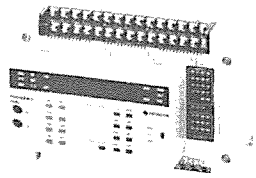
OPERATION MANUAL

E SERIES

HITACHI



NJI 110 (X)

WARNING TO PC SYSTEM MANUFACTURER

Control devices such as programmable controllers can fall into an unsafe condition. This means there is a possibility that certain types of device malfunctions could lead to sudden equipment run, unless proper local interlock is prepared by the equipment manufacturer.

Such a run could result in property damage and occasionally severe physical injury to the equipment driver.

Circuits for local interlock should be made without using the program in the programmable controller.

Eseries enhancement

Table 1-0 shows the difference between E2 and E series.
pay attention to the items of processing speed and program capacity.

Table 1-0 Basic specifications

Item \ Model			E2-xx (Enhance model)	E-xx (Standard model)
Control specification	Control system		Stored program cyclic system	←
	Processing speed		1.5μs/basic command	5μs/basic command (average)
	Program capacity		950 words/4020 words	950 words/1970 words
	Memory	Basic unit	EEPROM 950 words built- in	←
		Option memory pack	MPE- 1E, MPE- 2E, MPE- 2R	←
Processing functions	instructions	Basic instruction	12 kinds	←
		Apprication instruction	30 kinds (Include OUT T/C)	←
Input/output processing specifications	External input/output		Max. 128 points (Basic unit 64, Eypander 64)	←
	Internal output	Retestive at power failer	128 points (200 to 377)	←
		Non- retentive at power failer	248 points (400 to 767)	←
		Special internal output	8 points (770 to 777)	←
	Timer	No. of points	40 points (T00 to T47)	←
		Preset value	0.01sec to 999sec	←
	Counter	3 digits	16 points (C50 to C67)	←
		4 digits	8 points (C70 to C77)	←
		Preset value	1 to 999, 1 to 9999	←
	High speed counter	No. of points	1 point	←
		No. of digits	4.digits	←
		Max. frequenncy	Max. 10kHz	←

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1. CONFIGURATION AND SPECIFICATIONS

1.1 System Configuration

Fig. 1-1 shows system configuration.

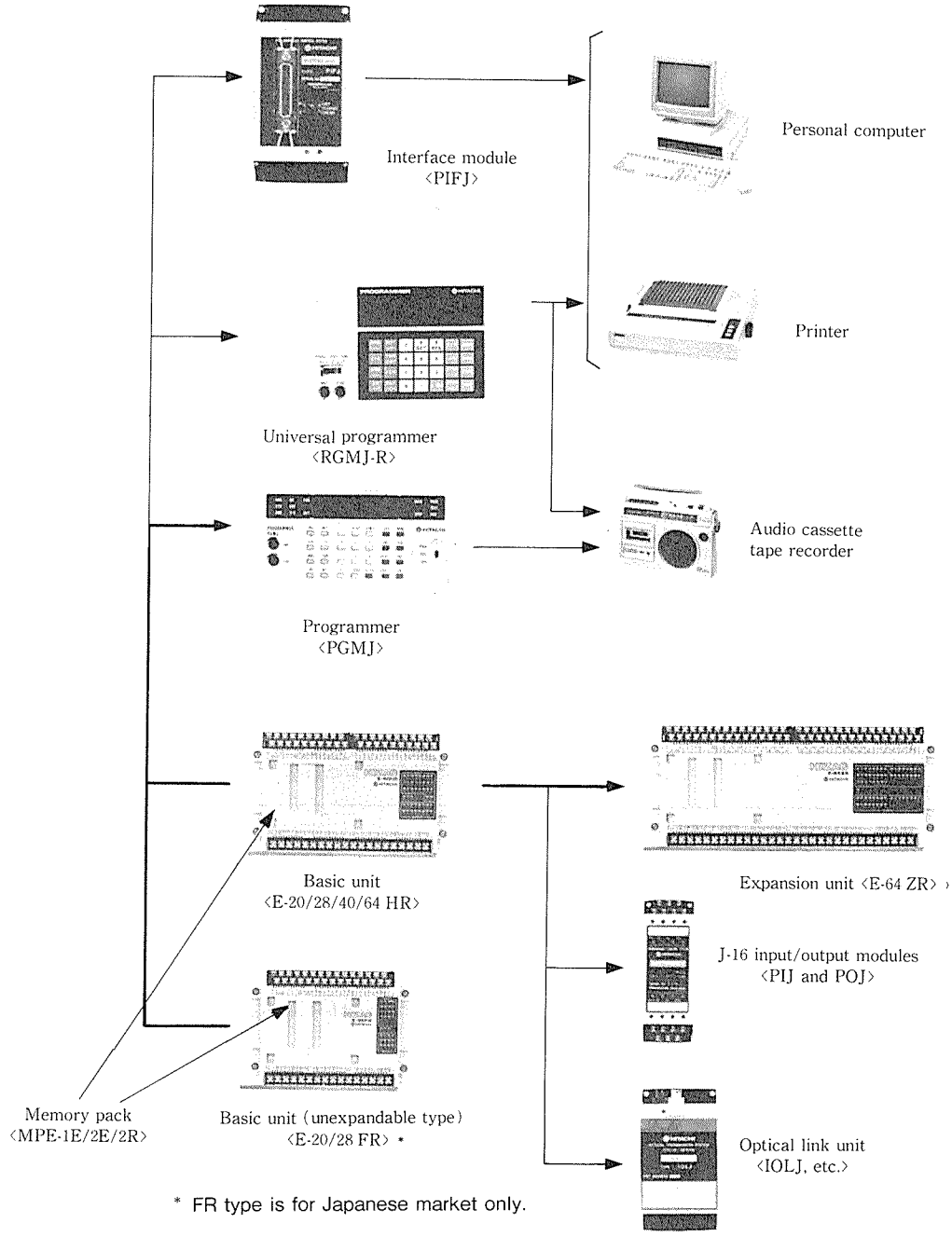


Fig. 1-1 System Configration

(1) Basic Modules

A maximum of 6 models are available as basic units. They are E-20HR having 20 input/output points, E-28HR having 28 points, and E-40HR having 40 input/output points, and E-64HR having 64 input/output points plus E-20FR having 20 input/output points and E-28FR having 28 input/output points. The former 4 models are of expansible type, and the latter 2 are not.

Table 1.1 shows differences between the expandable basic unit and unexpandable one.

Tadle. 1-1 Differences between Expandable Unit and Unexpandable Unit

Type / Item	Expandable unit <E−××HR>	Unexpandable unit <E−××FR> *
Expandable function	Provided	Not provided
Power for external input	Built in	Not built in (supplied form external device)
High speed counter	Built in	Not built in
RUN contact output	Provided	Not provided

* FR type is for Japanese market only.

(2) Expansion Equipments

The basic unit can be conbined with the E-64ZR expansion unit having 64 input/outpoints, which has been designed exclusively for the E series. In addition, the J-16 input/output unit having 8/16 points and optical transmission unit can also be connected as expansion equipments. Adding the E-64ZR to the E-64HR permits controlling up to 128 input/output points.

(3) Peripheral Equipments

Peripheral equipments include the standard programmer (PGMJ), universal programmer (PGMJ-R), and interface unit (PIFJ), each of which is common to that of the J-16. Table 1-2 shows the fuctions of each peripheral equipment.

Table 1-2 Functions of Peripheral Equipments

Function / Model	Programming	Audio cassette tape recorder interface	Printer interface	Personal computer interface	ROM writer
PGMJ	○	○	—	—	○ (note)
PGMJ−R	○	○	○	○	○
PIFJ	—	—	○	○	—

NOTE : Data cannot be written to EPROM memory pack unless the PGMJ-R is used.

(4) Memory Pack

A 950-word EEPROM is equipped on the basic module as a standard part. The memory pack installed as an external memory makes it easy to expand memory capacity, and change or store programs. It includes 3 models represented by 950-word EEPROM (MPE-1E), 1,970-word EEPROM (MPE-2E), and EPROM (MPE-2R). When any of these memory packs is installed, the control system operates as instructed by the contents of the memory pack. When the pack is removed, the system operation follows the instructions of the programs stored in the basic unit.

1.2 Unit Specifications

Table 1-3 shows unit specifications. A number of optional accessories are available. Select a proper one accorbing to the operation to be carried out.

Table 1.3 Unit Specifications

Item		Model Name	Specifications				Remarks
			Input		output		
Basic unit, power source voltage 100VAC—240VAC (24 V DC unit can also be manufactured on request.)		E—20H R	DC input	12points	Relay contact output	8 points	Expandable, power for external input built in
		E—28H R		16points		12points	
		E—40H R		24points		16points	
		E—64H R		40points		24points	
		E—20F R *		12points		8 points	Unexpandable, power for external input not built in
		E—28F R *		16points		12points	
Expansion unit		E—64Z R		40points		24points	
Expansion cable		C N E—06	Expansion unit connection cable			0.6m	Commonly used as programmer expansion cable
		C N E—10				1 m	
		C N E—15				1.5m	
Expansion module	Input module	P I J—D	DC input 8 points		—		J-16 input/output module connectable
		P I J—A	AC input 8 points		—		
		P I J—D H	DC input 16 points		—		
		P I J—A H	AC input 16 points		—		
	Output module	P O J—R	—		Relay contact output 8 points		
		P O J—S	—		Triac output 8 points		
		P O J—T	—		Transistor output 8 points		
		P O J—R H	—		Relay contact output 8 points		
		P O J—S H	—		Triac output 16 points		
		P O J—T H	—		Transistor output 16 points		
		P O J—R S	—		Independent contact output 8 points		
	Input/output module	P H J—D R	DC input 4 points		Relay contact output 4 points		
		P H J—D T	DC input 4 points		Transistor output 4 points		
Special function module	Timer module	T M J	On-delay timer 0 to 10 sec Number of timer points 8 points				J-16 special function module connectable
	Counter module	C N J	Preset counter 4 steps				
Optical trasmission unit	Input unit	P I T—D	DC input 8 points		—		Optical link connectable
	Output unit	P O T—R	—		Relay contact output 8 points		
	Remote input/output unit	R I O J	Input or output 8 points (selected by DIP switch)				
	I/O link unit	I O L J	Number of I/O link points 32 points				
	Interface unit	R I F J	Personal computer interface				
		R I F T—S 1	Personal computer ↔ RIFJ interface				
	Optical fiber cable	O C B I	Indoor type 250 m max.				
		O C B I E	Reinforced indoor type 1 km max.				
		O C B O	Outdoor type 1 km max.				
Memory pack		M P E—1 E	EEPROM 950 words				
		M P E—2 E	EEPROM 1,970 words				
		M P E—2 R	EPROM 1,970 words				

* FR type is for Japanese market only.

Table 1.3 Unit Specifications (2/2)

Item		Model Name	Specifications	Remarks
Peripheral equipment	Programmer	PGMJ	Audio cassette tape recorder interface	
	Universal programmer	PGMJ—R	Audio cassette tape recorder interface ROM writer function RS-232 C interface	Memory pack personal computer/printer connectable
	Interface module	PIFJ	RS-232 C interface	Personal computer printer connectable
	Software package for personal computer input	J—LDR (IBM5150)	Software for IBM personal computer 5150/5160	
	Personal computer	(Products available on market)	IBM personal computer 5150/5160 recommended	
	Printer	(Products availabe on market)	RX 80 (II), FX-80 and FX-85 made by EPSON recommended	Interface circuitboard No. 8145, 8148
	Tape recorder	(Products availabe on market)	—	

1-3 Names of Basic Unit Parts

Fig. 1-2 shows the name of each part provided on the basic unit (E-40HR) of E series. The names shown in the figure are common to those of the Model E-20HR, E-28HR, and E-64HR except for the number of input/output points.

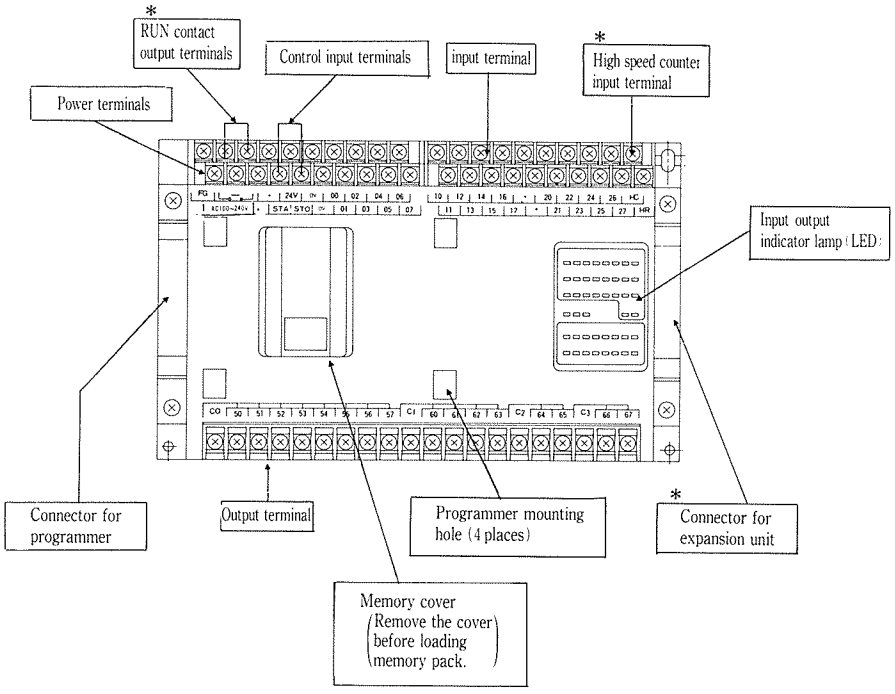


Fig. 1-2 Names of Basic Unit Parts

* The E-20FR or E-28FR basic unit (unexpandable type) does not have the following items.

(1) RUN contact output terminal
(2) High speed counter input terminal
(3) Connector for expansion unit

Further, a power of 24 V DC should be prepared externally for the basic unit since power for external input is not provided in the unit.

FR type is for Japanese market only.

1-4 Names of Expansion Unit Parts

Fig. 1-3 shows the name of each part provided on the expansion unit (E-64ZR) of E series.

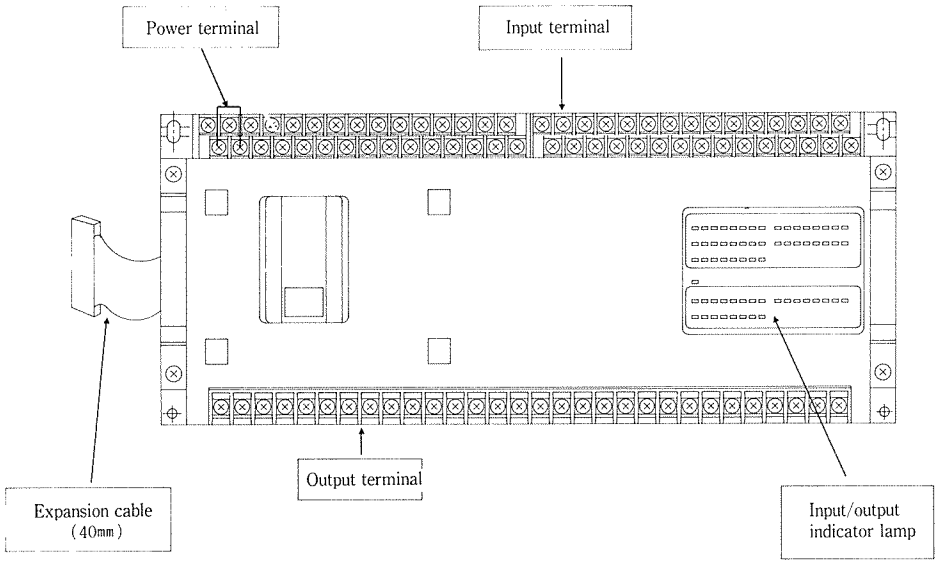


Fig. 1-3 Names of Expansion Unit Parts

1.5 Basic/General Specifications

(1) Basic Specifications

Table 1-4 lists basic specifications.

Table 1-4 Basic Specifications

Item \ Type / Model name			Expandable type				Unexpandable type	
			E—20H R P	E—28H R P	E—40H R P	E—64H R P	E—20F R P*	E—28F R P*
Control specification	Control system		Stored program cyclic system					
	Processing speed		5 μs/word in average (basic command)					
	Program capacity		950 words, 1970 words (NOTE 1)					
	Memory	Basic unit	EEPROM (950 words)					
		Memory pack	EEPROM (950 words, 1970 words),EPROM (1970 words)					
Arithmetic functions	Basic command		ORG, STR, AND, OR, AND STR, OR STR, NOT, OUT					
	Apprication command		FUN00(DI F), FUN02(I F), FUN03(IFR), FUN04(MCS) FUN05(MCR), FUN06(JMP), FUN07(JMP END) FUN30(WLOAD), FUN31(T/C LOAD), FUN32(WOUT) FUN33(T/C OUT), FUN34(WCMP), FUN35(T/C CMP) FUN36(HC LOAD), FUN40(UDC), FUN45(LATCH) FUN47(SFR), FUN99(END)					
Input/output processing specification	No. of external input points		12 points	16 points	24 points	40 points	12 points	16 points
	No. of external output points		8 points	12 points	16 points	24 points	8 points	12 points
	Internal output		384 points (Data for 128 points (200-377) not protected from power failure; Data for 248 points (400-767) protected from power failure; Data for 8 points (770-777) used as special function internal outputs)					
	Special internal output		770 : Output all OFF; 771 : Resetting of data protected from power failure 772 : One cycle oscillation; 773 : 0.1-sec clock 774 : 1-sec clock; 775 : 0.01-sec clock 776 : 1-min clock; 777 : 1 scan ON at operation start					
	Timer	No. of points	40 points (T00~T47)					
		Preset Value	0.01 sec ~ 9.99 sec, 0.1 sec ~ 99.9 sec, or 1 ~999 sec					
	Down counter	3 digits	16 points (C50~C67), protected from power failure (NOTE 2)					
		4 digits	8 points (C70~C77), protected from power failure (NOTE 2)					
		Preset value	1 ~999 times (3 digits), 1 ~9,999 times (4 digits)					
	Highspeed counter	No. of points	1 point				None	
		No. of digits	4 digits (1 ~9,999 times)					
		Counting speed	10 kHz max.					
	Type of external input		24 V DC (24 V DC power built in)				24 V DC (supplied from external unit)	
	Type of external output		Relay					
Peripheral	Peripheral equipment		Programmer : PGMJ (with audio cassette tape recorder interface) PGMJ-R (Audio cassette tape recorder interface; ROM writer function; RS-232C interface) Interface module : PIFJ (RS-232 C interface)					
Expandability	Expansion equipments		Expantion unit : E-64 ZR Small size expansion module : PIJ or POJ type Special module : TMJ, CNJ Optical transmission unit : IOLJ or others				None	

Table 1-4 Basic Specifications

Item \ Type / Model		Expandable type				Unexpandable type	
		E—20H R P	E—28H R P	E—40H R P	E—64H R P	E—20F R P *	E—28F R P *
Maintenance function	Self-diagnosis	Watchdog timer, sum check, undefined command check and self-check					
	RUN contact output	Contact output which is turned ON at normal operation				None	

NOTE 1 : program capacity can be increased by adding a memory pack of 1,970 words.

NOTE 2 : The data (protected from power failure) are backed up with a capacitor for 2 weeks (at 25 °C) after power is turned OFF.

(2) General Specifications

Table 1-5 shows general specifications.

Table 1-5 General Specifications

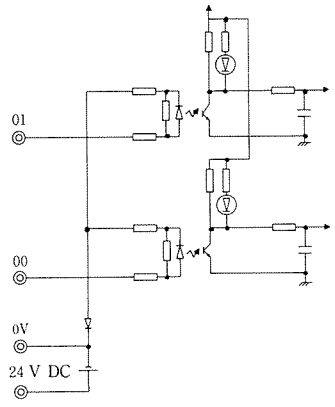
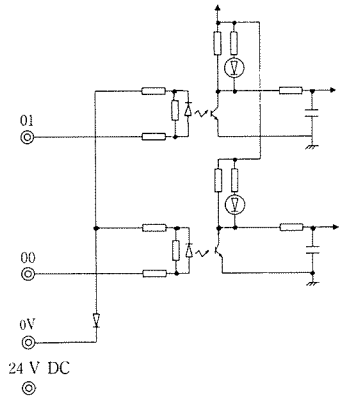
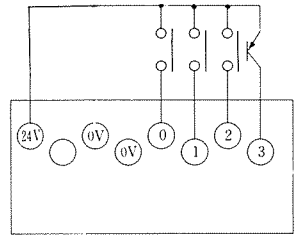
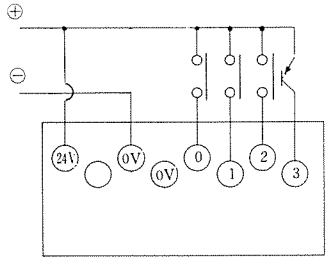
Item \ Type / Model		Expandable Type				Unexpandable type	
		E—20H R P	E—28H R P	E—40H R P	E—64H R P	E—20F R P *	E—28F R P *
Power source voltage		100 V AC—240 V AC (85 V AC~264 V AC), 50/60 Hz (common) (24 V DC unit can also be manufactured on request.)					
Max. power consumption (not including programmer)		22 V A	28 V A	31 V A	39 V A	19 V A	24 V A
Allowable instantaneous power failure time		20 m sec					
Noise resistance	AC power	Conforms to NEMA ICS 3 -304 Simulated noise 1500 Vp-p, 1 μs width (by Hitachi Method)					
	DC power	Simulated noise 500 Vp-p, 1 by width (by Hitachi Method)					
Insulation resistance		20 MΩ or more between external terminal and frame ground terminal					
Dielectric strength		1 min. at 1500 V AC between power terminal, output terminal, and frame ground terminal					
Vibration resistance		Conforms to JIS C0911 IIB, 3 rd class Vibration with frequency of 16.7 Hz and amplitude of 3 mm applied for two hours in X, Y, and Z directions.					
Shock resistance		Conforms to JIS C0912 10 G applied twice each in X, Y, and Z directions					
Ambient temperature		0 ~55℃					
Ambient humidity		30 to 90% RH (no condensing)					
Storage temperature		—10℃ ~65℃					
Environment		Corrosive gases, saline/iron powder air not allowed					
Mounting		Wall mounting type					
Dimensions (mm)	W	190		230	330	190	
	H	140		140	140	140	
	D	102		102	102	102	
Weight (kg)		1.2		1.4	1.8	1.2	

* FR type is for Japanese market only.

(3) Input Specifications

Table 1-6 shows input specifications.

Table 1-6 Input Specifications

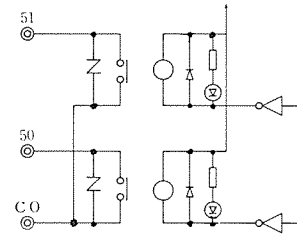
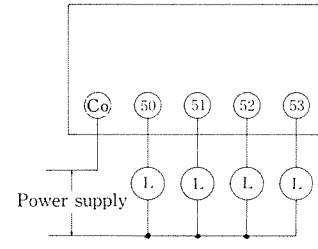
Item \ Type / Model		Expandable Type				Unexpandable type	
		E-20HRP	E-28HRP	E-40HRP	E-64HRP	E-20FRP*	E-28FRP*
Input specification		DC input Negative Logic for HR type, Positive Logic for HRP type					
Nominal voltage		24 V DC					
Input voltage		21.6~26.4 V DC					
Input current		Approx. 10 mA (24 V DC) at an impedance of about 2.4 kΩ					
Input signal	ON	External input contact closed; operation indicator lamp on					
	OFF	External input contact closed; operation indicator lamp off					
Operating voltage	ON	ON voltage: 19 V or more (ON resistance: 300Ω or less)					
	OFF	OFF voltage: 7 V or less (OFF resistance; 200 kΩ or more)					
Max. input delay time	ON→OFF	4 m sec					
	OFF→ON	4 m sec					
Polarity		HRP ··· Common terminal (+), HR ··· Common terminal (−)					
Isolation method		Photocoupler					
Circuit diagram (HRP type)							
External wiring (HRP type)		 · Power for external input built in · Power can be supplied to external device (proximity switch, etc.) via 24 V terminal. The current value to be supplied (I) is 400 mA−(10 mA) x number of input points which will be tuned on simultaneously				 · 24 V DC power should be connected to 24 V DC and 0V terminals.	
		· 0V terminals are wired internally. · PNP type transistor can be connected.					

* FR type is for Japanese market only.

(4) Output Specifications

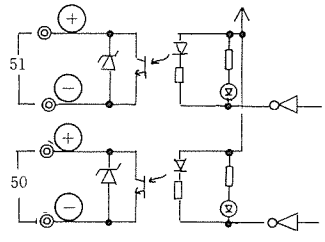
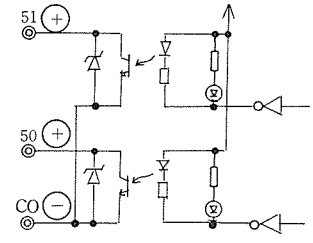
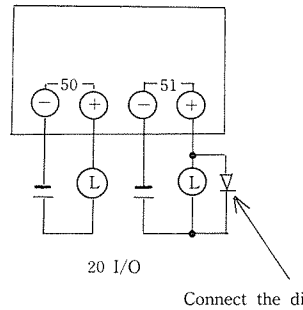
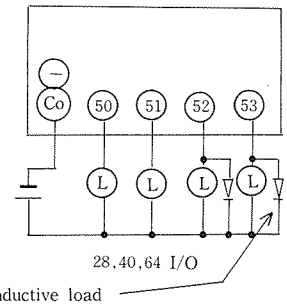
Table 1-7 shows output specifications.

Table 1-7 Output Specifications

Item \ Type		Expandable Type				Unexpandable Type	
Item \ Model		E—20HRP	E—28HRP	E—40HRP	E—64HRP	E—20FRP*	E—28FRP*
Output method		Relay contact output					
Nominal voltage		220 V AC, 24 V DC					
Output voltage		85~250 V AC, 21~27 V DC					
Output signal	ON	Output ON, operation indicator lamp on					
	OFF	Output OFF, operation indicator lamp off					
Max. load current	1 circuits	2 A (COSφ = 1), 1 A (COSφ =0.4)					
	4 circuits	—	4 A	4 A	4 A	—	4 A
	8 circuits	—	—	4 A	4 A	—	—
Min. load current		10mA (5 V DC)					
Max. leakage current		—					
Max. inrush current		6 A 0.1 sec or less					
Max. delay time	OFF→ON	10m sec					
	ON→OFF	10m sec					
Number of output prints	1a independent	8 sets	—	—	—	8 sets	—
	2 points/common	—	2 sets	2 sets	2 sets	—	2 sets
	4 points/common	—	2 sets	1 set	3 sets	—	2 sets
	8 points/common	—	—	1 set	1 set	—	—
Polarity		Optional					
Isolation method		Relay					
Lifetime	Electrical	More than 200 k times at 120 V AC and 2 A resistance load (more than 1,000k times for Hitachi H10 magnetic contactor. (17 VA at power ON, 6 VA after power ON)					
	Mechanical	More than 20,000k times					
Circuit diagram							
External wiring							

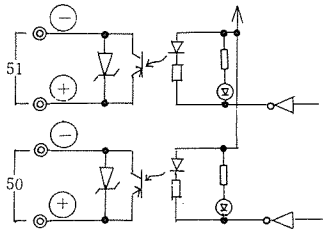
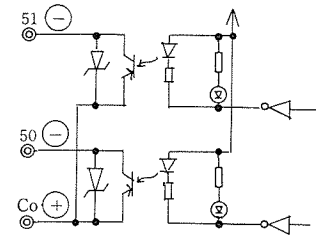
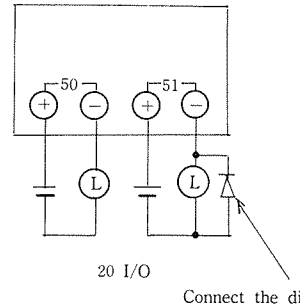
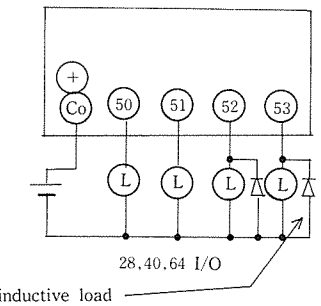
* FR type is for Japanese market only.

Table 1-8 TRANSISTOR OUTPUT SPECIFICATIONS (sink type)

Item \ Type / Model		Expandable Type					
		E−20HT	E−28HT	E−40HT	E−64HT		
Output method		Transistor Output					
Nominal voltage		24 V DC					
Output voltage		3~26 V DC					
Output signal	ON	Output ON, operation indicator lamp on					
	OFF	Output OFF, operation indicator lamp off					
Max. load current	1 circuit	0.5 A					
	2 circuits	—	1 A	1 A	1 A		
	4 circuits	—	2 A	2 A	2 A		
	8 circuits	—	—	4 A	4 A		
Min. load current		10 mA					
Max. leakage current		100 μA at 24 V DC					
Max, inrush current		3 A 10 m sec or less					
Max. delay time	OFF→ON	1 m sec					
	ON→OFF	1 m sec					
Number of output prints	1a Independent	8 sets	—	—	—		
	2 points/common	—	2 sets	2 sets	2 sets		
	4 points/common	—	2 sets	1 sets	3 sets		
	8 points/common	—	—	1 sets	1 sets		
Polarity		Common ⊖					
Isolation method		Photocoupler					
Circuit diagram		 20 I/O			 28,40,64 I/O		
External wiring		 20 I/O			 28,40,64 I/O		

Connect the diode to the inductive load

Table 1-9 TRANSISTAR OUTPUT SPECIFICATIONS
(source type)

Item \ Type / Model		Expandable Type					
		E−20HTP	E−28HTP	E−40HTP	E−64HTP		
Output method		Transistor Output					
Nominal voltage		24 V DC					
Output voltage		3~26 V DC					
Output signal	ON	Output ON, operation indicator lamp on					
	OFF	Output OFF, operation indicator lamp off					
Max. load current	1 circuit	0.5 A					
	2 circuits	—	1 A	1 A	1 A		
	4 circuits	—	2 A	2 A	2 A		
	8 circuits	—	—	4 A	4 A		
Min. load current		10 mA					
Max. leakage current		100 μA at 24 V DC					
Max, inrush current		3 A 10 m sec or less					
Max. delay time	OFF→ON	1 m sec					
	ON→OFF	1 m sec					
Number of output prints	1a Independent	8 sets	—	—	—		
	2 points/common	—	2 sets	2 sets	2 sets		
	4 points/common	—	2 sets	1 sets	3 sets		
	8 points/common	—	—	1 sets	1 sets		
Polarity		Common ⊕					
Isolation method		Photocoupler					
Circuit diagram		 20 I/O			 28,40,64 I/O		
External wiring		 20 I/O			 28,40,64 I/O		

Connect the diode to the inductive load

(5) Expansion Unit Specifications

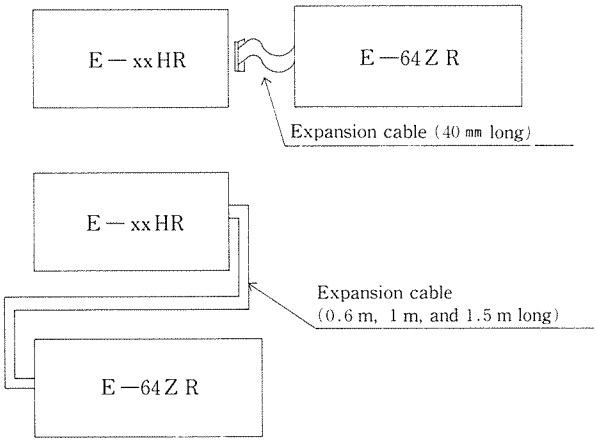
Table 1-10 shows the specifications of expansion unit (E-64Z).

Table 1-10 Expansion Unit Specifications

Item \ Model	E—64Z R
Number of external input points	40 points
Number of external output points	24 points
External input	24 V DC (built in)
External output	Relay

① Other general and input/output specifications than the above are the same as those of the basic unit.

② The expansion unit is provided with a 40-mm long expansion cable. The cable serves to connect them directly.



Expansion cables of 0.6 m, 1 m, and 1.5 m long are also provided as optional parts. If the expansion unit cannot be placed on the basic unit, a desired one of the optional cables should be ordered.

③ For details of the J-16 expansion module and optical transmission unit, refer to the instruction manuals separately prepared.

- ○ Operation manual for J-16.
- ○ Instruction manual for optical transmission unit

1-6 Comparison between E series and J-16

The peripheral equipments designed for J-16 can be used for E series. The programs used for the J-16 are also interchangeable with those for the E series. Note, however, that the specifications of the E series partially differ from those of the J-16. Table 1-9 shows main differences between the E series and J-16.

Table 1-11 Differences between E Series and J-16 Series

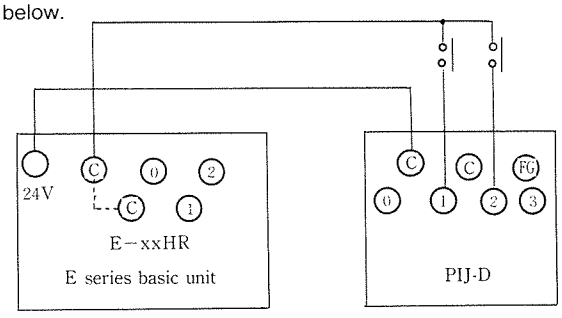
Item \ Model		E series	J −16
Processing speed		5 μs/word (average)	20 μs/word (average)
Memory	Memory extension	Expandable to 2 kw with memory pack.	Not expandable basic module exculsive for 1kw or 2kw
	Write-in to EEPROM	Edited data need not be transferred to EEPROM since they can be written in or deleted directly.	Edited data required to be transferred to EEPROM.
	Memory mounting/ dismounting	Detachable as a unit of memory pack	Detachable as a unit of EEPROM chip (for those manufactured in Oct. 1985 onward)
Response command		Transfer/compare command available in a unit of word	Only those manufactured in Jan. 1986 onward provided with transfer/compare command
Min. timer preset value		10ms	100ms
Counter preset value		· 3-digit counter for 16 points of C50 to C67 · 4-digit counter for 8 points of C70 to C77	3-digit counter for 24 points of C50 to C77
High speed counter		1 point built in (for expandable type) · Up counter − − − 4 digits · Possible to take in high speed pulse up to 10 kHz · Presettable in maximum of 24 steps	Depending on counter module (CNJ) · Up/down counter − − − 4 digits · Possible to take in high speed pulse up to 10 kHz · Presettable in 4 steps
Assignment of input/output		Fixed assignment	Free location assignment
Kind of external input		DC input (AC input of J-16 usable for transistor/ Triac output)	DC, AC
Kind of external output		Relay contact output (J-16 module usable for Transistor/Triac output.)	Relay contact /transistor/ Triac output
Input signal indication		· Indicator lamp comes on when external input contacts are closed regardless of programmer mode. (NOTE 1)	· Indicator lamp comes on after external input status is taken into CPU. · Indicator lamp comes on regardless of external input when programmer is in program mode or test mode (during operation).
Polarity of input common terminal		Common terminal (+) (NOTE 2)	Common terminal (−)
Internal output	No.770	Output all off, scan stops	Output all OFF, scan continues
	No.775	10 ms clock	10 sec clock

Table 1-11 Differences between E Series and J-16

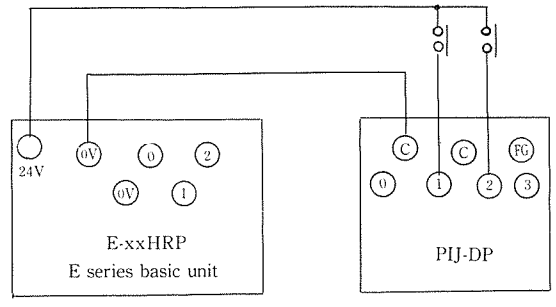
Item \ Model	E series	J —16
Change of present value on timer/ counter during operation	Possible when programmer is in TEST mode (Data transfer to EEPROM not required)	Possible when programmer is in both TEST and RUN modes (Data transfer to EEPROM required after operation stoppage)
Simulated input function	None	Possible in TEST mode
RUN contact output	Normally open contact (Contact not provided on unexpandable type)	Normally open and close contact
Output relay specifications	Closed type	Open type

NOTE 1 : When J-16 input module is added, its indicator lamp will not come on in program mode.

NOTE 2 : When DC input module of J-16 is expanded to E series, the external input wiring should be done as shown below.



a) Negative logic wiring



b) Positive logic wiring

2. INPUT/OUTPUT ASSIGNMENT

2-1 Assignment of Input / output Numbers

Table 2-1 shows assignment of input/output numbers.

Table 2-1 Assignment of Input/Output Numbers

Classification		Number	Remarks
External input/output	External input	00 ~ 07	E-20
		10 ~ 13	
		14 ~ 17	E-28
		20 ~ 27	E-40
		30 ~ 37	E-64
		40 ~ 47	
	External output	50 ~ 57	E-20
		60 ~ 63	E-28
		64 ~ 67	E-40
		70 ~ 77	E-64
	External input	100~107	E-64Z (NOTE 1)
		110~117	
		120~127	
		130~137	
		140~147	
	External output	150~157	
		160~167	
		170~177	
Internal output	Areas whose memories are not protected from power failure (128points)	200~207	Usable area for WLOAD, WOUT WCMP, DIF, SFR, UDC LATCH (NOTE 2)
		210~217	
		220~227	
		230~237	
		240~247	
		250~257	
		260~267	
		270~277	
		300~307	
		310~317	
		320~327	
		330~337	
		340~347	
		350~357	
		360~367	
		370~377	
	Areas whose memories are protected from power failure (248 points)	400~407	
		410~417	
		420~427	
		430~437	

Classification		Number	Remarks
Internal output	Areas whose memories are protected from power failure (248 points)	440 ~ 447	Usable area for WLOAD, WOUT WCMP DIF, SFR LATCH (NOTE 2)
		450 ~ 457	
		460 ~ 467	
		470 ~ 477	
		500 ~ 507	
		510 ~ 517	
		520 ~ 527	
		530 ~ 537	
		540 ~ 547	
		550 ~ 557	
		560 ~ 567	
		570 ~ 577	
		600 ~ 607	
		610 ~ 617	
		620 ~ 627	
		630 ~ 637	
		640 ~ 647	
		650 ~ 657	
		660 ~ 667	
		670 ~ 677	
		700 ~ 707	
		710 ~ 717	
		720 ~ 727	
		730 ~ 737	
		740 ~ 747	
		750 ~ 757	
		760 ~ 767	
	Special function	770 ~ 777	
Timer (40 points)		T00~T07	
		T10~T17	
		T20~T27	
		T30~T37	
		T40~T47	
Down counter (24 points)		C50~C57	Preset value ---3 digits
		C60~C67	
		C70~C77	Preset value ---4 digits

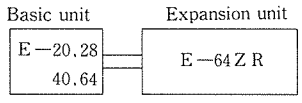
NOTE 1 : The input/output modules of J-16 can also be used for expansion of E series.
They should be assigned to adress 100 onward regardless of the the input and output.

NOTE 2 : External inputs can be used as a WLOAD or WCMP area, while both external outputs and internal outputs can also be used as WLOAD, WCMP, WOUT, SFR UDC and LATCH areas.

2-2 Assignment of Input/Output Numbers during Expansion

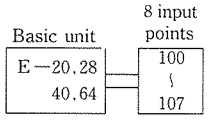
E series can be expanded by connecting the expansion unit desiged for E series and adding the input/output module of J-16 to the basic unit. In either case, the input/output numbers of the expansion unit should be set to 100 onward regardless of the type of the basic unit.

(Example 1)

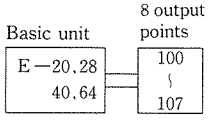


External input	External output
100~107	150~157
110~117	160~167
120~127	170~177
130~137	
140~147	

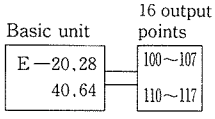
(Example 2)



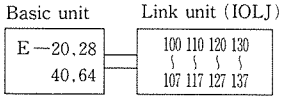
(Example 3)



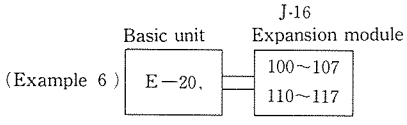
(example 4)



(Example 5)



(Example 6)



3. PROGRAMMING

3.1 Replacement of Relay Sequence for PC

Fig. 3-1 shows a programmable controller (PC) sequence replaced from a relay sequence. The PC should be wired for external input and output, and PC sequence be input via programmer.

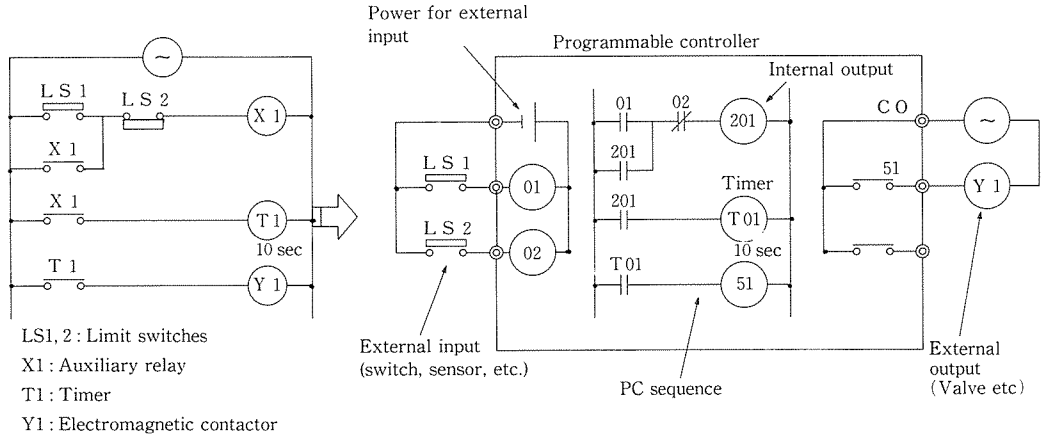


Fig. 3-1 Replacement of Relay sequence for PC

(1) External Input

Limit switch, pushbutton, proximity switch, and input sensor such as photoelectric switch will serve as external inputs of PC. They are connected to the input terminals of PC. A PC sequencs will be formed by using the terminal numbers to which the external inputs are connected. In the above example, the limit switch LSI is called input 01, while the LS2 is input 02.

(2) External Output

Electromagnetic contactor, solenoid valve, and indicator lamp will work as external outputs. They are connected to the output terminals of PC. A PC sequence will be formed by using the terminal numbers to which the external outputs are connected. In the above example the electromagnetic contactor Y1 is assigned as output 51.

(3) Internal Output

The function of internal output is equivalent to that of the auxiliary relay incorporated in relay sequence. In the above example, a sequence will be formed on the assumption that the auxiliary relay X1 is internal output 201.

- Internal output includes two types ; one is not protected from power failure (200~377), and the other one is protected from power failure (400~767). When a self-holding circuit is formed with these outputs, the respective outputs will operate differently as shown in Fig. 3-2. That is , the internal output not protected from power failure will be initialized to OFF status regardless of the ON/OFF status before powef OFF. On the other hand, the internal output protected from power failure will memorise the ON/OFF status before power OFF. The latter can be used as a keep relay by forming a self-holding circuit.

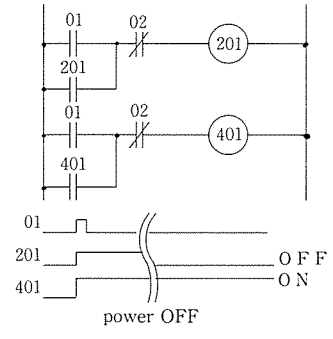


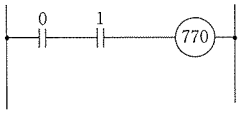
Fig. 3-2 Operation of Internal Output

④ **Special Fuction Internal Output**

Internal outputs ranging from no. 770 to 777 have special functions.

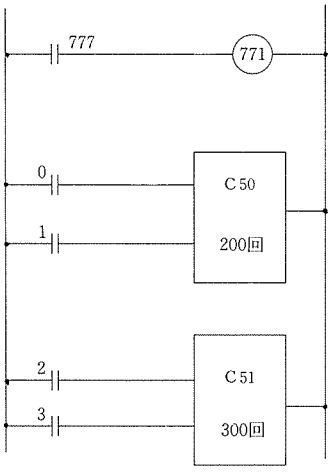
No. 770 : Output all OFF

When no. 770 internal output is turned on with a program, all outputs are automatically turned OFF.



- Generate a sequence capable of detecting an abnormaility (in the figure shown on the left side, the inputs 0 and 1 will not be turned ON at the same time during normal opration). Also prepare a program to be output to to the 770. These allow all outputs to be turned OFF when an abnormality is detected, and arithmetic operation also stops at the same time. "770 E" will appear on the display when an abnomality is detected.
- Correct the abnormality, and then turn ON the power switch.

No. 771 : Resetting of data protected from power failure

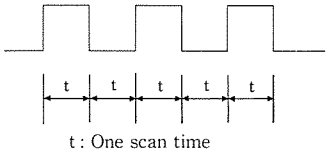


Use this output in conbination with the internal output 777 (one scan ON after start of operation). All internal outputs protected from power failure, counters, shift registers can be reset at operation start.

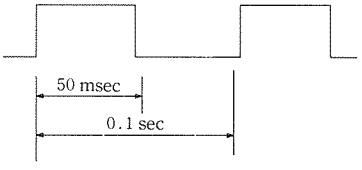
- In this figure, the data stored in the counters C50 and C51 are all reset immediately after operation start.
- The data are reset immediately after operation start. Note that the data protected from power failure will not be reset even if programming is made to allow the 771 to be turned ON during operation.

No. 772 : One cycle oscillation

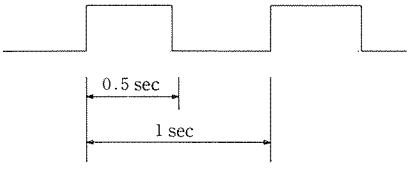
This output is turned ON/OFF every time one scan is completed.



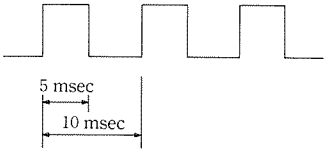
No. 773 : 0.1-sec clock



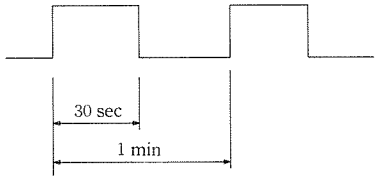
No. 774 : 1-sec clock



No. 775 : 10-msec clock



No. 776 : 1-min clock

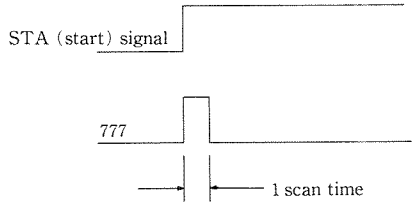


No. 777 : One scan ON after operation start

The signal sent out from this output is also applicable to reset the counters, shift registers, and internal outputs protected from power failure.

Use the output 771 for resetting all the data protected from power failure at operation start.

Be sure to use the output 777 for resetting the data independently.



⑤ **Timer**

ON-delay timer is incorporated in this series. When the current value of the timer reaches 0, the timer contacts are turned ON. For the functions of off-delay timer or single-shot timer, refer the application examples of on-delay timer.

⑥ **Counter**

Counters incorporated in this series are available in down-counters (C50 to C77), up/down-counter (FUN40), and highspeed counter.

The down-counter becomes ON when its current value reaches 0.

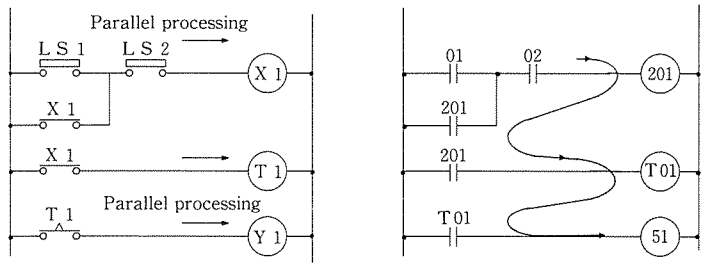
The up/down-counter makes programming by using the internal output, and sends out data in 4-digit BCD.

The highspeed counter is a kind of up-counter, and is capable of counting pulses of 10 kHz. FUN36 permits counting the current value of the highspeed counter, and taking in the counted value into the arithmetic register (AR).

3-2 Input/Output Processing

A relay circuit will permit parallel processing of all sequences at the same time, while PC will process a written program in series from the first step to the final step. Upon completion of processing the final step, control returns to the first step.This procedure is repeated periodically (cyclic processing). The time required to complete one cycle of processing is called scan time.

Fig. 3-4 shows processing procedure within one scan time of E series.



(a) Parallel processing in Relay Circuit

(b) Series Processing in PC

Fig. 3-3 Input/Output Processing in Relay Circuit and PC

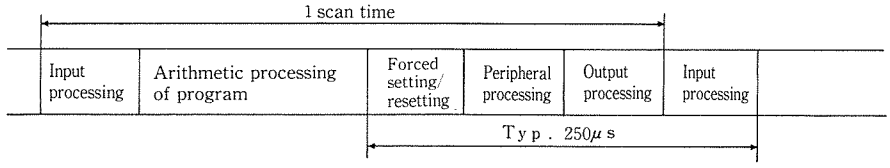


Fig. 3-4 Processing Procedure within Scan Time

① **Input Processing**

The ON-OFF status of external input is taken into the data RAM of E series.

The input status of the data RAM remains unchanged even when the ON/OFF status of external input changes during the arithmetic operation of program ; the status change will be taken in when input processing is made for the next scan.

Input signal will not be taken in unless the pulse width exceeds one scan time.

② **Arithmetic Processing of Program**
A written program is arithmetically processed starting from the first step according to the commands of the program. The arithmetic processing causes the contents of external output and internal output to be changed from time to time on the data RAM.

③ **Forced Setting/Resetting**
During operation, forced setting will be made after completion of arithmetic operation. Once this function is activated, the power failure-protected internal outputs, timers, and counters on the data RAM can be set or reset.

④ **Peripheral Processing**
In case the ON/OFF status of input/output or the current value of timer/counter is monitored via the programmer, the contents of the data RAM are displayed at peripheral processing.

⑤ **Output Processing**
This function serves to output the ON/OFF status of external output on the data RAM, drive the output relay, and send out data to external output terminal.

3-3 PC Sequence

① PC sequence makes a program by combining a command word and external input/output number, internal output number, timer or counter number.
Some commands (FUN04, 05, etc.), however, need not be combined with the numbers.
Each step should be formed with a command word plus input/output number. In E series, a command is composed of one word, and thus a program covering 950 steps (950 commands) can be created for the 950-word basic unit.

② There is no restriction in the number of usable contacts such as input/output, internal output, counter, etc. (Example 1)

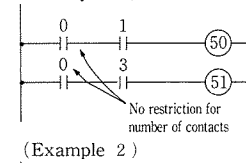
③ In serial and parallel circuits, no restriction is provided for the number of contacts to be connected in series and parallel. (Example 2)
When sequence is printed out onto a printer, however, the number of printable contacts is limited to a maximum of 8 points when being when connected in parallel. Be sure to form a circuit having a maximum of 8 serial contacts or a maximum of 24 parallel contacts.

④ An output coil (including timer output) cannot be connected to the bus line at the leftmost end of a circuit. Be sure to connect the output coil, if required, through the contact b (normally conductive)
example 3.

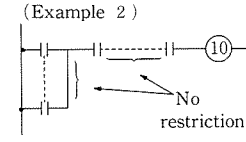
⑤ In relay sequence, a thermal relay contact should be added to the right of output coil. In PC sequence, however, the contact should not be added to the right of output coil ; it should be placed on the left side. (Example 4)

⑥ Output coils (including timers, etc.) should not be used twice or more ; they must be placed at one position. Otherwise, "Dual coil" error occurs at syntax check. (Example 5)
This is not applicable when output coils are placed between FUN02, FUN03, and FUN07.
Even when "Dual Coil" error is on, operation continues, and the system is put in an output status written in the latter step.

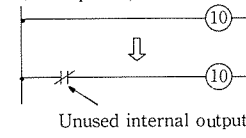
(Example 1)



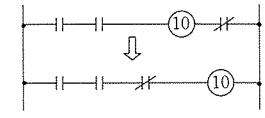
(Example 2)



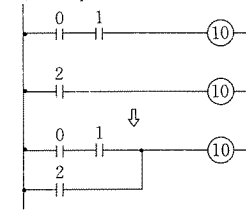
(Example 3)



(Example 4)



(Example 5)



3-4 PC Programming

① Programs should be written starting from the left to the right of a circuit.

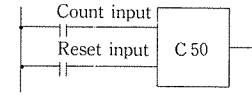
② When an output has two or more inputs formed by counters or shift registers, programs should be input in the specified order. To avoid confusion, be sure to write programs in the specified order. (Example 6)

③ Data for timer or counter should be prepared during coil programming. (Example 7)

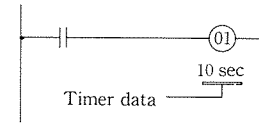
④ An external input/output number or step number is represented by 3 digits as a rule. In actual programming, it may be written with the significant digits only.
(Example : Input no. 007→7, step no. 050→50)
Only the significant digits are read out.

⑤ When timer data is 99 sec or less, it can be written in either 099 or 99.0, but it will be read out together with a decimal point as shown below.
(Example : 010→10.0
015→15.0
020→20.0)

(Example 6)



(Example 7)



3-5 How to Proceed with Programming

Divide a sepuence into blocks, and perform programming for each block starting from the leftmost one to the rightmost one (in up/down direction) until a program is finally formed.

○ **Sequence Circuit**

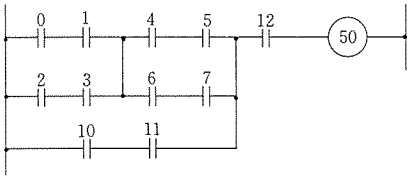


Fig. 3-5 Sequence Circuit

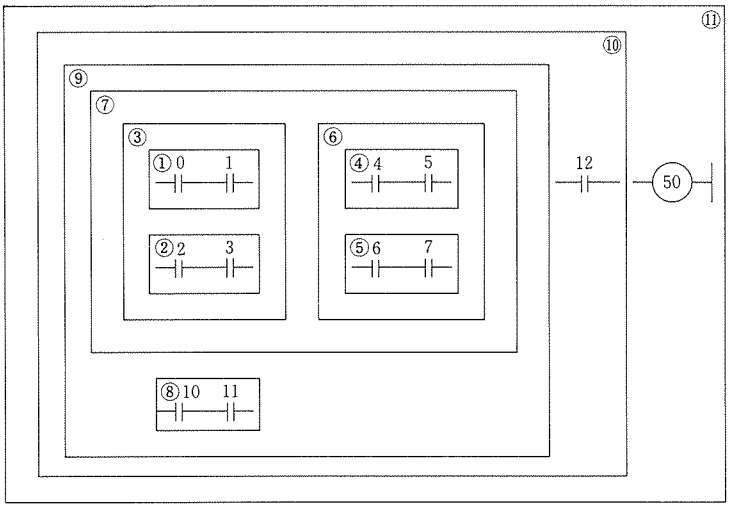


Fig. 3-6 Sequence Block

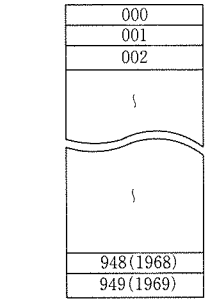
○ **Programming**

Command	Input/output No.	Sequence Block
ORG	0	
AND	1	
STR	2	
AND	3	
OR STR		
STR	4	
AND	5	
STR	6	
AND	7	
OR STR		
AND STR		
STR	10	
AND	11	
OR STR		
AND	12	
OUT	50	

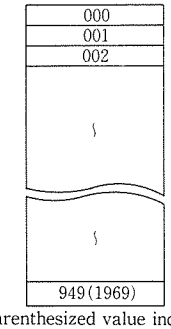
Table 3-1 Programming Sepuence

3-6 Program Write-in

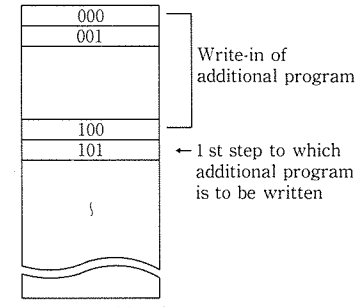
① The program memory has a capacity of 950 steps (1,970 steps in the case of MPE-2E 2k memory pack). The program steps are assigned with decimal numbers ranging from 000.
② Write programs into the memory starting from step 000.
③ When a program is added to the memory, write it starting from the step subsequent to the final step of the programs already written in.
④ An empty step is not assignable between the respective programs.
⑤ When a program is inserted or deleted from the memory, the subsequent programs are automatically stepped down or up.



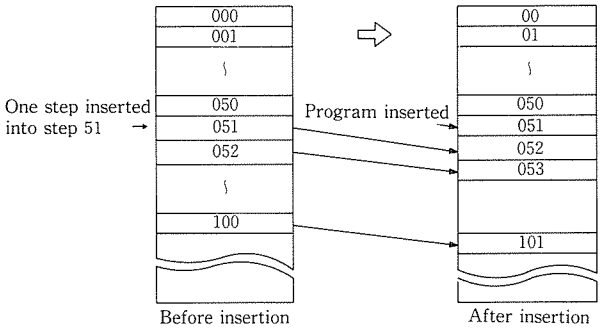
Parenthesized value indicates the number of steps when the 2 k step memory is adopted.



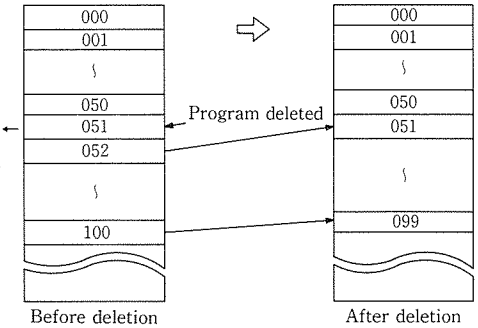
Parenthesized value indicates the number of steps when the 2 k step memory is adopted.
Write-in of the 1 st program



Write-in of additional program



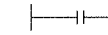
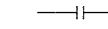
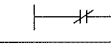
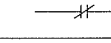
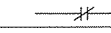
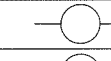
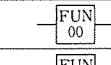
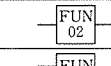
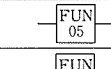
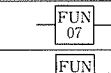
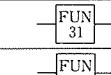
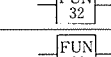
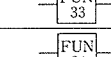
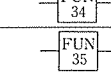
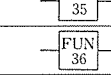
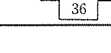
Program insertion

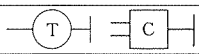


Program deletion

4. COMMANDS

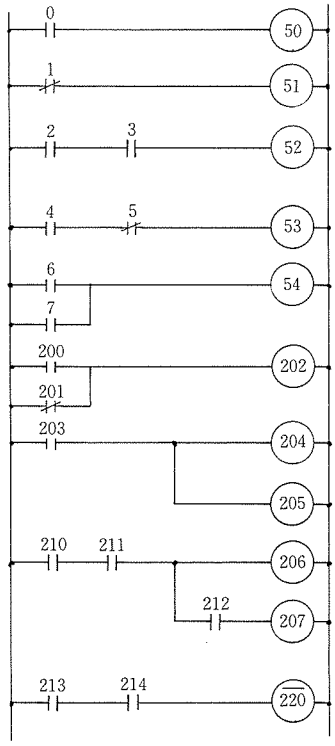
4.1 Description of Commands

No.	Command		Name 称	Function	Symbol
	Basic Command	Auxiliary Command			
1	ORG		Origin	Reads out the start data of a new circuit. (Used for the start of a circuit.)	Start 
2	STR		Store	Reads out the start data of a branch circuit. (Used for intermediate section of a circuit.)	Branch 
3	AND		And	Specifies that contacts are to be connected in series (logical product).	Series 
4	OR		Or	Specifies that contacts are to be connected in parallel (logical sum).	Parallel 
5	ORG NOT		Origin not	Specifies that the start data of a new circuit are not to be read out.	Start 
6	STR NOT		Store not	Specifies that the start data of a branch circuit are not to be read out.	Branch 
7	AND NOT		And not	Specifies that contacts are to be connected in series.	Series 
8	OR NOT		Or not	Specifies that b contacts are to be connected in parallel	Parallel 
9	AND STR		And store	Determines the logical product with the results acquired before the circuit is branched.	Parallel-parallel 
10	OR STR		Or store	Determines the logical sum with the results acquired before the circuit is branched.	Join 
11	OUT		Out	Outputs calculation results.	
12	OUT NOT		Out Not	Specifies that the calculation results are not to be output.	
13	FUN 00		DIF (edge detection)	Detects the rise of signal (⎍‾).	
14	FUN 02		IF	Specifies a process stepping IF.	
15	FUN 03		IFR (if reset)	Resettable IF command	
16	FUN 04		MCS (master control set)	Sets the master control.	
17	FUN 05		MCR (master control reset)	Resets the master control.	
18	FUN 06		JMP (jump)	Jump start	
19	FUN 07		JMP END (jump end)	Jump end	
20	FUN 30		WLOAD (word load)	Reads out data in unit of word (16 points).	
21	FUN 31		T/C LOAD (timer/counter load)	Reads out the current value of timer/counter.	
22	FUN 32		WOUT (word out)	Outputs data in unit of word (16 points).	
23	FUN 33		T/C OUT (timer/counter out)	Presets timer/counter.	
24	FUN 34		WCMP (word compare)	Compares data in unit of word (16 points).	
25	FUN 35		T/C CMP (timer counter compare)	Compares current value of timer/counter with constant.	
26	FUN 36		HCLOAD (high speed counter load)	Reads out the current value of high speed counter.	

No.	Command		Name	Function	Symbol
	Basic Command	Auxiliary Command			
27	FUN 40		UDC (up/down counter)	Outputs a 4-digit BCD.	
28	FUN 45		LATCH (latch)	Latch (Reset is prior to set.)	
29	FUN 47		SFR (shift register)	Specifies a 16-bit shift register.	
30	FUN 99		END (end)	Indicates the end of program.	
31		T／C	Timer/Counter	Specifies an on-delay timer or down counter.	

4.2 How to Use Commands

How to Use ORG, ORG NOT, AND, AND NOT, OR, OR NOT, OUT, and OUT NOT Commands



Coding		Remarks
ORG 0 OUT 50		Use ORG for the start of circuit.
ORG NOT 1 OUT 51		
ORG 2 AND 3 OUT 52		Use AND for the contacts connected in series.
ORG 4 AND NOT 5 OUT 53		
ORG 6 OR 7 OUT 54		Use OR for the contacts connected in parallel.
ORG 200 OR NOT 201 OUT 202		
ORG 203 OUT 204 OUT 205		Multiple output
ORG 210 AND 211 OUT 206 AND 212 OUT 207		
ORG 213 AND 214 OUT NOT 220		When 213 and 214 are activated, the output 220 is put OFF.

Description

1. Use the ORG or NOT command for the start of a circuit.
2. Use the AND or AND NOT command for the contacts to be connected in series. There is no limitation the number of contacts to be connected in series.
3. Use the OR or OR NOT command for the one-point contacts to be connected in parallel.There is no limitation on the number of contacts to be connected in parallel.
4. Use the OUT command for external Output, internal output, timer, and counter.
   Do not use the command for external input.
   Output can be disabled by the OUT NOT command. For the contacts connected in parallel, the OUT command can be consecutively used in multiple.
5. Following the OUT command, another coil can be driven through a contact. Note, however, that the coil to be driven should not be placed upside down as shown in Fig. 4-2.

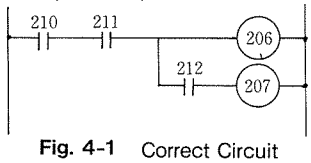


Fig. 4-1 Correct Circuit

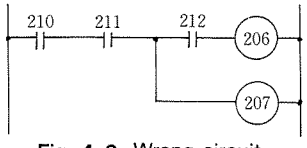
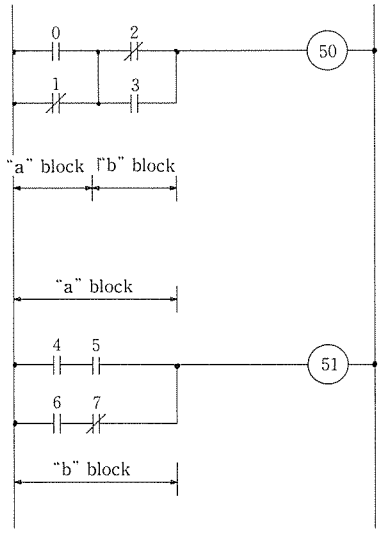


Fig. 4-2 Wrong circuit

How to Use STR, STR NOT, AND STR, and OR STR Commands



Coding		Remarks
ORG	0	┐ a ┘ · Programming is made for "a" block.
OR NOT	1	
STR NOT	2	┐ b ┘ · Programming is made for "b" block.
OR	3	
AND STR		a · b · "a" block and "b" block are formed by AND STR.
OUT	50	
ORG	4	┐ a ┘ · Programming is made for "a" block.
AND	5	
STR	6	┐ b ┘ · Programming is made for "b" block.
AND NOT	7	
OR STR		a+b · "a" block and "b" block are formed by OR STR.
OUT	51	

Description

1. The circuit in which 2 or more contacts are connected in parallel is parallel circuit block. When parallel circuit blocks are connected in series, use the STR NOT for the start of branch, and AND STR for the end of the branch.
2. The circuit in which 2 or more contacts are connected in serial circuit block. When many serial circuit blocks are connected in parallel, use the STR or STR NOT for the start of branch, and the OR STR for the ehd of the branch.
3. When there are many parallel (serial) circuit blocks, they can be connected sequentially by the AND STR (OR STR). In so doing, the number of connectable blocks is not limited.
4. Two or more AND STR's (OR STR's) can be used together. Note, however, that when the STR or STR NOT is repeatedly used, the number of commands should be limited to 7.
5. A syntax error will occur when the STR or STR NOT does not correspond to the AND STR (OR STR). This, however, will not apply to the counter, up/down counter, and shit register circuits.

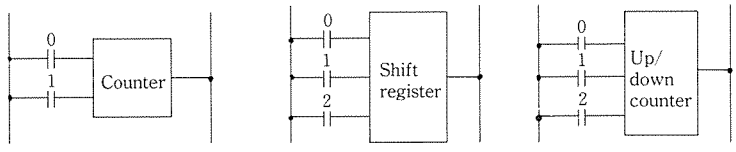
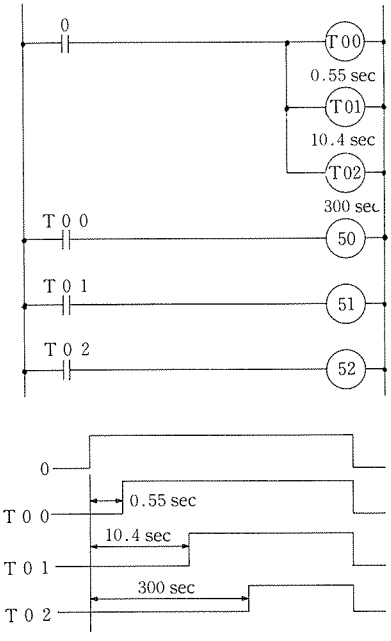


Fig. 4-3 STR and AND STR (OR STR) Do Not Match Each Other

How to Use T (Timer)



Coding			Remarks
O R G		0	
O U T	T	00 0.55	Time base − − − 0.01 sec
O U T	T	01 10.5	Time base − − − 0.1 sec
O U T	T	02 300	Time base − − − 1 sec
			· Timer No. − − − 2 digits
O R G	T	00	· Preset value − − − 3 digits
O U T		50	
O R G	T	01	
O U T		51	
O R G	T	02	
O U T		52	

Description

1 . The timer should be programmed by entering the timer no. (2 digits) and the timer value to be set (3 digits) in this order.

OUT	T/C	0	0	2	0	0

Timer No.
T00~T47 (40 points)

Timer value to be set : 1 ~999 sec, 0.1~99.9 sec, or 0.01~9.99 sec

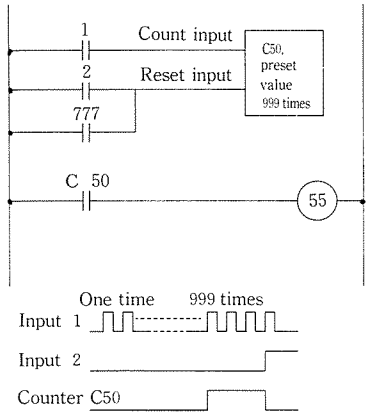
Time base is determined according to which position of the preset value (3 digits) a decimal point is to be keyed in.

Preset Value	Key-in Procedure
0.55 sec	0 · 5 5
10.5 sec	1 0 · 5
300 sec	3 0 0

2 . The timer specified is of on-delay type. Every time the timer input signal becomes ON, the timer counts down the preset value to indicate the timer reaches "000", the output is turned ON. When the input signal becomes OFF, the timer is also turned OFF, and its value returns to the preset value.

3 . Timer accuracy is follows.
10 ms timer error=±0.005 × preset value + timebase (10 ms) + 1 scan time
100 ms/1 sec timer error =±0.005 × preset value + time base (100 ms) + 1 scan time

How to Use C (Counter)



Coding	Remarks
ORG 1 STR 2 OR 777 OUT C 50 999 ORG C 50 OUT 55	Use the STR for reset input. · Counter No. ··· 2 digits · Preset value ··· 3 digits

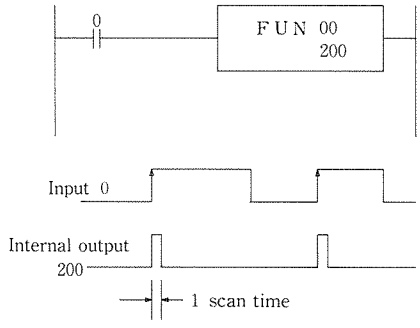
Description

1. The counter should be programmed by entering the count input and reset input in this order.
2. The counter specified here is of down counting type. It counts the rise point of the input signal to subtract the counted value from the preset value. When the value read by the counter reaches "000", the output is put ON. When the reset input signal becomes ON, the counter is turned OFF, and its value returns to the preset value. Priority is always given to the reset input signal.
3. The counter is available in 24 points ranging from C50 to 77, and the counters from C70 to C77 can be used as 4digit counters as shown in the following explanation.

Counter No.	Preset Value	Programming Procedure
C 50 ~ C 67	3 digits	OUT C 5 0 9 9 9 Counter No. Counter value to be preset ··· 1~999(3 digits)
	3 digits	OUT C 7 0 9 5 0 Counter No. Counter value to be preset ··· 1~999 (3 digits)
C 70 ~ C 77	4 digits	OUT C 0 · 9 9 9 9 4-digit counter using C70 Counter value to be preset ··· 1~9999(4 digits) C 0 . →C 70 C 1 . →C 71 C 2 . →C 72 ⋮ ⋮ C 7 . →C 77 Counters correspond to each other as shown left.

4. The counter value read by the counter is protected from power failure. If it need not be protected, the value should be reset in advance by using internal output no. 777 to permit activating one scan immediately after the start of operation.

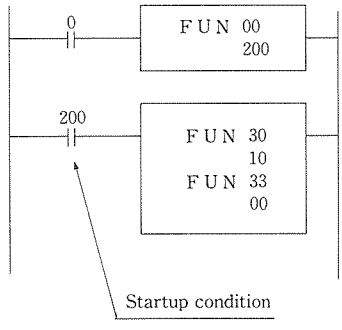
How to Use FUN00 (DIF : Edge detection) and FUN99 (END : End) Commands



Coding	Remarks
ORG 0 FUN 00 200	Use the FUN00 for edge detection.
FUN 99	Use the FUN 99 for indicating the end of command.

Description

1. To detect the rise point of input signal and output a pulse as long as one scan time, make programming in conbination with FUN 00 and internal output.
2. The FUN 00 may be used for determining the startup condition of word commands as will be described later.

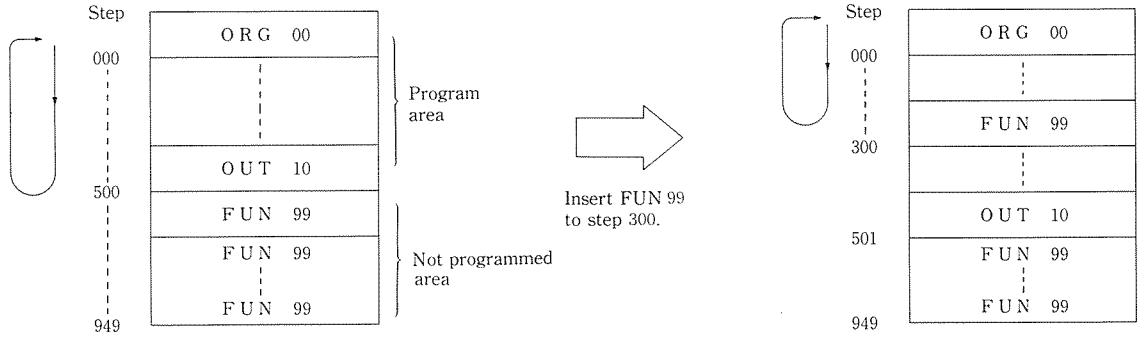


Detects the rise point of input 0, and activates one scan by the 200.

Takes in inputs 10~27 to arithmetic register as BCD data.

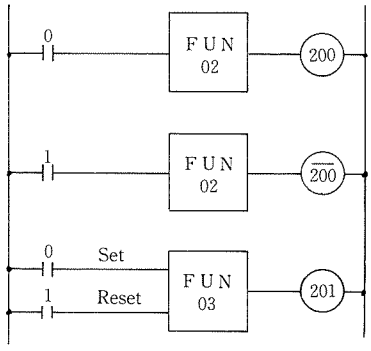
Determines the data of arihmetic register as the preset value of timer T00.

3. The FUN 99 indicates the end of program, and thus it need not be written to the end of the program. If written, an error will occur. During test-run, insert the FUN 99 to separate the respective programs, and then delete it after confirming that the system operates normally, Scanning will be made from step 000 to the FUN 99.

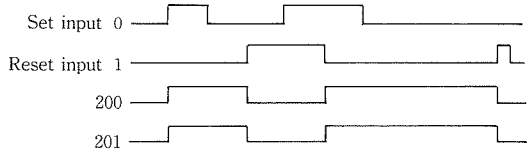


Caution The command which indicates the end of program area is FUN 99.

How to Use FUN02 (IF) and FUN03 (IFR : IF Reset) Commands



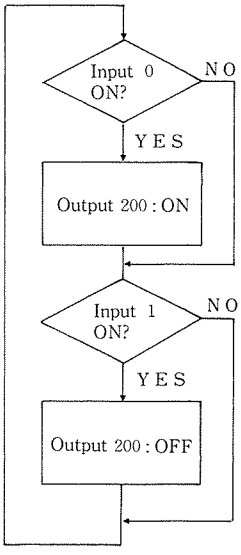
Coding		Remarks
ORG	0	
FUN	02	IF
OUT	200	
ORG	1	
FUN	02	IF
OUT NOT	200	
ORG	0	
STR	1	Use STR.
FUN	03	IFR
OUT	201	



Description

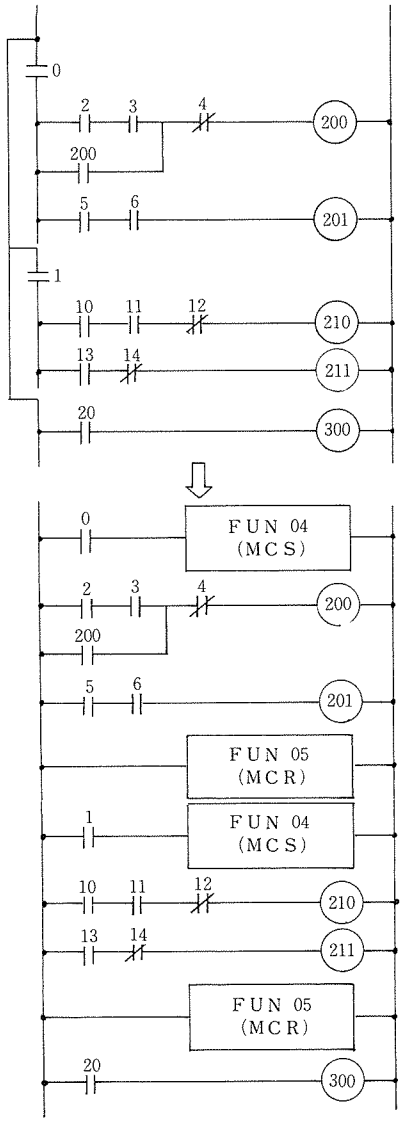
1 . The FUN 02 is an IF command, and the sequence shown above is equivalent to the program of IF-THEN structure. The operation is as follows.
   (1) If the input 0 is ON, then the output 200 is turned ON.
   (2) If the input 1 is Off, the system does nothing, and thus the output status remains unchanged.
   (3) If the input 0 is set to OFF, the system does nothing, (output 200 remains ON).
   (4) If the input 1 is turned ON, the output 200 is turned OFF.

2 . The FUN 03 is an IF command having a reset input.
   In the sequence described above, the operation of the internal output 200 is the same as that of 201.
   It is convenient to use :
   ○ The FUN 02 when the ON/OFF status is considered with reference to the output.
   ○ The FUN 03 when the ON/OFF status is considered with reference to the input.



Program of
IF-THEN Structure

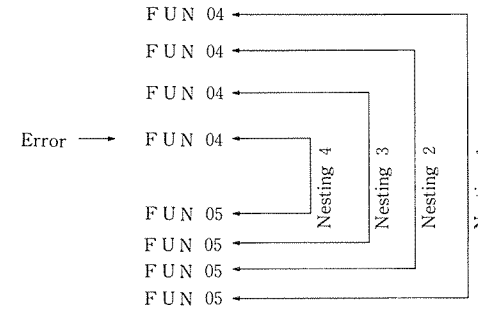
How to Use FUN04 (MCS : Master Control Set) and FUN05 (MCR : Master Control Reset) Commands



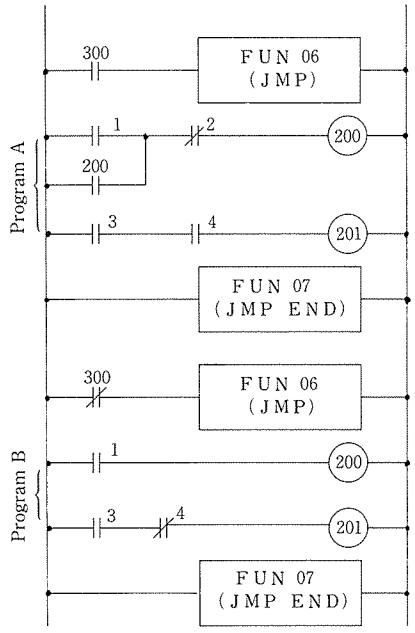
Coding		Remarks
ORG	0	
FUN	04	MCS ←
ORG	2	
AND	3	
OR	200	
AND NOT	4	
OUT	200	
ORG	5	
AND	6	
OUT	201	
FUN	05	MCR ←
ORG	1	
FUN	04	MCS ←
ORG	10	
AND	11	
AND NOT	12	
OUT	210	
ORG	13	
AND NOT	14	
OUT	211	
FUN	05	MCR ←
ORG	20	
OUT	300	

Description

1. The FUN 04 (MCS) and FUN 05 (MCR) control the bus line. Be sure to use them in pair. Otherwise, a syntax error will occur.
2. The FUN 04 must be followed by either ORG or ORG NOT command.
3. When the master control contact 0 is OFF, the internal outputs 200 and 201 are turned OFF.
4. Program can be nested up to 3 levels.If nested by 4 levels or more, a syntax error will occur.



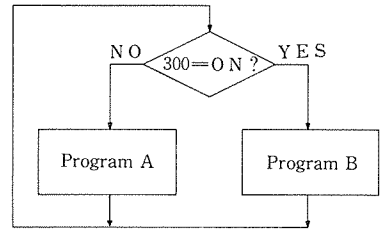
How to Use FUN06 (JMP : Jump) and FUN07 (JMP END : Jump End) Commands



Coding			Remarks
ORG		300	
FUN		06	JMP
ORG		1	
OR		200	
AND	NOT	2	
OUT		200	Status before JMP retained
ORG		3	
AND		4	
OUT		201	
FUN		07	JMP END
ORG	NOT	300	
FUN		06	JMP
ORG		1	
OUT		200	Status before JMP retained
ORG		3	
AND	NOT	4	
OUT		201	
FUN		07	JMP END

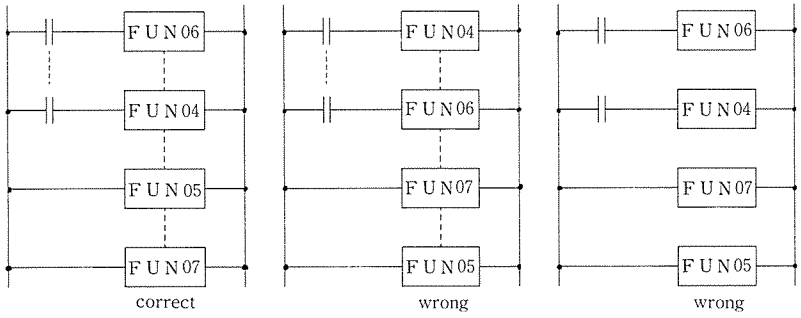
Description

1. The FUN06 (JMP) and FUN07 (JMP END) enable the system control to skip a certain part of sequence. In the sequence shown above, the control skips the program A when the jump condition 300 is turned ON. When the 300 is OFF, the program B is skipped. The jump condition 300 permits selecting either of the two programs.

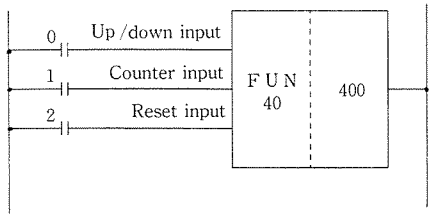


2. The FUN06 (JMP) and FUN07 (JMP END) must be used in pair. Oherwise, an syntax error will occur. No nesting is allowed in the program.
3. Once the jump condition is set, the program between the FUN06 and FUN07 is excluded from arithmetic operation, and thus the output remains unchanged from the previous. Timer also stops counting down (subtraction). When the jump condition is cleared, then the timer starts counting down.
4. Syntax error (dual coil error) will not occur even if the same output coil is specified for both the program A and program B.

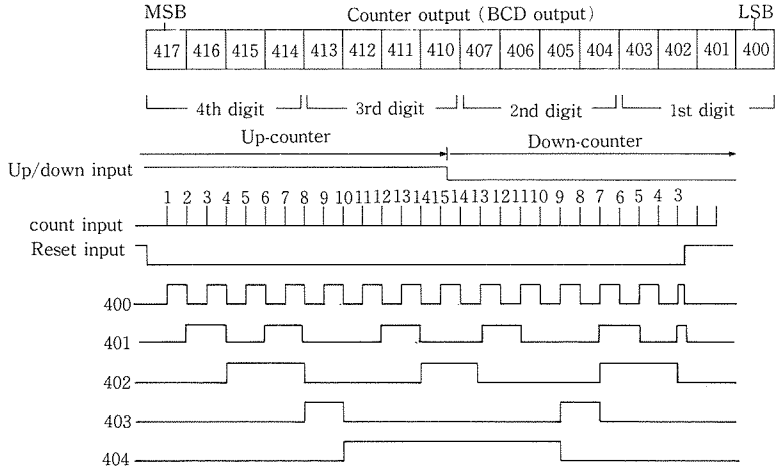
5 . FUN04 (MCS) and FUN05 (MCR) can be programmed between the FUN06 and FUN07, but the FUN06 and FUN07 cannot be programmed between the FUN04 and FUN05.



How to Use FUN40 (UDC : Up/Down Counter)

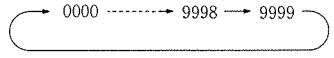


Coding			Remarks
ORG	0		
STR	1		Use STR.
STR	2		
FUN	40	400	



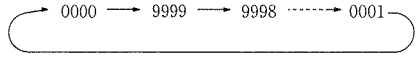
Description

1. The up/down counter should be programmed by using external output or internal output. Enter the up/down input (ON ··· count-up, OFF ··· count-down), count input, and reset input in this order for making the program.
2. The upper 16 points (in the above example, 400 to 417) starting from the internal output no. specified by the FUN40 will be output from the up/down counter in a 4-digit BCD.
3. If the up/down counter is used as a up-counter, it counts up the rise points of counter input (for addition).



(9999 is counted up to 0000.)

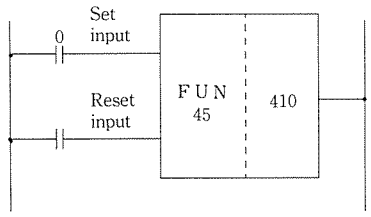
4. If the counter is used as a down-counter, it counts down the rise points of counter input (for subtraction).



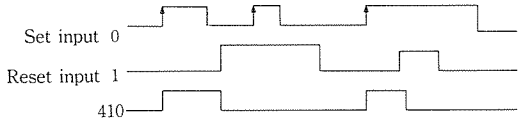
(0000 is count down to 9999.)

5. When the reset input is turned ON, the counter output will be preset to 0000.

How to Use FUN45 (LATCH) Command



Coding	Remarks
O R G 0 S T R 1 F U N 45 410	Use STR.



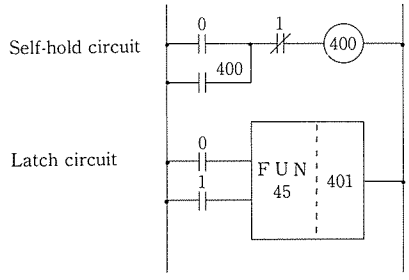
Description

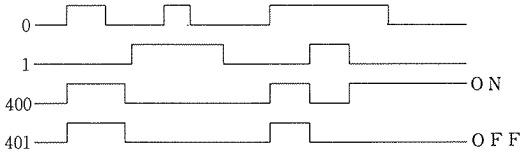
1 . The FUN45 is a LATCH provided preferentially for resetting, and should be programmed with the external outputs or internal outputs.

2 . The internal outputs will be latched at the rise of set input when the reset input is OFF.

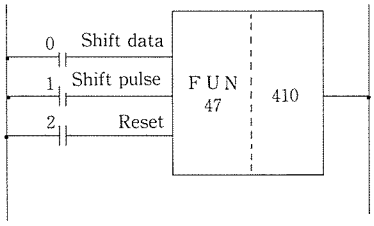
3 . The FUN45 can also be used as a keep relay if it is combined with the internal output protected from power failure.

4 . The operation of the self-hold circuit differs from that of the FUN45 only when the reset input is turned OFF→ON with the set input ON.

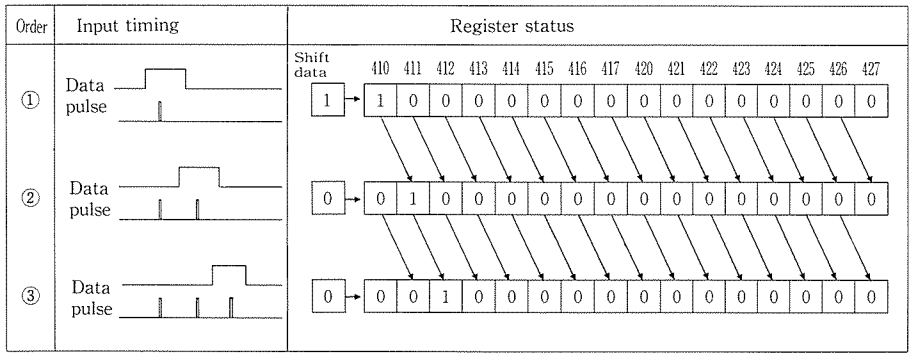




How to Use FUN47 (SFR : Shift Register)

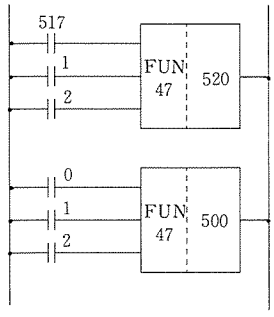


Coding			Remarks
ORG	0		
STR	1		Use STR.
STR	2		
FUN	47	410	



Description

1. The shift register be programmed by using the FUN47 and external outputs or internal outputs. In so doing, specify shift data, shift pulse and reset input in this order.
2. The upper 16 points (in the above example, 410~427) starting from the internal output number specified by the FUN47 will form the shift register.
3. Shift data ON/OFF status at the rise point of the shift pulse will be stored at the lowermost position of the register (internal output 410 in the above example). The ON/OFF status of each register will be shifted to the next higher position.
4. When the reset input is turned ON, the registers (410~427) will all become OFF.
5. The most significant data will be overflown. For connecting the shift registers vertically by utilizing the ovewrflown data, the registers on the rear stage should be programmed first.



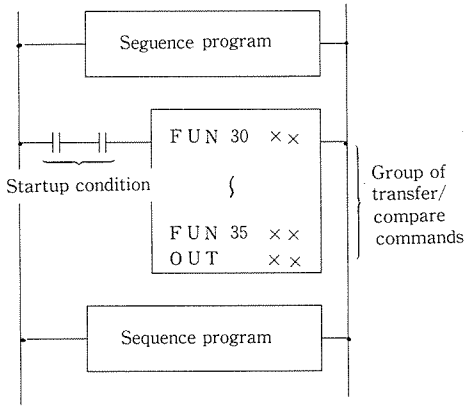
· Programming should be made first for rear state registers.

· 32 bits of internal outputs 500~537 will form shift registers.

4-3 Transfer/Compare Command

Concept of Transfer/Compare Command

(1) In E series, input/output, timer, or counter data can be transferred or compared in unit of word (1 word = 16 bits). Transfer/compare command will perform arithmetic operation with reference to the data stored in 16-bit arithmetic register (hereafter called AR).



(2) Basically, transfer/compare command can be represented as shown in Fig. 4-4, and should be programmed in combination with startup condition.

(3) Arithmetic operation is executed when startup condition is ON. When the condition is turned OFF, the output will retain the same contents as those retained immediately before the condition is turned OFF.

(4) Table 4-2 lists the processings of transfer/compare commands.

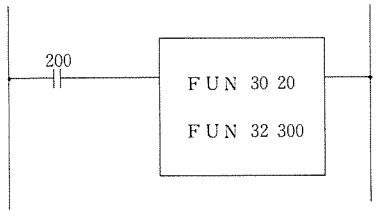
Fig. 4-4 Basic Pattern of Transfer/Compare Command

Table. 4-2 Processings of Transfer/Compare Commands

No.	Command	Name	Processing
1	FUN 30	W LOAD (Word Load)	External input/output, internal output→AR
2	FUN 31	T/C LOAD (Timer Countor Load)	External output and internal output→AR
3	FUN 32	W OUT (Word Out)	External output and internal output←AR
4	FUN 33	T/C OUT (Timer/Counter Out)	Preset value for timer and counter←AR
5	FUN 34	W CMP (Word Compare)	When external input/output or internal output ≧AR, 1→C When constant (preset value of timer/counter) < AR, 0→C
6	FUN 35	T/C CMP (Timer/Counter Compare)	When constant (preset value of timer/counter) ≧ AR, 1→C When constant (preset value of timer/counter) < AR, 0→C
7	FUN 36	HC LOAD	Current value read by high speed Counter → AR)

C; Carry

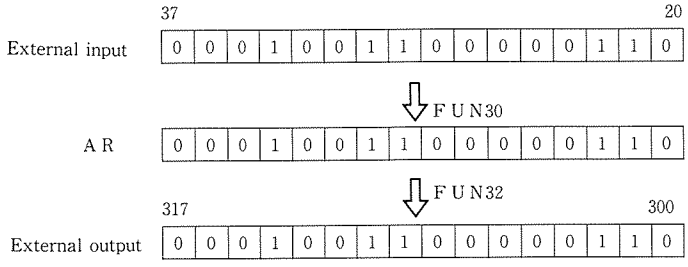
How to Use FUN30 (W LOAD : Word Load) and FUN 32 (W OUT : Word Out)



Coding			Remarks
ORG		200	
FUN	30	20	20~37→AR
FUN	32	300	300~317←AR

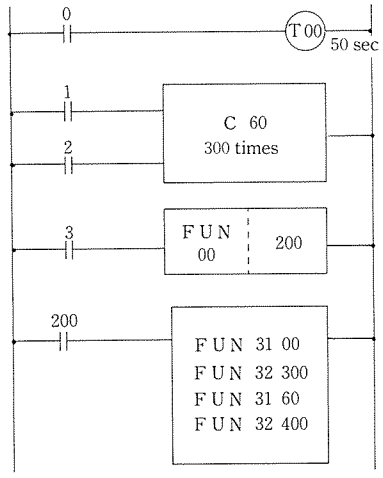
Description

1. The FUN30 should be used for taking in the contents external input/output and internal output to AR in unit of word. In so doing, the ON/OFF status of upper 16 points (external inputs 20~37) in the above example starting from the input/output number specified by the FUN30 will be taken into the AR.
2. The FUN32 should be used for externally or internally outputting the contents of AR. In so doing, the contents will be output to the upper 16 points (internal outputs 300~317 in the above example) starting from the output number specified by the FUN32.



3. When startup condition is ON, the statuses of external inputs 20~37 are taken into the AR, and the contents of AR are output to the internal outputs 300~317.
4. When the startup condition 200 is turned OFF, arithmetic operation is not executed, and thus the output will be retained available.

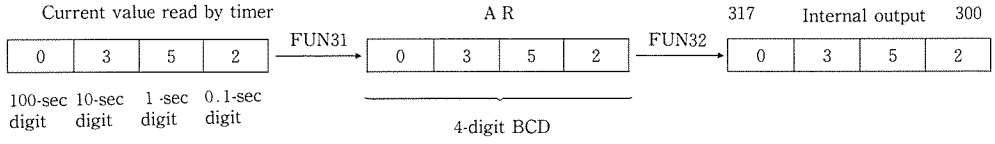
How to Use FUN 31 (T/C LOAD : Timer/Counter Load)



Coding			Remarks
ORG		0	
OUT	T00	50	
ORG		1	
STR		2	
OUT	C60	300	
ORG		3	} Edge detection
FUN	00	200	
ORG		200	Startup condition
FUN	31	00	Current value of T00→AR
FUN	32	300	300~317←AR
FUN	31	60	Current value of C60→AR
FUN	32	400	400~417←AR

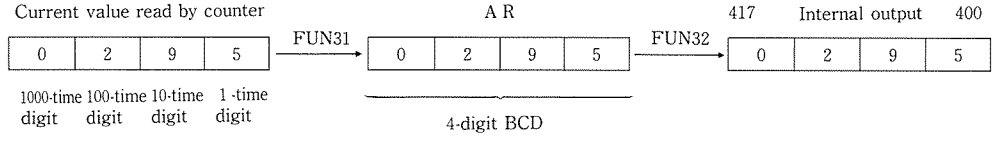
Description

1. The FUN31 should be used for taking in the current value read by the timer to the AR.
In the above example, the value read by the timer T00 is taken into the AR, from which it is output to the internal outputs ranging from 300 to 317. The current value read by the timer is taken into the AR in a 4-digit BCD whose least significant digit is 0.1 sec.

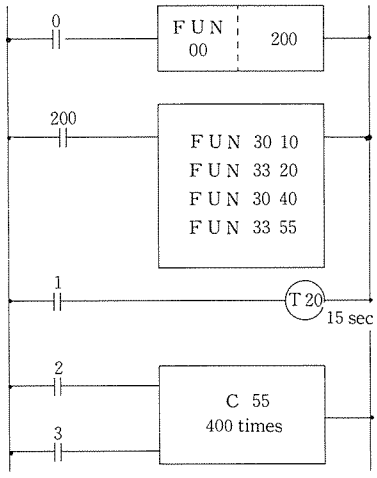


Note that the 0.01-sec digit of the timer will not be taken into the AR.

2. The FUN31 should be used for taking in the current value read by the counter to the AR too.
In the above example, the current value read by the counter C60 is taken into the AR, and is then output to the internal output no. 400 to 417.



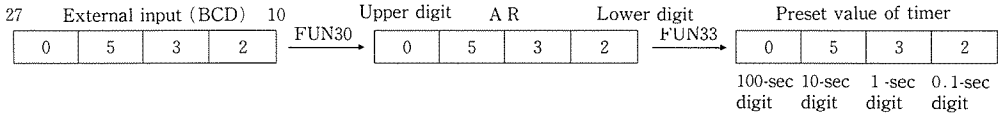
How to Use FUN33 (T/C OUT : Timer/Counter Out)



Coding			Remarks
ORG		0	Edge detection
FUN	00	200	
ORG		200	Startup condition
FUN	30	10	Input 10~27→AR
FUN	33	20	Set value of T20
FUN	30	40	Input 40~57→AR
FUN	33	55	Set value of C55
ORG		1	
OUT	T20	15	Initial set value of T20
ORG		2	
STR		3	
OUT	C55	400	Initial set value of C55

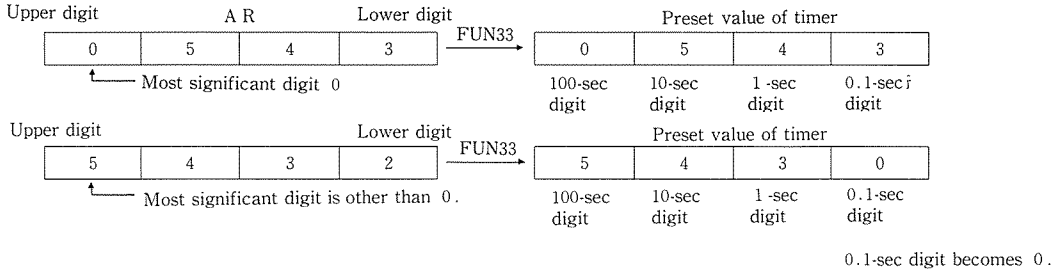
Description

1 . The FUN33 should be used for sending out the contents of AR as a timer preset value.
In the above example, the ON/OFF statuses of external inputs 10 to 27 are taken into the AR, and the contents of the AR are then output as the preset value of timer T20.

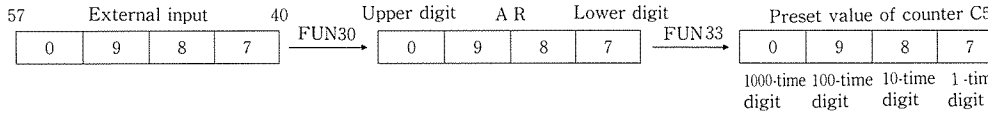


● When external input ranging from 10 to 27 is 0532 (BCD), timer T20 will be set to 53.2 sec.

2 . The preset value of timer consists of 3 digits, and thus the 0.1-sec digit of the timer will become 0 except when the most significant digit of the AR is 0.



3 . The FUN33 should also be used for outputting the contents of AR as a counter preset value.
In the above example, the ON/OFF statuses of external inputs 40~57 are taken into the AR, and the contents of the AR output as the preset value of counter C55.

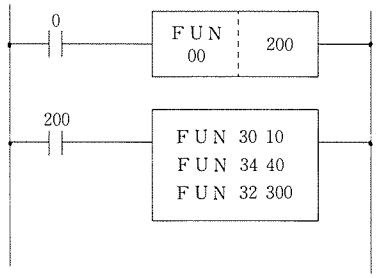


● When the external input (40~57) is 0987 (BCD), the preset value of counter C55 will become 987 times.

CAUTION

1. When the contents of the AR are other than BCD data (binary data, for example), they must not be output as the preset values of timers or counters. If you do, the timers or counters fail to operate normally. Be sure to store BCD data in the AR.
2. If the 4-digit BCD data are output from te AR to 3-digit counter (C50 to C67), counting operation will be made normally, but the most significant digit will not be displayed when the current value read by the counter is monitored through the programmer. Be sure to output 3-digit BCD data (with the most significant digit set to 0) to 3-digit counter.
3. When the abovementioned program is checked for syntax, "Dual Coil" error is displayed each for the timer T00 and counter C55, but there is no problem in system operation ; the system can be operated continuously.
4. When the FUN35 is followed by the FUN33, the latter will not be run when carry C=0.

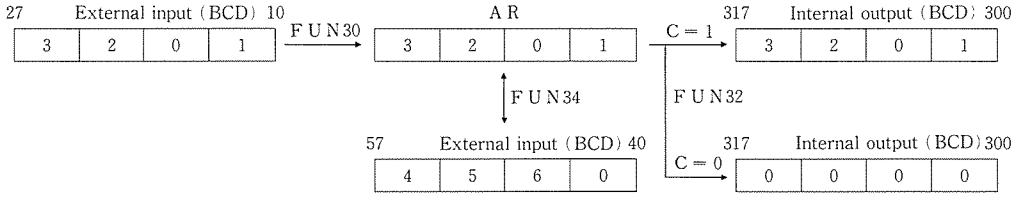
How to Use FUN34 (WCMP : Word Compare)



Coding			Remarks
ORG		0	} Edge detection
FUN	00	200	
ORG		200	Startup condition
FUN	30	10	Inputs 10~27→AR
FUN	34	40	(Inputs 40~57) ≧ AR··· 1 →C
			(Inputs 40~57) < AR··· 0 →C
FUN	32	300	C = 1 makes AR→300~317
			C = 0 makes 0 →300~317

Description

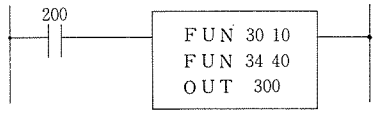
1 . The FUN34 should be used for comparing the contents of AR with those of external input/output in unit of word.



In the above example, the contents of external inputs 10~27 are taken into AR, and are then compared with those of external inputs 40~57 to permit the following processings.

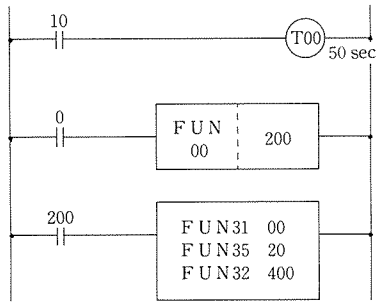
1) External input (40~57) ≧ AR makes C=1, and thus AR → internal output (300~317).
2) External input (40~57) < AR makes C=0, and thus 0 → internal output (300~317).

2 . The comparison results may be output in bit. In so doing, the ON/OFF status of carry C will be output together with the results.



1) External input (40~57) ≧ AR makes C=1 → internal output 300.
2) External input (40~57) < AR makes C=0 → internal output 300.

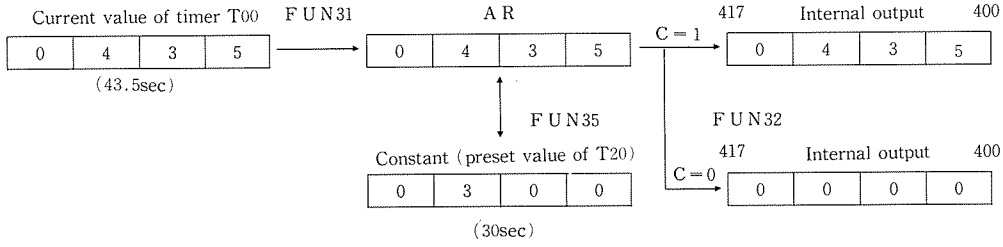
How to Use FUN35 (T/C CMP : Timer/Counter Compare)



Coding	Remarks
ORG 10	
OUT T00 50	Indicates that timer T00 is preset to 50 sec.
ORG 0	} Edge detection
FUN 00 200	
ORG 200	Startup condition
FUN 31 00	Current value of T00→AR
FUN 35 20	T20 constant ≧ AR··· 1 →C
	T20 constant < AR··· 0 →AR
FUN 32 400	C = 1 makes AR→400~417.
	C = 0 makes 0 →400~417.
(CLR)	
OUT T20 30	Constant (30 sec) is input to T20.

Description

1. The FUN35 should be used for comparing the contents of AR with the constant (preset value of timer/counter).

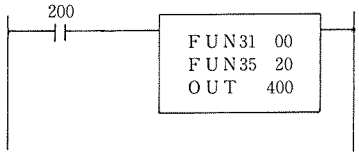


In the above example, the current value of timer T00 is taken into the AR, and are then compared with the constant (preset value of T20) which has been specified in advance to permit the following processings.

1) Constant (set value of T 20) ≧ AR makes C=1, and thus AR → internal output (400~417).

2) Constant (preset value of T20) < AR makes C =0, and thus 0 → internal output (400~417).

2. The comparison results may be output in bit. In so doing, the ON/OFF status of carry C will be output together with the results. In the program shown on the left side, the following processing will be made.



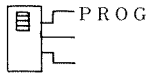
1) Constant (T20) ≧ AR makes C=1, → internal output 400.

2) Constant (T20) < AR makes C=0 → internal output 400.

3 . Constant Input Method

In the FUN35, the constant to be compared with the contents of AR should be specified by using a vacant timer or counter. The constant setting procedure is not included in the number of program steps ; it should be specified after completion of writing in a series of programs. The specification requires a special procedure since each constant is not to be written in program as a coil.

1) Input of Constant

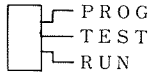
Function	Mode	Operational Status
How to Input Timer/Counter Constant		Stop

● Key-in Procedure

Item	Key-in procedure	Description
Input of timer constant	CLR OUT T 2 0 3 0 ENT	Setting 30 sec for timer T20
Input of 3-digit counter constant	CLR OUT C 6 0 9 4 0 ENT	Setting 940 times for counter C60
Input of 4-digit counter constant	CLR OUT C 0 • 5 4 6 7 ENT	Setting 5467 times for counter C70

Constant can be changed in the same way

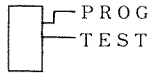
2) Read-out of Constant

Function	Mode	Operational Status
How to Read out Timer/Counter Constant		Operational or stop

● Key-in Procedure

Item	Key-in Procedure	Description
Read-out of timer constant	CLR OUT T 2 0 MON	Reading out the constant of timer T20
Read-out of 3-digit counter constant	CLR OUT C 6 0 MON	Reading out the constant of counter C60
Read-out of 4-digit counter constant	CLR OUT C 0 · MON	Reading out the constant of counter C70

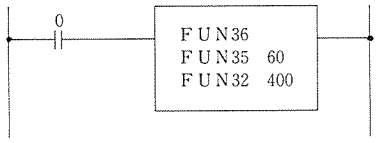
3) Change of Constant

Function	Mode	Operational Status
How to Change Timer/Counter Constant		Stop

● Key-in Procedure

Item	Key-in Procedure	Description
Constant change	CLR OUT T 2 0 MON 1 5 0 ENT	Reading out timer T20, and then entering a new constant (150 sec)

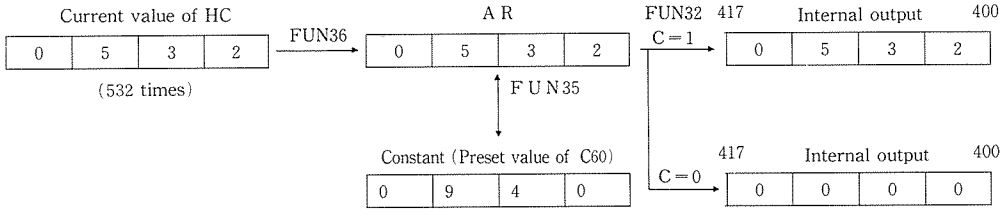
How to Use FUN36 (HCLOAD : Highspeed Counter Load)



Coding	Remarks
ORG 0	
FUN 36	Current value of HC → AR
FUN 35 60	C60 constant ≧ AR ··· 1 → C
	C60 cnnstant < AR ··· 0 → C
FUN 32 400	C = 1 makes AR → 400~417.
	C = 0 makes O → 400~417.
(CLR)	
OUT C60 940	Input of constant (940 times) for C60

Description

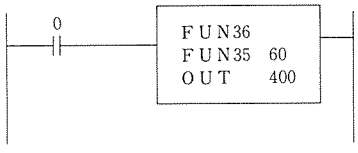
1 . E series has a high speed counter (HC) capable of counting up to 10 kHz. The FUN36 should be used for taking in the current value of the high speed counter to the AR.



In the above example, the current value of the HC is taken into the AR where it is compared with the constant (preset value of C60) which has been set previously, and then the following processings are to be made.

1) Constant (preset value of C60) ≧ AR makes C=1, and thus AR → internal output (400~417).
2) Constant (preset value of C60) < AR makes C=0, and thus 0 → internal output (400~417).

2 . The comparison results may be output in bit. In so doing, the ON/OFF status of carry C will be output.



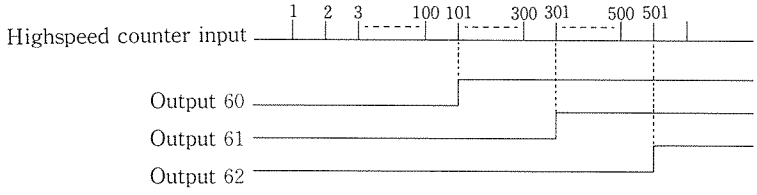
In the program shown on the left side, the following processings will be made.

1) Constant (T60) ≧ AR makes C=1 → internal output (400).

2) Constant (T60) < AR makes C=0 → internal output (400).

3 . The highspeed counter is a forward counter (up counter). The current value of the counter is compared ' with the constant, and is then output to an external unit if it exceed the constant. The following shows an example of the program.

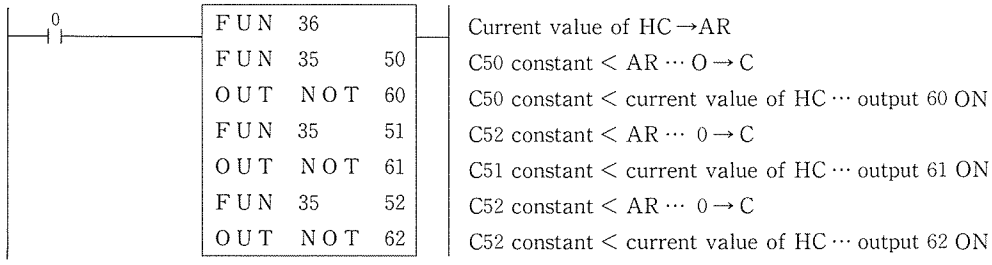
Time Chart



- Output 60 is turned ON when the current value of highspeed counter exceeds 100.
- Output 61 is turned ON when the current value of highspeed counter exceeds 300.
- Output 62 is turned ON when the current value of highspeed counter exceeds 500.

Program

Program sets a constant for an unused counter. Constants 100 times, 300 times, and 500 times are written in to the C50, C51, and C52, respectively for forming a program capable of comparing the current value of the highspeed counter with any of the constants specified for the C50, C51, and C52.

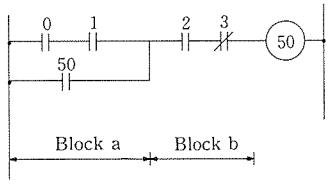
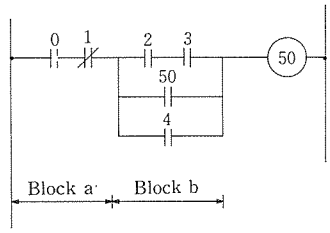
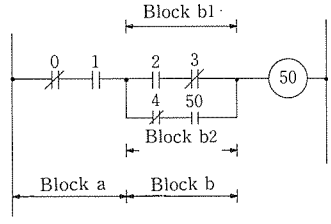
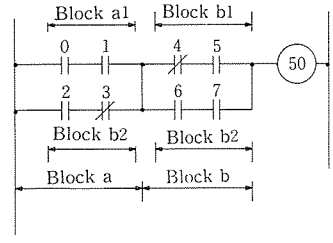


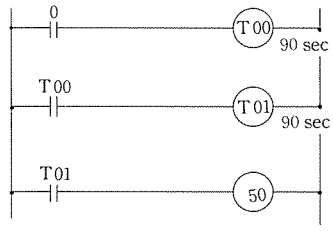
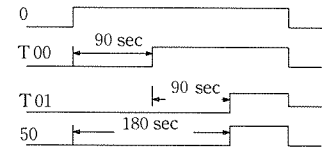
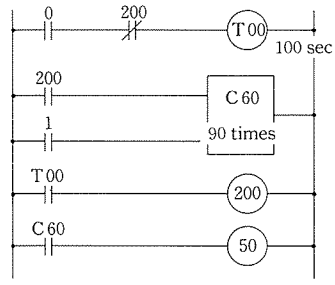
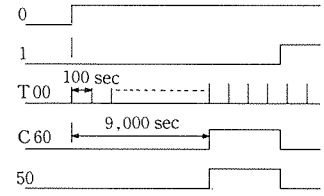
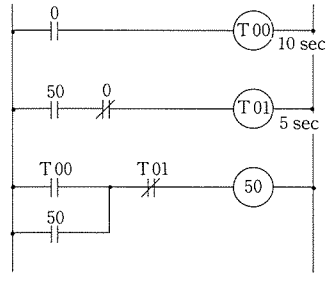
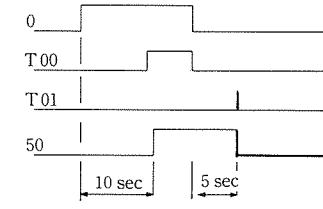
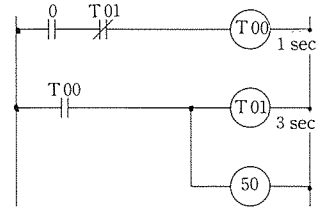
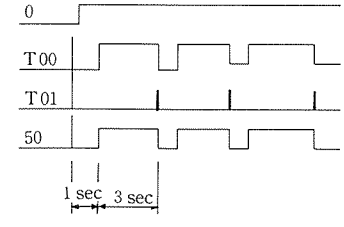
CAUTION

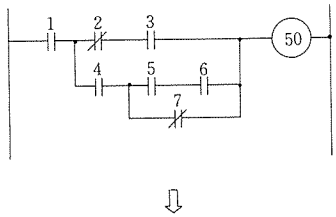
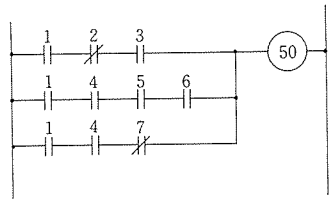
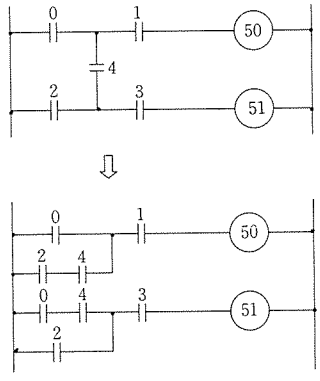
Constant C50 < AR causes the carry C to become "0". To negate the carry, use the OUT NOT command.

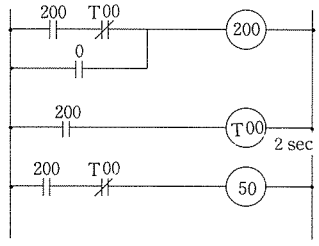
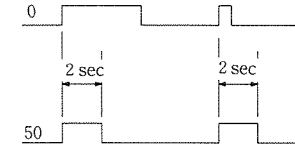
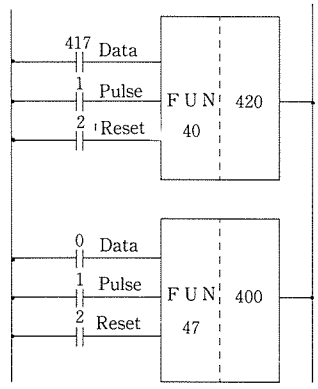
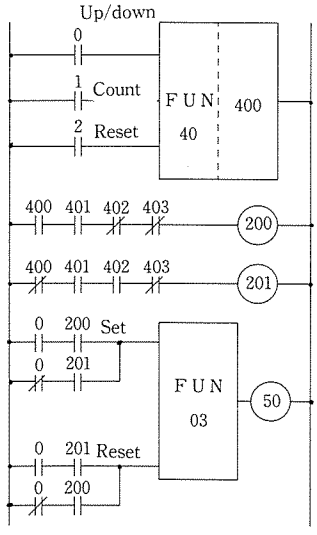
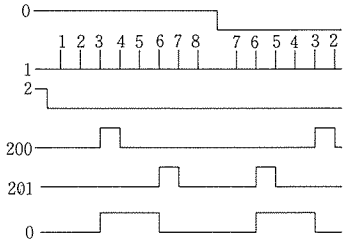
4 . The highspeed counter will be reset by turning ON the reset terminal (HR). Further, the current value of the highspeed counter will not be protected from power failure. It is preset to "0000" at start.

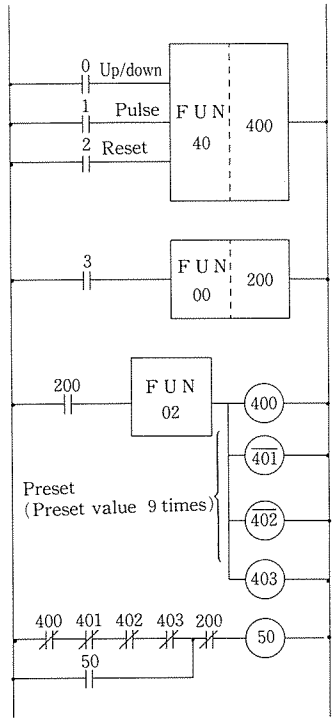
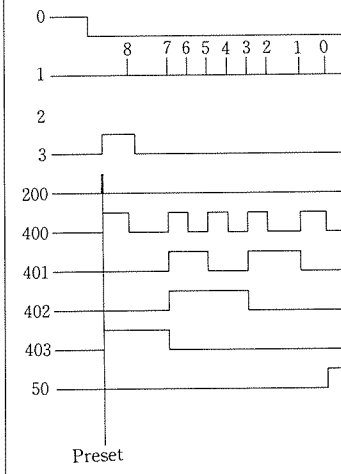
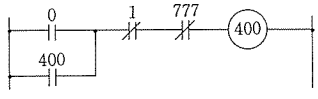
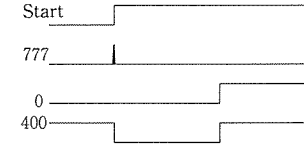
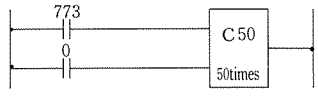
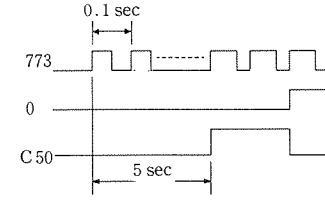
4.4 Application Examples of Programs

Circuit	Sequence	Program: Command code	Program: Data	Description
Parallel/serial circuit		ORG AND OR AND AND NOT OUT	0 1 50 2 3 50	a b · Parallel circuit of block a is programmed, and then block b is programmed.
Serial/parallel circuit		ORG AND NOT STR AND OR OR AND STR OUT	0 1 2 3 50 4 50	a b · Circuit is divided into block a and block b, each of which is then programmed. a · b · Two programs generated for both blocks are formed into one program with AND STR.
		ORG NOT AND STR AND NOT STR NOT AND OR STR AND STR OUT	0 1 2 3 4 50 50	a · Block a is programmed. b 1 · Block b1 is programmed. b 2 · Block b2 is programmed. b 1 + b 2 · Two programs generated for blocks b1 and b2 are formed into one program with OR STR. a · b · Two programs generated for blocks a and b are formed into one program with AND STR.
Two parallel circuit connected in series		ORG AND STR AND NOT OR STR STR NOT AND STR AND OR STR AND STR OUT	0 1 2 3 4 5 6 7 50	a 1 a 2 a 1 + b 2 · Blocks a1 and a2 are programmed, and then two programs generated for both blocks are formed into one program with OR STR. b 1 · Blocks b1 and b2 are also programmed. b 2 · Programs generated for blocks a and b are formed into one program with AND STR. b 1 + b 2 a · b

Circuit		Sequence	Program		Description
			Command Code	Data	
Applied timer/counter circuit	Timer + timer circuit		ORG OUT T ORG T OUT T ORG T OUT	0 00090 00 01090 01 50	
	Timer + counter circuit		ORG AND NOT OUT T ORG STR OUT C ORG T OUT ORG C OUT	0 200 00100 200 1 60090 00 200 60 50	
	ON/OFF delay circuit		ORG OUT T ORG AND NOT OUT T ORG T OR AND NOT T OUT	0 00010 50 0 01005 00 50 01 50	
	Flicker circuit		ORG AND NOT T OUT T ORG T OUT T OUT	0 01 00001 00 00003 50	

Circuit	Sequence	Program		Description
		Command Code	Data	
Equivalent circuit / Complex circuit		ORG	1	· If a circuit is too complex for programming, it should be rewritten into an equivalent circuit also allows you to see the circuit sequence easily.
		STR NOT	2	
		AND	3	
		STR	4	
		STR	5	
		AND	6	
		OR NOT	7	
		AND STR		
		OR STR		
		AND STR		
		OUT	50	
		ORG	1	
		AND NOT	2	
		AND	3	
		STR	1	
		AND	4	
		AND	5	
		AND	6	
		OR STR		
		STR	1	
		AND	4	
		AND NOT	7	
		OR STR		
		OUT	50	
Equivalent circuit / Bridge circuit		ORG	0	· The bridge circuit shown left cannot be rewritten. Rewrite it as shown in the figure just under the bridge circuit.
		STR	2	
		AND	4	
		OR STR		
		AND	1	
		OUT	50	
		ORG	0	
		AND	4	
		OR	2	
		AND	3	
		OUT	51	

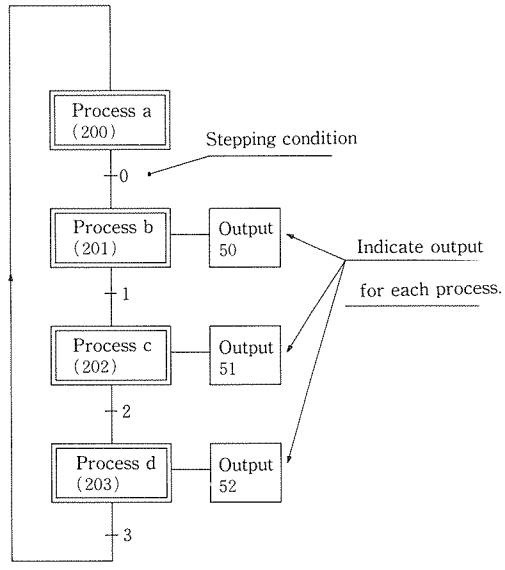
Circuit	Sequence	Program		Description
		Command Code	Data	
Applied timer/counter circuit One-shot circuit		ORG AND NOT T OR OUT ORG OUT T ORG AND NOT T OUT	200 00 0 200 200 00002 200 00 50	
32-bit shift register circuit		ORG STR STR FUN 47 ORG STR STR FUN 47	417 1 2 420 0 1 2 400	· Two 16-bit shift registers should be connected; the upper 16 bits should be programmed first. · 32 bits ranging from 400 to 437 will form the shift register.
Up/down counter circuit to be activated through 3 ~ 6 set values		ORG STR STR FUN 40 ORG AND AND NOT AND NOT OUT ORG NOT AND AND AND NOT OUT ORG AND STR NOT AND OR STR STR AND STR NOT AND OR STR FUN 03 OUT	0 1 2 400 400 401 402 403 200 400 401 402 403 201 0 200 0 201 0 201 0 200 50	 200 : Lower limit value (set value 3 times) 201 : Upper limit value (set value 6 times)

Circuit	Sequence	Program		Description
		Command	Code / Data	
Presetable down counter circuit		ORG STR STR FUN 40 ORG FUN 00 ORG FUN 02 OUT OUT NOT OUT NOT OUT ORG NOT AND NOT AND NOT AND NOT OR AND NOT OUT	0 1 2 400 3 200 200 400 401 402 403 400 401 402 403 50 200 50	 · The up/down counter is preset with input 3 ON. It starts counting down with pulse input, and then output 10 is turned ON when count value reaches 0.
Special internal output application circuit Circuit using internal output 777		ORG OR AND NOT AND NOT OUT	0 400 1 777 400	· Resetting of internal outputs protected from power failure at operation start. 
Circuit using internal output 773		ORG STR OUT C	773 0 50050	· Timer circuit using 0.1-sec clock pulse 

4.5 Application Examples of Process Stepping IF Command (1)

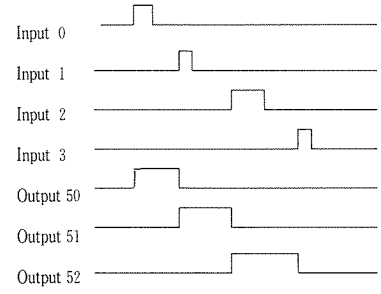
An If command can be used conveniently for sequential control such as process stepping control. The following shows status shift diagram when process stepping operation is applied. The diagram is called a graph set.

Status Shift Diagram (graph set)

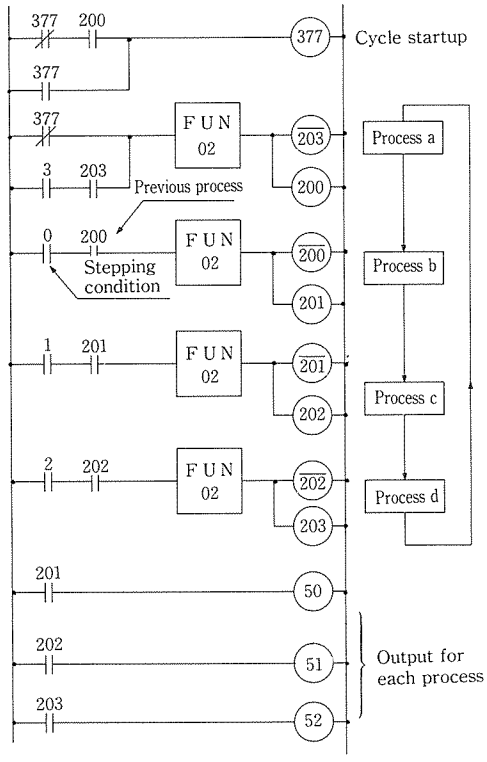


Description

(1) The system is put in process a (initial status) at operation start.
(2) When input 0 is turned ON, control steps to process b, and output 10 is turned ON.
(3) When input 1 is turned ON, control steps to process c. output 50 is turned OFF, and output 51 is turned ON.
(4) When input 2 is turned ON, control steps to process d, output 51 is turnde OFF, and output 52 is turned ON.
(5) When input 2 is turned ON, control steps to process a, and output 52 is turned OFF.



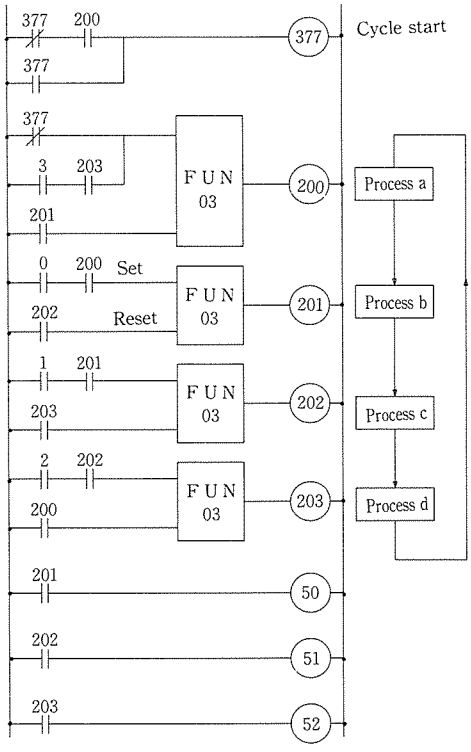
Program Using FUN02



Programming Procedure

(1) Write in a cycle start program. Output 377 is OFF immediately after operation start, and thus control moves to process a (internal output 200 ON). It is then turned ON when the next scan start, and remains in the same status. If data is to be protected from power failure, it should be stored in the internal output which has been protected from power failure.
(2) The input condition of FUN02 should be programmed with the internal output of the previous process and the AND of stepping condition.
Output should be made active by turning OFF the previous process and specifying the process to be run next.
Thereafter, programming should be made sequentially for each process.

Program Using FUN02



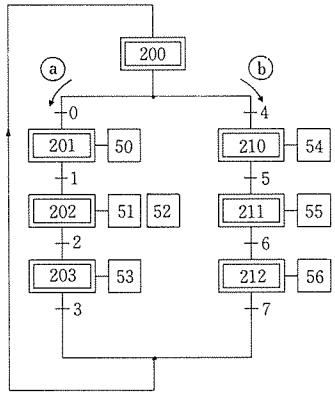
Programming Procedure

(1) Cycle start program to be used here is the same as that provided with FUN02.

(2) FUN03 includes set input and reset input. The former should be programmed with the internal output of the previous process and the AND of stepping condition. The latter should be represented by the internal output of the next process.
Thereafter, programming should be made sequentially for each process.

Application Examples of Process Stepping IF Command (2)

Graph Set



Description

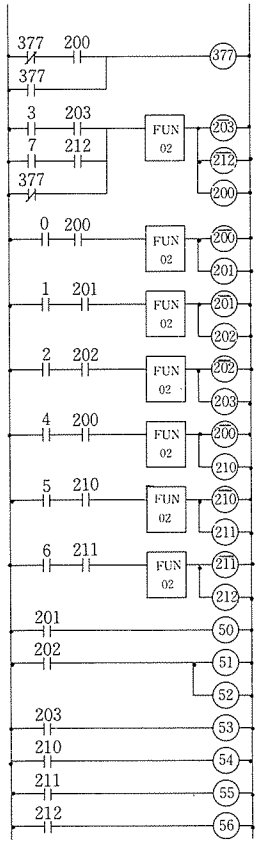
(1) The system is put in process 200 (initial status) at operation start.

(2) When input 0 is turned ON, line (a) is executed, and then input 4 is ON, line (b) is run. In other words, either up line (a) and (b) is executed according to whether input 0 or 4 is turned ON.

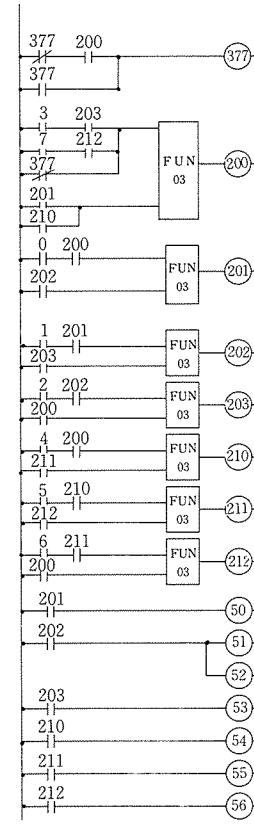
(3) In line (a), control steps to process 210, 202, and 203 in this order. When stepping condition input 3 is turned ON, then control 1 returns to process 200.

(4) In line (b), control steps to process 210, 211, and 212 in this order. When stepping condition input 7 is turned ON, then control returns to process 200.

Program Using FUN02

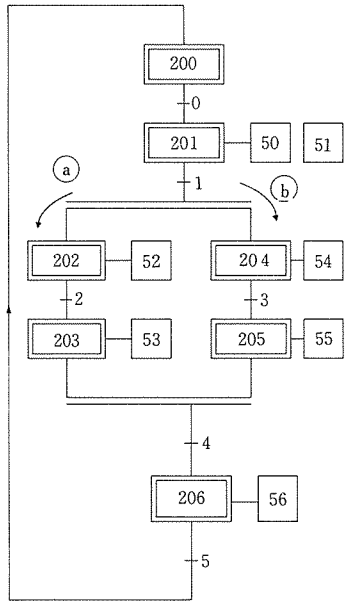


Program Using FUN03



Application Examples of Process Stepping IF Command (3)

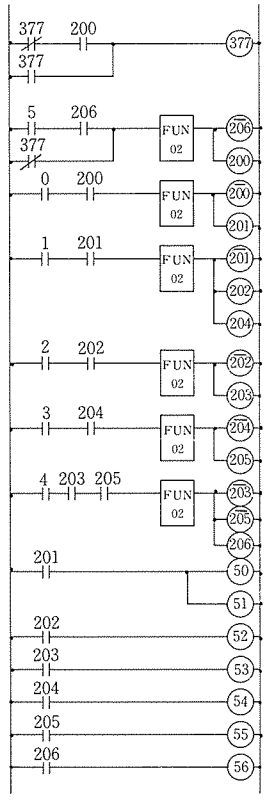
Graph Set



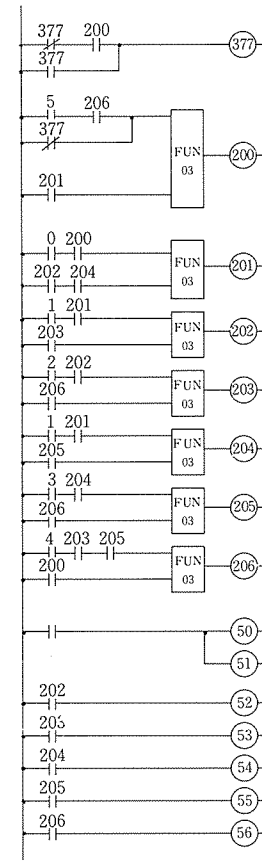
Description

(1) The system is put in process 200 (initial status) at operation start.
(2) When input 0 is turned ON, control steps to process 201, and outputs 50 and 51 are turned ON.
(3) When input 1 is turned ON, control steps to processes 202 and 204 simultaneously, and lines (a) and (b) are executed simultaneously in parallel.
(4) In line (a), control steps to process 203 when input 2 is turned ON.
(5) In line (b), control steps to process 205 when input 3 is turned ON.
(6) When input 4 is turned ON in processes 203 and 205, control steps to process 206. Note that control does not step to process 206 with line (a) in process 203 and line (b) in process 204 ; both lines (a) and (b) will step to process 206 simultaneously.
(7) When input 5 is turned ON in process 206, then control returns to process 200.

Program Using FUN02



Program Using FUN03



5. PERIPHERAL EQUIPMENT

5-1 Name of Programmer Parts

Fig. 5-1 shows the names of programmer parts, and Fig. 5-2 shows the external dimensions.

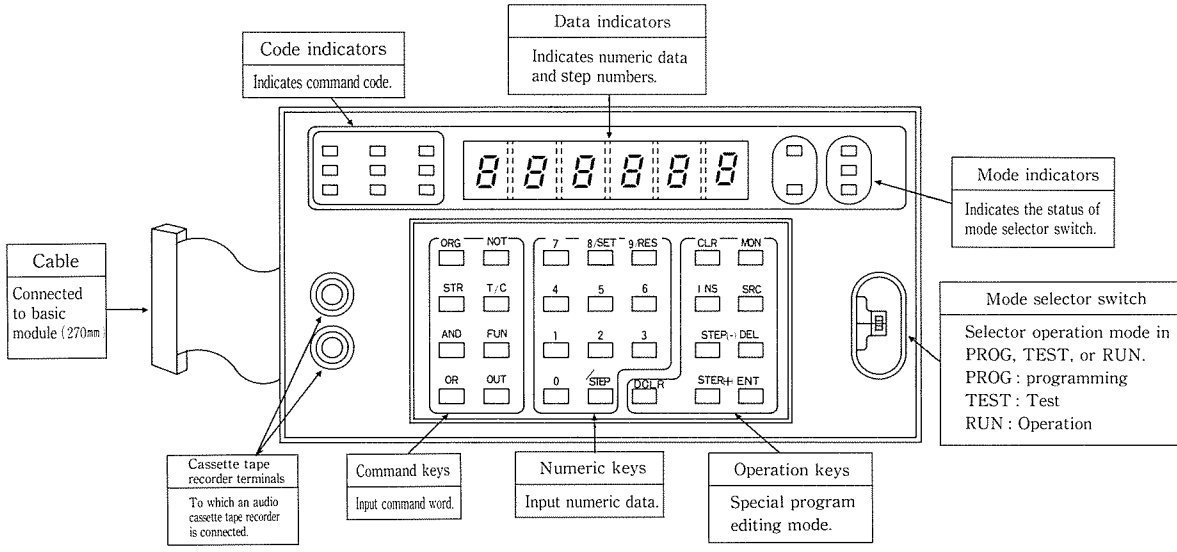


Fig. 5-1 Standard Programmer (PGMJ)

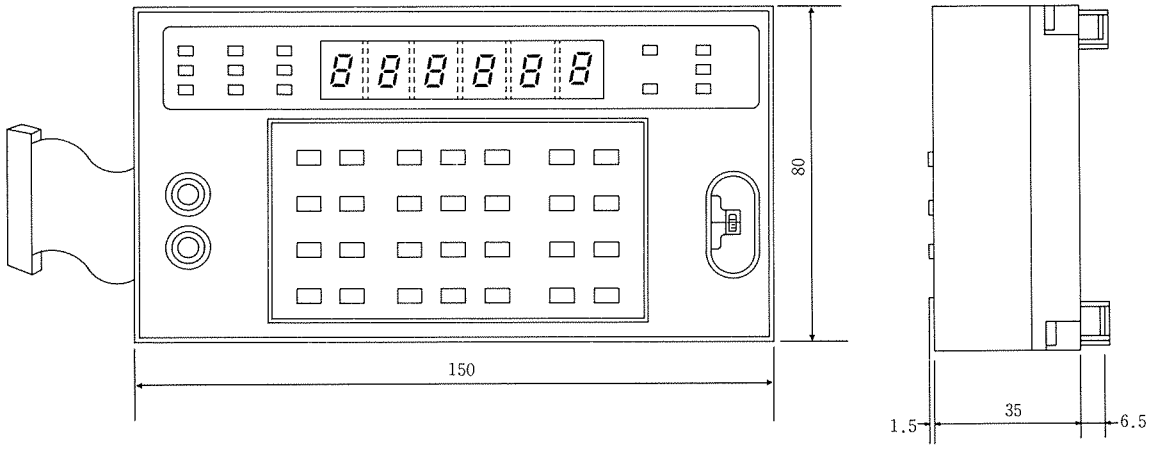


Fig. 5-2 External Dimensions of Standard Programmer

Fig. 5-3 shows the names of universal programmer (PGMJ-R) parts, and Fig. 5-4 demonstrates its external dimensions.

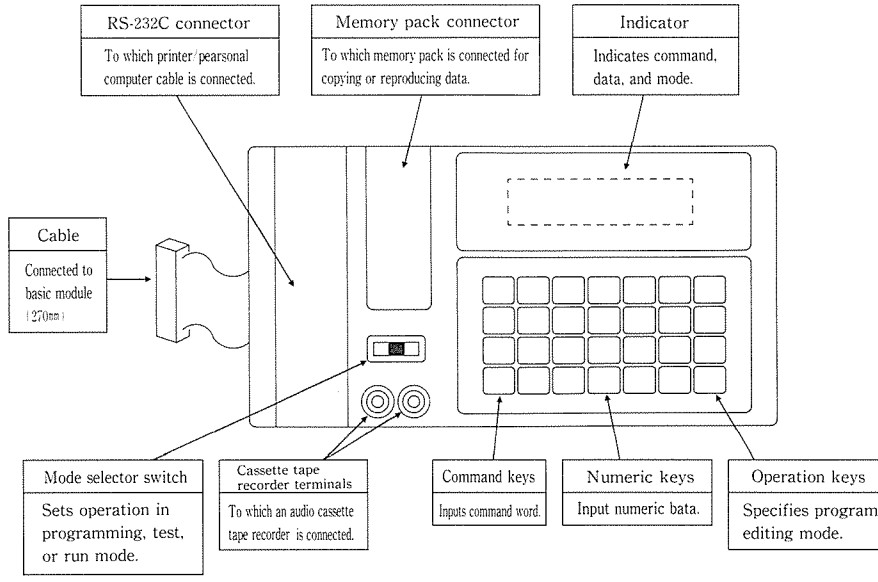


Fig. 5-3 Universal Programmer (PGMJ-R)

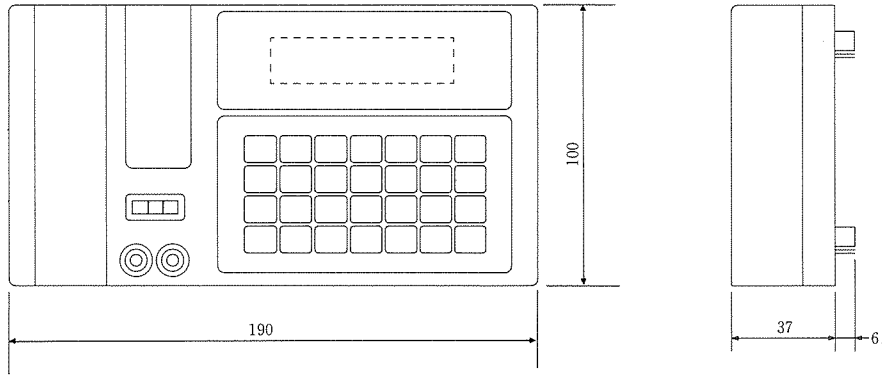


Fig. 5-4 External Dimensions of Universal Programmer

5-2 Specifications of Programmer

Table 5-1 lists the specifications of programmer.

Table 5-1 Fundamental Specifications of Programmer

Item \ Model			PGMJ	PGMJ—R
Functions	Programming function		Program all clear, Program write-in, Program read-out, Program search	
	Editing function		Program change, Program insertion, Program deletion	
	Monitoring function		Monitoring of input/output (confirmation of ON/OFF status) Monitoring of timer and counter confirmation of ON/OFF status)	
	Check function		Syntax check, Key-in procedure check, Input/output no. check	
	Test function		Forced output, Forced setting and resetting	
	CMT function	Recording (DUMP)	Basic unit → cassette tape	
		Reproducing (LOAD)	Basic unit ← cassette tape	
		Verification (VERIFY)	Basic unit memory ↔ cassette tape	
	ROM function	Copying (COPY)	Basic unit memory → memory pack	
		Reproducing (LOAD)	Basic unit memory ← memory pack	
		Verification (VERIFY)	Basic unit memory ↔ memory pack	
	Printer/personal computer function	Interface	———	RS—232C
		Synchronization		Asynchronous
		Bit rate		300, 600, 1,200, 2,400, 4,800 9,600, 19,200, 38,400, B.P.S (Selectable by DIP switch. Rate set to 4,800 B.P.S. before delivery)
		Word length		Start bit : 1 bit Data bit : 8 bits } Set before delivery Stop bit : 1 bit Any of other 6 kinds selectable by DIP switch
		Character code		ASCII (USA)
		Selection of function		Printer function or personal conputer function selectable by DIP switch
		Printer function		Code list, ladder diagram, and cross reference printed out
		Personal computer function		(1) Data sent or received to/from personal computer (2) Software of personal computer enables the following functions · Program write-in · Program read-out · Monitoring during operation
		Connectable peripheral equipment: Printer		Printer : EPSON RX-80II Interface circuit board : No.8145, or No.8148
		Connectable peripheral equipment: Personal computer		Recommended computer : IBM 5150/5160

Table 5-1 Fundamental Specifications of Programmer

Item \ Model			PGMJ	PGMJ—R
Indication/operation unit	Indication unit	Command indication	Indicated by LED	Liquid crystal display (provided with back-light) Data and step displayed simultaneously
		Data indication	Indicated by 6-digit numeric indicator	
		Step indication	Indicated by numeric indicator Data indicator commonly used (Data/step display switched over by pressing key)	
	Operation unit		8 command keys, 11 numeric keys, 9 operation keys, and mode selector switch (selection of PROG, TEST, or RUN mode)	

Table 5-2 shows the name of each key provided on the program

Table 5-2 Name of Each Key Provided on Programmer

Key Type	Key Symbol	Name	Function
Command key	ORG	Origin	Reads out the 1st data of a new circuit.
	STR	Store	Reads out the 1st data of a branch circuit.
	AND	And	Specifies that contacts are to be connected in series(logical product).
	OR	Or	Specifies that contactsare to be connected in parallel (logical sum).
	NOT	Not	Specifies logical negation.
	T/C	Timer/ Counter	Specifies a timer/counter.
	FUN	Function	Inputs a function command.
	OUT	Out	Specifies that data are to be sent to coil (output).
Data	0 ~ 9		Inputs a numeric ranging from 0 to 9.
	.		Inputs a decimal point.
Operation key	CLR	Clear	Initializes a program.
	DCLR	Data Clear	Clears a data or command indicated.
	INS	Insert	Inserts a program.
	DEL	Delete	Deletes a program.
	MON	Monitor	Monitors a program.
	SRC	Search	Searches a program.
	ENT	Enter	Writes in a program.
	STEP	Step	Switches over LED indication from step to data or vice versa.
	SET	Set	Forced Set
	RET	Reset	Forced Reset
	STEP(+)	Step Plus	Moves a program step forward step by step.
	STEP(-)	Step Minus	Moves a program step backward step by step.

5-3 Name of Interface Module Parts

Fig. 5-5 shows the names of interface module parts.

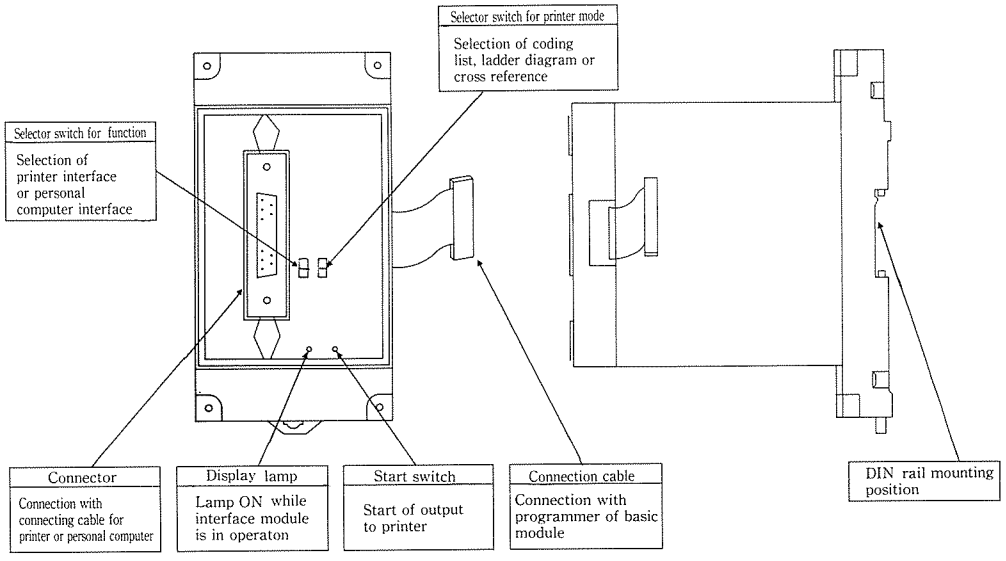
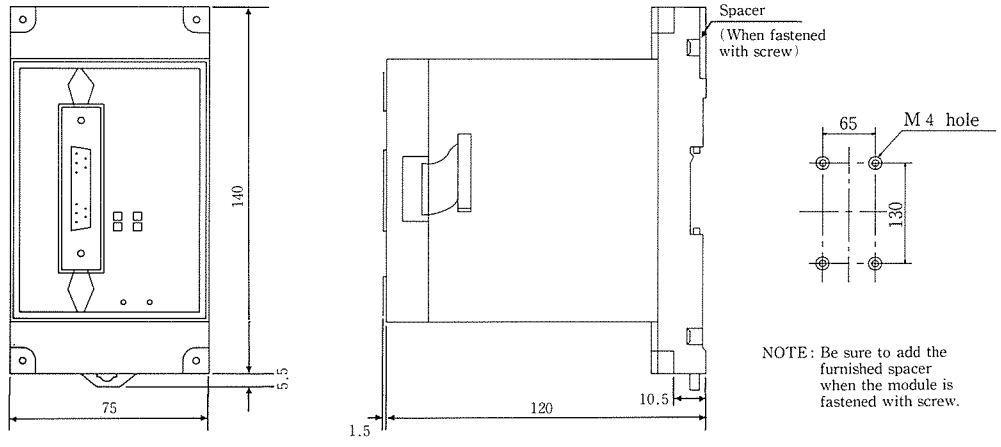


Fig. 5-5 Names of Interface Module Parts



5-4 Functional Specifications of Interface Module

Table 5-3 lists the specifications of interface module.

Table 5-3 Specifications of Interface Module〈PifJ〉

No	Item		Specifications	
1	Interface		RS—232C	
2	Synchronization method		Asynchronous method	
3	Bit rate		300, 600, 1,200, 2,400, 4,800, 9,600, 19,200, 38,400 B.P.S. (Changeable with incorporated DIP switch; set at 4,800 B.P.S. before delivery)	
4	Word length		Start bit: 1 bit, data bit: 8 bits, stop bit: 1 bit (Set befose delivery) (Any of other 6 types selectable with incorporated DIP switch)	
5	Character code		ASCII (USA)	
6	Selection of function		Printer interface or personal computer is selected by selector switch provided on front panel of interface module.	
7	Function	Printer interface function	Code list, ladder diagram and cross reference are printed out (changeable with print mode selector switch)	
		Personal computer interface function	(1) Data communication with personal computer possible (2) Following functions possible with software of personal computer ① Program write-in ② Program read out ③ On-line monit ring	
8	Recommendable peripheral equipment		Printer	Printer: EPSON RX-80II, FX-80 Interface board: No.8145, or 8148
			Personal computer	IBM 5150/5160

5-6 Programming with Personal Computer

Programming can be made with a personal computer which is connected to either the universal programmer or interface module for utilizing the software package exclusive for the computer. Table 5-4 lists the programming specifications with a personal computer. The software is sold separately.

Table 5-4 Programming Specifications with Personal Computer

Specifications			Off-Line	On-Line				
				PROG	TEST		RUN	
					Stop	Operation	Stop	Operation
Function	Editing function (EDIT)	Program read-out (READ)	○	○*	○*	○*	○*	○*
		Program write-in (WRITE NEXT)	○	○*	×	×	×	×
		Program change (CHANGE)	○	○*	×	×	×	×
		Program deletion (DELETE)	○	○*	×	×	×	×
	Program all clear (PROG CLEAR)		○	○*	×	×	×	×
	Label addition (LABEL)		○	○*	×	×	×	×
	Forced output function (FORCE OUT)		×	×	○	×	×	×
	Monitoring function (MONITOR)	Monitoring of input/output ON/OFF Monitoring of current value read by timer/counter	×	×	×	×	×	○
	Operation/stop control function (START/STOP)		×	×	○	×	○	○
	Mode select function (RUN/TEST/PROG)		×	○	○	×	○	×
	Program write-in from PC to E series (WRITE)		×	○	×	×	×	×
	Program read-out from PC to E series (READ)		×	○	×	×	×	×

NOTE : The item marked *indicates a processing to be made to data disk ; no processing is made to E series.

Two software packages are available as shown in Table 5-5. They are ready for delivery on request.

Table 5-5 Software Packages Available

Model	Personal computer
J—LDR (IBM5150)	IBM 5150/5160 (512k Bytes or more)

For the handling procedure of the interface module and the programming method of personal computer, refer to the following instruction manuals.

- ○ Interface module : Instruction manual for interface module (PIFJ)
- ○ Programming procedure : Instruction manual for J-16 programming software (sold separately)

6. OPERATION PROCEDURE

6-1 Outline

Fig. 6-1 shows the procedures which should be performed before operation.

(1) **All Clear**
Clear the memory when a new programming is to be made.

(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 erroneous programming.

(4) **Search**
Search for desired input/output no., step no., or command.

(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 with a forced output. Correct the wiring if there is any problem.

(8) **Operation**
Proceed with operation after completing test run.

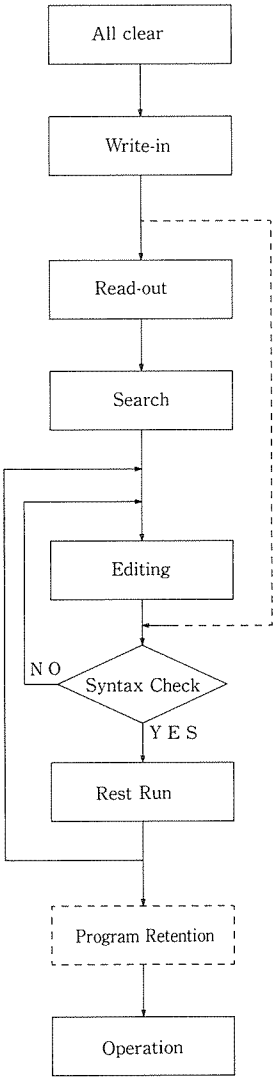


Fig. 6-1 Procedures before Operation

Table 6-1 shows a list of programmer key-in procedures.

The key-in procedures shown in the table are common to both the standard programmer and universal programmer. The contents of display shown in the above table are those of the standard programmer.

Table 6-1 Programmer Key-in Procedures

No	Function		Key-in Procedure	Contents of Display: Step No.	Data: Data	Data: —	Set value	Current value	Conductivity	☼ DATA	☼ STEP	Mode: PROG	Mode: TEST	Mode: RUN	Operation	Stop
1	Program all clear		CLR ENT DEL			○				○		○	×	×	×	○
2	Write-in	Write-in of new program	CLR ENT DEL → Generation of program for each step → ENT; Continuous write-in		○		○			○		○	×	×	×	○
		Write-in of additional program	CLR STEP − → Generation of program for each step → ENT; Continuous write-in		○		○			○		○	×	×	×	○
3	Read-out	Starting from step 000	CLR STEP +		○		○		○	○		○	○	○	○	○
		Starting from specified step	CLR Step No. STEP −		○		○		○	○		○	○	○	×	○
		After searching from I/O command	CLR Input/output No. or command SRC		○		○		○	○		○	○	○	○	○
		First step of unprogrammed area	CLR STEP −			○				○		○	○	○	○	○
			STEP + or STEP − : 1 step forward or backward													
	Switch-over of data display/ step display		Read-out STEP − (Data/step display can be switched over with this STEP − key)	○			○					○	○	○	○	○
4	Search	Input/output no.	CLR Input/output No. SRC → STEP + or STEP − → SRC		○		○		○	○		○	○	○	○	○
		Command word	CLR Command word SRC → STEP + or STEP − → SRC		○		○		○	○		○	○	○	○	○
		Command word + input/output no.	CLR Command word Input/output No. SRC		○		○		○	○		○	○	○	○	○
5	Editing	Insertion	Read-out of program to be inserted DCL Generation of step to be deleted INS		○		○			○		○	×	×	×	○
		Deletion	Read-out step to be deleted ↓ DEL		○		○			○		○	×	×	×	○
		Change	Read-out of step to be changed DCL Generation of program to be changed ENT		○		○			○		○	×	×	×	○
6	Monitor	Contact: External input/output, internal input/output Timer, counter	CLR Input/output No. MON; CLR 1/c Timer/counter No. MON → STEP + or STEP −		○				○	○		×	○	○	○	×
					○				○	○		×	○	○	○	×
		Coil: External output, internal output	CLR OUT Input/output No. MON → STEP + or STEP −		○				○	○		×	○	○	○	×
			CLR OUT 1/c Timer/countertNo. MON		○			○		○		×	○	○	○	×
7	Check.	Syntax check	CLR SRC	○							○	○	×	×	×	○
8	Maintenance function	Forced output: Forced set/reset	CLR SET SET ENT FUN 3 OUT External output No. SET or RES		○				○	○		×	○	×	×	○
			CLR OUT Internal output No. MON SET or RES		○				○	○		×	○	○	○	×
			CLR OUT 1/c Timer/counter No. MON SET or RES		○				○	○		×	○	○	○	×

6-2 All Clear

Function	Mode	Operational Status
All Clear	 PROG	Stop

● Key-in Procedure and Display

Key-in Procedure	Display			Remarks
	Command	Numerical Display	Mode Display	
CLR			● PROG ● DATA	
ENT		E		
DEL		-		All Clear Complete

Description

1. Be sure to perform "All Clear" before writing in new programs.
2. The "All Clear" enables clearing all programs.
   1) Timer/counter data are cleared.
   2) The contents of shift register are reset.
   3) Internal outputs protected from power failure are all reset.

Switchover of Data/Step No. Display

1. In usual operation, data are displayed by the LED ; step no. is not displayed. Depressing the STEP key enables switching over the data display to step no. display. To put back the step no. display to data display, depress the STEP key.

Key-in Procedure	Display			Remarks
	Command	Numerical Display	Mode Display	
CLR ENT DEL		-	● PROG ● DATA	Data Display
STEP		0	● PROG ● STEP	Step No. Display
STEP		-	● PROG ● DATA	Data Display

Description

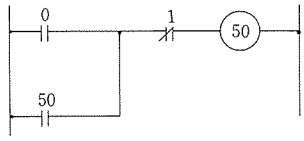
1. If "All Clear" is keyed in with 950-step program written in, a maximum of 4 sec is required before completing the "All Clear" (during which time programmer display remains off). The "All Clear" is completed when (underline) appears on the display. It will take a maximum of 8 sec before all clearing 2k steps (1,970 steps).
2. The contents of display shown in the above table are those when key-in is made via the standard programmer.
   Hereafter, description will be made in accordance with the display of the standard programmer.

6.3 Write-in

(1) Write-in of New Program

Function	Mode	Operational Status
Write-in of new program	 PROG	Stop

● Sequence



● Key-in Procedure and Display

Key-in Procedure	Display		
	command	Numerical Display	Mode Display
CLR ENT DEL		-	● PROG ● DATA
ORG 0 ENT	● ORG	0	
OR 5 0 ENT	● OR	50	
AND NOT 1 ENT	● AND ● NOT	1	
OUT 5 0 ENT	● OUT	50	

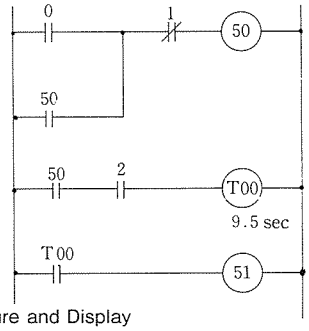
Description

1. Depressing the ENT key enables writing in the data currently shown by the LED into the memory, and displaying the command written at the next step.
2. The contents of the display exemplified above are those before depressing the ENT key.

(2) Write-in of Additional Program

Function	Mode	Operational Status
Write-in of Additional Program	PROG	Stop

● Sequence



● Key-in Procedure and Display

Key-in Procedure	Display		
	Command	Numerical Display	Mode Display
CLR STEP		-	● PROG ● DATA
ORG 5 0 ENT	● ORG	0	
AND 2 ENT	● AND	2	
OUT T/C 0 0 0 9 · 5 ENT	● OUT ● T/C	0009.5	
ORG T/C 0 ENT	● ORG ● T/C	0	
OUT 5 1 ENT	● OUT	51	

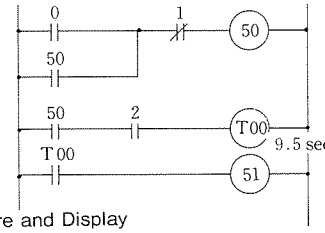
Description

1. Depressing the CLR STEP keys enables displaying the first step of empty program.

6.4 Read-out

Function	Mode	Operational Status
Read-out of Program	PROG TEST RUN	Operation/stop

● Sequence



● Key-in Procedure and Display

Key-in Procedure	Display		
	Command	Numerical Display	Mode Display
CLR STEP+	● ORG	0	● DATA
STEP+	● OR	50	
STEP+	● AND ● NOT	1	
STEP+	● OUT	50	● PROG ● TEST ● RUN
STEP+	● ORG	50	
STEP+	● AND	2	
STEP+	● OUT ● T/C	0009.5	
STEP+	● ORG ● T/C	0	
STEP+	● OUT	51	

Description

1. Programs can be read-out from step no. 000, or the step no. specified, or the input/output no. subsequent to the one searched.

Program Read-out	Key-in Procedure
Read-out from step No. 000	CLR → STEP+ → STEP+ or STEP−
Read-out from the input /output No.specified	CLR → Input/output No. → SRC → STEP+ or STEP−
Read-out from the command specified	CLR → Command → SRC → STEP+ or STEP−
Read-out from the command specified + input/output No.	CLR → Command → Input output No. → SRC → STEP+ or STEP−
Read-out from the step No. specified	CLR → Step No. → /STEP → STEP+ or STEP−

During operation, a program can be read starting from the step number specified.

6.5 Search

Function	Mode	Operational Status
Search of Program	PROG TEST RUN	Operation/stop

Classification		Key-in Procedure	Display: Command	Display: Numerical Display	Display: Mode Display	Remarks
Search from input/output No.	Input/output	CLR → 5 0 SRC (Input/output No.) → SRC → SRC	• OR • OUT • ORG	50 50 50	• DATA (• PROG • TEST • RUN)	Search for external output 50
	Timer/counter	CLR → T/C 0 0 SRC (Timer No.) → SRC	• OUT T/C • ORG T/C	0009.5 0		Search for timer T00
Search from command word		CLR → ORG SRC (Command word) → SRC → SRC	• ORG • ORG • ORG T/C	0 50 0		Search for ORG command
Search from command word + input/output No.		CLR → OUT 5 0 SRC (Command word + No.) → SRC	• OUT	50 -		Search for OUT50
Search from step No.		CLR → 5 → STEP (Step No.) → STEP+ → STEP+	• AND • OUT T/C • ORG T/C	2 0009.5 0		· Search for step No. 5 · Search cannot be made during operation

Description

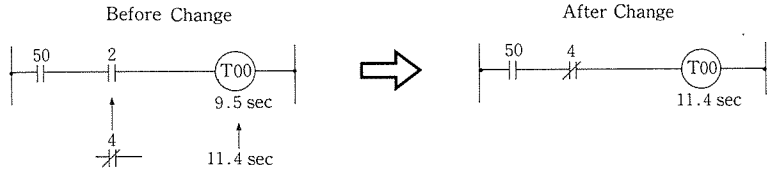
1. When you specifying an external input/output No., internal output No., timer No., counter No., or command, followed by depressing the SRC key, the input/output No. or command specified will be displayed. When the SRC key is depressed again, search is started in the order of step Nos. to find the data located next to the input/output No. or command specified. The data found will then be displayed.
2. If the number specified is not found in the programs, the LED will indicate the command (underlined command) preceding the memory area in which no program has been written in.
3. Upon comletion of searching, the programs written at the steps preceding and following the searched one will SRC displayed by depressing the STEP+ or STEP- key.
4. Search is started by deressing the SRC key. The display currently shown by the LED goes off, and the data searched will then be displayed.
5. When program is to be searched starting from a step No., the one whose step No., is 950 or higher cannot be searched. Such program should be searched with a different method.
6. It is impossible to search the program by the step No. during operation

6.6 Editing

(1) Change of Program

Function	Mode	Operational Status
Change of Program	PROG	Stop

● Sequence



● Key-in Procedure and Display

Key-in Procedure	Display		
	Command	Numerical Display	Mode Display
CLR AND 2 SRC	● AND	2	● DATA
DCLR			
AND NOT 4	● AND ● NOT	4	
ENT	● OUT ● T/C	0009.5	● PROG
DCLR			
OUT T/C 0 0 1 1 • 4 ENT	● OUT ● T/C	0011.5	

Display

1. Read-out data from the step to be changed. Depress the DCLR key to clear the command and data currently shown by the LED. Write a new program beginning with a command, and then depress the ENT key to complete the program chage for one step. The previous program remains ON if you do not depress the ENT key.
2. New program can be written unless DCLR key is depressed, but it is better to write new program after DCLR .
3. The preset value of timer/counter can be changed by entering a new value as examplified below after searching for the coil.

CLR OUT T/C 0 0 SRC ··· Searching for timer T00 coil

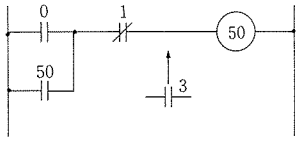
1 1 • 4 ENT ··· Write-in of new preset value

(2) Insertion of Program

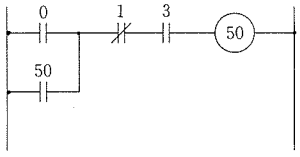
Function	Mode	Operational Status
Insertion of Program	 PROG	Stop

● Sequence

Before Insertion



After Insertion



● Key-in Procedure and Display

Key-in Procedure	Display		
	Command	Numerical Display	Mode Display
CLR OUT 5 0 SRC	● OUT	50	● DATA ● PROG
DCLR			
AND 3	● AND	3	
INS	● OUT	50	

Description

1. Read-out the step following the one into which a program is to be inserted. In the above example, output coil 50 is searched since a program is to be inserted into the coil. Depress the DCLR key to clear the command and data currently shown by the LED, write the program to be inserted, and then depress the INS key to complete inserting the new program. Upon completion of deprssing the INS key, the LED will indicate the next step No.. Note that the step Nos. of the programs following the one inserted will be automatically incremented by one.
2. Upon completion of inserting the new program, be sure to perform program check (CLR SRC) to ascertain that there is no erroneous program entry.
3. An error will occur when you try to insert a program with the memory area fully loaded ; program will not be inserted.

AND 5 INS ● AND

Memory overflow display

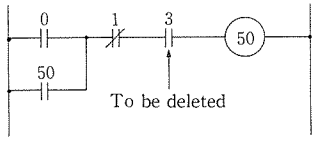
4. If a program Insertion is made to the first step of a program consisting of 900 steps, it will take about 3.6sec| before completing the insertion(during which time program display remains off).

(3) Deletion of Program

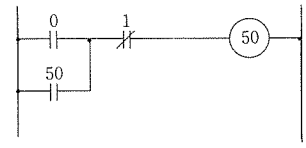
Function	Mode	Operational Status
Deletion of Program	 PROG	Stop

● Sequence

Before Deletion



After Deletion



● Key-in Procedure and Display

Key-in Procedure	Display		
	Command	Numerical Display	Mode Display
CLR AND 3 SRC	● AND	3	● DATA
DEL	● OUT	50	● PROG

Description

1. Read-out the step number from which a program is to be deleted. Depressing the DEL key enables deleting the step currently shown. The step No. of programs following the deleted one will automatically deleted by one.
2. Be sure to perform syntax check (CLR SRC) after deleting the program to make sure that there is no program error.
3. Avoid depressing the DEL key. Note that the steps shown by the LED will be sequentially deleted every time key is depressed.
4. If a program deletion is made to the first step of a program consisting of 900 steps, it will take about 3.6 sec before completing the deletion (during which time programmer display remains off).

6.7 Syntax Check

Function	Mode	Operational Status
Syntax Check	 PROG	Stop

Key-in Procedure	Judgement	Display			Remarks
		Command	Numerical Display	Mode Display	
CLR SRC	There is no error in program.		300	• PROG • STEP	Displays the 1st step of unprogrammed area.
	There is an error.		115 E		Indicates that an error is found in step 115.

Description

1. Be sure to perform syntax check down to the END command after writing in a program. When no error is found in the program, the first step of unprogrammed area will be displayed. Syntax check should be made down to FUN99 (END command) if the command has been inserted into the program.
2. The following table shows error displays and remedies.

Table 6-2 Error Displays and Syntax Check

Error Display	Items to be checked	
Step No. E		• Is ORG (ORG NOT) place at beginning of circuit? • Are FUN05 and FUN07 positioned properly?
Step No. n	Stack-over error	• Is STR (STR NOT) used 4 times or more in one circuit? • Is FUN04 used more than 4 times in one circuit? • Is FUN06 used more than twice in one circuit ? • Is FUN05 used for FUN 04? • Is OUT CNT, FUN03, FUN40, FUN 45, FUN47, or STR (STR NOT) used too much? • Is AND STR (OR STR) used too much for STR (STR NOT) ?
Step No. u - (END step) u	Stack-under error	• Is AND STR (OR STR) insufficient for STR (STR NOT)? • Is STR (STR NOT) insufficient for OUT CNT, FUN03, FUN40, FUN45, and FUN47? • Is FUN05 insufficient for FUN04? • Is FUN07 insufficient for FUN06? • Is OUT insufficient?
Step No. E.	Dual coil error	• Has dual coil been specified? (NOTE)
Step No. F	Framing error	• Is a command bit missing? • Is a data bit missing?

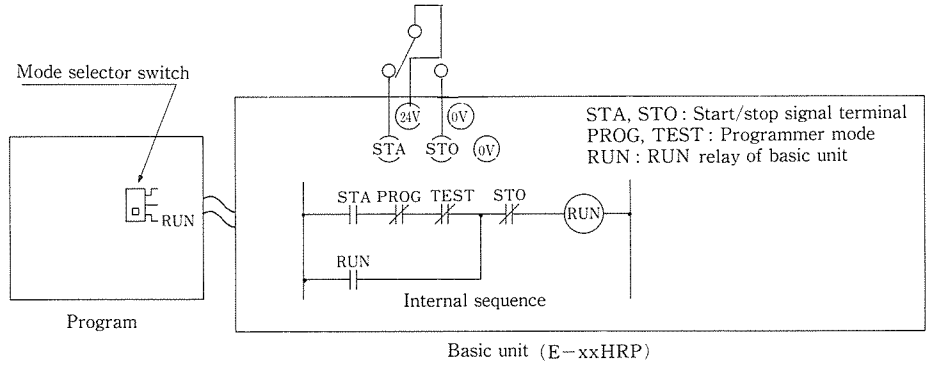
NOTE 1 : No error will occur even if dual coil is specified for the output coil following FUN02, FUN03, and FUN06.
NOTE 2 : For the command (shift register, up/down counter, tranfer, or compare command, for example), only the specified number should be checked for dual coil error.

6.8 Test Run and Operation

Write in a program, and then check the program for syntax error. Make sure that there is no syntax error, and then proceed with test run.

(1) Start/Stop Procedure

Function	Mode	Operational Status
Start/Stop Procedure	RUN	Operation stop



Description

1. Start and stop will be controlled via the start terminal (STA) and stop terminal (STO) of the basic unit. Start/stop signal is automatically processed in accordance with the above sequence in the basic unit. The sequence is as follows.
   (1) Operation with programmer connected :
   - Set the programmer mode selector switch to RUN, and turn ON the start signal. This allows the system to start operation.
   - Operation will continue regardless of whether the mode selector switch is set to "PROG" or "TEST".

   (2) Operation with programmer disconnected :
   Operation is started when start signal is turned ON.
   (3) Operation is started by turning ON the power with start signal ON.
   (4) Once the system is started, operation will continue even if start signal is turned OFF.
2. The RUN relay of the basic unit is activated immediately after the system is started. At the same time, the RUN lamp comes on
3. To stop the system operation, turn ON stop signal. If both start and stop signals are ON, priority is always given to stop signal.
4. The programmer can be mounted or dismounted while the basic unit power is ON. In so doing, to mode of the basic unit will be as follows.
   (1) When the programmer is dismounted, the mode will become the same as when the programmer mode selector switch is set to "RUN".
   (2) When the programmer is mounted, the operation will continue regardless of the current programmer mode. In order to much the basic mode with the programmer mode selector switch mode, the operation should be stopped, or the power switch of the basic unit should be turned OFF and then ON.

(2) Continuous Monitoring of Input/Output Numbers and Confirmation of Operational Status

Function	Mode	Operational Status
Continuous Monitoring of Input/Output Numbers and Confirmation of Operational Status	 RUN	Operation

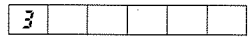
● Key-in Procedure and Display

Classification	Key-in Procedure	Display: Command	Display: Numerical Display	Display: Mode Display	Remarks
External or internal input/output (contact)	CLR, STEP +, Input/output No., MON		1 . 2		External input 1, ON External input 2, OFF
External or internal output (coil)	CLR, OUT, STEP +, Input/output No., MON	● OUT ● OUT	201 . 202	● DATA ● RUN	Internal output 201, ON External output 202, OFF
Timer/counter (contact)	CLR, STEP −, T/C, No., MON	● T / C ● T / C	10 . 7	(● TEST)	Timer 10, ON Timer 7, ON
Timer/counter (contact)	CLR, STEP +, OUT, T/C, No., MON	● OUT ● T / C ● OUT ● T / C	60 005 61 010		Counter 60, current value Counter 61, current value

Description

1. External input/output No. will be displayed by the LED. Further, the operational status of timer/counter contact "a" is also indicated with a dicimal point at the 2nd digit counting from the lowermost digit of the numerical display LED.

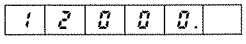
Input 2 ON



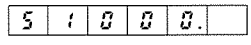
Input 3 OFF

● On when a decimal point (.)appears.
OFF when a decimal point (.)does not appear.

2. When the coil of timer/counter is monitored, the value read by the timer/counter will be displayed in decrement. When the timer/counter reads the time-up value, then a decimal point comes on at the 2nd digit counting from the lowermost digit on the LED.



Timer 12 Time-up



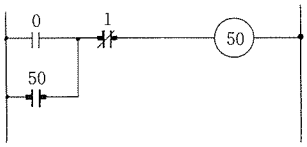
Counter 51 Count-up

3. Input/output number and timer/counter number will be incremented by one every time the MON key is depressed, followed by the STEP + or STEP − key. This function enables you to check if the numbers are assigned serially.

(3) Conduction Check

Function	Mode	Operational Status
Conduction Check	 RUN	Operation

● Sequence



Contacts 1 and 50 ··· Conductive
Contact 0 ··· Non-conductive

● Key-in Procedure and Display

Key-in Procedure	Display			※Remarks
	Command	Numerical Display	Mode Display	
CLR OUT 5 0 SRC	● O U T	5 0 •	● D A T A ● R U N	Indicates that output 50 is ON.
STEP —	● A N D ● N O T	1 •		Indicates that contact is conductive.
STEP —	● O R	5 0 •		〃
STEP —	● O R G	0		Indicates that contact is non-conductive.

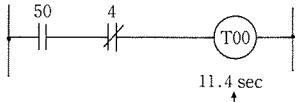
Description

1 . This function enables you to check the contacts contained in the circuit sequentially for conduction. That is, when a contact is conductive, a decimal point (•) will appear at the 2nd digit counting from the lowermost of the numerical display.

(4) Change of Timer/Counter Preset Value During Operation

Function	Mode	Operational Status
Change of Timer/Counter Preset valne during Operation	TEST	Operation

● Sequence



● Key-in Procedure

To be changed to 120 sec

Key-in Procedure	Display			Remarks
	Command	Numerical Display	Mode Display	
CLR OUT T/C 0 0 SRC	• OUT • T / C	0011.4	• DATA	Search for timer 00
1 2 0 ENT	• OUT • T / C	0012 0	• RUN	Write-in of new Preset value

Description

1 . This function enables searching a timer or counter for which the existing preset value is to be changed. The existing preset value will be changed to a new value by programming the new value and then depressing the ENT key. Note, however, that :

1) If the existing preset value is changed to a new one during durig timer operation, the timer continues operation on the value set previously. It will then operate on the new value after completing the existing time count.

2) The same also goes with the counter. That is, when the existing preset value is changed durig counter operation, the counter continues operation on the value set previously. It will then operate on the new value after completing the existing count.

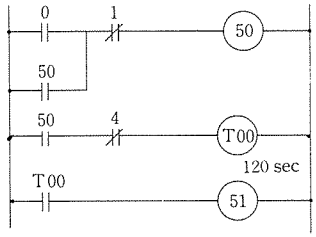
CAUTION

1 . The system hardware will not allow the memory of the basic unit to be rewritten when the programmer mode selector switch is set to "RUN". Be sure to set the mode selector switch to "TEST" before changing the preset value of timer/counter. The selector switch should be set back to "RUN" after completion of changing preset value to a new value.

(5) Forced Set or Reset

Function	Mode	Operational Status
Forced Set (ON) or Reset (OFF) of Internal Output. Timer, and Counter	TEST RUN	Operation

● Sequence



● Key-in Procedure and Display

Key-in Procedure	Display			Remarks
	Command	Numerical Display	Mode Display	
CLR OUT T/C 0 0 MON	● OUT ● T / C	00108	● DATA ● RUN	Monitoring the current value of timer T00
SET	● OUT ● T / C	00000.		Forced set · Timer T00 ON Output 51 ON
CLR				Release of forced set

Description

1 . Test run can be made efficiently through the forced set or reset of internal output, timer, or counter.
   1) Monitor the coil of internal output, timer, or counter to be forcibly set or reset.
   2) Depressing the SET key enables turning ON the coil (time-up for timer, count-up for counter).
   3) Depressing the CLR key releases the forced set or reset.

2 . Timer should be forcibly set only when the startup condition of the timer is ON (when the current value of the timer is down-counted). Similarly to this, counter should be forcibly set only when the reset input is OFF.
   ● Forced set or reset will be executed after the program covering one scan is calculated and then output. (For details, refer to 3.1 of Chapter 3.) If the output coil is forcibly set while the timer startup condition is not set (in the above example, contacts 50 and 4 are not conductive), the timer T00 will be turned OFF, and thus the output will not be turned ON. Note, however, that if the timer is monitored through the programmer, it will be displayed.

6.9 Recording and Playback to/from Audio Cassette Tape

Function	Mode	Operational Status
CMT Function	 PROG	Stop

● Key-in Procedure and Display

Function		Key-in Procedure: Tape recorder	Key-in Procedure: Programmer	Display: command	Display: Numerical Display	Display:	Display: Mode Display	Remarks
1	CMT function setting		CLR SET SET ENT FUN 1		C - - -	CMT function	· PROG · DATA	
2	Recording (DUMP)	Recording MIC ◎-□-□-◎ MIC (Programmer)(Tape recorder)	OUT ENT	● OUT	C - - P	Recording		Basic unit (EEPROM) ↓ Cassette tape recorder
					C - - -	Complete		
	Playback (LOAD)	Playback EAR◎-□-□-◎ Earphone (Programmer)(Tape recorder)	STR ENT	● STR	C - - H	Waiting for Start bit (30 sec)		Basic unit (EEPROM) ↑ Cassette tape recorder
					C - - P	Playing back		
					C - - -	Complete		
	Verification (VERIFY)	Playback EAR◎-□-□-◎ Earphone (Programmer)(Tape recorder)	AND ENT	● AND	C - - H	Waiting for start bit (30 sec)		Basic unit (EEPROM) ↕ Cassette tape recorder
					C - - P	Verifying		
					C - - -	Complete		
	Error display			● Command	C - - E	Key-in error		Depress CLR key to clear error, and retry.
					C b 2 E	Playback error		
					C 7 - E	Verification error		
					C 8 - E	Format error		
3	CMT function clear		CLR RES RES ENT					

※ Be sure to verify data after completion of recording or playback.

● Cassette Tape Recorder

Item	Description
Type of cassette tape recorder	Set 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.

CAUTION

1. Be sure to rewind the tape to the beginning before recording, playing back, or verifying a program.
2. If power is turned off, tape is taken out, or the CLR key is depressed during a process, then restart the key-in procedure from the beginning.
3. For data playback or verification, symbol H appear on the LED for about 30 sec until the tape is positioned at the start bit. If the symbol does not go off even after 30 sec, it means that nothing has been recorded on the tape. Record data again, or replace the tape with a proper one. The tape recorder cord without register should be used.
4. When a stereo cassette tape recorder is to be used, set the tape monaurally. Also turn fully clockwise (to max. position) the tone volume knob on the connection terminal side and the balance knob.
5. Execution time will be increased according to the number of program steps.
   Execution time ≒ 4 sec + number of steps × 0.22 sec

6.10 Copying and Loading to/from Memory Pack

(1) Key-in Procedure with Standard Programmer (PGMJ)

A combination of PGMJ and basic unit enables you to copy the contents of basic unit program to EEPROM memory pack (MPE-1E, MPE-2E). It is also possible to load the contents of memory pack (MPE-1E, MPE-2E, MPE-2R) to the basic unit. The following table shows the key-in procedures for the above operations.

Function	Mode	Operational Status
Copying and Loading to Memory Pack	 PROG	Stop

● Key-in Procedure and Display

Function		Key-in Procedure	Display: Command	Display: Numerical Display	Display: Mode Display	Remarks
Copying	1	Basic unit + PGMJ Power ON		P	● PROG ● DATA	Memory pack not installed
	2	CLR SET SET ENT		A - - -		Shift to ROM function mode
	3	STR ENT (Read-out)	● STR	A - -*P		Basic unit → Basic unit EEPROM RAM
	4	Turn power OFF, install memory pack, and turn power ON.		P		Memory pack prohibited to be attached/detached with power ON.
	5	CLR SET SET ENT		A - - -		Shift to ROM function mode
	6	OUT ENT (Write-in)	● OUT	A - - P		Basic unit → Memory pack RAM EEPROM
				A - - -		Copying complete
	7	AND ENT (Verification)	● AND	A - -*P		Verification
	8	CLR RES RES ENT				Clear of ROM function mode
Reproduction	1	Installation of memory pack Power ON after		P	● PROG ● DATA	
	2	CLR SET SET ENT		A - - -		Shift to ROM function mode
	3	STR ENT (Read-out)	● STR	A - - P		Memory pack → basic unit RAM
		AND ENT (Verification)	● AND	A - -*P		Memory pack ↔ basic unit RAM
	5	Turn power OFF, remove memory pack, and then turn power ON.		P		Memory pack prohibited to attach/detach with power ON.
	6	CLR SET SET ENT		A - - -		Shift to ROM function mode
	7	OUT ENT (Write-in)	● OUT	A - - P		Basic unit → basic unit RAM EEPROM
				A - - -		Loading complete
	8	CLR RES RES ENT				Clear of ROM function mode

*P is indicated for about 0.1 sec.

Description

When the programs contained in the basic unit are copied to the memory pack, or the contents of the memory pack are loaded to the basic unit, they are temporarily tranferred to the data RAM of the basic unit before being copied or loaded. In the key-in procedures shown in the above table, items 1 to 3 (copying function) and 1 to 4 (loading function) show data transfer to RAM.

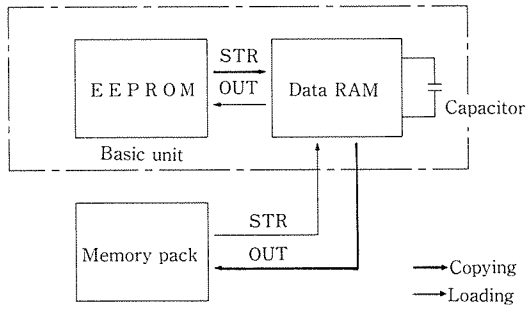


Fig. 6-2 Copying and Loading to/from Memory Pack

① The data RAM contained in the basic unit is backed up with a capacitor, and thus the contents are to be stored for about 2 weeks (at 25°C) even with power OFF.

② The contents of counter and internal output protected from power failure are stored in the data RAM of the basic unit. If they are copied or loaded to the memory pack, the contents protected from power failure are initialized. (In so doing, the internal output protected from power failure is turned OFF, and counter data is put back to the preset value.)

③ To copy data to 2 or more memory packs, repeat the procedures described in items 4 to 7 of copying function.

④ Data can be copied to the EEPROM memory pack by combining the standard programmer and basic unit, but they cannot be copied to the EPROM memory pack. The universal programmer (PGMJ-R) should be combined with the basic unit when data are copied to the EPROM memory pack.

⑤ If the program capacity (950 words) of the basic unit is not enough for adding new programs, a 2 k word EEPROM memory pack should be incorporated in the basic unit. If programs already written into the basic unit are to be copied to the 2 k word memory pack, perform the above mentioned copying operation.
Upon completion of copying them, additional programs can also be written into the memory pack.

CAUTION

1 . Do not attach nor detach a memory pack to/from the basic unit while the unit is energized. Be sure to turn OFF the power switch of the basic unit before attaching or detaching the memory pack.

Memory Pack Strictly Prohibited to be Attached or Detached during Power ON

2 . Be sure to clear the ROM function (CLR RES RES ENT) after copying or loading programs.
Otherwise, the system will not be RUN even if the power is turned OFF → ON, and start signal is turned ON.
(ｴﾗｰ will be displayed as an error.)
The following shows how to clear the error under the PROG mode.

CLR SET SET ENT ····· Shift to ROM function mode

CLR RES RES ENT ····· Clear of ROM function mode

7. INSTALLATION AND WIRING

7.1 Installation

(1) Dimensional Diagram of Basic Unit and Expansion Unit

Fig. 7-1 shows the external dimensions of basic unit and expansion unit, while Fig. 7-2 shows the demensions of mounting holes. The hight (H) and (D) shown in the figure are common to all models. Only the width (W) and the pitch (P) between horizontal mounting holes differ from those shown in the figure according to the respective models. Table 7-1 shows the W and P values of each model.

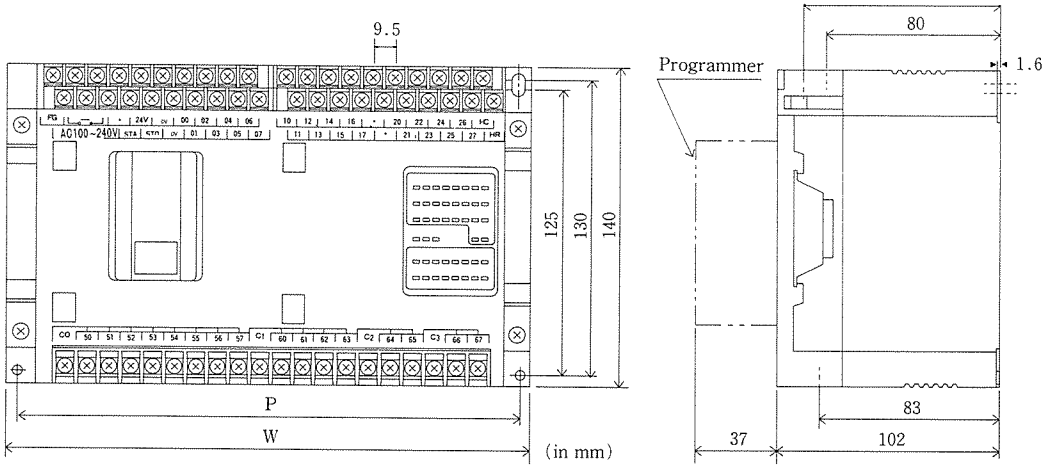


Fig. 7-1 Demensional Diagram of Basic Unit and Expansion Unit

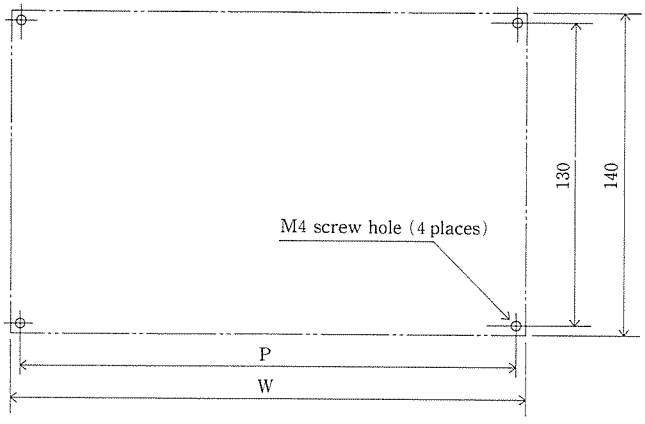


Fig. 7-2 Mounting Holes of Basic Unit and Expansion Unit

Table 7-1 P and W Values of Basic Unit and Expansion Unit

Item \ Model	E−20H R	E−28H R	E−40H R	E−64H R	E−64Z R	E−20F R	E−28F R
P	180	180	220	320	320	180	180
W	190	190	230	330	330	190	190

(in mm)

(2) Space Required for Expansion Module (J-16 Input/Output Module)

Fig. 7-3 shows the space required for the expansion module. The dimensions of 8-point module and 16-point module are the same except for the width (W) and pitch (P) between the horizontal mounting holes. Table 7-3 lists the W and P values of each model.

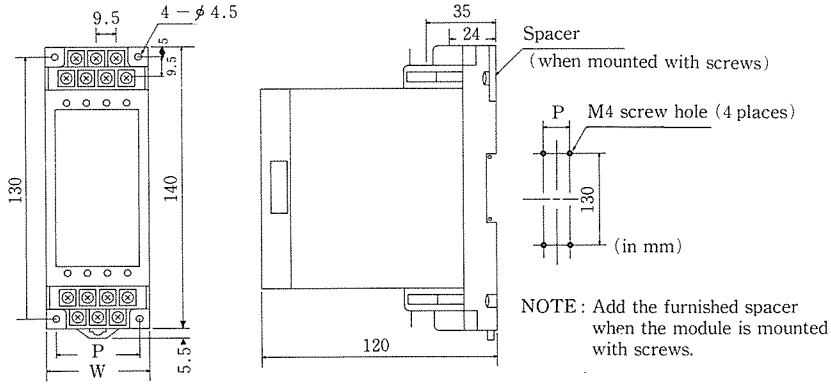


Fig. 7-3 Dimensional Diagram of Expansion Module

Table 7-2 P and W Values of Expansion Module

Item \ Model	8-point input/output module Combined input/output module	16-point input/output module Timer/counter module Independent contact module Optical transfer unit
P	40	65
W	50	75

(in mm)

(3) Space between Respective Units

① Provide a space of 50 mm or more above and below each unit for ventilation and maintainability. Also provide a space of 10 mm or more on the left and right sides of each unit for ventilation.

② When the expansion unit or module is mounted on its side, it should be kept apart 10 to 15 mm (20 to 25 mm in mounting holes) from the basic unit. If the expansion unit is mounted below the basic unit, connect them with an expansion cable of 0.6 m long, or 1 m long, or 1.5 m long.

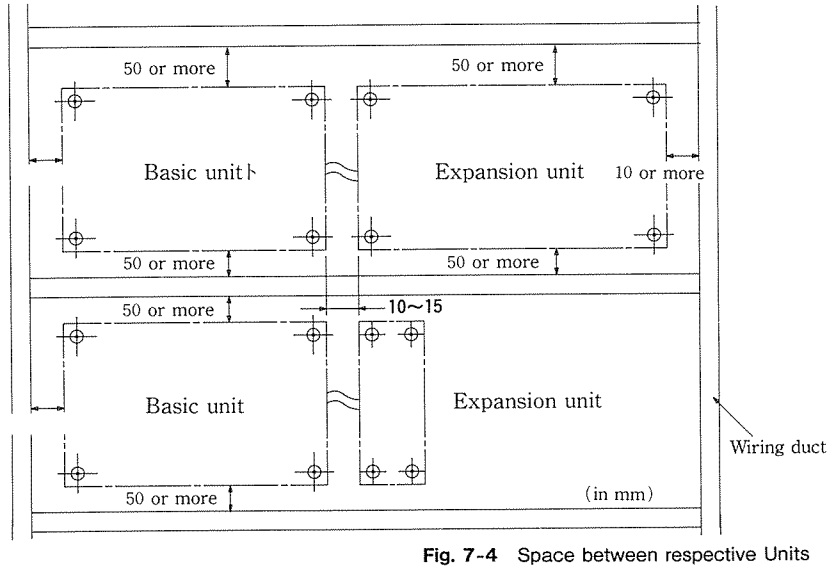
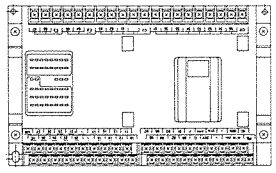


Fig. 7-4 Space between respective Units

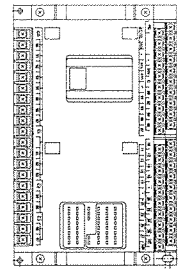
(4) Mounting Position

The basic unit and expansion unit can be mounted upside down or vertically, but should not be installed horizontally.



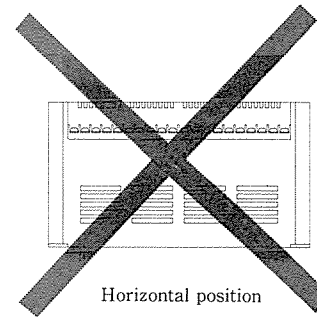
○

Upside down position



○

Vertical position



Horizontal position

7.2 Wiring and Related Equipments

(1) Power Source

Fig. 7-8 shows the power source of E series.

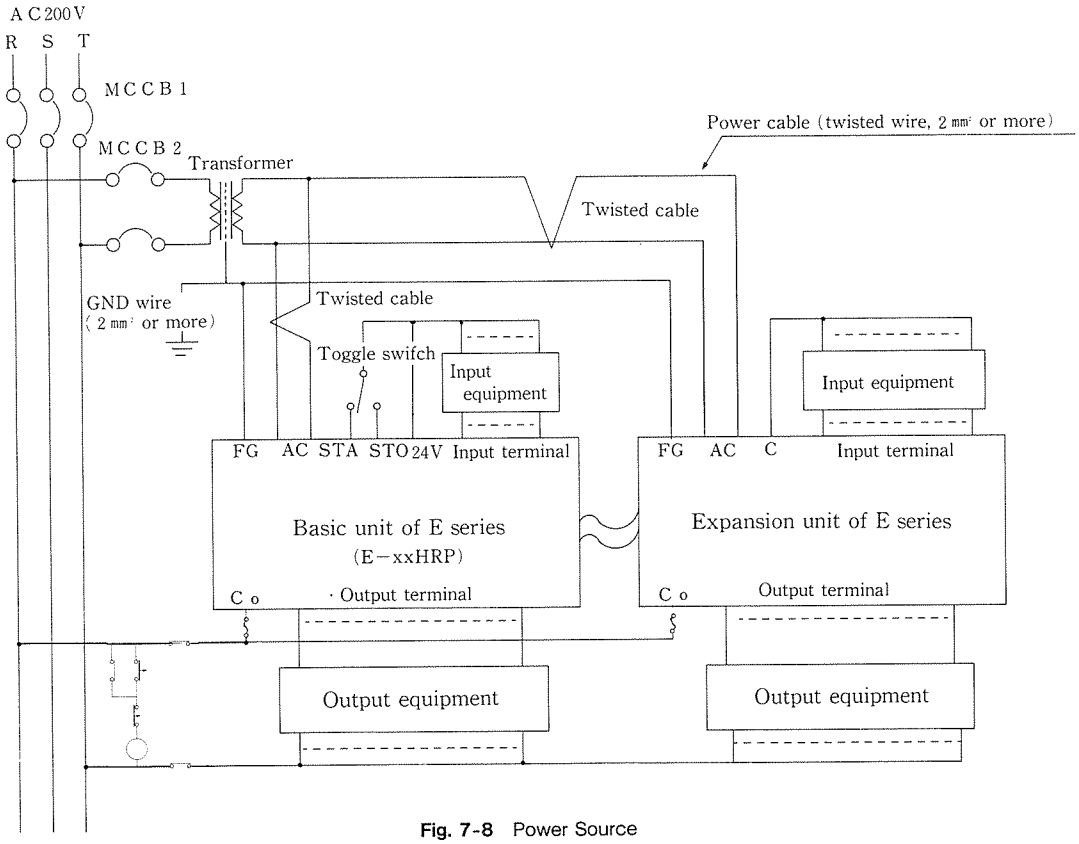


Fig. 7-8 Power Source

E series requires a power source of 220 V AC as rule. 24V DC models is also available. Table 7-3 lists the power consumption of E series. Prepare a transformer according to the specificatinos of the power source.

Table 7-3 Specifications of Power Source

Item \ Model	E−20H R	E−28H R	E−40H R	E−64H R	E−20F R	E−28F R	E−64Z R
Power source voltage	100 V AC−240 V AC (85 V AC−264 VAC)						
Power consumption	22VA or less	28VA or less	31VA or less	39VA or less	19VA or less	24VA or less	37VA or less

- The FG terminal of E series is a GND terminal. Connect the terminal to the 3rd class grounding (grounding resistance 100 Ω or less) to prevent an electric shock. Provide a grounding wire of less than 20 m long. If the 3rd class grounding cannot be provided, the FG terminal should be connected to the mounting frame.

(2) Wiring for Input Circuit

① Fig. 7-9 shows the wiring for the external input of the expansible basic unit.

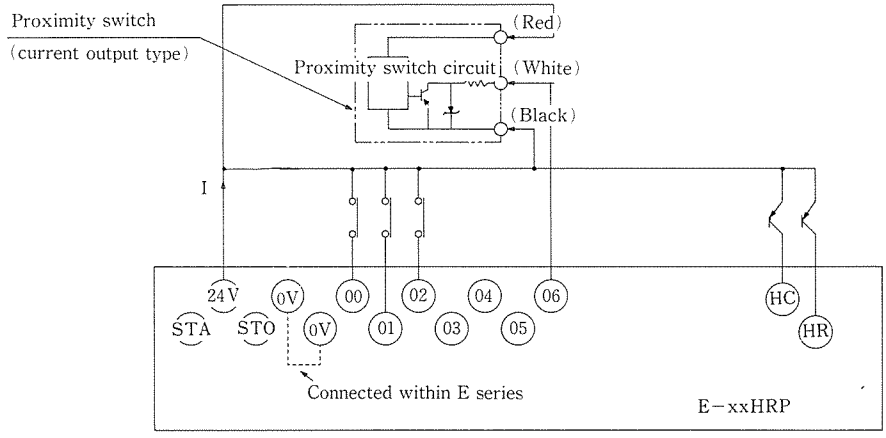


Fig. 7-9 Input wiring for Expansible Basic Unit

E series incorporates the power supply for external inputs. A current can also be supplied to the sensor such as proximity switch via the 24 V terminal. The current value I is represented by :

I = 400 mA − (10 mA × number of input points which will be turned ON simultaneously)

If there are so many sensors that the built-in power supply cannot cover them, prepare a power source such as switching regulator.

② The highspeed counter input terminal (HC ; count input terminal, HR ; reset input terminal) takes in highspeed pulses up to 10 kHz. If a relay contact is connected as input signal, it counts the chattering of the contact. To prevent this, connect a transistor output device.
The highspeed counter input signal line should be separated from other input/output lines since it must be protected from induction interference.

③ The proximity switch or photoelectric switch connectable directly to E series should be of current output type (PNP transistor open collector output). For voltage output type, a transistor should be added before it is connected to E series.

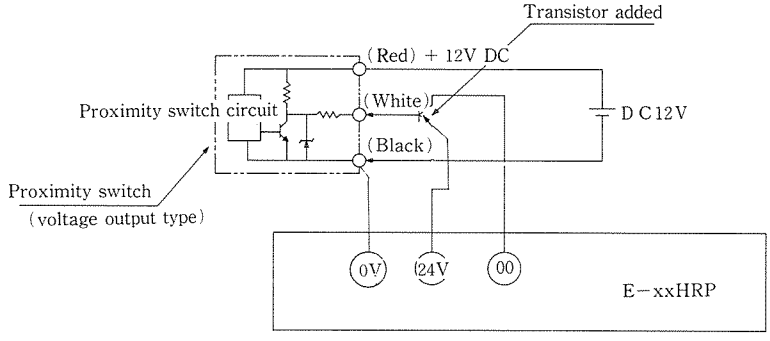


Fig. 7-10 Wiring for Voltage Output Proximity Switch

④ Fig. 7-11 shows the wiring diagram for the unexpandable basic unit. Table 7-4 lists the specifications of external input power supply. (For Japanese market only)

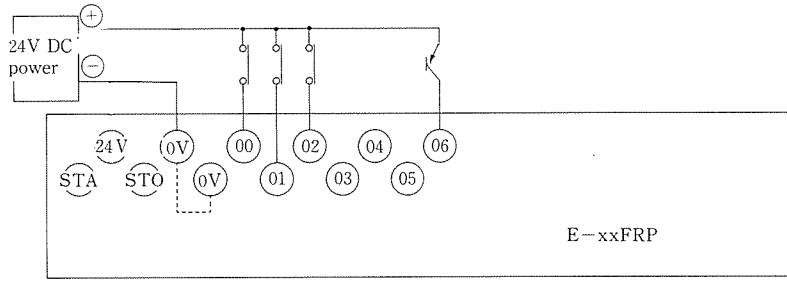
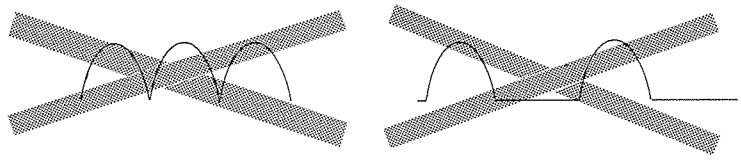


Fig. 7-11 Input Wiring for Unexpandable Basic Unit

Table 7-4 Specifications of External Input Power

Item	Specifications
Power voltage	DC21.6~26.4V
Current capacity (NOTE 1)	170 mA or more

NOTE 1 : The current value for the external sensor such as proximity switch is not included in the above table.
NOTE 2 : Ripples should be suppressed to 10 % or less. Do not use a full-wave rectified or half-wave rectified AC as an external input power.



(4) Output Wiring

① Output Wiring for E-20 HRP

The E-20HR of independent contact output. Fig. 7-13 shows an example of the output wiring.

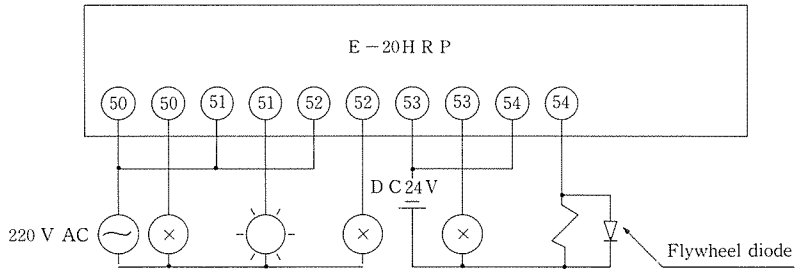


Fig. 7-13 Output Wiring for E-20HR

② Output Wiring for Other Than E-20

Other models than E-20HRPare provided with common output terminals. The common terminals C0, C1, ····· are independent of others. Connect a fuse or circuit protector to each of the common terminals for protecting a short circuit. Fig. 7-14 shows an example of output wiring for the E-28HRP.

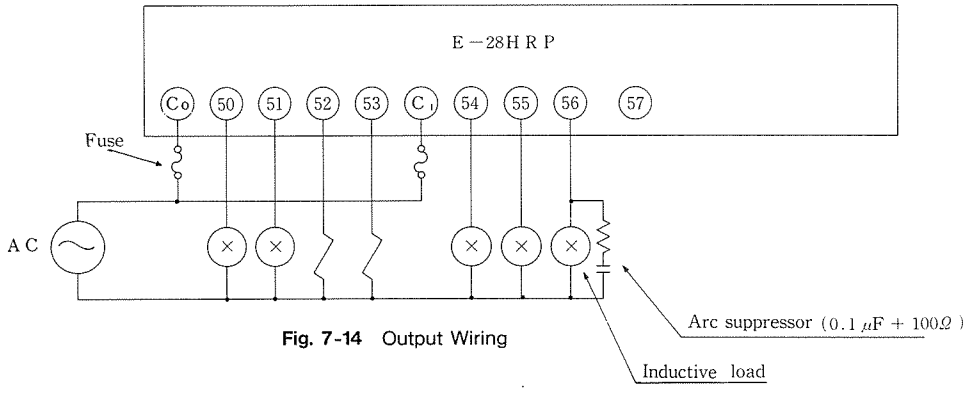


Fig. 7-14 Output Wiring

CAUTION

Connect a Arc suppressor (consisting of capacitor 0.1 μF + resistor 100Ω, for example) in parallel with the inductive load (Hitachi electromagnetic contactor H20 or higher) having a coil capacity of more than 10 VA after power ON. Connect a flywheel diode to a DC load.

7.3 Layout of Terminals

Fig. 7-15 shows the layout of terminals used for the respective models of E series.

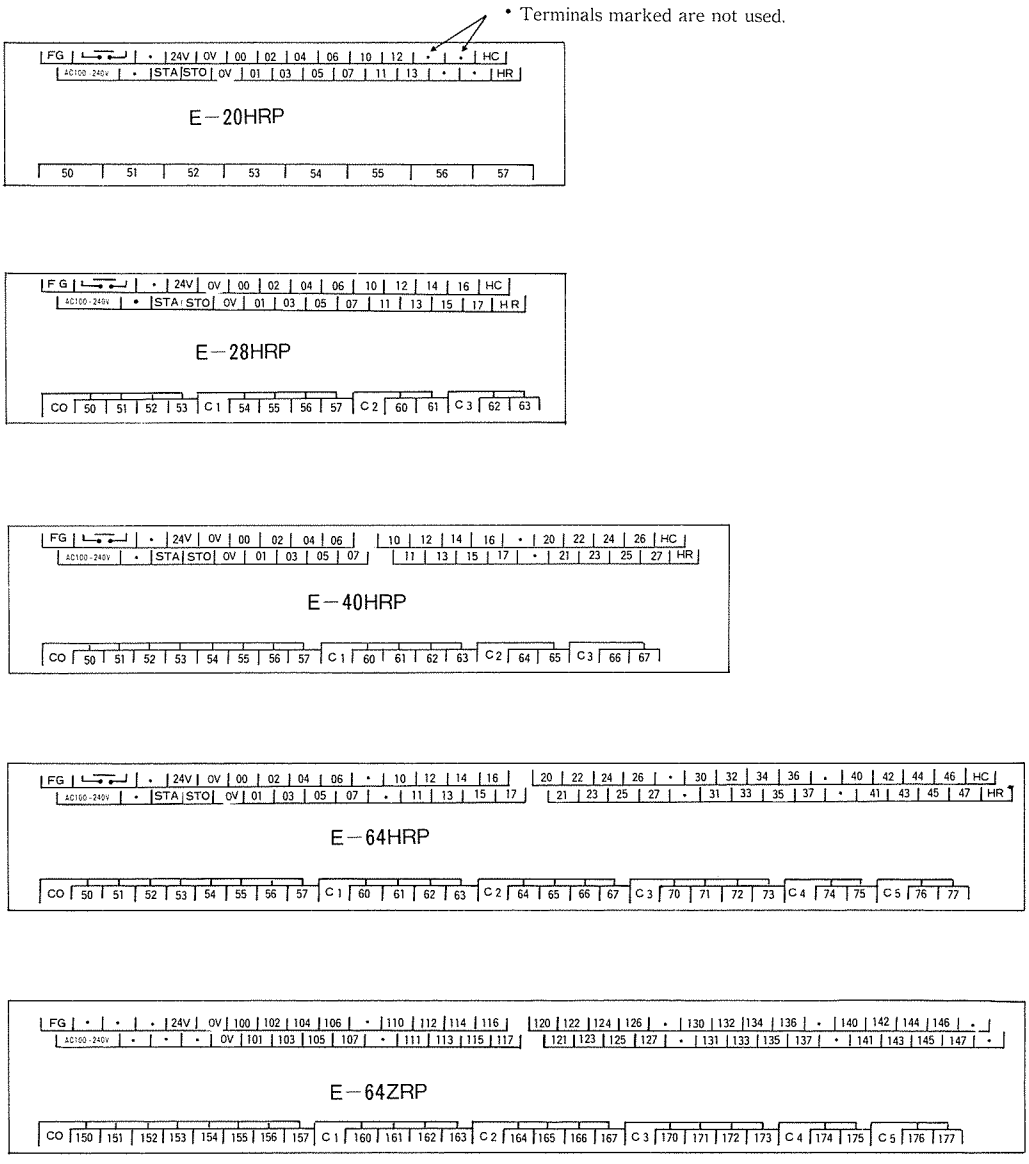


Fig. 7-15 Layout of Terminals

CAUTION

1 . Each terminal has M3.5 screw. When solderless terminal is used, its outside diameter should be limited to 8 mm or less. Each terminal is allowed to hold a maximum of 2 terminal tongues. Do not tighten 3 or more tongues at a time.

7.4 Forced Output

Upon completion of wiring, external outputs can be turned ON or OFF by a forced output regardless of the incorporated programs. This enables you to check if output wiring has been made properly.

Function	Mode	Force Output
Forced Output	TEST	Stop

● Key-in Procedure and Display

Key-in Procedure	Display			Remarks
	Command	Numerical Display	Mode Display	
CLR SET SET ENT		A - - -	● DATA ● TEST	Specification of forced output mode RUN contact ON
FUN 3		o - - - -		
CLR OUT 1 0 SET		o - 10.		External output 10, ON
CLR OUT 1 5 SET		o - 15.		External output 15, ON
RES		o - 15		External output 15, OFF
CLR OUT 1 0 RES		o - 10		External output 10 OFF
CLR RES RES ENT				Release of forced output mode

Description

1) This function enables turning ON or OFF the external output regardless of the incorporated programs while the TEST mode is OFF.

Item	Key-in Procedure	Description
Forced output ON	CLR OUT Output No. SET	External output is turned ON, and remains in the same status.
Forced output OFF	CLR OUT Output No. RES	Activated external output is turned OFF.

2) When forced output mode is specified, the RUN contact becomes ON.

3) Operation should be made with due consideration of safety.

4) An error will occur if the forced output is activated for the external input number of the basic unit. The external inputs (No. 100 onward) of the basic unit are of free location. If you activate the forced output for them, therefore, the following phenomena will occur.

(1) The programmer indicates ON/OFF status according to the operation applied.

(2) The expansion unit lamp does not come on even if you specify an input number for the expansion unit (E-64ZR) of E series. The forced output can be applied for output numbers only.

(3) The forced output is applicable when the J-16 output module is combined. When an input number is specified with the input module connected, the input lamp comes on just for a while.

7.5 Precautions on Installation

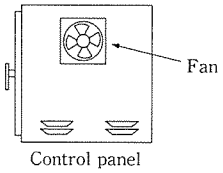
(1) Installation Environment

Select an installation location so that the environmental conditons shown in Table 7-5 are all met.

Table 7-5 Required Environmental Conditions

No.	Environment
1	Location where instrument is not exposed to direct sunlight.
2	Ambient temperature is within 0 to 55℃. (NOTE 1)
3	Relative humidity is within 30 to 90%. The temperature does not change so that condensation forms on the parts incorporated.
4	Free from corrosive or combustible gases.
5	Free from dust, saline air, or iron powder.
6	Not affected by vibration or shock.

NOTE : When ambient temperature exceeds 55℃, a fan should be provided to cool the air to less than 55℃. If the temperature is below 0℃, the power switch should remain ON, or a heater shoulb be provided to heat the air.



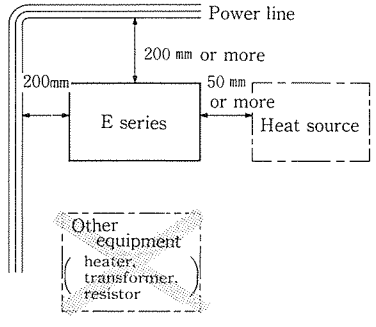
NOTE : If there is a fear of condensation, a heater should be provided on the installation location.

(2) Installation

Table 7-6 shows the items which should be kept in mind when the instrument is accommodated within the control panel of E series.

Table 7-6 Precautions on Installation of Instrument within Control Panel

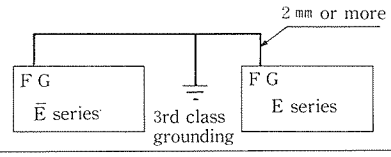
No.	Precautions
1	Do not drop drill chip or wiring trash into E series. E series is provided with dust protecting paper to prevent inclusion of wiring trash. Do not peel off the paper until wiring is completed.
2	E series should be apart at least 50 ㎜ from other equipment or strctures for ventilation.
3	Do not place a heat souce (heater, transformer, or large capacity resistor) below E series.
4	Install E series so that it is apart at least 200 ㎜ from a high voltage line (3,000 V or higher) or power line.



(3) Wiring

Table 7- 7 lists precautions on wiring.

Table 7-7 Precautions on Wiring

No.	Precations
1	FG terminal of E series should be connected to the 3rd class grounding completely separated from that of other high voltage equipment. Length of grounding wire should be limited to 20 m or less. 
2	Do not run input/output line and other power line in the same duct, nor hundle them altogether.
3	Length of input/output line should be limited to 30 m or less. If the legth exceeds 30 m (100 m or less),input line should be separated from output line.

(4) Emergency Stop Circuit

The E series is capable of resisting a noise level of 1500 Vp-p (Hitachi's measurement method). If the noise level exceeds this, the system may fail to operate normally.

The E series has the following check functions for detecting an abnormal operation.

1) Watchdog timer check
2) Undefined command check

When an abnormality is detected, the system is put in :

1) All outputs OFF
2) RUN lamp and RUN contact OFF

It is recommended to avoid depending fully on this abnormality detecting function. **Add an emergency stop circuit with external relays as shown in Fig. 7-16 for safe operation of E series.**

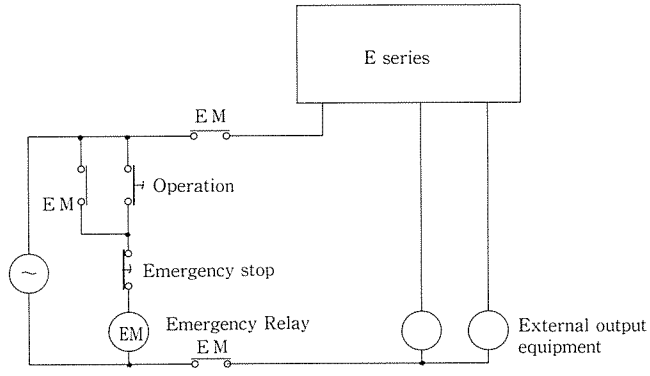


Fig. 7-16 Emergency Stop Circuit

7.6 Internal Sequence at Power ON

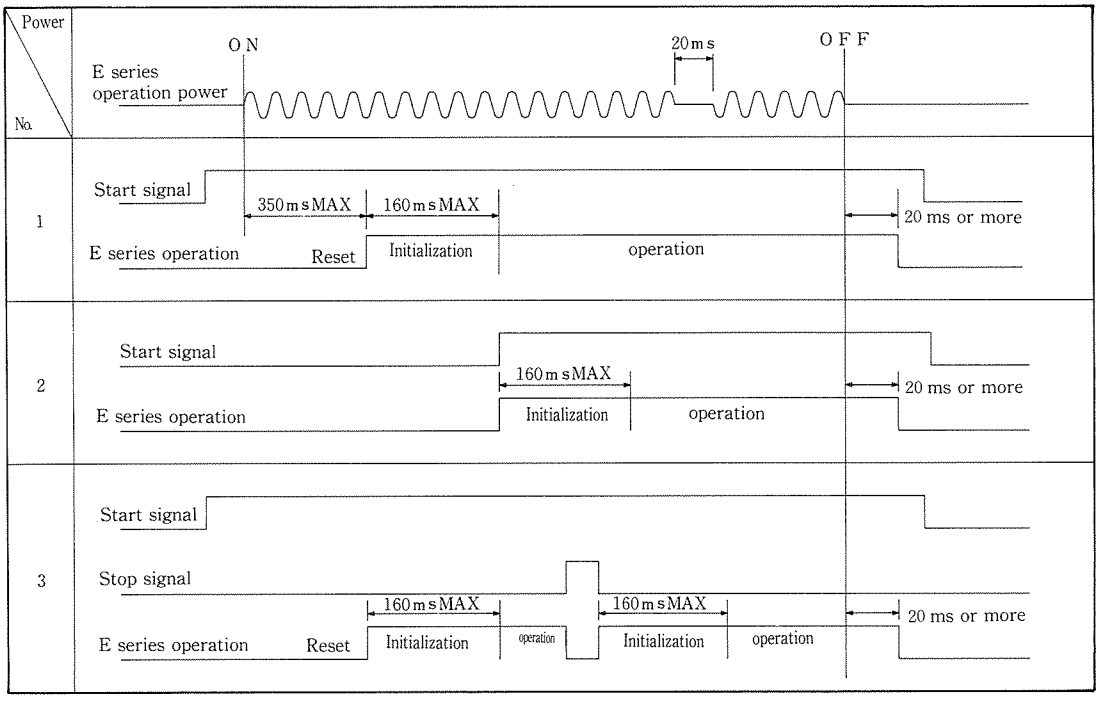
Table 7-8 shows the power waveform of E series and its operational status responsing to start signal and stop signal.

(1) Power ON with E series start signal ON (24V-STA terminals shorted).
As shown is No. 1 of Fig. 7-8, the E series starts operation 510 ms after power is turned on.
During this poriod, the E series will not take in the signal even if external input is ON.

(2) Start signal ON after E series power is turned ON.
As shown in No. 2, the E series is initialized (for a maximum of 160 ms) after start signal is turned on, and then starts operation.

(3) During operation, stop signal ON→OFF.
As shown in No. 3, the E series stops operation (reset) when stop signal is turned ON with start signal ON.
When stop signal OFF is cancelled, the E series is initialized, and then starts arithmetic operation.

Fig. 7-8 Internal Sequence at Power ON



(4) Operation against Instantaneous Power Failure

Operation continues when a power failure of less than 20 ms occurs.

In the E series, a power failure is detected by a voltage drop of 5 V DC power supply. When the system is composed only of the basic unit (no programmer added), the load of the 5 V power is so lit that the voltage is retained for some time. This allows the system to continue the operation for 100 ms or more.

8. MAINTENANCE

8.1 Periodic Checkup

Table 8-1 shows the displays while the E series is in normal status.

Table 8-1 Display durig Normal Status

Status \ Display			Lamp Indication POW	STA	RUN	Numerical Display of Programmer
Normal status	Operation	Basic unit	☼	☼(●)	☼	At power ON
		Expansion unit	☼	—	—	
	At power ON	Basic unit	☼	●	●	
		Expansion unit	☼	—	—	

NOTE : Once start signal (STA) is turned ON, it is self-retained within the E series. During operation, the STA display will change according to the status of external wiring.

Other Checkup Items

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

(2) Inclusion of dust, chip, or wiring trash

(3) Looseness of terminal

Do not use thinner or the like for cleaning. Such substance may cause the cover surface to be dissolved or discolored.

8.2 Troubleshootig

If an abnormality occurs in the system, the cause should be traced to see if the abnormality is caused by the failure of E series or other equipments. Follow the instructions given in the Tadle 8-2 for checking the system.

Table 8-2 Troubleshooting (1/2)

No.	Symptom	Item to be Checked	Possible Cause	Remedy
1	Power lamp "POW" goes OFF.	Check power voltage.	· Internal power is abnormal due to overvoltage. · Internal power is abnormal due inclusion of foreign matter.	Replace the product.
2	"STA" lamp goes OFF.	· Short STA terminal to check if lamp comes on.	Internal power is abnormal.	Replace the product.
			Externally supplied power is abnormal.	Supply a normal power (24 V DC).
3	"RUN" lamp goes OFF.	· Turn power OFF→ON. · Load programs, and perform syntax check (with start signal OFF).	Watchdog timer error occurs when system is in operational status. System stops when undefined command error occurs.	Remove a noise source (by adding noise filter to power supply, or arc suppressor to inductive load).
			Sum-check error or framing error, if occurred, may be cause by noise.	Correct programs.
			Internal parts are abnormal if system fails to operate.	Replace the product.

Table 8-2 Troubleshooting (2/2)

No.	Symptom	Item to be Checked	Possible Cause	Remedy
4	Input lamp stays OFF.	· Short the input terminal and 24V terminal. · Monitor ON/OFF status of input with programmer attached.	External wiring or external input is poor in contact if input lamp stays lit.	Correct the external wiring. Replace the external input equipment.
			Internal parts are abnormal if input lamp stays off.	Use a vacant input terminal, or replace the product.
5	Input lamp stays ON.	· Open the related input terminal. · Monitor ON/OFF status of input with programmer attached.	External wiring or external input equipment is abnormal if input lamp stays off.	Correct the external wiring. Replace the external input equipment.
			Internal parts are abnormal it input lamp does not stay off.	Use a vacant input terminal, or replace the product.
6	Output lamp does not come ON nor go OFF.	Monitor ON/OFF status of output and check for conductivity with programmer attached.	Monitor output via programmer. If normal, internal parts are abnormal.	Use a vacant output, or replace the product.
			Monitor output via programmer. If the out is not ON or OFF, startup condition is abnormal.	Correct the startup condition.
7	Load is not turned ON though output lamp stays lit.	Check conduction between the output terminal and common output terminal (by circuit tester).	Internal relay is poor in contact.	Use a vacant output, or replace the product.
8	Load is not turned OFF though output lamp stays OFF.		Contacts of internal relay are soldered	Use a vacant output, or replace the product. Load current may be too large, and thus intermediate relay is required.

8.3 Error Display and How to Deal with Error

Table 8-3 shows the error messages to be displayed on the programmer and how to deal with the errors.

Table 8-3 Error Display and Remedy (1/3)

No.	Display	Meaning	Description	Remedy	Error Detection Time
1	4E	Undefined command error	Undefined operation cord has been detected.	①Turn OFF and then ON the power switch. If this does not work, replace the basic module. ②If undefined command error occurs often, system may be affected adversely by external noise. To cope with this, perform the following. · Ground FG terminal. If grounding cannot be made as specified, ground the panel (BOX). · Ground the noise filter added to the power line.	During operation
2		Watchdog timer error	Watchdog timer error has been detected due to prolonged scan time (forming an endless loop).		
3	51E	Sum check error	Sum check error has been detected while checking all programs within user memory area.	Check programs for syntax, and correct an invalid one.	At start signal ON

Table 8-3 Error Display and Remedy (2/3)

No.	Display	Meaning	Description	Remedy	Error Detection Time
3	?-E	Uncleared ROM function error	Error has been detected since ROM function is not cleared after write-in or read-out to/from memory pack.	After the function is specified. (CLR SET SET ENT) Clear the specified function. (CLR RES RES ENT)	At start signal ON
4	R62E	Memory pack write-in error	Data cannot be written to memory pack. · EEPROM element is faulty.	Write data to memory pack after power OFF → ON. (· Data can not be written to EPROM via basic unit)	At write-in to memory pack
5	R?-E	EEPROM ⟷ RAM verification error	Verification has not been made on programs transferred to RAM for more than 2 weeks with power OFF. Contants of RAM do not match each other.	Write in the contents of EEPROM to RAM. (STR ENT)	CLR SET SET ENT AND ENT (At verification)
6	C62E	EEROM write-in error	Write-in from CMT to EEPROM cannot be made. Same as item no. 4 above.	Same as item No. 4 above.	At playback from CMT
7	C?-E	CMT ⟷ EEPROM verification error	Contents of CMT and EEPROM have been found unmatched.	Retry recording or playdack.	At verification with CMT
8	C8-E	Format error	Contents of CMT and EEPROM have been found unmatched.	①Replace the tape with a proper one. ②Check playback	At CMT playback
9	C--H	Time-out error	Data are not sent from cassette tape recorder. (H is shown for 30 sec until tape is positoned to the start bit.)	①Replace the tape with a proper one. (Nothing has been recorded on the existing tape.) ②Check coad for connection. ③Check tape for traveling. ④Check playback level.	At CMT playback
10	Step No. E	Syntax error	①ORG has not been programmed at proper position. (2)MCS, MCR, JMP, and JMP END have not been programmed at proper position.	Change program so that it is formated correctly.	At start signal ON or during syntax check
11	Step No. n	Stack-over error	①STR (STR NOT) has been used more than 8 times in one circuit. (2)MCS has been used more than 4 times in one circuit. (3)JMP has been used more than twice in one circuit. ④Too many MCR's have been used with reference to MCS. ⑤Too many AND STR (OR STR) have been use with reference to STR (STR NOT). ⑥Too many STR's (STR NOT's) have been used in counter or shift registers FUN03, FUN40, and FUN45.	Delete excess STR's (STR NOT's). Delete excess MCS's. Delete excess MCR's, or add MCS's. Delete excess AND STR's OR STR's), or add STR's (STR NOT's). Delete STR's (STR NOT's).	

Table 8-3 Error Display and Remedy (3/3)

No.	Display	Meaning	Description	Remedy	Error Detection Time
12	Step No. ᵾ	Stack-under check	①MCR is too short for MCS. ②AND STR (OR STR) is too short for STR (STR NOT).	Add MCR or delete MCS. Add AND STR (OR STR), or STR (STR NOT). Add STR (STR NOT). Add OUT.	At start signal ON or during syntax check.
13	Step No. ε . (Output step)	Dual coil error	Coil has been specified in duplicate. Operation continues.	Put together the outputs into one.	During syntax check
14	Step No. ε	Framing error	①Bit is off command word. When [STOP] key is depressed, then all command word lamps come on. ②Bit is off from data.	Rewrite the erroneous step. If does not work, replace basic module with new one.	At start signal ON or during syntax check
15	ᵑ	Key-in error	①Additional program has been inserted depressing the (by [INS] key) with all memories programmed. ②Non-program area has been specified for reading out a step. ③ [STEP] key has been depressed in excess of 970 steps with all memories programmed.	Depress [CLR] key to clear the error, and then retry operation.	At key-in procedure
16	ᵾ		① [STEP] key has been depressed immediately after power ON or operation start.	Depress [CLR] key to clear the error, and then retry operation.	
17	ε		Key-in has been made improperly.	Depress [SCLR] or [CLR] key to clear the error, and then retry operation.	

8.4 Self Check

(1) Self Check Procedure

The E series incorporates self check program to permit self diagnosis of the programmer and basic unit. Once self check is activated, input/output check program is automatically written in, and the programs previously wirtten are deleted. To store the programs, record them to either a cassette tape or the memory pack, and then perform self check on them. Table 8-4 shows the self check procedure, while Table 8-5 indicates the programmer keys to be depressed for self check and the corresponding displays.

Table 8-4 Self Check Procedure

Mode	Key-in Procedure	Display: During normal operation	Display: During abnormal operation	Description
PROG Stop	CLR SET SET ENT	A - - -		
	FUN 9 7 8	A - - E		
	MON	SELF 0	SELF3E	Sum check of system ROM incorporated in programmer
	MON Depress a key other than MON.	See Table 8-5		Check of programmer key and display
	Recording MIC MIC (PGM) (Tape recorder)			Check of CMT recording function
	MON	• OUT C - - H		
	Complete after about 30 sec	SELF 1		
	Playback EAR EAR (PGM) (Tape recorder)			Check of CMT playback function
	MON	• STR C - - H		
		• STR C - - P		
	Complete after about 33 sec	SELF2	SELF7E SELF8E	··· Verification error ··· Format error
	MON	CPU	3E	Sum check of system ROM incorporated in basic unit
		CPU	2E	Read/write check of data ROM
		CPU	1E	Read/write check of EEPROM Write-in of check program
	Complete after about 100 sec	950		Check complete

Table 8-5 Check Procedure of Programmer Key and Display

Key	Display	Key	Display	Key	Display
ORG	ORG 111111 DATA	FUN	FUN FFFFFF PROG	4	AND 444444 RUN
STR	STR 222222 STEP	OUT	OUT 888888 TEST	5	ORG AND 555555 DATA RUN
AND	AND 444444 RUN	0	000000	6	STR AND 666666 STEP RUN
OR	OR - - - - - -	1	ORG 111111 DATA	7	ORG RTR AND 777777 DATA STEP RUN
NOT	NOT 000000	2	STR 222222 STEP	8	OUT 888888 TEST
T/C	T/C 0.0.0.0.0.0.	3	ORG STR 333333 DATA STEP	9	ORG OUT 999999 DATA TEST
%STEP	STR AND FUN PPPPPP STEP RUN PROG	INS	FUN FFFFFF PROG	ENT	ORG STR FUN nnnnnn DATA PROG STEP
DCLR	FUN OUT HHHHHH PROG TEST	STEP(−)	ORG FUN E.E.E.E.E.E. DATA PROG	DEL	AND FUN uuuuuu PROG RUN
CLR	AND OUT CCCCCC TEST RUN	STEP(+)	STR FUN oooooo STEP PROG	SRC	ORG AND FUN ------ DATA PROG RUN

(2) Check Procedure for Basic Unit Only

Table 8-6 shows how to check the basic unit only (with no programmer checked).

Table 8-6 Check Procedure of Basic Unit

Key-in Procedure	Display
CLR SET SET ENT	A - - -
FUN 9 7 8 MON	SELF 0
MON	C - - P
CLR	SELF 1
MON	C - - H
CLR	SELF 2
MON	CPU 950

(3) Input/Output Check after Self Check

Upon completion of self check, input/output check program is automatically written into the EEPROM. Put the programmer in RUN mode, turn ON start signal, and then sequentially activate external input 5 starting from input No. 00. This allows the corresponding outputs to be turned ON as shown in Table 8-7, whereby the operation of inputs and outputs can be checked.

Table 8-7 Procedure of selt check

Input No. \ Output No.	50	51	52	53	54	55	56	57	60	61	62	63	64	65	66	67	70	71	72	73	74	75	76	77
00	○																							
01		○																						
02			○																					
03				○																				
04					○																			
05						○																		
06							○																	
07								○																
10	○																							
11		○																						
12			○																					
13				○																				
14									○															
15										○														
16											○													
17												○												
20													○											
21														○										
22															○									
23																○								
24													○											
25														○										
26															○									
27																○								
30																	○							
31																		○						
32																			○					
33																				○				
34																	○							
35																		○						
36																			○					
37																				○				
40																					○			
41																						○		
42																							○	
43																								○
44																					○			
45																						○		
46																							○	
47																								○

○ mark : Indicates that the output corresponding to input is activated.

Table E Series Command Processing Time

(Unit μsec)

Command Word	Processing Time						Remarks
	At Independent Use		At FUN04 OFF		At FUN06 ON		
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximam	
ORG		3		9		9.5	
ORG NOT		3		9		9.5	
STR		5		9		9.5	
STR NOT		5		9		9.5	
AND		3		9		9.5	
AND NOT		3		9		9.5	
OR		3		9		9.5	
OR NOT		3		9		9.5	
AND STR		4.5		9		9.5	
OR STR		4.5		9		9.5	
OUT		3		17.5		9.5	
OUT NOT		5.5		20		9.5	
OUT T	36.5	56	53	72.5		9.5	
OUT T NOT	37	56.5	56.5	76		9.5	
OUT C	22	52.5	29	29		9.5	
FUN 00	7.5	14		29.5		9.5	
FUN 00 NOT	7.5	14.5		33		9.5	
FUN 02	※1) 5	※2)		9.5		9.5	
FUN 03	※3) 11	※4)		9.5		9.5	
FUN 04		5		10		9.5	
FUN 05		3		13		9.5	
FUN 06		3.5	—	—		—	
FUN 07		1.5	—	—		12.5	
FUN 30	153	157		9		9.5	
FUN 31		19		9		9.5	
FUN 32	225	227		9		9.5	
FUN 33	10.5	34.5		9		9.5	
FUN 34	150.5	159		9		9.5	
FUN 35	23	30		9		9.5	
FUN 36		14.5		9		9.5	
FUN 40	41.5	513		39.5		9.5	
FUN 45	11	18		44.5		9.5	
FUN 47	38.5	146.5		37		9.5	
FUN 99 (END)	169.5	365					64 I / O ※5)
Monitoring time	⊕250~940						※6)

※1) and ※3) : FUN02……ON status, FUN03……Set status
※2) : OUT = 20μs and OUT T/C = 74μs when FUN02 is OFF
※4) : OUT = 24μs and OUT T/C = 74μs when FUN03 is reset
※5) : ⊕ 1,536μs when END is 128 I/O
※6) : ⊕ 4,335μs when set value of timer/counter is changed