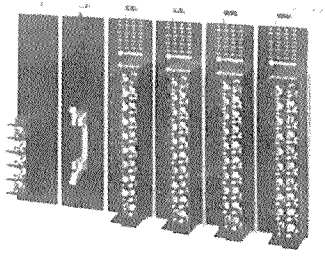
OPERATION MANUAL

EM-IISERIES



HITACHI

NJI 097(X)

USING THIS MANUAL

Introduction

This manual describes the EM-II Series Programmable Controller. This manual tells how to install, program, operate, and maintain your programmable controller.

Formore information on the HITACHI product line refer to the publications listed under additional information.

Manual Contents

- Chapter 1 - Configuration and Specifications.
- Chapter 2 - Peripheral equipment and Operation procedures
- Chapter 3 - Installation
- Chapter 4 - Maintenance

Additional Information

For more information on the Hitachi Product line refer to these publications:

- Hitachi programmable controller EB/EM-II series protocol manual (NJI 086(X))
- Graphic Programmer PGM-GPE operation manual (NJI 021AX)

Signs used through the manual except noted

- ○ : Applicable
- × : Not applicable
- △ : Partially applicable
- — : Unapplicable

WARNING

To ensure that the equipment described by this manual, as well as all equipment connected to and used with it, operate satisfactorily and safely, all applicable local and national codes that apply to installing and operating the equipment must be followed. Since codes can vary geographically and can change with time, it is the user's responsibility to determine which standards and codes apply, and to comply with them.

FAILURE TO COMPLY WITH APPLICABLE CODES AND STANDARDS CAN RESULT IN DAMAGE TO EQUIPMENT AND/OR SERIOUS INJURY TO PERSONNEL.
INSTALL EMERGENCY POWER STOP SWITCH WHICH OPERATES INDEPENDENTLY OF THE PROGRAMMABLE CONTROLLER TO PROTECT THE EQUIPMENT AND/OR PERSONNEL IN CASE OF THE CONTROLLER MALFUNCTION.

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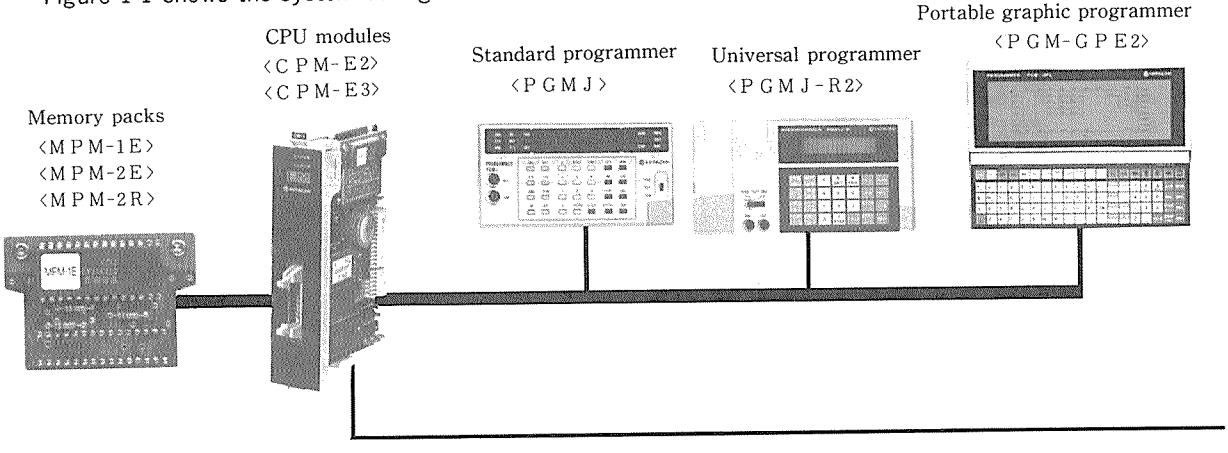
OPERATION

MANUAL

EM-II SERIES

TABLE OF CONTENTS

Figure 1-1 shows the system configuration of EM-II series.



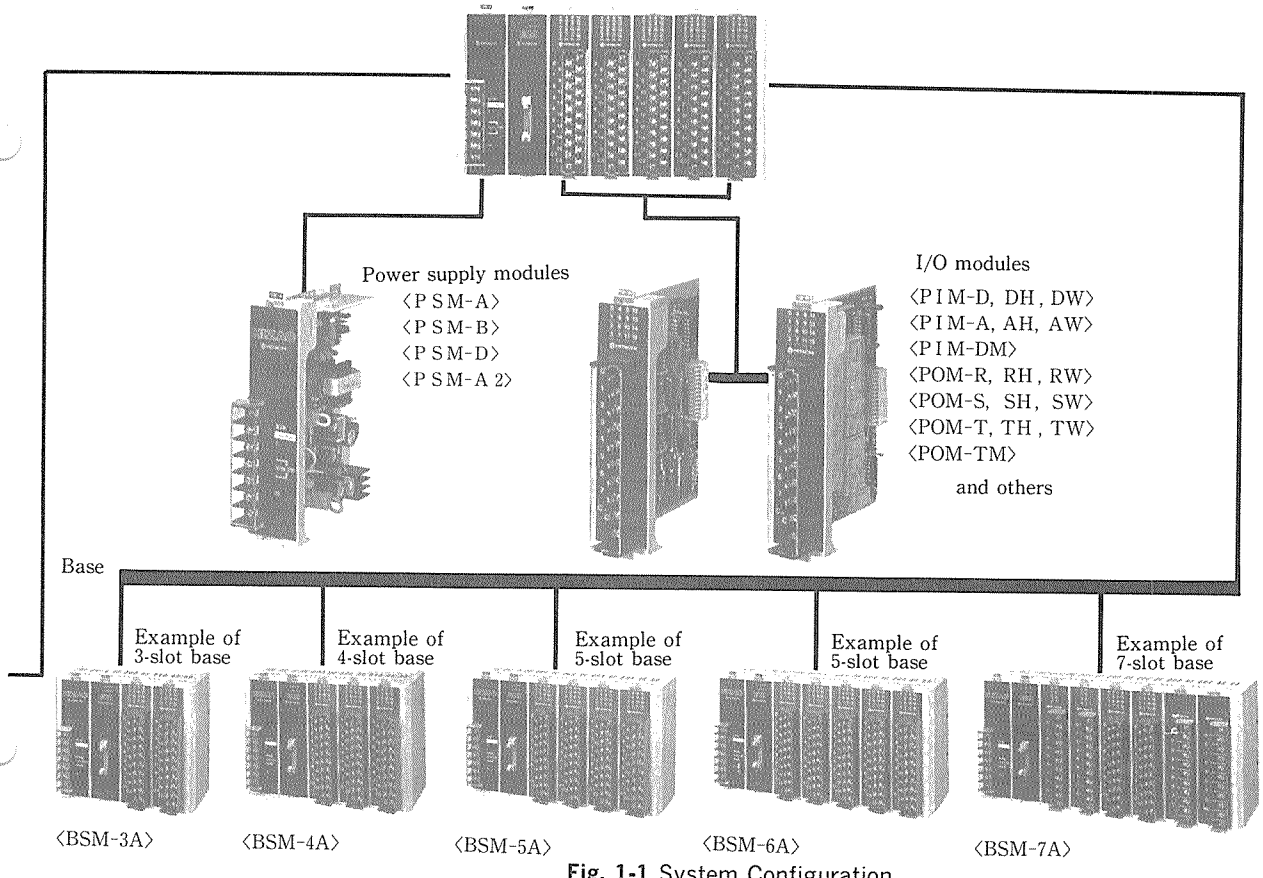


Fig. 1-1 System Configuration

[Explanation]

1. CPU Module

The CPU module comes in two types; CPM-E2 and CPM-E3. These modules have an upper compatibility with the preceding CPU module CPM-E. Functional differences between CPM-E and CPM-2/E3 are listed in Table 1-1.

Table 1-1 Differences from CPM-E

Type / Item	EM	EM－II	
	CPM－E	CPM－E2	CPM－E3
Processing speed	Average 5 μs/basic instruction	1.5 μs/basic instruction	1.5μs/basic instruction
Memory capacity	1949 words	3997 words	3997 words
No. of usable application instructions	44 instructions	89 instructions	89 instructions
RS－232C	Unavailable	Unavailable	Built in
Clock function	Unavailable	Unavailable	Built in
I/O link and remote I/O	Possible	Possible	Possible

2. The existing I/O modules, power supply modules, special modules, bases and memory packs are usable for CPM-E2 and CPM-E3 with no modification. The memory packs MPM-2E and MPM-2R can be used as 4K-word memories.

3. Peripherals

Peripherals include the standard programmer (PGMJ), universal programmer (PGMJ-R2), and portable graphic programmer (PGM-GPE2). These peripherals are all commonly usable for E, EM, EM-II and EB series. And they are capable of programming by use of the personal computer programming software (E-LADDER).

NOTE

Although the PGMJ, PGMJ-R and PBM-GPE in your possession are usable for CPM-E2 and CPM-E3, restrictions are imposed as listed in Table 1-2.

Table 1-2 Compatibility of Peripherals

Item	PGMJ	PGMJ-R		PGMJ-R2	PGM-GPE	PGM-GPE2	E-LADDER	
		Up to V:4	V:5				V:4	V:5
Programming in up to 2K words	○	○	○	○	○	○	○	○
Programming in up to 4K words	○	○	○	○	×	○	×	○
Programming in instructions compatible with EM	○	○	○	○	○	○	○	○
Printout accoding to instructions compatible with EM	–	○	○	○	○	○	○	○
Programming in new EM instructions	○	○	○	○	×	○	×	○
Printout according to new EM instructions	–	×	○	○	×	○	×	○
Decimal/hexadecimal monitor *1	○	×	○	○	×	○	×	○
CMT function in up to 2K words	○	○	○	○	○	○	–	–
CMT function in up to 4K words	○	×	×	○	×	○	–	–
ROM writer function in up to 2K words	–	○	○	○	○	○	–	–
ROM words function in up to 4K words	–	×	×	○	×	○	–	–
Time point of enhancement	–	–	Jun., '89	May, '90	–	May, '90	–	Near future

*1 Unless decimal monitoring is possible, error code in syntax check cannot be observed.

Table 1-3 Module List (1/3)

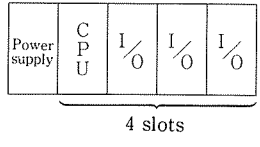
Item	Model Name	Specification	Remarks
CPU module	CPM-E2	Standart type	Completely interchangeable with CPM-E
	CPM-E3	With RS-232C interface and clock fanction	
Memory pack	MPM-1E	925-word EEPROM	Used as 1K-word memory
	MPM-2E	3997-word EEPROM	Used as 4K-word memory
	MPM-2R	3997-word EEPROM	
Power supply module	PSM-A	Line voltage 110/220 V AC	
	PSM-B	Line voltage 110/220 V AC, with increased output capacity	
	PSM-D	Line voltage 24 V DC	
	PSM-A2	Line voltage 110/220 V AC Continuous	
Base	BSM-3A	3 slots	(Example)  A 4-slot base modules except for the power supply.
	BSM-4A	4 slots	
	BSM-5A	5 slots	
	BSM-6A	6 slots	
	BSM-7A	7 slots	
	BSM-9A	9 slots	

Table 1-3 Module List (2/3)

Item		Model Name	Specification	Remarks
Input module	8 input points	PIM-D	24 V DC	
		PIM-A	110/220 V AC	
		PIM-DP	24 V DC (common terminal ⊖)	
	16 input points	PIM-DH	24 V DC	
		PIM-DW	24 V DC 〔Removable terminal block〕	
		PIM-AH	110/220 AC	
		PIM-AW	110/220 V AC 〔Removable terminal block〕	
		PIM-DPH	24 V DC (common terminal ⊖)	
	32 input points	PIM-DM	24 V DC(connector connection)	
Output module	8 output points	POM-R	Relay output	
		POM-RC	Relay output, independent contacts	
		POM-S	Triac output	
		POM-T	Transistor output	
		POM-TP	Transistor output (common terminal ⊕)	
	16 output points	POM-RH	Relay output	
		POM-RW	Relay output 〔removable terminal block〕	
		POM-SH	Triac output	
		POM-SW	Triac output 〔removable terminal block〕	
		POM-TH	Transistor output	
		POM-TW	Transistor output 〔removable terminal block〕	
		POM-TPH	Transistor output (common terminal ⊕)	
	32 output points	POM-TM	Transistor output (connector connection)	
Mixed input/ output	16 I/O Points	PHM-DT	DC input 8 points, transistor output 8 points	
	32 I/O points	PHM-TT	TTL input 16 points, TTL output 16 points (via connector)	

Table 1-3 Module List (3/3)

Item	Model Name	Specification	Remarks
Analog module	AGM-I	Current analog input 8 points	
	AGM-O	Current analog output 4 points	
	AGM-OD	Current analog output 2 points	
	AGM-IV	Voltage analog input 8 points	
	AGM-IV2	Voltage/Current analog input 8 points	
	AGM-OV	Voltage analog output 4 points	
	AGM-ODV	Voltage analog output 2 points	
Counter module	CTM	Up/down-counter, max. 10 kHz	
Remote I/O	RIOM-TM	Remote master station	Twisted pair cables
	RIOM-TL	Remote slave station	
I/O link	IOLM-T	I/O link	
Expansion cable	CNM-01	Cable for connecting expansion unit (0.1m)	Ribbon cable
	CNM-06	Cable for connecting expansion unit (0.6m)	
	CNEB-06	Cable for connecting expansion unit (0.6m)	Round cable
Cover	CVM	Cover for empty (unused)slot	
Programmer mounting seat	PAM-E	For mounting programmer on wall	

Table 1-4 Peripherals

Item	Model Name	Specification	Remarks
Portable graphic programmer	PGM−GPE 2	Liquid crystal type graphic programmer	
Standard programmer	P G M J	With audio cassette interface	
Universal programmer	P G M J − R 2	With audio cassette interface, ROM writer function and RS-232C serial port	
Software package for personal computer input	E-LADDER (IBM)	Software package for IBM 5150/5160	
I/O cable for 32-point I/O module	C B M−02	2m long	Commonly usable for H-200
	C B M−05	5m long	
	C B M−10	10m long	

Figure 1-2 shows the name of each external part in case of a 5-slot base.

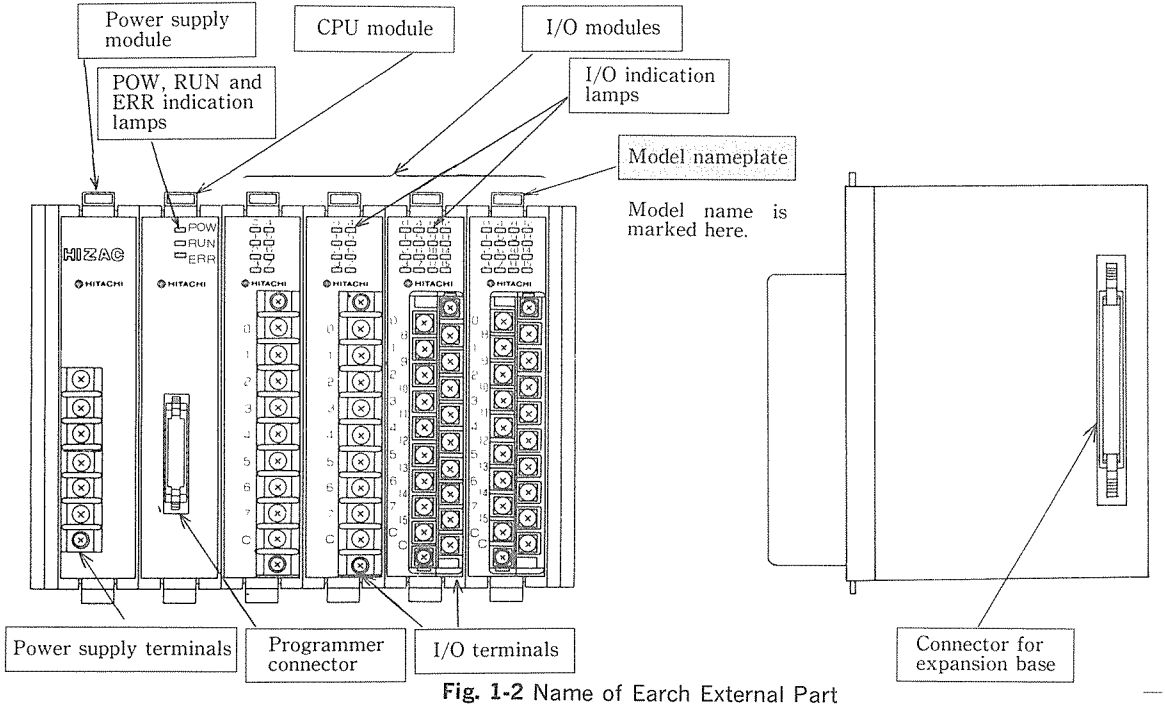


Fig. 1-2 Name of Earch External Part

Each of 3, 4, 6, and 7-slot bases has a different number of slots than the 5-slot base. The base is commonly used for basic and expanded configurations. For expansion, an I/O module is to be mounted in the CPU module slot of expansion unit.

(1) **Basic specifications**

Basic specifications are listed in Table 1-5.

Table 1-5 Basic Specifications (1/3)

Item		CPM-E2	CPM-E3
Control specifications	Control system	Stored program cyclic processing	
	Processing speed	1.5μs/basic instruction	
	Program capacity	925 words with EEPROM (MPM-1E)	
		3,997 words with EEPROM (MPM-2E)	
		3,997 words with EPROM (MPM-2R)	
Processing function	Basic instruction	12 kinds (ORG, STR, AND, OR, STR, AND STR, OUT, etc.)	
	Application instruction	20 kinds (edge detection, step, master control, jump, etc.)	
	Arithmetic instruction	69 kinds (word load, word out, arithmetic calculations, comparison, etc.)	

Table 1-5 Basic Specifications (2/3)

Item			CPM-E2	CPM-E3
Input/output processing specifications	Input/output allocation		Free location	
	No. of external input/output points		Max. 160 points with 16 I/O modules	
			Max. 320 points with 32 I/O modules (PHM-TT)	
	No. of internal output points	Non-retentive at power failure	256 points	
		Retentive at power failure	256 points (NOTE 1)	
		Special function	12 points + 4 words	
	Timer/counter	Counting system	Addition	
		No. of points	96 points	
		Time base	0.01, 0.1, 1 sec	
		Preset value	4 digits (max. 10 points), 3 digits (NOTE 2)	
	Kind of external input		24 V DC, 110/220 V AC, analog	
	Kind of external output		Relay, transistor, triac, analog	
	Operation control input		Programmable (a single input in a input module specifiable)	
	RUN contact output		Programmable (a single output in a output module specifiable)	

Table 1-5 Basic Specifications (3/3)

Item		CPM-E2	CPM-E3
Peripheral function	Peripherals	PGMJ, PGMJ−R2, PGM−GPE2	
	Monitor function	Bit monitor and word monitor	
Communication function	Personal computer link	Via PGMJ-R2	Direct hookup to personal computer (RS-232C built in)
	I/O link	I/O link module (IOLM-T)	
	Remote I/O	Remote I/O module (RIOM-TM, TL)	
Clock function			Calendar clock built in
Self-diagnosis function		Watchdog timer, sum check, undefined instruction check	

NOTES: 1 The internal output retentive at power failure and the current value of timer/counter are backed up with a capacitor. Backup is possible for 2 weeks (at 25°C). When using the calender clock, the number of internal output points is reduced to 240 in case of the CPM-E3.

2 10 points of T/C 0 to 9 are presettable in 4 digits.

(2) General specifications

The General specifications are listed in Table 1-6.

Table 1-6 General Specifications

Item	Specifications
Dielectric strength	1,500 V AC for 1 min. between input/output terminals (including power terminal) and ground terminal (NOTE 1)
Insulation resistance	20 MΩ or more for 1 min between input/output terminals (including power terminal) and ground terminal when measured with 500 V DC megger (NOTE 1)
Operating temperature	0 to 55℃
Storage temperature	− 10 to 75℃
Operating humidity	20 to 90%(non-condensing)
Strage humidity	10 to 90%(non-condensing)
Vibration resistance	Conforms to JIS C 0911 IIB, 3rd class on condition that vibration with frequency 10 to 55 Hz and amplitude 0.5 mm is applied for 2 hours in each of X, Y and Z directions
Shock resistance	Conforms to JIS C 0912on condition that shock of 10G is applied twice in each of X, Y and Z directions
Noise resistance	Noise voltage 1,500 Vp-p, pulse width 1 μs (Measurement by Hitachi method with noise simulator)
Environment	Must be free from corrosive gas and dust.
Altitude	2,000 m or less
Grounding	100 Ω max.

NOTE: 1 A varistor for suppressing lightning surge is connected to the power supply terminal. Therefore, the connector P3 in the power supply module must be separated when testing dielectiric strength or insulation resistance of the power supply terminal.

(3) Specifications of power supply modules

The specifications of each power supply module are listed in Table 1-7.

Table 1-7 Specifications of Power Supply Modules (1/3)

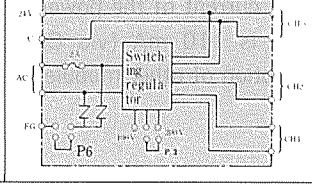
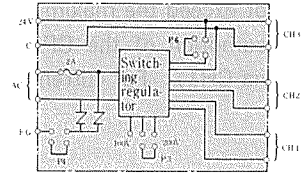
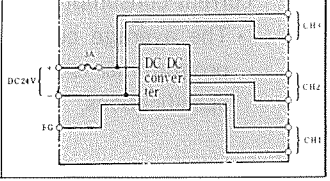
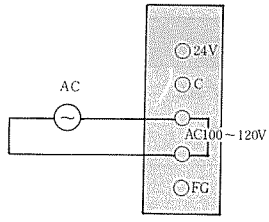
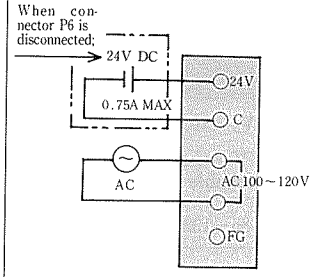
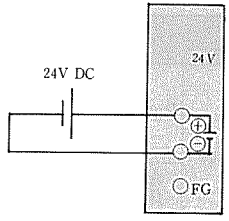
Item \ Model		PSM-A	PSM-B	PSM-D
Line voltage	Rated voltage	100 V/110/120 V AC, 200/220/240 V AC (110 V AC system and 220 V AC system switchable with connector P3)		24 V DC
	Allowable fluctuation	85~132 V AC, 170~264 V AC		19.2~30 V DC
Frequency	Rated frequency	50/60 Hz		—
	Allowable fluctuation	47~63 Hz		—
Input current		0.6 A or less		1.6 A or less
Output current	CH 1 (5 V)	1 A (for CPU, Programmer)	1.7 A (for CPU, Programmer)	1 A (for CUP, programmer)
	CH 2 (24 V)	0.3 A (for output module)	0.5 A (for output module)	0.3 A (for output module)
	CH 3 (24 V)	0.45 A (for input module)	0.25 A (for input module)	1 A (for input module)
Circuit diagram				

Table 1-7 Specifications of Power Supply Modules (2/3)

Item \ Model	P S M－A	P S M－B	P S M－D
External wiring			

[**Explanation**]

1. Each power supply module receives an AC or DC primary power supply and outputs the determined system power supply to the CPU, programmer and input/output modules. Its output consists of 3 channels; CH1 (5 V) for programmer, CH2 (24V) for output module and CH3 (24 V) for input module. The maximum output current is restricted as shown is the above table. The current consumption of each module is determined in the specifications below. The system must be configured so that the total current consumption does not exceed the maximum output current of the power supply module.
   - The average current consumption of the CPU module is 110 mA (via CH1), while that of the programmer is 260 mA (via CH1). For current consumption of other modules, refer to each table of specifications.

2. The PSM-A and PSM-B select the 110 or 220 V AC system by means of connector P3.
   These modules have been factory-set to the 220 V AC system. For 110 V system, switch over the connector to the 110 V side and attach the furnished voltage nameplate.

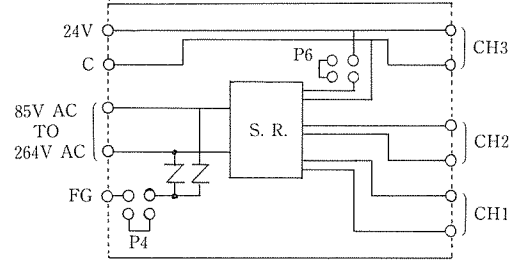
3. The PSM-A and PSM-B incorporate a varistor for protection against lightning surge. Therefore, the internal connector (P6 on PSM-A, P4 on PSM-B) must be separated before a dielectric strength or insulation resistance test. Otherwise, the varistor might be broken.

4. CH3 is also used for power supply to the sensor. Total output current in this channel must be limited to 0.45 A max. with the PMS-A, and to 0.25 A max. with the PSM-B.

NOTE

The PSM-B allows its channel 3 to receive power from an external switching power supply when the internal connector P6 is separated. Utilize this method in case the CH3 current is inadequate because there are many input modules connected.

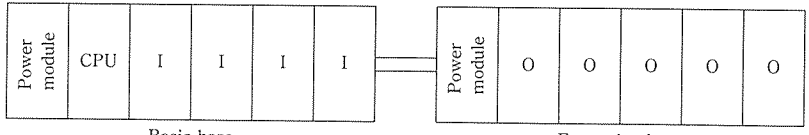
Table 1-7 Specifications of power modules (3/3)

Item \ Model		PSM-A2
Input	Voltage	85 to 264V AC
	Frequency	45 to 63Hz
	Rush current	40A or less
	Rated current	0.6A or less
Output current	C H 1	5V, 1A(for CPU and programmer)
	C H 2	24V, 0.7A in total(for input and output module)
	C H 3	
Circuit diagram		 • The PSM-A2 allow power supply from an external power unit to CH3 through separating the connector(P6). • The connector(P4) must be separated befoere testing dielectric strength.

5. The PSM-A2 has a wide range for power supply voltage which is from 85VAC to 264VAC, this module can operate on either 110V or 220VAC system.

①The PSM-A2 allows powor supply to 0.7A in total together CH2 and CH3.

Therefor, this module is applicable the system which only input modules on the basic base are installed and only output modules on the expansion base are installed.



Basic base

CH3 allows power supply to input modules. (MAX 0.7A)

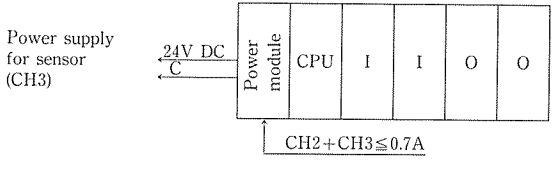
Expansion base

CH2 allows power supply to output modules. (MAX 0.7A)

②Of course I/O modules are able to installing together on the basic base. You can use to the 24Vterminal and common terminal to power supply for sensor.

CH3 and power supply for sensor is on the same.

Confirm that total current consumption does not exceed 0.7A with CH2 and CH3.



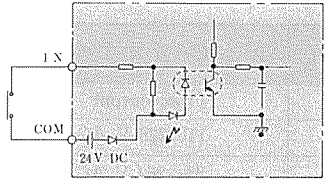
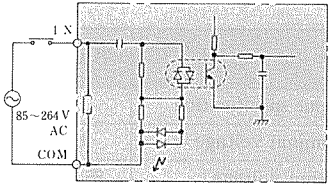
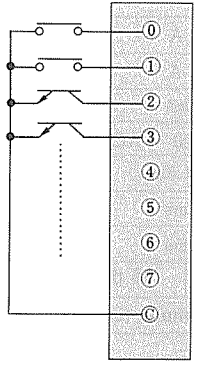
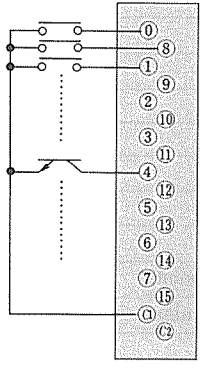
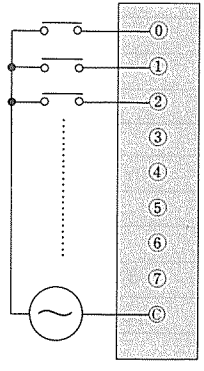
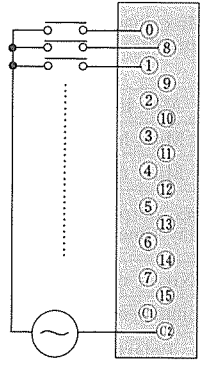
(4) Specifications of input modules

The specifications of each input module are listed in Table 1-8.

Table 1-8 Specifications of Input Modules (1/2)

Item \ Model		PIM—D	PIM—DH	PIM—A	PIM—AH
Input specification		DC input		AC input	
Nominal voltage		24V DC		AC110V/220V	
Input voltage		21.6~26V DC		85~264V AC, 50/60Hz	
Input current		9 mA (when input and common terminals are short-circuited)		7 mA (AC110V, 50Hz)	
Operational specification	ON	19 V DC or more (resistance 300 Ω or less)		85 V AC or more	
	OFF	7 V DC or less (resistance 200 kΩ or more)		30 V AC or less	
Input delay time	ON→OFF	4 ms or less		16ms or less	
	OFF→ON	4 ms or less		16ms or less	
No. of input points		8 points/module	16 points/module	8 points/module	16 points/module
Common input connection		8 inputs/common terminal		8 inputs/common terminal	
Polarity		Common terminal ⊖		—	
Isolation method		Photocoupler		Photocoupler	
Current consumption (average) (NOTE)	CH 1	0.5 mA + (no. of input ON points) × 0.5 mA		1 mA	
	CH 2	0 mA		0 mA	
	CH 3	(No. of input ON points) × 9 mA		0 mA	

Table 1-8 Specifications of Input Modules (2/2)

Item \ Model	P I M — D	P I M—D H	P I M — A	P I M—A H
Circuit diagram				
External wiring		 ○ C1 and C2 are internally connected.		 ○ C1 and C2 are internally connected.

NOTE. This represents the power consumption of each module. The total current consumption of each channel must not exceed the maximum load current of the power supply module.

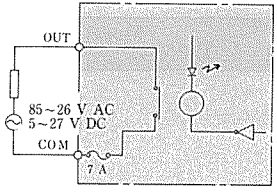
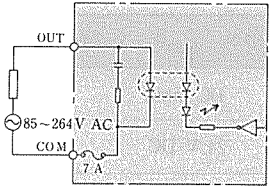
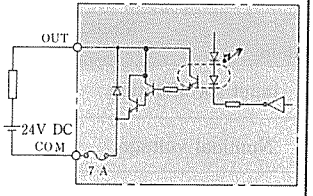
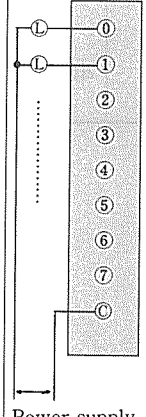
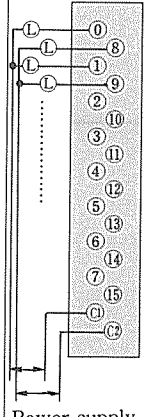
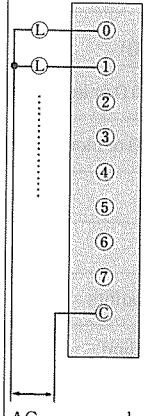
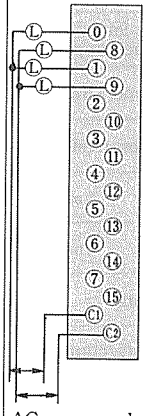
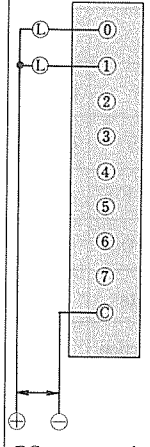
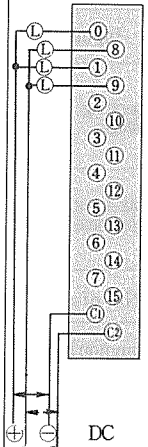
(5) Specifications of output modules

The specifications of each output module are listed in Table 1-9.

Table 1-9 Specifications of Output Modules (1/2)

Item \ Model		POM-R	POM-RH	POM-S	POM-SH	POM-T	POM-TH
Output specification		Relay output		Triac output		Transistor output	
Nominal voltage		110/220 V AC, 24 V DC		110/220 V AC		24 V DC	
Output voltage		85~264 V AC, 5~27 V DC		85~264 V AC		5~27 V DC	
Max. load current	1 circuit	2 A		1 A		0.5A	
	4 circuits	2 A		2 A		1.25A (Note)	
	8 circuits	4 A		4 A		2.5A (Note)	
Min. load current		10mA (5 V DC)		50mA		10mA (5 V DC)	
Max. leakage current		—		3mA (220 V AC)		0.1mA (24 V DC)	
Max. rush current		6 A (100m s)		20A (20ms)		3 A (20ms)	
Max. output delay time	ON→OFF	10ms		11ms		1 ms	
	OFF→ON	10ms		11ms		1 ms	
No. of output points		8 points	16 points	8 points	16 points	8 points	16 points
Common output connection		8 points/common terminal		8 points/common terminal		8 points/common terminal	
Polarity		—		—		Common terminal ⊖	
Isolation method		Relay		Photocoupler		Photocoupler	
Current consumption (average)	CH 1	0.2mA + (no. of output ON points) × 0.2mA		0.2mA + (no. of output ON points) × 0.2mA		0.2mA + (no. of output ON points) × 0.2mA	
	CH 2	(No. of output ON points) × 10mA		(No. of output ON points) × 10mA		(No. of output ON points) × 10mA	
	CH 3	0 mA		0 mA		0 mA	

Table 1-9 Specifications of Output Modules (2/2)

Item \ Model	POM—R	POM—RH	POM—S	POM—SH	POM—T	POM—TH
Circuit diagram						
External wiring						

Note: Since four-element transistor devices are used, max. load currents are limited for each group of terminals No. 0 to 3, 4 to 7, 8 to 11 and 12 to 15. Operation is unallowable beyond the maximum load current.

(6) Specifications of source type input/output modules

Table 1-10 Source Type Input Module (1/2)

Item \ Model		PIM-DP	PIM-DPH
Input specification		DC input	
Nominal voltage		24 V DC	
Input voltage		21.6~26 V DC	
Input current		Approx. 9mA/24 V DC (inpedance approx. 2.7 kΩ)	
Operating voltage	ON	19 V DC or more (resistance 300 Ω or less)	
	OFF	7 V DC or less (resistance 200 Ω or more)	
Max. input delay time	ON→OFF	4 msec	
	OFF→ON	4 msec	
No. of input points		8 points	16 points
Common input connection		8 points/common terminal	
Polarity		Common terminal ⊖	
Isolation method		Photocoupler	

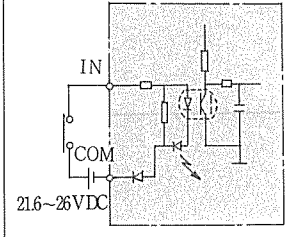
Item \ Model	PIM-DP	PIM-DPH
Circuit diagram		

Table 1-10 Source Type Output Module (2/2)

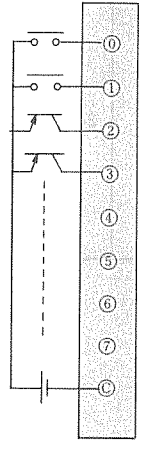
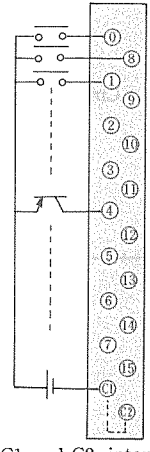
Item	PIM-DP	PIM-DPH
Extenal wiring		 C1 and C2 internally connected

Table 1-11 Source Type Output Module (1/2)

Item \ Model		POM-TP	POM-TPH
Output specification		Transistor output	
Nominal voltage		24 V DC	
Output voltage		3~26 V DC	
Max. load current	1 circuit	0.5 A	
	4 circuits	1.25 A	
	8 circuits	—	
Min. load current		10mA (24 V DC)	
Max. leakage current		0.1mA (24 V DC)	
Max. ruch current		3A (20msec)	
Max. output delay time	ON→OFF	1msec	
	OFF→ON	1msec	
No. of output points			
Common output connection		8 points/common terminal	
Polariy		Common terminal ⊕ (source type)	
Isolation method		Photocoupler	

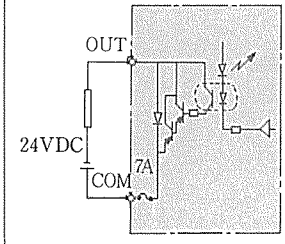
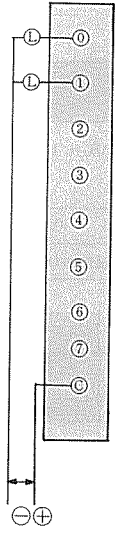
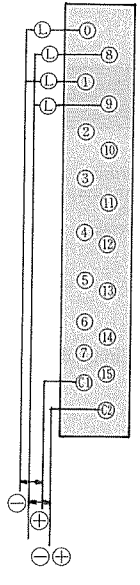
Item \ Model	POM-TP	POM-TPH
Circuit diagram		

Table 1-11 Source Type Output Module (2/2)

Item	POM-TP	POM-TPM
External wiring	 DC power supply	 DC power supply

(7) Specifications of hybrid modules

Table 1-12 and 1-13 list the specifications of I/O hybrid module and TTL I/O hybrid module, respectively.

Table 1-12 I/O Hybrid Module

Item \ Model		PHM-DT	
I/O specification		DC input	Transistor output
Nominal voltage		24 V DC	24 V DC
Permissible voltage range		21.6~26 V DC	5~27 V DC
Input current		9 mA	—
Operational specification	ON	Resistance 300 Ω or less	—
	OFF	Resistance 200 kΩ or more	—
Max. load current	1 circuit	—	0.5A
	4 circuits	—	1.25A
	8 circuits	—	2.5A
Max. leakage current		—	0.1mA (24 V DC)
Max. rush current		—	3 A (20ms)
Max. delay time	ON→OFF	4 ms	1 ms
	OFF→ON	4 ms	1 ms
No. of I/O points		8 points (0 to 7)	8 points (8 to 15)
Common connection		8 points/common terminal	8 points/common terminal
Polarity		Common terminal ⊖	Common terminal ⊖
Isolation method		Photocoupler	Photocoupler

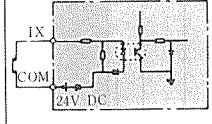
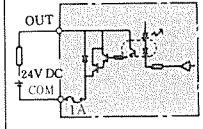
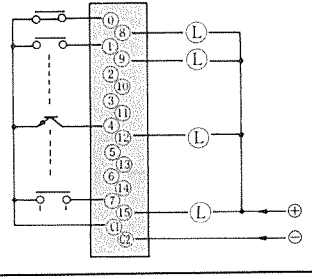
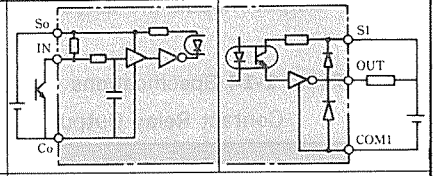
Item \ Model		PHM-DT	
Current consumption (average)	CH 1	10 mA + (no. of input ON points) × 9 mA + (no. of output ON points) × 8 mA	
	CH 2	0 mA	0 mA
	CH 3	(No. of input ON points) × 9 mA	0 mA
Circuit diagram			
External wiring			

Table 1-13 TTL I/O Hybrid Module

Item \ Model		PHM-TT	
I/O specification		TTL input	TTL output (open collector)
I/O voltage		4~27VDC	4~27VDC
Input current		6mA (5 V DC)	—
Input voltage	ON	1.5 V DC or less (5 V DC)	—
	OFF	3.5 V DC or more (5 V DC)	—
Max. load current		—	20 mA/point
Max. leakage current		—	50μ A
Max. delay time	ON→OFF	1 ms	1 ms
	OFF→ON	1 ms	1 ms
No. of I/O points		16 points/module	16 points/module
Common connection		16 points/common terminal	8 points/common terminal
Polarity		Common terminal ⊖	Common terminal ⊖
Isolation method		Photocoupler	Photocoupler
I/O indication		None	None
Current consumption (average)	CH1	(No. of output ON points) × 5 mA + 30 mA	
	CH2	0 mA	
	CH3	0 mA	

Item \ Model	PHM-TT
Circuit diagram	
External wiring	Pin layout of 40-pin flat cable connector
Connector for external wiring	Exclusive connector (made by Hirose Denki) Socket: HIF3C-40D-2. 54C

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	COM0	21	NC	2	COM1	22	COM2
3	S0	23	NC	4	S1	24	S2
5	IN0	25	IN8	6	OUT0	26	OUT8
7	1	27	9	8	1	28	9
9	2	29	10	10	2	30	10
11	3	31	11	12	3	32	11
13	4	33	12	14	4	34	12
15	5	35	13	16	5	36	13
17	6	37	14	18	6	38	14
19	7	39	15	20	7	40	15

Connector pin	Cable dia.
HIF3-2226SC	AWG22 to 26
HIF3-2428SC	AWG24 to 28

○ Be sure to use a connector with gold coating

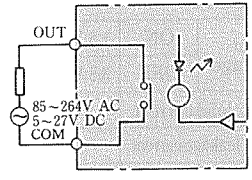
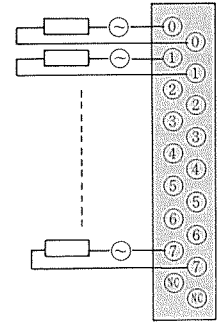
○ An exclusive solderless fastening tool is required.

(8) **Specifications of independent contact relay output module**

The specifications of independent contact rely output module are listed in Table 1-14.

Table 1-14 Specifications of Independent Contact Relay Output Module

Item \ Model		POM-RC
Output specification		Relay output
Nominal voltage		100/200 V AC, 24 V DC
Output voltage		85~264 V AC, 5~27 V DC
Max. load current	1 circuit	2 A
Max. rush current		6 A (100ms)
Max. output delay time	ON→OFF	4 ms
	OFF→ON	5 ms
No. of output points		8 points
Common output connection		1 point/common terminal
Isolation method		Relay
Current consumption (average)	CH1	0.2 mA + (no. of outpit ON points) × 0.2 mA
	CH2	(No. of output ON points) × 10 mA
	CH3	0 mA

Item \ Model	POM-RC
Circuit diagram	
External wiring	

(9) Specifications of counter module

The specifications of the counter module are listed in Table 1-15.

Table 1-15 Specifications of Counter Module

	Item		Specifications
Input specifications	Count puls frequency		MAX. 10kHz
	Input pulse voltage level	ON	0~2 V DC
		OFF	5~12 V DC
	Count pulse width		MIN. 20μ sec
	Marker pulse width		MIN. 20μ sec
	Input impedance		Approx.10 kΩ
	Isolation method		Photocoupler
	No. of pulse input points		3 points (A, B, M)
	Polarity		Common terminal ⊖
	2-phase imput pulse	Count-up (addition)	A, B: ON/OFF — B delayed 90° from A
		Count-down (subtraction)	A, B: 90° — B advanced 90°from A
	Power supply for external input device		12 V DC ± 10%, 50 mA (can be supplied to external device)
Output specifications	Output method		DC10~27V
	Load current		Max. 0.5 A/circuit, max. 1.25 A/4 circuits
	Output method		Transistor (open collector)
	Min. load current		1 mA
	Output delay time	ON→OFF	MAX. 1 msec
		OFF→ON	MAX. 1 msec
	Voltage drop at ON		MAX. 1.5V (0.5A)
	Isolation method		Photocoupler
	No. of output points		4 points (OUT, OUT1, OUT2, OUT3)
	Leakage current		MAX 0.1mA
	Polarity		Common ⊖
	Power supply input for output		10 to 27 V DC, 50 mA (external supply to module)

Item		Specifications
Count range		0 ~9999
Counting method		○2-phase pulse counting (up/down) ○Single-phase pulse and inverted pulse counting (Selectable between single phase and 2phases)
Output		○1 point/1preset value (open collector) ○Output held when preset value = count value selectable ○Output when present value < count value selectable
Marker		1 point (direct resetting of count value)
Operational indication		Output and pulse input imdicated
Register		○Count register ○Preset value (CU0, CU1, CU2, CU3) register
Functions		○Count value reset ○Preset value read ○Preset value write ○Status read A-phase pulse ON/OFF status B-phase pulse ON/OFF status Marker ON/OFF status Preset value = count value (latch) Preset value < count value Overflow Flag Underflow flag
Noise resistance		Noise voltage 500 Vp-p when measured by our company method with noise simulator
Insulation resistance		20 MΩ or more between external terminal and ground terminal (FG)
Dielectric strength		500 V DC for 1 min bitween external terminal and ground terminal
Vibration resistance		Conforms to JIS C0911 HB, 3rd class on condition that vibration with frequincy 16.7Hzand amplirude 3mm is applied in each of X.Y and Z directions.
Shock resistance		Conforms to JIS C0912 on condition that shock of X, Y and z directions.
Operating temperature		0 ~55℃
Operating humidity		30 to 90% RH (non-condensing)
Storage temperature		−10~65℃
Environment		Must be free from excessive corrosive gas, salinity and iron powder.
Current consumption	CH1	200mA MAX.
	CH2	0 mA
	CH3	160 mA max. when supplying about 50 mA to external imput device (sensor)
		110 mA max. without currint supply to external input device (sensor)

(10) Specifications of analog current modules

The specifications of each analog current module are listed in Table 1-16.

Table 1-16 Specifications of Analog Current Modules (1/2)

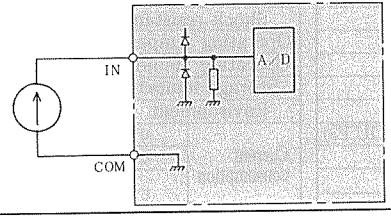
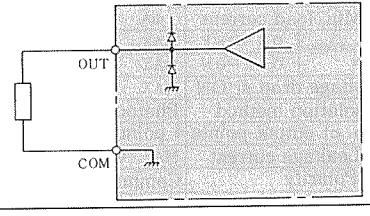
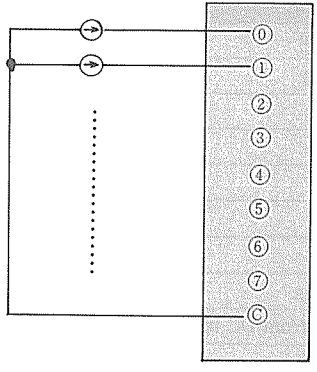
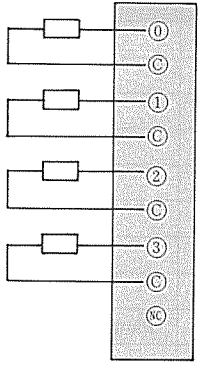
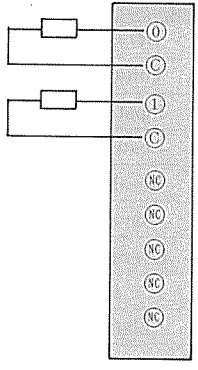
Item \ Model		AGM-I	AGM-O	AGM-OD
I/O specification		Analog current input	Analog current output	
Current range		4 ~20mA	4 ~20mA	
Input impedance		220Ω	—	
Load impedance		—	0 ~500Ω	
Resolution		8 bits	8 bits	
Conversion time		1 ms	1 ms	
Overall accuracy		±(1% + 1 bit)	±1%	
No.of poionts		8 points	4 points	2 points
Isolation method		Photocoupler (not isolated from DC input)	Photocoupler (not isolated from DC input)	
Isoration between imputs		Not provided	Not provided	
Current consumption (average)	CH1	25mA	50mA	50mA
	CH2	0mA	0mA	0mA
	CH3	60mA	250mA	140mA
Circuit diagfam				

Table 1-16 Specifications of Analog Current Modules (2/2)

Item \ Model	AGM-I	AGM-O	AGM-OD
External wiring			

(11) Specifications of analog voltage modules

The specifications of each analog voltage module are listed in Table 1-17.

Table 1-17 Specifications of Analog Voltage Modules (1/2)

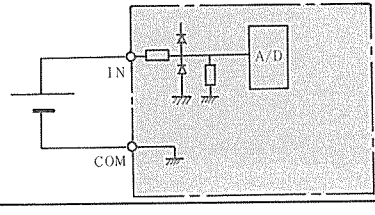
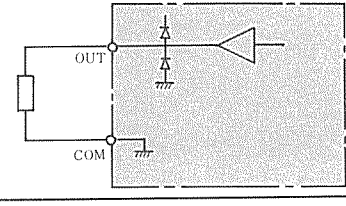
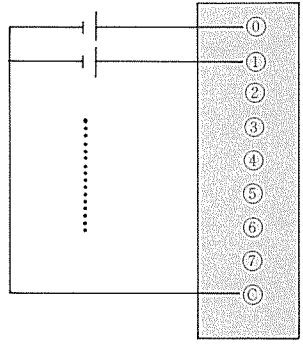
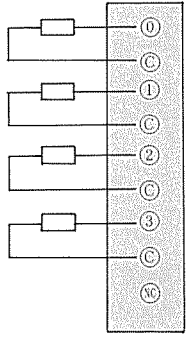
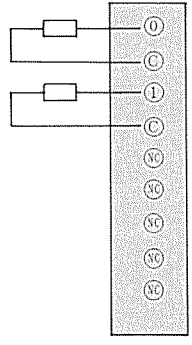
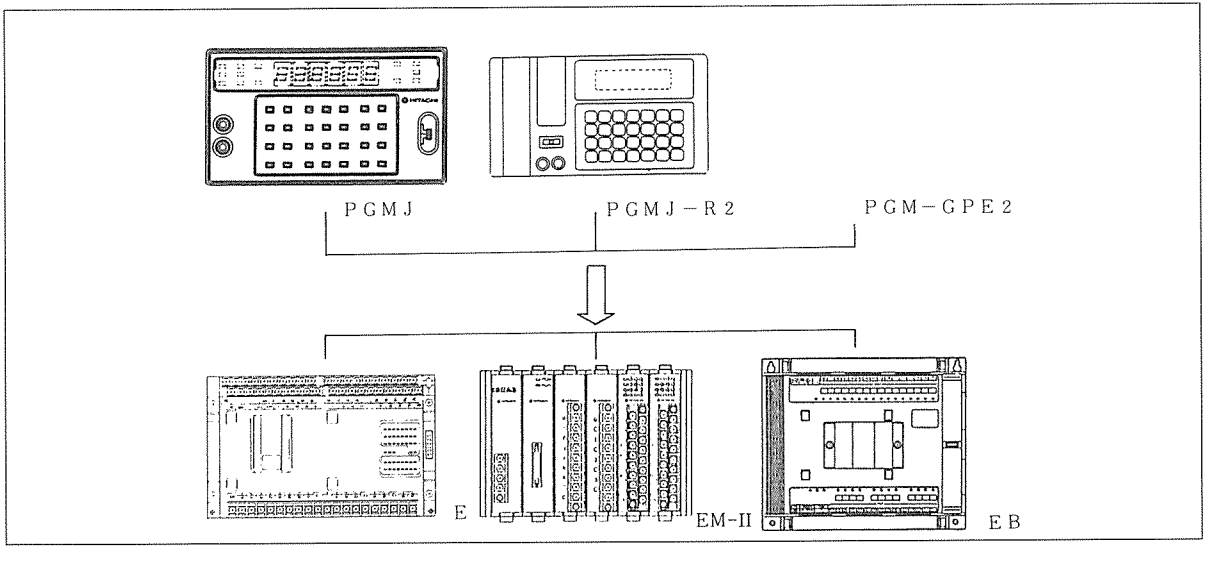
Item \ Model		AGM-IV	AGM-OV	AGM-ODV
I/O specification		Voltag range	Analog voltage output	
Voltage range		0~10 V DC	0~10 V DC	
Input impedance		100 kΩ	—	
Load impedance		—	10 kΩ or more	
Resolution		8 bits	8 bits	
Conversion time		1 ms	1 ms	
Overall accuracy		1% + 1 bit	1%	
No. of points		8 points	4 points	2 points
Isolation method		Photocoupler (not isolated from DC input)	Photocoupler (not isolated from DC input)	
Isosation between inputs		Not provided	Not provided	
Current consumption (average)	CH1	25mA	50mA	30mA
	CE2	0mA	0mA	0mA
	CH3	60mA	140mA	70mA
Circuit diagram				

Table 1-17 Specifications of Analog Voltage Modules (2/2)

Item \ Model	AGM−IV	AGM−OV	AGM−ODV
External wiring			



[Explanation]

1. Kinds of peripheral equipment

Peripheral equipment, or programmer is selectable among three kinds: standard programmer PGMJ, universal programmer PGMJ-R2 and portable graphic programmer PGM-GPE2. Each programmer can be used with E, EM, EM-II and EB series.

Besides, IBM*1 PC XT*2 personal comupter is usable for programming by running the personal computer programming software E-LADDER. The functions of each peripheral equipment are listed in the table below.

Table 2-1 Function of Peripheral Equipment

Model	Programming				CMT	ROM	RS-232C		Parallel
	Online	Offline	Instruction set	Ladder	I/F	writer	Printer	Personal computer	printer
PGMJ	○	–	○	–	○	–	–	–	–
PGMJ-R2	○	–	○	–	○	○	○	○	–
PGM-GPE2	○	○	○	○	○	○	○	○	–
Personal computer software 〈E-LADDER〉	○	○	○	○	–	–	–	–	○

○: Possible
–: Function unavailable

*1. IBM is a trademark of International Business Machines Corporation.

*2. PC XT is a product of International Business Machines Corporation.

2. Compatibilty

The module PGMJ, PGMJ-R and PGM-GPE in your possession are also usable for CPM-E2 or CPM-E3. However, each programming has restrictions as listed in the table below.

Table 2-2 Compatibility of Peripheral Equipment

Item	PGMJ	PGMJ-R		PGMJ -R2	PGM -GPE	PGM -GPE2	E-LADDER	
		Up to V : 4	V : 5				V:4	V:5
Programming in up to 2K words	○	○	○	○	○	○	○	○
Programming in up to 4K words	○	○	○	○	×	○	×	○
Programming by instructions compatible with EM	○	○	○	○	○	○	○	○
Printout according to instructions compatible with EM	–	○	○	○	○	○	○	○
Programming according to new instructions for EM	○	×	○	○	×	○	×	○
Printout accoring to new instructions for EM	–	×	○	○	×	○	×	○
Decimal and hexadecimal monitoring *1	○	×	○	○	×	○	×	○
CMT function in up to 2K words	○	○	○	○	○	○	–	–
CMT function in up to 4K words	○	×	×	○	×	○	–	–
ROM writer function in up to 2K words	–	○	○	○	○	○	–	–
ROM writer function in up to 4K words	–	×	×	○	×	○	–	–
Time point of enhancement	–	–	Jun, 1989	May, 1990	–	May, 1990	–	Near future

*1. Error code in syntax check cannot be observed unless decimal monitoring is possible.

Table 2-3 Specifications of Peripheral Equipment (1/2)

Item \ Model		PGMJ	PGMJ-R2	PGM-GPE2
Programming function	Display unit	Digital display (LED)	Liquid crystal	Liquid crystal
	Input system	Instruction set		Instructions, ladder deagram
	Editing function	Write, read, change, insert, delete, search		
	Monitoring function	One-point monitoring		Multi-point monitoring
	Test function	Forced output, forced setting/resetting		
CMT interface function		Audio cassette tape recording, reproduction and verification		
ROM writer function		—	Memory pack copying, reproduction and verification	
RS-232C function	Synchronization	—	Asynchronous	
	Baud rate	—	300, 600, 1,200, 2,400, 4,800, 9,600, 19,200, 38,400, bps (Selectable by DIP switch. Rate set to 4,800 bps before shipment)	
	Word length	—	Start bit: 1 bit Data bit: 8 bits } Set before shipment Stop bit: 1 bit (Other 6 kinds selectable by DIP switch)	
	Printer function	—	Code list, ladder diagram and cross reference printed out	

Table 2-3 Specifications of Peripheral Equipment (2/2)

Item \ Model			PGMJ	PGMJ-R2	PGM-GPE2
RS-232c function	Personal computer function			Data exchange with personal computer	
	Connectable peripheral equipment	Printer		Printer: EPSON SP-80T (old models RP-80 and EP-80 also connectable) Interface circuit board: No. 8148 (old model No. 8145 also connectable)	
		Personal computer		IBM PC XT	
General specifications	Operating temperature		0~55℃	5~40℃	0~40℃
	Storage temperature		−10~65℃	−10~60℃	−10~50℃
	Operating humidity		30 to 90% RH (non-condensing)		
	Power supply		Supplied from basic unit		Supplied from basic unit or via AC adapter

Key part names and external dimensions of each programmer are shown below.

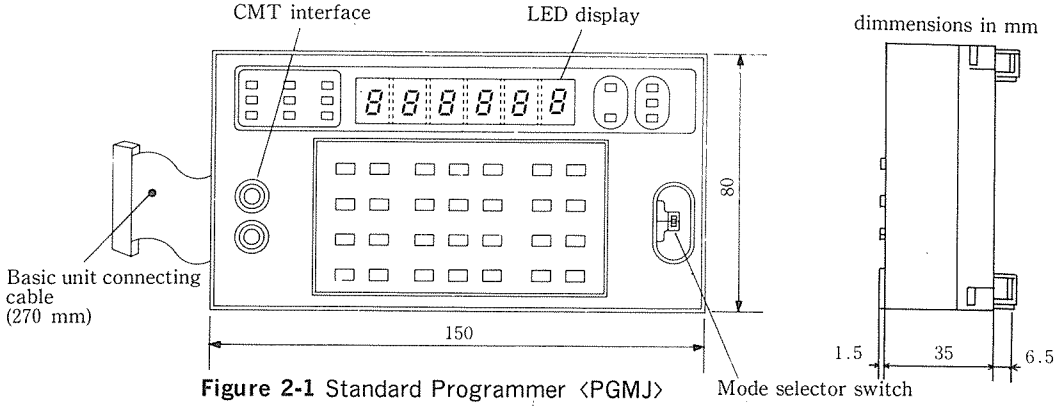


Figure 2-1 Standard Programmer ⟨PGMJ⟩

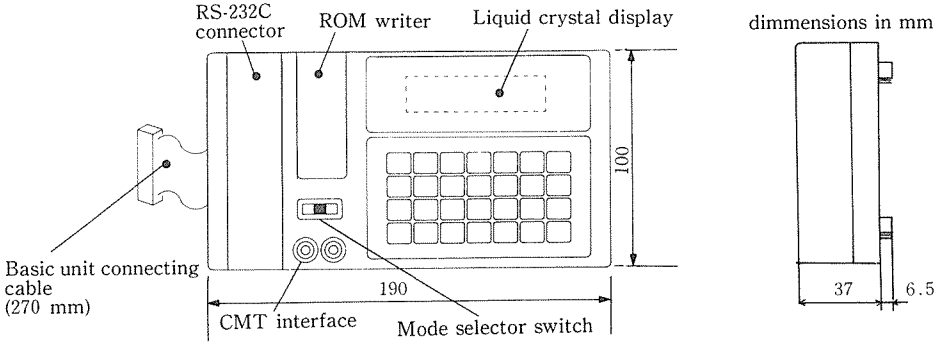


Figure 2-2 Universal Programmer ⟨PGMJ-R2⟩

Note: The power switch functions only in offline mode.

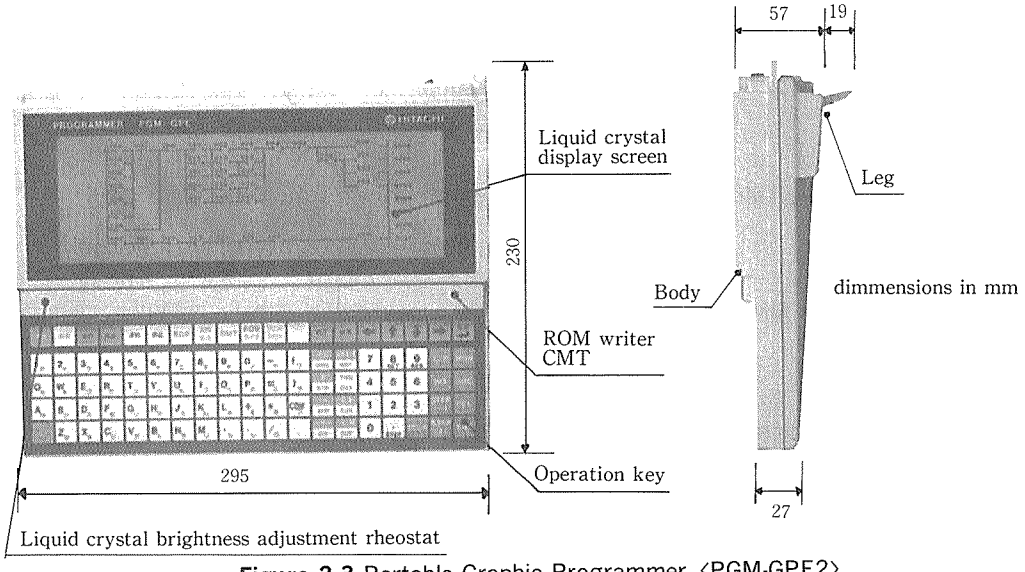


Figure 2-3 Portable Graphic Programmer ⟨PGM-GPE2⟩

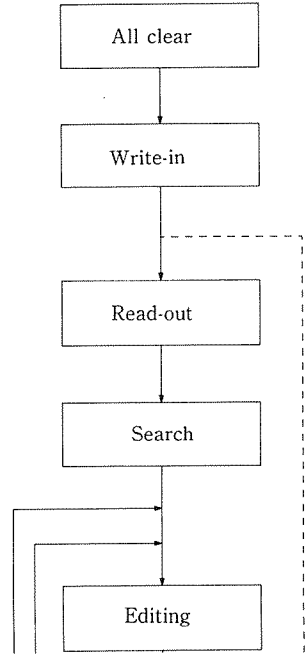
(1) All clear
Clear the memory before writing an entirely new program.

(2) Write-in
Write a program for each step.

(3) Read-out
Read out the program for each step to check if there is any programming error.

(4) Search
Search for desired input/output number, step number or instruction word.

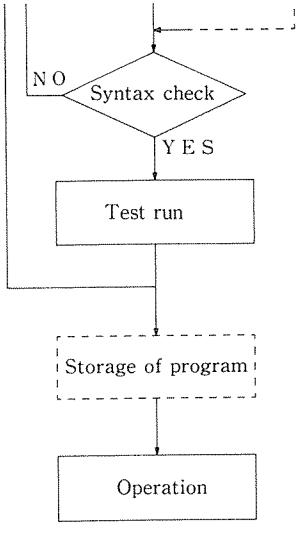
(5) Editing
Change, insert or delete the program.



(6) Syntax Check
Check if there is any syntax error in the program written in. If there is any, correct the program.

(7) Test Run
Perform test run after making sure that wiring has been made properly through forced output.

(8) Operation
Proceed to operation after completing test run.



Procedures before operation

The table below shows a list of programmer key-in procedures.

a The contents of display correspond to the standard programmer.
b Key-in procedures are the same between the standard and universal programmers.
c For operation of the portable graphic programmer PGM-GPE2, refer to its manual.

Table 2-4 Programmer Key-in Procedures (1/3)

No	Function		Key-in procedure	Contents of display: Step No.	Data	Data: —	Preset value	Current value	Continuity	DATA ☆	STEP ☆	Mode: PROG	TEST	RUN	Operation	Stop
1		Program all clear	CLR EXT DEL			○				○		○	×	×	×	○
2	Write-in	Write-in of new program	CLR EXT DEL → Generation of program for each step → EXT; Continuous write-in		○		○			○		○	×	×	×	○
		Write-in of additional program	CLR STEP/- → Generation of program for each step → EXT; Continuous write-in		○		○			○		○	×	×	×	○
3	Read-out	Starting from step 000	CLR STEP+		○		○		○	○		○	○	○	○	○
		Starting from specified step	CLR Step No. STEP/-		○		○		○	○		○	○	○	○	○
		From searched I/O or instruction	CLR I/O No. or instruction SRC		○		○		○	○		○	○	○	○	○
		First step of unprogrammed area	CLR STEP/-			○				○		○	○	○	○	○
			STEP+ or STEP− : 1 step forward or backward													
	Switchover between data display and step display		Read-out STEP/- (Data or step is selected by this STEP/- key.)	○	↔	○	○			○	↔	○	○	○	○	○

Table 2-4 Programmer Key-in Procedures (2/3)

No	Function			Key-in procedure	Contents of display: Step No.	Data	Data |	Preset value	Current value	Continuity	DATA ☆	STEP ☆	Mode: PROG	TEST	RUN	Operation	Stop
4	Search	I/O number	External input/output and internal output Timer and counter	CLR → I/O No. → SRC → (1 step forward or backward) / Timer/counter No. → SRC → (1 step forward or backward)		○		○		○	○		○	○	○	○	○
		Coil	External output and internal output Timer and counter	CLR → OUT → I/O No. → SRC → (STEP+ or STEP− → SRC) / Timer/counter No. → SRC → (STEP+ or STEP− → SRC)		○		○		○	○		○	○	○	○	○
		Instruction	Basic instruction Application instruction	CLR → Instruction word → SRC → (Search for step in which searched data is written next)		○		○		○	○		○	○	○	○	○
5	Editing		Insertion	Read-out of step to be inserted → DCLR → Generation of program to be inserted → INS		○		○			○		○	×	×	×	○
			Deletion	Read-out of step to be deleted → DEL		○		○			○		○	×	×	×	○
			Change	Read-out of step to be changed → DCLR → Generation of new program → ENT		○		○			○		○	×	×	×	○
6	Monitor	Contacts	External input/output and internal output Timer and counter	CLR → I/O No. → MON / CLR → 1/c → Timer/counter No. → MON / Read-out of program → MON → (STEP+ or STEP− → MON)		○				○	○		○	○	○	○	○
		Coil	External output and internal output Timer and counter	CLR → OUT → I/O No. → MON / CLR → OUT → 1/c → Timer/counter No. → MON / Read-out of program → MON → (STEP+ or STEP− → MON)		○			○	○	○		○	○	○	○	○

Table 2-4 Programmer Key-in Procedures (3/3)

No	Function		Key-in procedure	Contents of display: Step No.	Data	Data |	Preset value	Current value	Continuity	DATA ☼	STEP ☼	Mode: PROG	TEST	RUN	Operation	Stop
7	Check	Syntax check	CLR SRC (SRC Continuation of syntax check (possible only for double coil error))	○							○	○	○	○	○	○
8	Maintenance function	Forced output	External output	CLR SET SET ENT FUN 3 OUT External output No. SET or RES		○				○	○		×	○	×	×	○
		Forced setting/ resetting Simulation input	External input/ output Internal output Timer/ counter	CLR OUT Internal output No. MON SET or RES		○				○	○		×	○	○	○	×
				CLR OUT 1/C Timer/counter No. MON SET or RES		○				○	○		×	○	○	○	×

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
All Clear	○	×	×	×	○

· Key-in procedure and display

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR			· PROG · DATA	
ENT		E		
DEL		-		All Clear complete

[Explanation]

1. Be sure to perform "All Clear" before writing new programs. ("All Clear" operation has been performed before shipment from the factory.)
2. "All Clear" clears all the programs written in. In addition, timer/counter data is cleared, and the internal output protected from power failure and the shift register are reset.

[**Display switchover between data and step**]

1. In usual operation, step is not displayed and data alone is displayed. Press the [STEP] key for step No. display. When pressing this key under step No. display, data display returns.

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
[CLR] [ENT] [DEL]		-	· PROG · DATA	Data display
[STEP]		0	· PROG · STEP	Step display
[STEP]		-	· PROG · DATA	Data display

[**Explanation**]

1. If "All Clear" is keyed in with 925-step program written in, a maximum of 5 sec is required before completion of this operation (during this time period, programmer display remains off). "All Clear" operation is completed when "_" (underline) appears on the display. It will take 19 seconds to clear a 3997-step program.
2. The contents of display shown in the above table correspond to the standard programmer PGMJ. **Hereafter, this applies to all displays.**

Function	Programmer mode			Operational status	
	PRŌG	TEST	RUN	Operation	Stop
Second half initialization of memory pack MPM-2E	○	×	×	×	○

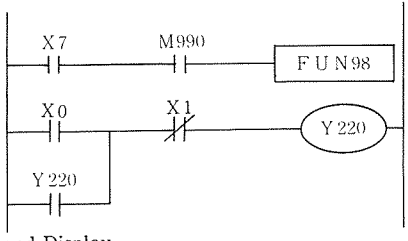
Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR			· PROG · DATA	
ENT		E		
INS	· ORG	990		Step 0
ENT	· AND	990		Sum value normalized

[**Explanation**]

1. This operation is required when reconnecting the memory pack MPM-2E (1950 words) used for the CPU module CPM-E to the EM-II. Contents over 1951 words are initialized.
2. Error may occur if the memory pack is used neglecting the above step.
3. However, the contents up to 1950 words remain unchanged.

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
Write-in of program	○	×	×	×	○

· Sequence

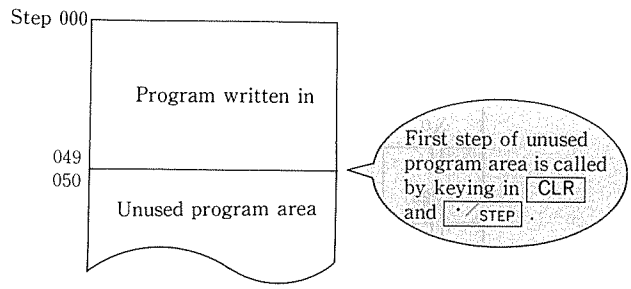


· Key-in procedure and Display

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
ORG 7 ENT	· ORG	7	· DATA · PROG	X7 written in
AND 9 9 0 ENT	· AND	990		M990 〃
FUN 9 8 ENT	· FUN	98		FUN98 〃
ORG 0 ENT	· ORG	0		X0 written in
OR 2 2 0 ENT	· OR	220		Y220 〃
AND NOT 1 ENT	· AND · NOT	1		X1 〃
OUT 2 2 0 ENT	· OUT	220		Y220 〃

[Explanation]

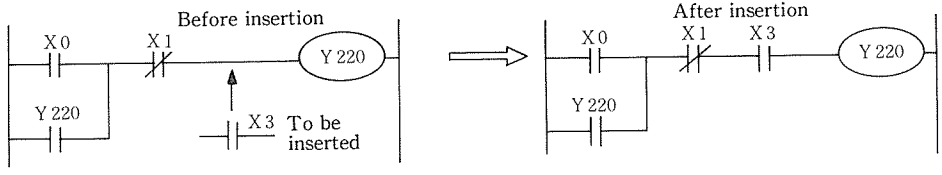
1. When pressing the [ENT] key, the contents shown on the display unit are written in the memory and program moves on the next step.
2. The contents of display exemplified above are those before pressing the [ENT] key.
3. Write-in of additional program
   When keying in [CLR] and [·/STEP] the first step of unused program area (step 50 in the example at right) is called. Program can be written in this area.



4. Program write-in from first step
   Step 0 is called by keying in [CLR] and [STEP +]. So program can be written from the first step.

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
Insertion of program	○	×	×	×	○

· Sequence



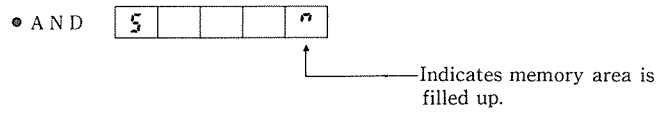
· Key-in procedure and display

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR OUT 2 2 0 SRC	· OUT	220	· DATA · PROG	Searches for coil Y200.
DCLR				Clears display.
AND 3	· AND	3		Inserts contacts X3.
INS				

[Exlpanation]

1. Read out the step following the one into which a program is to be inserted. In above example, output coil —(Y220)— is searched since the contact set —| |— X3 is to be inserted before the coil. Press the [DCLR] key to erase instruction and data display, and key in the program to be inserted, then press the [INS] key. This completes insertion of one step. Upon pressing the [INS] key, the next step is displayed.
   Note that the step numbers of the programs aftem the one inserted will be automatically incremented by one.
2. After completion of inserting the new program, be sure to perform syntax check (by keying in [CLR] [SRC]) to ascertain that there is no programming error.
3. An error will occure if you attempt to insert a program when the memory area is fully loaded, because program can no longer be inserted.

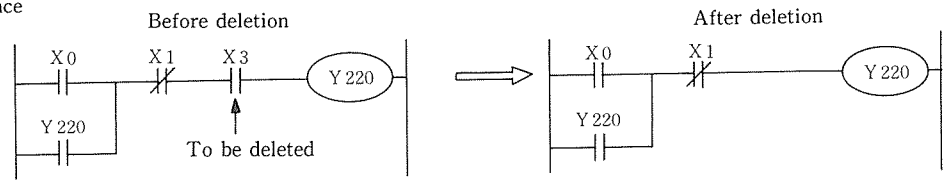
[AND] [5] [INS]



4. If a program insertion is made to the first step a program consisting of 900 steps, it will take about 5 sec for its completion. (Before completion, program display is turned off.)
5. Confirmation is required before pressing the [INS] key, because displayed programs are inserted sequentially whenever pressing the key.

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
Deletion of program	○	×	×	×	○

· Sequence



· Key-in procedure and display

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR 3 SRC	· AND	3	· DATA	Searches for contacts X3.
DEL	· OUT	220	· PROG	Deletes contacts X3.

[Explanation]

1. Read out the step to be deleted. When pressing the [DEL] key, the programs under the deleted one will be automatically decremented by one.
2. After deleting the program, be sure to perform syntax check (by keying in [CLR] [SRC]) to make sure that there is no programming error.
3. Confirmation is required before pressing the [DEL] key, because displayed programs are deleted sequentially whenever pressing the key.
4. If a program deletion is made from the first step of a progrmam consisting of 900 steps, it will take about 5 sec for its completion. (Before completion, program display is turned off.)
5. After insertion or delecion, the step numbers of the relevent program and thereafter will be automatically incremented.

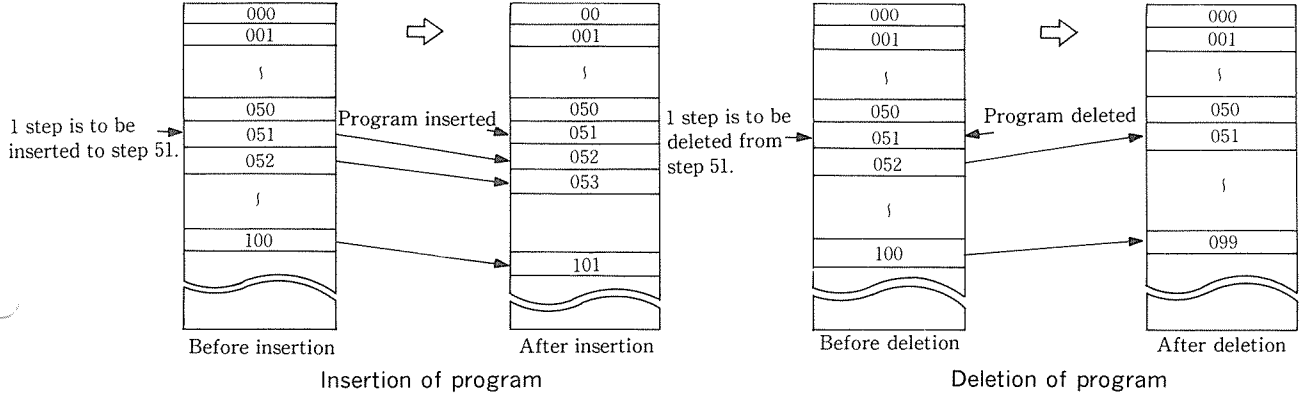
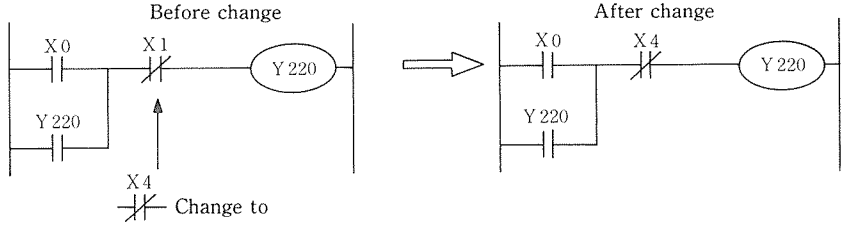


Figure 2-4 Insertion and Deletion of program

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
Change of program	○	×	×	×	○

· Sequenhe



· Key-in procedure and display

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR 1 SRC	· AND · NOT	001	· DATA · PROG	Searches for contacts X1
DCLR				Clears display.
AND NOT 4	· AND · NOT	4		Writes in contacts X4.
ENT	· OUT	220		

[**Explanation**]

1. Read out the step to be changed. Press the [DCLR] key to clear the instruction and data under display. Write a program beginning with an instruction. Pressing the [ENT] key completes the progrmam change for one step. Upon pressing this key, the next step is displayed. In case the number of words is different before and after change, the step numbers of the programs after the change one will be automatically incremented or decremented. The previous program remains unless the [ENT] key is pressed after program change.
2. Before change, the [DCLR] key must be pressed as a rule. However, a new program can be written even when instruction and data are displayed.
3. The preset value of timer/counter can be changed not only by the method above, but also by directly entering a new value as exemplified below after searching for the coil.

[CLR] [OUT] [T C] [0] [SRC] ···Searches for timer T00 coil.

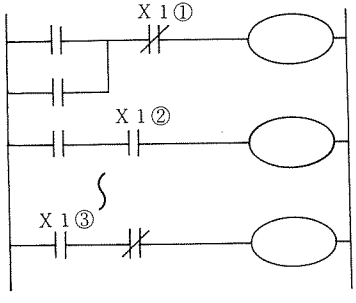
[1] [1] [•] [4] [ENT] ···Writes in new preset value.

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
Read out and search of program	○	○	○	○	○

Classification			Key-in procedure
Read-out	From start step		CLR → STEP(+) → STEP(+)
	From specified step		CLR → Step No. → STEP(/) → STEP(+) or STEP(−)
	From final step		CLR → STEP(/) → STEP(−)
Search	X, Y, M	I/O No.	CLR → Input/output No. → SRC → STEP(+) or STEP(−) or SRC
		Output No.	CLR → OUT → Output No. → SRC → STEP(+) or STEP(−) or SRC
	T/C	I/O No.	CLR → T/C → Input/output No. → SRC → STEP(+) or STEP(−) or SRC
		Output No.	CLR → OUT → T/C → Output No. → SRC → STEP(+) or STEP(−) or SRC
	Instruction word		CLR → Instruction word → SRC → STEP(+) or STEP(−) or SRC

[Explanation]

1. When pressing the [STEP] key after specifying a step number, data written in the specified step is displayed. Then the programs before and after this step can be read out by using the keys [STEP +] and [STEP −].
2. When pressing the [SRC] key after specifying X, Y, M, T/C number or instruction word, data in the step where the specified number or instruction word is written is displayed.
3. Continuous search for the same number is made by the following precedure.



Uey-in procedure	Display		Remarks
	Instruction	Numerical display	
[CLR] [1] [SRC]	· A N D · N O T	1	Searches for contact (1).
[SRC]	· A N D	1	Searches for contact (2).
[SRC]	· O R G	1	Searches for contact (3).

When pressing the [SRC] key again after completion of one search, another step written in the same number is searched for and displayed.

4. In case the specifyed number cannot be found in the program as a result of search operation, the first step of unused program area is displayed ("_" (underline) appears).
5. Programs before and after the search one can be read out by using the keys [STEP +] and [STEP −].

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
Syntax check	○	○	○	○	○

Key-in procedure	Judgement	Display			Remarks
		Instruction	Numerical display	Mode display	
CLR SRC	No error		300	・STEP (・PROG ・TEST ・RUN)	Displays first step of unprogrammed area.
	Error detected		115 E		Indicates error is found in step 115.

[**Explanatien**]

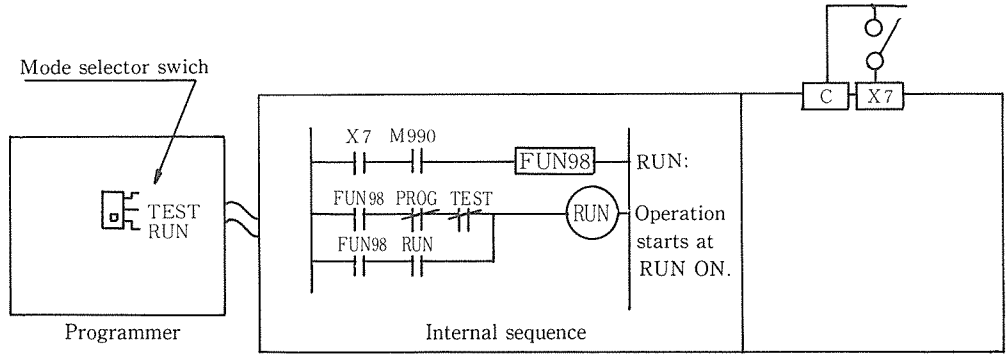
1. Syntax check is required after writing a program. So far as no error is found in the program, the first step number in the unprogrammed area is displayed.
2. The table below lists the error display which is presented when program contains an error, together with its factor. Each error factor can be judged by decimal monitoring of the special internal output WM980. Whenever performing syntax check, the result of the previous syntax check is cleared and the new rusult is displayed.
3. Only in case a double coil error, syntax check is performed contimuously from the first step by pressing the [SRC] key. Note, however, that no error will occur even if dual coil is specified for the output coil following FUN02 and FUN03.

Table 2-5 User Program Syntax Error Code List

Syntax error code (decimal)	Error display on PGMJ	Error display on PGMJ-R2	Error content
0	Blank	Blank	No error
1	E	E	Combination of instruction words does not meet syntax rule.
2	E	E	The structure of main routine or interrupt processing routine is abnormal.
3	E	E	The argument of INT instruction having the relevant number is not defined.
4	E	E	The structure of FUN06 and FUN07 is abnormal.
5	E	E	The structure of FUN08 and FUN09 is abnormal.
6	⌊	uE	STR level is under the one specified for instruction word.
7	⌈	oE	STR level is over the one specified for instruction word.
8	⌊	oE	Master control level is under the one specified for instruction word.
9	⌈	oE	Master control level is over the one specified for instruction word.
10	E	E	IF or IFR is duplicated. Prohibited instruction (OUT T/C) is written after IF or IFR.
11	E	E	The I/O number, constant or the like of instruction word is not within the specified range.
12	E	E	Prohibited dual coil is specified.
13	E	dE	Dual coil is specified though operation is bone (alarm).
14	E	E	There are multiple SB instructions. CALL does not correspond to SB.
15	E	E	JMP and INT instructions are used in the same step.
20	F	fE	Undefined operation coed or operand is used. So program cannot be interpreted. Or the user memory area is not formatted normally.
30	E	E	Error is detected in check sum of user program.

- At occurrence of an error, its code can be observed through decimal monitoring of WM980.
  CLR 9 8 0 MON MON
- These error codes are not cleared by turning on/off power supply (they are retained in memory).

Function	Programmer mode		
	PROG	TEST	RUN
Operation and stop	×	○	○



[Explanation]

1. Operation and stop are controlled according to the input codition of FUN98 (STA: Start). The start signal is processed in the basic unit along the above sequence as follows.
   (1) Operation with programmer
      ○ Operation starts when the start signal turns ON (external input X7 turns ON in the above examlple) with the mode selector switch of programmer set at RUN or TEST. Operation will not start in the PROG mode.
      ○ Mode cannot be changed over by manipulating the mode selector during operation. Therefore, operation will continue even if the mode selector switch is turned to PROG once operation has started.
   (2) Operation without programmer
      Operation starts when the start signal turns ON.
   (3) Operation starts when turning on power supply with the start signal turned ON.
2. As soon as operation starts, the RUN lamp of CPU module comes on.
3. Operation stops when the start signal turns OFF.
4. The programmer is mountable and dismountable while the basic unit is energized. This brings about a mode change in the basic unit.
   (1) When dismounting the progrmammer, the basic unit is set in the same status as when turning the mode selector switch of programmer to RUN.
   (2) When mounting the programmer during operation, operation continues indifferently to programmer mode. For matching the mode of basic unit with the mode selector switch setting of programmer, stop operation or turn off and then on the power supply to the basic unit.
5. For programming of start, refer to "Start and end" in "4.2Application Instruction (I)."
6. In case operation and stop are programmed by using a personnal compoter (runnning E-LADDER), the contacts like X7 in the above example must be kept open.

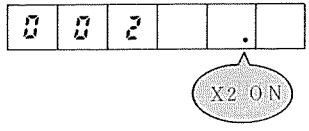
Function	Component	Programmer mode			Operational status	
		PROG	TEST	RUN	Operation	Stop
Monitor	X, Y, M, T/C					
	WX, WY, WM	○	○	○	○	○

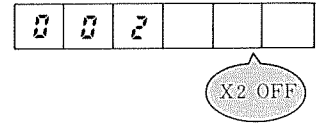
Classification			Key-in procedure	Display: Instruction	Display: Numerical display	Display: Mode display	Remarks
Bit	X, Y, M		CLR 2 MON		002 .	・DATA (・PROG ・TEST ・RUN)	X2 ON
Bit	T/C	I/O	CLR T/C 1 0 MON	・T/C	010 .		T/C10 ON
Bit	T/C	Coil	CLR OUT T/C 1 1 MON	・OUT ・T/C	11.065		T/C11 current value
Word	WX, WY		CLR 4 0 0 MON		400		M400 (bit)
Word	WM		MON		00255		WM400 (decimal)
Word	T/C (current value, preset value)		MON		00FFH		WM400 (hexadecimal)
Word			MON		400		M400 (bit)

[Explanation]

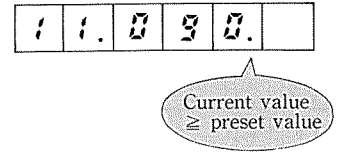
1. Monitoring of bit data (X, X, M, T/C) can be done as shown below.

(1) The ON/OFF status of bit data is indicated by means of a decimal point at the second lowest digit of the numerical display.





(2) The contacts of timer and counter are monitored in the same way as above. When the coil of timer/counter is monitored, its current value is displayed simultaneously. This value is displayed simultaneously. This value is incremented. When the current value becomes equal to or larger than the preset value, a decimal point appears at the second lowest digit of the numerical display.



(3) The number of bit data is incremented or decremented by 1 whenever pressing the [STEP +] of [STEP −] key in succession to [MON]. Therefore, ON/OFF status can be checked for successive numbers in both directions.

2. Monitoring of word data (WX, WY, WM, T/C ‹current value, preset value›) can be done as shown below.
After monitoring of bit data, word data can be monitored by pressing the [MON] key.

(1) When pressing the [MON] key, word data is displayed in decimal notation.
(2) When pressing the [MON] key again, word data is displayed in hexadecimal notation.
(3) When pressing the [MON] key again, display returns to monitoring of bit data.

(Example) The method of monitoring WM400 and WM402 word data is shown below.

M400	0	0	0	0	0	0	0	0
M401	1	1	1	1	1	1	1	1
M402	0	0	0	0	0	0	0	0
M403	0	0	0	0	1	0	1	0

WM400·····"255" in decimal number and "FF" in hexadecimal number

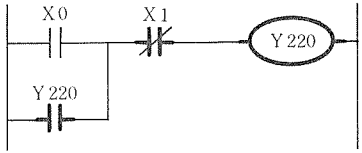
WM402·····"10" in decimal number and "A" in hexadecimal number

Key-in procedure	Display	Description
CLR 4 0 0 MON	400	Bit monitorring of M400
MON	00255	Decimal monitoring of WM400
MON	00FFH	Hexadecimal monitoring of WM400 "H" indicates hexadecimal notation.
MON	400	Bit monitoring of M400
STEP +	401	Bit monitoring of M401
STEP +	402	Bit monitoring of M402
MON	00010	Decimal monitoring of WM402
MON	000AH	Hexadecimal monitoring of WM402
MON	402	Bit monitoring of M402

3. Monitoring is possible even in the stop status. However, the contents of external input to be monitored during stop correspond to the ON/OFF status just before stop.

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
Conduction check	×	○	○	○	×

· Sequence



Contacts X1 Y220 — Conductive

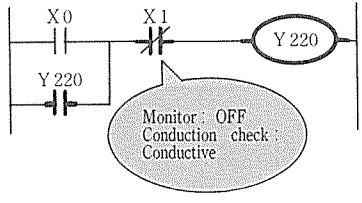
Contacts X0 — Non-conductive

· Key-in procedure and display

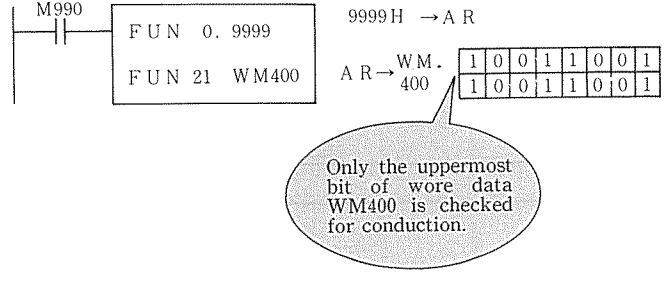
Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR OUT 2 2 0 SRC	· OUT	220 .	· DATA (· TEST · RUN)	Y220 ON
STEP (−)	· AND · NOT	001 .		X1 conductive
STEP (−)	· OR	220 .		Y220 conductive
STEP (−)	· ORG	000		X0 non-conductive

[Explanation]

1. This functios enables you to check the contacts contained in the circuit sequentially for conduction. That is, when a contact set is conductive, a decimal point (.) will appear at the second digit counting from the lowest one of the numerical display.
2. Key-in procedure for conduction check is the same as for search and read-out.
3. Difference between conduction check and monitor
   (1) The monitor is a function for displaying the ON/OFF status of coil irrespective of sequence.
   (2) Conduction check is a function for displaying the conductive or non-conductive status of contacts while following the sequence.

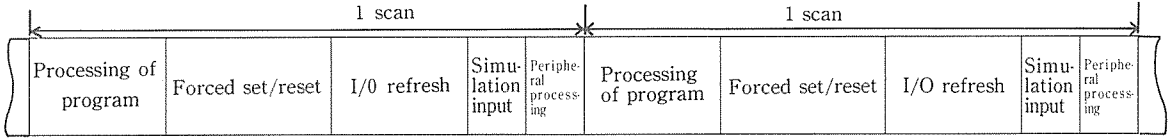


4. Conduction check of word data covers only the uppermost bit (b15) of that data, which does not have any significance. So word data must be checked by using the monitor function.

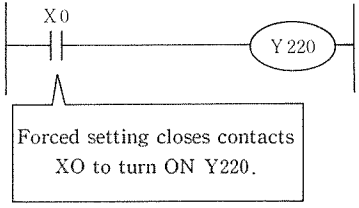


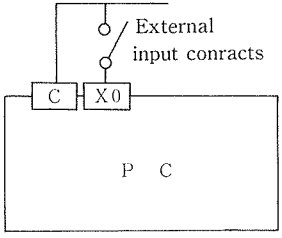
Function	Component	Programmer mode			Operational status	
		PROG	TEST	RUN	Operation	Stop
Forced set/reset (bit)	X, Y, M					
	T/C	×	○	○	○	×

· Processing timing of forced set/reset within one scan



· Sequence





· Operation

X, Y, M or T/C on image memory is set/reset indifferently to the ON/OFF status of external input conracts.

· Key-in procedure and display

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR OUT 0 MON		000	· DATA (· RUN · TEST)	Monitors X0.
SET		000 .		Forcibly sets X0 and turns on Y220 simultaneously.
RES		000		Forcibly resets X0 and turns off Y220.
CLR				Releases forced set/reset mode. Operation follows the ON/OFF status of external input contacts.

[Explanation]

1. When forced set/reset function is activated, X, Y, M or T/C on the image memory is set or reset.
2. Simulation input is enabled by utilizing the forced set and reset function for the external input (X). However, the input indicator lamp does not turn on when forced setting is made because the lamp responds to the physical conditions of the contacts. So judge input by activating the monitor function of programmer.
3. The forced set/reset mode is released by pressing the keys for interrupting the monitoring in the relevant I/O number such as CLR, STEP (+) and STEP (−).

Function	Component	Programmer mode			Operational status	
		PROG	TEST	RUN	Operation	Stop
Forced setting of decimal/hexadecimal numbers (word)	WY, WM T/C100~295	○	○	○	○	○

Furced setting of desimal number

· Key-in procedure

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR OUT 7 0 0 MON	· OUT	700	· DATA	Bit monitoring of M700
MON	· OUT	00000	(· PROG · TEST · RUN)	Decimal monitoring of WM700
1 2 3 4 5	· FUN · OUT	12345		Decimal number in 5 digits
SET	· OUT	12345		Forced setting of desimal number to WM700

Forced setting of hexadecimal number

· Key-in procedure

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR OUT 8 0 0 MON	· OUT	800	· DATA	Bit monitoring of M800
MON	· OUT	00000	(· PROG · TEST · RUN)	Decimal monitoring of WM800
MON	· OUT	0000H		Hexadecimal monitorring of WM800
0 1 2 3	· FUN · OUT	0123		Hexadecimal number in 4 digits
SET	· OUT	0123H		Forced setting of hexadecimal number in WM800

[Explanation]

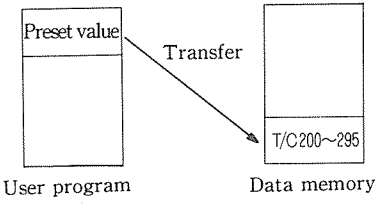
1. When entering a value and pressing the SET key while the monitor function is activated, the value is set as word data. Before pressing the SET key, be sure to enter decimal number in 5 digits, and a hexadecimal number in 4 digits.
2. Clock time can be set by forced setting of a hexadecimal number.
3. Listed below are applicable range of monitor and forced set/rset functions.

Table 2-6 Application Range of Monitor and Forced Set/Reset Functions

Classification	Monitor			Forced set/reset					
				Under stop			Under oparation		
	Bit	Decimal number	Hexadecimal number	Bit	Decimal number	Hexadecimal number	Bit	Decimal number	Hexadecimal number
X 0~195	○	○	○	×	×	×	◎	×	×
Y 200~395, M400~655	○	○	○	×	×	×	◎	○	○
M700~ 955	○	○	○	○	○	○	◎	○	○
M 960~991	○	○	○	×	×	×	×	×	×
T/C 0~95	○	×	×	×	×	×	◎	×	×
T/C 100~195, T/C 200~295	○	○	○	(Note) ○	(Note) ○	(Note) ○	×	○	○

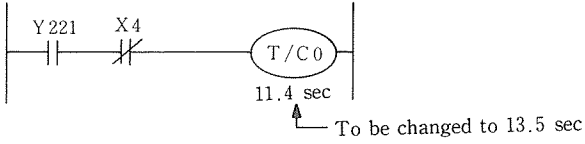
Symbol
- ○ : Possible
- × : Impossible
- ◎ : Possible (write-in every scan)

(Note) Just before operation, the preset values of timers/counters are transferred to T/C200 to 295. Therefore, rewriting the contents of T/C200 to 295 during stop, though possible, is meaningless because the contents are all replaced with the preset values before operation.



Function	Component	Programmer mode			Operational status	
		PROG	TEST	RUN	Operation	Stop
Change of timer/counter preset value during operation	T/C	×	○	×	○	×

· Sequence



· Key-in procedure and display

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR OUT T/C 0 SRC	· OUT · T/C	0,011,4	· DATA	Search for T/C0 coil
1 3 • 5 ENT	· OUT · T/C	0.13.5	· TEST	Write-in of new preset value

[Explanation]

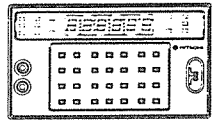
1. Each preset value of timers and counters is changeable by turning the programmer mode to TEST during operation. The value is unchangeable in the RUN mode.
2. Search for the coil of timr or counter whose preset value is to be changed. Then key in a new preset value and press the [ENT] key. The new value will be written in EEPROM of the basic unit and T/C200 through T/C295, and the current value will be reset to 0 sec or 0 time.

NOTE

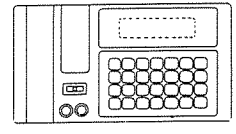
If preset value is changed during operation, both timer and counter operate according to the new value immediately after change.

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
CMT function	○	×	×	×	○

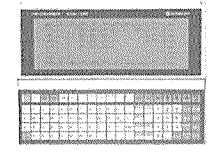
· Configuration



PGMJ

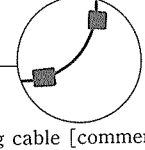


PGMJ－R2



PGM－GPE2

Audio cassette tape recorder [commercially available one]



Connecting cable [commercially available one] (without resistor)

· Key-in procedure and display (when using PGMJ)

	Function	Key-in procedure		Display				Remarks
		Tape recorder	Programmer	Instruction	Numerical display		Mode display	
1	CMT function setting		CLR SET SET ENT FUN 1		A - - - C - - -	 CMT function	・PROG ・DATA	
2	Recording (DUMP)	Recording M I C ◎-□-□-◎ Microphone (Programmer) (Tape recorder)	OUT ENT	・OUT	C - - P C - - -	Recording End		Basic unit (EEPROM) ↓ Cassette tape
	Playback (LOAD)	Playback E A R ◎-□-□-◎ Earphone (Programmer) (Tape recorder)	STR ENT	・STR	C - - H C - - P C - - -	Waiting for start bit (30 sec) Playing back End		Basic unit (EEPROM) ↑ Cassette tape
	Verification (VERIFY)	Playback E A R ◎-□-□-◎ Earphone (Programmer)(Tape recorder)	AND ENT	・AND	C - - H C - - P C - - -	Waiting for start bit (30 sec) Verifying End		Basic unit (EEPROM) ↓↑ Cassette tape
	Error display			・Instruction	C - - E C 6 2 E C 7 - E C 8 - E	Operation error Playback error Verification error Format error		Press CLR key to clear error and retry.
3	CMT function clear		CLR RES RES ENT					

※ Be sure to verify data after every recording or playback.

● Setting of cassette tape recorder

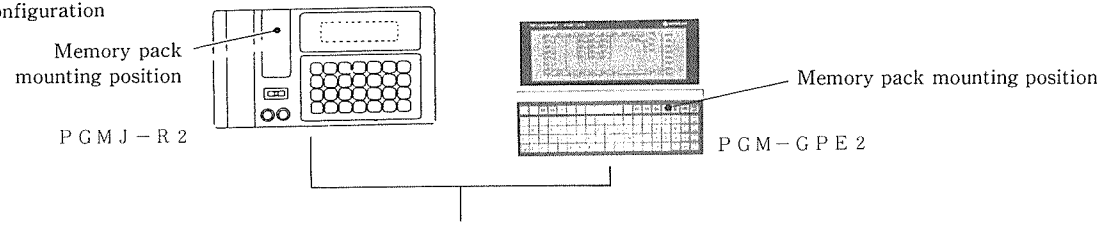
Item	Description
Type of cassette tape recorder	Use a monaural cassette tape recorder.
Tone quality	Set the tone adjusting knob to maximum.
Tone volume	Set the tone volume knob to maximum.
Tape	Select a tape not scratched nor wrinkled.

[**Explanation**]

1. Programs are storable on a cassete tape by using a commercially available tape recorder. Key-in procedure and display are exemplified above when the above-mentioned PGMJ is used. Key-in precedure remains the same when using the PGMJ-R2 instead of the PGMJ.
2. Be sure to rewind the tape to the beginning before recording, playing back or verifying a program.
3. If power is turned off, tape is taken out, or the CLR key is pressed during a process, then key-in precedure must be restated from the beginning.
4. For data palyback or verification, symbol H is presented on the LED for about 30 sec until the tape is positioned at the start bit. If the symbol does not disappear even after 30 sec, it can be judged that nothing has been recorded on the tape. In this case, record data again or change the tape to a proper one. **Recording becomes impossible when using a tape recorder cord with a resistor. So be sure to use a cord without a resistor.**
5. When a stereo cassette tape recorder is to be used, set the tape monaurally. In addition, turn the tone volume and balance knobs on the connection terminal side to the maximum position.
6. Execution time will be increased according to the number of program steps.
   Execution time ≒ 40sec + number of steps x 0.22 sec
7. A tape recorded with the PGMJ can be played back with the PGMJ-R2 or PGM-PGM-GPE2. However, a tape recorded with the PGMJ-R2 or PGM-GPE2 cannot be reproduced with the PGMJ.
8. For key-in prodcedure with PGM-GPE2, refer its instruction manual.

Function	Programmer mode			Operational status	
ROM writer function	PROG	TEST	RUN	Operation	Stop
	○	×	×	×	○

· Configuration



Memory pack for EM series

· Key-in procedure and display (when using PGMJ-R2)

No.	Function	Key-in procedure	Display	Remarks
1	Entrance into ROM	CLR SET SET ENT FUN 2	PROG P— 2 ROM MODE	
2	Recording (copying)	OUT 0 0 ENT	PROG R—P OUT00 2 ROM MODE	Basic unit → Memory pack EEPROM
	Reproduction (load)	STR 0 0 ENT	PROG R—P STR00 2 ROM MODE	Baisc unit ← Memory pack
	Verification (verify)	AND 0 0 ENT	PROG R—P AND00 2 ROM MODE	Basic unit ↔ Memory pack
	Blank check	NOT 0 6 ENT	PROG R—P NOT 2 ROM MODE	EPROM erasure check
	Error display	Key-in error	R—E	
		Copying error	R62E OUT	Exchange memory pack.
		Verification error	R 7—E AND	
		Blank chenk error	R61E NOT	EPROM not yet erased
3	Releasing of ROM function mode	CLR RES RES ENT		

Note:"P"display disappears when procedure is completed.

[Explanation]

1. Programs can be stored in the memory pack by using the PGMJ-R2.
2. For recording (copying), the kind of memory must be keyed in.

   [0] [0] ···925 Word EEPROM (MPM—1E)
   [0] [1] ··1949 Word EEPROM (MPM—2E)
   [0] [2] ··1949 Word EPROM (MPM—2R)
   [0] [4] ··3997 Word EEPROM (MPM—2E)
   [0] [6] ··3997 Word EPROM (MPM—2R)

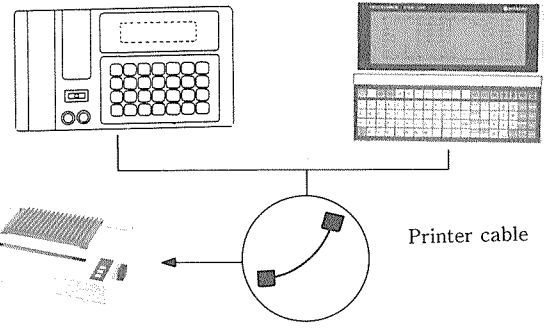
CAUTION

If EPROM is specified even though the EEPROM memory pack is used, the memory pack might be destroyed. To prevent this, the kind of memory must be confirmed.

3. If attempting to reproduce data with no memery pack mounted, undefined data is written in the basic unit.
4. For key-in procedure with PGM-GPE2, refer to its instruction manual.

Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
Print-out	○	×	×	×	○

· Configuration



· Key-in procedure and display (when using PGM-R2)

No.	Function	Key-is procedure	Display	Remarks
1	Change to printer function mode	CLR SET SET ENT FUN 6	PROG P – PRINT – OUT	FUN6 must be specified when the basic unit belongs to EM-II.
2	Specification of print-out	OUT 0 2 ENT ↑ Ladder diagram	PROG P – P–OUT02 PRINT–OUT	Basic unit → Printer EEPROM
3	Releasing of printer function mode (Note)	CLR RES RES ENT		

Note: Procedure is completed when "P"display disappears.

Specification of print-out format

Format specification (key operation)	Title	Code list	Ladder diagram	Cross reference
0 0	○	○	○	○
0 1	–	○	–	–
0 2	–	–	○	–
0 3	–	–	–	○

○ : Print-out

[Explanation]

1. Programs can be printed out onto a printer connected to the PGMJ-R2 or PGM-GPE2. Code list, ladder diagram and/or cross reference is selecteable for print-out. In case of PGMJ-R2, the printout format is to be specified in any case of codes 00 through 03 as listed above.
2. FUN6 must be specified for changeover to the printer function mode when the EM-II series (CPM-E2 or CM-E3) is used.

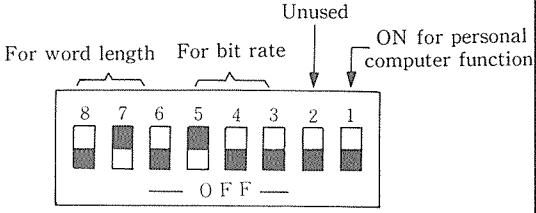
Although print-out is possible with the preceding PGMJ-R, it is restricted as listed below.

Table 2-7 Restrictions on Print-out with PGMJ-R

Item	Before June, 1989 (up to 9EXX)	From June, 1989 (from 9FXX on)
Change to printer function mode	FUN5 (specifies EM)	FUN6 (specifies EM-II)
Instructions commonly used between EM and EM-II	Can be printed	Can be printed
Instructions exclusive for EM-II	Cannot be printed correctly	Can be printed
Print-out capacity	2K words	2K words

3. DIP switch setting of PGMJ-R2 and PGM-GPE2

Bit rate and word length are changeable by the internal DIP switch. Settable bit rates and word lengths are listed in Tables 2-8 and 2-9, respectively.



Use a small blade-edge screwdriver for changing the settings of DIP switch.

■ indicates the current switch position.

Table 2-8 Bit Rate Setting

Switch No.			Bit rate (kbps)	Remarks
5	4	3		
ON	ON	ON	38.4	
ON	ON	OFF	19.2	
ON	OFF	ON	9.6	
ON	OFF	OFF	4.8	Setting made upon shipment
OFF	ON	ON	2.4	
OFF	ON	OFF	1.2	
OFF	OFF	ON	0.6	
OFF	OFF	OFF	0.3	

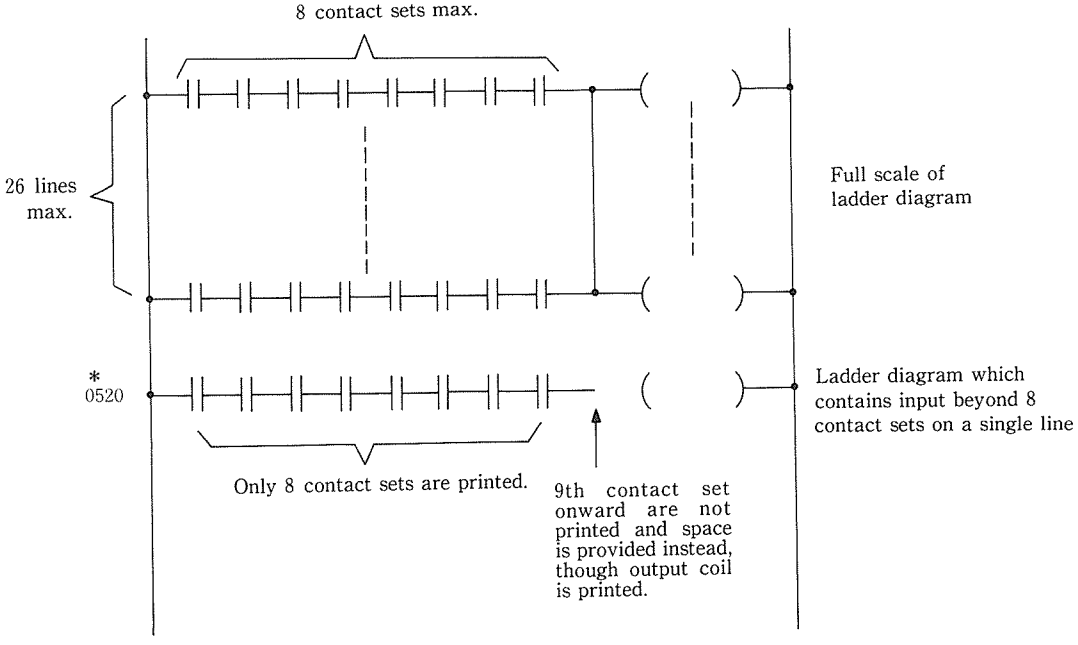
Table 2-9 Setting of Word Length

Switch No.			Word length				Remarks
8	7	6	Start bit	Data bit	Parity bit	Stop bit	
ON	ON	ON	1	7	1 (even number)	2	
ON	ON	OFF	1	7	1 (odd number)	2	
ON	OFF	ON	1	7	1 (even number)	1	
ON	OFF	OFF	1	7	1 (odd number)	1	
OFF	ON	ON	1	8	—	2	
OFF	ON	OFF	1	8	—	1	Setting made upon shipment
OFF	OFF	ON	1	8	1 (even number)	1	
OFF	OFF	OFF	1	8	1 (odd number)	1	

4. Print-out specifications of printer are explained below.

(1) Ladder diagram can be printed out normally when it contains 8 contact sets max. on each of up to 26 lines and when the number of concurrent blocks is within 8.

(2) If a ladder diagram exceeds the above limits, it is printed out only within the limits.
For example, when 10 contact sets are written on a single line, only 8 contact sets are printed excluding the ninth and tenth contact sets. In case the horizontal limit is exceeded, the asterisk "*" is printed at first step of the relevant circuit.



(3) Up to 9 contact sets can be printed on each line when using the PGM-GPE2.

5. Printer specifications

Connectable prints are limited to the ones made by ESPON*1. The table below lists the combinations of connectable printers and serial interface boards.

Table 2-10 Connectable Printers and Interface Boards

Printer model / Interface board	RP−80*2 (old version)	RP−8011*2 (old version)	FP−80*2 (old version)	SP−80T*2
No. 8143*2 (old version)	○	○	○	○
No. 8145*2 (old version)	○	○	○	○
No. 8148*2	○	○	○	○

Setting of the DIP switch in the printer have not been changed from those made upon shipment from the factory. Setting of the DIP switch on the interface board are listed on the next page.

*1. EPSON is a trademark of SEIKO EPSON corporation.

*2. RP-80, RP-8011, FP-80, SP-80T and Interface boards No. 8143, No. 8145, No. 8148 are products of SEIKO EPSON corporation.

Table 2-11 Settings of DIP Switch on Interface Board

Switch No. \ Interface board		No.8143	No.8145	(Note) No.8148
SW 1	1	ON	OFF	OFF
	2	OFF	ON	OFF
	3	ON	OFF	OFF
	4	OFF	OFF	OFF
	5	OFF	OFF	OFF
	6	OFF	OFF	ON
	7	OFF	ON	OFF
	8	ON	OFF	ON
SW 2	1		OFF	ON
	2		ON	OFF
	3		OFF	ON
	4		ON	ON
	5			OFF
	6			OFF

Note: The interface board No. 8148 requires shorting of the jumper wire J6.

6. Cable specifications

The cables for connecting the PGMJ-R2/PGM-GPE2 and serial printer are not included in the standard equipment. They must be prepared separately. If utilizing cables in your possesion, confirm beforehand that connection meets the figure below.

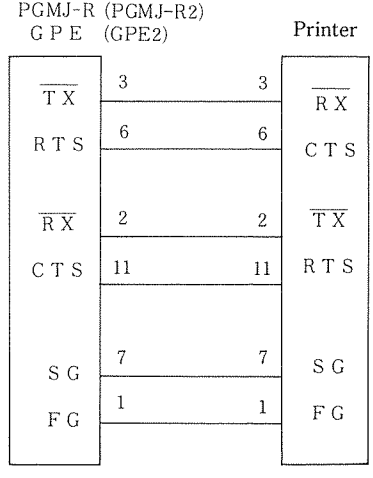
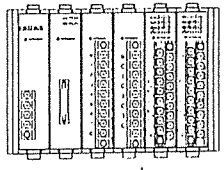


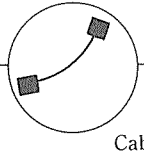
Figure 2-5 Printer Cable Connection Diagram

Personal computer interface function

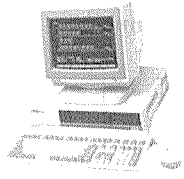
· Configuration



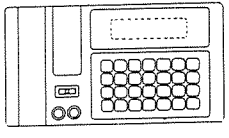
C P M − E 3



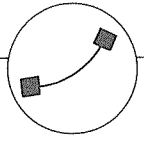
Cable B



Personal computer



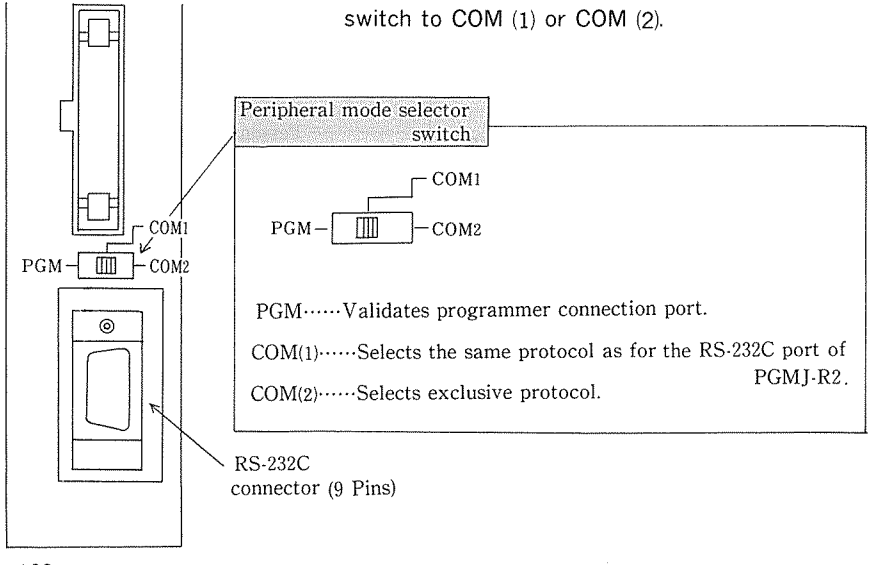
P G M J − R 2



Cable A

[**Explanation**]

1. Since the CPM-E3 comprises an RS-232C interface, it is directly connectable to a personal computer. The CPM-E2 can be hooked up to a personal computer via the PGMJ-R2.
2. **Connection via PGMJ-R2**
   A personal computer is enable to program and monitor sequence by running the personal computer programming software E-LADDER. This software package has been prepared for IBM PC XT* series. For details, refer to the personal computer programming manual 〈E-LADDER〉 (NJI 022 (X) -1).
3. **Direct connection to personal computer [CPM-E3]**
   For connection to a personal computer, turn the peripheral mode selector switch to COM (1) or COM (2).



At the PGM position, the programmer connection port is validated. At COM (1) or COM (2) position, the RS-232C port is validated, namely the programmer connection port is unusable.

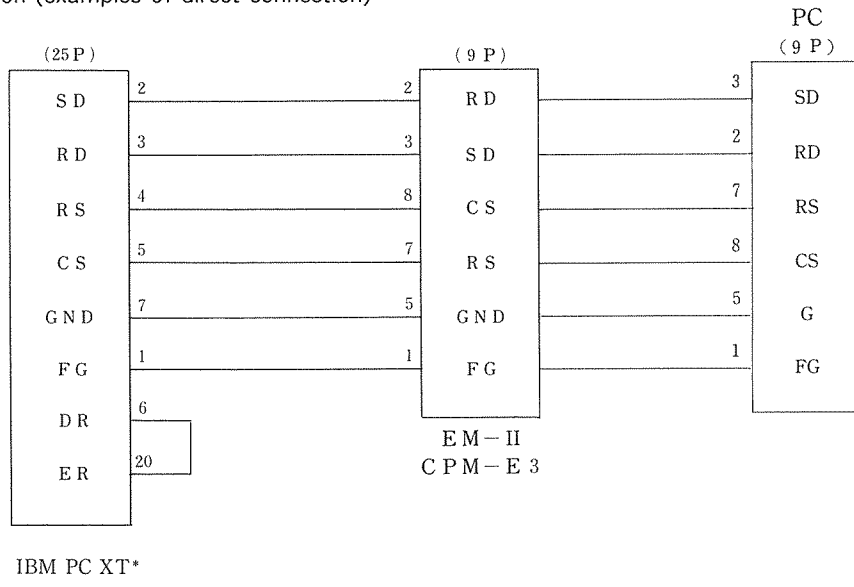
NOTE

The status of the peripheral mede selector switch is determined just when turning on power supply. Alteration of switch setting after energization is ineffective. For mode change, power supply must be turned off.

(1) At the COM (1) position, programming and monitoring are possible by use of the personal computer programming software E-LADDER.
In this mode, protocol is the same as in connection to a personal computer via the PGMJ-R2.

(2) At the COM (2) position, the exclusive protocol is selected.
Refer to the EB/EM-II protocol manual separately issued.

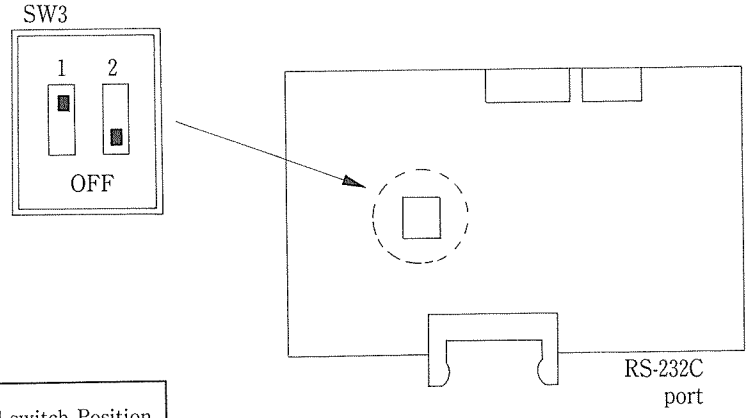
4. Cable connection (examples of direct connection)



* IBM PC XT is a product of International Business Machine corporation.

By the DIP switch (SW3) Position on PC board at power supply energized, the mode of CPM-E3 is decided.
After this time, CPU mode can not be changed by changing switch position.
The switch postion is shown as follows.

1 : Transmission speed control switch
2 : Operation control command selector



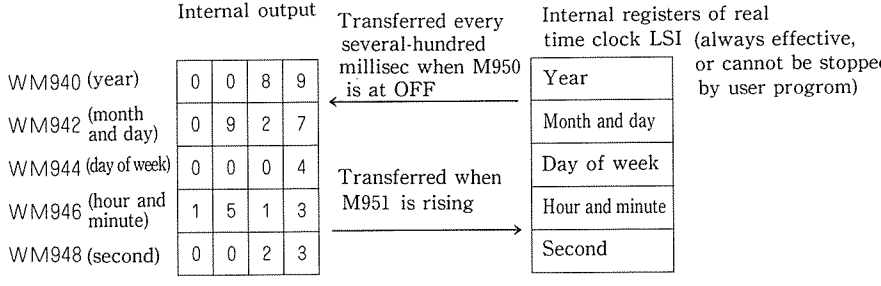
transmission speed (bps)	transmission speed switch Position
4800	OFF
9600	ON (preset state at shipment)

mode	operation control command	peripheral node selector	operation control selector
COMMAND MODE	uneffective	COM2 side	ON
	effecttive	COM2 side	OFF*

*Preset state at shipment

Clock function

Configuration of calendar clock (15:13:23, Wenesday, September 27, 1989)



0/1 --- M950 (selects display or editing mode)

0/1 --- M953 (turns on at battery error)

--- M951 (sets time point)

-- M952 (adjusts in ±30 sec)

· For year, the lower 2 digits of Christian year are represented by those of WM940, whose upper 2 digits are fixed at 00H.

· Month and day represented by the upper and lower 2 digits of WM942, respectively.

· Day of week is represented by the lower 2 digits of WM944 in the following way. The upper 2 digits are fixed at 00H.

Day of week	Sun.	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.
Lower 2 digits of WM944	01H	02H	03H	04H	05H	06H	07H

· Hour and minute are represented by the upper and lower 2 digits fo WM946, respectively.

· Second is represented by the lower 2 digits of WM948, whose upper 2 digits are fixed at 00H.

[Explanation]

1. Registers (M940 to M955) for calendar clock

Only the CPM-E3 uses 16 internal outputs M940 through M955 as registers for calendar clock. (The contents of these registers cannot be cleared by CLR, ENT and DEL operations.)

In case of the CPM-E2, the internal outputs M940 through M955 serve as usual memory-retentive internal outputs.

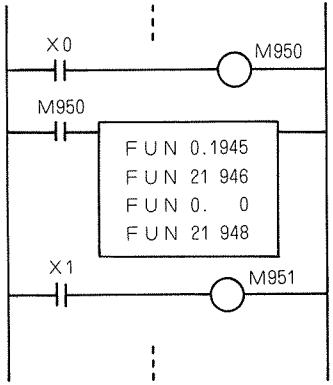
The real time clock LSI has registers for representing year, month,day of week, hour, minute and second. These registers are always operative indifferently to operation/stop and power on/off status.

Example of time setting with programmer (setting of 19:45:36, Saturday, July 28, 1990)

Key-in procedure	Display	Description
CLR OUT 9 5 0 MON	950	Bit monitoring of M950
SET	950.	Forced setting of M950 (editing mode)
CLR OUT 9 4 0 MON MON MON	0089H	Hexadecimal monitoring of WM940
0 0 9 0 SET	0090H	Forced setting of hexadecimal number (year) in WM940
STEP+ STEP+	0927H	Hexadecimal monitoring of WM942
0 7 2 8 SET	0728H	Forced setting of hexadecimal numbers (month and day) in WM942
STEP+ STEP+	0004H	Hexadecimal monitoring of WM944
0 0 0 7 SET	0007H	Forced setting of Hexadecimal number (day of week) in WM944
STEP+ STEP+	1513H	Hexadecimal monitoring of WM946
1 9 4 5 SET	1945H	Forced setting of hexadecimal numbers (hour and minute) in WM946
STEP+ STEP+	0023H	Hexadecimal monitoring of WM948
0 0 3 6 SET	0036H	Forced setting of hexadecimal number (second) in WM948
CLR OUT 9 5 1 MON	951 (Note)	Bit monitoring of M951
SET	951.	Forced setting of M951 (↱time setting)

Note: Make sure that M951 is at OFF. If at ON, press the RES key and then SET key. After completion of setting, press the RES key to forcibly reset M951.

Example of time setting with programmer (setting of 19:45:00)



X0: Turns on to write hour, minute and second values in WM946 and WM948.

X1: Sets time when status changes from OFF to ON.

(1) When M950 is OFF, the contents of registers in the real time clock LSI are transferred to the internal outputs M940 through M949 every several-hundred ms. So the user can know the current time point with the internal outputs.
When M950 is at ON, the contents of the same register are not transferred to the internal outputs M940 through M949. Therefore, time does not advance in the internal outputs M940 through M949. However, the registers in the real time clock LSI are functioning. So internal outputs M940 through M949 resume operation at the exact time point when turning off M950 again.

(2) M951 is used for rewriting the registers in the real time clock LSI. When M951 changes from OFF to ON (at the rising edge), data in the internal outputs M940 through M949 are transferred to the registers in the real time clock LSI and, at the same time, M950 is turned off.

(3) M952 is used for ±30sec adjustment. Time point is adjusted to 0 sec when current value is within 0 to 29 sec, and to 59 sec when within 30 to 59 sec.
At OFF to ON change of M952 (at the rising edge), only the registers in the real time clock LSI are subjected to ±30 sec adjustment. Within 1 sec, the adjusted contents of the registers are transferred to the internal outputs M940 through M949 when M950 is at OFF.

(4) M950, M951 and M952 are automatically turned off upon energization.

(5) M954 and M955 are for functional expansion and unused (undefined) at present.

2. Setting of time point

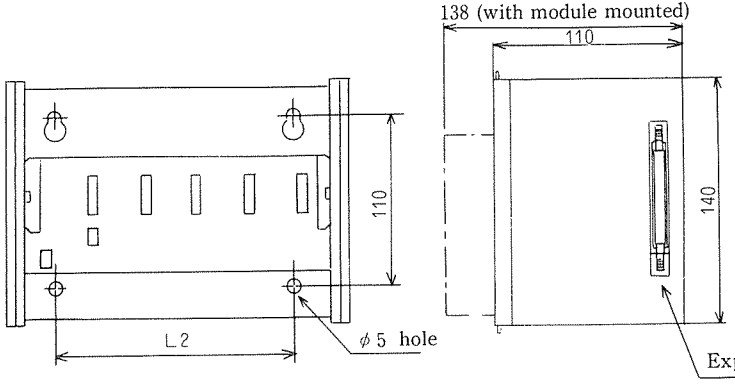
A desired time point is settable by turning M951 from OFF to ON after rewriting the contents of registers with M950 turned on to set the editing mode.
Time point is settable by utilizing the forced set/reset function of the programmer. It can also be set during operation as programmed.

3. Accuracy

Calendar clock has an accuracy of +30 sec and −3 min per month (at 0 to 45°C).
This accuracy may not be retained if ambient temperature rises beyond 45°C.

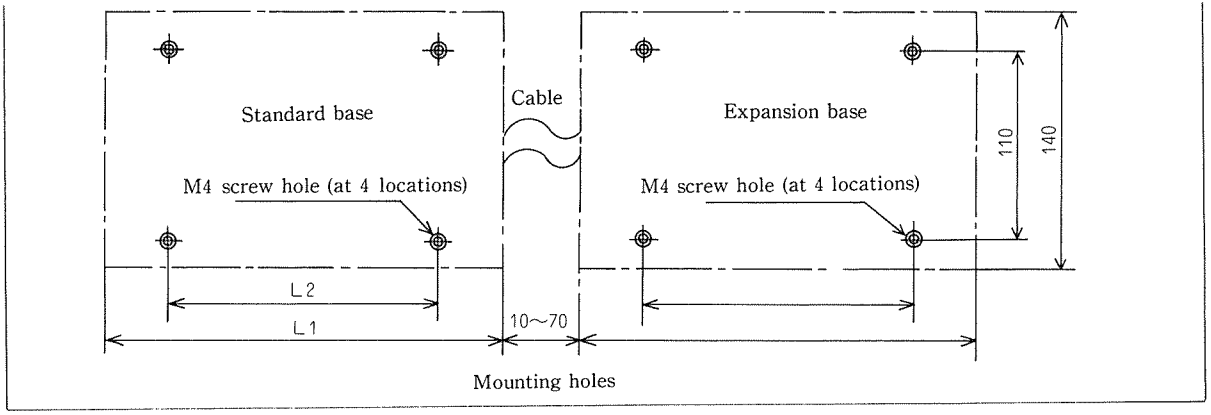
[External dimensions and mounting dimensions]

dimmensions in mm



Dimension Table

Model	L1(external dimension)	L2(mounting dimension)
BSM-3	160	80
BSM-4	195	120
BSM-5	230	160
BSM-6	265	200
BSM-7	300	240
BSM-9	370	310

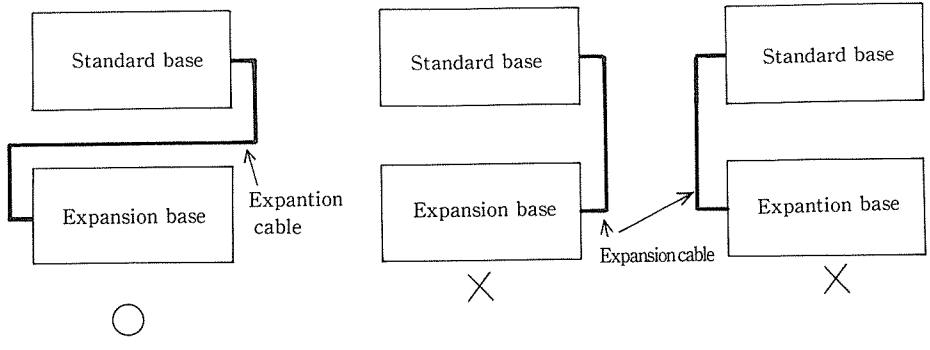


[Explanation]

1. The base alone with no module is to be mounted to control panel.
2. The expansion unit is to be installed at the right of the basic unit as a rule. Installation gap must be 10 to 70mm when using the 10 cm-long expansion cable 〈CNM-01〉 .

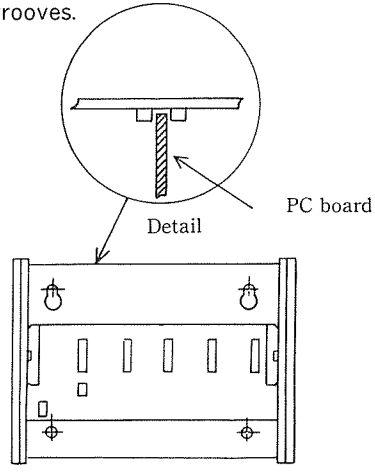
CAUTION

For vertical instllation with the 60 cm-long expansion cable ‹CNM-06› , attention must be paid to its connecting direction. If the cable is not connected correctly, not only will operation be impossible but the module might be broken.



3. Mounting of module

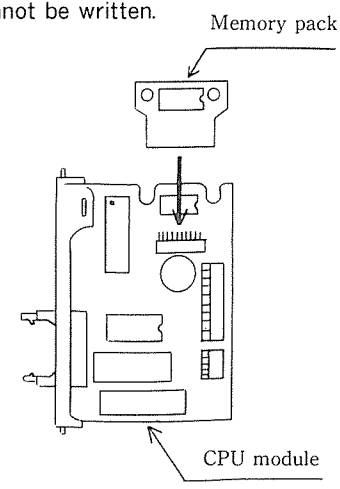
The base has grooves shown below at the top and bottom. Push in the PC board of each module while matching it with the upper and lower grooves.



Base sturcture

4. Mounting the memory pack

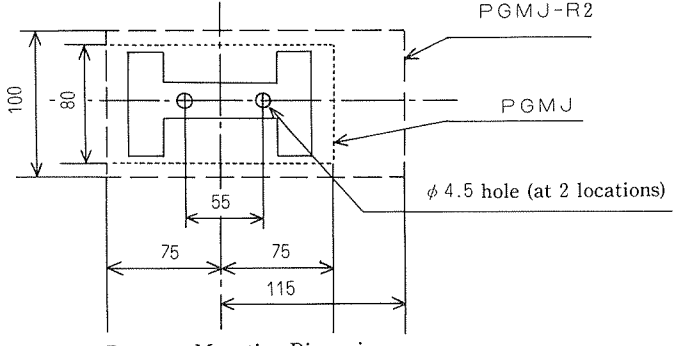
The CPU module necessitates a memory pack. Plug the memory pack into the 30P connector. Unless the memory pack is mounted, program cannot be written.



Mounting of Memory Pack

5. How to Mount Programmer

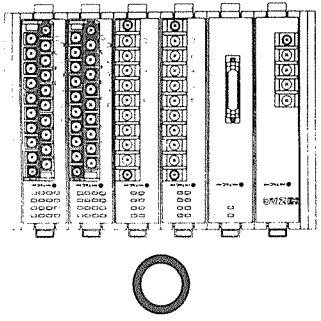
The programmer (model PGMJ) and universal programmer (model PGMJ-R2) must be mounted in the dimentions shown below when using the programmer mounting seat (model PAM-E).

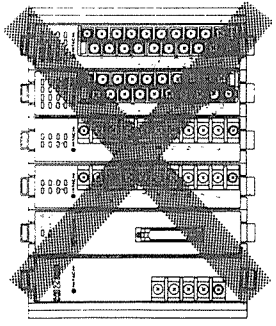


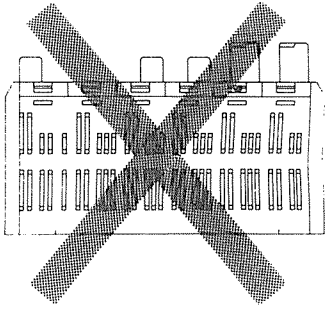
Program Mounting Dimensions

6. Mounting direction

The programmable controller is mountable upside down, but neither vertical nor reverse installation is allowable.







—— NOTICE ——

1. Installation Clearance

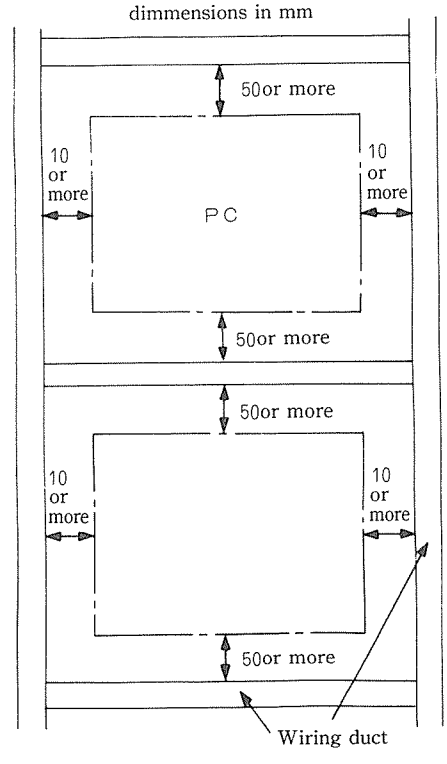
1. Provide a space of 50 mm or more at the top and bottom of each unit for facilitating ventilation and maintenance. Also secure a free space of 10 mm min. at the left and right for ventilation.
2. During installation, pay strict attention not to let fragments due to drilling or wiring fall into the programmable controller.
3. Avoid installation right above equipment which radiates much heat (such as a heater, transformer or large-capacity resistor).
4. Secure a distance of 200 mm or more from a high tension cable (3,000 V min.) or power cable.

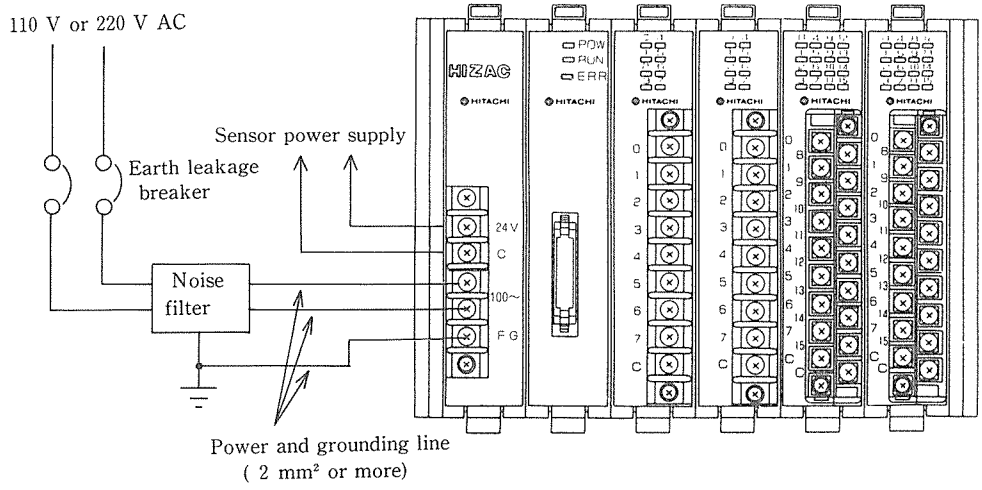
2. Installation environment

(1) Avoid locations which receive direct sunlight, or which are subjected to condensation or are exposed to wind and rain.

(2) Installation is unallowable at locations where the atomospheric air contains dust, oil vapor, smoke, conductive dust or corrosive gas in a significant amount.

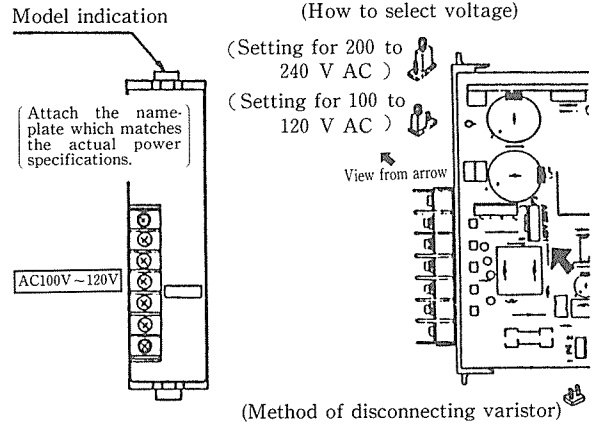
(3) Do not install the programmable controller at locations at which vibration or shock will be directly applied.




110 V or 220 V AC
Sensor power supply
Earth leakage breaker
Noise filter
Power and grounding line
(2 mm² or more)
HIZAC
HITACHI
POW
RUN
ERR
24 V
C
100~
F G

[Explanation]

1. **Line voltage**
   This instrument operates on either 110V or 220 V AC system. However, standard setting is 220 V AC (factory setting on shipment). For receiving 110 V AC, setting must be changed as shown at right.
2. Use a power cable of 2 mm² or more to prevent occurrence of voltage drop.
3. **Grounding**
   Connect the grounding terminal (FG terminal) to make 100Ω or less using a cable of 2 mm² or more.
   Restrict the length of grounding cable within 20m.
   (1) Grounding can be shared with an instrument panel or relay panel.
   (2) Common grounding must be avoided with equiqment which may generate high-level noise such as a high-frequency furnace, large-scale power panel (beyond a few kW), thyristor converter and electric welding machine.
   (3) In case line voltage fluctuates excessively, use of a noise filter is recommended.



Before dielectric strength test, be sure to remove the connector P6 in case of PSM-A or P4 in case of PSM-B

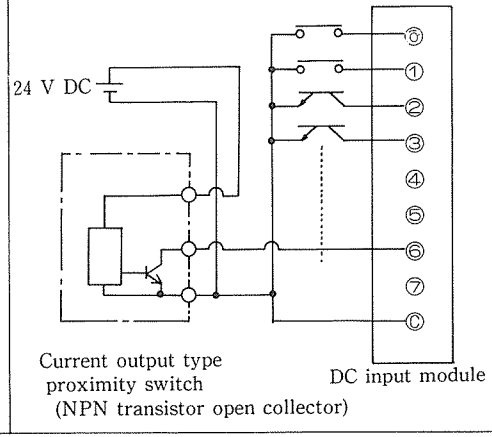
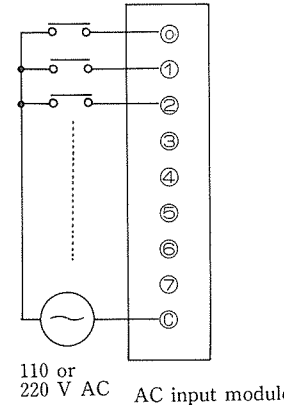
4. Insulation resistance and dielectric strength tests

A varistor (470 V class) is incorporated for suppressing a lightning surge. Before insulation resistance or dielectric strength test, be sure to disconnect the connector.

If either test is conducted without disconnecting the connector, the power module might be damaged.

5. Install a lightning arrester

To prevent damage to the equipment as a result of being struck by lightning, it is recommended that a lightning arrester be installed for each PLC's power supply circuit.

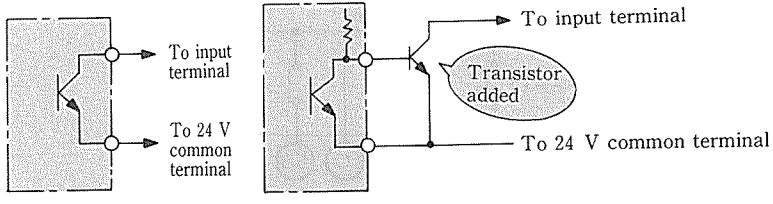
Item	DC input (PIM-D/DH, etc.)	AC input (PIM-A/AH, etc.)
External wiring		

[Explanation]

1. Wiring of DC input module (Example of negative logic input)

(1) The EM-II series incorporates the power supply (24 V DC) for external inputs. When each input terminal (X0, X1,·····) is short-circuited with the common terminal (C), input is turned on. As a rule, a current of about 10 mA flows from the PC to the external input contacts.

(2) Sensors such as proximity switch and photoelectric switch are directly connectable when they are of current output type (PNP transister open collector output).
Sensors of voltage output type must be connected to the input terminal via a transistor.



Current output type — ○ (directly connectable)

Voltage output type — × (requiring addition of transistor)

(3) Although the instrument is sensitive to an input current within 4 to 6 mA, 7 mA or more for reliable ON operation and 1 mA or less for reliable OFF operation.
Note: For connecting a 2-wire type proximity switch, LED display-equipped limit switch or the like, confirm its input impedance and single out a sensor within the above current specifications.

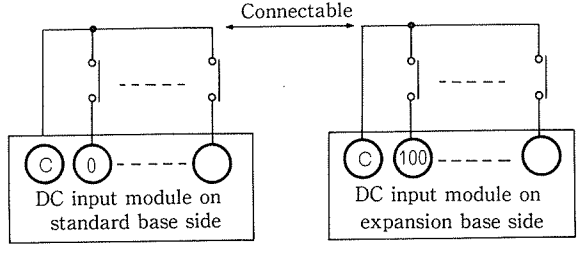
(4) As sensor power supply, 24 V DC of the power supply module PSM-A can be used. Its current value I is represented by:

[I = CH3 capacity of PSM-A (450 mA) − CH3 current consumed by I/O module]

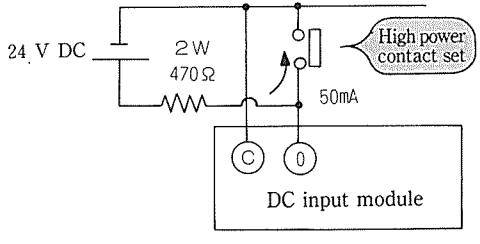
(5) For installing a switching regulator of 24 V DC for supplying power to the sensor, connect the negative pole of power supply with the common terminal of DC input module. (Refer to the above example of DC input wiring.)

(6) Connection of common terminal of DC input module

- ○ The common terminals of DC input module need not be connected within the same base. (Because they are connected via the mother board in the base.)
- ○ It is recommended to separate the common terminals of DC input between the standard base and expansion base. However, if this is impossible, connection of the common terminals between these bases does not pose any problem.



(7) Prevention of poor contact of high power contacts



When external contacts are closed, a current of about 9 mA flows through them. Therefore, use contacts which do not incur poor contact at that current level. If you must employ a high power contact set, an adequate current must be supplied to the contacts via a resistor as shown at left in order to prevent poor contact.

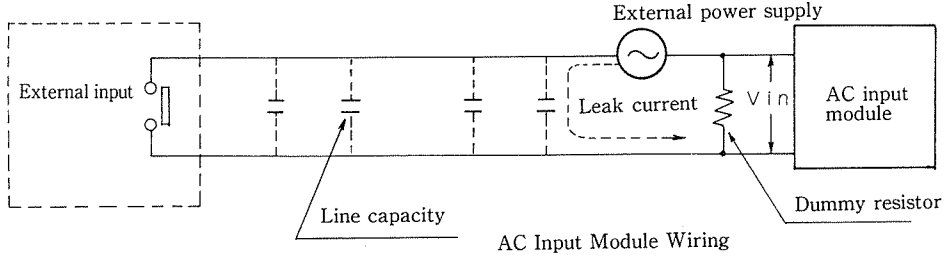
(8) Length of input wiring

Input wiring must be 30 m max. If wiring beyond 30 m is inevitable, the input wire and output wire must be separated completely.

Even in this case, wiring length must not exceed 100 m.

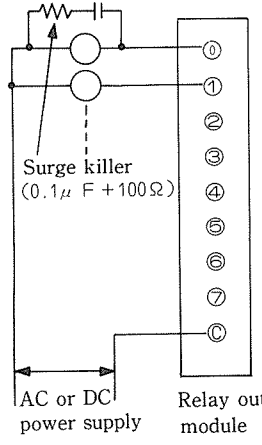
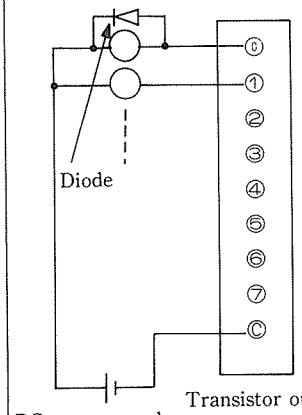
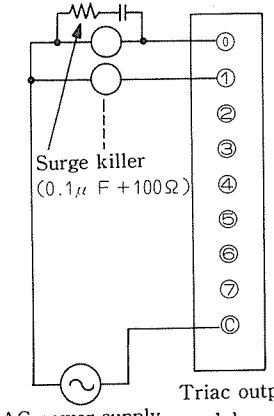
2. Wiring of AC input module

(1) With the AC input module, a voltage appears at the input terminal when wiring distance becomes long, though there is no signal actually.



AC Input Module Wiring

Even with the external input contacts open, if voltage applied to the input terminal because of leak current through line capacity exceeds the maximum OFF voltage of the input module, the module is under the same condition as when input signal is applied to it. Therefore, the module may operate. To prevent this, connect a dummy resistor in parallel of input module and thereby curb the terminal voltage due to electrostatic capacity to one half or less of the maximum OFF voltage of this module.

Item	Relay output (POM-R/RH, etc.)	Transistor output (POM-T/TH, etc.)	Triac output (POM-S/SH, etc.)
External wiring			

[Explanation]

1. Wiring of relay output module

(1) Service life of relay

○ Relay contacts are operable 200,000 times or more under a resistive load of 120 V AC, 2 A and 1,000,000 times or more under a load of electromagnetic contactor (Hitachi H10 with an inductive load of 170 VA upon energization and 6 VA after energization).

○ Relay life is in inverse proportions to the square of current (life quadrupled by reducing current to one half). So the life will be significantly shortened when breaking rush current or directly driving a capacitor load. For opening/closing the contacts at a high frequency, use of the transistor module or triac output module is recommended.

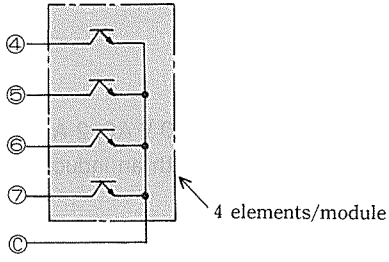
(2) Surge killer

In case of an inductive load whose coil capacity exceeds 10 VA, a surge killer (such as a 0.1 μF capacitor + 100Ω resistor combination) must be connected in parallel with the load. For DC load, connect a flywheel diode.

2. Wiring of transistor output module

(1) This module is used to control DC load. Although a protective circuit is incorporated against a surge which bauses inductive load, it is recommended to suppress the occurrence of surge by connecting a flywheel diode (current capacity 1 A and inverse dielectric strength 250 V as a standard) in parallel with inductive load.

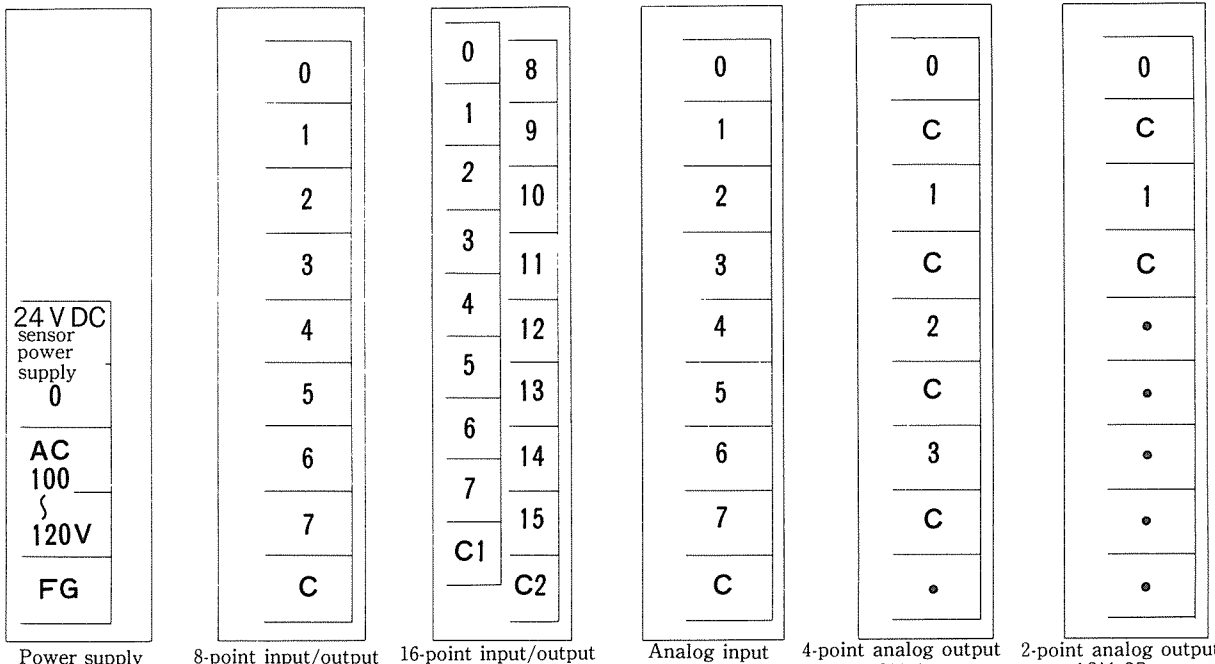
(2) The transistor is a composite part made up of 4 elements. Maximum current is restricted to 1.25 A for a total of 4 circuits which correspond to terminals 0 to 3, 4 to 7, 8 to 11 and 12 to 15. Allocate load so that maximum load current will not be exceeded.


④
⑤
⑥
⑦
©
4 elements/module

3. Wiring of triac output module

(1) This module is used to control AC load.

(2) Leak current flows (3 mA at 220 V AC and 1.5 mA at 110 V AC) because a snubber circuit is comprised in the module for protecting the triac.
If a slight current load or lamp load is connected, the triac may be turned on in error or unable to be turned off. In such case, connect a dummy load (aforementioned surge killer of 0.1 μF + 100Ω) in parallel with the above load to prevent influence by leak current.



Power supply
PSM-A

8-point input/output
PIM-A,D
POM-R,S,T

16-point input/output
PIM-AH,DH
POM-RH,SH,TH

Analog input
AGM-I

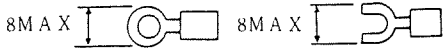
4-point analog output
AGM-O

2-point analog output
AGM-OD

*The DC power supply for sensor is shared by external input (9 mA/point). Its maximum current is rated at 450 mA.

[Explanation]

1. The above figure shows the terminal layout of EM-II series.
2. Each terminal is threaded in M3.5. When a solderless terminal is used, its outside diameter must be 8 mm max. Each terminal is allowed to hold a maximum of 2 solderless terminal tongues. Do not fasten 3 or more tongues at a time.



Function	Programmer mode			Operational status	
	PROG	TEST	RUN	Operation	Stop
Forced output	×	○	×	×	○

· Key-in procedure and display

Key-in procedure	Display			Remarks
	Instruction	Numerical display	Mode display	
CLR SET SET ENT		A - - -	● DATA ● TEST	Specification of forced output mode RUN contacts ON
FUN 3		o - - - -		
CLR OUT 2 0 0 SET		o - 200.		External output 200 ON
CLR OUT 2 0 1 SET		o - 201.		External output 201 ON
RES		o - 201		External output 201 OFF
CLR OUT 2 0 0 RES		o - 200		External output 200 OFF
CLR RES RES ENT				Release of forced output mode

[Explanation]

1. After wiring, external output (Y) can be turned on/off according to forced output unrelated to program. So output wiring can be checked easily.
2. The forced output function can be activated when the programmer is set in the test mode with the basic unit in the stop state.

Item	Key-in procedure	Operation
Forced output ON	CLR OUT Output No. SET	External output is turned on and remains in this status.
Forced output OFF	CLR OUT Output No. RES	Activated external output is turned off.

CAUTION

Operation must be carried out in adequate consideration of safety.

3. An error will occur if the forced output is activated for the external input number.

[**Caution on Mounting**]

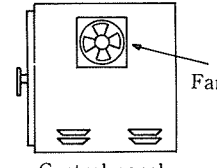
(1) Installation of EM-II series, avoid locations listed in Table 3-1.

Table 3-1 Installation-Prohibited Environment

No.	Environment
1	Location exposed to direct sunlight.
2	Location where ambient temperature exceeds a range of 0 to 55°C (Note 1).
3	Location where relative humidity exceeds a range of 30 to 90%. Location where temperature changes suddenly or condensation occurs (Note 2).
4	Location where atmospheric air contains much corrosive gas or inflammable gas.
5	Location where atmospheric air is laden with excessive dust, salinity or iron powder.
6	Location directly subjected to strong vibration or shock.

Notes: 1. If ambient temperature rises beyond 55 °C, it must be reduced to within 55 °C by using a cooling device such as a fan. If ambient temperature falls below 0 °C, avoid cutting off power supply or else provide a heater or the like in order to keep the temperature above 0 °C.

2. If there is a possibility of condensation, preventive measure such as provision of a heater is required.

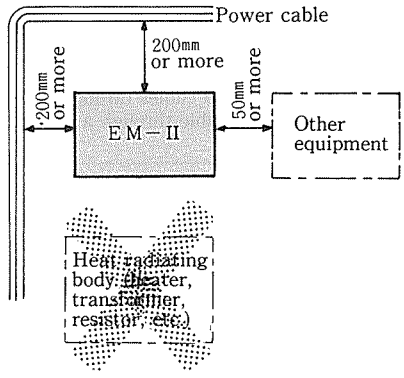


(2) Mounting

The EM-II series must be mounted in the cotrol panel while observing the precautions listed in Table 3-2.

Table 3-2 Precautions on Installation in Panel

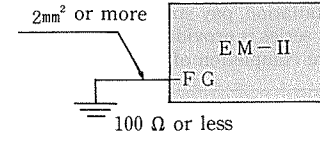
No.	Precautions
1	During installation, pay stric attention not to let fragments due to drilling or wiring fall into the programmable controller. The EM-11 series is provided with a dust-preventive sheet for protection against falling wire fragments. Do not remove the sheet before completion of installation and wiring.
2	Provide a space of 50 mm or more between the EM-II and other equipment or structure for facilitating ventilation.
3	Avoid installation right above equipment which radiates much heat (such as heater, transformer or large-capacity resistor).
4	Secure a distance of 200 mm or more from a high tension cable (3,000 V min.) or power cable.



(3) Wiring

The EM-II must be wired while observing the precautions listed in Table 3-3.

Table 3-3 Precautions on Wiring

No.	Precautions on wiring
1	Connect the grounding terminal (FG terminal) to a cable having a ground resistance of 100 Ω or less which is not used for high power grounding. Restrict the length of grounding cable within 20 m. 
2	Avoid passing the I/O cables through a duct which houses other power cable and bundling these cables together. Do not pass the expansion cable through a duct used for the I/O cables and bundle these cables together.
3	Restrict the length of I/O cabling within 30 m. If cabling byeond 30 m is unavoidable, separation of I/O cables or like measure is required. (Cabling beyond 100 m is unallowable in any case.)

(4) Emergency stop circuit

The EM-II series incorporates an adequate noise suppressing measure so that it withstands a noise level of 1,500 Vp-p or more (when measured by Hitachi method). If larger noise than above enters, misoperation might occur.

The following check functions are prepared for detecting anomaly upon misoperation.

1) Watch dog timer check
2) Undefined instruction check

On detection of anomaly:

1) All outputs turn off.
2) RUN lamp and RUN contacts turn off (a single output point programmed as RUN contacts). However, avoid complete dependence on these anomaly detection functions. **A safety ensuring cirucit such as for emergecy stop must be configured by utilizing an external relay or the like as shown in Fig. 3-4.**

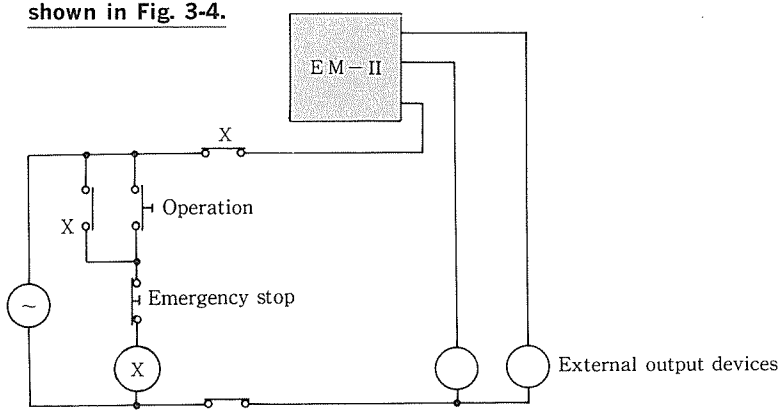


Fig. 3-4 Emergency Stop Circuit

[Internal Sequence upon Energization]

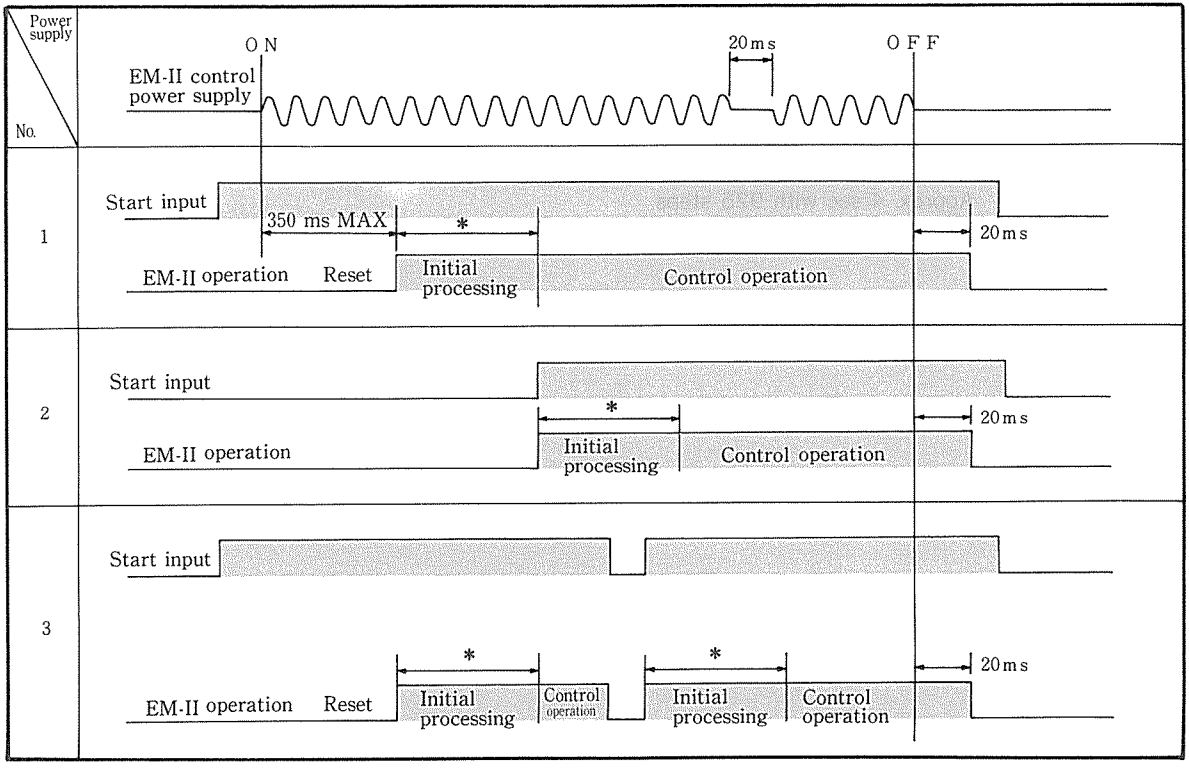
Table 3-5 shows the waveform of power supply to EM-II and its operational status in poperational status in response to start input.

(1) Energization with EM-II start input at ON (C and start input shorted)
Control operation starts as shown in No. 1.
During the control operation, external input is not fetched as a signal even when it turns on.

(2) Start input ON after EM-II energization
Control operation starts as shown in No. 2.

(3) Start input OFF during operation
When start input turns off, operation stops (EM-II is reset) as shown in No. 3.
Upon release of start input OFF, the EM-II performs control operation after initial processing.

Table 3-5 Internal Sequence upon Energization



(4) Operation at momentary power interruption

Control operation continues despite a momentary power interruption if shorter than 20 ms.

The EM-II detects power interruption through a voltage drop in the 5 V DC power supply. Therefore, **operation may continue for 100 ms or more despite power interruption if the 5 V DC charge is retained for a longer time because of a lighter load in a system which consists of the basic unit alone (does not have a programmer).**

(Note*) This time period varies with the length of program. As a standard:

Approx. 4 sec with 925 steps

Approx. 8 sec with 1950 steps

Display in normal status

Status \ Display			Lamp indication		
			POW	RUN	ERR
Normal status	Operation	Standard base	☼	☼	●
		Expansion base	☼	—	—
	Stop	Standard base	☼	●	●
		Expansion base	☼	—	—

☼ : Lit

● : Extinguished

Other Check Items

(1) Abnormal temperature rise due to heat source or direct sunlight

(2) Entrance of dust, chips or wiring scraps into panel

(3) Loosening of wire and terminal connections

[Explanation]

1. The EM-II series incorporates neither a battery nor a consumable whose life reaches its end in a short period of time. However, attention must be paid to the service life of the output relay in case it is activated frequently.
2. The aluminum electrolytic capacitor used in the power supply unit also has a limited lifetime.
   In this capacitor, a chemical reaction is taking place. And its lifetime changes widely at diffent ambient temperatures. Electrolytic capacitor is generally subordinate to the "Arrhenius's equation (double effect rule with change of 10°C)." This signifies that its lifetime is reduced by half with a temperature rise of 10°C and lengthened to a twofold value with a temperature fall of 10°C.
   For a longer service life, an adequate ventilation and appropriate ambient temperture should be ensured at installation.
3. Never use lacquer thinner or the like for cleaning because such a substance may cause the cover surface to be dissolved or discolored.

Table 4-1 Troubleshooting (1/3)

No.	Phenomenon	Check item	Check result	Remedy
1	POW lamp does not light when turning on power supply.	Check line voltage.	Abnormal	Correct to normal line voltage.
			Normal	Exchange the product.
2	Operation does not start though operation control input turns on.	Check programmer switch.	Set at PROG.	Set to TEST or RUN.
		Conduct syntax check by keying in (CLR SRC)	Error detected	Correct program.
			Error not detected	Exchange the product.
3	During operation, RUN lamp went off and operation stopped. (Or RUN lamp went off shortly after start of operation.)	Check if ERR lamp is lit.	Lit	Eliminate noise source and recheck program. Then restart operation. (If error recurs even after eliminating noise source, the product must be exchanged with a new one.)

Table 4-1 Irouble shooting (2/3)

No.	Phenomenon	Check item	Check result	Remedy
3	During operation, RUN lamp went off and operation stopped. (Or RUN lamp went off shortly after start of operation.)	Check if shorter program can be run.	Can be run.	Shorten scan time somehow because it is longer than 100 ms.
			Cannot be run.	Exchange the product.
4	Input lamp stays OFF.	Connect the relevant input terminal and 24 V terminal to check if the lamp lights up.	Lights up.	Correct external wiring or exchange external input device.
			Does not light up.	Utilize unassigned input terminal or exchange the product.
5	Input lamp won't go off.	Input the relevant input terminal and check if the lamp goes off.	Goes off.	Correct external wiring or exchange external input device.
			Does not go off.	Utilize unassigned input terminal or exchange the product.

Table 4-1 Troubleshooting (3/3)

No.	Phenomenon	Check item	Check result	Remedy
6	Output lamp will not come on or go off.	Monitor the relevant output with programmer and confirm that the lamp status matches the monitored contents.	Matches	Correct program.
			Does not match.	Utilize unassigned output terminal or exchange the product.
7	Output lamp does not meet load ON/OFF status.	Check for conductivity across relevant output terminal and C terminal (with the aid of tester).	Output lamp matches conductive status.	Correct external wiring or exchange external output device.
			Output lamp does not match conductive status.	Utilize unassigned output terminal or exchange the product. (If the contacts of internal relay are fused because of excessively large load current, an intermediate relay is required.)

[Explanation]

1. If a trouble occurs on the system under normal operation, we must judge first as to whether the trouble is attributable to the EM-II series or other section.
   Check and take a measure as per the table above.

Table 4-2 Syntax Error Codes (1/2)

Syntax error code (decimal)	Error display on PGMJ	Error display on PGMJ-R2	Description
0	Blank	Blank	No error
1	E	E	Combination of instruction words does not comply with the syntax rule.
2	E	E	The structure of main routine or interrupt processing routine is abnormal.
3	E	E	The argument of INT instruction having the relevant number is undefined.
4	E	E	The FUN06-FUN07 structure is abnormal.
5	E	E	The FUN08-FUN09 structure is abnormal.
6	⌊	u E	STR level is under that specified for instruction word.
7	⌈	o E	STR level is over that specified for instruction word.
8	⌊	u E	The level of master control is under that specified for instruction word.
9	⌈	o E	The level of master control is over that specified for instruction word.

Table 4-2 Syntay Error Codes (2/2)

Syntax error code (decimal)	Error display on PGMJ	Error display on PGMJ-R2	Description
10	E	E	IF or IFR is duplicated. An impermissible instruction (OUT T/C) is written after IF or IFR.
11	E	E	The I/0 number, constant or other element of instruction word is not within the specified range.
12	E	E	This double coil is impermissible.
13	E	d E	Occurrence of double coil though operation is allowed. (Alarm is issued.)
14	E	E	There are multiple SB instructions. CALL and SB do not correspond to each other.
15	E	E	Both JMP and INT instructions are used in the same step.
20	F	f E	Program cannot be interpreted because an undefined operation code or operand is used. Or the user memory area is not formatted correctly.
30	E	E	User program is judged to be abnormal according to the result of sum check.

[Explanation]

1. Syntax check of program is carried out just before operation or by keying in CLR SRC .
2. If error is detected in syntax check, syntax error code can be checked by keying in CLR 9 8 0 MON MON since the contents of error are coded in the special internal output WM980.

Table 4-3 System ERROR Codes

Syntax error code (decimal)	Description
10	Trap interruption has occurred.
11	Stack pointer abnorality is detected.
12	Contradiction to logic is detected.
13	Improbable interruption has occurred.
14	NMI interruption has occurred.
20	Data has not been written successfully in the user program memory.
21	Sum-check error is detected in system ROM.
30	Undefined PCS instruction word is fetched.
31	PCS stack pointer abnormality is detected.
32	Sum-check error has occurred in user program during operation.
40	Received signal has overflowed the buffer.

[Explanation]

1. If the ERR lamp comes on, system error code can be checked by keying in [CLR] [9] [7] [0] [MON] [MON] after turning on power supply again since the contents of system error are coded in the special internal output WM970.