

*Changes for the Better*

 **MITSUBISHI**  
PROGRAMMABLE CONTROLLERS  
MELSEC-F

# HARDWARE MANUAL

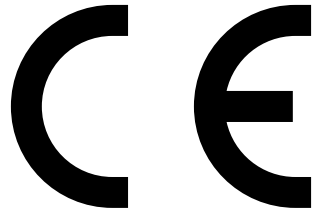
FX1S SERIES PROGRAMMABLE CONTROLLERS

# FX1S



## Foreword

- This manual contains text, diagrams and explanations which will guide the reader in the correct installation and operation of the FX1S Series Programmable Controllers. It should be read and understood before attempting to install or use the unit.
- Further information can be found in the FX Series Programming Manual II.
- If in doubt at any stage of the installation of an FX1S Series Programmable Controller always consult a professional electrical engineer who is qualified and trained to the local and national standards which apply to the installation site.
- If in doubt about the operation or use of FX1S Series Programmable Controller please consult the nearest Mitsubishi Electric distributor.
- This manual is subject to change without notice.



# FX<sub>1</sub>S Series Programmable Controllers

## Hardware Manual

Manual number : JY992D83901

Manual revision : H

Date : January 2004

## **Guidelines for the Safety of the User and Protection of the FX1S.**

This manual provides information for the use of the FX1S. The manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows:

- a) Any engineer who is responsible for the planning, design and construction of automatic equipment using the product associated with this manual, should be of a competent nature, trained and qualified to the local and national standards required to fulfill that role. These engineers should be fully aware of all aspects of safety with regards to automated equipment.
- b) Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards required to fulfill that job. These engineers should also be trained in the use and maintenance of the completed product. This includes being completely familiar with all associated documentation for said product. All maintenance should be carried out in accordance with established safety practices.
- c) All operators of the completed equipment (see Note) should be trained to use this product in a safe manner in compliance to established safety practices. The operators should also be familiar with documentation which is associated with the operation of the completed equipment.

**Note** : The term 'completed equipment' refers to a third party constructed device which contains or uses the product associated with this manual.

## Notes on the Symbols Used in this Manual

At various times throughout this manual certain symbols will be used to highlight points which are intended to ensure the users personal safety and protect the integrity of equipment. Whenever any of the following symbols are encountered its associated note must be read and understood. Each of the symbols used will now be listed with a brief description of its meaning.

### Hardware Warnings



1) Indicates that the identified danger **WILL** cause physical and property damage.



2) Indicates that the identified danger could **POSSIBLY** cause physical and property damage.



3) Indicates a point of further interest or further explanation.

### Software Warnings



4) Indicates special care must be taken when using this element of software.



5) Indicates a special point which the user of the associate software element should be aware.



6) Indicates a point of interest or further explanation.

- Under no circumstances will Mitsubishi Electric be liable responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
- All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- Please contact a Mitsubishi Electric distributor for more information concerning applications in life critical situations or high reliability.

## Note Concerning the CE Marking

This note does not guarantee that an entire mechanical module produced in accordance with the contents of this note will comply with the following standards. Compliance to EMC directive and LVD directive of the entire mechanical module should be checked by the user / manufacturer. For more details please contact the local Mitsubishi Electric sales site.

## EMC

The following products have shown compliance through direct testing (of the identified standards below) and design analysis (through the creation of a technical construction file) to the European Directive for Electromagnetic Compatibility (89/336/EEC) when used as directed by the appropriate documentation.

Refer to a manual or related material of each product for details concerning products not included below.

Type: Programmable Controller (Open Type Equipment)

Models : MELSEC FX1S series manufactured

from March 1st, 2000 FX1S-☆☆MR-ES/UL

from September 1st, 2000 FX1S-☆☆MR-DS FX1S-☆☆MT-DSS

from July 1st, 2001 FX1S-☆☆MT-ESS/UL

Where ☆☆ indicates:10,14,20,30

Models : MELSEC FX1N series manufactured

|                      |             |             |                |
|----------------------|-------------|-------------|----------------|
| from March 1st, 2000 | FX1N-232-BD | FX1N-485-BD | FX1N-422-BD    |
|                      | FX1N-8AV-BD | FX1N-5DM    | FX1N-EEPROM-8L |
|                      | FX1N-CNV-BD |             |                |

from June 1st, 2001

FX1N-4EX-BD  
FX1N-1DA-BD

FX1N-2EYT-BD

FX1N-2AD-BD

Models : MELSEC FX0N series manufactured

from May 1st, 1996

FX0N-232ADP

FX0N-485ADP

Models : MELSEC FX2NC series manufactured

from October 1st, 2002

FX2NC-232ADP

FX2NC-485ADP

| Standard                           |  | Remark  |
|------------------------------------|--|---|
| EN50081-2:1993<br>EN61000-6-4:2001 | Electromagnetic compatibility<br>- Generic emission standard<br>Industrial environment | Compliance with all relevant aspects of the standard.<br>(Radiated Emissions and Mains Terminal Voltage Emissions)  |
| EN61000-6-2:2001                   | Electromagnetic compatibility<br>- Generic immunity standard<br>Industrial environment | Compliance with all relevant aspects of the standard.<br>(RF immunity, Fast Transients, ESD, Conducted, Surge, Power magnetic fields, Voltage dips and Voltage interruptions) |

## LVD

The following products have shown compliance through direct testing (of the identified standards below) and design analysis (through the creation of a technical construction file) to the European Directive for Low Voltage (73/23/EEC) when used as directed by the appropriate documentation.

Refer to a manual or related material of each product for details concerning products not included below.

Type : Programmable Controller (Open Type Equipment)

Models : MELSEC FX1S series manufactured

from March 1st, 2000 FX1S-☆☆MR-ES/UL

from September 1st, 2000 FX1S-☆☆MR-DS

from July 1st, 2001 FX1S-☆☆MT-ESS/UL

Where ☆☆ indicates:10,14,20,30

| Standard   | Remark  |
|--|---|
| EN61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use<br>- General requirements | The equipment has been assessed as a component for fitting in a suitable enclosure which meets the requirements of EN61010-1:2001 |

## Associated Manuals

The following manuals are recommended as essential reference material for the correct operation of a FX1S series Programmable controller.

| Manual Name                    | Manual Number | Description  |
|--------------------------------|---------------|--|
| FX Programming Manual II       | JY992D88101   | This manual contains instruction explanation about FX1S, FX1N, FX2N and FX2NC Series PLC.                    |
| FX Communication User's Manual | JY992D69901   | This manual contains explanation for N:N network, parallel link, no protocol communication and computer link |
| FX1N-5DM User's Manual         | JY992D84901   | This manual contains hardware explanation for installation, specification and operation.                     |
| FX-10DM-E User's Manual        | JY992D86401   | This manual contains hardware explanation for installation, specification and operation.                     |
| FX1N-422-BD Users Manual       | JY992D84101   | This manual contains hardware explanation for installation and specification.                                |
| FX1N-485-BD Users Manual       | JY992D84201   | This manual contains hardware explanation for installation and specification.                                |
| FX1N-232-BD Users Manual       | JY992D84401   | This manual contains hardware explanation for installation and specification.                                |
| FX1N-4EX-BD Users Manual       | JY992D95001   | This manual contains explanation for installation, specification and special auxiliary relay allocation.     |
| FX1N-2EYT-BD Users Manual      | JY992D95201   | This manual contains explanation for installation, specification and special auxiliary relay allocation.     |

| Manual Name                              | Manual Number | Description  |
|--|---------------|--|
| FX <sub>1</sub> N-2AD-BD<br>Users Manual | JY992D96201   | This manual contains explanation for installation, specification and special auxiliary relay allocation. |
| FX <sub>1</sub> N-1DA-BD<br>Users Manual | JY992D96401   | This manual contains explanation for installation, specification and special auxiliary relay allocation. |
| FX <sub>1</sub> N-8AV-BD                 | JY992D84601   | This manual contains hardware explanation for installation and specification.                            |
| FX <sub>1</sub> N-CNV-BD                 | JY992D84701   | This manual contains explanation for installation.   |

# MEMO

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## 1. Introduction

This manual covers the hardware installation instructions for the FX1S Series Programmable (Logic) Controller.

**Table 1.1: AC Power, Relay Output Units**

| MODEL           | INPUT |                            | OUTPUT |       | POWER SUPPLY    | DIMENSIONS<br>mm (inches) |    |    | MASS (WEIGHT)<br>kg (lbs) |
|-----------------|-------|----------------------------|--------|-------|-----------------|---------------------------|----|----|---------------------------|
|                 | QTY   | TYPE                       | QTY    | TYPE  |                 |                           |    |    |                           |
| FX1S-10MR-ES/UL | 6     | 24V DC<br>Sink /<br>Source | 4      | Relay | 85 - 264<br>VAC | 60                        | 90 | 75 | 0.30                      |
| FX1S-14MR-ES/UL | 8     |                            | 6      |       |                 | (2.37)                    |    |    | (0.66)                    |
| FX1S-20MR-ES/UL | 12    |                            | 8      |       |                 | (2.96)                    |    |    | (0.88)                    |
| FX1S-30MR-ES/UL | 16    |                            | 14     |       |                 | (3.94)                    |    |    | (0.99)                    |

**Table 1.2: AC Power Transistor Output Units**

| MODEL            | INPUT |                            | OUTPUT |                        | POWER SUPPLY    | DIMENSIONS<br>mm (inches) |    |    | MASS (WEIGHT)<br>kg (lbs) |
|------------------|-------|----------------------------|--------|------------------------|-----------------|---------------------------|----|----|---------------------------|
|                  | QTY   | TYPE                       | QTY    | TYPE                   |                 |                           |    |    |                           |
| FX1S-10MT-ESS/UL | 6     | 24V DC<br>Sink /<br>Source | 4      | Transistor<br>(Source) | 85 - 264<br>VAC | 60                        | 90 | 75 | 0.3                       |
| FX1S-14MT-ESS/UL | 8     |                            | 6      |                        |                 | (2.37)                    |    |    | (0.66)                    |
| FX1S-20MT-ESS/UL | 12    |                            | 8      |                        |                 | (2.96)                    |    |    | (0.88)                    |
| FX1S-30MT-ESS-UL | 16    |                            | 14     |                        |                 | (3.94)                    |    |    | (0.99)                    |

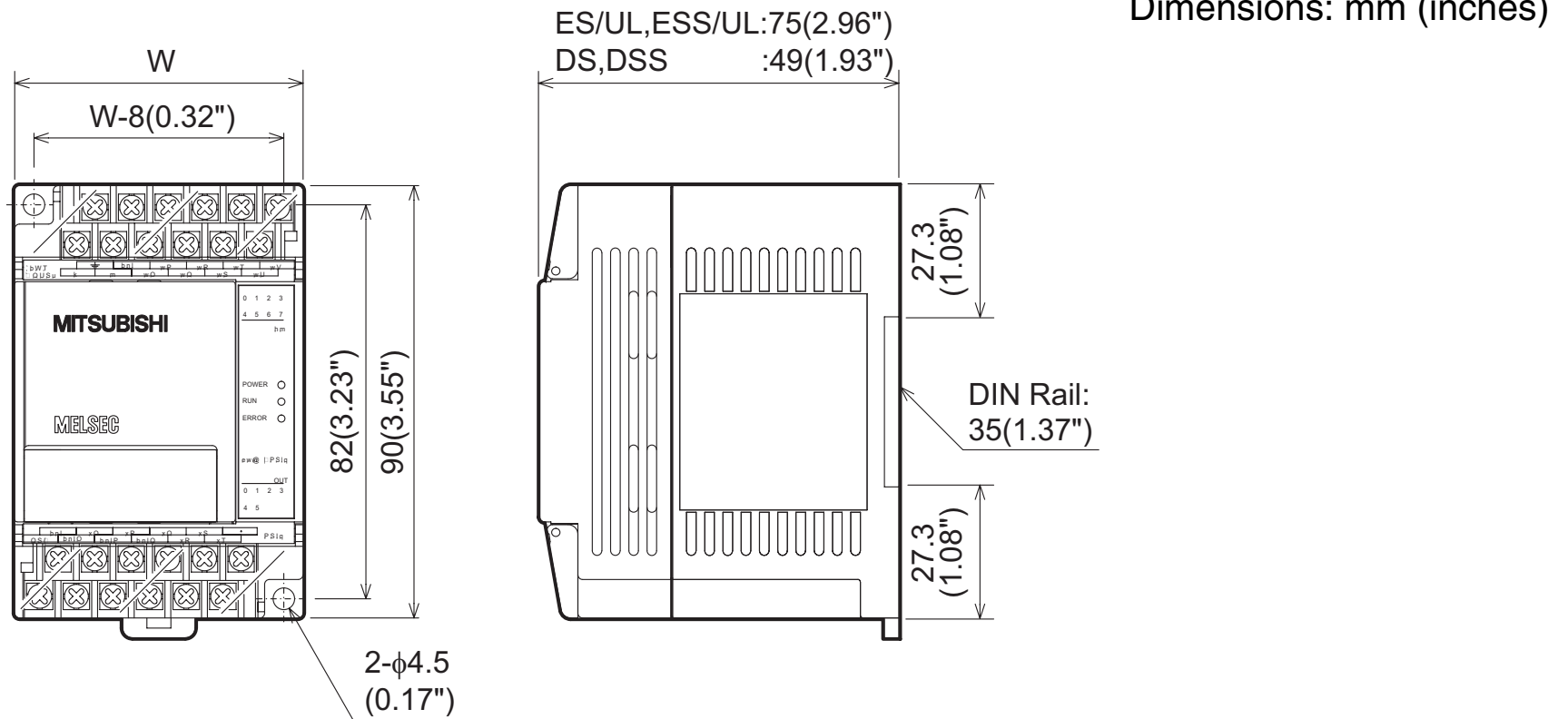
**Table 1.3: DC Power, Relay Output Units**

| MODEL        | INPUT |                            | OUTPUT |       | POWER SUPPLY           | DIMENSIONS<br>mm (inches) |        |        | MASS (WEIGHT)<br>kg (lbs) |
|--------------|-------|----------------------------|--------|-------|------------------------|---------------------------|--------|--------|---------------------------|
|              | QTY   | TYPE                       | QTY    | TYPE  |                        |                           |        |        |                           |
| FX1S-10MR-DS | 6     | 24V DC<br>Sink /<br>Source | 4      | Relay | 24 VDC<br>+10,<br>-15% | 60                        | 90     | 49     | 0.22                      |
| FX1S-14MR-DS | 8     |                            | 6      |       |                        | (2.37)                    |        |        | (0.48)                    |
| FX1S-20MR-DS | 12    |                            | 8      |       |                        | 75                        |        |        | (0.66)                    |
| FX1S-30MR-DS | 16    |                            | 14     |       |                        | 100                       |        |        | (0.77)                    |
|              |       |                            |        |       |                        | (2.96)                    | (3.55) | (1.93) |                           |
|              |       |                            |        |       |                        | (3.94)                    |        |        |                           |

**Table 1.4: DC Power Transistor Output Units**

| MODEL         | INPUT |                            | OUTPUT |                        | POWER SUPPLY            | DIMENSIONS<br>mm (inches) |        |        | MASS (WEIGHT)<br>kg (lbs) |
|---------------|-------|----------------------------|--------|------------------------|-------------------------|---------------------------|--------|--------|---------------------------|
|               | QTY   | TYPE                       | QTY    | TYPE                   |                         |                           |        |        |                           |
| FX1S-10MT-DSS | 6     | 24V DC<br>Sink /<br>Source | 4      | Transistor<br>(Source) | 24 VDC<br>+10, -<br>15% | 60                        | 90     | 49     | 0.22                      |
| FX1S-14MT-DSS | 8     |                            | 6      |                        |                         | (2.37)                    |        |        | (0.48)                    |
| FX1S-20MT-DSS | 12    |                            | 8      |                        |                         | 75                        |        |        | (0.66)                    |
| FX1S-30MT-DSS | 16    |                            | 14     |                        |                         | 100                       |        |        | (0.77)                    |
|               |       |                            |        |                        |                         | (2.96)                    | (3.55) | (1.93) |                           |
|               |       |                            |        |                        |                         | (3.94)                    |        |        |                           |

**Figure 1.1: FX1S Outline Drawing**



The distance between the vertical centerlines is 8mm (0.32") less than the width of the unit. Please see previous page for each model's width measurement.

- 1
- 2
- 3
- 4
- 5
- 6
- 7

**Table 1.5: Expansion Board and Communication Adapter**

| MODEL          | DESCRIPTION                                     | POWER SUPPLY<br>(External<br>24V DC) | DIMENSIONS                         |              |              | MASS<br>(WEIGHT)<br>kg (lbs)          |
|----------------|---|--------------------------------------|------------------------------------|--------------|--------------|---------------------------------------|
| FX1N-4EX-BD    | Four point special input                        | -                                    | Mounts directly into<br>top of PLC |              |              | Mounts<br>directly into<br>top of PLC |
| FX1N-2EYT-BD   | Two point special output                        | -                                    |                                    |              |              |                                       |
| FX1N-2AD-BD    | Two channel special analog to digital converter | -                                    |                                    |              |              |                                       |
| FX1N-1DA-BD    | One channel special digital to analog converter | -                                    |                                    |              |              |                                       |
| FX1N-232-BD    | RS-232C communication interface                 | -                                    |                                    |              |              |                                       |
| FX1N-422-BD    | RS-422 communication interface                  | -                                    |                                    |              |              |                                       |
| FX1N-485-BD    | RS-485 communication interface                  | -                                    |                                    |              |              |                                       |
| FX1N-8AV-BD    | Analog potentiometer                            | -                                    |                                    |              |              |                                       |
| FX1N-CNV-BD    | Communication adapter connection interface      | -                                    |                                    |              |              |                                       |
| FX2NC-232ADP*1 | RS-232C communication adapter                   | -                                    | 19.1<br>(0.76)                     | 90<br>(3.55) | 85<br>(3.35) | 0.1 (0.22)                            |
| FX0N-232ADP*1  | RS-232C communication adapter                   | -                                    | 43<br>(1.70)                       |              | 68<br>(2.68) |                                       |
| FX2NC-485ADP*1 | RS-485 communication adapter                    | -                                    | 19.1<br>(0.76)                     |              | 78<br>(3.08) |                                       |
| FX0N-485ADP*1  | RS-485 communication adapter                    | 50mA                                 | 43<br>(1.70)                       |              | 87<br>(3.43) |                                       |

\*1 The communication adapter needs to connect via an FX1N-CNV-BD to the FX1S Series PLC.

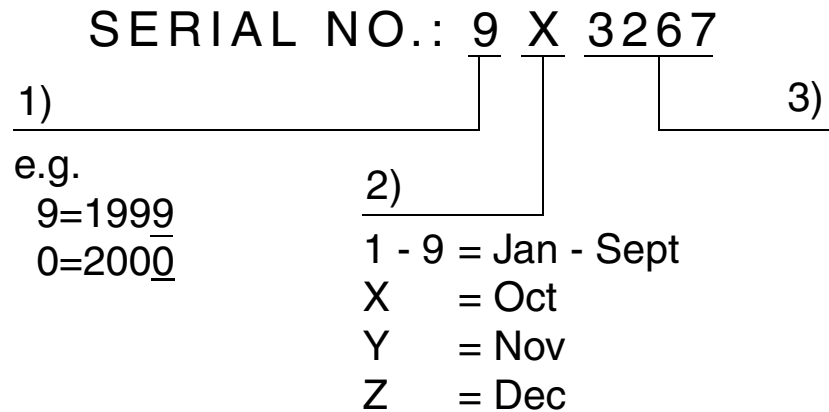


## 1.2 World Specification

**Table 1.7: World / Japanese Specifications**

|                                |  |
|--------------------------------|--|
| <b>Input<br/>Sink / Source</b> | World spec models: SINK / SOURCE<br>Japanese models: ALWAYS SINK |
| <b>Outputs<br/>Transistor</b>  | World spec models: ALWAYS SOURCE<br>Japanese models: ALWAYS SINK |

### 1.3 Serial Numbers



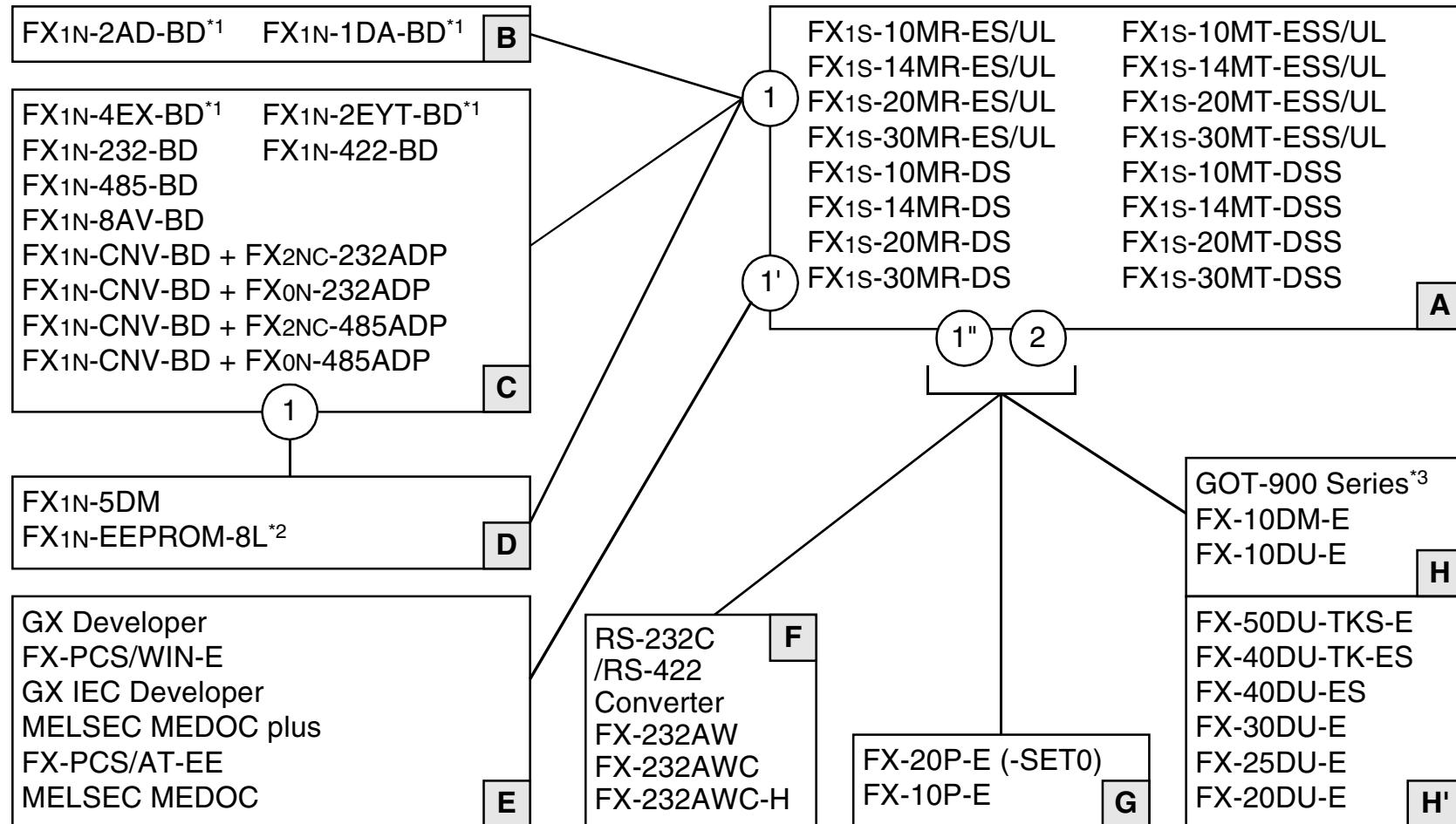
**Table 1.8: Notes on Serial Numbers**

|    |                          |
|----|--------------------------|
| 1) | Production year          |
| 2) | Production month         |
| 3) | Production serial number |

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## 1.4 Configuration

Figure 1.2: Schematic System



- \*1 Available for use with FX1S version 2.00 or later.
- \*2 When using the FX<sub>1N</sub>-EEPROM-8L with an expansion board in group C, only the loader function (transfer program) can be used. Remove it from the PLC after using the loader function and attach the top cover onto the PLC.
- \*3 GOT-F900 Series can connect via an FX<sub>1N</sub>-232-BD to the FX<sub>1S</sub> PLC.

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**Table 1.9: Configuration Notes**

|           |   |
|-----------|---|
| <b>A</b>  | FX <sub>1S</sub> Series Main Unit   |
| <b>B</b>  | FX <sub>1N</sub> Expansion Boards for Analog I/O  |
| <b>C</b>  | FX <sub>1N</sub> Expansion Boards without Analog I/O  |
| <b>D</b>  | Memory Cassette or Display Module   |
| <b>E</b>  | Programming Software  |
| <b>F</b>  | RS-232C/RS-422 Converter for PC   |
| <b>G</b>  | Dedicated Programming Tools   |
| <b>H</b>  | HMI Devices (GOT-F900/ GOT-A900/ DM/ DU)<br><GOT: Graphic Operation Terminal, DM: Display Module, DU: Data access Unit> |
| <b>H'</b> | DU Series (Discontinued since Sept. 2002)   |

**Table 1.10: Connection Ports**

|           |   |
|-----------|---|
| <b>1</b>  | Left hand side port   |
| <b>1'</b> | Left hand side port + FX <sub>1N</sub> -232-BD<br>or<br>Left hand side port + FX <sub>1N</sub> -CNV-BD + FX <sub>2NC</sub> -232ADP<br>or<br>Left hand side port + FX <sub>1N</sub> -CNV-BD + FX <sub>0N</sub> -232ADP |
| <b>1"</b> | Left hand side port + FX <sub>1N</sub> -422-BD  |
| <b>2</b>  | Programming Port  |

### 1.4.1 Note for Using Expansion Board



The following conditions cannot be accomplished with an FX<sub>1</sub>S PLC.

- FX<sub>1</sub>N-422-BD + FX-2PIF
- FX<sub>1</sub>N-5DM + FX<sub>1</sub>N-422-BD + FX-10DM
- FX-10DM + FX<sub>1</sub>N-422-BD + FX-10DM
- Connect two Programming tools (FX-10P-E, FX-20P-E, Programming software, etc.)
- The use of Special function Blocks



#### Caution

Connect a programming tool (such as an FX-10P-E, FX-20P-E and personal computer) to either the connector built in to the PLC or the connector on the FX<sub>1</sub>N-422-BD or FX<sub>1</sub>N-232-BD. If a programming tool is connected to both connectors, the program stored in the PLC may not match the program stored in the programming tool. If the program is changed or the set value of timers or counters are changed with this configuration, the program may be partially overwritten and the PLC may malfunction.

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## 1.5 Backup Data

### 1.5.1 Data Backup

Data includes the Program, Comment, File Register (D1000 ~ D2499), and parameter data. This will be stored as long as the EEPROM is not damaged. Mitsubishi Electric has guaranteed a life cycle time of **10,000** writes to the EEPROM memory. Users may experience operational writes to the EEPROM in excess of 10,000; however, due to temperature effects a quantitative estimation cannot be given.

If the PLC has been powered ON for five minutes or more, the following device data will be saved in the EEPROM at power-down:

S0~S127, M384 ~ M511, C16 ~ C31, C235 ~ C255 and D128 ~ D255.

If the PLC is powered ON for less than 5 minutes, the above data is not saved!

### 1.5.2 Capacitor backup

Only the RTC is backed up by the capacitor.

The capacitor backed memory will retain data for 10 days. The capacitor requires 30 minutes to recharge upon power-up. There is no internal hardware reset function, thus, after a 10day duration the RTC data may be unfixed and not reset to 0.

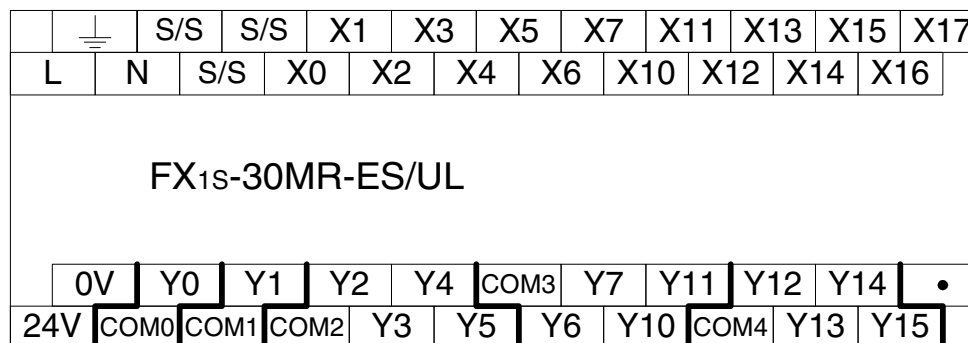
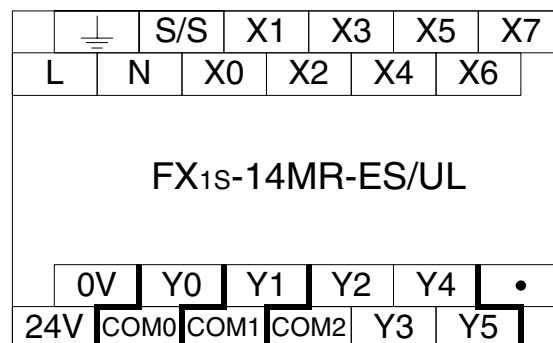
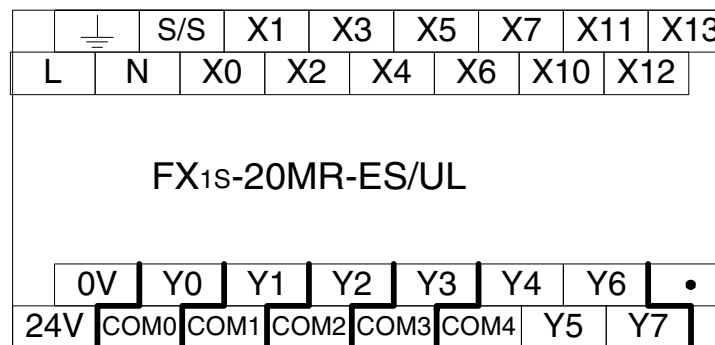
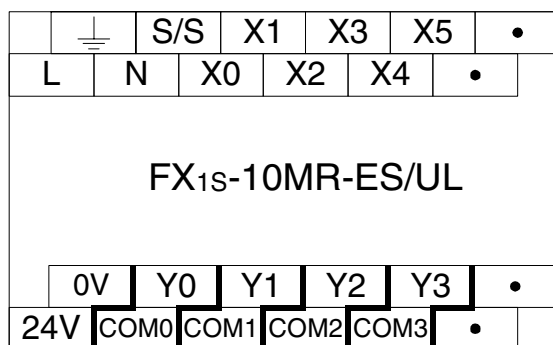
## 2. Terminal Layouts

The following selection of terminal layouts are taken from the FX<sub>1S</sub> product range.

Note: All layouts are schematic only and are intended to aid in the creation of wiring diagrams.

### 2.1 FX<sub>1S</sub>-\*\*MR-ES/UL

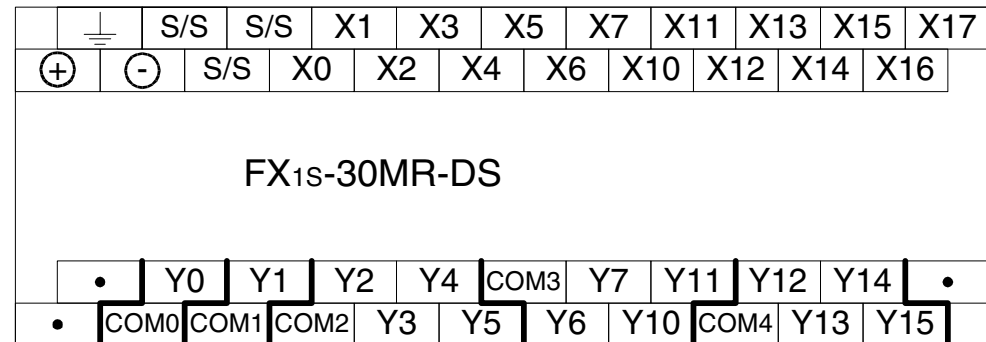
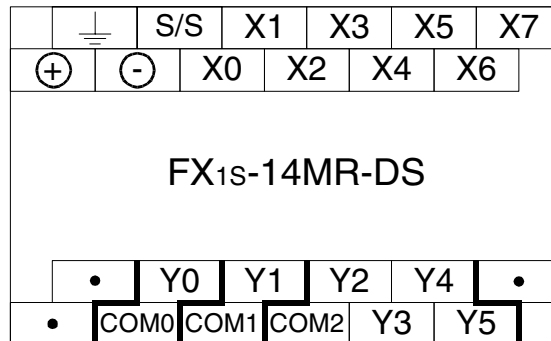
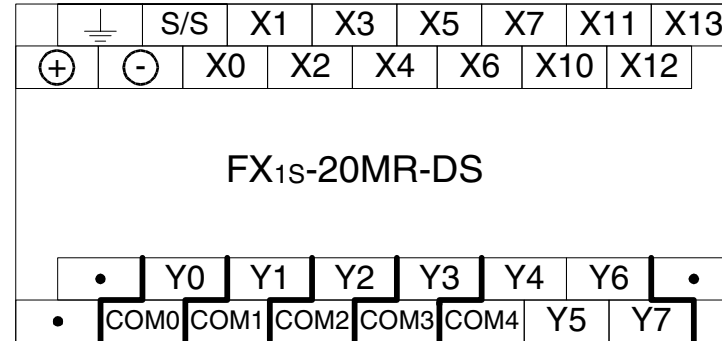
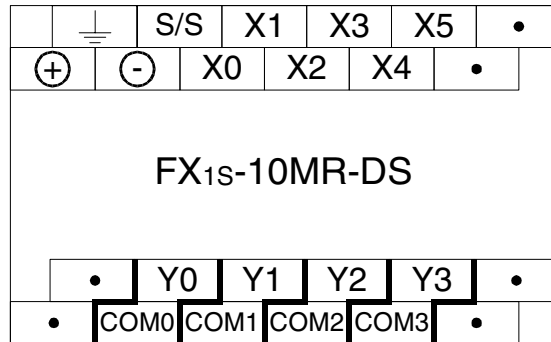
**Figure 2.1: Terminal Layouts, Relay Outputs, AC Power**



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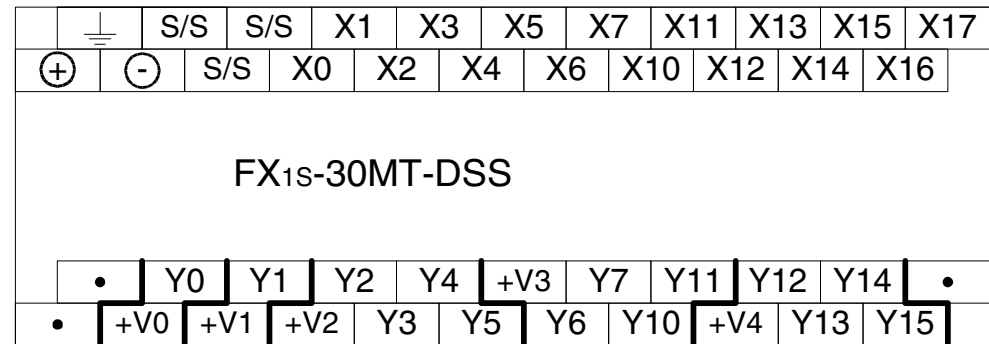
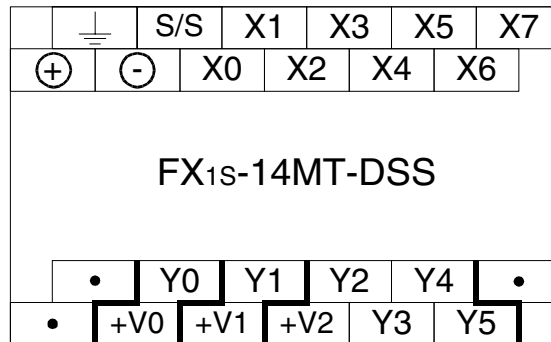
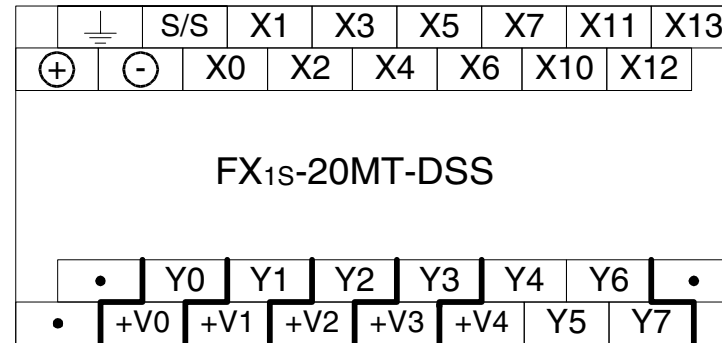
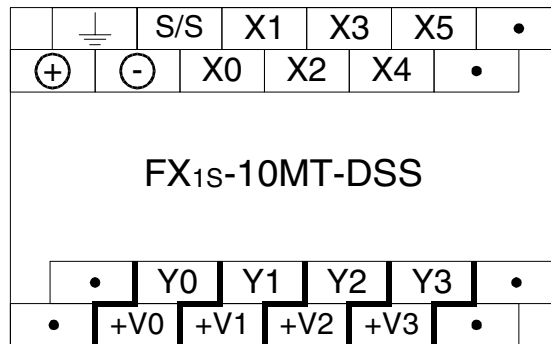
## 2.2 FX1S-\*\*MR-DS

Figure 2.2: Terminal Layouts, Relay Outputs, DC Power



### 2.3 FX1S-\*\*MT-DSS

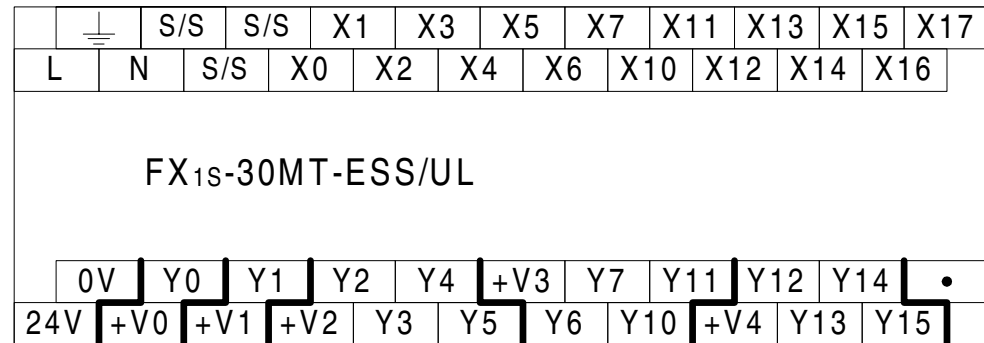
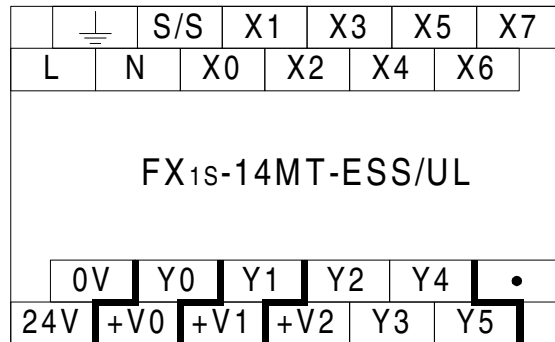
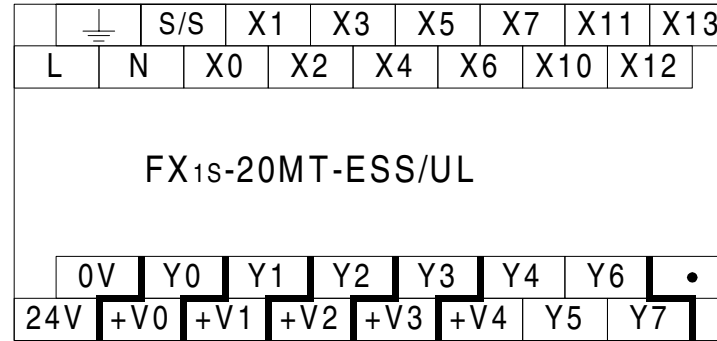
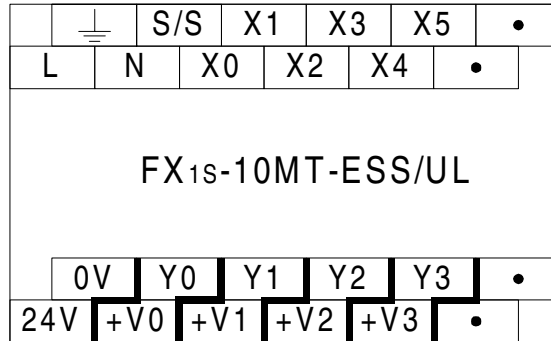
Figure 2.3: Terminal Layouts, Transistor Outputs, DC Power



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## 2.4 FX1S-\*\*MT-ESS/UL

Figure 2.4: Terminal Layouts, Transistor Outputs, AC Power



### 3. Installation Notes

The installation of FX1S products has been designed to be safe and easy. When the products associated with this manual are used as a system or individually, they must be installed in a suitable enclosure. The enclosure should be selected and installed in accordance to the local and national standards.

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### 3.1 Product Outline

Figure 3.1: Features of the FX1s PLC

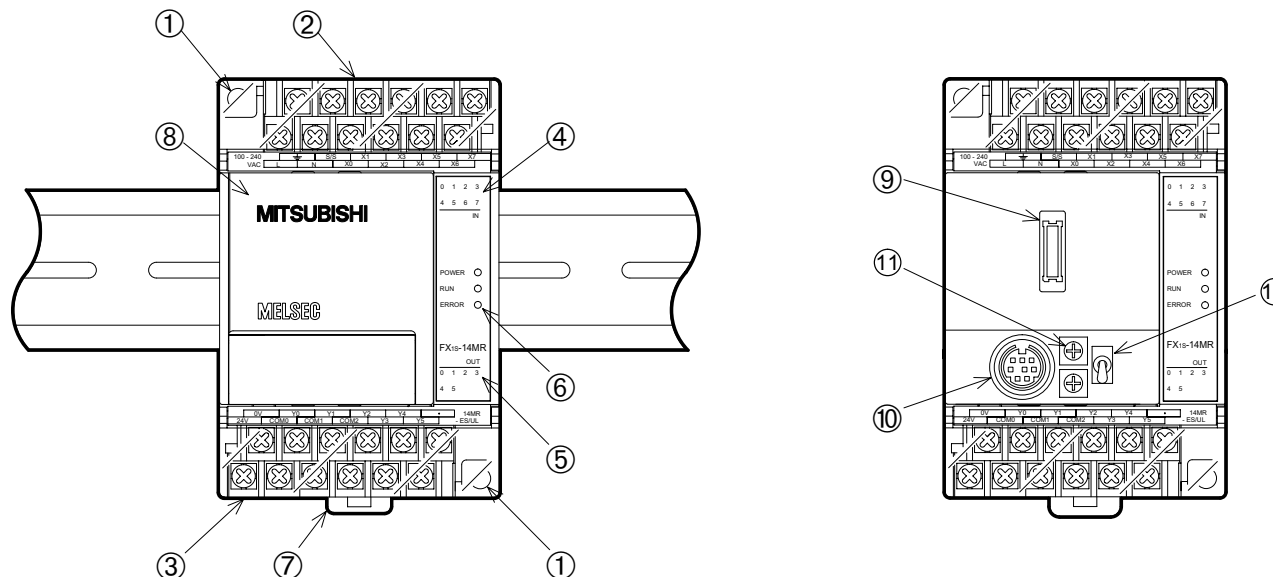


Table 3.1: Feature Table

|   |   |    |  |
|---|---|----|--|
| 1 | Direct Mounting Holes (4.5 mm<0.17"> Diameter)      | 7  | DIN Rail Mounting Clip   |
| 2 | Input Terminals (24V DC) and Power Supply Terminals | 8  | Top Cover  |
| 3 | Output Terminals and Power Supply Source Terminals  | 9  | Optional Equipment port - Memory Cassette, FX1N-232, 422, 485, 8AV, and CNV BDs, FX1N-5DM          |
| 4 | Input LED Status Indicators                         | 10 | Programming Port   |
| 5 | Output LED Status Indicators                        | 11 | Analog Trim Pots. D8030 read from VR1, the top trim pot. D8031 read from VR2, the bottom trim pot. |
| 6 | PLC Status Indicators (POWER, RUN, ERROR)           | 12 | Run/Stop Switch  |

### 3.2 FX1s RUN/STOP Control

RUN or STOP of the FX1s can be controlled by:

- ❶ The RUN/STOP switch mounted next to the programming port.
- ❷ A standard input (X0 to X17) defined by the system parameters.
- ❸ Remotely from a personal computer or other programming peripheral.

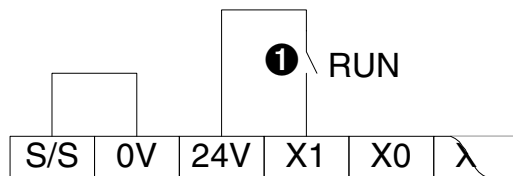


**Note:** The FX1s RUN/STOP switch works in parallel with the RUN input terminal. Please refer to Table 3.2.

During remote operation the FX1s RUN/STOP status is determined by the most recently operated control.

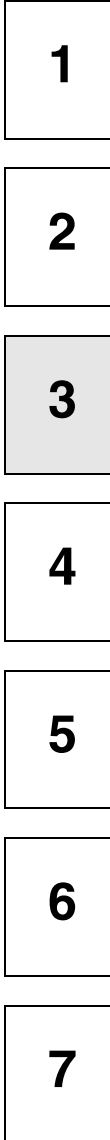
E.g. If the RUN/STOP switch is in RUN and a remote STOP is made from a personal computer, the PLC can only be restarted with the RUN/STOP switch by first moving the switch to STOP and then back to RUN.

**Figure 3.2: RUN/STOP Input Wiring Diagram**



**Table 3.2: Run Status Table**

| RUN/STOP SWITCH | ❶ RUN INPUT TERMINAL | FX1s MPU STATUS |
|-----------------|----------------------|-----------------|
| ✓               | ✓                    | RUN             |
| ✓               | x                    | RUN             |
| x               | x                    | STOP            |
| x               | ✓                    | RUN             |



### 3.3 General Specifications

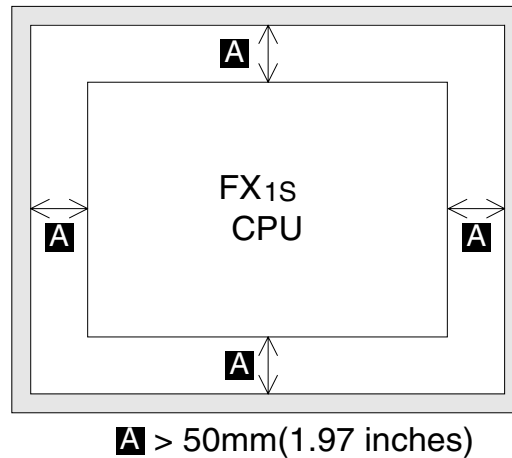
**Table 3.3: General Specifications**

| Item  | Description   |
|---|---|
| Operating Temperature                       | 0 to 55 °C (32 to 131 °F)   |
| Storage Temperature                         | -20 to 70 °C (-4 to 158 °F)   |
| Operating Humidity                          | 35 to 85% Relative Humidity, No condensation  |
| Storage Humidity                            | 35 to 90% Relative Humidity, No condensation  |
| Vibration Resistance<br>- Direct Mounting   | Conforms to EN 68-2-6; 10 - 57 Hz: 0.075 mm Half Amplitude<br>57 - 150 Hz: 9.8 m/s <sup>2</sup> Acceleration<br>Sweep Count for X, Y, Z: 10 times (80 min. in each direction) |
| Vibration Resistance<br>- DIN Rail Mounting | Conforms to EN 68-2-6; 10 - 57 Hz: 0.035 mm Half Amplitude<br>57 - 150 Hz: 4.9 m/s <sup>2</sup> Acceleration<br>Sweep Count for X, Y, Z: 10 times (80 min. in each direction) |
| Shock Resistance                            | Conforms to EN 68-2-27: 147m/s <sup>2</sup> Acceleration, Action Time: 11 ms<br>3 times in each direction X, Y, and Z   |
| Noise Immunity                              | 1000 Vp-p, 1microsecond, 30 - 100 Hz, tested by noise simulator   |
| Dielectric<br>Withstand Voltage             | AC PSU: 1500 VAC > 1 min., tested between all points, terminals, and ground   |
|   | DC PSU: 500 VAC > 1 min., tested between all points, terminals and ground   |
| Insulation Resistance                       | 5 MΩ > at 500 V DC, tested between power terminals and ground   |
| Ground                                      | Grounding resistance 100Ω or less   |
| Certification                               | UL/cUL (UL508)  |
| EC Directive                                | EMC(EN61000-6-2, EN50081-2), LVD(EN61010-1)   |

### 3.4 PLC Mounting Arrangements

To prevent a rise in temperature, mount the units to walls. Never mount them to the floor or ceiling of an enclosure.

**Figure 3.3: PLC Mounting Diagram**



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## Caution

- Units should not be installed in areas subject to the following conditions: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration.
- Take special care not to allow debris to fall inside the unit during installation e.g. cut wires, shavings etc. Once installation is complete remove the protective paper band to prevent overheating.
- Always ensure that mounted unit is kept as far away as possible from high-voltage cables, high-voltage equipment and power equipment.
- Do not lay signal cables near high voltage power cabling or cabinet housing along the same trunking duct. Effects of noise or surge induction may occur. Keep signal cables of more than 100 mm (3.94") away from these power cables.
- Install necessary power supply cut off precautions to the enclosure of the final system. Attach a warning label (hazard symbol 417-IEC-5036) concerning electric shock to the enclosure.
- Use the FX1S series PLC with consideration for electrical noise in an environment that does not exceed conditions provided by EN50081-2 and EN61000-6-2.
- Cut off all phases from the power source before installation or performing wiring work to avoid electric shock. Incorrect operation can lead to serious damage to the product.
- Cut off all phases from the power source before installing/removing extension or communication cables to modules to avoid electric shock, incorrect operation or serious damage to the product.

- Replace the terminal cover provided, after installation or wiring work is completed, and before supplying power and operating the unit to avoid electric shock.
- After reading the manual's safety instructions, initiate the operation for making program changes while the PLC is in RUN mode, forcing ON/OFF, and switching RUN/STOP.
- DO NOT use the “●” terminal in PLC.
- When using an incorrect power source or performing incorrect operation, serious damage will occur regardless of the level of the voltage and frequency.
- When performing incorrect wiring or operation, serious damage will occur.
- The “L” and “N” terminals are not reversible.  
If the “L” and “N” terminals are reversed, the units may be seriously damaged.
- The “24V” and “0V” terminals are not reversible.  
If the “24V” and “0V” terminals are reversed, the units may be seriously damaged.
- During transportation avoid any impact as the PLC is a precision instrument.  
It is necessary to check the operation of PLC after transportation, in case of any impact damage.
- When storing the PLC, conform to the environmental conditions specified by the general specification.

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### 3.5 DIN Rail Mounting

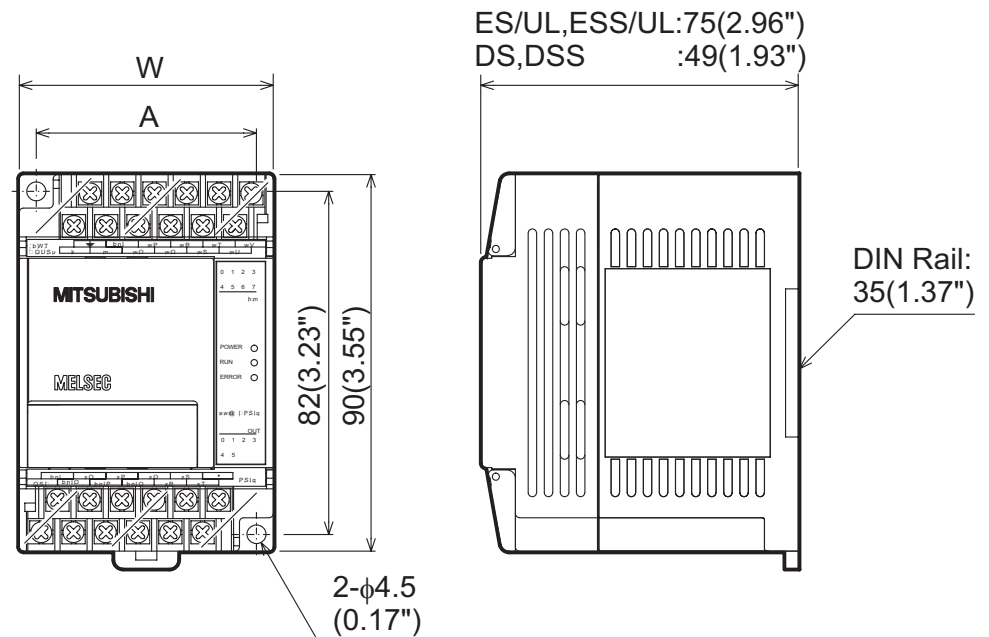
Units can be snap mounted to 35mm(1.37") DIN rail (DIN EN 50022). To release, pull the spring loaded clips away from the rail and slide the unit off and up.

### 3.6 Direct Mounting

**Table 3.4: Hole positions**

| UNIT      |            | mm<br>± 0.2              | inches<br>± 0.01 |
|-----------|------------|--------------------------|------------------|
|           |            | <b>A = W-8mm (0.32")</b> |                  |
| FX1S-10M☆ | 2-∅<br>(→) | 52                       | 2.05             |
| FX1S-14M☆ |            | 52                       | 2.05             |
| FX1S-20M☆ |            | 67                       | 2.64             |
| FX1S-30M☆ |            | 92                       | 3.63             |

∅ = 4.5 mm (0.17")



### 3.7 Termination of Screw Terminals

Terminal screws should be tightened to between 0.5 to 0.8 N·m. Terminal screws must be secured to prevent a loose connection thus avoiding a malfunction.

The terminal screws for the FX1S Series PLC are M3.0. The crimp style terminal (see Figure 3.4 and 3.6) is suitable for use with these screws and should be fitted to the cable for wiring.

When installing 1 or 2 crimp terminals to a terminal, see explanation Figure 3.5 and 3.7.

However, 3 crimp terminals or more should not be installed to a single terminal.

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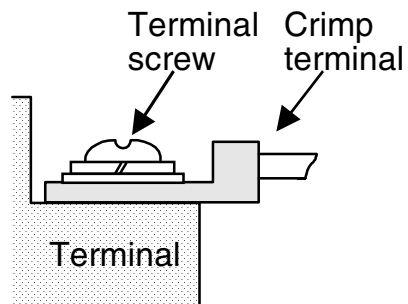
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- 1) Handle the crimp terminal of the following size when 1 wire is used per terminal. Refer to Figure 3.5 for installation instructions.

**Figure 3.4: Crimp Terminal for M3 Screws**

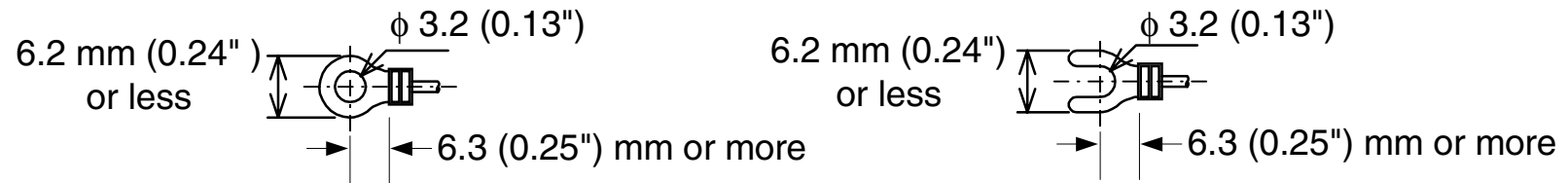


**Figure 3.5: Installing 1 wire Per a Terminal**

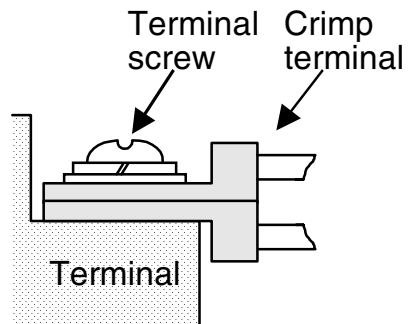


- 2) Handle the crimp terminal of the following size when 2 wires are used per terminal. Refer to Figure 3.7 for installation instructions.

**Figure 3.6: Crimp Terminal for M3**



**Figure 3.7: Installing 2 Wires Per a Terminal**



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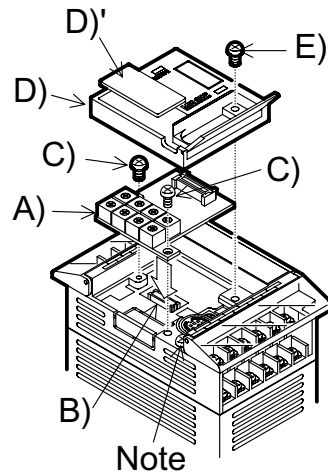
## 3.8 Installing Optional Units

### 3.8.1 Expansion Boards

The following is a generic explanation of how to install an expansion board onto the FX1S PLC. For greater detail and specifications of each optional unit, please see the relevant products manual.

| MODEL        | USE WITH FX1N-5DM | USE WITH FX1N-EEPROM-8L   |
|--------------|-------------------|---|
| FX1N-232-BD  | ✓                 | Possible for program upload and download while the PLC is in the STOP mode. |
| FX1N-422-BD  | ✓                 |   |
| FX1N-485-BD  | ✓                 |   |
| FX1N-CNV-BD  | ✓                 |   |
| FX1N-8AV-BD  | ✓                 |   |
| FX1N-4EX-BD  | ✓                 |   |
| FX1N-2EYT-BD | ✓                 |   |
| FX1N-2AD-BD  | ✗                 | ✗   |
| FX1N-1DA-BD  | ✗                 | ✗   |

Always make sure the power is turned off, before installing a special function board. Only one board can be used at one time, do not try to stack multiple boards.



A) Special function or optional equipment board.

B) Optional equipment connector port.

C) M3 screw to secure board.

D) Top cover for board.

E) M3 screw to secure top cover.

Note: Do not remove this screw.

- Remove base unit top cover.
- Plug board A) into connector B).
- Fix board to base unit using screws C).
- Attach top cover for board D) removing section D)' to expose connector etc. (if applicable)
- Secure top cover with M3 screw E).

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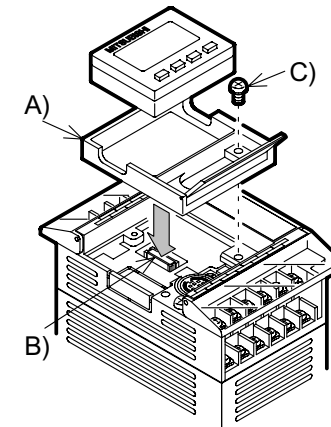
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### 3.8.2 FX<sub>1N</sub>-5DM Display Module

Always make sure the power is turned off, before installing the 5DM.

- A) Top cover for DM
- B) Optional equipment connector.
- C) M3 screw to secure top cover.

- Remove the base unit top cover.
- Attach the top cover for DM A), and secure with screw C) (if 5DM is to be permanently mounted)
- Plug in the 5DM at connector B)



For further information please refer to the FX<sub>1N</sub>-5DM user's manual.

## 4. Power Supply

### 4.1 Wiring Techniques

Wiring for FX1S products has been designed to be safe and easy. If the user is concerned about the correct installation of these products or associated products, please contact a professional electrician who is trained to the local and national standards applicable to the installation site.

### 4.2 Wiring Cautions



- Do not run input signals in the same multicore cable as output signals or allow them to share the same wire.
- Do not lay I/O signal cables next to power cables or allow them to share the same trunking duct. Low voltage cables should be reliably separated or insulated with regard to high voltage cabling.
- Where I/O signal lines are used over an extended distance consideration for voltage drop and noise interference should be made.

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### 4.3 Power Supply



- When wiring an AC supply, the “Live” cable should be connected to the “L” terminal and the “Neutral” cable should be connected to the “N” terminal. Do NOT connect the “Live” wire to the “N” terminal, otherwise, the user may receive a dangerous shock upon powerup.
- When wiring a DC supply, the “Live” cable should be connected to the “+” terminal and the “Neutral” cable should be connected to the “-” terminal. Do NOT connect the “Live” wire to the “-” terminal, otherwise, the user may receive a dangerous shock upon powerup.

## 4.4 Power Supply Characteristics

**Table 4.1: AC Input Power Requirements, FX1S-\*\*M\*-ES/UL, ESS/UL**

| Description                                   | FX1S-10M   | FX1S-14M          | FX1S-20M          | FX1S-30M          |
|---|--|-------------------|-------------------|-------------------|
| Power supply                                  | 100 - 240V AC, +10% -15%, 50/60 Hz   |                   |                   |                   |
| Max. allowable momentary power failure period | 10ms; if less than 10ms, the PLC will continue operation.<br>If 10ms or more, the PLC will shut down |                   |                   |                   |
| Fuse (size) rating                            | 250V 1.0A  |                   |                   |                   |
| In-rush current                               | 100V AC - Max. 15A for 5ms<br>200V AC - Max. 25A for 5ms   |                   |                   |                   |
| Power consumption                             | 19W <sup>*1</sup>  | 19W <sup>*1</sup> | 20W <sup>*1</sup> | 21W <sup>*1</sup> |
| 24V DC Service Supply                         | 400 mA   |                   |                   |                   |

\*1 Includes the input current (5 or 7mA per point).

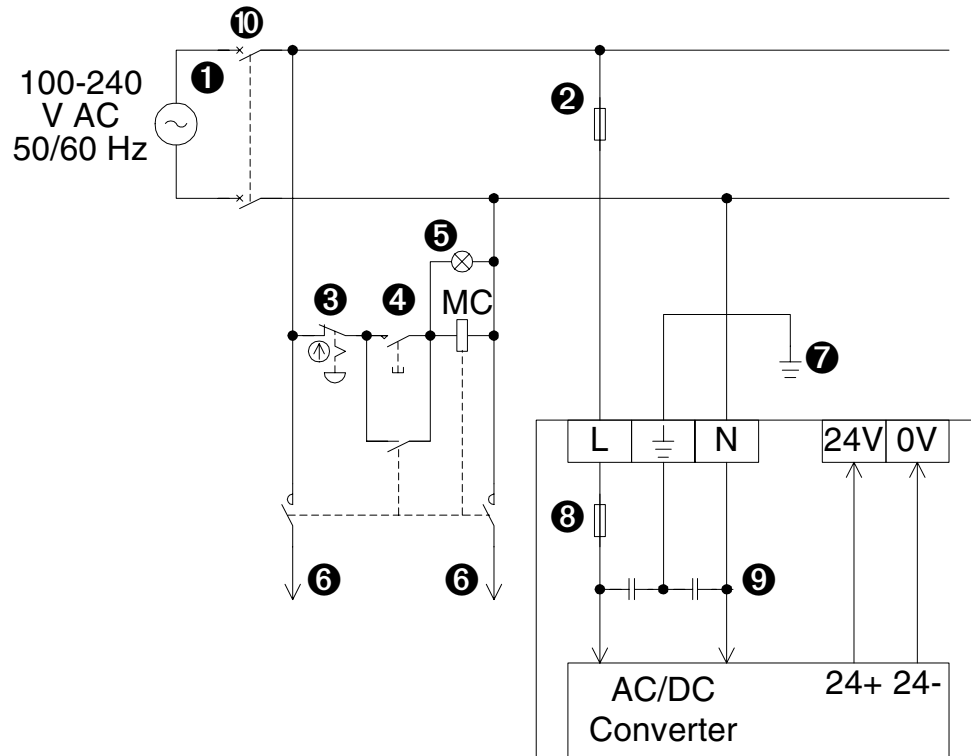
**Table 4.2: DC Input Power Requirements, FX1S-\*\*M\*-DS, DSS**

| Description                                   | FX1S-10M   | FX1S-14M | FX1S-20M | FX1S-30M |
|---|--|----------|----------|----------|
| Power supply                                  | 24 V DC +10% -15%  |          |          |          |
| Max. allowable momentary power failure period | 5 ms; If less than 5 ms, the PLC will continue operation.<br>If 5 ms or more, the PLC will shut down |          |          |          |
| Fuse rating                                   | 0.8A   |          |          |          |
| In-rush current                               | 15A for 0.1 ms   |          |          |          |
| Power consumption <sup>*1</sup>               | 6W   | 6.5W     | 7W       | 8W       |

\*1 Includes the input current (5 or 7mA per point).

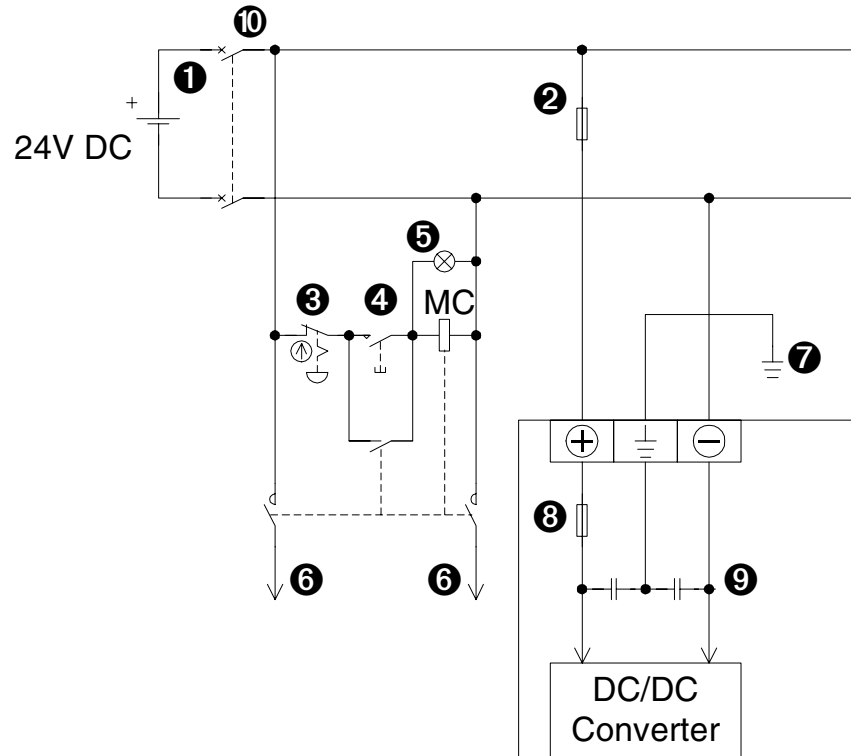
## 4.5 Power Supply Wiring

Figure 4.1: AC Power Supply Example Wiring



|   |   |
|---|---|
| ① | Power supply 100 - 240V AC, +10% -15%, 50/60 Hz |
| ② | Circuit protector or Fuse                       |
| ③ | Emergency stop                                  |
| ④ | Power supply switch                             |
| ⑤ | Power ON pilot indicator                        |
| ⑥ | Power supply for loads                          |
| ⑦ | Grounding resistor 100Ω or less                 |
| ⑧ | Fuse  |
| ⑨ | Main unit                                       |
| ⑩ | Breaker   |

**Figure 4.2: DC Power Supply Example Wiring**



|   |                                 |
|---|---------------------------------|
| ① | Power supply 24V DC, +10% -15%  |
| ② | Circuit protector or Fuse       |
| ③ | Emergency stop                  |
| ④ | Power supply switch             |
| ⑤ | Power ON pilot indicator        |
| ⑥ | Power supply for loads          |
| ⑦ | Grounding resistor 100Ω or less |
| ⑧ | Fuse                            |
| ⑨ | Main unit                       |
| ⑩ | Breaker                         |

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## 4.6 Service Power supply

An AC powered FX1S can supply a service current of 24V DC at 400mA.

A DC powered FX1S does not have the capacity to supply a service current.

## 4.7 Earthing / Grounding



Use a cable at least  $0.2\text{mm}^2$  (AWG24) to ground equipment. Ground resistance must be less than  $100\Omega$ . Note that the ground cable must not be connected to the same ground as the power circuits.

## 5. Inputs

### 5.1 24V DC Input Specifications

**Table 5.1: FX1s Input Specifications**

|                         |          | FX1s Main Unit   |             |
|-------------------------|----------|--|-------------|
|                         |          | X0 - X7  | X10 - X17   |
| Input voltage           |          | 24V DC +/- 10%   |             |
| Input current           |          | 24V DC, 7mA  | 24V DC, 5mA |
| Input switching current | OFF → ON | >4.5mA   | >3.5mA      |
|                         | ON → OFF | <1.5mA   |             |
| Response time           |          | 10ms (default)   |             |
| Variable response time  |          | 0 - 15ms for X000-X017 via use of the FX1s digital filter. |             |
| Circuit isolation       |          | Photocoupler   |             |
| Operation indication    |          | LED is lit   |             |

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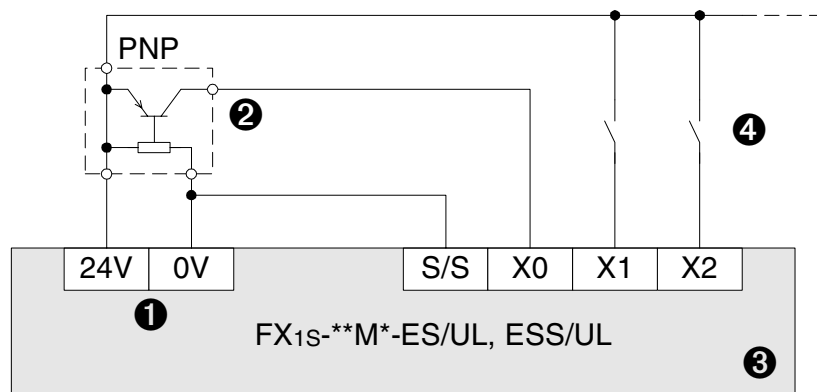
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## 5.2 Wiring Diagrams

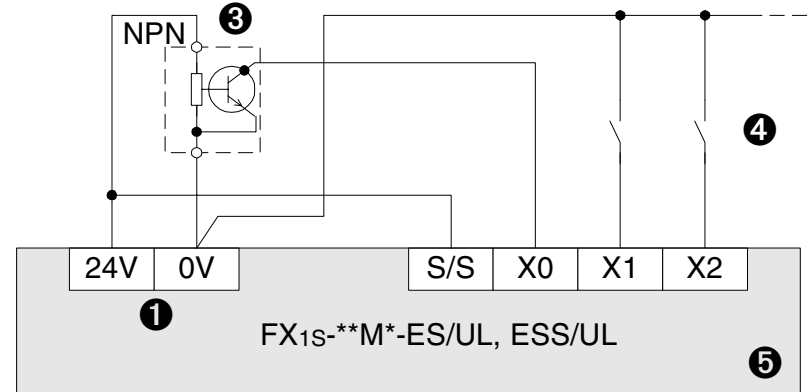
### 5.2.1 Input Wiring

**Figure 5.1: Input Wiring Diagrams**

FX1s-Source



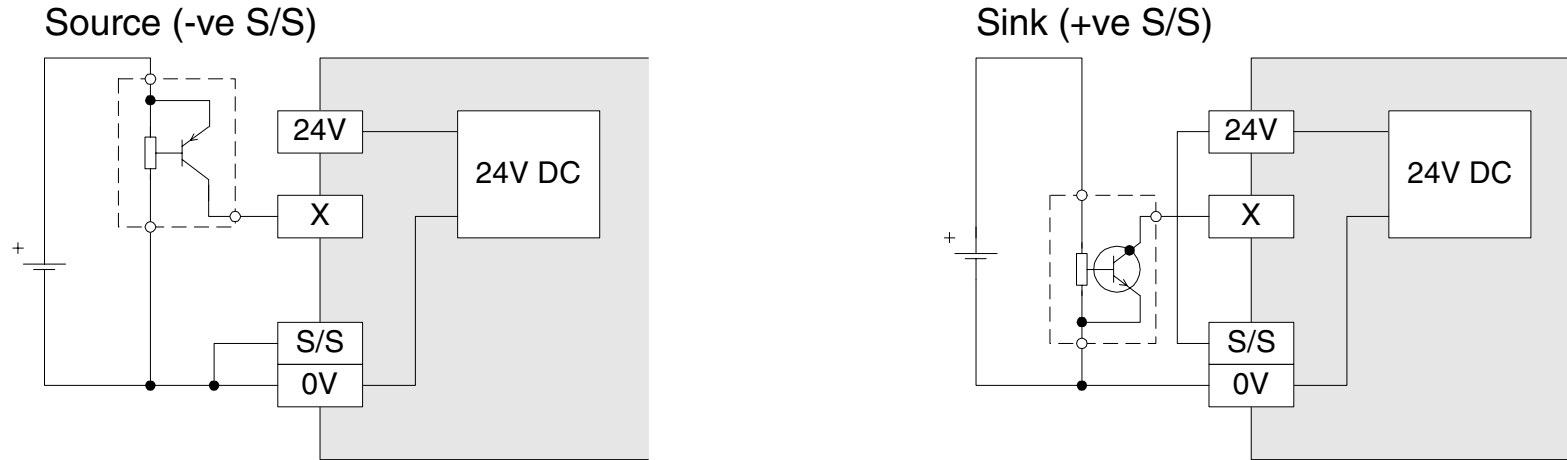
FX1s-Sink



|   |                           |
|---|---------------------------|
| ① | 24V DC Service Supply     |
| ② | PNP Sensor                |
| ③ | NPN Sensor                |
| ④ | Input Device Contact      |
| ⑤ | FX1s Controller Main Body |

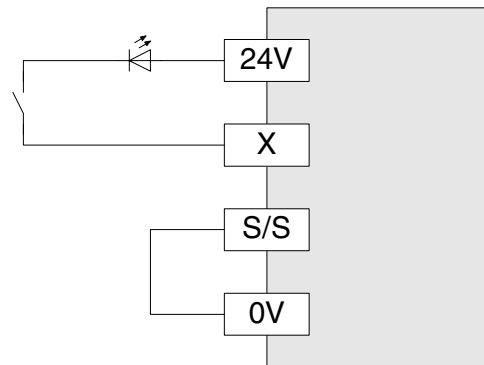
### 5.2.2 Input Circuit Connection

**Figure 5.2: Input Circuit Diagrams (Source/Sink)**



### 5.2.3 Diodes and Inputs Connected in Series

**Figure 5.3: Diode Connection Diagram**



Voltage drop across the diode is Max. 4V.  
No more than 2 LEDs should be connected in series.

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### 5.2.4 Resistors and Inputs Connected in Parallel

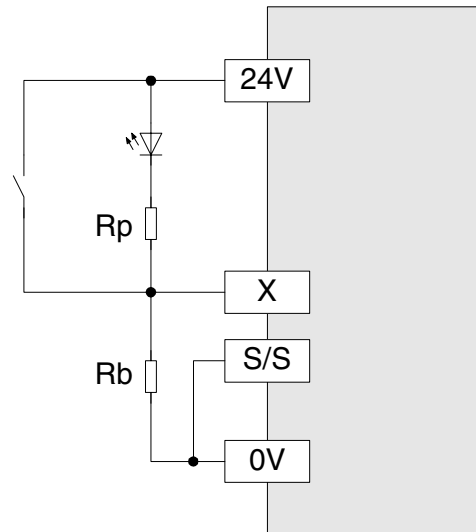
Parallel resistance  $R_p$ :  $FX_{1S} = 15k\Omega$ . If resistance  $R_p$  is less than the stated value, then add the  $R_b$  value using the Equation 1 calculation.

Alternatively; Current leakage:  $FX_{1S} = 1.5mA$ . If the current leakage is greater than the stated value, then add the  $R_b$  value using the equation 2 calculation.

**Figure 5.4: Parallel LED Diagram**

$$\text{Eqn 1 : } R_b \leq \frac{4R_p}{15 - R_p}$$

$$\text{Eqn 2 : } R_b \leq \frac{6}{I - 1.5}$$



## 6. Outputs

### 6.1 Output Specifications

**Table 6.1: Output Specifications**

| Description                                      |                       | Relay Output   | Transistor Output                      |
|--|-----------------------|--|--|
| <b>Switched voltages (resistive load)</b>        |                       | ≤ 240V AC, ≤ 30V DC                                    | 5 - 30V DC                             |
| <b>Rated current / N points (resistive load)</b> |                       | 2A/1 point, 8A/COM                                     | 0.5A/1 point, 0.8A/COM                 |
| <b>Max. Inductive load</b>                       |                       | 80VA, 120/240 VAC,<br>See table 6.2 for more details   | 12W/24V DC                             |
| <b>Max. Lamp load (tungsten load)</b>            |                       | 100W<br>(1.17A/85V AC, 0.4A/250V AC)                   | 0.9W/24V DC                            |
| <b>Minimum load</b>                              |                       | When supply voltage < 5V DC<br>allow at least 2mA flow | -                                      |
| <b>Response time (approx.)</b>                   | <b>OFF → ON</b>       | 10ms   | < 0.2ms; <5μs (Y0,Y1 only)             |
|  | <b>ON → OFF</b>       | 10ms   | < 0.2ms (I > 0.2 A); <5μs (Y0,Y1 only) |
| <b>Circuit isolation</b>                         |                       | By Relay   | PhotoCoupler                           |
| <b>Open circuit current leakage</b>              |                       | -  | 0.1mA/30V DC                           |
| <b>Operation indication</b>                      |                       | LED is lit when coil is energized                      |  |
| <b>Output protection</b>                         | Internal device       | None   |  |
|  | Outside device (Fuse) | Rated value according to the load.                     |  |

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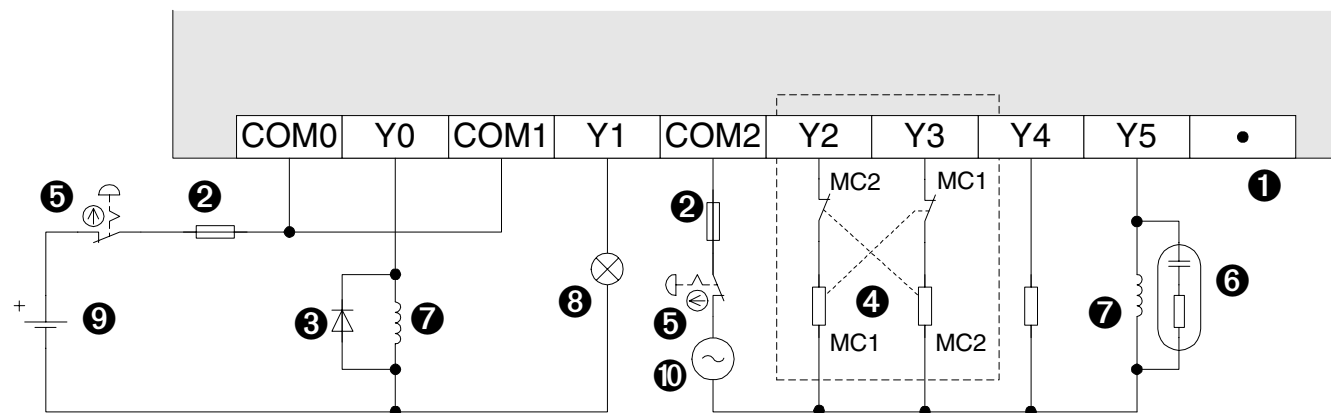
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## 6.2 Relay Output Example

Figure 6.1: Typical Relay Wiring Diagram



|   |   |
|---|---|
| ① | Do not use this terminal  |
| ② | Fuse  |
| ③ | Reverse-current protection diode (See section 6.4)                        |
| ④ | External Mechanical Interlock   |
| ⑤ | Emergency Stop  |
| ⑥ | Surge absorber (0.1μF capacitor + 100-120Ω resistor)<br>(See section 6.4) |

|   |                   |
|---|-------------------|
| ⑦ | Inductive load    |
| ⑧ | Incandescent Lamp |
| ⑨ | DC Power Supply   |
| ⑩ | AC Power Supply   |

## 6.2.1 Reliability Tests



The test results in Table 6.2 were gathered from a 1 sec ON/OFF test cycle. Please note that the over current induced by in-rush greatly reduces the relay contact's service life. The rated life for an inductive AC load such as a contactor or solenoid valve is 500,000 operations at 20VA.

**Table 6.2: Relay Life Cycle Data**

| Description                         | 20VA                       | 35VA                           | 80VA                         |
|-------------------------------------|----------------------------|--------------------------------|------------------------------|
| Load capacity                       | 0.2A/100VAC<br>0.1A/200VAC | 0.35A/100V AC<br>0.17A/240V AC | 0.8A/100V AC<br>0.4A/240V AC |
| Life of contact (cycles)            | 3,000,000                  | 1,000,000                      | 200,000                      |
| Example load (Mitsubishi contactor) | S-K10 ~ S-K95              | S-K100 ~ S-K150                | S-K180,S-K400                |

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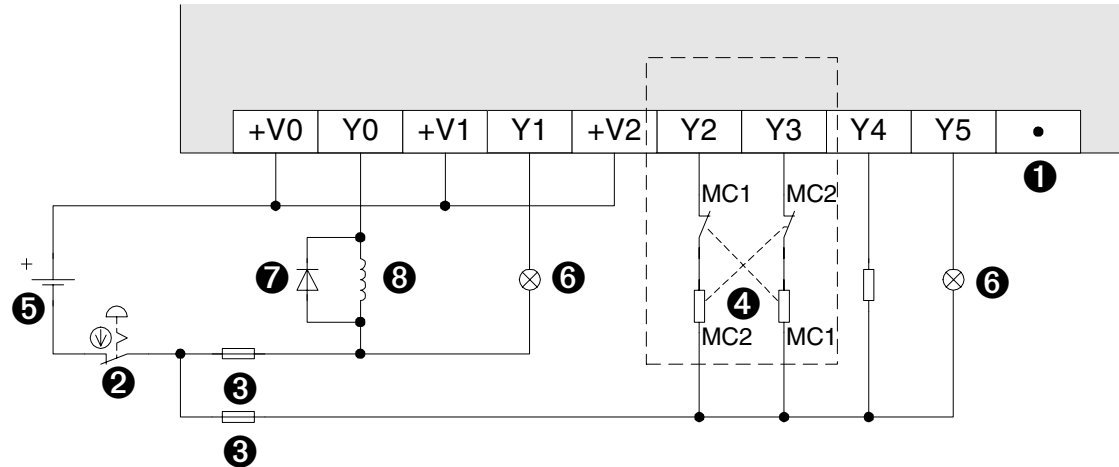
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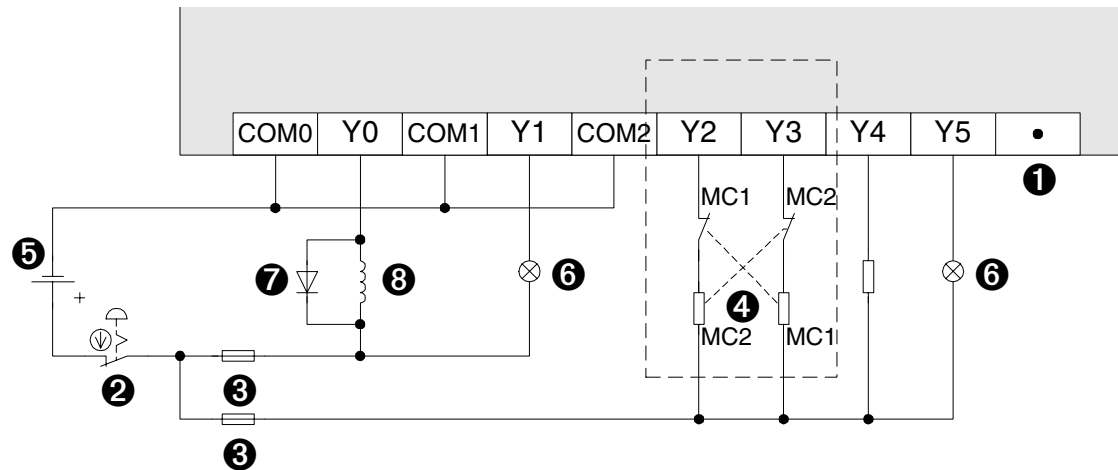
### 6.3 Transistor Output Examples

Figure 6.2: Transistor Output Wiring Diagram



|   |  |
|---|--|
| ① | Do not use this terminal                           |
| ② | Emergency Stop                                     |
| ③ | Fuse   |
| ④ | External Mechanical Interlock (See Section 6.4)    |
| ⑤ | DC Power Supply                                    |
| ⑥ | Reverse-current protection diode (See Section 6.4) |
| ⑦ | Inductive load                                     |

Figure 6.3: Japanese Model Transistor Output

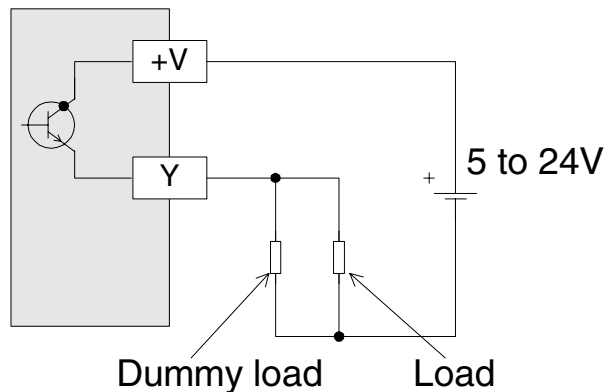


### 6.3.1 Response Times

OFF times increase as the load current decreases.

For improved response times use a 'dummy' resistor, see Figure 6.4. If a response time of 0.5 ms or better is required when using 'light loads' use a 'dummy' resistor and ensure the signal line has a current greater than 60mA/24V DC.

**Figure 6.4: Dummy load**



Y000 and Y001 are high speed response outputs with the following characteristics:

10 - 100 mA at 5 - 24V DC, 100 kHz maximum output signal.

If the high speed response is required, a current of 10 - 100mA must be used.

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## 6.4 Applying Safe Loads



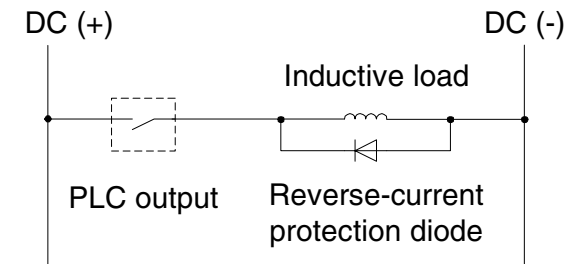
### Caution for DC Loads

#### 1) Relay output case

This PLC does not have any internal protection circuitry on the relay outputs. For switching direct current on inductive loads, a reverse-current protection diode should be installed in parallel with the load. The relay contact life decreases significantly if this is not done.

The reverse-current protection diode needs to satisfy the following specifications.

- The diode is rated for maximum reverse voltage of 5 to 10+ times the load voltage.
- The forward current is more than the load current.

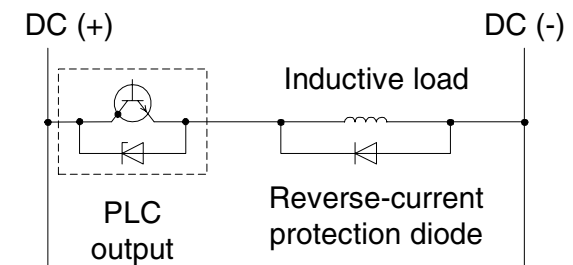


#### 2) Transistor output case

Transistor outputs use internal zener diode (50V) as protection circuitry. When driving the inductive load with transistor output, a reverse-current protection diode can be installed in parallel with the load if necessary.

The reverse-current protection diode needs to satisfy the following specifications.

- The diode is rated for maximum reverse voltage of 5 to 10+ times the load voltage.
- The forward current is more than the load current.



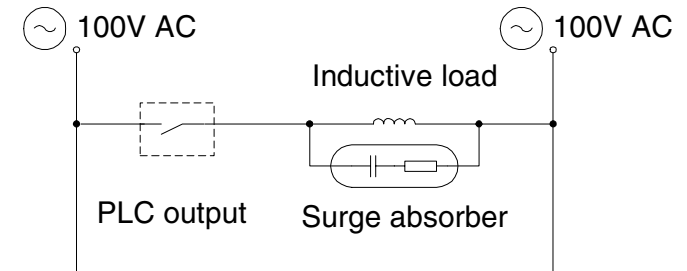
### Caution for AC Loads



#### 1) Relay output case

This PLC does not have any internal protection circuitry on the relay outputs. For switching AC on inductive loads, a surge absorber (0.1μF + “100 to 120Ω”) should be installed in parallel with the load. The relay contact life decreases significantly if this is not done.

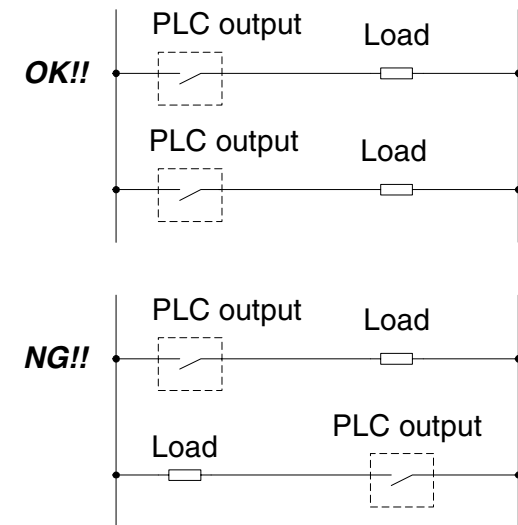
Besides protecting the internal circuitry of the PLC, a surge absorber decreases the noise emissions to the load.



#### Component Side of Loads

The output contact of the PLC should be connected to components consistently as indicated in the figure

Note: If using another output type, please replace symbol with appropriate symbol.



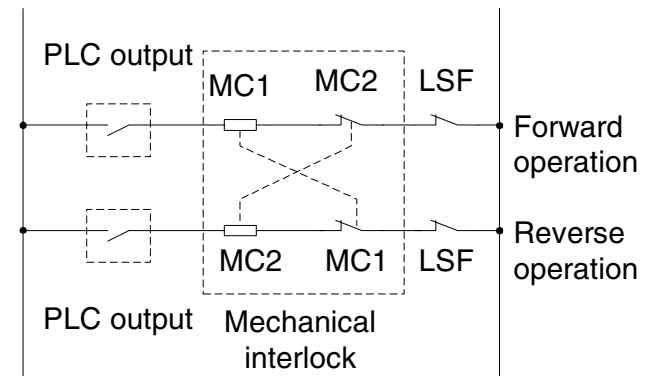
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## Mechanical Interlock

Ensure all loads are applied to the same side of each PLC output, see previous figures. Loads which should NEVER simultaneously operate (e.g. direction control of a motor), because of a critical safety situation, should not rely on the PLC's sequencing alone. Mechanical interlocks MUST be fitted to all critical safety circuits. (See proceeding figure.)


Note: If using another output type, please replace symbol with appropriate symbol.



## 7. Diagnostics

### 7.1 Preliminary Checks

**Table 7.1: Preliminary Checks**

|  |   |
|--|---|
| POWER <input type="checkbox"/><br>RUN <input type="checkbox"/><br>ERROR <input type="checkbox"/>                       | Check power supply, ground and I/O cables are wired correctly.  |
| POWER <input checked="" type="checkbox"/><br>RUN <input type="checkbox"/><br>ERROR <input type="checkbox"/>            | Turn the power supply on. Check that the power LED is lit. Down load a small test program to the PLC. Verify the program to ensure it has been written to the PLC correctly. Using the programming device, force each output ON/OFF. Check the output LEDs for operation. |
| POWER <input checked="" type="checkbox"/><br>RUN <input checked="" type="checkbox"/><br>ERROR <input type="checkbox"/> | Put the PLC into RUN. Check the RUN LED is lit. Check that the previously down loaded program works correctly. Once all checks are complete take the PLC out of run and turn OFF the power supply.  |
|                                     | During this testing stage take extreme care not to touch any live or hazardous parts.   |

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## 7.2 ERROR LED ON (CPU ERROR)

Table 7.2: Error LED Checks

|                             |   |   |  |  |  |
|-----------------------------|---|---|--|--|--|
| POWER ■<br>RUN □<br>ERROR ■ | <b>Fault</b><br>ERROR<br>LED ON   | <b>Remedy</b><br>Reset PLC.<br>Turn power<br>OFF, then<br>ON and<br>trigger RUN<br>input. | <b>Possible<br/>                 results</b> | LED OFF  | Has the memory cassette been installed or removed while the unit was still powered On? |
|                             |   |   |  | LED is lit   | A  |
| A                           | <b>Remedy</b><br>Power OFF<br>Disconnect<br>earth/ground<br>terminal<br>Power ON  | <b>Possible<br/>                 results</b>  | LED is lit                                   | B  |  |
|                             |   |   | LED is flashing                              | Check for programming error. Ensure the earth/ground cable is correctly rewired.<br> |  |
| B                           | <b>Remedy</b><br>Possible program/scan time error.<br>Check D8012 for program scan time,<br>(units 0.2 ms must be less than 0.2<br>sec, i.e. - data value <2000). |   | Possible results<br>D8012 > D8000            |  |  |

### 7.3 Common Errors

- Corroded contact points at some point in an I/O line.
- An I/O device has been used outside its specified operating range.
- An input signal occurs in a shorter time period than that taken by one program scan.

### 7.4 Maintenance

- Check interior temperature of the panel.
- Check panel air filters if fitted.
- Check for loosening of terminals or mounting facilities (due to vibration).

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## 7.5 Operation and Error Flags

**Table 7.3: Operation and Error Flags**

|                              |  |
|------------------------------|--|
| <b>M8004</b><br>(ref. 8004)  | Error occurrence<br>(ON when M8060-7 are ON) |
| <b>M8035</b>                 | Forced RUN mode                              |
| <b>M8036</b>                 | Forced RUN signal                            |
| <b>M8037</b>                 | Forced STOP signal                           |
| <b>M8039</b><br>(ref. D8039) | Constant scan mode                           |

|                                     |                         |
|-------------------------------------|-------------------------|
| <b>M8061</b><br>(ref. D8061)        | PLC hardware error      |
| <b>M8063</b><br>(ref. D8063)        | Parallel link error     |
| <b>M8064</b><br>(ref. D8064)        | Parameter error         |
| <b>M8065</b><br>(ref. D8065, D8069) | Syntax error            |
| <b>M8066</b><br>(ref. D8066, D8069) | Program (circuit) error |
| <b>M8067</b><br>(ref. D8067, D8069) | Program execution error |
| <b>M8068</b><br>(ref. D8068)        | Execution error latch   |

## 7.6 PLC Status Registers

**Table 7.4: PLC Status Registers**

|                                   |  |
|-----------------------------------|--|
| <b>D8000</b><br>(default 200msec) | Watchdog timer   |
| <b>D8001</b>                      | PLC version<br>22100 = FX1s Version 1.00<br>22 = FX1s, 100 = Version 1.00                      |
| <b>D8002</b>                      | Memory capacity<br>0002=2K steps   |
| <b>D8003</b>                      | Memory type<br>02H=EEPROM protect switch OFF<br>0AH=EEPROM protect switch ON<br>10H=MPU memory |
| <b>D8004</b>                      | Error flag number<br>8060=M8060, (8060-8068)   |

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## 7.7 Error Registers

**Table 7.5: Error Registers**

|              |  |
|--------------|--|
| <b>D8061</b> | Error code for PLC hardware error                                |
| <b>D8063</b> | Error code for parallel link fault                               |
| <b>D8064</b> | Parameter error code   |
| <b>D8065</b> | Syntax error code  |
| <b>D8066</b> | Program (circuit) error code                                     |
| <b>D8067</b> | Program execution error code                                     |
| <b>D8068</b> | Latched step<br>number of execution error                        |
| <b>D8069</b> | Step number of errors associated<br>with error flags M8065-M8067 |

## 7.8 Error Codes

**Table 7.6: Error Codes**

|              |  |                              |
|--------------|--|------------------------------|
| <b>D8061</b> | Check cable connections                |                              |
|              | 0000                                   | No error                     |
|              | 6101                                   | RAM error                    |
|              | 6102                                   | Operation circuit error      |
|              | 6103                                   | I/O bus error (M8069 = ON)   |
| <b>D8062</b> | Check the programmer / PLC connections |                              |
|              | 0000                                   | No error                     |
|              | 6201                                   | Parity/overrun/framing error |
|              | 6202                                   | Character error              |
|              | 6203                                   | Data sum check error         |
|              | 6204                                   | Data format error            |
|              | 6205                                   | Command error                |

|              |   |                              |
|--------------|---|------------------------------|
| <b>D8063</b> | Check both power and communications connections |                              |
|              | 0000  | No error                     |
|              | 6301  | Parity/overrun/framing error |
|              | 6302  | Character error              |
|              | 6303  | Data sum check error         |
|              | 6304  | Data format error            |
|              | 6305  | Command error                |
|              | 6306  | Watchdog timer error         |

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## 7.9 Instruction List

**Table 7.7: Numerically Sorted**

|     |                   | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
|-----|-------------------|------|------|------|------|------|------|------|------|------|------|
| 000 | PROGRAM FLOW      | CJ   | CALL | SRET | IRET | EI   | DI   | FEND | WDT  | FOR  | NEXT |
| 010 | TRANSFERS, COMP   | CMP  | ZCP  | MOV  |      |      | BMOV |      |      | BCD  | BIN  |
| 020 | +·×÷, LOGICS      | ADD  | SUB  | MUL  | DIV  | INC  | DEC  | WAND | WOR  | WXOR |      |
| 030 | SHIFT             |      |      |      |      | SFTR | SFTL |      |      | SFWR | SFRD |
| 040 | DATA OPERATION 1  | ZRST | DECO | ENCO |      |      |      |      |      |      |      |
| 050 | HIGH-SPEED        | REF  |      | MTR  | HSCS | HSCR |      | SPD  | PLSY | PWM  | PLSR |
| 060 | HANDY INSTR. 1    | IST  |      | ABSD | INCD |      |      | ALT  | RAMP |      |      |
| 070 | FX I/O DEVICES    |      |      | DSW  |      | SEGL |      |      |      |      |      |
| 080 | FX SERIAL DEVICES | RS   | PRUN | ASCI | HEX  | CCD  | VRRD | VRSC |      | PID  |      |
|     |                   |      |      |      |      |      |      |      |      |      |      |
| 150 | POSITIONING       |      |      |      |      |      | ABS  | ZRN  | PLSV | DRVI | DRVA |
| 160 | REAL TIME CLOCK   | TCMP | TZCP | TADD | TSUB |      |      | TRD  | TWR  |      | HOUR |
|     |                   |      |      |      |      |      |      |      |      |      |      |
| 220 | IN-LINE COMPARE   |      |      |      |      | LD=  | LD>  | LD<  |      | LD≠  | LD≤  |
| 230 |                   | LD≥  |      | AND= | AND> | AND< |      | AND≠ | AND≤ | AND≥ |      |
| 240 |                   | OR=  | OR>  | OR<  |      | OR≠  | OR≤  | OR≥  |      |      |      |

**Table 7.8: Alphabetically sorted**

|          | Symbol | FNC No. | D | P |
|----------|--------|---------|---|---|
| <b>A</b> | ABS    | 155     |   |   |
|          | ABSD   | 062     |   |   |
|          | ADD    | 020     |   |   |
|          | ALT    | 066     |   |   |
|          | AND□   | 232-238 |   |   |
|          | ASCI   | 082     |   |   |
| <b>B</b> | BCD    | 018     |   |   |
|          | BIN    | 019     |   |   |
|          | BMOV   | 015     |   |   |
| <b>C</b> | CALL   | 001     |   |   |
|          | CCD    | 084     |   |   |
|          | CJ     | 000     |   |   |
|          | CMP    | 010     |   |   |

|          | Symbol | FNC No. | D | P |
|----------|--------|---------|---|---|
| <b>D</b> | DEC    | 025     |   |   |
|          | DECO   | 041     |   |   |
|          | DI     | 005     |   |   |
|          | DIV    | 023     |   |   |
|          | DRVA   | 159     |   |   |
|          | DRVI   | 158     |   |   |
|          | DSW    | 072     |   |   |
| <b>E</b> | EI     | 004     |   |   |
|          | ENCO   | 042     |   |   |
| <b>F</b> | FEND   | 006     |   |   |
|          | FOR    | 008     |   |   |

|          | Symbol | FNC No. | D | P |
|----------|--------|---------|---|---|
| <b>H</b> | HEX    | 083     |   |   |
|          | HOUR   | 169     |   |   |
|          | HSCR   | 054     |   |   |
|          | HSCS   | 053     |   |   |
| <b>I</b> | INC    | 024     |   |   |
|          | INCD   | 063     |   |   |
|          | IRET   | 003     |   |   |
|          | IST    | 060     |   |   |
| <b>L</b> | LD□    | 224-230 |   |   |
| <b>M</b> | MOV    | 012     |   |   |
|          | MTR    | 052     |   |   |
|          | MUL    | 022     |   |   |
| <b>N</b> | NEXT   | 009     |   |   |
| <b>O</b> | OR□    | 240-246 |   |   |

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|          | Symbol | FNC No. | D | P |
|----------|--------|---------|---|---|
| <b>P</b> | PID    | 088     |   |   |
|          | PLSR   | 059     |   |   |
|          | PLSV   | 157     |   |   |
|          | PLSY   | 057     |   |   |
|          | PRUN   | 081     |   |   |
|          | PWM    | 058     |   |   |
| <b>R</b> | RAMP   | 067     |   |   |
|          | REF    | 050     |   |   |
|          | RS     | 080     |   |   |
| <b>S</b> | SEGL   | 074     |   |   |
|          | SFRD   | 039     |   |   |
|          | SFTL   | 035     |   |   |
|          | SFTR   | 034     |   |   |

|          | Symbol | FNC No. | D | P |
|----------|--------|---------|---|---|
| <b>S</b> | SFWR   | 038     |   |   |
|          | SPD    | 056     |   |   |
|          | SRET   | 002     |   |   |
|          | SUB    | 021     |   |   |
|          | TADD   | 162     |   |   |
| <b>T</b> | TCMP   | 160     |   |   |
|          | TRD    | 166     |   |   |
|          | TSUB   | 163     |   |   |
|          | TWR    | 167     |   |   |
|          | TZCP   | 161     |   |   |

|          | Symbol | FNC No. | D | P |
|----------|--------|---------|---|---|
| <b>V</b> | VRRD   | 085     |   |   |
|          | VRSC   | 086     |   |   |
| <b>W</b> | WAND   | 026     |   |   |
|          | WDT    | 007     |   |   |
|          | WOR    | 027     |   |   |
| <b>Z</b> | WXOR   | 028     |   |   |
|          | ZCP    | 011     |   |   |
|          | ZRN    | 156     |   |   |
|          | ZRST   | 040     |   |   |

## 7.10 Device List

**Table 7.9: Device List**

| Device Type                  |                                  | Specification   | Remarks  |
|------------------------------|----------------------------------|---|--|
| Program capacity             |                                  | 2k steps by FX1S internal EEPROM<br>or<br>2k steps by FX <sub>1N</sub> -EEPROM-8L |  |
| I/O configuration            |                                  | Max total I/O set by Main Processing Unit   |  |
| Auxiliary relay<br>(M coils) | General                          | 384 points  | M0 to M383   |
|                              | Latched<br>(EEPROM<br>backed-up) | 128 points  | M384 to M511   |
|                              | Special                          | 256 points  | From the range M8000 to M8255                        |
| State relays<br>(S coils)    | Latched<br>(EEPROM<br>backed-up) | 128 points  | S0 to S127   |
|                              | Initial                          | 10 points (subset)  | S0 to S9   |
| Timers (T)                   | 100 msec                         | 63 points<br>Range: 0 to 3,276.7 sec  | T0 to T62  |
|                              | 10 msec                          | 31 points<br>Range: 0 to 327.67 sec   | T32 to T62 when special M coil<br>M8028 is driven ON |
|                              | 1 msec                           | 1 point<br>Range: 0.001 to 32.767 sec   | T63  |

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| Device Type                              |                              | Specification  | Remarks                               |
|--|------------------------------|--|---------------------------------------|
| Counters (C)                             | General                      | 16 points<br>Range: 1 to 32,767 counts   | C0 to C15<br>Type: 16 bit up counter  |
|  | Latched (EEPROM backed-up)   | 16 points<br>Range: 1 to 32,767 counts   | C16 to C31<br>Type: 16 bit up counter |
| High speed counters (C)<br>Max. 6 points | 1 phase                      | Range: -2,147,483,648 to +2,147,483,647 counts<br>General rule: Select counter combinations with a combined counting frequency of 60kHz or less.<br>Note;<br>all counters are latched (EEPROM backed-up)<br>If high speed counter is used with the HSCS or HSCR instruction, a combined counting frequency of 30kHz or less. | C235 to C240, 6 points                |
|  | 1 phase c/w start stop input |  | C241 to C245, 5 points                |
|  | 2 phase                      |  | C246 to C250, 5 points                |
|  | A/B phase                    |  | C251 to C255, 5 points                |

| Device Type        |                            | Specification                    | Remarks  |
|--------------------|----------------------------|----------------------------------|--|
| Data registers (D) | General                    | 128 points                       | D0 to D127<br>Type: 16 bit data storage register pair for 32 bit device                                |
|                    | Latched (EEPROM backed-up) | 128 points                       | D128 to D255<br>Type: 16 bit data storage register pair for 32 bit device                              |
|                    | File                       | Maximum 1500 points              | D1000 to D2499 set by parameter in 3 blocks of 500 program steps<br>Type: 16 bit data storage register |
|                    | Externally adjusted        | 2 points<br>Range: 0 to 255      | D8030 & D8031<br>Data is entered indirectly through the external setting potentiometer                 |
|                    | Special                    | 256 points (inclusive of D8013)  | From the range D8000 to D8255<br>Type: 16 bit data storage register                                    |
|                    | Index                      | 16 points                        | V and Z<br>Type: 16 bit data storage register  |
| Pointers (P)       | For use with CALL          | 64 points                        | P0 to P63  |
|                    | For use with interrupts    | 6 points                         | I00□ to I50□<br>(rising trigger □ = 1, falling trigger □ = 0)  |
| Nest levels        |                            | 8 points for use with MC and MCR | N0 to N7   |

- 1
- 2
- 3
- 4
- 5
- 6
- 7

| Device Type |                   | Specification  | Remarks |
|-------------|-------------------|--|---------|
| Constants   | Decimal K         | 16 bit: -32,768 to +32,767<br>32 bit: -2,147,483,648 to +2,147,483,647 |         |
|             | Hexadecima<br>I H | 16 bit: 0000 to FFFF<br>32 bit: 00000000 to FFFFFFFF                   |         |

|          |                           |          |
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| <b>3</b> | <b>INSTALLATION NOTES</b> | <b>3</b> |
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| <b>4</b> | <b>POWER SUPPLY</b>       |
| <b>5</b> | <b>INPUTS</b>             |
| <b>6</b> | <b>OUTPUTS</b>            |
| <b>7</b> | <b>DIAGNOSTICS</b>        |



# HARDWARE MANUAL

FX1S SERIES PROGRAMMABLE CONTROLLERS



HEAD OFFICE: MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100-8310  
HIMEJI WORKS: 840, CHIYODA CHO, HIMEJI, JAPAN

|            |           |
|------------|-----------|
| MODEL      | FX1S-HW-E |
| MODEL CODE | 09R510    |

JY992D83901H  
(MEE)

Effective Jan. 2004  
Specifications are subject to change without notice.