# MITSUBISHI

PROGRAMMABLE CONTROLLER

# MELSEC-K

Instruction Manual

type MELSEC-K0J2P

A) 66014-A

MITSUBISHI ELECTRIC

# CONTENTS

# 1. GENERAL DESCRIPTION

## 1. GENERAL DESCRIPTION

Like the K0J2, the K0J2P is an A4-size, highly economical, high-function and small-scaled programmable controller and has the following features:

(1) The number of inputs/outputs can be extended from 56 points of the basic unit to a maximum of 280 points.

(2) The maximum program capacity is 4096 steps. 1024 or 4096 steps can be selected for the RAM, and 2048 or 4096 steps can be selected for the ROM.

(3) In addition to the sequence instructions (18 types) and data instructions (8 types), the K0J2 is provided with 19 types of application instructions including the addition, subtraction, multiplication and division of BCD six digits.

(4) Using the K3 or KGPC as a master channel (master programmable controller), the K0J2P can constitute a programmable controller system which consists of a maximum of 32 channels of local programmable controllers and remote I/O units through connection by optical fiber cables, and therefore, is applicable to a wide range of system control from small to large scale.

# 2. EQUIPMENT LIST

## 2. EQUIPMENT LIST



### 2.1 Equipment List

| Unit Division | Description | Type Name | Remarks | |
|---|---|---|---|---|
| Basic unit | Basic unit | K0J2P-AR<br>K0J2P-AS<br>K0J2P-DR<br>K0J2P-DS<br>K0J2P-DT | Input: 32 points<br>Output: 24 points<br>Total: 56 points | *1 Input<br>A: 100VAC, 10mA<br>Photocoupler insulation<br>D: 24VDC, 10mA<br>Photocoupler insulation<br><br>Output<br>R: Relay contact output<br>200VAC/24VDC, 2A<br>S: Triac output<br>200VAC, 1A<br>T: Transistor output<br>24VDC, 0.5A<br>All points indicated by LEDs<br>Terminal block connection |
| Extension unit | 32-point extension unit (with extension cable K0J61CBL) *4 | K0J1-E32AR<br>K0J1-E32AS<br>K0J1-E32DR<br>K0J1-E32DS<br>K0J1-E32DT | Input: 16 points<br>Output: 16 points<br>Total: 32 points | |
| | 56-point extension unit (with extension cable K0J-61CBL) | K0J1-E56AR<br>K0J1-E56AS<br>K0J1-E56DR<br>K0J1-E56DS<br>K0J1-E56DT<br>K0J2-E56AR<br>K0J2-E56AS<br>K0J2-E56DR<br>K0J2-E56DS<br>K0J2-E56DT | Input: 32 points<br>Output: 24 points<br>Total: 56 points | |
| Memory | EP-ROM | 2KROM | For 2K steps | Select required memory and load it into socket. (RAM for 1K step is standard-equipped.) |
| | | 4KROM | For 4K steps | |
| | IC-RAM | 4KRAM | For 4K steps | |
| Extension power supply | Power supply for extension unit | K0J1-PW | 100VAC input, 24VDC 1A output *5 | |
| Extension cable | Extension cable used between K0Js | K0J-61CBL | 500mm length | 100VAC input, 24VDC 1A output *5 |
| | | K0J-61CBL2 | 1000mm length | |
| Fuse *2 | For power supply | MN51NR | Encased in glass tube, 250V, 2A | |
| | For triac (S) output | MP75 | Plug type, 7.5A | |
| Battery *3 | Lithium battery | K6BAT | For IC-RAM, standard-equipped for basic unit, commonly used for K0, 1, 2 and 3. | |
| Switch | Switch unit | K0SW | For simulation input, 16 points/unit | |

**Table 2.1 List of Equipment**

*1: The last two letters of type names of basic units and extension units indicate inputs/outputs.

Example: K0J2P-AR

- AR → Output: R: relay contact output; S: triac output; T: transistor output
- AR → Input: A: 100VAC input; D: 24VDC input

*2: A fuse is provided for each unit as spare.

*3: If the memory is ROM, a battery is required for back up for power failure.

*4: When the 32-point extension unit is used, the system configuration is restricted. (See Section 4.1.2.)

*5: The extension power supply can be loaded only to Type E56 extension unit.

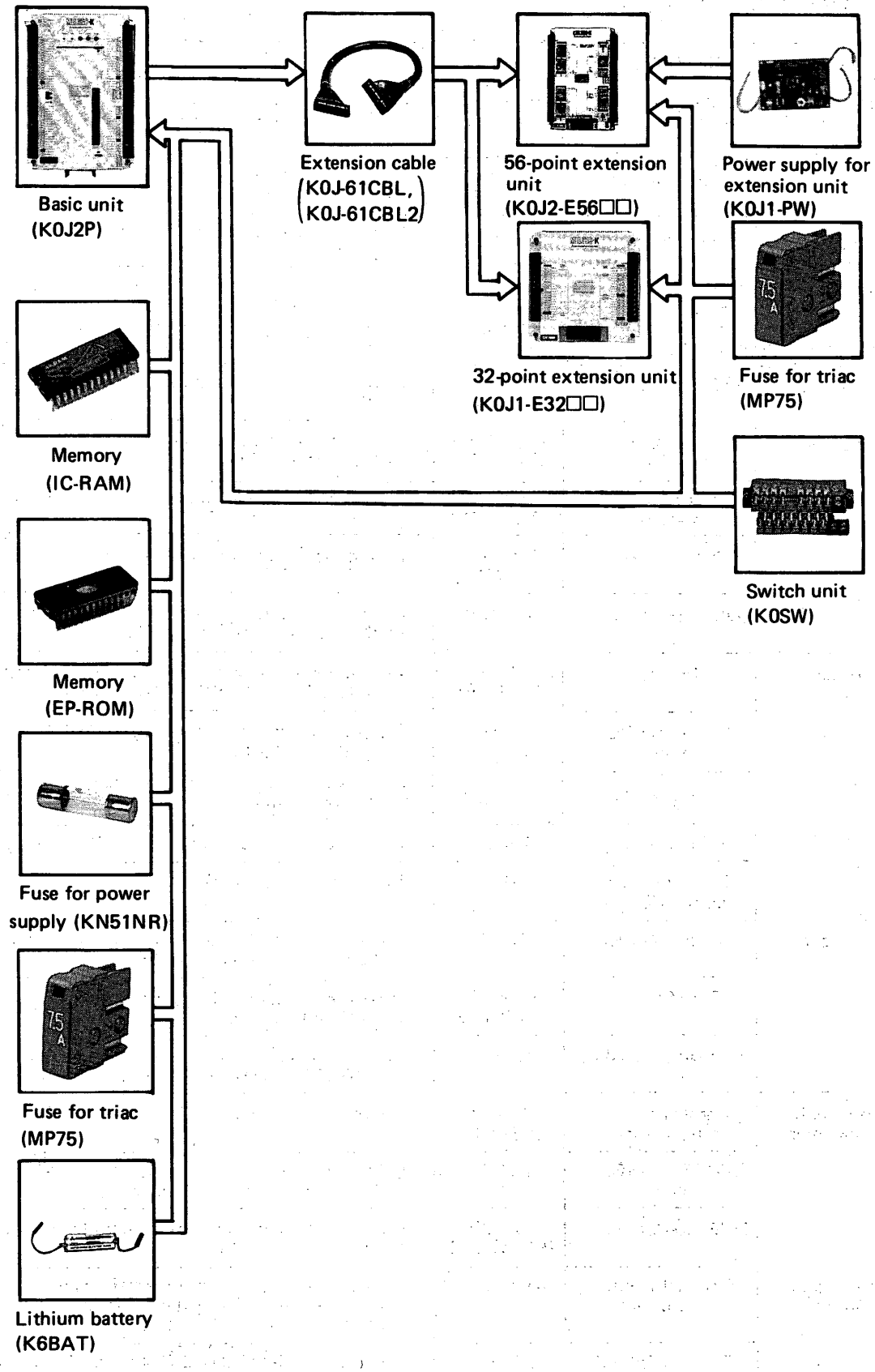


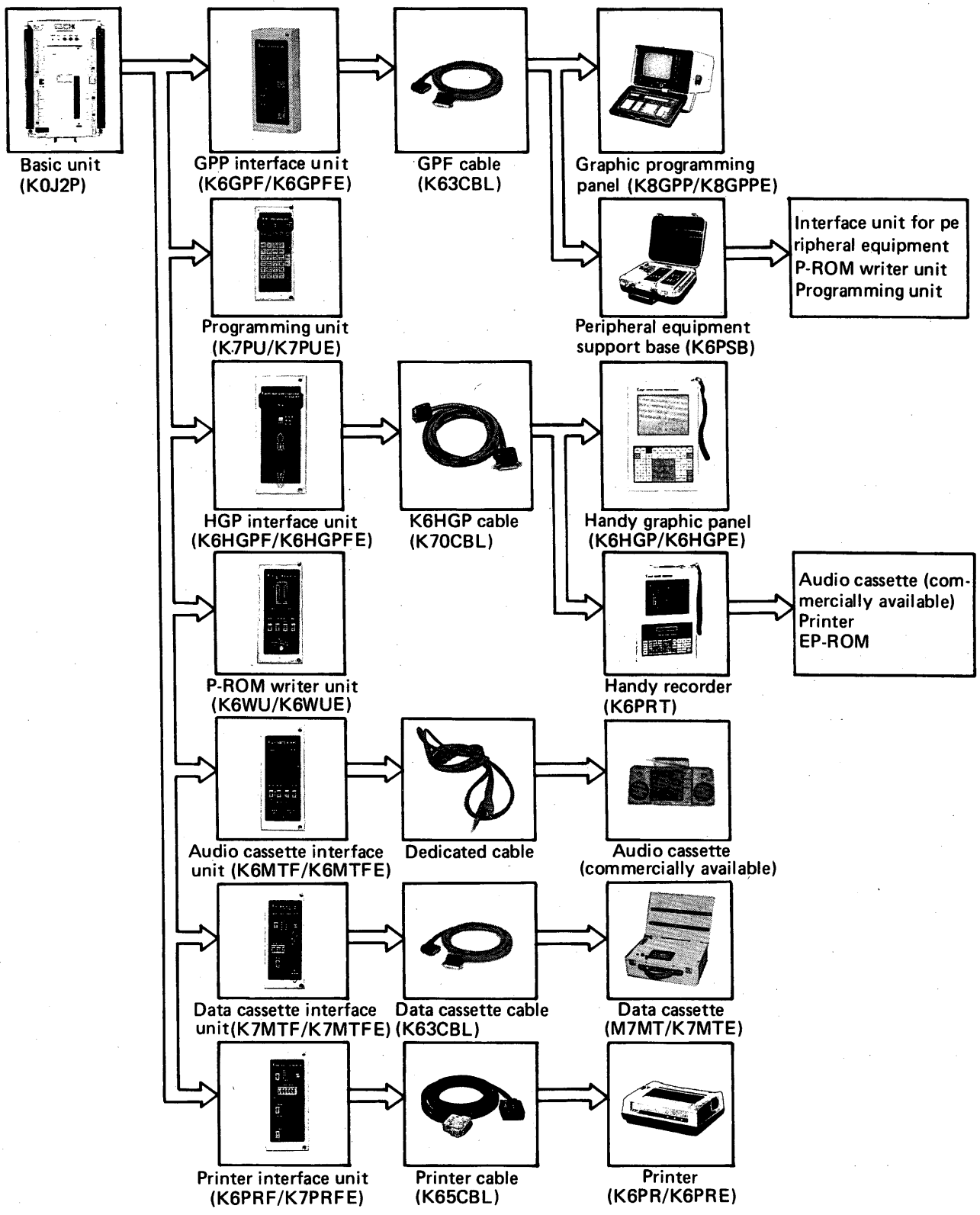

**Fig. 2.1 Equipment**

## 2.2 Peripheral Equipment List

| Unit | Description | Type | Remarks |
|---|---|---|---|
| Programming unit with CRT | Graphic programming panel GPP | K7GPP (K7GPPE) / K8GPP (K8GPPE) | Programming unit with CRT, used together with K6GPF (K6GPFE) and K63CBL. |
| | GPP interface unit | K6GPF (K6GPFE) | Interface used for connection of main unit CPU and GPP or K6PSB. |
| | GPF cable | K63CBL | Cable for connection of K6GPF (K6GPFE) and GPP, length 3m |
| Support base | Peripheral equipment support base | K6PSB | Two peripheral units can be loaded, used together with K6GPF (K6GPFE) and K63CBL. |
| Programming unit | Programming unit | K7PU (K7PUE) | Program I/O unit loaded into main unit CPU or K6PSB |
| P-ROM writer | P-ROM writer unit | K6WU (K6WUE) | Loaded into main unit CPU, GPP, or K6PSB, for 2KROM |
| Audio cassette | Audio cassette interface | K6MTF (K6MTFE) | Interface for commercially available audio cassette, with dedicated cable. |
| Data cassette | Data cassette interface | K7MTF (K7MTFE) | Interface for connection of main unit CPU, GPP, or K6PSB and K7MT (K7MTE) |
| | Data cassette | K7MT (K7MTE) | Data cassette for industrial use. Tape for this unit is CT-300 by TEAC and is commercially available. |
| | Data cassette cable | K63CBL | Cable for connection of K7MT (K7MTE) and K7MTF (K7MTFE), same as GPF cable. |
| Printer | Printer | K6PR (K6PRE) | For circuit diagram of program and hard copy of list, used together with K6PRF (K7PRFE) and K65CBL. |
| | Printer interface unit | K6PRF (K7PRFE) | Interface of connection of K6PR (K6PRE) and main unit, GPP, or K6PSB. |
| | Printer cable | K65CBL | Cable for connection of K6PR (K6PRE) and K6PRF (K7PRFE), length 3m. |
| | Printer paper | K6PR-Y | 9-inch paper, available in units of 2000 sheets. |
| | Ink ribbon for K6PR (K6PRE) | K6PR-R | Replacement ink ribbon |
| Handy recorder | Handy recorder | K6PRT | Equipped with P-ROM writer, printer interface, and audio cassette interface functions. |
| | HGP interface unit | K6HGPF (K6HGPFE) | Interface for connection of main unit CPU and K6PRT or K6HGP (K6HGPE) |
| | K6HGP (K6HGPE) cable | K70CBL | Cable for connection of K6HGP (K6HGPE) or K6PRT and K6HGPF (K6HGPFE), length 2m. |
| Handy graphic programmer | Handy graphic programmer | K6HGP (K6HGPE) | Handy graphic programming unit with LCD. |
| | K6HGP (K6HGPE) cable | K70CBL | Cable for connection of K6HGP (K6HGPE) or K6PRT and K6HGPF (K6HGPFE), length 2 m. |
| | HGP interface unit | K6HGPF (K6HGPFE) | Interface for connection of main unit CPU and K6PRT or K6HGP (K6HGPE) |
| External failure monitor* | External failure monitor unit | K0J2-EX0N | Capable of displaying external failure number in decimal three digits. Number is displayed by connecting K6FD-J. |
| | External failure number display unit | K6FD-J | Connected with K0J2-EX0N, capable of displaying failure numbers of 100 ~ 999. |

**Table 2.2 Peripheral Equipment**

*: External failure monitors (K0J2-EX0N and K6FD-J) will be available soon.




**CAUTION**

The external failure monitor unit cannot be loaded into Type K0J1-E32 unit.

**Fig. 2.2 Peripheral Equipment**

# MEMO

# 3. SPECIFICATIONS

## 3. SPECIFICATION

### 3.1 Common Specifications

| Item | | Specifications | |
|---|---|---|---|
| Power Supply | Applied voltage | 100–110VAC, 85 ~ 110%, single phase 50/60Hz ± 2Hz | |
| | Power Consumption | 66VA, current: maximum 0.9A, inrush current 20A, 10mS (110VAC 60Hz) | |
| Operating ambient temperature | | 0 ~ 55°C (32 ~ 132°F) | |
| Storing ambient temperature | | –10 ~ 75°C (14 ~ 167°F) | |
| Operating ambient humidity | | 10 ~ 90% RH, free of dew condensation | |
| Storing ambient humidity | | 10 ~ 90% RH, free of dew condensation | |
| Vibration resistance | | Conforms to class 3, IIB, JIS C 00911 (16.7 Hz, 3-mm double amplitude, 2 hrs.) | |
| Shock resistance | | Conforms to JIS C 0912 (10 g x 3 times in X, Y, Z, directions) | |
| Noise resistance | | 1000 Vp-p noise voltage, 1μs noise width, 25 ~ 60 Hz noise frequency by noise simulator | |
| Dielectric withstand voltage | | 1500VAC for 1 minute | Across 100VAC external I/O terminals and case |
| | | | Across 100VAC external I/O terminals and 24VDC external I/O terminals |
| | | | Across 100VAC power supply voltage terminals and case |
| | | | Across 24VDC external I/O terminals and case |
| Insulation | | 5MΩ or larger by 500VDC insulation resistance meter | Across 100VAC external I/O terminals and case |
| | | | Across 100VAC external I/O terminals and 24VDC external I/O terminals |
| | | | Across 100VAC power supply voltage terminals and case |
| | | | Across 24VDC external I/O terminals and case |
| Grounding | | Class 3 grounding. Grounding may not be required when it is impossible. | |
| Operating ambience | | Particularly dust and corrosive gas should be minimal. | |
| Cooling method | | Self-cooling | |

*Note: Before voltage withstand test, disconnect the grounded terminal. Also, apply voltage to batch of 100V AC power supply terminals.*

**Table 3.1 Common Specifications**

## 3.2 Performance Specifications

### 3.2.1 CPU performance specifications

(1) Performance specifications

<table>
<tr><th colspan="2">Item</th><th colspan="4">Specifications</th></tr>
<tr><td colspan="2">Control method</td><td colspan="4">Stored program, repeated operation</td></tr>
<tr><td colspan="2">I/O control method</td><td colspan="4">Input and output are provided each time during repeated operation.</td></tr>
<tr><td colspan="2">Programming language</td><td colspan="4">Dedicated language to sequence control (relay symbol type, used together with logic symbolic language)</td></tr>
<tr><td rowspan="2">Instruction</td><td>Number of instruction</td><td colspan="4">26 types of basic instructions (sequence instructions + data instructions) + 19 types of application instructions</td></tr>
<tr><td>Word length</td><td colspan="4">16 bits/step</td></tr>
<tr><td colspan="2">Sequence instruction execution time</td><td colspan="4">5.6μs/step/step on average.(*1)</td></tr>
<tr><td colspan="2">Data instruction execution time</td><td colspan="4">See Section 2 of APPENDIX.</td></tr>
<tr><td colspan="2" rowspan="4">Program capacity and memory *1</td><td></td><td>IC-RAM</td><td>EP-ROM</td><td rowspan="4">• Select required memory and load it into socket.<br>(*: RAM for 1K step is standard-equipped.)<br>• RAM is backed up by lithium battery. Total power failure guarantee period: 300 days *2</td></tr>
<tr><td>1024 steps</td><td>*</td><td>—</td></tr>
<tr><td>2048 steps</td><td>—</td><td>2KROM</td></tr>
<tr><td>4096 steps</td><td>4KRAM</td><td>4KROM</td></tr>
<tr><td colspan="2" rowspan="3">Number of I/O points</td><td colspan="3">Basic unit: input — 32 points, output — 24 points</td><td rowspan="3">Maximum number of inputs/outputs: 280 points</td></tr>
<tr><td colspan="3">E32 extension unit: input — 16 points, output — 16 points</td></tr>
<tr><td colspan="3">E56 extension unit: input — 32 points, output — 24 points</td></tr>
<tr><td colspan="2">Number of temporary memories</td><td>250 points (M0 ~ M249)</td><td colspan="3">M250 (off at initial receiving)<br>M251 (off during link communication)<br>M252 (empty: not usable)<br>M253 (on at link communication error)<br>M254 (on at battery error)<br>M255 (on during run)</td></tr>
<tr><td rowspan="3">Timer/counter (built-in)</td><td>Number of points</td><td colspan="4">128 points (T/C0 ~ 127 including timers and counters)</td></tr>
<tr><td>Timer specifications</td><td colspan="4">T0 ~ T95: 0.1 ~ 999.9 sec setup time; 0.1 sec setup time increments; on delay<br>T96 ~ T127: 0.01 ~ 99.99 sec setup time; 0.01 sec setup time increments; on delay</td></tr>
<tr><td>Counter specifications</td><td colspan="4">1 ~ 9999 setting range</td></tr>
<tr><td rowspan="2">Shift register</td><td>Number of usable points</td><td colspan="4">249 bits (M1 ~ M249) excluding those used for temporary memory.</td></tr>
<tr><td>Specifications</td><td colspan="4">With temporary memories combined in units of one bit, up to 249 bits are possible (data shift is also possible).</td></tr>
<tr><td rowspan="2">Data register</td><td>Specifications</td><td colspan="4">96 points (D0 ~ 95), 16 bits for 1 data, maximum of four digits can be handled in units of four bits.</td></tr>
<tr><td>Data input/output</td><td colspan="4">Four I/O points make up one digit. Usable jointly with process input/output. Decimal one ~ four digits in the range of 0 ~ 9999.</td></tr>
<tr><td colspan="2">Power failure latch range</td><td colspan="4">Power failure latch is possible by LATCH key switch of basic unit.<br>M128 ~ 249, T/C64 ~ 111, D64 ~ 95</td></tr>
<tr><td colspan="2">Allowable instantaneous stop time</td><td colspan="4">20mS (at the time of independent use)</td></tr>
<tr><td colspan="2">Self-diagnostic function</td><td colspan="4">Watch dog error monitor (WDT = 200mS), error machine code detection, power supply error detection, RUN signal is output by program from exterior.</td></tr>
</table>

*Note:* *1: *The memory is used for independent system and local programmable controller of data link system, and is not required for remote I/O unit.*

*2: *For replacement of battery, see Section 6.4.*

(2) List of devices

| | Device | Description | Number | Number of Points | Remarks |
|---|---|---|---|---|---|
| 1 | X | Input | X00 ~ 1F | 160 points | Numbers allotted to basic unit |
| | | | X80 ~ 9F | | Numbers allotted to extension 1 |
| | | | XC0 ~ DF | | Numbers allotted to extension 2 |
| | | | X180 ~ 19F | | Numbers allotted to extension 3 |
| | | | X1C0 ~ 1DF | | Numbers allotted to extension 4 |
| | | | X100 ~ 17F | 128 points | For data link |
| 2 | Y | Output | Y20 ~ 37 | 120 points | Numbers allotted to basic unit |
| | | | YA0 ~ B7 | | Numbers allotted to extension 1 |
| | | | YE0 ~ F7 | | Numbers allotted to extension 2 |
| | | | YA0 ~ 1B7 | | Numbers allotted to extension 3 |
| | | | Y1E0 ~ 1F7 | | Numbers allotted to extension 4 |
| | | | Y100 ~ 17F | 128 points | For data link |
| 3 | M | Temporary memory | M0 ~ 249 | 250 points | ○M254: Turns on when battery voltage reduces.<br>○M255: Turns on when output of self-diagnostic result is normal during run. Turns off at stop, error and power-off. |
| 4 | T | Timer | 0 ~ 127 for both T and C | 128 points | ○T and C are numbered in series like T0, T1, C2, T3, C4 ..... The same number cannot be used for T and C.<br>○T0 ~ 95 (96 points) are 100ms timers. T96 ~ 127 (32 points) are 10ms timers. |
| 5 | C | Counter | | | |
| 6 | F | Function number | F0 ~ 126 | 118 points | ○F0 ~ 99: external failure memories<br>○F100 ~ 104, 108 ~ 119, 126: application instructions |
| 7 | D | Data register | D0 ~ 95 | 96 points | D100 and following numbers are for special application. |
| 8 | K | Constant | K0 ~ 9999 | | ○Numeric contant: 0 ~ 9999<br>○Master control: 0 ~ 63<br>○Digit designation: 1 ~ 4<br>○Jump destination step number: 3 ~ 4095 |

**Table 3.3 Device List**

(3) Instruction list

| No. | Instruction Symbol (Name) | Function | Drawing Representation | No. | Instruction Symbol (Name) | Function | Drawing Representation |
|---|---|---|---|---|---|---|---|
| 1 | LD Load | Logic operation start (Contact a operation start) | X.Y.M.T.C.F | 10 | MC Master control | Master control start | MC Kn, Kn, n=0~63 |
| 2 | LDI Load inverse | NOT logic operation start (Contact b operation start) | X.Y.M.T.C.F | 11 | MCR Master control reset | Master control reset | MCR Kn, n=0~63 |
| 3 | AND AND | Logical product (Contact a series connection) | X.Y.M.T.C.F | 12 | SET Set | Set of Y, M, F | SET Y.M.F |
| 4 | ANI AND inverse | Logic NAND (Contact b series connection) | X.Y.M.T.C.F | 13 | RST Reset | Reset of Y, M, F Reset of counter temporary value | RST Y.M F.C |
| 5 | OR OR | Logical add (Contact a parallel connection) | X.Y.M.T.C.F | 14 | SFT Shift | 1-bit shift of temporary value | SET M |
| 6 | ORI OR inverse | Logic NOR (Contact b parallel connection) | X.Y.M.T.C.F | 15 | CJ Conditional jump | Conditional jump (Jump to latter step number when input signal is on) | CJ K, Jump destination number |
| 7 | ANB AND block | Logic block AND (Series connection between blocks) | | 16 | PLS Pulse | Pulse (Pulses for 1 cycle of program is generated at rise of input signal) | PLS M |
| 8 | ORB OR block | Logic block OR (Parallel connection between blocks) | | 17 | NOP NOP | No operation | For program delete or space |
| 9 | OUT OUT | Coil output (Y, M) Timer output (T) Counter output (C) Function No. output (F) | *1 Y.M.T.C.F | 18 | END END | Program end | Return to step 0 Be sure to enter END at the end of program. |

**Table 3.4 Sequence Instruction List**

*Note: *1: T and C set values can be specified for constant K and data register D.*
**2: OUT T, C and CJ are 2-word instructions. All others are 1-word instructions.*

| No. | Instruction Symbol (Name) | Function | Drawing Representation | No. | Instruction Symbol (Name) | Function | Drawing Representation |
|---|---|---|---|---|---|---|---|
| 1 | MOV Move | Data transfer S→D | *5 *1 *2 MOV S D | 5 | + Plus | Addition *4 D+S→D | *5 *1 *2 + S D |
| 2 | > Larger | Magnitude comparison S>D | *5 *6 *1 *2 > S D Y.M.T.C.F | 6 | − Minus | Subtraction *4 D−S→D | *5 *1 *2 − S D |
| 3 | < Smaller | Magnitude comparison S<D | *5 *6 *1 *2 < S D Y.M.T.C.F | 7 | BCD BCD | BIN→BCD conversion S→BCD conversion →D | *5 *1 *2 BCD S D |
| 4 | = Equal | Coincidence S=D | *5 *6 *1 *2 = S D Y.M.T.C.F | 8 | BIN Binary | BCD→BIN conversion S→BIN conversion →D | *5 *1 *2 BIN S D |

**Table 3.5 Data Instructions**

*Note: *1: S stands for source.*
**2: D stands for destination.*
**3: All data instructions are 3-word instructions.*
**4: Negative numbers are not handled.*
**5: Instruction data operation is initiated when input signal is on.*
**6: These instructions are used for series contact a, while others are for coils.*

3

| | S \ D | K | D | T | C | X | Y | M |
|---|---|---|---|---|---|---|---|---|
| MOV BCD BIN +, − | K | | ○ | ○ | ○ | | ○ | ○ |
| | D | | ○ | ○ | ○ | | ○ | ○ |
| | T | | ○ | ○ | ○ | | ○ | ○ |
| | C | | ○ | ○ | ○ | | ○ | ○ |
| | X | | ○ | ○ | ○ | | ○ | ○ |
| | Y | | ○ | ○ | ○ | | ○ | ○ |
| | M | | ○ | ○ | ○ | | ○ | ○ |
| >,<,= | S \ D | K | D | T | C | X | Y | M |
| | K | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | D | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | T | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | C | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | X | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | Y | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | M | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | |
|---|---|---|---|
| MOV | Km | Dn | Constant set : constant Km (0 ~ 9999) is set to Dn. |
| MOV | Dm | Dn | Transfer : Content of Dm is transferred to Dn. |
| MOV | Dm | T,Cn | Change of T, C temporary value : Content of Dm is written into T, C temporary value. |
| MOV | Dm | KnY,M | Batch output : Dm content is output in blocks in units of 4 points up to 16 points. |
| MOV | T,Cm | Dn | Read of T, C temporary value : T, C temporary value is transferred to Dn. |
| MOV | KmX,M | Dn | Batch input : X, M content is inputted to Dn in blocks in units of 4 points up to 16 points. |
| MOV | Km | KnY | Pattern output to Y : Bit pattern is output to Y in blocks in units of 4 points up to 16 points. |
| MOV | KmX | KnM | Batch input of X to M : X is inputted to M in blocks in units of 4 points up to 16 points. |
| MOV | KmY | Dn | Output pattern save of Y : Y is transferred to Dn in units of 4 points up to 16 points. |
| BCD | Dm | Dn | Binary data of data register is converted into BCD. |
| BCD | T,Cm | Dn | T, C temporary value is read and converted into BCD. |
| BIN | Dm | Dn | BCD data of data register is converted into binary. |
| BIN | KmX | Dn | BCD data of input is converted into binary and inputted in blocks. |
| BCD | T,Cm | KnY | T, C temporary value (binary) is converted into BCD and output directly to Y. |
| BCD | Dm | KnY | Binary data of Dm is converted into BCD and output directly to Y. |
| + | Km | Dn | Constant addition : Km (0 ~ 9999) + Dn content is done and the result is stored into Dn. |
| + | Dm | Dn | Addition : Dn content + Dm content is done and the result is stored into Dn. |
| − | Km | Dn | Constant subtraction : Dn content − Km (0 ~ 9999) is done and the result is stored into Dn. |
| − | Dm | Dn | Subtraction : Dn content − Dm content is done and the result is stored into Dn. |
| > | Dm | Dn | Magnitude comparison : Dm content > Dn content is judged. |
| < | Km | Dn | Magnitude comparison : Constant Km (0 ~ 9999) < Dn content is judged. |
| = | Dm | Dn | Coincidence judgement : Dm content = Dn content is judged. |
| >,<,= | Km | T,Cn | Direct comparison of T, C temporary value and reference value (Km). |
| >,<,= | Km | KnY | Comparison of output pattern and reference pattern (Km). |

**Table 3.6 S, D Instruction List of Data Instructions**

## CAUTION

Note that when programming is performed by use of K6GPP, K7GPP, K6PU or K7PU (unit having a legend plate which does not indicate "DATE" as shown below), only the S and D combinations of programmable data instructions shown in the following tables can be used.

□□ K3 □
- → Version
- → Year and month of manufacture

MOV

| S \ D | K | D | T | C | X | Y | M |
|---|---|---|---|---|---|---|---|
| K | | ○ | | | | | |
| D | | ○ | ○ | ○ | | ○ | ○ |
| T | | ○ | | | | | |
| C | | ○ | | | | | |
| X | | ○ | | | | | |
| Y | | | | | | | |
| M | | ○ | | | | | |

>,<,=,+,−

| D | K | D | T | C | X | Y | M |
|---|---|---|---|---|---|---|---|
| K | | ○ | | | | | |
| D | | ○ | | | | | |
| T | | | | | | | |
| C | | | | | | | |
| X | | | | | | | |
| Y | | | | | | | |
| M | | | | | | | |

BCD(○)
BIN(•)

| S \ D | K | D | T | C | X | Y | M |
|---|---|---|---|---|---|---|---|
| K | | | | | | | |
| D | | ○ | | | | | |
| T | | ○ | | | | | |
| C | | ○ | | | | | |
| X | | • | | | | | |
| Y | | | | | | | |
| M | | | | | | | |

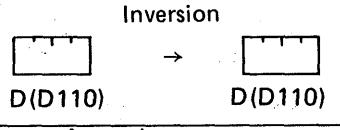
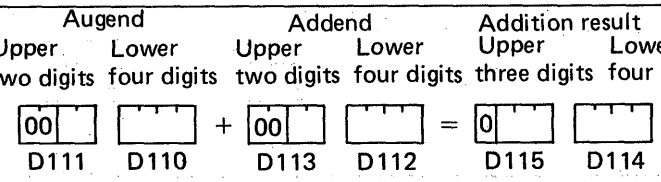
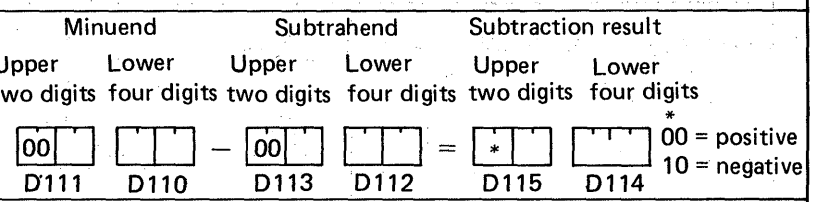
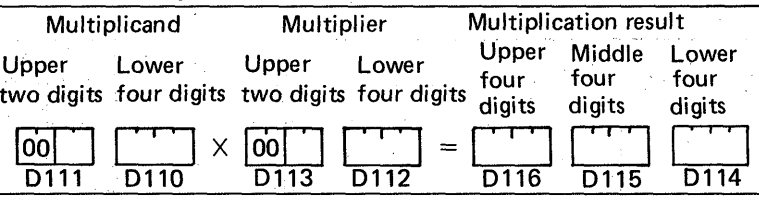
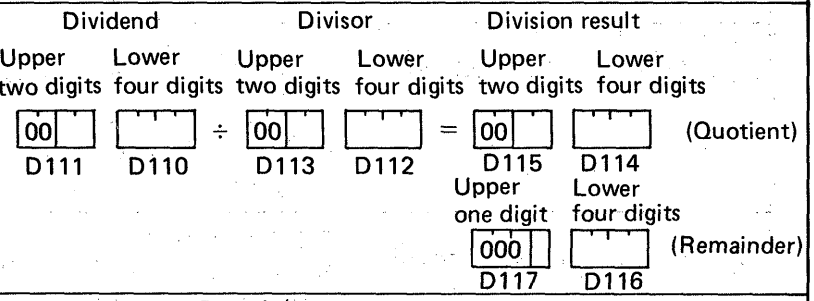
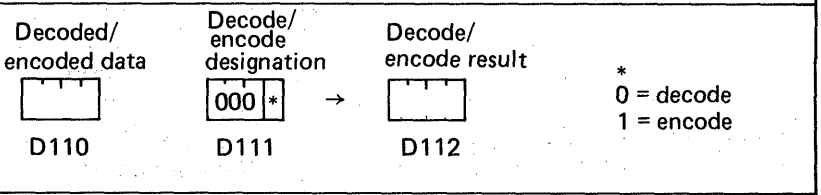
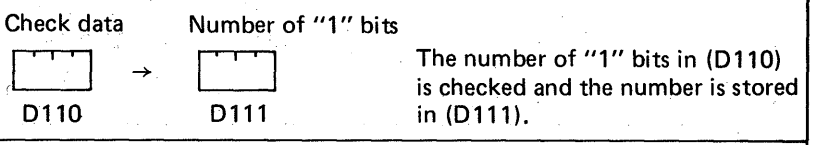
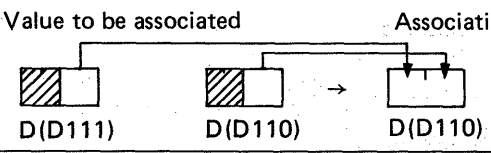
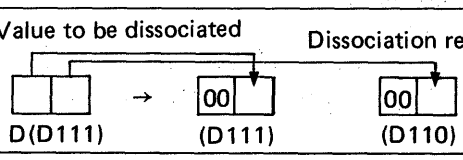
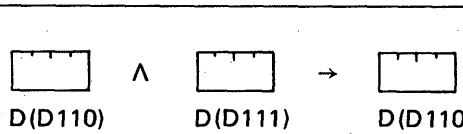
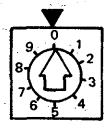
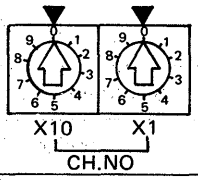
| Instruction | Function | Operation Result |
|---|---|---|
| OUT F100 | Indirect inversion of 16-bit data |   ● 1's complement ● (D110) is data register number. |
| OUT F101 | BCD 6 digit Addition |   |
| OUT F102 | BCD 6 digit subtraction |   |
| OUT F103 | BCD 6 digit multiplication |   |
| OUT F104 | BCD 6 digit division |   |
| OUT F108 | 4 ↔ 16 bit decode/encode |   |
| OUT F109 | 16 bit check |   The number of "1" bits in (D110) is checked and the number is stored in (D111). |
| OUT F110 | 8-bit data association |   |
| OUT F111 | 16-bit data dissociation |   |
| OUT F112 | Indirect AND operation of 16-bit data |   |

**Table 3.7 List of Application Instructions (Continued)**

| Instruction | Function | Operation Result |
|---|---|---|
| OUT F113 | Indirect OR operation of 16-bit data | D(D110) V D(D111) → D(D110) |
| OUT F114 | Batch shift of temporary memory M | Head number of M: 0 D110; Number of D points to be shifted: 0 D111; Designation of shift direction: 000* D112. *0 = leftward shift, 1 = rightward shift. Head number of M is placed in (D110) and the number of points in (D111) is shifted once. |
| OUT F115 | Batch shift of data resistor D | Head number of D: 00 D110; Number of D points to be shifted: 00 D111; Designation of shift direction: 000* D112. *0 = leftward shift, 1 = rightward shift. Head number of D is placed in (D110) and the number of points in(D111) is shifted once. |
| OUT F116 | Batch reset of data register D | Head number of D: 00 D110; Number of D points to be reset: 00 D111. Head number of D is placed in (D110) and the number of points in (D111) is reset. |
| OUT F117 | Indirect reading of T, C, D | T, C, D number Three digits: * D110 → Reading result: D111. *0 = T·C, 1 = D |
| OUT F118 | Indirect writing of T, C, D | T, C, D number Three digits: * D110 → Writing result: D111. *0 = T·C, 1 = D |
| OUT F119 | Data transfer from Y to D | Number of digits and head number of Y: Number of digits; Head number; D number of transfer destination: 1 D110 → D111. Batch transfer from output Y to data register D. A maximum of 16 points are transferred in units of four points. |
| OUT F126 | High-speed processing program call | Used for call of high-speed processing program (SET F126) in normally processed program and return to normally processed program (RST F126) at the end of high-speed processing program. |
| RST F126 | High-speed processing program return | |

**Table 3.7 List of Application Instructions**

### 3.2.2 Optical data link specifications

| Item | | Specifications |
|---|---|---|
| Data link function | | Slave channel function ● Remote I/O channel of remote I/O system<br>● Local programmable controller of local programmable controller system<br>(selectable by the internal setting switch) |
| Programmable controller applicable to master channel (Number of connected slave channels) | | KGPC, K3<br>A maximum of 32 channels: K0J2P can be used together with local programmable controller (KJ71P3) and remote I/O unit (KJ72P5) composed of K2 or K3. |
| Transmission cable | | Optical fiber cable (quartz glass) |
| Maximum transmission cable length | | Maximum 2 km between channels (between master channel and slave channel / between slave channel and slave channel) |
| Communication speed | | 500 k BPS |
| Number of points for data link with master programmable controller | | Remote I/O unit: maximum 280 points for X and Y<br>Local programmable controller: 128 points for each of X and Y, maximum 256 points, macimum 24 points for D |
| Test function | | Master test, slave test (test can be made by selection of the mode setting switch) |
| Automatic reconnection function | | Provided (selectable by the internal setting switch) |
| Setting | Optical link mode setting | [Front digital switch]<br>  <br>0: ONLINE mode<br>1: OFFLINE mode<br>2: MASTER TEST mode<br>3: SLAVE TEST mode<br>4 ~ 9: Not used |
| | Channel number setting | [Front digital switch]<br>  <br>X10 X1<br>CH.NO<br>Specified by 0 ~ 32<br>0: indenpendent programmable controller<br>1 ~ 32: channel numbers for remote I/O unit and local programmable controller |
| | Function setting | [Internal setting switch]<br>1 Empty<br>2 Empty<br>3 ---- Independent programmable controller: OFF / Remote I/O: ON / Local programmable controller: OFF<br>4 ---- Independent programmable controller: OFF / Remote I/O: OFF / Local programmable controller: ON<br>5 Empty<br>6 Empty<br>7 Empty<br>8 ---- Automatic reconnection: OFF / No automatic reconnection: ON |
| During suspension of data link | | Remote I/O unit: all output points are turned OFF.<br>Local programmable controller: all data link points are turned off. M251 turns ON, sequence processing is continued. |

*Note: The ▼mark in the table indicates factory-set state.*

**Table 3.8 Optical Data Link Specifications**

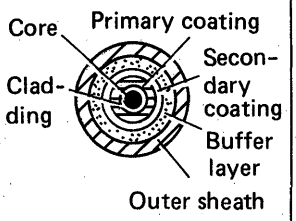
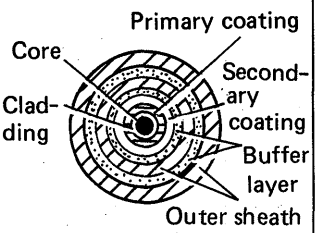
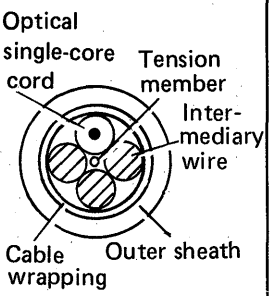
| Item | Optical Single-core Cord (3 mm dia.) | Reinforced Optical Single-core Cord (5 mm dia.) | Optical Cable |
|---|---|---|---|
| Structure |  |  |  |
| Finish OD | Approx. 3 mm | Approx. 5 mm | Approx. 11 mm |
| Allowable bending radius | 20 mm | 30 mm | 110 mm |
| Allowable tension | 30 kg | 50 kg | 60 kg |
| Weight | Approx. 10 g/m | Approx. 25 g/m | Approx. 100 g/m |
| Number of applicable cores | 1 core | 1 core | 1 core |
| Application | For wiring inside panel | For wiring between indoor equipment | For wiring between outdoor equipment |
| Transmission loss | Maximum 3.5 dB/km ($\lambda$ = 0.85$\mu$m) | | |
| Transmission band | Maximum 220 MHz/km ($\lambda$ = 0.85$\mu$m band LD) | | |
| Core | Quartz glass, diameter: 50 ± 3$\mu$m | | |
| Cladding | Quartz glass, diameter: 125 ± 3$\mu$mm | | |
| Core eccentricity and ellipticity | Maximum 6%, respectively | | |
| Primary coating | Silicone resin, approx. 0.4 mm dia. | | |
| Secondary coaring | Nylon, 0.9 ± 0.1 mm dia. | | |
| Buffer layer | Nylon fiber | | |
| Tension member | PE coated steel wire, approx. 2 mm dia. | | |
| Intermediary wire | Polyethylene string, approx. 3 mm dia. | | |
| Cable wrapping | Plastic tape | | |
| Outer sheath | Black PVC | | |
| Profile | GI | | |

**Table 3.9 Specifications of Optical Fiber Cable**

*Note: 1. Designation of optical fiber cable*

0F-010D-□ E0-□M

- *Cable structure* — *A: optical single-core cord (3mm dia.)*, *B: reinforced optical single-core cord (5mm dia.)*, *C: optical cable (11mm dia.)*
- *Cable length (specify in meters: 5 ~ 2000m)*

*2. Designation of connection of connector to optical fiber cable*

0D-9475B-□-□M-D

- *Connection of connector — 1: only one end of cable, 2: both ends*
- *Cable length (specify in meters: 5 ~ 2000m)*

### 3.2.3 Memory specifications

| | RAM | | ROM | |
|---|---|---|---|---|
| Type name | * | 4KRAM | 2KROM | 4KROM |
| Capacity | 1024 steps | 4096 steps | 2048 steps | 4096 steps |
| Construction | IC chip | IC chip | IC chip | IC chip |
| Remarks | *Standard-equipped RAM | ——— | ROM writer K6WU K6PRT | ROM writer K6PRT |

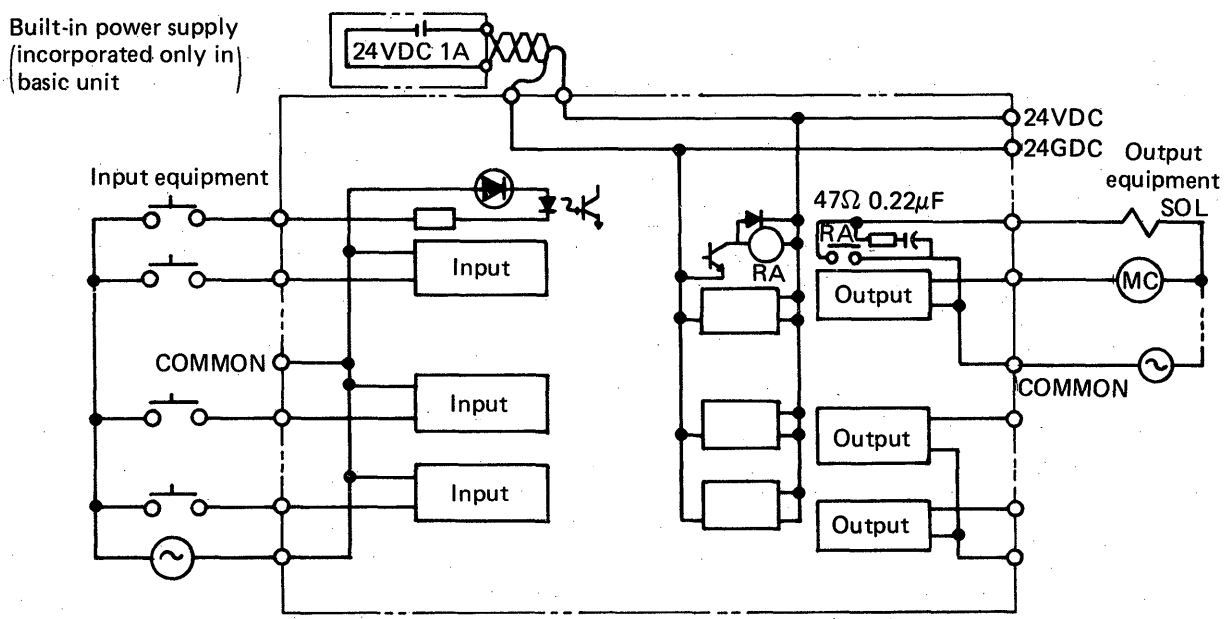
*Note: Applicable RAM and ROM are restricted to Mitsubishi's products.*

**Table 3.10 Memory Specifications**

### 3.2.4 I/O specifications

(1) Type AR (100VAC input, relay contact output)

| Input Specifications | | | Output Specifications | | |
|---|---|---|---|---|---|
| Insulation system | Photocoupler | | Insulation system | Relay | |
| Operating indicator | All points indicated by light-emitting diodes | | Operating indicator | All points indicated by light-emitting diodes | |
| Input voltage | 85 ~ 121VAC | | Maximum load voltage | 250VAC/125VDC | |
| | | | Load power supply | 1 point | 2A (120VAC cosφ=0.7, 24VDC L/R=7mS) |
| Operating current | 10mA (100VAC) | | | 8 points | 8A (all points simultaneous ON) |
| Operating voltage | OFF → ON | 80VAC minimum | Maximum inrush load current | 5A/points | |
| | ON → OFF | 40VAC maximum | Minimum load current | 5mA (100V/200VAC), 10mA (24VDC) | |
| Response time | OFF → ON | 5 ~ 15mS | Response time | OFF → ON | 5mS |
| | ON → OFF | 15 ~ 30mS | | ON → OFF | 15mS |
| Input impedance | 10kΩ | | Contact life | Electrical | 500 thousand times or more (110VAC 1.5A) |
| | | | | Mechanical | 20 million times or more |
| Common wiring | All points/common (provided with terminal block for bridiging external wiring per 16 points) | | Leak current | 2mA (220VAC 60Hz) | |
| | | | Common wiring | 8 points/common | |
| External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | | External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | |
| Applicable solderless terminals | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | | Applicable solderless terminal | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | |
| Applicable wire size | 2mm² maximum | | Applicable wire size | 2mm² maximum | |

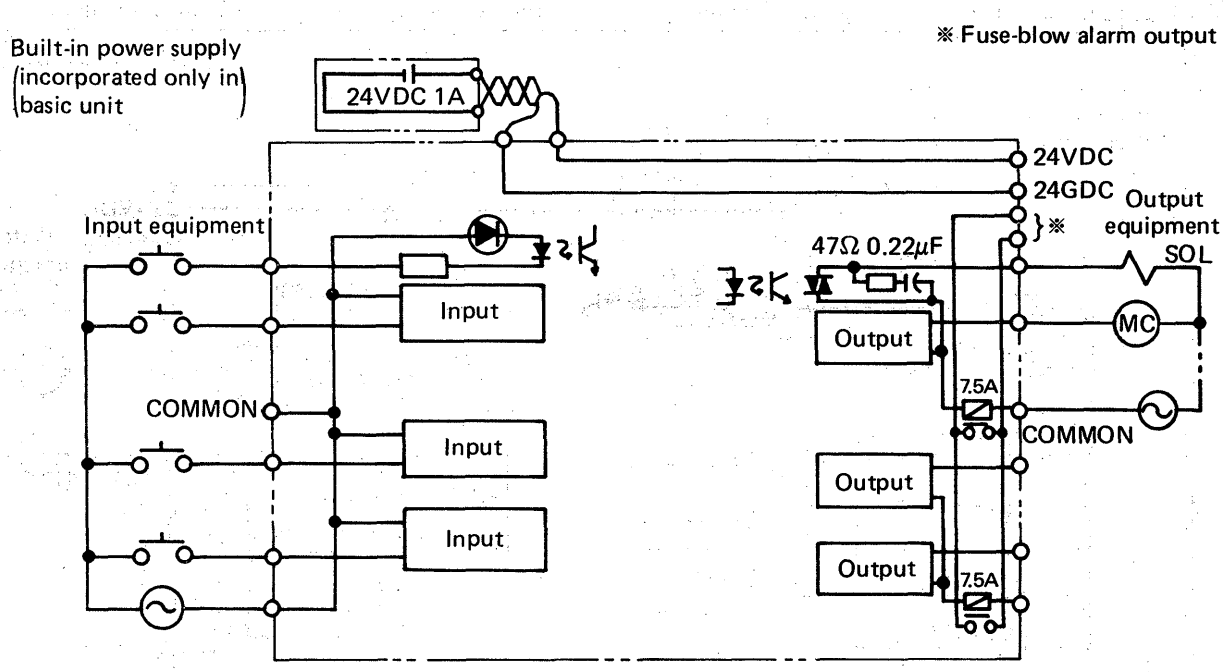



Since the basic unit incorporates 24V DC power supply, it is not required to supply the relay power supply for output circuit from the exterior. Connect E32, E56 extension unit in the exterior so that power is supplied from the 24V DC supply terminal of basic unit.

**Table 3.11 Type AR Specifications**

(2) Type AS (100VAC input, triac output)

| Input Specifications | | | Output Specifications | | |
|---|---|---|---|---|---|
| Insulation system | Photocoupler | | Insulation system | Photocoupler | |
| Operating indicator | All points indicated by light-emitting diodes | | Operating indicator | All points indicated by light-emitting diodes | |
| Input voltage | 85 ~ 121VAC | | Load voltage | 80 ~ 242VAC | |
| | | | Load power supply | 1 point | 1A |
| Operating current | 10mA (100VAC) | | | 8 points | 5A (8 points simultaneous ON) |
| Operating voltage | OFF → ON | 80VAC minimum | Maximum inrush load current | 30A/point (1 cycle) | |
| | ON → OFF | 40VAC maximum | Minimum load current | 30mA (25°C) | |
| Response time | OFF → ON | 5 ~ 15mS | Response time | OFF → ON | 1mS |
| | ON → OFF | 15 ~ 30mS | | ON → OFF | 1/2 cycle |
| Input impedance | 10kΩ | | Fuse-blow alarm contact | 125VAC Maximum current: 0.5A | |
| Common wiring | All points/common (provided with terminal block for bridiging external wiring per 16 points) | | Leak current | 3mA (220VAC 60Hz) | |
| | | | Common wiring | 8 points/common | |
| External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | | External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | |
| Applicable solderless terminals | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | | Applicable solderless terminal | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | |
| Applicable wire size | 2mm² maximum | | Applicable wire size | 2mm² maximum | |

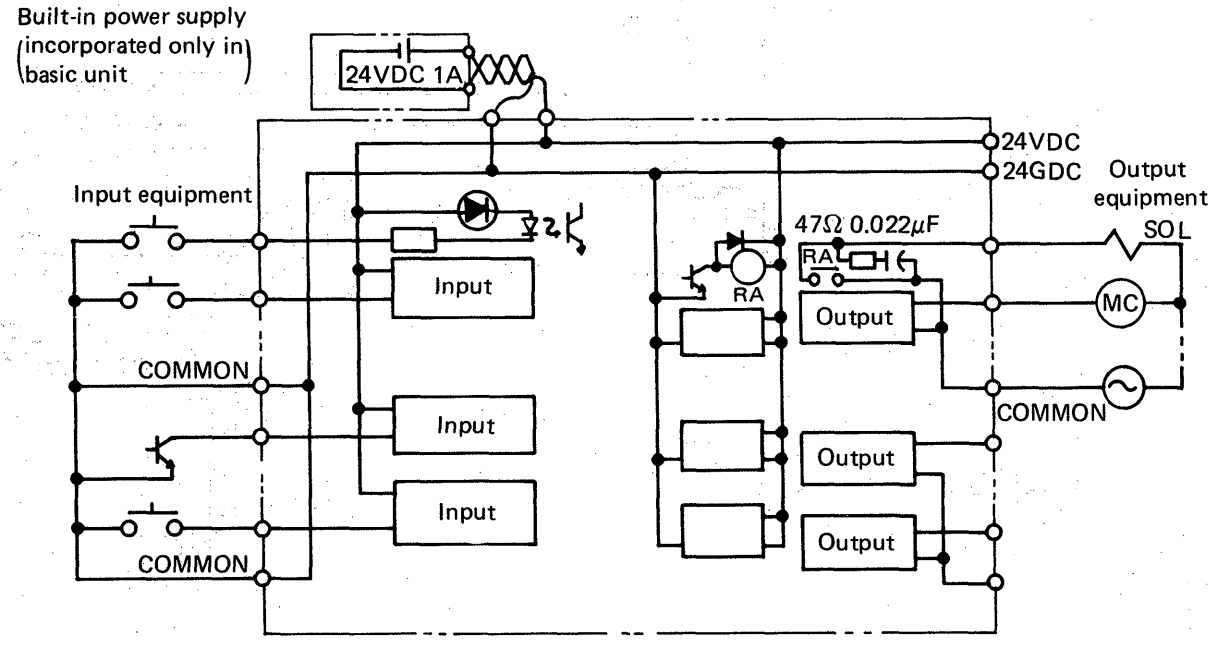



The basic unit incorporates 24V DC power supply. When Type DR, AR, DT or DS is used, connect E32, E56 extension unit in the exterior so that power is supplied from the 24V DC supply terminal.

**Table 3.12 Type AS Specifications**

(3) Type DR (24VDC input, relay contact output)

| Input Specifications | | | Output Specifications | | |
|---|---|---|---|---|---|
| Insulation system | Photocoupler | | Insulation system | Relay | |
| Operating indicator | All points indicated by light-emitting diodes | | Operating indicator | All points indicated by light-emitting diodes | |
| Input voltage | 24VDC +10 ~ −10% | | Maximum load voltage | 250VAC/125VDC | |
| | (Power supply built in basic unit is used) | | Load power supply | 1 point | 2A (120VAC cosϕ=0.7, 24VDC L/R=7mS) |
| Input current | 8.5 ~ 11mA (24VDC) | | | 8 points | 8A (8 points simultaneous ON) |
| Operating voltage | OFF → ON | 8 ~ 10VDC | Maximum inrush load current | 5A/points | |
| | ON → OFF | 8 ~ 10VDC | Minimum load current | 5mA (100V/200VAC), 10mA (24VDC) | |
| Response time | OFF → ON | 9 ~ 15mS | Response time | OFF → ON | 5mS |
| | ON → OFF | 9 ~ 15mS | | ON → OFF | 15mS |
| Input resistance | Approximately 2.4kΩ | | Contact life | Electrical | 500 thousand times or more (110VAC 1.5A) |
| Input system | Sink input (input current efflux system) | | | Mechanical | 20 million times or more |
| Common wiring | 32 points/common (provided with terminal block for bridiging external wiring per 16 points) | | Leak current | 2mA (220VAC 60Hz) | |
| | | | Common wiring | 8 points/common | |
| External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | | External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | |
| Applicable solderless terminals | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | | Applicable solderless terminal | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | |
| Applicable wire size | 2mm² maximum | | Applicable wire size | 2mm² maximum | |

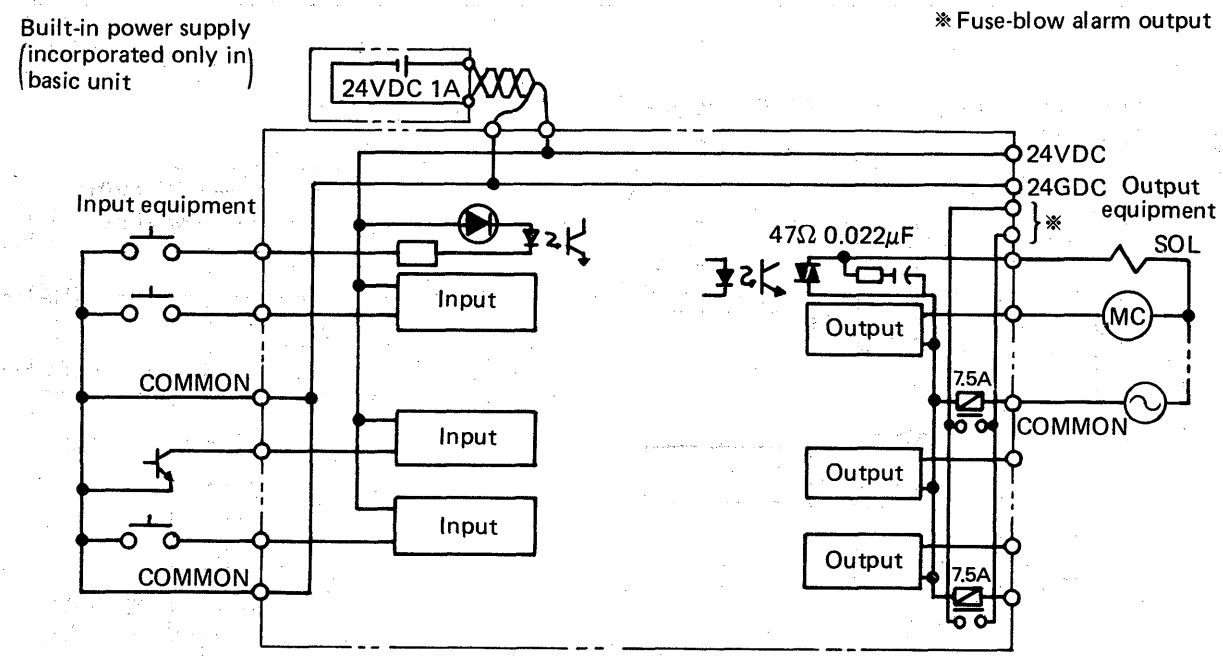



Since the basic unit incorporates 24V DC power supply, it is not required to supply the power supply for input circuit and the relay power supply for output circuit from the exterior. Connect E32, E56 extension unit in the exterior so that power is supplied from the 24V DC supply terminal of basic unit.

**Table 3.13 Type DR Specifications**

(4) Type DS (24VDC input, triac output)

| Input Specifications | | | Output Specifications | | |
|---|---|---|---|---|---|
| Insulation system | Photocoupler | | Insulation system | Photocoupler | |
| Operating indicator | All points indicated by light-emitting diodes | | Operating indicator | All points indicated by light-emitting diodes | |
| Input voltage | 24VDC +10 ~ −10% | | Load voltage | 80 ~ 242VAC | |
| | (Power supply built in basic unit is used) | | Load power supply | 1 point | 1A |
| Input current | 8.5 ~ 11mA (24VDC) | | | 8 points | 5A (8 points simultaneous ON) |
| Operating voltage | OFF → ON | 8 ~ 10VDC | Maximum inrush load current | 30A/point (1 cycle) | |
| | ON → OFF | 8 ~ 10VDC | Minimum load current | 30mA/point (25°C) | |
| Response time | OFF → ON | 9 ~ 15mS | Response time | OFF → ON | 1mS |
| | ON → OFF | 9 ~ 15mS | | ON → OFF | 1/2 cycle |
| Input resistance | Approximately 2.4kΩ | | Fuse-blow alarm contact | 125VAC Maximum current: 0.5A | |
| Input system | Sink input (input current efflux system) | | | | |
| Common wiring | All points/common (provided with terminal block for bridiging external wiring per 16 points) | | Leak current | 3mA (220VAC 60Hz) | |
| | | | Common wiring | 8 points/common | |
| External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | | External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | |
| Applicable solderless terminals | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | | Applicable solderless terminal | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | |
| Applicable wire size | 2mm² maximum | | Applicable wire size | 2mm² maximum | |

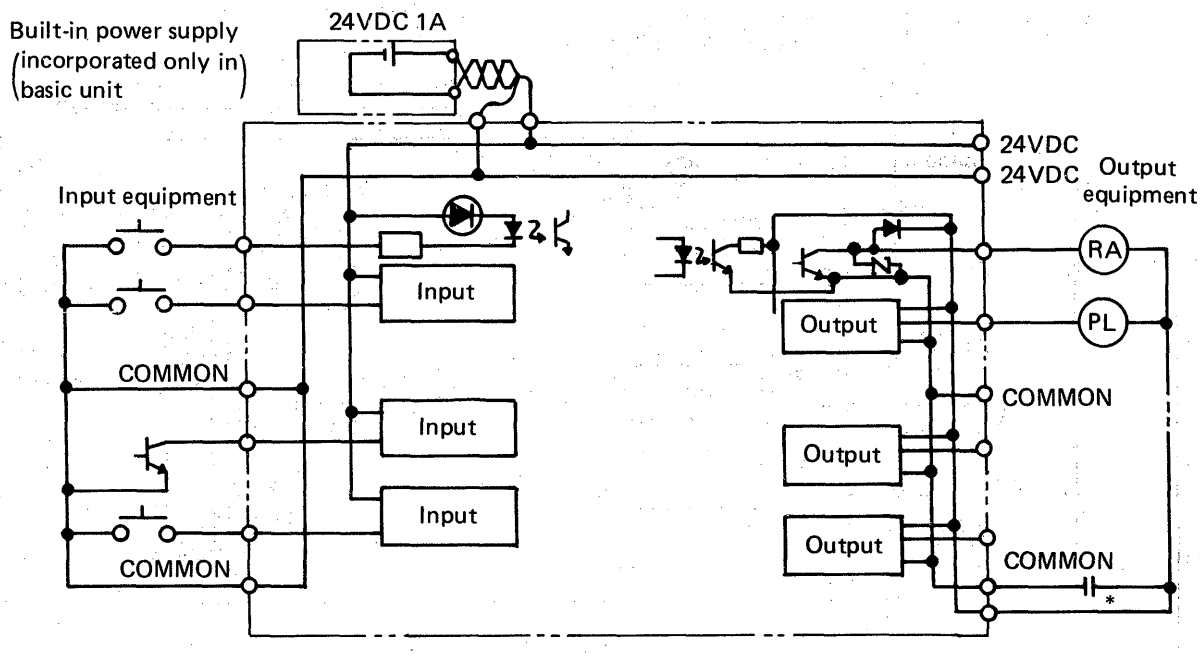



Since the basic unit incorporates 24V DC power supply, it is not required to supply the power supply for input circuit and the relay power supply for output circuit from the exterior. Connect E32, E56 extension unit in the exterior so that power is supplied from the 24V DC supply terminal of basic unit.

Table 3.14 Type DS Specifications

(5) Type DT (24VDC input, transistor output)

| Input Specifications | | | Output Specifications | | |
|---|---|---|---|---|---|
| Insulation system | Photocoupler | | Insulation system | Photocoupler | |
| Operating indicator | All points indicated by light-emitting diodes | | Operating indicator | All points indicated by light-emitting diodes | |
| Input voltage | 24VDC +10 ~ −10% | | Rated load voltage | 5/12/24VDC | |
| | (Power supply built in basic unit is used) | | Maximum Load power supply | 30VDC | |
| Input current | 8.5 ~ 11mA (24VDC) | | Load power supply | 1 point | 0.5A |
| Operating voltage | OFF → ON | 8 ~ 10VDC | | 8 points | 4A (8 points simultaneous ON) |
| | ON → OFF | 8 ~ 10VDC | Maximum inrush load current | 15A (50mS) | |
| Response time | OFF → ON | 9 ~ 15mS | Response time | OFF → ON | 0.1mS |
| | ON → OFF | 9 ~ 15mS | | ON → OFF | 0.5mS |
| Input resistance | Approximately 2.4kΩ | | Maximum voltage drop at ON | 1.5V | |
| Input system | Sink input (input current efflux system) | | External supply unit | 160mA/16 points (24VDC) | |
| Common wiring | All points/common (provided with terminal block for bridiging external wiring per 16 points) | | Common wiring | All points/common (provided with terminal block for bridiging external wiring per 16 points) | |
| External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | | External connection system | 20-point terminal block connector (terminal screw: M3 x 0.5 x 6) | |
| Applicable solderless terminals | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | | Applicable solderless terminal | 1.25–3, 2–S3 (proper tightening torque: 7kg/cm) | |
| Applicable wire size | $2mm^2$ maximum | | Applicable wire size | $2mm^2$ maximum | |

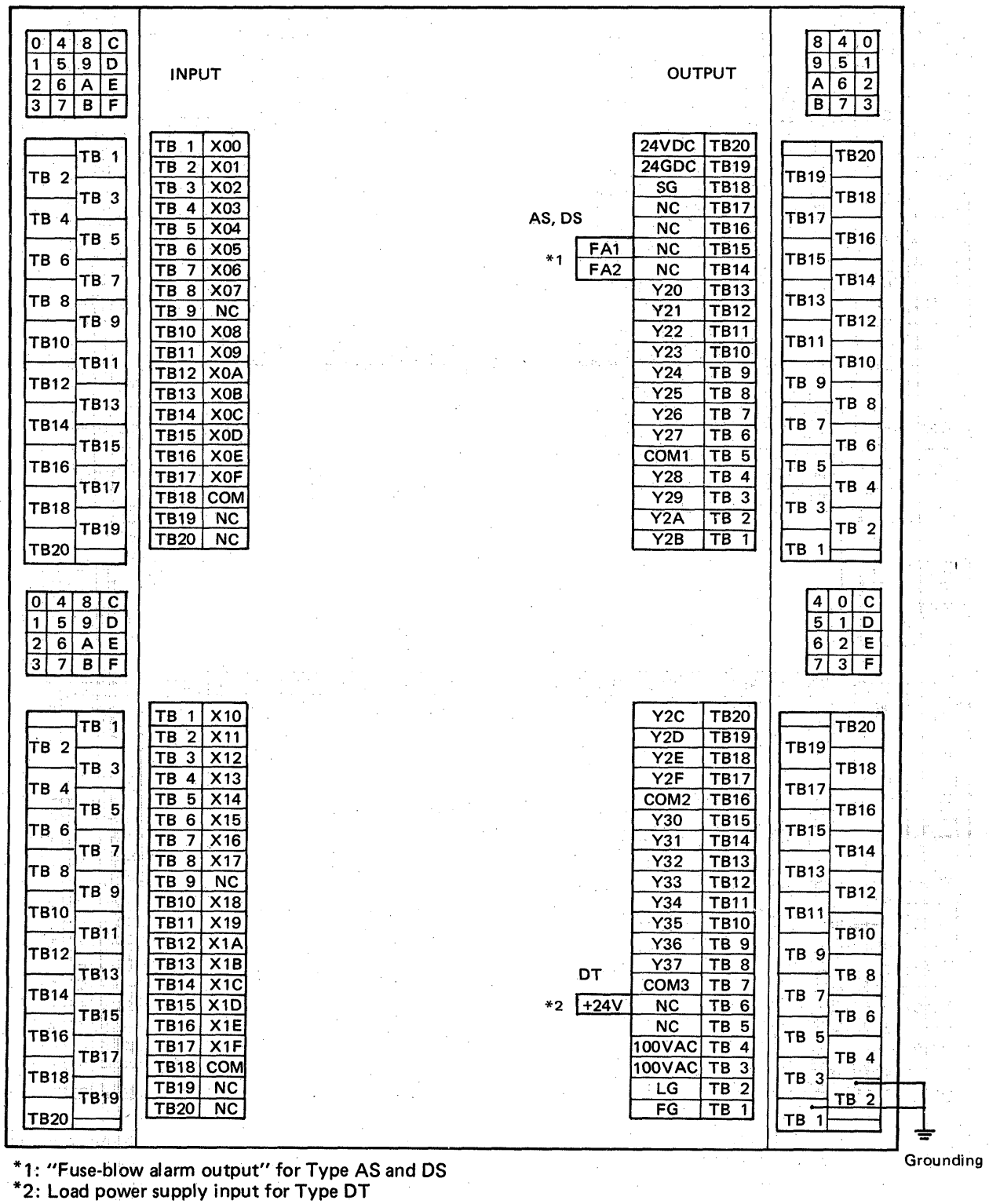



Since the basic unit incorporates 24V DC power supply, it is not required to supply the power supply for input circuit from the exterior. Connect E32, E56 extension unit in the exterior so that power is supplied from the 24VDC supply terminal of basic unit. The power supply with * mark is a power supply device in the exterior and used for load.

**Table 3.15 Type DT Specifications**

### 3.2.5 Terminal arrangement

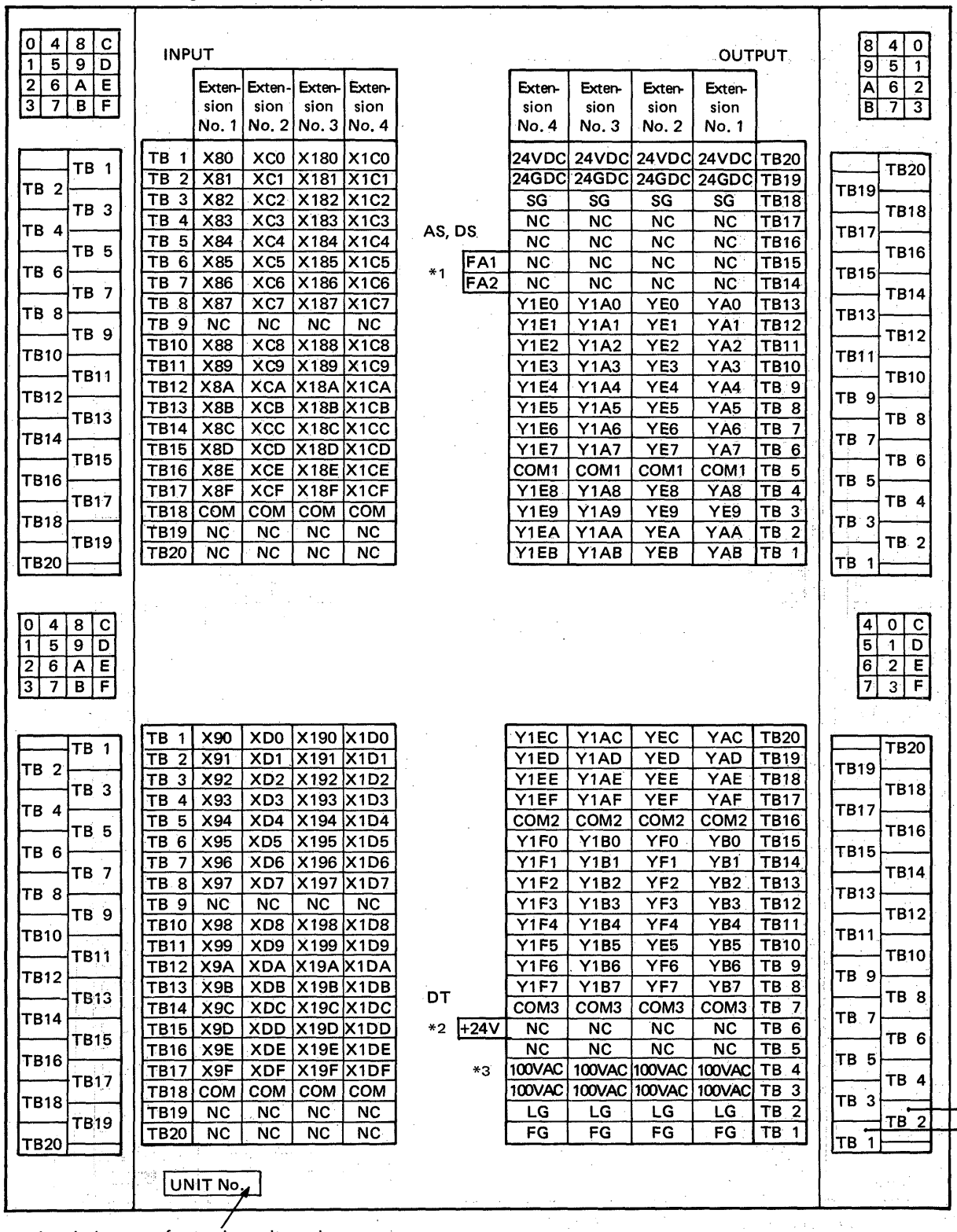
(1) Terminal arrangement of basic unit




*1: "Fuse-blow alarm output" for Type AS and DS
*2: Load power supply input for Type DT

**Fig. 3.1 Terminal Arrangement of Basic Unit**

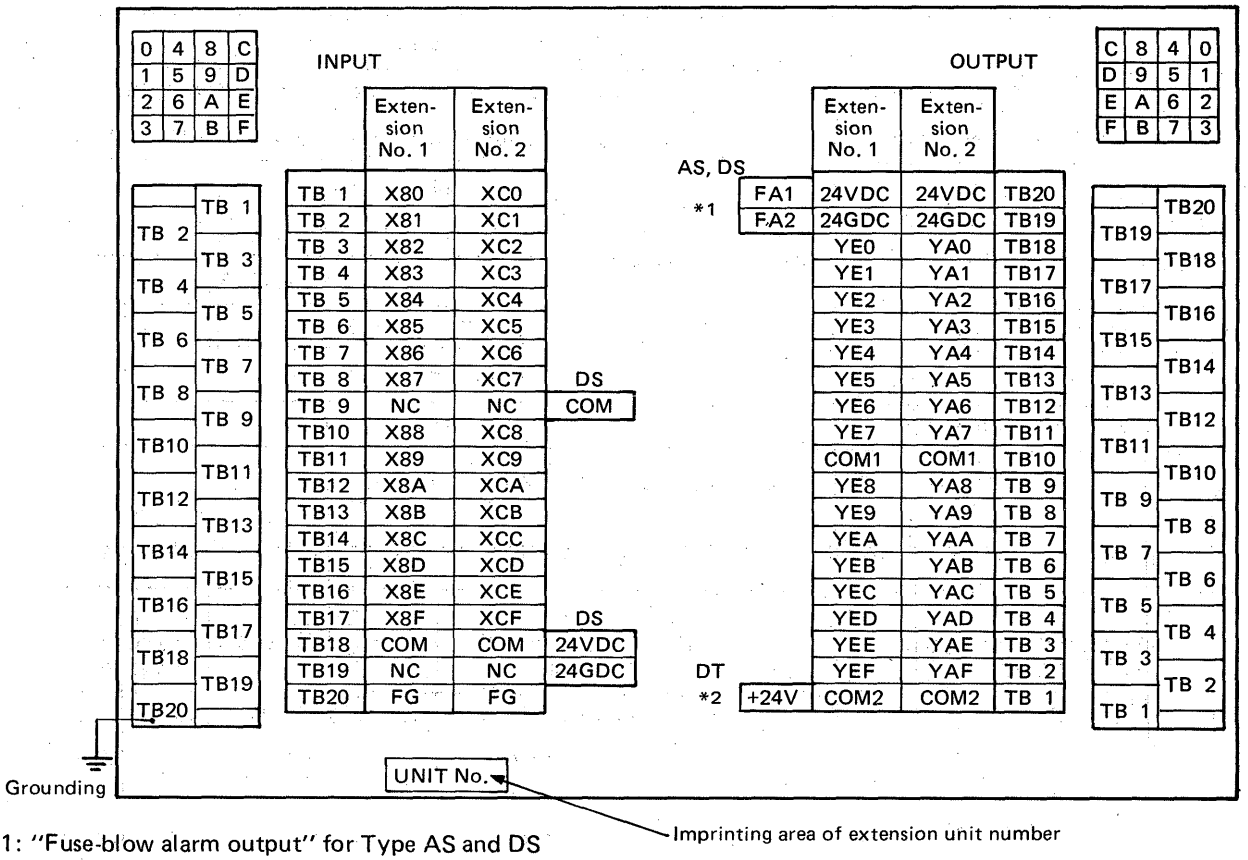
(2) Terminal arrangement of Type E56 extension unit




*1: "Fuse-blow alarm output" for Type AS and DS
*2: Load power supply input for Type DT
*3: Connect 100VAC power supply when extension power supply is loaded.

**Fig. 3.2 Terminal Arrangement of Type E56 Extension Unit**

(3) Terminal arrangement of Type E32 extension unit




*1: "Fuse-blow alarm output" for Type AS and DS
*2: Load power supply input for Type DT

**Fig. 3.3 Terminal Arrangement of Type E32 Extension Unit**

(4) Terminals of each unit and their applications

| Terminal | Application |
|---|---|
| TB1 ~ 20 | Terminal numbers. Take care because there are the same numbers. |
| Xm | Input number |
| Yn | Output number |
| NC | Abbreviation of No. Connection. An empty terminal which is not connected with interior. Can be used as a junction terminal. |
| COM | Abbreviation of Common. A common terminal to input or output. |
| 24VDC | + side of 24VDC of programmable controller interior. |
| 24GDC | 0V side of 24VDC of programmable controller interior. |
| 100VAC | 100VAC power supply input (Extension unit is connected only when extension power supply is loaded. |
| LG | Grounding of line filter |
| FG | Grounding for prevention of noise |
| SG | 0V terminal of internal power 5VDC. Do not ground. |
| FA1, 2 | Fuse-blow alarm output which outputs fuse blow to exterior for protection of triac of Type AS and DS. Turns on when fuse is blown. |
| +24V | Connect +24V of power supply for load. |

**Table 3.16 Applications of Terminals**

### 3.2.6 Extension power supply unit specifications

| Type name | | K0J1-PW | |
|---|---|---|---|
| Input | Applied voltage | 100 – 110VAC, 85 ~ 110%, single phase 50/60Hz ± 2Hz | |
| | Power consumption | 66VA, current: maximum 0.9A, inrush current 20A, 10ms (110VAC 60Hz) | |
| Output | Voltage | 24VDC | |
| | Current | Ambient temperature | 45°C 1.0A |
| | | | 55°C 0.8A |
| External dimensions | | 120 x 170 mm | |
| Weight | | 0.5kg (1.1 lbs) | |
| Usable extension unit | | Type E56 extension unit | |

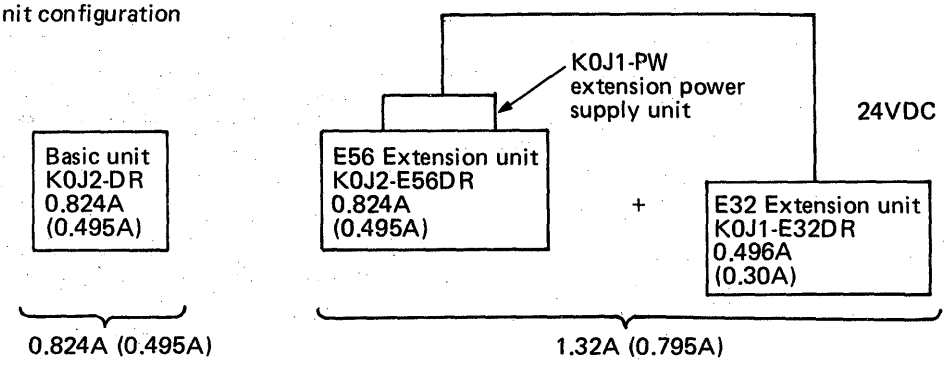
**Table 3.17 Extension Power Supply Unit Specifications**

*: To judge whether or not the extension power supply unit is required, refer to the table shown below.

| Current consumption of 24VDC (at all I/O simultaneous ON) | I/O symbol | Current consumption of 24V per point | Current consumption of basic unit | Current consumption of E32 extension unit | Current consumption of E56 extension unit |
|---|---|---|---|---|---|
| | DR | Input current: 10mA<br>Output current: 21mA | 10mAx32+21mAx24<br>=0.824A | 10mAx16+21mAx16<br>=0.496A | 10mAx32+21mAx24<br>=0.824A |
| | AR | Input current: –<br>Output current: 21mA | 21mAx24<br>=0.504A | 21mAx16<br>=0.336A | 21mAx24<br>=0.504A |
| | AS | Input current: –<br>Output current: – | – | – | – |
| | DT | Input current: 10mA<br>Output current: – | 10mAx32<br>=0.32A | 10mAx16<br>=0.16A | 10mAx32<br>=0.32A |
| | DS | Input current: 10mA<br>Output current: – | 10mAx32<br>= 0.32A | 10mAx16<br>=0.16A | 10mAx32<br>=0.32A |

Calculation example of current consumption of 24VDC

Unit configuration




When current consumption is calculated assuming that the simultaneous ON ratio of each unit is 60%, the result is as indicated in parenthesis. Therefore, add the K0J1-PW power supply unit to the E56 extension unit to supply power also to the E32 extension unit.

### 3.2.7 Extension unit specifications

| | | 32-point Extension Unit | 56-point Extension Unit |
|---|---|---|---|
| Type name | | K0J1-E32□□ * | K0J2-E56□□ * |
| Extended unit | Basic unit | K0J1, K0J1H, K0J2, K0J2P | K0J1, K0J1H, K0J2, K0J2P |
| | Extension unit | K0J1-E32, K0J1-E56, K0J2-E56 | K0J1-E32, K0J1-E56, K0J2-E56 |
| Connection cable | | K0J-61CBL, K0J-61CBL2 | K0J-61CBL, K0J-61CBL2 |
| Number of I/O points | Input | 16 points | 32 points |
| | Output | 16 points | 24 points |
| External dimensions | | 210 x 210 x 100 mm | 210 x 300 x 100 mm |
| Weight | | 1.3kg (2.9 lbs) | 1.6kg (3.5 lbs) |

*Note: (*) The last two letters of extension unit indicate I/O specifications. (See Section 2.1 "List of Equipment" and section 3.2.4 "I/O specifications".)*

**Table 3.18 Extension Unit Specifications**

### 3.2.8 Extension cable specifications

| Type Name | K0J-61CBL | K0J-61CBL2 |
|---|---|---|
| Cable length | 500 mm | 1000 mm |
| Dielectric withstand voltage | 500V AC for one minute | |
| Application | (1) Connection of K0J basic unit and extension unit<br>(2) Connection of K0J extension unit and extension unit | |

**Table 3.19 Extension Cable Specifications**

*Note: One piece of Type K0J-61CBL extension cable is provided per extension unit.*

### 3.2.9 Switch unit specifications

| Type name | K0SW |
|---|---|
| Number of switch points | 16 points |
| Rated voltage | 125V AC/DC, 250V AC/DC |
| Rated current | 0.1A |
| Contact resistance | 50mΩ or lower at 2 ~ 4V DC, 0.1A |
| Insulation resistance | 1000Ω or higher at 500V DC |
| Dielectric withstand voltage | 1000V AC/minute |
| Switch life | 30000 times |
| Operating power | 1 kg or less |

**Table 3.20 Switch Unit Specifications**

### 3.2.10 Battery specifications

| Type name | K6BAT |
|---|---|
| Rated voltage | 3.6V |
| Battery guarantee period | Five years |
| Total power failure time | 300 days (7200 hours) |
| Application | Back up of IC-RAM memory<br>Back up of latch function |

**Table 3.21 Battery Specifications**

### 3.2.11 Fuse specifications

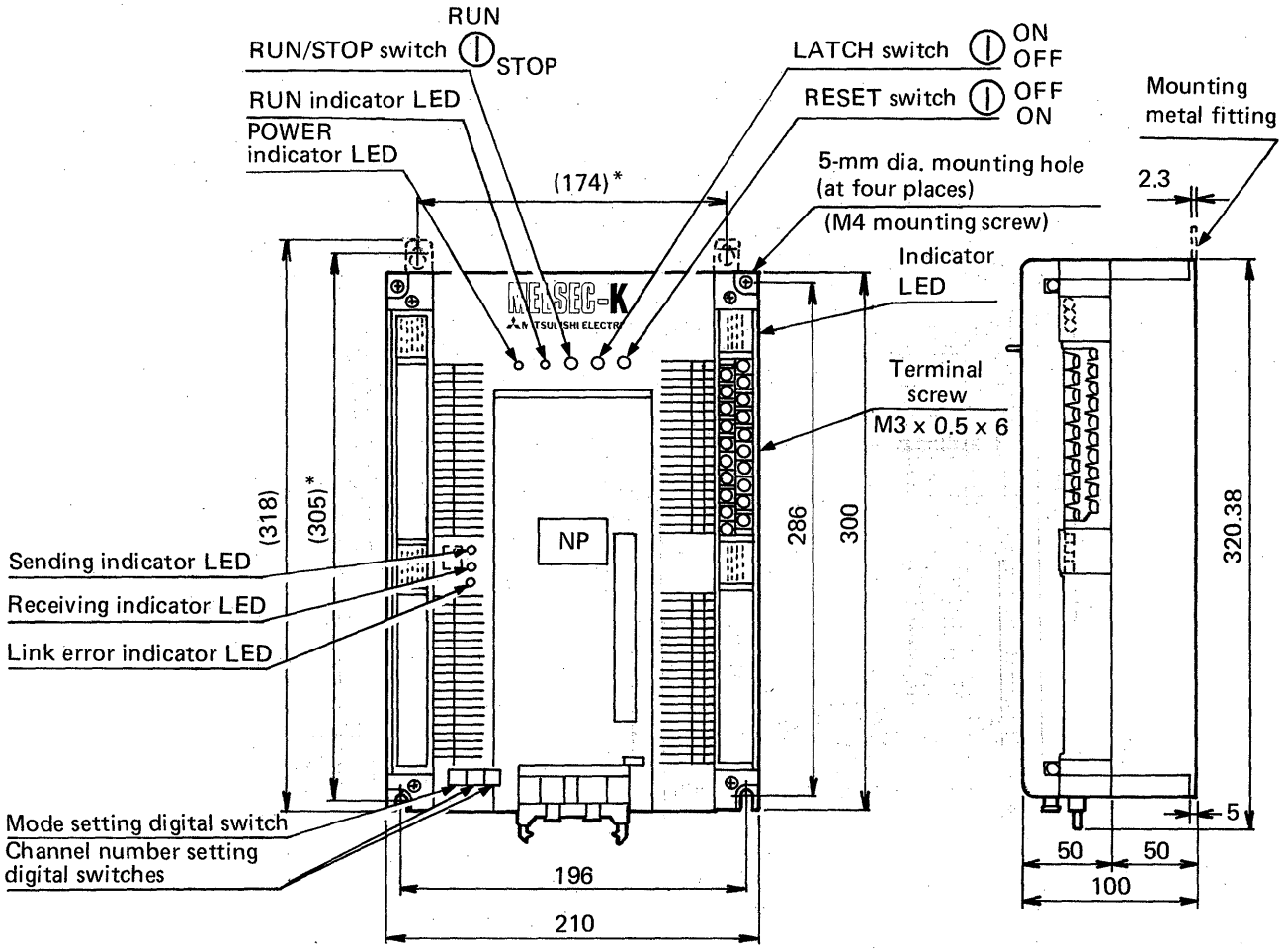
| Type name | MN51R | MP75 |
|---|---|---|
| Application | For power supply | For triac output* |
| Shape | Encased in glass tube | Plug type |
| Rated voltage | 250V | 125V |
| Rated current | 2A | 7.5A |
| Melting characteristics | Wihtin one hour at 160% of rated current<br>Within two minutes at 200% of rated current | Within one hour at 135% of rated current<br>Within one second at 250% of rated current |

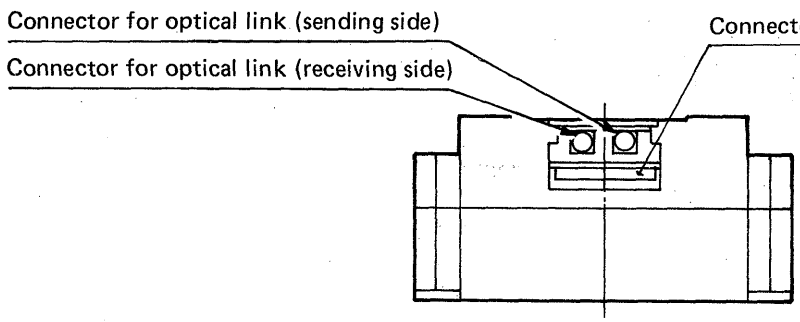
*Note:* **Fuse for triac (MP75) is used for protection of unit at the time of short-circuit. Provide the fuse, which is used for protection of load, at the exterior in units of one point.*

**Table 3.22 Fuse Specifications**

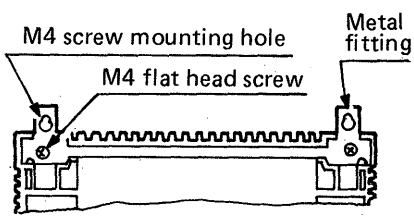
### 3.3 External Dimensions

(1) Basic unit K0J2P-□□ 2.6 kg (5.7 lbs)



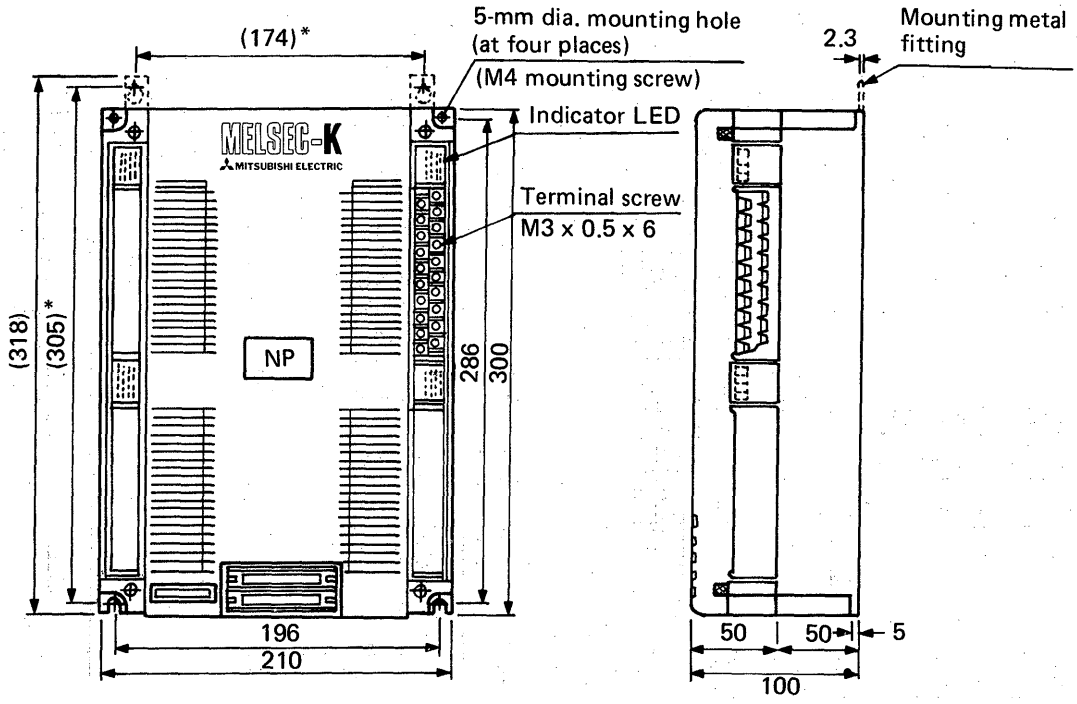

*Note: Upper mounting holes can be changed to * mark by changing the mounting positions of metal fittings.*

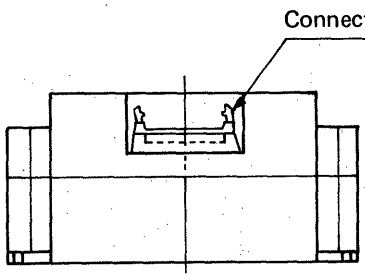



By removing two M4 flat head screws, the metal fittings can be mounted as shown above.

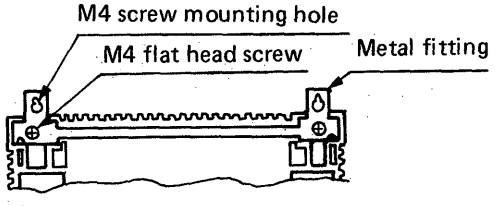
(2) Extension unit K0J2-E56□□ 2.2 kg (4.9 lbs)

3



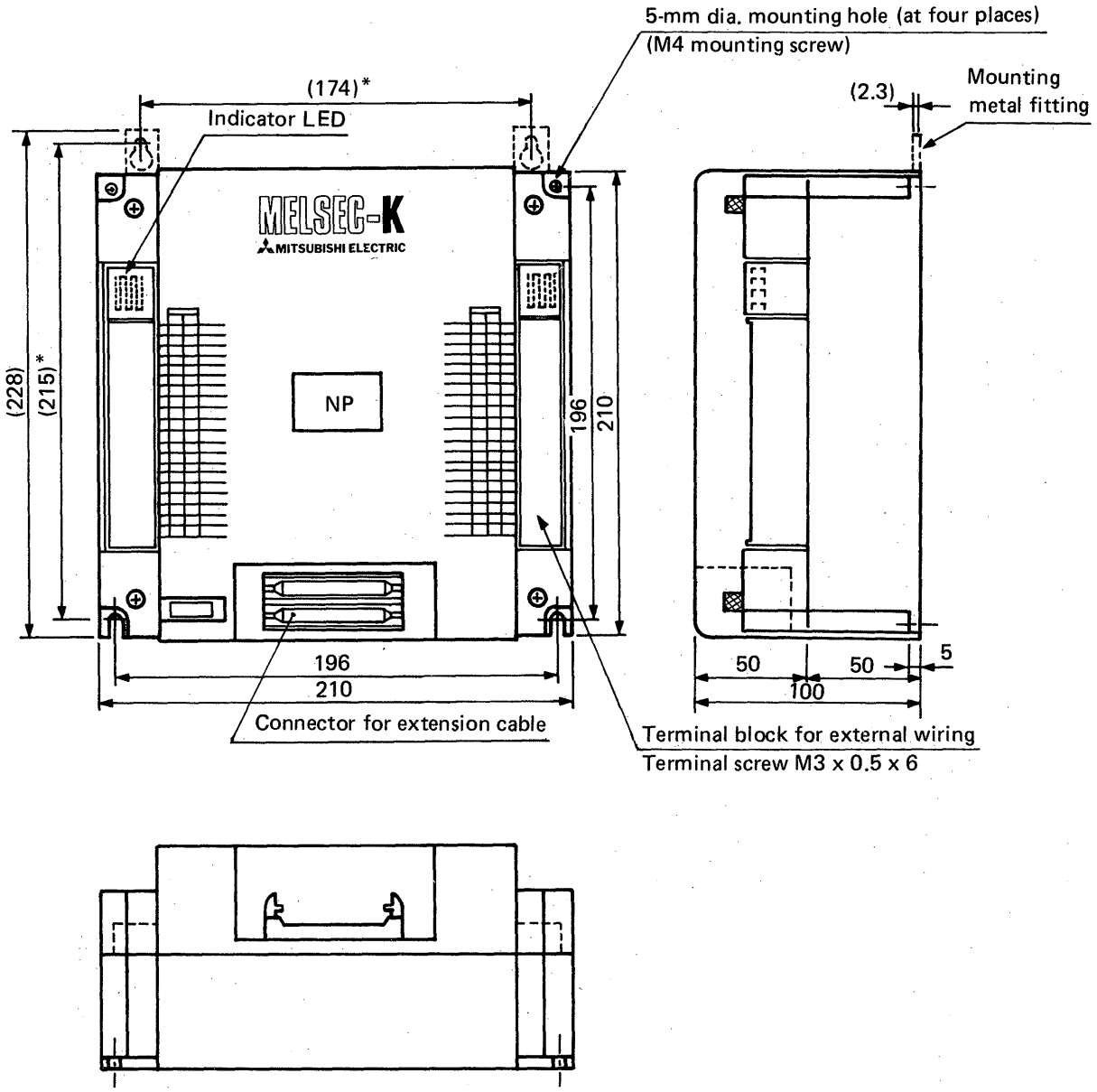




*Note:* *Upper mounting holes can be changed to * mark by changing the mounting positions of metal fittings.*

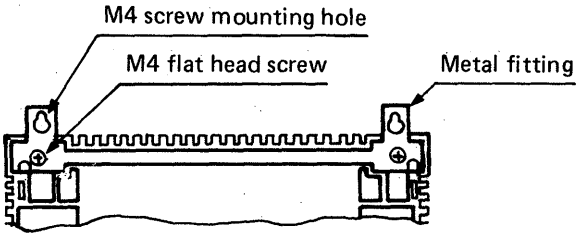



By removing two M4 flat head screws, the metal fittings can be mounted as shown above.

(3) Extension unit K0J1-E32□□




*Note:* *Upper mounting holes can be changed to * mark by changing the mounting positions of metal fittings.*




By removing two M4 flat head screws, the metal fittings can be mounted as shown above.

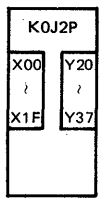
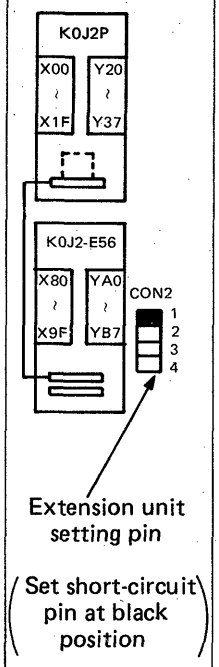
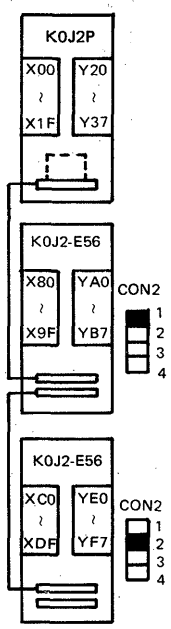
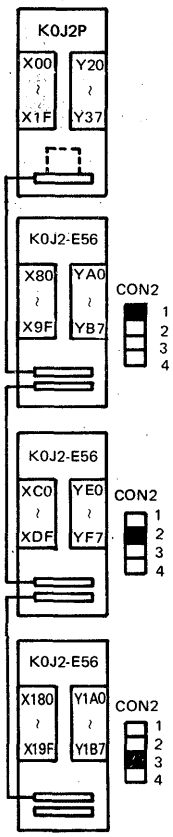
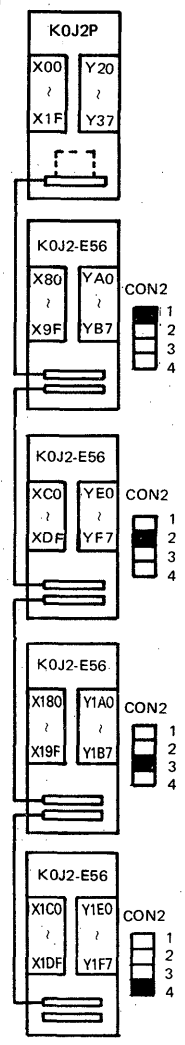
# MEMO

# 4. SYSTEM CONFIGURATION

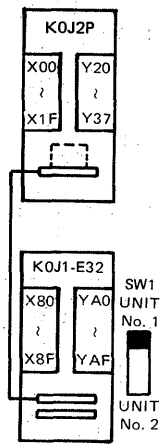
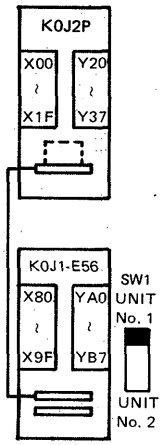
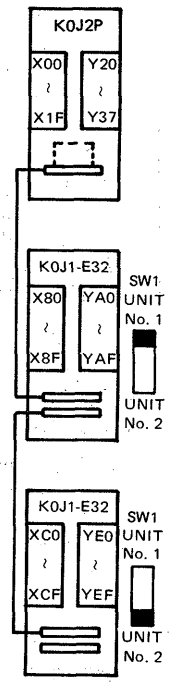
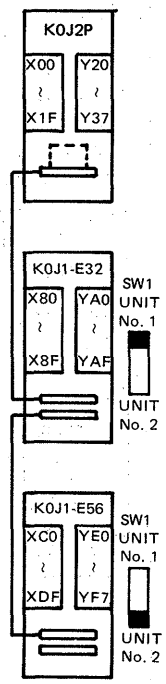
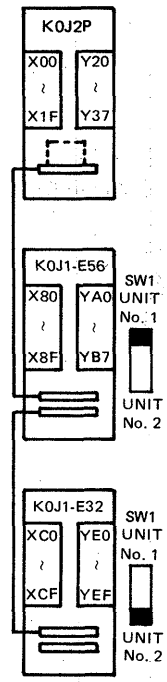
## 4. SYSTEM CONFIGURATION

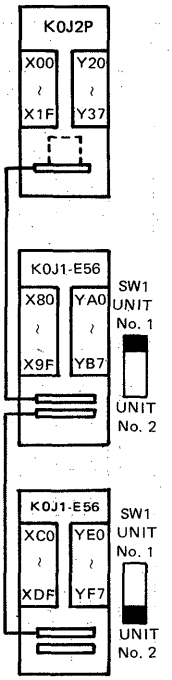
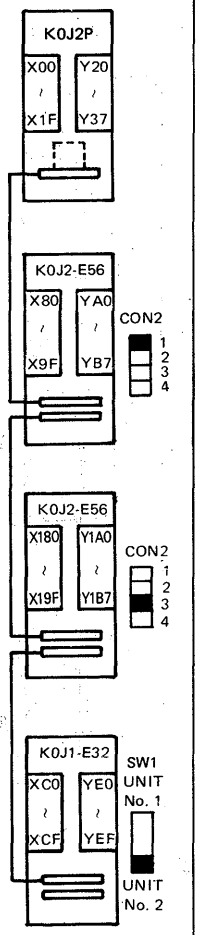
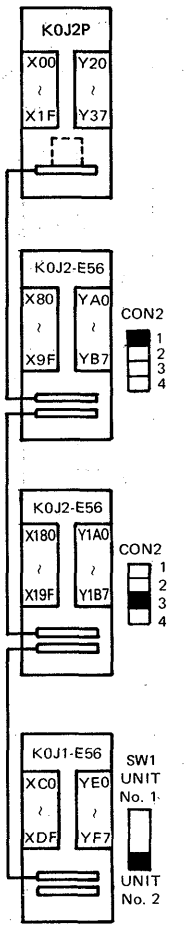
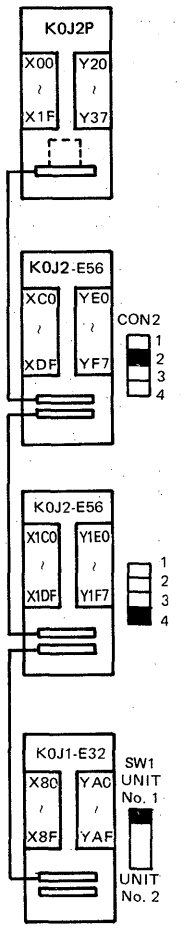
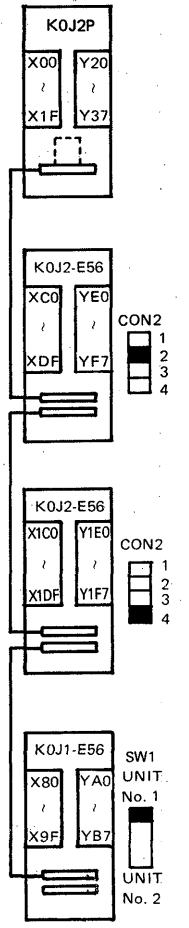
### 4.1 Independent System

#### 4.1.1 Extension system by use of Type K0J2-E56 extension unit

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Combination<br>(Basic unit)<br><br>(Extension unit) |  |  |  |  |  |
| Numver of maximum I/O points | 56 points | 112 points | 168 points | 224 points | 280 points |
| Number of input points | 32 points | 64 points | 96 points | 128 points | 160 points |
| Number of output points | 24 points | 48 points | 72 points | 96 points | 120 points |
| Y numbers which can be used as temporary memory | Y numbers which are not used as output Y00~1F, Y38~BF YE0~FF, Y180~1BF, Y1E0~1FF | Y numbers which are not used as output Y00~1F, Y38~9F YE8~BF, YE0~FF Y180~1BF, Y1E0~1FF | Y numbers which are not used as output Y00~1F, Y38~9F YB8~BF, YF8~FF Y180~1BF, Y1E0~1FF | Y numbers which are not used as output Y00~1F, Y38~9F YB8~BF, YF8~FF Y180~19F, Y1B8~1BF, Y1E0~Y1FF | Y numbers which are not used as output Y00~1F, Y38~9F YB8~BF, YF8~FF Y180~19F, Y1B8~1BF, Y1F8~1FF |
| Loading of external failure monitor unit (K0J2-EXON) | Cannot be loaded | Can be loaded into only the unit located at the last stage. | | | |
| Optical data link | Link possible | | | | |

### 4.1.2 Extension system by use of Type K0J1-E32, E56 and K0J2-E56 extension units

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Combination<br>(Basic unit)<br><br>(Extension unit) |  |  |  |  |  |
| Number of maximum I/O points | 88 points | 112 points | 120 points | 144 points | 144 points |
| Number of input points | 48 points | 64 points | 64 points | 80 points | 80 points |
| Number of output points | 40 points | 48 points | 56 points | 64 points | 64 points |
| Y numbers which can be used as temporary memory | Y numbers which are not used as output<br>Y00~1F, Y38~9F<br>YB0~BF, YE0~FF<br>Y180~1BF, Y1E0 ~1FF | Y numbers which are not used as output<br>Y00~1F, Y38~9F<br>YB8~BF, YE0~FF<br>Y180~1BF, Y1E0 ~1FF | Y numbers which are not used as output<br>Y00~1F, Y38~9F<br>YB8~BF, YF0~FF<br>Y180~1BF, Y1E0 ~1FF | Y numbers which are not used as output<br>Y00~1F, Y38~9F<br>YB0~BF, YF8~FF<br>Y180~1BF, Y1E0 ~1FF | Y numbers which are not used as output<br>Y00~1F, Y38~9F<br>YB8~BF, YF0~FF<br>Y180~1BF, Y1E0 ~1FF |
| Loading of external failure monitor unit (KOJ2-EXON) | Cannot be loaded | Can be loaded into only the unit located at the last stage (KOJ1-E56) | Cannot be loaded | Can be loaded into only the unit located at the last stage (KOJ1-E56) | Cannot be loaded |
| Optical data link | Link possible | | | | |

| | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|
| Combination<br>(Basic unit)<br><br>(Extension unit) |  |  |  |  |  |
| Number of maximum I/O points | 168 points | 200 points | 224 points | 200 points | 224 points |
| Number of input points | 96 points | 112 points | 128 points | 112 points | 128 points |
| Number of output points | 72 points | 88 points | 96 points | 88 points | 96 points |
| Y numbers which can be used as temporary memory | Y numbers which are not used as output Y00~1F, Y38~9F YB8~BF, YF8~FF Y180~1BF, Y1E0 ~1FF | Y numbers which are not used as output Y00~1F, Y38~9F YB0~BF, YF8~FF Y180~1BF, Y1E0 ~1FF | Y numbers which are not used as output Y00~1F, Y38~9F YB8~BF, YF8~FF Y180~1BF, Y1E0 ~1FF | Y numbers which are not used as output Y00~1F, Y38~9F YB8~BF, YF0~FF Y180~1BF, Y1E0 ~1FF | Y numbers which are not used as output Y00~1F, Y38~9F YB8~BF, YF8~FF Y180~1BF, Y1E0 ~1FF |
| Loading of external failure monitor unit (KOJ2-EXON) | Can be loaded into only the unit located at the last stage (KOJ1-E56) | Cannot be loaded | Can be loaded into only the unit located at the last stage (KOJ1-E56) | Cannot be loaded | Can be loaded into only the unit located at the last stage (KOJ1-E56) |
| Optical data link | Link possible | | | Link impossible as remote I/O unit | |
| Caution | | 1 The setting order of setting switches is different from the connecting order of extension units.<br>2 The allocating order of I/O numbers is the same as the setting order of setting switches.<br>3 Only one unit of Type KOJ1-E32 or E56 extension unit can be used. For other two units, use Type KOJ2-E56 extension unit. | | | |

## 4.2 Optical Data Link System

### 4.2.1 System configuration

Using the K3CPU or KGPC as a master channel, a data link system can be constructed by optical fiber cables.

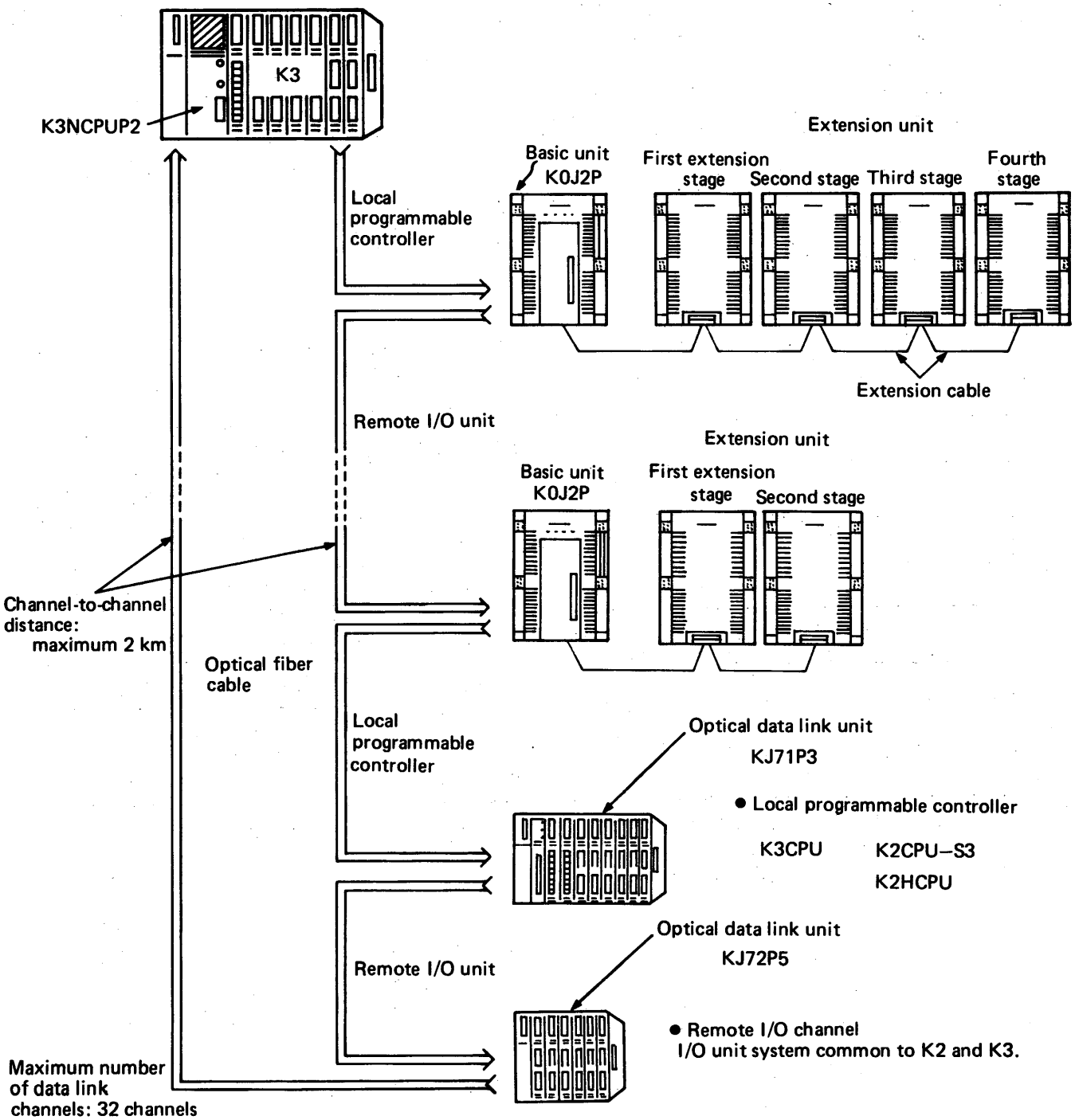



Fig. 4.1 Optical Data Link System Configuration Example

1) A maximum of 32 channels can be linked as the slave channels (local programmable controllers) of a local programmable controller system which is designed to expand the total number of inputs/outputs and for integrated management and decentralized control.

2) A maximum of 32 channels can be linked as the slave channels (remote I/O units) of a remote I/O system which is designed to reduce long-distance I/O wiring work expenses.

3) A maximum of 32 channels can be linked, with the local programmable controllers and remote I/O units used together in the system.

4) The system can be linked with a local programmable controller which is composed of K3CPU, K2CPU-S3 or K2HCPU system (loaded with Type KJ71P3 data link unit).

5) The system can be linked with a remote I/O unit (loaded with Type KJ72P5 data link unit) which is composed of I/O units used commonly for K1, K2 and K3.

6) The channel-to-channel distance (optical fiber transmission route) is maximum 2 km.

*Note: When the K3 is utilized as a master channel, use Type K3CPUP2 CPU unit.*
*When the KGPC is utilized as a master channel, load Type K30LU1P2 link unit into the KGPC unit.*

| | | | |
|---|---|---|---|
| Master programmable controller | K3 | Number of X link points | Maximum 2048 points (X000 ~ 7FF) |
| | | Number of Y link points | Maximum 2048 points (Y000 ~ 7FF) |
| | KGPC | Number of X link points | Maximum 2032 points (X000 ~ 7EF) |
| | | Number of Y link points | Maximum 2032 points (Y000 ~ 7EF) |
| Local programmable controller* (K0J2P) | | Number of X link points | Maximum 128 points (X100 ~ 17F) |
| | | Number of Y link points | Maximum 128 points (Y100 ~ 17F) |
| Remote I/O unit (K0J2P) | | Number of X link points | Maximum 160 points |
| | | Number of Y link points | Maximum 120 points |

*Note: (*) the link I/O number of local programmable controller K0J2P are allotted separately from its own I/O numbers.*

**Table 4.1 Number of Link Points and Link I/O Numbers**

### 4.2.2 Link I/O numbers

(1) K0J2P is used as a local programmable controller

1) System configuration example

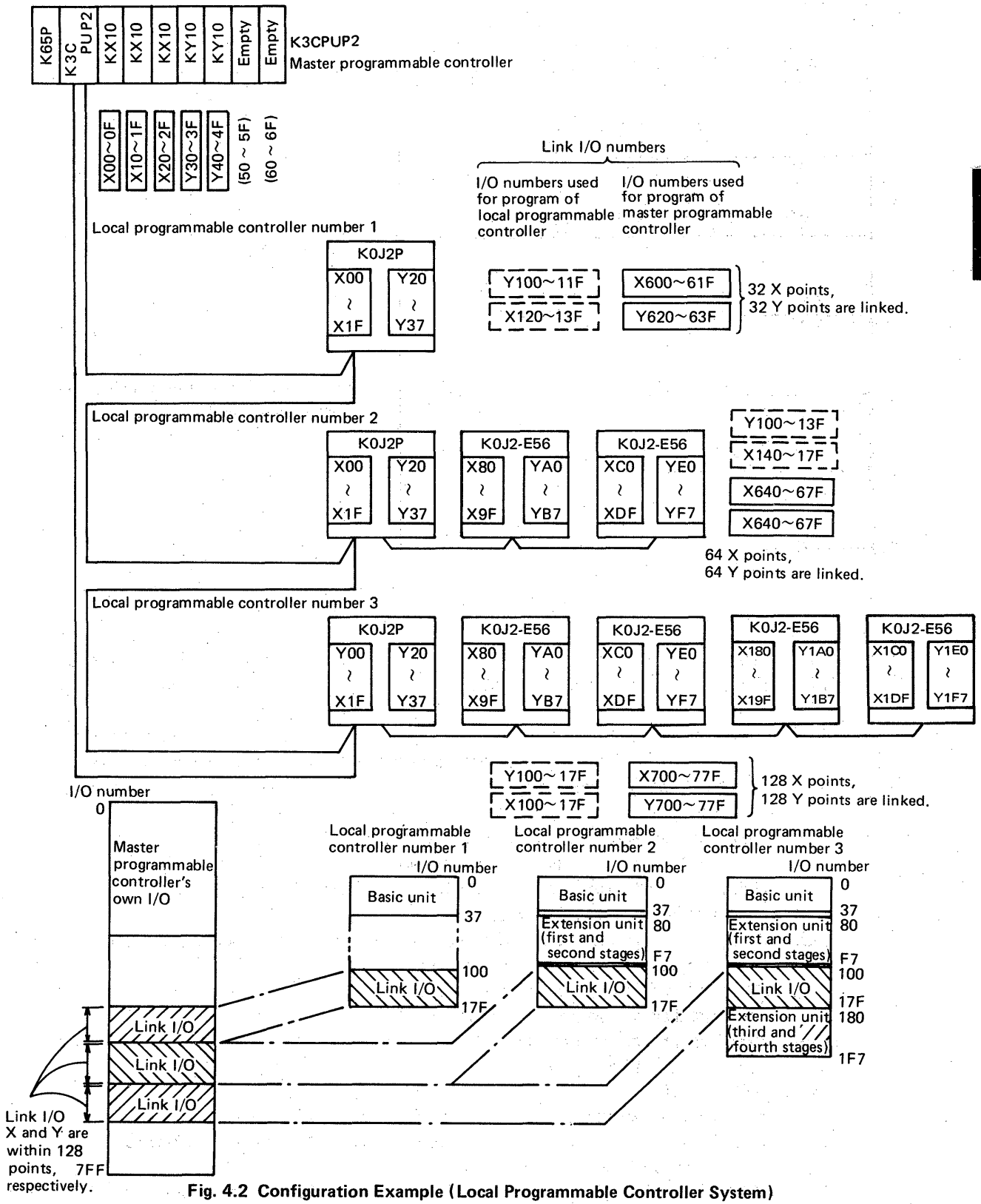
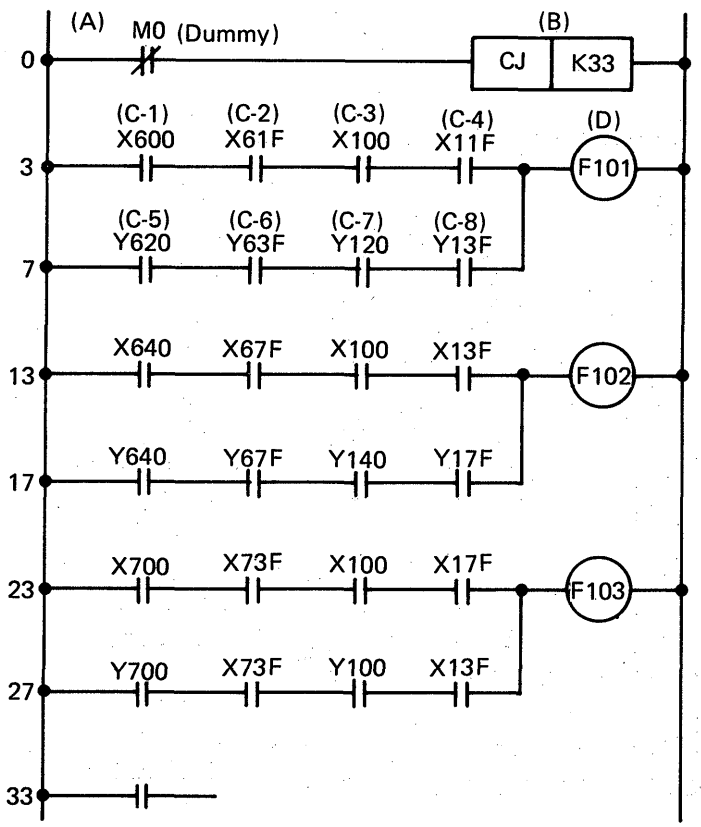



Fig. 4.2 Configuration Example (Local Programmable Controller System)

2) Link range designation: link range is specified by initial program.

Write the initial program at the beginning of the program of master programmable controller.




Link range of local programmable controller number 1 is specified.

Link range of local programmable controller number 2 is specified.

Link range of local programmable controller number 3 is specified.

**Fig. 4.3 Intial Program Example**

*Note: (A) M0: Be sure to write a temporary memory M which is not used (dummy).*

*(B) CJ K33: The jump destination of CJ (K33) should be the step number next to the last OUT F.*

*(C-1) X600 is the head number of input signal from the programmable controller number 1 as seen from the master programmable controller. Use care so that this head number does not overlap the final number assigned to the master programmable controller.*

*(C-2) X61F is the final number of input signal from the programmable controller number 1 as seen from the master programmable controller. The last digit of head number should be "0" and that of final number should be "F". (Be sure to specify these numbers in units of 16 points.)*

*(C-3) X100 is the link head number corresponding to the link output number Y100 of local programmable controller number 1.*

*(C-4) X11F is the link final number corresponding to the link output number Y11F of local programmable controller number 1.*

*(C-5) Y620 is the head number of output signal to the local programmable controller number 1 as seen from the master programmable controller.*

*(C-6) Y63F is the final number of output signal to the local programmable controller number 1 as seen from the master programmable controller.*

*(C-7) Y120 is the link head number corresponding to the link input number X120 of local programmable controller number 1.*

*(C-8) Y13F is the link final number corresponding to the link input number X13F of local programmable controller number 1.*

*(D) F101: The lower one digits of F101 indicates the local programmable controller number 1. In regards to number 2 and succeeding programmable controllers, specify in serial numbers like F102, F103, .....*

| I/O numbers used for master programmable controller | Handled by master programmable controller link card as below | I/O numbers used for local programmable controller | |
|---|---|---|---|
| X600 ~ 61F ←<br>Y620 ~ 63F → | X100 ~ 11F ←<br>Y120 ~ 13F → | Y100 ~ 11F (output)<br>X120 ~ 13F (input) | Number 1 |
| X640 ~ 67F ←<br>Y640 ~ 67F → | X100 ~ 13F ←<br>Y140 ~ 17F → | Y100 ~ 13F (output)<br>X140 ~ 17F (input) | Number 2 |
| X700 ~ 77F ←<br>Y700 ~ 77F → | X100 ~ 17F ←<br>Y100 ~ 17F → | Y100 ~ 17F (output)<br>X100 ~ 17F (input) | Number 3 |

**Table 4.2 Link I/O Numbers**

3) Data register link

When the K0J2P is used as a local programmable controller (local programmable controller system) data registers (D) can be linked in addition to the data link of X/Y between the master and local channels.

| | |
|---|---|
| Link data registers | D0 ~ D95 (96 points) |
| Number of simultaneous link points | Maximum 24 points |

*Note: For details, see the "Instruction Manual for Optical Data Link System" for the master programmable controller.*

(4) K0J2P is used as remote I/O unit

1) System configuration example

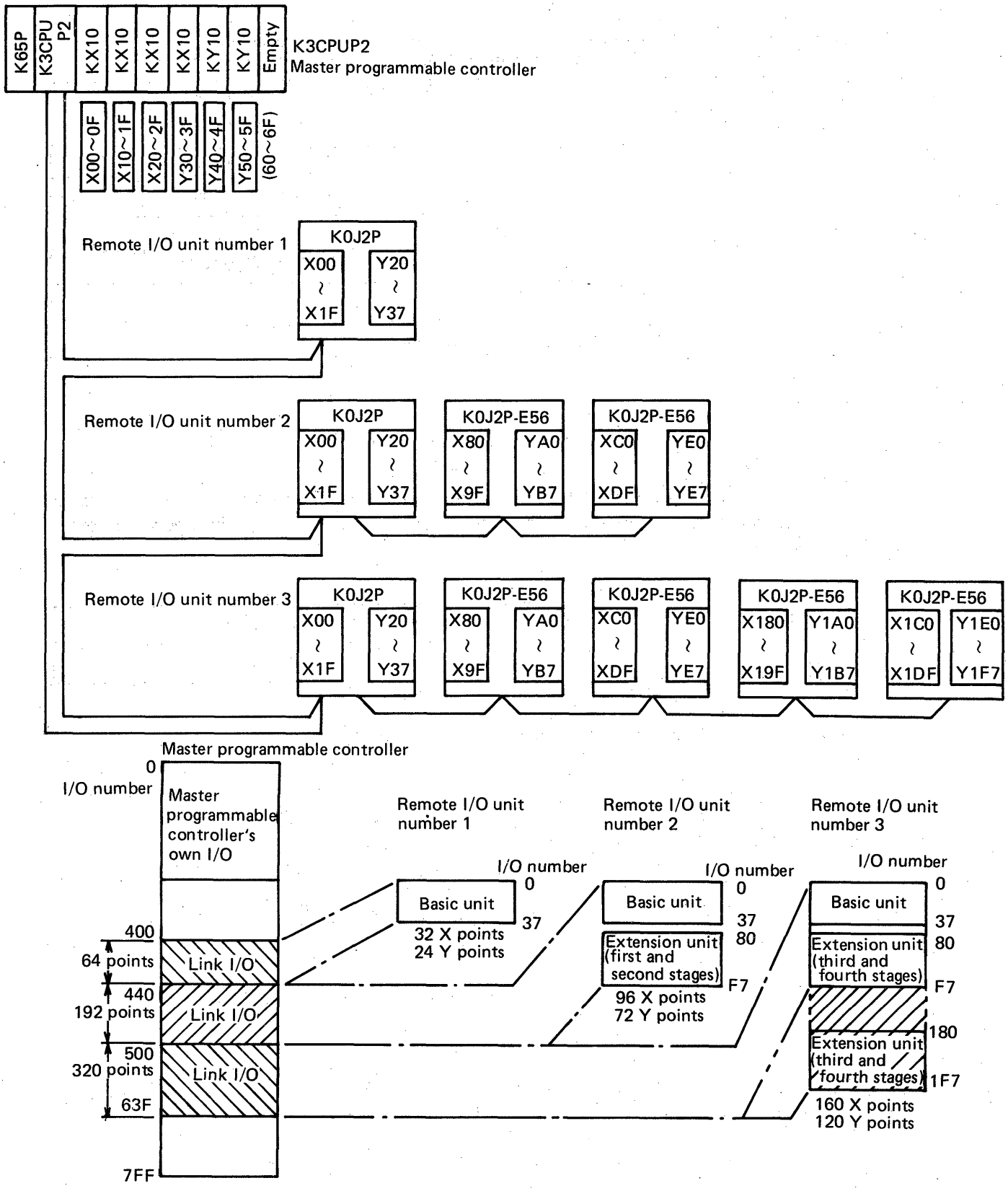


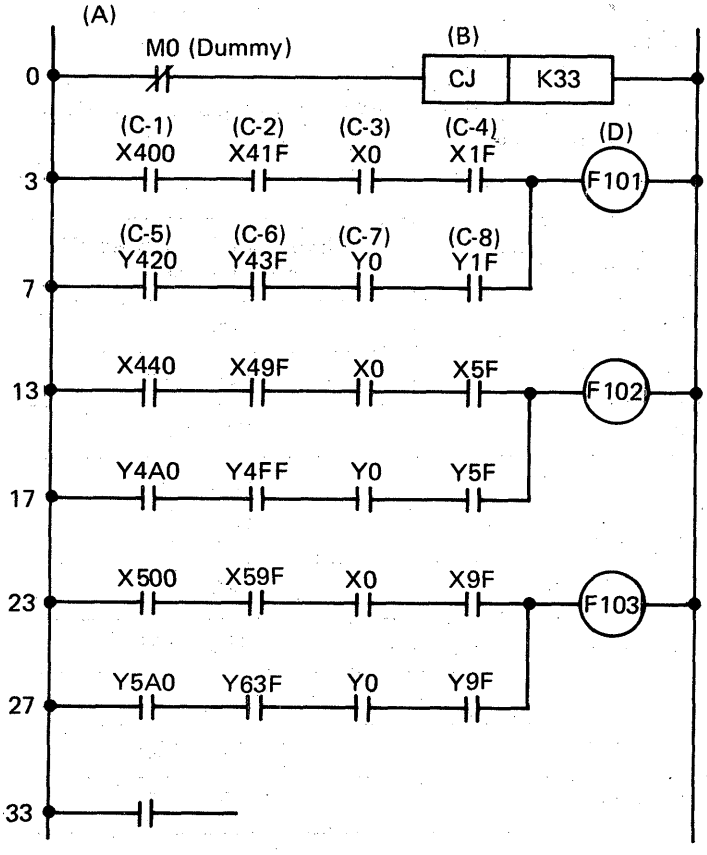

**Fig. 4.4 Configuration Example (Remote I/O System)**

2) Link range designation

Specify the link range by the initial program of master programmable controller in units of 32 points for each of the basic units and extension units, as indicated in the following table, depending on the remote I/O system configuration.
Therefore, any of the basic units and 32-point and 56-point extension units exclusively uses 32 I/O points (addresses) per unit.

| Remote I/O Unit Configuration | Link Range Designation |
|---|---|
| Only basic unit (K0J1PE) | X0 ~ X1F, Y0 ~ Y1F |
| Basic unit + extension unit (first stage) | X0 ~ X3F, Y0 ~ Y3F |
| Basic unit + extension units (first and second stages) | X0 ~ X5F, Y0 ~ Y5F |
| Basic unit + extension units (first ~ third stages) | X0 ~ X7F, Y0 ~ Y7F |
| Basic unit + extension units (first ~ fourth stages) | X0 ~ X9F, Y0 ~ Y9F |

Note that there are no real addresses for eight points of Y of basic unit and 56-point extension unit, and 16 points of X and Y of 32-point extension unit, respectively, in regards to the remote I/O unit.




Link range of remote I/O unit number 1 is specified.

Link range of remote I/O unit number 2 is specified.

Link range of remote I/O unit number 3 is specified.

Fig. 4.5 Initial Program Example

*Note: (A) M0: Be sure to write a temporary memory M which is not used (dummy).*
*(B) CJ K33: The jump destination of CJ (K33) should be the step number next to the last OUT F.*
*(C-1) X400 is the head number of input signal from the remote I/O unit number 1 as seen from the master programmable controller. Use care so that this head number does not overlap the final number assigned to the master programmable controller.*
*(C-2) X41F is the final number of input signal from the remote I/O unit number 1 as seen from the master programmable controller.*
*(C-3) Write X0 according to the regular format.*
*(C-4) X1F indicates that the remote I/O unit number 1 is consists of only the basic unit.*
*(C-5) Y420 is the head number of output signal to the remote I/O unit number 1 as seen from the master programmable controller. This head number should be a number which is equal to or higher than the head number of input signal.*
*(C-6) Y43F is the final number of output signal to the remote I/O unit number 1 as seen from the master programmable controller.*
*(C-7) Write Y0 according to the regular format.*
*(C-8) Y1F indicates, like X1F, that the remote I/O unit number 1 is consists of only the basic unit.*
*(D) F101: The lower one digits of F101 indicates the local programmable controller number 1. In regards to number 2 and succeeding programmable controllers, specify in serial numbers like F102, F103, .....*



The X link range [(C-1) ~ (C-2)] and the Y link range [(C-5) ~ (C-6)] of master programmable controller may overlap each other. However, the head numbers of X and Y should be the same or X should be lower than Y [(C-1)≦(C-5)].

The I/O numbers used by the master programmable controller, which correspond to the existing I/O signals of remote I/O unit number 3, are as follows:

| | I/O Numbers Used by Master Programmable Controller | Existing I/O Numbers of Remote I/O Unit |
|---|---|---|
| Basic unit | X500 ~ 51F | X00 ~ 1F |
| | Y5A0 ~ 5B7 | Y20 ~ 37 |
| Extension unit First stage | X520 ~ 53F | X80 ~ 9F |
| | Y5C0 ~ 5D7 | YA0 ~ B7 |
| Extension unit Second stage | X540 ~ 55F | XC0 ~ DF |
| | Y5E0 ~ 5F7 | YE0 ~ F7 |
| Extension unit Third stage | X560 ~ 57F | X180 ~ 19F |
| | X600 ~ 617 | Y1A0 ~ 1B7 |
| Extension unit Fourth stage | X580 ~ 59F | X1C0 ~ 1DF |
| | Y620 ~ 637 | Y1E0 ~ 1F7 |

# 5. HANDLING

## 5. HANDLING

### 5.1 Nomenclature and Explanation

#### 5.1.1 Basic unit

(1) Front view of basic unit

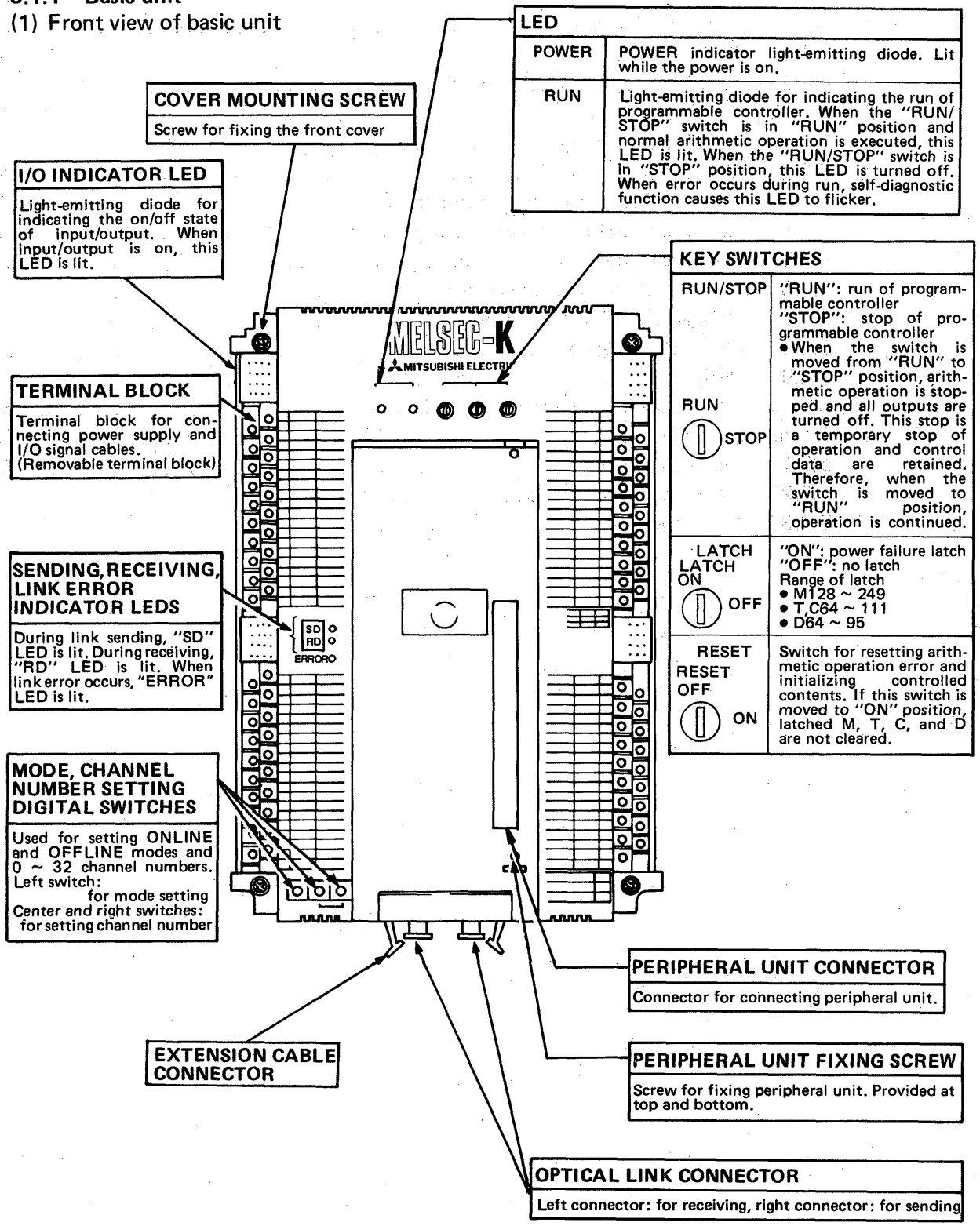
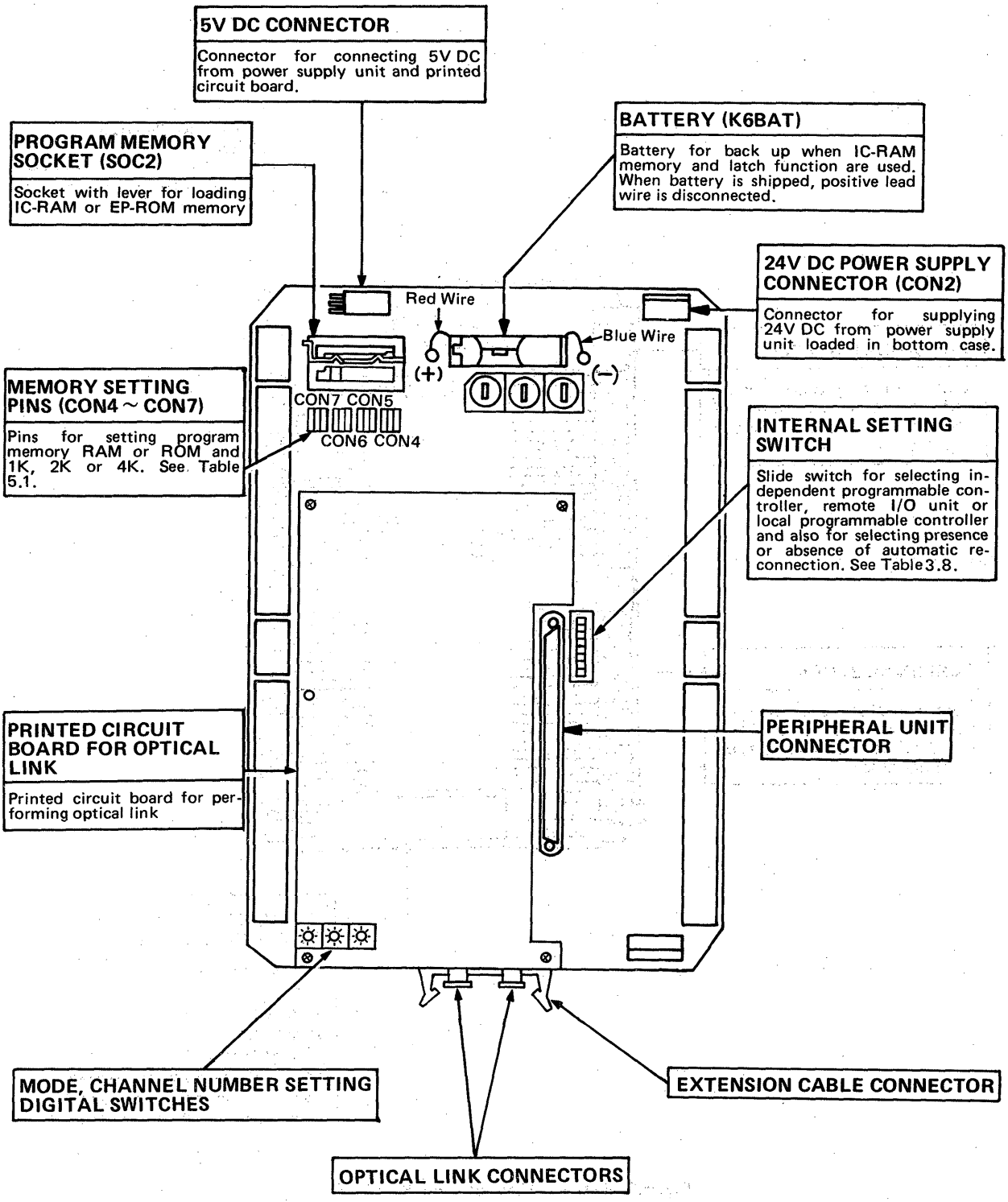



Fig. 5.1 External View of Basic Unit

(2) Internal Configuration of Basic Unit



### 5.1.2 Extension units (K0J2-E56, K0J1-E32)

(1) External view of Type K0J2-E56

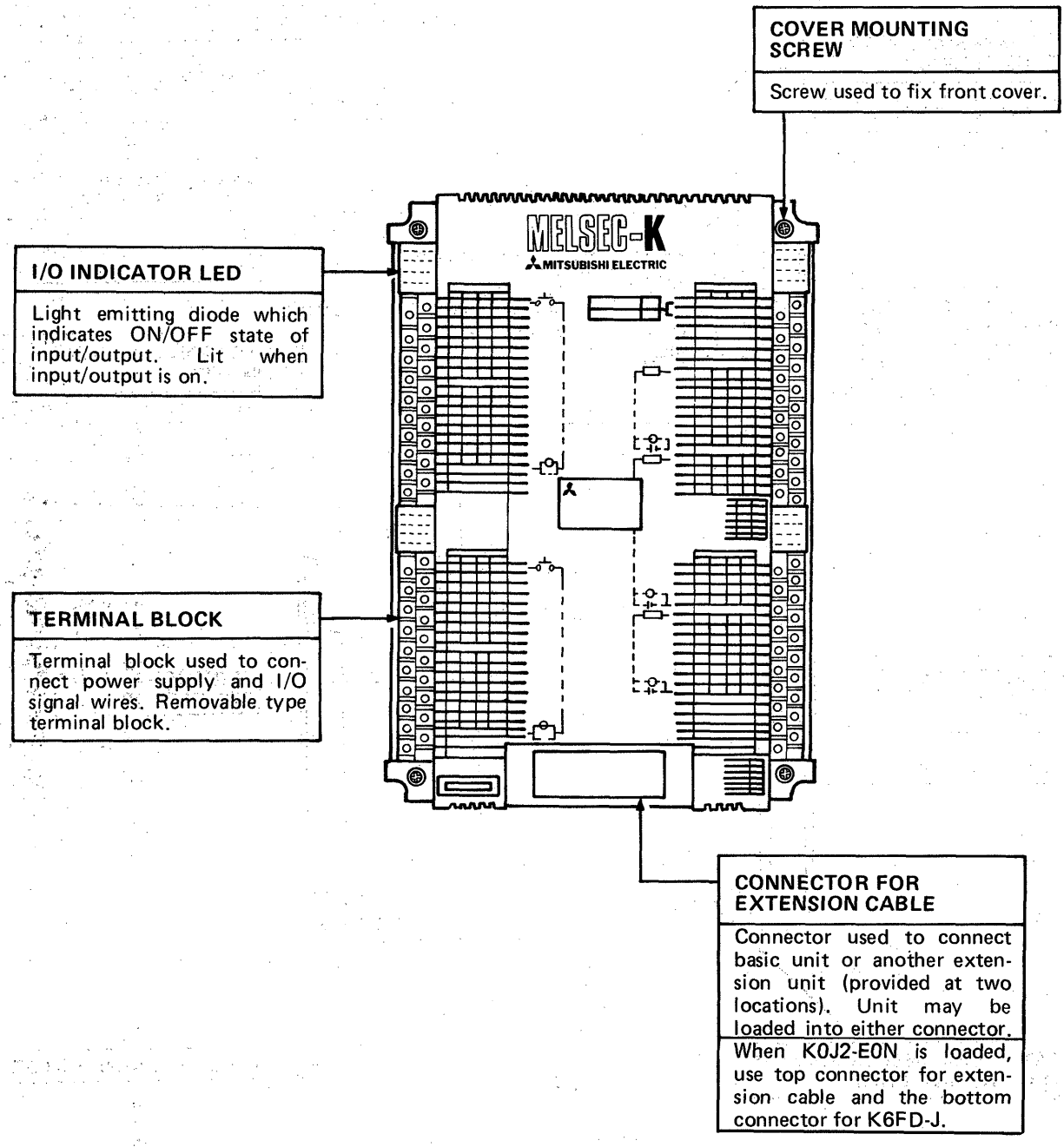



Fig. 5.3 External View of Type K0J2-E56

(2) Internal view of Type K0J2-E56

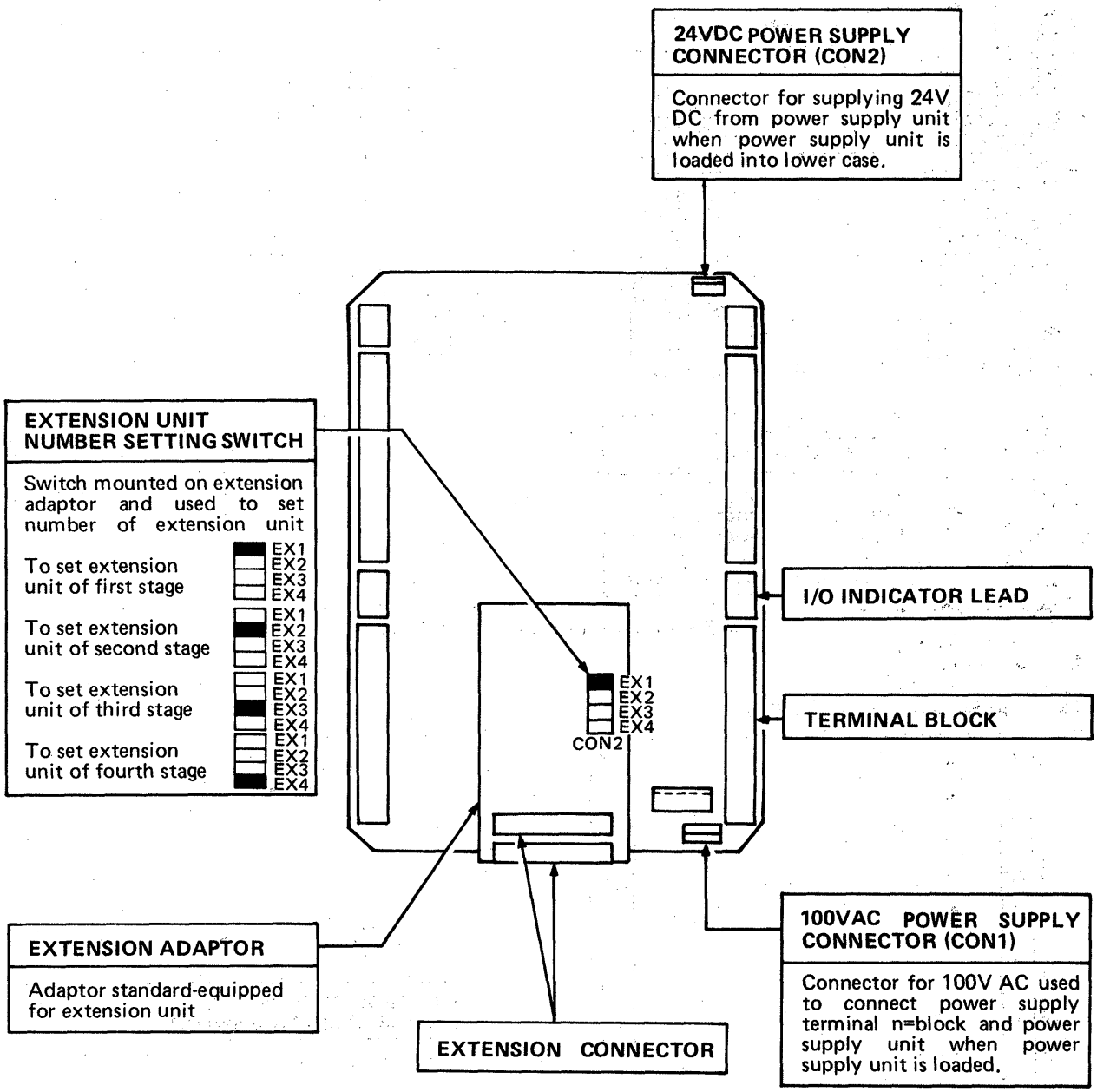



Fig. 5.4 Internal View of Type K0J2-E56

(3) External view of Type K0J1-E32

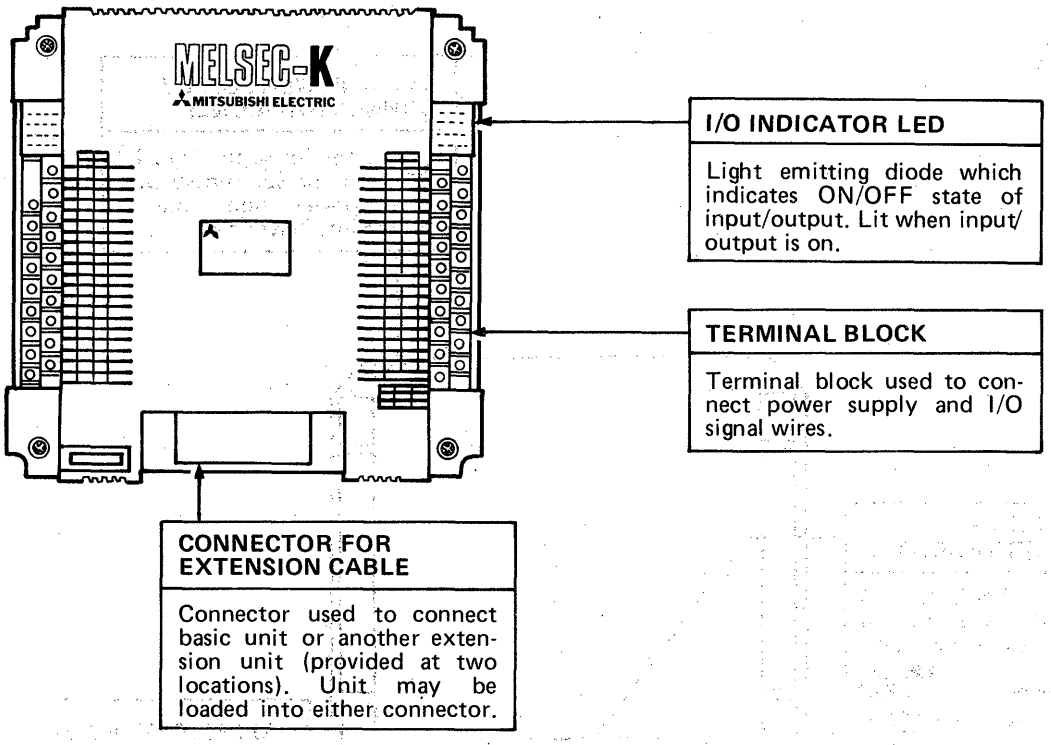



Fig. 5.5 External View of Type K0J1-E32

(4) Internal view of Type K0J1-E32

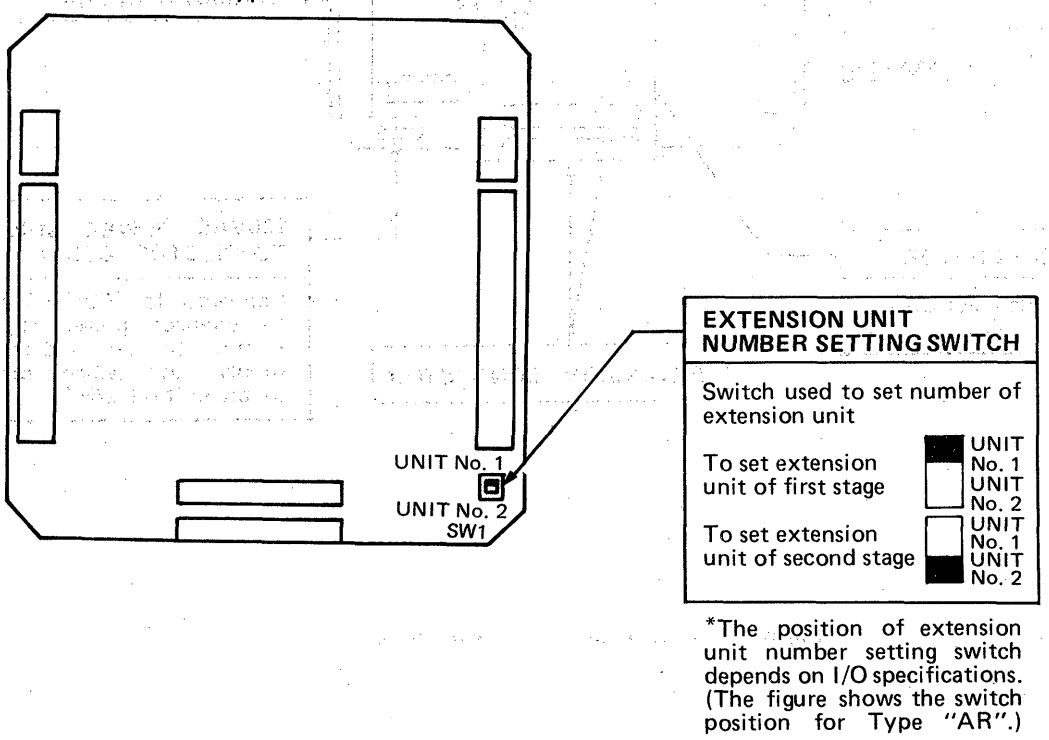
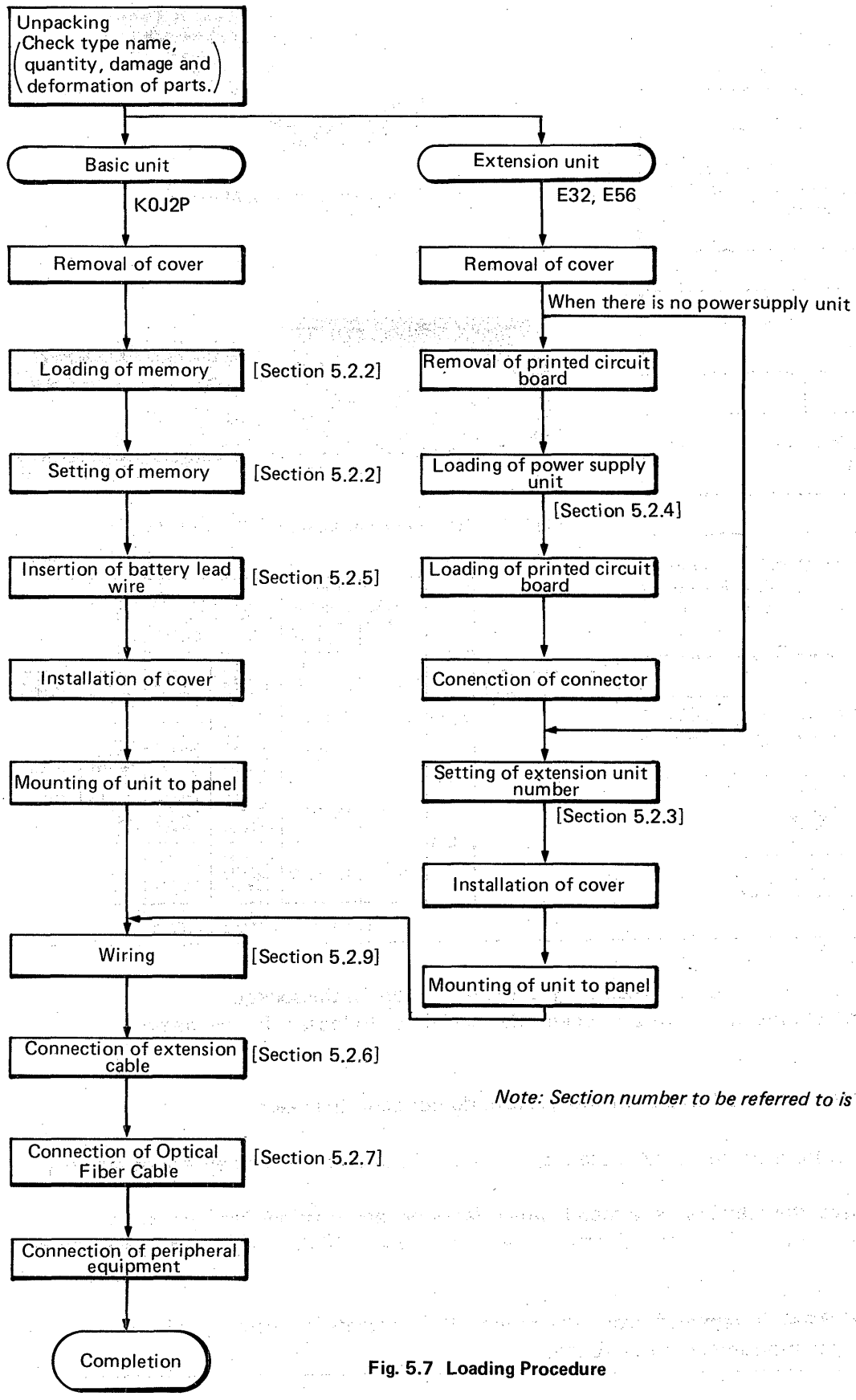



Fig. 5.6 Internal View of Type K0J1-E32

## 5.2 Loading

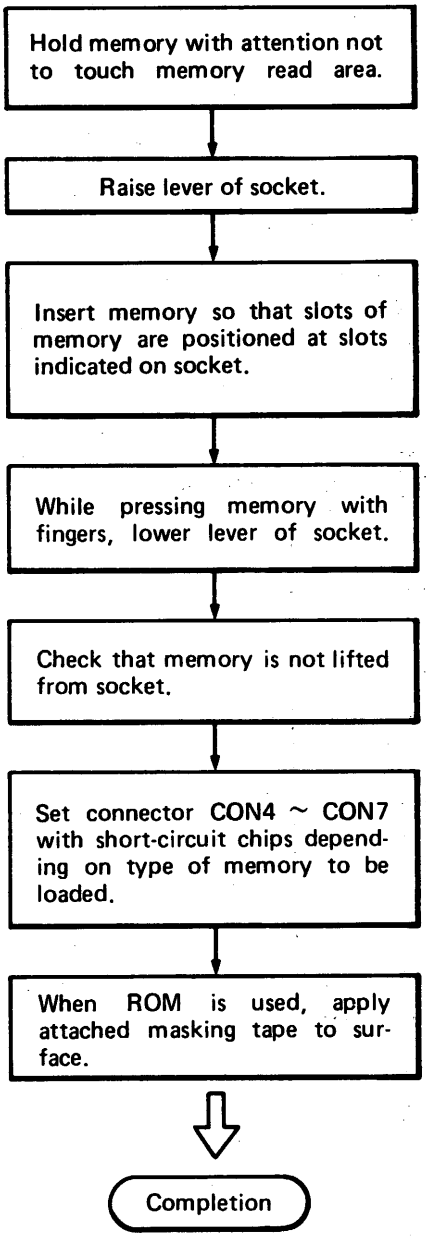
### 5.2.1 Loading procedure




*Note: Section number to be referred to is shown in brackets.*

**Fig. 5.7 Loading Procedure**

### 5.2.2 Memory loading and setting



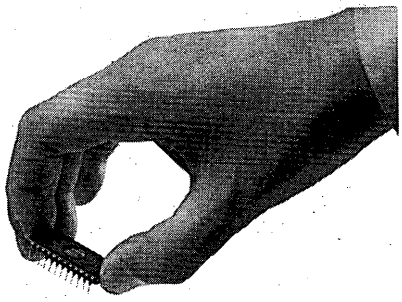
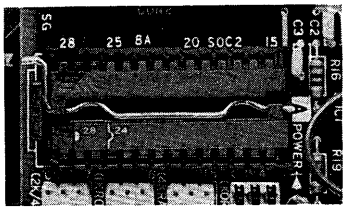



Fig. 5.9 How to Hold Memory



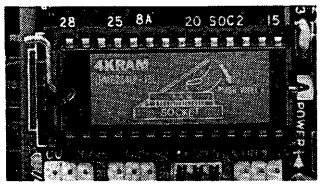


Fig. 5.10 Before Loading Memory Fig. 5.11 After Loading Memory (4KRAM)

(*Factory-set position)

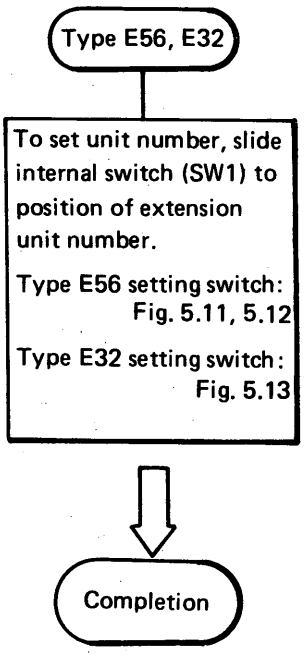
| | Number of Steps | Memory Loaded into Socket | Connector Type and Setting | | | |
|---|---|---|---|---|---|---|
| | | | CON7 | CON6 | CON5 | CON4 |
| RAM | 1024 | Standard-equipped RAM for 1K step | | | | * |
| RAM | 4096 | 4KRAM | | | | |
| ROM | 2048 | 2KROM | | | | |
| ROM | 4096 | 4KROM | | | | |

Table 5.1 Setting of Memory

**CAUTION**

1. Be sure to load the memory according to the indication on the socket.
   Snugly fit the memory into the socket. Be careful not to loosely fit the memory into the socket.
2. Do not touch the read area of memory. Also, do not bend the reads.
3. Be sure to store the memory in the case which has been used for the delivery of memory.
4. Never place the memory on a metal, which leaks or may possibly leak, or on an object which is charged with static electricity, such as wood, plastic, vinyl, fiber, cable, and paper.
5. If the IC-RAM is removed from the socket, the contents of memory will be erased. Therefore, caution should be exercised.

### 5.2.3 Setting of extension unit number



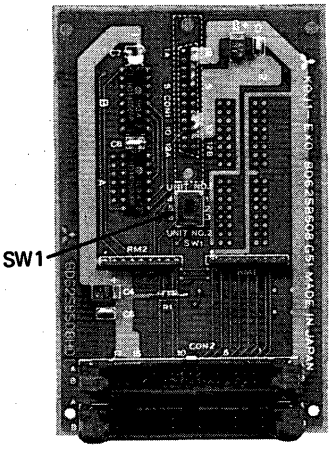




Fig. 5.11 Type K0J1-E56 Setting Switch

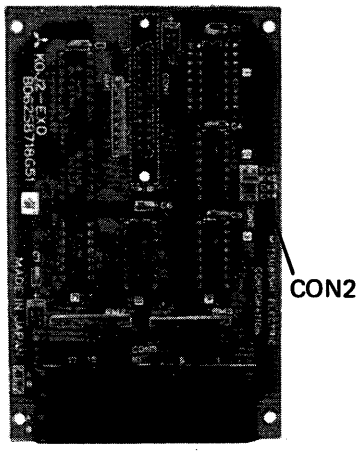



Fig. 5.12 Type K0J2-E56 Setting Switch

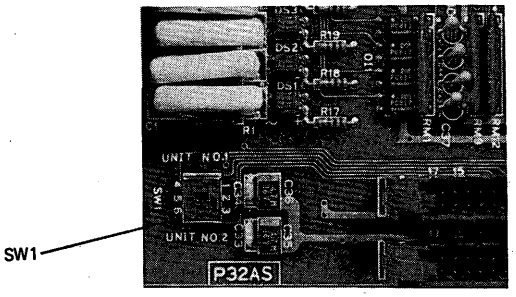



Fig. 5.13 Type K0J1-E32 Setting Switch

Setting of Extension Unit and Base Numbers

| | Type K0J1-E56 | Type K0J2-E56 | Type K0J1-E32 |
|---|---|---|---|
| Detail of setting switch | UNIT No. 1<br>4 1<br>5 2<br>6 3<br>UNIT No. 2 | EX1<br>EX2<br>EX3<br>EX4<br>CON2 | UNIT No. 1<br>4 1<br>5 2<br>6 3<br>UNIT No. 2 |
| Setting | For first extension stage: UNIT No. 1 / UNIT No. 2<br>For second extension stage: UNIT No. 1 / UNIT No. 2 | For first extension stage: EX1<br>For second extension stage: EX2<br>For third extension stage: EX3<br>For fourth extension stage: EX4 | For first extension stage: UNIT No. 1 / UNIT No. 2<br>For second extension stage: UNIT No. 1 / UNIT No. 2 |

*:Black area indicates the setting position of slide switch.

### 5.2.4 Loading of extension power supply unit

Load power supply unit into Type E56 extension unit case and tighten and fix it with four fixing screws.

↓

Connect 24VDC connector with lead wire (Fig. 5.14 ①) to 24VDC/24GDC connector (CON2) of I/O printed circuit board so that red wire is located on 24VDC side.

↓

Connect 5V DC connector with lead wire (Fig. 5.14 ②) to connector of power supply unit (CON1) so that blue wire is located on top side.

↓

Connect 100VDC connector with lead wire to 100VAC/FG (Fig. 5.14 ③ ) connector (CON1) of I/O printed circuit board so that green wire is located on FG side.

↓

Completion

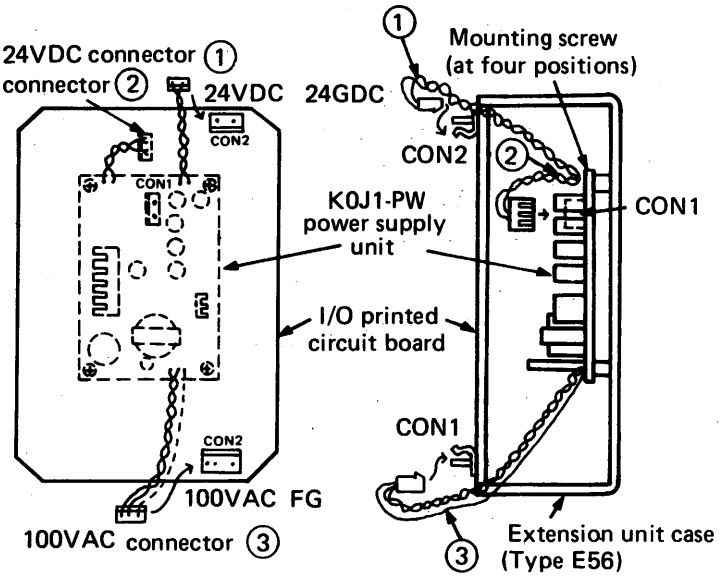



Fig. 5.14 Loading Procedure of Power Supply Unit to Type E56

### 5.2.5 Loading of battery

To newly use CPU

↓

Insert lead wire, which is provided for positive pole of battery, into connector (CON3). (Positive red lead

To change battery

↓

Check polarity and load battery.

↓

Insert lead wires, which are provided for battery, into connectors (CON2, CON3). (Positive red lead wire)

↓

Completion

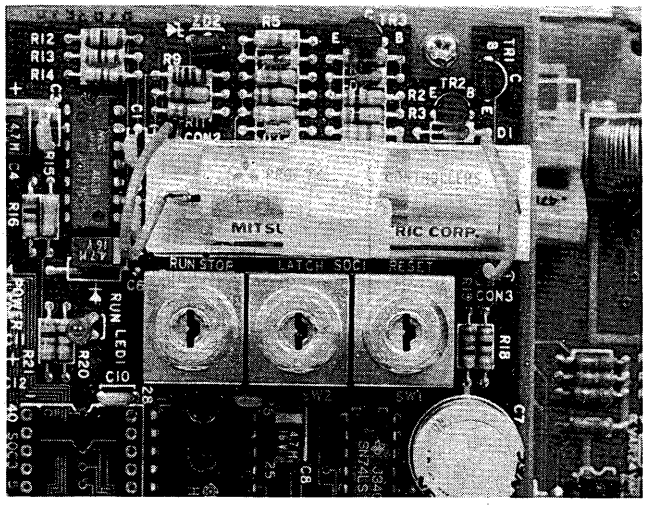
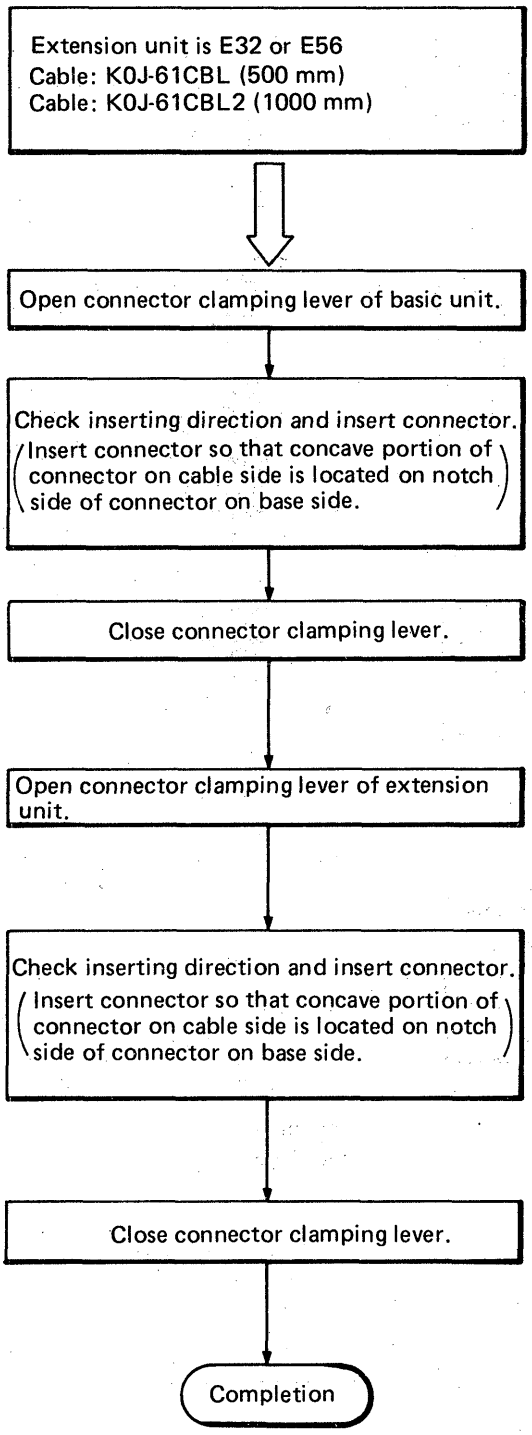



Fig. 5.15 Loaidng of Battery

**CAUTION**

1. To prevent the battery from being consumed, the positive lead wire of battery is disconnected at the time of shipment. When the memory is IC-RAM or even when it is EP-ROM, connect the lead wire when power failure backup is required.
2. Change the battery within 15 minutes.

### 5.2.6 Connection of extension cable




**CAUTION**

1. Although the extension unit and extension base have two connectors, respectively, the cable may be connected to either of the connectors.

### 5.2.7 Connection of optical cables

Remove the white cap mounted on the connector for optical link of K0J2P.

↓

Remove the white cap mounted on the connector of optical cable coming from master channel or another slave channel. (The white cap is of thread-in type.)

↓

Insert the optical cable, which comes from the sending side of another channel, into the receiving side (left side) connector of K0J2P and thread it in to fix it.

↓

Insert the optical cable, which comes from the receiving side of another channel, into the sending side (right side) connector of K0J2P and thread it in to fix it.

↓

Completion

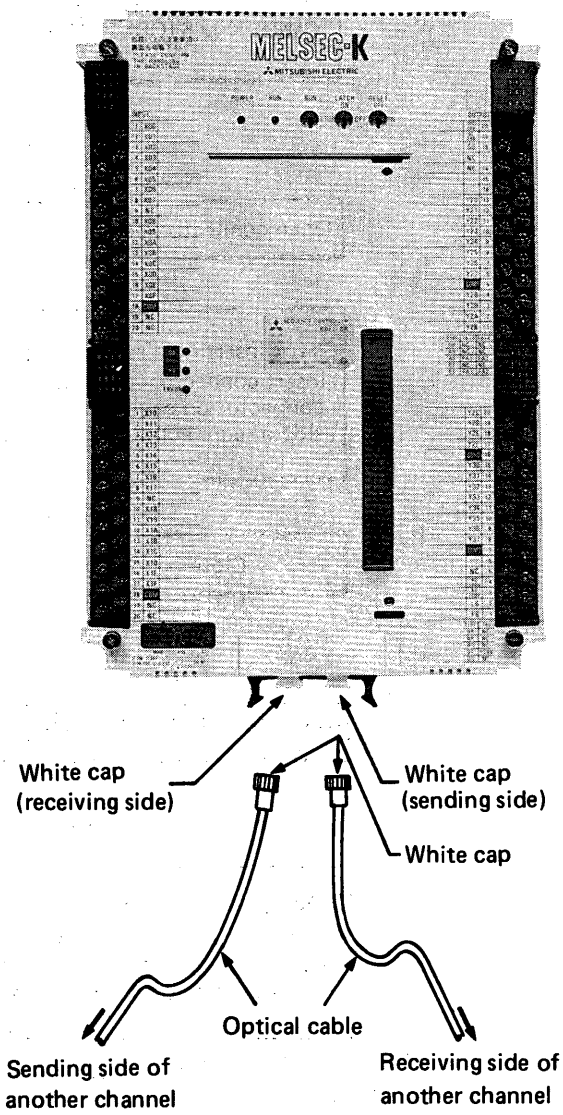



Table 5.16 Connection of Optical Cables

**CAUTION**

1. Do not directly touch the connecting portion of optical cable with finger.
2. Connect the optical cables with care not to mistake the sending side for the receiving side and vice versa.
3. Do not forcibly bend, compress, twist, pull or stamp the optical cable.

### 5.2.8 Mounting to panel

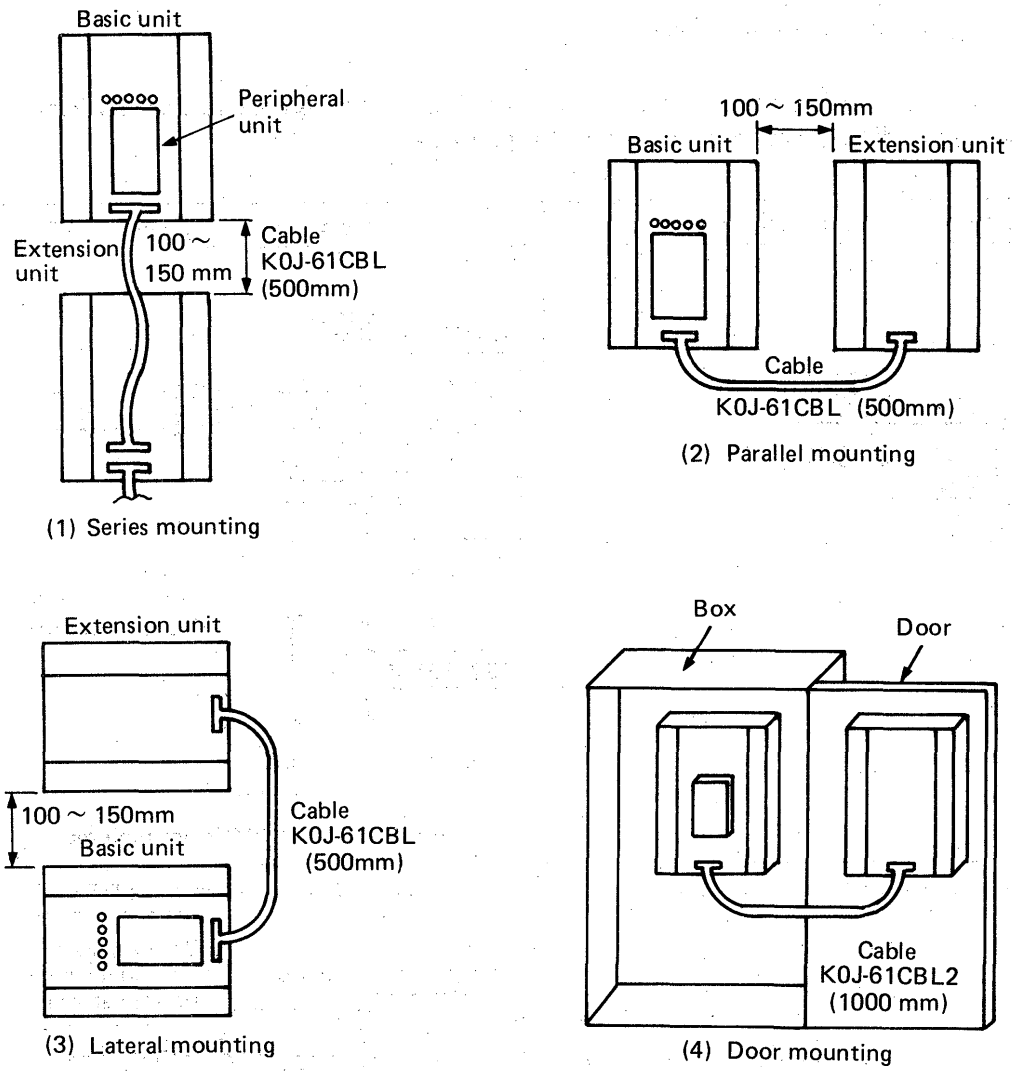



**Fig. 5.17 Mounting Methods of K0J**

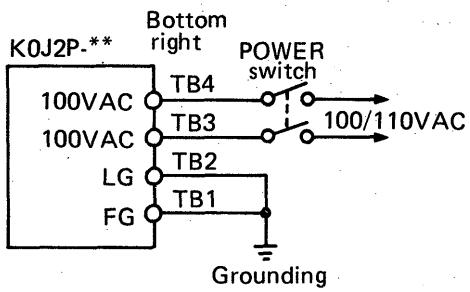
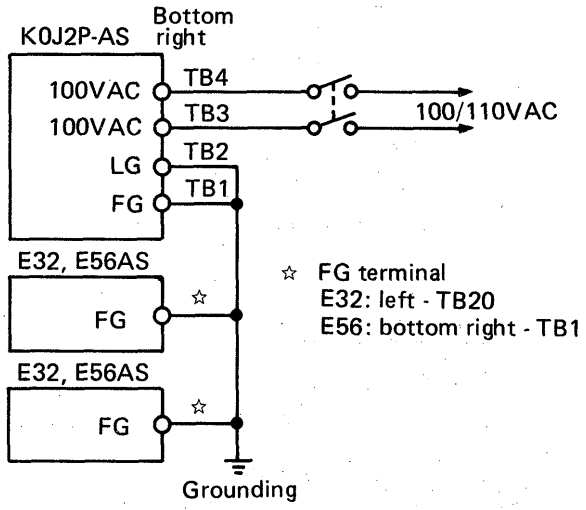
**CAUTION**

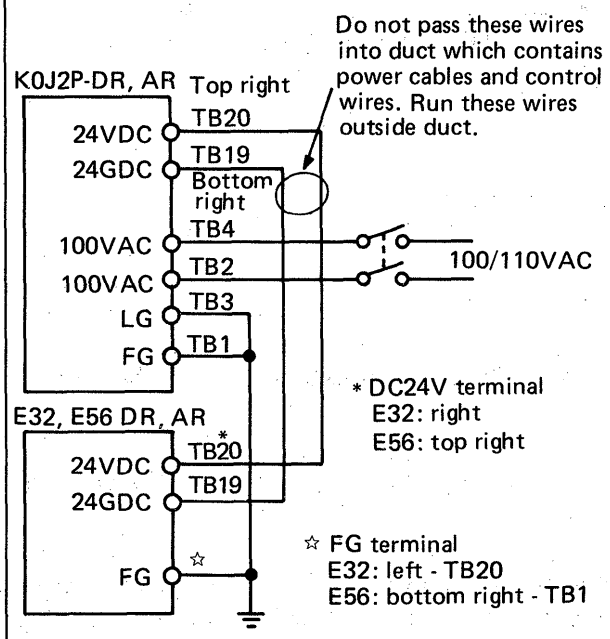
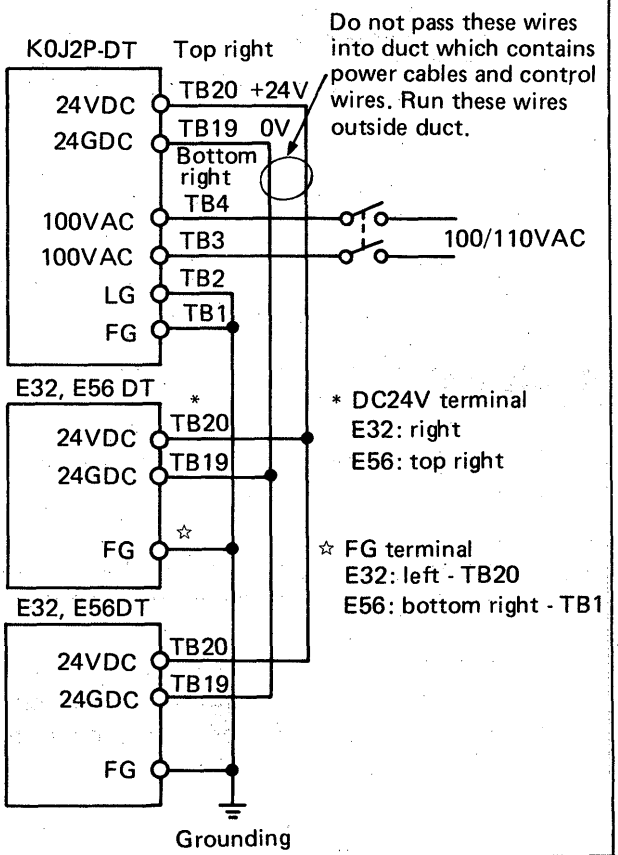
1. The positions of basic unit and extension unit or basic unit and extension base shown in the above figure may be reverse.
2. The K0J2P, K0J2-E56, K0J1-E56 and E53 units can be mounted horizontally on the bottom of operation panel. In this case, provide cooling means.
3. The mounting surface should be level and should not be uneven and distorted. When there are parts which generate vibration and shock (such as contactor and breaker), provide sufficient distance from such parts or mount the units on another panel.

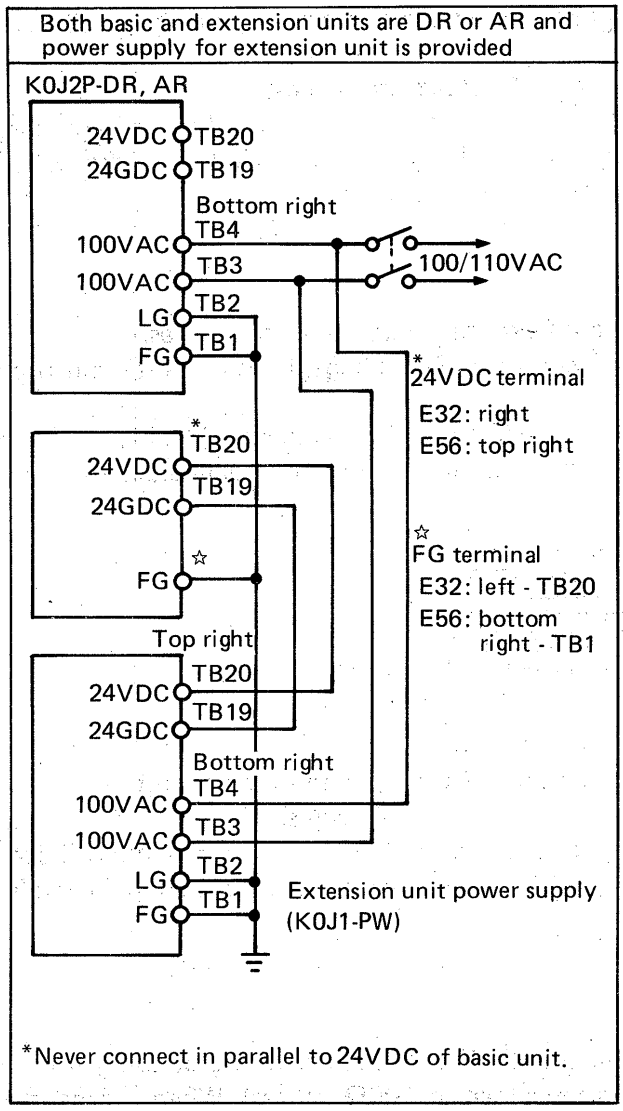
### 5.2.9 Wiring

(1) Wiring of power supply and grounding

When the system consists of only basic unit or has been extended, perform the wiring of power supply and grounding in accordance with I/O type name.

<table>
<tr><td>System consists of only basic unit</td><td>Both basic and extension units are AS</td></tr>
<tr><td> 
</td><td> 

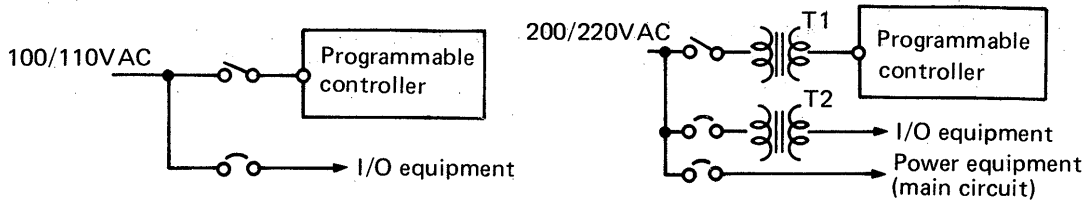
*Grounding of 24VDC is not required.</td></tr>
<tr><td>Both basic and extension units are DR or AR</td><td>Both basic and extension units are DT or DS</td></tr>
<tr><td> 
</td><td> 
</td></tr>
</table>




(2) Wiring instructions

Power supply

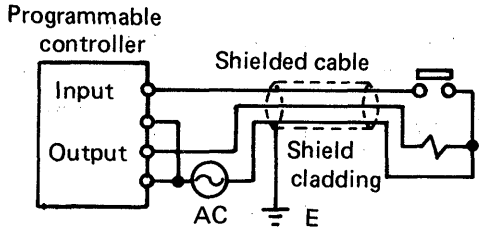
1) When voltage fluctuation is large, connect a constant-voltage transformer.
2) Use power supply, which generates minimal noise, across wires and across terminals and ground. When much noise is generated, connect an insulation transformer or filter.
3) When 200V AC is supplied, the capacity of voltage lower control transformer is as indicated below, and the transformer with shield is the most suitable.
   System consists of only basic unit: 100VA
   System is provided with extension power supply: 150VA
4) Separate the route of power supply of programmable controller from the routes of I/O equipment and power equipment as shown below.



5) Twist the 100VAC cable and the 24VDC cable to extension unit as closely as possible, and connect the units at the shortest distance.
6) Do not use 24VDC of K0J as the power supply of output equipment.
7) Do not bundle both 100VAC and 24VDC cables with main circuit (high-voltage, large-current) wire and I/O signal wire. Also do not wire the cables in the vicinity of the wires. If possible, separate the cables at least 100 mm away from the wires.

I/O equipment

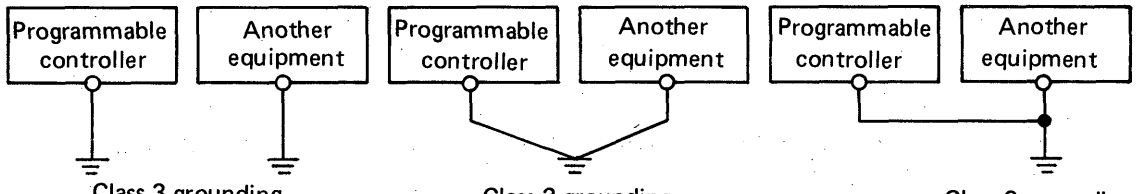
1) If possible, wire the I/O equipment separately from the input and output wires.
2) Wire the I/O signal wires at least 100 mm away from high-voltage, large-current main circuit cable.
3) When it is impossible to separate the I/O signal wires from the main circuit cable and power cable, use batch-shielded cables and ground on the programmable controller side.




4) When wiring has been conducted by use of conduit, securely ground the conduit.
5) Separate the I/O wires of 24VDC from the 100VAC and 200V wires.
6) When wiring has been conducted at a long distance more than 200 mm, trouble will occur due to leak current caused by line capacity. Take preventive means described in Example 4 of Section 5.2.10 (1) or Example 2 of (2).

Grounding

1) Ground the programmable controller independently if possible. Perform grounding work by way of Class 3 grounding (with grounding resistance of 100Ω or less). When independent grounding cannot be performed, use the joint grounding method (2) shown below.

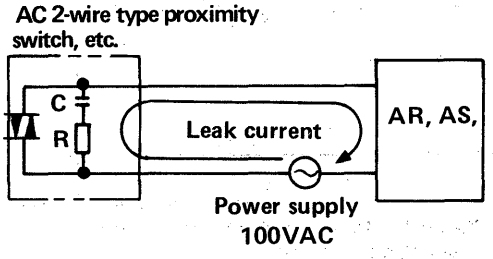
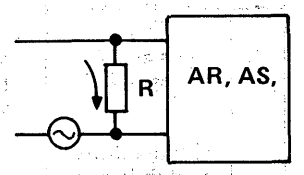
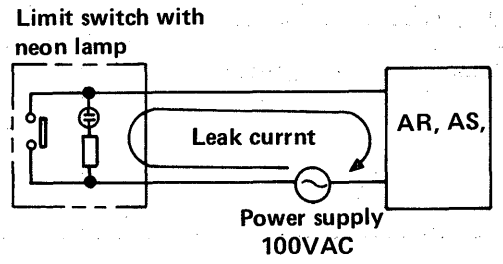
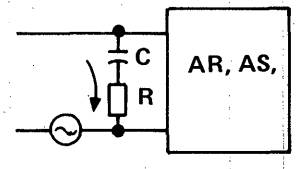
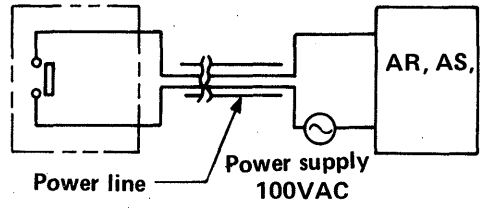


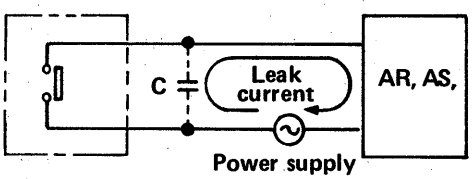
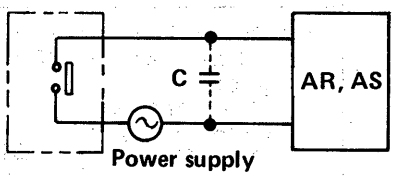
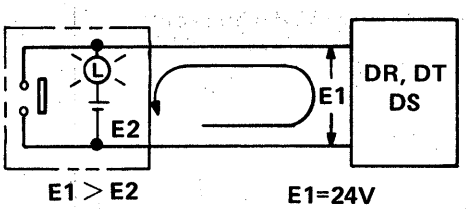
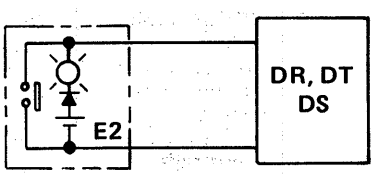

(1) Independent grounding -best (2) Joint grounding - good (3) Joint grounding - not allowed

2) Use 2 $mm^2$ or larger grounding cable.
3) Grounding point should be closest possible to the programmable controller and the length of grounding cable should be minimal.
4) Should malfunction occur due to grounding, disconnect either or both of the grounding terminals (LG and FG) of base unit from the ground.
5) Since this programmable controller is fully provided with measures against noise, it can be used without grounding except when there is especially much noise.

### 5.2.10 Troubles and corrective actions of I/O circuits

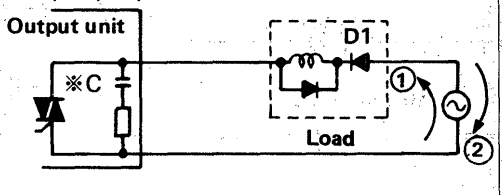
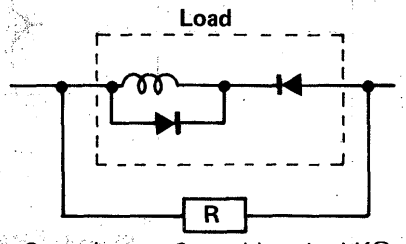
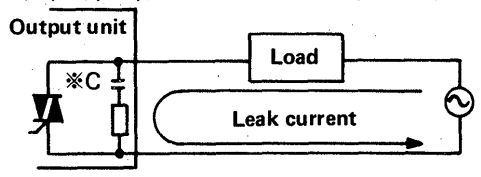
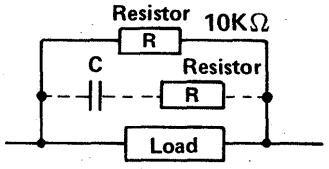
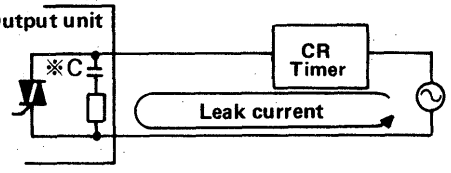
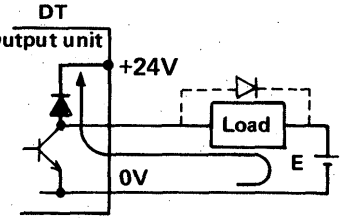
(1) Troubles and corrective actions of input circuit

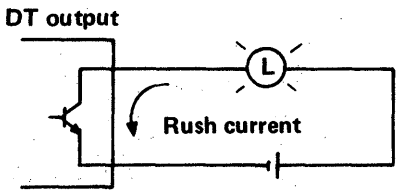
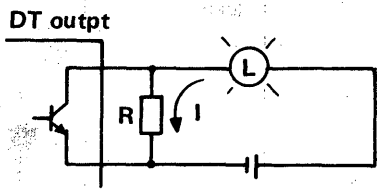
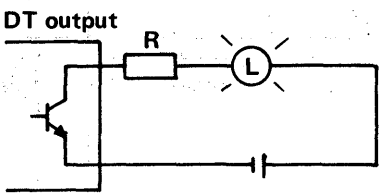
| Ex. | Condition | Cause | Corrective Action |
|---|---|---|---|
| 1 | Though triac is not on, input turns on.<br>Though triac is turned off, input fails to turn off. | Input is turned on by leak current from the CR absorber used to protect triac from surge.<br>  <br>This occurs in AR or AS when leak current excedds 4 mA. | Connect resistor or series combination of resistor and capacitor as shown below in order to reduce input impedance so that voltage across input terminals of input unit is lower than input operation "off" voltage.<br>  <br>Example: R: 15KΩ 2W |
| 2 | Though limit switch is not on, turns on.<br>Though limit switch is turned off, input fails to turn off. | When limit switch is provided with neon lamp, input is turned on by leak current caused by neon lamp.<br>  |  <br>Example: CR: 0.5μF + 50Ω<br>DCR2-1203-5041<br>(Matsuo Electric make) |
| 3 | Same as example 2. | In case input signal line is wired long distance in parallel to other power line, etc., input turns on because voltage is induced by induced voltage from power line.<br>  | *Note: Determine R and CR values depending on leak current values.*<br>*When only resistors is used, more heat is generated.*<br>*If possible, use the combination of resistor and capacitor.*<br>*This combination produces an effect also on large surge.* |

| Ex. | Condition | Cause | Corrective Action |
|---|---|---|---|
| 4 | Same as example 2. | Input is turned on by leak current caused by line-to-line capacity across wired cable.<br>  | (a) Same as examples 1, 2, and 3.<br>(b) As shown below, provide power supply on limit switch side.<br>  |
| 5 | Same as example 2.<br><br>Though limit switch is not on, lamp turn on. | With 2 power supplies used, since E1 voltage is larger than E2 voltage, unidentified flowing current flows as show below.<br>  | (a) Use 1 power supply.<br>(b) Take action so that E1 ≦ E2 is established.<br>(c) Connect snake path prevention diode as shown below.<br>  |

(2) Troubles and corrective actions of output circuit

(Varistor with ※mark is provided for only AS and DS.)

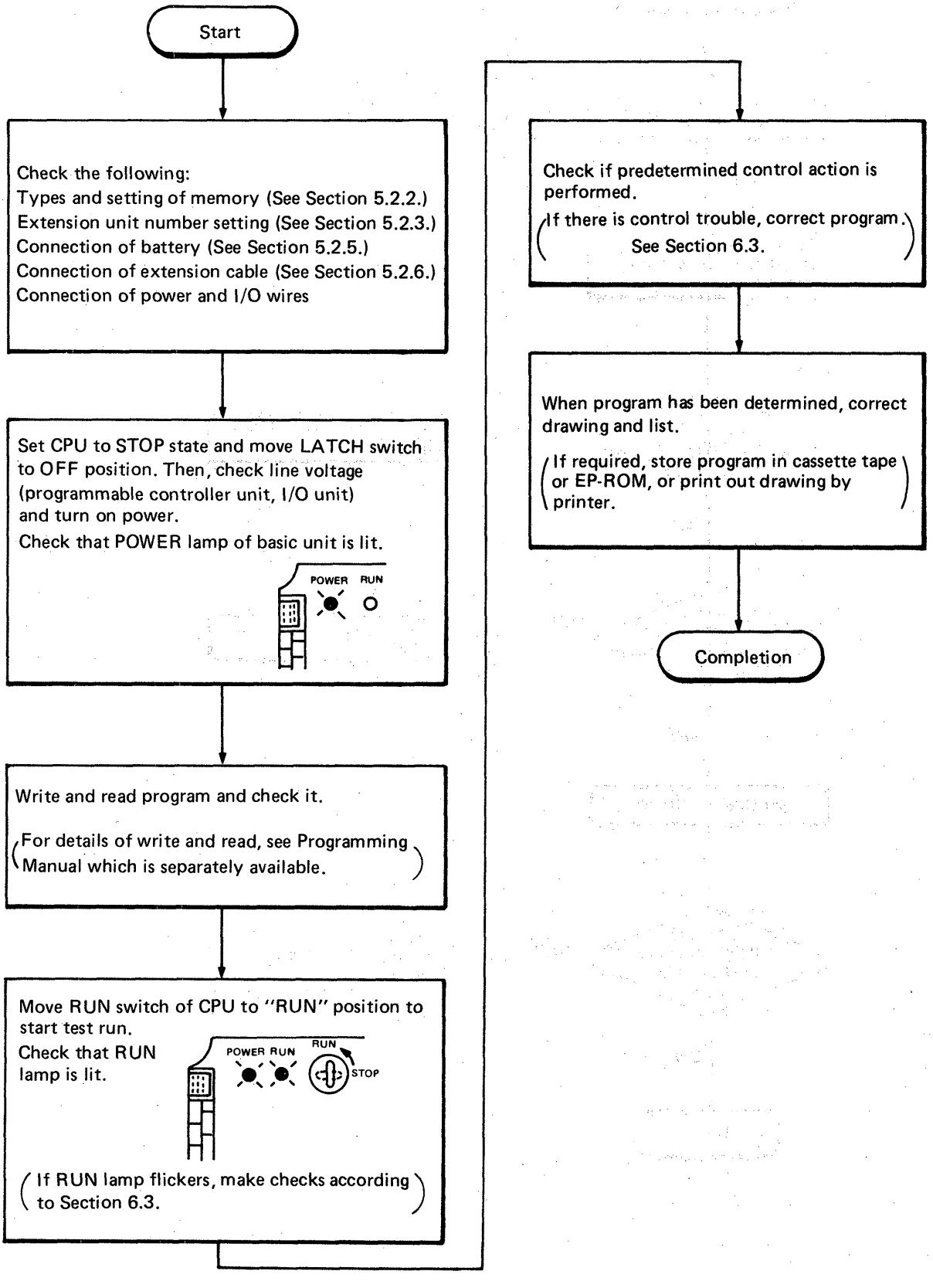
| Ex. | Condition | Cause | Corrective Action |
|---|---|---|---|
| 1 | When output off, ecess voltage is applied to load. | ○ Load is half-wave rectified internally (seen in some solenoids)<br>AR, DR, AS, DS<br>Output unit<br>  <br>○ When power supply polarity is as shown by ①, C is charged. When polarity is as shown by ②, voltage charged in C plus line voltage are applied across D1.<br>Max. voltage is approx. $2\sqrt{2E}$. | ○ Connect resistor of several ten K across load.<br>*Note: When resistor is used in this way, it does not offer problem to output elemnt, be may sometimes cause the diode, which is built in the load, to deteriorate or burn.*<br>  <br>Several ten ~ Several hundred KΩ |
| 2 | Load does not turn off. | ○ Leak current caused by built-in snubber. This is especially liable to occur in the case of small-capacity load.<br>AR, DR, AS, DS<br>Output unit<br>  | ○ Connect resistor of approx. several ten K across load.<br>*Note: In case wiring distance from output card to load is long, take care because there may exist leak current due to line-to-line capacity.*<br>○ Connect C and R across load.<br>  <br>CR: 0.1 ~ 0.47μF + 47 ~ 120 Ω |
| 3 | When motor type or C, R type timer is used as load, time limit fluctuates. | AR, DR, AS, DS<br>Output unit<br>  | ○ After driving relay, drive timer at the same contact.<br>○ Connect C and R across CR timer.<br>*Note: Since some timers are half-wave rectified internally, caution described in Example 1 is required.* |
| 4 | Load fails (for direct current) | ○ Circulation occurs because 2 power supplies are used.<br>DT<br>Output unit<br>  <br>○ +24V < E, circulation occurs. | ○ Use load power supply of 24V DC.<br>○ Connect circulation preventive diode. (See note.)<br>*Note: In case relay or the like is used as load, it is necessary to connect reverse voltage absorbing diode (shown in dotted line in figure at left) with load.* |

| Ex. | Condition | Cause | Corrective Action |
|---|---|---|---|
| 5 | Output transistor is destroyed. | In case transistor is used for output and lamp is used as load, since inrush current flows through lamp when transistor turn on, output transistor is destroyed.<br>  <br>Since DT has max. withstand rush current or 1.5A (50mS), rush current for lamp should be below this value. | (a) Provide resistor as shown below so that small current, which will not turn on the flows at all times, in order to prevent rush current from generating.<br>Example I : rush current x 1/3 ~ 1/4<br>  <br>(b) Provide resistor as shown below to restrict rush current.<br>  |

## 5.3 Operating Procedures

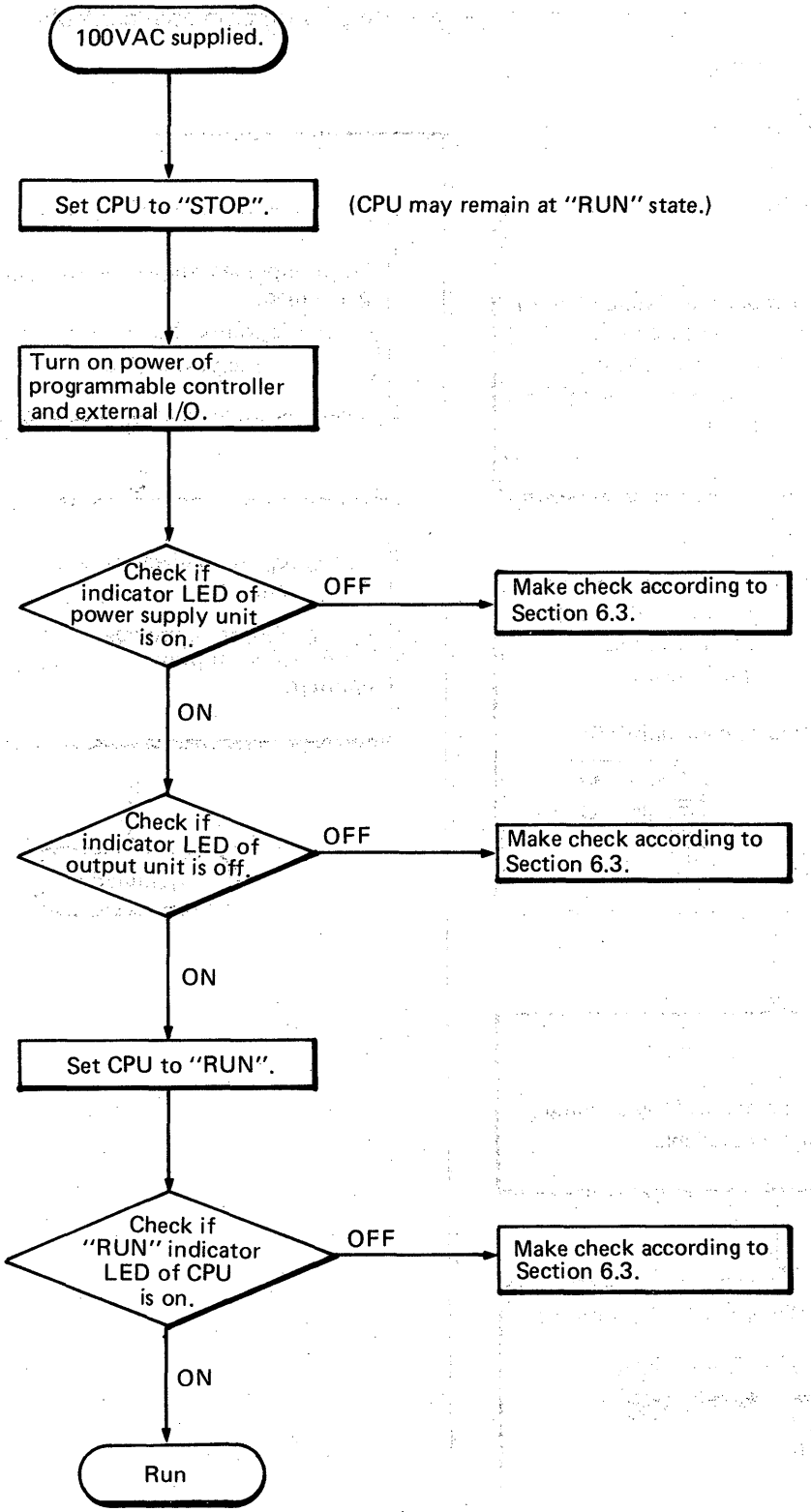
### 5.3.1 Test run flow chart

This section shows the test run flow chart after completion of programmable controller installation.



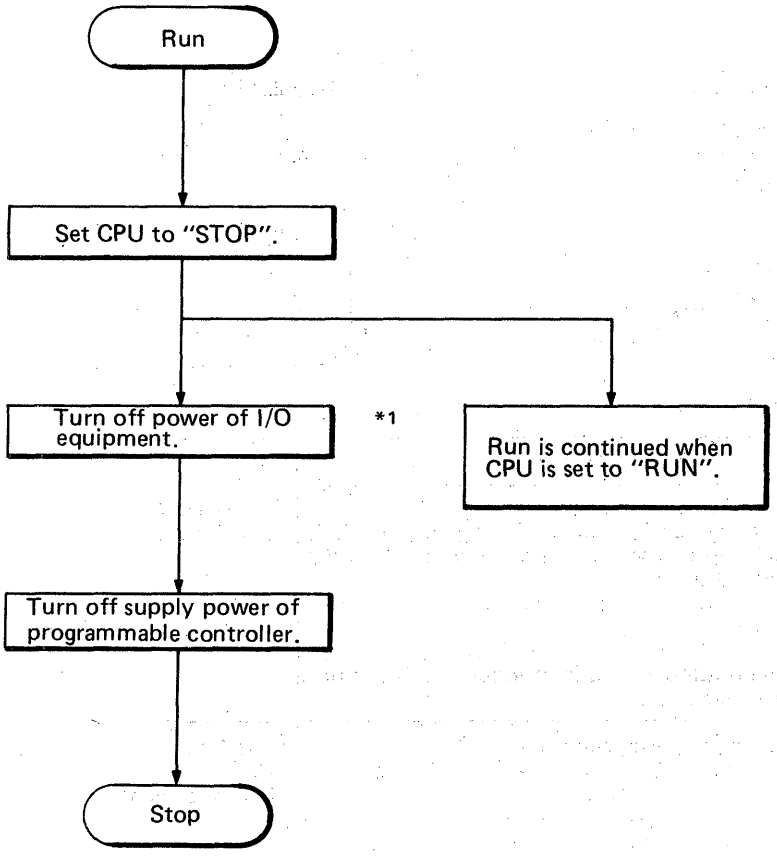
### 5.3.2 Daily operation

(1) Operation start



(2) Operation stop

Stop operation when operation can be stopped, judging the controlled state of controlled unit.




**CAUTION**

1. If only the power supply of I/O equipment is turned off in the step indicated by *1, arithmetic operation is performed with all inputs off.

2. When the "RESET" switch is moved on ON position during run or stop of CPU, the interior of CPU is set to initial state. If the "RESET" switch is moved to ON position during run when the latch function is not used, all outputs are reset and the temporary values of timers/counters are also cleared.

### 5.3.3 Error code list

When error has been detected as a result of self-diagnosis by turning on the RUN switch of K0J2P, the error code can be read by the test function of programming unit (PU) or graphic programming panel (GPP).

Example: 1) PU

[Operation]

TEST | K | STEP ±

[Display]

[ ] | K | 5021

2) GPP

[Operation]

KCPU

TEST | K | GO

[Display] ..... CRT

ERROR STEP
5021

Table 5.2 shows the error code types and corrective actions.

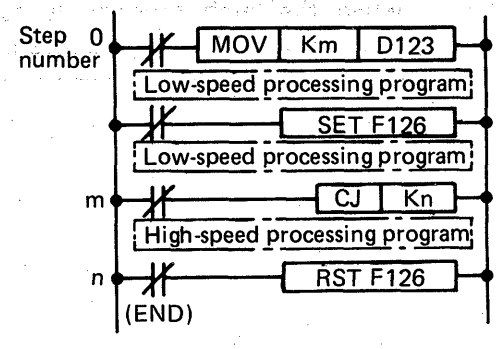
| Error Display | Content | Corrective Action |
|---|---|---|
| 0 ~ 4095 | Display of error step number<br>(1) The instruction code of program, which is being processed, has a code which the CPU cannot decode.<br>(2) The result of conversion into BCD exceeds "9999".<br>(3) Since the program has jumped to a step below END by CJ instruction, END has not been executed. | The step indicated by error display has a program error. Correct the program. |
| 1024<br>2048<br>4096 | The program is not provided with END.<br>(Error number differs depending on the capacity of loaded memory.<br>Standard-equipped 1KRAM: 1024<br>2KROM: 2048<br>4KRAM, ROM: 4096) | Write END in the program.<br>(When END instruction is not provided, GPP cannot display a circuit mode.) |
| 5008 | K0J83 is not loaded when remote I/O or local programmable controller is selected (the internal setting switch 3 or 4 is set to ON position). | Check if the built-in optical data link card (K0J83) is loaded. When the K0J83 is loaded, also check its loading condition. |
| 5021 | The process time of program has exceeded 200mS. | Reduce the process time of program by using a CJ instruction, for example. |
| 5031 | Jump instruction (CJKn) to END, which is specified at the end of low-speed processing program, or return instruction (RST F126), which is specified at the end of high-speed processing program, has not been written. | Correctly write the instruction, referring to the programming manual. |
| 5032 | The format of high-speed processing program has error. | Modify the format of high-speed processing program as shown below.<br>  |

Table 5.2 Error Code List

# 6. MAINTENANCE AND INSPECTION

## 6. MAINTENANCE AND INSPECTION

### 6.1 Daily Inspection

Check the items in Table 6.1 when the power is turned on or the door of panel is opened.

| Item | Checking Item | Checking Point | Judgement | Corrective Action |
|---|---|---|---|---|
| 1 | Unit mounting conditions | Check for looseness and play of mounting, looseness of cover, disconnection of terminal cover. | Unit should be mounted firmly. | Retighten screws. |
| 2 | Connecting conditions | Looseness of terminal screw. | Screws should not be loose. | Retighten terminal screws. |
| | | Closeness of solderless terminals. | Terminals should be tightened parallel to each other. | Retighten terminal screws. |
| | | Connector of extension cable. | Connectors should be connected firmly. | Latch connectors. |
| 3 | Unit indicator lamp | | | |
| | 1) "POWER" lamp | Check that lamp is on. | On.<br>Off is error. | See Section 6.3.3. |
| | 2) "RUN" lamp | Check that lamp turns on when switch is moved to "RUN" position. | On.<br>Off or flicker is error. | See Section 6.3.4 and Section 6.3.5. |
| | 3) Input lamp | Check that lamp is turned on or off. | On when input is on.<br>Off when input is off.<br>State other than above is error. | See Section 6.3.6. |
| | 4) Output lamp | Check that lamp is turned on or off. | On when output is on.<br>Off when output is off.<br>State other than above is error. | See Section 6.3.6. |
| 4 | When external indicator lamps are provided | | | |
| | 1) "Run" check by M255 | Check that lamp turns on when "RUN" switch is moved to ON position. | On.<br>Off is error. | See Section 6.3.4 and Section 6.3.5. |
| | 2) "Battery error" check by M254 | When lamp is on, battery capacity has reduced. | When lamp is off, battery is normal. | Change battery. |

**Table 6.1 Daily Inspection Items**

### 6.2 Periodic Inspection

Check the items in Table 6.2 once six months. Also check the items when the facility has been moved, modifications have been made, or wiring has been changed.

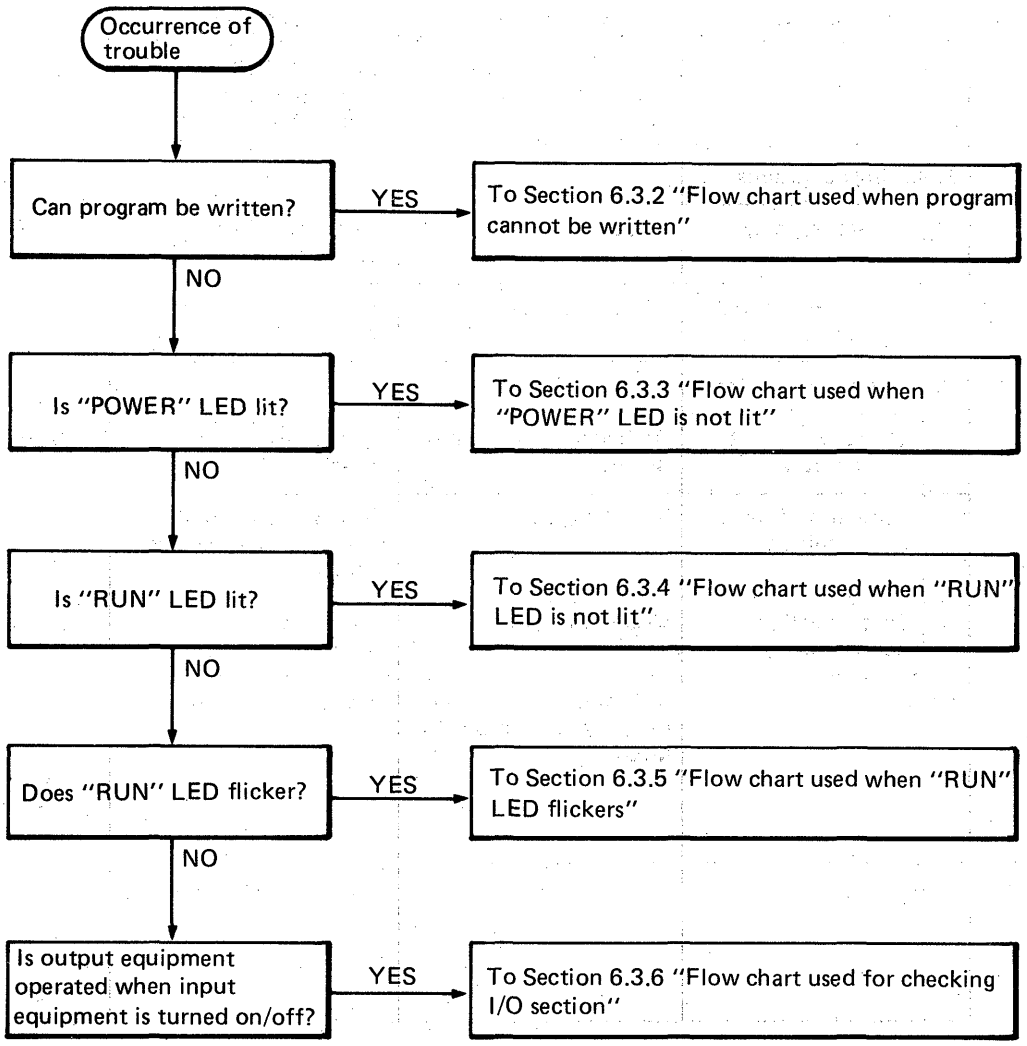
| Item | Checking Item | Checking Point | Judgement | Corrective Action |
|---|---|---|---|---|
| 1 | Line voltage check | Measure voltage across 100VAC terminal. | 85 ~ 121VAC Approximately 95 ~ 110VAC is desirable. | Change supply power. Change transformer tap. |
| 2 | Mounting conditions | | | |
| | 1) Looseness, play | Move unit. | Unit should be mounted firmly. | Retighten screws. |
| | 2) Adhesion of dust or foreign matter | Visual inspection | Free of dust or foreign matter. | Remove and clean. |
| 3 | Connecting conditions | | | |
| | 1) Looseness of terminal screw | Retighten by screwdriver. | Screws should not be loose. | Retighten. |
| | 2) Closeness of solderless terminals | Visual inspection | Proper space should be provided between terminals. | Correct. |
| | 3) Disconnection of connector | Visual inspection | Connectors should be connected firmly. | Latch connectors. |
| 4 | Battery | Indication of battery capacity reduction by M254. | (Preventive maintenance) | If battery capacity reduction is not indicated, change battery when predetermined life has exceeded. It is also desired to change battery periodically. |
| 5 | Fuse | | (Preventive maintenance) | If fuse is not melted, it is desired to change fuse periodically because element may be worn due to rush current. |

**Table 6.2 Periodic Inspection Items**

### 6.3 Troubleshooting

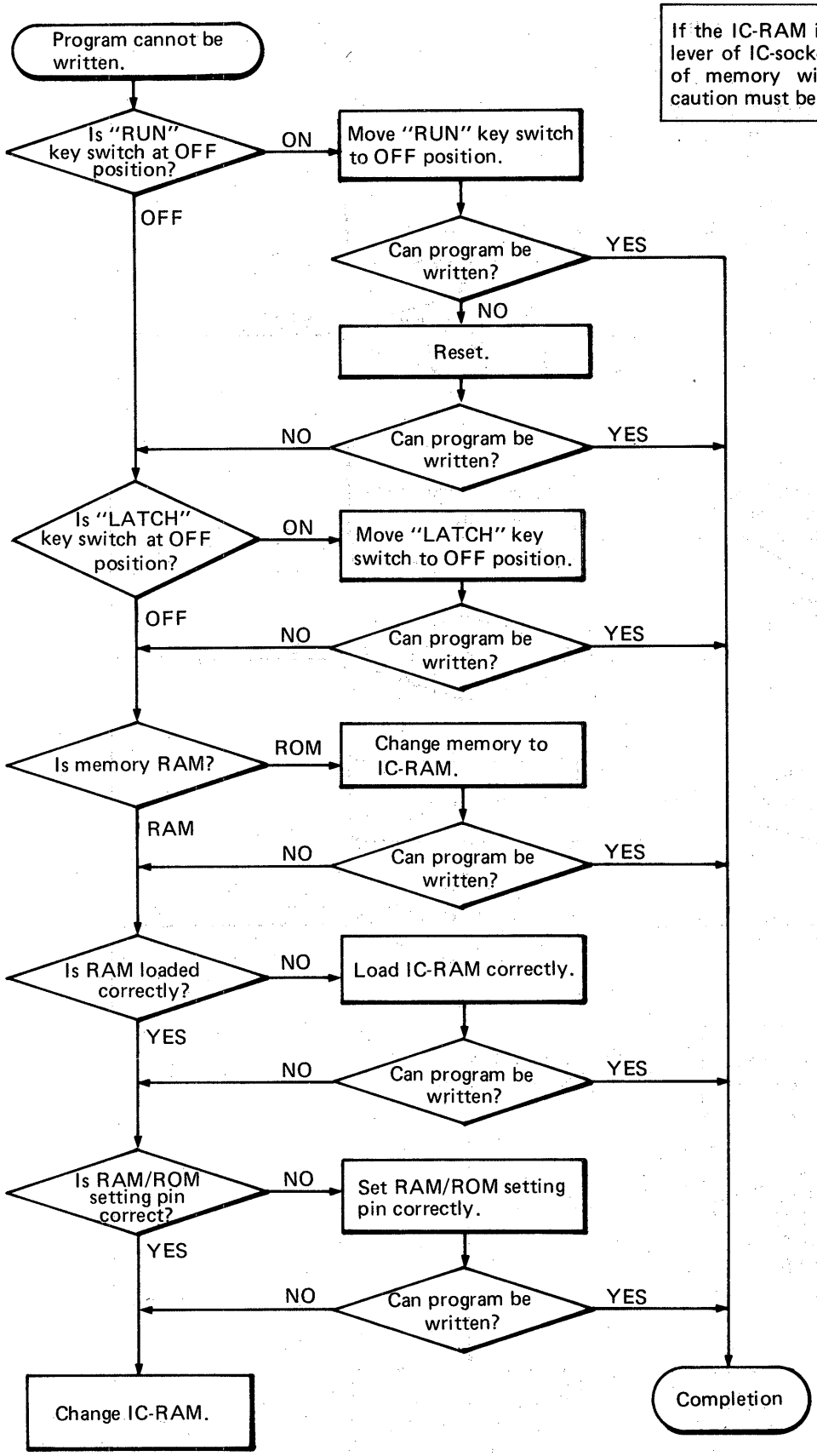
This section explains simple troubleshooting procedures.

#### 6.3.1 Troubleshooting flow chart



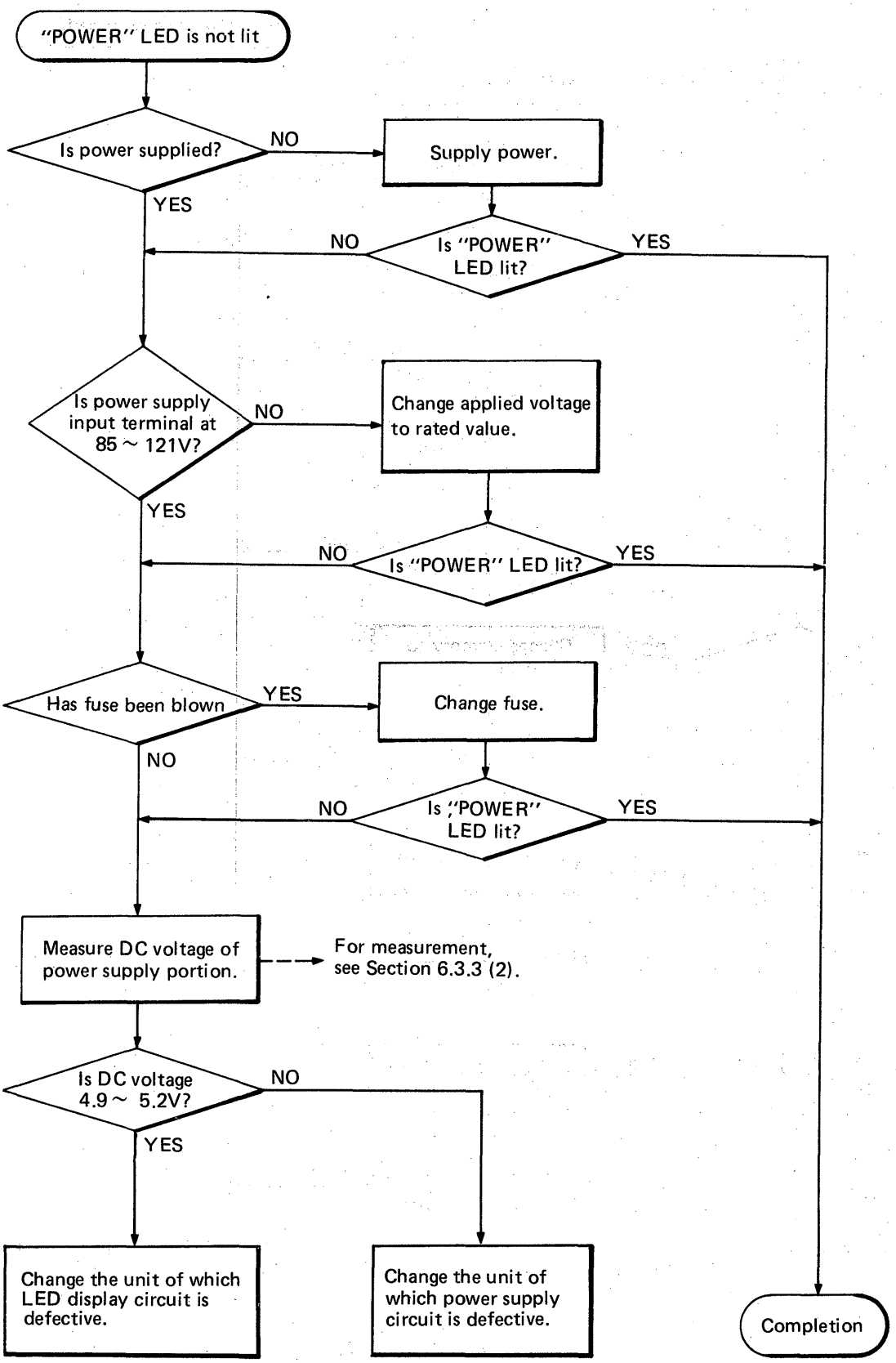
### 6.3.2 Flow chart used when program cannot be written

If the IC-RAM is unloaded or the loading lever of IC-socket is moved, the contents of memory will be erased. Therefore, caution must be exercised.



### 6.3.3 "POWER" LED is not lit

(1) Flow chart used when "POWER" LED is not lit



(2) Measurement of direct current power supply

1) Basic unit
   a. Measure 5V at 5V of CON2 and SG. (Fig. 6.1)
   b. Measure 24V across terminals TB19 (–) and TB20 (+).

2) Type E56 extension unit
   a. Measure 5V at the pin of IC as shown in Fig. 6.2. (5V may be measured at any IC if it is a 16-pin IC.)
   b. Measure 24V across terminals TB19 (–) and TB20 (+).

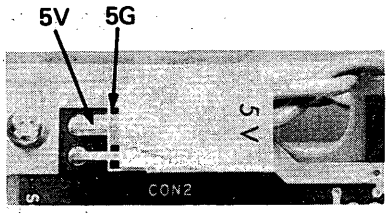



Fig. 6.1 Voltage Measuring Points of Basic Unit

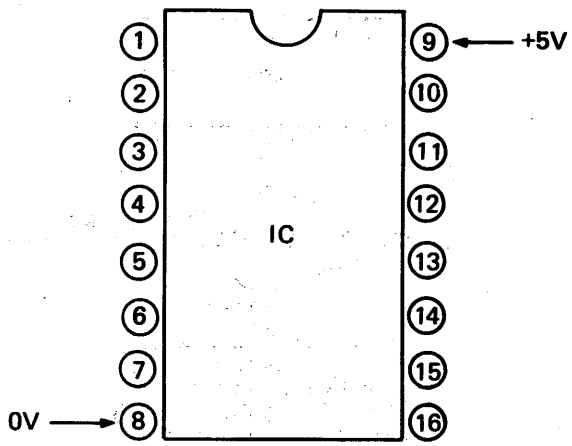
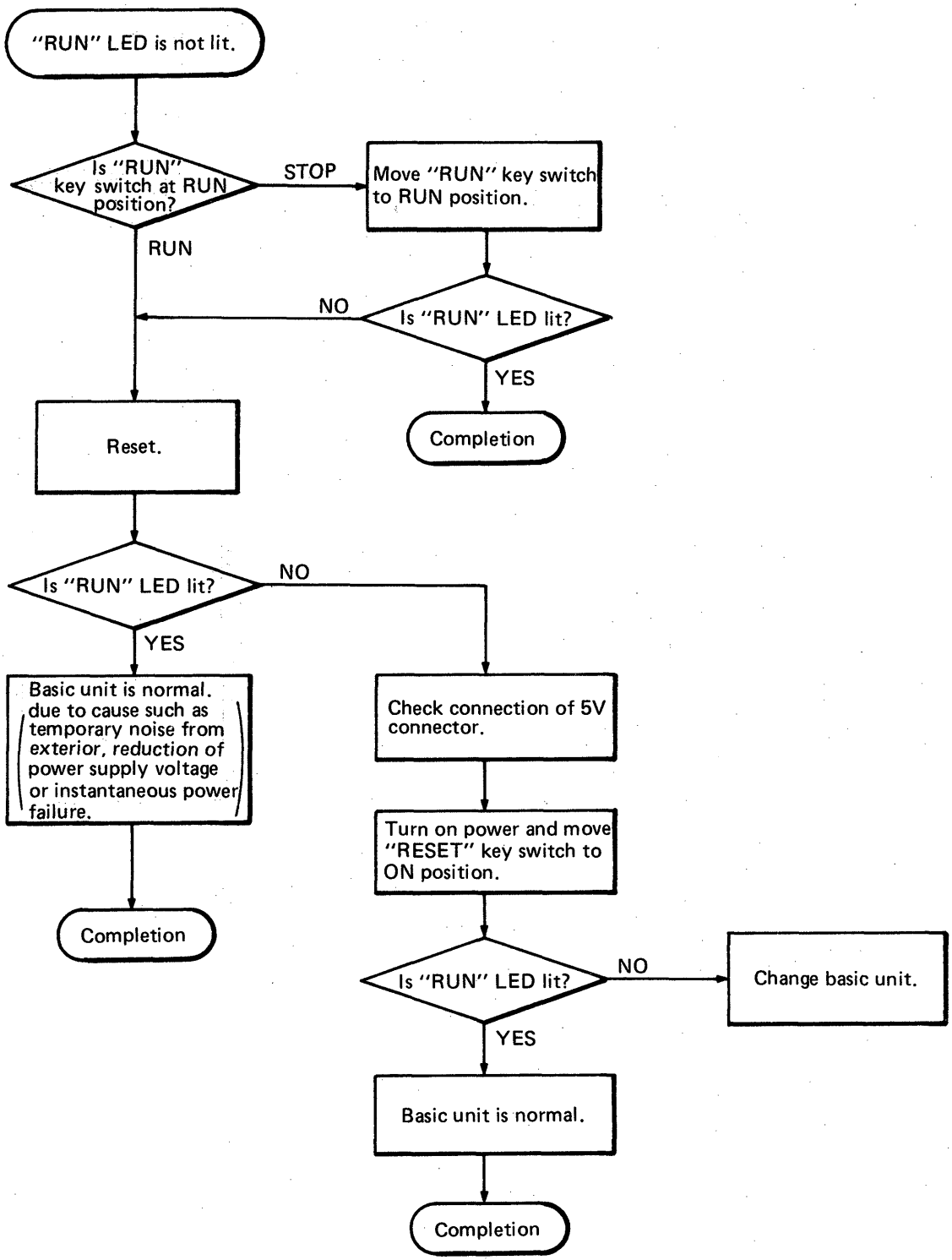
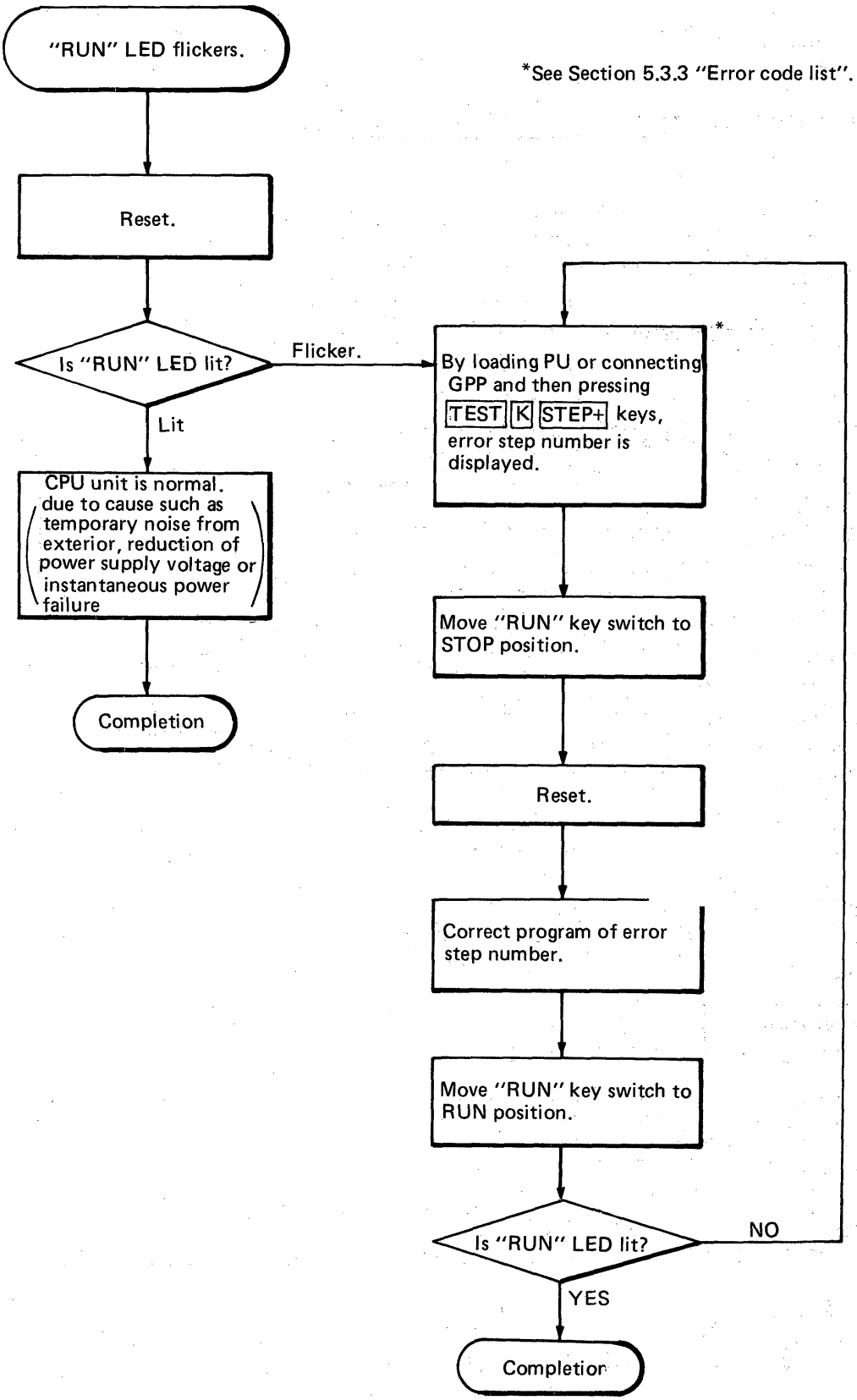



Fig. 6.2 Voltage Measuring Points of IC

### 6.3.4 Flow chart used when "RUN" LED is not lit

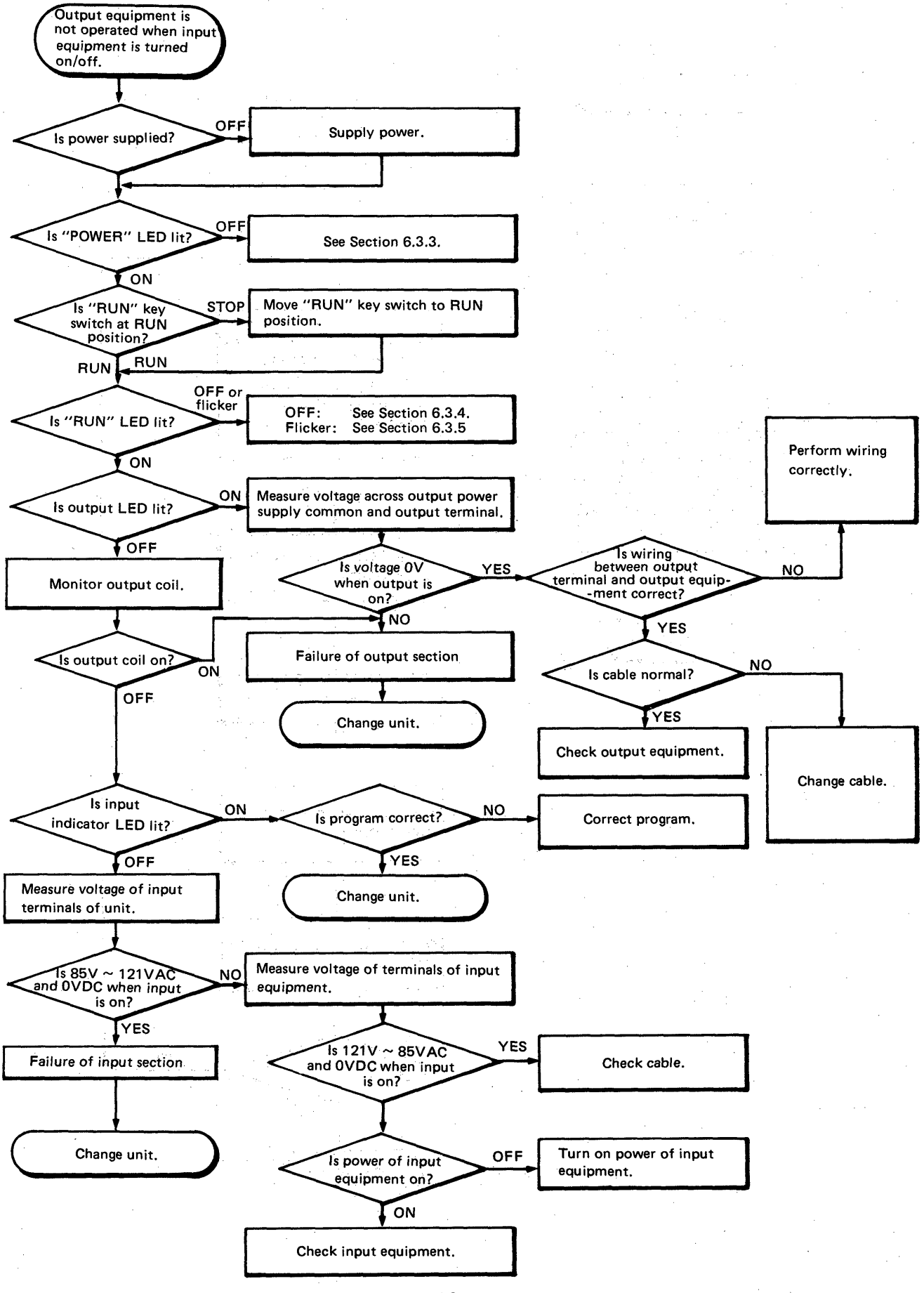


### 6.3.5 Flow chart used when "RUN" LED flickers




*See Section 5.3.3 "Error code list".

### 6.3.6 Flow chart for I/O section



### 6.4 Change of Battery

#### 6.4.1 Life of battery

The battery for backup of IC-RAM and power failure gives alarm (M254) when the battery voltage (capacity) reduces. The battery can provide back up for power failure for approximately one month after this alarm is given. However, the alarm may escape the operator's notice. Therefore, it is recommended to change the battery as soon as possible.

The guides of preventive maintenance are as follows:

1) When the battery is guaranteed within five years and the total power cut time is less than 300 days (7200 hours), change the battery in four to five years.
2) When the battery is guaranteed within five years and the total power cut time has exceeded 300 days (7200 hours), calculate the day when the total power cut time will exceed 7200 hours, in terms of the operating hours during one day or one week, and also the power cut time, thus obtaining the time to change the battery.

Example: If the operating time is 10 hours a day (i.e. power is stopped for 14 hours a day) and the power is stopped for two days (i.e. 24 hours) a week,

14 hours x 5 = 70 hours

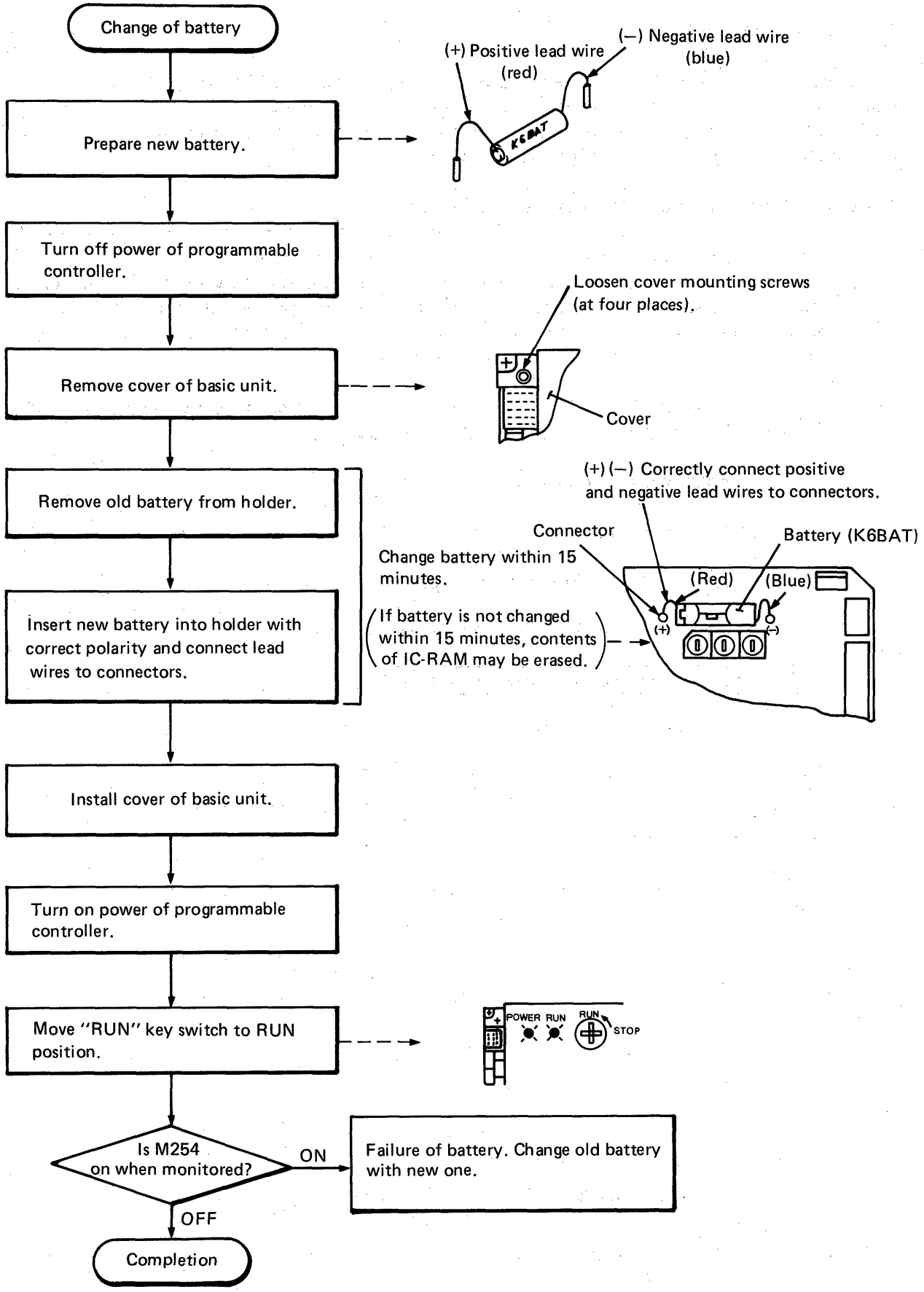
24 hours x 2 = 48 hours

7200 hours/(70 + 48) hours = 61 weeks

61 weeks x 7 days/30 days = approx. 14 months

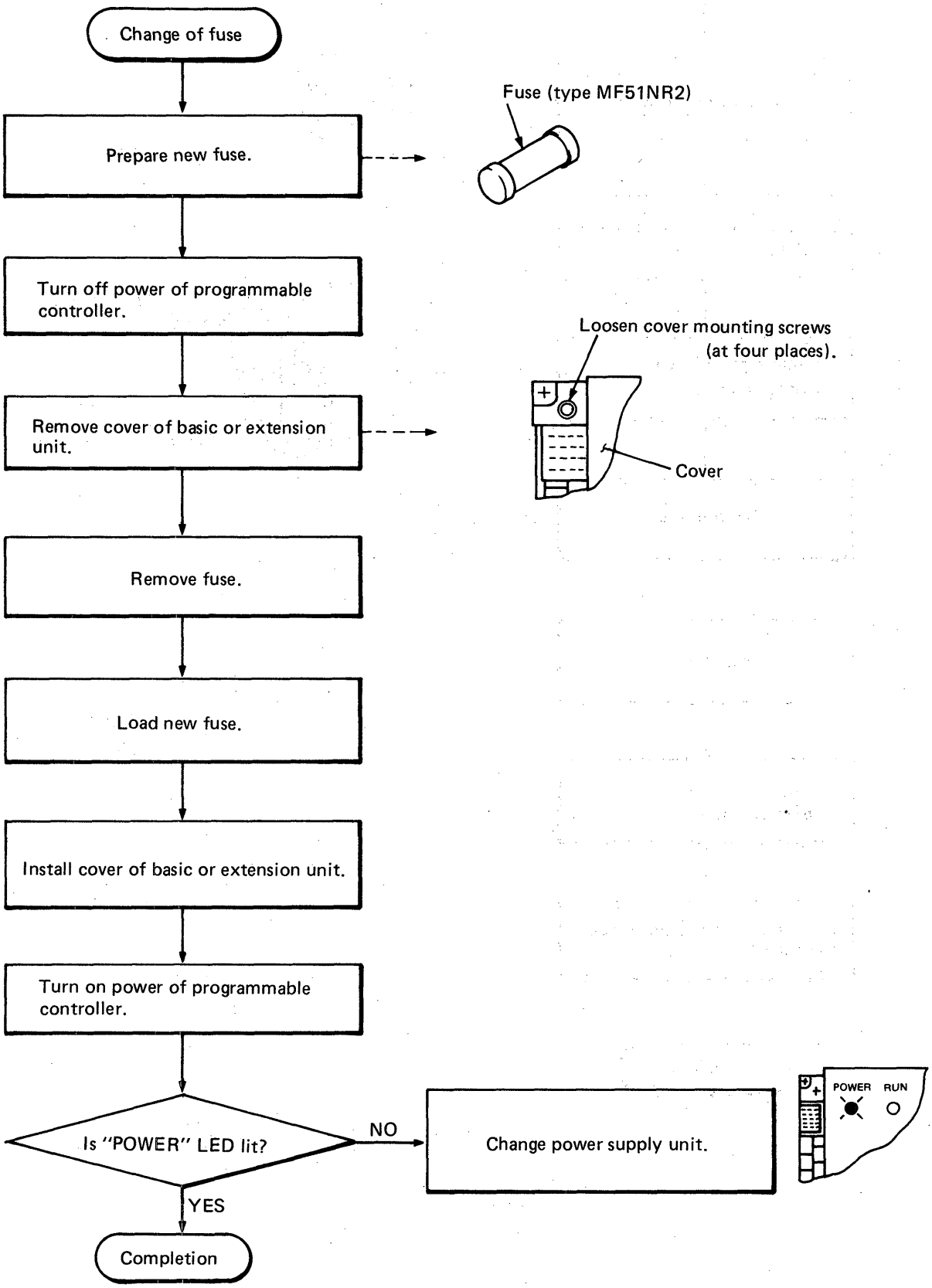
Therefore, change the battery every 14 months.

### 6.4.2 Battery changing procedure

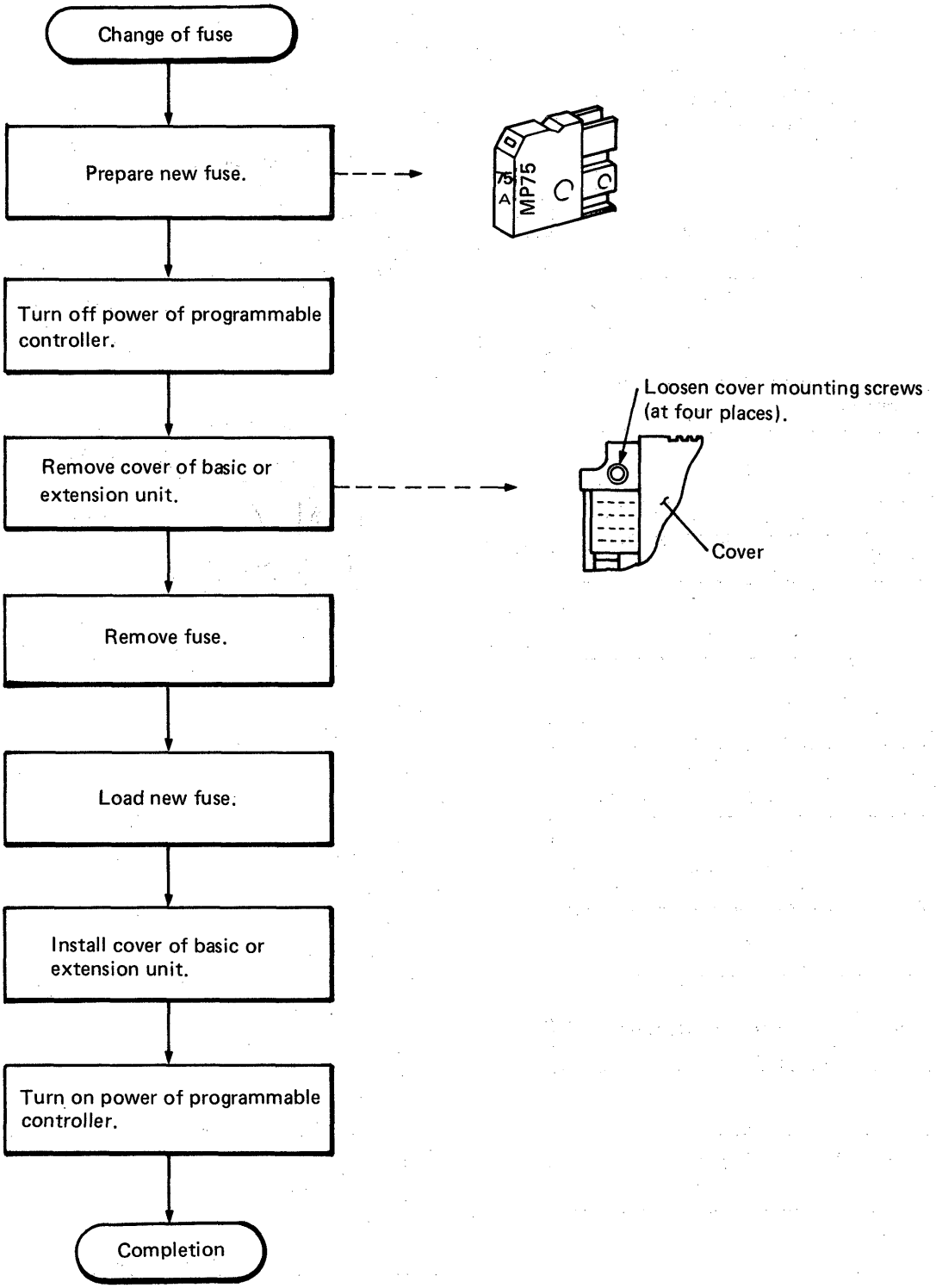


### 6.5 Change of Fuse

(1) Change of power supply fuse



(2) Change of fuse for triac output



# 7. INSTRUCTIONS FOR SPECIFICATIONS

## 7. INSTRUCTIONS FOR SPECIFICATIONS

### 7.1 Watch DOG Timer (WDT)

(1) The watchdog timer is the self-diagnostic function of hardware and detects the following:

- The predetermined period of one program cycle (scan time) has been exceeded. (Software)
- Failure of component or memory, stop of arithmetic operation due to noise. (Hardware)

(2) The watchdog timer is set to 0.2 second by the hardware.

(3) When WDT error has been detected, the display of "RUN" LED and the cause of error are as follows:

| "RUN" LED | Cause |
|---|---|
| Flicker | Scan time has exceeded 0.2 sec. *1 |
| Off *2 | ● Due to failure of component or memory, WDT error has been detected and arithmetic operation has been stopped.<br>● Due to noise, WDT error has been detected and arithmetic operation has been stopped. |

*Note:* *1 *The "RUN" LED also flickers when program error occurs, namely:*
- *END is not written.*
- *Instruction is abnormal.*

*2 *When the "RUN" LED has turned off due to the cause indicated above, the error code "5021" is not displayed.*

### 7.2 Accuracy of Timer

The accuracy of timer depends on scan time (timer accuracy = ± scan time). Fig. 7.1 shows an example in which the 10mS timer, T127, is used with a set value of 6 seconds (K 600) for a program with 25mS scan time.

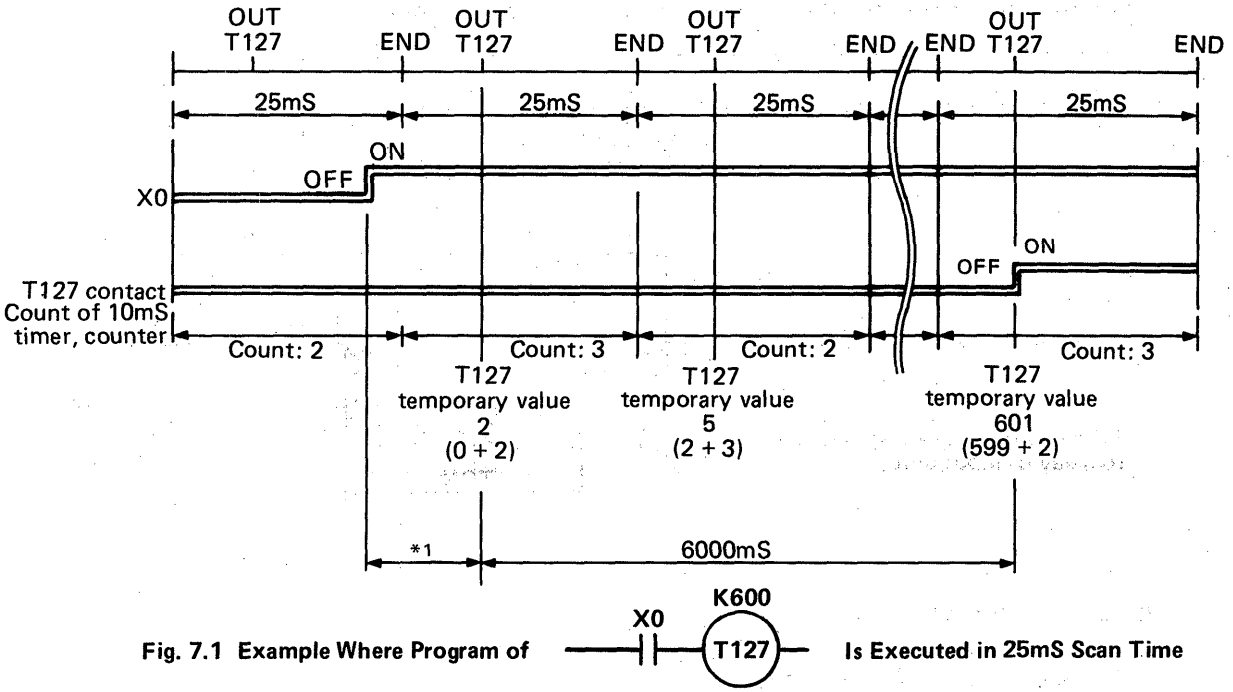



**Fig. 7.1 Example Where Program of** **Is Executed in 25mS Scan Time**

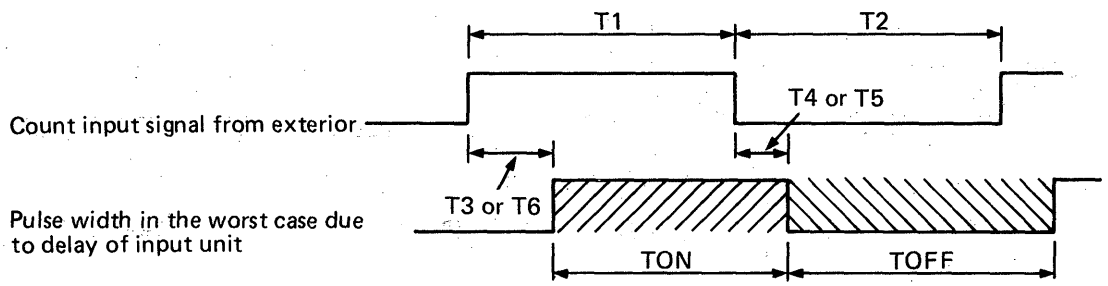
The interval of time until when the 10mS timer times up includes the counting error of 10mS timer ($\pm \begin{smallmatrix}\text{scan time}\\ 0\end{smallmatrix}$) and also the error produced depending on where the timer start condition has been set in the program*1 ($\pm \begin{smallmatrix}0\\ \text{scan time}\end{smallmatrix}$). Therefore, the accuracy of timer is ± (scan time). Accordingly, the accuracy of timer in the above example is ± 0.025 second in relation to the set value of 6 seconds.

### 7.3 Maximum Counting Speed of Counter

The maximum counting speed of counter depends on the arithmetic operation time of one program cycle (scan time) and the response time of input unit. Counting is possible only when each of TON and TOFF is greater than scan time in the following figure.

Calculation expression of the maximum counting speed of counter

$$\text{Maximum counting speed } Cmax < \frac{1000}{\frac{1}{n} \cdot ts + \alpha} \quad \text{(counts/second)}$$




where, n = ON/OFF ratio of count input signal ($n = \frac{T1}{T1 + T2}$)

$$\left\{ \begin{array}{l} \text{When } n = \frac{T1}{T1 + T2} \leqq 0.5,\ n = \frac{T1}{T1 + T2} \\ \text{When } n = \frac{T1}{T1 + T2} \geqq 0.5,\ n = 1 - \frac{T1}{T1 + T2} \end{array} \right\}$$

ts = scan time (mS)

$\alpha$ = response time constant of input unit

$$\alpha = T3 + T4 - T5 - T6$$

T3 = maximum ON response time of input unit (mS)
T4 = minimum OFF response time of input unit (mS)
T5 = maximum OFF response time of input unit (mS)
T6 = minimum ON response time of input unit (mS)

[Exercise]

Calculate the maximum counting speed under the following conditions:

Scan time = 100 mS
ON response time of input unit = max. 20 mS, min. 5 mS
OFF response time of input unit = max. 30 mS, min. 10 mS
ON/OFF ratio = 40%

$\alpha = 20 + 10 - 30 - 5 = -5$ (mS)

$$C\,max < \frac{1000}{\frac{100}{40} \times 100 + (-5)}$$

Consequently, the maximum counting speed is 4 (counts/second) or lower.

## 7.4 Latch Function

The retention of control data at the time of power failure is referred to as the latch function (power failure latch). Retained at the time of power failure are timers (T), counters (C), data registers (D) and temporary memories (M).

(1) Selection of latch
When the "LATCH" key switch on the front panel of basic unit is in "ON" position, data is retained at the time of power failure. When the switch is in "OFF" position, data is not retained.

(2) All clear of latched contents
When it is desired to clear all of latched contents, move the "LATCH" key switch to "OFF" position and move the "RESET" key switch to "ON" position.

(3) Latch range

| LATCH switch | Unlatch Range | | | Latched Range | | |
|---|---|---|---|---|---|---|
| | Temporary memory | Timer, counter | Data register | Temporary memory | Timer, counter | Data register |
| OFF | M0 ~ 249 | T.C0 ~ 127 | D0 ~ 95 | None | None | None |
| ON | M0 ~ 127<br>M254, M255 | T.C0 ~ 63<br>T112 ~ 127 | D0 ~ 63 | M128 ~ 253 | T.C64 ~ 111 | D64 ~ 95 |

**LATCH Setting Range**

(4) Caution for program
To latch the temporary memory, do not use a self-holding circuit but use a set-and-reset circuit. This circuit is used to prevent the latched signal from being cleared, when the power is restored, by the difference of time between the rise of power of programmable controller and the rise of power of input signal.

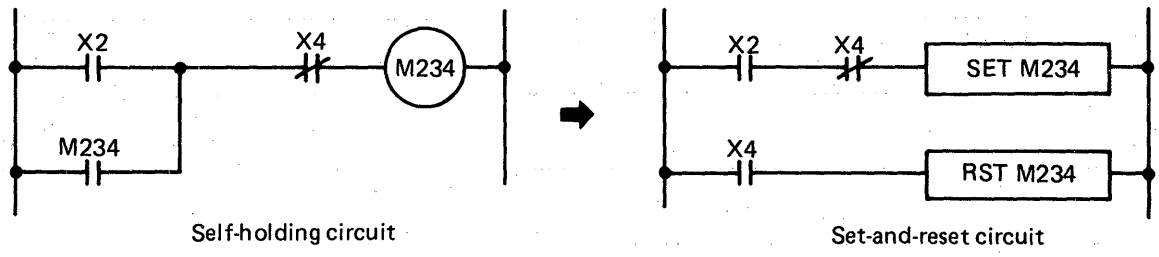



**Fig. 7.2 Latch Circuit Example**

# MEMO

# 8. HANDLING INSTRUCTIONS

## 8. HANDLING INSTRUCTIONS

### 8.1 Programmable Controller Unit

(1) Since the case of this programmable controller is made of plastic, do not drop or give strong shock.

(2) At the time of wiring, take care to prevent the entry of conductive matters, such as wire chips and drill chips, into the unit. If such matters have entered, remove them.

(3) Be sure to mount the front cover.

(4) When the unit for K1 or K2 is used, do not overtighten the unit fixing screws.

(5) Do not overtighten the terminal screws.

### 8.2 Memory

(1) When loading the memory to the socket, securely press the memory against the socket and lock it with the lever. Check if the memory is lifted from the socket.

(2) In regards to the handling of memory, be sure to follow Section 5.2.2.

(3) If the IC-RAM, which stores program, is unloaded from the socket, the program will be erased immediately. Therefore, never unload the IC-RAM from the socket.

### 8.3 Battery

(1) Do not let the battery short-circuited.

(2) Do not disassemble the battery.

(3) Do not put the battery into flame.

(4) Do not heat the battery.

(5) Do not solder the poles of battery.

(6) Do not measure voltage with a circuit tester.

8

### 8.4 Optical fiber cable

The optical fiber cable is glass of approximately 125$\mu$m diameter which is coated with resin. Since various reinforcements have been provided for the optical fiber for use as a cable, it can be handled like the general cables. However, avoid the following extreme handling because the optical fiber cable will be damaged.

(1) Bending the cable extremely forcibly.

(2) Compressing the cable with a sharp, rigid body.

(3) Twisting the cable extremely.

(4) Pulling the cable by holding the optical connector and cord portion.

(5) Pulling the optical cable extremely forcibly.

(6) Stamping the optical cable.

(7) Placing an object on the optical cable.

# APPENDIX

# APPENDIX

## 1. COMPARISON BETWEEN K0J1, K0J1H and K0J2, K0J2P

### 1.1 Comparison of Specifications

| ITEM \ TYPE | | K0J1 | K0J1H | K0J2 | K0J2P |
|---|---|---|---|---|---|
| Instruction | Number of standard Instructions | 26 types (18 types of sequence instructions + 8 types of data instructions) *1 | | | |
| | Number of application instructions | 15 types | | 19 types *2 | |
| | Word length | 16 bits (two bytes)/step, 1-, 2-, 3-step instruction | | | |
| Program capacity | | Maximum 2048 steps | | Maximum 4096 steps | |
| Sequence instruction execution time | | 30μs/step on average | 5.6μs/step *3 | | 30μs/step on average |
| Data instruction execution time | | 100 ~ 500μs/instruction (one instruction consists of three steps.) | | | |
| Program memory | IC-RAM | 1024 steps – standard-equipment 2048 steps | | 1024 steps – standard-equipped 4096 steps | |
| | EP-ROM | 1024 steps / 2048 steps } Selectively loaded | | 2048 steps / 4096 steps } Selectively loaded | |
| Number of I/O points | | Maximum 184 points | | Maximum 280 points | |
| Number of temporary memories | | 254 points (M0 ~ 253) | | | 250 points (M0 ~ 249) |
| Shift register | Number of usable points | 253 bits (M1 ~ M253) excluding those used for temporary memory. | | | 249 bits (M1 ~ 249) |
| | Specifications | Constructed by temporary memories combined in units of one bit combined Used for SFT instruction and application instruction. | | | |
| Power failure latch (latched range) (Power failure latch is possible by LATCH key switch of basic unit.) | | M128 ~ 253 T.C64 ~ 111 D64 ~ 95 | | | M128 ~ 249 T.C64 ~ 111 D64 ~ 95 |
| Watchdog timer | | 100mS | | 170mS | 200mS |
| 10mS timer program | | Inserted into high-speed processing program which is operated per 10ms | Possible by the same method as 100mS timer program. | | |
| Data link function | | Not provided | | | Provided (Optical data link, slave channel of local programmable controller system, slave channel of remote I/O system) |
| Type of RUN, LATCH and RESET switches | | Toggle switch | | Key switch | |
| Extension | Number of extended stage of 32-points (E32) and 56-points (E56) extension units | Two stages | | Four stages (When K0J2-E56 extension units are used. For other units, see Section 1, 2 of APPENDIX.) | |
| | Usability of K65B and K68B extension bases | Usable | | | Not usable |
| | Requirement of extension adaptor | Required for extension K0J1-EX1 (for E32 and E56 extension units) K0J1-EX2 (for K65B and K68B extension bases) | | Required for extension K0J2-EX1 K0J2-EX2 | Not required Adaptor equivalent to EX1 is incorporated. |
| Usability of special units (High-speed counter – KD61 Positioning – KD71 Analog I/O – KA62A, KA63A) | | Usable (loaded into K65B or K68B extension base) | | | Not usable |

*Note:*

1. *(*1) S and D combinations of data instructions have been greatly increased.*

K0J1, K0J1H

| S \ D | K | D | T | C | X | Y | M |
|---|---|---|---|---|---|---|---|
| K | | ○ ◐ | | | | | |
| D | | ○ ◐ ▲ △ | ○ | ○ | | ○ | ○ |
| T | | ○ △ | | | | | |
| C | | ○ △ | | | | | |
| X | | ○ ▲ | | | | | |
| Y | | | | | | | |
| M | | ○ | | | | | |

MOV ..... ○
BCD ..... △
BIN ..... ▲
>, <, =, +, − ..... ●

K0J2, K0J2P

| S \ D | K | D | T | C | X | Y | M |
|---|---|---|---|---|---|---|---|
| K | ● | ○ ● | ○ ● | ○ ● | ● | ○ ● | ○ ● |
| D | ● | ○ ● | ○ ● | ○ ● | ● | ○ ● | ○ ● |
| T | ● | ○ ● | ○ ● | ○ ● | ● | ○ ● | ○ ● |
| C | ● | ○ ● | ○ ● | ○ ● | ● | ○ ● | ○ ● |
| X | ● | ○ ● | ○ ● | ○ ● | ● | ○ ● | ○ ● |
| Y | ● | ○ ● | ○ ● | ○ ● | ● | ○ ● | ○ ● |
| M | ● | ○ ● | ○ ● | ○ ● | ● | ○ ● | ○ ● |

MOV, BCD, BIN, +, − ..... ○
>, <, = ..... ●

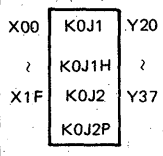
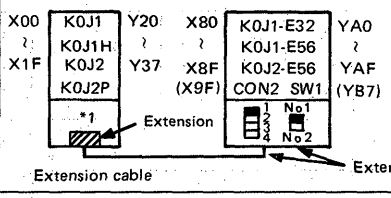
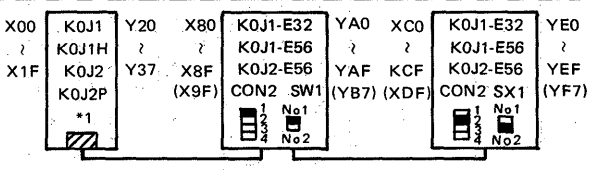
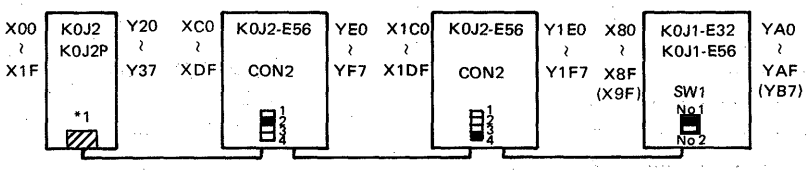
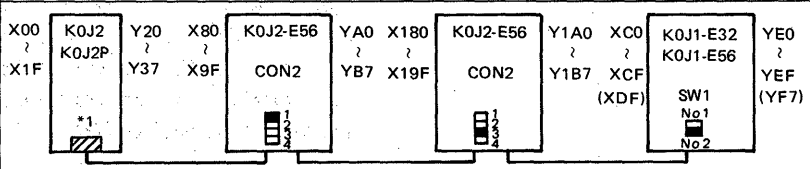
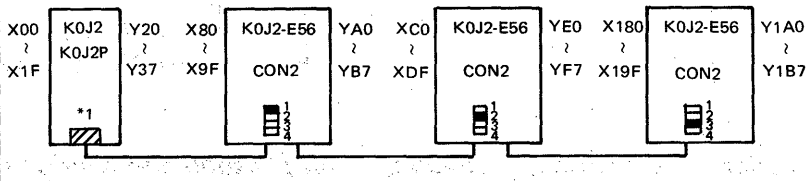
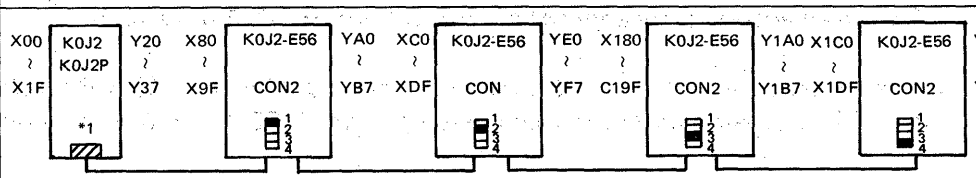
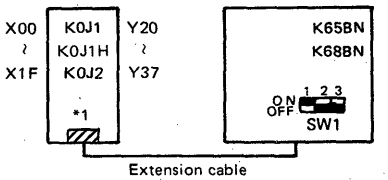
*Note that when programming is performed by use of PU or GPP with a legend plate which does not indicate "DATE" as shown below, the S and D combinations of data instructions are the same as those of K0J1 and K0J1H.*

□□ K3 □
- → Version
- → Year and month of manufacture

2. *(*2) Four instructions, i.e. addition, subtraction, multiplication and division of BCD six digits, have been added to the application instructions of K0J2 and K0J2P.*

3. *(*3) The sequence instruction execution time of K0J1H and K0J2 is 5.6 μS/step for the E32 and E56 extension units and 7.0 μS/step for the K65BN and K68BN extension bases.*

## 1.2 Comparison of System Configurations

| | Number of I/O Points | Basic and Extension Units and I/O Numbers |
|---|---|---|
| 1 | Input: 32 points<br>Output: 24 points<br>Total: 56 points |  |
| 2 | (Maximum number of points)<br>Input: 64 points<br>Output: 48 points<br>Total: 112 points |  |
| 3 | (Maximum number of points)<br>Input: 96 points<br>Output: 72 points<br>Total: 168 points |  |
| 4 | (Maximum number of points)<br>Input: 128 points<br>Output: 96 points<br>Total: 224 points |  |
| 5 | (Maximum number of points)<br>Input: 128 points<br>Output: 96 points<br>Total: 224 points |  |
| 6 | Input: 128 points<br>Output: 96 points<br>Total: 224 points |  |
| 7 | Input: 160 points<br>Output: 120 points<br>Total: 280 points |  |
| 8 | Input:<br>32+16m points<br>Output:<br>24+16n points<br>(m+n = 8)<br>Total: 184 points |  |

**IMPORTANT**

In extension systems 4 and 5 in above table, the setting of extension switches and the allotment of I/O numbers differ depending on extension order. Therefore caution should be exercised.

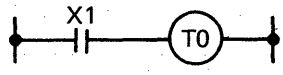
## 2. PROCESS TIME

(unit : μs)

| Instruction | Condition | | | | Process time |
|---|---|---|---|---|---|
| LD | X, Y | | | | 30 |
| | M, T, C, F | | | | 30 |
| LDI | X, Y | | | | 30 |
| | M, T, C, F | | | | 30 |
| AND | X, Y | | | | 30 |
| | M, T, C, F | | | | 30 |
| ANI | X, Y | | | | 30 |
| | M, T, C, F | | | | 30 |
| OR | X, Y | | | | 30 |
| | M, T, C, F | | | | 30 |
| ORI | X, Y | | | | 30 |
| | M, T, C, F | | | | 30 |
| ANB | – | | | | 30 |
| ORB | – | | | | 30 |
| OUT | Y | | | | 120 |
| | M | | | | 30 |
| | T | Non execution *1 | | | 45 |
| | | Execution *2 | Before time-up | | 50 |
| | | | After time-up | | 35 |
| | | | Per 0.1 second | K | 85 |
| | | | | D | 65 |
| | C | Non execution | | | 35 |
| | | Execution | Non-count | | 35 |
| | | | After count-up | | 35 |
| | | | Count | K | 110 |
| | | | | D | 110 |
| | F | Non execution | | | 160 |
| | | Execution | | | 270 |

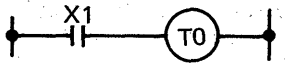
| Instruction | Condition | | Process time |
|---|---|---|---|
| MC | – | | 75 |
| MCR | – | | 65 |
| SET | Y | Non execution | 30 |
| | | Execution | 45 |
| | M | Non execution | 30 |
| | | Execution | 50 |
| | F | Non execution | 25 |
| | | Execution | 95 |
| RST | Y | Non execution | 30 |
| | | Execution | 45 |
| | M, F | Non execution | 25 |
| | | Execution | 50 |
| | C | Non execution | 30 |
| | | Execution | 45 |
| SFT | M | Non execution | 30 |
| | | Execution | 45 |
| CJ | K | Non execution | 25 |
| | | Execution | 65 |
| PLS | M | Non execution | 35 |
| | | Execution | 40 |
| NOP | – | | 20 |
| END | – | | 110 |

*Note 1: *1 Non execution means that arithmetic operation condition is off.*




*(When X1 is off)*

*Note 2: *2 Execution means that arithmetic operation condition is on.*




*(When X1 is on)*

(Unit: μs)

| | S \ D | K | D | T | C | X | Y | M |
|---|---|---|---|---|---|---|---|---|
| Process Time of MOV Instruction | K | – | 133 | 133 | 133 | – | 199 | 189 |
| | D | – | 133 | 133 | 133 | – | 199 | 189 |
| | T | – | 133 | 133 | 133 | – | 199 | 189 |
| | C | – | 133 | 133 | 133 | – | 199 | 189 |
| | X | – | 292 | 292 | 292 | – | 357 | 347 |
| | Y | – | 282 | 292 | 269 | – | 337 | 327 |
| | M | – | 282 | 292 | 269 | – | 337 | 327 |
| Process Time of > Instruction | K | 165 | 165 | 165 | 165 | 277 | 265 | 260 |
| | D | 165 | 165 | 165 | 165 | 277 | 265 | 260 |
| | T | 165 | 165 | 165 | 165 | 277 | 265 | 260 |
| | C | 165 | 165 | 165 | 165 | 277 | 265 | 260 |
| | X | 322 | 322 | 322 | 322 | 437 | 420 | 417 |
| | Y | 340 | 340 | 340 | 340 | 407 | 397 | 392 |
| | M | 340 | 340 | 340 | 340 | 407 | 397 | 392 |
| Process Time of = Instruction | K | 160 | 160 | 160 | 160 | 275 | 262 | 255 |
| | D | 160 | 160 | 160 | 160 | 275 | 262 | 255 |
| | T | 160 | 160 | 160 | 160 | 275 | 262 | 255 |
| | C | 160 | 160 | 160 | 160 | 275 | 262 | 255 |
| | X | 317 | 317 | 317 | 317 | 427 | 417 | 407 |
| | Y | 297 | 297 | 297 | 297 | 410 | 397 | 392 |
| | M | 297 | 297 | 297 | 297 | 410 | 397 | 392 |
| Process Time of + Instruction | K | – | 167 | 167 | 167 | – | 347 | 332 |
| | D | – | 167 | 167 | 167 | – | 347 | 332 |
| | T | – | 167 | 167 | 167 | – | 347 | 332 |
| | C | – | 167 | 167 | 167 | – | 347 | 332 |
| | X | – | 327 | 327 | 327 | – | 507 | 487 |
| | Y | – | 305 | 305 | 305 | – | 487 | 467 |
| | M | – | 305 | 305 | 305 | – | 487 | 467 |

*Note 1: The process time of each data instruction shown in the tables is the time required when the instruction is executed. When the instruction is not executed, process time is 30μs.*

*Note 2: The process time of X, Y and M is the time required when four digits are specified.*

(Unit: μs)

| | S \ D | K | D | T | C | X | Y | M |
|---|---|---|---|---|---|---|---|---|
| Process Time of — Instruction | K | — | 215 | 230 | 230 | — | 695 | 640 |
| | D | — | 235 | 230 | 230 | — | 710 | 660 |
| | T | — | 230 | 230 | 230 | — | 710 | 660 |
| | C | — | 230 | 230 | 230 | — | 710 | 660 |
| | X | — | 480 | 480 | 480 | — | 800 | 750 |
| | Y | — | 440 | 430 | 440 | — | 790 | 740 |
| | M | — | 430 | 430 | 430 | — | 790 | 740 |
| Process Time of < Instruction | K | 165 | 165 | 165 | 165 | 277 | 267 | 260 |
| | D | 165 | 165 | 165 | 165 | 277 | 267 | 260 |
| | T | 165 | 165 | 165 | 165 | 277 | 267 | 260 |
| | C | 165 | 165 | 165 | 165 | 277 | 267 | 260 |
| | X | 365 | 365 | 365 | 365 | 467 | 424 | 417 |
| | Y | 345 | 345 | 345 | 345 | 445 | 402 | 397 |
| | M | 345 | 345 | 345 | 345 | 445 | 402 | 397 |
| Process Time of BIN Instruction | K | — | 302 | 302 | 302 | — | 435 | 372 |
| | D | — | 302 | 302 | 302 | — | 435 | 372 |
| | T | — | 302 | 302 | 302 | — | 435 | 372 |
| | C | — | 302 | 302 | 302 | — | 435 | 372 |
| | X | — | 457 | 457 | 457 | — | 547 | 537 |
| | Y | — | 437 | 457 | 437 | — | 527 | 517 |
| | M | — | 437 | 437 | 437 | — | 527 | 517 |
| Process Time of BCD Instruction | K | — | 617 | 617 | 617 | — | 710 | 697 |
| | D | — | 204 | 204 | 204 | — | 295 | 275 |
| | T | — | 287 | 287 | 287 | — | 377 | 367 |
| | C | — | 249 | 249 | 249 | — | 340 | 327 |
| | X | — | 467 | 467 | 467 | — | 557 | 547 |
| | Y | — | 337 | 337 | 337 | — | 430 | 417 |
| | M | — | 337 | 337 | 337 | — | 430 | 417 |

*Note 1: The process time of each data instruction shown in the tables is the time required when the instruction is executed. When the instruction is not executed, process time is 30μs.*

*Note 2: The process time of X, Y and M is the time required when four digits are specified.*

**Application Instruction**

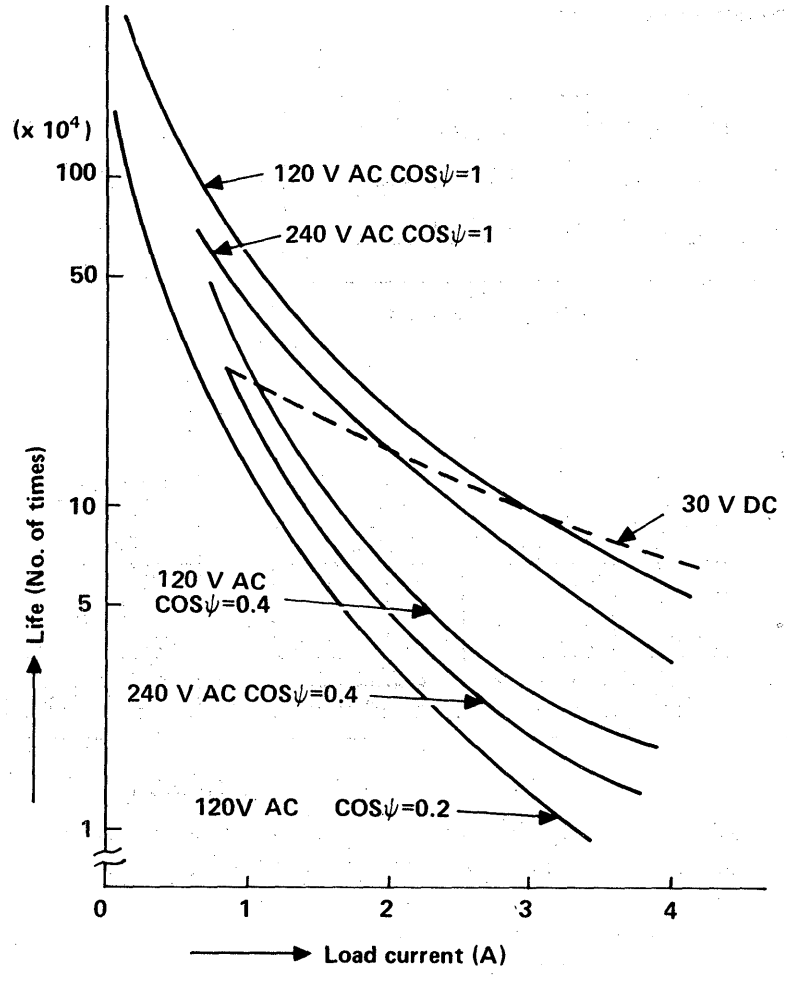
(Unit: μs)

| Instruction | Condition | | Process Time | Instruction | Condition | Process Time |
|---|---|---|---|---|---|---|
| OUT F100 | | | 100 | OUT F113 | | 160 |
| OUT F101 | 6 digits + 6 digits | | 273 | OUT F114 | 10 bits<br>100 bits<br>200 bits | 250<br>1120<br>2160 |
| OUT F102 | 6 digits − 6 digits | | 2258 | OUT F115 | 5 data<br>10 data<br>50 data | 240<br>320<br>960 |
| OUT F103 | 6 digits X 6 digits | | 2518 | OUT F116 | 10 data<br>30 data<br>90 data | 300<br>520<br>1220 |
| OUT F104 | 6 digits ÷ 6 digits | | 2778 | OUT F117 | | 207 |
| | | | | OUT F118 | | 208 |
| OUT F108 | 4 ↔ 16 | Decode | 250 | OUT F119 | | 308 |
| | | Encode | 310 | | | |
| OUT F109 | | | 280 | | | |
| OUT F110 | | | 130 | | | |
| OUT F111 | | | 150 | | | |
| OUT F112 | | | 160 | | | |

*Note: The above process time is the time required when the instruction is executed. When the instruction is not executed, process time is 30μs.*

## 3. CONTACT LIFE OF RELAY CONTACT OUTPUT

The following chart shows the life curve of output relay used for Type DR and AR.
If a high-capacity DC load is driven by relay contact, the contact will be extremely worn and its life will be shortened.




Contact life curve

## 4. USAGE OF EXTERNAL FAILURE MONITOR UNIT (K0J1-EX0N)

### 4.1 General Description

The external failure monitor unit (K0J1-EX0N) is loaded into the K0J2P 56-point extension unit (Type K0J1-E56) located in the last stage of extension units, and has interface with the basic unit and also the output function of failure display.
The K0J1-EX0N outputs display signals for displaying the failure type of external equipment (such as limit switch and solenoid) and the failure number as shown in Fig. 1. It is required for the user to program the failure detecting circuit.

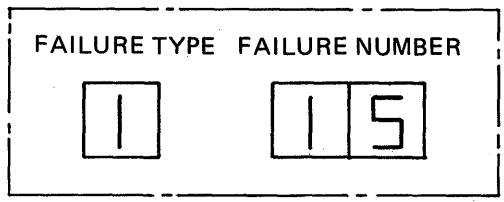
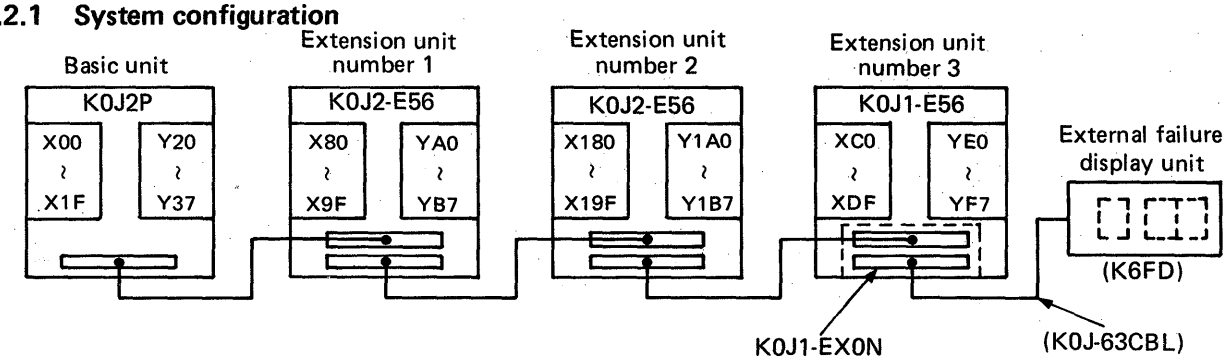



**Fig. 1 Example of Display Unit**

### 4.2 Specifications

#### 4.2.1 System configuration




The K0J1-EX0N is loaded into the 56-point extension unit. As shown above, the upper connector is connected to the extension unit number 2 and the lower connector is connected to the external failure display unit.
For the system configuration to which the external failure monitor unit can be loaded, see Section 4 "SYSTEM CONFIGURATION" in page .

#### 4.2.2 Output signals and number of signals

| | | |
|---|---|---|
| (1) Failure number: | BCD two digits | 4 signals x 2 = 8 signals |
| (2) Failure type: | BCD one digit | 4 signals x 1 = 4 signals |
| (3) Blanking signal: | One point | 1 signal |
| (4) Common wire (– side of 24VDC): | | 14 signals |
| | Total: | 27 signals |

### 4.2.3 Output signal specifications

| Item | Specifications |
|---|---|
| Insulation system | Photocoupler |
| Output form | Transistor, open collector output ("L" level of signal is 2V or lower (at rated load).) |
| Rated load voltage | 24VDC |
| Maximum load current | 0.1A |

### 4.2.4 Input signals and number of signals

(1) Reset signal: 1 signal
(2) Common wire (+ side of 24VDC): 2 signal

Total: 3 signals

### 4.2.5 I/O signal specifications

| Item | Specifications |
|---|---|
| Insulation system | Photocoupler |
| Rated input voltage | 12/24VDC |
| Rated input current | 10mA |

### 4.2.6 Type K6FD failure display unit

(1) The types of failures should be 1 ~ 9 and the failure type "0" cannot be used.

(2) Use active "LOW" for the failure display unit. The failure display unit should be blanked (turned off) when the failure type is "0" and the failure number is "00".
The blanking signal can be used to blank the display unit.
When there is no failure, the blanking signal can be used by switching it to either "L" or "H" by the chip switch in the substrate.

### 4.3 Failure Output Circuit Example

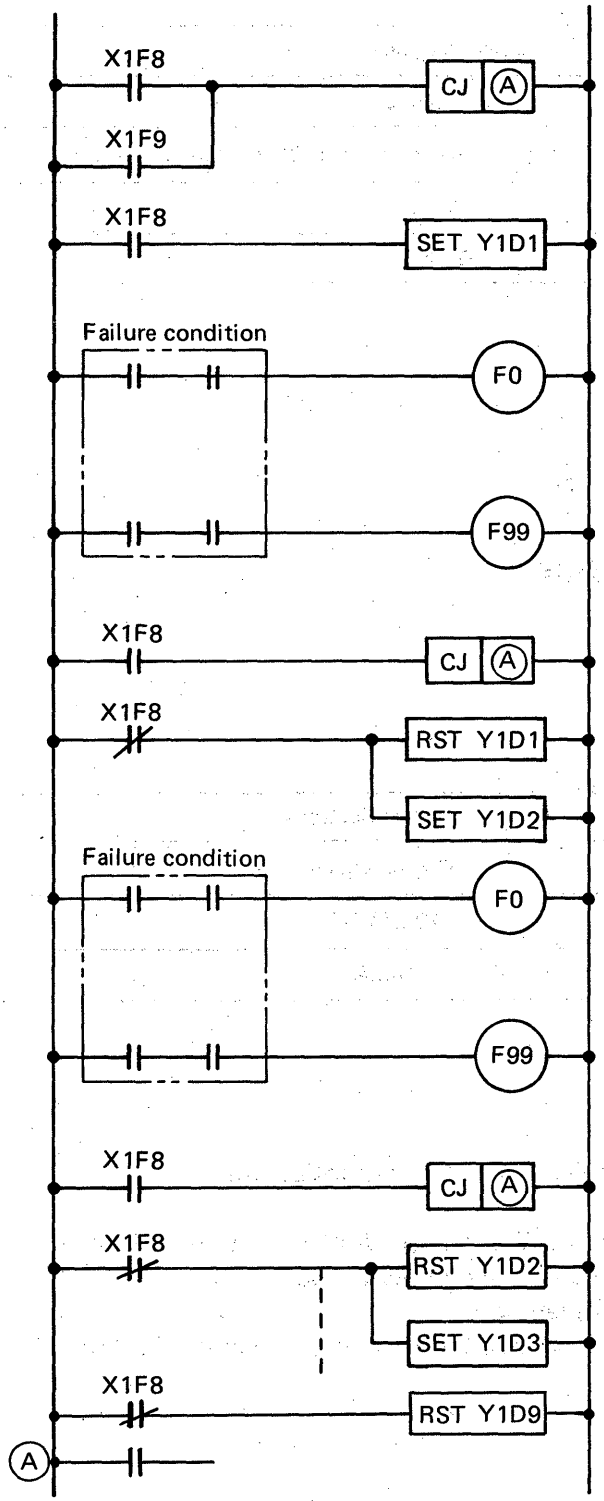



**Fig. 2 Failure Output Circuit Example**

*Note:*

1. *X1F8 is a fixed number. This signal turns on when either failure occurs.*
2. *Ⓐ is a jump destination step number. Set a step number which is located next to the failure output circuit.*
3. *Y1D1 ~ Y1D9 are fixed numbers and indicate failure types.*
4. *X1F9 is a fixed number and turns on when a reset signal is input.*
   *When inputting the reset signal, be sure to insert it into the circuit as shown in the example of Fig. 2.*

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100 TELEX J24532 CABLE MELCO TOKYO

IB (NA) 66014-A (8501) REC Printed in Japan