1. Introduction

The FX1N-1DA-BD analog output expansion board (hereafter called “1DA” or “expansion board”) is to be installed in an FX1S or FX1N series PLC, to increase the analog output by 1 point.

1.1 Features of 1DA

1) Analog output of 1 point can be increased using 1DA. If a 1DA is used, internal mounting in the top of the PLC means there is no need for a change to the installation area of the PLC.

2) Voltage output (0 ~ 10V) or current output (4 ~ 20mA) for digital to analog conversion can be set by switching a dedicated special auxiliary relay.

Moreover, the digital value for conversion is stored in a dedicated special data register, as shown in the table below. However, the digital to analog conversion characteristics cannot be adjusted.

1.2 External Dimensions and Each Part Name

Dimensions: mm (inches) Accessory: Top cover for board

10V
20mA

10V
20mA

Table 1.1: Allocated Device

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB114</td>
<td>Switch of output mode</td>
</tr>
<tr>
<td>ON:</td>
<td>Voltage output mode (0 ~ 10V)</td>
</tr>
<tr>
<td>OFF:</td>
<td>Current output mode (4 ~ 20mA)</td>
</tr>
<tr>
<td>DR114</td>
<td>Digital value for analog output</td>
</tr>
</tbody>
</table>

1.3 System Configuration

• Only one expansion board can be used on one FX1S and FX1N PLC main unit.

• Do not try to install two or more expansion board. (They will not function)

• The 1DA cannot be used together with a FX1N-EEPROM-8L or FX1N-5DM.

1.4 Applicable PLC

Table 1.2: Allocation of Terminals

<table>
<thead>
<tr>
<th>Terminal name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>No connection (DO NOT use this terminal)</td>
</tr>
<tr>
<td>V+</td>
<td>Voltage output terminal</td>
</tr>
<tr>
<td>I+</td>
<td>Current input terminal</td>
</tr>
<tr>
<td>VI</td>
<td>Common terminal for analog output</td>
</tr>
<tr>
<td>b)</td>
<td>Mounting holes (0 /0.4/0.16)</td>
</tr>
<tr>
<td>c)</td>
<td>Connector for PLC</td>
</tr>
</tbody>
</table>

2. Specifications

2.1 General Specifications

Same as the programmable controller main unit. (Refer to the programmable controller main unit manual)

2.2 Power Supply Specifications

Power supplied by internal leads of the programmable controller main unit.

3. Installation

Associated Manual

<table>
<thead>
<tr>
<th>Manual Name</th>
<th>Manual Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX1S Series Programmable controllers</td>
<td>JY992D89001</td>
<td>Describes contents related to hardware of FX1S series PLC, such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>FX1N Series Programmable controllers</td>
<td>JY992D89001</td>
<td>Describes contents related to hardware of FX1N series PLC, such as specifications, wiring and installation.</td>
</tr>
<tr>
<td>FX Series of Programmable controllers</td>
<td>JY992D88101</td>
<td>Describes instructions in FX-5/FX1S/FX1N/FX2N series.</td>
</tr>
</tbody>
</table>

Table 1.3: Applicable Programmable Controller

<table>
<thead>
<tr>
<th>PLC Type</th>
<th>Applicable version</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX1S</td>
<td>V2.00 or later</td>
</tr>
<tr>
<td>FX1N</td>
<td>V2.00 or later</td>
</tr>
</tbody>
</table>

2.3 Performance Specifications

Table 2.1: Performance Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of analog output</td>
<td>DC 0 ~ 10V (External load resistance 2k ~ 1MΩ)</td>
</tr>
<tr>
<td>Current output</td>
<td>DC 4 ~ 20mA (External load resistance 50Ω or less)</td>
</tr>
<tr>
<td>Resolution</td>
<td>2.5mV (10V /4000)</td>
</tr>
<tr>
<td>Integrated accuracy</td>
<td>±1% Against the full scale (0 ~ 10V ±0.1V)</td>
</tr>
<tr>
<td>±0.1%</td>
<td>(4 ~ 20mA ±0.16mA)</td>
</tr>
<tr>
<td>D/A conversion time</td>
<td>Approx. 10ms (D/A conversion is started after the END statement)</td>
</tr>
</tbody>
</table>

Note:

1) When external load resistance is 2kΩ, the overall accuracy of voltage output is adjusted ±1%.

2) When using current output, be sure to have an external load resistance of 50Ω or less. If the load is greater than 50Ω, the output current will be lower than the correct value.

Indispensable manual
1. Introduction
The FX1N-1DA-BD analog output expansion board (hereafter called "1DA" or "expansion board") is to be installed in an FX1N or FX1N series PLC, to increase the analog output by 1 point.

1.1 Features of 1DA
1) Analog output of 1 point can be increased using 1DA. If a 1DA is used, internal mounting in the top of the PLC means there is no need for a change to the installation area of the PLC.
2) Voltage output (0 ~ 10V) or current output (4 ~ 20mA) for digital to analog conversion can be set by switching a dedicated special auxiliary relay. Moreover, the digital value for conversion is stored in a dedicated special data register, as shown in the table below. However, the digital to analog conversion characteristics cannot be adjusted.

Table 1.1: Allocated Device

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB114</td>
<td>Switch of output mode</td>
</tr>
<tr>
<td>ON</td>
<td>Voltage output mode (0 ~ 10V)</td>
</tr>
<tr>
<td>OFF</td>
<td>Current output mode (4 ~ 20mA)</td>
</tr>
<tr>
<td>DRH114</td>
<td>Digital value for analog output</td>
</tr>
</tbody>
</table>

1.2 External Dimensions and Each Part Name
Dimensions: mm (inches)

- Top cover for board: <1>
- M3 self-tapping screw: x3 (to fix top cover, 1, to mount board -2)

1.3 System Configuration
- Only one expansion board can be used on one FX1N and FX1N PLC main unit. Do not try to install two or more expansion board. (They will not function)
- The 1DA cannot be used together with a FX1N-EEMPRINT-8L or FX1N-5DM.

1.4 Applicable PLC

Table 1.2: Allocation of Terminals

<table>
<thead>
<tr>
<th>Terminal name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>No connection (DO NOT use this terminal)</td>
</tr>
<tr>
<td>V+</td>
<td>Voltage output terminal</td>
</tr>
<tr>
<td>V-</td>
<td>Current output terminal</td>
</tr>
<tr>
<td>*</td>
<td>Common terminal for analog output</td>
</tr>
<tr>
<td>b)</td>
<td>Mounting holes (0.040/0.016&quot;)</td>
</tr>
<tr>
<td>c)</td>
<td>Connector for PLC</td>
</tr>
</tbody>
</table>

2. Specifications

2.1 General Specifications
Same as the programmable controller main unit. (Refer to the programmable controller main unit manual)

2.2 Power Supply Specifications
Power supplied by internal head of the programmable controller main unit.

2.3 Performance Specifications

Table 2.1: Performance Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage output</td>
<td>DC 0 ~ 10V (External load resistance 2k – 1MΩ)</td>
</tr>
<tr>
<td>Current output</td>
<td>DC 4 ~ 20mA (External load resistance 500Ω or less)</td>
</tr>
<tr>
<td>Digital output</td>
<td>12bit binary</td>
</tr>
<tr>
<td>Resolution</td>
<td>2.5mV (10V/4000)</td>
</tr>
<tr>
<td>Integrated accuracy</td>
<td>±1% Against the full scale (0 ~ 10V ±0.1V)</td>
</tr>
<tr>
<td>±1% Against the full scale (4 ~ 20mA ±0.16mA)</td>
<td></td>
</tr>
<tr>
<td>D/A conversion time</td>
<td>Approx. 10ms (D/A conversion is started after the END instruction)*1</td>
</tr>
</tbody>
</table>

Table 2.2: Applicable Programmable Controller

<table>
<thead>
<tr>
<th>PLC Type</th>
<th>FX1N series</th>
<th>FX1N series</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V2.00 or later</td>
<td>V2.00 or later</td>
</tr>
</tbody>
</table>

3. Installation

Caution:
- Cut off all phases of power source before installing / removing or performing wiring work on the expansion board in order to avoid electric shock or damage of product.
- After the installation and wiring etc. replace the PLCs top cover before power ON.

Note:
- Securely install the expansion board, and fix to the PLC. Defective contact can cause malfunction.
- The tightening torque for fixing the board or top cover is 0.3 – 0.6 Nm. Tighten securely to avoid malfunction.

Note:
Only one expansion board can be used per main unit of FX1N and FX1N series PLC. Do not try to install two or more expansion boards. Moreover, the 1DA cannot be used with the FX1N-EEMPRINT-8L or FX1N-5DM.

The following is a generic explanation of how to install an expansion board to the PLC.

a) Top cover for expansion board
b) M3 self-tapping screw to mount expansion board
c) M3 self-tapping screw to fix top cover
d) External port for optional equipment
e) Expansion board

Note:
Do not remove this screw.

1) Remove the top cover of the main unit and keep.
2) Plug expansion board "a)" into the external port "d)".
3) Fix expansion board to main unit using M3 self-tapping screws "c)". (Tightening torque: 0.3 ~ 0.6N.m)
4) Attach top cover for expansion board "b)" removing section "a)" to expose connector etc.
5) Secure top cover with M3 self-tapping screw "b)". (Tightening torque: 0.3 ~ 0.6N.m)
1. Introduction

The FX1n-1DA-BD analog output expansion board (hereafter called “1DA” or “expansion board”) is to be installed in an FX1n or FX1n series PLC, to increase the analog output by 1 point.

1.1 Features of 1DA

1) Analog output of 1 point can be increased using 1DA. If a 1DA is used, internal mounting in the top of the PLC means there is no need for a change to the installation area of the PLC.
2) Voltage output (0 ~ 10V) or current output (4 ~ 20mA) for digital to analog conversion can be set by switching a dedicated special auxiliary relay. Moreover, the digital value for conversion is stored in a dedicated special data register, as shown in the table below. However, the digital to analog conversion characteristics cannot be adjusted.

Table 2.1: Performance Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage output</td>
<td>Range of analog output: DC 0 ~ 10V (External load resistance 2k ~ 1MΩ)</td>
</tr>
<tr>
<td>Digital output</td>
<td>DC 4 ~ 20mA (External load resistance 50Ω or less)</td>
</tr>
<tr>
<td>Resolution</td>
<td>2.5mV (10V /4000) 8µA {(20mA - 4mA) /2000}</td>
</tr>
<tr>
<td>Integrated accuracy</td>
<td>±1% Against the full scale (4 ~ 20mA: ±0.16mA)</td>
</tr>
<tr>
<td>D/A conversion time</td>
<td>Approx. 10ms (D/A conversion is started after the END instruction) *1</td>
</tr>
</tbody>
</table>

1.2 External Dimensions and Each Part Name

Dimensions: mm (inches)

Accessory: Top cover for board

1.3 System Configuration

- Only one expansion board can be used on one FX1n and FX1n PLC main unit. Do not try to install two or more expansion boards. (They will not function)
- The 1DA cannot be used together with a FX1n EEPROM-8L or FX1n-SDM.

1.4 Applicable PLC

Table 1.3: Applicable Programmable Controller

<table>
<thead>
<tr>
<th>PLC Type</th>
<th>FX1S series</th>
<th>FX1N series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable version</td>
<td>V2.00 or later</td>
<td>V2.00 or later</td>
</tr>
</tbody>
</table>

2. Specifications

2.1 General Specifications

Same as the programmable controller main unit. (Refer to the programmable controller main unit manual)

2.2 Power Supply Specifications

Power supplied by internal head of the programmable controller main unit.

3. Installation

Caution:
- Cut off all phases of power source before installing / removing or performing wiring work on the expansion board in order to avoid electric shock or damage of product.
- After the installation and wiring etc. replace the PLCs top cover before power ON.
- Securely install the expansion board, and fix to the PLC. Defective contact can cause malfunction.
- The tightening torque for fixing the board or top cover is 0.3 ~ 0.6 Nm. Tighten securely to avoid malfunction.

Note:
- Only one expansion board can be used per main unit of FX1S and FX1N series PLC. Do not try to install two or more expansion boards. Moreover, the 1DA cannot be used with the FX1N-EEPROM-8L or FX1n-SDM.

The following is a generic explanation of how to install an expansion board to the PLC.

a) Top cover for expansion board
b) M3 self-tapping screw to mount expansion board
c) M3 self-tapping screw to fix top cover
d) External port for optional equipment
e) Expansion board

Note: Do not remove this screw.

1) Remove the top cover of the main unit and keep.
2) Plug expansion board “a)” into the external port “d”.
3) Fix expansion board to main unit using M3 self-tapping screws “c” (Tightening torque: 0.3 ~ 0.6Nm)
4) Attach top cover for expansion board “a” removing section “a)” to expose connector etc.
5) Secure top cover with M3 self-tapping screw “b)” (Tightening torque: 0.3 ~ 0.6Nm)
5.3.2 Example Application Program 2

In current output mode, the 1DA converts digital values from 0 ~ 2000 to the analog output of 0 ~ 20 mA. If using a digital range of 0 ~ A in the program, the range must be converted to 0 ~ 4000 as shown in the programming example below. Digital values for conversion to analog are stored in D8114. The analog output does not have exact resolution of 8 µA because the digital value is converted from 0 ~ A to range of 0 ~ 2000. A > 0.

If a digital value in the range of 0 ~ A is used in D60, please see below.

Digital value used in user program: D8114 = 2000 + D60 ~ A = 2000 + D60 - 10000 (In A = 10000 case) = D60 - 5

The value of D60 is given as a multiple of five.

5.3.1 Example Application Program 1

In voltage output mode, the 1DA converts digital values from 0 ~ 4000 to the analog output of 0 ~ 10 Volts. The analog output does not have exact resolution of 0.5 µV because the digital value is converted from 0 ~ 4000 to range of 0 ~ 10V.

Digital value used in user program: D8114 = 2 × D0 - 5

The value of D0 is given as a multiple of five.

5.3.1 Example Application Program 1

In voltage output mode, the 1DA converts digital values from 0 ~ 4000 to the analog output of 0 ~ 10 Volts. If using a digital range of 0 ~ 10000 in the program, the range must be converted to 0 ~ 4000 as shown in the programming example below. Digital values for conversion to analog are stored in D8114. The analog output does not have exact resolution of 0.5 µV because the digital value is converted from 0 ~ 10000 to range of 0 ~ 10V.

Digital value used in user program: D8114 = 2 × D0 - 5

The value of D0 is given as a multiple of five.
4. Wiring

**Caution:**
Cut off all phases of power source before installing / removing or performing wiring work on the expansion board in order to avoid electric shock or damage of product.

**Note:**
- Do not lay signal cable near to high voltage power cable or house them in the same trunking duct. Effects of noise or surge induction may occur. Keep signal cables a safe distance of more than 100 mm (3.94”) from these power cables.
- Ground the shield wire or the shield of a shielded cable. Do not, however, ground at the same point as high voltage lines.
- Never solder the end of any cables. Make sure that the number of connected cables is not more than the unit has been designed for.
- Never connect cables of a non permitted size.
- Fix cables so that any stress is not directly applied on the terminal block or the cable connection area.
- Tighten the terminals to a torque of 0.5 – 0.6 Nm. Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.
- Do not use to the terminal.

4.1 Applicable cables
- Use AWG26 – 16 with connection with output equipment.
- Tighten the terminals to a torque of 0.5 – 0.6 Nm. Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.
- Use a crimp terminal to achieve a good contact.

### Table 4.1: Linear and Sectional Area

<table>
<thead>
<tr>
<th>Linear</th>
<th>Sectional</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG26</td>
<td>0.128 mm2</td>
<td>Stranded cable: Remove sheath, twist core wires, then connect cable. Single cable: Remove sheath, then connect cable.</td>
</tr>
<tr>
<td>AWG18</td>
<td>1.306 mm2</td>
<td></td>
</tr>
</tbody>
</table>

5. Wiring

#### 4.2 Voltage Output Mode

![Inverter, etc.](image)

Grounding resistance of 100Ω or less (Class D)

*1 Connect a 0.1 ~ 0.47µF at 25V DC capacitor in position”*1” when there will be a lot of noise.

#### 4.3 Current Output Mode

![Inverter, etc.](image)

Grounding resistance of 100Ω or less (Class D)

5. Example Program

An analog output is converted from a digital value (DB114) using the DA conversion characteristic specified by special auxiliary relay MB114 at each END instruction.

5.1 Allocated Device

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB114</td>
<td>Switch of output mode</td>
</tr>
<tr>
<td>MB800</td>
<td>Digital value (When power supply is turned Off, DB114 will initialize to ‘0’.)</td>
</tr>
</tbody>
</table>

#### 5.2 Basic Example Program

**Note:**
Drive MB114 which specifies the digital to analog conversion characteristic with MB800 (*A* type contact of the RUN/monitor) or MB800 (*B* type contact of the RUN/monitor).

Do not change the ON/OFF state while the digital to analog conversion is operating.

The Digital to analog conversion is not executed correctly when MB114 is turned ON and OFF during the conversion process.

**5.2.1 Voltage Output Mode**

The following program example sets the voltage output mode, and a digital value in D0 is converted to analog.

**Example:**

\[
D0 = \frac{D8114 \times 2000}{10000} = \frac{D8114 \times 20}{100} = \frac{D8114 \times 0.2}{1} \text{ mV}
\]

\[
D8114 \text{ is converted digital value to analog output.}
\]

*1 If a digital value is not stored in D0, D8114 can be used directly for other instructions.

**5.2.2 Current Output Mode**

The following program example sets the current output mode, and a digital value in D2 is converted to analog.

**Example:**

\[
D2 = \frac{D8114 \times 2000}{10000} = \frac{D8114 \times 20}{100} = \frac{D8114 \times 0.2}{1} \text{ mA}
\]

\[
D8114 \text{ is converted digital value to analog output.}
\]

*1 If a digital value is not stored in D2, D8114 can be used directly for other instructions.

5.3 Example Application Program

As the 1DA does not have Offset and Gain capabilities, if values are required outside the standard specification range, additional program commands are required to either multiply or divide the conversion values. For an example application program, please see FX programming manual II.

**Note:**
- Accuracy and resolution of the digital to analog conversion are different from the specification because of the additional program commands.
- The original range of the analog output is not changed.

5.3.1 Example Application Program

In voltage output mode, the 1DA converts digital values from 0 ~ 4000 to the analog output of 0 ~ 10V.

If using a digital range of 0 ~ 10000 in the program, the range must be converted to 0 ~ 4000 as shown in the programming example below. Digital values for conversion to analog are stored in DB114. The analog output does not have exact resolution of 0.2 mV because the digital value is converted from 0 ~ 10000 to a range of 0 ~ 4000.

**Example:**

\[
\text{Digital value used in user program (D0)} = \frac{D8114 \times 10000}{2000} = \frac{D8114 \times 5}{1} \text{ (in A = 10000 case)}
\]

**5.3.2 Example Application Program 2**

In current output mode, the 1DA converts digital values from 0 – 2000 to the analog output of 0 – 20 mA.

If using a digital range of 0 – A in the program, the range must be converted to 0 – 4000 as shown in the programming example below. Digital values for conversion to analog are stored in DB114. The analog output does not have exact resolution of 8 μA because the digital value is converted from 0 – A to range of 0 – 2000. A > 0.

**Example:**

\[
\text{Digital value used in user program: } D8114 = \frac{D8114 \times 10000}{2000} = \frac{D8114 \times 5}{1} \text{ (in A = 10000 case)}
\]

The value of D60 is given as a multiple of five.

---

**Attention**
- This product is designed for use in industrial applications.
- Authorized Representative in the European Community: Mitsubishi Electric Europe B.V. Gothard Str. 8, 40880 Ratingen, Germany

---

**Manual number:** JY992D96401

**Date:** April 2015

MITSUBISHI ELECTRIC CORPORATION
**4. Wiring**

**Caution:**
Cut off all phases of power source before installing / removing or performing wiring work on the expansion board in order to avoid electric shock or damage of equipment.

**Note:**
- Do not lay signal cable near to high voltage power cable or house them in the same trunking duct. Effects of noise or surge induction may occur. Keep signal cables a safe distance of more than 100 mm (3.94") from these power cables.
- Ground the shield wire or the shield of a shielded cable. Do not, however, ground at the same point as high voltage lines.
- Never solder the end of any cables. Make sure that the number of connected cables is not more than the unit has been designed for.
- Never connect cables of a non permitted size. Fix cables so that any stress is not directly applied on the terminal block or the cable connection area.
- If cables are not used for a long period of time, and the power cord is unplugged, tightening the terminal screws exceeding the specified torque. Failure to do so may cause equipment failures or malfunctions.

**4.1 Applicable cables**
- Use AWG26 ~ 16 with connection with output equipment.
- When using a different type of cable, check the noise and surge induction on the output side of the terminal. Make sure that the number of connected cables is not more than the unit has been designed for.

**4.2 Wiring**

**4.2.1 Voltage Output Mode**
- When using a different type of cable, check the noise and surge induction on the output side of the terminal. Make sure that the number of connected cables is not more than the unit has been designed for.

**4.2.2 Current Output Mode**
- When using a different type of cable, check the noise and surge induction on the output side of the terminal. Make sure that the number of connected cables is not more than the unit has been designed for.

**4.3.2 Example Application Program 2**
In current output mode, the 1DA converts digital values from 0 ~ 2000 to the analog output of 0 ~ 20 mA.
- If a digital value is not stored in D0, D8114 can be used directly for other instructions.
- The Digital to analog conversion is not executed correctly when M8114 is turned ON and OFF during the conversion process.

**5. Example Program**

An analog output is converted from a digital value (D8114) using the DA conversion characteristic specified by special auxiliary relay M8114 at each END instruction.

**5.1 Allocated Device**

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8114</td>
<td>Switch of output mode</td>
</tr>
<tr>
<td>OFF: Voltage output mode (0 ~ 10V)</td>
<td></td>
</tr>
<tr>
<td>ON: Current output mode (4 ~ 20mA)</td>
<td></td>
</tr>
<tr>
<td>D8114</td>
<td>Digital value (When power supply is turned ON, D8114 will initialize to &quot;0&quot;)</td>
</tr>
</tbody>
</table>

**Note:**
- This DA conversion is done regardless of the RUN/STOP status of the PLC. Any time power is supplied to the PLC when the 1DA is attached, the analog value in D8114 will be output. The analog output value will continue to be output when the PLC status is changed from RUN to STOP.
1. Introduction

The FX1n-1DA-BD analog output expansion board (hereafter called “1DA” or “expansion board”) is to be installed in an FX1S or FX1n series PLC, to increase the analog output by 1 point.

1.1 Features of 1DA

1) Analog output of 1 point can be increased using 1DA. If a 1DA is used, internal mounting in the top of the PLC means there is no need for a change to the installation area of the PLC.

2) Voltage output (0 ~ 10V) or current output (4 ~ 20mA) for digital to analog conversion can be set by switching a dedicated special auxiliary relay. Moreover, the digital value for conversion is stored in a dedicated special data register, as shown in the table below. However, the digital to analog conversion characteristics cannot be adjusted.

1.2 External Dimensions and Each Part Name

Dimensions: mm (inches) Accessory: Top cover for board

Table 1.1: Allocation of Device

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB114</td>
<td>Switch of output mode</td>
</tr>
<tr>
<td>DH114</td>
<td>Digital value for analog output</td>
</tr>
</tbody>
</table>

1.3 System Configuration

• Only one expansion board can be used on one FX1S and FX1N main unit. Do not try to install two or more expansion board. (They will not function)
• The 1DA cannot be used together with a FX1n-EEPROM-8L or FX1n-SDM.

1.4 Applicable PLC

Table 1.2: Allocation of Terminals

<table>
<thead>
<tr>
<th>Terminal name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>No connection (DO NOT use this terminal)</td>
</tr>
<tr>
<td>V+</td>
<td>Voltage output terminal</td>
</tr>
<tr>
<td>V-</td>
<td>Current output terminal</td>
</tr>
<tr>
<td>VI</td>
<td>Common terminal for analog output</td>
</tr>
<tr>
<td>a)</td>
<td>Mounting holes (Ø0.6/0.15)</td>
</tr>
<tr>
<td>b)</td>
<td>Connector for PLC</td>
</tr>
</tbody>
</table>

1.5 Specifications

Power supplied by internal head of the programmable controller main unit.

2. Specifications

2.1 General Specifications

Same as the programmable controller main unit. (Refer to the programmable controller main unit manual)

2.2 Power Supply Specifications

Power supplied by internal head of the programmable controller main unit.

2.3 Performance Specifications

Table 2.1: Performance Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage output</td>
<td>DC 0 ~ 10V (External load resistance 2k ~ 1MΩ)</td>
</tr>
<tr>
<td>Current output</td>
<td>DC 4 ~ 20mA (External load resistance 500Ω or less)</td>
</tr>
<tr>
<td>Resolution</td>
<td>2.5mV (10V /4000) 8µA {(20mA - 4mA) /2000}</td>
</tr>
<tr>
<td>Integrated accuracy</td>
<td>±1% Against the full scale (0 ~ 10V ±0.1V)</td>
</tr>
<tr>
<td>±1% Against the full scale (4 ~ 20mA ±0.16mA)</td>
<td></td>
</tr>
<tr>
<td>D/A conversion time</td>
<td>Approx. 10ms (D/A conversion is started after the END instruction)</td>
</tr>
</tbody>
</table>

Note:

1) When external load resistance is 2kΩ, the overall accuracy of voltage output is adjusted to 0 ~ 10V when the external load is 250Ω. If the load is greater than 500Ω, the output current will be lower than the correct value.

2) When using current output, be sure to have an external load resistance of 500Ω or less. If the load is greater than 500Ω, the output current will be lower than the correct value.

Note's on the Symbols Used in this Manual

At various times throughout this manual certain symbols will be used to highlight points of information which are intended to ensure the users personal safety and protect the integrity of equipment.

Indispensable manual
4. Wiring

5. Example Program

An analog output is converted from a digital value (D8114) using the DA conversion characteristic specified by special auxiliary relay M8114 at each END instruction.

5.1 Allocated Device

Table 5.1: Allocation of Device

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8114</td>
<td>Switch of output mode</td>
</tr>
<tr>
<td></td>
<td>OFF: Voltage output mode (0 ~ 10V)</td>
</tr>
<tr>
<td></td>
<td>ON: Current output mode (4 ~ 20mA)</td>
</tr>
<tr>
<td>D8114</td>
<td>Digital value (When power supply is turned OFF, D8114 will initialize to '0'.)</td>
</tr>
</tbody>
</table>

Note:

This DA conversion is done regardless of the RUN/STOP status of the PLC. Any time power is supplied to the PLC when the 1DA is attached, the analog value in D8114 will be output. The analog output value will continue to be output when the PLC status is changed from RUN to STOP.

5.2 Basic Example Program

Note:

Drive M8114 which specifies the digital to analog conversion characteristic with MB800 (‘a’ type contact of the RUN monitor) or MB800 (‘b’ type contact of the RUN monitor). Do not change the ON/OFF state while the digital to analog conversion is operating. The Digital to analog conversion is not executed correctly when M8114 is turned ON and OFF during the conversion process.

5.2.1 Voltage Output Mode

The following program example sets the voltage output mode, and a digital value in D0 is converted to analog.

If a digital value is not stored in D0, D8114 can be used directly for other instructions.

5.2.2 Current Output Mode

The following program example sets the current output mode, and a digital value in D2 is converted to analog.

If a digital value is not stored in D2, D8114 can be used directly for other instructions.

5.3 Example Application Program

As the 1DA does not have Offset and Gain capabilities, if values are required outside the standard specification range, additional program commands are required to either multiply or divide the conversion values. For an example application program, please see FX programming manual II.

Note:

- Accuracy and resolution of the digital to analog conversion are different from the specification because of the additional program commands.

The original range of the analog output is not changed.

5.3.1 Example Application Program 1

In voltage output mode, the 1DA converts digital values from 0 ~ 4000 to the analog output of 0 ~ 10 Volts. If using a digital range of 0 ~ 10000 in the program, the range must be converted to 0 ~ 4000 as shown in the programming example below. The analog output value does not have exact resolution of 0.25mV because the digital value is converted from 0 ~ 10000 to a range of 0 ~ 4000.

Digital value used in user program (D8114) = 2 × D0 + 5

If a digital value in the range of 0 ~ 10000 is used in D0, please see below.

Digital value used in user program: D8114 = 2 × D0 + 5 (In A = 10000 case) = D60 - 5

The value of D60 is given as a multiple of five

5.3.2 Example Application Program 2

In current output mode, the 1DA converts digital values from 0 ~ 2000 to the analog output of 0 ~ 20 mA. If using a digital range of 0 ~ A in the program, the range must be converted to 0 ~ 4000 as shown in the programming example below. Values for conversion to analog are stored in D8114. The analog output does not have exact resolution of 8 ηA because the digital value is converted from 0 ~ A to range of 0 ~ 2000. A > 0.

If a digital value in the range of 0 ~ A is used in D60, please see below.

Digital value used in user program: D8114 = 2000 + D60 - A = 2000 + D60 - 10000 (In A = 10000 case) = D60 - 5

The value of D60 is given as a multiple of five

Attention

- This product is designed for use in industrial applications.

Note

- Authorized Representative in the European Community: Mitsubishi Electric Europe B.V.

Gothen Str. 8, 40880 Ratingen, Germany

Manual number : JY992D96401

Manual revision: D

Date : April 2015

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN