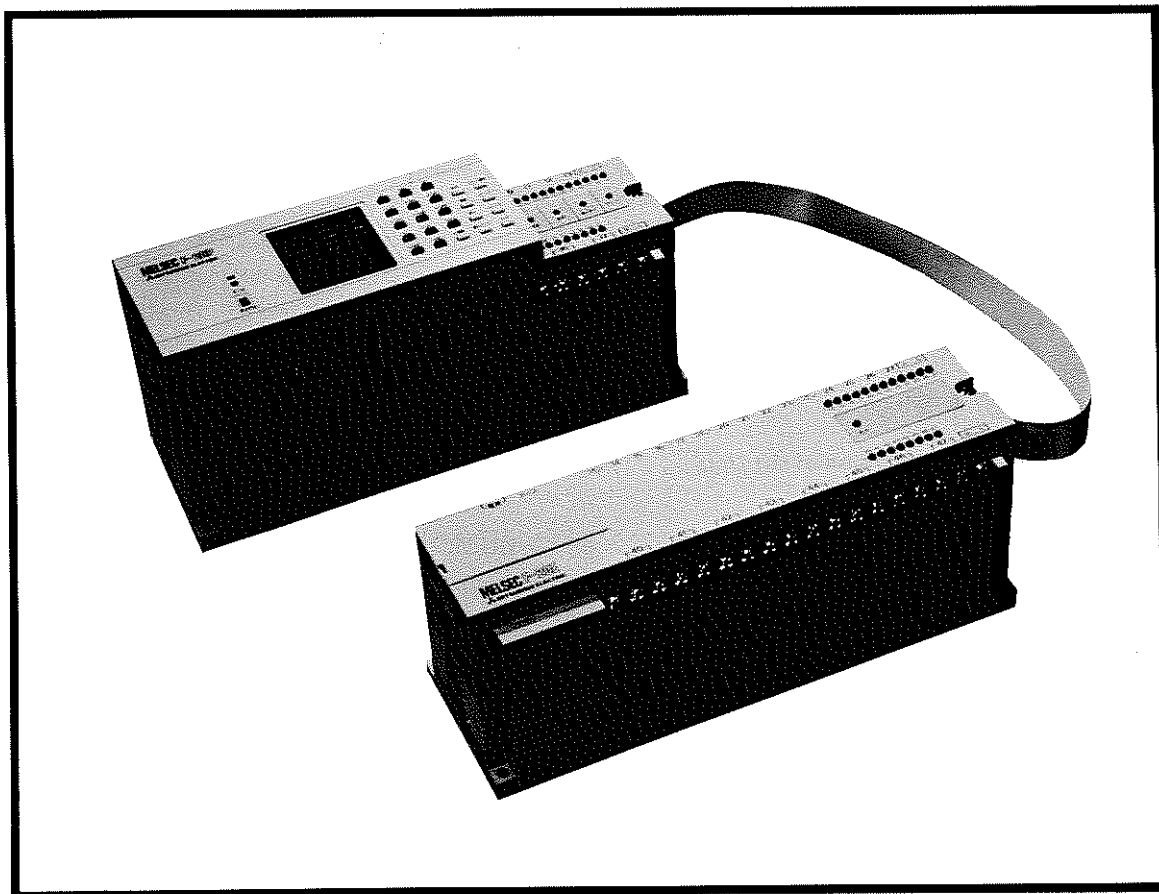


# MITSUBISHI

## MELSEC F-20MR-UL Programmable Controller

### INSTRUCTION MANUAL



- This manual provides technical information and guidance on the installation and use of the Mitsubishi F-20MR-UL Programmable Controller and its extension unit.
- Users should ensure that the detail of this manual is studied and understood before attempting to install or use the units.
- Information concerning the programming of the system, using the F-20P-E programmer unit, is covered in a separate manual.

 **MITSUBISHI ELECTRIC CORPORATION**

## Contents

	Page
1. The Mitsubishi F Series PC RANGE . . . . .	1
2. Unit Installation . . . . .	2
3. Power Supply . . . . .	3
4. Wiring . . . . .	4
5. Extension of the Unit . . . . .	5
6. Input Handling . . . . .	6
7. Output Handling . . . . .	7
8. Maintenance and Diagnostics . . . . .	8
9. Outlines and Specifications . . . . .	11

## THE MITSUBISHI F SERIES PC RANGE

The Mitsubishi F series of programmable controllers and auxiliary equipments are of compact size and light weight, and are ideal for small industrial process control requirements and machines. A separate range, the K series, is available for larger and more complex application requirements.

Essentially there are two ranges (F-20 and F-40) in the F series. They share a common programmer. The ROM writer, program loader and other peripherals are also common to the F-20 and F-40 ranges. The F-12R model is fully compatible with F-20 and its peripherals except the ROM function is not available.

The extension units to expand the number of inputs and outputs can be used with the base unit to give an overall choice of I/O numbers from 12 to 80 by 10 points.

In addition to large variations such as supply voltage, output type, the analog timer unit and positioning counter module are available to cover many applications.

### Nomenclatures of Base & Extension Unit

Model F - □ □ □ - □ □

Expl. F - 20 M R - U L

① ② ③ ④ ⑤

- ① indicates the number of inputs/outputs
- ② indicates type of the unit  
M: Base Unit (RAM and ROM)  
E: Extension Unit
- ③ indicates type of output  
R: Relay, S: SSR, T: Transistor
- ④ specifies power supply voltage ratings  
U: 110/120VAC
- ⑤ indicates type of input/output connections  
L: UL Listing type  
N/A: Sink Input and Sink Output

### PERIPHERALS

Programming Panel	F-20P-E
Graphic Programming Panel	GP-80F
ROM Writer	F-20MW
Program Loader	F-20H
ROM Cassette	F-ROM-1
Remote Cable	F-20P-CAB
DIN Rail Attachment	F-20D (for F-10, 12, 20) F-40D (for F-40)

### BASIC MODELS OF BASE UNIT & EXTENSION UNIT

Unit OUTPUT TYPE	F-10/12		F-20		F-40	
	Base Unit	Extension Unit	Base Unit	Extension Unit	Base Unit	Extension Unit
Relay Output	F-12R	F-10ER	F-20MR	F-20ER	F-40MR	F-40ER
SSR Output	—	—	F-20MS	F-20ES	F-40MS	F-40ES
Transistor Output	—	—	F-20MT	F-20ET	F-40MT	F-40ET

### F-20MR-UL, F-20ER-UL OUTPUT LOADS

The models F-20MR-UL and F-20ER-UL, have been designed specially for UL listings.

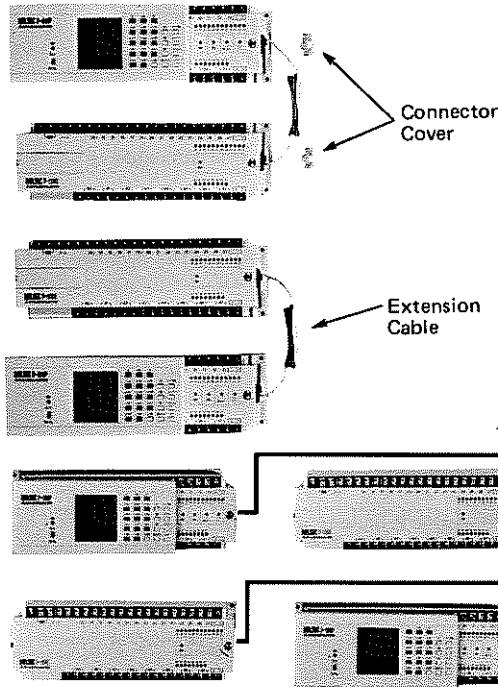
The basic unit and extension unit have the output power ratings indicated in the following table. For loads over the rated maximum limits shown, operation should be performed through an extra relay, capable of handling the load. Loads under the minimum limits shown will need an additional bleed resistor to prevent incorrect operation due to leakage currents flowing in the output circuits.

Type of Output		Relay Output
MAX. Load	Rated Output Current (Resistance load)	2A a Point
	Inductive Load (Ex: Contactor, Solenoid, Solenoid Valve, etc.)	72VA 120/240VAC
	Rush Current	10A/Cycle
MIN. Load	Inductive Load (Ex: Contactor, Solenoid, Solenoid Valve, etc.)	0.6VA (110/120VAC) 2.3VA (220/240VAC)
	Lamp Load	0.4W (110/120VAC) 1.5W (220/240VAC)

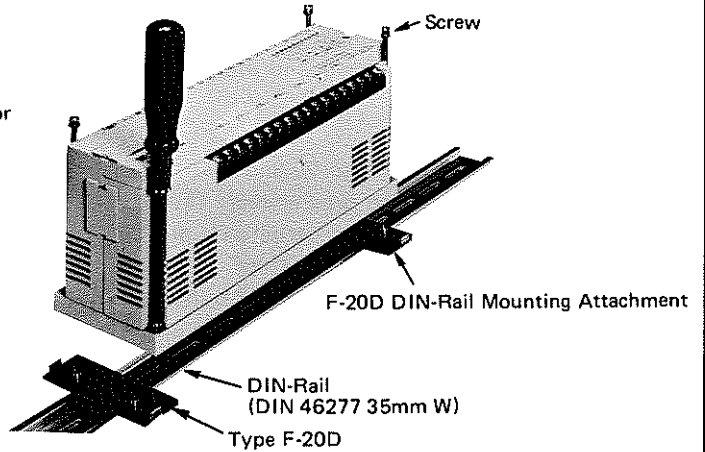
N.B. = Leakage Current of Circuits = 0.5/0.6mA (110/120VAC) Max. 1.1/1.2mA (220/240VAC) Max.

## Unit Installation

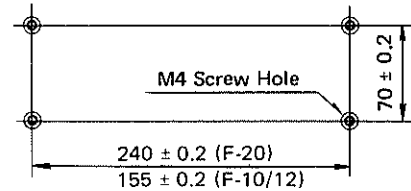
### Disposition of Extension Unit



### Installation on DIN-Rail



Screw Hole Pitch  
(Direct Installation) mm



### DISCRIPTION

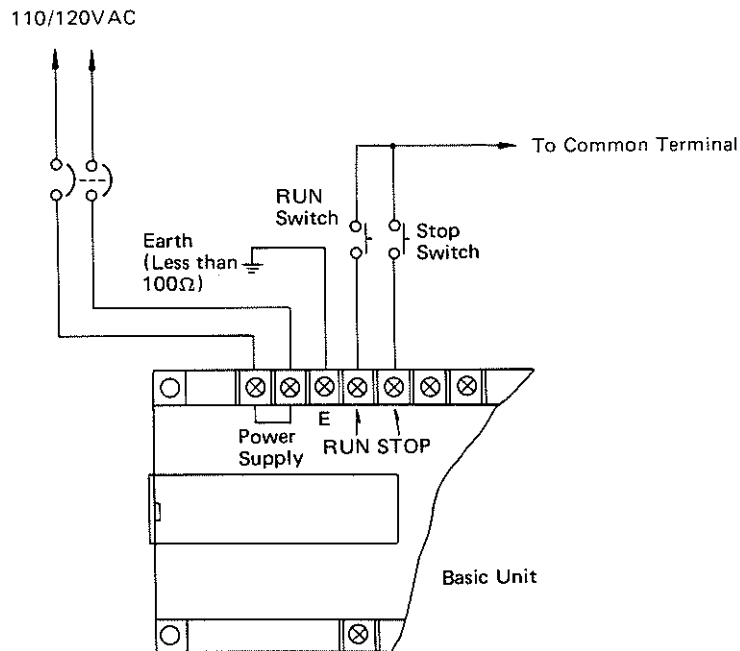
1. The base unit and extension unit can be mounted with suitable screws direct to any flat surface by using the four corner holes provided.
2. Alternatively an optional DIN rail mounting kit is available.
3. Basic and extension units are of the same dimensions and can be connected with the 450mm long extension cable provided with the extension unit. Connectors for the extension cable are located at the side of each unit and protected (when not in use) by a replaceable pliable cover.

### CAUTION

1. Whilst the F series PC is suitable for most industrial situations, it should not be used in excessively hostile environments associated with extremes of damp, dust, temperature, corrosive gases, vibration or mechanical impact.
2. A space of some 30mm should be allowed around the unit for heat dissipation.
3. The PC should not be installed near to high voltage supply cables or other such electrical apparatus.

## Power Supply

### Power Supply



### DISCRIPTION

1. Connect a power supply cable of the correct rating to the basic unit and extension unit (if used) as illustrated.
2. The power consumption of the basic unit is less than 11VA and that of the extension unit is less than 6VA. However this does not include the power consumption of any external loads.
3. All units must be earthed as illustrated.
4. 'Stop' or 'Run' function terminals should be connected to key switches or other suitable control devices (push buttons) as illustrated.
5. The 'Run' mode is used when the programmable controller is running a programme (controlling a system).

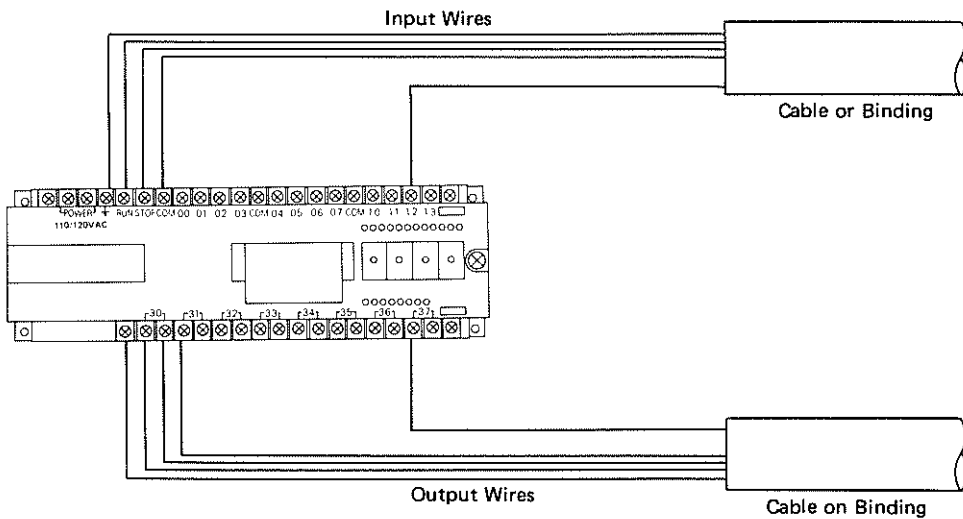
When the 'Stop' mode is used (or there is a power failure of more than 20 m/sec) all outputs are turned off and timers, plus 48 of the 64 auxiliary relays, are reset. However, all counters and 16 of the auxiliary relays are maintained in the cpu by integral auxiliary battery support.

### CAUTION

1. Supply voltages should be as specified, and earthing specific to the programmable controller e.g. not shared with any high power equipment such as a motor system.
2. When the 'Stop' switch is 'on', all outputs will be 'off'. However, it is recommended that external facilities be provided in case of emergencies to support and back this facility.
3. The power must be off when the ROM cassette is loaded on the basic unit or unloaded from the unit.

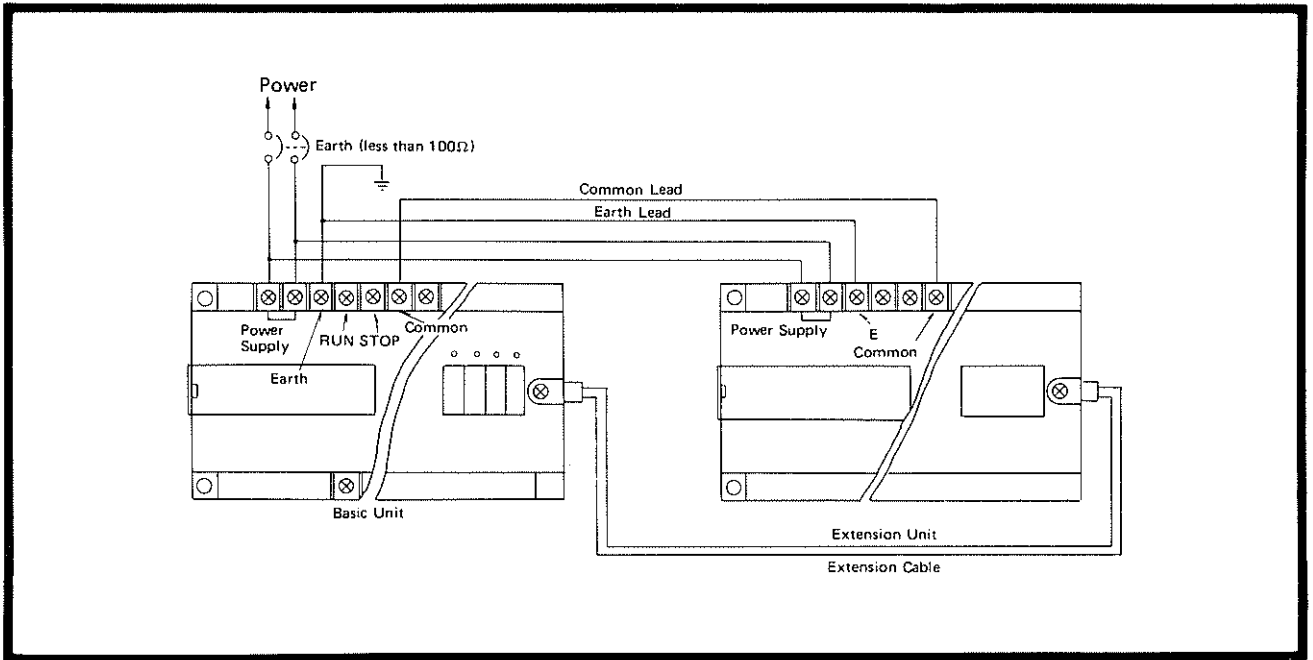
## Wiring of Input/Output

### Wiring of Input/Output



1. Input and output wires must be kept separate and away from any power supply cables or high voltage cables.
2. For the sake of convenience, appearance and to avoid damage or failure, input wires should be bound or cabled together as should output wires.
3. It is recommended that input and output wires are not longer than 20 meters for the general use. However the length depends upon the conditions of the noise environment and voltage drop.

## Extension of the unit



### DISCRIPTION

#### 1. EXTENSION CABLE

The extension cable used to connect the basic unit and an extension unit should be kept separate from any other cables or wires by a distance of 30mm at least.

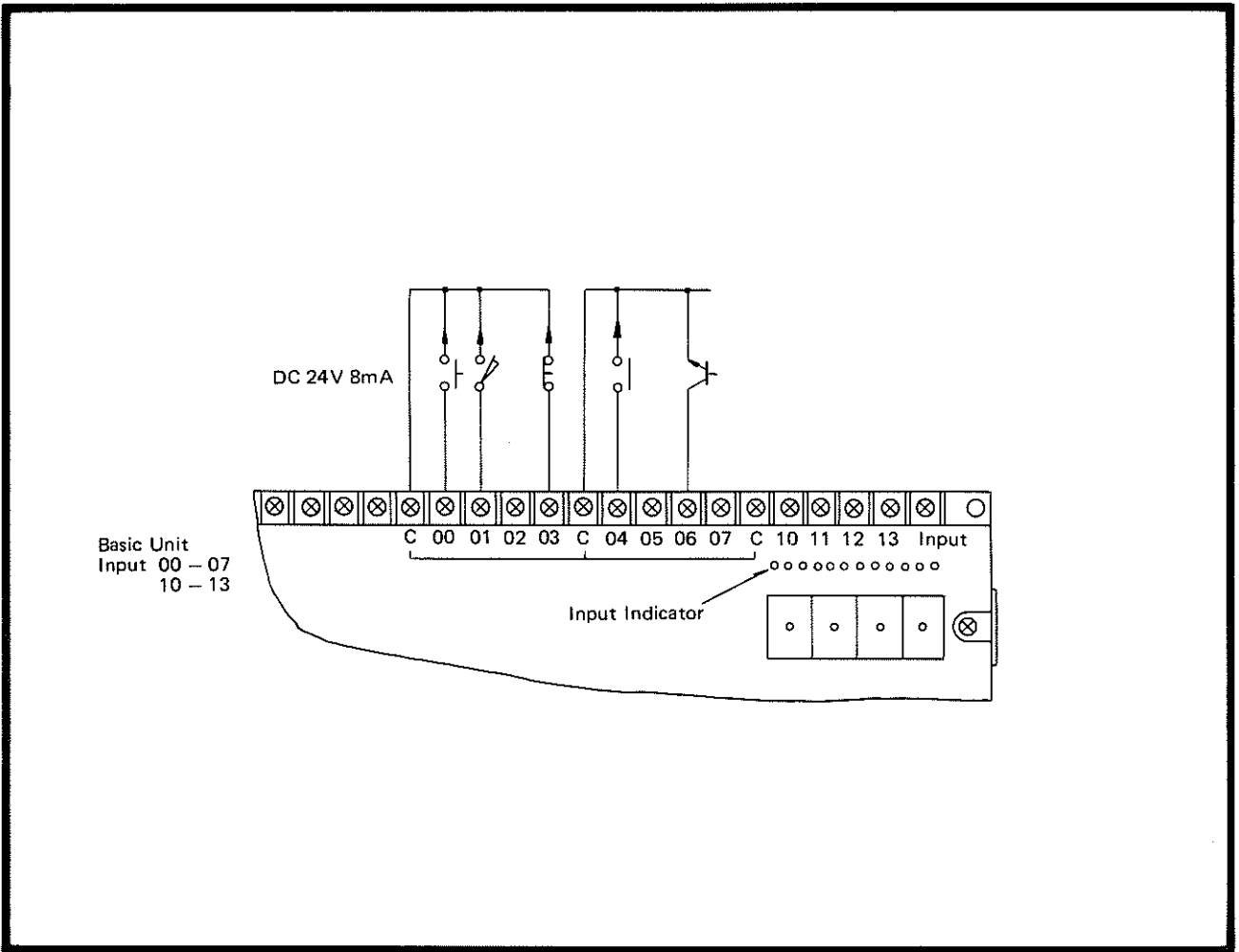
#### 2. EARTH TERMINAL

The extension unit must be specifically earthed in the same manner as the basic unit.

#### 3. COMMON TERMINAL

One of the common terminals of the extension unit should be connected to any one of the common terminals of the basic unit as illustrated.

## Input Handling



### DESCRIPTION

1. Connect control devices, e.g. limit switches, push buttons etc., to the input terminations 00 to 13 of the base unit and 14 to 27 of the extension unit.
2. All common terminals are connected internally and are common. However base and extension unit commons are not linked unless connected together externally as detailed in another section.

### CAUTION

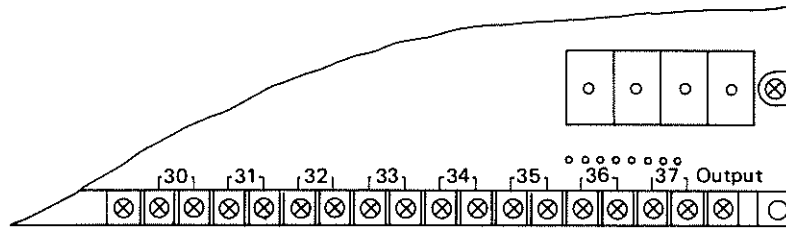
1. The input current rating at each input terminal is DC24V 8mA and control devices should be specified accordingly.
2. If transistor circuits such as proximity switches are connected to input terminals then their parallel resistance should be more than 100k $\Omega$  and their series resistance less than 1k $\Omega$ .
3. A pulse input of less than 50 milliseconds may not be accepted by the controller.



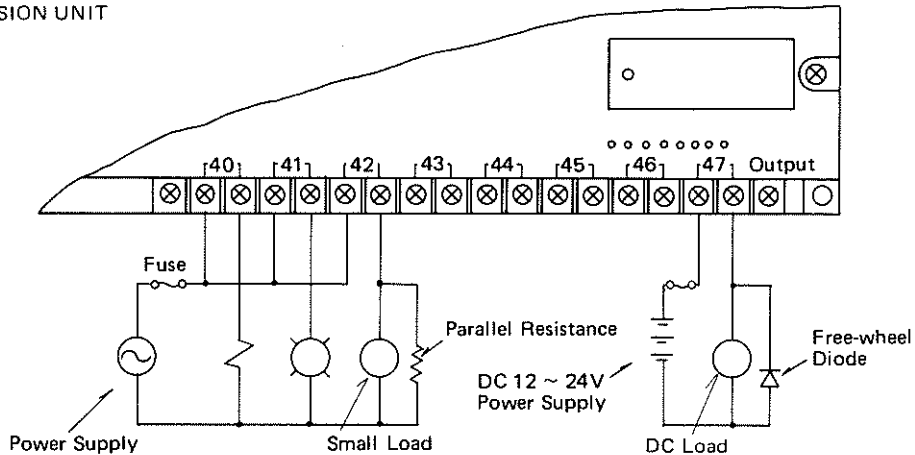
## Output Handling

### Relay Output Type

#### BASE UNIT



#### EXTENSION UNIT



### DESCRIPTION

1. Connect external load devices e.g. contactors, pilot lamps, solenoid (electromagnetic) valves etc., to output terminations.
2. Normal open relay contacts are connected internally to the output terminals on the base and extension units. The ratings of the contacts are 2A at 24VDC, 110/120VAC, 220/240VAC. These ratings apply for resistive loads ( $\text{COS } \phi = 1.0$ ). The ratings of the contacts are 72VA at 120VAC, 240VAC. These ratings apply for inductive loads.
3. Applicable loads to the output relays are subject to the frequency of operations. According to our life test data, followings are given for a reference of the relay durability level;

Inductive Load	Frequency of Operation
Less than 35VA	Up to 3,000,000
Less than 72VA	Up to 1,000,000

Manufacturer's guaranty level: 500,000 operations at 35VA.

### CAUTION

1. Each internal contact is protected by a residual current circuit. When the contact is opened, its current leakage will normally be less than 1.1mA at 220VAC or 0.6mA at 120VAC. However it is possible that this might have some effect on external loads. Where the external current demand is very low it may prove necessary to provide additional parallel resistance because of the influence of leakage (see diagram above).
2. When using the controller in a direct current circuit, it is recommended to connect a free wheel diode in parallel to the inductive load.
3. Overload Protection  
Back-up fuses or circuit protectors are recommended on output circuits to prevent damage to the circuit boards of the PC in the event of a short circuit fault in an external output circuit.

## Maintenance and Diagnostics

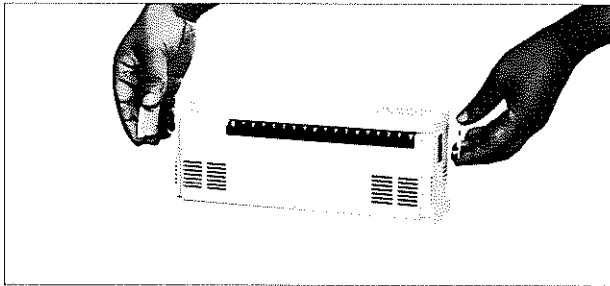
### Battery Maintenance

1. The program memory, counters and 16 of the 64 auxilliary relays are backed by a non-chargeable lithium battery (list no: F-20BC).
2. When the battery runs low, LED indicator on the base unit is illuminated. (See next page).
3. However, regardless of its condition, it is recommended that the battery be replaced every five years.

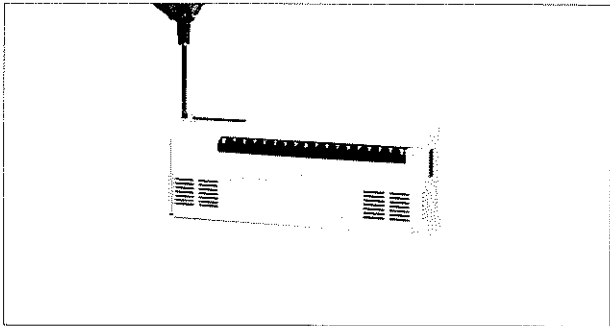
### BATTERY and FUSE RENEWAL:

Battery and fuse are renewed by the following procedure.

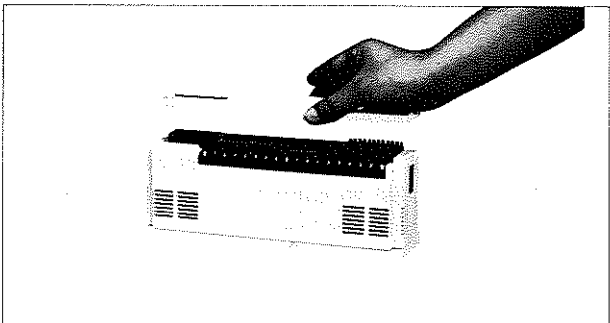
- 1 Remove covers for extension cable, ROM cassette and Programming Panel connector.



- 2 Remove 2 screws at both ends of upper cover.

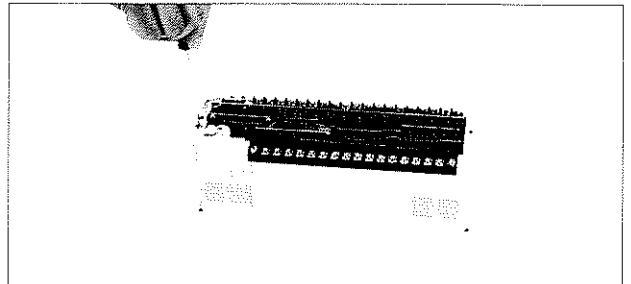


- 3 Take off upper cover.



In case of fuse renewal, renew the fuse installed on input card assembly. The fuse must be Listed Miscellaneous fuse rated 1A, 250V.

- 4 In case of battery renewal, remove a retaining screw for battery holder and pull out the battery together with holder, connector and installation screw.



- 5 Renew the battery set together with holder and connecting lead.

Service battery is supplied with battery holder and connecting lead in a set.

- 6 Re-assemble the installation screw and upper cover of the unit in reverse of the procedure.

### CAUTION:

1. Disconnection of existing battery and connection of new battery must be completed within 30 seconds, whilst an inside capacitor supports the program memory.
2. Ensure that power is off during battery replacement.

3. Battery is renewed only by exparty engineer, and ensure that following cautions are understood;

### WARNING:

Fire, Explosion, And Severe Burn Hazard. Do Not Recharge, Disassemble, Heat Above 100°C (212°F), Incinerate, Or Expose Contents To Water.

## PRELIMINARY CHECKS

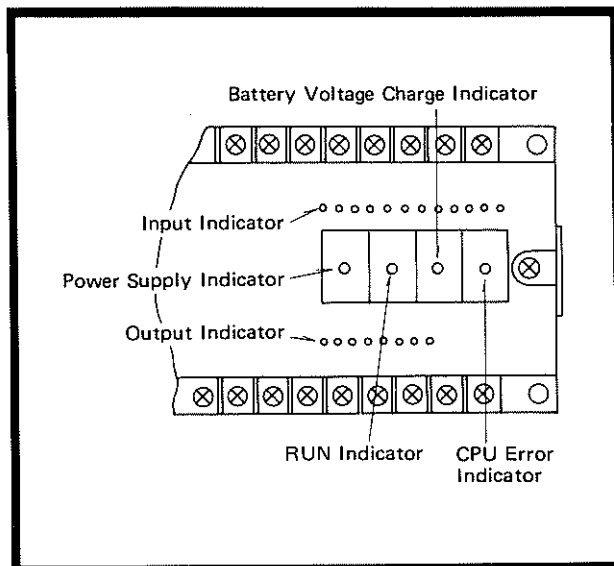
Before operating the unit, it is advisable to carry out the following checks:

- a. That the power and earth leads are properly connected.
- b. That input and output leads are properly connected and not entangled. (It is worthwhile numbering each lead according to its input and output assignment).
- c. That output loads and input contacts are within the specification limits detailed earlier.

## DIAGNOSTICS

The base unit's LEDs enable the following conditions to be checked:

1. Power Supply  
LED illumination indicates that the power is 'on'.  
If the LED fails to illuminate when the unit is under apparent power, then the unit may be faulty.
2. Run  
If the run LED is not illuminated when the programming panel is turned to 'monitor' and the unit is in 'run' mode then (assuming all wiring connections to be correct), it is likely the unit is faulty.
3. Battery  
If the battery LED illuminates then renew the battery.
4. Interference from external apparatus  
If the 'cpu error' LED illuminates this may be as a result of electrical noise interference from some external apparatus. Otherwise it indicates a fault in the unit.



5. Input circuit operation  
Failure of the input LEDs to illuminate when properly connected and powered may be fault of the unit.
6. Outputs  
If outputs fail to function, whether the LEDs are illuminated, it may be a unit fault. However, in the case of those units fitted with relay outputs the life of the relay is stated in the section of Relay Output. If the unit has exceeded this number of operations or the output relays are obviously worn out then a replacement relay board should be fitted as detailed in the next section.

### Checking the Programme

Programmes can be checked and monitored by using the facility available on the programming panel for this purpose.

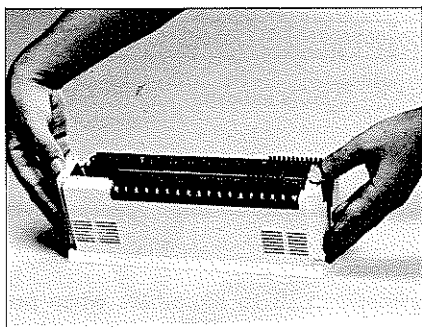
### Maintenance

Periodically the unit's installation should be checked to ensure that it has not been contaminated by dust or other contaminants, also that all termination connections are still tight. The unit should not be installed in a situation where the temperature is likely to rise to above 50°C.

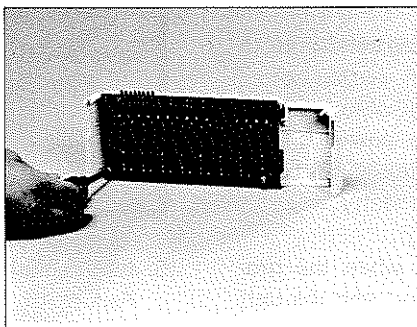
### Relay Board Replacement

The relay output board can be changed as follows:

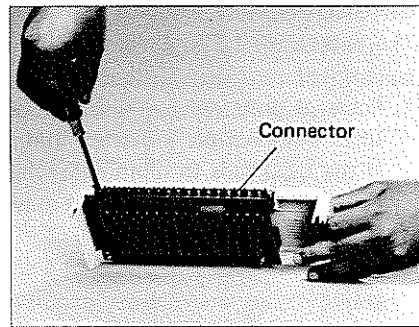
Remove the front cover with same procedure in the section of battery renewal, and renew the relay board as illustrated:



Remove front cover



Remove mounting screws for board



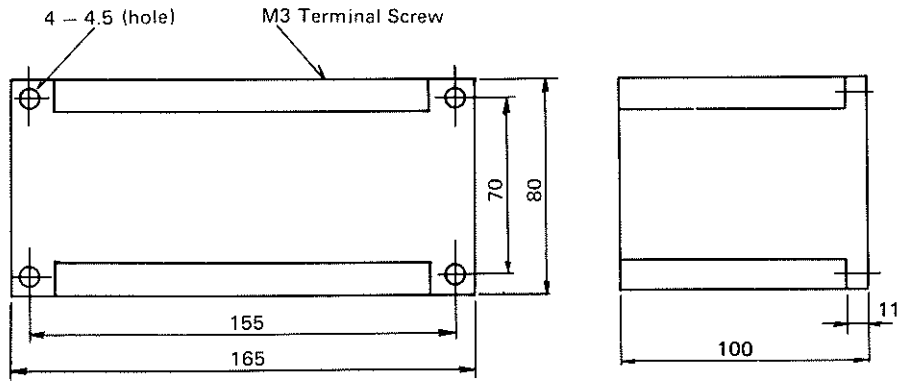
Remove mounting screws for terminal box

### Insulation

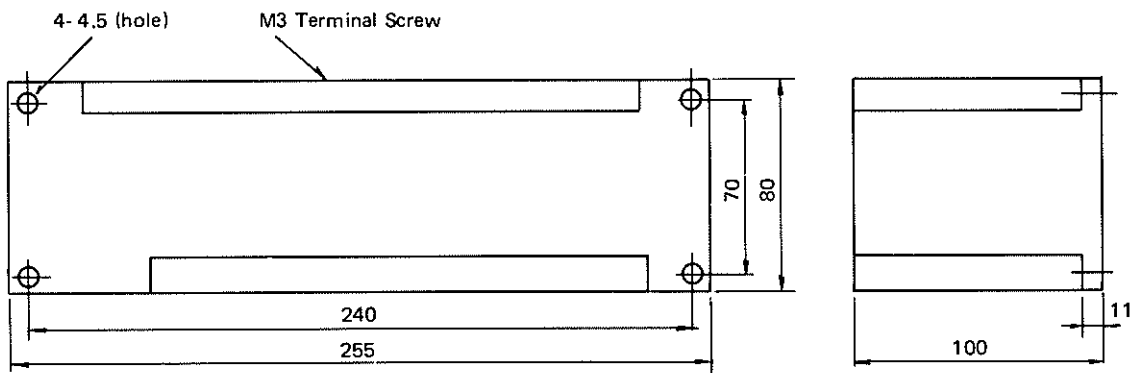
In order to measure the insulation resistance of the programmable controller, first remove all terminal leads and take measurements between the earth and other required terminals.

**Outlines (mm)**

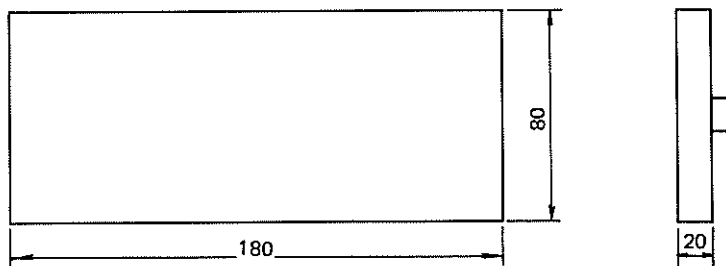
**\* F-12R Base Unit and F-10ER Extension Unit**



**\* F-20 Base Unit and Extension Unit**



**\* F-20P-E programming unit**



## SPECIFICATIONS

Main voltage	Voltage	90 ~ 132VAC, 50/60Hz with LED indication	
	Consumption	F-20MR-UL : Less than 11VA F-20ER-UL : Less than 6VA	
Input	Number of points	F-20MR-UL } 12 Points F-20ER-UL }	
	Type and method	No-voltage contact, Photocoupler isolated	
	Current and voltage	8mA/24VDC	
	Indication	LED, all inputs	
Output	Number of points	F-20MR-UL } 8 Points F-20ER-UL }	
	Indication	LED, all outputs	
	Output type	Relay	
	Method	No-Voltage contact	
	Current and voltage	72VA 120/240VAC (Inductive Load)	2A 24VDC 120/240VAC (Resistance Load)
Timer	Number of points	8 Points (Base unit)	
Timer	Type and method	Digital, set by PP, on-delay timer	
	Range	0.1 ~ 9.9s or 1 ~ 99s	
	Counter	Number of points	8 Points (Base unit)
Counter	Type and method	Digital, set by PP, down-counter, Power-failure compensated	
	Setting range	1 ~ 99	
	Auxiliary relay	Number of points	64 Points (Included 16 Points of battery back-up)
Program	Method	Stored program	
	Language	Relay symbols, 14 instructions	
	Memory	C-MOS RAM + EP-ROM (Option)	
	Capacity	320 steps	
	Speed	Average: 45 $\mu$ .sec/step	
	Write in	by key of PP	
Protection	Power-failure compensation	Operation continues if failure duration is less than 20ms	
	Battery	Lithium, capable of 5-year RAM backup	
	Self-diagnostic functions	Battery voltage-drop indication, CPU error indication	
	Insulation resistance	More than 5M $\Omega$ , 500VDC between terminals and earth	
	Insulation withstand voltage	1,500VAC, 1min	
	Noise immunity	1,000V, 1 $\mu$ sec Verified using a noise simulator	
Environment	Noise Spike	Withstand NEMA noise spike test (NEMA-ICS2-230)	
	Ambient-temperature	0 ~ 55°C	
	Storage temperature	-15 ~ 65°C	
	Ambient humidity	Less than 95% RH, no condensation	
Dimensions	Vibration resistance	10 ~ 55Hz, 0.5mm (max.: 2G)	
	W x H x D (mm)	See the outlines	
Weight	kg	F-20MR-UL } approx. 1.5 kg F-20ER-UL }	

PP: Programming panel



 **mitsubishi electric corporation**  
HEAD OFFICE MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100 TELEX J24532 CABLE MELCO TOKYO

---