Chapter3 Specifications

3-1 General Specifications

Items	Specifications
Rated power voltage	100 ~ 120Vac (Voltage changeover system by a short bar in terminal board) 200 ~ 220Vac
Allowable power voltage fluctuation range	85 ~ 132Vac 170 ~ 264Vac
Rated frequency	48 ~ 62 Hz
Current consumption	Lower than 0.6A (at 100Vac) Lower than 0.4A (at 200Vac)
Working ambient temperature	0 ~ 55℃
Storage ambient temperature	−20 ~ 70℃
Working ambient humidity	30 ~ 90%RH No condensation is allowed.
Storage ambient humidity	5 ~ 95%RH No condensation is allowed.
Noise resistance	Noise simulator noise voltage 1500Vp-p, pulse width 1 μs
Dielectric strength	100/200Vac terminal - FG 1500Vac, 50/60Hz, 1min DC external terminal - FG 500Vac, 50/60Hz, 1min
Insulation resistance	100/200Vac terminal FG Higher than 5M Ω by a 500Vdc megger
Grounding	Category 3 grounding
Vibration resistance	10 ~ 55Hz, 9.8m/s^2 Conforms to JIS C0911
Shock resistance	98m/s^2 in X,Y,Z directions, 3 times eachConforms to JIS C0912
Mounting structure	Wall-mount type
Working atmosphere	Shall be free corrosive gases and noticeable dust.
Dimensions	For 2 slots 250(W)×250(H)×98(D)mm For 4 slots 330(W)×250(H)×98(D)mm For 6 slots 404(W)×250(H)×98(D)mm For 8 slots 480(W)×250(H)×98(D)mm

3-2 Performance Specifications

Items	Specifications
Control system	Stored program system
Input/output control system	Cyclic scan system
Program system	Ladder diagram/mnemonic system
Types of instructions	Basic instructions 12 types (2 ~ 4 bytes/instruction) Function instructions 117 types (2 ~ 13 bytes/instruction)
Processing time	Basic instructions: 2～46 μs Compare instructions: 3.3～13 μs Transfer instructions: 4.3～77 μs
Program capacity	15K bytes
No. of input/output points	Input 160 points (X000 ~ X09F) Output 160 points (Y000 ~ Y09F)
No. of input/output points for OP link	Input 160 points (X200 ~ X29F) Output 160 points (Y200 ~ Y29F)
Auxiliary relay	800 points (M000 ~ M49F)
Holding relay	800 points (L000 ~ L49F)
Special relay	160 points (M900 ~ M99F)
Input/output register	Input 20 word (R500 ~ R519) Output 20 words (R600 ~ R619)
Special register	40 words (R900 ~ R939) 16 bits/words
Timer/counter	200 points Timer setting time 0.01～99.99s 0.1～999.9s 1～9999s Counter setting range 1～99,999,999
Data register	500 words
Allowable interruption time	20ms
Battery backup	Battery life: 5 years (25°C) Backup guarantee when batteries are removed: 10min (at 25°C)
Self-diagnostic function	System program ROM sum check User program sum check Internal RAM read/write check I/O bus Missing I/O modules Fuse blown out Abnormal battery Watch dog timer Abnormal power supply

3-3 Outline of Instructions

This section outlines the instructions employable in the machine controller MX100 .
The MX100 can excute versatile programming according to 129 kinds of instructions.
For detailed description of instructions and programming method, see the operation manual (Programming).

Type	No.	Functions
Basic instructions	12	LD, AND, OR, OUT, etc.
Compare instructions	18	Comparison of 16-bit data, such as =, ≠, <, >, etc.
Double-length compare instructions	18	Comparison of 32-bit data, such as =, ≠, <, >, etc.
Transfer instructions	9	MOV, BMOV, DCPT, etc.
BCD operation instructions	10	Addition, subtraction, multiplication, and division of BCD data
Quasi-basic instructions	9	PLS↑ , PLF↓ , SET, etc.
Branch instructions	12	MC, MCR, JMP, CALL, END, etc.
Conversion instructions	10	Binary ←→ BCD, 4 ←→ 16, and other conversions.
Shift instructions	7	Shift, rotate, etc.
BIN operation instructions	10	Addition, subtraction, multiplication, and division of binary data
Logical operation instructions	4	AND, OR, and other logical operations of 16-bit data
Special instructions	10	Read/write of timer/counter set values and present times

■ Specifications

Items	Specifications
Program capacity	15K bytes
Internal power capacity	5V dc 3A
Current consumption	Max. 0.4A (2.6A is suppliable to I/O modules, handy loader, etc.)
RUN input	Contact input (RUN status is set when the contact is closed.)
STOP input	Contact input (STOP status is set when the contact is closed.)
Error output	Relay contacts are closed during normal operation. Contact rating: 30V dc 1A or 250V ac 1A (Resistance load)
Alarm output	Relay contacts are closed when an alarm occurs. Contact rating: 30V dc 1A or 250Vac 1A (Resistance load)
Communication port	RS-232C: Host communication: For connecting the host personal computer, handy loader,and personal computer loader No. of connectable units: Max. 15 units Transmission speed : 2400/4800/9600/19200 bps; provided that it is automatically set to 9600 bps when the handy loader is connected.
	RS-485: OP link For connecting data link and OP I/O Transmitting distance: Max. 300m No. of connectable units: Max. 5 units (including the master station) in case of data link Max. 15 units (Input/output: 160 points each) in case of OP I/O Transmission speed: 2400/4800/9600/19200 bps
Terminal screw	M3.5
Applicable cable diameter	0.75 ~ 2mm²
Applicable crimp style terminal	For M3.5
External dimensions	136 (W) × 250 (H) × 91 (D)mm
Weight	Approx. 1.2kg

■ Features of Processor Module

- Built-in power supply
  The processor module is provided with a built-in power supply to produce DC + 5V for internal circuits.
  This power supply is also fed to I/O modules and other special function modules.

- Twin CPUs
  Two 8-bit high-performance CPUs are used for sharing functions.
  The entire processing speed is increased by executing functions required for the controller by using two CPUs.

- System status display
  The operating conditions of the controller are always displayed on the display panel.
  Display contents are operating status, error contents, alarm contents, fuse blown-out points, and module numbers in trouble.
  Owing to this display, troubleshooting and remedial measures can be easily taken .

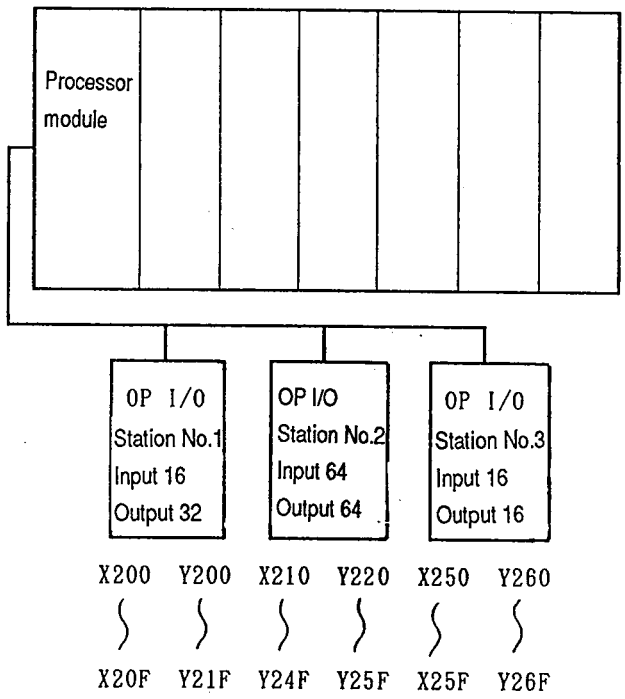
- ROM operation function
  The ROM operation can executed by writing a program into a PROM.

- Communication ports
  The processor module is provided with an RS-232C port and an RS-485 port as the standard equipment.
  The RS-232C port is used for connecting the host communication and loader, while the RS-485 port is used for connecting the OP I/O and data link as an OP link.
  Communications are possible without special communication modules.

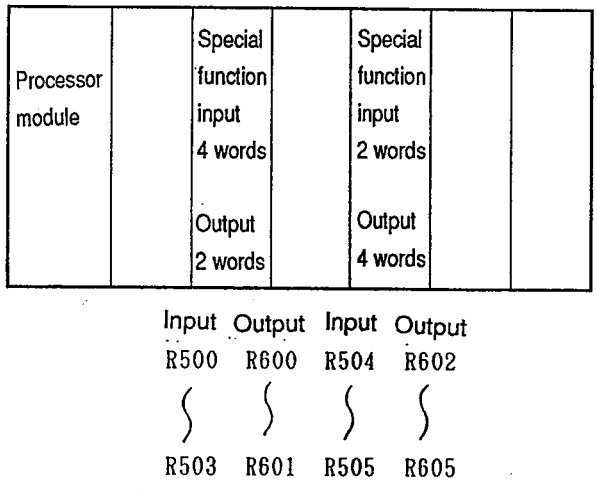
I/Os exceeding 160 points each are ignored.
When the I/O registration is specified by the loader, data are registered as check data, and if a difference occurs in a mounted data, it is indicated as an error.
If not registered, data are checked with mounted data employed as reference data, each time power is turned on.
For details, refer to the operation manuals: Personal computer loader and Handy loader.

[Operator's I/O]
The I/O of OP link are registered by setting the number of necessary words by means of the loader depending on the number I/O points. Inputs are assigned from X200, while outputs are assigned from Y200. Excessive inputs/ outputs exceeding 160 points are neglected. Be careful since the processor module does not automatically read any connected OP I/O information.
An alarm is displayed in the following cases.
- No OP I/O response returns at the start up time.
- OP I/O mounted data are different from fixed data
- No OP I/O response returns during operation.

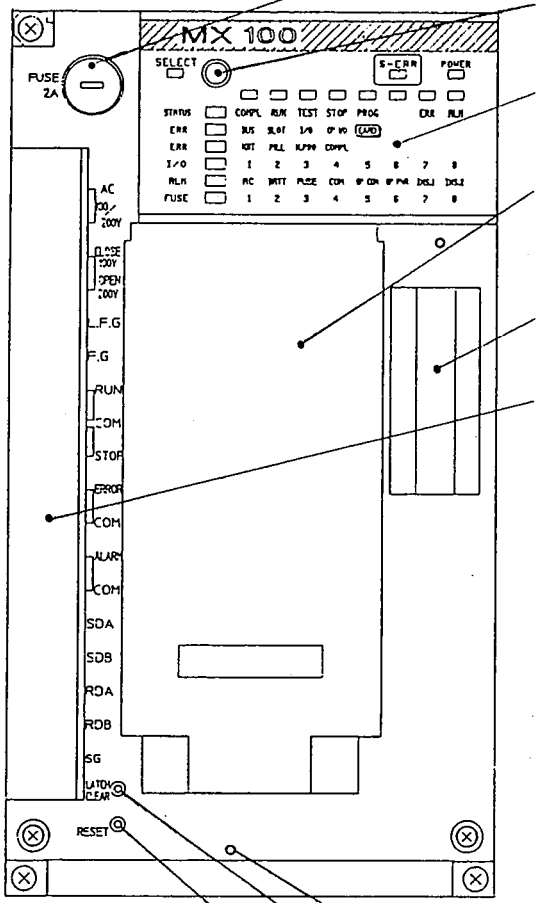
The OP I/O does not function even if they are connected, so long as they are not assigned by the loader.



[Special Function Modules]
These modules are assigned by either personal computer loader or handy loader in the same way as in general-purpose I/O. The MX100 special function modules are assigned to I/O registers in units of words (16 bits).
Inputs are automatically assigned to R500 ~ R519, while outputs are assigned to R600 ~ R619, starting with those nearer to the processor module when power supply is turned on or when the reset switch is pressed.
Special function modules may be mounted to optional I/O slots. After assignment, a missing condition of I/O modules can be detected by comparing with fixed data (if I/O assignment is fixed by the loader) or with data when turning on the power supply or when pressing the RESET switch (if not fixed).



■ Names and Functions of Component Parts



Fuse: Protective fuse on the AC power input side
A 250V - 2A ac fuse is built-in.

SELECT button:
Selects the line to be displayed.

Display assembly:
Indicates modes, errors, alarms, and other conditions.
(For details, refer to page 3-13)

Cover: A lithium battery and setting swithes are mounted inside. A PROM socket is mounted on the rear face of the cover as an option.

RS-232C connector:
This connector is used for connecting to the handy loader and personal computer loader.

Terminal:

1		AC input
2		AC input
3		Voltage changeover terminal *
4		
5		Grounding of LFG line filter
6		Grounding of frame
7		RUN input (Contact input)
8		
9		STOP input (Contact input)
10		Error output
11		(Contact output to be turned off when an error occurs)
12		Alarm output
13		(Contact output to be turned on when an alarm occurs)
14	SDA	RS-485 transmitting data
15	SDB	
16	RDA	RS-485 receiving data
17	RDB	
18	SG	Signal ground

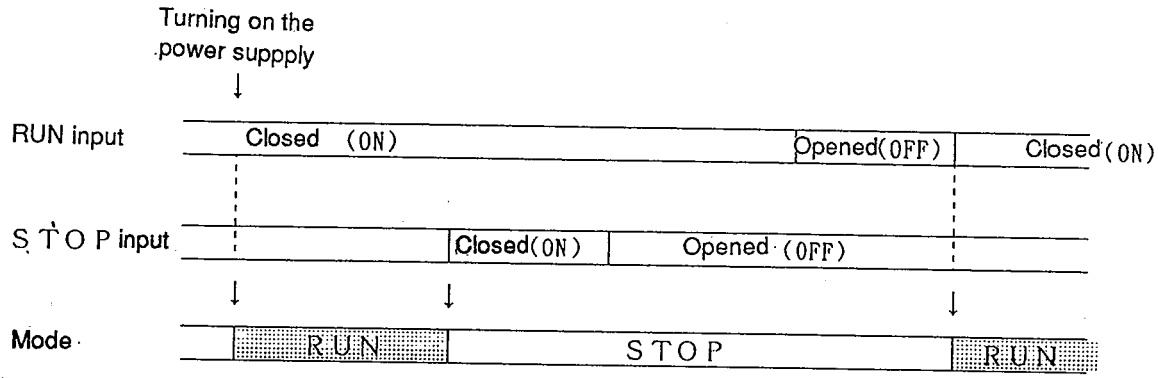
Handy loader fixing screw holes provided at an upper position and a lower position.

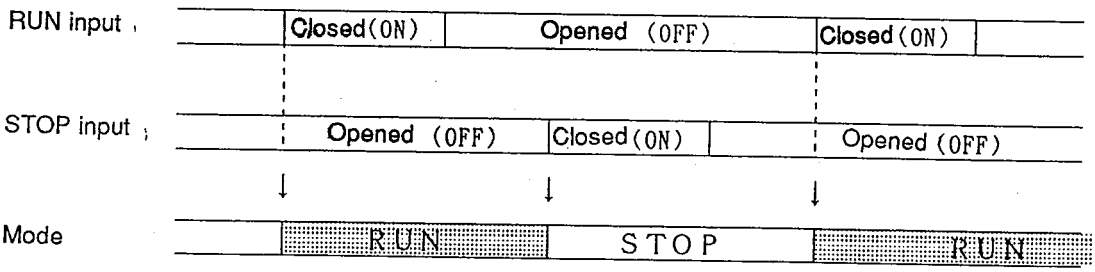
Latch clear switch:
Clears the present values of holding relays, registers, and timer/counter.
This function is effective in the stop mode only.

Reset switch:
The equipment is reset to the initialized condition in the same way as in turning on the power supply.

* For 100V when terminals 3-4 are closed.
For 200V when terminals 3-4 are open (Preset)

- Caution on using the RUN input and STOP input
  If the RUN input is closed (turned on), the equipment is immeditely set to the RUN mode when turning on the power supply. This is called auto start.
  If the STOP input is closed (turned on) under this condition, the equipment is set to the STOP mode.
  However, the equipment is not set to the RUN mode even if the STOP input is opened later.
  The equipment is set to the RUN mode when the RUN input is closed (turned on) again.
  If the RUN input or STOP input is momentarily closed (turned on), the equipment is set to the input mode.



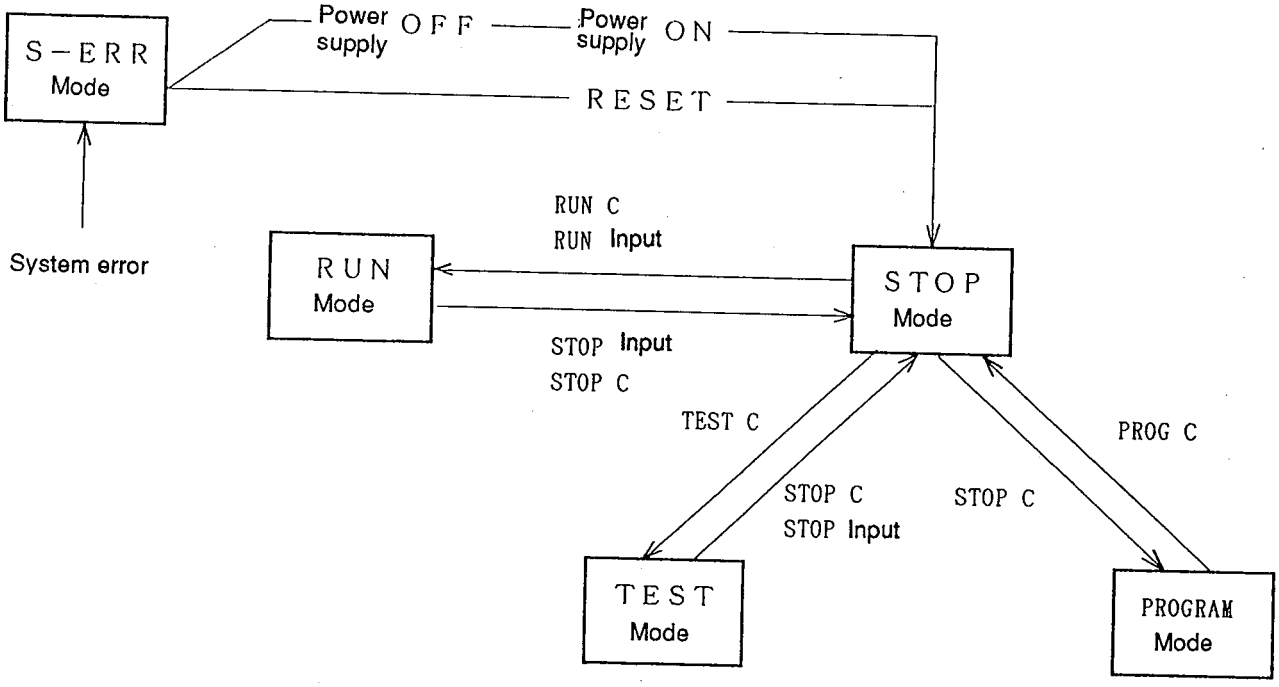


Caution:

- When the STOP input is closed, the STOP mode takes precedence, and the equipment is kept to the STOP mode without any mode transfer even if the RUN input is closed.
- If the RUN input is closed during the compile operation at the time of turning on the power supply, the equipment does not accept it, but it is set to the RUN mode when the RUN input is closed after the end of compile.
- If the RUN input remains closed (auto start), the equipment is started again to the RUN mode at the time of recovery of momentary stop even if the operation is set to STOP by DIP switch S1-4 at the momentary stop time in advance.
  For setting the DIP switches, refer to 3-4 (page 3-11).
- Status transition
  The processor operation modes are related to each other as shown below.

● Status transition

The processor operation modes are related to each other as shown below.



(Note) RUN input and STOP input are contact inputs from the terminals of processor module, while RUN C and STOP C are mode selection commands input from the loader.

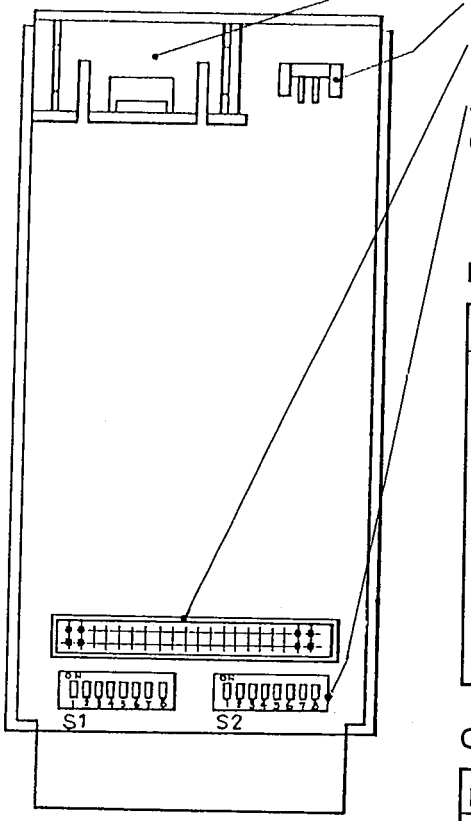
The RUN, TEST, and PROGRAM modes are transferred to each other via STOP mode. The output turns off in the STOP mode.

Since the MX100 uses a compile system, a compile time of 1 ~ 3 seconds is required for the following cases:

(1) When the power supply is turned on RESET switch is pressed;
(2) When the MX100 is transferred from PROGRAM mode;
(3) When the MX100 is transferred from TEST mode;

The mode transition is restricted according to the RUN input and STOP input conditions of the processor module.

For details, refer to the operation manualy: Personal computer loader Handy loader.



Battery holder : Encases the lithium battery.
Battery connector : Lithium battery connector
Connector : Cover connector to PROM IC socket

Setting switches : Communication setting DIP switches S1 and S2
Caution: The selection of these switches is not effective during operation, since the switch conditions are read when turning on the power supply or when pressing the RESET button.

Host communication setting switches : S1

No.	Description	OFF	ON	Delivery time
1	Transmission speed setting	*1	*1	OFF
2	"			OFF
3	Data type	A *2	B *2	OFF
4	Operation at the time of momentary interruption	Stop	Continued	OFF
5	MSB			OFF
6	Host communication station No.	*3	*3	OFF
7	1 ~ 15			OFF
8	LSB			ON

OP link setting switches: S2

No.	Description	OFF	ON	Delivery time
1	Transmission speed setting	*1	*1	OFF
2	"			OFF
3	Data type	A *2	B *2	OFF
4	Mode selection *4	Slave	Master	ON
5	MSB			OFF
6	OP link station No.	*3	*3	OFF
7	1 ~ 15			OFF
8	LSB			OFF

*1 Transmission speed setting

1	2	Transmission speed
OFF	OFF	19200
OFF	ON	9600
ON	OFF	4800
ON	ON	2400

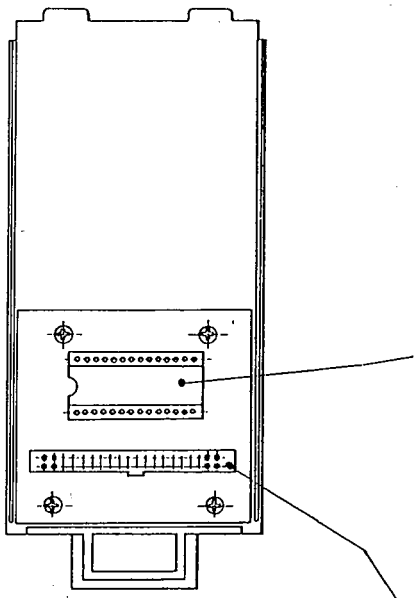
*3 Station No. setting method

Station No.	Setting
Not effective	0000
1	0001
2	0010
⋮	
15	1111

*2 Data type A: Data 8 bits 1-stop bit, even parity
Data type B: Data 8 bits, 2 stop bits, odd parity

*4 Station number setting of OP links is neglected when the mode is turned on (master).
Set the mode, so that the channel station numbers are not doubled when turning off the mode (slave).

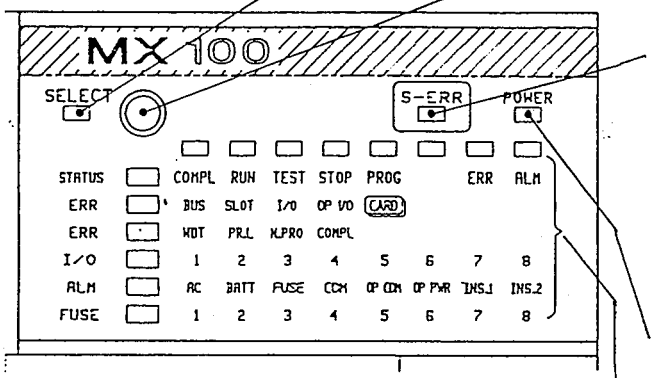
● PROM cover (Option model No. MX100ST02)



PROM socket:
PROM is inserted to this socket.

Connector: The processor module is connected to this connector.

● Details of the display assemby



SELECT lamp:

This lamp flickers to designate the selection of the display by SELECT button, if an error or an alarm occurs.

It goes out after error or alarm item has been eliminated.

SELECT button:

Selects the display block line.

The display circulates in the sequence of STATUS-ERR-ERR-I/O-ALM-FUSE.

S-ERR lamp:

This system error lamp lights, if the processor module hardware trouble, a system ROM check sum error, or a read/write error of the internal RAM occurs.

An error output or an alarm output is issued.

No operation mode is selectable under this condition.

POWER lamp:

Lights when power supply is turned on.

Display block:

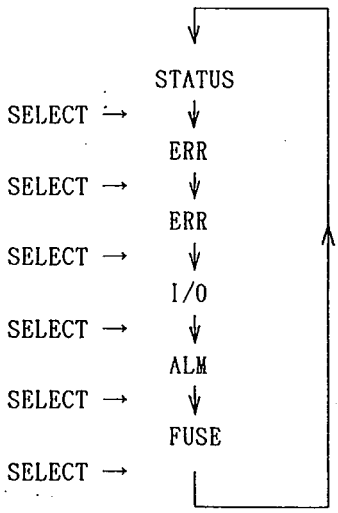
The dot-matrix displays features 6W X8L rows of LEDs.

Numerics 1 ~ 8 of I/O and FUSE lines show module numbers.

For the contents of STATUS, ERR, and ALM lines, refer to pages. 3-15 ~ 3-17.

● Display mode selection

The display mode is selected by pressing the SELECT button as follows.



STATUS : Indicates the operating status of the MX100. Lights when power supply is turned on or reset switch is pressed.

ERR : Indicates the error contents when an error occurs.

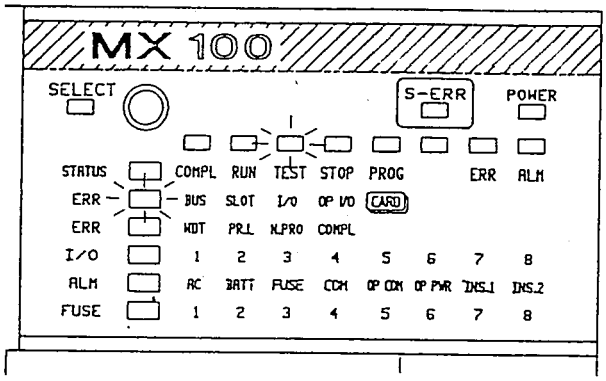
I/O : Indicates an I/O module number in error.

ALM : Indicates the alarm contents when an alarm occurs.

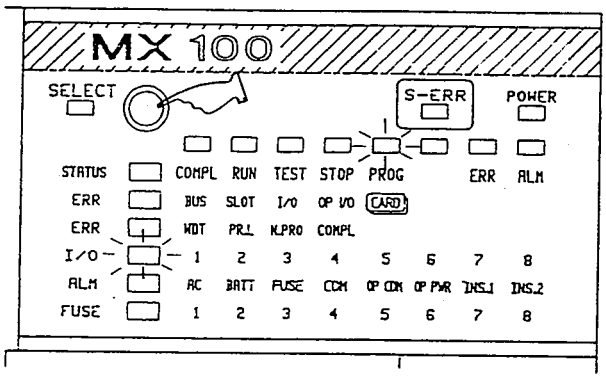
FUSE : Indicates an I/O module No. when the fuse is blown out.

- How to read the display block

  If the SELECT lamp flickers, it shows that a certain item is in error or in alarm. Press the SELECT button to find out the position where the horizontal (row) lamp lights.
  The lamps in the vertical (line) direction are transferred, each time the SELECT button is pressed.
  Each line indicates the kinds of errors and alarms, except for the STATUS line, while each row shows the error or alarm contents.



For example assume that the lamp lights in the 3rd row in ERR line (2nd line) as shown in the left figure. It indicates an I/O module error, or certain I/O module is defective.



For example, assume that the lamp lights in the 5th row in the I/O line (4th line).
It indicates that the I/O module in the 5th slot is defective.

- Display contents

STATUS line
Indicates the MX100 operation modes.

Display	Name	Description	Special contact address
COMPL	Compile	Indicates that the compile operation is in progress.	M980
RUN	Run	Run mode.	M981
TEST	Test	Test mode employed in debug run. Forced set and forced reset break points can be set.	M982
STOP	Stop	This mode is selected when turning on the power supply. It is also selected when resetting an error. The mode transition is done via this STOP mode. The I/O output is turned off. Latch clear function is effective in this mode. Programming mode	M983
PROG	Program	Indicates an error status.	M984
ERR	Error *1	The error contents can be checked by ERR line.	M986
		Indicates an alarm status.	
ALM	Alarm *2	The alarm contents can be checked by ALM line.	

Cautions: *1: The error mode is forcibly transferred to the STOP mode, since trouble may occur in the operation.
*2: If an alarm occurs, it is indicated by an LED. Its special contact is turned on and operation continues.

ERR line
Indicates error contents when an error occurs.

Display	Name	Description	Error output	Special contact address
BUS	Bus error	All I/O modules or I/O bus line is defective.	O	M990
SLOT	I/O check error	An I/O module is not properly mounted, or it does not function normally.	O	M991
I/O	I/O module error	An I/O module connector or internal circuits are defective. The defective module is indicated by the I/O line No.	O	M992
OP I/O	OP I/O error	OP I/O communication ass'y interior of the processor module is defective.	O	M993
CARD	Memory card error	A memory card is defective, internal data are broken, or a program is not completed.	O	M994
WDT	User WDT error	Processing does not end even after one scan time has exceeded a preset time (100ms ~ 2s).	O	M998
PR.L.	Program damage	A user program in processor module is missing.	O	M999
N. PRO	Program error	A user program in processor module contains a syntax error.	O	M99A
COMPL	Compile error	A compile error occurs.	O	M99B

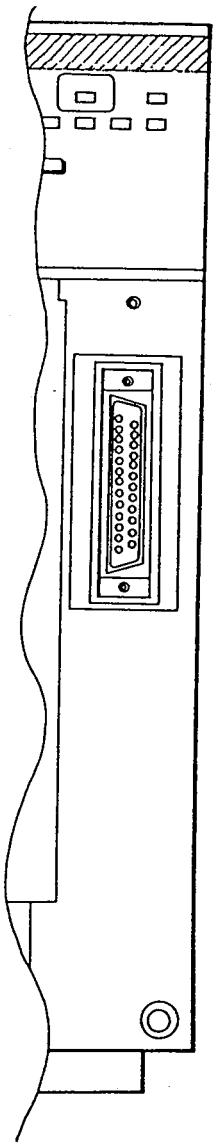
The items marked with O in the error output column show those where terminal 10 - 11 contacts of the processor module are open (turned off).

ALM line
Indicates alarm contents when an alarm occurs.

Display	Name	Description	Error output	Special contact address
AC	Momentary power interruption	A power interruption of longer than 20mS occurred in the AC power supply.	O	M908
BATT	Battery alarm	The battery voltage is lower than specified.	O	M931
FUSE	Fuse blown out	A fuse is blown in an I/O module. The module in trouble is indicated by the number of the fuse line.	O	M932
COM	RS232C communication alarm	Communication failure with loader	O	M933
OP COM	OP I/O communication failure	A communication failure with OP I/O	O	M934
OP PWR	OP I/O check error	No response returns from an OP I/O, or fixed data do not match mounted data.	O	M935
INS. 1	Operation error 1	An operation error occurs. Lights during one scan only when an error occurs.	O	M90E
INS. 2	Operation error 2	An operator error occurred once.	O	M90F

The items marked with O in the alarm output column show those where terminals 12 - 13 contacts of the processor module are closed (turned on).

- Details of RS-232C connector



Mounting layout of connector pins for loader connection

Pin No.	Signal name
1	FG
2	SD Transmitting data
3	RD Receiving data
4	RS Request to send
5	CS Ready to send
6	DR Data set ready
7	SG
8	
9	+5V
10	SG
11	SG
12	
13	
14	
15	
16	
17	
18	+5V
19	
20	ER Data terminal ready
21	
22	
23	LNK Unit connection detection line
24	
25	SG

Caution: When pin 23 turns to 1 (high level), the loader is connected, so that the setting of dip switch S1 is neglected.
When pin 23 turns to 0 (low level), the host communication is connected, and the setting of dip switch S1 becomes effective.