	Y	4	3	0	GO
7	⊔├	Y	4	3	0	GO
8	→	→				······Move the cursor position.
9	⊣├	M	7	0	GO	
10	⊸├	T	4	5	0	GO ···K ??? is displayed.
11	⊣□├	K	8		4	GO ···Timer Constant.
12	CNV	GO				······Editing and writing in the RAM.
13	WR	SSN	GO			······The next ladder space is displayed to make additional programming.

(2) REVISORS

If an incorrect symbol key or element number is depressed before the GO key, key-in the correct symbol or element number to revise.

If such mis-key operation was made after depressed the GO key, reverse the cursor and key-in correctly.

(3) Special Instructions

When special instructions such as MC, MCR, S, R, STL, RET, PLS, SFT, RST, CJP, EJP or END are programmed, depress the ⊣□├ symbol key as illustrated below.

EXPL.

⊣□├	PLS	1	0	0	GO	,	⊣□├	CJP	7	0	0	GO
⊣□├	SFT	3	0	0	GO	,	⊣□├	EJP	7	0	0	GO
⊣□├	RST	4	6	0	GO	,	⊣□├	END	GO			
⊣□├	MC	1	0	1	GO	,	⊣□├	MCR	1	0	1	GO
⊣□├	S	2	0	0	GO	,	⊣□├	R	2	0	0	GO
⊣□├	STL	6	0	0	GO	,	⊣□├	RET	GO			

(4) NOP

To reserve some program space after the circuit block made, any number of NOP can be written by following procedure;
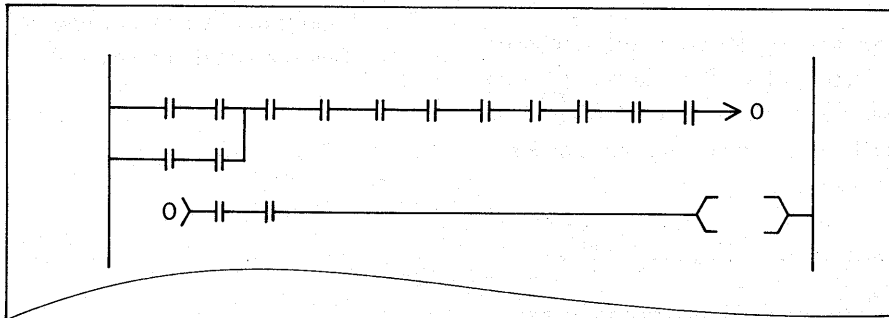
EXPL. to put ten NOPs

|					
Making a ladder circuit block	CNV	NOP	K	1 0	GO

(5) Returnning the circuit

When a contact is written in the last column where a coil is normally written, the ladder rung is automatically returned and the contact is re-written in the first column on the next line after the [GO] key is depressed.

When more than one parallel circuits are returned, finish the parallel circuits before entering any additional contacts in the last column providing space for the return. (If line space is required, see the section on Inserting.)

To return the circuit manually, key-in a address number in the last column and the first column on the next line as following procedure;

[—] [K] [0] [GO]
                └──────── address
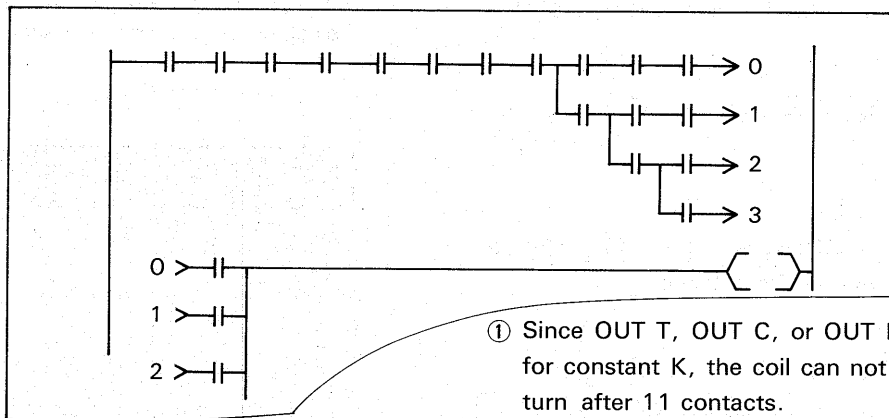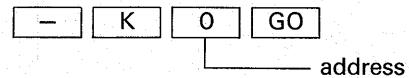
① Since OUT T, OUT C, or OUT F need 2 columns for constant K, the coil can not get automatic return after 11 contacts.

② After step ladder contact STL , the circuit can not get return operation.

3-4 READING A PROGRAM

(1) Reading by step number starting at the step number designation, one screen of diagram is displayed.

EXPL.

Procedure	Key-stroke	
1	LDR	·············Ladder Mode
2	RD	·············Reading Function
3	SSN	·············Designation of the step number
4	1 4	·············Step 14
5	GO	·············Execution
	Display a ladder diagram	
6	SSN	
7	3 0	·············Reading can be continued.
8	GO	
	Display	

When the circuit block is larger than one screen of diagram, a message "DISPLAY OVERFLOW" is displayed at the bottom of the screen. Read the rest of diagram by using the scrolling function stated in other section.

7 lines of ladder diagram can be displayed in one screen and maximum of 21 lines can be read by using the scrolling functions.

(1) Line Scrolling

Locate the cursor position at top of the screen or bottom of the screen, then depress the ↑ or ↓ key to move the cursor position further. The screen is scrolled up or down one line per keystroke. (Max 21 lines.)
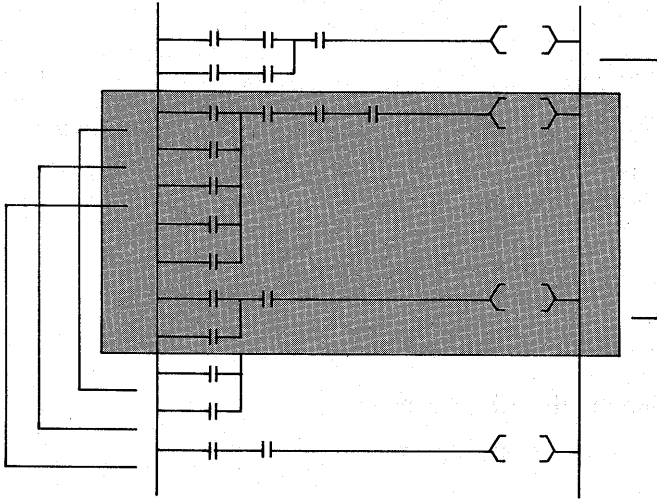
(2) Circuit Block Scrolling

Depress the — GO keys or + GO keys to scroll up or down one circuit block.
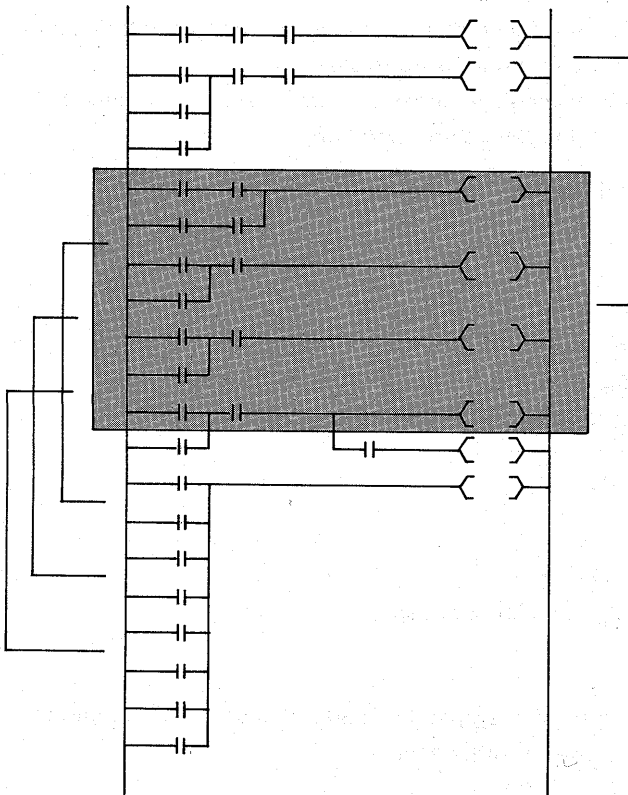
When the last circuit block of the program is over the screen, the rest of program can not be read out by the circuit block scrolling because no circuit block is left.

Read it by the line scrolling or List mode function. (See the List mode section)

(3) Screen Scrolling

After a certain diagram is found and displayed according to the step number, the next 7 lines diagram can be displayed by depressing the GO key.

This procedure can be repeated to read through the program but this function does not work after using the circuit block scrolling function.
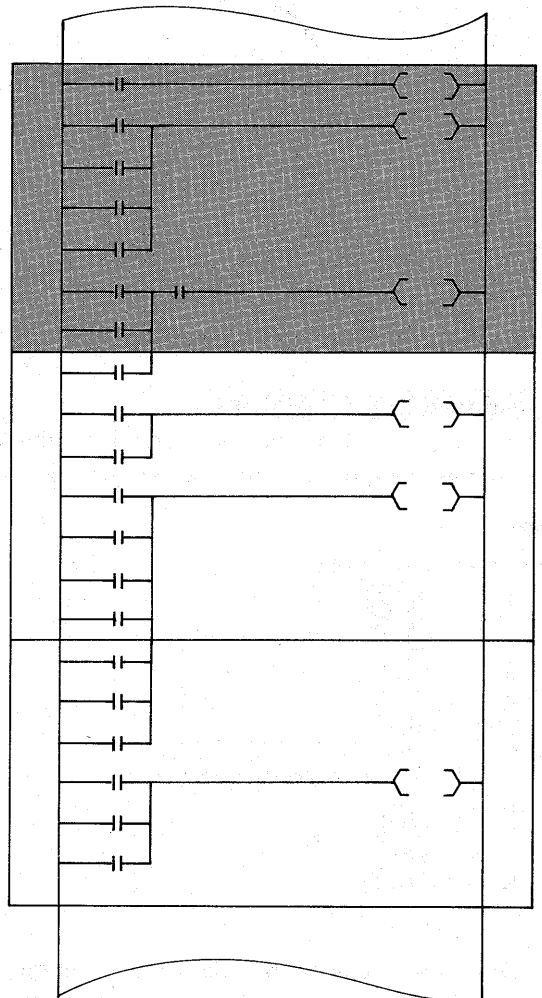
(1) To find a circuit block including a given instruction, proceed as per the following example;

Procedure   Key-stroke
1   [LDR] ·· Ladder Mode
2   [RD] ·· Reading Function
3   [-||-] [X] [4] [0] [0] ········· Instruction Element (Contact 400)
4   [GO] ·· Execution to find and display the first circuit block in which a contact 400 exists.
5   [GO] ·· Search and display the following circuit block in which a contact 400 exists.
6   [-○|-] [Y] [4] [3] [0] ········· Other Instruction Element (coil 430)
7   [GO] ·· Execution to find and display the first curcuit block in which a coil 430 exists.
8   [GO] ·· Search and display the following circuit block in which a coil 430 exists.

(2) If there is no instruction element designated in the program, a message "NOT FOUND" is displayed.

EXPL.

-□-	MC	1	0	1	GO
-□-	S	2	0	0	GO
-□-	PLS	1	0	0	GO
-□-	SFT	3	0	0	GO
-□-	RST	4	6	0	GO
-□-	STL	6	0	0	GO

(3) Special Instructions

When special instructions such as MC, MCR, S, R, STL, RET, PLS, SFT, RST, CJP or EJP is searched, depress the [-□-] key as the symbol key.

-□-	MCR	1	0	1	GO
-□-	R	2	0	0	GO
-□-	CJP	7	0	0	GO
-□-	EJP	7	0	0	GO

-□-	RET	GO

(4) Scrolling

a) When the circuit block is over 7 lines, the first 7 lines are displayed, read out the following lines by using the line scrolling function.

b) To find a circuit block one before or one after the block which is displayed, depress the [+] [GO] keys or [—] [GO] keys after the [CL] key is depressed for the circuit block scrolling.

(5) Searching without the instruction symbol

This searching function can be alternatively executed by using the [CL] key instead of the symbol key as following procedure;

[LDR] [RD] ····························· Ladder Mode, Reading Function.
[CL] ·· Require no symbol.
[Y] [5] [3] [0] ····················· Instruction Element (coil 530).
[GO] ·· Execution to find and display the first circuit block in which a coil 530 or contact 530 exists.
[GO] ·· Search and display the following circuit block in which a coil 530 or contact 530 exists.

(1) To read out the last circuit block in the program proceed as follows;

Procedure   Key-stroke
1   [LDR] , [RD] ····························· Ladder Mode, Reading Function
2   [END] ·· Last Circuit Block
3   [GO] ·· Execution to find and display the last circuit block.
            (Even if no END instruction exists in the program)

(2) More than one END instruction can be programmed for the convenience of editing the program. To read the circuit block one before the END instruction, proceed as follows;

Procedure   Key-stroke
1   [LDR] , [RD] ·······································Ladder Mode, Reading Function
   [-□-] , [END] ·····································Circuit Block one before END instruction.
   [GO] ··Execution to find and display a circuit block one before the first END instruction.
   [GO] ··Execution to find and display a circuit block one before the following END instruction.

3-8 ADDING A PROGRAM AT THE END OF PROGRAM

To add a new program at the end of an existing program, proceed follows;

Procedure   Key-stroke
1   [LDR] , [RD] ·································Ladder Mode, Reading Function
2   [END] , [GO] ·································Reading the last circuit block
3   [WR] , ···Writing Function
4   [SSN] [GO] ·································Changing the display ready to write a additional program.
5   [Write a cicuit block] ·······················⎫
6   [CNV] [GO] ····································⎬ as same procedure as writing a new program.

3-9 RE-WRITING OF EXISTING CIRCUIT BLOCK

To re-write a existing circuit block, proceed as per the following example;

EXPL.

Procedure   Key-stroke
1   [LDR] , [RD] ······································Ladder Mode, Reading Function
2   [SSN] [2] [0] [GO] ····················Reading circuit of step number 20.
3   [WR] ··· Writing Function, only the circuit block is displayed ready to re-write.

cursor

— Move the cursor to the position to be written —

■ X400 ········· 4   [-/↑] [4] [0] [3] [GO] ············ X400 → X403 —|↑— → —/↑—
■ X401 ········· 5   [ ] [GO] ·······································Short-circuit the contact X401 (Contact X401 is deleted.)
           6   [-|↑] [4] [0] [4] [GO] ···········Contact X404 is written in.
X404   7   [|] [GO] [↓] ·······························Write vertical line and move cursor down.
           8   [-○-] [4] [5] [0] [GO] ···········Write timer T450.
           9   [-□-] [K] [1] [0] [GO] ···········Write timer constant K10.
          10   [CVT] [GO] ····································Convert the new program in the RAM.
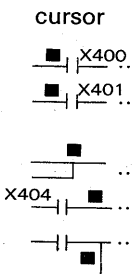
3-10 INSERTING A CIRCUIT BLOCK IN A PROGRAM

To add a new circuit block in an existing program, proceed as per the following example;

Procedure	Key-stroke	
1	LDR RD	·····Ladder Mode, Reading Function.
2	⊣⊢ 1 3 0 GO	·····Reading a circuit block after which a new circuit block is written.
		(the circuit block can be also found by the step number)
3	WR	·····Writing Function.
4	SSN GO	·····Changing the display ready to write a additional circuit block.
5	Write a circuit block	⎫ ·····Same procedure as writing a new program.
6	CNV GO	⎭ (Step numbers change automatically)

3-11 DELETING A CIRCUIT BLOCK

To delete a circuit block in a program, proceed as per the following example;

Procedure	Key-stroke	
1	LDR RD	·····Ladder Mode, Reading Function.
2	⊣⊢ 1 2 0 GO	·····Reading a circuit block to be deleted.
		(The circuit block can be also found by the step number.)
3	DEL	·····Deleting Function.
4	⊣O⊢ GO	·····Deleting the circuit block.

(The key operations of the CNV GO are not required)

(1) Even when the circuit block has more than one coil, whole instructions in the block are deleted by above procedure.

(2) When the circuit block has a special instruction such as RST, PLS, SFT instead of the coil, depress the ⊣☐⊢ key instead of the ⊣O⊢ key.

(3) The step numbers do not change because all instructions of the block are replaced with NOP instructions. To delete the NOPs, see the section of the List Mode.

To delete instructions in a circuit block, proceed as per the example below. The normal contact can be also deleted by re-writing function. (See re-writing section)

EXPL.
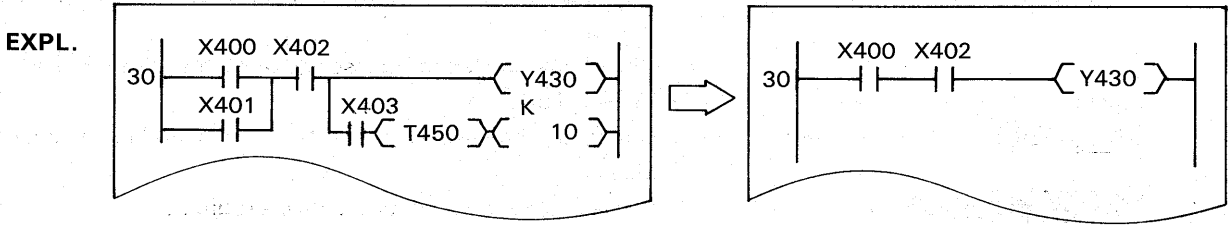
	Procedure	Key-stroke	
	1	LDR , RD	·······Ladder Mode, Reading Function.
	2	SSN 3 0 GO	·······Reading a circuit block to be modified. (The circuit block can be also found by instructions.)
cursor	3	DEL	·······Deleting function.
		— Move the cursor to the position to be deleted —	
■ X401 ■	4	⊣⊢ GO	·······Parallel contact X401 is deleted.
X403	5		GO	·······Vertical line is deleted.
■ X403	6	⊣⊢ GO GO GO	·······Contact X403, horizontal line and timer T450 are deleted.
	7	CNV GO	·······Convert the modification in the RAM.
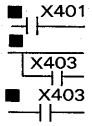
(1) The above procedure is only for the purpose of program modifications. When whole circuit blocks are deleted, proceed to the circuit block deleting function with the DEL ─○─ GO keys. (See the section on circuit block deleting)

(2) The ⊣⊢ or ⊔⊔ key is effective to delete horizontal lines and all instructions except the END instruction. The vertical line is deleted with the | key. In some cases the contacts in series can be deleted with the ─ key at the WR function. (See the re-writing section)

(3) Deleting the END instruction.
To delete the END instruction in a program, proceed follows;

Procedure	Key-stroke	
1	LDR , RD	·······Ladder Mode, Reading Function.
2	⊣⊔⊢ END GO	·······Read the END instruction.
		(The last circuit block and END instruction are displayed)
3	DEL	·······Deleting Function.
4 ※	Move the cursor position to the first column of the line where the 〈END〉 is displayed.	
5	⊣⊢ GO	·······Delete the END instruction.
6	CNV GO	·······Convert the deleting in the RAM.

※ cursor: ⊢─⊣⊢──⊣⊢──
END ■
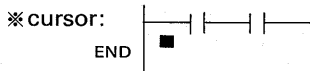
3-13 INSERTING INSTRUCTIONS

In most cases, contacts or coils are inserted in a existing circuit block by the $\boxed{\text{WR}}$ function (See the re-writing section).

A new circuit block can be also inserted in a program by the $\boxed{\text{WR}}$ function (See the circuit block inserting section).

This section introduces the function of the $\boxed{\text{INS}}$ key to complement the inserting procedure above.

(1) Providing a column space

To provide a column space for inserting the new instructions in a circuit block, proceed as per the following example;
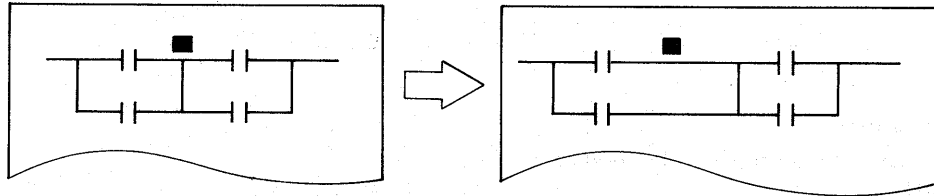
Procedure	Key-stroke
1	Display a circuit block to be modified.
2	INS ···Inserting function.
3	Move the cursor position where the column space is required
4	─ GO

a) The column space is made on the left of the cursor position.

b) Even if some spaces are left after inserting the new instructions, the circuit is re-arranged when the $\boxed{\text{CNV}}$ $\boxed{\text{GO}}$ keys are depressed.

(2) Providing a line space

To provide a line space for inserting the new instructions in parallel, proceed as per the following example;
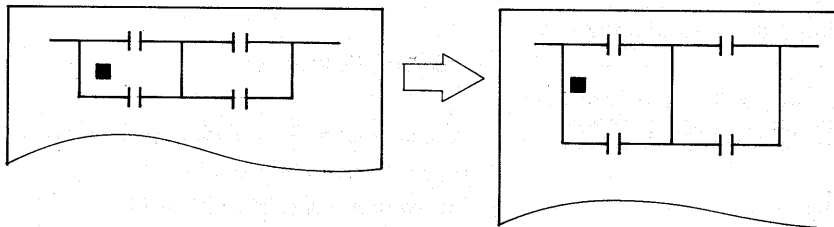
Procedure	Key-stroke
1	Display a circuit block to be modified.
2	INS ···Inserting Function.
3	Move the cursor position where the line space is required.
4	┃ , GO

a) The line space is made beneath the cursor position.

b) Even if some spaces are left after inserting the new instructions, the circuit is re-arranged when the $\boxed{\text{CNV}}$ $\boxed{\text{GO}}$ keys are depressed.

(3) Inserting contacts

When a circuit block has enough column space or line space to insert additional contacts, the contacts can be written by the WR function.

Even though a circuit block does not have enough space, the contacts are inserted by the INS function as per the following example;

EXPL. 1
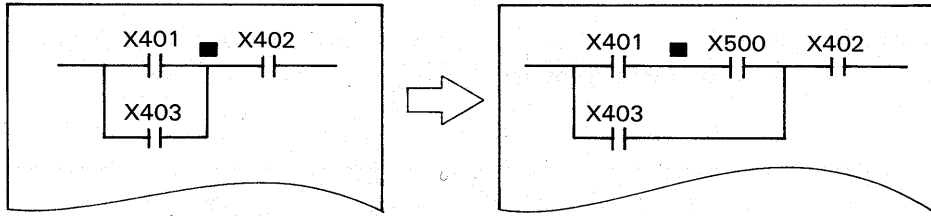
Procedure Key-stroke
1   Display a circuit block to be modified.
2   INS ··Inserting Function.
3   Move the cursor to where the new contact is inserted.
4   -| |- 5 0 0 GO ···········A column space is provided and contact X500 is inserted on the left of the cursor position.
5   CNV GO ····································Inserting is completed in RAM.

EXPL. 2
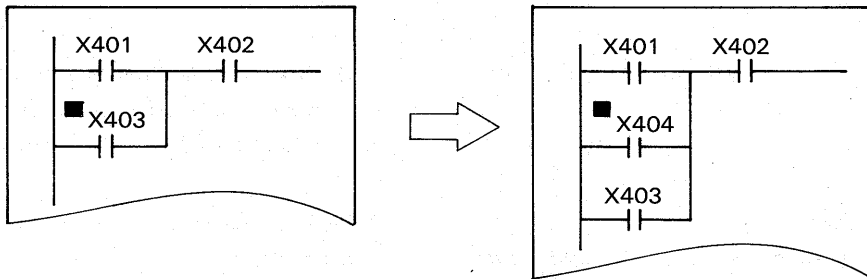
Procedure Key-stroke
1   Display a circuit block to be modified.
2   INS ··Inserting Function.
3   Move the cursor as illustrated above.
4 |- -| 4 0 4 GO ···········A line space is provided and contact X404 is inserted beneath the cursor position.
5   CNV GO ····································Inserting is completed in RAM.

When a circuit block similar to the preceding block in a program is written, the skeleton of the preceding circuit block can be diverted for convenience.

A new circuit block can be completed by re-writing only element numbers.

The summary of procedure is as follows;

Procedure	Key-stroke
1	Read and display a circuit block to be diverted.
2	WR ···Writing Function.
3	※ SSN n GO ·······························Designate where new block is written and erase all instruction numbers of the display ready to make new block.

　※ a) In case that a new block is written beneath the block to be diverted ·················$n = 0$

　　b) In case that a new block is written in a address of a given step number ··············$n = N$ step Number

　　When a given step number is occupied in other circuit block, a new block is inserted one before the block including the step number.

| 4 | Write new element numbers on the skeleton to complete new block.
(The modifications of the skeleton is also possible) |
| 5 | CNV GO ··New block is written in the RAM. |

EXPL.: New block is written beneath the block to be converted.

Procedure	Key-stroke
1	Read and display a circuit block to be diverted.
2	WR SSN 0 GO
3	⊣⊢ 4 1 1 GO
4	⊣≠⊢ 4 1 2 GO
5	⊣⊢ 4 0 0 GO
6	─○⊣ 4 3 1 GO
7	⊣⊢ 4 1 3 GO
8	⊣⊢ 4 1 4 GO
9	CNV GO
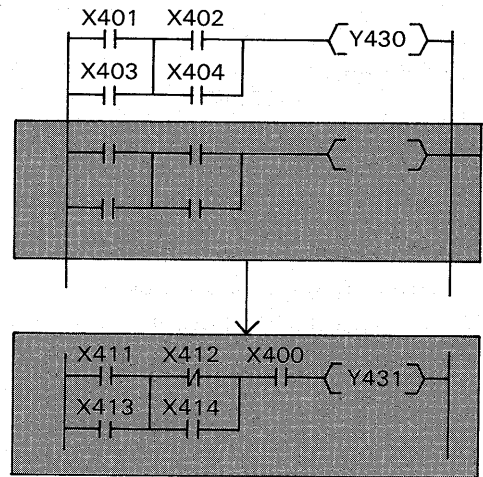
3-15 CIRCUIT LAYOUT DESIGN

When the CNV GO keys are depressed after circuits are written, some circuit layouts are automatically re-arranged to the standard layouts. However in case that the circuit is not correct, a error message "BAD CIRCUIT" is displayed.

Re-write the circuit as per the following examples;

(1) Re-arrangement examples by the CNV key operation.
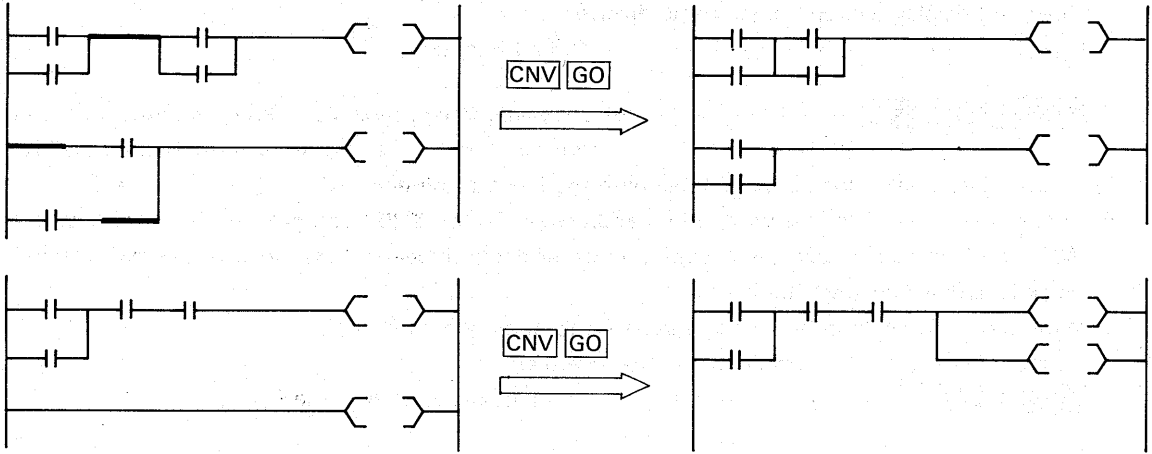
(2) Incorrect circuit examples.

(Incorrect)   (Re-write)

Short Circuit

Short Circuit

(Incorrect)   (Re-write)

Coil branch before
a contact

Bridge Circuit

Sholders
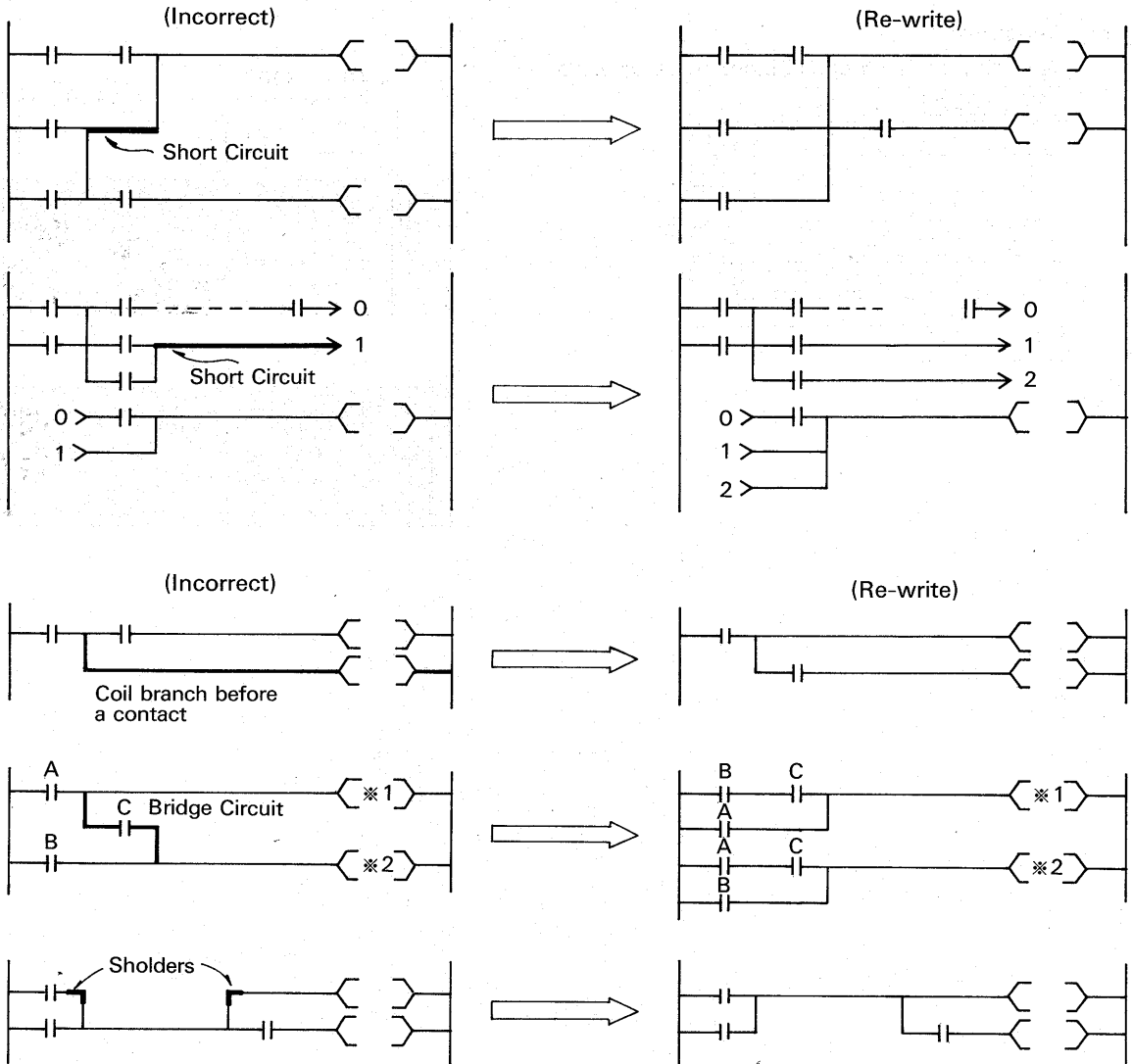
4. LIST MODE FUNCTIONS

This section introduces the list mode functions such as programming or program checks.
For this function, the instruction keys are used instead of the ladder symbol keys and the procedure of con verting CNV is not required when a program is written in RAM.

4-1 READING

A program can be read out by tracing the step numbers or instructions similar to the ladder mode functions. In addition the step locations of a given instruction can be displayed on a list.

(1) Reading a program according to a step number. According to the designation of a step number, a program list including the given step number is displayed as per the following example;

EXPL.

Procedure   Key-stroke

1   LST RD ··List mode, Reading function.

2   SSN 1 0 GO ····················Designating a step number "10"

Display

3	OUT	Y	430
4	AND	M	70
5	OUT	T	450
6	K		8.5
7	LD	X	400
8	OR	X	401
9	OR	X	402
▶ 10	OR	X	403
11	OR	X	404
12	ANI	X	405
13	OUT	Y	431
14	LD	X	500
15	OR	X	501
16	ANI	X	502

14 lines

Designated step number

Step number

Instructions

Instruction numbers

Function Symbols
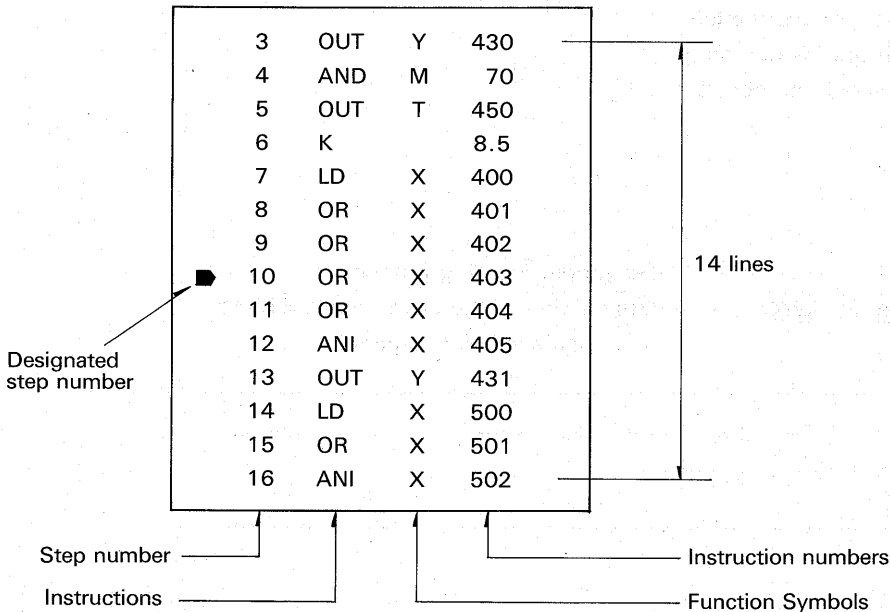
3   GO ······ GO ·······························The program list is scrolled down by 13 steps when depressing the GO key.

4   ↑ ······ ↑
     or
     ↓ ······ ↓
     } ···························The program list can be scrolled up and down one step. (The circuit block scrolling is not available.)

(2) Reading a program according to a instruction.
    According to the designation of an instruction,
    a program list including the given instruction is
    displayed as per the following example;

EXPL.

Procedure   Key-stroke
    1   `LST` `RD` ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯List mode, Reading function.
    2   `OR` `4` `0` `3` `GO` ⋯⋯⋯⋯Designating an instruction "OR 403"
            Display a List ⋯⋯⋯⋯⋯⋯⋯⋯⋯Same as the example before.
                                        Part of the program list including the given instruction is
                                        displayed.
    3   `GO` ⋯⋯ `GO` ⋯⋯⋯⋯⋯⋯⋯⋯⋯By depressing the [GO] key, the list is changed to display
                                        part of the program including the same instruction in turn.
                                        (if the instruction is used more than one time)
    4   `↑` ⋯⋯ `↑` ⎫
                or   ⎬⋯⋯⋯⋯⋯⋯⋯⋯The program list displayed is scrolled up and down one
            `↓` ⋯⋯ `↓` ⎭   step.

(3) Reading I/O list according to a instruction.
    According to the designation of an instruction,
    all inputs and outputs for which the instruction is
    used in a program, are displayed as per the
    following example;

EXPL.

Procedure   Key-stroke
    1   `LST` `RD` ⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯⋯List mode, Reading function.
    2   `M` `1` `3` `0` `GO` ⋯⋯⋯⋯Designation of the instruction "M130"
                                        (Function symbol is required)
            Display

            ┌───┐
            │   M130   12 ─< >─   26 ─┤├─   29 ─┤/├─   ⋯⋯⋯ 43 ─┤├─   │
            │   56 ─┤├─   ⋯⋯⋯   │
            │   │
            └───┘
            Step Number ─────────┘

    3   `GO` ⋯⋯ `GO` ⋯⋯⋯⋯⋯⋯⋯⋯⋯If the list is over the screen, depress the [GO] key to display
                                        the rest of the list.

(1) Instruction List and Instruction Check

Following procedure gives a list of instructions, with which elements can be checked for usage;

Procedure	Key-stroke	
1	LST RD	·········· List mode, Reading function.
2	Y GO	·········· Make a list of function Y.

Display

```
        Y430    1    0
        Y431    1    1    EO
        Y432    1    0
        Y433    0    1
        Y434    0    1
          ⋮
```

Error Message

EO : The coil is used more than one time in a program.

E1 : The contact is used without the corresponding output.

E2 : The output is used without the corresponding input.

E3 : The counter or shift resister is used without the RST.

E4 : The timer, counter or special instruction is used without the constant K.

E5 : Corresponding S and R, or CJP and EJP are not provided.

Contact
When the element is used
for the contact ···········1 ※
If not ·························0

Coil
When the element is used
for the coil ·················1 ※
If not ·························0

※ Even if the contact or coil is used more than once, a number 1 is displayed.

3	GO ······ GO	·········· When the list is beyond the screen, depress the ⬚GO key to display the remaining elements.

(2) Code check

It is possible to check all program codes through a program by the procedure below. PGM CHECK ⬚1 is utilized to check a program which might be damaged in the PC by a noise interference etc. PRG CHECK ⬚2 is the checking of the programming error or grammatical error in a program.

When the verification is completed without any error in a program, a message "FINISHED" is displayed.

If there is any error, the step number and error code are displayed.

Procedure	Key-stroke	
1	LST	·········· List mode
2	VER	·········· Verification function.
3	GO	·········· Display

Display

```
PGM CHECK
  1  OBJ CODE CHECK
  2  CIRCUIT CHECK
```

Procedure Key-stroke

4 (1) [1] ···OBJ CODE ERROR check

If there is any code error, the step number and error code
"E0" are displayed.

(2) [2] ···CIRCUIT CHECK

If there is any circuit error, the step number and error code
"E1~E4" are displayed.

E1 : ① First instruction from bus bar is not LD, LDI or STL.
       (exept END, MCR, RET, EJP, CJP)
     ② Numbers of LD/LDI and ANB are unmatched.
     ③ LD/LDI instruction is used for MCR, RET, EJP,
       END.
E2 : ① LD/LDI instructions are programmed more than 8
       times per ladder rang.
E3 : ① The timer, counter or special instruction is used
       without the constant K.
E4 : ① Continued STL instruction over than 8 times.
     ② MC, MCR, OUT F670 K7, OUT F670 K6 instruc-
       tion is used after STL instruction.
     ③ There is RET instruction outside STL circuit.
     ④ OUT F670 K6 instruction is used more than once.
     ⑤ There is OUT F670 K9 instruction without OUT
       F670 K6.
     ⑥ There is STL, RET, MC, MCR instruction after OUT
       F670 K6.
     ⑦ There is OUT F670 K6 without OUT F670 K9.

(3) [CL] ···Cancel of code check.

(1) Clearing the RAM ready to receive a new program.

To clear a program in RAM to receive a new program, proceed as follows;

Procedure	Key-stroke	
1	LST RD	·············List mode, Reading function.
2	SSN 0 GO	·············Program is listed.
		(Display any program before clearing a program)
3	WR	·············Writing function.
4	SSN 0 GO	·············From step "0"
5	NOP	·············Writing "NOP"
6	K 8 8 9 GO	·············By the end of step.

$$\left(\begin{matrix} \text{F-20M}\cdots\cdots 477 \\ \text{F-40M}\cdots\cdots 889 \end{matrix}\right) \left(\begin{matrix} \text{F}_2\text{-40M}\cdots\cdots 999 \\ \text{F}_2\text{-60M}\cdots\cdots 999 \end{matrix}\right)$$

The entire program is cleared and "NOP" is written in all step from 0 to 889 (F-20M ········ 477) by the above procedure.

(2) Writing a new program.

To write a new program after clearing the previous program, display step "0" and start writing as per the following example;

EXPL.
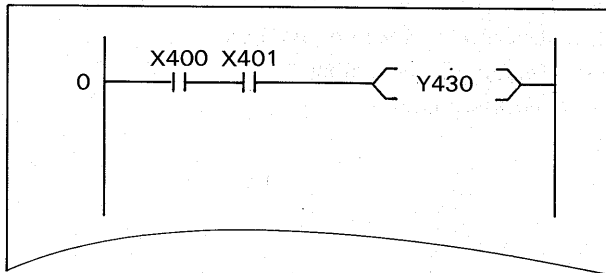
Procedure	Key-stroke	
1	LST RD	·············List Mode, Reading Function.
2	SSN 0 GO	·············Display step "0".
3	WR	·············Writing Function.
4	LD 4 0 0 GO	
5	AND 4 0 1 GO	
6	OUT 4 3 0 GO	

a) When depressing the GO key after a instruction, the instruction is written and the cursor automatically moves to the next position.

b) When the key-stroke is mis-operated before depressing the GO key, depress the CL key to clear and write the correct instruction. After depressing the GO key, move the cursor back and write the correct instruction.

c) There is no limitation to the number of contacts that can be written in series or parallel. However, any circuit over three screens of ladder diagram can not be read in the ladder mode or printed out by the printer.

d) The operation of the CNV GO is not required to write a program in the RAM.

(1) Adding a program.

When new program is added at the end of a program, read the program end as per the following example;

EXPL.

Procedure   Key-stroke
1   `LST` `RD` ·····································List mode, Reading function.
2   `END` `GO` ·····························Reading the program end.
3   `GO` ······· `GO` ····························When there are more than one END instructions in a program, depress the $\boxed{GO}$ key to read the following program end.
4   `WR` ··Writing function.
5   `LD` `1` `0` `0` `GO`
6   `AND` `1` `0` `1` `GO`
7   `OUT` `1` `1` `0` `GO`

(2) Re-writing a program.

To re-write instructions, proceed as per the following example;

EXPL.

Procedure   Key-stroke
1   `LST` `RD` ·····································List mode, Reading function.
2   `SSN` `8` `GO` ·····························Reading step number 8.
3   `WR` ·····································Writing function.
4   `LDI` `1` `0` `0` `GO`
5   `ANI` `1` `0` `1` `GO`
6   `OUT` `1` `3` `0` `GO`

	Step	Instr	Value
	7	OUT	434
▶	8	LD	120
	9	AND	121
	10	OUT	435
	11	LD	403
	12	AND	404
	13	OUT	436

⟹
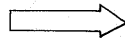
	Step	Instr	Value
	7	OUT	434
	8	LDI	100
	9	ANI	101
	10	OUT	130
▶	11	LD	403
	12	AND	404
	13	OUT	436

(3) Deleting a program.

To delete instructions in a program, proceed as per the following example;

EXPL.

Procedure	Key-stroke	
1	[LST] [RD]	············List mode, Reading function.
2	[SSN] [1] [0] [GO]	············Reading the step number 10.
3	[DEL] [GO]	} ············Deleting the instruction at the step number 10 and 11.
4	[DEL] [GO]	(After deleting, the step numbers are re-arranged.)

```
      9    LD    400                    9    LD    400
►    10    AND   401               ►   10    OUT   430
     11    OR    402                   11    LD    100
     12    OUT   430        ⟹         12    AND   101
     13    LD    100                   13    OR    102
     14    AND   101                   14    OUT   431
```
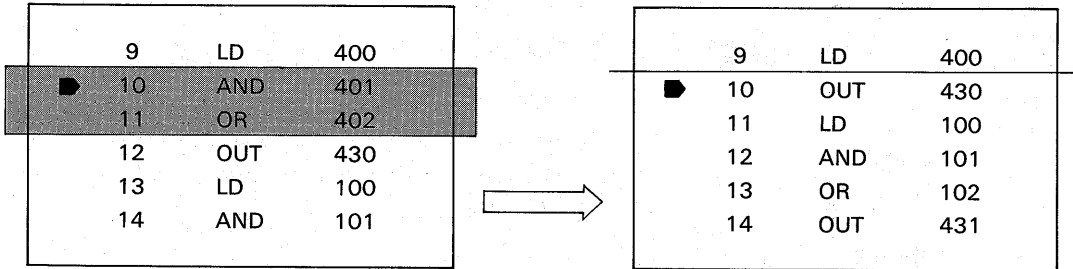
(4) Inserting a program.

To insert instructions in a program, proceed as per the following example;

EXPL.

Procedure	Key-stroke	
1	[LST] [RD]	············List mode, Reading function.
2	[SSN] [1] [0] [GO]	············Reading step number 10.
3	[INS]	············Inserting function.
4	[AND] [4] [0] [1] [GO]	
5	[OR] [4] [0] [2] [GO]	

```
      9    LD    400                    9    LD    400
►    10    OUT   430                    10   AND   401
     11    LD    100                    11   OR    402
     12    AND   101        ⟹      ►   12    OUT   430
     13    OR    102                   13    LD    100
     14    OUT   431                   14    AND   101
```
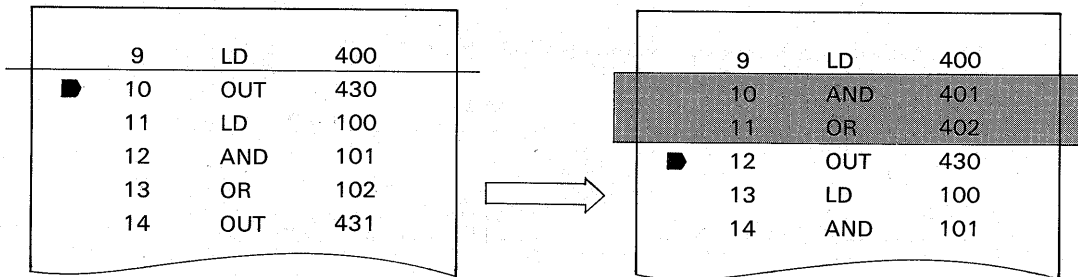
(5) Deleting NOP instructions.

When a circuit is deleted in the ladder mode, NOP instructions are written in the steps of the circuit. (See the ladder mode, deleting section.) To delete these NOP instructions in a program, proceed as follows;

EXPL.

Procedure	Key-stroke	
1	[LST] [RD]	············List mode, Reading function.
2	[SSN] [0] [GO]	············Reading the step number 0.
3	[DEL] [NOP] [GO]	············Deleting all NOP instruction in a program.

(1) Program Conversion between F-40M and F2-40/60M

Procedure   Key-stroke

1   LST CNV ···Program conversion mode.

Display

```
┌─────────────────────────────┐
│   LIST CONVERT              │
│     1  F-40 → F2            │
│     2  F2   → F-40          │
│                    F-40     │
└─────────────────────────────┘
```

2   1 (or 2) then GO ··············Excution.

Display   NOTE : F2 → F-40M

```
┌─────────────────────────────┐
│   LIST CONVERT              │
│       F-40 → F2            │
│                            │
│     FINISHED    F2         │
└─────────────────────────────┘
```

NOTE : F2 → F-40M

F-40M must have same instructions and same element numbers for F2 program, also F2 program must be less than 890 steps.

(2) Conversion of element number.

When same elements are used many times in a program, the element can be changed collectively as following procedures;

Procedure   Key-stroke

1   LIST RD ··List mode, reading.
2   OUT Y 4 3 0 GO ···A given element number.
                                   (either coil or contact)
3   CNV Y 4 3 1 GO ···Executing.

EXPL.   The conversion shall be same elements(X→X, Y→Y, M→M ·········)

```
 X400                              X400
──┤├────────⟨ Y430 ⟩─┤      ⟹   ──┤├────────⟨ Y431 ⟩─┤

 Y430                              Y431
──┤├────────⟨ M100 ⟩─┤           ──┤├────────⟨ M100 ⟩─┤
```

5. CPU MODE

This section introduces interfacing functions between the PC and the HGP.
Connect the HGP to the PC in conjunction with the interface unit, control ROM cassette and cable (See the preparation section).

5-1 PROGRAM TRANSFER FROM PC TO HGP

When PC operation is monitored or a program in the
PC is amended, it is necessary to transfer the program
in the PC to the RAM of the HGP.
To transfer the program, proceed as follows;

Procedure   Key-stroke
   1   CPU ....CPU Mode
                                                    When the cable connection is not correct or the PC power
                                                    is not turned ON, a message "TRANSFER TROUBLE" is
                                                    displayed.
   2   RD GO ....Reading function.
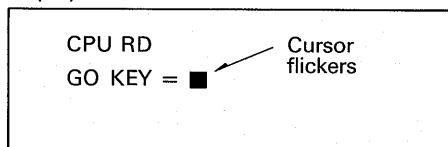
        Display
        ┌─────────────────────────────┐   The display re-confirms the intention to transfer the program.
        │   CPU RD   ╱ Cursor   │   If the intention is "NO", depress the CL key.
        │   GO KEY = ■ ╱   flickers   │
        │   │
        └─────────────────────────────┘

   3   GO ....If the intention is yes, depress the GO key again.
   4   The program transfer is executed and a message "FINISHED" is displayed when the transfer is
          completed.

   a) This function can be executed when the PC is in either RUN mode or STOP mode.

5-2 PROGRAM VERIFICATION

After the program transfer is completed, the programs
in the PC and HGP can be verified as following
procedure;

Procedure   Key-stroke
   1   CPU ....CPU mode.
   2   VER GO ....Verification function.
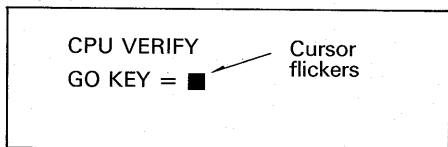
        Display
        ┌─────────────────────────────┐   The display re-confirms the intention to verify the
        │   CPU VERIFY   ╱ Cursor   │   programs.
        │   GO KEY = ■ ╱   flickers   │
        │   │
        └─────────────────────────────┘

   3   GO ....If the intention is "Yes", depress the GO key. If not,
                                                    depress the CL key.
   4   The program verification is executed and a message "FINISHED" is displayed if the verification has
          no errors.   If an error occurred, a message "VERIFY ERROR" is displayed and a list of the error
          instructions is displayed.

   a) This function can be executed when the PC is in either RUN mode or STOP mode.

5-3 PROGRAM TRANSFER FROM HGP TO PC

A program in the HGP can be loaded in the PC. In this case the PC should be in the STOP mode and turn the protect switch of the HGP "OFF".

Procedure　Key-stroke

1　CPU　……………………………………………………CPU mode.

2　WR　GO　………………………………………Writing function.

Display

```
┌─────────────────────────────────┐
│                                 │
│     CPU WR          Cursor      │
│     GO KEY = ■ ←── flickers     │
│                                 │
│                                 │
│                                 │
└─────────────────────────────────┘
```
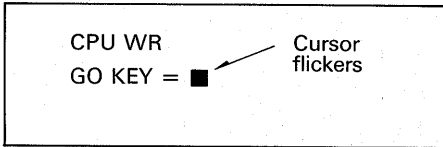
The display re-confirms the intention to load the program in the PC.

3　GO　………………………………………………If the intention is "Yes", depress the $\boxed{GO}$ key. If not, depress the $\boxed{CL}$ key.

4　The program is transferred from the HGP to the PC. After the transfer is completed, the programs in the HGP and PC are automatically verified and a message "FINISHED" is displayed if there is no writing error. If a writing error occurred, a list of the error instructions are displayed with a message "WRITE ERROR" writing.

6. TEST FUNCTIONS

6-1 FORCING OF AUXILIARY RELAYS, TIMERS AND COUNTERS

The F-40M, F2-40M, and F2-60M models have the functions to force certain contacts ON or OFF by means of the programming panel F-20P-E, F2-20P-E but the F-20M model has not. However by using the HGP, this function can be given to the F-20M and F-40M, F2-40M, F2-60M as per the example below.

This function is available when the PC is in either RUN mode or STOP mode except for timer setting or resetting (The PC should be in RUN mode for the timer).

Possible Contact	F-20M model	F-40M model	F2-40M, F2-60M
Auxiliary relay	M160~177	M300~377	Possible for all
Timer	T 50 ~57	T 450~457, 550~557	contact X,Y,M,T,C,S
Counter	C 60 ~67	C 460~467, 560~567	

(1) Setting $\boxed{S}$

When the timer or counter is set by the key-stroke of the HGP, the timer or counter increments and the contact is forced "ON". When the auxiliary relay is set, the contact is forced "ON" for one scanning cycle of the PC. If the status of the contact is required to be kept, it is recommended to provide a latch circuit in a program.

(2) Resetting $\boxed{R}$

The timer or counter can be forcibly reset and the contact is turned OFF.

In the case of auxiliary relays, the contact is forced OFF for one scanning cycle of the PC. If the latch circuit is provided in a program, the latch is released.

EXPL.

Procedure	Key-stroke	
1	CPU TST	CPU mode, Test function.
2	⊡ S 4 5 0 GO	Setting timer T450.
		The timer contact T450 is forced ON.
3	⊡ R 4 5 0 GO	Resetting timer T450.
		The timer contact T450 is forced OFF.

a) It is not required that the PC program be in RAM of the HGP. However the above function is sometimes utilized in conjunction with the monitoring function which requires that the HGP has the PC program.

6-2 LOADING PRESET VALUES

By means of the programming panel F-20P-E, F2-20P-E, the F2-40M, F2-60M, F-40M model have the function to set the constant value "K" of the timer or counter, with the base unit either in RUN mode or in STOP mode. The HGP can provide this function for both F-20M and F-40M, F2-40M, F2-60M models. This function is utilized in conjunction with the monitoring function after the PC program is transferred to RAM in the HGP. (Monitoring function: see the monitoring section)

Procedure   Key-stroke

1   LDR MNT ....Ladder mode, Monitoring function.

2   SSN 1 6 GO ....Reading the circuit of step number 16. Same procedure as the reading function in the ladder mode.

Display
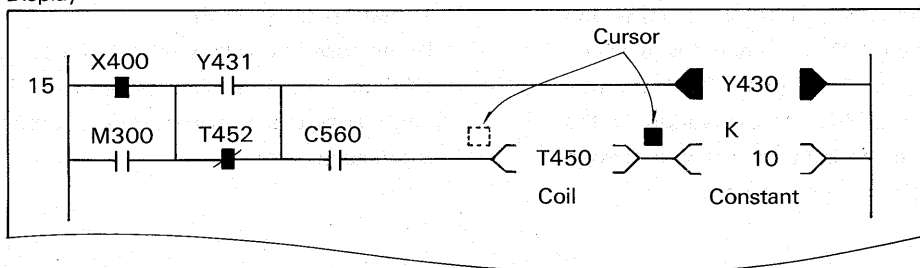
3   ↑ ↓ → ← ....Moving the cursor to the timer constant of which the constant value is changed.

4   TST ....Test function.

5   K 8 GO ....The constant value K10 for the timer T450 is changed to K8.

a) When the constant value is changed for the timer or counter proceeding the count, the new constant value is valid after resetting once.

b) Moving the cursor to the timer or counter coil, constant of data register is changed in the same manner above (F2-40/60M).

7. MONITORING

To monitor the PC operation in RUN mode, proceed as per the following example after the PC program is transferred to the HGP;

EXPL.

Procedure   Key-stroke

1   [LDR] ··Ladder mode.

2   [MNT] ···Monitoring function.

3   [SSN] [1] [6] [GO] ··················Displaying a circuit which includes step number 16 for monitoring.

      OR

  [⊶] [4] [3] [0] [GO] ···········The same circuit can be displayed by the address of the instruction in the ladder mode.
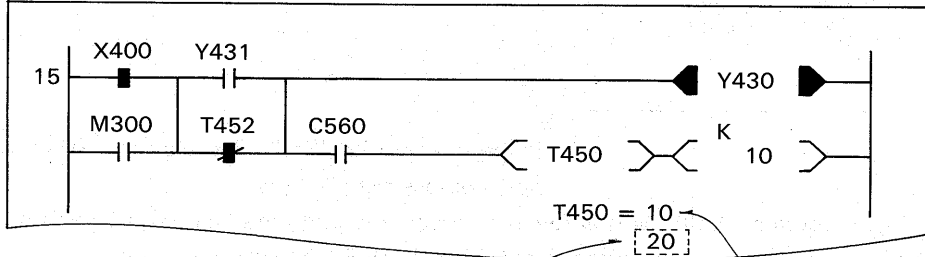
Display

Display of data register value of timer, counter.
(F2-40M, F2-60M)
If this value is zero, display is not shown.

a) The monitoring function is utilized with the PC base unit in either RUN mode or STOP mode.

b) The ON/OFF status of the contact and coil is displayed as follows;

	OPEN	CLOSED
normally open contact	—| |—	—■—
normally closed contact	—|/—	—■—
coil	—(	)■ ▶

c) When the [MNT] key is depressed, the programs in the PC and HGP are automatically verified. If there is any error, a message "VERIFY ERROR" is displayed.

d) When the transmit cable is not connected correctly with the units or the PC power is turned off, a message "TRANSFER TROUBLE" is displayed.

e) When the timer or counter is monitored on the screen, the time or count value remaining is displayed in the column for messages. (Less than 4 timers or counter)

f) Be aware that the contact status is not visible when the contact is turned on or off for a very short time.

8. RMW MODE

This section provides a introduction to the interfacing procedures with the ROM writer unit GP-80ROW or GP-80ROW-E for the functions such as a program transfer between the ROM cassette and the RAM in the HGP, program verification and erase check.

Before the HGP is operated, connect the ROM writer unit to the HGP and push $\boxed{1}$ key of selecter switch on ROM writer. The ROM cassette should not be inserted or removed when the power is supplied to the ROM writer unit.

8-1 PROGRAM TRANSFER FROM HGP TO ROM
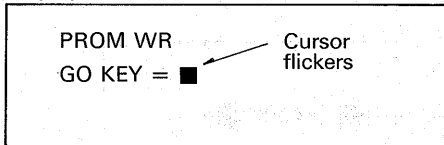
A program in the HGP is written in the blank ROM cassette as follows;

Procedure	Key-stroke	
1	RMW	······ROM writer mode.
2	WR GO	······Writing function.

Display

```
┌─────────────────────────────┐
│                             │
│   PROM WR        Cursor     │
│   GO KEY = ■     flickers   │
│                             │
│                             │
└─────────────────────────────┘
```

The display re-confirms the intention to write a program.

3   GO ·······················If the intention is "Yes", depress the $\boxed{\text{GO}}$ key again. If not, depress the $\boxed{\text{CL}}$ key.

4   Before writing a program, the ROM is automatically checked and the writing is executed if no program is in the ROM. If any program is evident, a message "NOT ERASED" is displayed.
When the writing is completed, the programs in the ROM and HGP are automatically verified and a message "FINISHED" is displayed if there is no error. If there is an error, a message "WRITE ERROR" is displayed.

8-2 PROGRAM TRANSFER FROM ROM TO HGP

A program in the ROM cassette is transferred to the RAM in the HGP as follows;

Procedure	Key-stroke	
1	RMW	······ROM writer mode.
2	RD GO	······Reading function.

Display

```
┌─────────────────────────────┐
│                             │
│   PROM RD        Cursor     │
│   GO KEY = ■     flickers   │
│                             │
│                             │
└─────────────────────────────┘
```
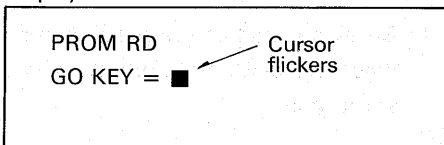
The display re-confirms the intention to read a program.

3   GO ·······················If the intention is "Yes", depress the $\boxed{\text{GO}}$ key again. If not, depress the $\boxed{\text{CL}}$ key.

4   Before reading a program, the ROM is automatically checked and the reading is executed if any program exists in the ROM. If not, a message "ROM ERASED" is displayed and the power to the ROM writer is swiched off. When the reading is completed, a message "FINISHER" is displayed.

8.3 PROGRAM VERIFICATION

The programs in the ROM and HGP are verified as follows;

Procedure Key-stroke
1   RMW ··ROM writer mode.
2   VER GO ···Verification function.

Display

```
┌─────────────────────────────────┐
│                                  │
│   PROM VER          Cursor       │
│                     flickers     │
│   GO KEY = ■                     │
│                                  │
│                                  │
└─────────────────────────────────┘
```

The display re-confirms the intention to verify the programs.

3   GO ··If the intention is "Yes", depress the GO key again. If not, depress the CL key.

4   Before the verification starts, the ROM is automatically checked and verification is executed if any program exits in the ROM. If not, a message "ROM ERASED" is displayed and the power to the ROM writer is turned off.
     When the verification is completed without any error, a message "FINISHED" is displayed.

If there is any error in the programs a message "VERIFY ERROR" is displayed and a list of the error step is displayed (max. 12 steps) as per the following example;
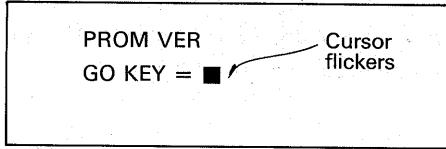
PROGRAM IN THE HGP ─────────────────────┐   ┌───── PROGRAM IN THE ROM CASSETTE

```
┌─────────────────────────────────────────────────┐
│                  ↓              ↓                 │
│                                                   │
│       STEP        RAM           ROM               │
│       010         LD X123       LD X124           │
│       152         K15           K20               │
│       321         K123          K234              │
│                                                   │
│                                                   │
└─────────────────────────────────────────────────┘
```
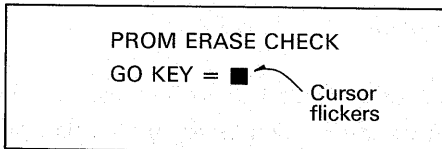
8.4 ROM ERASE CHECK

The ROM cassette is checked if any program is left or not as follows;

Procedure Key-stroke
1   RMW ··ROM writer mode.
2   TST GO ···Test function.

Display

```
┌─────────────────────────────────┐
│                                  │
│   PROM ERASE CHECK               │
│                                  │
│   GO KEY = ■                     │
│                     Cursor       │
│                     flickers     │
│                                  │
└─────────────────────────────────┘
```

The display re-confirms the intention to check the ROM.

3   GO ··If the intention is "Yes", depress the GO key again. If not, depress the CL key.

4   The erase check is executed through all 2K byte. A message "FINISHED" is displayed when no program is found. If any program is left, a message "NOT ERASED" is displayed.

9. CMT MODE

This section provides a introduction to the interfacing procedures with the CMT (cassette magnetic tape) recorder for the functions such as a program transfer between the CMT and HGP, and program verification.
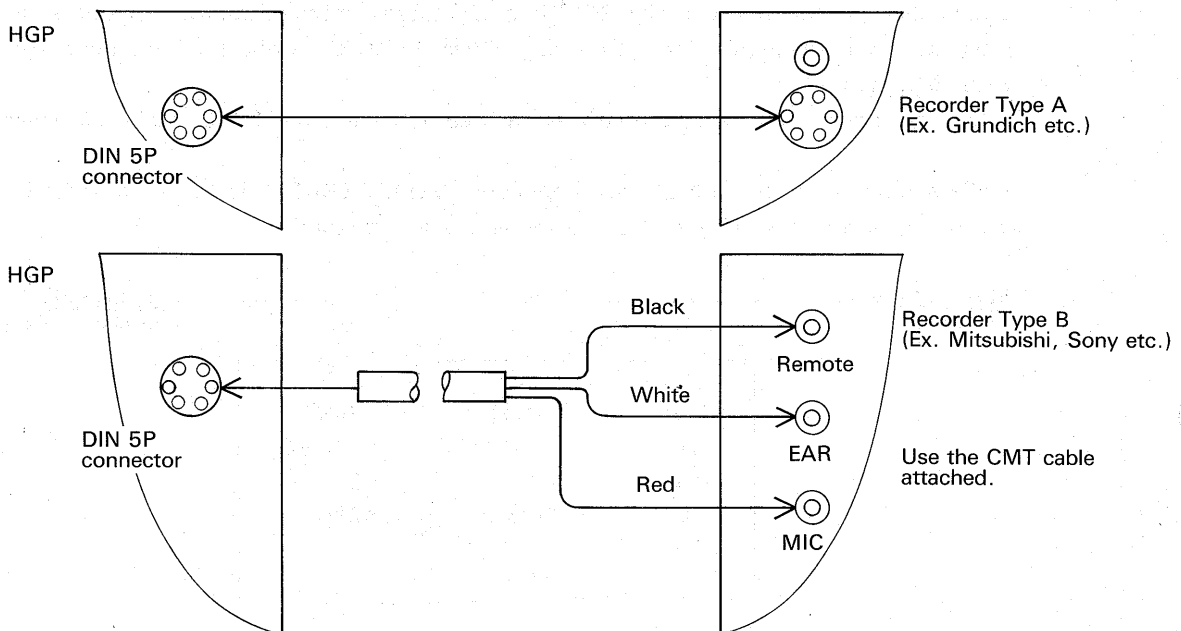
9-1 HANDLING A CMT RECORDER

(1) Recorder Model

For the functions above, any ordinary cassette tape recorder on the market can be used including the recorder with a remote start/stop switch function.

(2) Tape

The cassette magnetic tape shall have a capacity more than 30 MIN, in which five programs can be recorded on the side A or B.

(3) Connection

HGP

DIN 5P connector

Recorder Type A
(Ex. Grundich etc.)

HGP

DIN 5P connector

Black

White

Red

Remote

EAR

MIC

Recorder Type B
(Ex. Mitsubishi, Sony etc.)
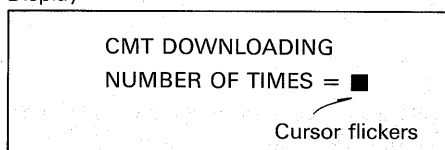
Use the CMT cable attached.

9-2 RECORDING

(4) Adjustment

The volume level shall be at maximum level and the winding speed of the cassette tape shall be at a constant and standard speed.

To download a program in the CMT, proceed as follows;

Procedure   Key-stroke
   1   CMT   ···CMT mode.
   2   WR   GO   ·································Writing function.

Display

```
CMT DOWNLOADING
NUMBER OF TIMES = ■
```
Cursor flickers

A program can be loaded up to 5 times. When a program is recorded more than two times, the correct program can be chosen out of all the programs if a program error occurs after recording.

3   `5` `GO` ·······························Five recordings.

Display

```
CMT DOWNLOADING
NUMBER OF TIMES = 5
RUN TAPE
GO KEY = ■      Cursor
                flickers
        REMOTE ON
```

4   `GO` ·······························Run the tape recorder and depress the `GO` key a few seconds later.

(In case of the recorder with remote function, the recorder automatically runs after the `GO` key is depressed.)

5   The recording is executed repeatedly 5 times. According to the recording process, the progress is displayed as per the following example;

Display

```
    CMT DOWNLOADING
    NUMBER OF TIMES = 5, RUN TAPE
    GO KEY = GO

EXECUTING, NUMBER OF TIMES = 2, STEP 16
```

6   After the recording is completed, a message "FINISHED" is displayed.

9-3 PLAYBACK

To upload a program from the CMT, proceed as follows;

Procedure   Operations

1   `CMT` ·······························CMT mode.

2   `RD` `GO` ·······························Reading function.

Display

```
    CMT UPLOADING
    WHICH PROG. NBR ? = ■
                        Cursor
                        flickers
```

The display asks which program is read out.
(When more than one program have been recorded.)

3   `1` `GO` ·······························Designation of the program number one is chosen. If no existing program number is designated, a message "NOT FOUND" is displayed.

Display

```
    CMT UPLOADING
    WHICH PROG. NBR ? = 1
    RUN TAPE
    GO KEY = ■      Cursor
                    flickers
          REMOTE ON
```

The display re-confirms the intention to execute.

4   `GO` ·······························If the intention is "Yes", depress the `GO` key after the recorder is run. If not, depress the `CL` key. (In case of the recorder with the remote function, the recorder is automatically run after the `GO` key is depressed.

5   If the volume level is not high enough, a message "ADJUST SIGNAL LEVEL" is displayed. The volume level should be at the maximum level beforehand.

6   The playback is executed and display as follows;

Display

```
CMT UPLOADING
WHICH PROG. NBR ? = 1, RUN TAPE
GO KEY = GO
SIGNAL LEVEL OK
EXECUTING WHICH PROG. NBR = 1  Step 30
```

7   After the playback is completed, a message "FINISHED" is displayed.

9-4 VERIFICATION OF PROGRAM

To verify the programs in the HGP and the CMT, proceed as follows;

Procedure   Operation

1   CMT ....CMT mode.

2   VER GO ....Verification function.

Display

```
CMT VER
VERIFY PRG. NBR = ■
              Cursor flickers
```

The display asks which program number in the CMT is verified to the program in the HGP.

3   2 GO ....Designation of the program number two. If no existing number is designated, a message "NOT FOUND" is displayed.

Display

```
CMT VER
VERIFY PRG. NBR = 2
RUN TAPE
GO KEY = ■      Cursor flickers



         REMOTE ON
```

The display re-confirms the intention to execute.

4   GO ....If the intention is "Yes", depress the GO key soon after the recorder starts. If not, depress the CL key. (In case of the recorder with the remote function, the recorder starts automatically after the GO key is depressed.

5   If the volume level is not high enough, a message "ADJUST SIGNAL LEVEL" is displayed. The volume level should be at maximum level before starting.

6   The verification is executed and display as follows;

Display

```
CMT VER
VERIFY PRG. NBR = 2, RUN TAPE
GO KEY = GO
SIGNAL LEVEL OK

EXECUTING VERIFY PRG. NBR = 2, STEP 15
```

7   When the verification has completed without any error, a message "FINISHED" is displayed.
If there is any error, the verification stops at the step of the error and a message "VERIFY ERROR" is displayed.

10. GPT MODE

This section provides a introduction to the interfacing procedures with the GPT (graphic printer) for functions such as printing of the ladder diagram, program list and input/output list.
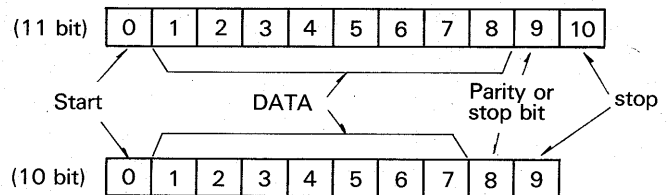
10-1 PRINTER

The above functions can be utilized by means of any ordinary graphic printer on the market which satisfies the conditions below.
However the compatibilities are not guarantied because the printers may have exclusive commands or exclusive cond—
itions. For covenience in choosing printer models, the HGP has the menu of the specific printer models to use.

(1) Common conditions

Interface	: RS232C
Charactor Code	: ASCII
BAUD Rate	: 2400 or 300
Input Comm	: D Subminiture 25P (HGP)
Protocol	: 11 bit or 10 bit

(11 bit)

0	1	2	3	4	5	6	7	8	9	10

Start   DATA   Parity or stop bit   stop

(10 bit)

0	1	2	3	4	5	6	7	8	9

(2) Printer Model Menu

Following printer model can be selected in the menu;

Item	Maker	Page Length	bit	Ref
1	EPSON	12 inch	Data 8/11	MX-80,FX-80 plus I/F 8145,8148
2	//	11 inch	//	//
3	OKI	12 inch	//	MICROLINE 84 etc.
4	//	11 inch	//	//
5	EPSON	12 inch	//	Swedish charactor
6	GENERAL	PARAMETER CHANGE		GENERAL PRINTER SELECTION

(3) Parameter Change

When number six is chosen in the above menu, the second menu is displayed as follows;

```
     PARAMETER
 ➡   BAUD RATE          ※1. 2400 BPS     2. 300 BPS
     DATA BIT           ※1. 8 BIT        2. 7 BIT
     PARITY CHECK       ※1. YES          2. NO
     PARITY BIT         ※1. EVEN         2. ODD
     STOP BIT           ※1. 1 BIT        2. 2 BIT
     PAGE LENGTH        ※1. 12 INCH      2. 11 INCH
     CHARACTOR CODE     ※1. ASC II       2. OTHER
     SELECT 1 OR 2,
```

To set the protocal conditions, select number "1" or "2" for all parameters in the menu. At the time of each selection, a mark "※" i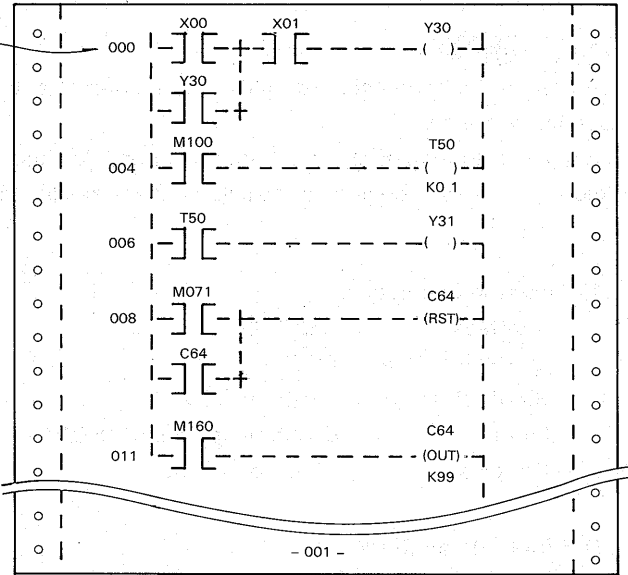s displayed on the number selected and cursor position moves to next parameter column automatically. After all selection is completed, depress GO to forward.

A ladder diagram, program list and I/O list are printed
out as per the following example;

(1) Ladder Diagram

First step number
of each ladder rung

(2) Program List

000	LD	00
001	OR	30
002	ANI	01
003	OUT	30
004	LD	100

– 001 –

(3) Input/Output List

| X00 | 000 | –] / [– | 030 | –] / [– |
| X01 | 001 | –] / [– | 031 | –] [– |

– 001 –
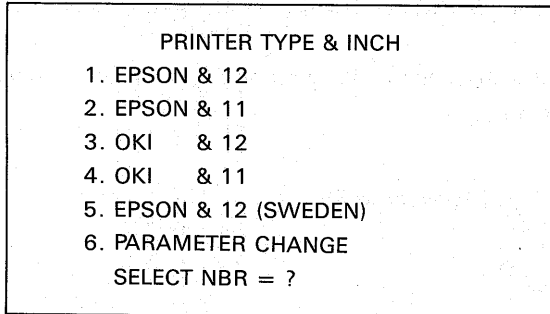
To print a ladder diagram, program list or I/O list of a program in the RAM of the HGP, proceed as follows after the power is supplied to the printer;

Procedure   Operation

1   GPT   ··GPT function mode.
                                                      A printer model menue is displayed.

Display

```
            PRINTER TYPE & INCH
        1. EPSON & 12
        2. EPSON & 11
        3. OKI    & 12
        4. OKI    & 11
        5. EPSON & 12 (SWEDEN)
        6. PARAMETER CHANGE
            SELECT NBR = ?
```

2   1   ···Designation and display of the printer model.
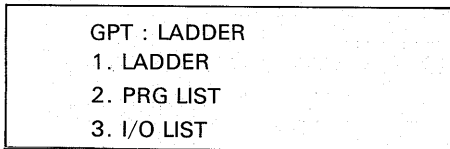   If number six is chosen, designate all parameters according
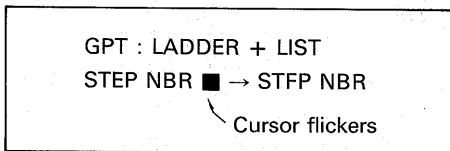   to the printer conditions as mentioned in the section 10-1.

3   WR GO   ···Writing function.

Display

```
        GPT : LADDER
        1. LADDER
        2. PRG LIST
        3. I/O LIST
```

The display asks "1" ~ "3" in the menu.
1······Ladder diagram print.
2······Program list.
3······I/O list.

4   1 2 GO   ··Selection in the menu. (Ladder + PRG List)

Display

```
        GPT : LADDER + LIST
        STEP NBR ■ → STFP NBR
                      Cursor flickers
```

The extent of the program step can be designated.
$$\left(\begin{array}{l} \text{F-20M} ······0\sim477 \\ \text{F-40M} ······0\sim889 \\ \text{F}_2\text{-40M}······0\sim999 \\ \text{F}_2\text{-60M}······0\sim999 \end{array}\right)$$ when just No.3 is selected, this display is not shown.

5   2 0 0 GO   ···································Designation of the first step number.
                                                      (From step NBR 200)

6   8 8 9 GO   ···································Designation of the last step number.
                                                      (To step NBR 889)

Display

```
        GPT : LADDER + LIST
        STEP NBR 200 → STEP NBR 889
        PUSH GO KEY → ■
                        Cursor flickers
```
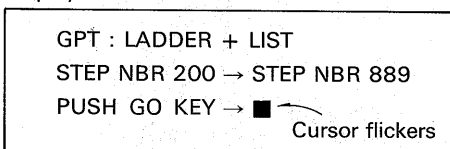
7   GO   ···Depress the GO key to start the printing after the power
                                                      to the printer is switched ON.

8   The printing is executed and a message "FINISHED" is displayed after the printings of the ladder
    diagram, program list and input/output list are completed.

# 11. MAINTENANCE AND PARTS REPLACEMENTS

11-1 ENVIRONMENT

While the HGP is suitable for most industrial situations, it should not be used in excessively hostile environments associated with extremes of damp, dust, corrosive gases, vibration or mechanical impact. The unit should not be kept in a situation where the temperature is likely to exceed the low or high temperature specified.

11-2 BATTERY REPLACEMENT

The RAM memory inside the HGP is backed by a non-chargeable lithium battery. It is recommended that the battery be replaced every five years.

To replace the battery, remove the battery case cover on the back of the unit and replace the battery within 30 seconds. A inside capacitor will support the program memory.
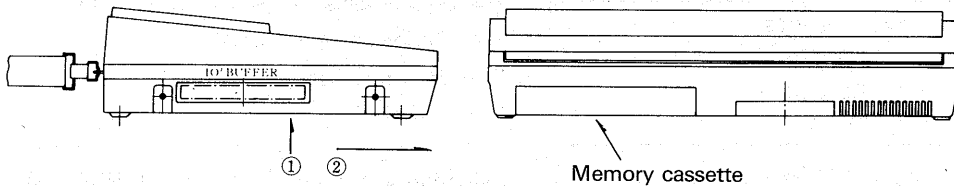
Ensure that the power is off before battery is replaced.

Battery cover   Screw driver etc.
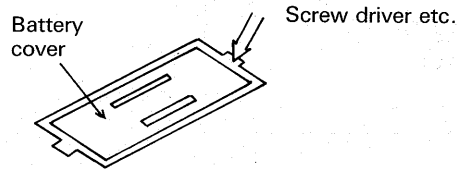
11-3 MEMORY CASSETTE REPLACEMENT

If the memory cassette and keyboard sheet are changed, the base unit GP-80A is also used for other Mitsubishi PCs such as G series and K series.

In this case, replace the memory cassette in following manner;

IO BUFFER

① ②   Memory cassette

1. Turn the power OFF.
2. Depressing the hook ① on the back, slide the cassette out forward.
3. Insert other memory cassette surely.

11-4 KEYBOARD SHEET REPLACEMENT

①   ①

Keyboard sheet

hook   hook

VOLUME CONTRAST

Keyboard sheet

OFF ON

②

③
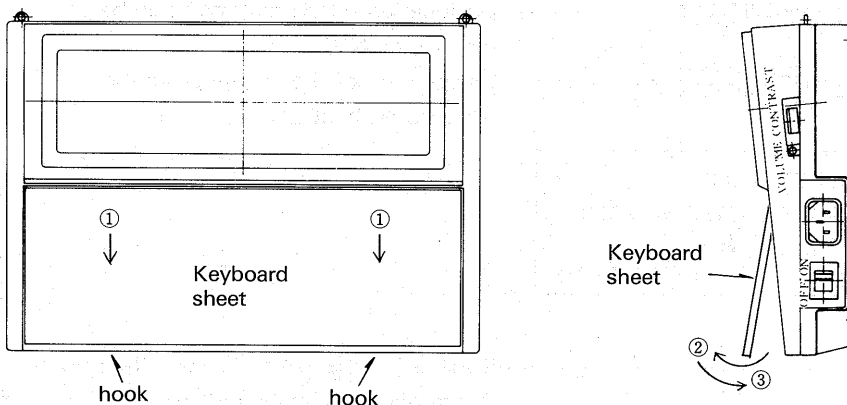
Replace the keyboard sheet in following manner;

1. Drawing the keyboard sheet forward ①, undo the hooks.
2. Lift the sheet-end up ② to remove.
3. Insert other keyboard sheet in reverse ③.

SPECIFICATIONS

POWER SOURCE	GP-80F$_2$-E : 220/240VAC $^{+10\%}_{-15\%}$ 50/60Hz
	GP-80F$_2$-U : 110/120VAC $^{+10\%}_{-15\%}$ 50/60Hz
POWER CONSUMPTION	Less than 15VA
INSULATION RESISTANCE	More than 10MΩ, 500VDC
INSULATION WITHSTAND VOLTAGE	1,500VAC, 1min.
AMBIENT TEMPERATURE	0~40°C
STORAGE TEMPERATURE	−20~60°C
AMBIENT HUMIDITY	10~90%RH No condensation
DIMENSIONS	W 300 × L 215 × H 70 (mm), W 11.8 × L 8.46 × H 2.76 (inch) HGP
WEIGHT	APROX. 2 KGs (4.4 lbs) HGP

OUTLINES AND DIMENSIONS

mm(inch)
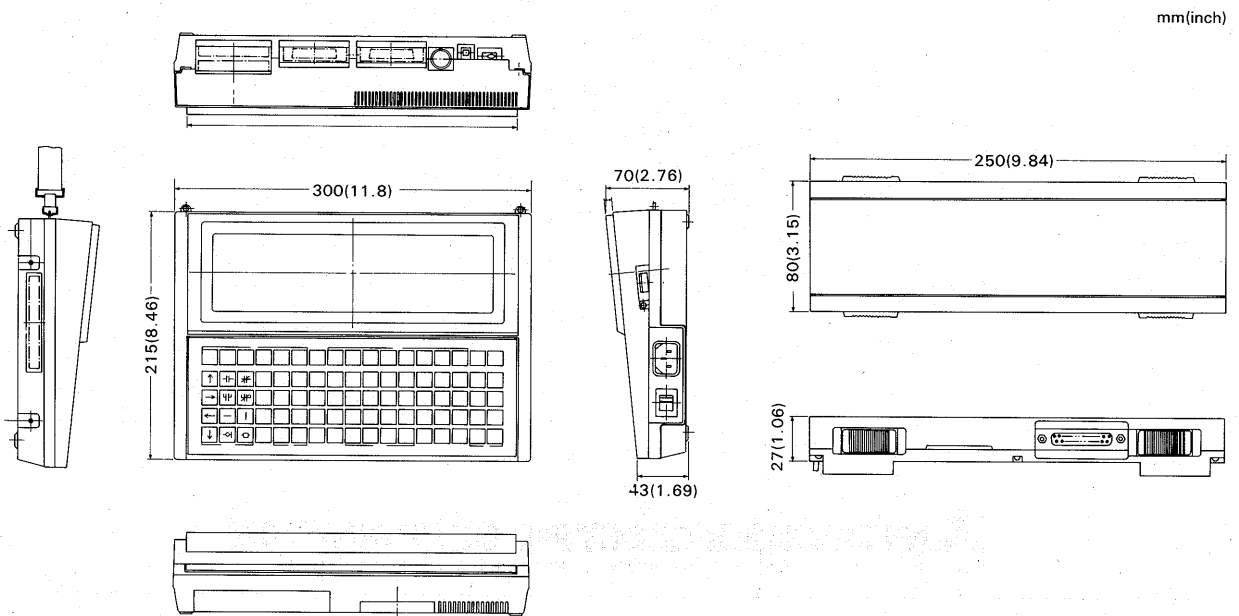
GP-80 HGP UNIT

F$_2$-20GF INTERFACE UNIT

MITSUBISHI ELECTRIC CORPORATION