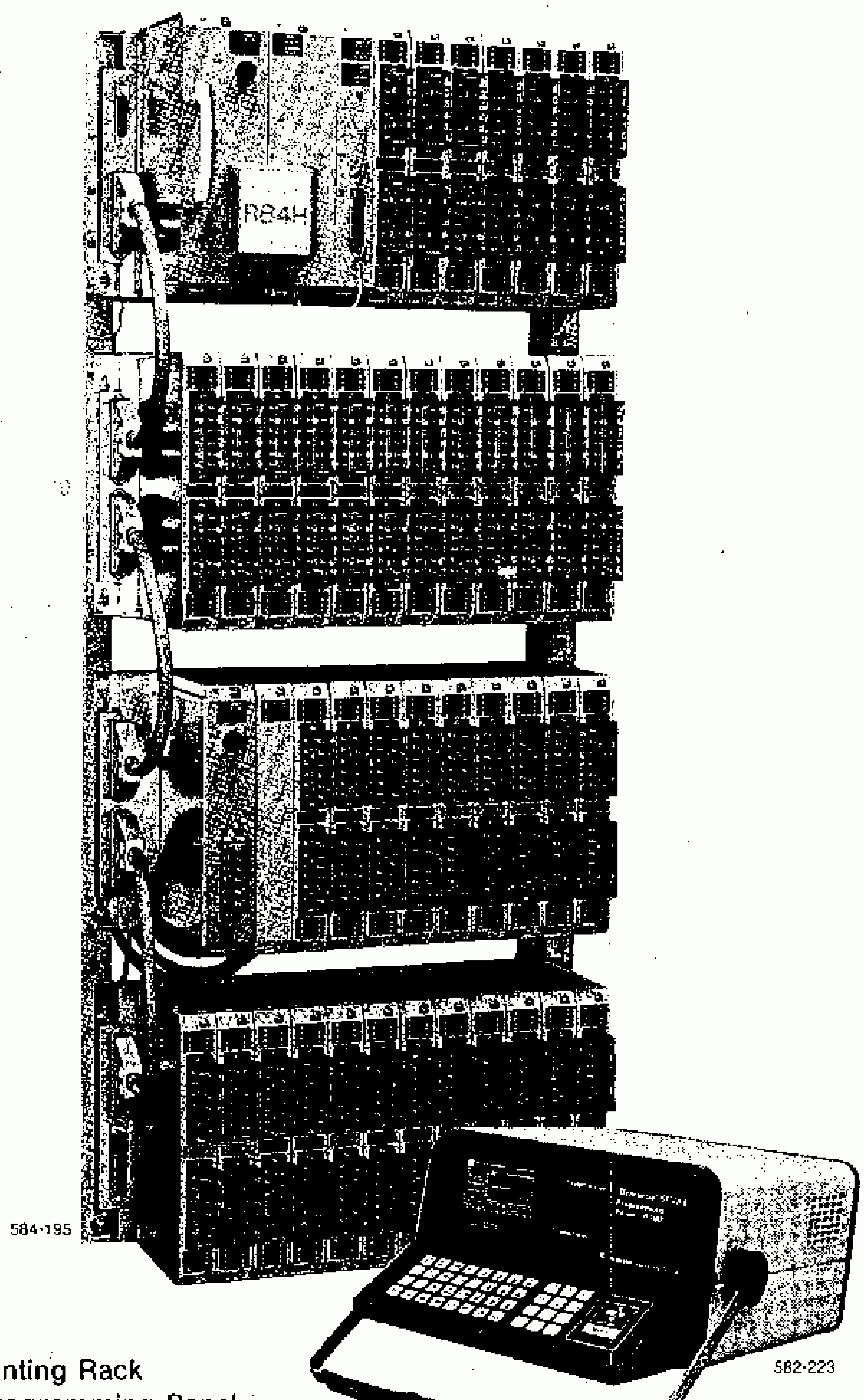
YASKAWA ELECTRIC

SIE-C815-9.4G
DESCRIPTIVE INFORMATION

PROGRAMMABLE CONTROLLER

Memocon-SC™ R84H

DESIGNER'S REFERENCE MANUAL



R84H on the Mounting Rack
and P180 CRT Programming Panel

FOREWORD

This manual provides the designer with the detailed information needed to design control systems utilizing the Memocon-SC R84H Controller.

The designer need not be familiar with digital equipment or computer technology to use this manual. The simple and versatile Ladder Line concept enables the designer to make use of Memocon-SC R84H Controller available functions, and to communicate his design easily to plant technicians.

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SECTION I
INTRODUCTION

1.1 GENERAL

A Programmable Controller (P.C.) is a solid-state device designed to perform logic decision making for industrial control applications. The P.C. can be used as a direct replacement for relays or solid-state electronics in an industrial environment. Features of a P.C. compared to other industrial control devices include the following:

- Solid-state device for maximum reliability.
- Programmed with a simple ladder diagram language.
- Easily reprogrammed with a programming panel if requirements change.
- Controller is reusable if no longer required on original application.
- Indicator lights provided at major diagnostic points to simplify trouble-shooting.
- Maintenance is simple, based upon module replacement, and insures minimum downtime and maximum production.
- Communicated to a central computer for machine monitoring, and data gathering and reporting.

The R84H Controller is the finest example of P.C. technology available today. It is designed to replace control systems that previously required 10 to 800 relays. Some of the advantages of this in addition to all the above features include the following:

- Low cost — hardware cost less than installed relays.
- Smaller cabinet size and floor space requirement.
- Expandable I/O with 1000 series modules.
- Easy installation of field wiring, intermixing any type of I/O.
- Retentive memory for logic and timer/counter values.
- Programmable devices plug directly into controller.
- Real-Time, On-Line Programming — a YASKAWA standard of excellence for maximum flexibility.

1.2 R84H CONFIGURATIONS

Table 1.1 R84H Configurations

Components	Description
CPU Module	R84H is provided with two type processors; with MEMOBUS (industrial communications system) interface and no MEMOBUS. However, CPU module with no MEMOBUS interface can communicate with a central computer by using J470 adapter. The former CPU module consists of three circuit boards; CPU, memory and MEMOBUS interface, and the latter two circuit boards; CPU and memory. The ladder diagram program is entered and into the processor, it is processed by I/O data from I/O section, and the result is output to I/O section. · Discrete I/O: 512 points · Register I/O: 64 points (BCD, 3-Digit)
Basic Power Supply Module	Used for supplying DC power to CPU module and I/O modules of I/O sections 1 and 2.
Expanding Power Supply Module	Used for supplying DC power to I/O buffer module and I/O modules of I/O sections 3 and 4.
Input/Output Buffer Module	Used for I/O sections 3 and 4.
Input/Output Module	· Discrete I/O module: 16 or 32 circuits per module (available for register signal). · Register I/O module: 8 I/O points (BCD 3-digit) per module. · Analog I/O module: A/D converting module — 4 circuits per module. D/A converting module — 2 circuits per module.
Mounting Base 1	Used for mounting CPU module, basic power supply module and up to 8 I/O modules as I/O section 1 (up to 7 I/O modules for CPU with MEMOBUS).
Mounting Base 2	Used for mounting up to 12 I/O modules as I/O sections 2 and 4.
Mounting Base 3	Used for mounting expanding power supply module, I/O buffer module and up to 9 I/O modules as I/O section 3.
Input/Output Cable	Used for connecting between each mounting base. Two different lengths of cable (40 cm, 150 cm) can be applied in accordance with a required space between mounting bases. As for 150 cm cable, only one cable can be used for connection.
P180 CRT Programming Panel	Used for storing programs, adding, altering and deleting of logic and data, and monitoring. Available ladder list using printer. With 5-inch CRT.
P190 CRT Programming Panel	Used for storing programs, adding, altering and deleting of logic and data, monitoring and making ladder list. With 9-inch CRT.
P100 LCD Programming Panel	Used for storing programs, adding, altering and deleting of logic and data and monitoring. Available dump, load and verify of program using tape recorder. With liquid crystal display (LCD).
J470 EIA Adapter	Used for connecting CPU module with no MEMOBUS interface to computer or P190 CRT programming panel.

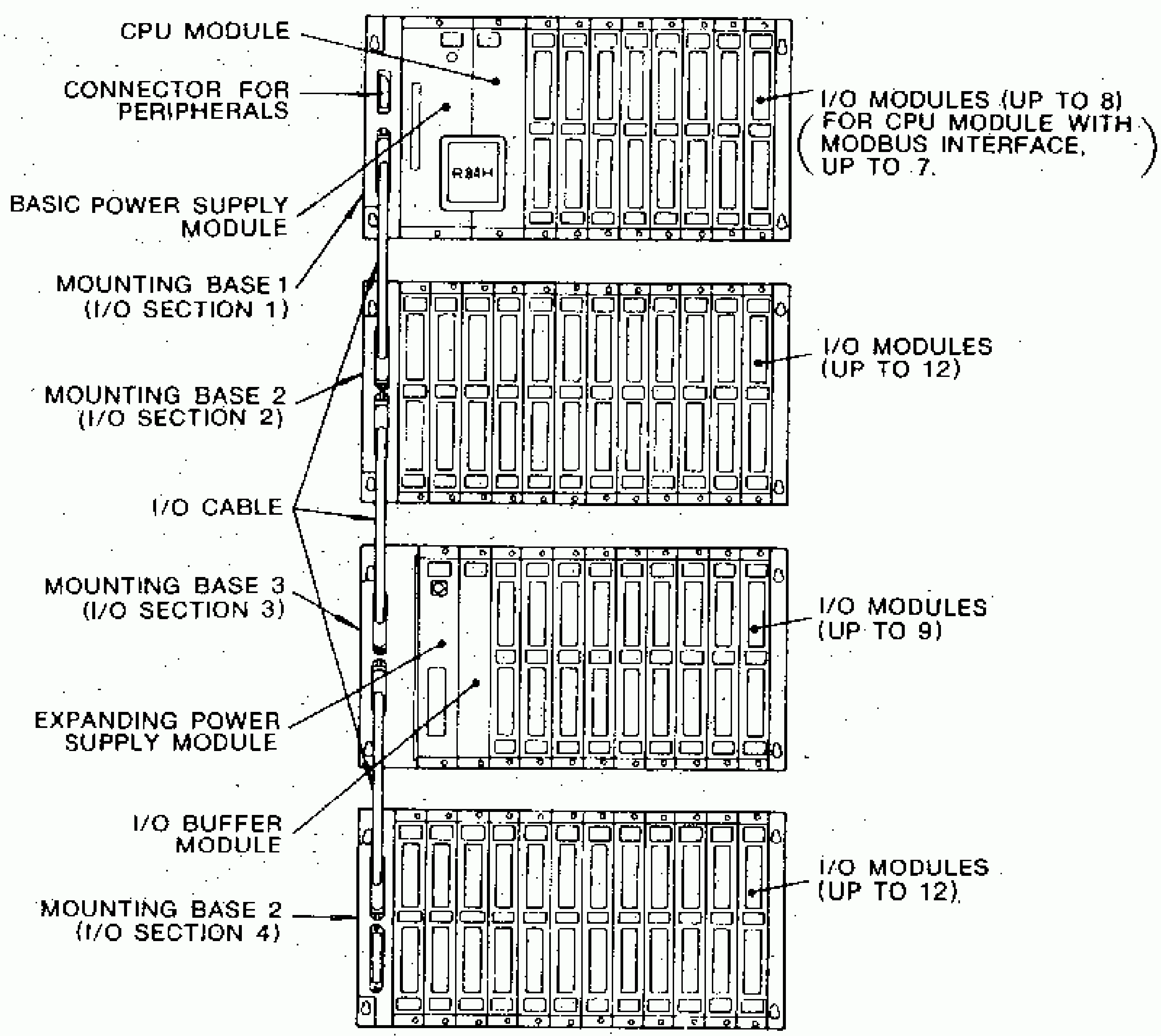


Fig. 1.1 Maximum R84H Configuration

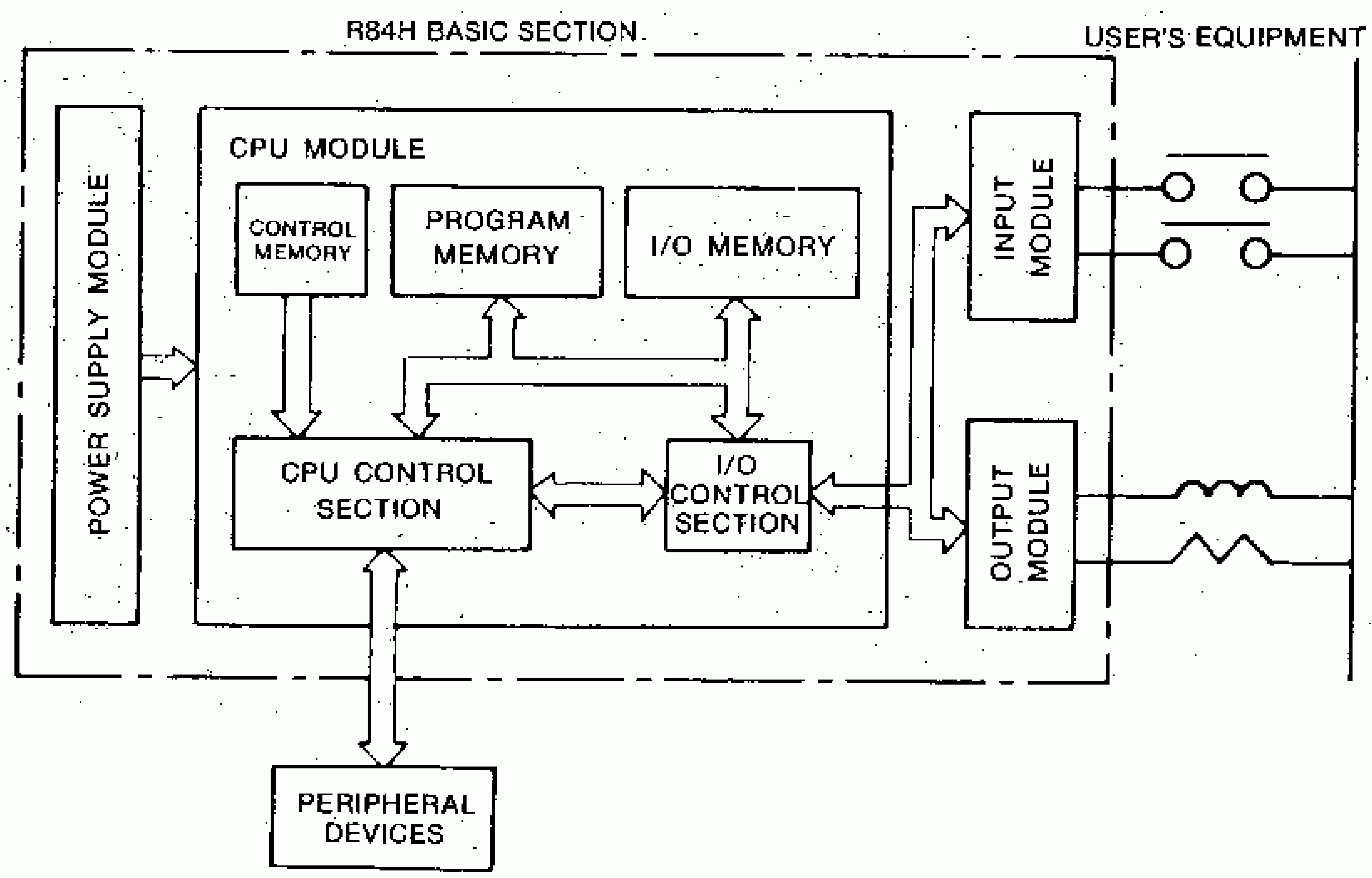


Fig. 1.2 Typical R84H Block Diagram

SECTION II
SPECIFICATIONS

2.1 BASIC SPECIFICATIONS

Table 2.1 Basic R84H Specifications

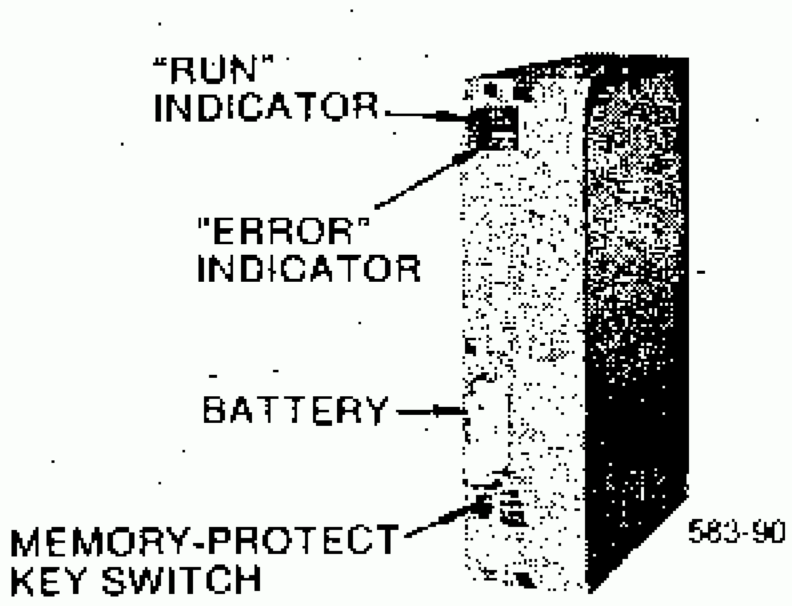
Items	Specifications	Remarks
Power Supply	Single phase, 85 to 121 VAC, 50/60 Hz (47.5 to 63 Hz).	—
Dissipated Power	· 170 VA (power supply module.) · 90 VA (expanding power supply module.)	Excluding power supplied from external to I/O section.
Holding Time	10 ms	—
Ambient Temperature	0 to + 55°C	Excluding peripheral devices.
Storage Temperature	- 20°C to + 85°C	Excluding lithum battery.
Humidity	5% to 95% relative (non-condensing)	—
Vibration - Resistance	In compliance with JIS*C 0911	Excluding peripheral devices.
Shock - Resistance	10G MAX	Excluding peripheral devices.
Dielectric Strength	1500 VAC for 1 minute.	—
Environmental Condition	Free from explosive, inflammable, corrosive gases.	—

* Japanese Industrial Standard

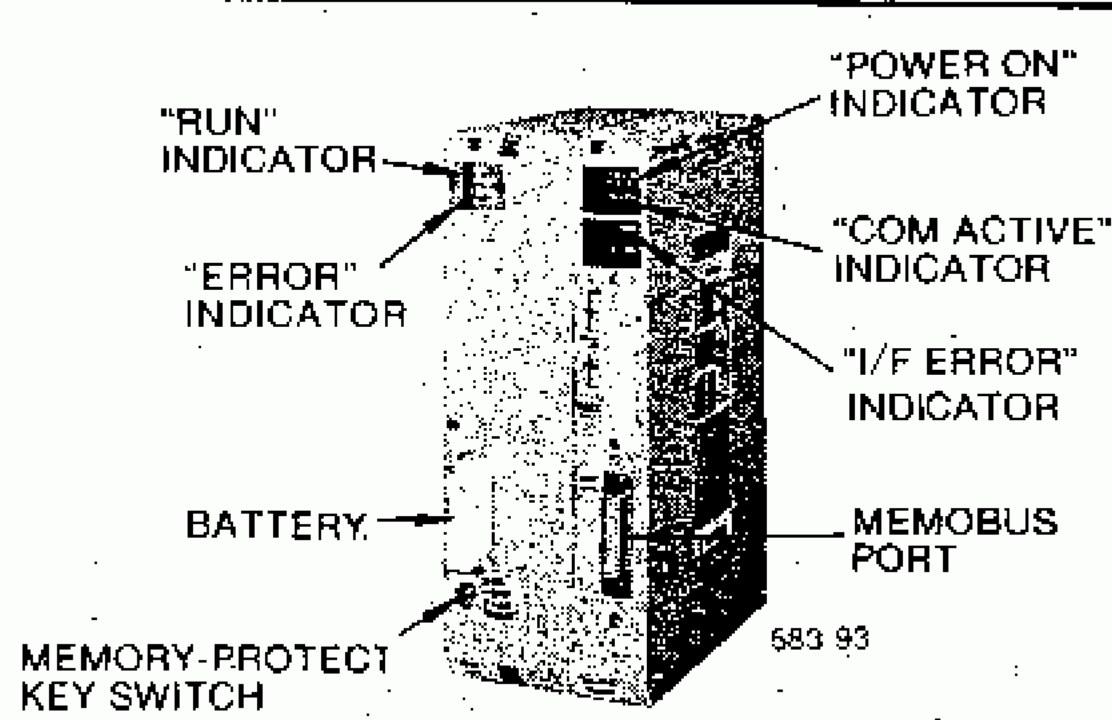
2.2 CPU MODULE

Table 2.2 CPU Module Specifications

Items	Specifications	Remarks
Type	• DDSCR-R84H (without MEMOBUS Interface.) • DDSCR-R84H-M (with MEMOBUS Interface.)	—
Control Method	Scan control by stored program.	—
Programming	Relay ladder diagram symbology.	—
Program Memory Size	8 k words CMOS RAM with battery back-up.	1 word = 8 bits
Data Memory Size	254 Words CMOS RAM with battery back-up.	1 word = 10 bits
Scan Time	30 ms	Depending on number of memory and logic function to be used.
Logic Function	Relay, timer, counter, arithmetic, convert (BCD ⇄ binary, binary ⇄ binary), stepping switch, transitional contacts, move, skip	—
Elements (Contacts and Coils)	3200 (Equivalent to 800 relays.)	—
I/O Points	• Discrete input: 256 points max. • Discrete output: 256 points max. • Register input: 32 points max. • Register output: 32 points max.	—
Communication Function	• EIA RS-422: for connecting to P100 or P180 programming panel. • EIA RS-232C(no MEMOBUS): for connecting to computer or P190 programming panel (J470 EIA adapter is required).	Used for either type DDSCR-R84H or -R84H-M.
	• EIA RS-232C (MEMOBUS): for connecting to computer or P190 programming panel.	Used for type DDSCR-R84H-M.
Diagnostic Function	• Total checking of watchdog timer and memory. • Battery monitoring. • Checking of I/O bus.	—
Mounting	I/O section 1 (mounting base 1)	—
Dimensions in mm	65 (W) × 250 (H) × 160 (D)	For type DDSCR-R84H
	100 (W) × 250 (H) × 160 (D)	For type DDSCR-R84H-M
Approx. Weight	1.6 kg	For type DDSCR-R84H
	2.3 kg	For type DDSCR-R84H-M



(a) R84H CPU Module



(b) R84H-M CPU Module

Fig. 2.1 CPU Modules

(1) Indicating Lamp

- RUN (Running): lights when CPU module is proper in operation.
- ERROR (Battery trouble): lights when the output voltage of CMOS RAM back-up battery is low level, with AC power supply turned on.
- POWER ON (Running): lights when MEMOBUS interface is proper.
- COM ACTIVE (Communicating): lights when communicating between MEMOBUS interface and MEMOBUS master such as computer, P190 programming panel and Memocon-SC584.
- I/F ERROR: lights when any error occurs during communication between MEMOBUS interface and CPU.
- COM ERROR (Communication error): lights when any error occurs during communication between MEMOBUS interface and MEMOBUS master.

Table 2.3 Key Switch Position and, Read and Write of Memory

Position of Memory-Protect Key Switch		ON	OFF	I/O TABLE
Network	Read	○	○	×
	Write	×	○	×
Input/Output Status	Read	○	○	○
	Write	×	○	×
Holding Register	Read	○	○	×
	Write	○	○	×
Input Register	Read	○	○	○
	Write	×	×	×
Input/Output Allocation Table	Read	×	×	○
	Write	×	×	○

○ Available.
× Not available.

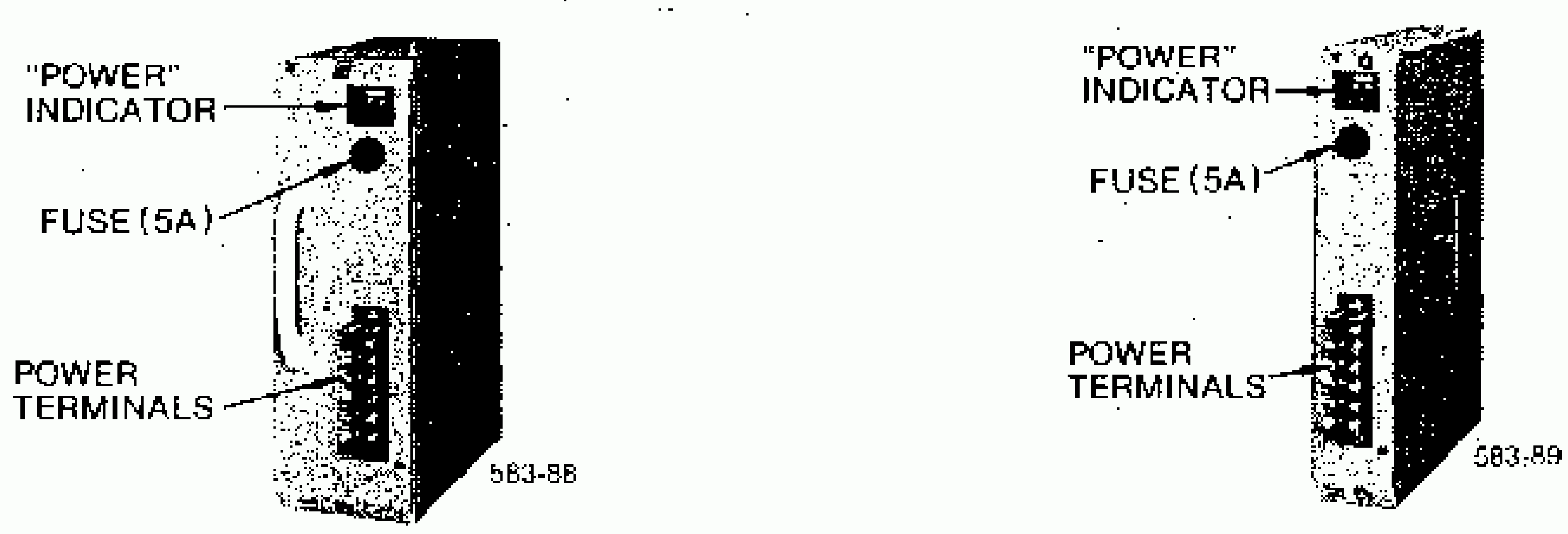
(2) Battery

- Kind: Lithium battery
- Type: BR-2/3 A-1
- Life: One year. ERROR LED is only a warning of low battery voltage. When this indicator goes OFF there is sufficient capacity to maintain memory for at least thirty days.
- Backed-up Memory: Network, holding register, I/O allocation register.

2.3 POWER SUPPLY MODULE

Table 2.4 Power Supply Module Specifications

Items	Basic Power Supply Module	Expanding Power Supply Module
Type	JRMSP-P8051	JRMSP-P8052
Application	• CPU module • I/O section 1 • I/O section 2	• I/O buffer module • I/O section 3 • I/O section 4
Mounting Location	I/O section 1 (on mounting base 1)	I/O section 3 (on mounting base 3)
Input Voltage	85 - 121 VAC (47.5 - 63 Hz)	85 - 121 VAC (47.5 - 63 Hz)
Transient Input Voltage	0 - 140 VAC (10 ms)	0 - 140 VAC (10 ms)
Dissipated Power	170 VA	90 VA
Dimensions in mm	80 (W) × 250 (H) × 160 (D)	45 (W) × 250 (H) × 160 (D)
Approx. Weight	2.8 kg	1.1 kg



(a) Basic Power Supply Module (b) Expanding Power Supply Module

Fig. 2.2 Power Supply Modules

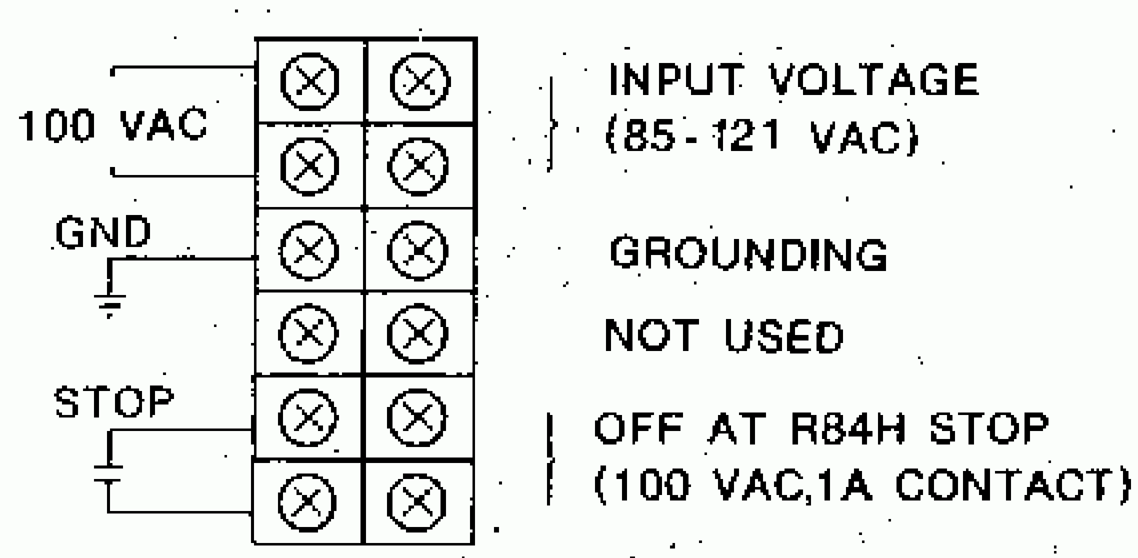
(1) Indicating Lamp

• POWER: lights when power supply DC output is the proper voltage.

(2) Fuse

Glass tube fuse (5A)

(3) Power Terminals



Note: Each designated pair of terminals are in common.

Fig. 2.3 Power Terminals of Power Supply Module

2.4 INPUT/OUTPUT BUFFER MODULE

Table 2.5 I/O Buffer Module Specifications

Items	Specifications
Type	JAMSC-B1011
Application	· I/O section 3 · I/O section 4
Mounting Location	I/O section 3 (on mounting base 3)
Dimensions in mm	34.5(W) × 250(H) × 160(D)
Approx. Weight	0.7 kg

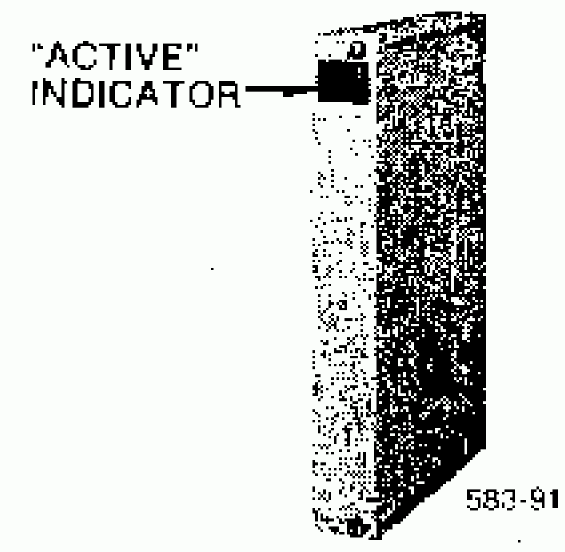


Fig. 2.4 Input/Output Buffer Module

(1) Indicating Lamp

· ACTIVE: lights when CPU module communicates with I/O section 3 and I/O section 4 which have I/O allocation.

2.5 INPUT/OUTPUT MODULE

Table 2.6 I/O Module Specifications

Modules / Items			Type JAMSC-	Voltage	Current	Input Impedance	External Power Supply	Maximum Response Time	No. of I/O's	Module Span
Input	AC	100V	B1051B	80 to 130V	11mA	9kΩ	—	OFF → ON 10ms ON → OFF 20ms	16	1
		200V	B1055	160 to 260V	9mA	23kΩ	—		16	1
	DC	5, 12V	B1053	4.75 to 13.2V	4.5mA (5V) 11.5mA (12V)	1kΩ	—		16	1
		48V	B1057	38 to 58V	10mA	4.8kΩ	—		16	1
		24V	B1059C	19 to 29V	10mA	2.4kΩ	—		16	1
			B1061	20.4 to 26.4V	5mA	4.8kΩ	—		64	1
			B1063	20.4 to 26.4V	10mA	2.4kΩ	—		32	1
			B1065	19 to 29V	6mA	4kΩ	—		32	1
	Register		B1071	—	—	12kΩ	External power: +24V at 200mA.	64ms	8	1
	Analog		B1073-1	0 to +10V	—	2MΩ	• Resolution: 1/1024 (10 bits) • External power: +15V 120mA, −15V 40mA.	—	4	1
			B1073-2	+1 to +5V	—	2MΩ		—	4	1
			B1075-1	0 to +10V	—	2MΩ	• Resolution: 1/4096 (12 bits) • External power: +15V 120mA, −15V 40mA.	—	4	1
			B1075-2	+1 to +5V	—	2MΩ		—	4	1
Output	AC	100V	B1050	80 to 130V	2A per output 5A per 8 outputs	—	Min. load current: 10mA (rms).	10ms	16	1
		200V	B1054	160 to 260V	1A per output 5A per 8 outputs	—	Min. load current: 10mA (rms).	10ms	16	1
	DC	5, 12V	B1052	4.75 to 13.2V	0.1A per output (5V) 0.3A per output (12V)	—	OFF current: less than 0.2mA.	1ms	64	1
		48V	B1056	38 to 58V	2A per output 5A per output	—	OFF current: less than 1mA.	1ms	16	1
		24V	B1058	19 to 29V	2A per output 5A per 8 outputs	—	OFF current: less than 1mA.	1ms	16	1
			B1060	20.4 to 26.4V	0.1A per output 0.4A per 8 outputs	—	OFF current: less than 0.2mA. (without fuse)	1ms	64	1
			B1062	20.4 to 26.4V	0.3A per output 0.6A per 4 outputs	—	OFF current: less than 0.2mA. (without fuse)	1ms	32	1
			B1064	19 to 29V	0.3A per output	—	OFF current: less than 0.2mA (without fuse).	1ms	32	1
	AC/DC*		B1090B	• 220VAC, 0.8A (PF: 0.4) • 110VAC, 1.2A (PF: 0.4) • 24VDC, 1A (TM†: 40ms)		—	Miniature relay, coil voltage: 24VDC	OFF → ON 7ms max ON → OFF 3ms max	16	1
			B1094	• 220VAC, 1A (PF: 0.4) • 110VDC, 0.5A (TM†: 100ms)		—	Power read relay, coil voltage: 24VDC		8	1
	Register		B1070	—	50mA	—	External power: +24V at 200mA.	64ms	8	1
	Analog		B1072B-1	0 to +10V	10mA	—	• Resolution: 1/1024 (10 bits) • External power: +15V 60mA, −15V 50mA.	—	2	1
			B1072B-2	0 to +5V	10mA	—		—	2	1
			B1072B-3	−5 to +5V	10mA	—		—	2	1
			B1072B-4	−10 to +10V	10mA	—		—	2	1
			B1074-1	0 to +10V	10mA	—	• Resolution: 1/4096 (12 bits) • External power: +15V 60mA, −15V 50mA.	—	2	1
			B1074-2	0 to +5V	10mA	—		—	2	1
			B1074-3	−5 to +5V	10mA	—		—	2	1
			B1074-4	−10 to +10V	10mA	—		—	2	1
Motion Control	Reversible Counter		B1081C	—	—	—	Max count speed: 40 kpps. External power: +12V at 100mA.	—	1	1
	Preset Counter		B1082C	—	—	—		—	1	1
	Positioning		B1083C	—					1	2
PID			B1080	—					1	1
Power Supply			B1089	—			Power supply for PID module.	—	1	1

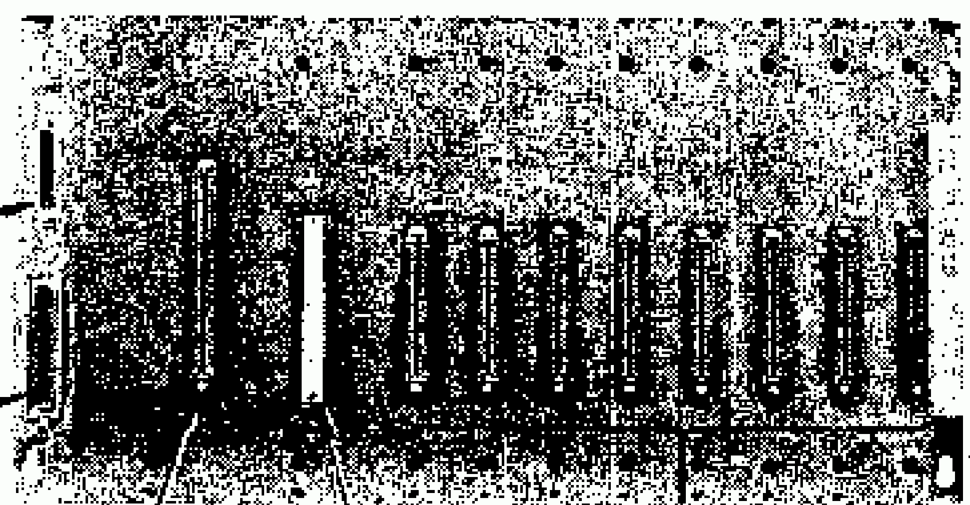
* Requires power supply for exciting the coil of relay built-in.
† Time constant

2.6 MOUNTING BASE

(1) Mounting Base 1

Table 2.7 Mounting Base 1 Specifications

Items	Specifications
Type	JRMSI - B1026
Application	For mounting basic power supply module, CPU module and up to 8 I/O modules as I/O section 1.
Dimension in mm	480 (W) × 250 (H) × 28 (D)
Approx. Weight	2.5 kg



Note: Where CPU module with MEMOBUS is used, an I/O module connector at the most left side cannot be used.

Fig. 2.5 Mounting Base 1

(2) Mounting Base 2

Table 2.8 Mounting Base 2 Specifications

Items	Specifications
Type	JRMSI - B1027
Application	For mounting up to 12 I/O modules as I/O sections 2 and 4.
Dimension in mm	480 (W) × 250 (H) × 28 (D)
Approx. Weight	2.5 kg

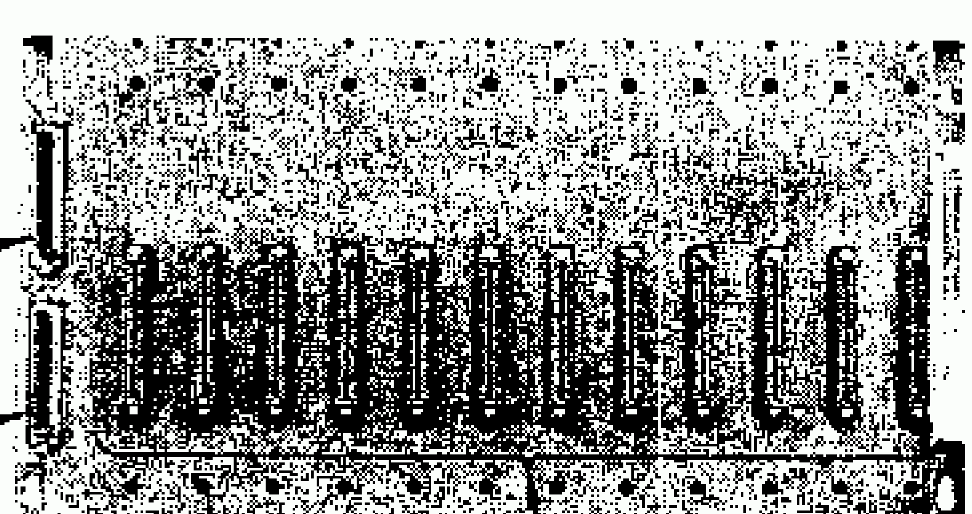


Fig. 2.6 Mounting Base 2

(3) Mounting Base 3

Table 2.9 Mounting Base 3 Specifications

Items	Specifications
Type	JRMSI - B1028
Application	For mounting expanding power supply module, I/O buffer module and up to 9 I/O modules as I/O section 3.
Dimension in mm	480 (W) × 250 (H) × 28 (D)
Approx. Weight	2.5 kg

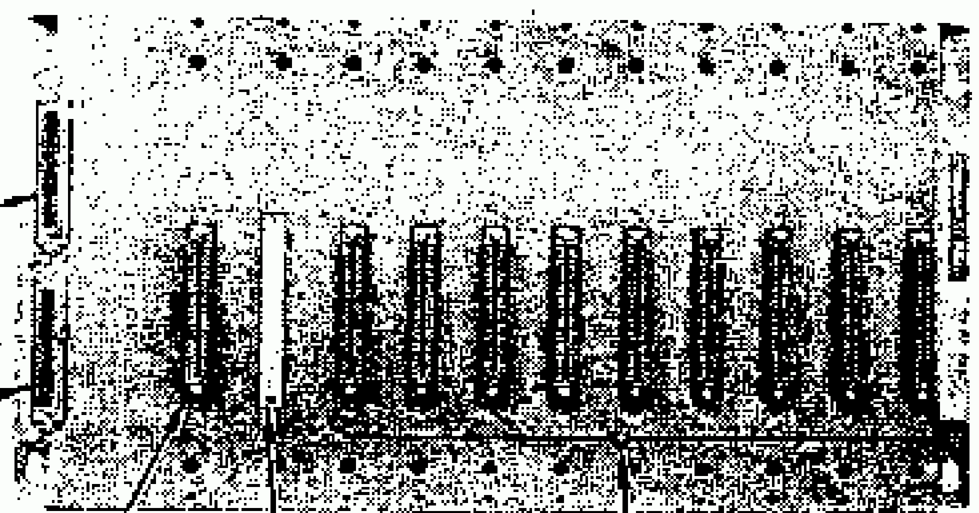


Fig. 2.7 Mounting Base 3

2.7 INPUT/OUTPUT CABLE

Table 2.10 I/O Cable Specifications

Items	Specifications	
Type	JZMSZ - W1021*	JZMSZ - W1022
Length	1500 mm	400 mm
Application	Used for connecting across each mounting base respectively.	

*Used for only any one space among three spaces between each mounting base.

2.8 PERIPHERAL DEVICES

(1) P180 CRT Programming Panel

Table 2.11 P180 CRT Programming Panel Specifications

Items	Specifications
Type	• Standard type: DISCT - P180 • Deluxe type: DISCT - P180-011
Functions	• Entry, adding, altering and deleting of logic and data • Read and display • Monitoring • Simulation • Search • Ladder list (for only deluxe type.)
Power Requirements	85 to 115 VAC, 50/60 Hz, 80 VA
Ambient Temperature	+ 5 to + 45°C
Storage Temperature	- 20 to + 85°C
Humidity	10 to 80% relative (non-condensing)
Dimension in mm	470 (W) × 350 (H) × 205 (D)
Approx. Weight	12 kg

(2) P100 LCD Programming Panel

Table 2.12 P100 LCD Programming Panel Specifications

Items	Specifications
Type	DISCT - P100
Functions	• Entry, adding, altering and deleting of logic and data • Read and display • Monitoring • Simulation • Search • "Dump," "load" and "Verify" of program using tape recorder
Power Requirements	12 VDC, 0.5 A
Ambient Temperature	+ 5 to + 45°C
Storage Temperature	- 20 to + 60°C
Humidity	10 to 80% relative (non-condensing)
Dimension in mm	250 (W) × 115 (H) × 45 (D)
Approx. Weight	0.8 kg

(3) P190 CRT Programming Panel

Table 2.13 P190 CRT Programming Panel

Items	Specifications
Type	DISCT - P190
Functions	• Entry, adding, altering and deleting of logic and data • Read and display • Monitoring • Simulation • Search • Ladder list
Power Requirements	85 to 115 VAC, 50/60 Hz, 150 VA
Ambient Temperature	+ 5 to + 45°C
Storage Temperature	- 20 to + 60°C
Humidity	10 to 80% relative (non-condensing)
Dimension in mm	550 (W) × 440 (H) × 280 (D)
Approx. Weigth	15 kg

(4) J470 EIA Adapter

Table 2.14 J470 EIA Adapter Specifications

Items	Specifications
Type	DISCT - J470
Functions	Signal conversion (EIA RS422 ←→ EIA RS232C)
Application	Used for connecting CPU module to computer and/or P190 CRT programming panel.
Power Requirements	12 VDC, 0.3 A (Supplied from basic power supply module.)
Connection Cable	With connection cable (2 m) for peripheral device connector on mounting base 1.
Dimensions in mm	324 (W) × 57 (H) × 144 (D)
Approx. Weight	1 kg

SECTION III
IMPORTANT MACHINE CONCEPTS

3.1 CONTROLLER REFERENCE NUMBERS

Throughout the programming of the R84H Controller, four-digit reference numbers are utilized to build the user's logic. These reference are divided into two broad categories: discrete and registers. Discrete references are used for individual items that can be either ON or OFF, such as limit switches, pushbuttons, relay contacts, motor starters, relay coils, solenoid valves, etc. Register references are used to store numerical values such as counts, times, analog values, etc.; all register references are three BCD digits long (maximum value 999).

Only five types of references are required to program the R84H Controller. Any specific references can be used as many times as required by the particular application; there are no limitations on the number of times a reference is used. References are defined as follows:

0XXX - coils/discrete outputs
1XXX - discrete inputs
2XXX - sequencer steps
3XXX - input registers
4XXX - holding registers

Table 3.1 shows the number of reference.

Table 3.1 The Number of Reference

Reference Number	Elements	Remarks
0001 - 0256	Output coil and its contact (256 points)	Available as internal coil.
0257	Battery monitoring contact	ON when battery voltage is proper.
0258 - 0512	Internal coil (255 points)	—
1001 - 1256	Input relay (256 points)	—
2 YXX	Sequencer contact Y: Sequencer number (1-8) XX: Sequencer step number (01-32)	—
3001 - 3032	Input register (32 points)	—
4001 - 4032	Output register (32 points)	Available as holding register.
4001 - 4254	Holding register (254 points)	—
4051 - 4058	Sequencer control register (8 points)	Available as holding register.
4001 - 4041* 4101 - 4141*	I/O allocation register (82 points)	Not available as holding register.

*I/O allocation register is assigned by the same reference number that holding register uses, but it uses different memory address which is accessible only when the memory protect switch is set to "I/O TABLE" position.

3.2 THE PROGRAMMING FORMAT

As previously discussed, the R84H Controller controls the user's equipment by a program stored in its memory and operating with the Input/Output section. In block diagram form this can be illustrated as shown in Fig. 3.1.

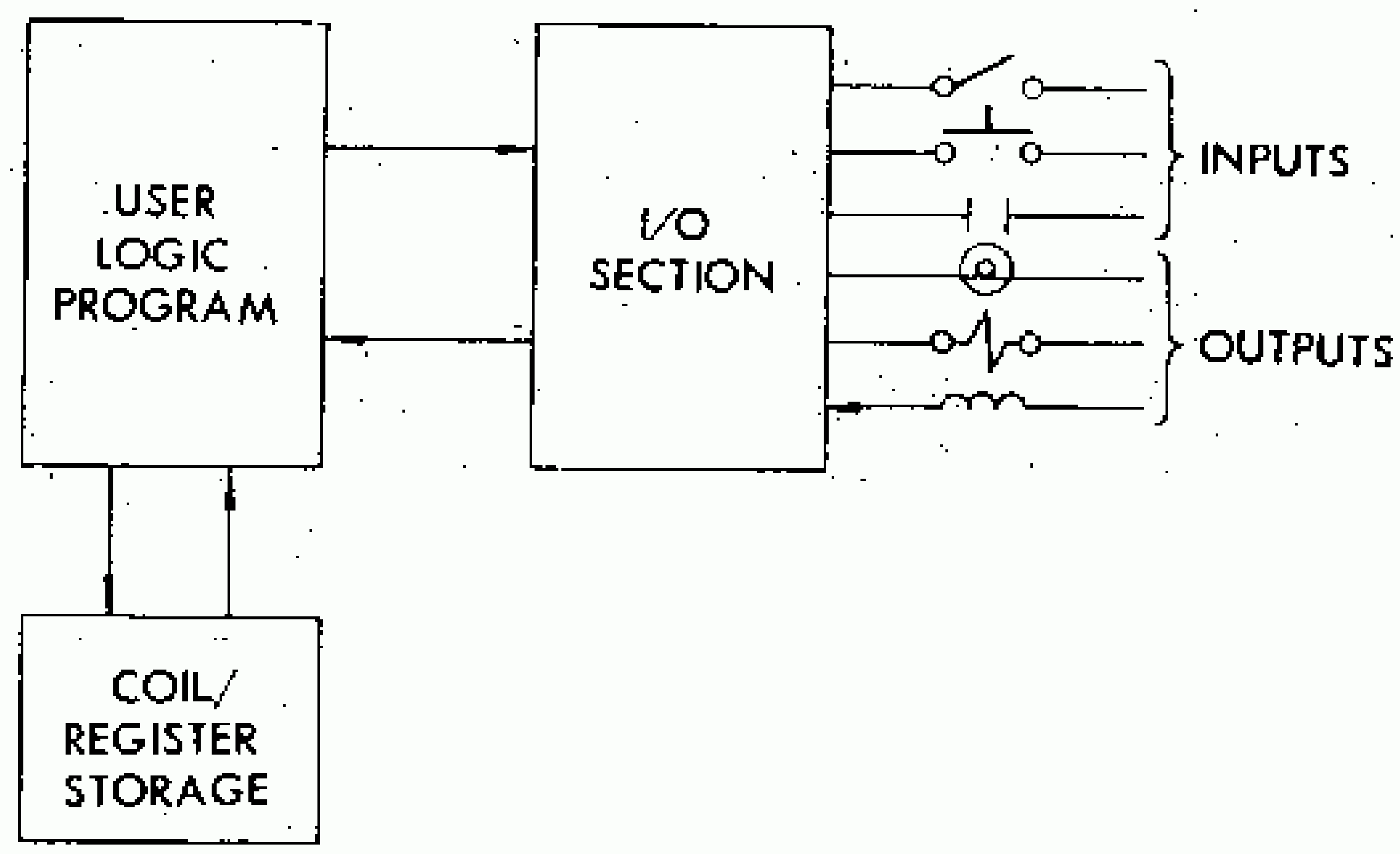


Fig. 3.1 Mainframe Block Diagram

All user programs are entered in a multi-node format as follows:

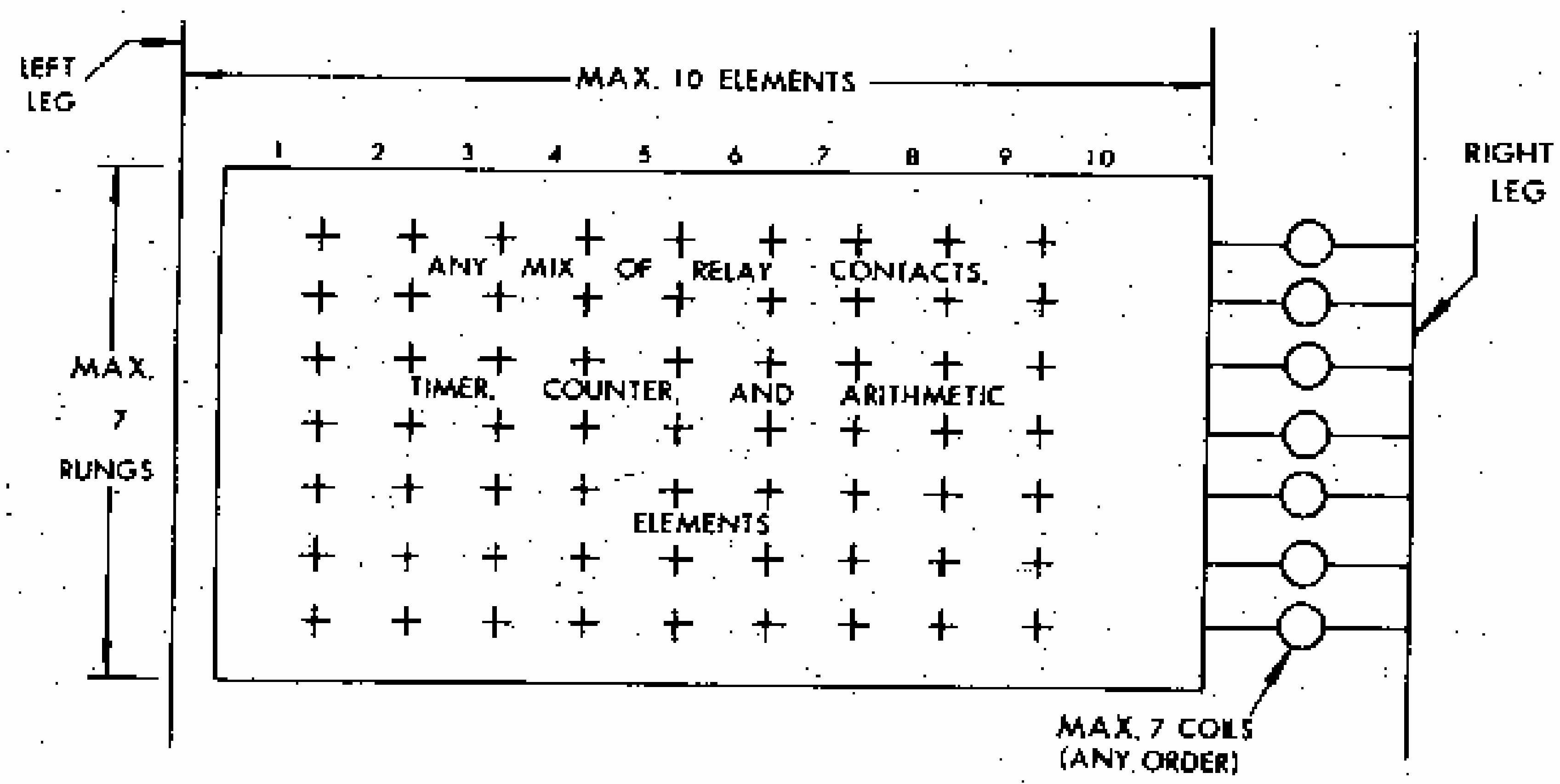


Fig. 3.2 Multi-node Program Format

The multi-node format allows for up to ten elements of the program in each horizontal rung of the ladder diagram. Up to seven of these rungs can be combined into a network of relay contacts and other programming elements (timers, counters, etc.); each network can have up to seven coils placed at the extreme right of the network.

The network becomes one basic parameter of the ladder diagram program; it is defined as a group of program elements comprising from one to seven rungs, each with up to ten elements, that are connected. The quantity of networks that can be entered depend upon the complexity of the network. Each programed element requires two words of memory as does each coil. This results in a very efficient memory utilization, especially since each word is only eight bits long. See Section 3.1.4 for exact details on memory utilization.

NOTE

The P180 Programming Panel will display in real time the amount of memory used with previously entered logic.

The basic element of programming is the relay contact, as shown in Fig. 3.3. The contact can be either normally open or normally closed; the branch to next rung is optional. Below the contact is a four digit reference number that controls the power flow of this contact. Within a network, power flow will be allowed only from left to right or vertically (up and down); it is never allowed to flow from right towards the left. When properly displayed on the P180 CRT screen, power flow will be indicated for all relay contacts by intensifying those contacts that are passing power from left towards the right.

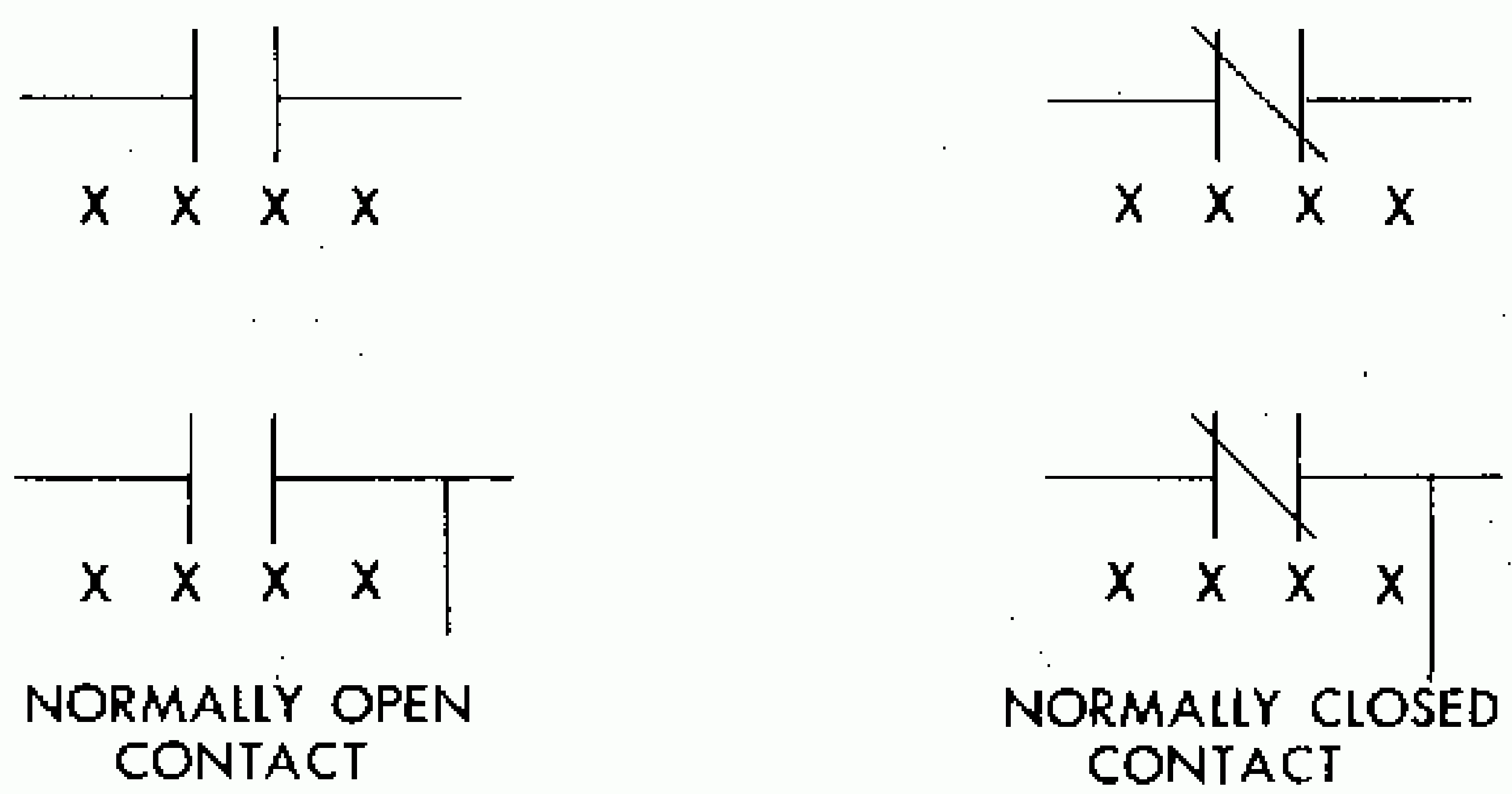


Fig. 3.3 Relay Contact Types

Whenever data is being entered into the Controller with any Programming Panel (references, conact type, disable status, etc.), this data is entered directly into the memory of the Controller. If power should be interrupted prior to complection of the programming, whatever data has been entered will be retained. No additional processing is required, such as further assembly of the data; whatever data the user enters is the data stored for use by the Controller. Networks can be changed either in whole or in part, or added and deleted, at any time, using the Programming Panel; in addition, any coil output or input may be tested by simulating outputs and inputs with the disable feature.

3.3 SCAN

The R84H Controller processes its logic data by solving networks by network number, beginning at network 1 and continuing until the last network programmed into the controller.

NOTE

Controller scans only memory actually programmed with logic.

A network is defined again as a group of connected programmed elements; these elements can be relay contacts or numerical references. After all logic is solved, the inputs and outputs are all serviced together in one group. This completes one scan. As soon as one scan is completed, the next scan begins again with network 1.

Each network is independently solved from column one to column ten and then to the coils. Within each column, the logic is solved from the top rung to the bottom rung of that column. The new results from each network (either coil status or register content) are immediately available for use by the next network or column. The scan is by network number NOT by output coil number. The scanning technique is very basic to the operation of the R84H controller and should be understood before proceeding.

Every scan each network is solved and each I/O module is serviced. The exact time to complete a scan varies from application to application, but depends on the number of networks programmed and the types of logic utilized.

NOTE

When power is applied, a power-up sequence is performed. The time required for power up operation is the typical scan time provided in Table 4.1 plus 400 mSec for update of input registers.

After this power up sequence, scanning is performed, based upon real data (inputs, disables, and latched coils updated), beginning at network 1. If a power failure is detected, scanning is terminated at whichever network is currently being solved and the power-down sequence is initiated, which includes turning all outputs OFF.

Whenever an output transfer occurs, the status of the I/O bus lines is compared to the output data. If they do not agree, a fault has occurred in the I/O Section which may cause unreliable operation; thus, the processor will stop, forcing all outputs OFF, and extinguish the RUN light. Since the same bus lines are used to read inputs, error checking the output transfers will also verify bus lines for input transfers.

3.4 MEMORY

(1) Memory Protect

The R84H Controller is provided with a Memory Protect hardware feature designed to prevent accidental or unauthorized changes to part of the memory. When the Memory Protect keylock switch is placed in the ON position, the user's logic cannot be altered by any external device, such as the Programming Panel, Program Loader, or Computer Interface. The logic can be examined, but not altered. Thus, by placing Memory Protect ON and removing the key, maintenance personnel can use the Programming Panel to monitor the system, but they cannot make unauthorized changes. Only specific personnel who are provided access to the key can change the system.

NOTE

The Memory Protect feature protects the user's logic, but does not protect those elements that normally change - such as registers and I/O status.

(2) Memory Utilization

The logic program entered by the user is stored in the user memory in successive words of memory. The logic is stored by network number, with the first network in the lower memory addresses (first to be scanned), and the last network in the upper memory addresses. If new networks are to be added, they are normally placed after all existing networks. However, the P180 Programming Panel has the ability to either add logic elements to an existing network or to insert networks between existing networks. If additional memory is required, existing logic is moved down as necessary to make room for the new logic.

Each network is stored in memory by vertical columns. The entire first column is stored, then the second column, etc. until finally the coils (if any) are stored. Since coils are optional, there are two words of memory used to indicate when one network ends another begins; these words are the first two words stored in memory for a network (start of network indication). Each element (contact, preset, register reference, coil, etc.) in the network requires two eight bit words of memory.

The first rung of a network must be complete from left power rail towards the right for as many columns as this network is going to use (excluding coils). Horizontal shunts or opens are added as necessary to complete the required elements in the top rung. Within each column, elements must be programmed from the top (first rung) down to the last element OF THAT COLUMN that will contain user logic. Any column that is to be used, can have from one to seven elements; there is no requirement to "match" any column in size. Columns to right that occur after all user logic, but prior to the coils, do not require ANY memory. If there are any vertical connections in a column, two additional words are required for each column with vertical connections, to indicate where these connections are. Only two words are required regardless of the quantity, location, or continuity of these vertical connections in any column. The column containing coils requires two words for each coil or space between coils.

3.5 DISABLE/ENABLE

To simplify the checkout and maintenance of a control system using the R84H Controller, a special feature is incorporated into the Controller. This feature is called the Disable function. The Disable status is alterable only if Memory Protect is OFF. Any logic coil selected by the CRT's cursor can be disconnected from its logic by depressing the DISABLE pushbutton. If the coil was OFF when the pushbutton was depressed, it will remain OFF; if it was ON, it will remain ON. The coil is no longer controlled by the program in the Controller, but is now controlled by the operator via the CRT Programming Panel. The coil can be toggled ON/OFF/ON/OFF by successively depressing the FORCE pushbutton.

When disabled, the logic coil, all references to this coil in the ladder diagram, and any outputs driven from this coil, will be affected solely by the disable condition. The internally programmed logic still remains in the Controller and will re-establish control when the coil is enabled, however, this internal logic has been completely bypassed for this coil by the disable function. The disable status of any coil is permanent until altered by a programming device. New networks can be displayed, other coils disabled, power interrupted, memory protect turned ON, or any other change made to the system without affecting the disable status of any coils; any coil disabled either OFF or ON will retain that state until changed by a programming device.

NOTE

To re-enable a logic coil, the DISABLE pushbutton is depressed a second time while the cursor is on that coil.

In addition to logic coils, discrete inputs can also be disabled in a manner similar to logic coils. The cursor is placed on the input when displaying its status and the DISABLE pushbutton is depressed. This action removes control of that input from the "real world" and assigns that control to the operator via the CRT Programming Panel. The input can be forced either ON or OFF and all logic that uses this discrete input will now respond to the disable status and not the real world.

NOTE

Sequencer references cannot be disabled.

The disable status is permanent and can be altered only by Programming devices with memory protect OFF. At any one time, as many logic coils and discrete inputs as desired can be disabled each either ON or OFF.

NOTE

Since the disable status is permanent, a record should be maintained of all disabled logic coils and inputs, so that they can be enabled at a later date.

In checking out a system, the disable function can be used to verify the proper wiring and operation of all discrete outputs. Each output is displayed in a network on the CRT Programming Panel and then disabled. The coil can be cycled ON-OFF-ON-OFF, etc., and proper operation of the discrete device is observed. It is recommended that the logic coil is enabled before the next output is tested to prevent undesirable disable statuses from occurring.

CAUTION

Insure disabling outputs or inputs does not create unsafe machine operation.

If an input such as a limit switch fails to operate properly, its effect can be temporarily simulated by disabling the input and forcing it to the required state (ON or OFF). This is particularly useful if the input is preventing the control system from functioning. Another use for disabling inputs is to simulate the operation of the control system prior to connections of the real I/O. However, since the disable feature for either inputs or logic coils is a very powerful function and can cause catastrophic results if improperly used, the keylock memory protect can be used to ensure changes of the disable states can be made only be qualified and authorized personnel.

NOTE

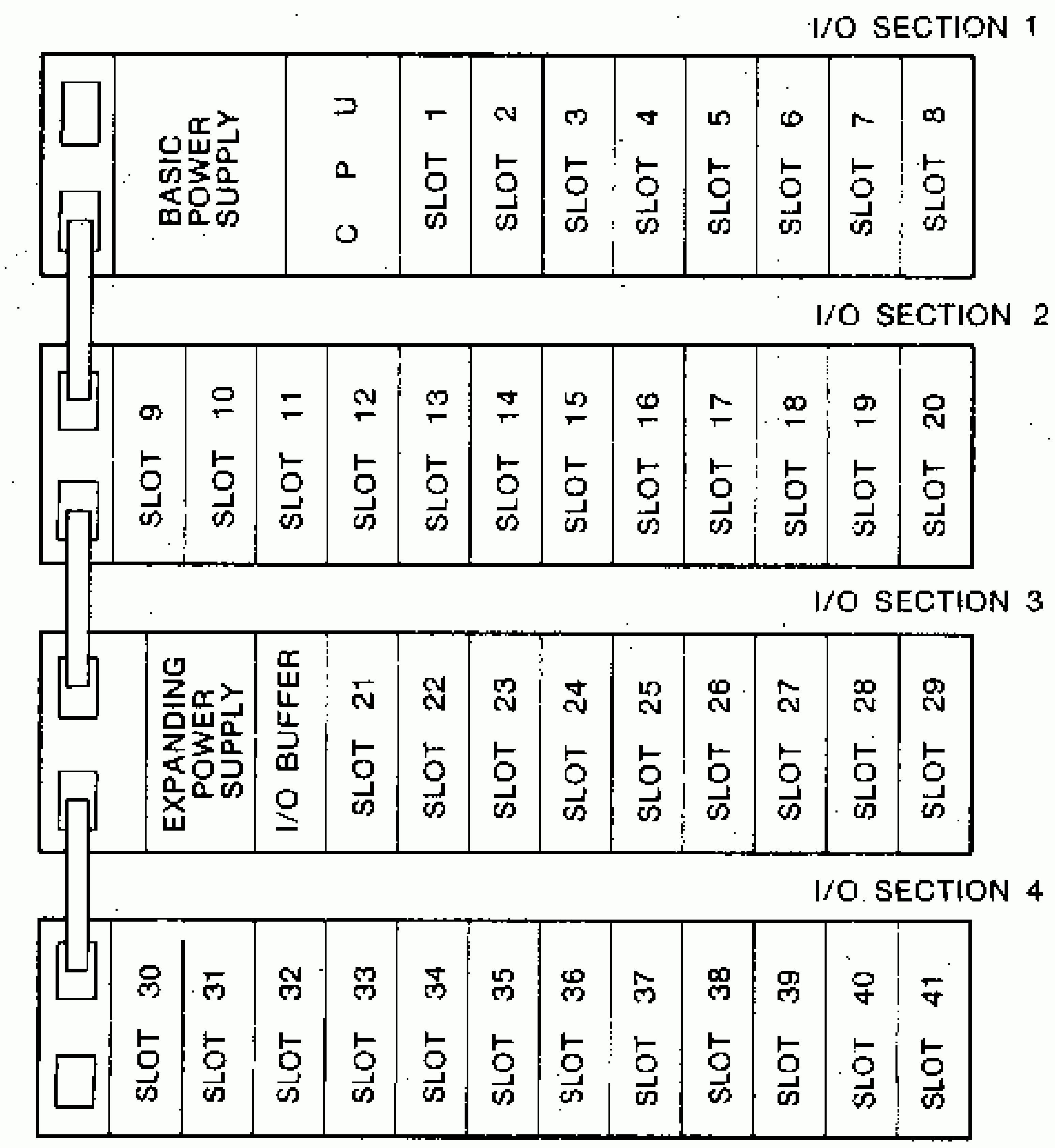
Transitional contacts will not respond properly to disabled references.

3.6 INPUT/OUTPUT ALLOCATION

Since I/O module can be located at any module slot number corresponding to I/O allocation register number shown in Table 3.2, a variety of combination of I/O modules is available. Before operating R84H controller, be sure to set I/O allocation register using the programming panel. For I/O allocation, set the memory protect key switch of CPU module to "I/O TABLE" and stop the R84H controller (scan stop).

(1) Slot Number

A slot number is determined as shown in Fig. 3.4.



Note: For CPU module with MEMOBUS interface, SLOT 1 cannot be used.

Fig. 3.4 Slot Numbers

(2) I/O Allocation Register

Two I/O allocation registers are assigned to each I/O slot as shown in Table 3.2. The I/O allocation registers are numbered in the 4000 series which are used for the holding register. But a different memory address is applied for each register. Where using I/O allocation register, the memory protect switch of CPU module should be set to "I/O TABLE" position. For the holding register, set to other positions. See Table 2.3.

Table 3.2 Relationship of Slot Number and I/O Allocation Register Number

Section Number	Slot Number	I/O Allocation Register Number		Section Number	Slot Number	I/O Allocation Register Number	
		For Input signal	For Output signal			For Input signal	For Output signal
I/O Section 1	1	4101	4001	I/O Section 3	21	4121	4021
	2	4102	4002		22	4122	4022
	3	4103	4003		23	4123	4023
	4	4104	4004		24	4124	4024
	5	4105	4005		25	4125	4025
	6	4106	4006		26	4126	4026
	7	4107	4007		27	4127	4027
	8	4108	4008		28	4128	4028
I/O Section 2	9	4109	4009		29	4129	4029
	10	4110	4010	I/O Section 4	30	4130	4030
	11	4111	4011		31	4131	4031
	12	4112	4012		32	4132	4032
	13	4113	4013		33	4133	4033
	14	4114	4014		34	4134	4034
	15	4115	4015		35	4135	4035
	16	4116	4016		36	4136	4036
	17	4117	4017		37	4137	4037
	18	4118	4018		38	4138	4038
	19	4119	4019		39	4139	4039
	20	4120	4020		40	4140	4040
	–	–	–		41	4141	4041

(3) Stored Numerical Value of I/O Allocation Register

Numerical decimal values of three digits are stored in the I/O register according to I/O module types. See Fig. 3.5.

L	M	N

- Units Digit: $\frac{\text{The number of discrete*}}{8}$
- Tens Digit: The number of register (binary)
- Hundreds Digit: The number of register (BCD)

* N = 2 for 16 I/O points module;
N = 4 for 32 I/O points module.

Fig. 3.5 Stored Numerical Value of I/O Allocation Register

Table 3.3 shows each numerical value stored in I/O allocation register.

Table 3.3 Numerical Values stored in I/O Allocation Register

		Module Type JAMSC-	Stored Numerical Value		
			Discrete	Binary	BCD
Input	16 Points	B1051B, B1053, B1055, B1057, B1059C	002	010	100
	32 Points	B1063, B1065	004	020	200
	64 Points	B1061	008	040	400
	Register	B1071	–	080	800
	Analog	B1073	–	040	–
Output	16 Points	B1050,B1052,B1054,B1056, B1058,B1090B	002	010	100
	8 Points	B1094	001	–	–
	32 Points	B1062, B1064	004	020	200
	64 Points	B1060	008	040	400
	Register	B1070	–	080	800
	Analog	B1072B	–	020	–
Reversible Counter		B1081C	021	021	–
Preset Counter		B1082C	022	022	–
Positioning Control		B1083C	042	042	–
PID Control		B1080	021	031	–

Note:

1. Abbreviated values can be stored in the I/O allocation register.

   Example: "002" → "2"
   "080" → "80"

2. For a slot without I/O module, store "0" in the I/O allocation register.

(4) Relationship of I/O Reference and I/O Allocation

I/O reference number is allocated from slot number 1 in turn according to I/O allocation. Where "0" is stored in I/O allocation register, its slot cannot be used. Table 3.4 shows an example of I/O allocation.

Table 3.4 Example of I/O Allocation

Slot Number	I/O Module	I/O Allocation Register Number	I/O Allocation Register Stored Value	I/O Number	Slot Number	I/O Module	I/O Allocation Register Number	I/O Allocation Register Stored Value	I/O Number
1	B1051F (100 VAC, 16 Inputs)	4101	2	1001-1016	10	B1071 (Register input)	4110	800	3002-3009
		4001	0				4010	0	
2	B1051B (100 VAC, 16 Inputs)	4102	2	1017-1032	11	B1073 (A/D Conversion)	4111	40	3010-3013
		4002	0				4011	0	
3	B1050 (100 VAC, 16 Outputs)	4103	0	0001-0016	12	B1072 (D/A Conversion)	4112	0	4001-4002
		4003	2				4012	20	
4	B1050 (100 VAC, 16 Outputs)	4104	0	0017-0032	13	B1082C (Preset counter)	4113	22	1081-1096 3014-3015 0049-0064 4003-4004
		4004	2				4013	22	
5	B1050 (100 VAC, 16 Outputs)	4105	0	0033-0048	14	B1064 (24 VDC, 32 Outputs)	4114	0	0065-0096
		4005	2				4014	4	
6	Not used.	4106	0	–	15	B1070 (Register Outputs)	4115	0	4005-4012
		4006	0				4015	80	
7	B1065 (24 VDC, 32 Inputs)	4107	4	1033-1064	16	Not used.	4116	0	–
		4007	0				4016	0	
8	B1059C (24 VDC, 16 Inputs)	4108	100	3001	17 - 41	Not used.	4117-4141	0	–
		4008	0				4017-4041	0	
9	B1059C (24 VDC, 16 Inputs)	4109	2	1065-1080	–	–	–	–	–
		4009	0						

Note: If the slot stored "0" in I/O allocation register is allocated, the following I/O module numbers become the next higher number in order.

(5) I/O Allocation Procedure

I/O allocation should be done in the following cases:

- Before R84H first operation.
- After loading the program using M302 program loader or P190 CRT programming panel.

I/O allocation is made by using P100, P180 or P190 programming panel. Fig. 3.6 shows I/O allocation procedure using P180 programming panel. I/O allocation procedure is as follows:

1. Set the memory protect switch of CPU module to "I/O TABLE" position.
2. Stop the CPU (scan stop).
3. Store the value corresponding to I/O module to be used in the I/O allocation register for each slot. See Tables 3.2 and 3.3. Where the slot is not used for I/O module mounting, store "0" in the I/O allocation register.
4. Repeat the operation of item 3 for all slots. However, the operation should be done for each I/O section. If I/O sections 3 and 4 are not used, I/O allocation for slot numbers 21 to 41 is unnecessary.
5. Check if the contents of I/O allocation register are correct or not. Where it is correct, CPU can be started (scan start). where I/O allocation changing is required, use the above procedures.

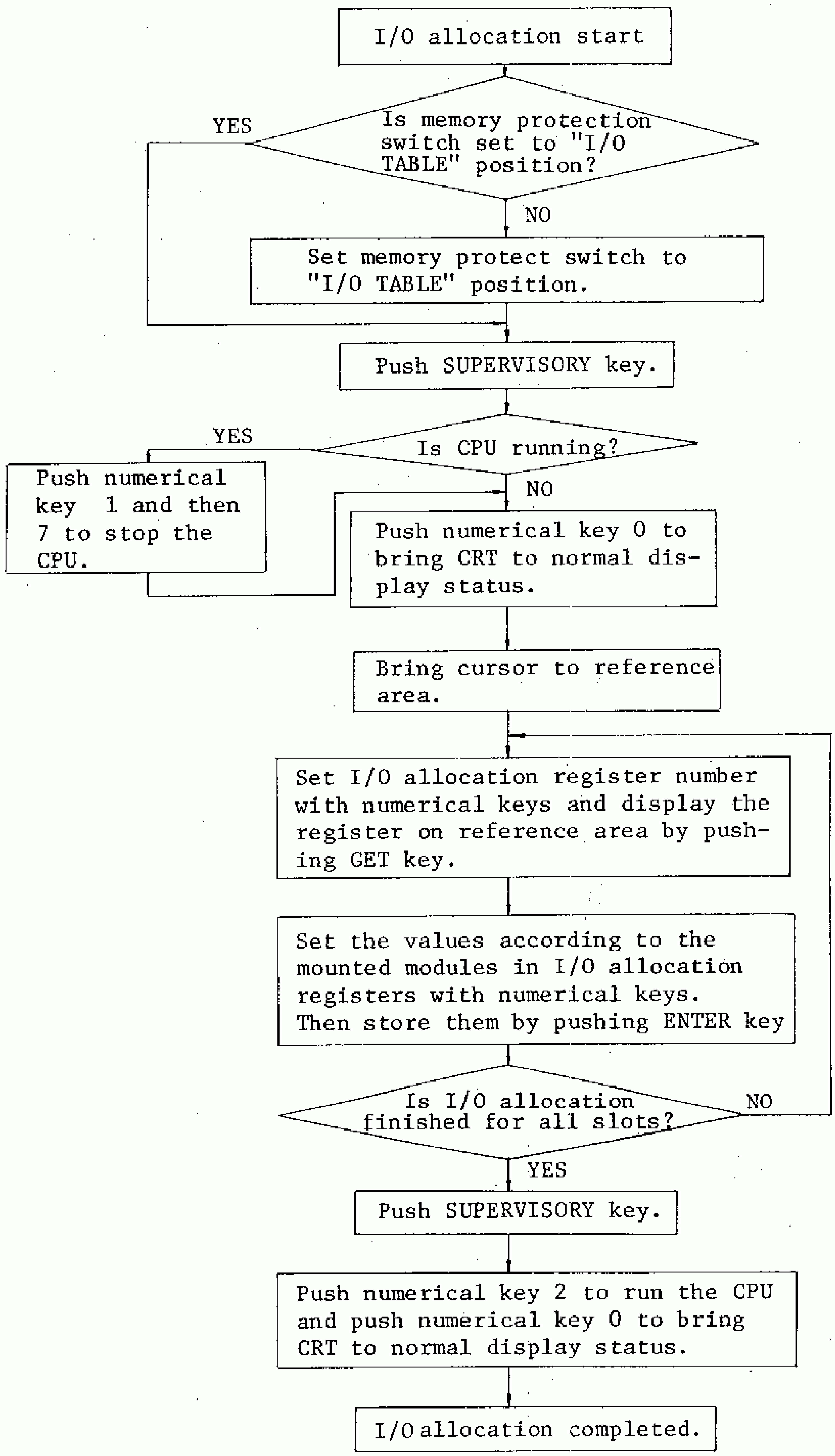


Fig. 3.6 I/O Allocation Procedure
Using P180 CRT Programming Panel

(5) I/O Allocation Procedure (Cont'd)

Table 3.5 Error Messages Related to I/O Allocation

Error Message	Possible Cause
MEM PROTECT	With the memory protect switch turned ON, I/O allocation is performed.
484 RUNNING	When CPU is running, I/O allocation is performed.
BAD ADR RNGE	For I/O allocation, a number other than the specified number (4001 to 4041 and 4101 to 4141) is set. Then a writing operation is performed.
BAD COMMAND	With the memory protect switch set to "I/O TABLE" position, the ladder diagram is read out and the disable/enable operation is performed.

(6) Precaution for I/O Allocation

- The numerical values stored in I/O allocation register have the following limitations for input and output:

- $0 \leqq L + M \leqq 8,\ 0 \leqq \sum_{n=1}^{41} (Ln + Mn) \leqq 32$

- $0 \leqq N \leqq 8,\ 0 \leqq \sum_{n=1}^{41} Nn \leqq 32$

L: The number of value (BCD)

M: The number of value (Binary)

N: $\frac{\text{The number of discrete I/Os}}{8}$

n: Slot number

- If the above limitations are ignored, the value cannot be stored in I/O allocation register. In this case, an error message is not indicated.
- Each slot is provided with two I/O allocation registers for input and output signals, respectively. The correct value should be stored in each register. For the slot without I/O modules, store "0" in both registers.
- Discrete I/O modules are used as BCD or binary I/O by I/O allocation. But the following circuit numbers of I/O module cannot be used:
  - BCD — 13 to 16 circuits.
  - Binary — 11 to 16 circuits.

  Where many register I/Os are required, use the following method:
- Discrete I/O module and convert function.
- Register I/O module.

- For discrete I/O modules, where using BCD value, the value of each digit is up to 9.
- Where clearing the tens of I/O allocation register, set the memory protect switch to "I/O TABLE" position and then stop the CPU. Finally, perform the clearing operation (where using P180, push SUPERVISORY key and then numerical keys 3 and 0. At that time, the ladder diagram and the holding register are also cleared.

  If the clearing operation is performed with the memory protect switch set to OFF position, only the ladder diagram and the holding register are cleared, but the contents of I/O allocation register are not cleared.

During I/O allocation, if a wrong operation is performed, the programming panel displays an error message corresponding to the contents of error. Table 3.5 shows error messages related to I/O allocation using P180 CRT programming panel.

SECTION IV
PROGRAMMING FUNCTIONS

4.1 INTRODUCTION

All programming is done on the basic format of up to ten elements in each horizontal row or rung, and up to seven of these rungs connected together to form a network. A network can be a single rung, two rungs, or up to seven rungs as long as there is some connection between the elements of each rung. This connection can be as simple as the left of the ladder diagram. Each network can have up to seven coils, located to the extreme right of any/all rungs of the network. These coils can be assigned any valid logic coil numbers available in the Controller; logic coil numbers can be used only once.

Table 4.1 R84H Memory Configuration

Memory (8 Bit Words)	Typical Elements (Contacts & Coils)	Maximum I/O		Internal Coils	Holding Registers	Typical Scan Time (M sec)
		Inputs	Outputs			
8192	3200	256	256	256	254	30

Note: Typical Scan Time computed for CPU memory full of relay logic and representative Timer/Counter logic.

4.2 BASIC PROGRAMMING

The R84H Controller is provided with the following programming capabilities.

a) Relays

b) Timers

c) Counters

d) Arithmetic functions, including add, subtract, multiply, and divide.

e) Transitional Contacts.

f) Eight separate sequencers.

g) Convert discrete inputs into BCD register values, and vice verse for coils.

h) Binary Converts.

i) Move functions.

j) Skip Logic.

4.2.1 Relays

When programming relay contacts into the general format (see Fig. 3.2), any horizontal arrangement of Normally Open or Normally Closed contacts can be used.

Normally Open: —| |—

Normally Closed: —|/|—

In addition, shunts (short circuits) or opens can be placed either vertically or horizontally between any two adjacent nodes; contacts cannot be placed vertically. Power flow can occur only from the left leg towards the right or vertically (up or down); power flow is not possible in the reverse direction (right to left). Logic coils (0XXX references) are divided into references that can be used to control discrete outputs, or to provide completely internal references as follows.

0001-0256 Output Coils

0258-0512 Internal Coils

Internal coil 0257 is an internal indication of battery voltage. This reference will be ON as long as this voltage is sufficient to insure retention of memory. Whenever the batteries reduce their capacity to a minimum level, this coil will be de-energized and the Battery error LED of CPU module comes ON. This is a warning level only; the batteries will still be able to maintain memory for at least 30 days without AC power.

Any logic coil (output or internal) can be used as a coil only once; however, references to contacts controlled by that coil can be used as many times as required. There is no limit to how many times any reference (0XXX-coils, 1XXX-discrete inputs, 2XXX-sequencer steps, 3XXX-input registers, and 4XXX-holding registers) is used in a program. Output coils that are not used to drive discrete outputs (e.g., no output module assigned to that address in the I/O section), can still be used as coils in programming. Thus any unused output coils can be used for internal functions, exactly as internal coils are used.

Example Logic:

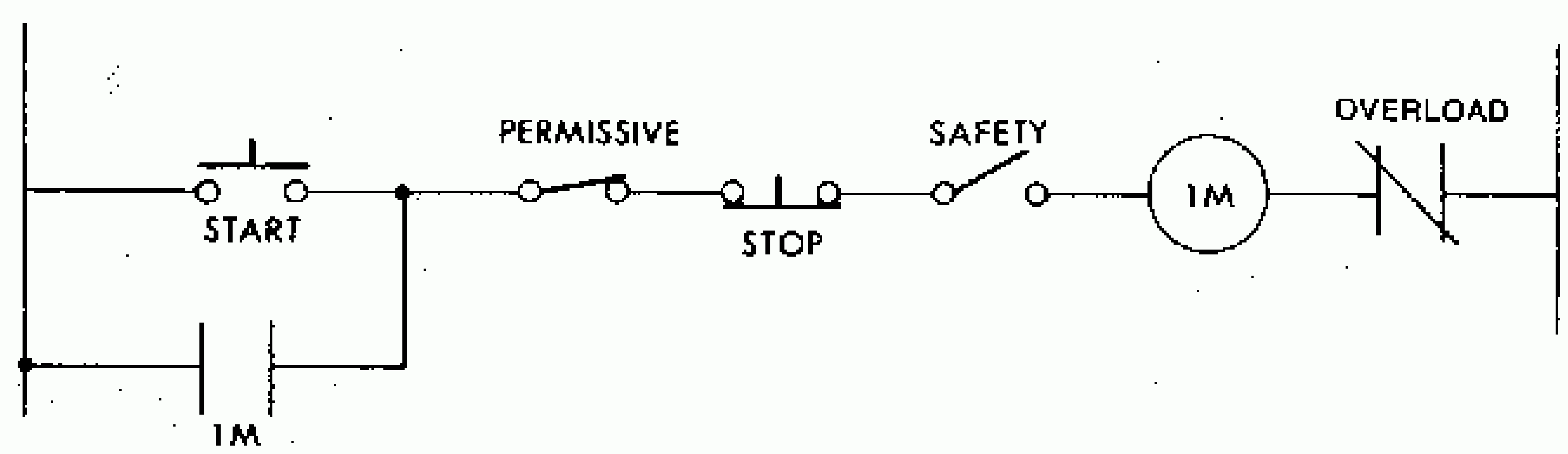


Fig. 4.1 Example Relay Logic

If the logic in Fig. 4.1 were to be implemented in the R84H controller, the control elements must be connected to input circuits in the I/O configuration and outputs assigned. Any available inputs of the proper voltage level can be used; Fig. 4.2 illustrates assumed input assignments and wiring details. Output number 12 is assigned to operate the external device. The resultant internal logic to be programmed by the user is shown in Fig. 4.3.

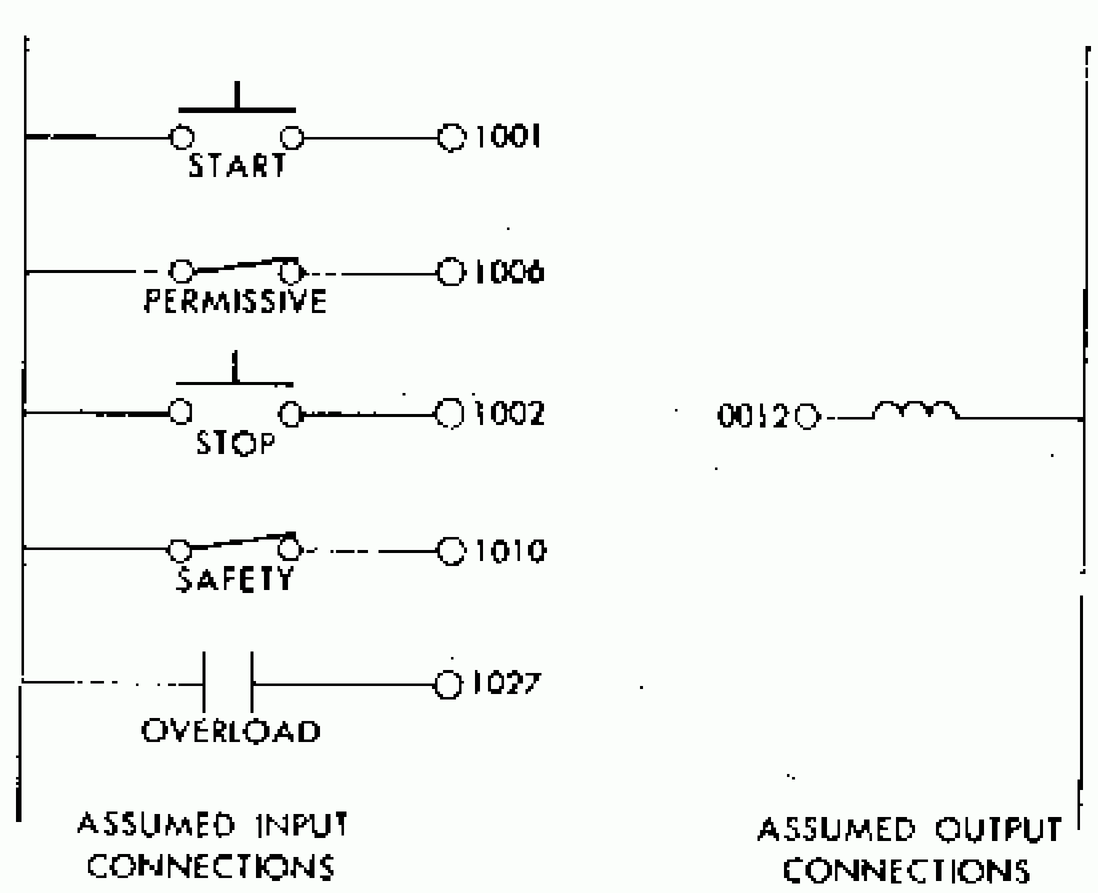


Fig. 4.2 Assumed I/O Wiring

4.2.1 **Relays** (Cont'd)

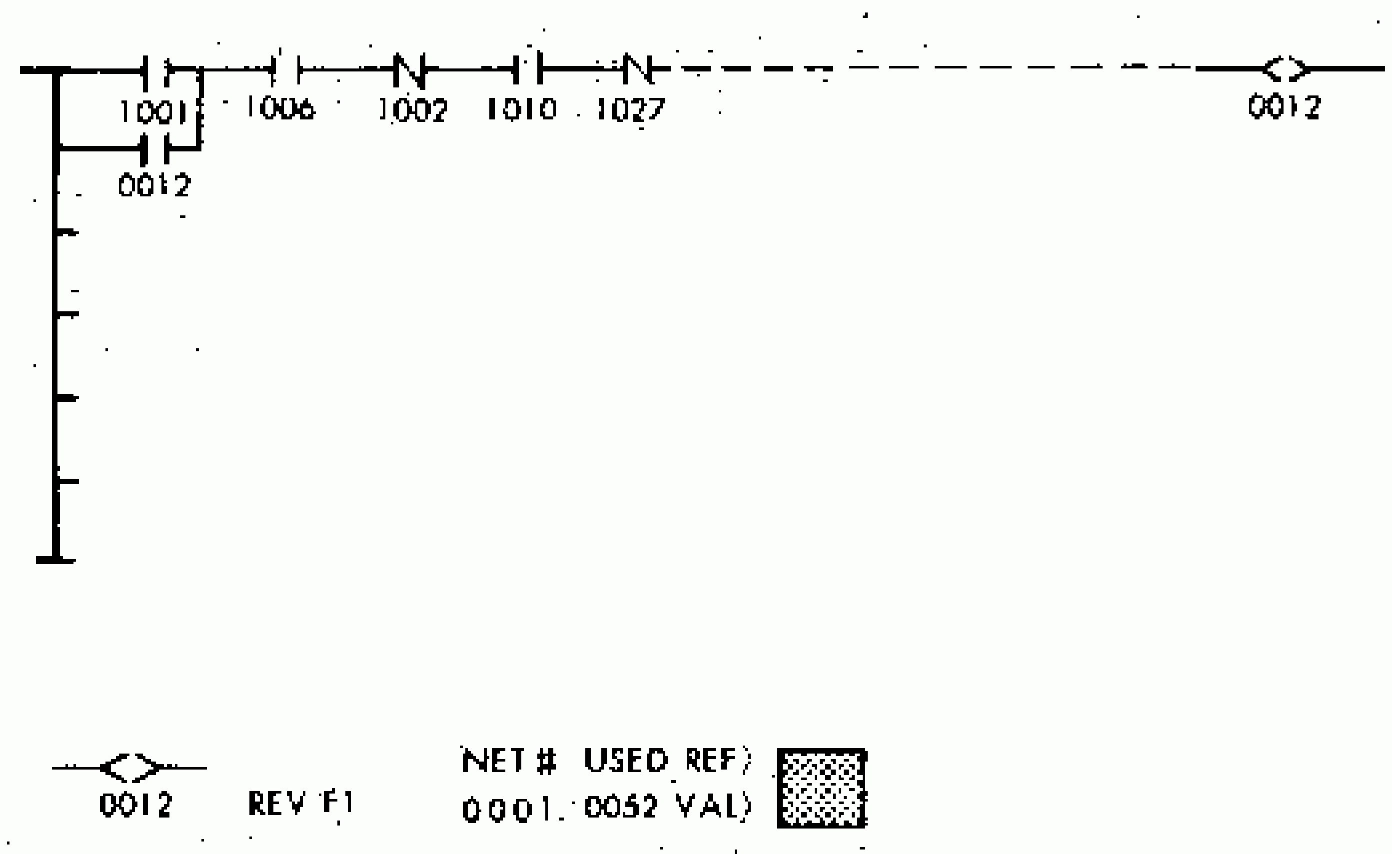


Fig. 4.3 Equivalent R84H Program

NOTE

Any input that is wired normally closed (e.g., 1006 and 1010), will be normally energized (ON reference). When used in the logic it should be programmed as a normally-open contact which will allow power to flow unless the input is de-energized.

Latches

Any logic coil can be latched, such that it is returned to its previous state (ON or OFF) after a power failure, similar to a latching relay. Thus, if a latched coil is ON and power is lost, it will return to the ON state when power is restored, regardless of how long power was lost. Of course, if the coil was OFF, it will remain OFF when power is restored. All logic coils that are not latched will be de-energized when power is restored (power up).

To latch a logic coil, its coil symbol is changed to ——(L)—— in lieu of the normal ——( )——. No relay contacts need be programmed to implement a latch function, nor is any time delay between logic coils and their latch. As soon as a logic coil is energized or de-energized, latch is also set or cleared respectively. All logic coils (outputs or internal) are latchable. If the logic coil of Fig. 4.3 were to be latched, it would be programmed as shown in Fig. 4.4.

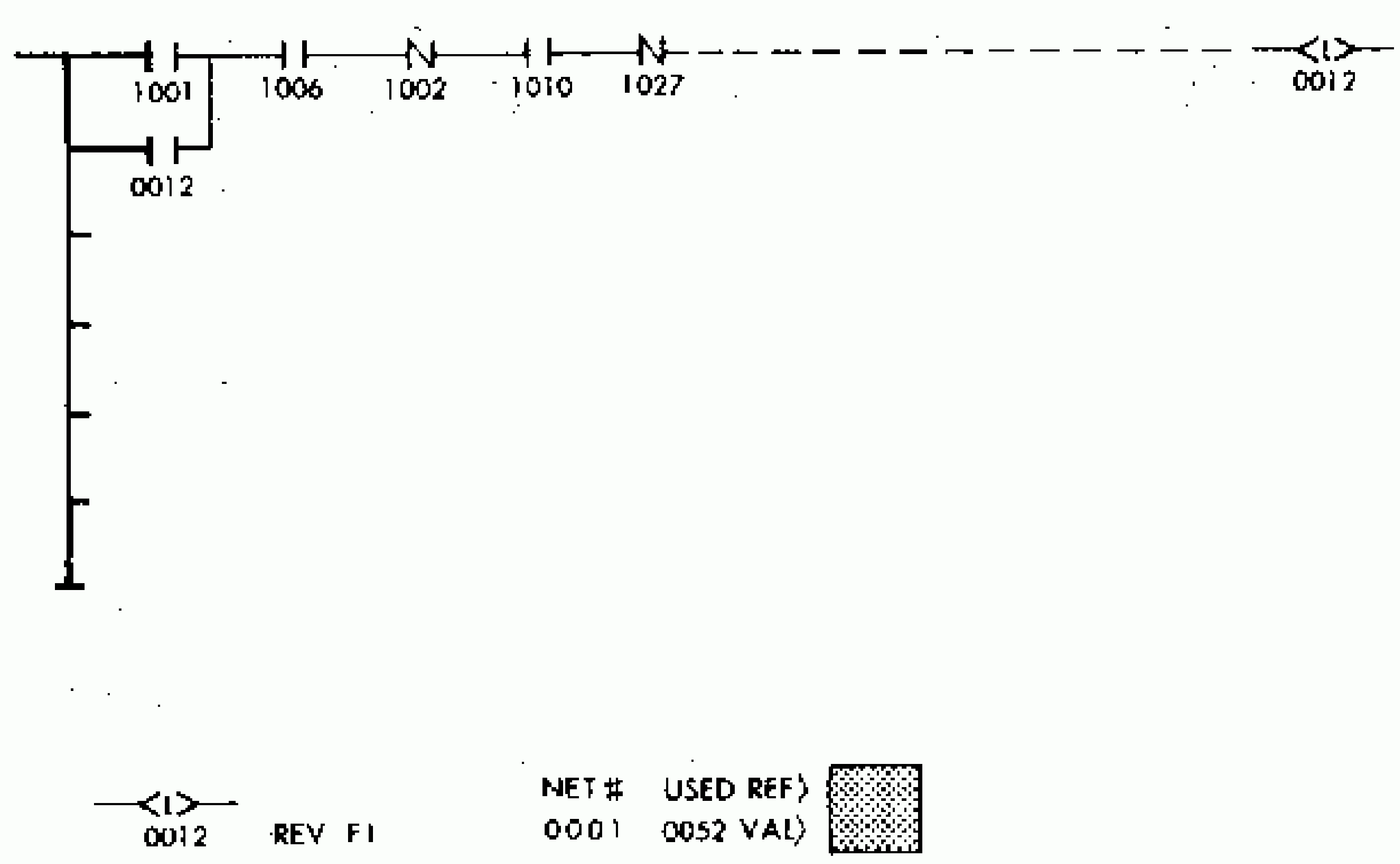


Fig. 4.4 R84H Latched Program

Extended Logic

If more than ten elements are required in a rung to satisfy a complex control function, an internal coil can be used to represent a partial result. A contact referenced to this coil is then placed as the first element in another network and additional contacts are entered into this second network. The coil of this second network can be an output that represents the resultant logic of up to 19 series elements or an internal coil for further extension of the logic. There is no limit to how many times the logic is cascaded in this manner. Internal coils can also be used with up to ten elements to represent a single block of logic that is to be used repetitively in the program. As an example of extended logic, refer to Fig. 4.5.

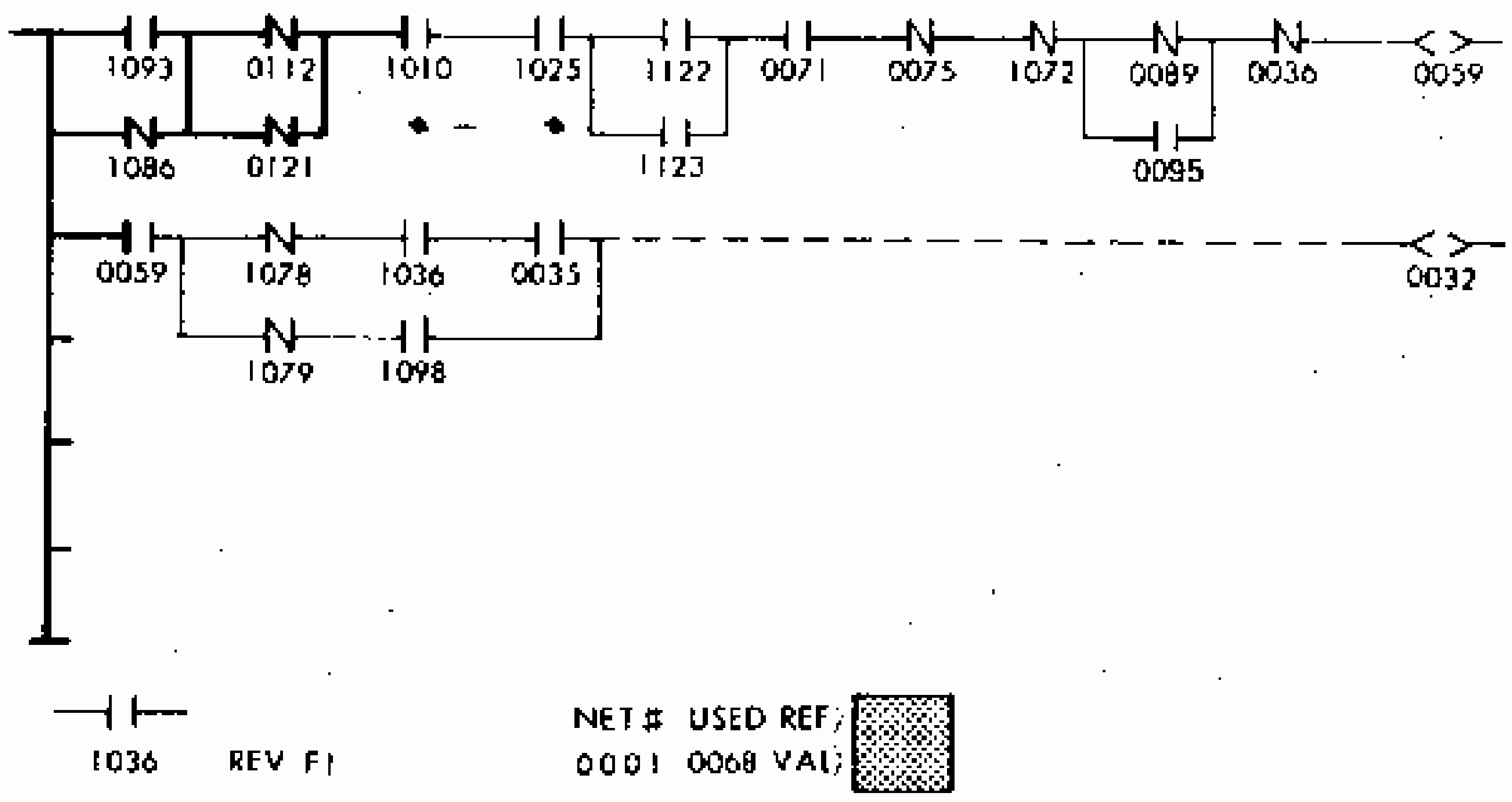


Fig. 4.5 R84H Extended Logic Program

Example of Programming Using P180 Programming Panel

If the logic Fig. 4.3 were to be entered into the R84H Controller, the following steps are utilized assuming the Programming Panel has been connected to the R84H peripheral connector.

1. Dpress START NEXT to create a new network. Verify that the left leg has a small break indicating where the new network will be constructed. The cursor will be at the location where the first element is to be entered.

2. Into the assembly area at the lower left of the CRT screen, the first element is developed. The normally open (⊣⊢) pushbutton is depressed, reference number is entered with the keypad (1, 0, 0, 1) below the contact, and finally the vertical short is entered at the right end of the contact. This element can be developed in any order that is convenient for the operator.

NOTE

Errors are easily corrected by reentry of only affected values.

3. Once completely developed, the element can be moved into the network by depressing the ENTER pushbutton. If corrections to an element already in the network are desired, only the corrected portion of this element (contact type reference numbers, or vertical connector) need be placed in the assembly area.

4. The cursor is moved to the next element location in the network.

5. Repeat steps 2, 3, and 4 for other elements in the network. After all elements are entered, the coil is entered and labeled with any unused output or internal logic coil.

NOTE

The CRT will automatically display horizontal shunts between the last programmed element and the coil in the extreme right column. These shunts will appear as dotted lines and do not require memory locations in the R84H Controller. If these shunts were programmed by the user, they would use memory.

4.2.2 Timers

Timers can be placed anywhere in a network where sufficient space exists. As long as sufficient room exists, more than one timer can be placed in a network. Timers are built vertically and require two elements, one on top, the other on the bottom; the general form of a timer is shown in Fig. 4.6. Within the R84H Controller is three crystal-controlled clock signals that drive all timers. Any timer can be programmed to respond to either the seconds clock or 1/10 second clock or 1/100 second clock; there is no limitation on which or how many timers are referenced to either clock signal.

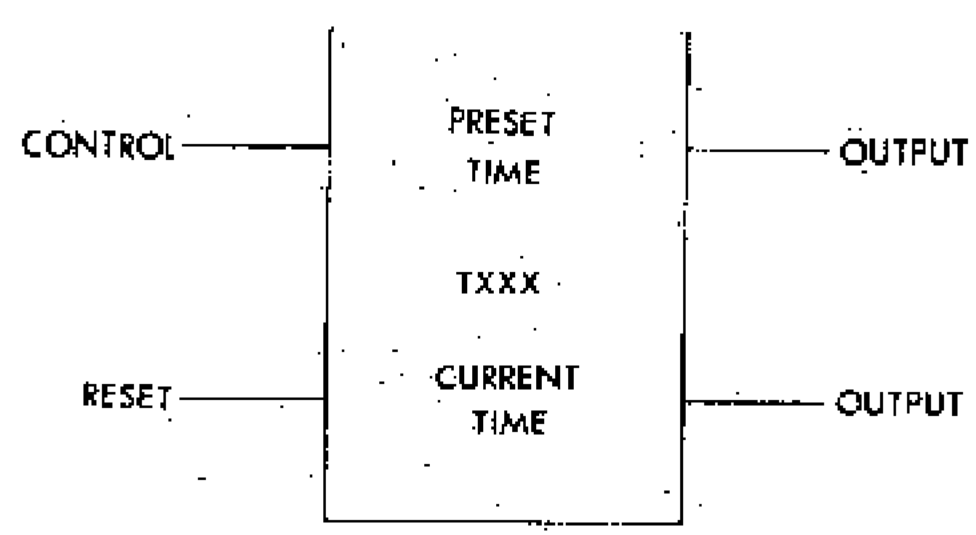


Fig. 4.6 Timer Format

Referring to the typical timer of Fig. 4.6, there are two nodes for entry of relay contact type control to the left of the timer. The upper node controls when the timers accumulate time and the lower node controls when the timer is reset to zero; the timer is enabled when the lower node receives power flow, and reset when no power flow is available. The upper element of the timer contains the preset value which limits the maximum value of the timer. This preset can be a fixed value of three digits (0001 to 0999), which represents up to 999 seconds (timer in seconds) or up to 99.9 seconds (timer in tenths of seconds) or up to 9.99 seconds (timing in hundredths of second). The timer can never exceed this preset value. The lower element refers to a storage location within the Controller where the current time is stored. In the center of timer is a display to indicate the rate at which that particular timer is programmed to operate (T1.0 = seconds, T0.1 = tenths of seconds, and T.01 = hundredths of second).

On the right of the timer are two nodes from which the logical output (i.e., coil) of the timer are available. These will provide power to any contacts, shunts, coil etc. programmed to the right of the timer. The upper node provides power only when the timer is at its preset value; this output will be de-energized and stops providing power whenever the lower node on the left (reset) stops receiving power. Whenever this output is energized, the timer stops and no further accumulating of time beyond the preset is possible. The lower node provides power whenever the timer is NOT at its preset (exact opposite of upper node). This output will stop passing power only when the timer is at its preset.

With the timer enabled (lower node on left receiving power), the timer will accumulate time whenever the upper node on the left receives power. The upper signal can be turned ON-OFF-ON as many times as necessary and the timer will accumulate how long the signal was ON up to the preset value. Each time the upper node is re-energized, time begins to be accumulated from its previous value held in the storage location, regardless of how long this signal was OFF. Timers are accumulative, they are reset only by the lower node signal, and they are completely retentive on power failure. Whenever the reset signal (lower left node) is de-energized regardless of the time value, the timer will be reset to zero and held at that value until the reset signal is re-energized.

Specifying Time

The upper element (or box) of the timer is reserved for entering the desired amount of time, in seconds or tenths of seconds, to which the timer is to time. The units digit is a value from zero to nine; whether it specifies up to 9 seconds or 0.9 seconds or 0.09 seconds will depend on which type of timer is selected (seconds of tenths of seconds or hundredths of seconds). This reference can be to a fixed value up to 0999, or to a register quantity. When referenced to a register value, the content of that register is used as the preset value, again up to three digits (0XXX).

Storing Time

The number entered into the lower element of the timer must be a storage register (reference 4XXX) wherein the current time is stored. Registers are an extremely useful concept and should be examined closely. Fig. 4.7 illustrates the R84H memory in a block diagram format.

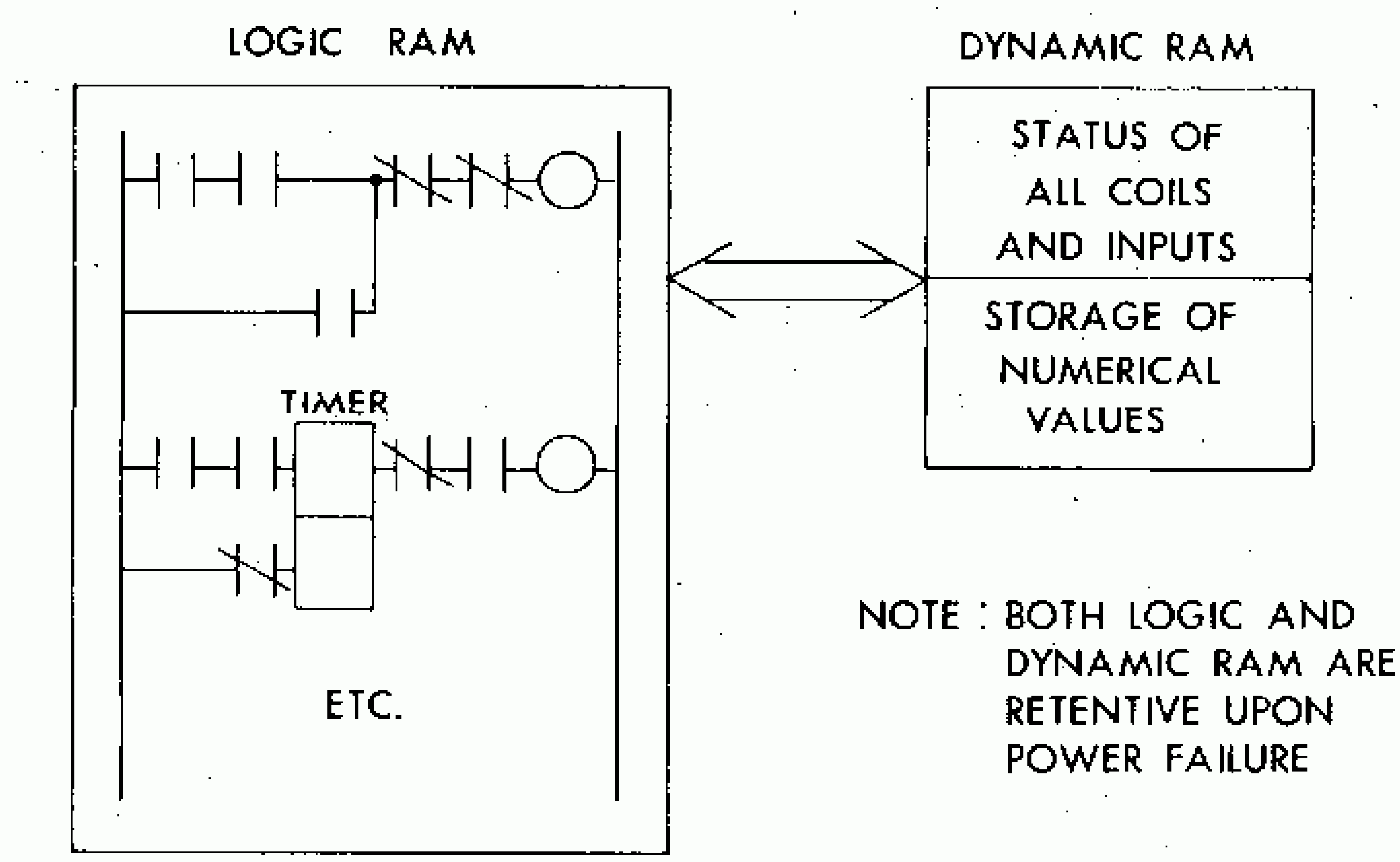


Fig. 4.7 Relationship Between Logic and Dynamic RAM

Registers are locations within the memory where numerical values, up to three digits (999) are stored. A simple definition of registers would be a "mailbox" or "bucket" where information (in this case, time) is permanently stored. The registers are referred to or named by reference numbers beginning with 4001 and continuing consecutively to the maximum memory.

NOTE

Holding Registers are inherently retentive upon power failure.

Normally, each timer will have its own holding register selected by the user. Thus the maximum number of timers available is the quantity of holding registers. Do not use a holding regester as the storage location for more than one timer. Fig. 4.8 shows an example of a timer.

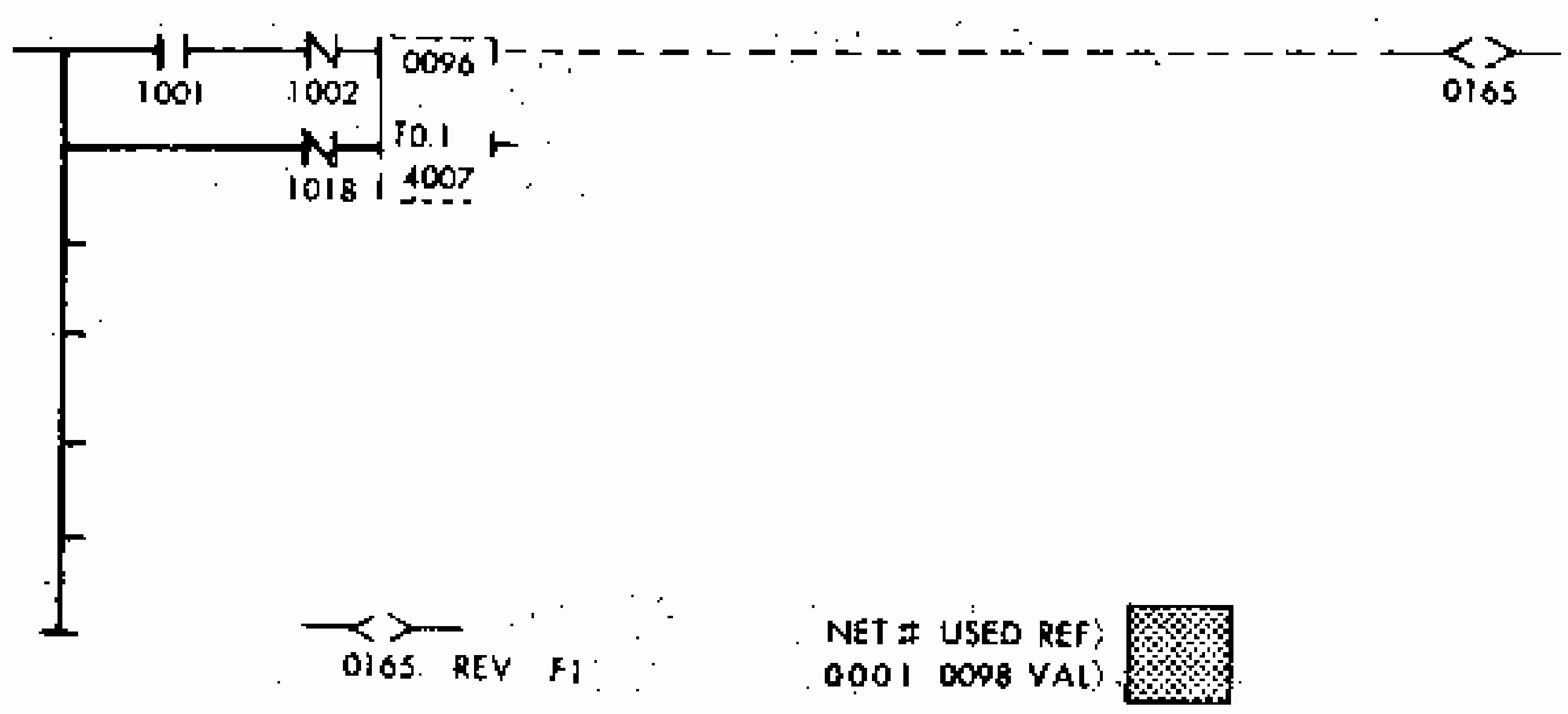


Fig. 4.8 Sample Timer

The timers in the R84H Controller are ON-delay energizing timers. To obtain other types such as OFF-delay energizing, ON-delay de-energizing, or OFF-delay de-energizing, the programming is adjusted to obtain the desired result. For OFF-delaying action, the energizing logic (upper node, left side) is programmed with reverse logic, i.e., normally closed contacts instead of normally open contacts. To have de-energizing action, the lower output of the timer is used in lieu of the upper output.

In addition, a shunt can be connected to any timer between the nodes on the left of the timer. With such a shunt, the timer is both energized and enabled by the same logic; thus, timer will not accumulate time, and is reset to zero whenever it stops timing. Figs. 4.9 to 4.12 illustrate the four various types of timers, none of which are accumulative. Input 1053 is used to start the timers, and coil 0019 is the output reflecting the desired timing signal. Of course, additional logic can be added to either input 1053 or the output or both up to ten elements per horizontal rung. Fig. 4.13 illustrates the timing relationship of the various types shown in Figs. 4.9 to 4.12.

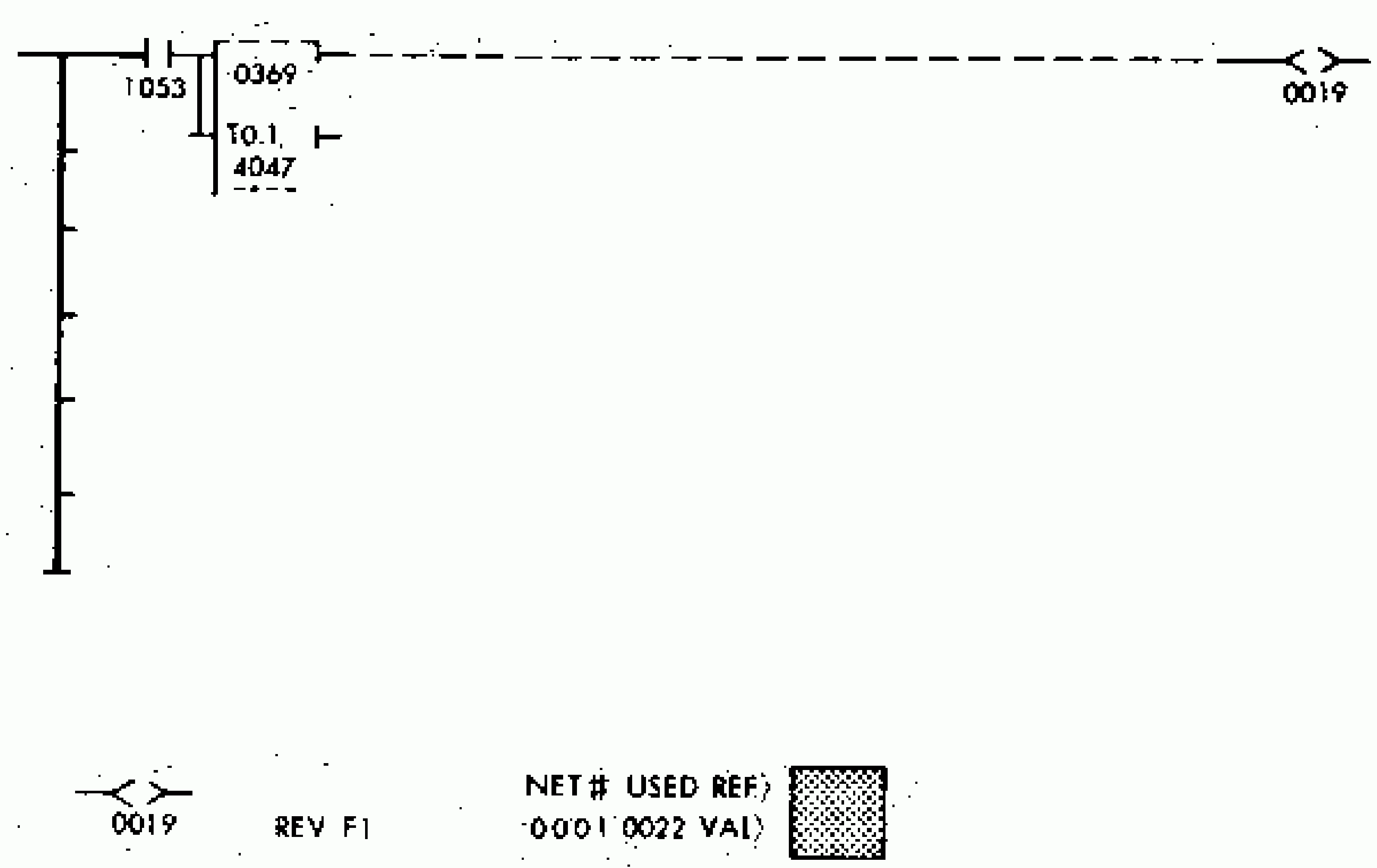


Fig. 4.9 ON Delay Energizing Timer

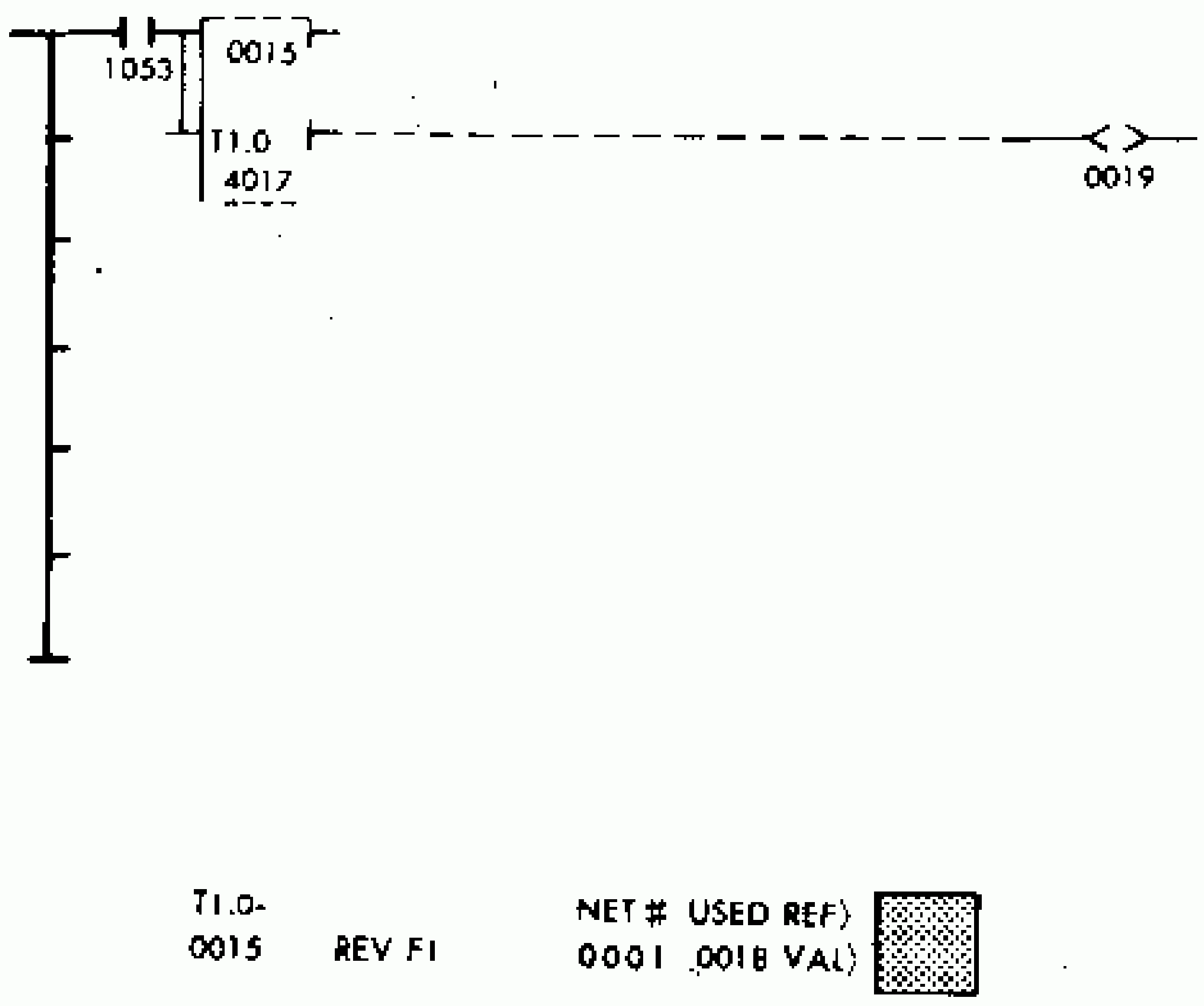


Fig. 4.10
ON Delay De-Energizing Timer

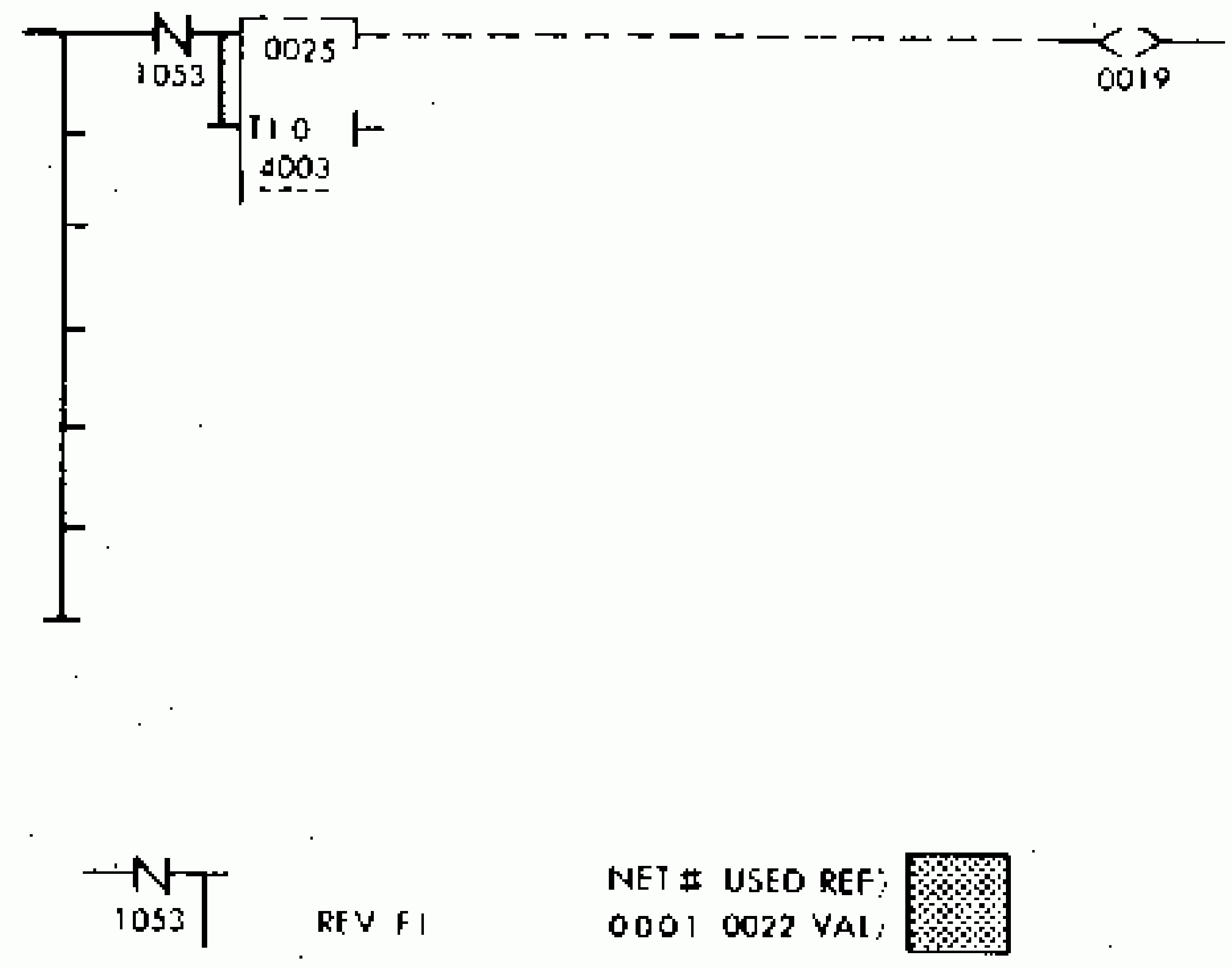


Fig. 4.11
OFF Delay Energizing Timer

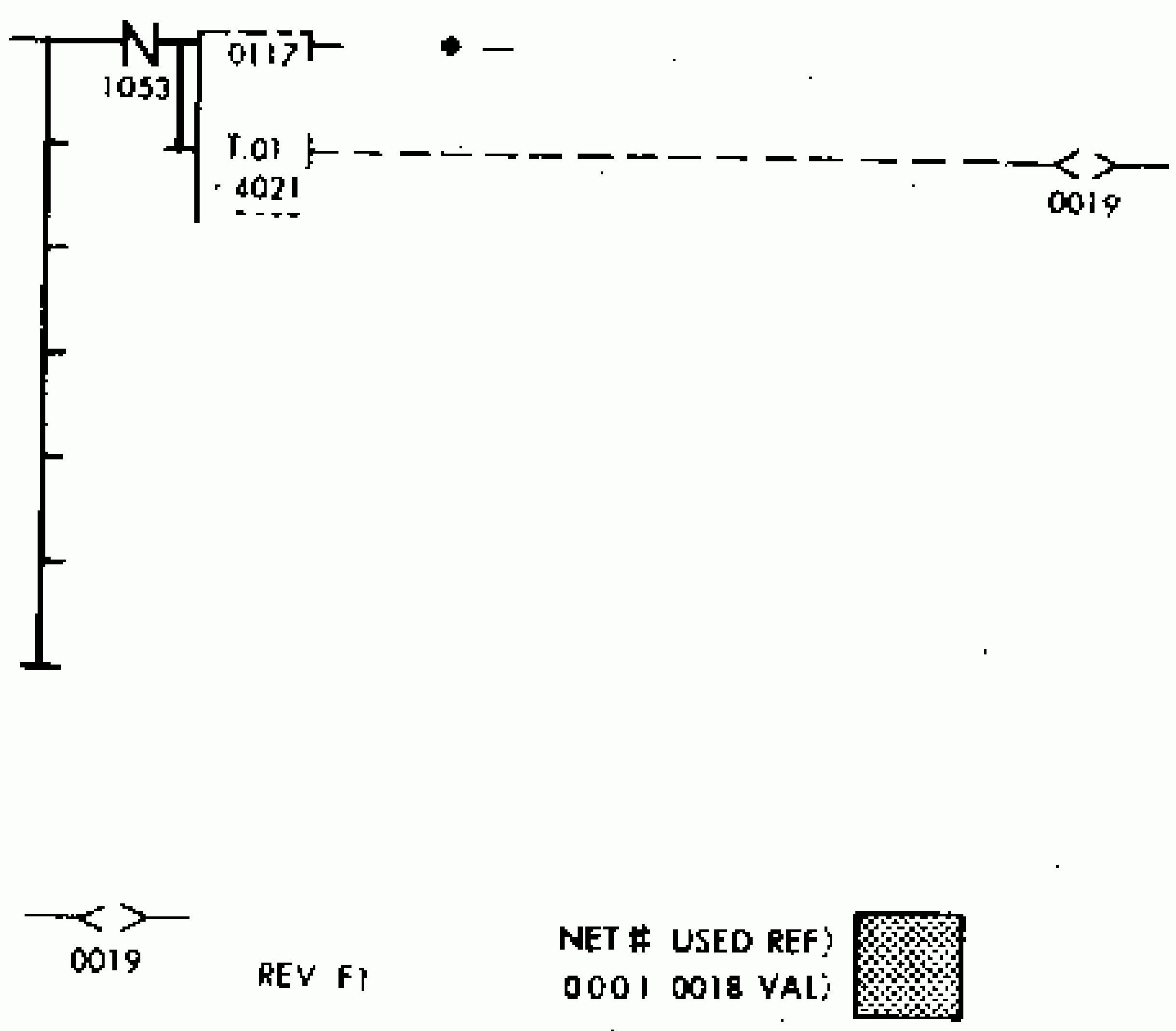


Fig. 4.12
OFF Delay De-Energizing Timer

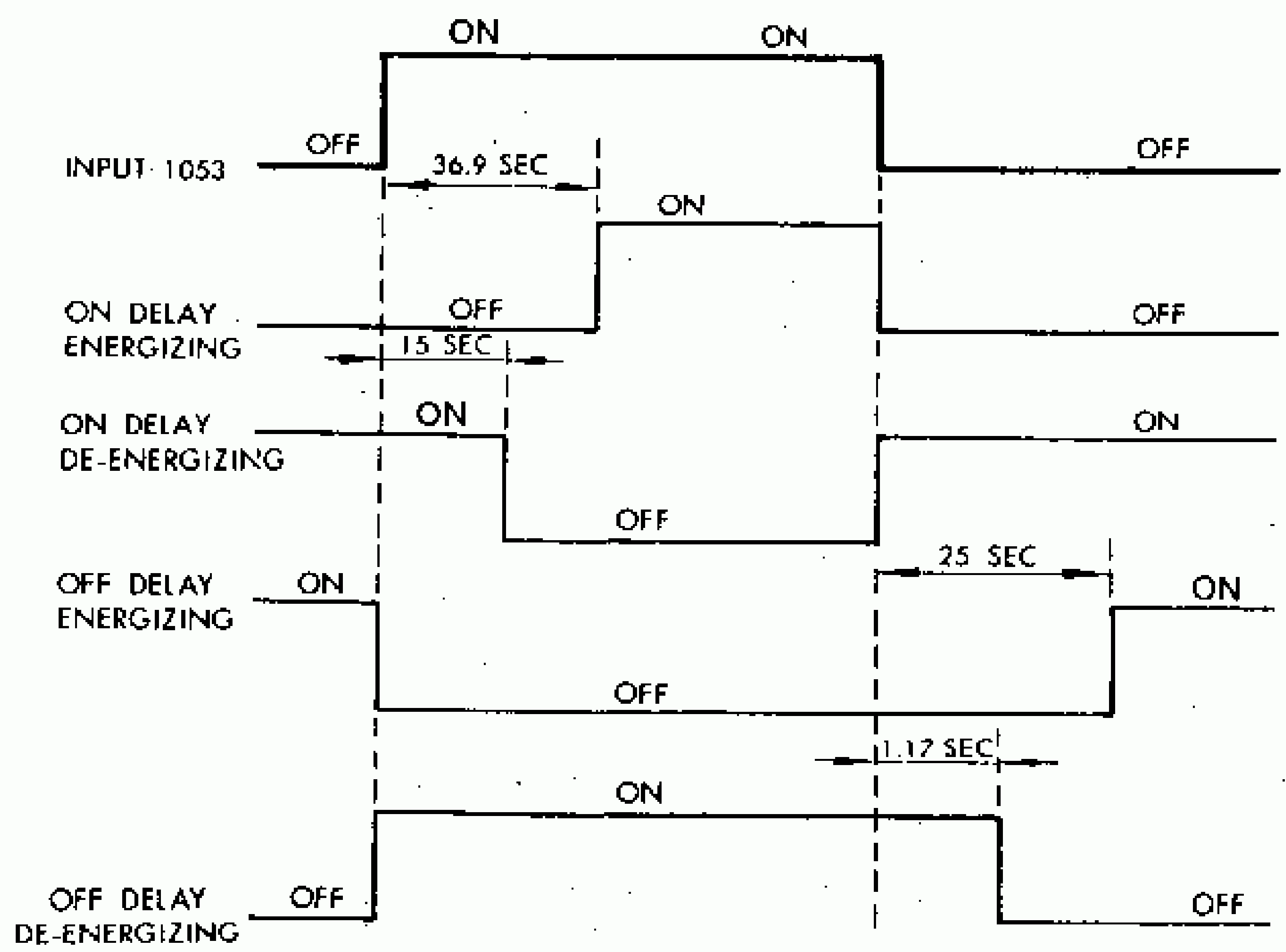


Fig. 4.13
Timing Relationships

4.2.3 Counters

Counters operate exactly the same as timers previously discussed, except for the control node (upper left node of the timer). The counter increments its current count by one whenever the control signal goes from OFF (de-energized) state to the ON (energized) state. Only on this positive (OFF to ON) transition is the count incremented. If the control signal remains ON for several hours, it represents only one transition and thus one count.

The lower left node still controls the enable/reset of the counter; whenever this signal is de-energized (no power flow), the counter is reset to zero and held there until the signal is again energized. The number of events to be counted (up to 999) is entered into the upper element of the counter and the current count is stored in a holding register identified in the lower element of the counter. Unique registers should be used to store the current time or count of each timer/counter; do not share holding registers between timers or counters.

The output of the counter (upper node or right side) is energized whenever the current count equals the preset; counting stops at the preset value. Whenever the counter is reset to zero via the lower node on the left side, the coil is de-energized. The current count is retentive on the power failure since it is stored in a holding register (reference 4XXX). Counters also have a second output (lower right node) that provides power flow as long as count is NOT at its preset.

Cascaded Counters/Timers

Timers and counters can be cascaded or interconnected to satisfy any required logic. Fig. 4.14 illustrates a cascade timer and counters to produce a calendar measuring time in seconds, minutes, and hours.

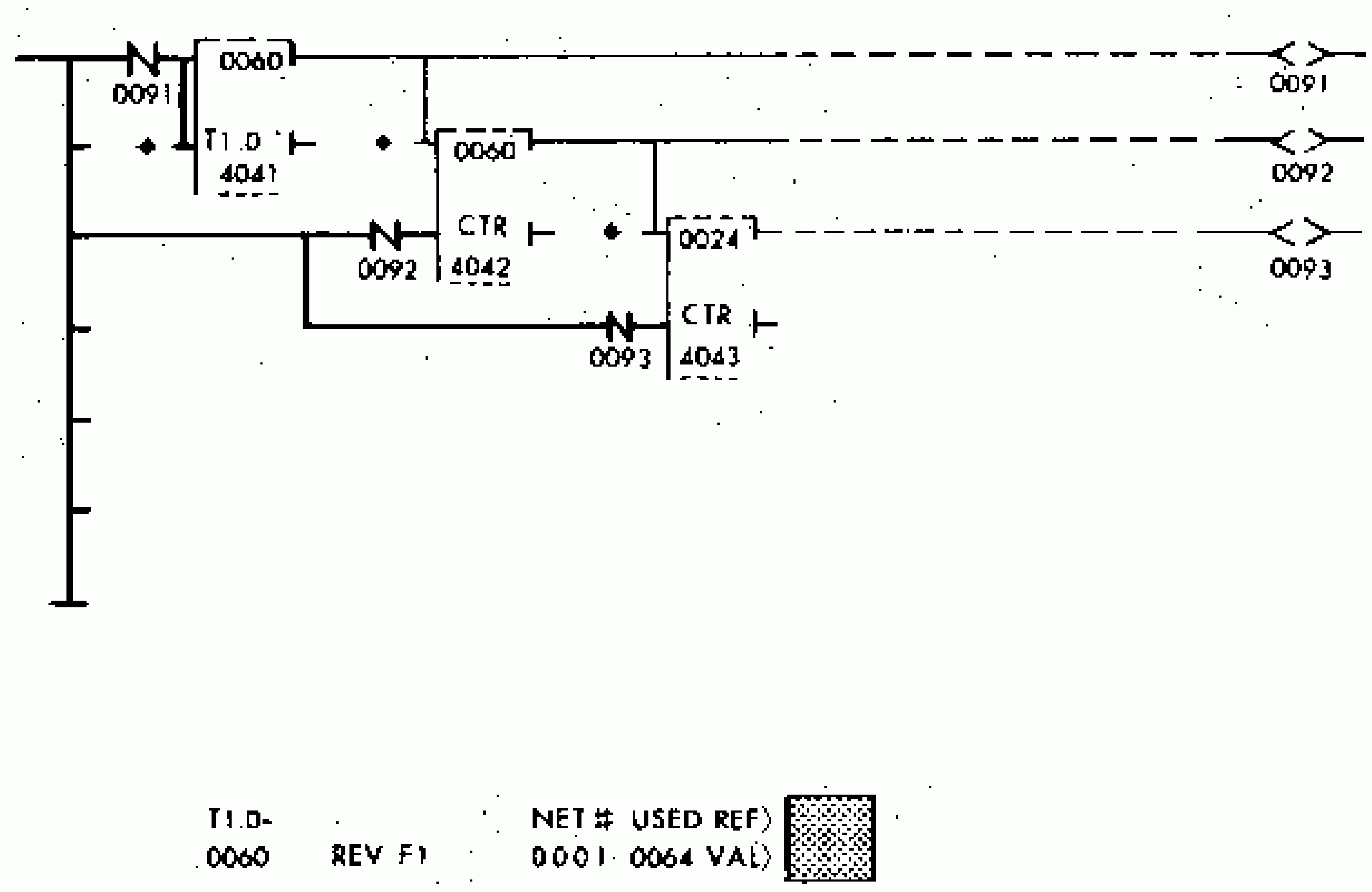


Fig. 4.14 Sample Timer/Counter Cascaded Logic

Entering a Timer or Counter

If the logic of Fig. 4.8 is to be entered into a R84H Controller with the P180 Programming Panel, the following steps can be utilized. It is assumed that memory protect is OFF and the Programming Panel has been properly connected:

1. Depress START NEXT to create a new network. Verify that the left leg only is now displayed indicating where the new network will be constructed. The cursor will be at the location where the first element is to be entered.

2. Into the assembly area at the lower left of the CRT screen, the first element is developed. The normally open —| |— pushbutton is depressed and the reference number is entered with the keypad (1, 0, 0, 1) below the contact.

3. Once completely developed, the element can be moved into the network by depressing the ENTER pushbutton.

4. The cursor is moved to the right, and the next element (1002) is entered by repeating steps 2 and 3.

5. The cursor is moved again to the right into the third column. The SHIFT pushbutton is depressed.

NOTE

The letter S will appear at the bottom of the CRT screen as long as the shift control is active.

6. To create a timer incrementing in tenths of a second, the digit 2 on the keyboard is depressed. This key is labelled T0.1 near the top of the key.

7. Into the assembly area, the value 96 is entered from the keypad (0, 0, 9, 6). The ENTER pushbutton is depressed to move the element into the network. The CRT screen will now display the timer format in the third column, with a preset of 0096 and a current time storage location of 4000.

8. The cursor is moved down, the value 4007 entered into the assembly area, and the ENTER pushbutton is depressed. The timer will use register 4007 to store its current time.

9. The cursor is moved to the left, the contact —|/|— 1018 is entered into the assembly area, and the ENTER pushbutton is depressed.

10. The cursor is moved to the left again (next to power rail) and a shunt is assembled and entered as previously discussed.

11. The cursor is moved to the upper right node of the timer where its output is shown. The coil —( )— pushbutton is depressed, and the value 165 is entered into the assemble area.

12. The ENTER pushbutton is depressed and the CRT will automatically place the coil at the right power rail and connect it with dotted shunts. Dotted shunts do not require memory within the controller.

4.2.4 Arithmetic Functions

All arithmetic operations require three elements placed vertically, one above the other (see Fig. 4.15). Both the top element and the middle element can be either fixed three digit value (maximum 0999) or a register reference; however, the bottom element must be a holding register (4XXX reference).

NOTE

> If register I/O is provided, input registers (30XX) can be used in the upper or middle element. The last holding register (e.g., 4254) and the last input register (e.g., 3032) can NOT be used in any element of an arithmetic operation.

Each arithmetic function has one input node at the top left that controls when the operation is performed, and up to three output nodes at the right. Each and every scan of the controller that the input node receives power flow, the arithmetic function is performed regardless of type. Up to three outputs are possible from a single arithmetic function, depending upon type. These outputs are updated every scan the input node receives power.

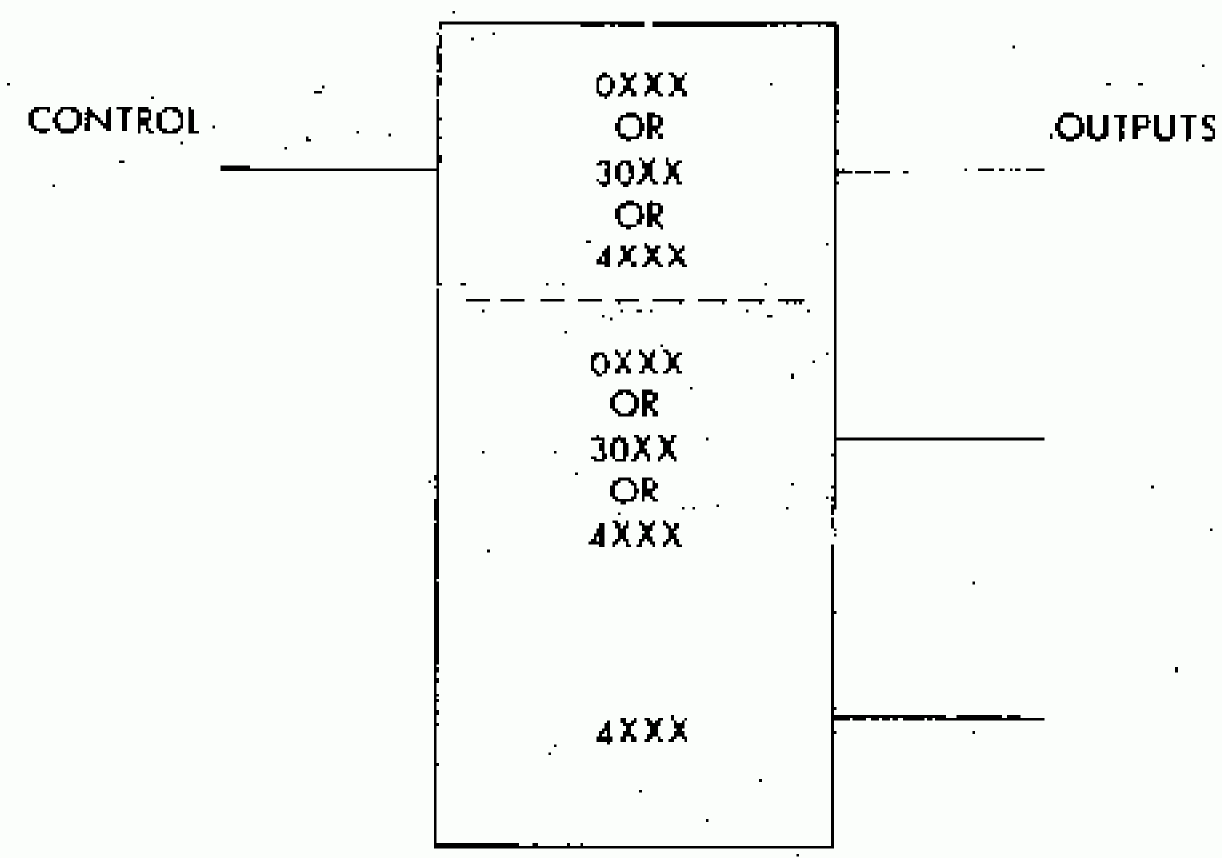


Fig. 4.15 Typical Calculate Logic

NOTE

> No outputs can be energized until the input node receives power.

ADDITION

This function adds the upper value to the middle value, and places the sum into the holding register addressed in the lower element. The upper or middle values can be fixed (000 to 999) or register reference (30XX or 4XXX); the lower element must be a holding register (4XXX). Only one output is provided with this function. If the result of an add function is a value greater than the holding register can store (three digits - maximum value 999), the portion of the result that will fit into the register is placed there. For example, if 850 is added to 325, the result is 1175. The value 175 (three least significant digits of result) is placed in the holding register and the upper output energized to indicate an overflow has occurred.

Example - Addition

Referring to the example in Fig. 4.16, when inputs 1017, 1123, and 1095 are all energized, the content of register 4027 is added to the fixed value 0050, and the sum placed in register 4021. If the content or register 4027 was 523, the result placed in register 4021 would be 573; this operation is performed every scan that the input node receives power flow. In this example, the output is utilized and connected to coil 0033; the use of the output and the coil assigned are optional functions that can be adjusted by the user. With the previously assumed value in register 4027, the output would not pass power; thus coil 0033 would be OFF. If the value in register 4027 was greater than 949 (i.e., 963), the output would energize coil 33. In the last example, since 963 plus 50 is 1013, and register 4021 can contain only a three digit value, the quantity 013 would be placed in register 4021, and coil 33 would be ON.

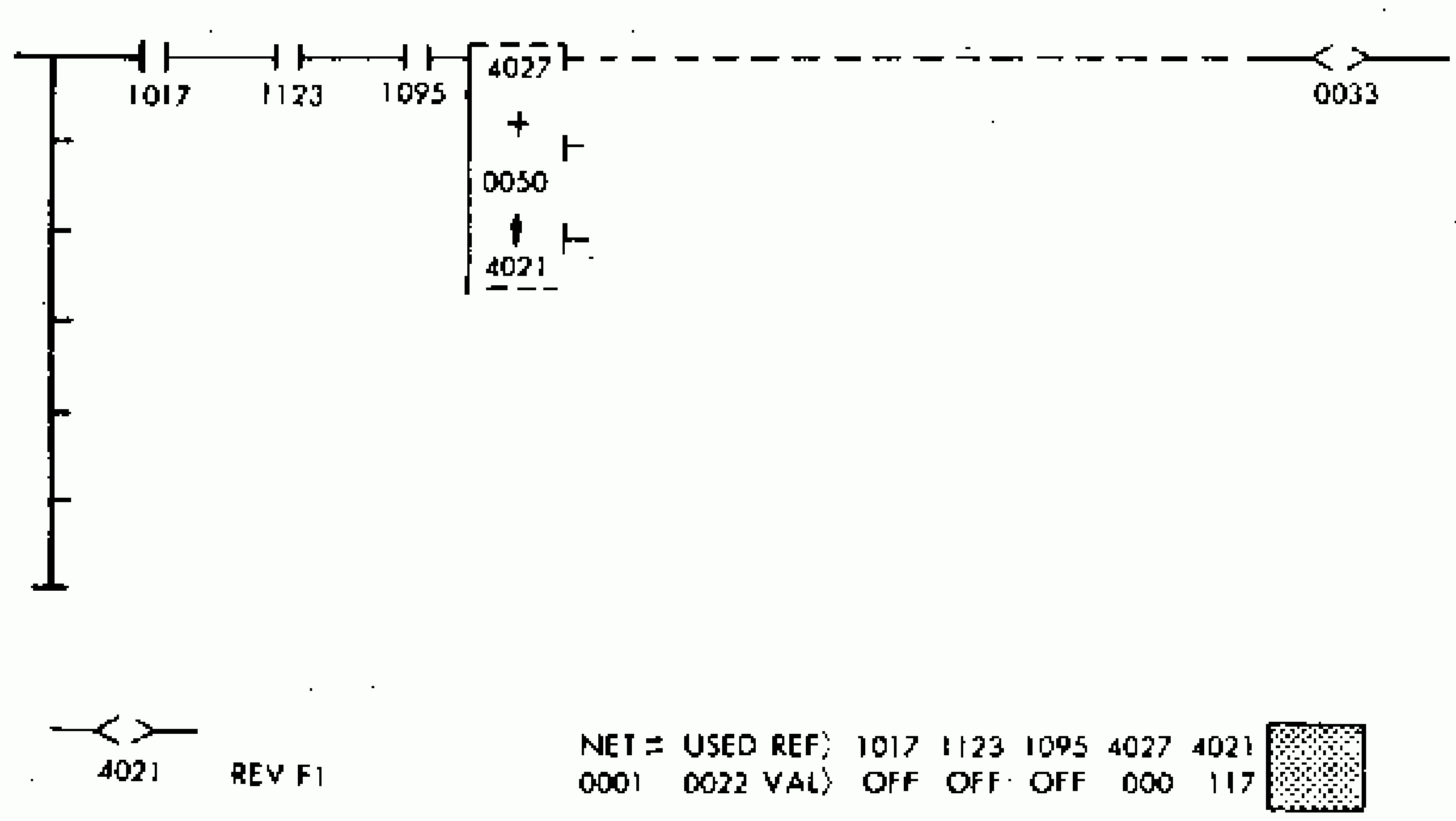


Fig. 4.16 Sample ADD Logic

SUBTRACTION

The subtraction function operates similarly to the add function, except that the difference of the upper and middle elements is placed in the lower element holding register. Additionally, there are three outputs to the right of the numerical elements. The upper output passes power when the upper value is greater than the middle value. The middle output is energized when the upper value and the middle element are exactly equal. Finally, the lower output passes power when the upper element is less than the middle element. The use of any or all of these outputs is at the user's option. Adjacent outputs can be connected with a shunt to provide greater than and equal or less than and equal functions when these are required.

Example - Subtraction

The use of the subtraction function is illustrated in Fig. 4.17. When coil 080 and input 1012 are energized, and coil 137 is de-energized, the content of register 4040 is subtracted from the content of register 4062, and the resultant difference placed in register 4063. If the content of register 4062 is 729 and register 4040 contains 453. when power flows to the input node, register 4063 is loaded with the value 276. This subtraction occurs every scan the input node receives power. When input 1028 is energized and the subtraction is being performed coil 139 will be energized since the result is a positive value (729 - 453 = +276). If the value in register 4040 is increased to 730 or above while register 4062 remains the same, coil 139 would be-energized since the subtraction function would no longer output power (729 - 730 = -1).

NOTE

The value placed in register 4063 (in this example) is the absolute value of the difference of the values. No sign is associated with the content or register 4063.

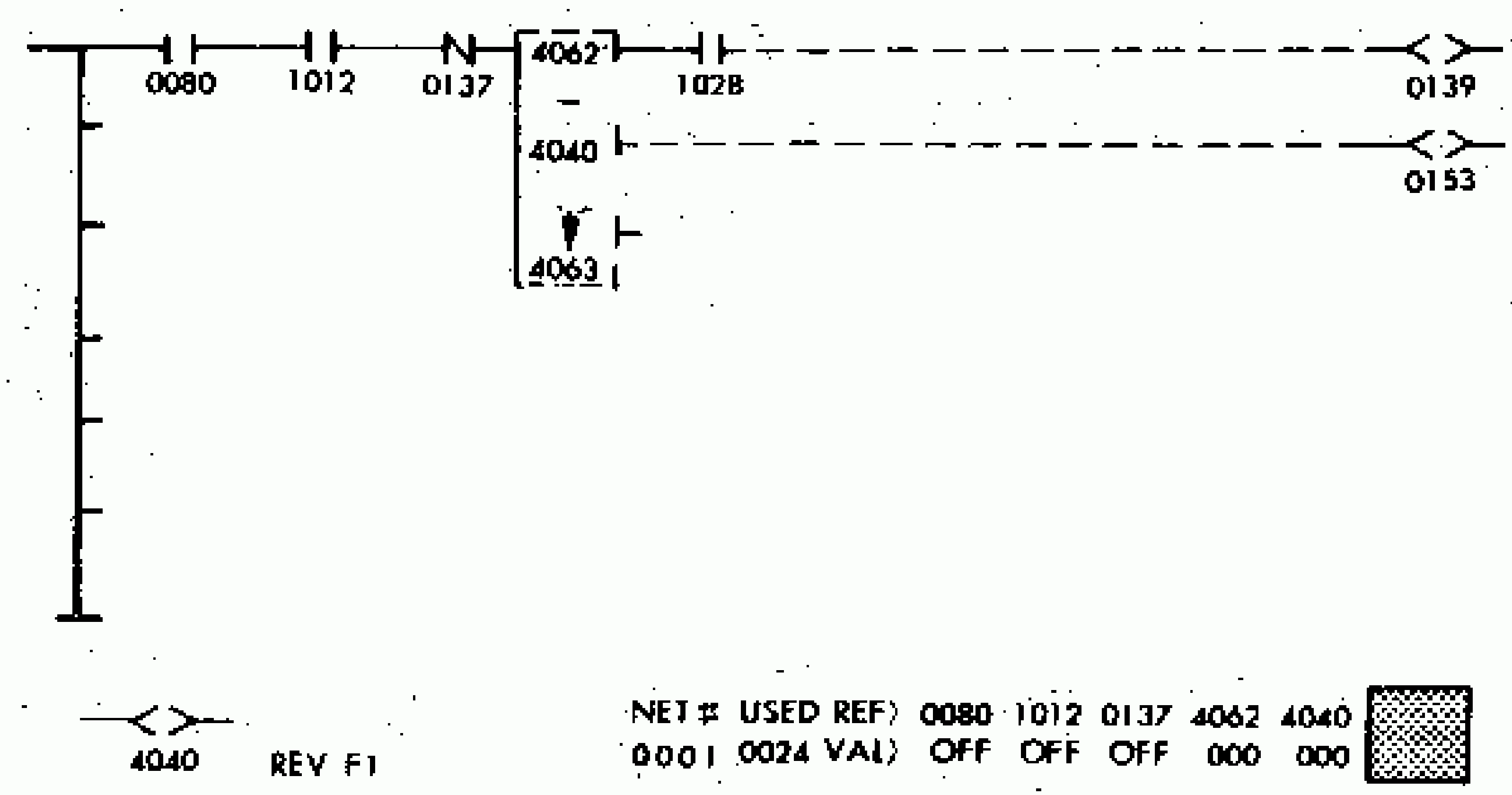


Fig. 4.17 Sample SUBTRACT Logic

When the values in registers 4062 and 4040 are equal, the middle output will pass power and coil 153 will be energized.

MULTIPLY

The multiply function takes the product of the upper value and the middle value, and places the result in two registers as indicated by the lower element. The multiply is performed every scan that the input node receives power flow. One output is utilized opposite the upper element which provides power whenever the multiply is performed (i.e., input node receives power). Since the multiply of three digit values can result in an answer up to six digits, the product is stored in two consecutive holding registers. For example, 150 multiplied by 325 is 48,750. This result is separated into 048 (high order) and 750 (low order) for storage into two holding registers. The register addressed in the lower element always receives the high order portion of the product, even if it is zero; the next holding register in numerical sequence receives the low order portion of the product.

NOTE

The lower element can not be programmed with the last available holding register provided with that controller's memory size.

Example - Multiply

As illustrated in Fig. 4.18, multiply operates upon two 3-digit numbers to produce a six-digit product. In this example, when input 1007 is energized, the value in register 4005 is multiplied by the value in holding register 4059, and the resulting product stored in registers 4036 and 4037. For example, if registers 4005 and 4059 contained the values 217 and 065, registers 4036 and 4037 would be loaded with the values 014 and 105 respectively, when input 1007 is energized. Every scan that this input is energized, a new value is placed in registers 4036 and 4037. If the values in registers 4005 or 4059 are altered, the resultant product will also change accordingly. In this example, the output is not utilized since its use is optional depending upon the control requirements. If an output was used the upper output would pass power whenever input 1007 is energized.

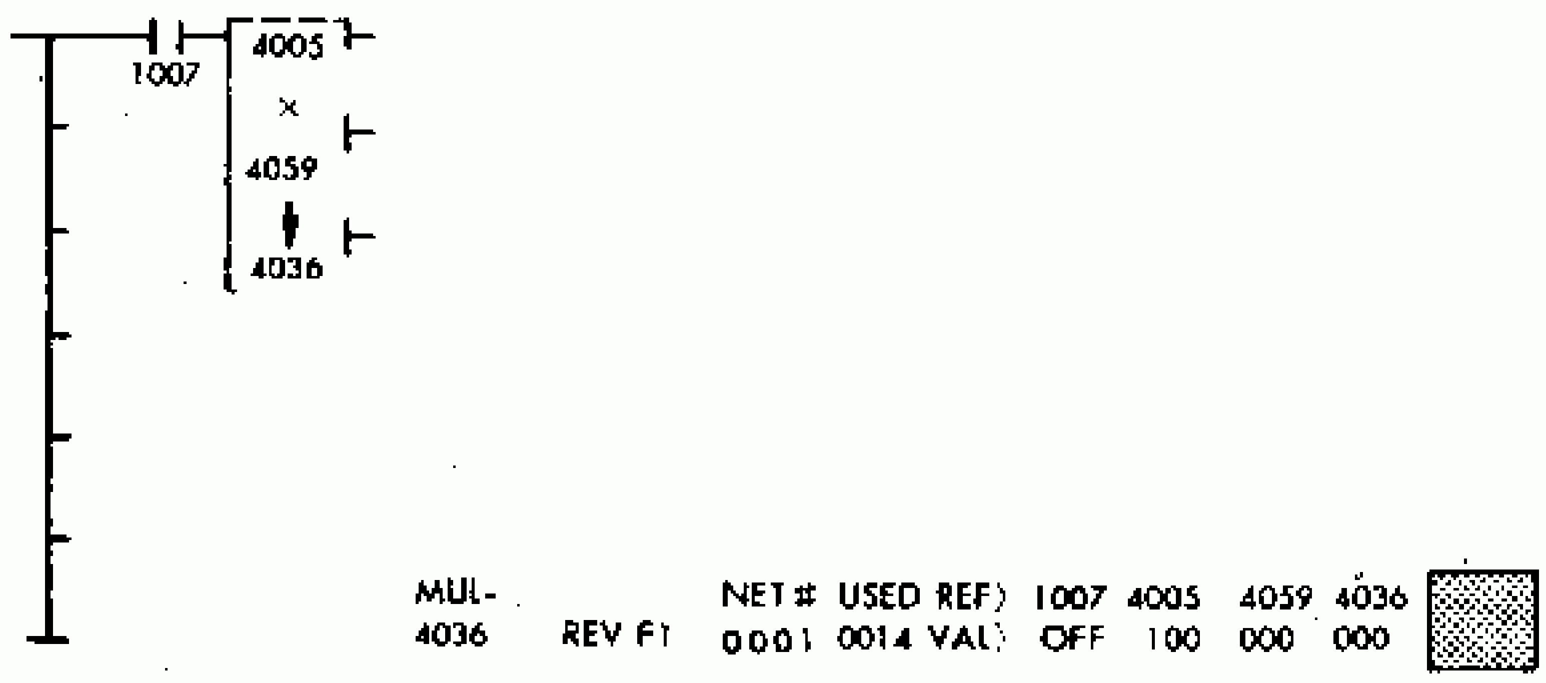


Fig. 4.18 Sample MULTIPLY Logic

DIVIDE

The divide function operates similarly to the multiply function, except that it results in the quotient of two numbers. The quantity referred to in the upper element (dividend) is divided by the quantity referred to by the middle element (divisor) and the resultant quotient is placed in the holding register indicated by the lower element. When the dividend is a register reference, it always is a double precision number (maximum 999,999) utilizing two consecutive registers; this can possibly be the result of a multiply, but does not have to be.

NOTE

> If the upper element is a fixed value (maximum 999), it becomes the dividend as a single precision value. If it is a register reference, it can not be the last available register of that type.

The middle element is the divisor (maximum 999) as either a single register reference or a fixed value. The lower element is a holding register reference (4XXX) in which the quotient is stored.

All three outputs are utilized by this function, and all require the input to receive power to operate. The upper output will pass power whenever the division is successful; the lower two outputs indicate when division is unsuccessful. The middle output will pass power if the quotient is too large (but not infinite) to fit on one register (exceeds 999). The lowest output will pass power if the divisor is exactly zero. When either of the two outputs are energized, the value 000 is placed into the lower element's register as the quotient.

Example - Divide

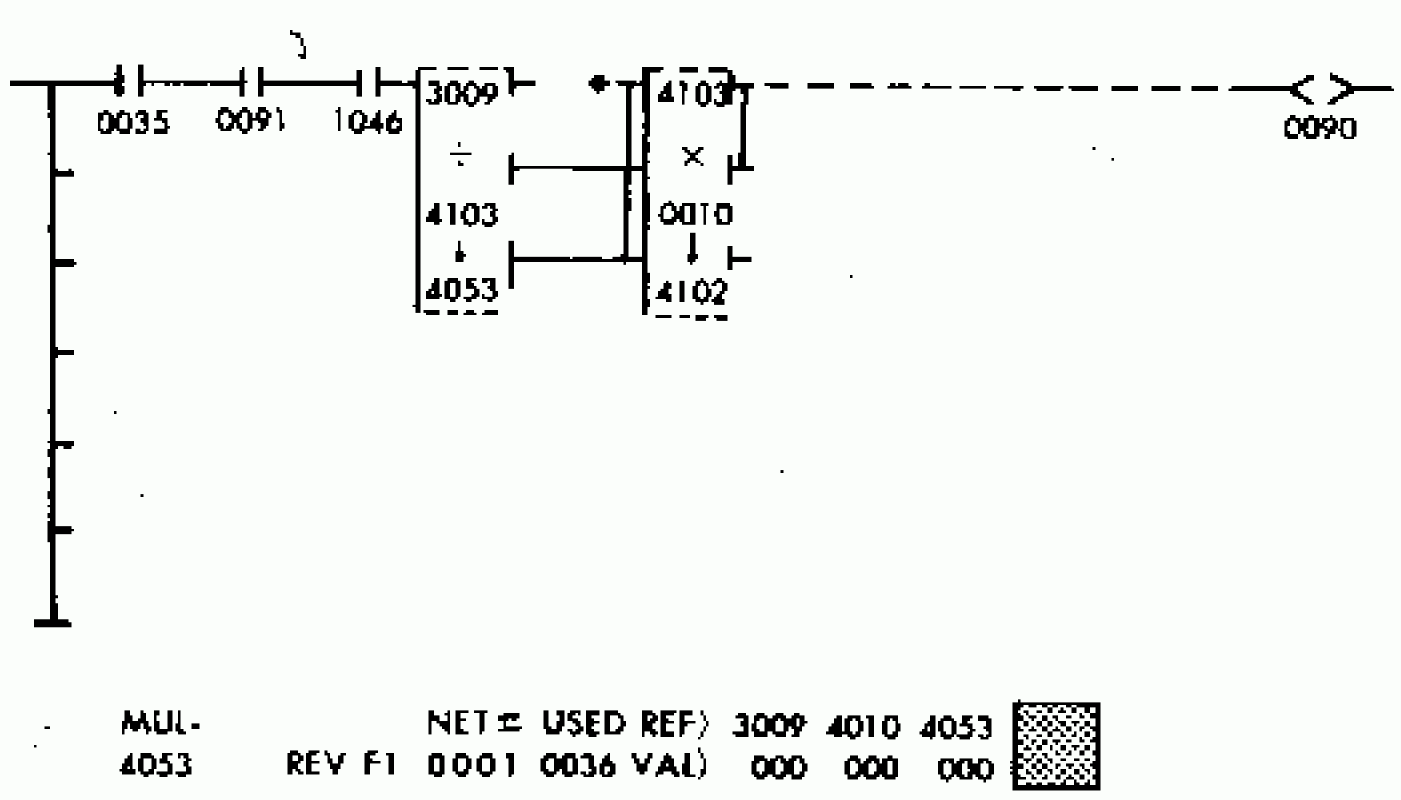


Fig. 4.19 Sample DIVIDE Logic

The operation of the divide function is illustrated in Fig. 4.19. When coils 0035, 0091, and input 1046 are all energized, the content of registers 3009 and 3010 (double precision number) is divided by the content of register 4103, and places the quotient into register 4053. Every scan that the input node receives power flow, the division is accomplished. Assuming the values in registers 3009, 3010 and 4103 are 010, 742, and 013, respectively, the value 826 (10,742 ÷ 13) will be placed in the holding register 4053. If the value in register 3009 is reduced to 008, the value placed in register 4053 becomes 672 (8,742 ÷ 13).

NOTE

Division is a whole number integer operation.

If the content of register 4103 becomes zero, or register 3009 becomes 013 or greater, the quotient becomes too large for register 4053 to store. When this occurs, a divide output will pass power and, in this example, energize the multiply operation.

4.2.5 Transitional Contacts

In addition to the conventional normally open and normally closed contacts, the R84H controller also provides transitional contacts as follows.

OFF to ON —┤↑├—

ON to OFF —┤↓├—

Transitional contacts can be used anywhere in networks where the more conventional NO and NC contacts had previously been utilized. These transitional contacts will pass power for exactly one scan whenever the coil to which they are referenced is transitioned from either OFF to ON or ON to OFF (depending upon transitional type selected). The timing diagram of Fig. 4.20 illustrates the operation of transitional contacts.

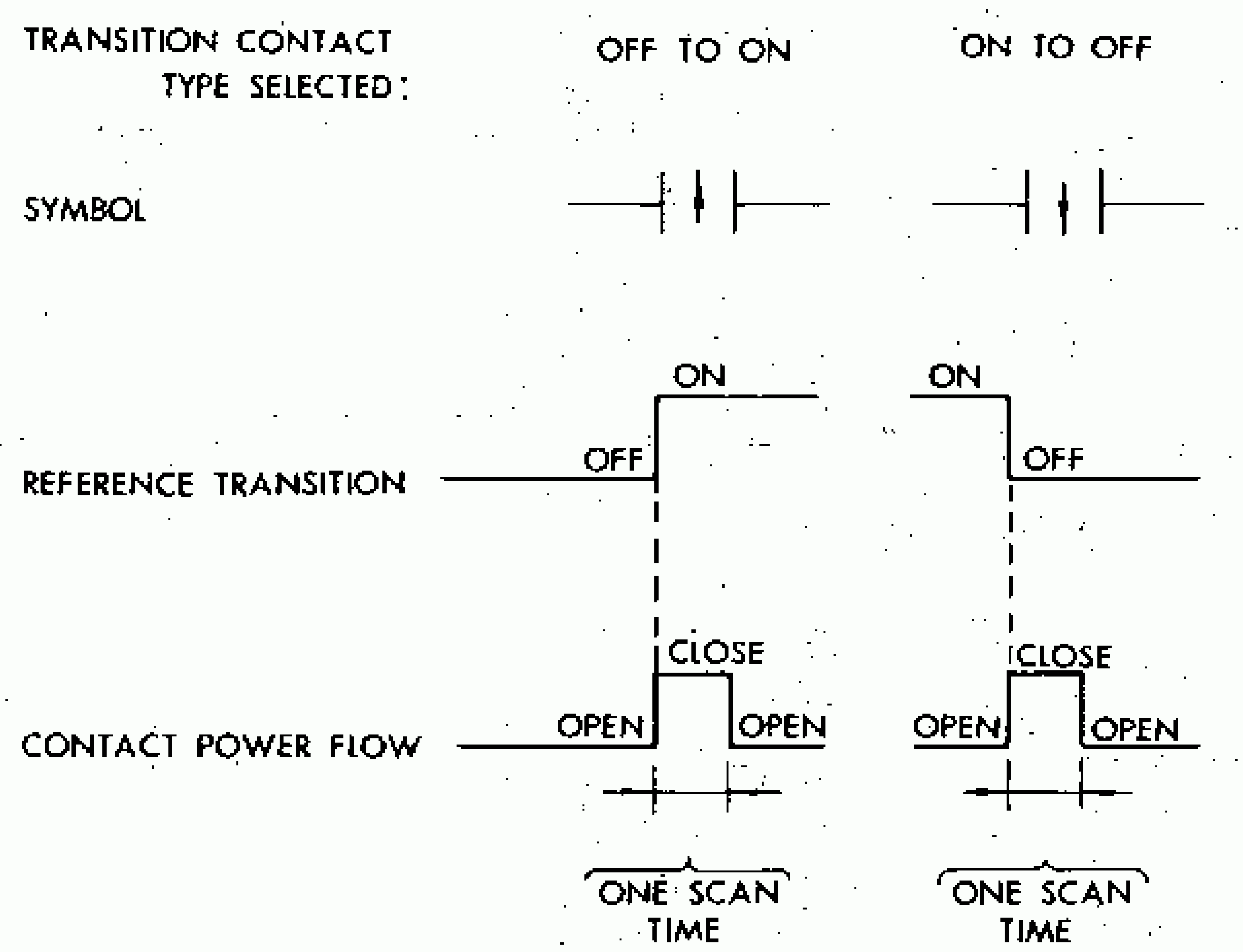


Fig. 4.20 Transitional Contact Timing

Transitional contacts can be referenced to any input or coil (output or internal); transitional contacts cannot be referenced to sequencer references.

NOTE

Transitional contacts will not respond properly to disabled references.

As an example, refer to Fig. 4.21. When input 1062 is energized, zero is added to the content of register 4007 and the result placed in register 4093. Since a transitional contact is used, this calculation is not performed every scan input 1062 is energized, but only on the first scan. Thus this circuit will sample the content of register 4007, store the sample unchanged into register 4093, and not update the value (even if the register changes) until input 1062 is de-energized and then re-energized. This is a classic sample and hold circuit used to store numerical values.

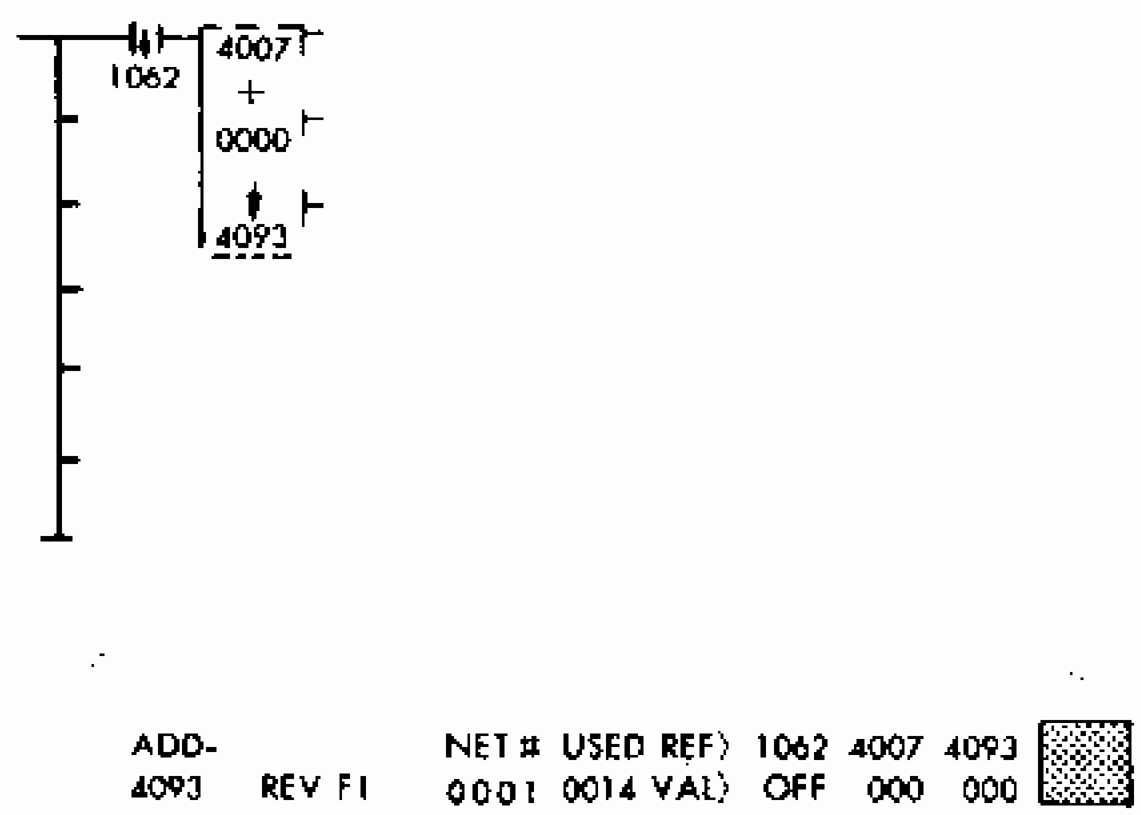


Fig. 4.21 Sample of Transitional Contact Logic

4.2.6 Sequencers

The R84H Controller is provided with eight independent 32 step sequencers. Each sequencer operates similar to a stepping switch with a single specific reference energized at each position of the stepping switch. These references start with the digit 2 in the form 2YXX. The significance of the remaining three digits of the reference is as follows:

2 Y X X

Sequencer Number (1-8) — Y

X X — Sequencer Step (1-32) Number

Sequencers one to eight are controlled by numerical values placed in registers 4051-4058, respectively.

NOTE

If all sequencers are not being used, the spare sequencer driving registers can be used exactly as any other holding register.

The numerical values can be placed in these specific registers by any of the non-relay functions such as counter, timers, or any arithmetic operations. A value of zero or above 32 will result in all references to that sequencer being de-energized and all other references to that sequencer being de-energized. As an example, refer to Fig. 4.22.

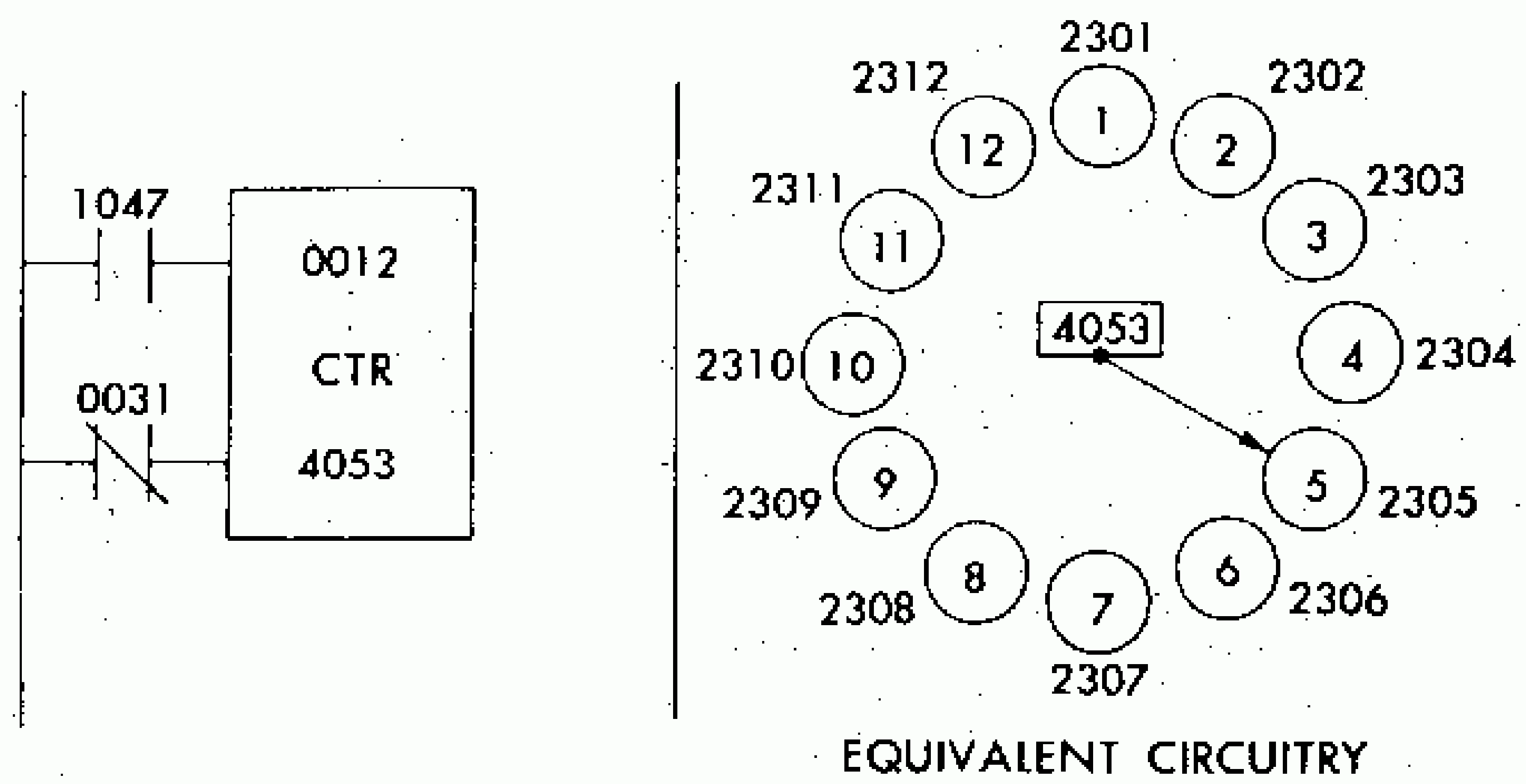


Fig. 4.22 Sample Sequencer Logic

The counter has a preset of 12 and stores its current count in register 4053. Every time input 1047 is energized, the value in register 4053 is incremented by one. This is equivalent to moving the stepping switch one position. If register 4053 contains the value five, reference 2305 (third sequencer, step five) is energized. When the current count equals the preset (0012), the stepping switch stops with reference 2312 energized.

NOTE

This example is a twelve step sequencer; 32 steps are available in ALL sequencers. The counter limits this circuit to 12 steps, since that is its preset.

Whenever coil 0031 is energized, the counter is reset to zero and the stepping switch goes back to home (no references energized) regardless of its current count. Intermediate references are not energized.

Each sequencer is completely independent since it is controlled by separate register values. Sequencer references can be used as often as necessary, anywhere in the logic where relay contacts are appropriate. By using calculate logic, any sequencer can be made to skip steps and jump forward or move backwards as necessary; intermediater references are NOT energized. Sequencers references are updated as soon as a change in the content of a sequencer register is made. Thus one network can drive the sequencers, and the next network uses the most recent value of the sequencer references. Sequencer references cannot be used on transitional contacts.

4.2.7 Convert

This function allows register devices such as thumbwheels and LED displays to be connected to discrete I/O modules. This is especially useful when only a few registers (e.g., one or two of each type) are required; the discrete modules can be of any voltage type necessary to interface to external equipment. Up to twelve adjacently numbered circuits can be combined to provide full numerical range (000-999) for a single register. However, fewer circuits can be dedicated to this register I/O if the magnitude of the value is sufficiently small (e.g., 000-099). Each register value will be converted and supplied to/from the I/O Section every scan (i.e., no multiplexing).

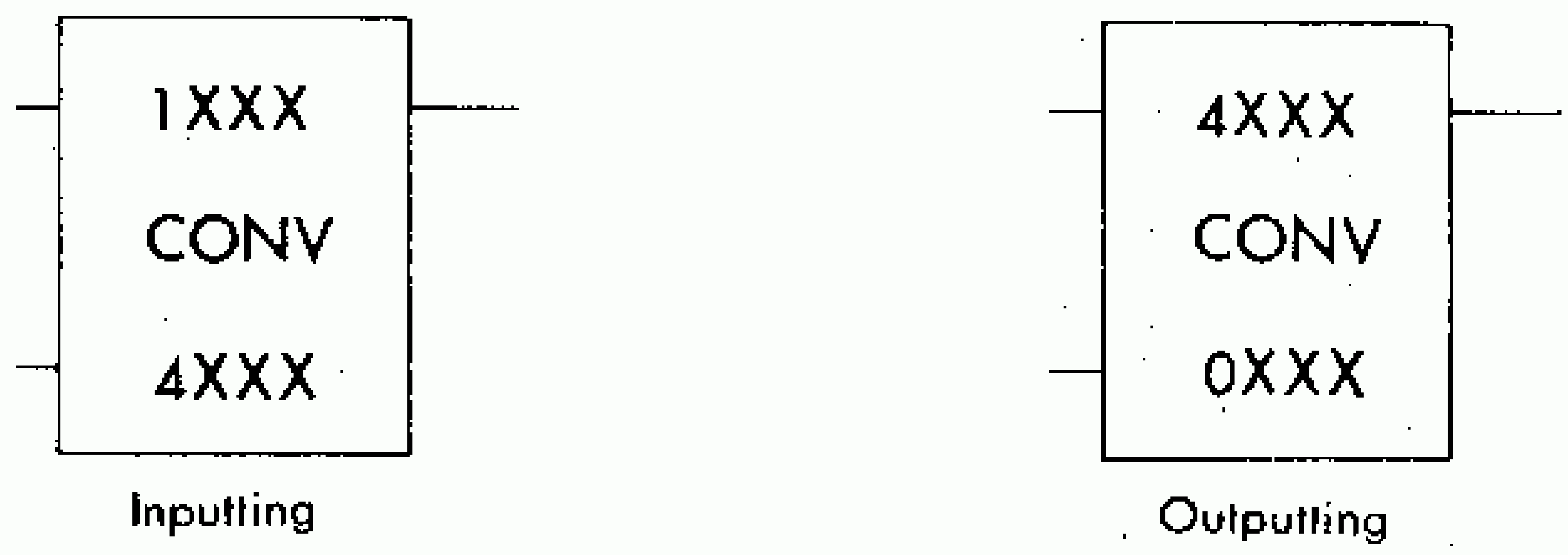


Fig. 4.23 Convert General Form

In general, the upper node on the left controls when the conversion is done; if it receives power flow from the left, the conversion is done every scan. When it receives power flow the inputs are converted from BCD to binary (the normal internal numerical magnitude), then stored in the holding register. A similar conversion is done on outputting, wherein the data is output by first converting to BCD. The upper output (right side, top node) provides power flow when a BCD conversion is done. The lower output is not used.

When inputting values, the upper element is the first input in the I/O structure that contains numerical values. The conversion will always use this input reference plus the next eleven (total 12 discrete inputs). Typically, this input represents the 800 BCD value. If less than three digits of BCD are applied, this input plus those that follow it down to the BCD values, should not be used. For example, if one- and two-digit digital switches are wired to input 1021-1028, inputs 1017-1020 should not be used. Inputs 1021-1028 are converted from BCD to binary with the result placed into register 4062 (see Figs. 4.24 and 4.25).

When outputting, the upper element is a register from which the numerical values are taken every scan the top left node receives power flow. The lower element is the first output coil to be controlled by the result of the conversion; the convert always uses this coil plus the next eleven. A typical output wiring diagram is shown in Fig. 4.24 and the logic to drive this conversion is shown in Fig. 4.25. Output coils 0041-0052 are provided with the BCD equivalent of the value stored in register 4096. All 12 coils used by a convert operation can not be used as logic coils elsewhere in the program.

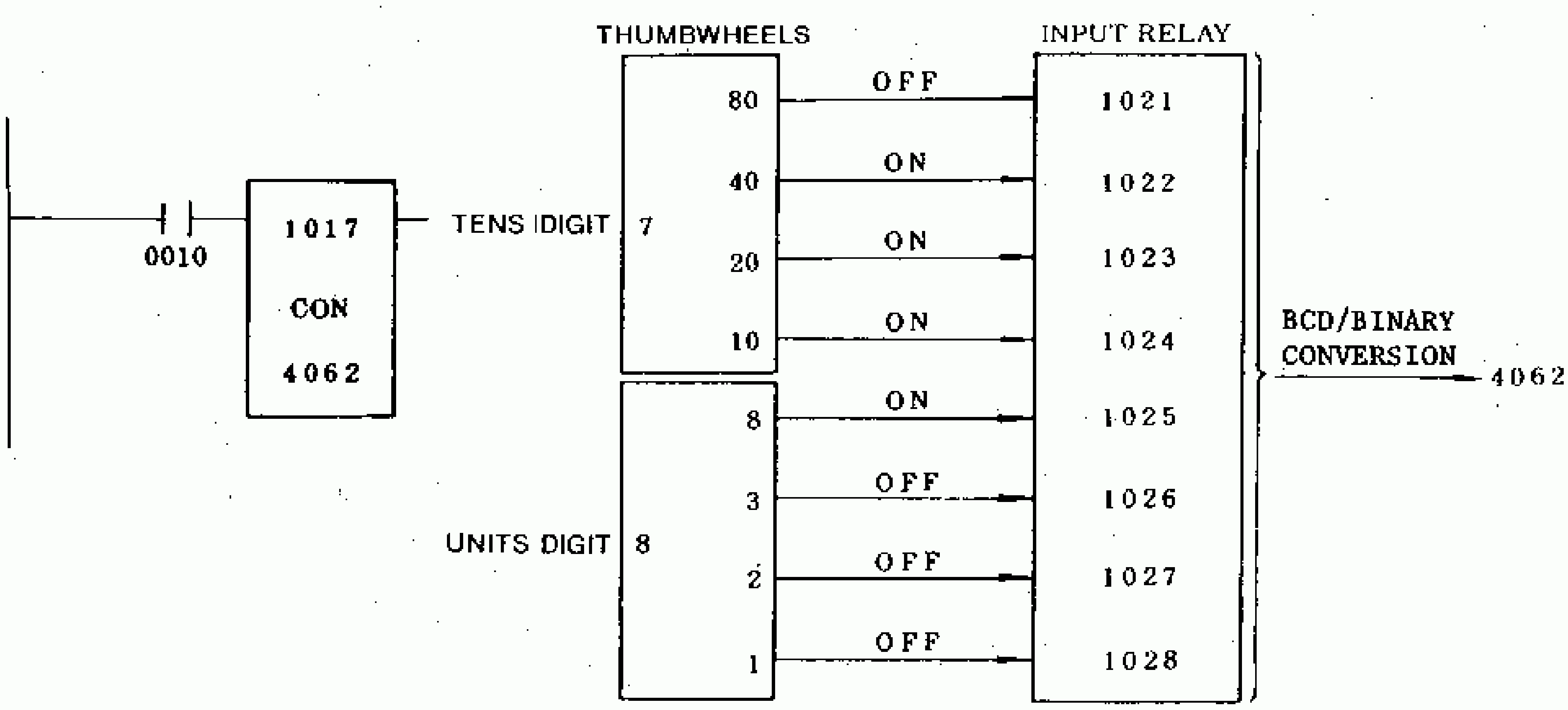


Fig. 4.24 Example of Input Conversion

4.2.7 Convert (Cont'd)

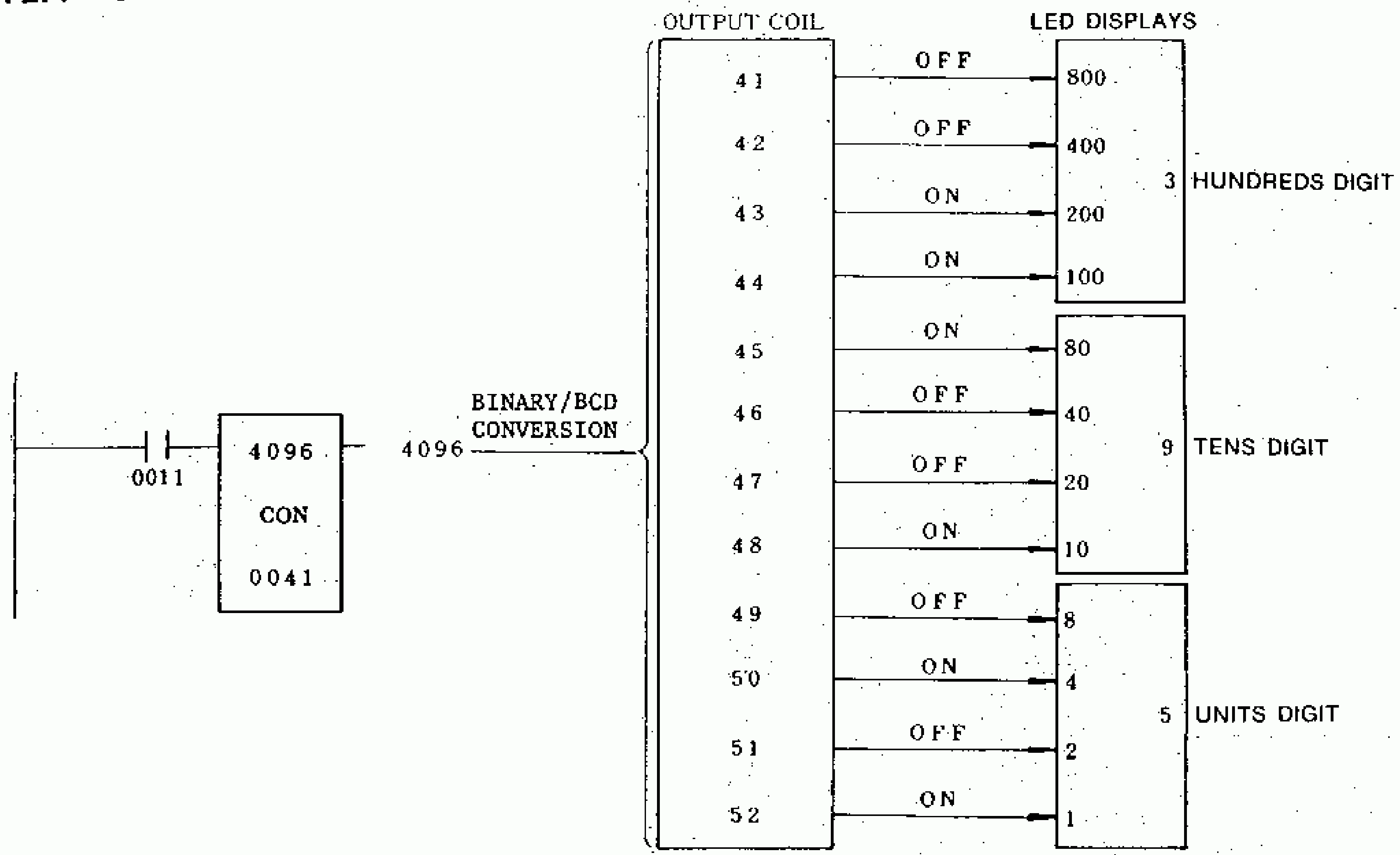


Fig. 4.25 Example of Output Conversion

4.2.8 Binary Convert

The previous convert function operated with BCD devices wired to discrete I/O modules; typically thumbwheels and LED displays are used. The BCD convert will accept BCD inputs, convert their data to binary (normal internal numerical format), and store the result in a holding register (4XXX reference). Similarly numerical values in a holding register can be converted from binary to BCD and sent out via logic output coils (references 0001 to 0256) to control output devices.

Conversions that do not use BCD data formats are also possible. The conversions put in and put out the binary data directly. Binary conversions operate upon ten bits of data in lieu of twelve bits required by the BCD format to represent three digit values (000 to 999). Conversions are still possible in both directions, wherein inputs (1XXX references) control the contents of holding registers and holding registers control output coils (0XXX references).

To select which type of conversion is implemented, the lower input node is utilized (see Fig. 4.23). If this input does not receive power flow, the conversion will be BCD; Binary conversion is utilized when this input receives power flow.

Of the twelve references used by the binary convert, only the first ten will represent the binary digits. The last two will be ignored by the input conversion or turned OFF by the output conversion. For example, if the input binary convert is programmed to start at reference 1010, the ten inputs used will be 1001 through 1010. If the output binary convert is programmed to start at reference 0041, coils 0041 through 0052 will reflect the binary data.

NOTE

In this example, coils 0041 and 0052 can not be programmed elsewhere in the logic. The last two, 0051 and 0052, are always OFF.

As an example of Binary Convert, refer to Fig. 4.26. Until coil 510 is energized, the status of inputs 1017-1026 will be placed in register 4062 and the binary content of register 4096 will control output coils 41-50, updated every scan. The vertical connections will ensure that both converts will be done in binary. With the assumed inputs, the following will result from the input convert:

INPUT	STATUS	REGISTER 4062 BIT PATTERN	NUMERICAL VALUE
1017	OFF	0 (MSB)	180
1018	OFF	0	
1019	ON	1	
1020	OFF	0	
1021	ON	1	
1022	ON	1	
1023	OFF	0	
1024	ON	1	
1025	OFF	0	
1026	OFF	0 (LSB)	
1027	*	-	
1028	*	-	

* IGNORED

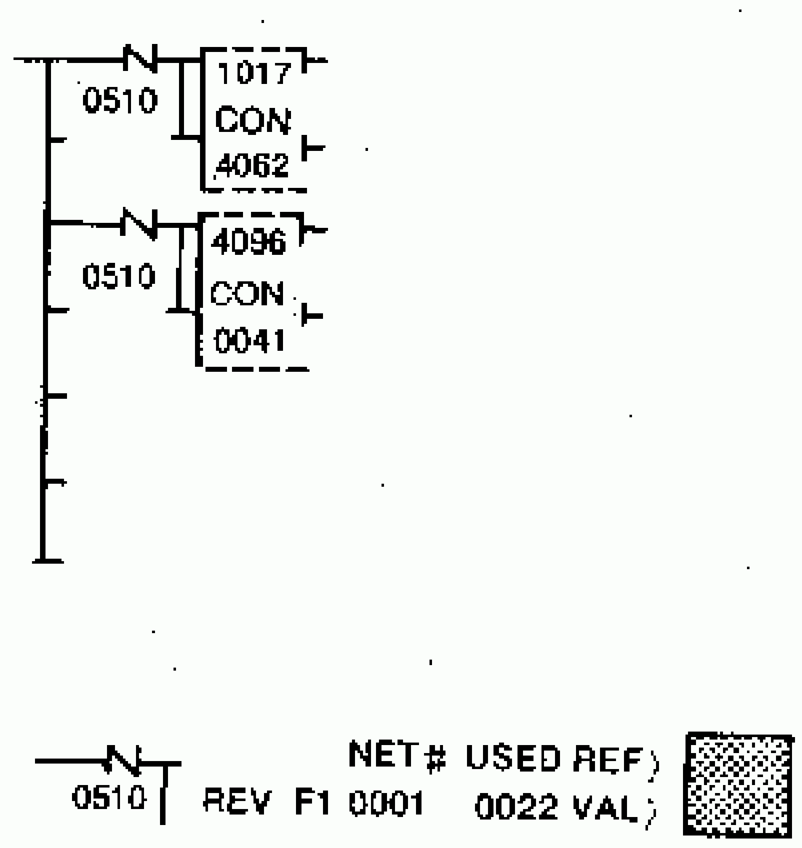


Fig. 4.26 Example Binary Convert

4.2.8 Binary Convert (Cont'd)

The following will be the output results with the value 287 in register 4096.

REGISTER 4096 BIT PATTERN	OUTPUT COIL	STATUS
0 (MSB)	0041	OFF
1	0042	ON
0	0043	OFF
0	0044	OFF
0	0045	OFF
1	0046	ON
1	0047	ON
1	0048	ON
1	0049	ON
1 (LSB)	0050	ON
–	0051	OFF (Permanently)
–	0052	OFF (Permanently)

4.2.9 Move

Numerical values contained in registers (input and holding) can be transferred or moved to other holding registers within the controller with this function. Data is not altered only moved; at a maximum, each move logic operation can transfer the content of one register into another each scan. Two forms of move are possible: Register to Table, and Table to Register.

The table is a group of consecutive registers and can be either all holding registers or all input registers (3001-3032). The specific register in the table that is used by the move, is controlled by a pointer. The pointer is the content of a register referred to by the move logic function. The content 1 to 254 refers to holding registers 4001 to 4254 respectively; the content 801 to 832 refers to input registers 3001 to 3032. The move logic will not operate if the pointers are beyond these limits. Data moving can be symbolically represented as shown in Fig. 4.27.

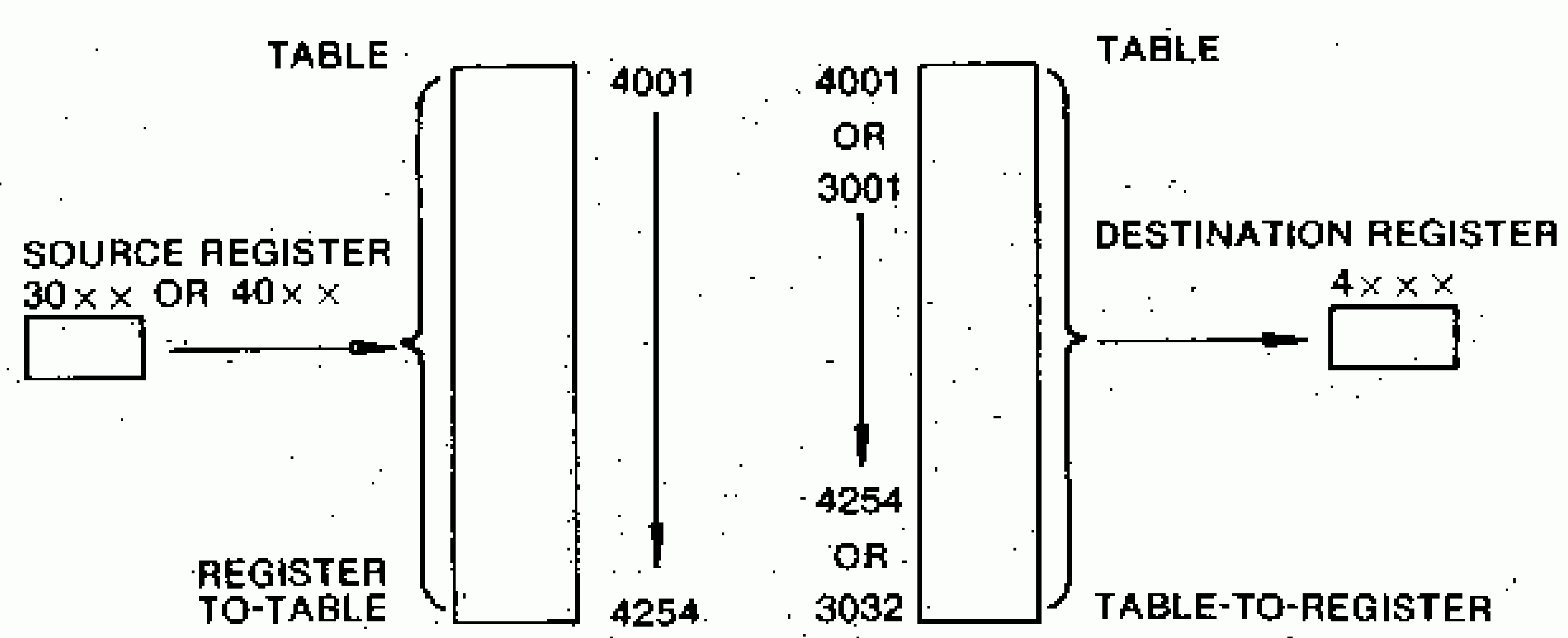


Fig. 4.27 Move Schematic

The general form of the move function is shown in Fig. 4.28. Every scan that the input receives power flow, the move is performed. In the case of a Register-to-Table move, the value in the source register is moved into the holding register specified by the pointer. The value in the source register is NOT altered; the previous value in the table register is destroyed and replaced with a copy of the content of the source register. The pointer is NOT altered.

A similar operation occurs with the Table-to-Register move. The content of a register in the table (either input or holding register) as selected by the pointer is moved to the specified destination register. The value in the table register is NOT altered; the previous value in the destination register is destroyed and replaced by a copy of the table register. The pointer is NOT altered.

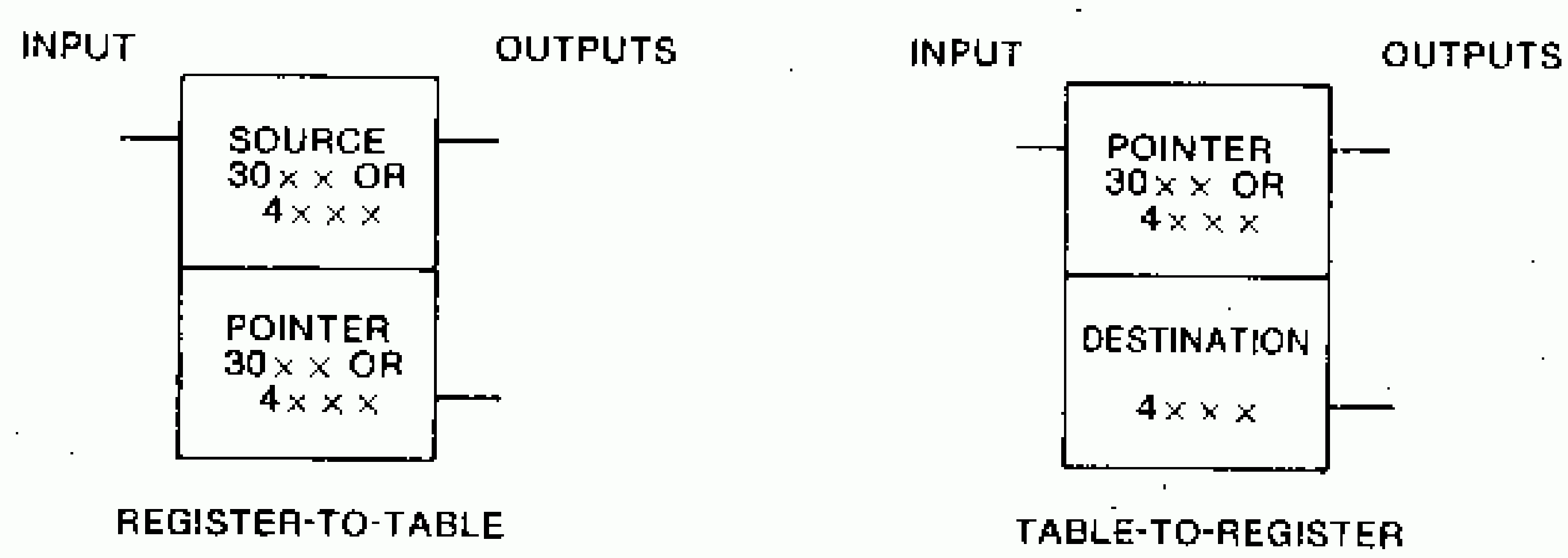


Fig. 4.28 MOVE General Form

NOTE

Since the pointers are not automatically incremented, to make maximum use of the move functions, additional logic such as a counter or arithmetic function should be used to increment the pointer value. Limits can be easily implemented in this logic to restrict the moves to smaller tables.

The upper output will provide power flow every scan the input is enabled (supplying power). The lower output will provide power flow only if a move is attempted (input enabled) with an illegal pointer value. Use of either output is optional and depends upon the application requirements.

As an example refer to Fig. 4.29, noting the content of the registers shown in the status area. When inputs 1001 and 1065 are energized and coil 236 is de-energized, the move will be performed. Since the content of register 4037 (pointer) is 156, the value in register 4156 will be moved into register 4083 (Destination register). The current content of 4083 (value 917) will be replaced with the content of 4156 (value 361); all other register will retain their content. In this example, coil 64 will be energized whenever the move is attempted and coil 261 will be OFF. If the pointer was 305 or 999, both coils 64 and 261 would be energized.

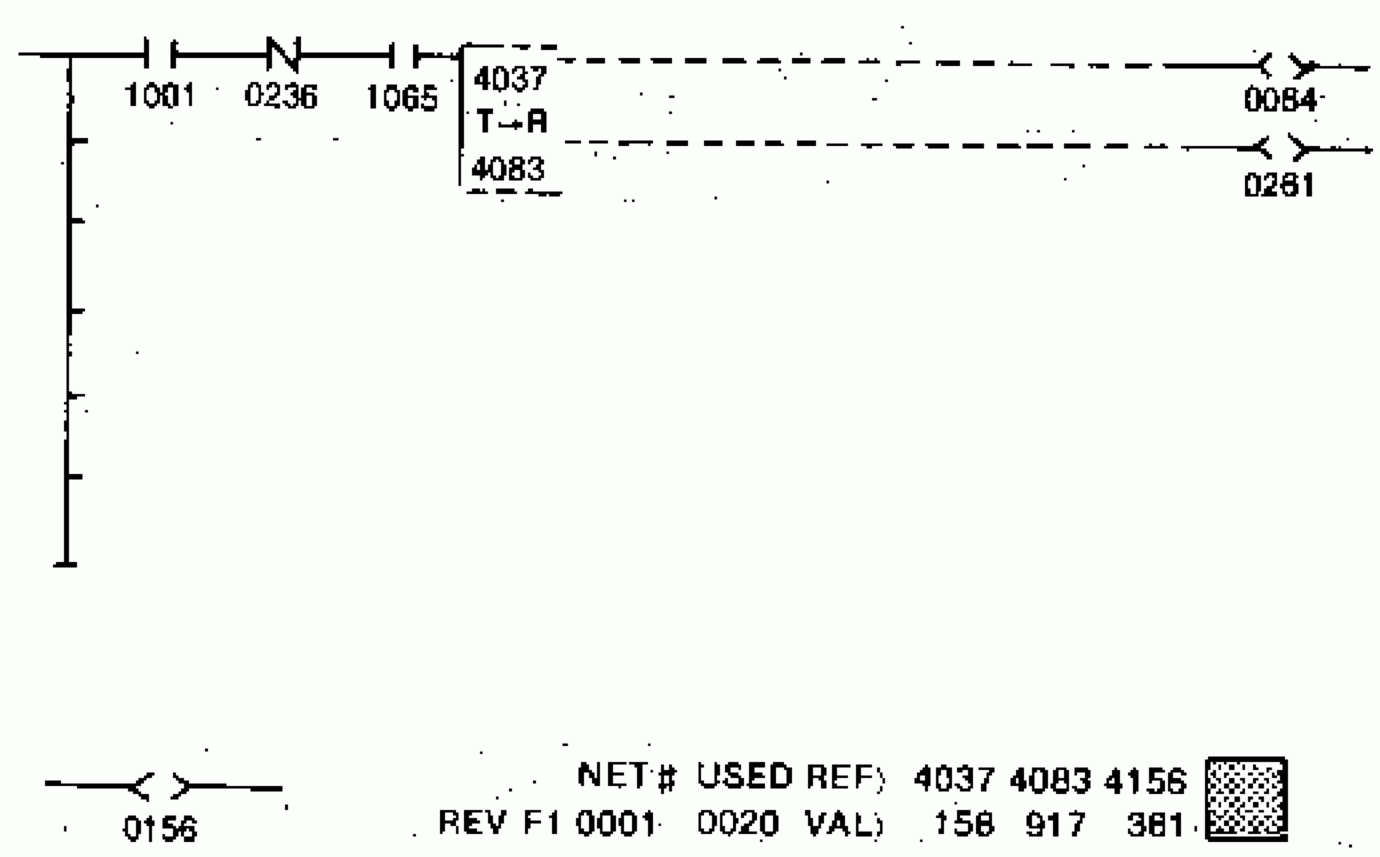


Fig. 4.29 Example Move

4.2.10 Skip

This function, when enabled, allows a group of consecutive networks to be skipped or omitted in the scanned logic solution. The status (ON/OFF) of all coils and register content controlled by these networks will not be altered while they are being skipped.

NOTE

> If the controller should lose AC power, the coils will follow their latched/non-latched condition upon restoration of power even if the skip is enabled.

The skip is the only non-relay function currently available that utilizes only one element for programming. Into this element is placed the quantity of networks to be skipped. This quantity can be a fixed value from zero to 255 or it can be a register reference (30XX or 4XXX) whose content indicates the quantity of networks to be skipped. The remainder of the current network is skipped; this is the first network skipped.

The value zero indicates to skip all remaining logic and go directly to the end of scan functions. If the quantity of networks to be skipped is greater than the number of networks remaining, only those networks remaining will be skipped.

The skip function is useful to build shift registers, and reduce scan time. The skip of zero networks (go to end of scan) will save the scan time required to process all subsequent logic. When skipping a non-zero quantity of networks, the scan time is reduced to that of the remaining relay logic.

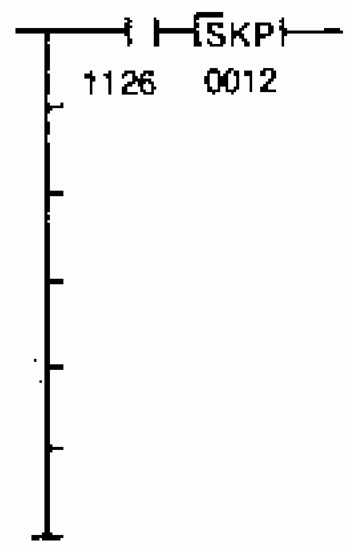


Fig. 4.30 Example SKIP

As an example, refer to Fig. 4.30. When input 1126 is energized, the remainder of the current network and the entire eleven following networks will be skipped. Any outputs, coils, or registers controlled by these networks will be "frozen" and not change state/content. When input 1126 is de-energized, these networks will return no their normal logic solving capabilities; they will be solved based upon the current state of inputs and non-skipped logic results.

SECTION V
INPUT/OUTPUT MODULES

5.1 SPECIFICATIONS OF 1000 SERIES INPUT/OUTPUT MODULES

(1) B1051B 100 VAC Input Module

Table 5.1 100 VAC Input Module Specifications

Items	Specifications
Type	JAMSC - B1051B.
Number of Inputs	16 - Inputs per module.
Indicator	16 - Input Status LED's provided for each input, lighting up when input ON.
Electrical characteristics	
• Input conditions	ON level: ON at input voltage between 80 and 130 VAC continuous. OFF level: 30 VAC or less.
• Input impedance	Approx. 9 kΩ.
• Input current	Approx. 11 mA (when supplying 100 VAC).
• Transient voltage	200 VAC (1 cycle or less).
• Response time	OFF to ON: 10 ms maximum. ON to OFF: 20 ms maximum.
• Isolation voltage	1500 VAC for 1 minute.

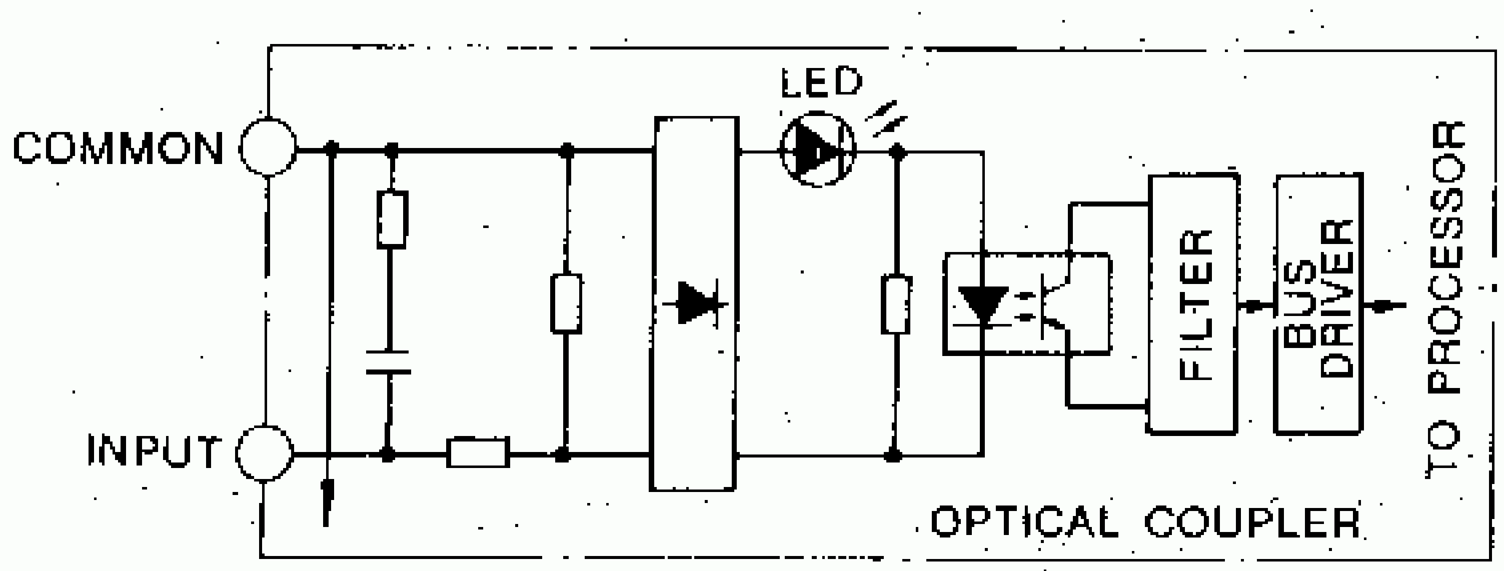


Fig. 5.1 B1051B 100 VAC Input Module Simplified Schematic for One Circuit

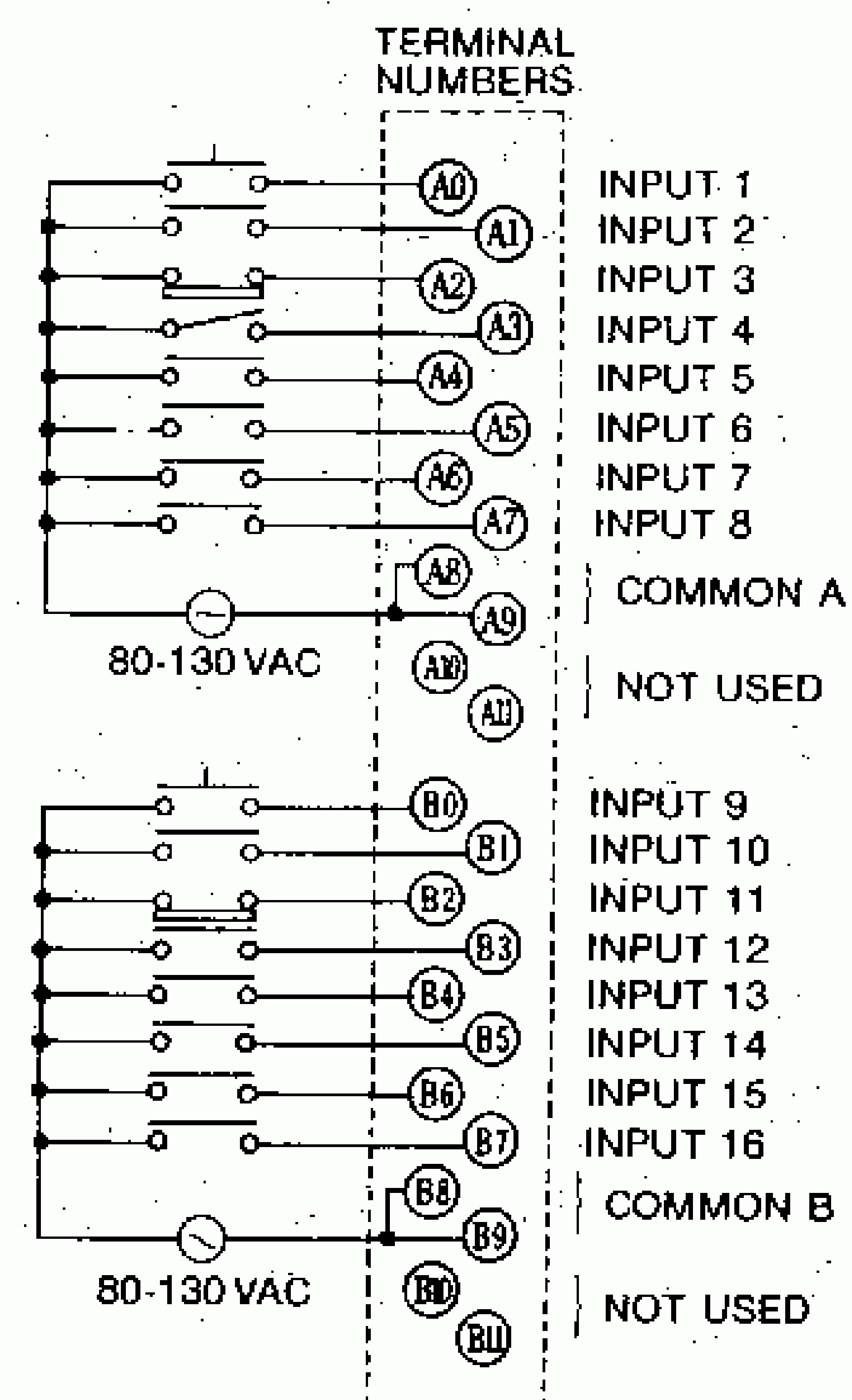


Fig. 5.2 B1051B 100 VAC Input Module Terminal Numbering and Input Connections

(2) B1053 5/12 VDC Input Module

Tbale 5.2 5/12 VDC Input Module Specifications

Items	Specifications
Type	JAMSC - B1053.
Number of Inputs	16 - Inputs per module.
Indicator	16 - Input status LED's, provided for each input, lighting up when input ON.
Fuse Rating	1A (Glass tube fuse, Type DM10)
Electrical Characteristics · Input conditions	See table below
· Input impedance	Approx. 1 kΩ.
· Input current	See table below (measured at input terminals when input voltage is 0 volts.)
· Working voltage	4.75 to 13.2 VDC
· Transient voltage	15 VDC (Peak)
· Response time	OFF to ON: 10 ms maximum. ON to OFF: 20 ms maximum.
· External power supply current (per module)	See table below
· Isolation voltage	150 VAC for 1 minute.

Input conditions:

External Source Voltage	5 VDC	12 VDC
ON Level	1.0 V max.	2.4 V max.
OFF Level	3.5 V min.	9.0 V min.

Input current:

External Source Voltage	5 VDC	12 VDC
Input Current	4.5 mA	11.5 mA

(measured at input terminals when input voltage is 0 volts.)

External power supply current (per module):

External Source Voltage	5 VDC	12 VDC
Inputs OFF	1 mA max.	1 mA max.
Inputs ON	180 mA max.	320 mA max.

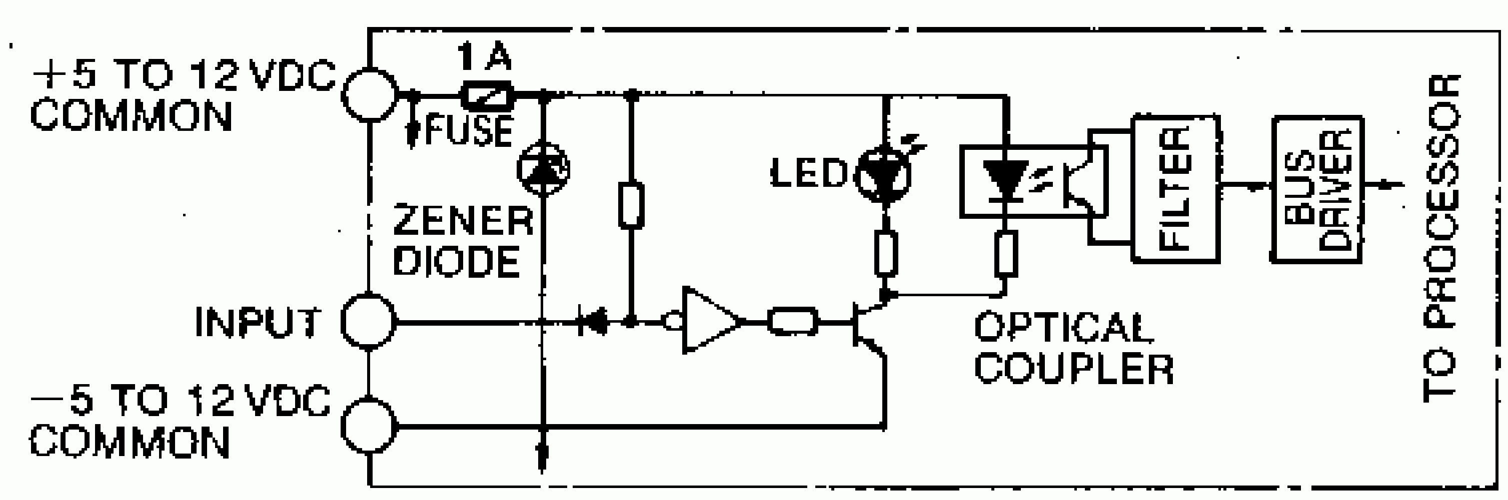


Fig. 5.3 B1053 5/12VDC Input Module Simplified Schematic for One Circuit

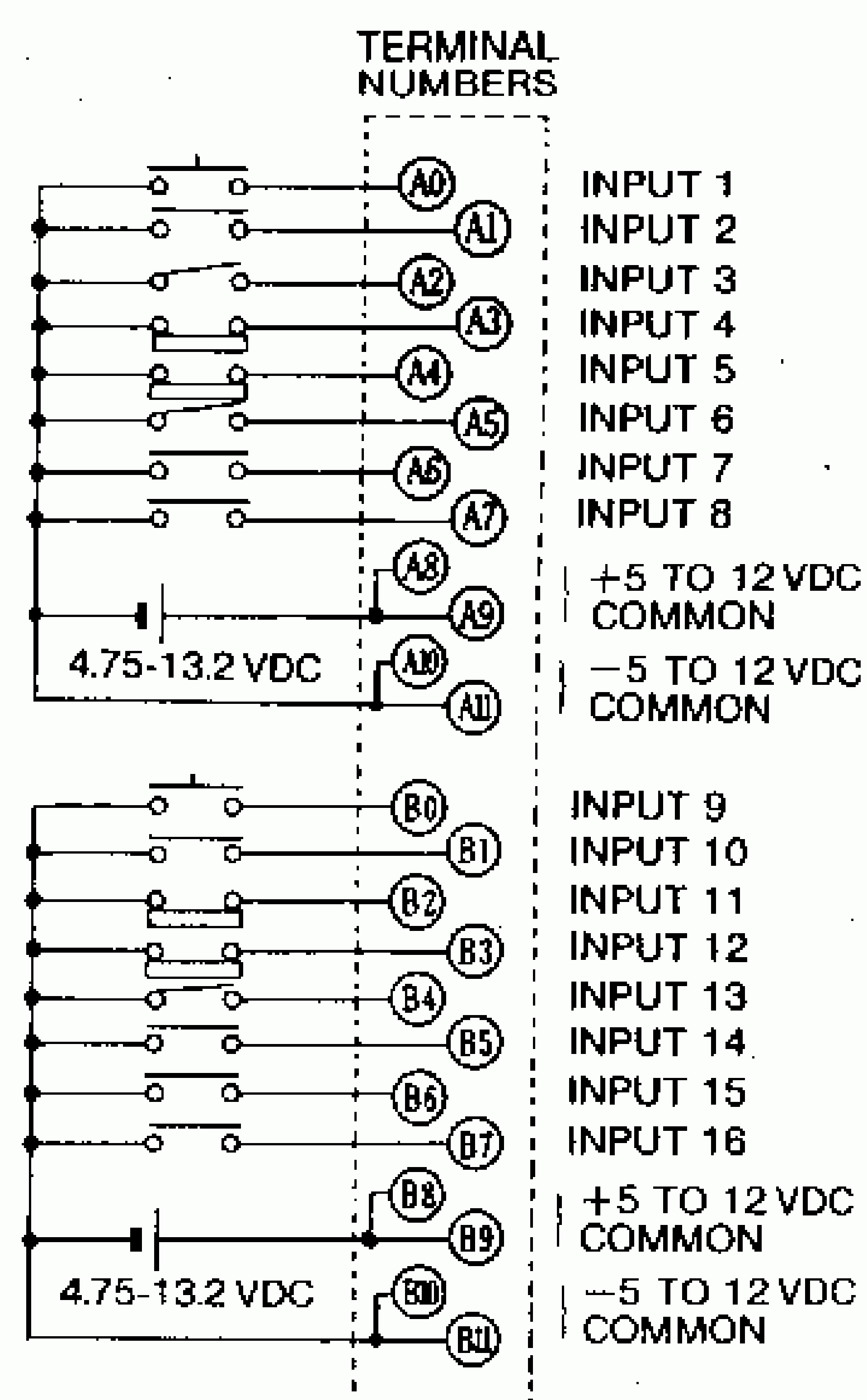


Fig. 5.4 B1053 5/12 VDC Input Module Terminal Numbering and Input Connections

(3) B1055 200 VAC Input Module

Table 5.3 200 VAC Input Module Specifications

Items	Specifications
Type	JAMSC - B1055.
Number of Inputs	16 - Inputs per module.
Indicator	16 - Input status LED's, provided for each input, lighting up when input ON.
Electrical Characteristics	
• Input conditions	ON level: ON at input voltage between 160 and 260 VAC continuous. OFF level: 60 VAC or less.
• Input impedance	Approx. 23 kΩ.
• Input current	Approx. 9 mA (when supplying 200 VAC).
• Transient voltage	400 VAC (1 cycle or less).
• Response time	OFF to ON: 10 ms maximum. ON to OFF: 20 ms maximum.
• Isolation voltage	1500 VAC for 1 minute.

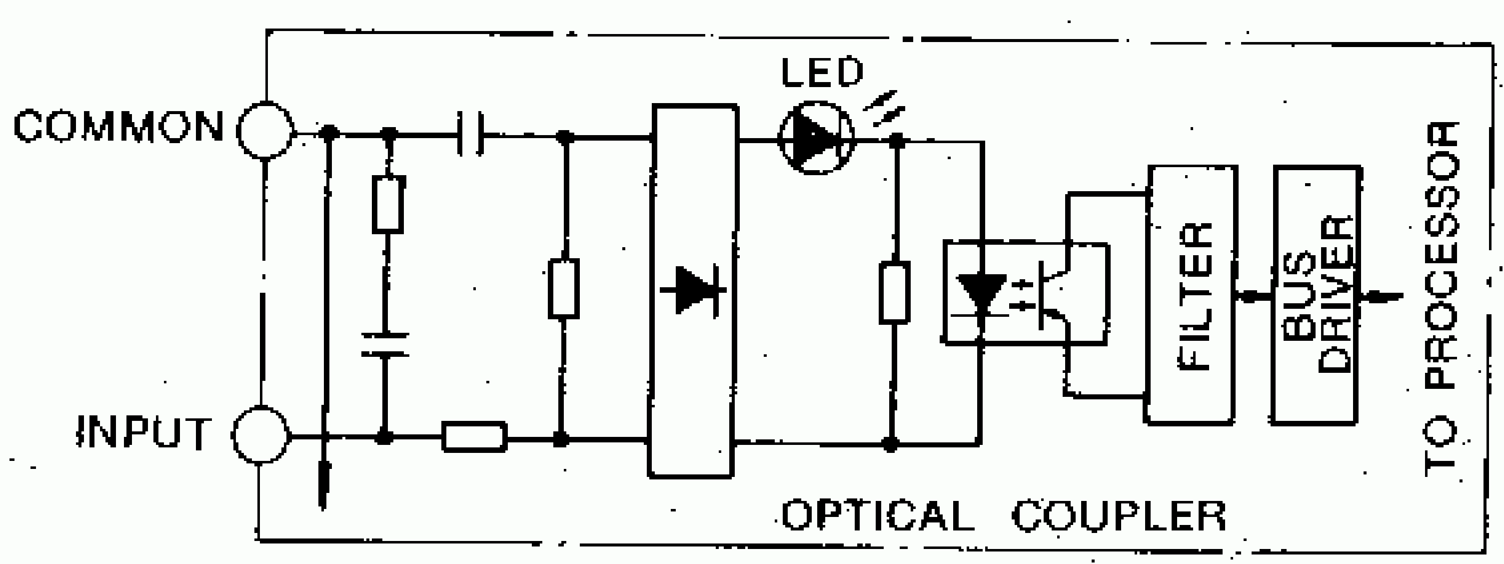


Fig. 5.5 B1055 200 VAC Input Module Simplified Schematic for One Circuit

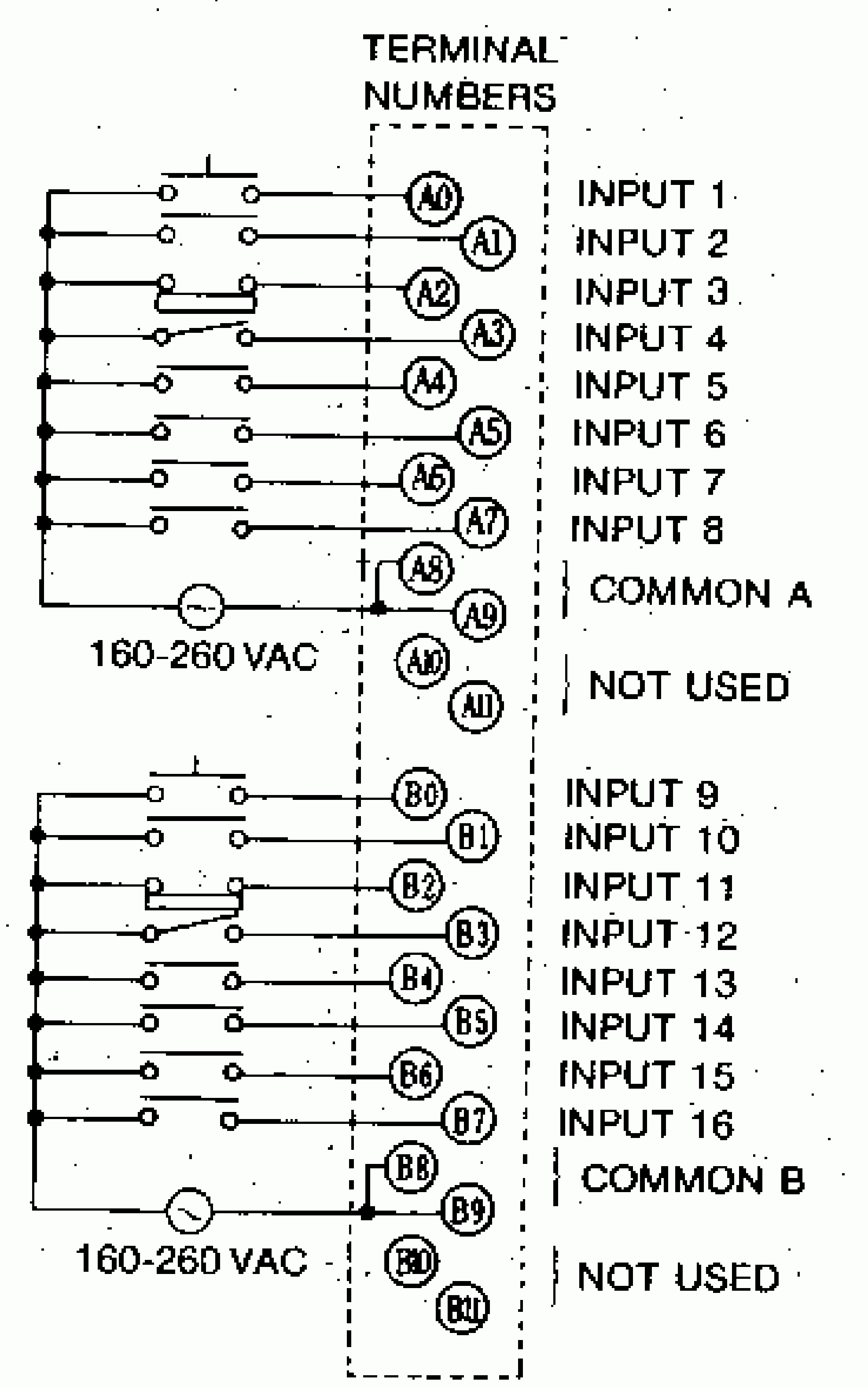


Fig. 5.6 B1055 200 VAC Input Module Terminal Numbering and Input Connections

(4) B1057 48 VDC Input Module

Table 5.4 48 VDC Input Module Secifications

Items	Specifications
Type	JAMSC - B1057.
Number of Inputs	16 - Inputs per module.
Indicator	16 - Input status LED's, provided for each input, lighting up when input ON.
Electrical Characteristics	
• Input conditions	ON level: 16 VDC maximum. (negative logic) OFF level: 28 VDC minimum.
• Input impedance	Approx. 4.8 kΩ.
• Input current	10 mA (measured at input terminals when input voltage is 0 volts).
• Working voltage	38 to 58 VDC
• Transient voltage	70 V (Peak)
• Response time	OFF to ON: 10 ms maximum. ON to OFF: 20 ms maximum.
• External power supply current (per module)	External Source Voltage: 48 VDC; Inputs OFF: 1 mA max.; Inputs ON: 160 mA
• Isolation voltage	1500 VAC for 1 minute.

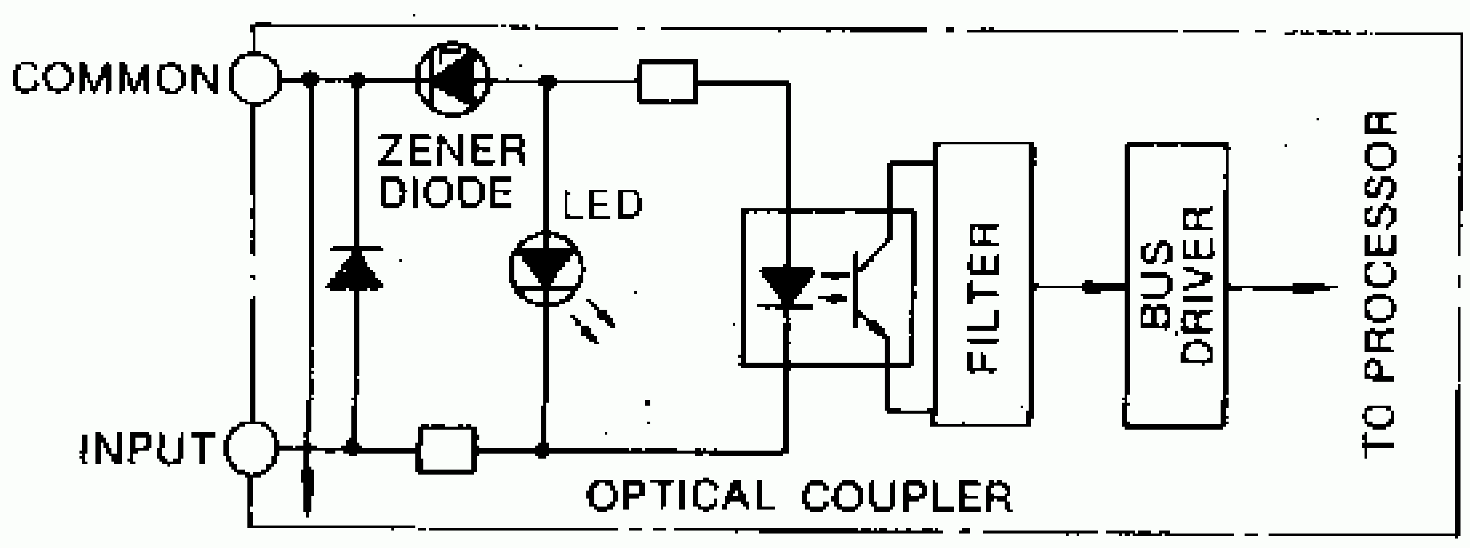


Fig. 5.7 B1057 48 VDC Input Module Simplified Schematic for One Circuit

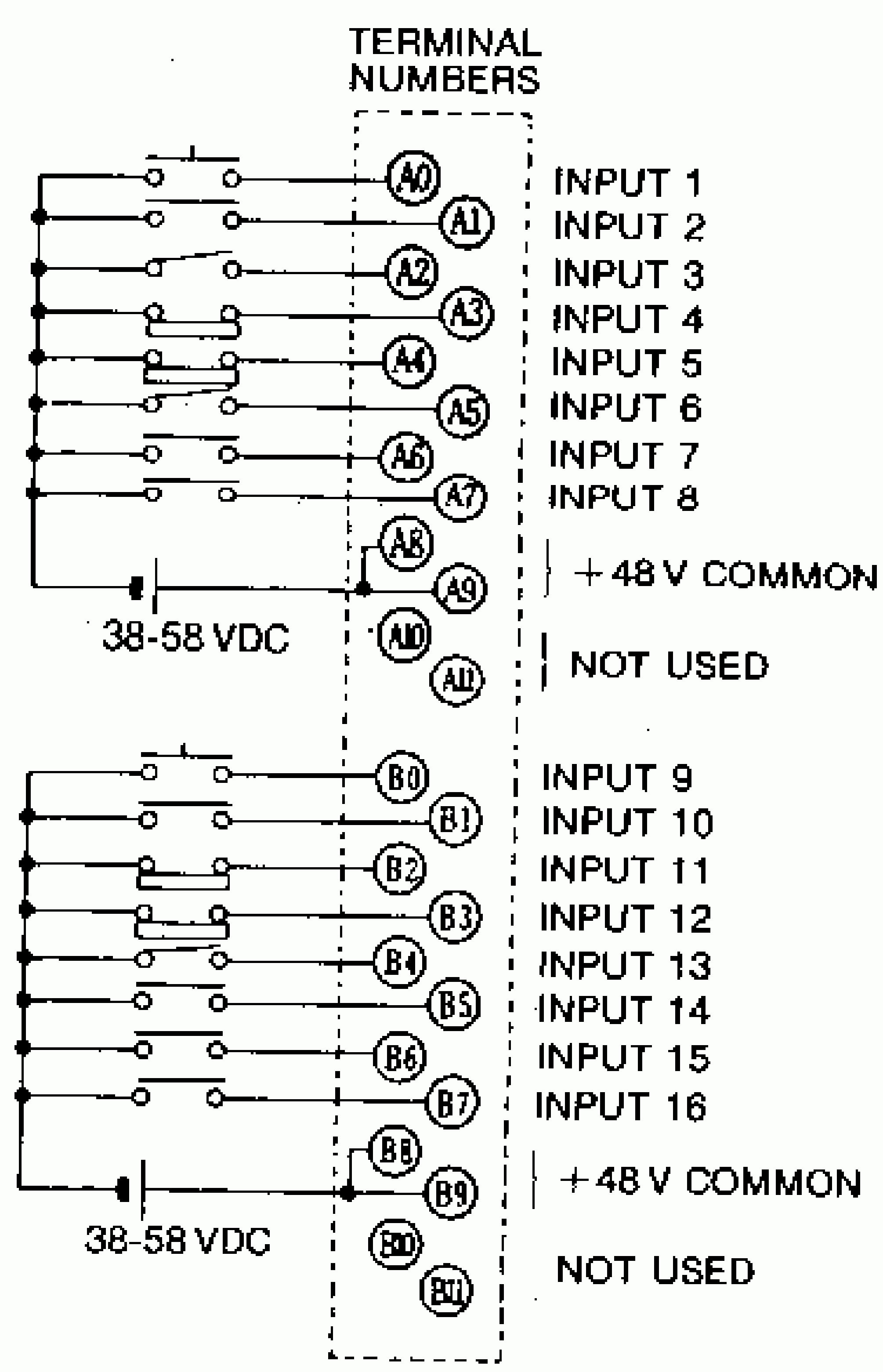


Fig. 5.8 B1057 48 VDC Input Module Terminal Numbering and Input Connections

(5) B1059C 24 VDC Input Module

Table 5.5 24 VDC Input Module Specifications

Items	Specifications		
Type	JAMSC - B1059C.		
Number of Inputs	16 - Inputs per module.		
Indicator	16 - Input status LED's, provided for each input, lighting up when input ON.		
Electrical Characteristics			
• Input conditions	ON level: 8 VDC maximum. (negative logic) OFF level: 14 VDC minimum.		
• Input impedance	Approx. 2.4 kΩ.		
• Input current	10 mA (measured at input terminals when input voltage is 0 volts).		
• Working voltage	19 to 29 VDC		
• Transient voltage	35 V (Peak)		
• Response time	OFF to ON: 10 ms maximum. ON to OFF: 20 ms maximum.		
• External power supply current (per module)	Source Voltage	Inputs OFF	Inputs ON
	24 VDC	1 mA max.	160 mA
• Isolation voltage	1500 VAC for 1 minute.		

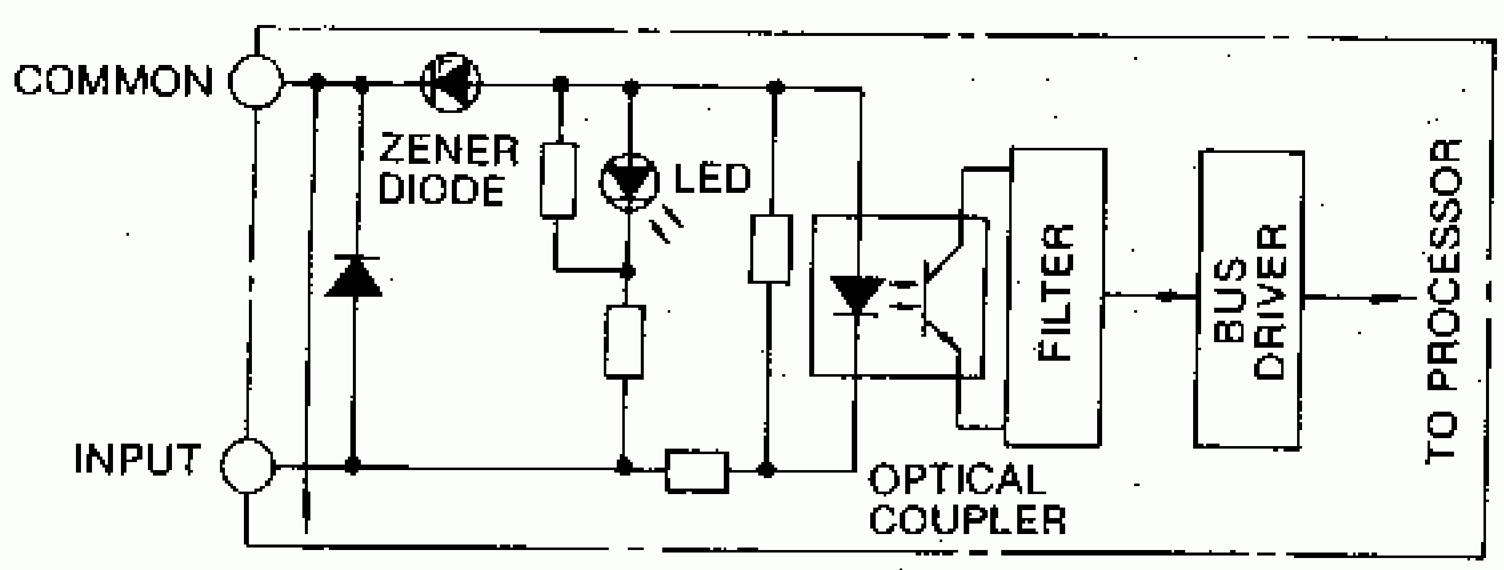


Fig. 5.9 B1059C 24 VDC Input Module Simplified Schematic for One Circuit

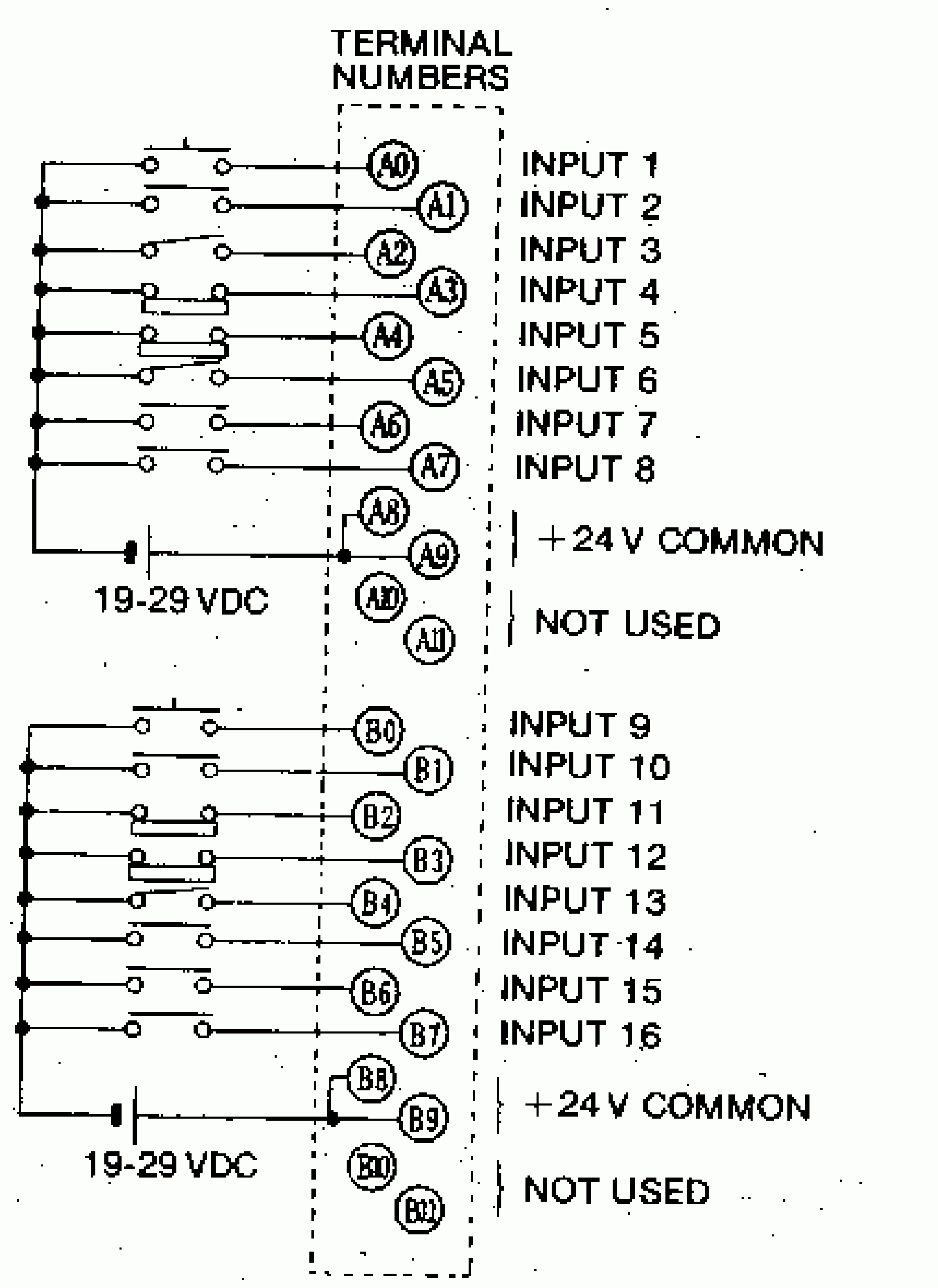


Fig. 5.10 B1059C 24 VDC Input Module Terminal Numbering and Input Connections

(6) B1061 24 VDC Input Module

Table 5.6 24 VDC Input Module Specifications

Items		Specifications
Type		JAMSC-B1061.
Number of Inputs		64-Inputs per module.
Indicators		Upper (1 to 32) inputs/lower (1 to 32) inputs status LED's selection, lighting up when input ON.
Electrical Character-istics	Input Condition	ON level: 6 VDC max (Negative logic). OFF level: 13 VDC min.
	Input Impedance	Approx 4.8 kΩ.
	Input Current	5 mA (measured at input terminals when input voltage is 0 V.).
	Working Voltage	20.4 to 26.4 VDC.
	Transient Voltage	35 V (Peak).
	Response Time	OFF to ON: 10ms maximum. ON to OFF: 20ms maximum.
	External Power Supply Current (per Module)	External Source Voltage: 24 VDC; Inputs OFF: 360 mA max; Inputs ON: 1 mA max
	Isolation Voltage	1500 VAC for 1 minute.

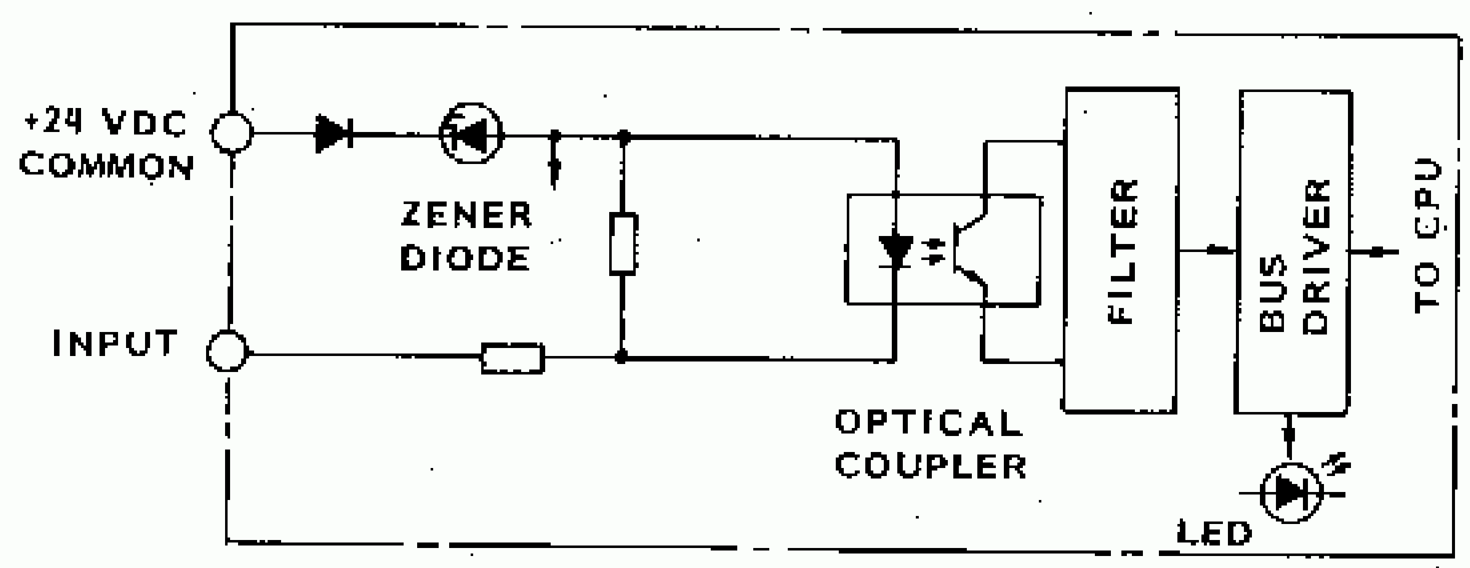


Fig. 5.11 B1061 24 VDC Input Module Simplified Schematic for One Circuit

Note: B1061 is provided with two connectors (connectors 1 and 2): These connectors have same terminal numbers and input connections.

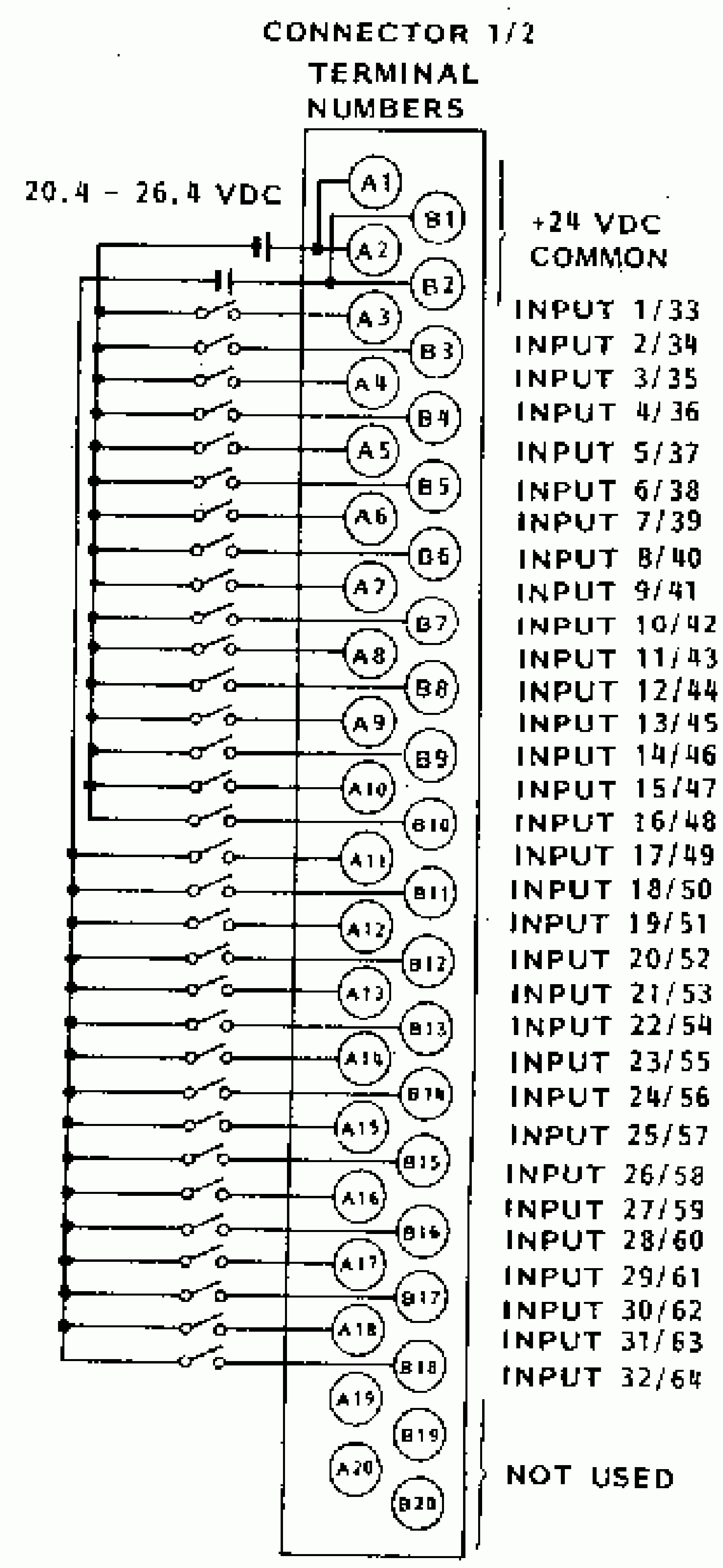


Fig. 5.12 B1061 24 VDC Input Module Terminal Numbering and Input Connections

(7) B1063 24 VDC Input Module

Table 5.7 24 VDC Outupt Module Specifications

Items		Specifications		
Type		JAMSC-B1063.		
Number of Inputs		32-Inputs per module.		
Indicators		32-Input status LED's, provided for each input, lighting up when input ON.		
Electrical Character-istics	Input Condition	ON level: 6 VDC max (Negative logic) OFF level: 13 VDC min.		
	Input Impedance	Approx 2.4 kΩ.		
	Input Current	10 mA (measured at input terminals when input voltage is 0 V.).		
	Working Voltage	20.4 to 26.4 VDC.		
	Transient Voltage	35 V (Peak).		
	Response Time	OFF to ON: 10ms maximum. ON to OFF: 20ms maximum.		
	External Power Supply Current (per Module)	External Source Voltage	Inputs OFF	Inputs ON
		24 VDC	320 mA max	1 mA max
	Isolation Voltage	1500 VAC for 1 minute.		

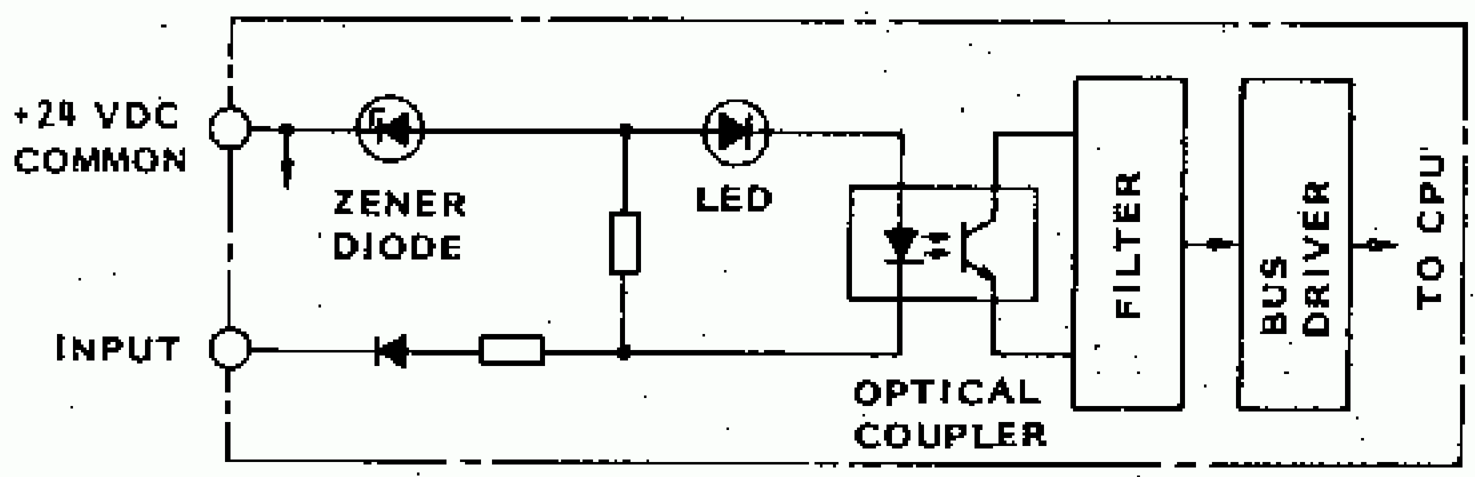


Fig. 5.13 B1063 24 VDC Input Module
Simplified Schematic for One Circuit

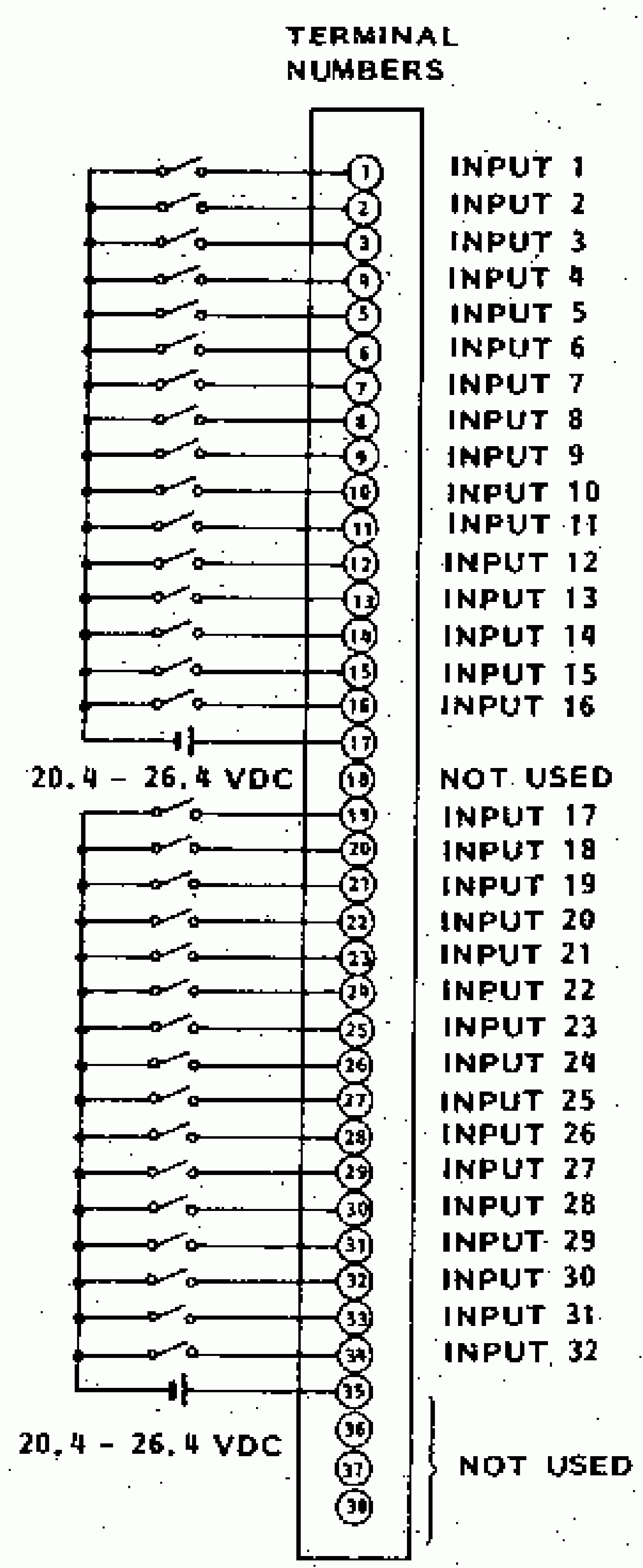


Fig. 5.14 B1063 24 VDC Input Module
Terminal Numbering and
Input Connections

(8) B1065 24 VDC Input Module

Table 5.8 24 VDC Input Module Specifications

Items	Specifications
Type	JAMSC - B1065.
Number of Inputs	32 - Inputs per module.
Indicator	16- Input status LED's, provided for each input, lighting up when input ON.
Electrical Characteristics	
· Input condition	ON level: 8 VDC maximum. (negative logic) OFF level: 14 VDC minimum.
· Input impedance	Approx. 4 kΩ.
· Input current	6 mA (measured at input terminals when input voltage is 0 volts).
· Working voltage	19 to 29 VDC.
· Transient voltage	35 V (Peak).
· Response time	OFF to ON: 10 ms maximum. ON to OFF: 20 ms maximum.
· External power supply current (per module)	External Source Voltage: 24 VDC; Inputs OFF: 1 mA max; Inputs ON: 192 mA
· Isolation voltage	1500 VAC for 1 minute.

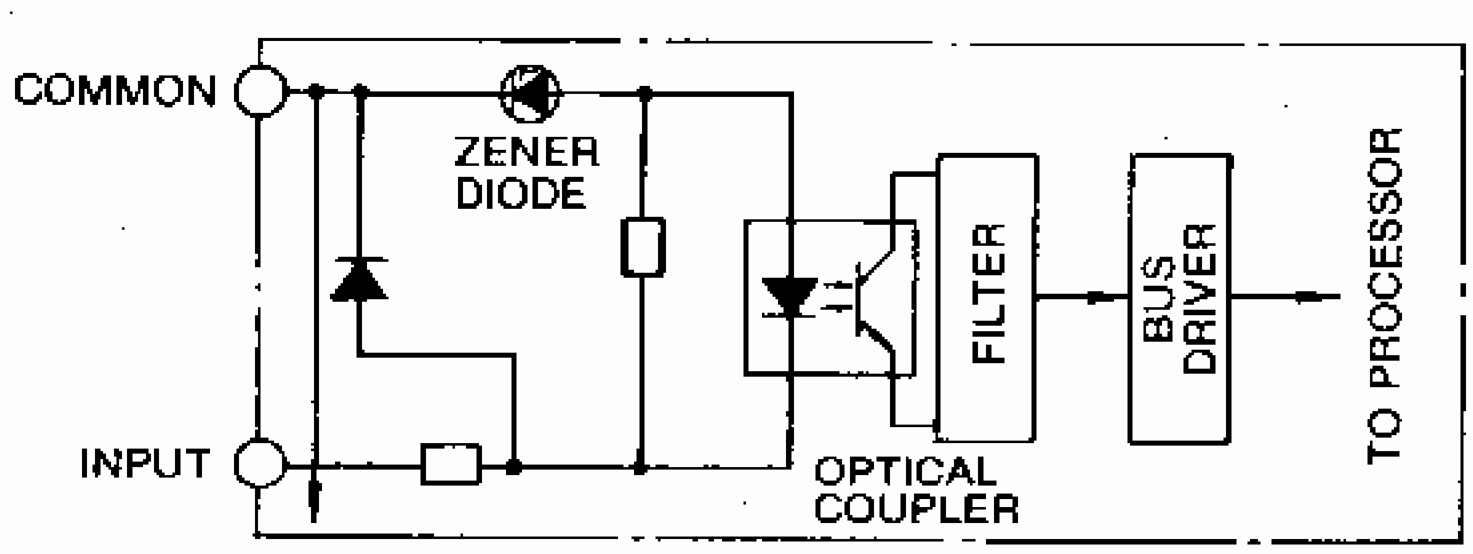


Fig. 5.15 B1065 24 VDC Input Module Simplified Schematic for One Circuit

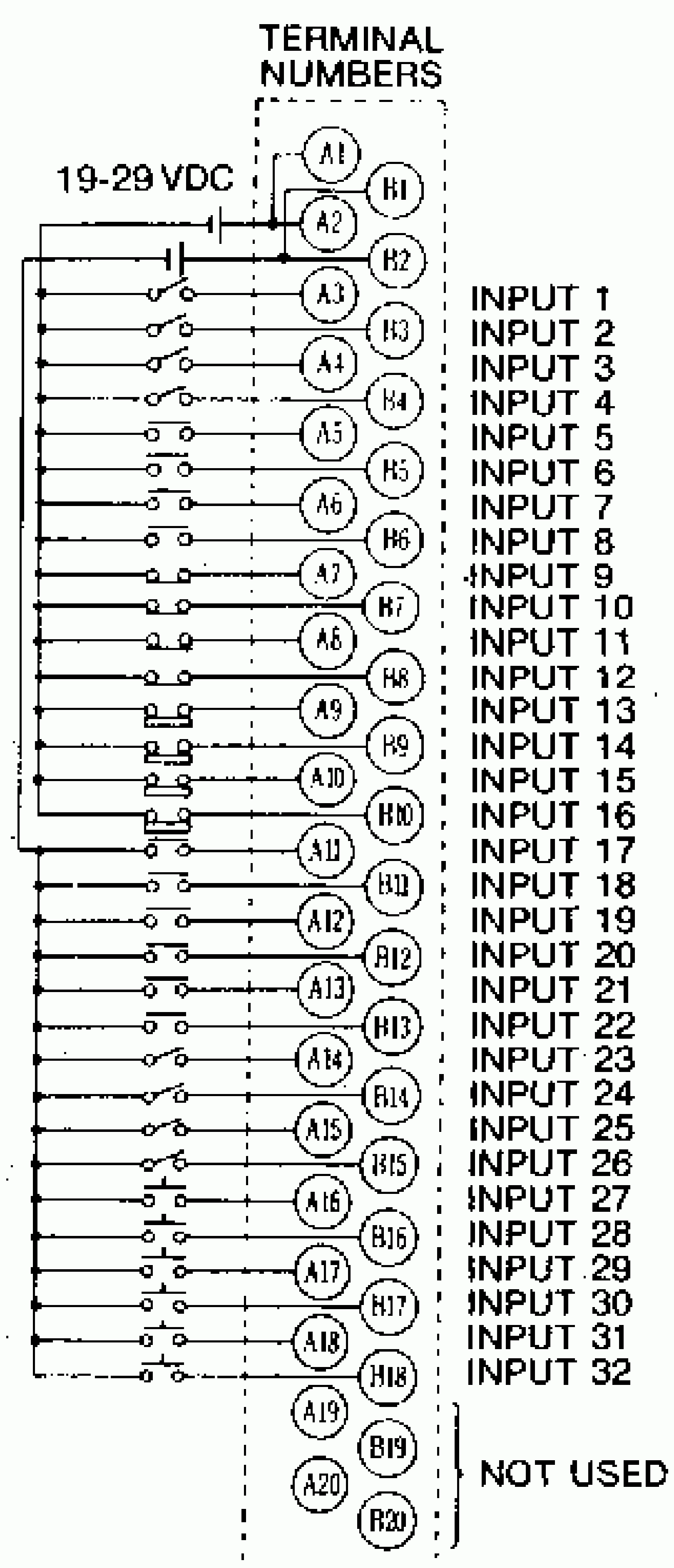


Fig. 5.16 B1065 24 VDC Input Module Terminal Numbering and Input Connections

(9) B1050 100 VAC Output Module

Table 5.9 100 VAC Output Module Specifications

Items	Specifications
Type	JAMSC – B1050.
Number of Outputs	16 – Outputs per module.
Indicators	16 – Output status LED's, provided for each output, lighting up when output ON (at internal logic side). 2 – Blown fuse LED's, provided for every 8 outputs, lighting up with fuse blown.
Fuse Rating	5 A (Glass tube fuse).
Electrical Characteristics	
• Load voltage	
Working voltage	80 to 130 VAC.
Transient voltage	200 VAC for 1 cycle.
Average ON voltage	1.5 V rms (Load current: 2 A rms).
• Load current	
ON current	2 A rms per output; 5 A per 8 outputs.
OFF current	2 mA rms maximum.
Inrush current	15 A (10 ms).
Minimum load current	10 mA rms.
• Response time	OFF to ON: 10 ms maximum. ON to OFF: 10 ms maximum.
• Isolation voltage	1500 VAC for 1 minute.

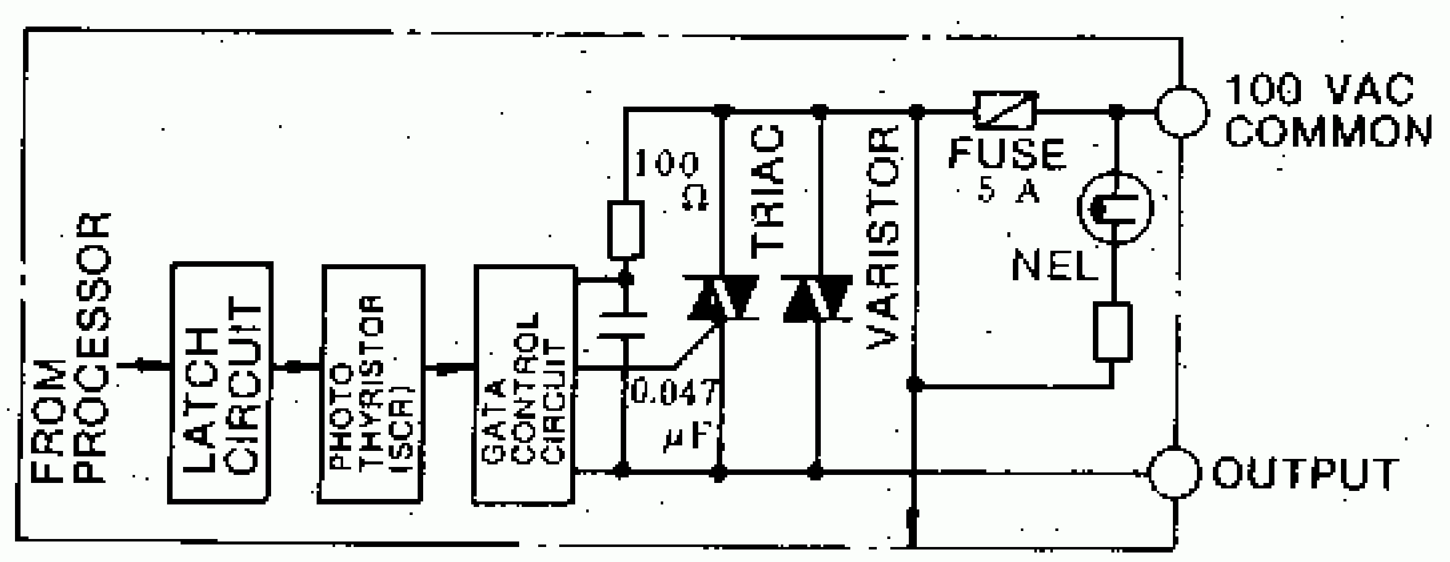


Fig. 5.17 B1050 100 VAC Output Module Simplified Schematic for One Circuit

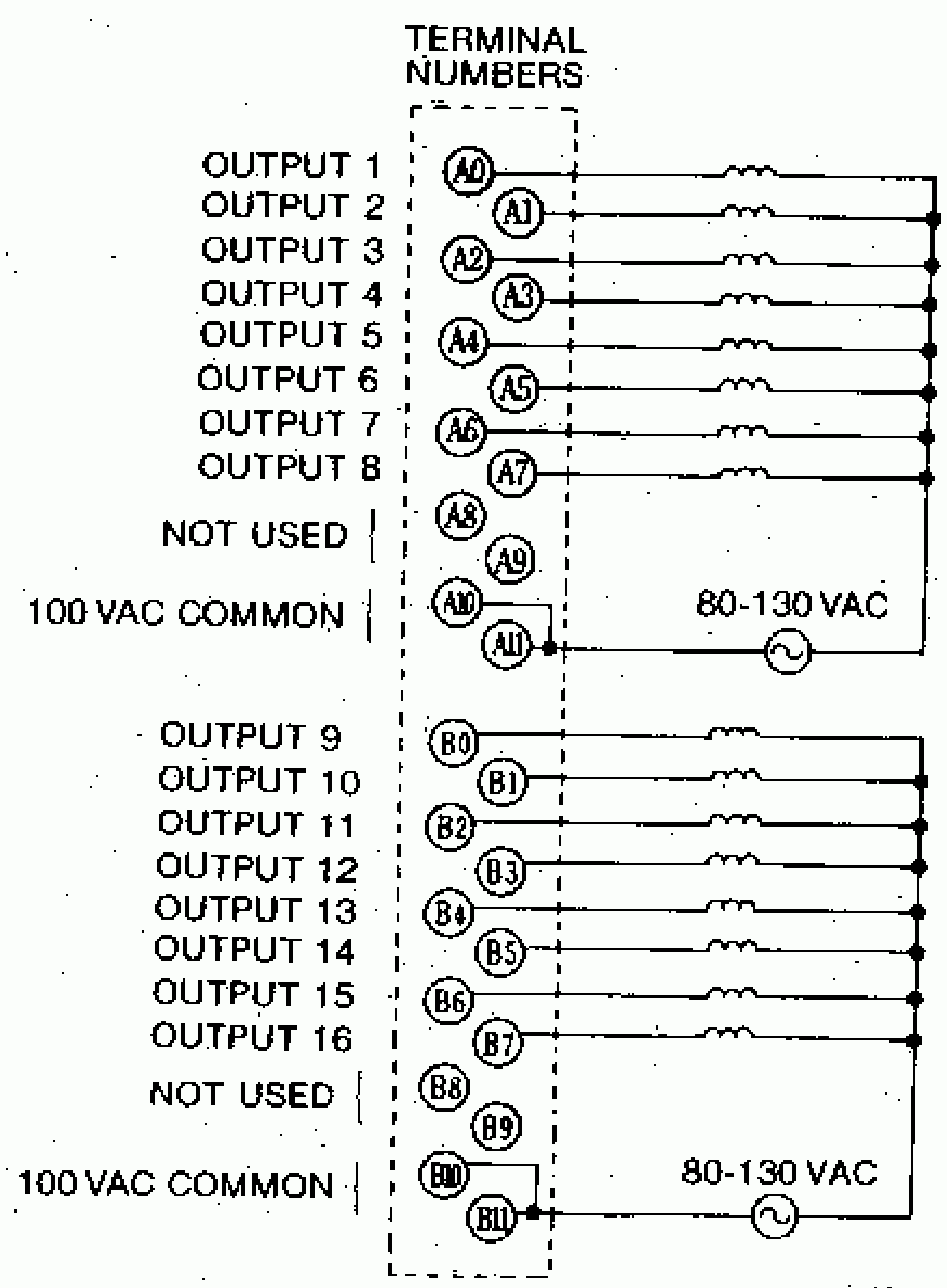


Fig. 5.18 B1050 100 VAC Output Module Terminal Numbering and Output Connections

(10) B1052 5/12 VDC Output Module

Table 5.10 5/12 VDC Output Module Specifications

Items	Specifications
Type	JAMSC - B1052.
Number of Outputs	16 - Outputs per module.
Indicators*	16 - Output status LED's, provided for each output, lighting up when output ON. 2 - Blown fuse LED's, provided for every 8 outputs, lighting up with fuse blown.
Fuse Rating	3A (Glass tube fuse).
Electrical Characteristics	
· Load voltage	
Working voltage	4.75 to 13.2 VDC.
Transient voltage	18 VDC (Peak).
Average ON voltage	0.6 V maximum(Load current: 0.3 A).
· Load current	
ON current	5 VDC: 0.1 A rms per output. 12 VDC: 0.3 A rms per output.
OFF current	0.2 mA rms maximum.
Inrush current	1 A (10 ms).
· Response time	OFF to ON: 1 ms maximum. ON to OFF: 1 ms maximum.
· External power supply current (per module)	see table below
· Isolation voltage	1500 VAC for 1 minute.

External power supply current (per module):

External Source Voltage	Outputs OFF	Outputs ON
5 VDC	1 mA max.	110 mA max.
12 VDC	1 mA max.	320 mA max.

*Blown fuse LED will not light with fuse blown if all 8 outputs are OFF.

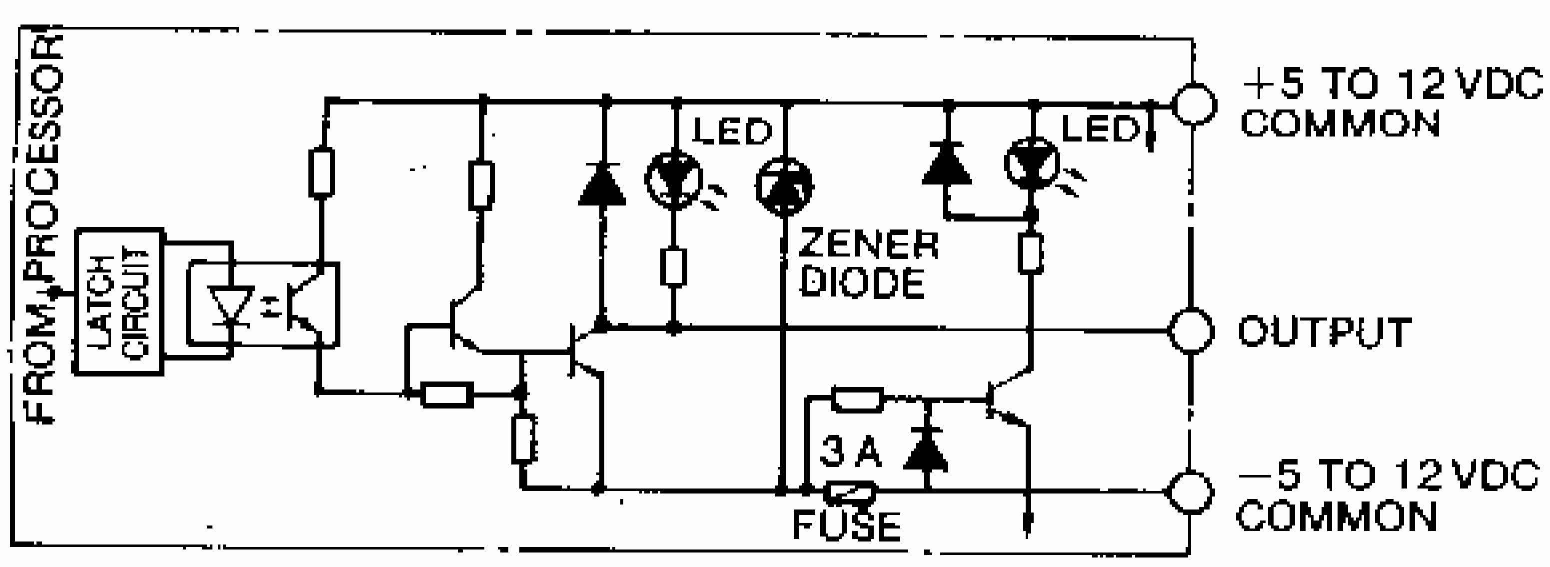


Fig. 5.19 B1052 5/12 VDC Output Module Simplified Schematic for One Circuit

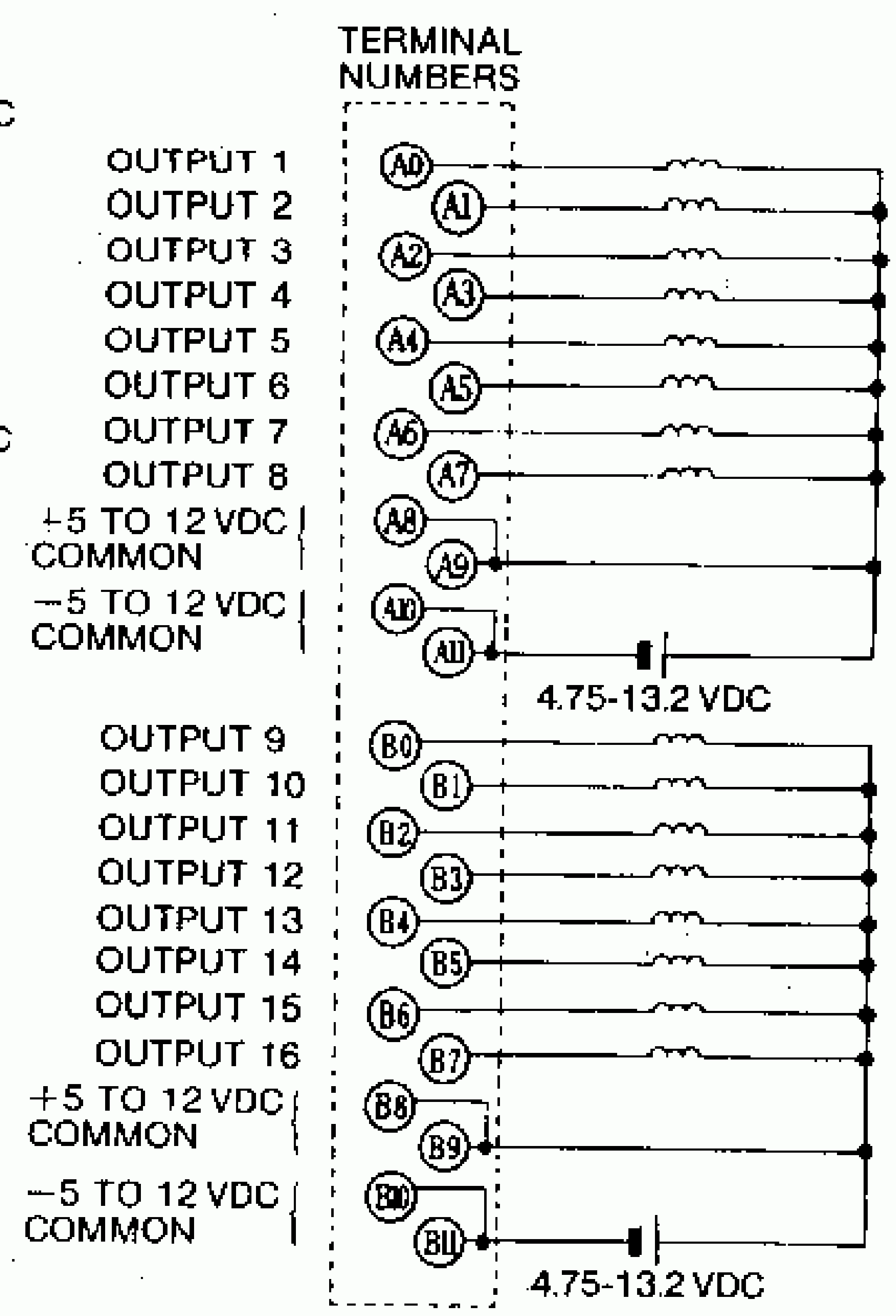


Fig. 5.20 B1052 5/12 VDC Output Module Terminal Numbering and Output Connections

(11) B1054 200 VAC Output Module

Table 5.11 200 VAC Output Module Specifications

Items	Specifications
Type	JAMSC - B1054.
Number of Outputs	16 - Outputs per module.
Indicators	16 - Output status LED's, provided for each output, lighting up when output ON (at internal logic side). 2 - Blown fuse LED's, provided for every 8 outputs, lighting up with fuse blown.
Fuse Rating	5 A (Glass tube fuse).
Electrical Characteristics	
• Load voltage	
Working voltage	160 to 260 VAC.
Transient voltage	400 VAC for 1 cycle.
Average ON voltage	1.5 V rms (Load current: 1 A rms).
• Load current	
ON current	1 A rms per output, 5 A per 8 outputs.
OFF current	2 mA rms maximum.
Inrush current	15 A (10 ms).
Minimum load current	10 mA rms.
• Response time	OFF to ON: 10 ms maximum. ON to OFF: 10 ms maximum.
• Isolation voltage	1500 VAC for 1 minute.

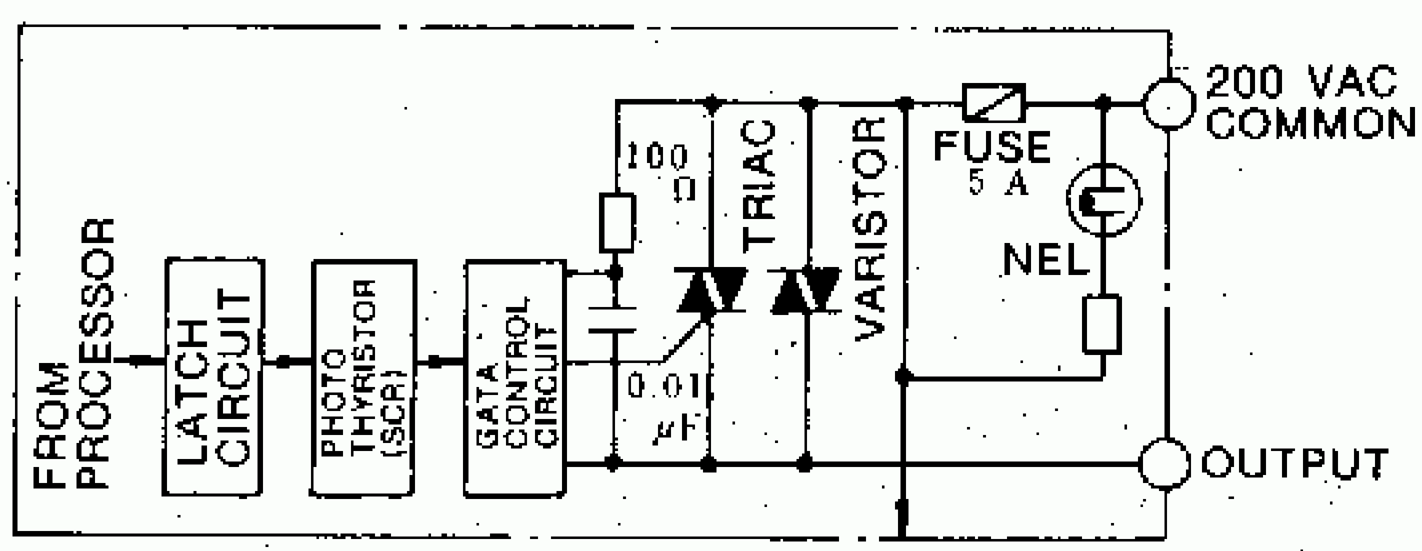


Fig. 5.21 B1054 200 VAC Output Module Simplified Schematic for One Circuit

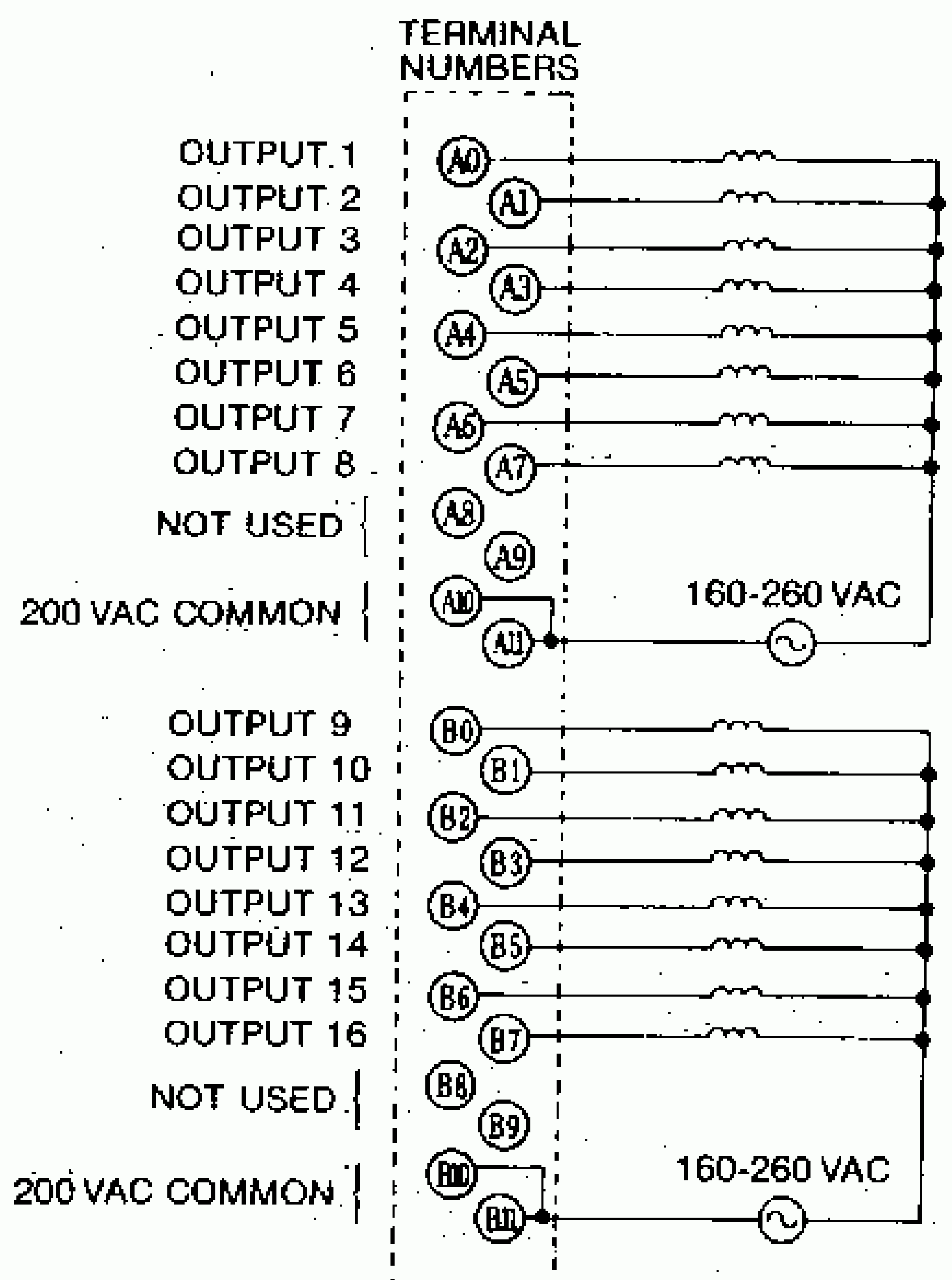


Fig. 5.22 B1054 200 VAC Output Module Terminal Numbering and Output Connections

(12) B1056 48 VDC Output Module

Table 5.12 48 VDC Output Module Specifications

Items	Specifications
Type	JAMSC - B1056.
Number of Outputs	16 - Outputs per module.
Indicators	16 - Output status LED's, provided for each output, lighting up when output ON. 2 - Blown fuse LED's, provided for every 8 outputs, lighting up with fuse blown.
Fuse Rating	5 A (Glass tube fuse).
Electrical Characteristics	
• Load voltage	
Working voltage	38 to 58 VDC.
Transient voltage	70 VDC (Peak).
Average ON voltage	1.5 V (Load current: 2 A).
• Load current	
ON current	2 A per outputs; 5 A per 8 outputs.
OFF current	1 mA maximum.
Inrush current	7 A (10 ms).
• Response time	OFF to ON: 1 ms maximum. ON to OFF: 1 ms maximum.
	External Source Voltage: 48 VDC; Outputs OFF: 20 mA; Outputs ON: 190 mA
• Isolation voltage	1500 VAC for 1 minute.

External Source Voltage	Outputs OFF	Outputs ON
48 VDC	20 mA	190 mA

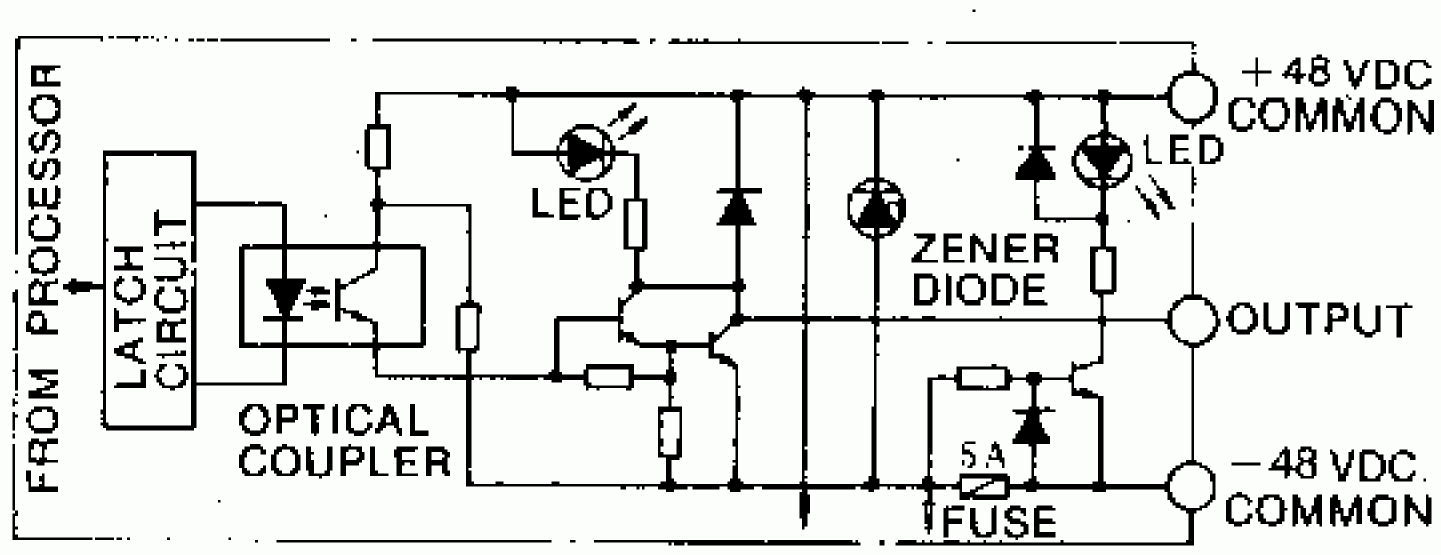


Fig. 5.23 B1056 48 VDC Output Module Simplified Schematic for One Circuit

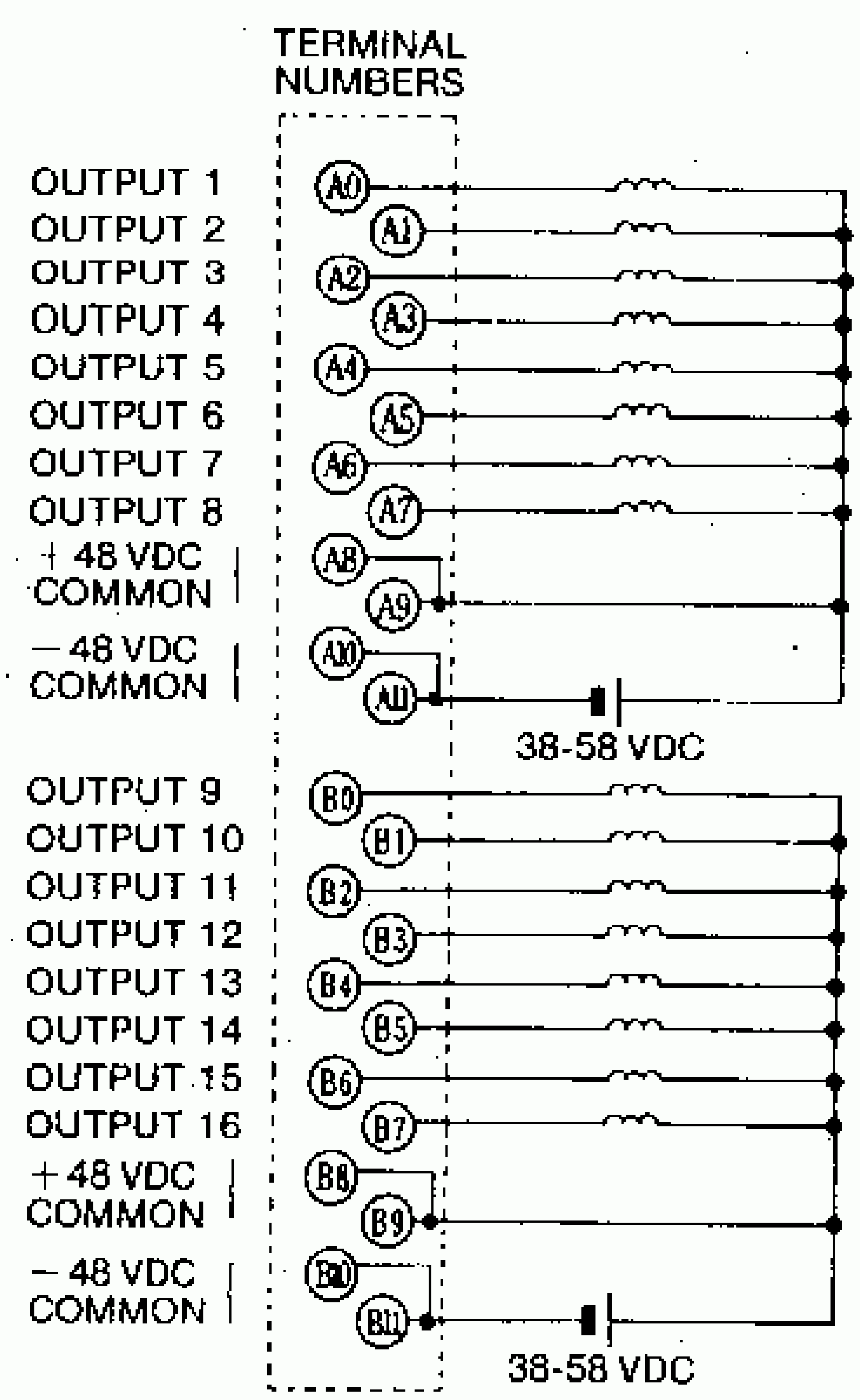


Fig. 5.24 B1056 48 VDC Output Module Terminal Numbering and Output Connections

(13) B1058 24 VDC Outpu

Table 5.13 24 VDC Output Module Specifications

<table>
<tr><th>Items</th><th>Specifications</th></tr>
<tr><td>Type</td><td>JAMSC - B1058.</td></tr>
<tr><td>Number of Outputs</td><td>16 - Outputs per module.</td></tr>
<tr><td>Indicators</td><td>16 - Output status LED's, provided for each output, lighting up when output ON.
2 - Blown fuse LED's, provided for every 8 outputs, lighting up with fuse blown.</td></tr>
<tr><td>Fuse Rating</td><td>5 A (Glass tube fuse).</td></tr>
<tr><td>Electrical Characteristics</td><td></td></tr>
<tr><td>• Load voltage</td><td></td></tr>
<tr><td>Working voltage</td><td>19 to 29 VDC.</td></tr>
<tr><td>Transient voltage</td><td>35 VDC (Peak).</td></tr>
<tr><td>Average ON voltage</td><td>1.5 V (Load current: 2 A).</td></tr>
<tr><td>• Load current</td><td></td></tr>
<tr><td>ON current</td><td>2 A per outputs; 5 A per 8 outputs.</td></tr>
<tr><td>OFF current</td><td>1 mA maximum.</td></tr>
<tr><td>Inrush current</td><td>7 A (10 ms).</td></tr>
<tr><td>• Response time</td><td>OFF to ON: 1 ms maximum.
ON to OFF: 1 ms maximum.</td></tr>
<tr><td></td><td><table><tr><th>External Source Voltage</th><th>Outputs OFF</th><th>Outputs ON</th></tr><tr><td>24 VDC</td><td>20 mA</td><td>190 mA</td></tr></table></td></tr>
<tr><td>• Isolation voltage</td><td>1500 VAC for 1 minute.</td></tr>
</table>

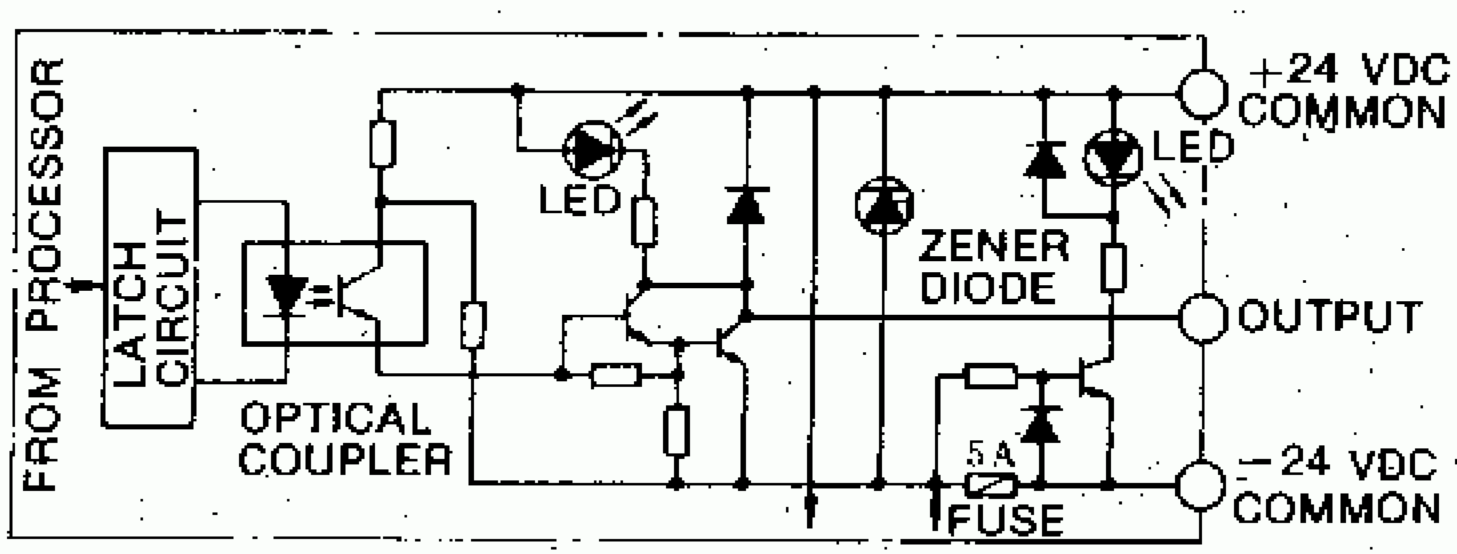


Fig. 5.25 B1058 24 VDC Output Module Simplified Schematic for One Circuit

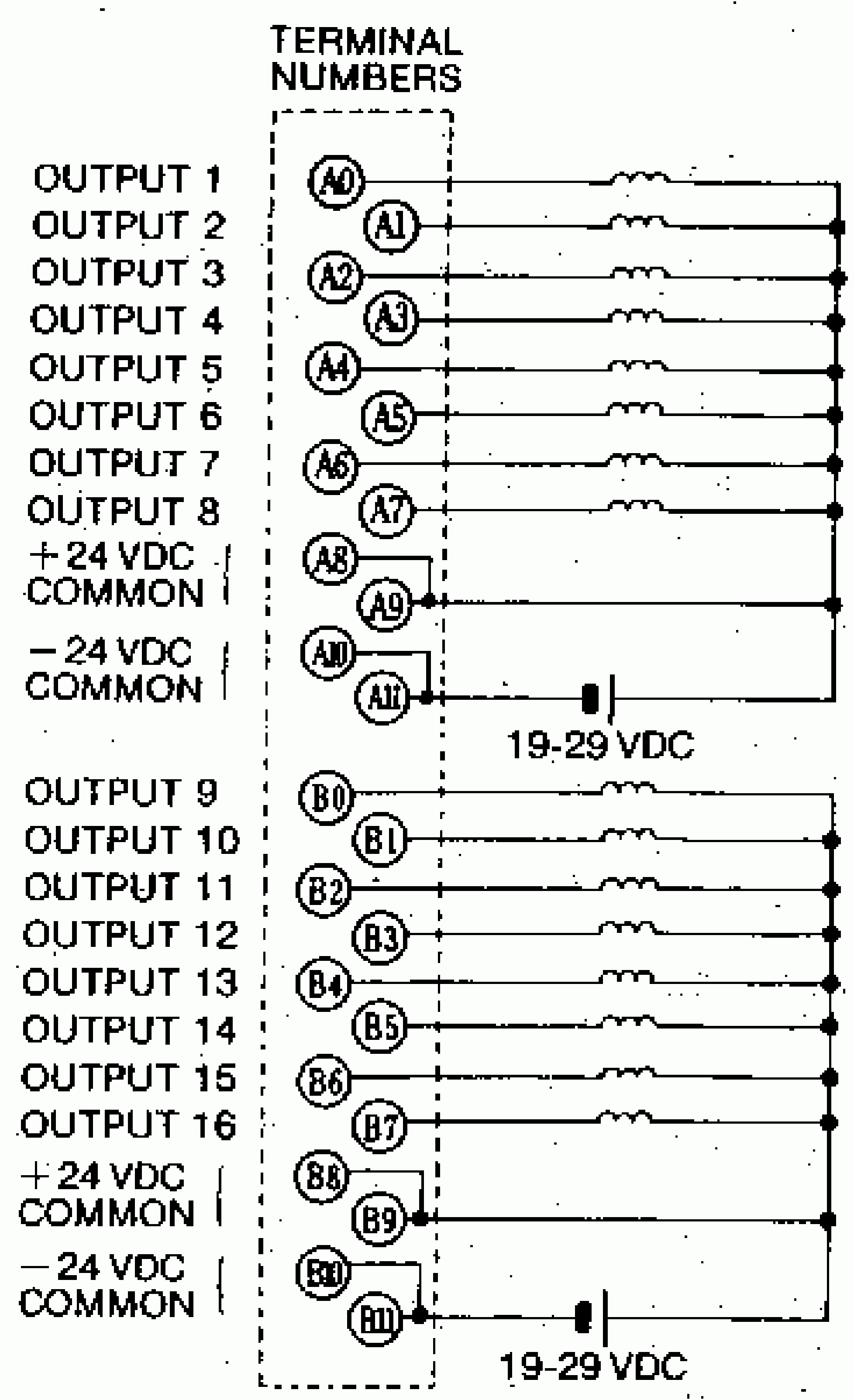


Fig. 5.26 B1058 24 VDC Output Module Terminal Numbering and Output Connections

(14) B1060 24 VDC Output Module

Table 5.14 24 VDC Output Module Specifications

Items			Specifications
Type			JAMSC-B1060.
Number of Outputs			64-Outputs per module.
Indicators			Upper (1 to 32) inputs/lower (1 to 32) inputs status LED's selection, lighting up when output ON.
Electrical Characteristics	Load Voltage	Working Voltage	20.4 to 26.4 VDC.
		Transient Voltage	35 VDC (Peak).
		Average ON Voltage	2.1 V max (Load current: 0.1 A).
	Load Current	ON Current	0.1 A per output; 0.4 A per 8 outputs.
		OFF Current	0.2 mA maximum.
		Inrush Current	0.5 A
	Response Time		OFF to ON: 1ms maximum. ON to OFF: 1ms maximum.
	External Power Supply Current (per Module)		External Source Voltage: 24 VDC; Inputs OFF: 1 mA max; Inputs ON: 60 mA max
	Isolation Voltage		1500 VAC for 1 minute.

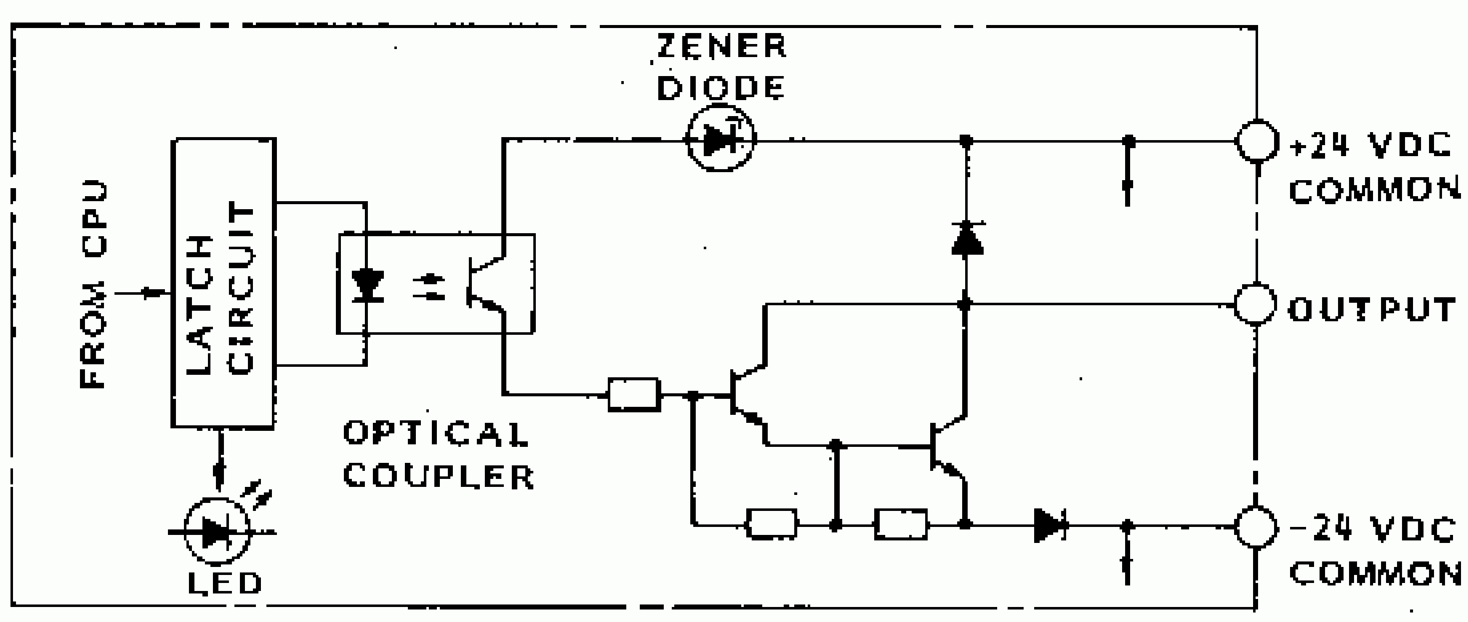
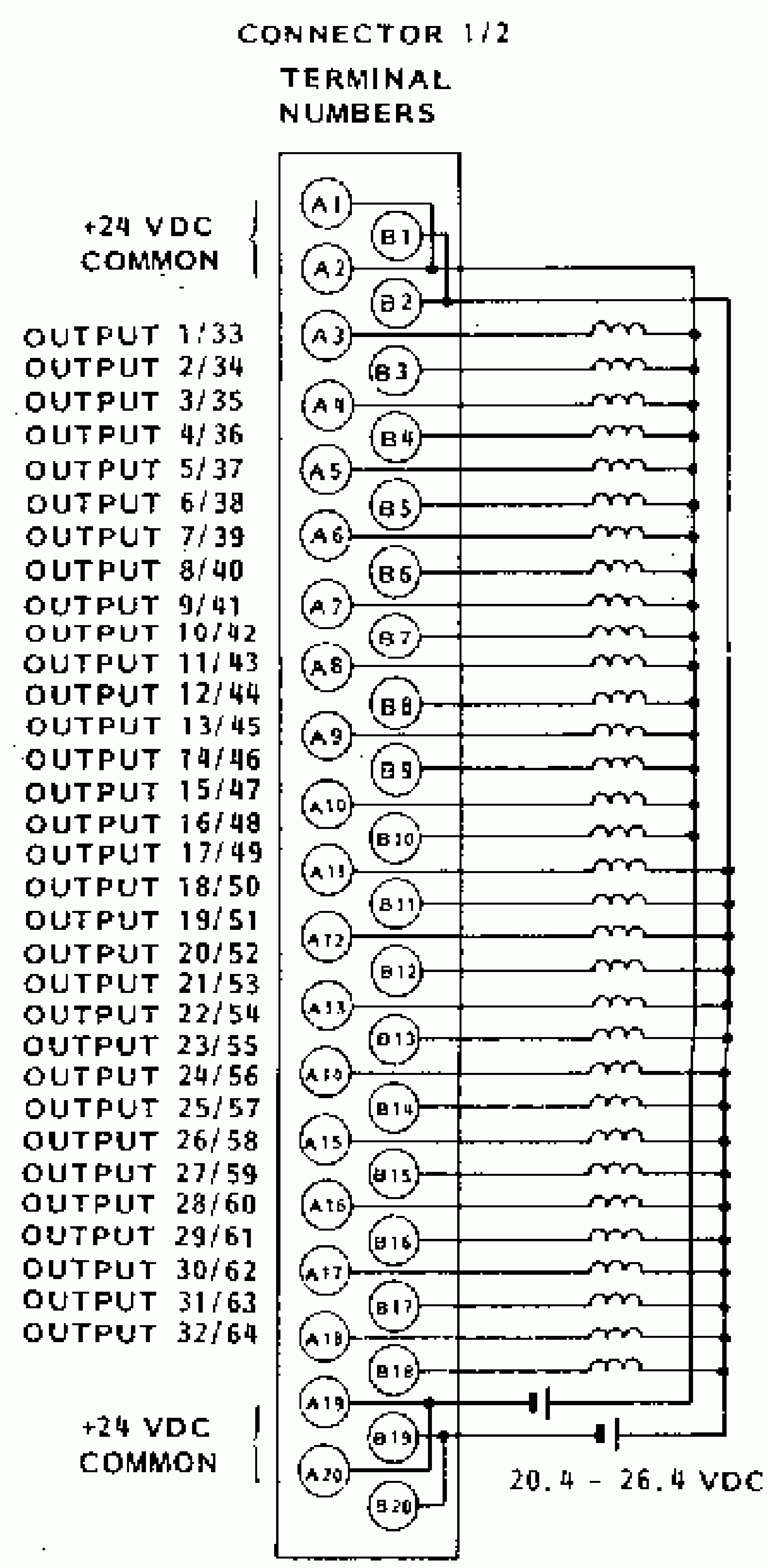


Fig. 5.27 B1060 24 VDC Output Module Simplified Schematic for One Circuit



Note: B1060 is provided with two connectors (connectors 1 and 2): These connectors have same terminal numbers and output connections.

Fig. 5.28 B1060 24 VDC Output Module Terminal Numbering and Output Connections

(15) B1062 24 VDC Output Module

Table 5.15 24 VDC Output Module Specifications

Items			Specifications
Type			JAMSC-B1062.
Number of Outputs			32-Outputs per module.
Indicators			32-Output status LED's, provided for each output, lighting up when output ON.
Electrical Character-istics	Load Voltage	Working Voltage	20.4 to 26.4 VDC.
		Transient Voltage	35 VDC (Peak).
		Average ON Voltage	2.1 V max (Load current: 0.3 A).
	Load Current	ON Current	0.3 A per output; 0.6 A per 4 outputs.
		OFF Current	0.2 mA maximum.
		Inrush Current	1 A (10ms).
	Response Time		OFF to ON: lms maximum. ON to OFF: lms maximum.
	External Power Supply Current (per Module)		External Source Voltage: 24 VDC; Outputs OFF: 1 mA max; Outputs ON: 160 mA max
	Isolation Voltage		1500 VAC for 1 minute.

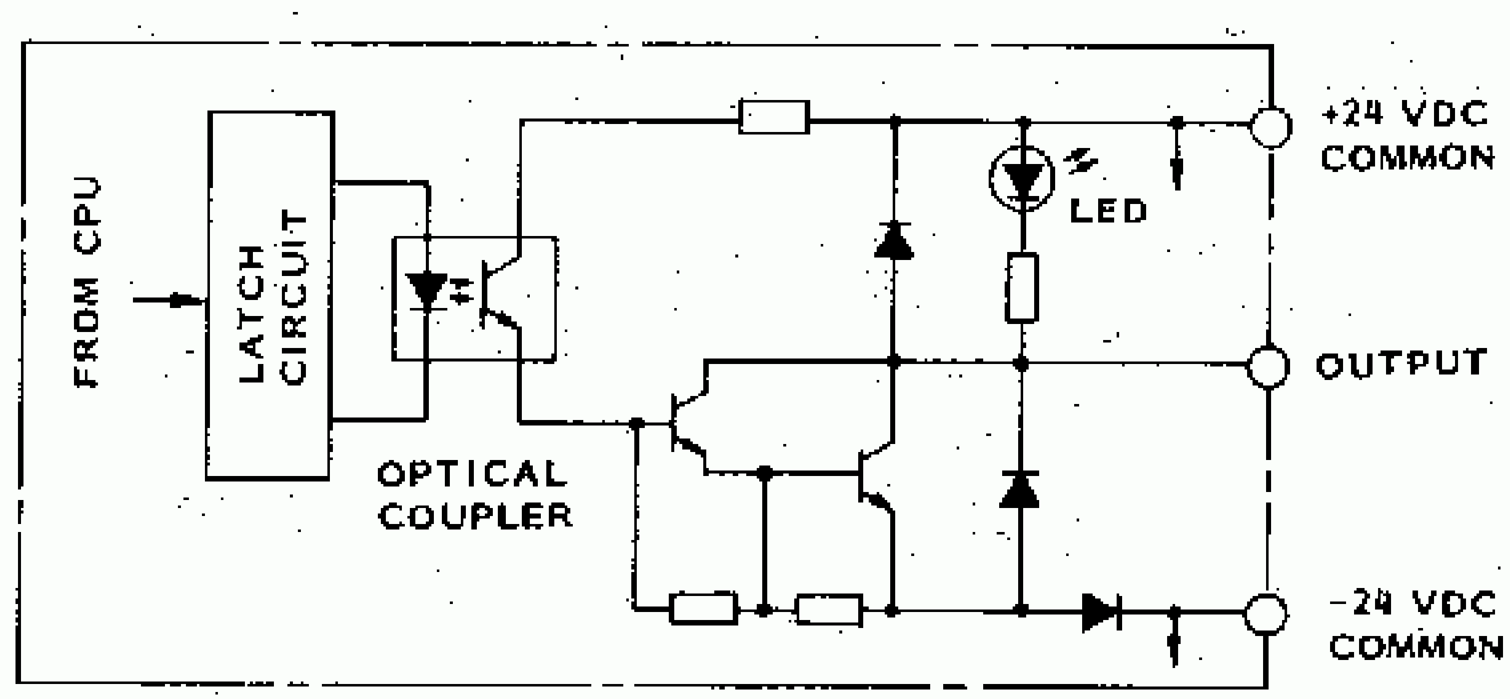


Fig. 5.29 B1062 24 VDC Output Module Simplified Schematic for One Circuit

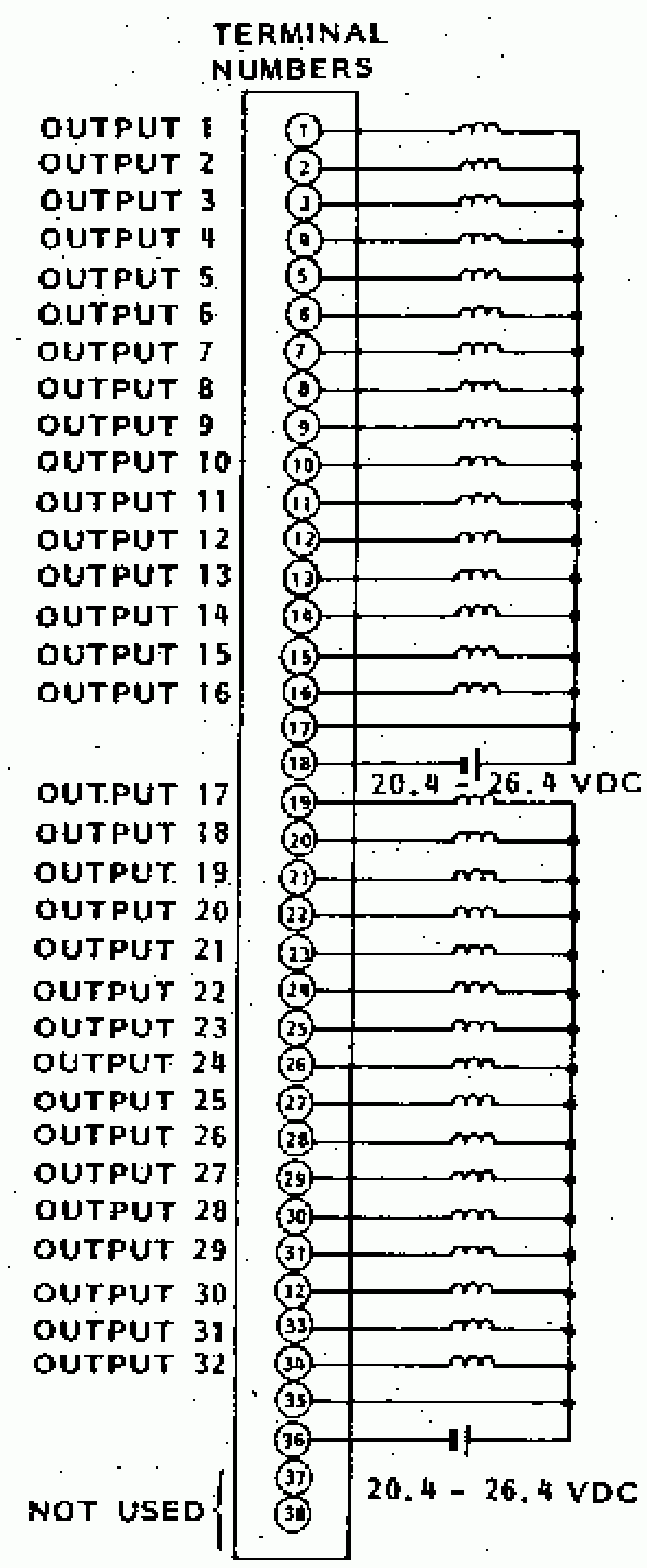


Fig. 5.30 B1062 24 VDC Output Module Terminal Numbering and Output Connections

(16) B1064 24 VDC Output Module

Table 5.16 24 VDC Output Module Specifications

Items			Specifications		
Type			JAMSC - B1064.		
Number of Outputs			32 - Outputs per module.		
Indicators			32 - Output status LED's provided for each output, lighting up when output ON.		
Fuse Rating			—		
Electrical Character-istics	Load Voltage	Working Voltage	19 to 29 VDC.		
		Transient Voltage	35 VDC (Peak).		
		Average ON Voltage	1.5 V (Load current: 0.3 A). (Negative logic)		
	Load Current	ON Current	0.3 A per output.		
		OFF Current	0.2 mA maximum.		
		Inrush Current	1 A maximum for 10 ms.		
	Response Time		OFF to ON: 1 ms maximum. ON to OFF: 1 ms maximum.		
	External Power Supply Current (per Module)		External Source Voltage	Outputs OFF	Outputs ON
			24 VDC	75 mA	240 mA
	Isolation Voltage		1500 VAC for 1 minute		

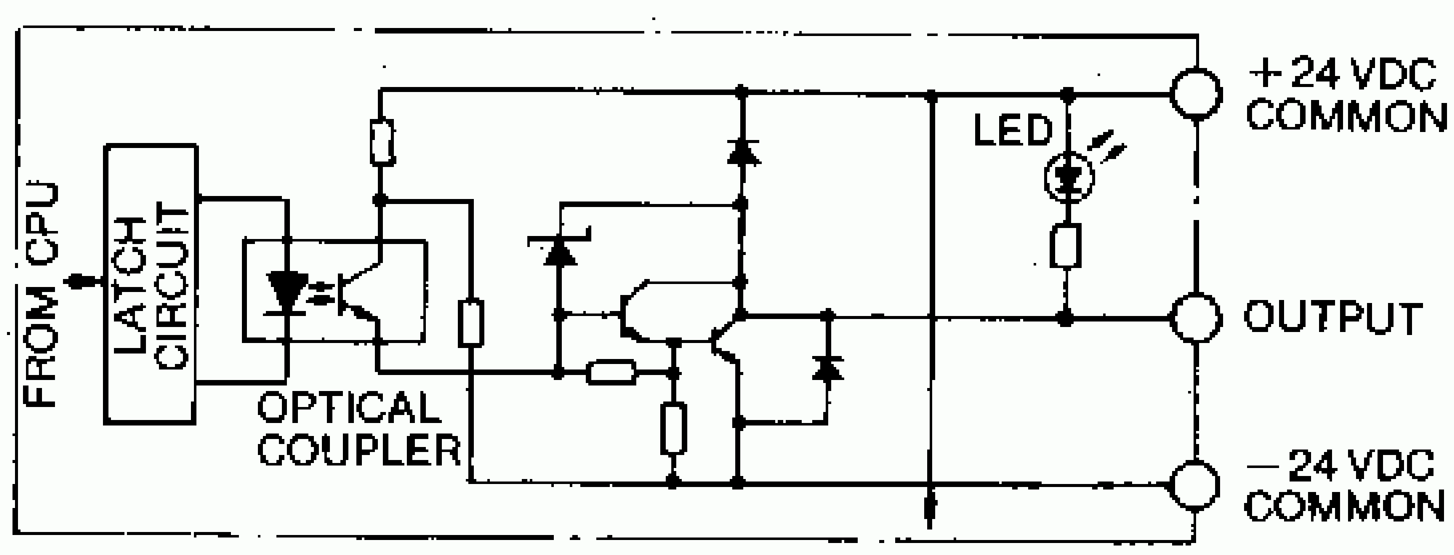


Fig. 5.31 B1064 24 VDC Output Module
Simplified Schematic for One Circuit

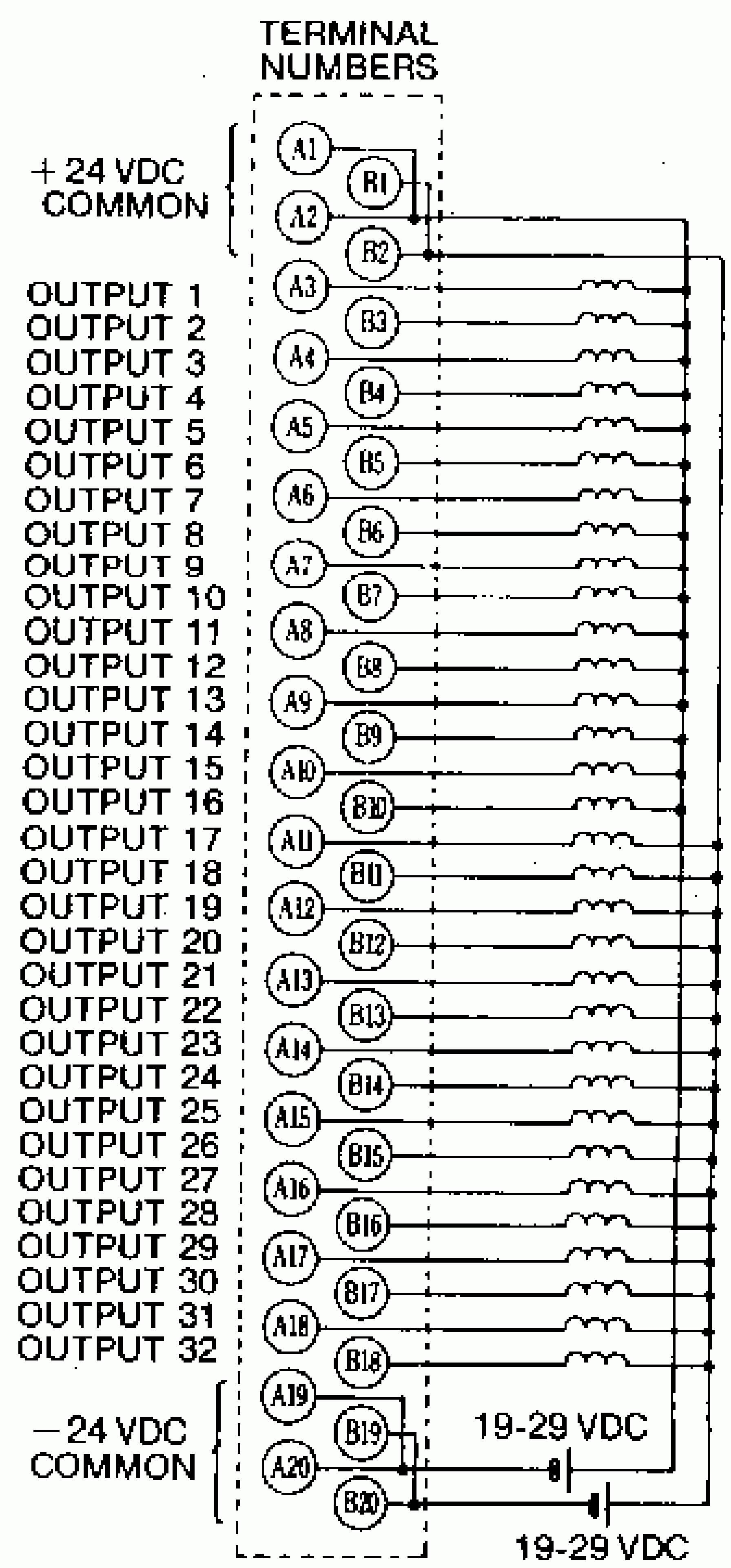


Fig. 5.32 B1064 24 VDC Output Module
Terminal Numbering and
Output Connections

(17) B1090B Relay Output Module

Table 5.17 Relay Outupt Module Specifications

Items			Specifications
Type			JAMSC-B1090B.
Number of Outputs			16-Outputs per module.
Indicators			16-Output status LED's provided for each output, lighting up when output ON.
Fuse Rating			1 A (Glass tube fuse) for external power supply.
Electrical Charac-teristics	Contact Ratings	Rated Voltage, Current	220 VAC, 0.8 A (Induction load, PF 0.4). 110 VAC, 1.2 A (Induction load, PF 0.4). 24 VDC, 1 A (Induction load, time constant 40 ms).
		OFF Leakage Current	200 VAC, 2mA maximum. 100 VAC, 1mA maximum.
		Min Operational Voltage, Current	1 V, 10 mA, 100 mW.
		Max Operational Voltage	250 VAC/30 VDC.
		Max Closing Current	220 VAC, 15 A (PF 0.7).
		Max Interrupting Current	220 VAC, 5 A (PF 0.4). 24 VDC, 2 A (Time constant 40 ms).
		Contact Resistance	100 mΩ maximum.
		Switching Life	100,000 swiching min (at rated load).
	Response Time		OFF to ON: 7 ms maximum. ON to OFF: 3 ms maximum.
	External Power Supply for Coil		24 VDC ±10% (riple 5% or less). 450 mA (at all outputs ON).
	Insulation Voltage		1500 VAC for 1 minute.

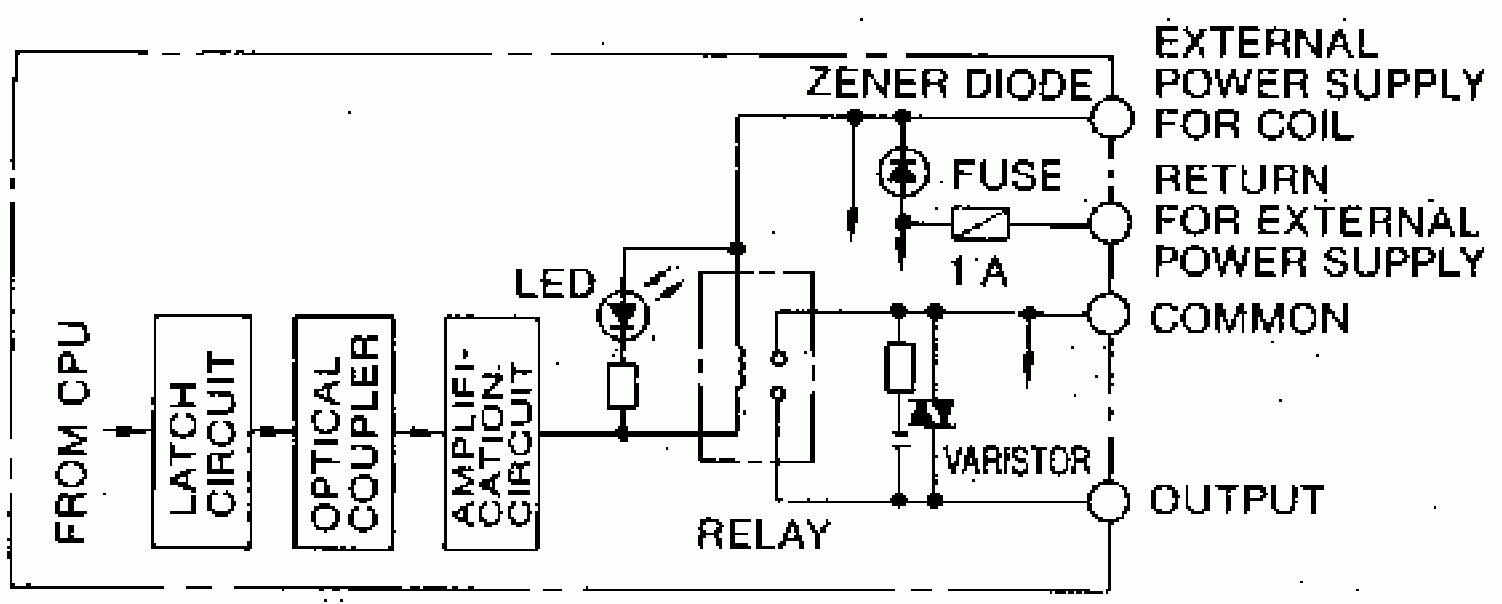


Fig. 5.33 B1090B Relay Output Module Simplified Schematic for One Circuit

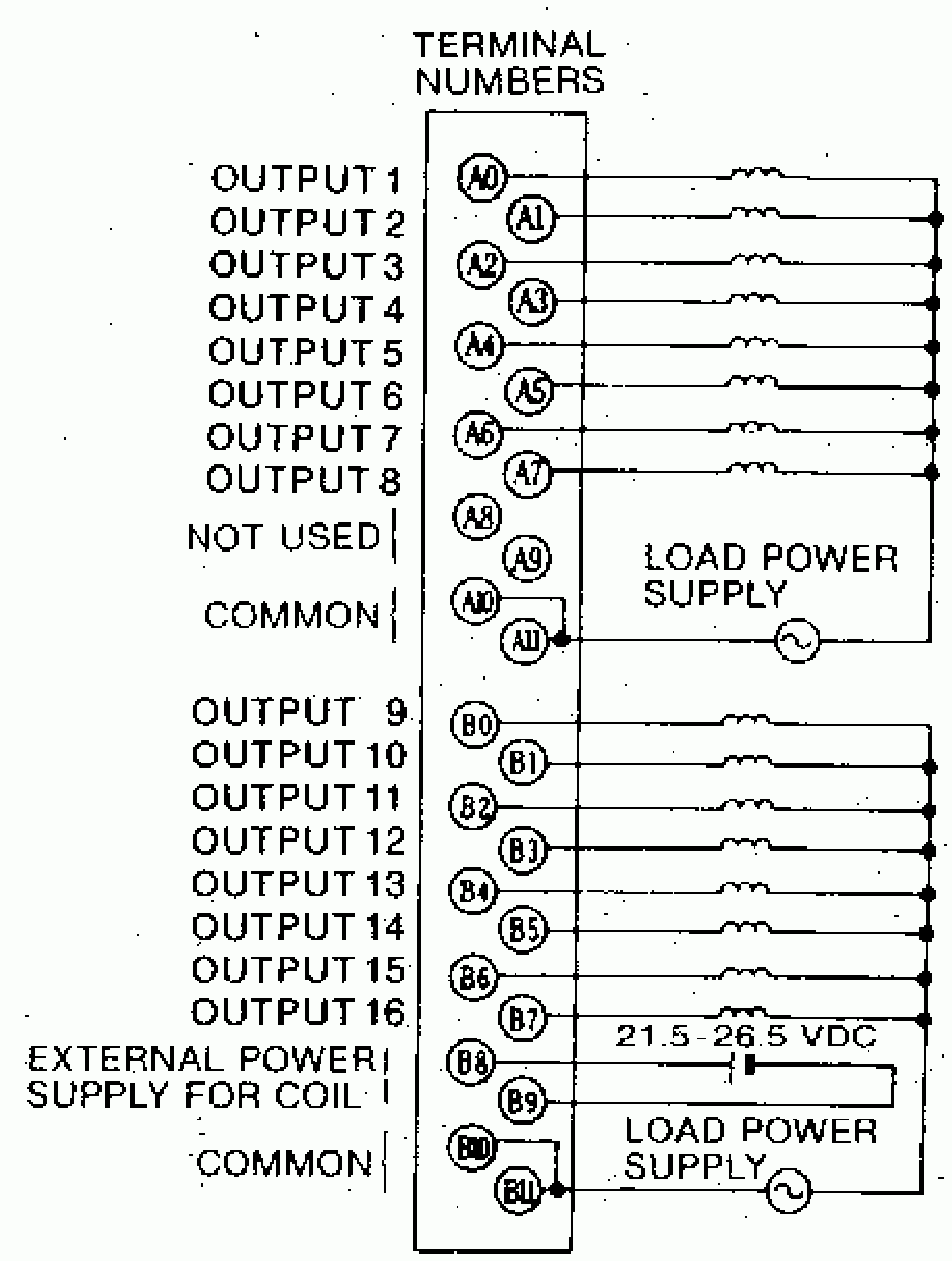


Fig. 5.34 B1090B Relay Output Module Terminal Numbering and Output Connections

(18) B1094 Power Reed Relay Output Module

Table 5.18 Relay Output Module Specifications

Items			Specifications
Type			JAMSC - B1094.
Number of Outputs			8 - Outputs per module.
Indicators			16 - Output stalus LED's provided for each output, lighting up when output ON.
Fuse Rating			1 A (Glass tube fuse) for external power supply.
Electrical Characteristics	Contact Ratings	Rated Voltage, Current	220 VAC, 1 A(PF 0.4) 110 VDC, 0.5 A(Time constant 100 ms)
		Min Operational Voltage, Current	1 V, 1 mA
		Max Closing Current	220 VAC, 30 A(PF 0.7)
		Max Interrupting Current	220 VAC, 30 A(PF 0.4) 110 VDC, 0.6 A(Time constant 100 ms).
		Contact Resistance	100 mΩ maximum.
		Switching Life	500,000 Switching maximum (at rated load).
	Response Time		OFF to ON: 7 ms maximum. ON to OFF: 3 ms maximum.
	External Power Supply for Coil		24 VDC $^{+10\%}_{-20\%}$ (ripple 5% or less), 270 mA (at all outputs ON).
	Insulation Voltage		1500 VAC for 1 minute.

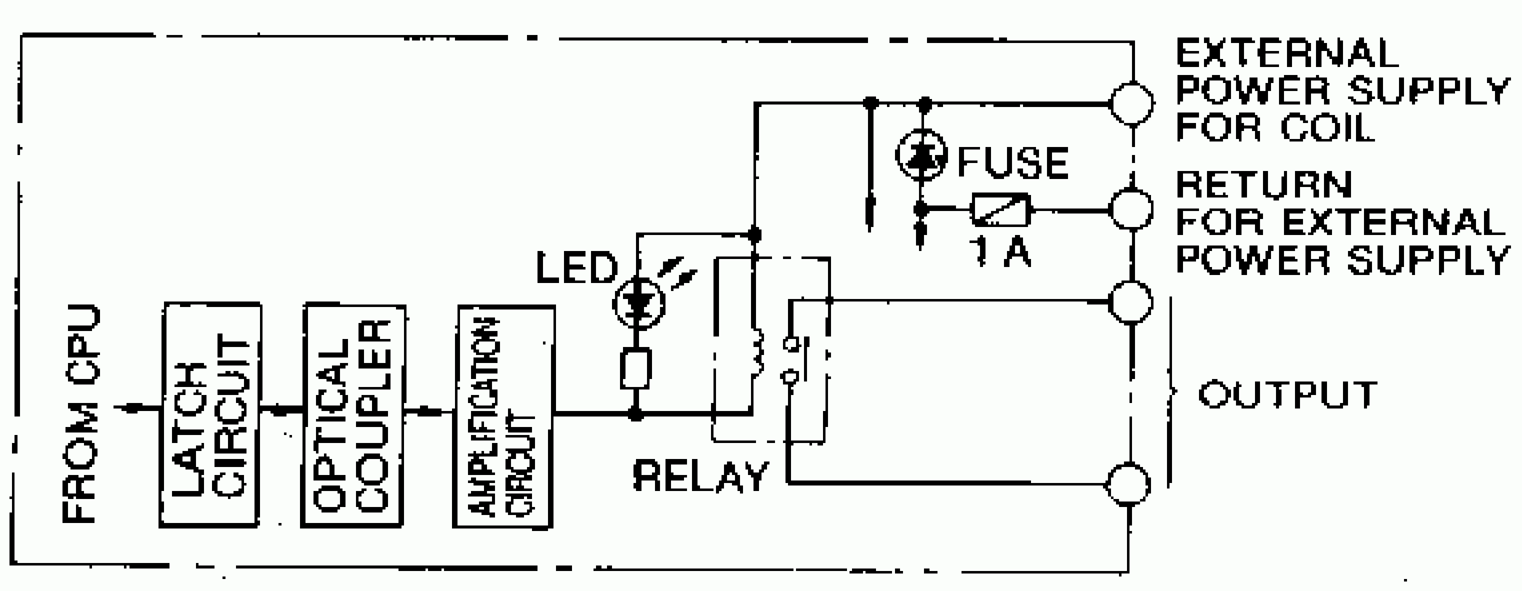


Fig. 5.35 B1094 Power Reed Relay Output Module Simplified Schematic for One Circuit

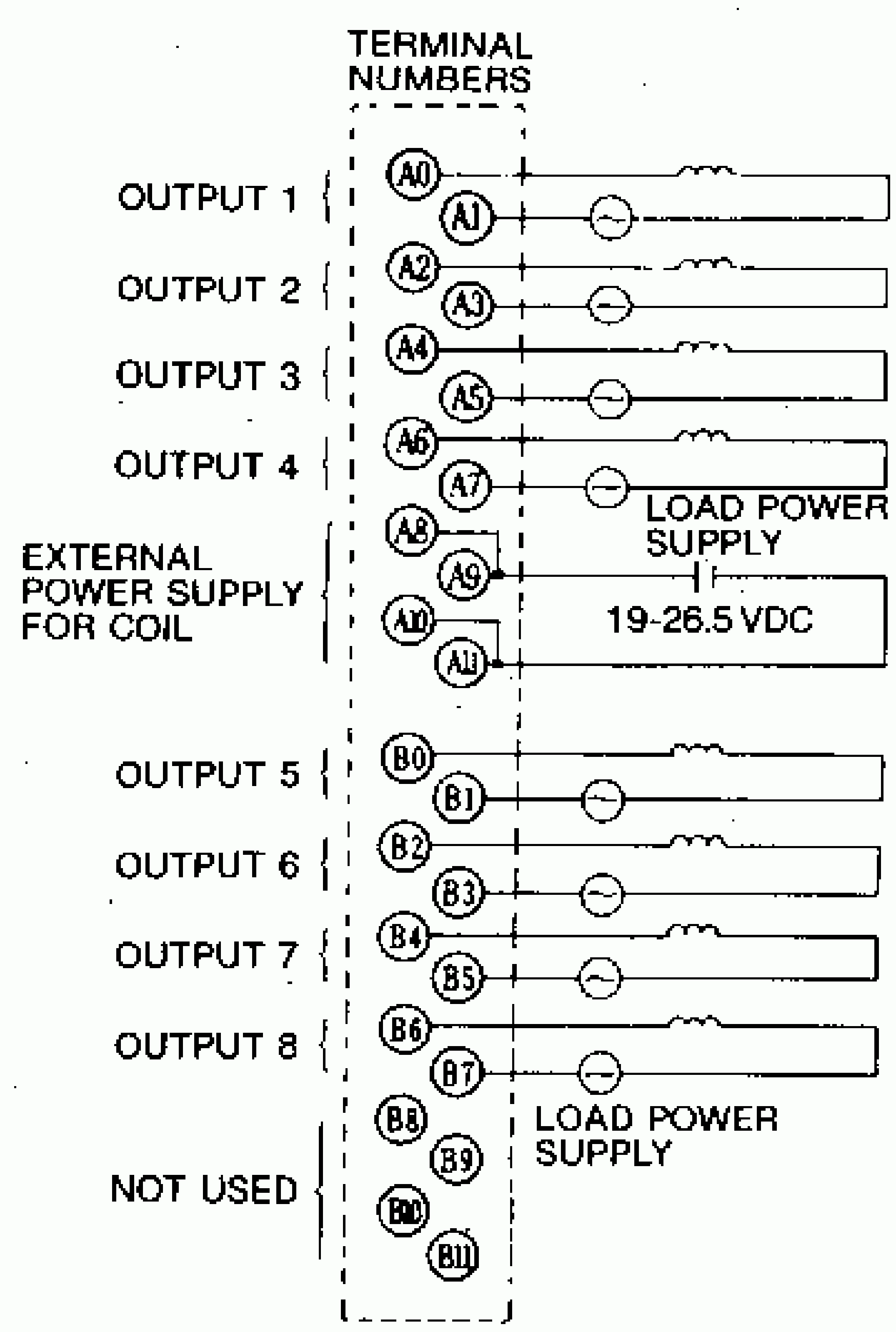


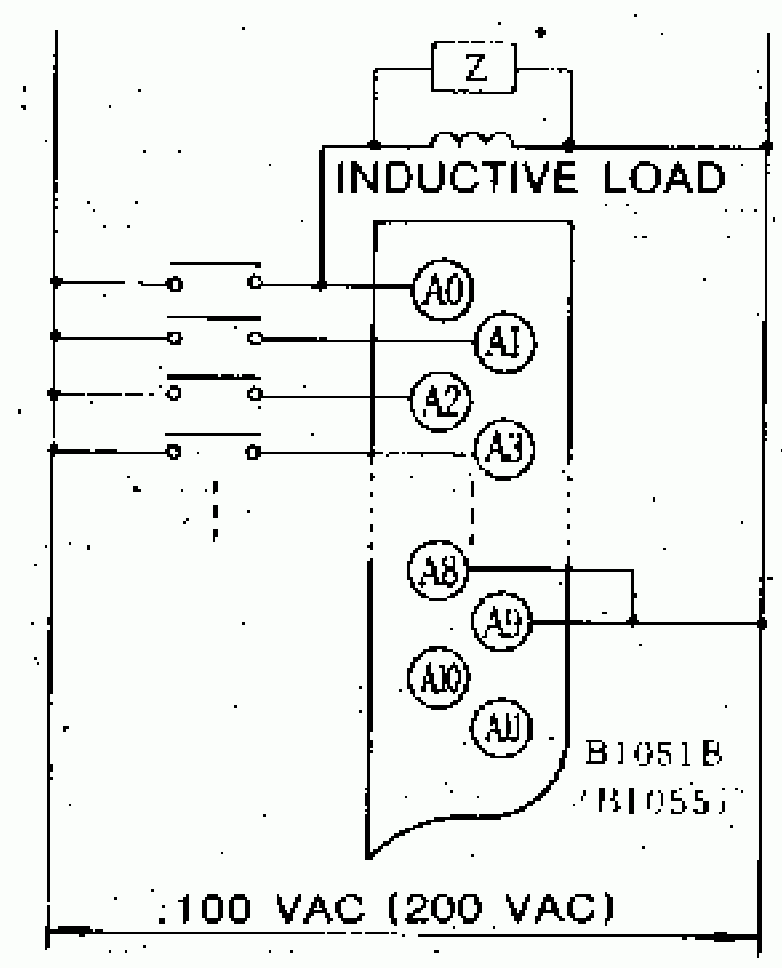
Fig. 5.36 B1094 Power Reed Relay Output Module Terminal Numbering and Output Connections

5.2 PRECAUTIONS FOR USING INPUT/OUTPUT MODULES

5.2.1 Input Module

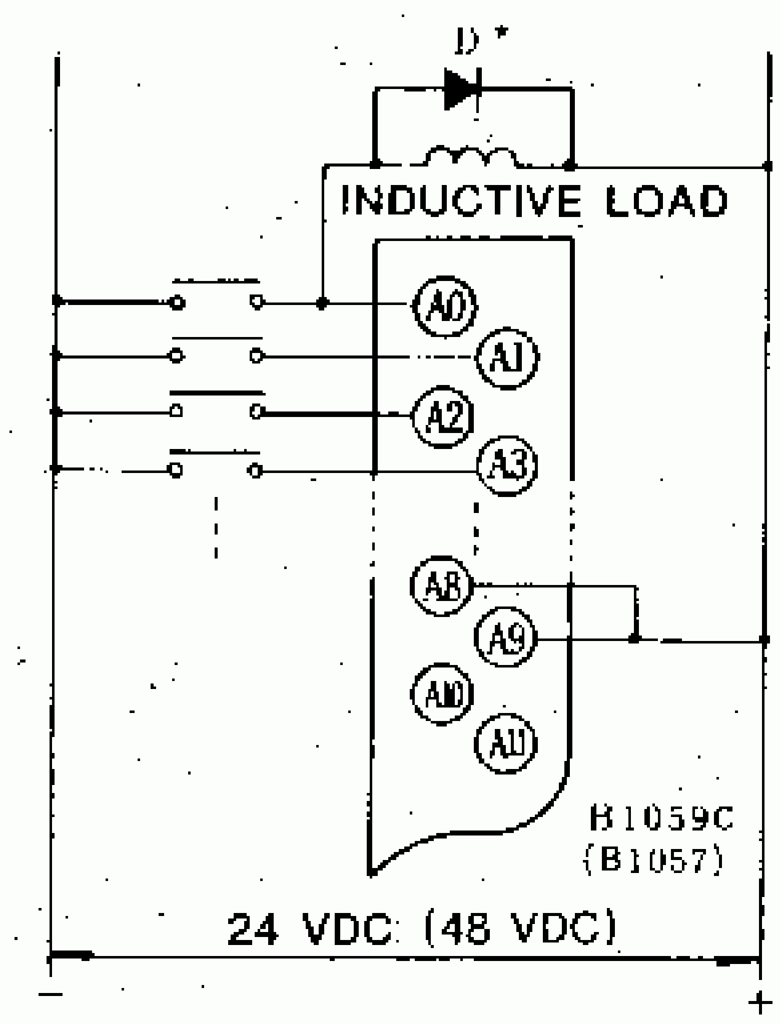
(1) Inductive Load

where an inductive load is connected in parallel with the input module as shown in Figs. 5.37 and 5.38, connect a surge absorber and flywheel diode in parallel with the inductive load, respectively for the AC input module and DC input module. However, when the current flow throuth the inductive load connected to the DC input module is below 0.5 A, no flywheel diode is required to be connected.



* The surge absorber capacity should be selected corresponding to the load. It is recommended that type CR 50500 (made by Okaya Denki Co.) or equivalent be used.

Fig. 5.37 AC Input Module

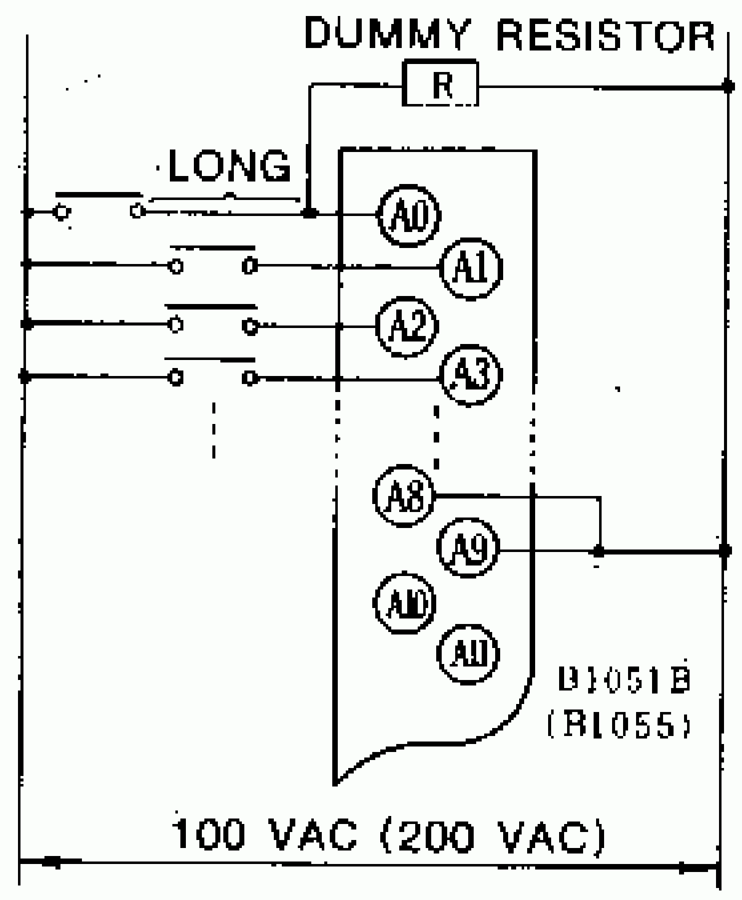


* The flywheel diode should be selected corresponding to the load. It is recommended that type F14 series (made by NEC) or equivalent be used.

Fig. 5.38 DC Input Module

(2) Input Dummy Resistor

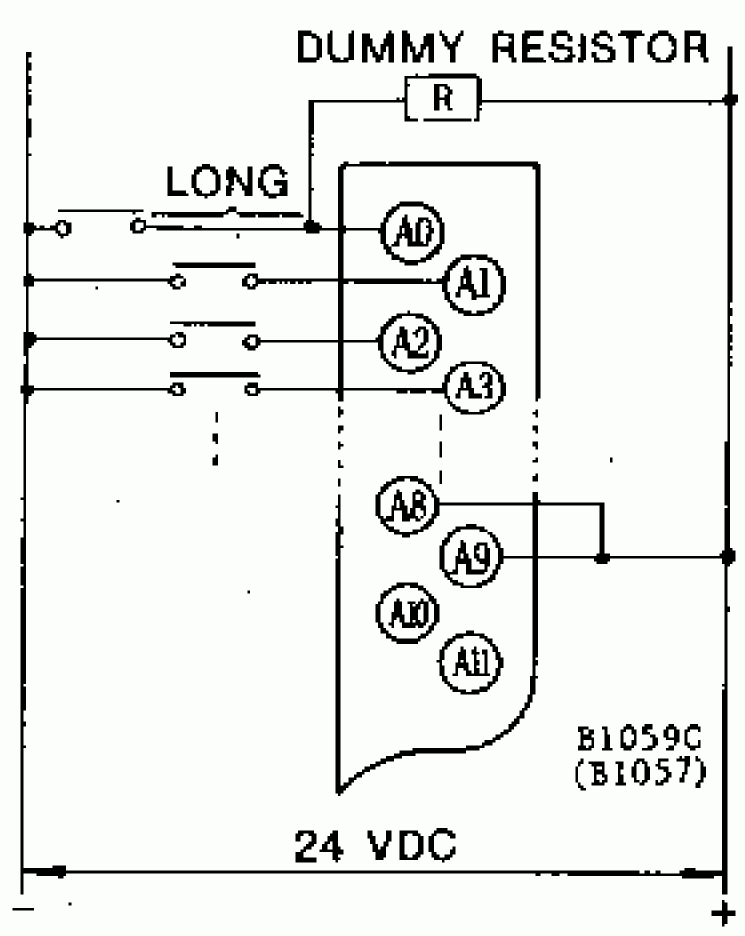
Where the external wiring is long or where there is an induction source in the vicinity, connect a dummy resistor in parallel to the input module, as shown in Figs. 5.39 and 5.40.



R: Input dummy resistor

- B1051B: 5 kΩ (10 W minimum)
- B1055: 10 kΩ (20 W minimum)

Fig. 5.39 AC Input Module



R: Input dummy resistor

- B1059C: 2 kΩ (2 W minimum)
- B1057: 5 kΩ (2 W minimum)

Fig. 5.40 DC Input Module

(3) Leakage Current in Input Equipment

Some input equipment (e.g. noncontact switches and limit switches with LED) has leakage current during the OFF state. It this equipment is connected to AC input modules, it may fail to maintain the voltage for an OFF condition which is an input due to leakage current, and input signals may not be cut off.

(Example) A non-contact switch with 5 mA of leakage current is connected to B1051B.

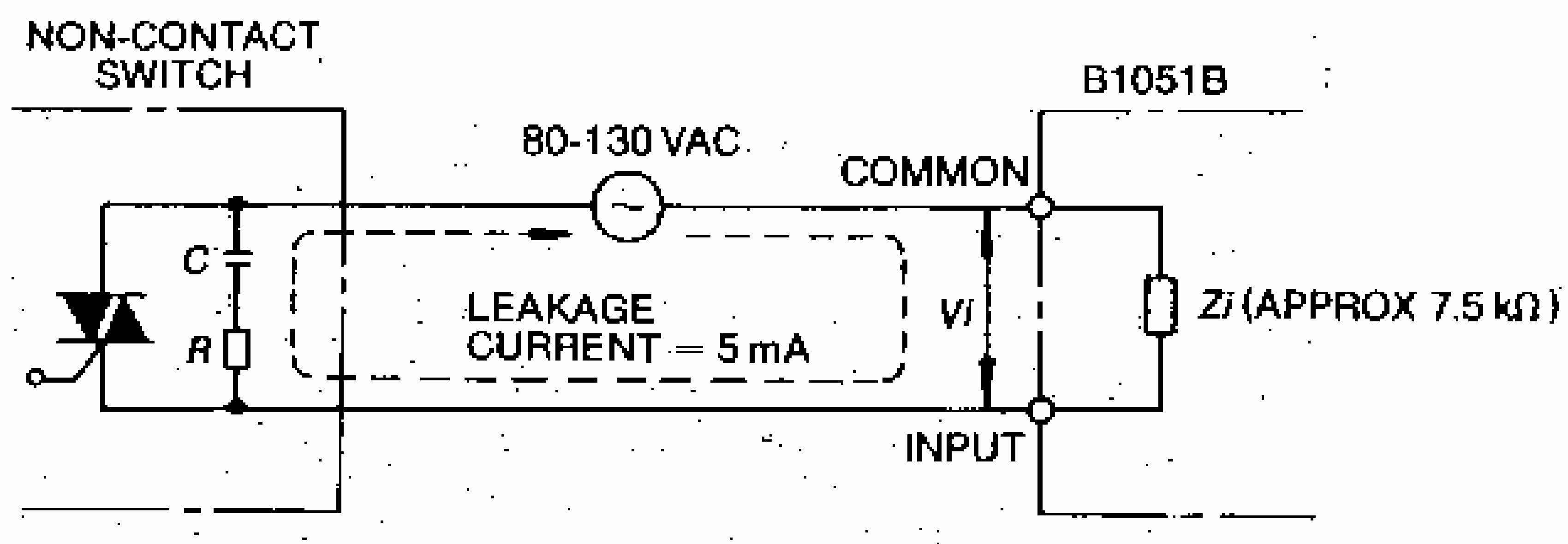


Fig. 5.41 Connection of a Non-contact Switch

If the leakage current is 5 mA, the input voltage (Vi) of B1051B becomes;

$$Vi = 5\ mA \times Zi = 5\ mA \times 7.5\ k\Omega = 37.5\ V$$

Since this does not satisfy an input condition (OFF voltage = 30 V or less), input signals may not be cut off. In this case, add a proper dummy resistor to the input terminal of B1051B.

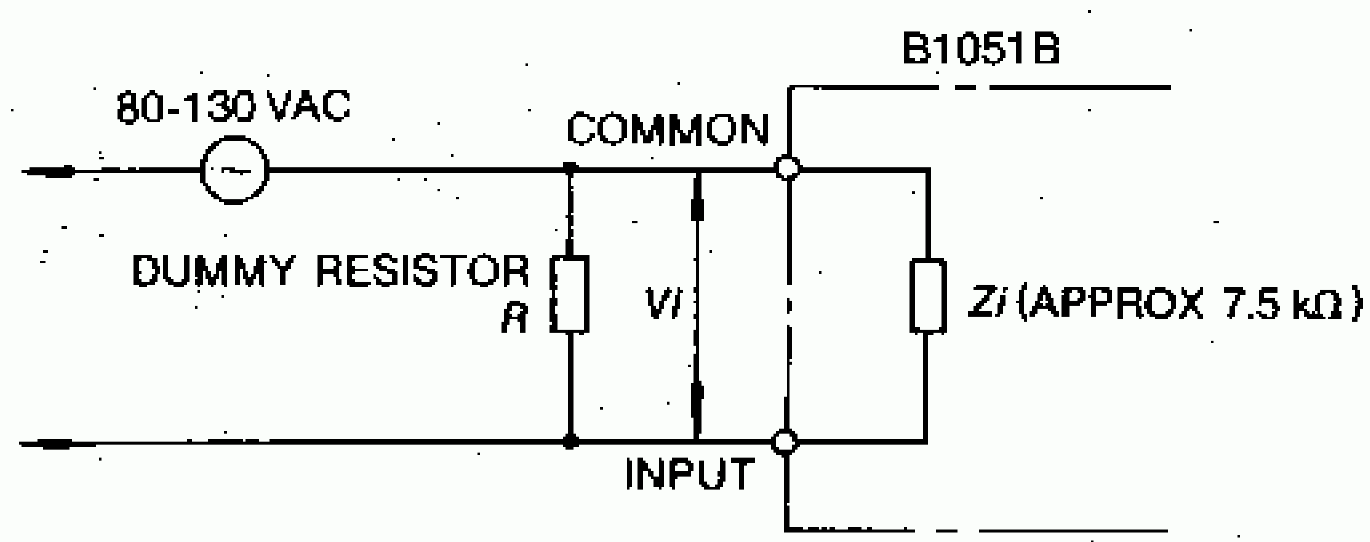


Fig. 5.42 Addition of a Dummy Resistor

The value of the dummy resistor R should be decided so that an input voltage Vi of B1051B becomes 30 V or less.

$$\frac{R \times Zi}{R + Zi} + leakage\ current < 30\ V$$

$$\frac{R \times 7.5\ k\Omega}{R + 7.5\ k\Omega} \times 5\ mA < 30\ V \qquad \therefore R < 30\ k\Omega$$

Thus, the value of R becomes 30 kΩ or less. However, if the value is too small, heating value increses, resulting in the need of a resistor with large wattage.

Assume that the value of R is 20 kΩ. Then the wattage W of the dummy resistor becomes;

$$W = \frac{(power\ source)^2}{R} = \frac{(100\ V)^2}{20\ k\Omega} = 0.5\ W \qquad \therefore W = 0.5\ W$$

Generally, the wattage W of the dummy resistor is taken to be 2 W to provide a surplus wattage about three time more than required.

(4) ON/OFF Conditions of DC Input Module

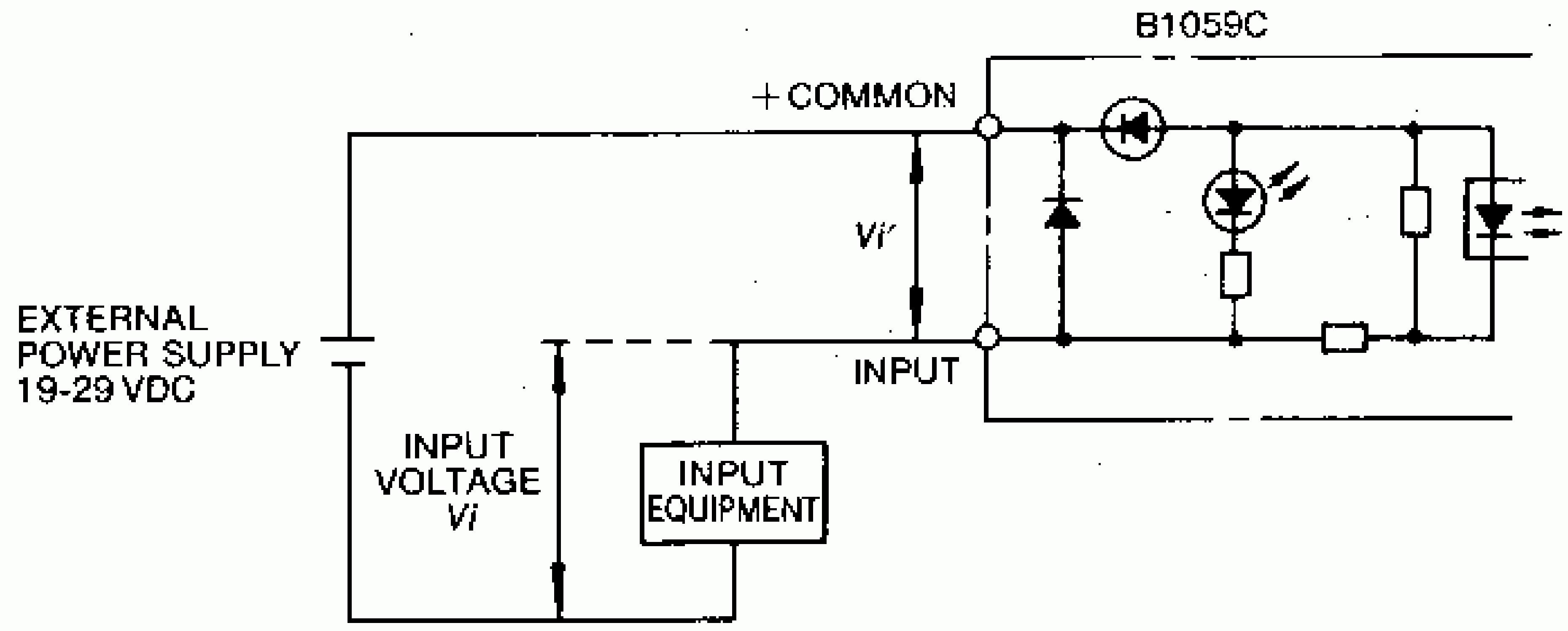


Fig. 5.43 ON/OFF Conditions of B1059C

Input conditions of B1059C are;

ON level: 8 VDC or less

OFF level: 14 VDC or more

However, these values reflect the input voltage Vi in Fig. 5.37 when external voltage is 24 VDC. Accurate input conditions at external voltage Vo are;

ON level: Vo - 16 V or less

OFF level: Vo - 10 V or more

These conditions are summarized as follows:

Table 5.19 Relationship of External Power Supply Voltage and Input Conditions for Vi

	External Power Supply Voltage		
	19 VDC	24 VDC	29 VDC
ON Level	3 VDC or less	8 VDC or less	13 VDC or less
OFF level	9 VDC or more	14 VDC or more	19 VDC or more

If input equipment with leakage current during OFF time is connected to DC input modules (B1053, B1057, B1061, B1063), input signals in OFF state may be called up as in ON state due to leakage current, or the input signal state indicator may turn on.

(Example) When a limit switch with LED is connected to B1059C

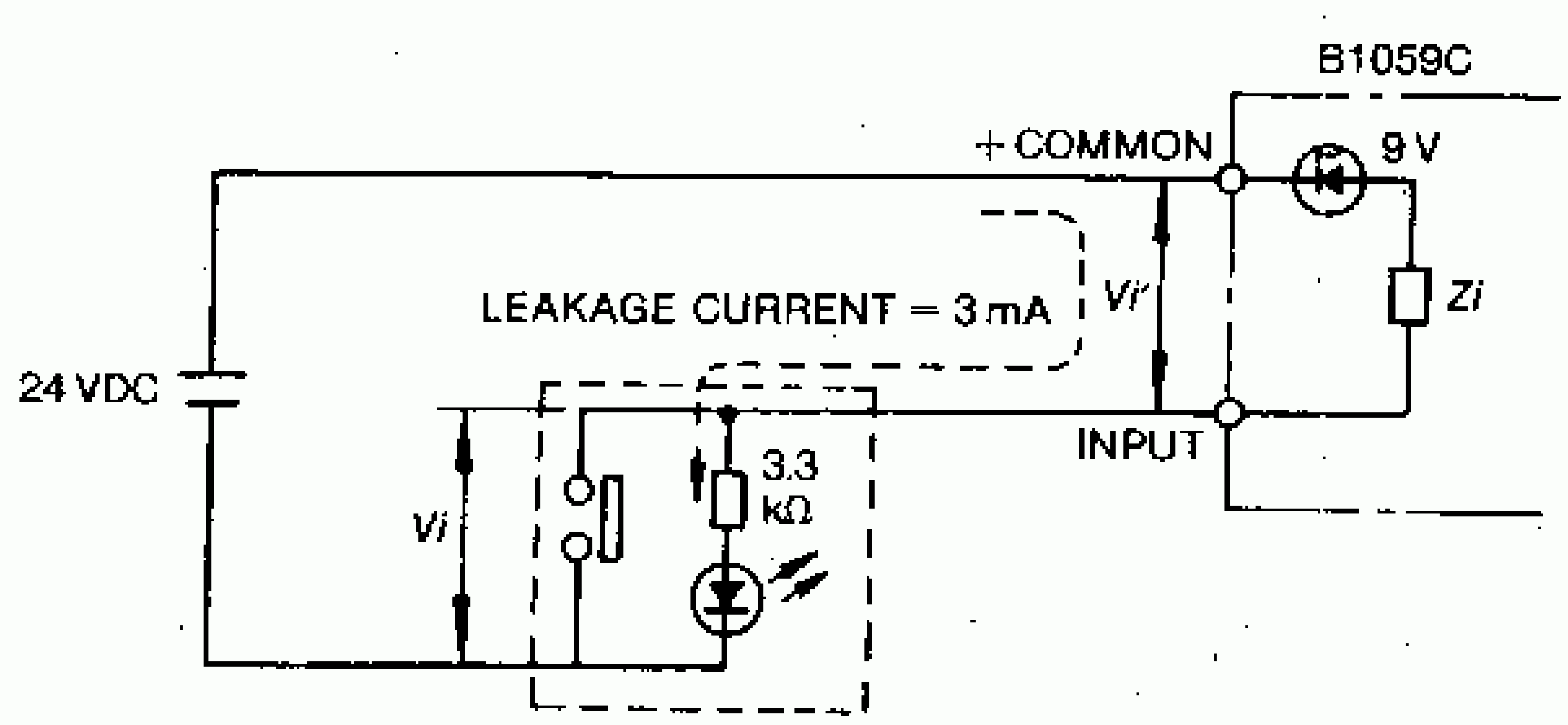


Fig. 5.44 Connection of a Limit Switch with LED

(4) ON/OFF Conditions of DC Input Module (Cont'd)

If a serial resistor of LED is 3.3 kΩ and the leakage current is 3 mA, then

$$Vi = 3.3\ k\Omega \times 3\ mA = 9.9\ V$$

This does not satisfy the input condition (OFF level = 14 V or more).
Therefore, add a proper dummy resistor to the input terminal of B1059C so that the input condition is satisfied.

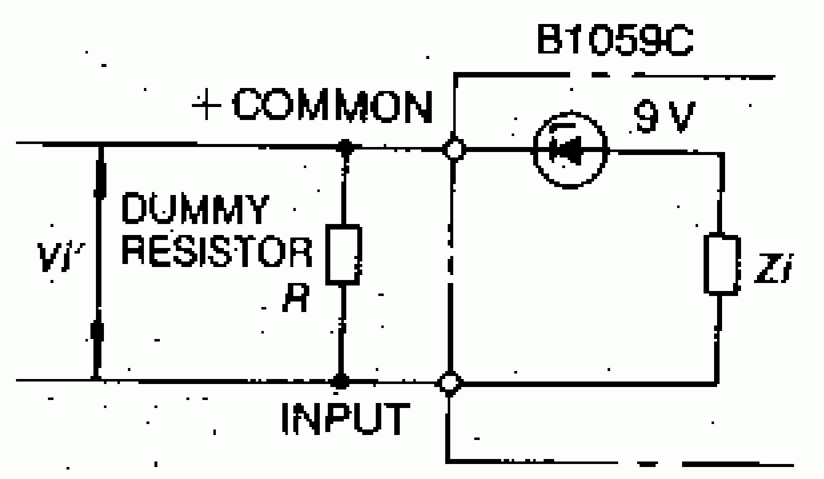


Fig. 5.45 Addition of a Dummy Resistor

The value of a dummy resistor R should be chosen such that the input voltage Vi' of B1059C becomes 10 V or less.

$$24\ V \times \frac{R}{3.3\ k\Omega + R} < 10\ V \qquad \therefore R < 2.35\ k\Omega$$

Thus, the value of the resistor becomes 2 kΩ.

Necessary wattage W is:

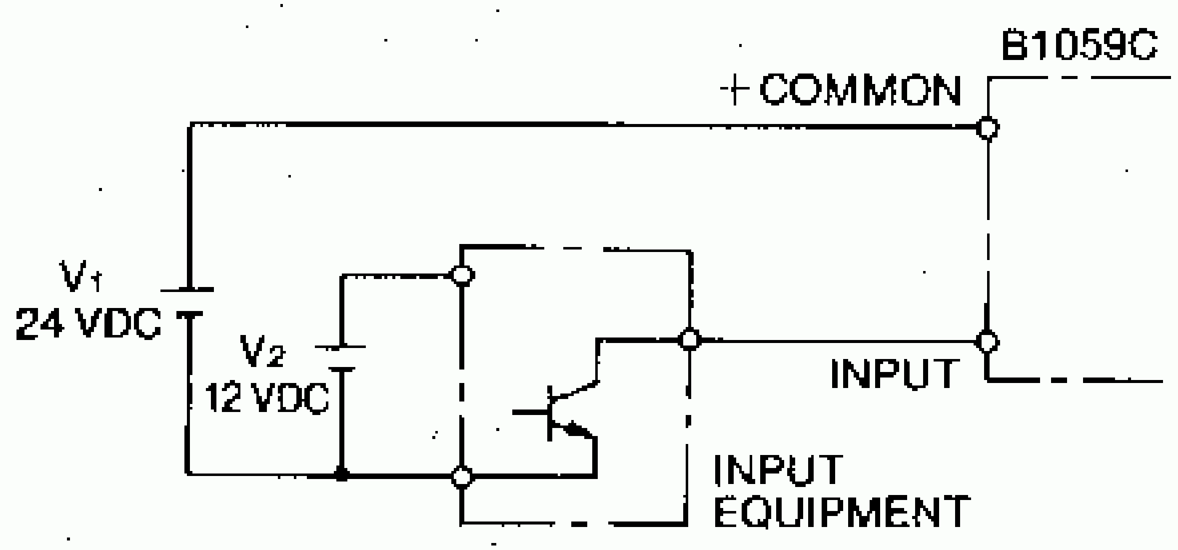
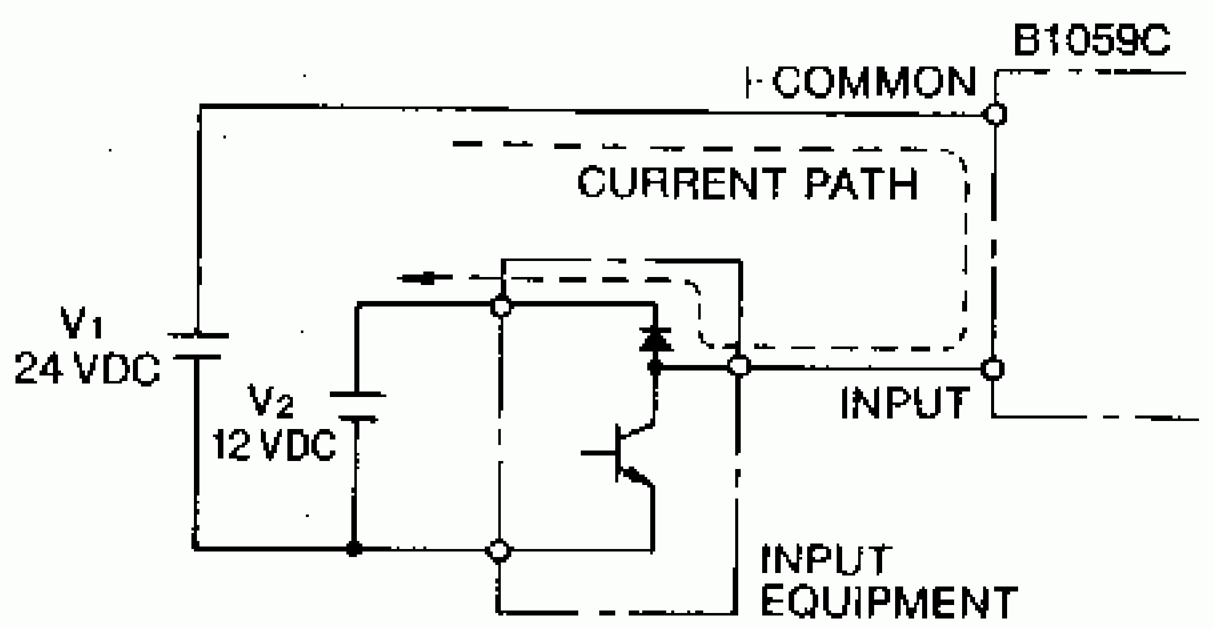
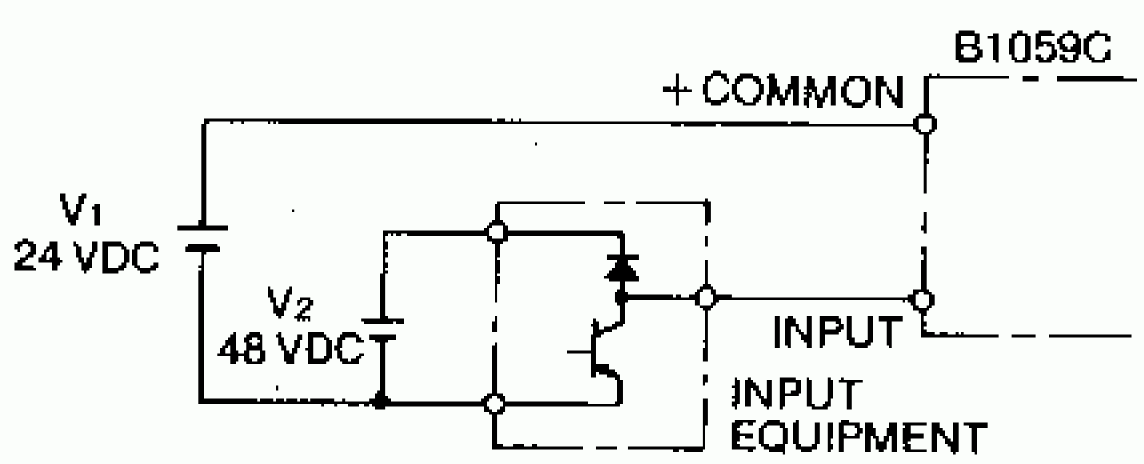
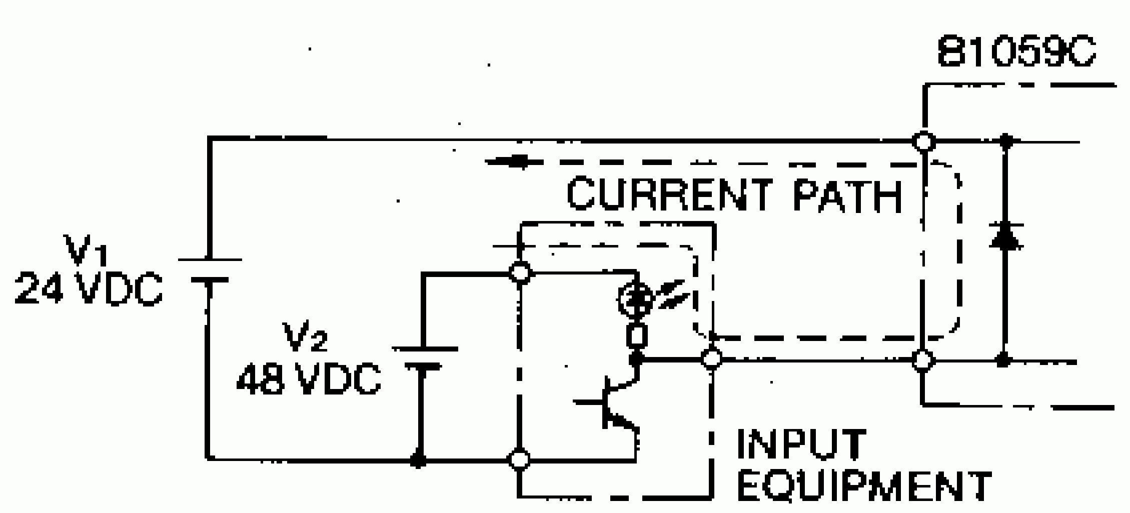
$$W = \frac{(\text{power supply voltage})^2}{R} = \frac{(24\ V)^2}{2\ k\Omega} = \text{about } 300\ mW$$

In general, the wattage of a dummy resistor is taken to be 1W to provide a surplus wattage about three times more than required.

(5) Connection to Input Equipment with Different Voltage

Usually, power voltage of input equipment should be matched that of input modules. However, Table 5.20 shows possibilities of connecting input equipment having different voltages.

Table 5.20 Possibilities of Connecting Input Equipment Having Different Voltages

Examples of Input Equipment	Connection Possibilities
① Open collector output ($V_1 > V_2$) 	Can be connected. However, the voltage resistance of the output transistor of the input equipment should be 40 V or more.
② With resistor, LED or diode ($V_1 > V_2$) 	Cannot be connected. When the input equipment is OFF, current shown by a dotted line in the left figure may flow and input does not become OFF. Especially, in case of LED, reverse voltage may be applied during the OFF time to the equipment with LED and the LED may be broken.
③ With open collector or diode ($V_1 < V_2$) 	Can be connected.
④ With resistor or LED ($V_1 < V_2$) 	Cannot be connected. When the input equipment is OFF, current shown by a dotted line in the left figure may flow and the LED of the input equipment comes on dimly.

(6) Note for Using I/O Modules B1061 and B1063

- When using 64-input module B1061 or 32-input module B1063, use them within ambient temperature ranges shown in Fig. 5.46. Fig. 5.46 shows allowable ambient temperature according to the external power voltage and module input activity ratio.

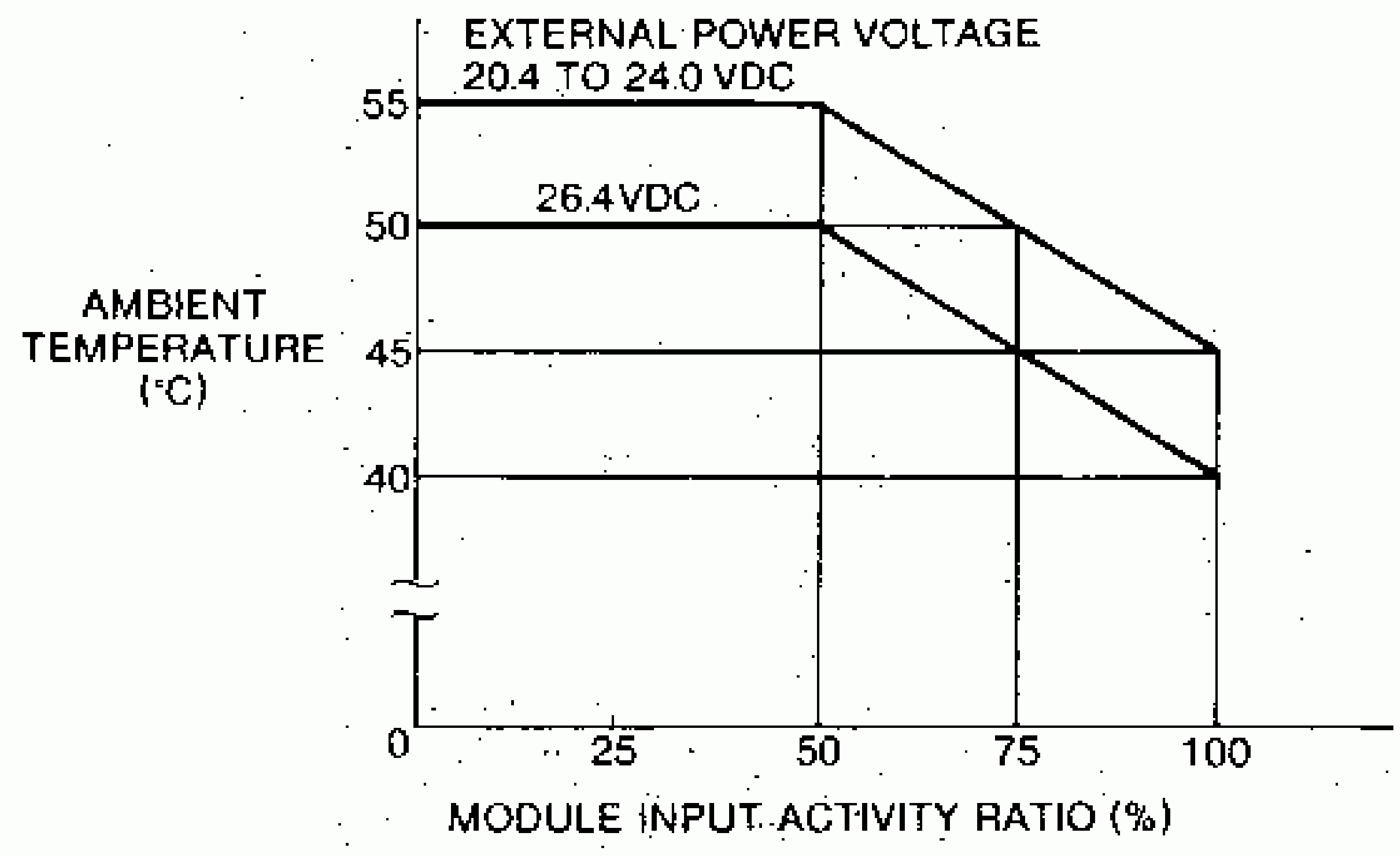


Fig. 5.46 Allowable Ambient Temperature

- Correspondence of input signal status indicating lights to input signals are shown in Tables 5.21 and 5.22.

Table 5.21 Correspondence of Input Signal Status Indicating Lights and Input Signals for B1061

Indicating Light	Input Signal No.		Indicating Light	Input Signal No.	
	Upper 32-point	Lower 32-point		Upper 32-point	Lower 32-point
A0	1	33	B0	17	49
A1	2	34	B1	18	50
A2	3	35	B2	19	51
A3	4	36	B3	20	52
A4	5	37	B4	21	53
A5	6	38	B5	22	54
A6	7	39	B6	23	55
A7	8	40	B7	24	56
A8	9	41	B8	25	57
A9	10	42	B9	26	58
AA	11	43	BA	27	59
AB	12	44	BB	28	60
AC	13	45	BC	29	61
AD	14	46	BD	30	62
AE	15	47	EE	31	63
AF	16	48	BF	32	64

Table 5.22 Correspondence of Input Signal Status Indicating Lights and Input Signals for B1063

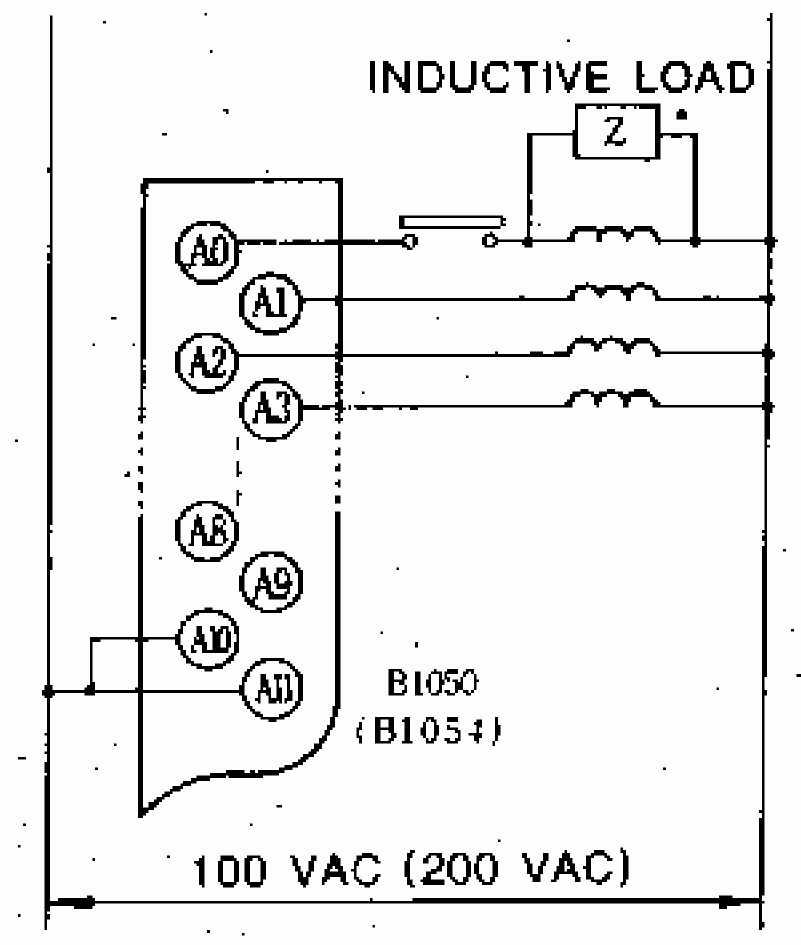
Indicating Light	Input Signal No.	Indicating Light	Input Signal No.
A0	1	B0	17
A1	2	B1	18
A2	3	B2	19
A3	4	B2	20
A4	5	B4	21
A5	6	B5	22
A6	7	B6	23
A7	8	B7	24
A8	9	B8	25
A9	10	B9	26
AA	11	BA	27
AB	12	BB	28
AC	13	BC	29
AD	14	BD	30
AE	15	BE	31
AF	16	BF	32

5.2.2 Output Module

(1) Connection to Contacts

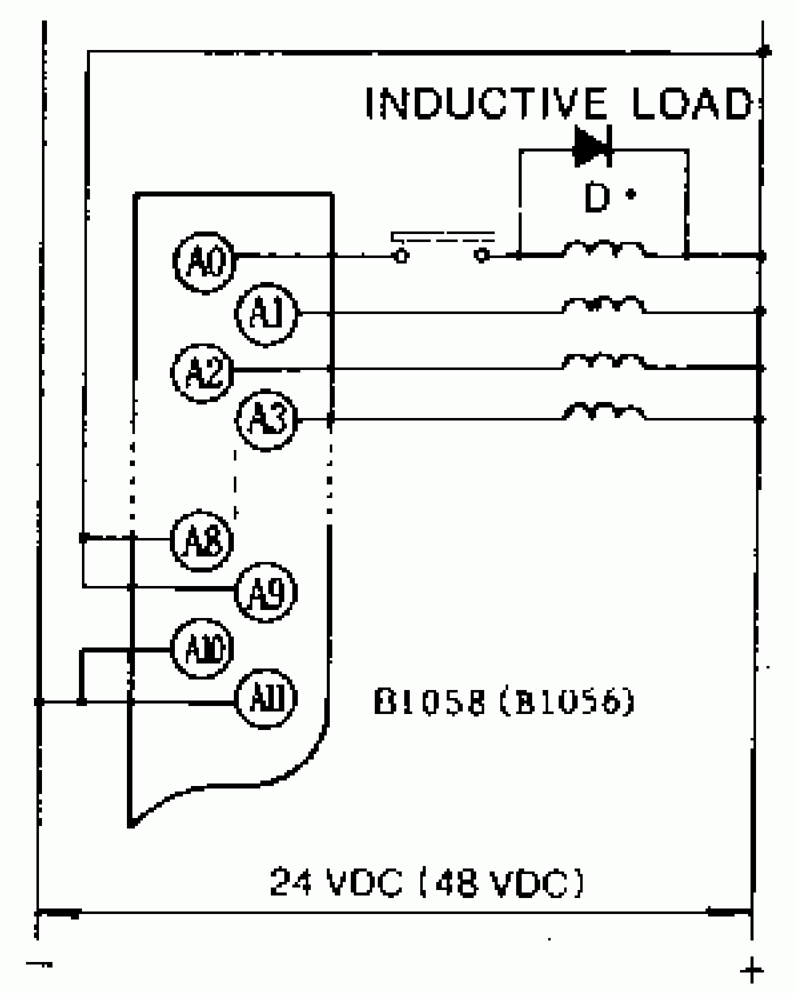
Where connecting contacts to an inductive load of the output module, as shown in Figs. 5.47 and 5.48, always connect a surge absorber or a flywheel diode in parallel to the inductive load.

Where connecting contacts in parallel to the output module, no surge absorber nor flywheel diode need be connected.



* The surge absorber capacity should be selected corresponding to the load. It is recommended that type CR 50500 (made by Okaya Denki Co.) or equivalent be used.

Fig. 5.47 AC Output Module



* The flywheel diode should be selected corresponding to the load. It is recommended that type F14 series (made by NEC) or equivalent be used.

Fig. 5.48 DC Output Module

(2) Minimum Load Current

As the output switch of the AC output module, a triac is used. Since a triac cannot operate stably if the load is less than the specified minimum load current, make sure to use the load which is secure current levels above the minimum load current. If the minimum load current cannot be kept, connect a dummy resistor in parallel to the load so that the total load current is above the minimum load current.

(3) Maximum Load Current

Although an output point can accommodate a 2 A load, the total load for 8 output points must be up to 5 A. This should be taken into consideration for distributing loads.

(4) Output Fuse

The output fuse is used for preventing the trouble caused by shortcircuit of the load, but not for protecting the output element of the module.

(5) Output Status LED Indicator for 100 VAC Output Module

The output status LED indicator for the AC output module lights up by power supply for the internal logic circuit.

(6) Leakage Current from the Output Module

AC output module and relay contact output module contain a surge supressing circuit. Therefore, leakage current flows during OFF.

Table 5.23 Leakage Current in Output Modules

Output Module Type JAMSC-	Output Impedance during OFF(50 Hz)	Maximum Leakage Current
B1050	Approx 68 kΩ	Approx 2 mA at 130 VAC
B1054	Approx 145 kΩ	Approx 2 mA at 260 VAC
B1090B	Approx 145 kΩ	Approx 2 mA at 260 VAC

When a light-load relay is connected to these output modules, the relay does not turn off due to the current.

(Example) When load impedance is 6 kΩ and the load responds incorrectly due to 2 mA of leakage current.

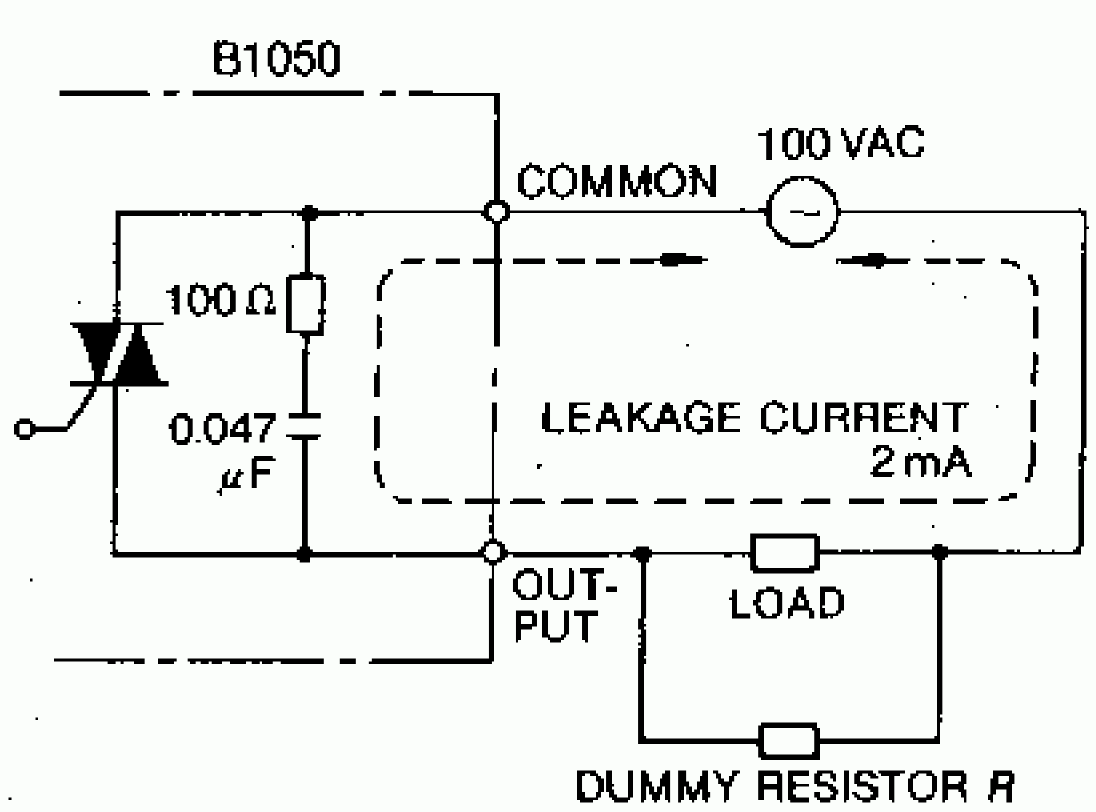


Fig. 5.49 Connection of Light Load

If 1 mA or less of current flow in the load does not cause any malfunction, then the value of dummy resistor R becomes:

$$2\ mA \times \frac{R}{R + 6\ k\Omega} < 1\ mA$$

$$\therefore R < 6\ k\Omega$$

Thus, make the value of R 5 kΩ.

Necessary wattage W is;

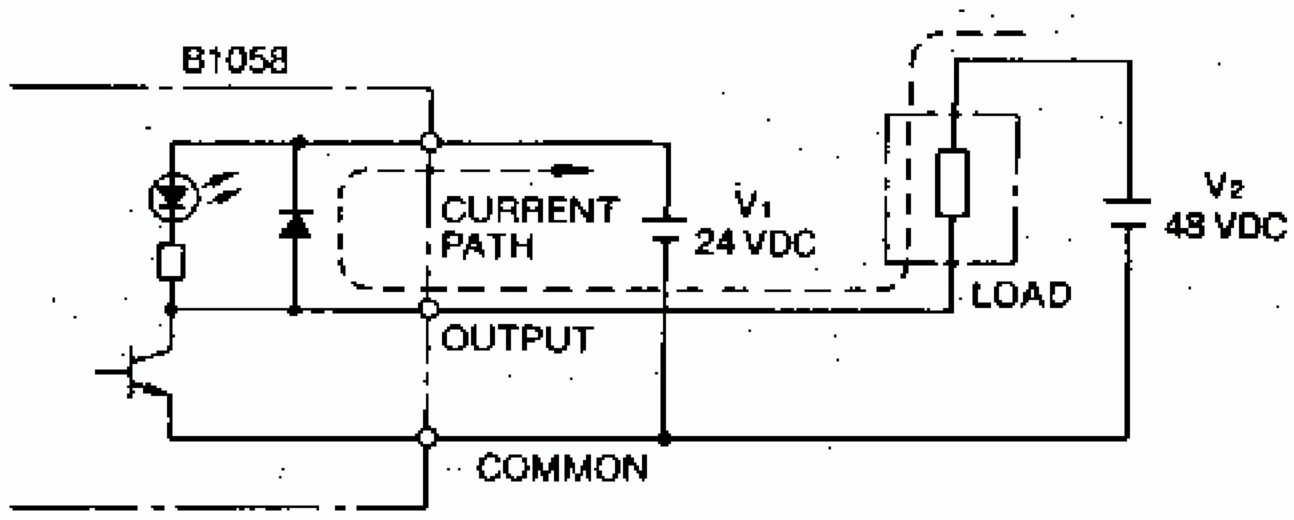
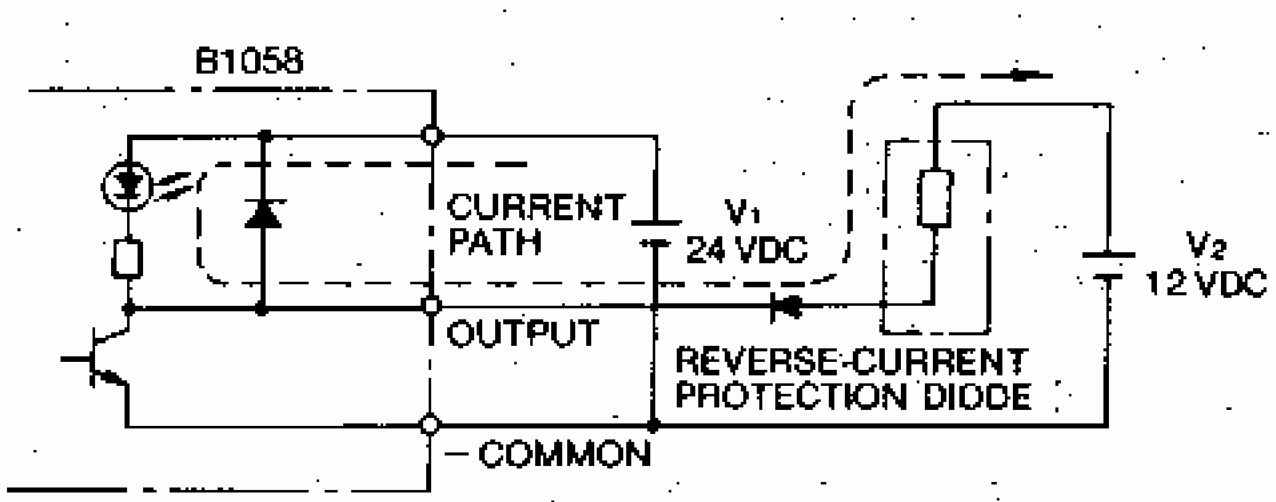
$$W = \frac{(power\ source\ voltage)^2}{R} = \frac{(100\ v)^2}{5\ k\Omega} = 2\ W$$

Generally, the wattage of the dummy resistor is taken to be 5 W to provide surplus wattage about 3 times more than required.

(7) Connection to a Load with Different Voltage

In principle, power voltage of a load shoud be matched to that of an output module.. Table 5.24 shows connection examples with loads having different voltages.

Table 5.24 Examples of Connections with Loads Having Different Voltages

Examples of Loads	Connection Possibilities
① High power voltage of load ($V_1 < V_2$) 	Cannot be connected. When B1058 is OFF, current shown by a dotted line in the left figure flows and the load does not go OFF completely. 35 V or more may be applied transiently to the output transistor.
② Low power voltage of load ($V_1 > V_2$) 	Cannot be connected. When B1058 is OFF, current shown by the dotted line flows and the output signal state indicator of B1058 comes on dimly. However, when a reverse-current protection diode is added as shown in the left figure, connection can be made.

(8) Connection of Solenoid with Diode

Solenoids with diodes have the advantage being driven by half-wave rectification and less starting current. When solenoids with diodes are used as load of AC output module, be carefull of the following points.

① When output is OFF, overvoltage is applied to load:

When output of AC output module is OFF, current Ⓐ, shown by a dotted line, flows at half-cycle of the power supply to be a forward-biased diode for rectification, and is charged on capacitors. See Fig. 5.50.

With next half-wave, after polarity is reversed, diode for rectification is reversebiased and current Ⓐ is blocked; discharge current Ⓑ, shown by a dotted line, flows from the capacitor. At this time, supply voltage and voltage charged on the capacitor are superimposed, and applied to the rectification solenoid with diode. The peak value of this voltage is approximately $2\sqrt{2}$ E (E: supply voltage). Rectification diode should require a withstand reverse voltage of $2\sqrt{2}$ E or more.

Connect a resistance of approximate multiples of 10 kΩ to several hundred kΩ on solenoid ends so that voltage applied to the solenoid is reduced. See Fig. 5.51.

② When output is ON, solenoid may not turn on:

AC output module does not allow that output is ON even if receiving the ON signal before voltage of output ends are limited to approximately 50 V or less (for B1054). This is for reducing the inrush current when output is turned ON.

Where the solenoid with diode is connected, solenoid may not turn ON because voltage of output ends is not reduced to operation level by effect of voltage charged in the capacitor. Connect a resistance of approximate multiples of 10 kΩ to several hundred kΩ on solenoid ends so that voltage applied to solenoid is reduced. See Fig. 5.51.

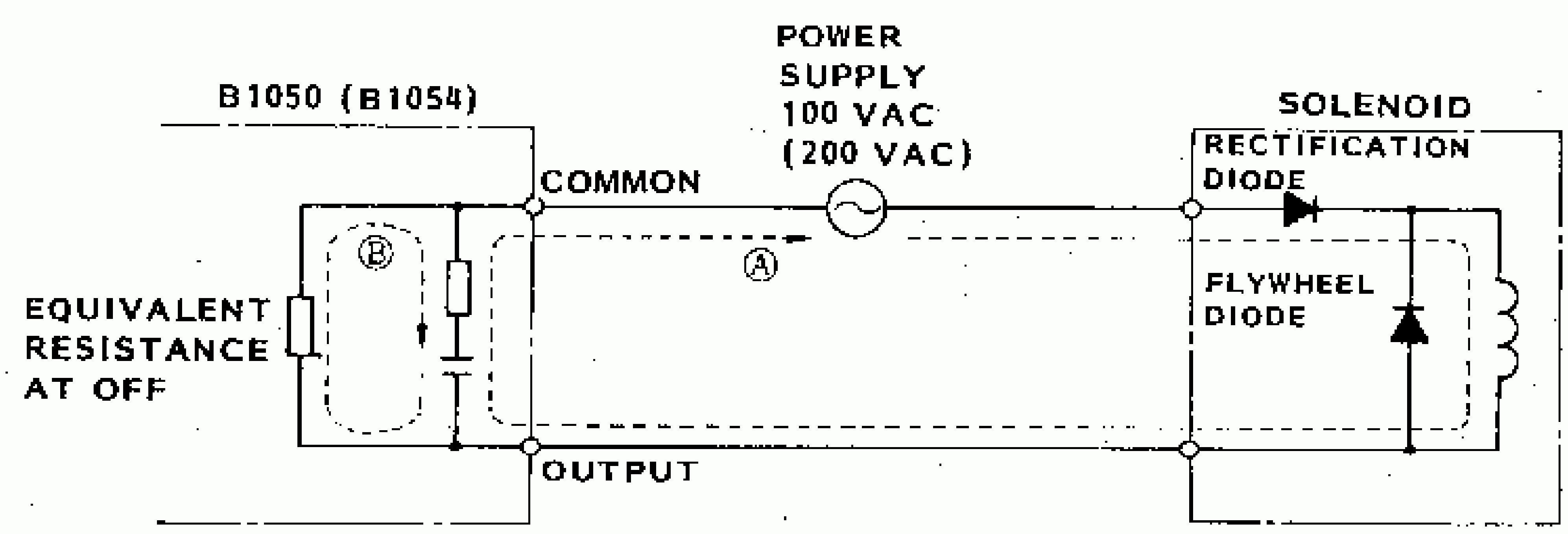


Fig. 5.50 Connection of Solenoid with Diode

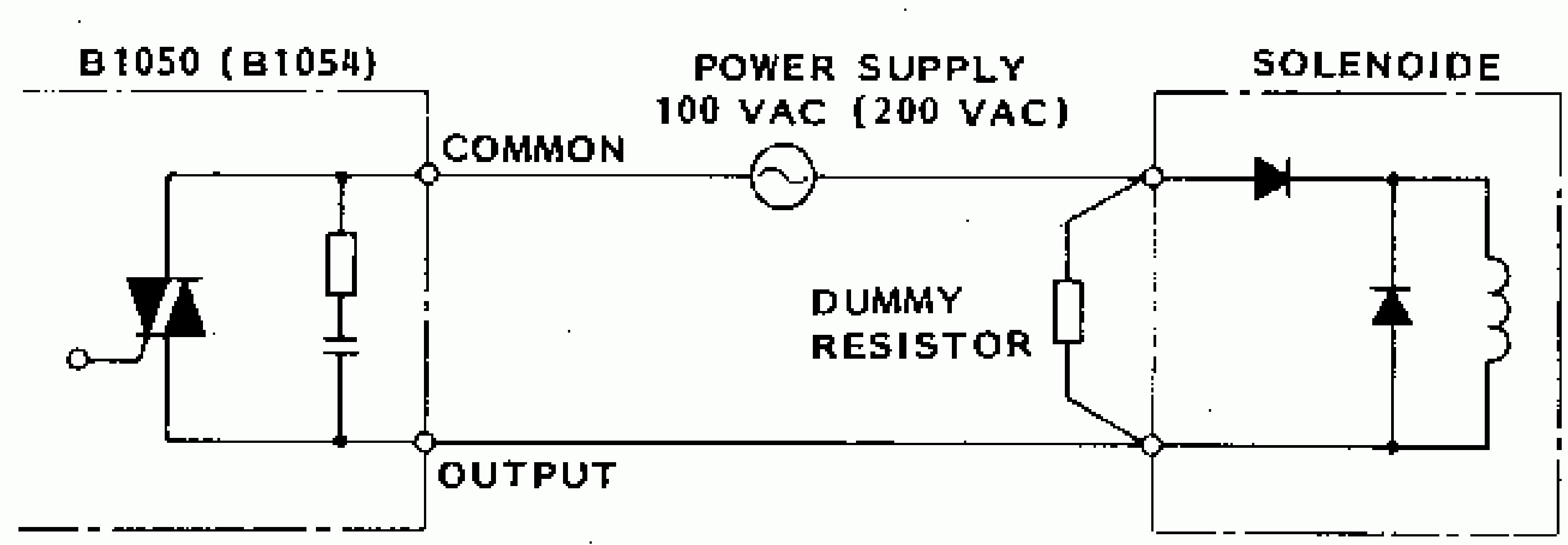


Fig. 5.51 Connection of Dummy Resistor

(9) Note for Using I/O Modules B1060 and B1062

- When using 64-output module B1063 and 32-output module B1062, use them within ambient temperature ranges shown in Fig. 5.52. Fig. 5.52 shows allowable ambient temperature according to the external power voltage and module output activity ratio.

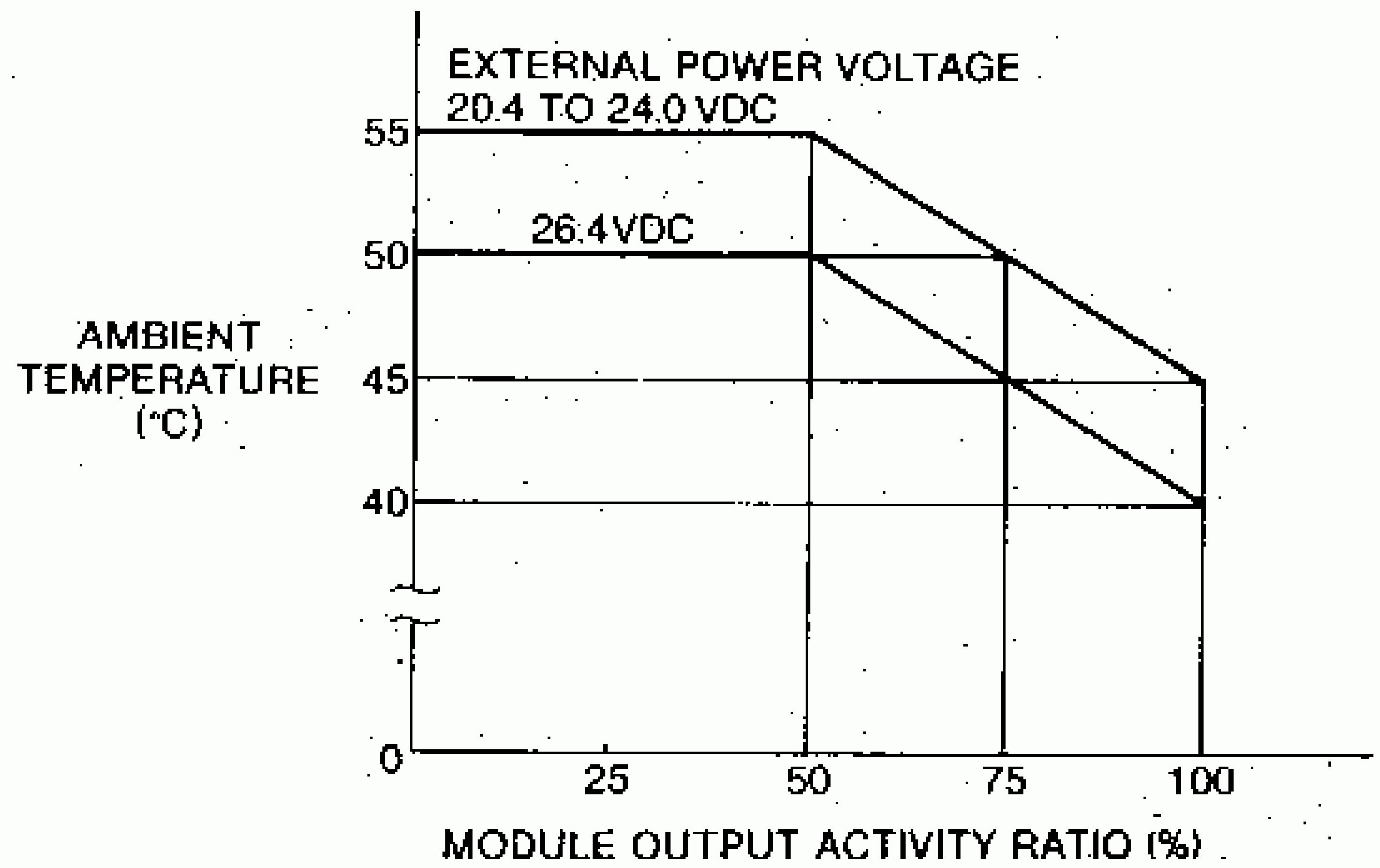


Fig. 5.52 Allowable Ambient Temperature

- Correspondence of output signal status indicating lights to output signals are shown in Table 5.25 and 5.26.

Table 5.25 Correspondence of Output Signal Status Indicating Lights and Output Signals for B1060

Indicating Light	Output Signal No.		Indicating Light	Output Signal No.	
	Upper 32-point	Lower 32-point		Upper 32-point	Lower 32-point
A0	1	33	B0	17	49
A1	2	34	B1	18	50
A2	3	35	B2	19	51
A3	4	36	B3	20	52
A4	5	37	B4	21	53
A5	6	38	B5	22	54
A6	7	39	B6	23	55
A7	8	40	B7	24	56
A8	9	41	B8	25	57
A9	10	42	B9	26	58
AA	11	43	BA	27	59
AB	12	44	BB	28	60
AC	13	45	BC	29	61
AD	14	46	BD	30	62
AE	15	47	EE	31	63
AF	16	48	BF	32	64

Table 5.26 Correspondence of Output Signal Status Indicating Lights and Output Signals for B1062

Indi-cating Light	Output Signal No.	Indi-cating Light	Output Signal No.
A0	1	B0	17
A1	2	B1	18
A2	3	B2	19
A3	4	B2	20
A4	5	B4	21
A5	6	B5	22
A6	7	B6	23
A7	8	B7	24
A8	9	B8	25
A9	10	B9	26
AA	11	BA	27
AB	12	BB	28
AC	13	BC	29
AD	14	BD	30
AE	15	BE	31
AF	16	BF	32

(10) Connection of I/O Module B1094

Where power reed relay contact output module B1094 is connected to load of DC power supply, connect as shown in Fig. 5.53 observing polarity of contact output. If the B1094 is used with reversed polarity, the electrical life may be shortened.

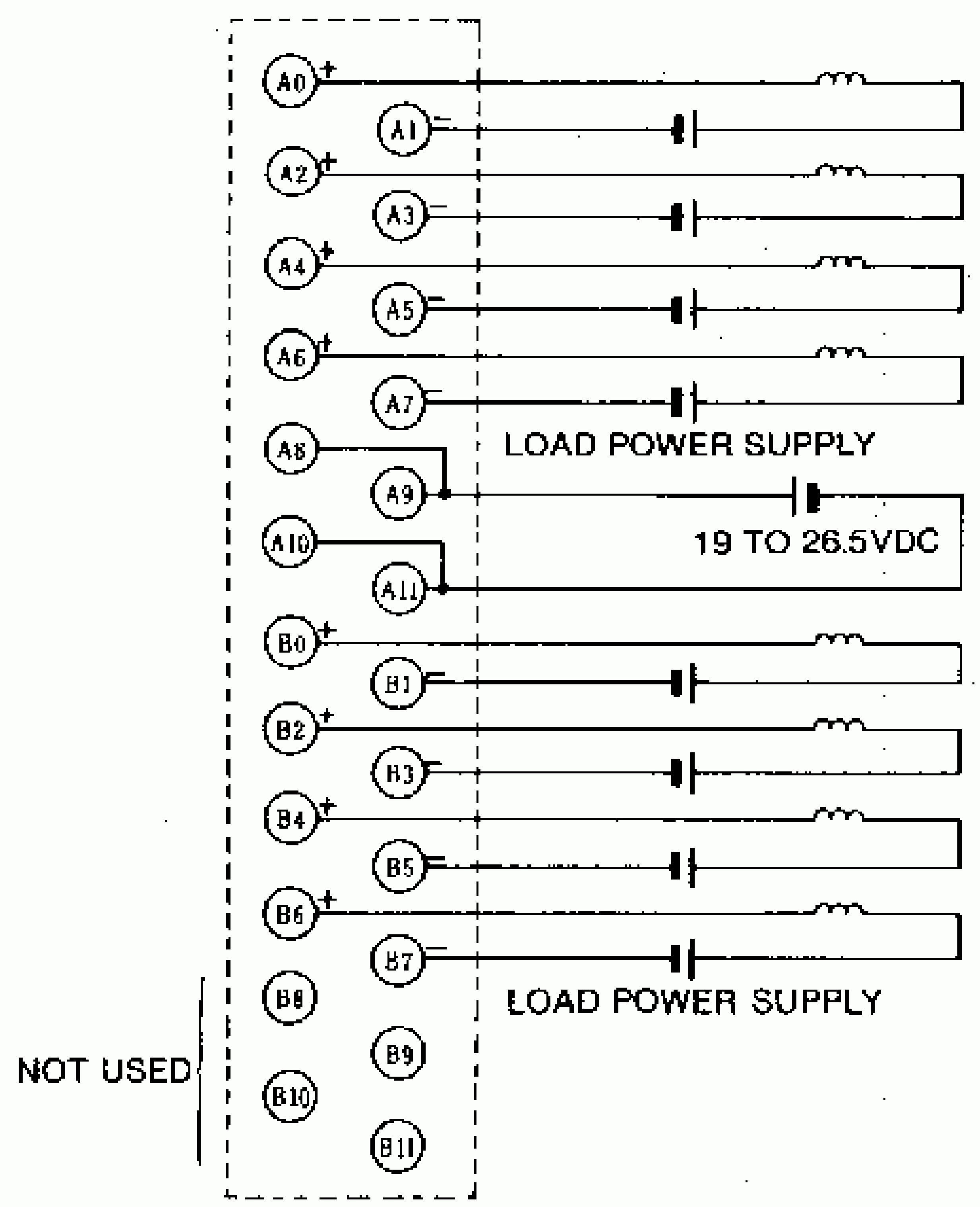


Fig. 5.53 Connection between B1094 and DC Load

5.2.3 Connection between Input and Output Modules

Where two or more R84H controllers are used in a system, and signals are exchanged between R84H controllers via input and output modules, connections should be as shown in Figs. 5.54 and 5.55. In this case, make sure to use modules of the same voltage rating, and connect a dummy resistor to the output module, to make stable operation.

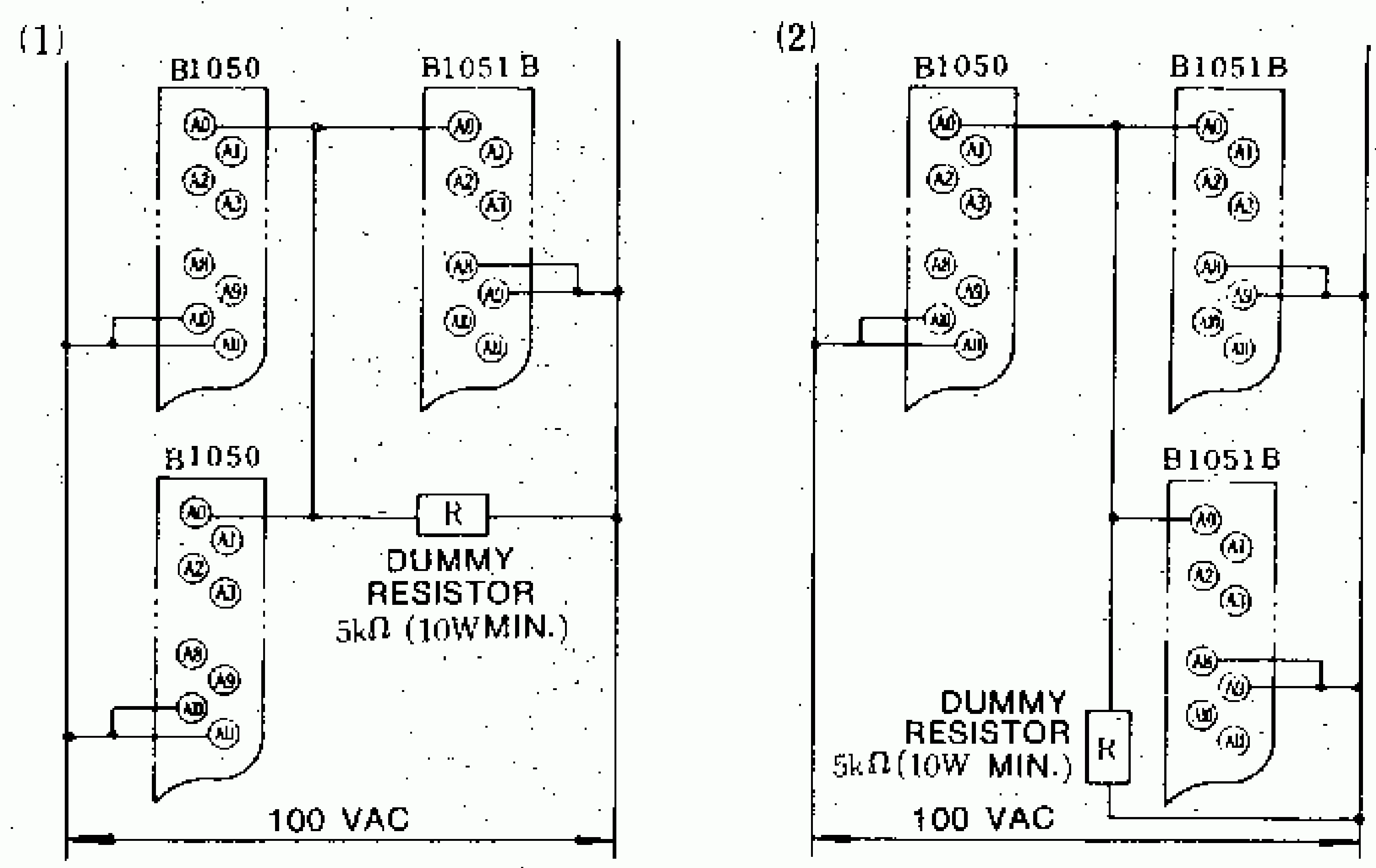


Fig. 5.54 Connection Between AC Input and Output Modules

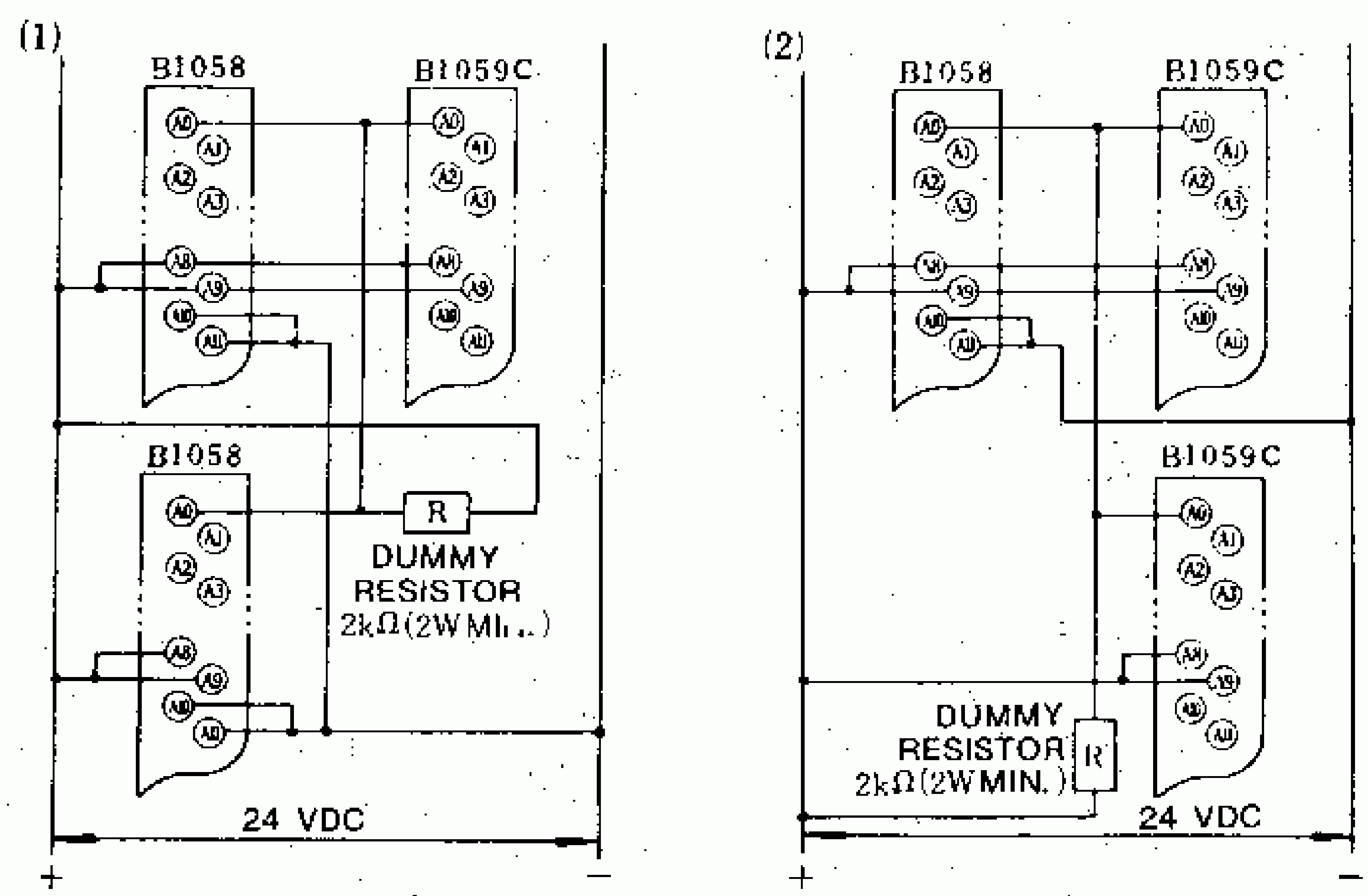


Fig. 5.55 Connection Between DC Input and Output Modules

5. 2. 4 External Power Supply

General DC stabilized power supply should be used for DC I/O modules as an external power supply. Add a noise filter on the AC input side of the DC stabilized power supply for special modules such as a register module, analog module, or counter module. Do not run the primary and the secondary side of the noise filter and the DC output side in the same wire duct.

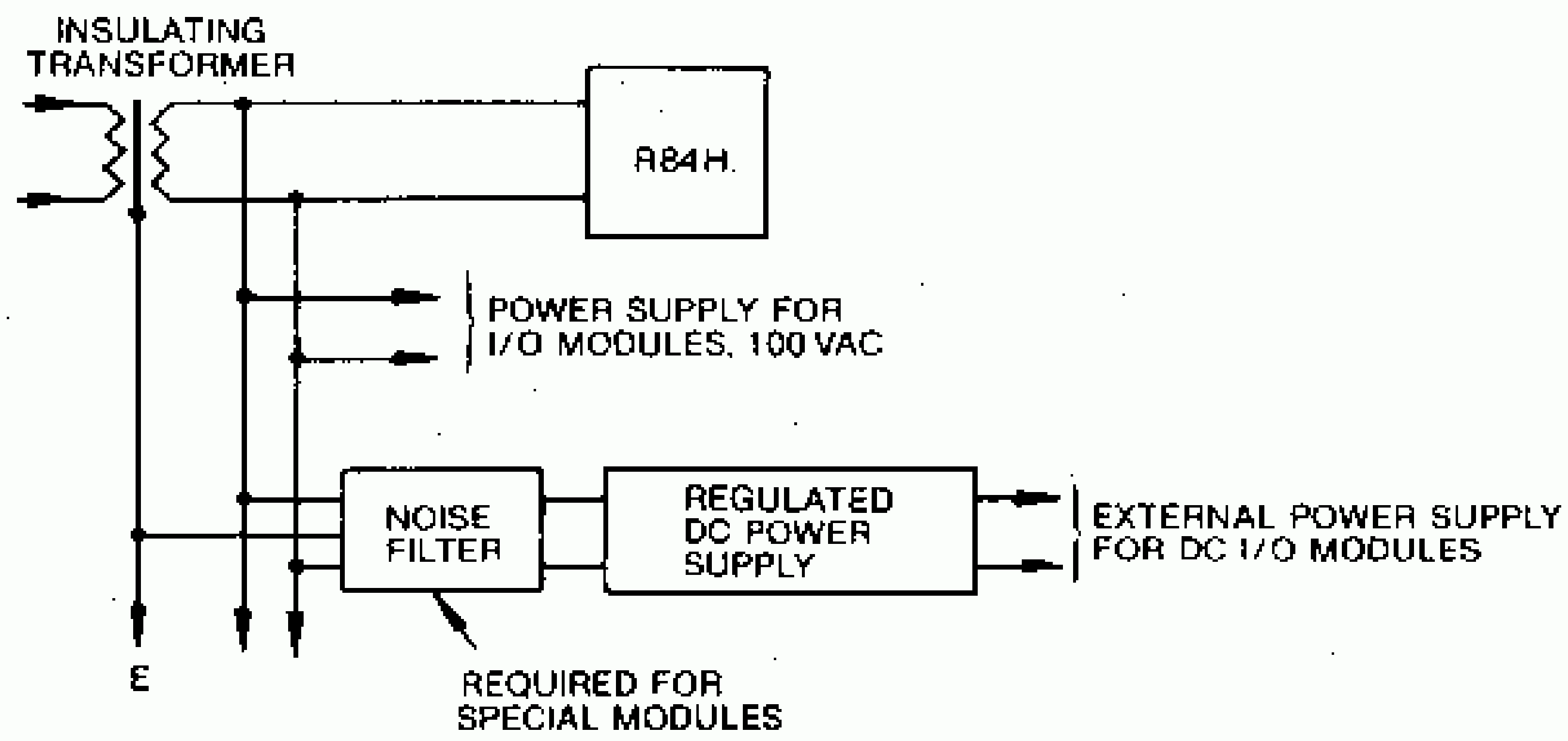


Fig. 5.56 External Power Supply for DC I/O Modules

If it is necessary to use a simple DC power supply such as full wave rectification, minimize the ripple by adding a smoothing capacitor. The following should be observed:

- Instantaneous output voltage with ripple should always be within the range of the operation voltage of the DC I/O modules.
- Output voltage, including that of the power ON time and power OFF time, should never exceed the transient voltage of the DC I/O modules.
- Prevent the introduction of surge voltage by adding a noise filter on the input side of a rectifying device.

5. 2. 5 Numbers of I/O Module Mounting

R84H system can mount up to 20 I/O modules in racks 1 and 2 and up to 21 I/O modules in racks 3 and 4.

However, the numbers are limited for I/O modules which expend much internal power due to the limited capacity of internal power supply (power supply provided from power supply module P8051 or P8052).

Calculate the total current consumption in accordance with Fig. 5.57, and set the current consumption within capacity of power supply unit. For 16-point and 32-point discrete input modules the calculation is not required.

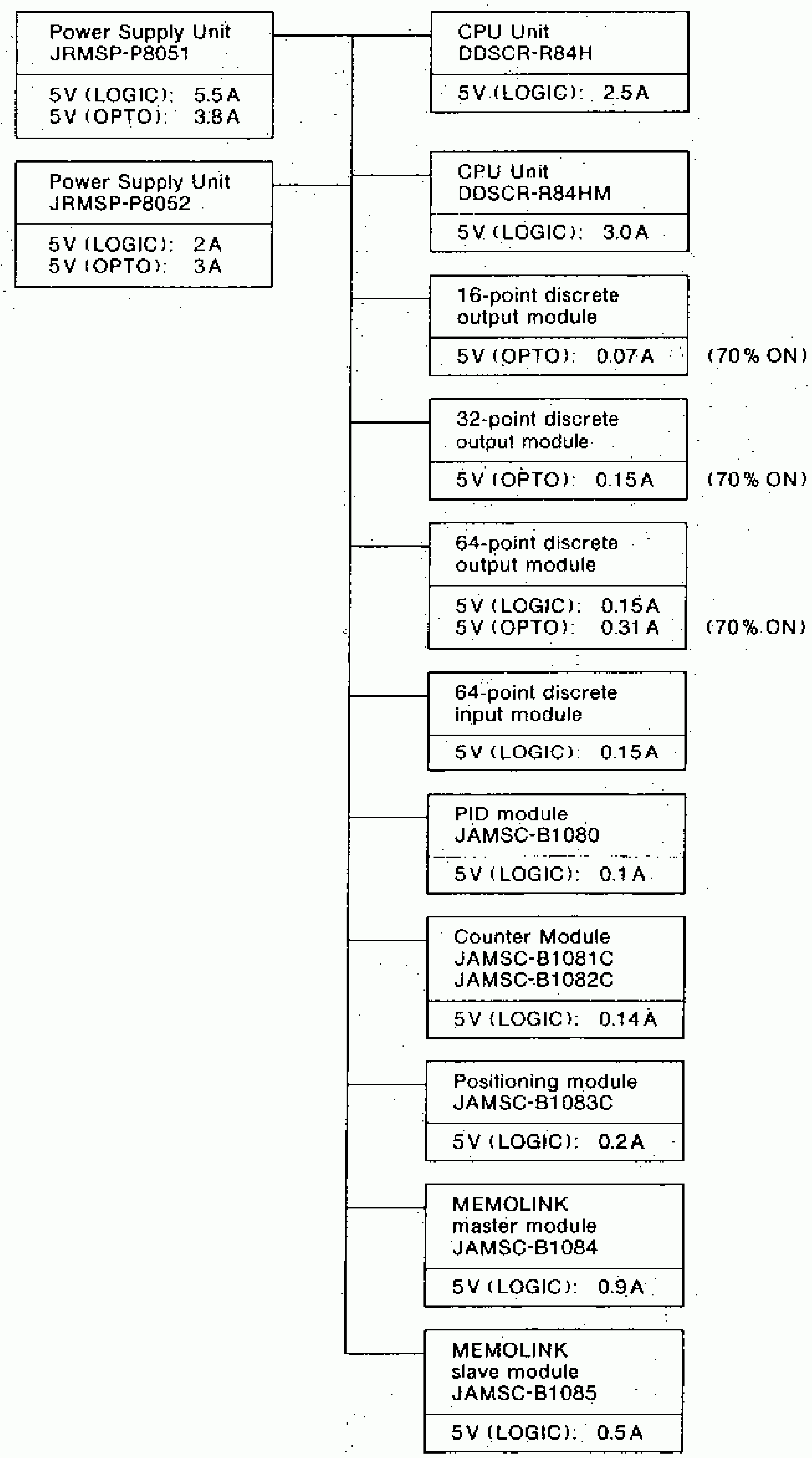


Fig. 5.57 Current Consumption of I/O Modules

SECTION VI
APPLICATIONS

6.1 NOTES ON APPLICATIONS

Memocon-SC R84H should be used to meet your system specifications paying attention to the following points.

6.1.1 Backup Circuit

Since R84H is more reliable than relays, and also their eventual faults can be repaired quickly, it requires no backup circuit in ordinary systems. However, when it does require a backup circuit because of the special nature of the system, the selection of a proper backup method is an important consideration. An external manual circuit and standby R84H are sound methods.

6.1.2 Interlock

The R84H main frame is provided with a self-diagnosis function of stopping operation and turning output OFF when the stored ladder circuits (program) are destroyed, or when main frame cards develop faults. However, some faults and misoperations are not detected, and may destroy machines and devices. Where there is a possibility of such destruction, start and stop the system under redundant control such as external interlock and electric-mechanical redundant control.

6.1.3 Control Panel Layout

Lay out the control panel locations in consideration of the electrical environment conditions. For details, refer to Para. 6.3 "CONSTRUCTION, INSTALLATION AND WIRING OF CONTROL PANEL."

6.1.4 Network Processing

The network processing method of R84H has been explained in this manual. However, for reading the ON and OFF states of all input signals into the main frame of R84H correctly, the ON and OFF states of input signals must continue longer than the total delay time in the input module and one scan time. Therefore, when dealing with signals of short duration, special devices such as external memory circuits must be used, and for limit switch signals, the dog length must be sufficiently long. Refer to Fig. 6.1.

Output signals are also delayed up to the total of one scan time and the delay time within the output module. Therefore, for applications requiring a high degree of accuracy, some external devices are required. Refer to Fig. 6.2.

6.1.4 Network Processing (Cont'd)

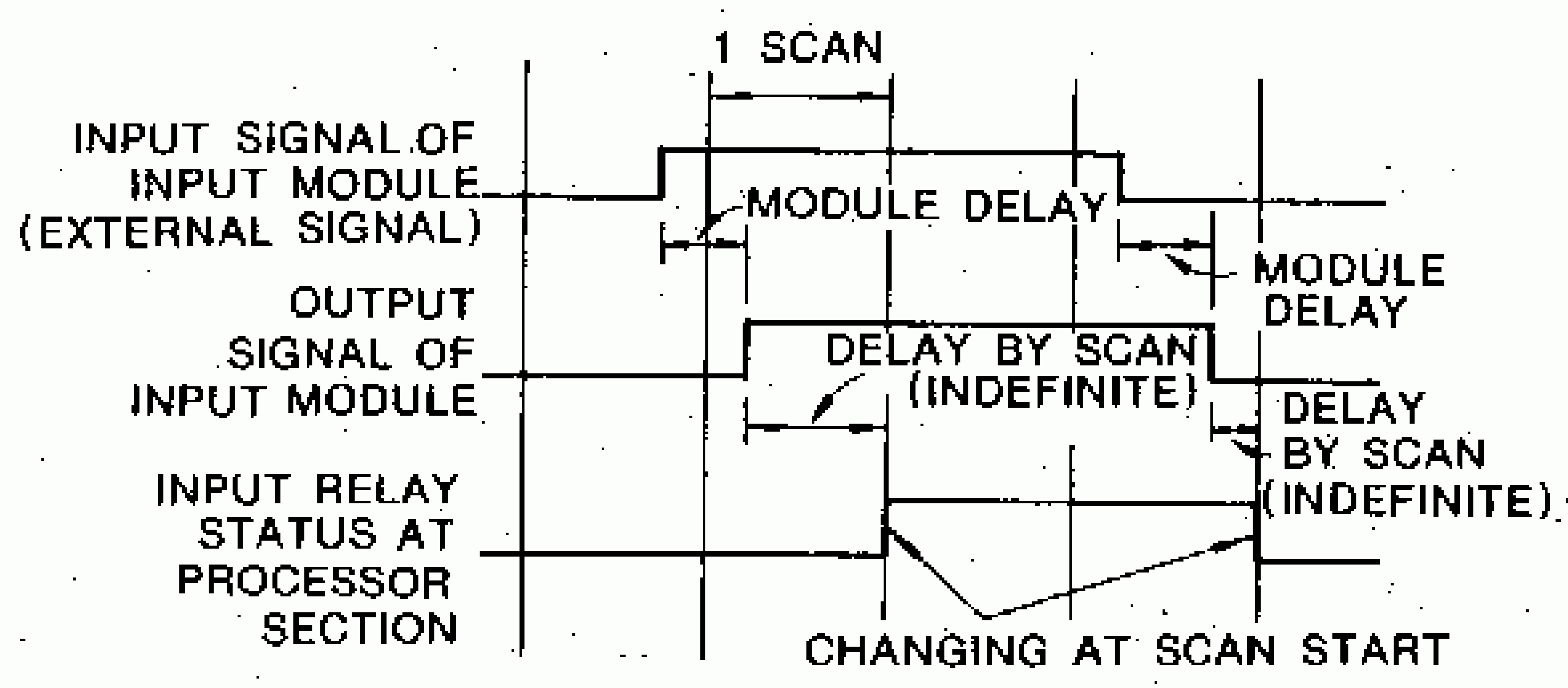


Fig. 6.1 Input Signal Delay

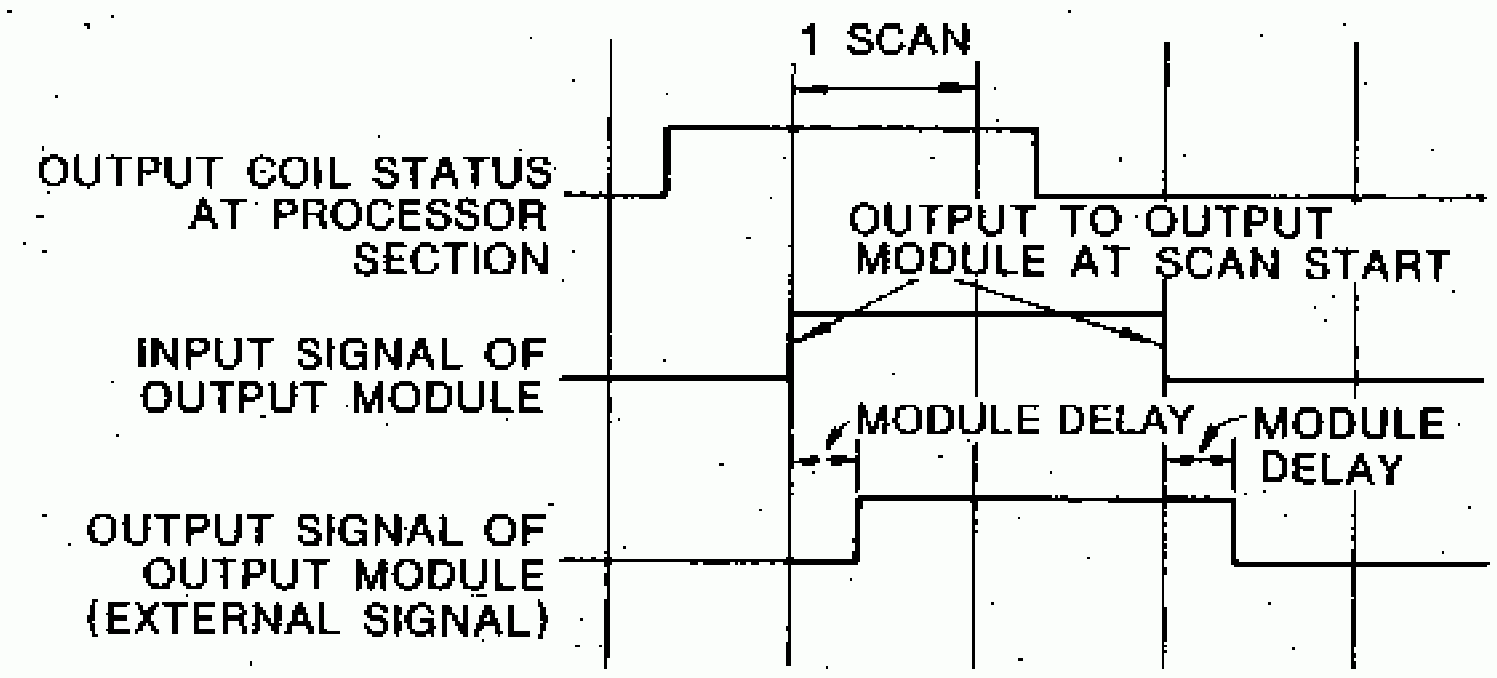


Fig. 6.2 Output Signal Delay

6.2 CALCULATION OF MEMORY CAPACITY

To find the required number of memories is a difficult task in composing any system. Exact numbers can only be determined from the intended ladder circuits, but here, the memory capacity of R84H may be roughly found as follows. Although more memories are required when the number of input and output signals increases, and when the sequence becomes more complex (more complex control),

40 × Number of Output Coils

is taken as a rough guideline regarding the number of memories (words).

Additional sequences may become required during trial and adjustment operations, and for this reason, some reserve memories should be prepared from the beginning.

6.3 CONSTRUCTION, INSTALLATION AND WIRING

The R84H systems are delivered with the CPU module, the power supply module, the input and output modules, the plate cover, the mounting base, the cable, etc. separated from each other.

These components must be installed in a control panel housing, the construction, layout, and wiring of which shall conform to the following standards. Where more strict conditions for the wiring, etc. are specified by separate specifications, etc., there should be given priority. For further details not sepcified below, applicable statutes or regulations apply.

6.3.1 Construction of Control Panel

For the control panel, the following construction is recommended.

- Enclosed steel housing, self-standing (or wall-mounting)
- Dustproof, or semi-dustproof
- Cooling: Where the panel-interior temperature (R84H ambient temperature) rises above 55°C, ceiling fan or other cooling devices must be used.
  A cooling fan should in principle be used to discharge air from the panel interior.

The respective modules have the heating value given in Table 6.1, the heating value for input and output modules applies when all the 16 points are simultaneously ON.

Table 6.1 Heating Value of Modules

Module(Type)			Heating Value W
CPU Module	Without MEMOBUS	(R84H)	14
	With MEMOBUS	(R84H-M)	20
Basic Power Supply		(P8051)	60
Expanding Power Supply		(P8052)	25
I/O Buffer Module		(B1011)	1
100 VAC Input Module		(B1051B)	5
200 VAC Input Module		(B1055)	5
5/12 VDC Input Module		(B1053)	5
48 VDC Input Module		(B1057)	7
24 VDC Input Module		(B1059C)	4
24 VDC Input Module		(B1061,B1063)	8
24 VDC Input Module		(B1065)	5
100 VAC Output Module		(B1050)	10
200 VAC Output Module		(B1054)	10
5/12 VDC Output Module		(C1052)	7
48 VDC Output Module		(B1056)	10
24 VDC Output Module		(B1058)	10
24 VDC Output Module		(C1060)	8
24 VDC Output Module		(C1062)	13
24 VDC Output Module		(B1064)	10
Relay Output Module		(B1090B)	10
Power Reed Relay Output Module		(B1094)	5
Register Input Module		(B1071)	6
Register Output Module		(B1070)	6
Analog Input(A/D) Module		(B1073,B1075)	4
Analog Output(D/A) Module		(B1072,B1074)	4
Reversible Counter Module		(B1081C)	10
Preset Counter Module		(B1082C)	10
Positioning Module		(B1083C)	8
PID Module		(B1080)	2
Power Supply Module		(B1089)	12

Note:
1. The heat generation from the mounting base is negligible.
2. The heating value of input and output modules when they are OFF (all points) is below 2 W.

· Dimension

Determine the size, etc. of the control panel by referring to the dimension of the each unit modules (Appendix B) and the R84H panel mounting dimension (Appendix C).

· Layout of mounting base

Install these in the relative positions as shown in Appendix C, taking the cooling and other conditions into consideration.

6.3.2 Module Installation and Wiring in Control Panel

Install the modules of R84H, as shown in Appendix C, and determine the layout of the R84H in the control panel by taking the size of the panel and the layout of other devices into consideration together with the following items.

(1) Weight (Table 6.2)

Table 6.2 Weight of Modules

Module (Type)		Approx Weight kg
CPU Module	Without MEMOBUS (R84H)	1.6
	With MEMOBUS (R84H-M)	2.3
Basic Power Supply (P8051)		2.8
Expanding Power Supply (P8052)		1.1
I/O Buffer Module (B1011)		0.7
16-point Discrete Input Module (B1051B, B1053, B1055, B1057, B1059C)		0.8
8-point Discrete Output Module (B1094)		1.1
16-point Discrete Output Module (B1050, B1052, B1054, B1056, B1058, B1090)		1.1
32-point Discrete I/O Module (B1063, B1065, B1062, B1064)		0.8
64-point Discrete I/O Module (B1061, B1060)		0.8
Register I/O Module (B1071, B1070)		0.8
Analog I/O Module (B1072B, B1073, B1074, B1075)		1.0
Reversible Counter Module (B1081C)		0.8
Preset Counter Module (B1082C)		0.9
Positioning Module (B1083C)		1.8
PID Module (B1080)		1.0
Power Supply Module (B1089)		1.0
Mounting Base (B1026, B1027, B1028)		2.5
I/O Cable	Length: 0.4 m (W1022)	0.3
	Length: 1.5 m (W1021)	0.5

(2) Electrical Noise

- Avoid installing R84H together with elements or wires carrying high-voltage and large current power* in the same panel.
- When installing R84H together with the low-voltage main circuit† in the same panel, install the elements and wires related to the low-voltage main circuit as far apart from the R84H and its wiring as possible.
- Do not bind the R84H wiring together with general control circuit‡ wiring.
- Install the mounting base to a solid steel panel (frame). Never install these on a insulator. When the panel (frame) is painted, remove the paint from the area around the mounting holes before installing the base, in order to secure good grounding, and to prevent noise.

* Above 600 VAC, 750 VDC or 800 A.

† Below 600 VAC or 750 VDC, with a current above 20 A.

‡ Below 600 VAC or 750 VDC, with a current below 20 A.

(3) Power Supply Circuit

- When the power supply is in an unfavorable condition, connect a line filter (noise filter) or an insulating transformer to the power supply line of a power supply module, input module and output module.
- The voltage and capacity of the power supply depend on the types of input and output modules and the connected loads. Determine these factors by referring to the I/O specifications in SECTION V.
- R84H starts deciphering processes immediately when the power supply is turned ON. In some systems, the power module of R84H may have to be energized only after connecting the input and output power supply and determining the input and output states.

NOTE

The expanding power supply module should be turned on at previous time or same time compared with that of the basic power supply module. If reverse procedure is used, CPU module functions for error detection and RUN indicator lamp goes off.

(4) Wiring in Panel

The wiring related to R84H in the panel is in types shown in Table 6.3. Use the wires of the listed sizes.

Table 6.3 Types of Wiring in Panel

Type of Wiring	Wire Size (mm^2)	Description
Power Supply	1.25	To be connected to the power supply terminal "100 VAC" of power supply module, via circuit breaker, etc.
I/O Signal	0.3-1.25	To be connected to input and output signal lines and input and output module terminals (two 1.25 mm^2 wires can be connected to one terminal).
Grounding	1.25	Connection between the GND terminal of the power supply module and the control panel housing (ground).

Note: For 32-point discrete module and register module, the wire size should be 0.3 mm^2 or less.

6.3.3 Grounding Wire

- The GND terminal of the power supply module should be connected to the control panel housing,as shown in Fig. 6.3 at E, and connecting point E should be connected to a ground pole.
- The grounding wire between point E and the ground pole should be larger than 8 mm^2 in the cross-sectional area, and should be as short as possible.
- The grounding resistance should be 100 Ω or less. (Ordinary building frames may be used. However, do not use a ground wire or ground pole in common with power lines, motors, etc.)

NOTE

When metal ducts, metal tubes or wiring racks are used, ground them in accordance with the accepted technical standards.

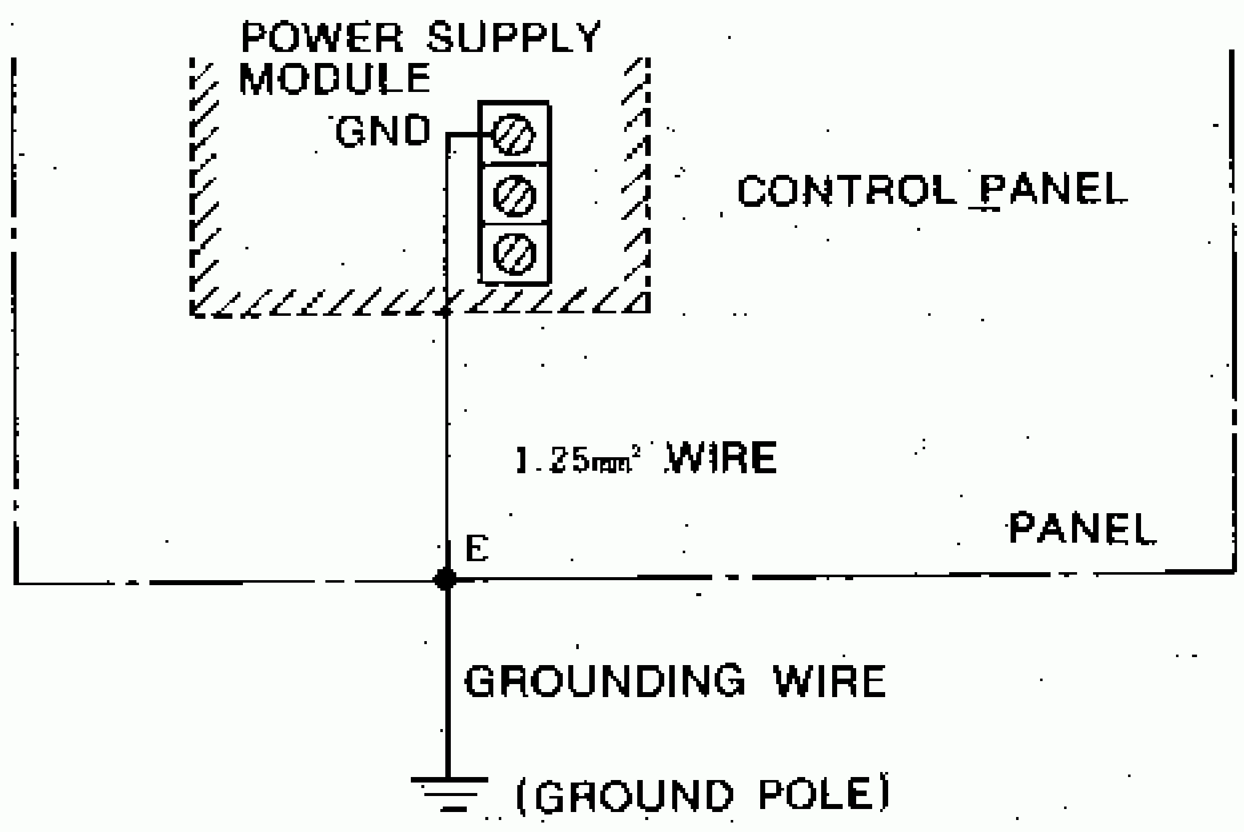


Fig. 6.3 Grounding Wire

6.3.4 External Wiring

(1) Cables for Input and Output Signal Lines

Cables to be used as external input and output signal lines should be selected in full consideration of the environmental conditions, mechanical strength, electrical noise, wiring length, operational voltage, etc. Isolate the input and output signal lines from each other and select cables on the basis of the guidelines given in Table 6.4.

(2) Installation of Input and Output Signal Line Cables

Since the input and output signal lines are low-voltage control circuit lines, separate these lines from ordinary control circuit lines and the main circuit lines as far as possible. Keep the space of minimum 10 centimeters between the lines. If they cannot separated, use the totally shielded cables and palce the iron plate between the lines to separate them completely.

Table 6.4 I/O Signal Line Cable Installation

Wiring Distance	Description
30 m max.	• DC input/output signal lines and AC input/output lines may be contained in the respective AC/DC ducts.
30 - 300 m	• DC input signal lines, DC output signal lines, AC input signal lines and AC output signal lines should be contained in their respective ducts, separately. • Where induced voltage is high, connect a dummy resistor as described in 5.2 PRECAUTIONS FOR USING INPUT/OUTPUT MODULES, or use the totally shielded cables.
300 m min.	• Do not use cables over 300 m, in view of the rush current to the output module. • Where the wiring distance is over 300 m, use a relay, and limit the wiring length between the relay and the control panel within 300 m.

6.4 SPARE PARTS

Generally, it is recommended that the following spare parts should be stocked.

- CPU module: one unit
- Power supply module: one unit
- Input and output modules: At least one unit each of all the used models. Where many modules are used, 3% of the used number of modules are recommended as a spare parts quantity.

APPENDIX A
R84H COMPONENTS LIST

Memocon-SC R84H Components

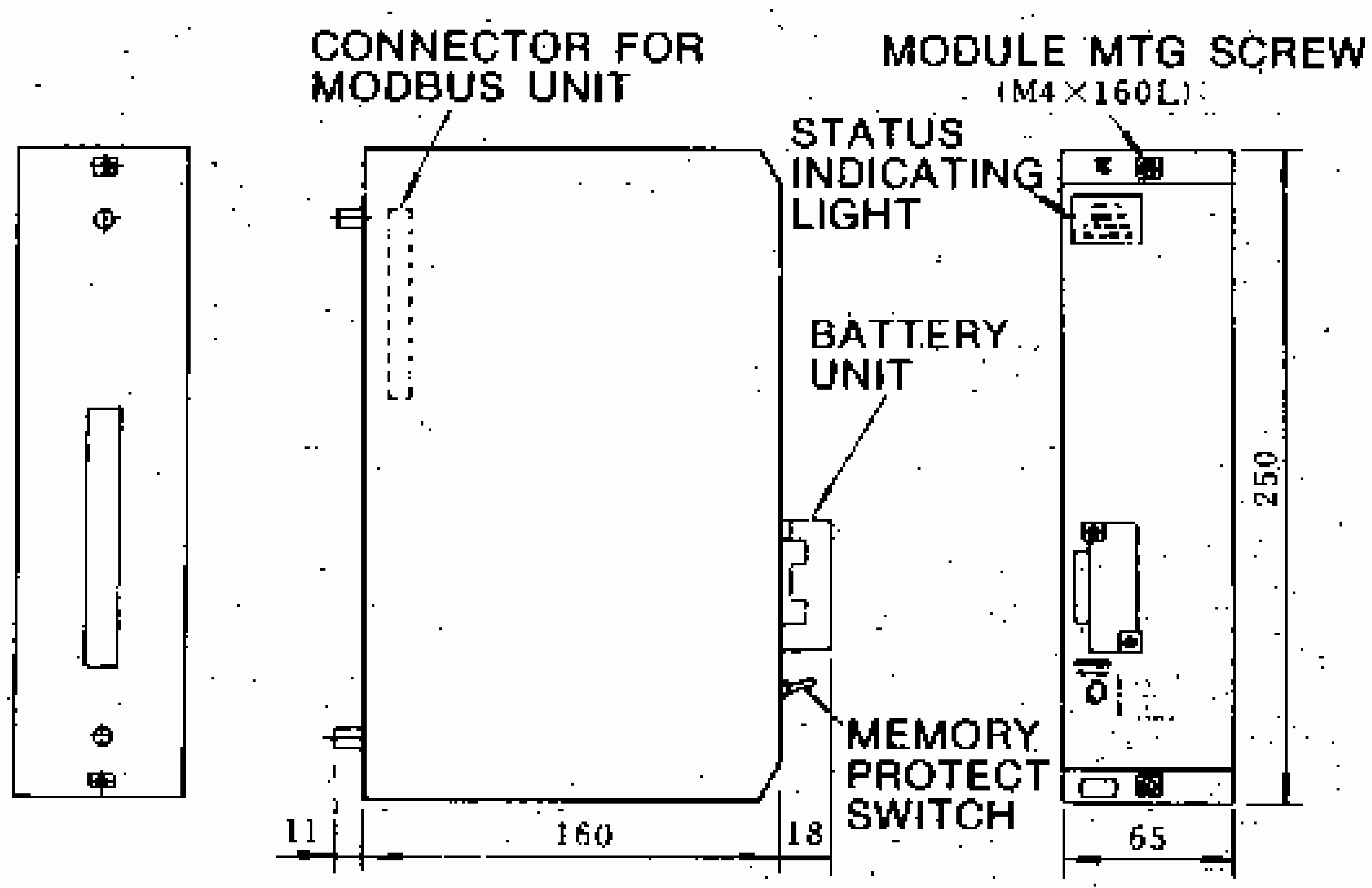
Component	Type	Function or Application	Remarks
CPU Module	DDSCR-R84H	8 K memory size of processor.	—
	DDSCR-R84H-M	8 K memory size of processor.	With MEMOBUS interface.
Basic Power Supply Module	JRMSP-P8051	DC power supply for CPU and I/O sections 1, 2.	—
Expanding Power Supply Module	JRMSP-P8052	DC power supply for I/O buffer and I/O sections 3, 4.	—
I/O Buffer Module	JAMSC-B1011	For I/O buffer and I/O sections 3, 4.	—
Mounting Base 1	JRMSI-B1026	For CPU, basic power supply and I/O section 1.	—
Mounting Base 2	JRMSI-B1027	For I/O sections 2, 4.	—
Mounting Base 3	JRMSI-B1028	For expanding power supply, I/O buffer and I/O section 3.	—
I/O Cables	JZMSZ-W1022	Connects mounting base with 40cm cable.	—
	JZMSZ-W1021	Connects mounting base with 150cm cable.	—
I/O Modules	JAMSC-B1050	100 VAC output.	• 16 Circuits per module. (8 circuits for B1094) • With signal status indicating light. • Blown fuse indicating lamp provided for output modules (except for B1090B, B1094. (1 fuse per 8 circuits))
	JAMSC-B1051B	100 VAC input.	
	JAMSC-B1052	5/12 VDC input.	
	JAMSC-B1053	5/12 VDC output.	
	JAMSC-B1054	200 VAC output.	
	JAMSC-B1055	200 VAC input.	
	JAMSC-B1056	48 VDC output.	
	JAMSC-B1057	48 VDC input.	
	JAMSC-B1058	24 VDC output.	
	JAMSC-B1059C	24 VDC input.	
	JAMSC-B1090B	Relay output.	
	JAMSC-B1094	Power reed relay contact output.	
	JAMSC-B1060	24 VDC output.	• 64 Circuits per module. • With no fuse.
	JAMSC-B1061	24 VDC input.	
	JAMSC-B1062	24 VDC output.	• 32 Circuits per module. • With no fuse.
	JAMSC-B1063	24 VDC input	
	JAMSC-B1064	24 VDC output.	
	JAMSC-B1065	24 VDC input.	
	JAMSC-B1070	Register output.	8 Circuits per module.
	JAMSC-B1071	Register input.	
	JAMSC-B1072B-1	Analog output (D/A), 0 to +10V.	2 Circuits per module.
	JAMSC-B1072B-2	Analog output (D/A), 0 to +5V.	
	JAMSC-B1072B-3	Analog output (D/A), −5 to +5V.	
	JAMSC-B1072B-4	Analog output (D/A), −10 to +10V.	

Memocon-SC R84H Components (Cont'd)

<table>
<tr><th colspan="2">Component</th><th>Type</th><th>Function or Application</th><th>Remarks</th></tr>
<tr><td colspan="2" rowspan="7">I/O Modules (Cont'd)</td><td>JAMSC-B1073-1</td><td>Analog input (A/D), 0 to +10V.</td><td rowspan="2">4 Circuits per module.</td></tr>
<tr><td>JAMSC-B1073-2</td><td>Analog input (A/D), +1 to +5V.</td></tr>
<tr><td>JAMSC-B1081C</td><td>Reversible counter.</td><td rowspan="4">1 Circuit per module.</td></tr>
<tr><td>JAMSC-B1082C</td><td>Preset counter.</td></tr>
<tr><td>JAMSC-B1083C</td><td>Positioning control.</td></tr>
<tr><td>JAMSC-B1080</td><td>PID control.</td></tr>
<tr><td>JAMSC-P1089</td><td>DC power supply for PID module</td><td>4 PID modules max.</td></tr>
<tr><td rowspan="5">Peripheral Devices</td><td rowspan="4">Programming Panel</td><td>DISCT-P180</td><td>Storing programs, checking, monitoring.</td><td>—</td></tr>
<tr><td>DISCT-P180-011</td><td>Storing programs, checking, monitoring, printing out.</td><td>Printer required</td></tr>
<tr><td>DISCT-P100</td><td>Storing programs, checking, monitoring, loading dumping.</td><td>Tape recorder required.</td></tr>
<tr><td>DISCT-P190</td><td>Storing programs, chceking, monitoring, loading, dumping.</td><td>Programming tape required.</td></tr>
<tr><td>EIA Adapter</td><td>DISCT-J470</td><td>With on MEMOBUS function, communicates CPU to P190 or computer.</td><td>Converting RS422 to RS232C.</td></tr>
<tr><td rowspan="4">P190 Program Tapes</td><td>Programmer</td><td>T484-S001</td><td>Storing, checking, monitoring.</td><td>—</td></tr>
<tr><td>Utility</td><td>T484-S002</td><td>Printing out ladder list.</td><td>—</td></tr>
<tr><td>Tape Loader</td><td>T190-S001</td><td>Loading, dumping, verifying programs.</td><td>—</td></tr>
<tr><td>Blank Tape</td><td>T190-000</td><td>Dumping Programs.</td><td>—</td></tr>
<tr><td colspan="2" rowspan="4">Interface Cables</td><td>JZMSZ-W470-001</td><td>Connects P190 to J470 with 2.5-meter cable.</td><td>—</td></tr>
<tr><td>JZMSZ-W181</td><td>Connects P180-011 or P190 to printer with 2.5-meter cable.</td><td>—</td></tr>
<tr><td>JZMSZ-W194-001</td><td>Connects R84H-M to modem J478 with 2.5-meter cable.</td><td>—</td></tr>
<tr><td>JZMSZ-W198-001</td><td>Connects R84H-M to master computer with 2.5-meter cable.</td><td>—</td></tr>
</table>

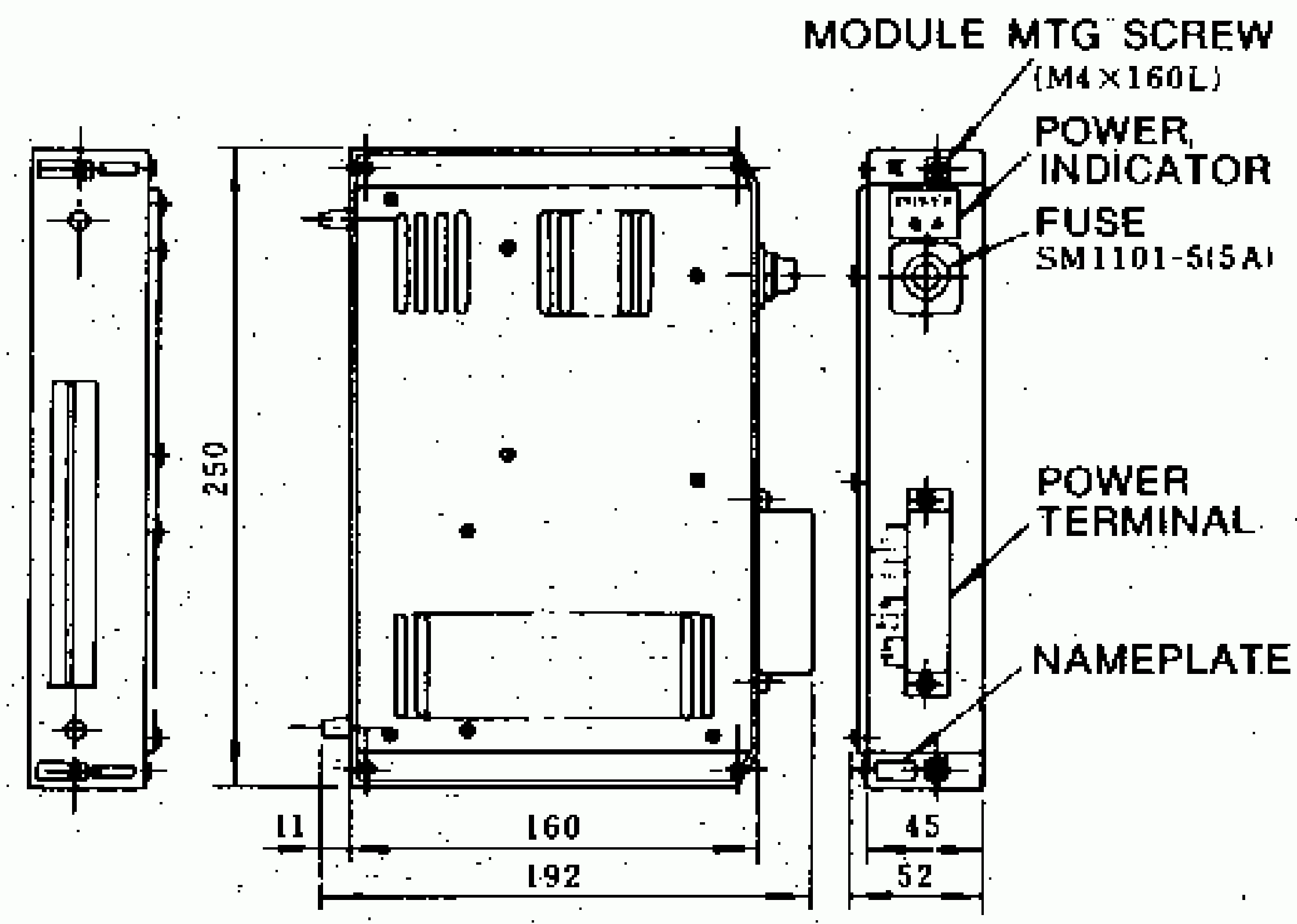
APPENDIX B
DIMENSIONS in mm

(1) CPU MODULE (TYPE DDSCR-R84H)



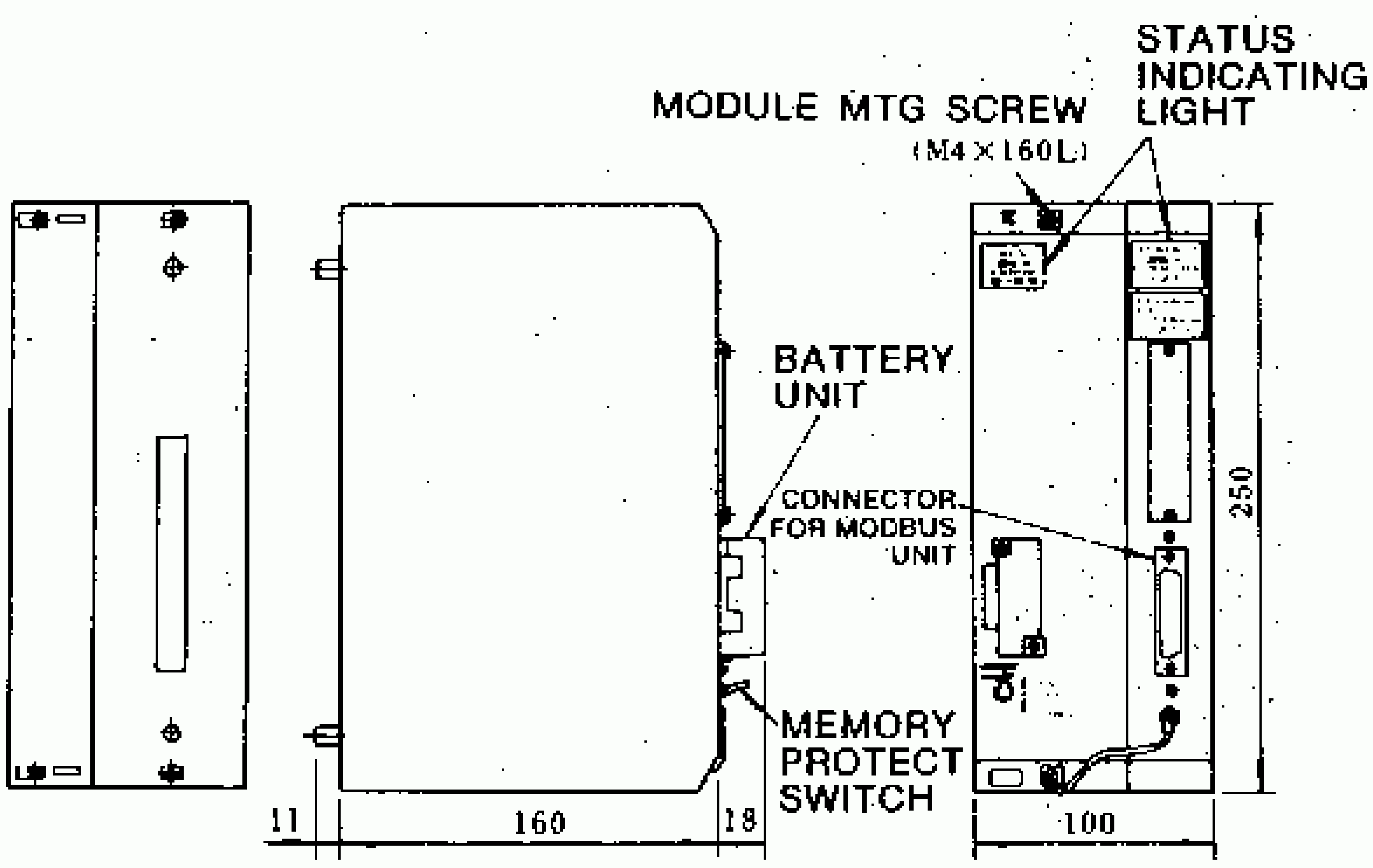
APPROX WEIGHT: 1.6kg

(4) EXPANDING POWER SUPPLY MODULE (TYPE JRMSP-P8052)



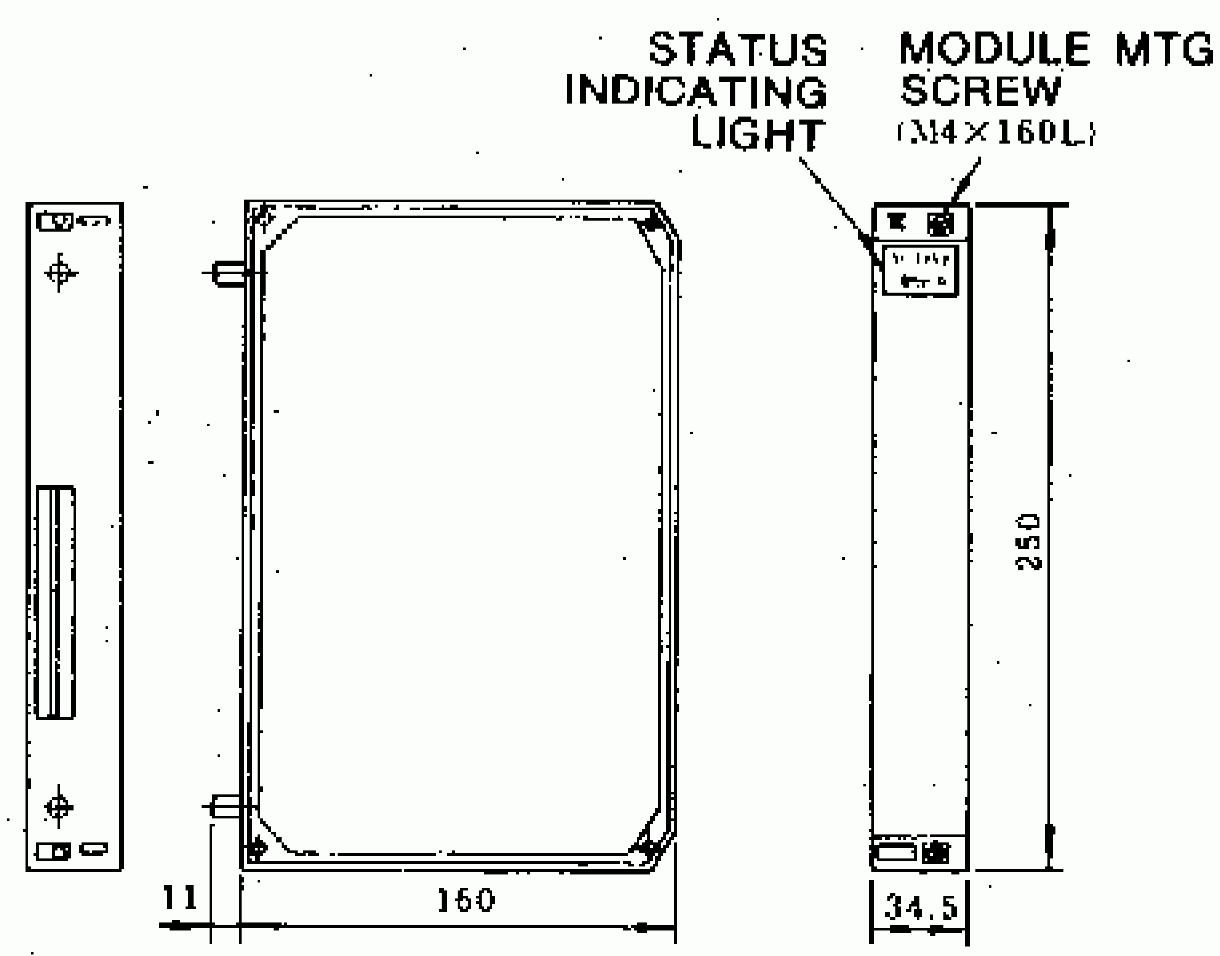
APPROX WEIGHT: 1.1kg

(2) CPU MODULE (TYPE DDSCR-R84H-M)



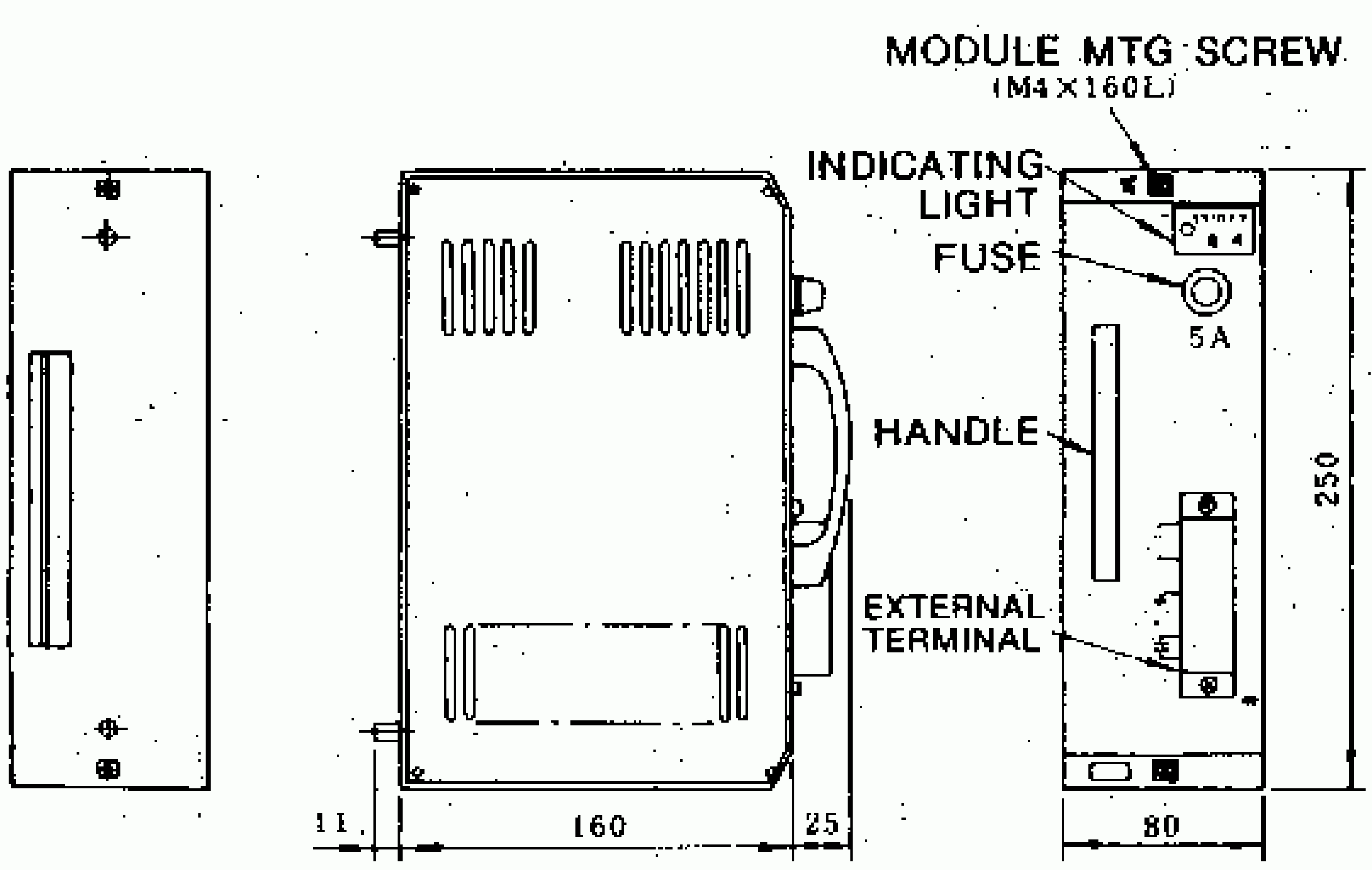
APPROX WEIGHT: 2.3kg

(5) I/O BUFFER MODULE (TYPE JAMSC-B1011)



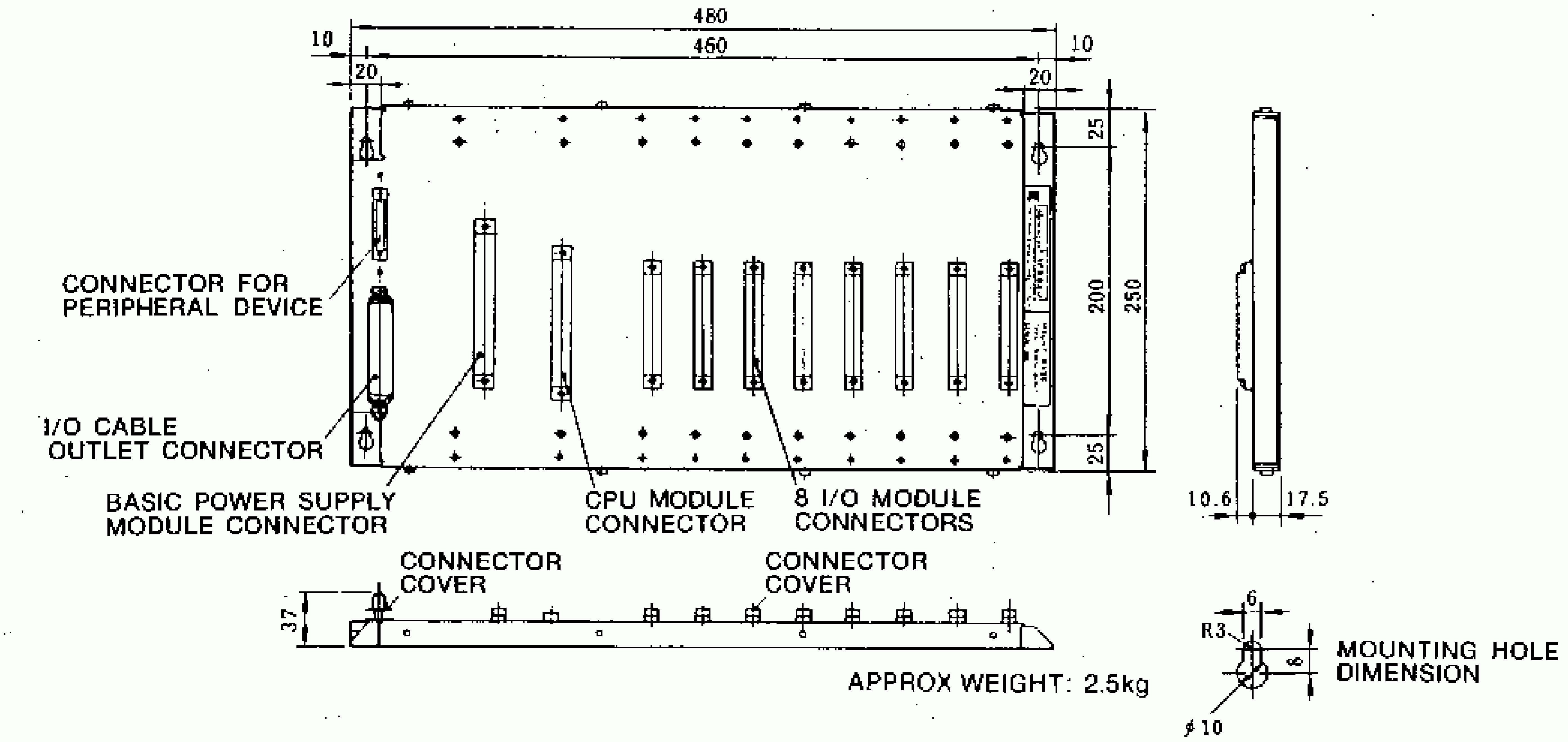
APPROX WEIGHT: 0.7kg

(3) BASIC POWER SUPPLY MODULE (TYPE JRMSP-P8051)

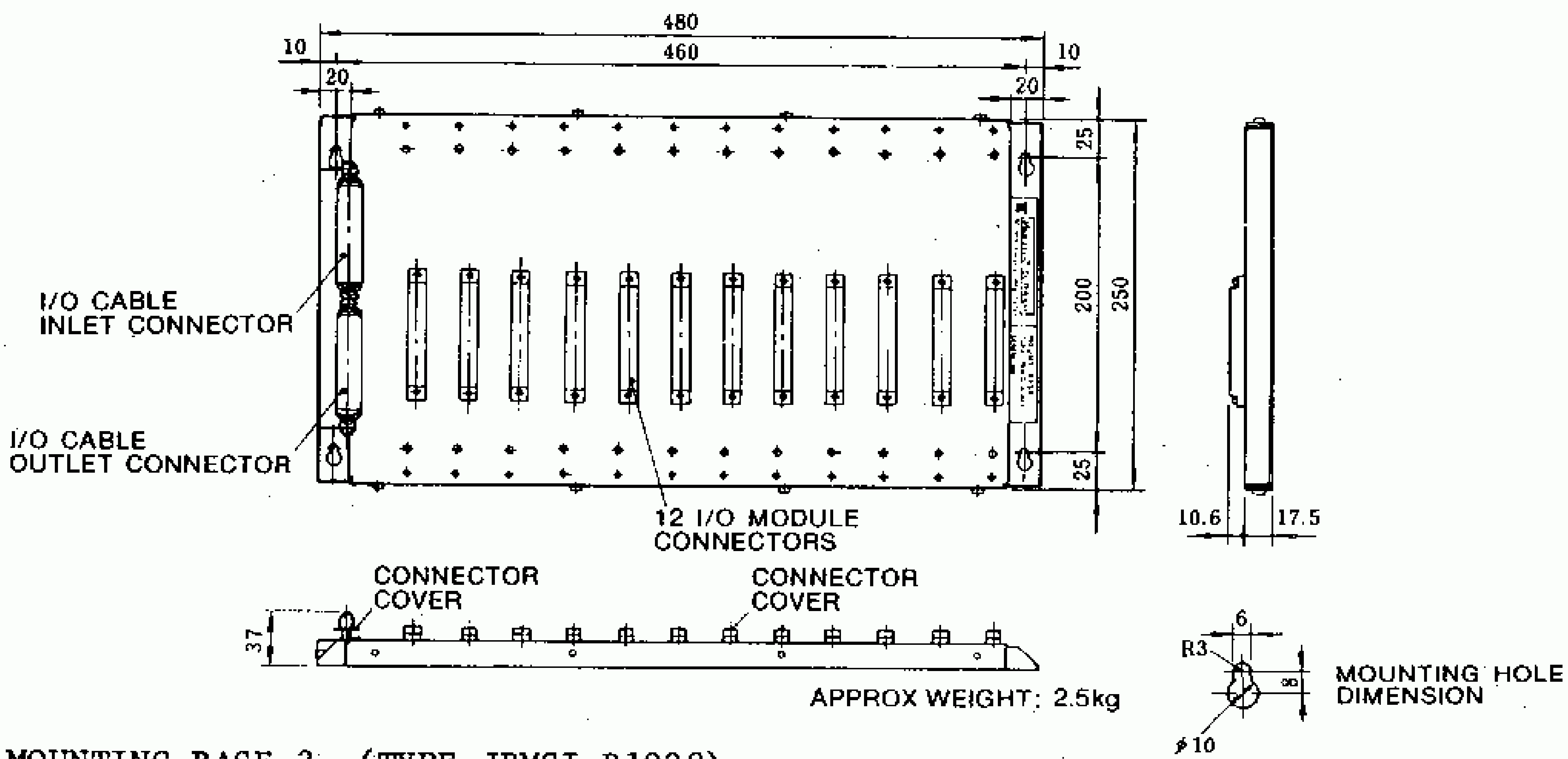


APPROX WEIGHT: 2.8kg

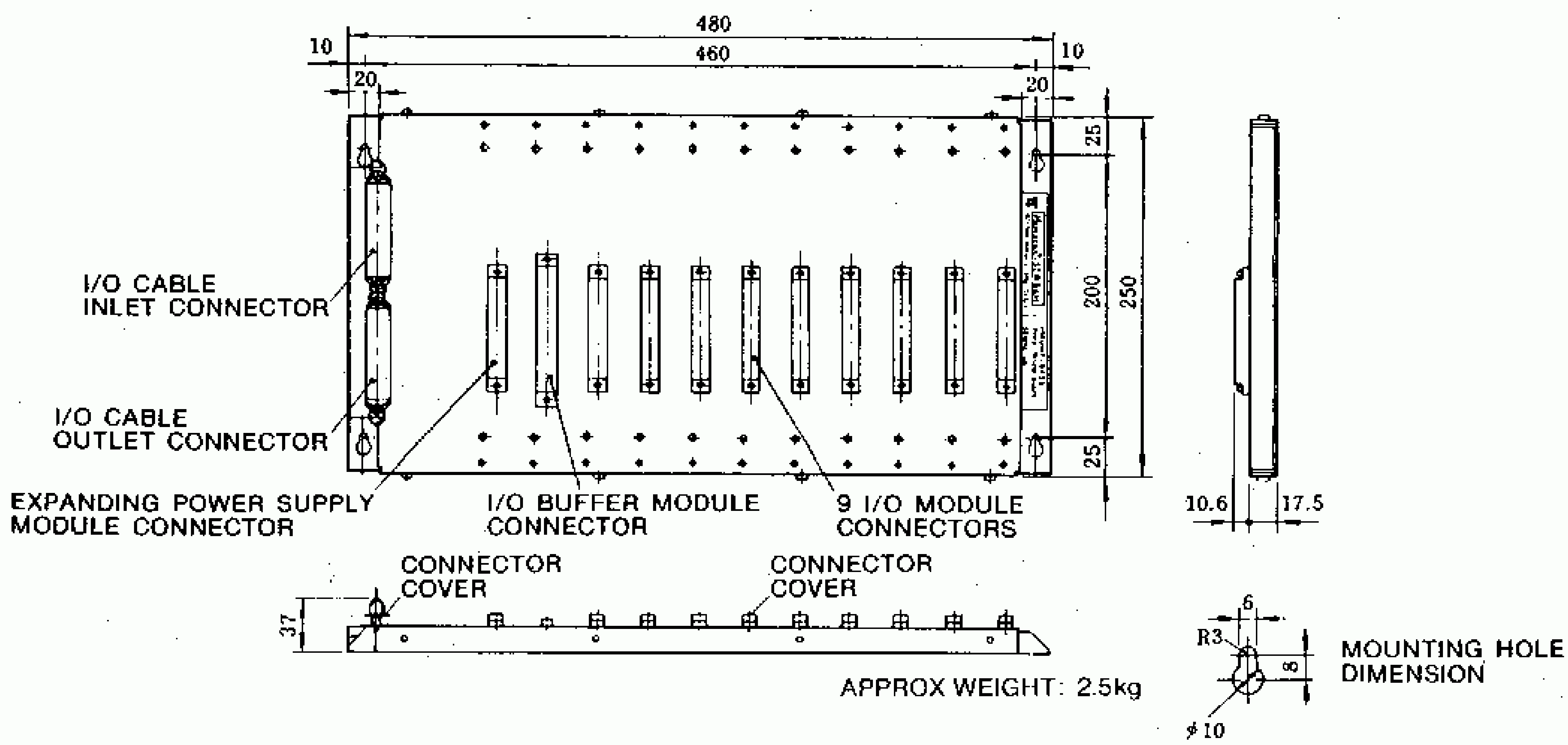
(6) MOUNTING BASE 1 (TYPE JRMSI-B1026)



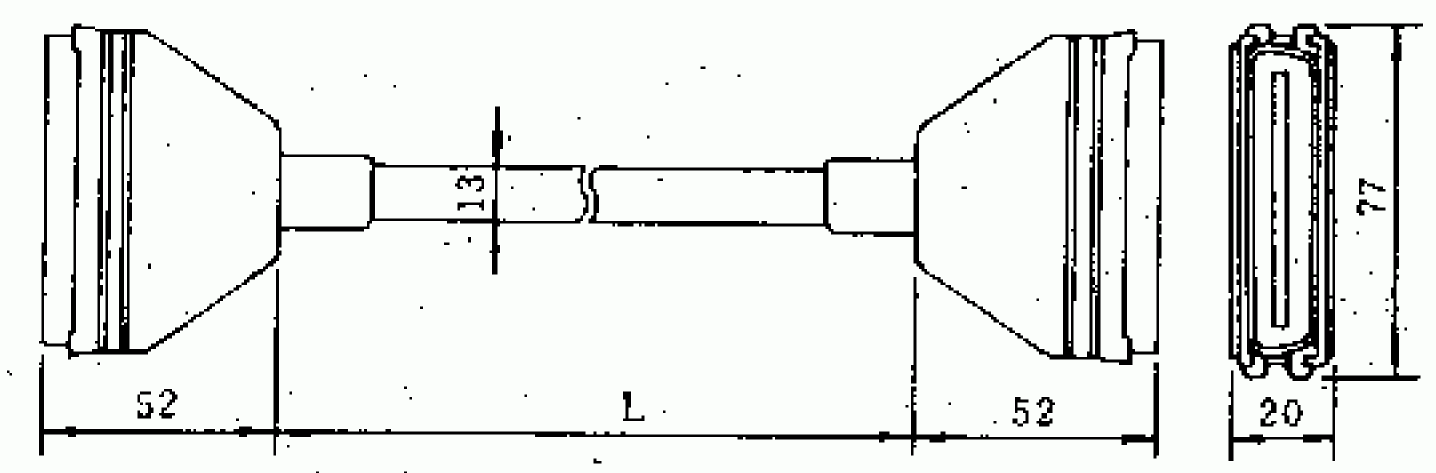
(7) MOUNTING BASE 2 (TYPE JRMSI-B1027)



(8) MOUNTING BASE 3 (TYPE JRMSI-B1028)

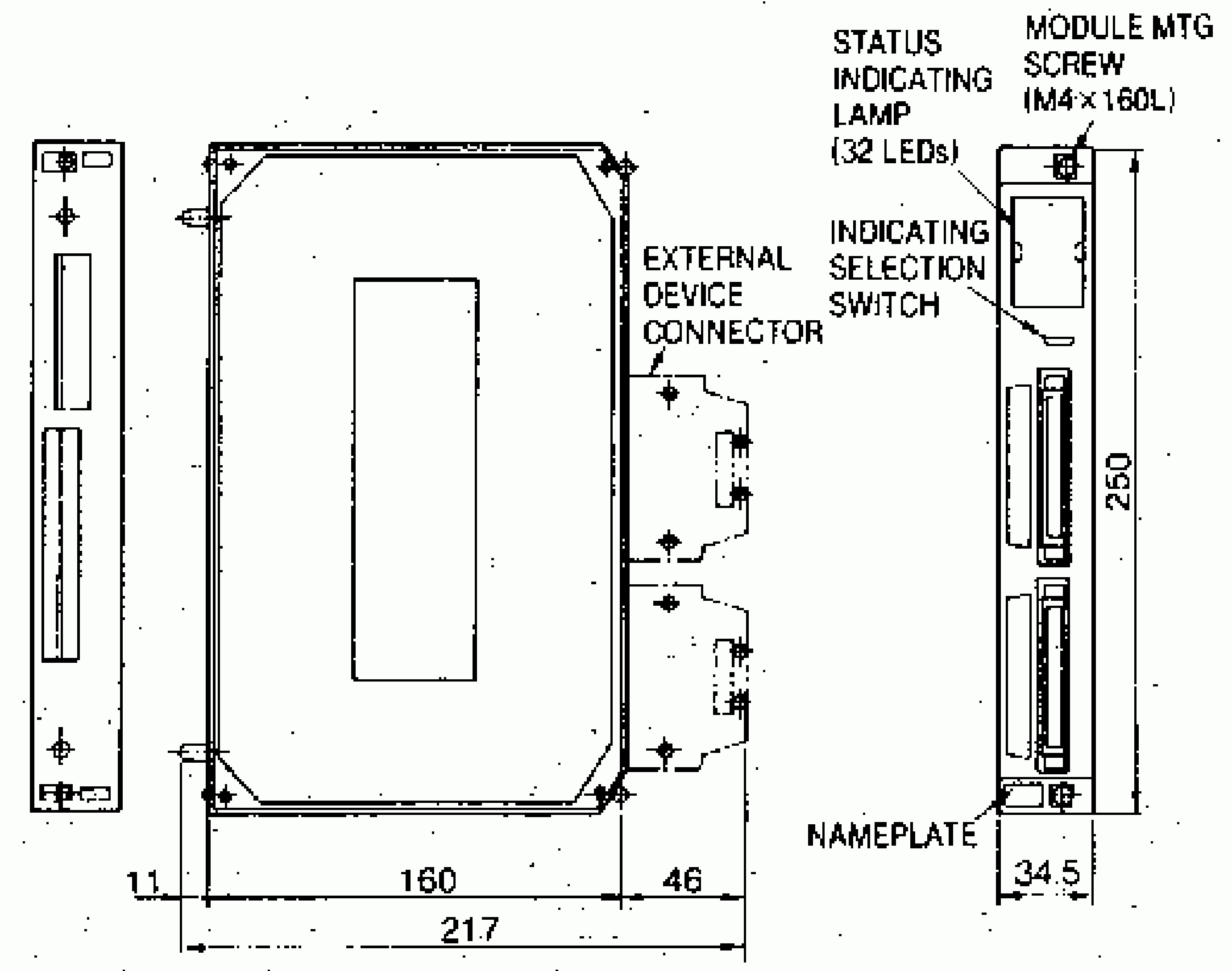


(9) I/O CABLE
(TYPES JZMSZ-W1021, -W1022)



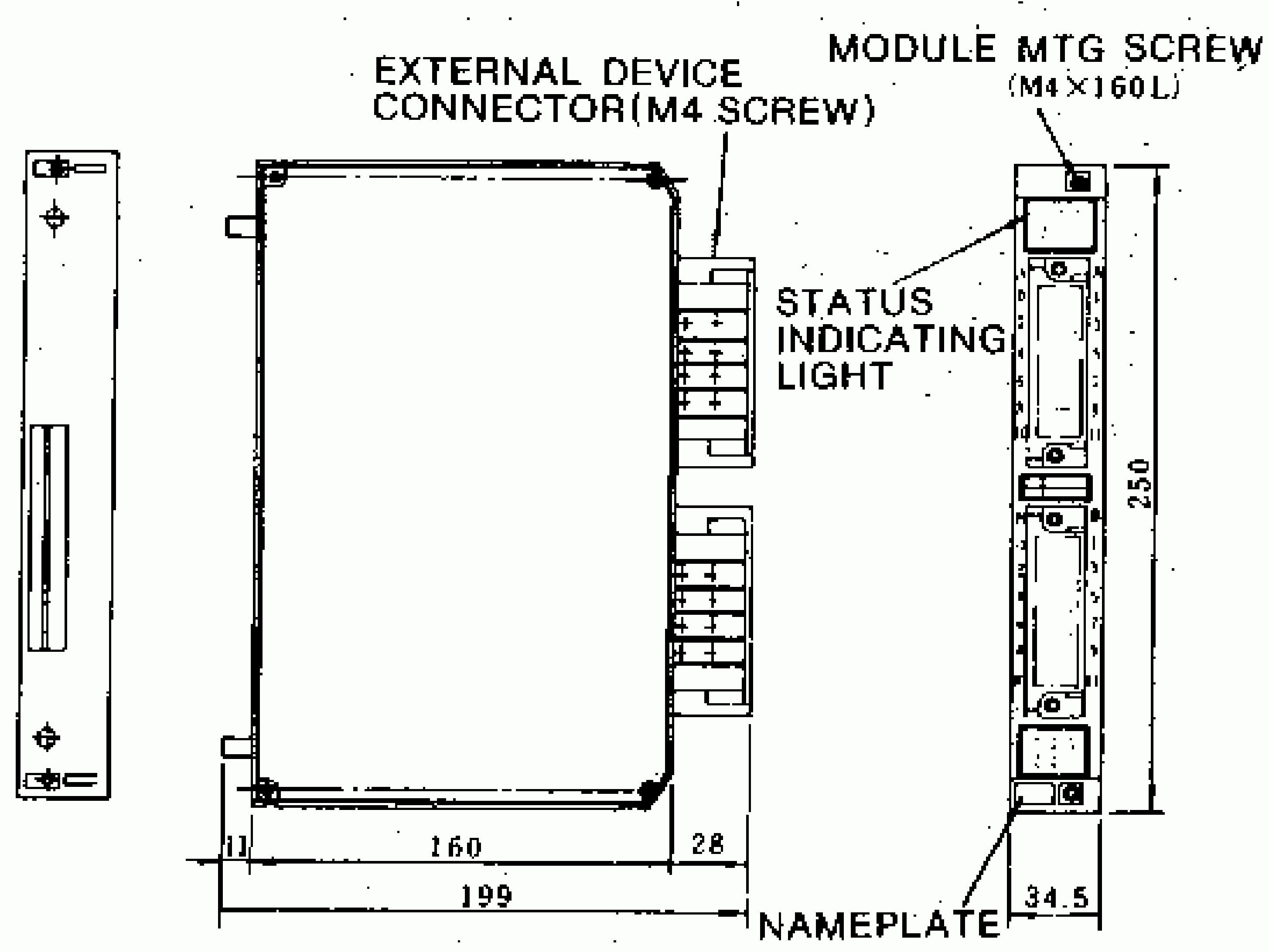
Type	Length L	Approx Weight
JZMSZ-W1021	1500	0.5kg
JZMSZ-W1022	400	0.3kg

(12) Input Module Type JAMSC-B1061
Output Module Type JAMSC-B1060



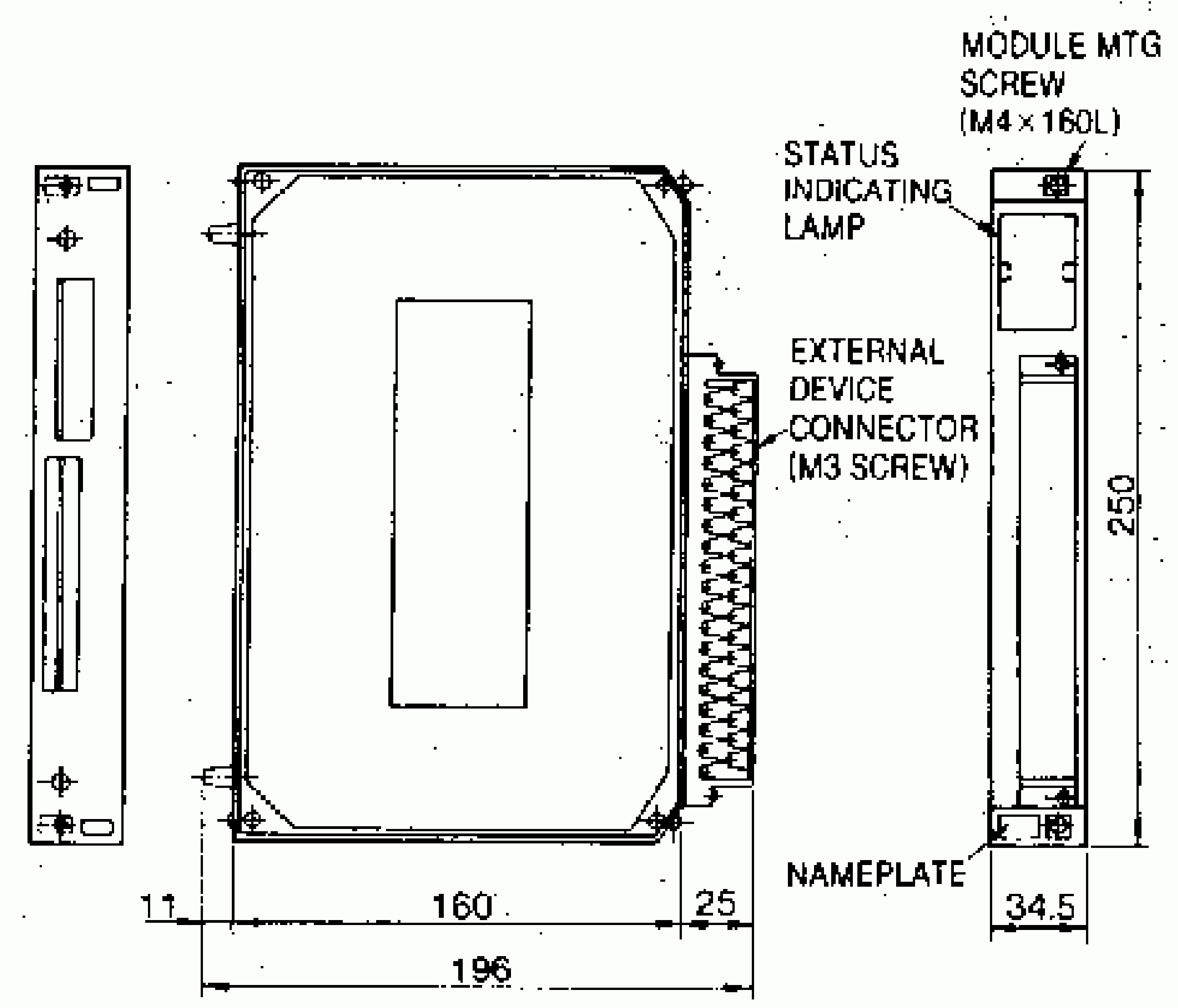
APPROX WEIGHT: 0.8kg

(10) INPUT MODULE (TYPES JAMSC-B1051B, -B1053, -B1055, -B1057, -B1059C)



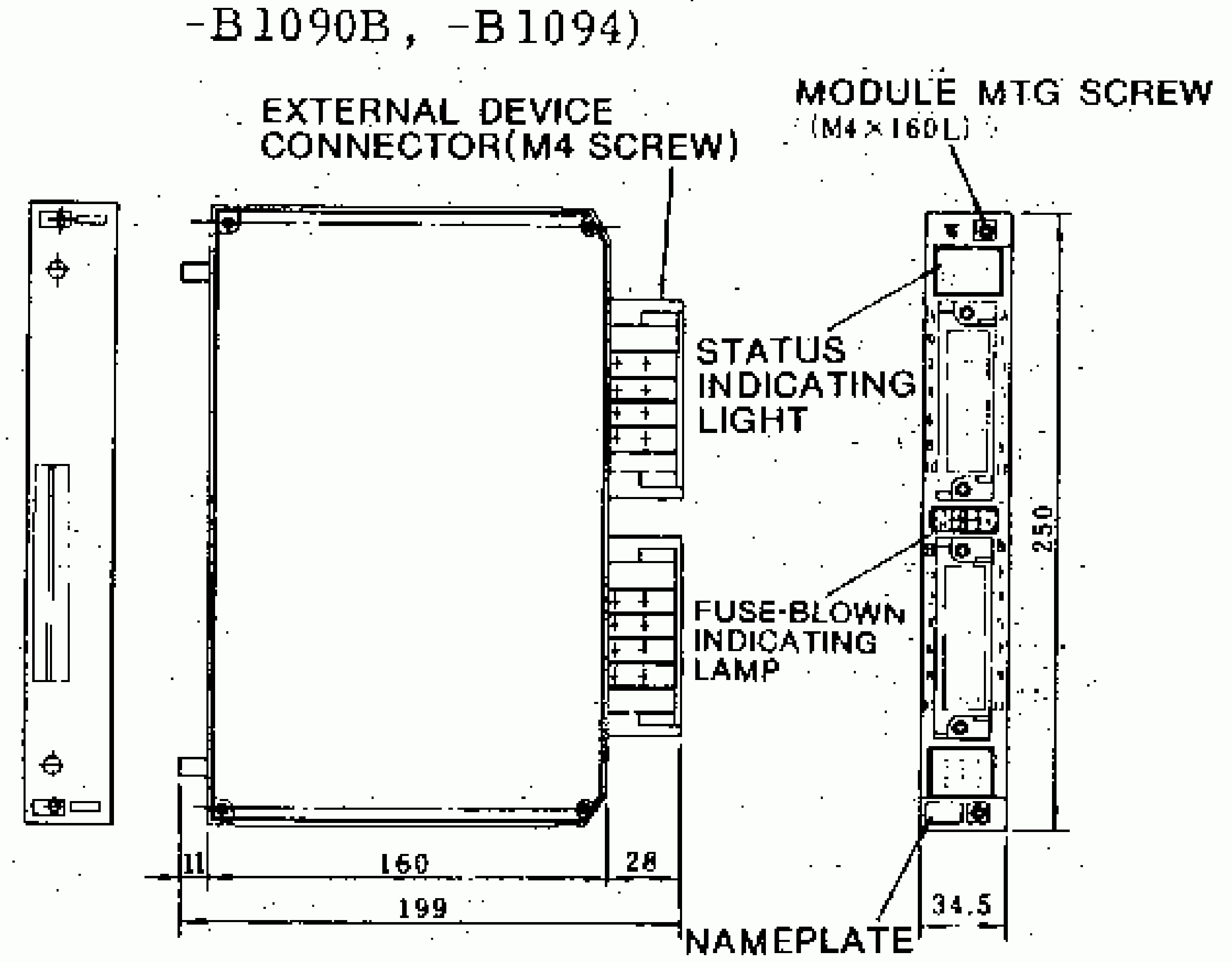
APPROX WEIGHT: 0.8kg

(13) Input Module Type JAMSC-B1063
Output Module Type JAMSC-B1062



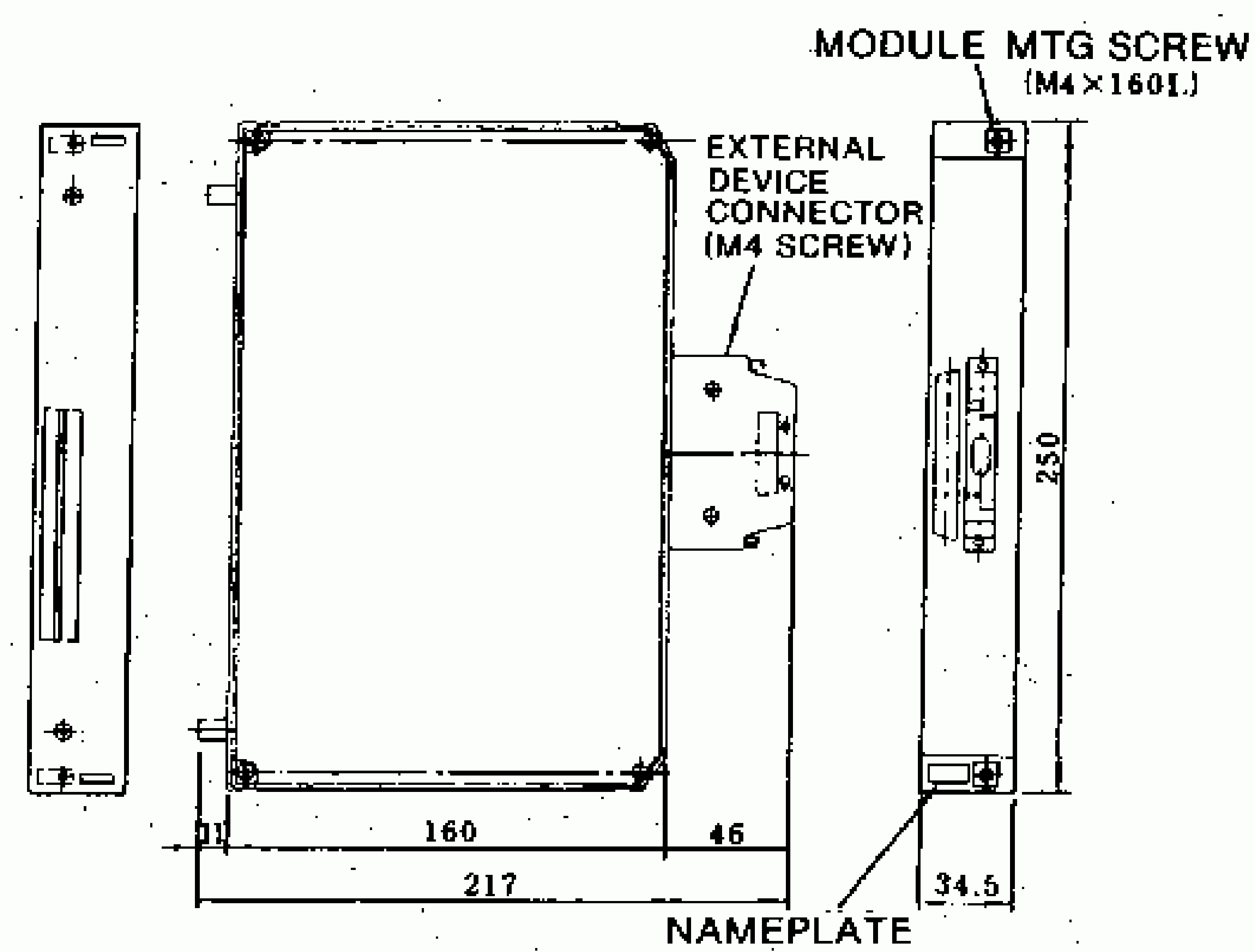
APPROX WEIGHT: 0.8kg

(11) OUTPUT MODULE (TYPES JAMSC-B1050, -B1052, -B1054, -B1056, -B1058, -B1090B, -B1094)



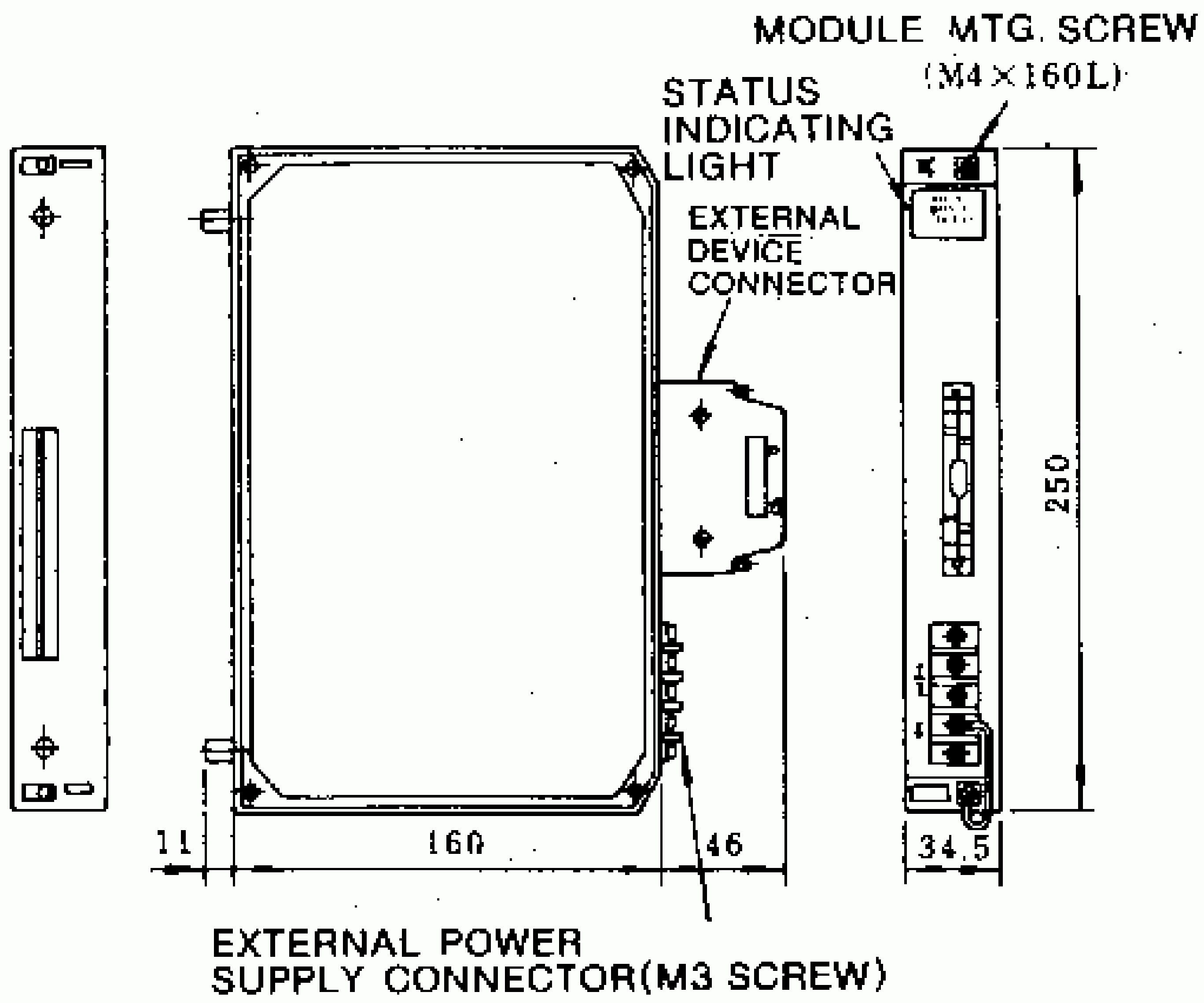
APPROX WEIGHT: 1.1kg

(14) INPUT MODULE (TYPE JAMSC-B1065)
OUTPUT MODULE (TYPE JAMSC-B1064)



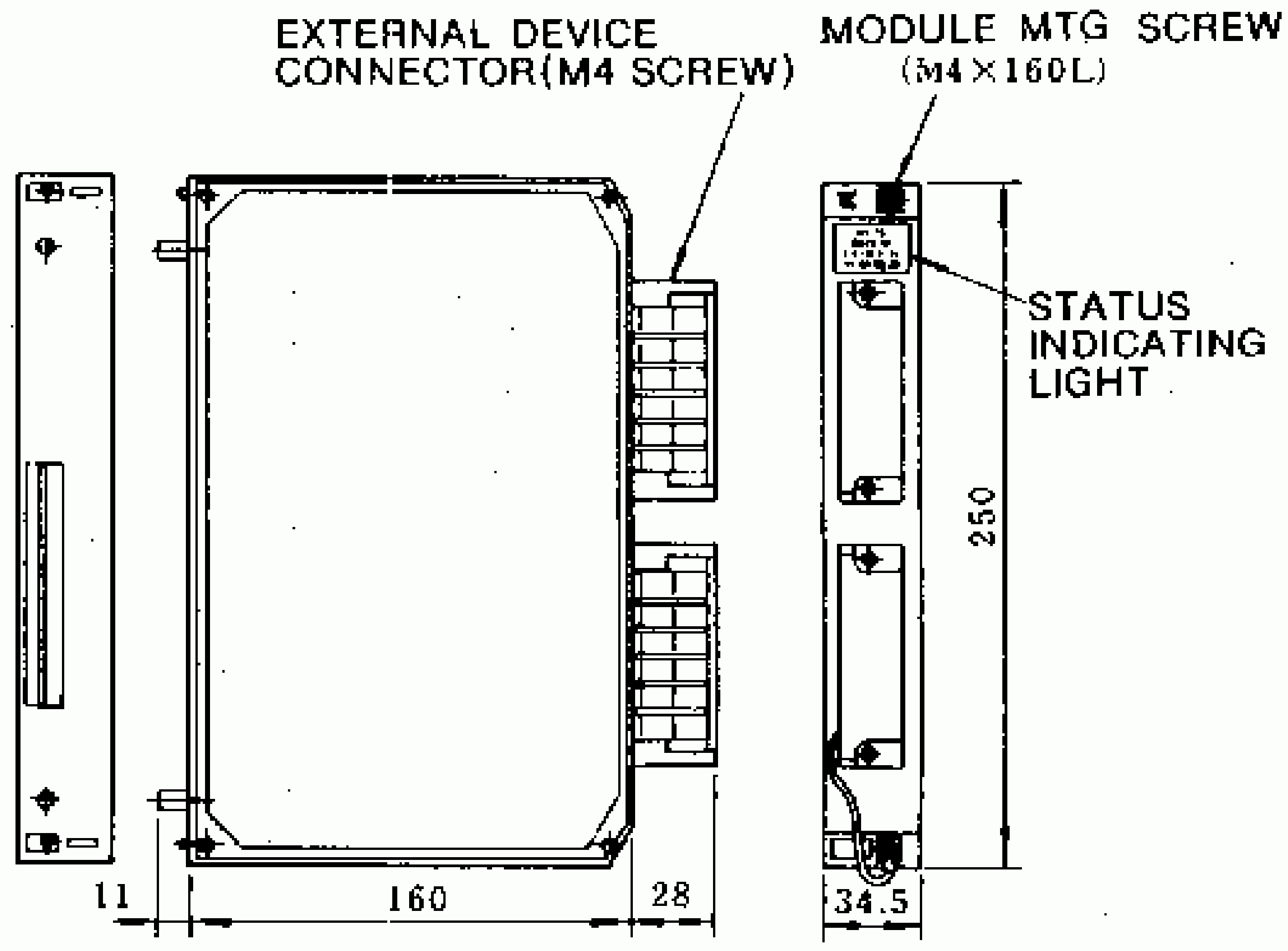
APPROX WEIGHT: 0.8kg

(15) INPUT MODULE (TYPE JAMSC-B1071)
OUTPUT MODULE (TYPE JAMSC-B1070)



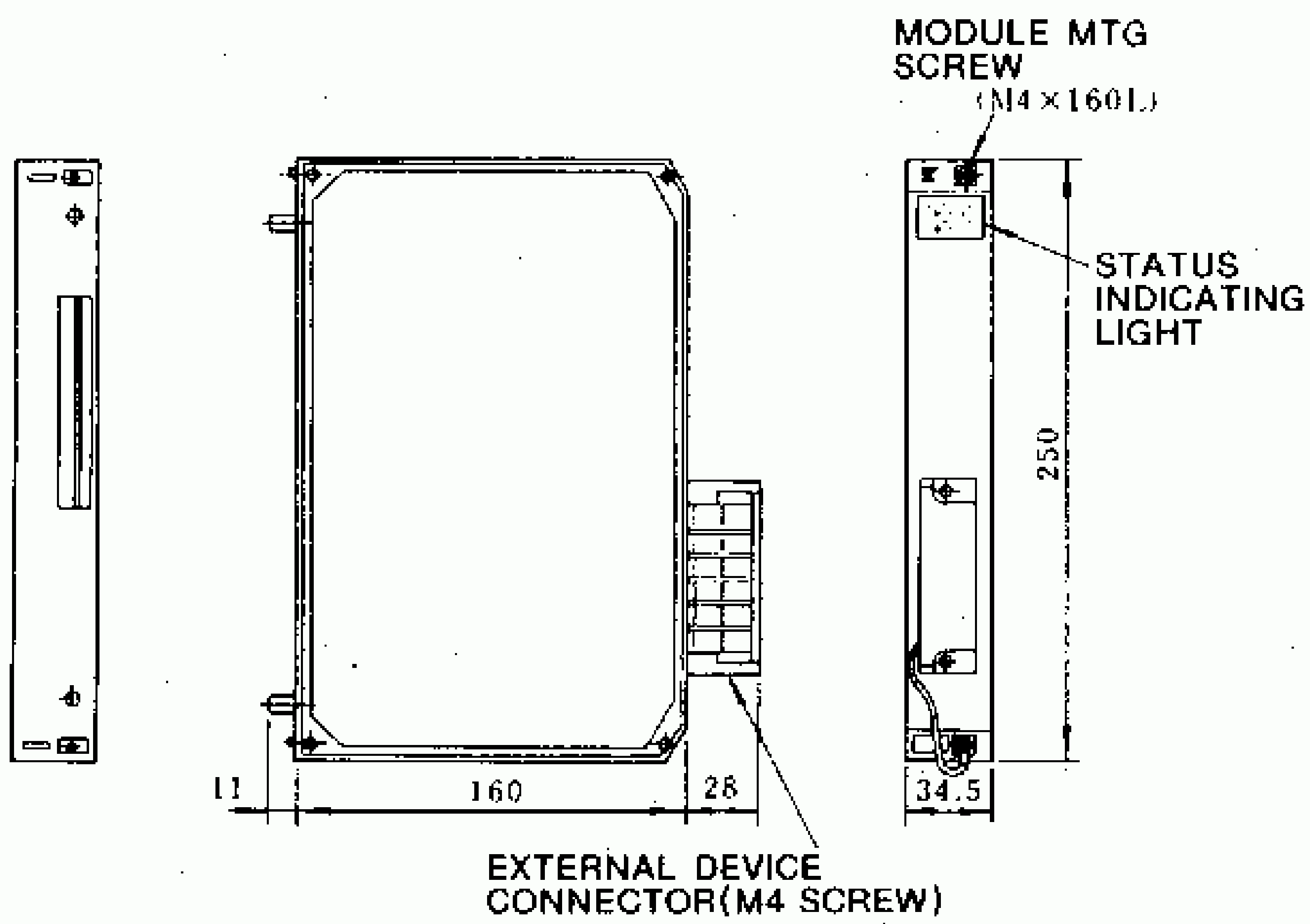
APPROX WEIGHT: 1kg

(16) INPUT MODULE
(TYPES JAMSC-B1073-1,



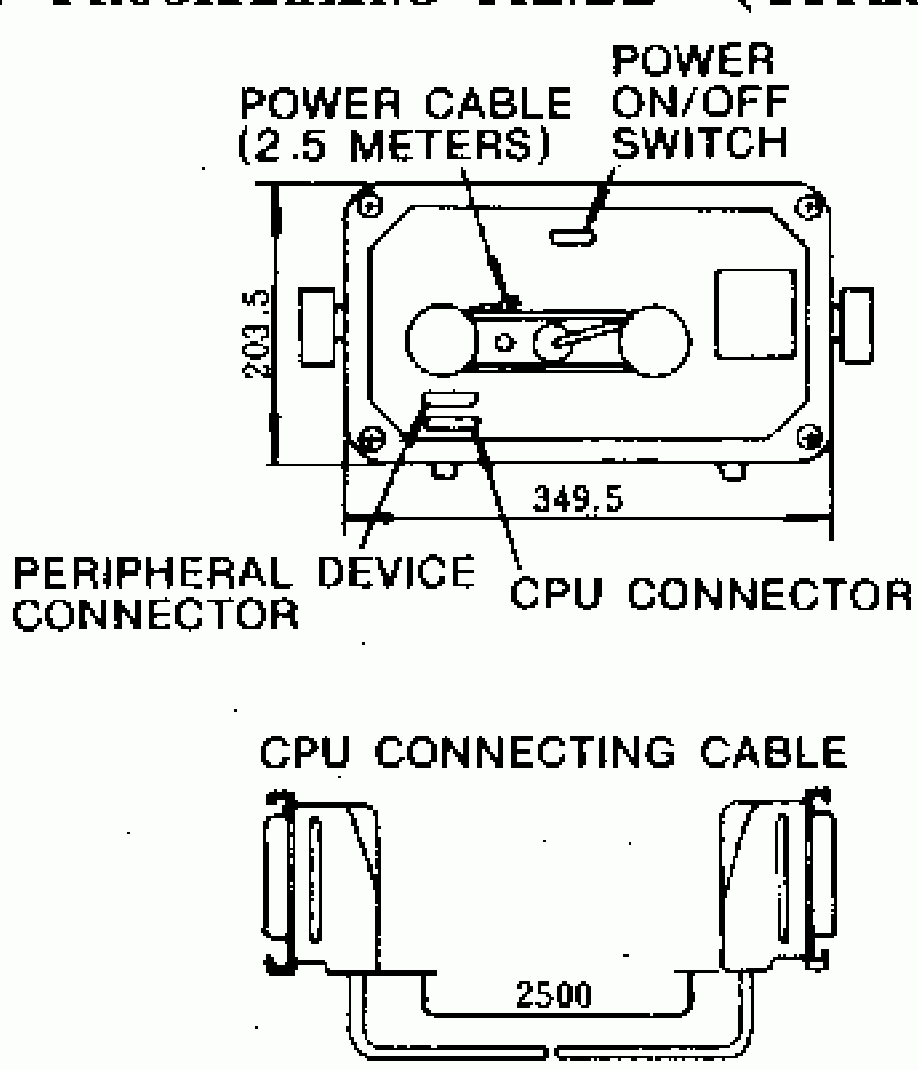
APPROX WEIGHT: 1kg

(17) OUTPUT MODULE (TYPES JAMSC-B1072B-1, -B1072B-2, -B1072B-3, -B1072B-4)

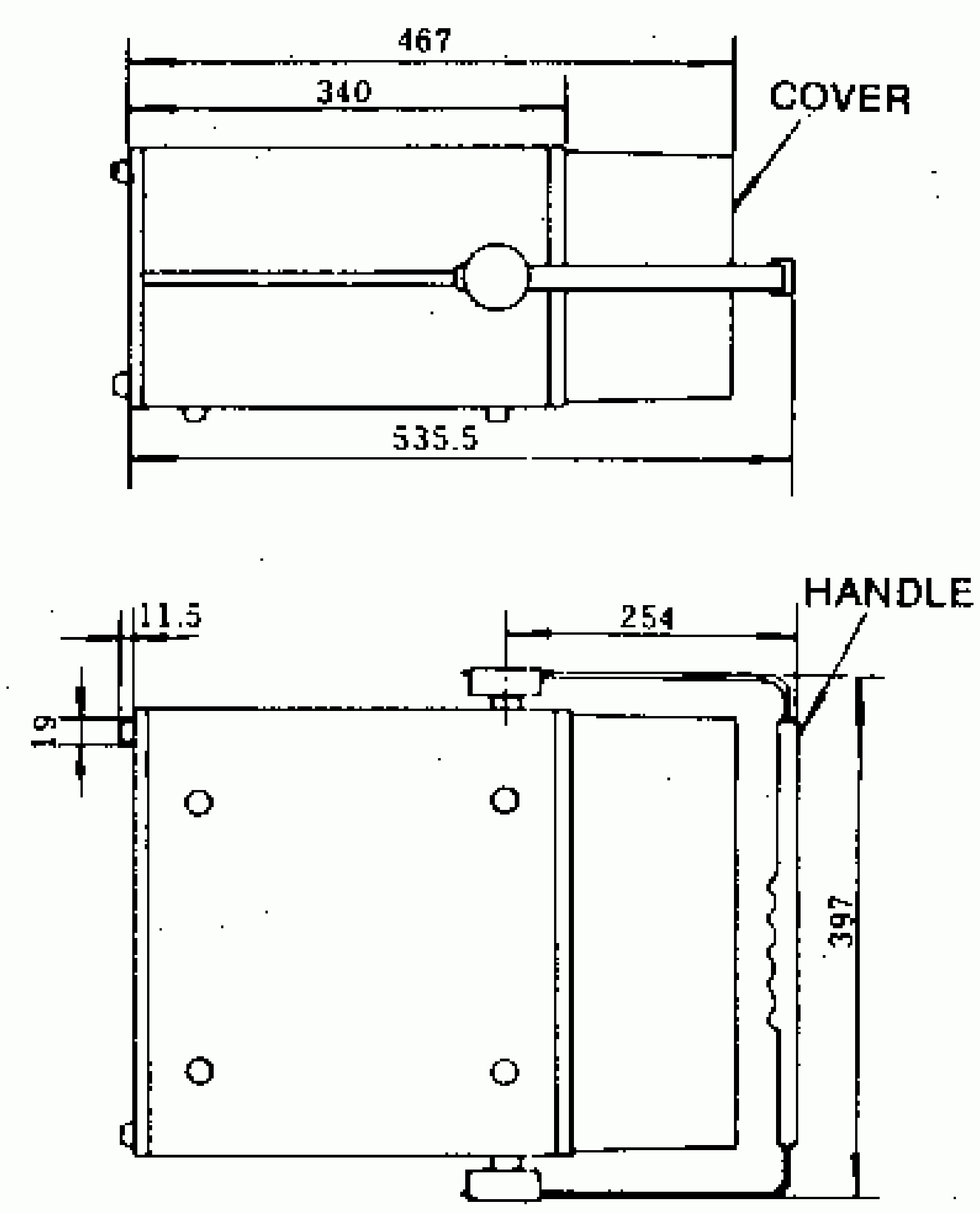


APPROX WEIGHT: 1kg

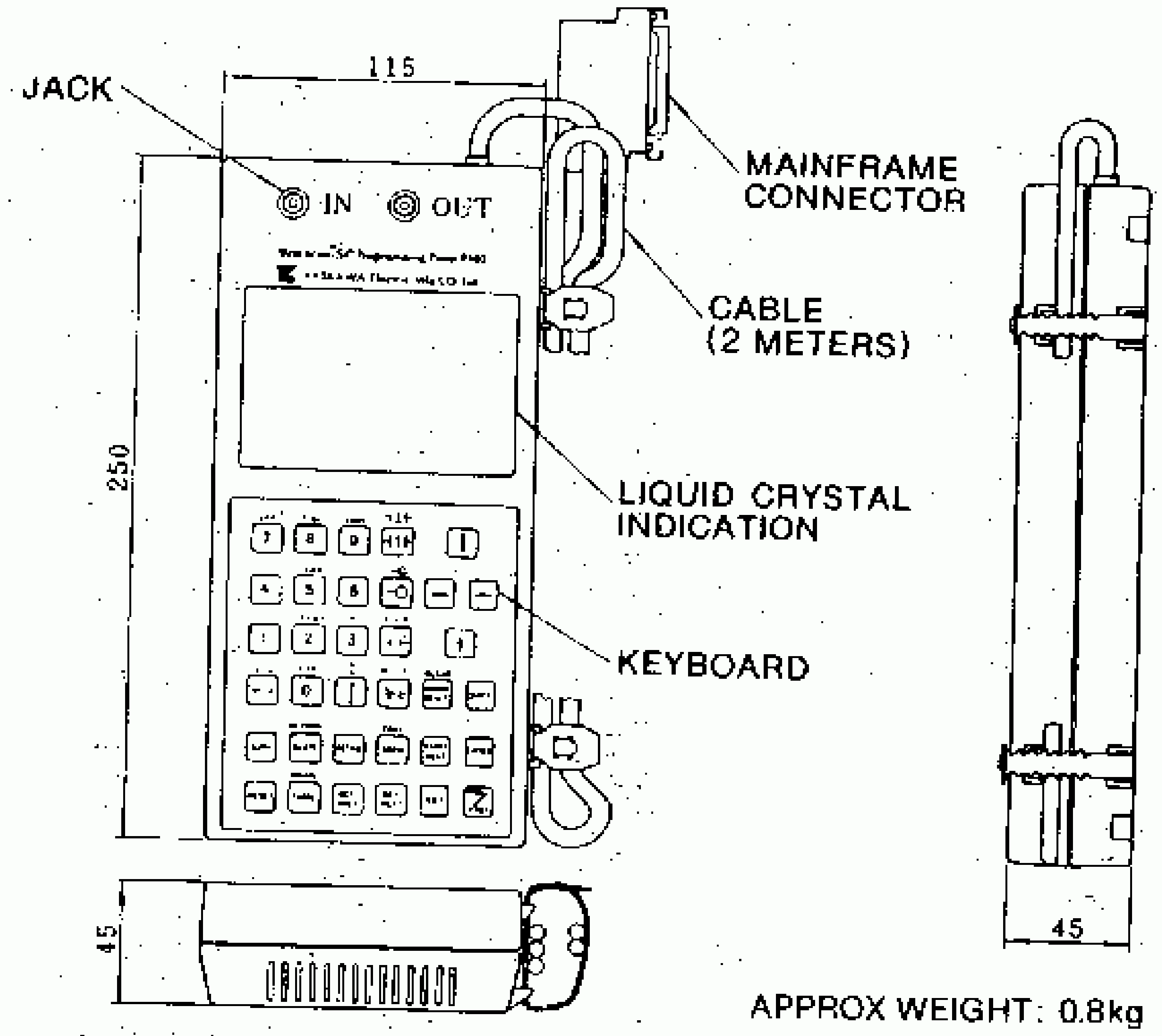
(18) P180 PROGRAMMING PANEL (TYPES DISCT-P180, -P180-011)



APPROX WEIGHT: 12kg

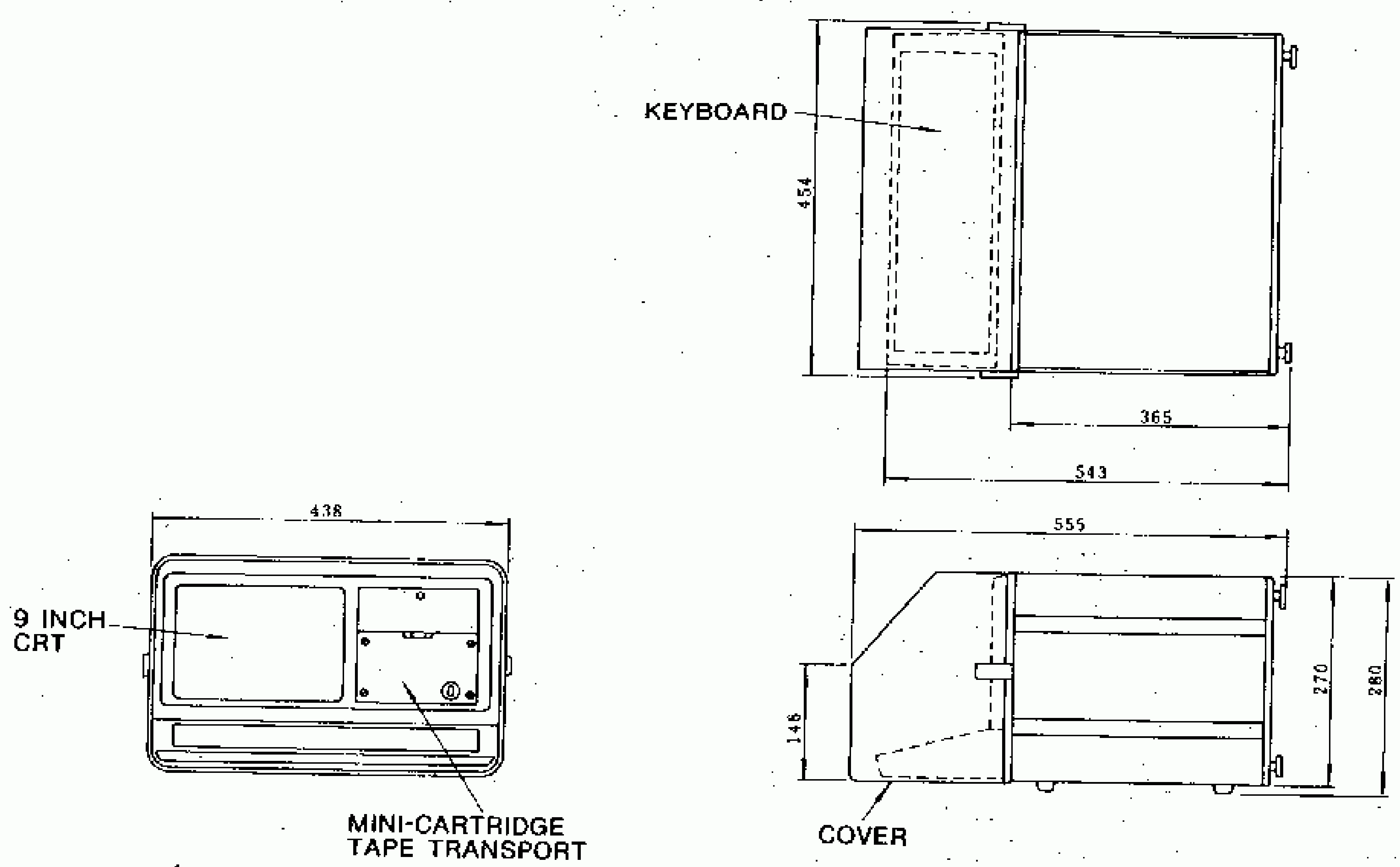


P100 PROGRAMMING PANEL (TYPE DISCT-P100)



APPROX WEIGHT: 0.8kg

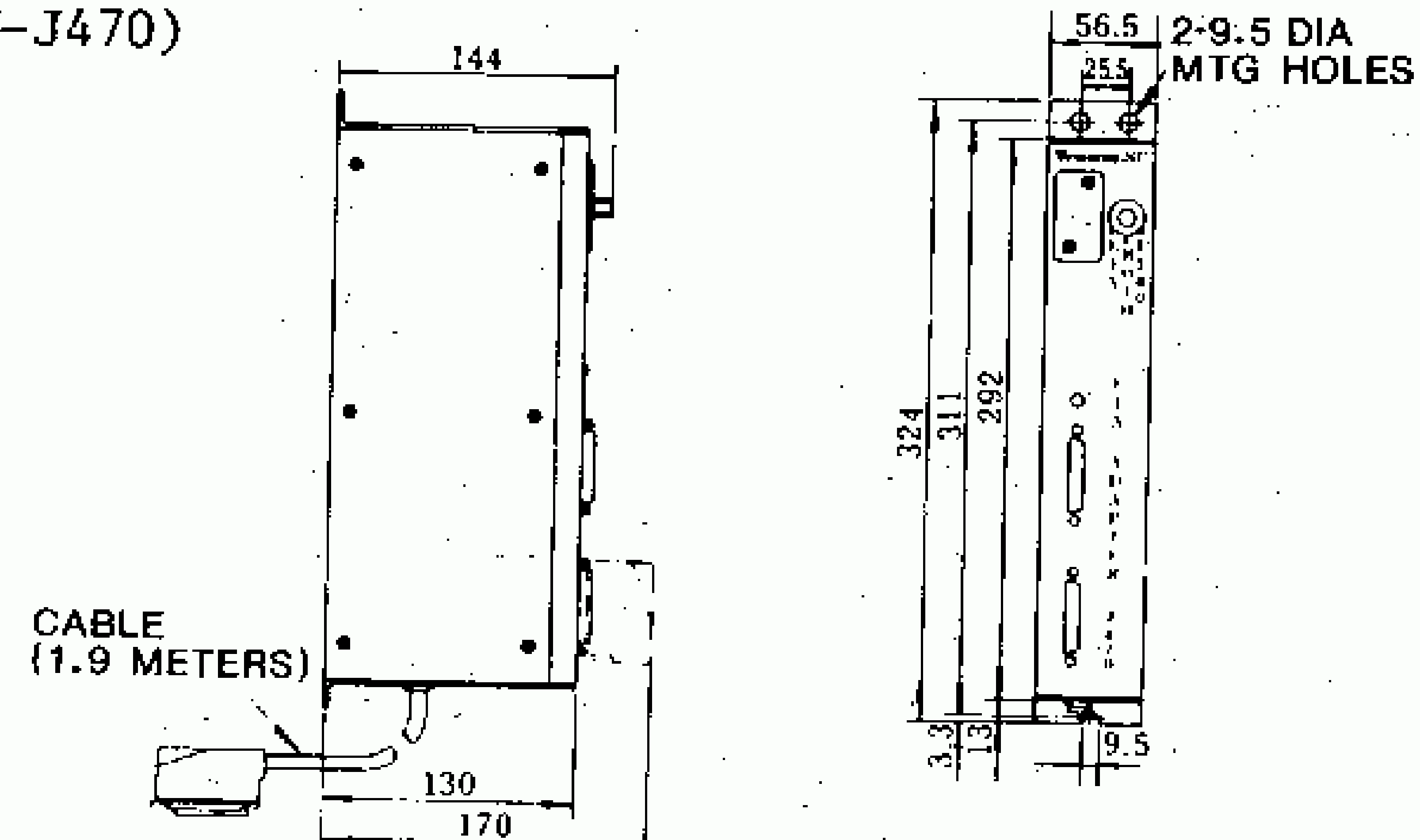
(20) P190 PROGRAMMING PANEL (TYPE DISCT-P190)



(with the cover removed.)

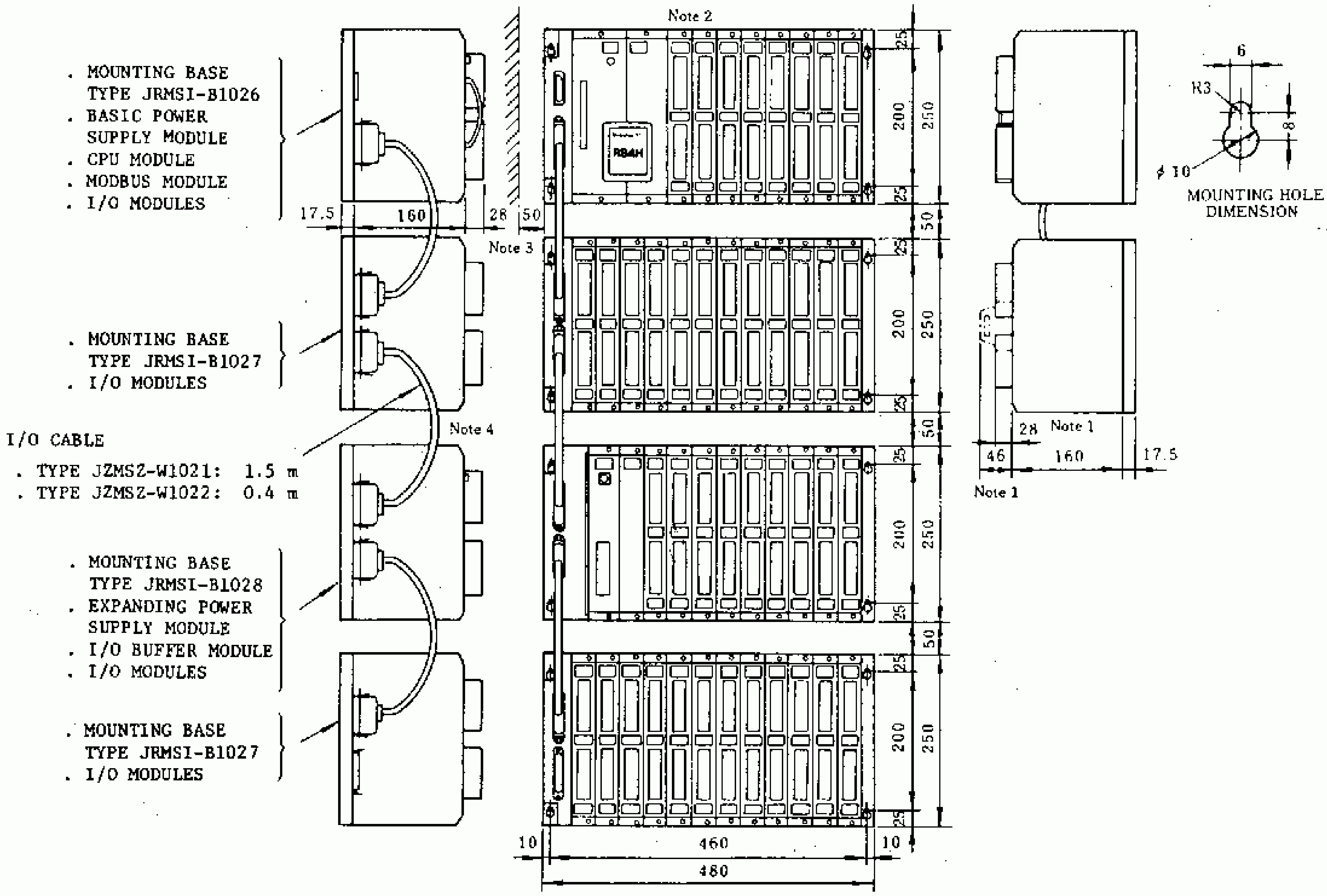
APPROX WEIGHT: 15kg

(21) EIA ADAPTER (TYPE DISCT-J470)



APPROX WEIGHT: 1kg

APPENDIX C
LAYOUT OF R84H in mm



Note:

1. Each I/O module is provided with a different type of peripheral device connector.
2. Where CPU module with MEMOBUS (Type DDSCR-R84H-M) is used, an I/O module connector at the most left side cannot be used.
3. When installing the mounting base 1 (Type JRMSI-B1026), make the space over 50 mm for connecting the peripheral device.
4. Each type of I/O cable should be used in accordance with a space between mounting bases:
   - From 50 mm to 160 mm: 0.4 m cable
   - More than 160 mm: 1.5 m cable (Used for only any one space among three spaces).

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YASKAWA Electric Mfg. Co., Ltd.

TOKYO OFFICE Ohtemachi Bldg., Chiyoda-ku, Tokyo, 100 Japan
Phone (03) 284-9111, -9145 Telex YASKAWA J33530 Fax (03) 284-9034

SEOUL OFFICE Seoul Center Bldg., 91-1, So Kong-Dong, Chung-Ku, Seoul, Korea
Phone (02) 776-7844 Fax (02) 753-2639

SINGAPORE OFFICE CPF Bldg., 79 Robinson Road No. 24-03, Singapore 0106.
Phone 2217530 Telex (87) 24890 YASKAWA RS Fax (65) 224-5854

TAIPEI OFFICE Union Commercial Bldg., 137, Nanking East Road, Sec. 2, Taipei, Taiwan
Phone (2) 507-7065, 507-7732 Fax (2) 506-3837

YASKAWA ELECTRIC AMERICA, INC.: SUBSIDIARY

Chicago Office (Head Office) 3160 MacArthur Blvd., Northbrook, Illinois 60062, U. S. A.
Phone (312) 291-2340 Telex (230) 270197 YSKW YSNC NBRK Fax (312) 498-2430

Los Angeles Office 7341 Lincoln Way, Garden Grove, California 92641, U. S. A.
Phone (714) 894-5911 Telex (230) 678396 YASKAWAUS TSTN Fax (714) 894-3258

New Jersey Office 30 Two Bridges Road, Fairfield, New Jersey 07006, U. S. A.
Phone (201) 575-5940 Fax (201) 575-5947

YASKAWA ELECTRIC EUROPE GmbH: SUBSIDIARY
Monschauerstrasse 1, 4000 Dusseldorf 11, West Germany
Phone (0211) 501127 Telex (41) 8588673 YASO D Fax (0211) 507737

YASKAWA ELÉTRICO DO BRASIL COMÉRCIO LTDA.: SUBSIDIARY
Av. Brig. Faria Lima, 1664-cj. 611, Pinheiros, São Paulo-SP, Brasil CEP-01452
Phone (011)212-5464, 813-3694 Telex (11) 83077 FERN BR

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