

# SPECIFICATIONS: ANALOG I/O MODULES

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## In This Chapter...

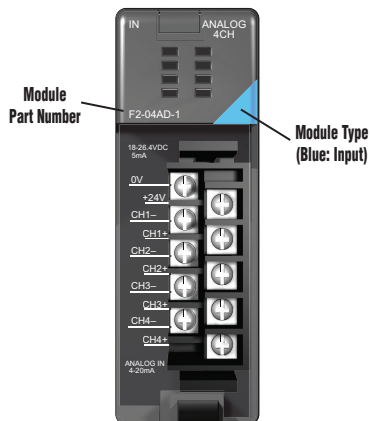
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## Analog I/O Modules Overview

There are 19 analog I/O modules that can be used in local and remote I/O bases. The specifications and wiring diagrams for these modules are found in this chapter. Each analog I/O module is identified as an “Input”, “Output”, or “Input/Output” module using the color coding scheme shown below. A blue bar on the front panel signifies an Input I/O module, a red bar signifies an Output I/O module and a white bar signifies a combination Input/Output module.

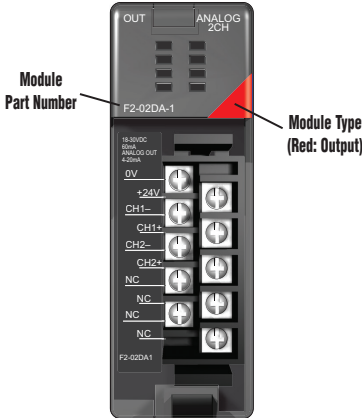
### Analog Input Modules



| Analog Input Modules |                    |                      |          |
|----------------------|--------------------|----------------------|----------|
| Part Number          | Number of Channels | Description          | See Page |
| <i>F2-04AD-1</i>     | 4                  | Analog Current Input | 6-6      |
| <i>F2-04AD-2</i>     | 4                  | Analog Voltage Input | 6-9      |
| <i>F2-08AD-1</i>     | 8                  | Analog Current Input | 6-12     |
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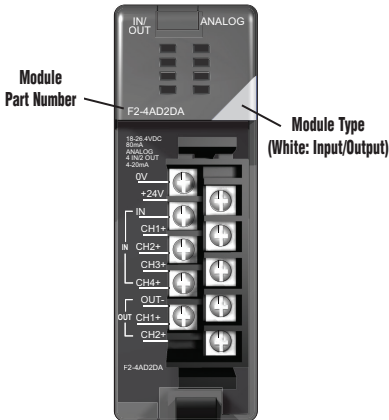
# Analog I/O Modules Overview - continued

## Analog Output Modules



| Analog Output Modules |                    |                                |          |
|-----------------------|--------------------|--------------------------------|----------|
| Part Number           | Number of Channels | Description                    | See Page |
| <i>F2-02DA-1(L)</i>   | 2                  | Analog Current Output          | 6-28     |
| <i>F2-02DA-2(L)</i>   | 2                  | Analog Voltage Output          | 6-30     |
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| <i>F2-02DAS-2</i>     | 2                  | Isolated Analog Voltage Output | 6-36     |
| <i>F2-08DA-1</i>      | 8                  | Analog Current Output          | 6-39     |
| <i>F2-08DA-2</i>      | 8                  | Analog Voltage Output          | 6-41     |

## Analog Input/Output Module



| Analog Input/Output Modules |                          |                           |                             |          |
|-----------------------------|--------------------------|---------------------------|-----------------------------|----------|
| Part Number                 | Number of Input Channels | Number of Output Channels | Description                 | See Page |
| <i>F2-4AD2DA</i>            | 4                        | 2                         | Analog Current Input/Output | 6-44     |
| <i>F2-8AD4DA-1</i>          | 8                        | 4                         | Analog Current Input/Output | 6-47     |
| <i>F2-8AD4DA-2</i>          | 8                        | 4                         | Analog Voltage Input/Output | 6-54     |

## Analog I/O Modules Overview- continued

### How to Access the Analog I/O Modules

With the Do-more PLC, the WX and WY memory addresses are assigned to exchange analog data with the analog I/O modules. (WX = Analog input data, WY = Analog output data and setup data) X addresses are also assigned to some analog I/O modules to indicate the status of those analog I/O modules.

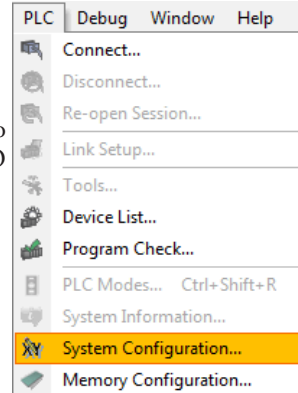
The following table shows how many X, WX and WY addresses are assigned to each analog I/O module type.

| Analog Input/Output Module Addressing |           |   |    |    |
|---------------------------------------|-----------|---|----|----|
| Part Number                           | Module ID | X | WX | WY |
| <i>F2-04AD-1</i>                      | 0x3E      | 8 | 4  | -  |
| <i>F2-04AD-2</i>                      | 0x3E      | 8 | 4  | -  |
| <i>F2-08AD-1</i>                      | 0x3B      | 8 | 8  | -  |
| <i>F2-08AD-2</i>                      | 0x3B      | 8 | 8  | -  |
| <i>F2-04RTD</i>                       | 0x3C      | 8 | 4  | -  |
| <i>F2-04THM</i>                       | 0x3C      | 8 | 4  | -  |
| <i>F2-02DA-1(L)</i>                   | 0x3F      | - | -  | 2  |
| <i>F2-02DA-2(L)</i>                   | 0x3F      | - | -  | 2  |
| <i>F2-02DAS-1</i>                     | 0x4E      | - | -  | 2  |
| <i>F2-02DAS-2</i>                     | 0x4E      | - | -  | 2  |
| <i>F2-08DA-1</i>                      | 0x4F      | - | -  | 8  |
| <i>F2-08DA-2</i>                      | 0x4F      | - | -  | 8  |
| <i>F2-4AD2DA</i>                      | 0x3D      | 8 | 4  | 2  |
| <i>F2-8AD4DA-1</i>                    | 0x37      | 8 | 8  | 7  |
| <i>F2-8AD4DA-2</i>                    | 0x37      | 8 | 8  | 7  |

## Analog I/O Modules Overview- continued

You can check which X, WX and WY addresses are assigned to each analog I/O module in the I/O Mapping tab of the System Configuration window, as shown below.

Select the pull-down menu PLC > System Configuration to open the System Configuration window and click the I/O Mapping tab.



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The screenshot shows the 'System Configuration' window with the 'I/O Map' tab selected. The table below shows the mapping for a DL205 Local I/O Master. Red boxes and arrows highlight specific parts of the table: 'I/O Slot Number' points to the 'Slot' column, 'Module ID' points to the 'Mod ID' column, and 'Assigned X, WX and WY Addresses' points to the 'X Map', 'WX Map', and 'WY Map' columns.

| Slot                          | Mod ID | Slot I/O | X Map       | Y Map | WX Map       | WY Map       |
|-------------------------------|--------|----------|-------------|-------|--------------|--------------|
| <b>DL205 Local I/O Master</b> |        |          |             |       |              |              |
| <b>DL205 Base</b>             |        |          |             |       |              |              |
| 0                             | 3E     | 4X / 4WX | <b>X0-7</b> |       | <b>WX0-3</b> |              |
| 1                             | 3F     | 2WY      |             |       |              | <b>WY0-1</b> |
| 2                             |        | *Empty*  |             |       |              |              |
| 3                             |        | *Empty*  |             |       |              |              |
| 4                             |        | *Empty*  |             |       |              |              |
| 5                             |        | *Empty*  |             |       |              |              |
| 6                             |        | *Empty*  |             |       |              |              |
| 7                             |        | *Empty*  |             |       |              |              |

Mapping Mode:  Auto  Manual

Manual Mode Instructions: Automatically assigned addresses are shown in gray. Manually assigned addresses are shown in black. Map range overlaps are errors, and are shown in red. Map values that exceed memory config are shown in bold red. Clear manual entry to return it to auto.

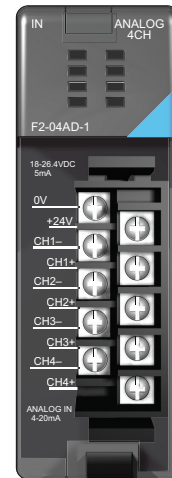
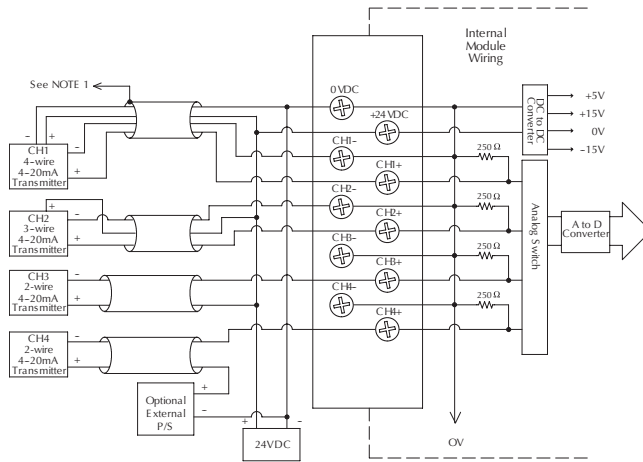
# F2-04AD-1(L) Analog Input

| F2-04AD-1(L) 4-Channel Analog Current In                     |  |
|--|--|
| <b>Number of Channels</b>                                    | 4, single ended (1 common)   |
| <b>Input Ranges</b>  | 4–20mA current   |
| <b>Resolution</b>  | 12-bit (1 in 4096)   |
| <b>Active Low-pass Filtering</b>                             | -3dB at 120Hz, 2 poles<br>(-12dB per octave)                                     |
| <b>Input Impedance</b>                                       | 250Ω ±0.1%, 1/2W current input   |
| <b>Absolute Maximum Ratings</b>                              | -40mA to +40mA, current input  |
| <b>Converter Type</b>  | Successive approximation   |
| <b>Conversion Time (PLC Update Rate)</b>                     | 4 channels per scan maximum  |
| <b>Linearity Error (End to End)</b>                          | ±1 count (0.025% of full scale) maximum  |
| <b>Input Stability</b>                                       | ±1 count   |
| <b>Full Scale Calibration Error (not incl. offset error)</b> | ±12 counts max., @ 20mA current input  |
| <b>Offset Calibration Error</b>                              | ±7 counts max., @ 4mA current input  |
| <b>Step Response</b>   | F2-04AD-1: 4.9 ms to 95% of F.S. change<br>F2-04AD-1L: 4ms to 95% of F.S. change |
| <b>Maximum Inaccuracy</b>                                    | ±0.5% @ 77°F (25°C)<br>±0.65% 32° to 140°F (0° to 60°C)                          |
| <b>Accuracy vs Temperature</b>                               | ±50ppm /°C maximum full scale<br>(Including max. offset change)                  |

|                                  |   |
|----------------------------------|---|
| <b>Recommended Fuse</b>          | 0.032 A, Series 217 fast-acting, current inputs                                   |
| <b>Base Power Required 5 VDC</b> | F2-04AD-1: 100mA<br>F2-04AD-1L: 50mA  |
| <b>External Power Supply</b>     | F2-04AD-1: 5 mA maximum, +10 to +30VDC<br>F2-04AD-1L: 90mA maximum, +10 to +15VDC |
| <b>Operating Temperature</b>     | 32° to 140°F (0° to 60°C)   |
| <b>Storage Temperature</b>       | -4° to 158°F (-20° to 70°C)   |
| <b>Relative Humidity</b>         | 5 to 95% (non-condensing)   |
| <b>Environmental Air</b>         | No corrosive gases permitted  |
| <b>Vibration</b>                 | MIL STD 810C 514.2  |
| <b>Shock</b>                     | MIL STD 810C 516.2  |
| <b>Noise Immunity</b>            | NEMA ICS3-304   |
| <b>Terminal Type (included)</b>  | Removable; D2-8IOCON  |
| <b>ZIPLink Module</b>            | ZL-RTB20 (Feedthrough)  |
| <b>ZIPLink Cable</b>             | ZL-D2-CBL10 (0.5 m)<br>ZL-D2-CBL10-1 (1.0 m)<br>ZL-D2-CBL10-2 (2.0 m)             |

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

Note 1: Shields should be grounded at the signal source.



More than one external power supply can be used provided all the power supply commons are connected. A Series 217, 0.032A, fast-acting fuse is recommended for 4–20 mA current loops. If the power supply common of an external power supply is not connected to 0 VDC on the module, then the output of the external transmitter must be isolated. To avoid “ground loop” errors, recommended 4–20 mA transmitter types are: 2 or 3 wire - Isolation between input signal and power supply or 4 wire - Isolation between input signal, power supply, and 4–20 mA output.

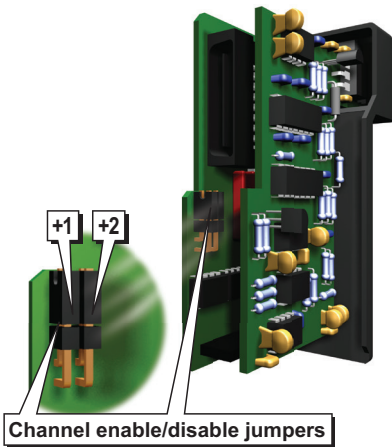
## F2-04AD-1(L), Analog Input - continued

### Setting the Module Jumpers

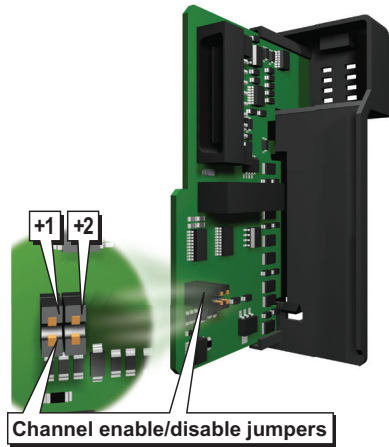
There are two channel selection jumpers, labeled +1 and +2, that are used to select the number of channels that will be used. See the figure below to find the jumpers on your module. The module is set from the factory for four channel operation. Any unused channels are not processed, so if you only select channels 1 thru 3, channel 4 will not be active. The following table shows how to use the jumpers to select the number of channels. Unused jumpers can be stored on a single post to prevent losing them.

Yes = Jumper Installed    No = Jumper Removed

| F2-04AD-1(L) Module Jumper Table |                        |     |     |
|----------------------------------|------------------------|-----|-----|
| Number of Channels               | Active Channels        | +1  | +2  |
| <i>One</i>                       | Channel 1              | No  | No  |
| <i>Two</i>                       | Channels 1 and 2       | Yes | No  |
| <i>Three</i>                     | Channels 1, 2 and 3    | No  | Yes |
| <i>Four</i>                      | Channels 1, 2, 3 and 4 | Yes | Yes |



Jumper Location on Modules Having Date Code 0609F3 and Previous  
(Two Circuit Board Design)



Jumper Location on Modules Having Date Code 0709G and Above  
(Single Circuit Board Design)



## F2-04AD-1(L), Analog Input - continued

### F2-04AD-1(L) Addressing

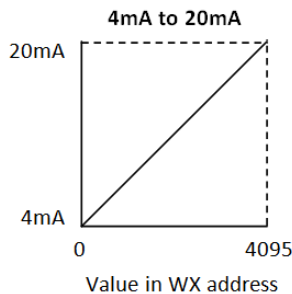
The Do-more CPU module assigns the following memory addresses to this module.

| F2-04AD-1(L) X Addressing |  |
|---------------------------|--|
| Address                   | Description  |
| $Xn$                      | On when the external 24VDC input power is missing or terminal block is removed.  |
| $Xn+1$                    | On when the external 24VDC input power is missing or terminal block is removed.<br>(This address stays off if Channel 2 input is not used) |
| $Xn+2$                    | On when the external 24VDC input power is missing or terminal block is removed.<br>(This address stays off if Channel 3 input is not used) |
| $Xn+3$                    | On when the external 24VDC input power is missing or terminal block is removed.<br>(This address stays off if Channel 4 input is not used) |
| $Xn+4$                    | Not used   |
| $Xn+5$                    | Not used   |
| $Xn+6$                    | Not used   |
| $Xn+7$                    | Not used   |

*Xn: Starting X address assigned to this module*

| F2-04AD-1(L) WX Addressing |                                  |
|----------------------------|----------------------------------|
| Address                    | Description                      |
| $WXn$                      | Channel 1 Input Data (0 to 4095) |
| $WXn+1$                    | Channel 2 Input Data (0 to 4095) |
| $WXn+2$                    | Channel 3 Input Data (0 to 4095) |
| $WXn+3$                    | Channel 4 Input Data (0 to 4095) |

*WXn: Starting WX address assigned to this module*



# F2-04AD-2(L), Analog Input

## F2-04AD-2(L) 4-Channel Analog Voltage In

|  |   |
|--|---|
| <b>Number of Channels</b>                                    | 4, single ended (1 common)  |
| <b>Input Ranges</b>  | 0 to 5 V, 0 to 10 V, $\pm 5V$ , $\pm 10VDC$                                       |
| <b>Resolution</b>  | 12 bit (1 in 4096) uni-polar<br>13 bit (1 in 8191) bi-polar                       |
| <b>Active Low-pass Filtering</b>                             | -3 dB at 80 Hz, 2 poles<br>(-12 dB per octave)                                    |
| <b>Input Impedance</b>                                       | >20M $\Omega$   |
| <b>Absolute Maximum Ratings</b>                              | -75 to +75 VDC  |
| <b>Converter Type</b>  | Successive approximation  |
| <b>Conversion Time (PLC Update Rate)</b>                     | 4 channels per scan maximum   |
| <b>Linearity Error (End to End)</b>                          | $\pm 1$ count (0.025% of full scale) maximum<br>$\pm 2$ counts maximum (bi-polar) |
| <b>Input Stability</b>                                       | $\pm 1$ count   |
| <b>Full Scale Calibration Error (not incl. offset error)</b> | $\pm 3$ counts maximum  |
| <b>Offset Calibration Error</b>                              | $\pm 1$ count maximum (0V input)  |
| <b>Step Response</b>   | F2-04AD-2: 8.2 ms to 95% of F.S change<br>F2-04AD-2L: 10ms to 95% of F.S change   |

|                                 |  |
|---------------------------------|--|
| <b>Maximum Inaccuracy</b>       | $\pm 0.1\%$ @ 77°F (25°C)<br>$\pm 0.3\%$ 32° to 140°F (0° to 60°C)                   |
| <b>Accuracy vs. Temperature</b> | $\pm 50ppm/^\circ C$ full scale calibration change (Including maximum offset change) |
| <b>Base Power Required 5VDC</b> | F2-04AD-2: 110mA<br>F2-04AD-2L: 60mA   |
| <b>External Power Supply</b>    | F2-04AD-2: 5mA maximum, +10 to +30 VDC<br>F2-04AD-2L: 90mA maximum, +10 to +15 VDC   |
| <b>Operating Temperature</b>    | 32° to 140°F (0 to 60°C)   |
| <b>Storage Temperature</b>      | -4° to 158°F (-20° to 70°C)  |
| <b>Relative Humidity</b>        | 5 to 95% (Non-condensing)  |
| <b>Environmental Air</b>        | No corrosive gases permitted   |
| <b>Vibration</b>                | MIL STD 810C 514.2   |
| <b>Shock</b>                    | MIL STD 810C 516.2   |
| <b>Noise Immunity</b>           | NEMA ICS3-304  |
| <b>Terminal Type (included)</b> | Removable; D2-8IOCON   |
| <b>ZIPLink Module</b>           | ZL-RTB20 (Feedthrough)   |
| <b>ZIPLink Cable</b>            | ZL-D2-CBL10 (0.5 m)<br>ZL-D2-CBL10-1 (1.0 m)<br>ZL-D2-CBL10-2 (2.0 m)                |

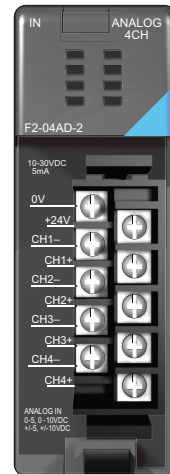
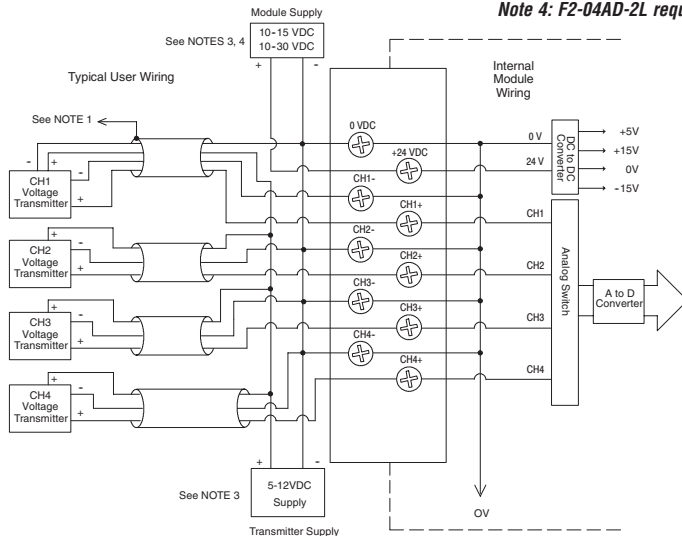
One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

**Note 1:** Shields should be grounded at the signal source.

**Note 2:** Unused inputs should be jumpered together (i.e. CH4- to CH4+).

**Note 3:** More than one external power supply can be used provided the commons are connected together.

**Note 4:** F2-04AD-2L requires 10–15 VDC input supply.



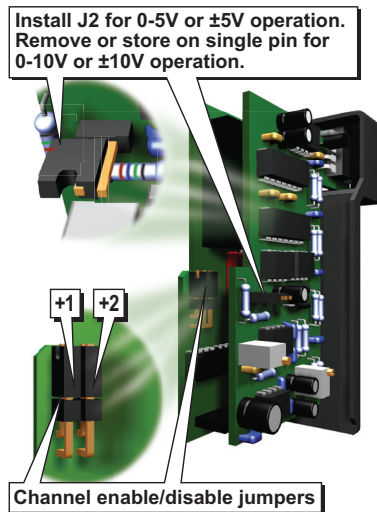
## F2-04AD-2(L), Analog Input - continued

### Setting the Module Jumpers

There are two channel selection jumpers, labeled +1 and +2, that are used to select the number of channels that will be used. See the figure below to find the jumpers on your module. The module is set from the factory for four channel operation. Any unused channels are not processed, so if you only select channels 1 thru 3, channel 4 will not be active. The following table shows how to use the jumpers to select the number of channels. Unused jumpers can be stored on a single post to prevent losing them.

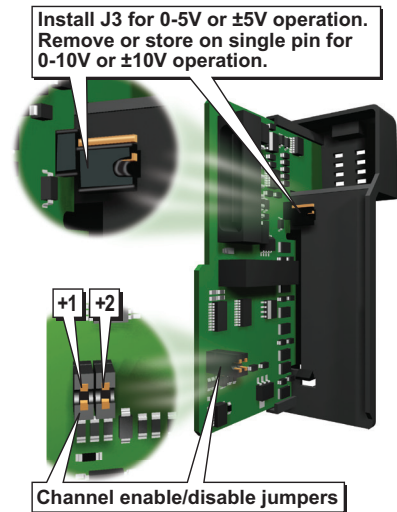
Yes = Jumper Installed    No = Jumper Removed

| F2-04AD-2(L) Module Jumper Table |                        |     |     |
|----------------------------------|------------------------|-----|-----|
| Number of Channels               | Active Channels        | +1  | +2  |
| <i>One</i>                       | Channel 1              | No  | No  |
| <i>Two</i>                       | Channels 1 and 2       | Yes | No  |
| <i>Three</i>                     | Channels 1, 2 and 3    | No  | Yes |
| <i>Four</i>                      | Channels 1, 2, 3 and 4 | Yes | Yes |



Jumper Location on Modules Having Date Code 0609F3 and Previous

(Two Circuit Board Design)



Jumper Location on Modules Having Date Code 0709G and Above

(Single Circuit Board Design)

As seen above, there is also one input signal range jumper, labeled J2 or J3, that is used to select between the 5V and 10V signal ranges. The module is set from the factory for 10V operation (jumper not installed).

## F2-04AD-2(L), Analog Input - continued

### F2-04AD-2(L) Addressing

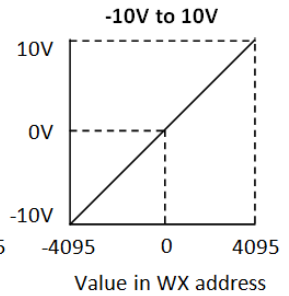
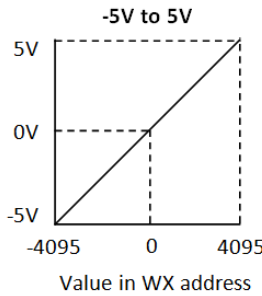
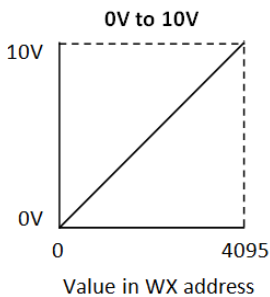
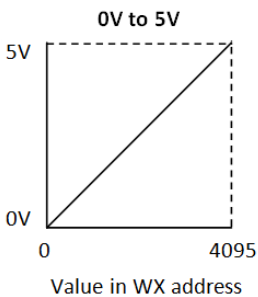
The Do-more CPU module assigns the following memory addresses to this module.

| F2-04AD-2(L) X Addressing |  |
|---------------------------|--|
| Address                   | Description  |
| $Xn$                      | On when the external 24VDC input power is missing or terminal block is removed.  |
| $Xn+1$                    | On when the external 24VDC input power is missing or terminal block is removed.<br>(This address stays off if Channel 2 input is not used) |
| $Xn+2$                    | On when the external 24VDC input power is missing or terminal block is removed.<br>(This address stays off if Channel 3 input is not used) |
| $Xn+3$                    | On when the external 24VDC input power is missing or terminal block is removed.<br>(This address stays off if Channel 4 input is not used) |
| $Xn+4$                    | Not used   |
| $Xn+5$                    | Not used   |
| $Xn+6$                    | Not used   |
| $Xn+7$                    | Not used   |

$Xn$ : Starting X address assigned to this module

| F2-04AD-2(L) WX Addressing |   |
|----------------------------|---|
| Address                    | Description                                       |
| $WXn$                      | Channel 1 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+1$                    | Channel 2 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+2$                    | Channel 3 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+3$                    | Channel 4 Input Data (0 to 4095 or -4095 to 4095) |

$WXn$ : Starting WX address assigned to this module

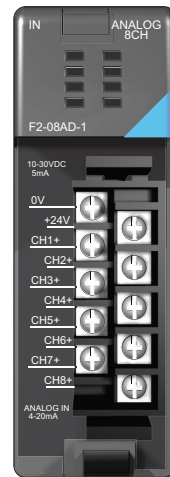
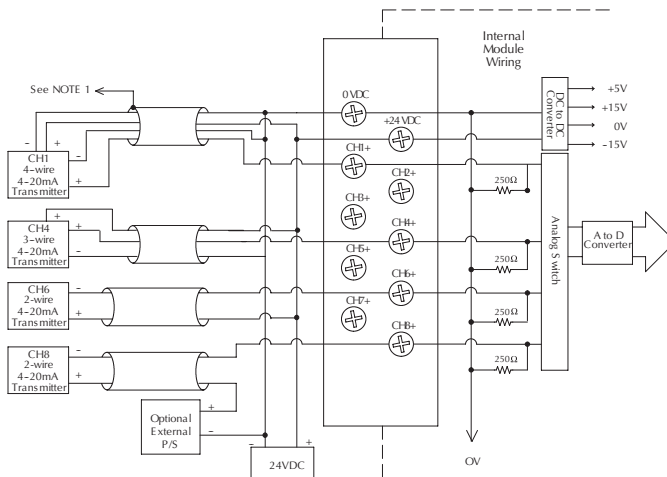


# F2-08AD-1, Analog Input

| F2-08AD-1 8-Channel Analog Current In                           |   |
|---|---|
| <b>Number of Channels</b>                                       | 8, single ended (1 common)  |
| <b>Input Ranges</b>   | 4 to 20mA current   |
| <b>Resolution</b>   | 12 bit (1 in 4096)  |
| <b>Low-pass Filtering</b>                                       | -3 dB at 200 Hz, (-6 dB per octave)   |
| <b>Input Impedance</b>  | 250Ω ±0.1%, 1/2W current input  |
| <b>Absolute Maximum Ratings</b>                                 | -45mA to +45mA  |
| <b>Converter Type</b>   | Successive approximation  |
| <b>Conversion Time (PLC Update Rate)</b>                        | 8 channels per scan maximum   |
| <b>Linearity Error (End to End)</b>                             | ±1 count (0.025% of full scale) maximum   |
| <b>Input Stability</b>  | ±1 count  |
| <b>Full Scale Calibration Error (Offset error not included)</b> | ±5 counts max., @ 20mA current input  |
| <b>Offset Calibration Error</b>                                 | ±2 counts max., @ 4mA current input   |
| <b>Step Response</b>  | 1 ms to 95% of F.S. change  |
| <b>Maximum Inaccuracy</b>                                       | ±0.1% @ 77°F (25°C)<br>±0.25% 32° to 140°F (0° to 60°C)<br>±50ppm/°C maximum full scale |
| <b>Accuracy vs Temperature</b>                                  | (Including max. offset change of two counts)  |
| <b>Recommended Fuse</b>   | 0.032 A, Series 217 fast-acting, current inputs   |
| <b>Base Power Required 5VDC</b>                                 | 100mA   |
| <b>External Power Supply</b>                                    | 5mA maximum, +10 to +30VDC  |
| <b>Operating Temperature</b>                                    | 32° to 140°F (0° to 60°C)   |
| <b>Storage Temperature</b>                                      | -4° to 158°F (-20° to 70°C)   |
| <b>Relative Humidity</b>  | 5 to 95% (non-condensing)   |
| <b>Environmental Air</b>  | No corrosive gases permitted  |
| <b>Vibration</b>  | MIL STD 810C 514.2  |
| <b>Shock</b>  | MIL STD 810C 516.2  |
| <b>Noise Immunity</b>   | NEMA ICS3-304   |
| <b>Terminal Type (included)</b>                                 | Removable; D2-8IOCON  |
| <b>ZIPLink Module</b>   | ZL-RTB20 (Feedthrough)  |
| <b>ZIPLink Cable</b>  | ZL-D2-CBL10 (0.5 m)<br>ZL-D2-CBL10-1 (1.0 m)<br>ZL-D2-CBL10-2 (2.0 m)                   |

*One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).*

*Note 1: Shields should be grounded at the signal source.*



More than one external power supply can be used provided all the power supply commons are connected. A Series 217, 0.032A, fast-acting fuse is recommended for 4-20 mA current loops. If the power supply common of an external power supply is not connected to 0 VDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are: 2 or 3 wire - Isolation between input signal and power supply or 4 wire - Isolation between input signal, power supply, and 4-20 mA output

## F2-08AD-1, Analog Input - continued

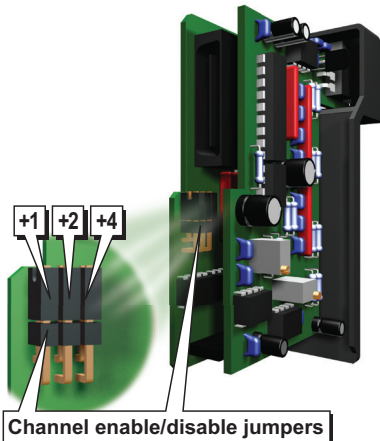
### Setting the Module Jumpers

There are three channel selection jumpers, labeled +1, +2, and +4, that are used to select the number of channels that will be used. See the figure below to find the jumpers on your module. The module is set from the factory for eight channel operation (all three jumpers installed). Any unused channels are not processed, so if you only select channels 1 thru 3, channels 4 thru eight will not be active. The following table shows how to use the jumpers to select the number of channels. Unused jumpers can be stored on a single post to prevent losing them.

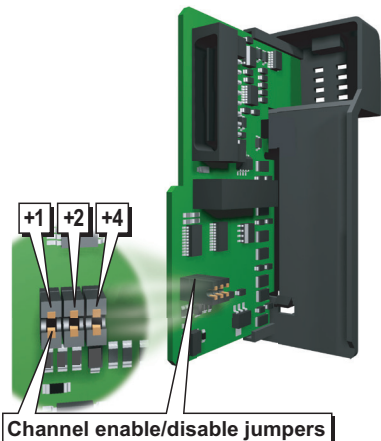
Yes = Jumper Installed    No = Jumper Removed

| F2-08AD-1 Module Jumper Table |                 |     |     |     |
|-------------------------------|-----------------|-----|-----|-----|
| Number of Channels            | Active Channels | +1  | +2  | +4  |
| <i>One</i>                    | Channel 1       | No  | No  | No  |
| <i>Two</i>                    | Channels 1 - 2  | Yes | No  | No  |
| <i>Three</i>                  | Channels 1 - 3  | No  | Yes | No  |
| <i>Four</i>                   | Channels 1 - 4  | Yes | Yes | No  |
| <i>Five</i>                   | Channels 1 - 5  | No  | No  | Yes |
| <i>Six</i>                    | Channels 1 - 6  | Yes | No  | Yes |
| <i>Seven</i>                  | Channels 1 - 7  | No  | Yes | Yes |
| <i>Eight</i>                  | Channels 1 - 8  | Yes | Yes | Yes |

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Jumper Location on Modules Having Date Code 0609B5 and Previous  
(Two Circuit Board Design)



Jumper Location on Modules Having Date Code 0709C1 and Above  
(Single Circuit Board Design)

## F2-08AD-1, Analog Input - continued

### F2-08AD-1 Addressing

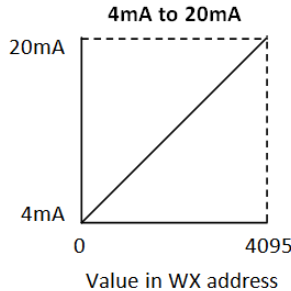
The Do-more CPU module assigns the following memory addresses to this module.

| F2-08AD-1 X Addressing |  |
|------------------------|--|
| Address                | Description  |
| $Xn$                   | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed.   |
| $Xn+1$                 | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 2 input is not used) |
| $Xn+2$                 | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 3 input is not used) |
| $Xn+3$                 | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 4 input is not used) |
| $Xn+4$                 | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 5 input is not used) |
| $Xn+5$                 | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 6 input is not used) |
| $Xn+6$                 | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 7 input is not used) |
| $Xn+7$                 | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 8 input is not used) |

$Xn$ : Starting X address assigned to this module

| F2-08AD-1 WX Addressing |                                  |
|-------------------------|----------------------------------|
| Address                 | Description                      |
| $WXn$                   | Channel 1 Input Data (0 to 4095) |
| $WXn+1$                 | Channel 2 Input Data (0 to 4095) |
| $WXn+2$                 | Channel 3 Input Data (0 to 4095) |
| $WXn+3$                 | Channel 4 Input Data (0 to 4095) |
| $WXn+4$                 | Channel 5 Input Data (0 to 4095) |
| $WXn+5$                 | Channel 6 Input Data (0 to 4095) |
| $WXn+6$                 | Channel 7 Input Data (0 to 4095) |
| $WXn+7$                 | Channel 8 Input Data (0 to 4095) |

$WXn$ : Starting WX address assigned to this module



## F2-08AD-2, Analog Input

### F2-08AD-2 8-Channel Analog Voltage In

|  |  |
|--|--|
| <b>Number of Channels</b>                                    | 8, single ended (1 common)   |
| <b>Input Ranges</b>  | 0 to 5 V, 0 to 10V, $\pm 5V$ , $\pm 10VDC$   |
| <b>Resolution</b>  | 12 bit (1 in 4096) uni-polar<br>13 bit (1 in 8191) bi-polar                                      |
| <b>Active Low-pass Filtering</b>                             | -3 dB at 200 Hz,<br>(-6 dB per octave)   |
| <b>Input Impedance</b>                                       | >20M $\Omega$  |
| <b>Absolute Maximum Ratings</b>                              | -75 to +75VDC  |
| <b>Converter Type</b>  | Successive approximation   |
| <b>Conversion Time (PLC Update Rate)</b>                     | 8 channels per scan maximum  |
| <b>Linearity Error (End to End)</b>                          | $\pm 1$ count (0.025% of full scale) maximum   |
| <b>Input Stability</b>                                       | $\pm 1$ count  |
| <b>Full Scale Calibration Error (not incl. offset error)</b> | $\pm 3$ counts maximum   |
| <b>Offset Calibration Error</b>                              | $\pm 1$ count maximum (0V input)   |
| <b>Step Response</b>   | 1 ms to 95% of F.S. change<br>$\pm 0.1\%$ @ 77°F (25°C)<br>$\pm 0.3\%$ 32° to 140°F (0° to 60°C) |
| <b>Maximum Inaccuracy</b>                                    | $\pm 50$ ppm/°C maximum full scale<br>(Including max. offset change of 2 counts)                 |

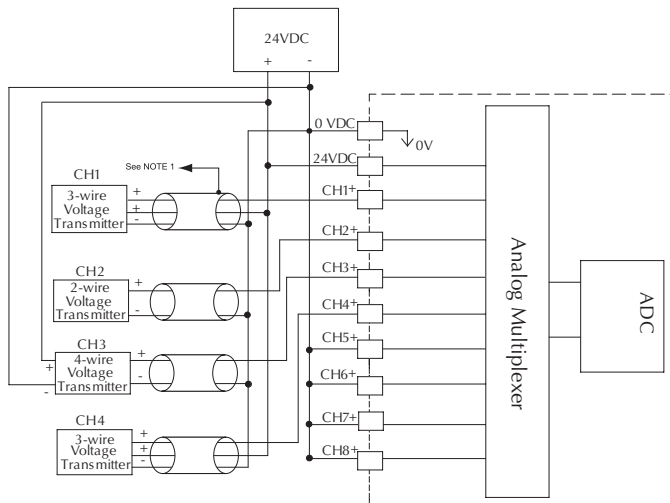
|                                 |   |
|---------------------------------|---|
| <b>Base Power Required 5VDC</b> | 100mA   |
| <b>External Power Supply</b>    | 5mA maximum, +10 to +30 VDC   |
| <b>Operating Temperature</b>    | 32° to 140°F (0° to 60°C)   |
| <b>Storage Temperature</b>      | -4° to 158°F (-20° to 70°C)   |
| <b>Relative Humidity</b>        | 5 to 95% (non-condensing)   |
| <b>Environmental Air</b>        | No corrosive gases permitted  |
| <b>Vibration</b>                | MIL STD 810C 514.2  |
| <b>Shock</b>                    | MIL STD 810C 516.2  |
| <b>Noise Immunity</b>           | NEMA ICS3-304   |
| <b>Terminal Type (included)</b> | Removable; D2-8IOCON  |
| <b>ZIPLink Module</b>           | ZL-RTB20 (Feedthrough)  |
| <b>ZIPLink Cable</b>            | ZL-D2-CBL10 (0.5 m)<br>ZL-D2-CBL10-1 (1.0 m)<br>ZL-D2-CBL10-2 (2.0 m) |

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096). Includes circuitry to automatically detect broken or open transmitters.

Note 1: Shields should be grounded at the signal source.

Note 2: Connect all external power supply commons.

Note 3: Connect unused channels (CH5+, CH6+, CH7+, CH8+ in this example) to 0VDC.





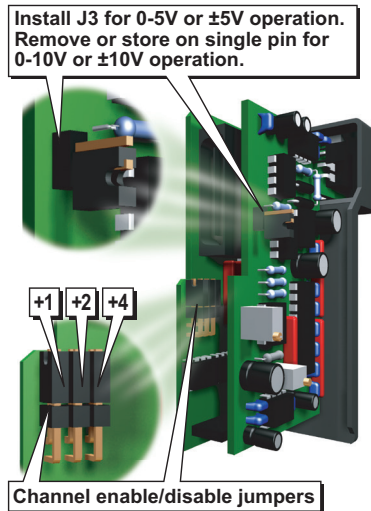
## F2-08AD-2, Analog Input - continued

### Setting the Module Jumpers

There are three channel selection jumpers, labeled +1, +2, and +4, that are used to select the number of channels that will be used. See the figure below to find the jumpers on your module. The module is set from the factory for eight channel operation (all three jumpers installed). Any unused channels are not processed, so if you only select channels 1 thru 3, channels 4 thru eight will not be active. The following table shows how to use the jumpers to select the number of channels. Unused jumpers can be stored on a single post to prevent losing them.

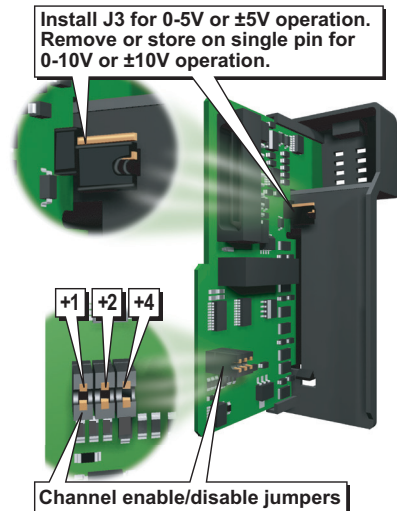
Yes = Jumper Installed    No = Jumper Removed

| F2-08AD-2 Module Jumper Table |                 |     |     |     |
|-------------------------------|-----------------|-----|-----|-----|
| Number of Channels            | Active Channels | +1  | +2  | +4  |
| <b>One</b>                    | Channel 1       | No  | No  | No  |
| <b>Two</b>                    | Channels 1 - 2  | Yes | No  | No  |
| <b>Three</b>                  | Channels 1 - 3  | No  | Yes | No  |
| <b>Four</b>                   | Channels 1 - 4  | Yes | Yes | No  |
| <b>Five</b>                   | Channels 1 - 5  | No  | No  | Yes |
| <b>Six</b>                    | Channels 1 - 6  | Yes | No  | Yes |
| <b>Seven</b>                  | Channels 1 - 7  | No  | Yes | Yes |
| <b>Eight</b>                  | Channels 1 - 8  | Yes | Yes | Yes |



Jumper Location on Modules Having Date Code 0609D4 and Previous

(Two Circuit Board Design)



Jumper Location on Modules Having Date Code 0709E1 and Above

(Single Circuit Board Design)

As seen above, there is another jumper labeled J3 that is used to select between the 5V and 10V signal ranges. The module is set from the factory for 10V operation (jumper not installed).

## F2-08AD-2, Analog Input - continued

### F2-08AD-2 Addressing

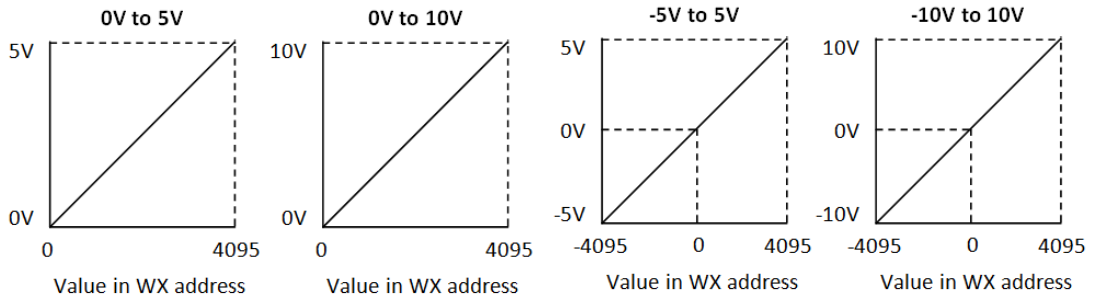
The Do-more CPU module assigns the following memory addresses to this module.

| F2-08AD-2 X Addressing |   |
|------------------------|---|
| Address                | Description   |
| $Xn$                   | On when the external 24VDC input power is missing or terminal block is removed.   |
| $Xn+1$                 | On when the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 2 input is not used) |
| $Xn+2$                 | On when the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 3 input is not used) |
| $Xn+3$                 | On when the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 4 input is not used) |
| $Xn+4$                 | On when the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 5 input is not used) |
| $Xn+5$                 | On when the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 6 input is not used) |
| $Xn+6$                 | On when the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 7 input is not used) |
| $Xn+7$                 | On when the external 24VDC input power is missing or terminal block is removed. (This address stays off if Channel 8 input is not used) |

$Xn$ : Starting X address assigned to this module

| F2-08AD-2 WX Addressing |   |
|-------------------------|---|
| Address                 | Description                                       |
| $WXn$                   | Channel 1 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+1$                 | Channel 2 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+2$                 | Channel 3 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+3$                 | Channel 4 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+4$                 | Channel 5 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+5$                 | Channel 6 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+6$                 | Channel 7 Input Data (0 to 4095 or -4095 to 4095) |
| $WXn+7$                 | Channel 8 Input Data (0 to 4095 or -4095 to 4095) |

$WXn$ : Starting WX address assigned to this module



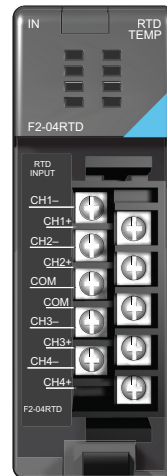
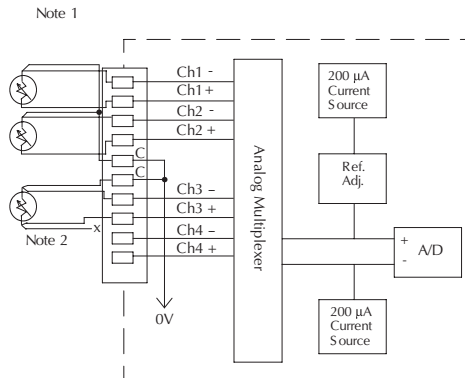
## F2-04RTD

| F2-04RTD 4-Channel RTD          |  | Converter Type                  | Charge Balancing                   |
|---------------------------------|--|---------------------------------|------------------------------------|
| <b>Number of Channels</b>       | 4  | <b>Linearity Error</b>          | ±0.05 °C maximum, ±0.01 °C typical |
| <b>Input Ranges</b>             | Type Pt100:<br>-200.0 to 850.0 °C,<br>-328.0 to 1562.0 °F    | <b>Maximum Inaccuracy</b>       | ±1°C                               |
|                                 | Type Pt1000:<br>-200.0 to 595.0 °C,<br>-328.0 to 1103.0 °F   | <b>PLC Update Rate</b>          | 4 channels per scan maximum        |
|                                 | Type jPt100:<br>-38.0 to 450.0 °C,<br>-36.0 to 842.0 °F      | <b>Base Power Required 5VDC</b> | 90mA                               |
|                                 | Type CU-10/25Ω:<br>-200.0 to 260.0 °C,<br>-328.0 to 500.0 °F | <b>Operating Temperature</b>    | 32° to 140°F (0° to 60°C)          |
| <b>Resolution</b>               | 16 bit (1 in 65535)  | <b>Storage Temperature</b>      | -4° to 158°F (-20° to 70°C)        |
| <b>Display Resolution</b>       | ±0.1 °C, ±0.1 °F (±3276.7)                                   | <b>Temperature Drift</b>        | None (self-calibrating)            |
| <b>RTD Excitation Current</b>   | 200µA  | <b>Relative Humidity</b>        | 5 to 95% (non-condensing)          |
| <b>Input Type</b>               | Differential   | <b>Environmental Air</b>        | No corrosive gases permitted       |
| <b>Notch Filter</b>             | >100 db notches at 50/60Hz<br>-3db =13.1 Hz                  | <b>Vibration</b>                | MIL STD 810C 514.2                 |
| <b>Maximum Setting Time</b>     | 100ms (full-scale step input)                                | <b>Shock</b>                    | MIL STD 810C 516.2                 |
| <b>Common Mode Range</b>        | 0-5 VDC  | <b>Noise Immunity</b>           | NEMA ICS3-304                      |
| <b>Absolute Maximum Ratings</b> | Fault protected inputs to ±50VDC                             | <b>Terminal Type (included)</b> | Removable; D2-8IOCON               |
| <b>Sampling Rate</b>            | 160ms per channel  |                                 |                                    |

**Note 1.** The three wires connecting the RTD to the module must be the same type and length. Do not use the shield or drain wire for the third connection.

**Note 2.** If an RTD sensor has four wires, the plus sense wire should be left unconnected as shown.

**Note 3.** This module is not compatible with the ZIPLink wiring systems.



## F2-04RTD - continued

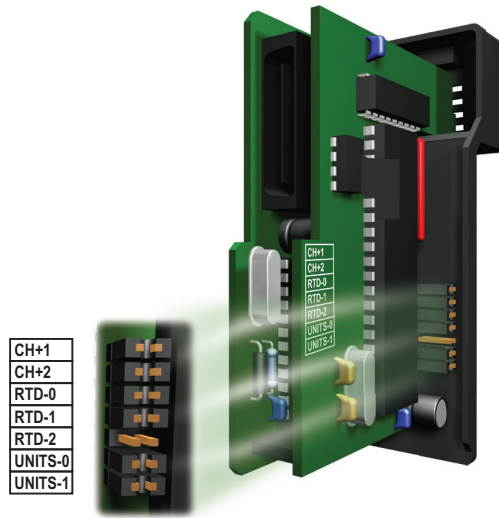
### Setting the Module Jumpers

There are seven jumpers (J8) located on the PC board of this module. The description of each jumper's function is also located on the PC board. These jumpers configure the module for the following options:

- Number of channels: 1 thru 4.
- The input type: 10Ω or 25Ω copper RTDs; jPt 100Ω, Pt 100Ω or Pt 1000 Ω RTDs.
- Temperature conversion: 2's complement or magnitude + sign format in Fahrenheit or Celsius.

There are two channel selection jumpers, labeled CH+1 and CH+2, that are used to select the number of channels that will be used. The module is set from the factory for four channel operation. Any unused channels are not processed, so if you only select channels 1 thru 3, channel 4 will not be active.

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The following table shows how to use the jumpers to select the number of channels. Unused jumpers can be stored on a single post to prevent losing them.

Yes = Jumper Installed    No = Jumper Removed

| F2-04RTD Module Jumper Table (Channel) |                        |      |      |
|--|------------------------|------|------|
| Number of Channels                     | Active Channels        | CH+1 | CH+2 |
| <i>One</i>                             | Channel 1              | No   | No   |
| <i>Two</i>                             | Channels 1 and 2       | Yes  | No   |
| <i>Three</i>                           | Channels 1, 2 and 3    | No   | Yes  |
| <i>Four</i>                            | Channels 1, 2, 3 and 4 | Yes  | Yes  |

## F2-04RTD - continued

The jumpers labeled RTD-0, RTD-1, and RTD-2 are used to select the type of RTD. The module can be used with many types of RTDs. All channels of the module must be the same RTD type.

The default setting from the factory is Pt100Ω (RTD-2 comes with the jumper removed). This selects the DIN43760 European type RTD. European curve type RTDs are calibrated to DIN43760, BS1905, or IEC751 specifications which is  $0.00385 \Omega/\Omega/^{\circ}\text{C}$  ( $100^{\circ}\text{C} = 138.5 \Omega$ ).

The jPt100Ω type is used for the American curve ( $0.00392 \Omega/\Omega/^{\circ}\text{C}$ ), platinum 100Ω RTDs. The 10Ω and 25Ω RTD settings are used with copper RTDs.

The following table shows how to arrange the jumpers to set the different input types.

Yes = Jumper Installed    No = Jumper Removed

| F2-04RTD Module Jumper Table (Input Type) |       |       |       |
|---|-------|-------|-------|
| RTD Inputs                                | RTD-0 | RTD-1 | RTD-2 |
| <i>CU 10Ω</i>                             | No    | No    | No    |
| <i>CU 25Ω</i>                             | Yes   | No    | No    |
| <i>jPt 100Ω</i>                           | No    | Yes   | No    |
| <i>Pt 100Ω</i>                            | Yes   | Yes   | No    |
| <i>Pt 1000Ω</i>                           | No    | No    | Yes   |

The last two jumpers, Units-0 and Units-1, are used to set the conversion unit. The 2's complement options are Fahrenheit or Celsius. The module comes from the factory with both jumpers installed. For Fahrenheit, remove Units-1 jumper. For Celsius remove both Units-0 and Units-1 jumpers.

All RTD types are converted into a direct temperature reading in either Fahrenheit or Celsius. The data contains one implied decimal place. For example, a value in WX memory of 1002 would be 100.2°C or °F.

Negative temperatures are represented in 2's complement form.

To view this data format in the Do-more Designer software, select Native.

The following table shows how to arrange the jumpers to set the different conversion units.

Yes = Jumper Installed    No = Jumper Removed

| F2-04RTD Module Jumper Table (Temperature Conversion Unit) |         |         |
|--|---------|---------|
| Temperature Conversion Units                               | Units-0 | Units-1 |
| <i>2's Complement (°F)</i>                                 | Yes     | No      |
| <i>2's Complement (°C)</i>                                 | No      | No      |

## F2-04RTD - continued

### F2-04RTD Addressing

The Do-more CPU module assigns the following memory addresses to this module.

| F2-04RTD X Addressing |  |
|-----------------------|--|
| Address               | Description  |
| $Xn$                  | On when the RTD is open or terminal block is removed.  |
| $Xn+1$                | On when the RTD is open or terminal block is removed.<br>(This address stays off if Channel 2 input is not used) |
| $Xn+2$                | On when the RTD is open or terminal block is removed.<br>(This address stays off if Channel 3 input is not used) |
| $Xn+3$                | On when the RTD is open or terminal block is removed.<br>(This address stays off if Channel 4 input is not used) |
| $Xn+4$                | Not used   |
| $Xn+5$                | Not used   |
| $Xn+6$                | Not used   |
| $Xn+7$                | Not used   |

*Xn: Starting X address assigned to this module*

| F2-04RTD WX Addressing |   |
|------------------------|---|
| Address                | Description   |
| $WXn$                  | Channel 1 Input Data (Temperature [Unit: 0.1 degree]) |
| $WXn+1$                | Channel 2 Input Data (Temperature [Unit: 0.1 degree]) |
| $WXn+2$                | Channel 3 Input Data (Temperature [Unit: 0.1 degree]) |
| $WXn+3$                | Channel 4 Input Data (Temperature [Unit: 0.1 degree]) |

*WXn: Starting WX address assigned to this module*

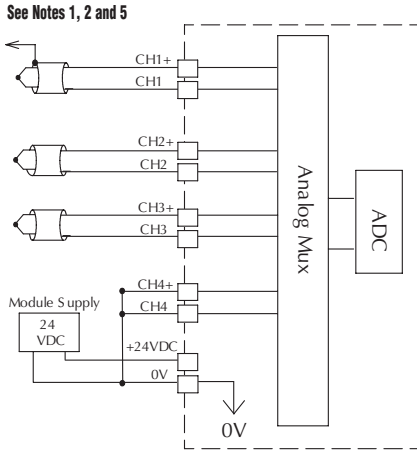
## F2-04THM

| F2-04THM 4-Channel Thermocouple |   |
|---------------------------------|---|
| <b>General Specifications</b>   |   |
| <b>Number of Channels</b>       | 4, differential   |
| <b>Common Mode Range</b>        | ±5VDC   |
| <b>Common Mode Rejection</b>    | 90dB min. @ DC, 150dB min. @ 50/60Hz.                                     |
| <b>Input Impedance</b>          | 1MΩ   |
| <b>Absolute Maximum Ratings</b> | Fault-protected inputs to ±50VDC  |
| <b>Accuracy vs. Temperature</b> | ±5ppm/°C maximum full scale calibration (Including maximum offset change) |
| <b>PLC Update Rate</b>          | 4 channels per scan maximum   |
| <b>External Power Supply</b>    | 60mA maximum, 18 to 26.4 VDC  |
| <b>Base Power Required 5VDC</b> | 110mA   |
| <b>Operating Temperature</b>    | 32° to 140°F (0° to 60°C)   |
| <b>Storage Temperature</b>      | -4° to 158°F (-20° to 70°C)   |
| <b>Relative Humidity</b>        | 5 to 95% (non-condensing)   |
| <b>Environmental Air</b>        | No corrosive gases permitted  |
| <b>Vibration</b>                | MIL STD 810C 514.2  |
| <b>Shock</b>                    | MIL STD 810C 516.2  |
| <b>Noise Immunity</b>           | NEMA ICS3-304   |
| <b>Terminal Type (included)</b> | Non-removable   |

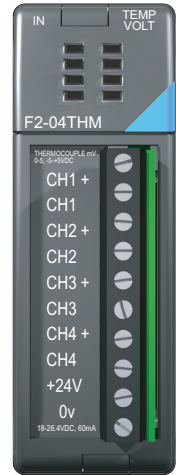
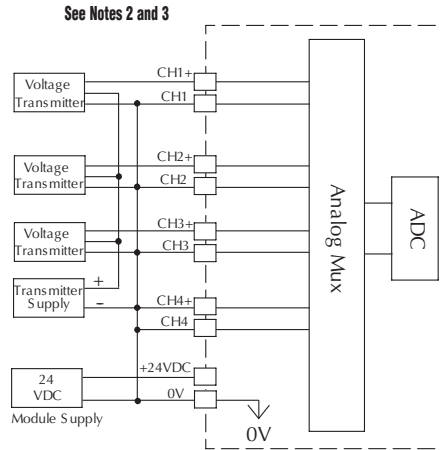
| Thermocouple Specifications                                  |   |                               |
|--|---|-------------------------------|
| <b>Input Ranges</b>  | Type J                                  | -190 to 760°C -310 to 1400°F  |
|  | Type E                                  | -210 to 1000°C -346 to 1832°F |
|  | Type K                                  | -150 to 1372°C -238 to 2502°F |
|  | Type R                                  | 65 to 1768°C 149 to 3214°F    |
|  | Type S                                  | 65 to 1768°C 149 to 3214°F    |
|  | Type T                                  | -230 to 400°C -382 to 752°F   |
|  | Type B                                  | 529 to 1820°C 984 to 3308°F   |
|  | Type N                                  | -70 to 1300°C -94 to 2372°F   |
|  | Type C                                  | 65 to 2320°C 149 to 4208°F    |
| <b>Display Resolution</b>                                    | ±0.1 °C or ±0.1 °F                      |                               |
| <b>Cold Junction Compensation</b>                            | Automatic                               |                               |
| <b>Conversion Time</b>                                       | 100ms per channel                       |                               |
| <b>Warm-Up Time</b>  | 30 minutes typically ±1°C repeatability |                               |
| <b>Linearity Error (End to End)</b>                          | ±0.05 °C maximum, ±0.01 °C typical      |                               |
| <b>Maximum Inaccuracy</b>                                    | ±3°C (excluding thermocouple error)     |                               |
| Voltage Input Specifications                                 |   |                               |
| <b>Voltage Ranges</b>  | 0–5V, ±5V, 0–156.25 mV, ±156.25 mVDC    |                               |
| <b>Resolution</b>  | 16 bit (1 in 65535)                     |                               |
| <b>Full Scale Calibration Error (not incl. offset error)</b> | ±13 counts typical ±33 maximum          |                               |
| <b>Offset Calibration Error</b>                              | ±1 count maximum, @ 0V input            |                               |
| <b>Linearity Error (End to End)</b>                          | ±1 count maximum                        |                               |
| <b>Maximum Inaccuracy</b>                                    | ±0.02% @ 25°C (77°F)                    |                               |

## F2-04THM - continued

Thermocouple input wiring diagram



Voltage input wiring diagram



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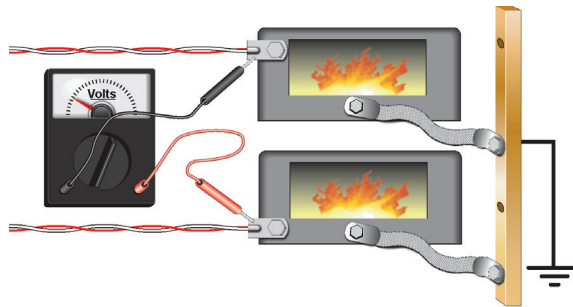
**Note 1:** Terminate shields at the respective signal source.

**Note 2:** Connect unused channels to a common terminal (0V, CH4+, CH4).

**Note 3:** When using 0–156 mV and 5V ranges, connect (-) or (0) volts terminal to 0V to ensure common mode range acceptance.

**Note 4:** This module is not compatible with the ZIPLink wiring system.

**Note 5:** With grounded thermocouples, take precautions to prevent having a voltage potential between thermocouple tips. A voltage of 5V or greater between tips will skew measurements.



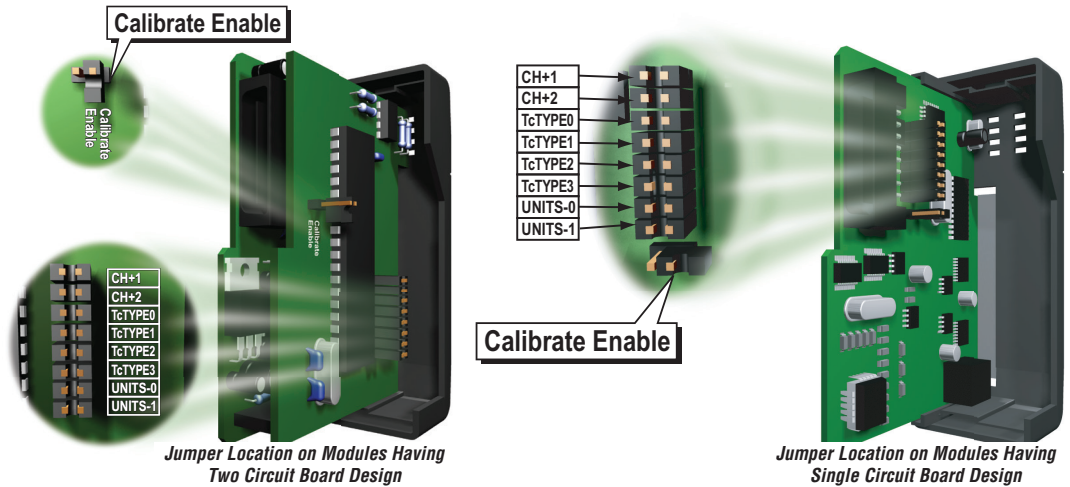


## F2-04THM - continued

### Setting the Module Jumpers

There are eight jumpers (J7) and one single jumper (J9) located on the PC board of this module. These jumpers configure the module for the following options:

- Number of channels
- Input type
- Thermocouple or Voltage conversion units
- Calibrate enable



There are two channel selection jumpers, labeled CH+1 and CH+2, that are used to select the number of channels that will be used. The module is set from the factory for four channel operation. Any unused channels are not processed. The following table shows how to use the jumpers to select the number of channels. Unused jumpers can be stored on a single post to prevent losing them.

Yes = Jumper Installed      No = Jumper Removed

| F2-04THM Module Jumper Table (Channel) |                        |      |      |
|--|------------------------|------|------|
| Number of Channels                     | Active Channels        | CH+1 | CH+2 |
| <i>One</i>                             | Channel 1              | No   | No   |
| <i>Two</i>                             | Channels 1 and 2       | Yes  | No   |
| <i>Three</i>                           | Channels 1, 2 and 3    | No   | Yes  |
| <i>Four</i>                            | Channels 1, 2, 3 and 4 | Yes  | Yes  |

## F2-04THM - continued

The jumpers labeled Tc Type 0, Tc Type 1, Tc Type 2, and Tc Type 3 must be set to match the type of thermocouple being used or the input voltage level. This module can be used with many types of thermocouples, so use the following table to determine your settings.

This module comes from the factory with all four jumpers installed for use with a J type thermocouple. For example, to use an S type thermocouple, remove the jumper labeled Tc Type 2. All channels of the module must be the same thermocouple type or input voltage level.

Yes = Jumper Installed    No = Jumper Removed

| F2-04THM Module Jumper Table (Input Type) |           |           |           |           |
|---|-----------|-----------|-----------|-----------|
| Thermocouple/<br>Voltage Level            | TC Type 0 | TC Type 1 | TC Type 2 | TC Type 3 |
| J   | Yes       | Yes       | Yes       | Yes       |
| K   | No        | Yes       | Yes       | Yes       |
| E   | Yes       | No        | Yes       | Yes       |
| R   | No        | No        | Yes       | Yes       |
| R Wide*                                   | No        | Yes       | No        | No        |
| S   | Yes       | Yes       | No        | Yes       |
| T   | No        | Yes       | No        | Yes       |
| B   | Yes       | No        | No        | Yes       |
| N   | No        | No        | No        | Yes       |
| C   | Yes       | Yes       | Yes       | No        |
| 0-5V                                      | No        | Yes       | Yes       | No        |
| ±5V                                       | Yes       | No        | Yes       | No        |
| 0-156 mV                                  | No        | No        | Yes       | No        |
| ±156mV                                    | Yes       | Yes       | No        | No        |

\* R Wide range is available only on modules with date code 0410E2 and later

Units-0 and Units-1 jumpers are used to set the conversion unit for either thermocouple or voltage inputs. The options are 2's complement in Fahrenheit or Celsius.

All thermocouple types are converted into a direct temperature reading in either Fahrenheit or Celsius. The data contains one implied decimal place. For example, a value in WX memory of 1002 would be 100.2°C or °F.

For thermocouple ranges which include negative temperatures (J,E,K,T,N), the display resolution is from -3276.7 to +3276.7. For positive-only thermocouple ranges (R,S,B,C), the display resolution is 0 to 6553.5. Negative temperatures are represented in 2's complement form.

## F2-04THM - continued

The 2's complement data format may be required to correctly display bipolar data on some operator interfaces. This data format could also be used to simplify averaging a bipolar signal. To view this data format in the Do-more software, select Native.

For unipolar thermocouple ranges (R,S,B,C), 2's complement should be selected.

This module comes with both jumpers installed. For Fahrenheit remove Units-1 jumper. For Celsius remove both Units-0 and Units-1 jumpers. Use the following table to select temperature conversion unit.

Yes = Jumper Installed    No = Jumper Removed

| F2-04THM Module Jumper Table (Temperature Conversion Unit) |         |         |
|--|---------|---------|
| Temperature Conversion Units                               | Units-0 | Units-1 |
| 2's Complement ( °F )                                      | Yes     | No      |
| 2's Complement ( °C )                                      | No      | No      |

The bipolar voltage input ranges,  $\pm 5V$  or  $\pm 156mV$  (see previous page for  $\pm 5V$  and  $\pm 156mV$  input settings), is converted to a 16-bit 2's complement value.

This module comes with both jumpers installed. Use the following table to select voltage conversion unit. For Example, remove the Units-1 jumper and leave the Units-0 jumper installed for 2's complement conversion. For Fahrenheit remove Units-1 jumper. For Celsius remove both Units-0 and Units-1 jumpers.

Yes = Jumper Installed    No = Jumper Removed

| F2-04THM Module Jumper Table (Voltage Conversion Unit) |         |         |
|--|---------|---------|
| Voltage Conversion Units                               | Units-0 | Units-1 |
| 2's Complement   | Yes     | No      |

The Calibrate Enable jumper J9 comes from the factory in the "jumper removed" setting (the jumper is installed over only one of the two pins). Installing this jumper disables the thermocouple active burn-out detection circuitry, which enables you to attach a thermocouple calibrator to the module. To make sure that the output of the thermocouple calibrator is within the 5V common mode voltage range of the module, connect the negative side of the differential voltage input channel to the 0V terminal, then connect the thermocouple calibrator to the differential inputs (for example, Ch 3+ and Ch 3).

For the voltage input ranges, this jumper is inactive and can be installed or removed with no effect on voltage input.

## F2-04THM - continued

The Do-more CPU module assigns the following memory addresses to this module.

| F2-04THM X Addressing |  |
|-----------------------|--|
| Address               | Description  |
| $Xn$                  | On when the thermocouple is open or the external 24VDC input power is missing.   |
| $Xn+1$                | On when the thermocouple is open or the external 24VDC input power is missing. (This address stays off if Channel 2 input is not used) |
| $Xn+2$                | On when the thermocouple is open or the external 24VDC input power is missing. (This address stays off if Channel 3 input is not used) |
| $Xn+3$                | On when the thermocouple is open or the external 24VDC input power is missing. (This address stays off if Channel 4 input is not used) |
| $Xn+4$                | Not used   |
| $Xn+5$                | Not used   |
| $Xn+6$                | Not used   |
| $Xn+7$                | Not used   |

*Xn: Starting X address assigned to this module*

| F2-04THM WX Addressing |   |
|------------------------|---|
| Address                | Description   |
| $WXn$                  | Channel 1 Input Data (Temperature [Unit: 0.1 degree] or Voltage [0 to 65535 <sup>1</sup> ]) |
| $WXn+1$                | Channel 2 Input Data (Temperature [Unit: 0.1 degree] or Voltage [0 to 65535 <sup>1</sup> ]) |
| $WXn+2$                | Channel 3 Input Data (Temperature [Unit: 0.1 degree] or Voltage [0 to 65535 <sup>1</sup> ]) |
| $WXn+3$                | Channel 4 Input Data (Temperature [Unit: 0.1 degree] or Voltage [0 to 65535 <sup>1</sup> ]) |

*WXn: Starting WX address assigned to this module*

**NOTE 1:** The data format of the WX addresses is 'Signed Word'. They store -32768 to 32767 as default. To read and write 0 to 65535 into these memory addresses, use the casting 'U' ('U' is the casting for 'Unsigned' format). For instance, if you selected the voltage input for the first analog input channel and WX0 is assigned to the channel, use 'WX0:U' to access this memory address in the ladder program and other tools in Do-more Designer.



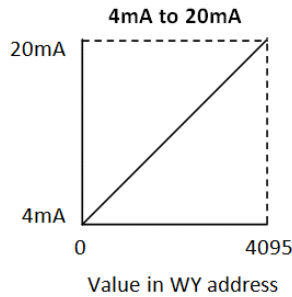


## F2-02DA-1(L), Analog Output - continued

The Do-more CPU module assigns the following memory addresses to this module.

| F2-02DA-1(L) WY Addressing |                                   |
|----------------------------|-----------------------------------|
| Address                    | Description                       |
| <i>WYn</i>                 | Channel 1 Output Data (0 to 4095) |
| <i>WYn+1</i>               | Channel 2 Output Data (0 to 4095) |

*WYn*: Starting *WY* address assigned to this module



# F2-02DA-2(L), Analog Output

| F2-02DA-2(L) 2-Channel Analog Voltage Output                 |  |
|--|--|
| <b>Number of Channels</b>                                    | 2  |
| <b>Output Ranges</b>   | 0 to 5V, 0 to 10V, ±5V, ±10V   |
| <b>Resolution</b>  | 12 bit (1 in 4096)   |
| <b>Output Type</b>   | Single ended, 1 common   |
| <b>Peak Output Voltage</b>                                   | 15VDC<br>(clamped by transient voltage suppressor)   |
| <b>Load Impedance</b>  | 2000Ω minimum  |
| <b>Load Capacitance</b>                                      | 0.01 μF maximum  |
| <b>PLC Update Rate</b>                                       | 2 channels per scan maximum  |
| <b>Linearity Error (end to end)</b>                          | ±1 count (0.025% of full scale) maximum  |
| <b>Conversion Settling Time</b>                              | 5μs maximum (full scale change)  |
| <b>Full Scale Calibration Error (not incl. offset error)</b> | ±12 counts max. unipolar @ 77°F (25°C)<br>±16 counts max. bipolar @ 77°F (25°C)  |
| <b>Offset Calibration Error</b>                              | ±3 counts max., unipolar @ 77°F (25°C)<br>±8 counts max., bipolar @ 77°F (25°C)  |
| <b>Accuracy vs. Temperature</b>                              | ±50 ppm/°C full scale calibration change (including maximum offset change of 2 counts)   |
| <b>Maximum Inaccuracy</b>                                    | +0.3% unipolar ranges @ 77°F (25°C)<br>±0.45% unipolar ranges >77°F (25°C)<br>±0.4% bipolar ranges @ 77°F (25°C)<br>±0.55% bipolar ranges >77°F (25°C) |

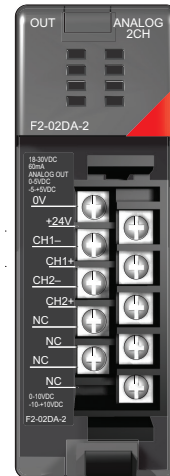
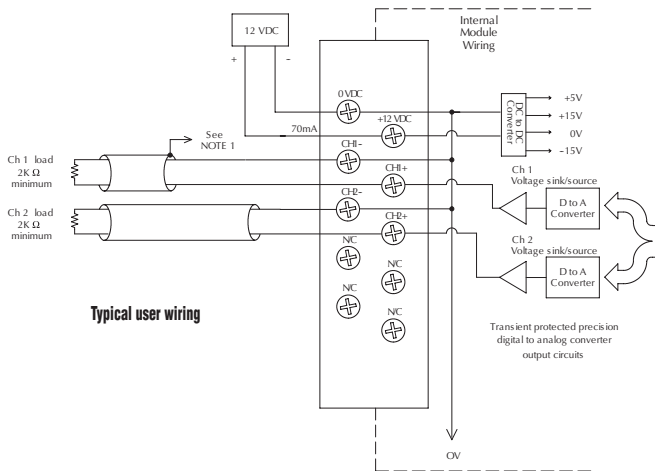
|                                 |   |
|---------------------------------|---|
| <b>Base Power Required 5VDC</b> | 40mA  |
| <b>External Power Supply</b>    | F2-02DA-2: 18 to 30VDC, 60mA (outputs fully loaded)<br>F2-02DA-2L: 10 to 15VDC, 70mA (outputs fully loaded) |
| <b>Operating Temperature</b>    | 32° to 140°F (0° to 60°C)   |
| <b>Storage Temperature</b>      | -4° to 158°F (-20° to 70°C)   |
| <b>Relative Humidity</b>        | 5 to 95% (non-condensing)   |
| <b>Environmental Air</b>        | No corrosive gases permitted  |
| <b>Vibration</b>                | MIL STD 810C 514.2  |
| <b>Shock</b>                    | MIL STD 810C 516.2  |
| <b>Noise Immunity</b>           | NEMA ICS3-304   |
| <b>Terminal Type (included)</b> | Removable; D2-8IOCON  |
| <b>ZIPLink Module</b>           | ZL-RTB20 (Feedthrough)  |
| <b>ZIPLink Cable</b>            | ZL-D2-CBL10 (0.5 m)<br>ZL-D2-CBL10-1 (1.0 m)<br>ZL-D2-CBL10-2 (2.0 m)                                       |

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One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

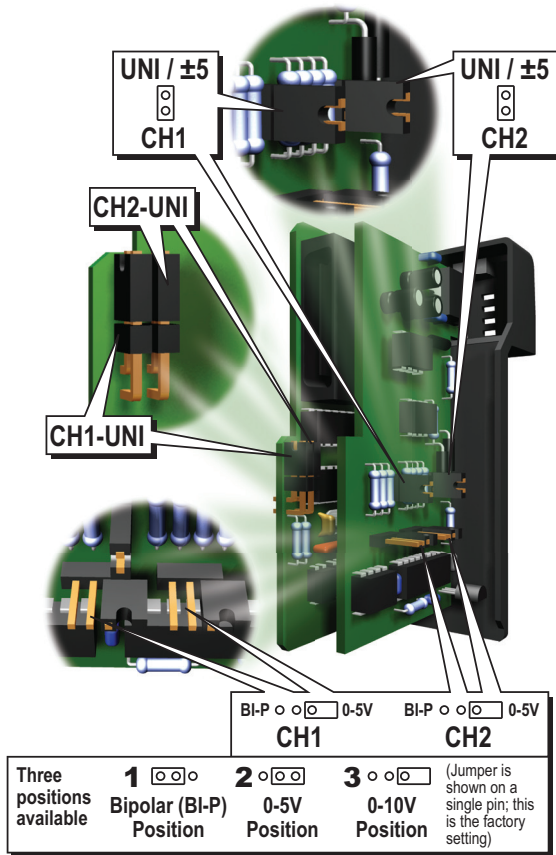
**Note 1:** Shields should be connected to the 0V of the module or the 0V of the P/S.

**Note 2:** Unused voltage outputs should remain open (no connections) for minimum power consumption.



## F2-02DA-2(L), Analog Output - continued

The F2-02DA-2(L) Analog Output module uses jumpers for selecting the voltage ranges for each channel. The range of each channel can be independently set. Available operating ranges are 0–5 V, 0–10 V,  $\pm 5V$ , and  $\pm 10V$ . There are three jumpers for each channel. Two sets are on the top board, and the third set is along the edge of the bottom board with the black D-shell backplane connector. Install or remove these jumpers to select the desired range.



- Two of the top board jumpers are labeled “UNI/ $\pm 5$ ” and there is one for each channel. These jumpers are used in conjunction with the “BI-P 0-5” jumpers to determine output voltage polarity and range.
- The two bottom board jumpers are labeled “UNI” and there is one for each channel. These jumpers determine the format of the channel output data, and the effect of their settings is independent from that of the other jumpers on the module. With a UNI jumper removed, the corresponding channel requires data values in the range of  $\pm 2047$ . With a UNI jumper installed, the channel requires data values in the range of 0 to 4095.
- The other two top board jumpers are labeled “BI-P 0-5” and there is one for each channel. These jumpers are used in conjunction with the “UNI/ $\pm 5$ ” jumpers to determine output voltage polarity and range.



**NOTE:** It is important to set the module jumpers correctly. The module will not operate correctly if the jumpers are not properly set for the desired voltage range.



## F2-02DA-2(L), Analog Output - continued

The table below lists the eight possible combinations of voltage ranges and data formats along with their corresponding jumper settings. For most applications, use one of the four standard selections shown in the shaded blocks in the table. Standard unipolar voltage ranges accept a data format of 0 to 4095. Standard bipolar ranges accept a data format of -2047 to +2047. Unused jumpers can be stored on a single post to prevent losing them.

Yes = Jumper Installed    No = Jumper Removed

| F2-02DA-2(L) Module Jumper Table |                    |                     |                    |                         |               |
|----------------------------------|--------------------|---------------------|--------------------|-------------------------|---------------|
| Voltage Range                    | Output Data Format | UNI/±5V (Top board) | UNI (Bottom board) | BI-P 0-5V (Top board)   |               |
|                                  |                    |                     |                    | BI-P (Bipolar) Position | 0-5V Position |
| <i>0 to 5V</i>                   | <i>0 to 4095</i>   | Yes                 | Yes                | No                      | Yes           |
| <i>0 to 10V</i>                  | <i>0 to 4095</i>   | Yes                 | Yes                | No                      | No            |
| <i>0 to 5V</i>                   | <i>±2047</i>       | Yes                 | No                 | No                      | Yes           |
| <i>0 to 10V</i>                  | <i>±2047</i>       | Yes                 | No                 | No                      | No            |
| <i>±5V</i>                       | <i>±2047</i>       | Yes                 | No                 | Yes                     | No            |
| <i>±10V</i>                      | <i>±2047</i>       | No                  | No                 | Yes                     | No            |
| <i>±5V</i>                       | <i>0 to 4095</i>   | Yes                 | Yes                | Yes                     | No            |
| <i>±10V</i>                      | <i>0 to 4095</i>   | No                  | Yes                | Yes                     | No            |

For example, to select settings of “±5V” voltage range with a “±2047” output data format for channel 1, refer to the table above and the figure on the previous page and arrange the jumpers as follows:

- Install the “CH1” “UNI/±5V” jumper.
- Remove the “CH1-UNI” jumper. Store the jumper so it does not get lost by placing it on one pin.
- Install the “CH1” “BI-P 0-5” jumper in the BI-P (bipolar) position on the left and center pins.

The non-standard selections in the table provide the opposite data format for both unipolar and bipolar voltage ranges. If you are using unipolar output (0–5 V or 0–10 V) on one channel and bipolar output (±5V, ±10V) on the other channel, then one of the outputs will use a non-standard data format.

## F2-02DA-2(L), Analog Output - continued

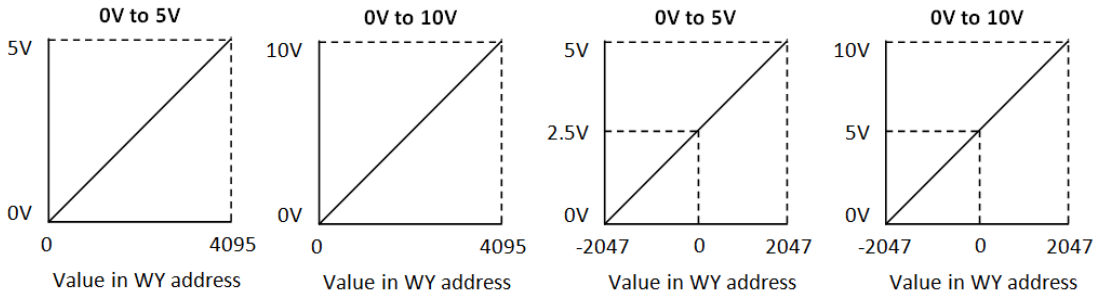
The Do-more CPU module assigns the following memory addresses to this module.

| F2-02DA-2(L) WY Addressing |  |
|----------------------------|--|
| Address                    | Description  |
| WYn                        | Channel 1 Output Data (0 to 4095 or -2047 to 2047) |
| WYn+1                      | Channel 2 Output Data (0 to 4095 or -2047 to 2047) |

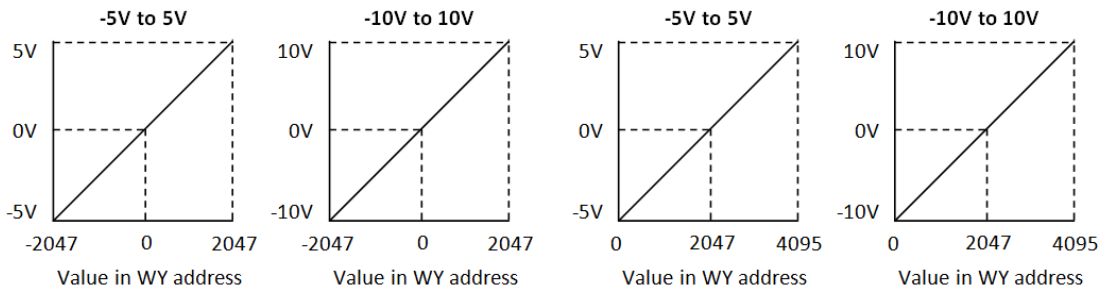
WYn: Starting WY address assigned to this module

### Unipolar Ranges

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### Bipolar Ranges



# F2-02DAS-1, Analog Output

| F2-02DAS-1 2-Channel Isolated Analog Current Output |   |
|---|---|
| <b>Number of Channels</b>                           | 2, isolated   |
| <b>Output Ranges</b>                                | 4–20mA  |
| <b>Resolution</b>                                   | 16 bit (1 in 65536)                                       |
| <b>Output Type</b>                                  | Current sourcing  |
| <b>Isolation Voltage</b>                            | ±750V continuous, channel to channel,<br>channel to logic |
| <b>Base Power Required 5VDC</b>                     | 100mA   |
| <b>Loop Supply</b>                                  | 18–32 VDC   |
| <b>External Power Supply</b>                        | 18–32 VDC @ 50mA per channel                              |
| <b>Output Loop Compliance</b>                       | V <sub>in</sub> - 2.5 V                                   |
| <b>Load Impedance</b>                               | 0–1375 Ω (@ 32V)  |
| <b>Maximum Load/ Power Supply</b>                   | 375Ω /12V, 975Ω /24V, 1375Ω/32V                           |
| <b>PLC Update Rate</b>                              | 2 channels per scan maximum                               |
| <b>Conversion Settling Time</b>                     | 3ms to 0.1% of full scale                                 |
| <b>Linearity Error (end to end)</b>                 | ±10 count (±0.015% of full scale) maximum                 |

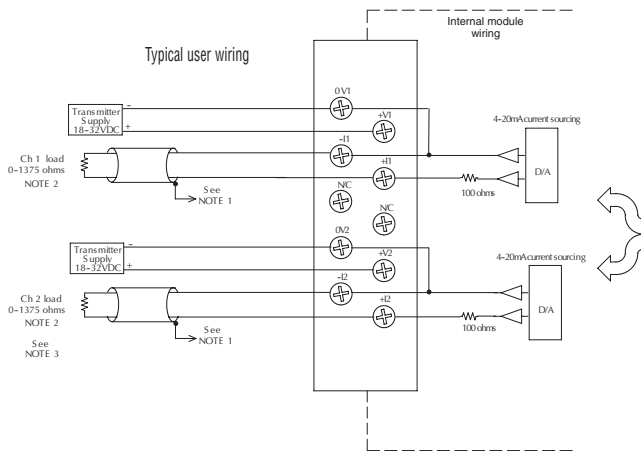
|                                 |   |
|---------------------------------|---|
| <b>Gain Calibration Error</b>   | ±32 counts (±0.05%)   |
| <b>Offset Calibration Error</b> | ±13 counts (±0.02%)   |
| <b>Output Drift</b>             | 50ppm/ °C   |
| <b>Maximum Inaccuracy</b>       | 0.07% @ 25°C (77°F)<br>0.18% 0 to 60°C (32° to 140°F)                 |
| <b>Operating Temperature</b>    | 0° to 60°C (32° to 140°F)   |
| <b>Storage Temperature</b>      | -20° to 70°C (-4° to 158°F)   |
| <b>Relative Humidity</b>        | 5 to 95% (non-condensing)   |
| <b>Environmental air</b>        | No corrosive gases permitted  |
| <b>Vibration</b>                | MIL STD 810C 514.2  |
| <b>Shock</b>                    | MIL STD 810C 516.2  |
| <b>Noise Immunity</b>           | NEMA ICS3-304   |
| <b>Terminal Type (included)</b> | Removable; D2-8IOCON  |
| <b>ZIPLink Module</b>           | ZL-RTB20 (Feedthrough)  |
| <b>ZIPLink Cable</b>            | ZL-D2-CBL10 (0.5 m)<br>ZL-D2-CBL10-1 (1.0 m)<br>ZL-D2-CBL10-2 (2.0 m) |

One count in the specification table is equal to one least significant bit of the analog data value (1 in 65536).

Note 1: Shields should be connected to the 0V terminal of the module.

Note 2: Load must be within compliance voltage.

Note 3: For non-isolated outputs, connect all 0V's together (0V1...0V2) and connect all +V's together (+V...+V2).



## F2-02DAS-1, Analog Output - continued

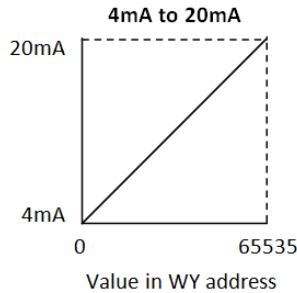
The Do-more CPU module assigns the following memory addresses to this module.

| F2-02DAS-1 WY Addressing |  |
|--------------------------|--|
| Address                  | Description                                      |
| <b>WYn</b>               | Channel 1 Output Data (0 to 65535 <sup>1</sup> ) |
| <b>WYn+1</b>             | Channel 2 Output Data (0 to 65535 <sup>1</sup> ) |

*WYn: Starting WY address assigned to this module*



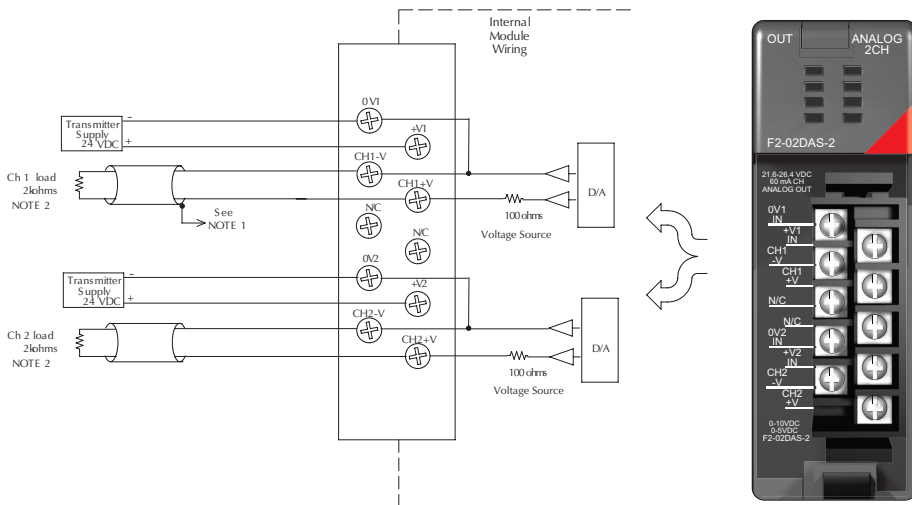
**NOTE 1:** The data format of the WY addresses is 'Signed Word'. They store -32768 to 32767 as default. To read and write 0 to 65535 into these memory addresses, use the casting 'U' (':U' is the casting for 'Unsigned' format). For instance, if WY0 is assigned to the first analog output channel, use 'WY0:U' to access this memory address in the ladder program and other tools in Do-more Designer.



## F2-02DAS-2, Analog Output

| F2-02DAS-2 2-Channel Isolated Analog Voltage Output |   |
|---|---|
| <b>Number of Channels</b>                           | 2, isolated   |
| <b>Output Ranges</b>                                | 0–5 V, 0–10 V   |
| <b>Resolution</b>                                   | 16 bit (1 in 65536)   |
| <b>Output Type</b>                                  | Sourced through external loop supply                                  |
| <b>Isolation Voltage</b>                            | ±750V continuous, channel to channel, channel to logic                |
| <b>Base Power Required 5VDC</b>                     | 60mA  |
| <b>External Power Supply</b>                        | 21.6–26.4 VDC @ 60mA per channel                                      |
| <b>Load Impedance</b>                               | 2kΩ min   |
| <b>PLC Update Rate</b>                              | 2 channels per scan maximum   |
| <b>Conversion Settling Time</b>                     | 3ms to 0.1% of full scale   |
| <b>Linearity Error (end to end)</b>                 | ±10 count (±0.015% of full scale) maximum                             |
| <b>Gain Calibration Error</b>                       | ±32 counts (±0.05%)   |
| <b>Offset Calibration Error</b>                     | ±13 counts (±0.02%)   |
| <b>Output Drift</b>                                 | 50ppm/°C  |
| <b>Maximum Inaccuracy</b>                           | 0.07% @ 25°C (77°F)<br>0.18% 0 to 60°C (32° to 140°F)                 |
| <b>Operating Temperature</b>                        | 0° to 60°C (32° to 140°F)   |
| <b>Storage Temperature</b>                          | -20° to 70°C (-4° to 158°F)   |
| <b>Relative Humidity</b>                            | 5 to 95% (non-condensing)   |
| <b>Environmental air</b>                            | No corrosive gases permitted  |
| <b>Vibration</b>                                    | MIL STD 810C 514.2  |
| <b>Shock</b>  | MIL STD 810C 516.2  |
| <b>Noise Immunity</b>                               | NEMA ICS3-304   |
| <b>Terminal Type (included)</b>                     | Removable; D2-8IOCON  |
| <b>ZIPLink Module</b>                               | ZL-RTB20 (Feedthrough)  |
| <b>ZIPLink Cable</b>                                | ZL-D2-CBL10 (0.5 m)<br>ZL-D2-CBL10-1 (1.0 m)<br>ZL-D2-CBL10-2 (2.0 m) |

**Note1:** Shields should be connected to the 0V of the module or the 0V of the P/S.



## F2-02DAS-2, Analog Output - continued

### Setting the Module Jumpers

The F2-02DAS-2 Analog Output module uses jumpers for selecting the voltage range for each channel. The range of each channel can be independently set. The available operating ranges are 0–5 V and 0–10 V.

There is one jumper for each channel. Install or remove these jumpers to select the desired range. See the figures below to find the jumpers on your module. The module is set from the factory for the 0–5 V range. Refer to the following table in order to configure module differently. Unused jumpers can be stored on a single post to prevent losing them.

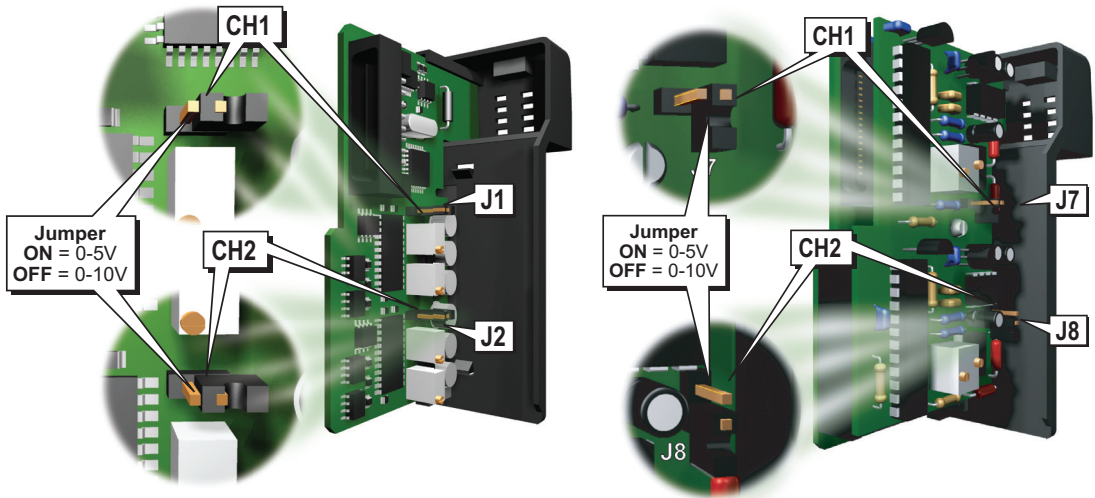


**NOTE:** It is important to set the module jumpers correctly. The module will not operate correctly if the jumpers are not properly set for the desired voltage range.

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Yes = Jumper Installed    No = Jumper Removed

| F2-02DAS-2 Module Jumper Table |                   |
|--------------------------------|-------------------|
| Voltage Range                  | 0-5V/0-10V Jumper |
| 0 to 5V                        | Yes               |
| 0 to 10V                       | No                |



## F2-02DAS-2, Analog Output - continued

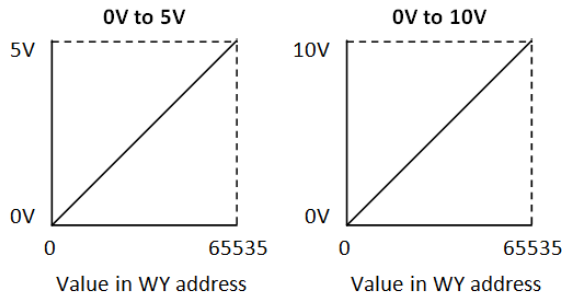
The Do-more CPU module assigns the following memory addresses to this module.

| F2-02DAS-2 WY Addressing |  |
|--------------------------|--|
| Address                  | Description                                      |
| <b>WYn</b>               | Channel 1 Output Data (0 to 65535 <sup>1</sup> ) |
| <b>WYn+1</b>             | Channel 2 Output Data (0 to 65535 <sup>1</sup> ) |

*WYn: Starting WY address assigned to this module*



**NOTE 1:** The data format of the WY addresses is 'Signed Word'. They store -32768 to 32767 as default. To read and write 0 to 65535 into these memory addresses, use the casting ':U' (':U' is the casting for 'Unsigned' format). For instance, if WY0 is assigned to the first analog output channel, use 'WY0:U' to access this memory address in the ladder program and other tools in Do-more Designer.

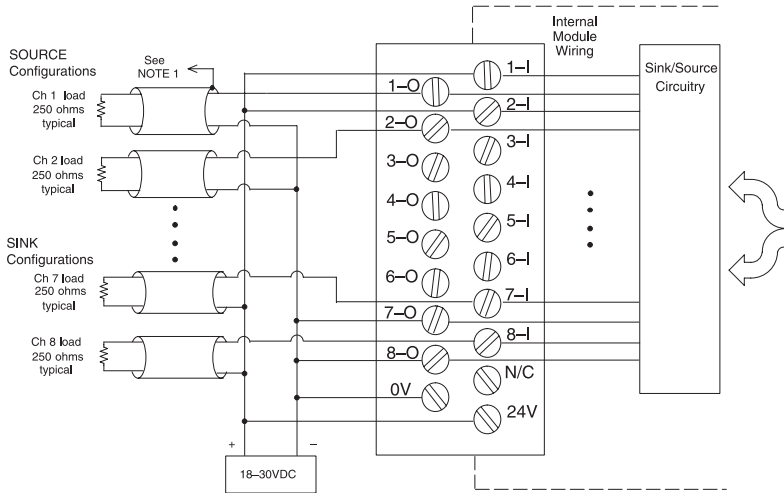


# F2-08DA-1, Analog Output

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| F2-08DA-1 8-Channel Analog Current Output  |  |
|--|--|
| <b>Number of Channels</b>  | 8, single-ended  |
| <b>Output Ranges</b>   | 4 to 20mA  |
| <b>Resolution</b>  | 12 bit (1 in 4096)   |
| <b>Output Type</b>   | Current sinking or current sourcing  |
| <b>Base Power Required 5VDC</b>  | 30mA   |
| <b>Maximum Loop Voltage</b>  | 30VDC  |
| <b>External Power Supply</b>   | 18 to 30VDC, 50mA., class 2<br>(Add 20mA for each current loop used)   |
| <b>Source Load</b>   | 0-400 Ω @ 18-30 VDC  |
| <b>Sink Load</b>   | 0-600Ω/18V, 0-900Ω/24V, 0-1200Ω/30V  |
| <b>Total Load (sink + source)</b>  | 600Ω/18V, 900Ω/24V, 1200Ω/30V  |
| <b>PLC Update Rate</b>   | 8 channels per scan maximum  |
| <b>Conversion Settling Time</b>  | 400µs maximum (full scale change)  |
| <b>Linearity Error (end to end)</b>  | ±2 count (±0.050% of full scale) maximum   |
| <b>Full Scale Calibration Error</b>  | ±12 counts max. sinking @ any load<br>±12 counts max. sourcing @ 125Ω load<br>±18 counts max. sourcing @ 250Ω load<br>±26 counts max. sourcing @ 400Ω load |
| <b>Offset Calibration Error</b>  | ±9 counts max. sinking @ any load<br>±9 counts max. sourcing @ 125Ω load<br>±11 counts max. sourcing @ 250Ω load<br>±13 counts max. sourcing @ 400Ω load   |
| <b>Maximum Full Scale Inaccuracy @ 60°C</b>                                      | 0.5% sinking (any load) sinking & sourcing @ 125Ω load<br>0.64% sourcing @ 250Ω load<br>0.83% sourcing @ 400Ω load   |
| <b>Maximum Full Scale Inaccuracy @ 25°C (Includes all errors and temp drift)</b> | 0.3% sinking (any load) sinking & sourcing @ 125Ω load<br>0.44% sourcing @ 250Ω load<br>0.63% sourcing @ 400Ω load   |
| <b>Operating Temperature</b>   | 32° to 140°F (0° to 60°C)  |
| <b>Storage Temperature</b>   | -4 to 158°F (-20 to 70°C)  |
| <b>Relative Humidity</b>   | 5% to 95% (non-condensing)   |
| <b>Environmental air</b>   | No corrosive gases permitted   |
| <b>Vibration</b>   | MIL STD 810C 514.2   |
| <b>Shock</b>   | MIL STD 810C 516.2   |
| <b>Noise Immunity</b>  | NEMA ICS3-304  |
| <b>Terminal Type (included)</b>  | Removable; D2-16IOCON  |
| <b>ZIPLink Module</b>  | ZL-RTB20 (Feedthrough)   |
| <b>ZIPLink Cable</b>   | ZL-D2-CBL19 (0.5 m)<br>ZL-D2-CBL19-1 (1.0 m)<br>ZL-D2-CBL19-2 (2.0 m)<br>ZL-D2-CBL19-1P (1.0 m Pigtail)<br>ZL-D2-CBL19-2P (2.0 m Pigtail)                  |

Note 1: Shields should be connected to the 0V of the module.



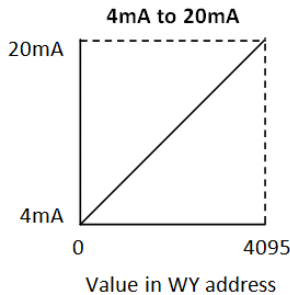


## F2-08DA-1, Analog Output - continued

The Do-more CPU module assigns the following memory addresses to this module.

| F2-08DA-1 WY Addressing |                                   |
|-------------------------|-----------------------------------|
| Address                 | Description                       |
| <b>WY<sub>n</sub></b>   | Channel 1 Output Data (0 to 4095) |
| <b>WY<sub>n+1</sub></b> | Channel 2 Output Data (0 to 4095) |
| <b>WY<sub>n+2</sub></b> | Channel 3 Output Data (0 to 4095) |
| <b>WY<sub>n+3</sub></b> | Channel 4 Output Data (0 to 4095) |
| <b>WY<sub>n+4</sub></b> | Channel 5 Output Data (0 to 4095) |
| <b>WY<sub>n+5</sub></b> | Channel 6 Output Data (0 to 4095) |
| <b>WY<sub>n+6</sub></b> | Channel 7 Output Data (0 to 4095) |
| <b>WY<sub>n+7</sub></b> | Channel 8 Output Data (0 to 4095) |

*WY<sub>n</sub>: Starting WY address assigned to this module*



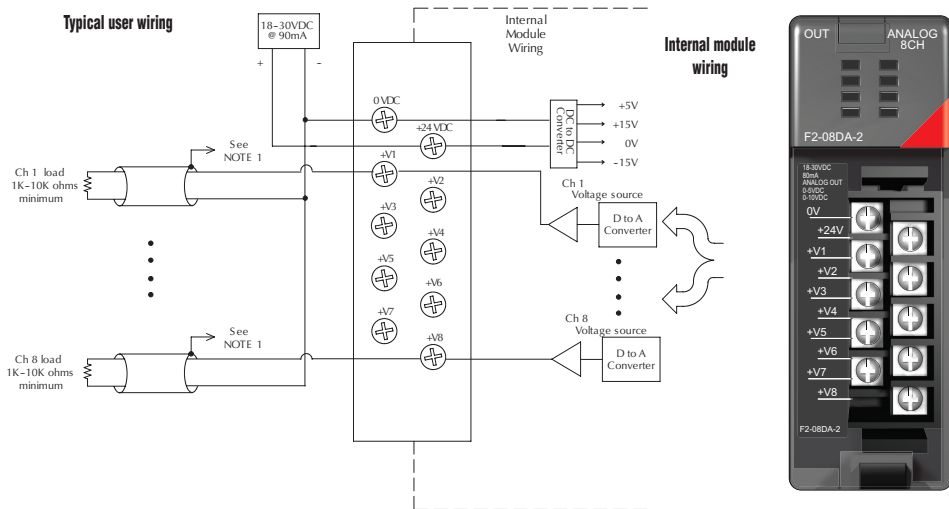
## F2-08DA-2, Analog Output

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| F2-08DA-2 8-Channel Analog Voltage Output |  |
|---|--|
| <b>Number of Channels</b>                 | 8, single-ended, 1 common  |
| <b>Output Ranges</b>                      | 0 to 5V, 0 to 10V  |
| <b>Resolution</b>                         | 12 bit (1 in 4096)   |
| <b>Output Type</b>                        | Voltage sourcing   |
| <b>Base Power Required 5VDC</b>           | 60mA   |
| <b>External Power Supply</b>              | 21.6-26.4 VDC, 140mA (outputs fully loaded)  |
| <b>Peak Output Voltage</b>                | 15VDC (clamped by transient voltage suppressor)  |
| <b>Load Impedance</b>                     | 1–10 kΩ  |
| <b>Load Capacitance</b>                   | 0.01 μF maximum  |
| <b>PLC Update Rate</b>                    | 8 channels per scan maximum  |
| <b>Conversion Settling Time</b>           | 400μs maximum (full scale change)<br>4.5 ms to 9ms for digital out to analog out       |
| <b>Linearity Error (end to end)</b>       | ±1 count (±0.025% of full scale) maximum   |
| <b>Full Scale Calibration Error</b>       | ±12 counts max. unipolar @ 25°C (77°F)   |
| <b>Offset Calibration Error</b>           | ±3 counts max., unipolar @ 25°C (77°F)   |
| <b>Accuracy vs. Temperature</b>           | ±57ppm/ °C full scale calibration change (including maximum offset change of 2 counts) |
| <b>Maximum Inaccuracy</b>                 | ±0.3% @ 25°C (77°F)<br>±0.45% @ 0-60°C (32-140°F)                                      |
| <b>Operating Temperature</b>              | 0° to 60°C (32° to 140°F)  |
| <b>Storage Temperature</b>                | -20° to 70°C (-4° to 158°F)  |
| <b>Relative Humidity</b>                  | 5 to 95% (non-condensing)  |
| <b>Environmental air</b>                  | No corrosive gases permitted   |
| <b>Vibration</b>                          | MIL STD 810C 514.2   |
| <b>Shock</b>                              | MIL STD 810C 516.2   |
| <b>Noise Immunity</b>                     | NEMA ICS3-304  |
| <b>Terminal Type (included)</b>           | Removable; D2-8IOCON   |
| <b>ZIPLink Module</b>                     | ZL-RTB20 (Feedthrough)   |
| <b>ZIPLink Cable</b>                      | ZL-D2-CBL10 (0.5 m)<br>ZL-D2-CBL10-1 (1.0 m)<br>ZL-D2-CBL10-2 (2.0 m)                  |

One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

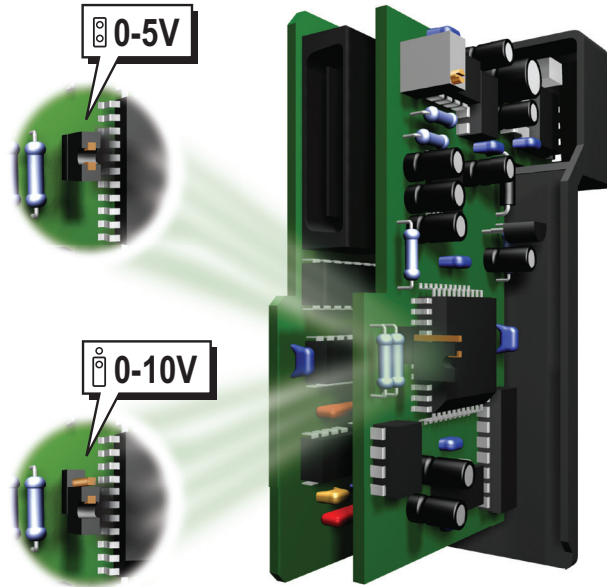
Note 1: Shields should be connected to the 0V of the module.



## F2-08DA-2, Analog Output- continued

### Setting the Module Jumpers

The F2-08DA-2 module uses one jumper to select between the 0–5 V or 0–10 V operating ranges. Refer to the following figure and table for proper selection of voltage range. The output data format remains 0–4095 for either voltage range selected. Unused jumpers can be stored on a single post to prevent losing them.



Yes = Jumper Installed    No = Jumper Removed

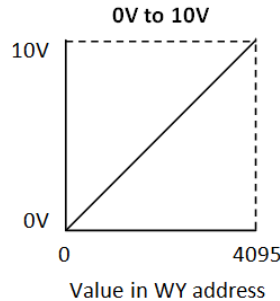
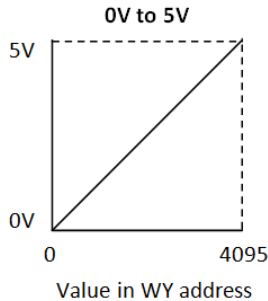
| F2-08DA-2 Module Jumper Table |                    |                                 |
|-------------------------------|--------------------|---------------------------------|
| Voltage Range                 | Output Data Format | 0–5 V/0–10 V Jumper (top board) |
| 0 to 5V                       | 0 to 4095          | Yes                             |
| 0 to 10V                      | 0 to 4095          | No                              |

## F2-08DA-2, Analog Output- continued

The Do-more CPU module assigns the following memory addresses to this module.

| F2-08DA-2 WY Addressing |                                   |
|-------------------------|-----------------------------------|
| Address                 | Description                       |
| <b>WYn</b>              | Channel 1 Output Data (0 to 4095) |
| <b>WYn+1</b>            | Channel 2 Output Data (0 to 4095) |
| <b>WYn+2</b>            | Channel 3 Output Data (0 to 4095) |
| <b>WYn+3</b>            | Channel 4 Output Data (0 to 4095) |
| <b>WYn+4</b>            | Channel 5 Output Data (0 to 4095) |
| <b>WYn+5</b>            | Channel 6 Output Data (0 to 4095) |
| <b>WYn+6</b>            | Channel 7 Output Data (0 to 4095) |
| <b>WYn+7</b>            | Channel 8 Output Data (0 to 4095) |

*WYn: Starting WY address assigned to this module*

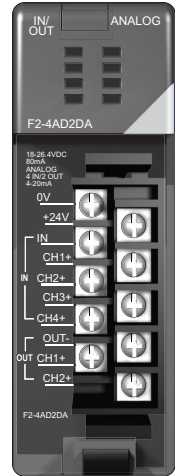
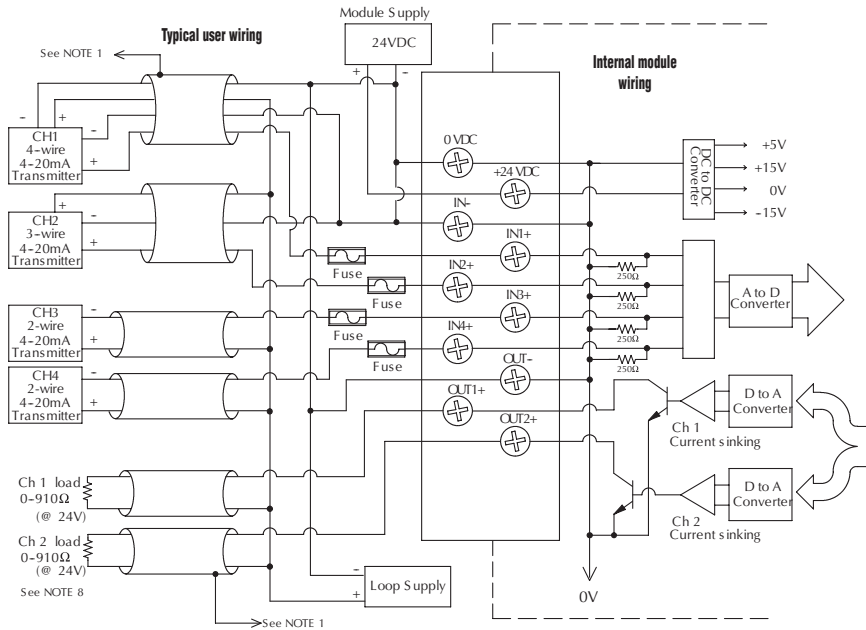


## F2-4AD2DA, Analog Input/Output

| F2-4AD2DA 4-Channel Analog Current Input / 2-Channel Analog Current Output |  |  |  |
|--|--|--|--|
| <b>Number of Input Channels</b>  | 4, single-ended (1 common)                               | <b>Accuracy vs. Temperature</b>          | ±50ppm/ °C full scale calibration change (including maximum offset change) |
| <b>Number of Output Channels</b>   | 2, single-ended (1 common)                               | <b>Maximum Inaccuracy</b>                | ±0.1% @ 77°F (25°C)<br>±0.3% @ 32 to 140°F (0 to 60°C)                     |
| <b>Ranges</b>  | 4 to 20mA current (Current sinking)                      | <b>PLC Update Rate</b>                   | 4 input channels per scan maximum<br>2 output channels per scan maximum    |
| <b>Resolution</b>  | 12 bit (1 in 4096)                                       | <b>Base Power Required 5VDC</b>          | 90mA   |
| <b>Peak Withstanding Voltage</b>   | 75VDC, current outputs                                   | <b>External Power Supply Requirement</b> | 18–26.4 VDC @ 80mA<br>20mA per loop  |
| <b>Maximum Continuous Overload</b>   | -40 to +40mA, each current output                        | <b>Operating Temperature</b>             | 32° to 140°F (0° to 60°C)  |
| <b>Input Impedance</b>   | 250Ω, ±0.1%, 1/2W,<br>25ppm/ °C current input resistance | <b>Storage Temperature</b>               | -4° to 158°F (-20° to 70°C)  |
| <b>External Load Resistance</b>  | 0Ω minimum, current outputs                              | <b>Relative Humidity</b>                 | 5 to 95% (non-condensing)  |
| <b>Maximum Loop Supply</b>   | 30VDC  | <b>Environmental Air</b>                 | No corrosive gases permitted   |
| <b>Recommended Fuse</b>  | 0.032 A, series 217 fast-acting, current inputs          | <b>Vibration</b>                         | MIL STD 810C 514.2   |
| <b>Maximum Load/Power Supply</b>   | 910Ω/24V, current outputs<br>620Ω/18V, 1200 Ω/30 V       | <b>Shock</b>                             | MIL STD 810C 516.2   |
| <b>Active Low-pass Filter</b>  | -3dB @ 20Hz, 2 poles (-12dB per octave)                  | <b>Noise Immunity</b>                    | NEMA ICS3-304  |
| <b>Linearity Error (best fit)</b>  | ±1 count (±0.025% of full scale) maximum                 | <b>Terminal Type (included)</b>          | Removable; D2-8IOCON   |
| <b>Output Settling Time</b>  | 100μs maximum (full scale change)                        | <b>ZIPLink Module</b>                    | ZL-RTB20 (Feedthrough)   |
|  |  | <b>ZIPLink Cable</b>                     | ZL-D2-CBL10 (0.5 m)<br>ZL-D2-CBL10-1 (1.0 m)<br>ZL-D2-CBL10-2 (2.0 m)      |

# F2-4AD2DA, Analog Input/Output - continued

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One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096).

**Note 1:** Shields should be connected at their respective signal source.

**Note 2:** Unused channel should remain open for minimum power consumption.

**Note 3:** More than one external power supply can be used provided the power supply commons are connected.

**Note 4:** A Series 217, 0.032A fast-acting fuse is recommended for 4-20 mA current input loops.

**Note 5:** If the power supply common of an external power supply is not connected to 0 VDC on the module, then the output of the external transmitter must be isolated. To avoid "ground loop" errors, recommended 4-20 mA transmitter types are: 2 or 3 wire - Isolation between input signal and power supply or 4 wire - Isolation between input signal, power supply, and 4-20 mA output.

**Note 6:** If an analog channel is connected backwards, then erroneous data values will be returned for that channel.

**Note 7:** To avoid small errors due to terminal block losses, connect 0 VDC, IN-, and OUT- on the terminal block as shown. The module's internal connection alone of these nodes is not sufficient to permit module performance up to the accuracy specifications.

**Note 8:** Choose an output transducer resistance according to the maximum load/power listed in the Output Specifications.

## F2-4AD2DA, Analog Input/Output - continued

The Do-more CPU module assigns the following memory addresses to this module.

| F2-4AD2DA X Addressing |   |
|------------------------|---|
| Address                | Description   |
| $Xn$                   | On when the external 24VDC input power is missing or terminal block is removed. |
| $Xn+1$                 | On when the external 24VDC input power is missing or terminal block is removed. |
| $Xn+2$                 | On when the external 24VDC input power is missing or terminal block is removed. |
| $Xn+3$                 | On when the external 24VDC input power is missing or terminal block is removed. |
| $Xn+4$                 | Not used  |
| $Xn+5$                 | Not used  |
| $Xn+6$                 | Not used  |
| $Xn+7$                 | Not used  |

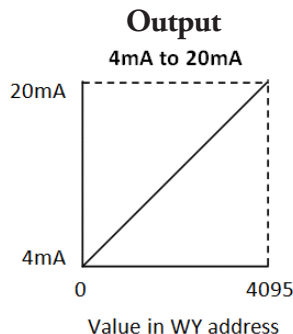
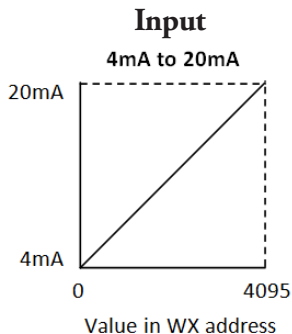
*Xn: Starting X address assigned to this module*

| F2-4AD2DA WX Addressing |                                  |
|-------------------------|----------------------------------|
| Address                 | Description                      |
| $WXn$                   | Channel 1 Input Data (0 to 4095) |
| $WXn+1$                 | Channel 2 Input Data (0 to 4095) |
| $WXn+2$                 | Channel 3 Input Data (0 to 4095) |
| $WXn+3$                 | Channel 4 Input Data (0 to 4095) |

*WXn: Starting WX address assigned to this module*

| F2-4AD2DA WY Addressing |                                   |
|-------------------------|-----------------------------------|
| Address                 | Description                       |
| $WYn$                   | Channel 1 Output Data (0 to 4095) |
| $WYn+1$                 | Channel 2 Output Data (0 to 4095) |

*WYn: Starting WY address assigned to this module*



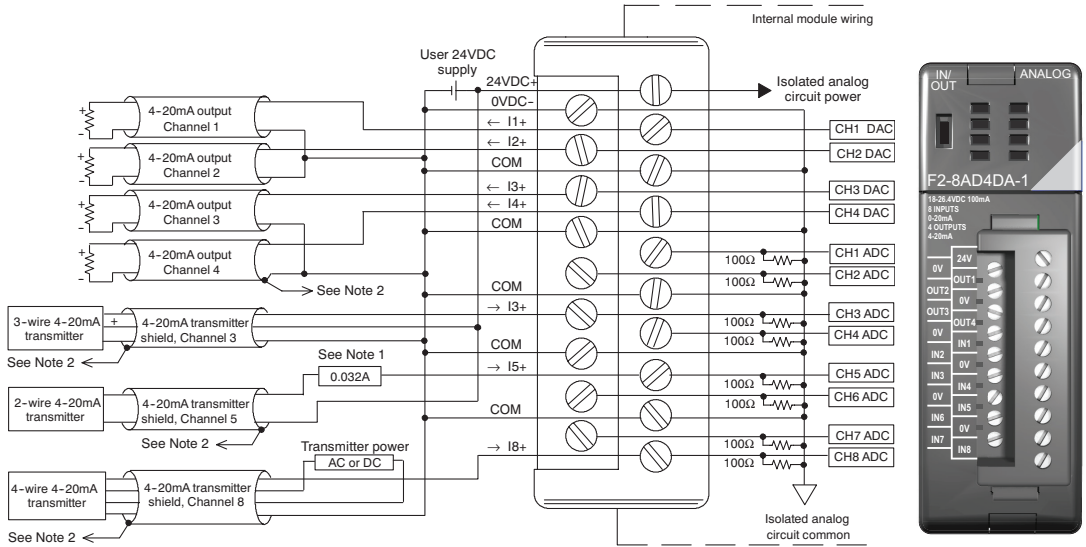
## F2-8AD4DA-1 Analog Input/Output

| F2-8AD4DA-1 8-Channel Analog Current Input / 4-Channel Analog Current Output |   |
|--|---|
| <b>Input Channels per Module</b>   | 8, single ended (one common)  |
| <b>Input Range</b>   | 0 to 20mA   |
| <b>Resolution</b>  | 12, 14, 16-bit selectable   |
| <b>External DC Power Required</b>  | 100mA @ 18–26.4 VDC   |
| <b>Max. Continuous Overload</b>  | ±45mA   |
| <b>Input Impedance</b>   | 100Ω 0.1% 1/4W  |
| <b>Filter Characteristics</b>  | Active low pass, -3dB @ 80 Hz   |
| <b>Conversion Time</b>   | 12-bit = 1.5 ms per channel<br>14-bit = 6ms per channel<br>16-bit = 25ms per channel  |
| <b>Conversion Method</b>   | Over sampling successive approximation  |
| <b>Accuracy vs. Temperature</b>  | ±25ppm / °C Max.  |
| <b>Maximum Inaccuracy</b>  | 0.1% of range   |
| <b>Linearity Error (End to End)</b>  | 12-bit = ±2 count max. (±0.06% of range)<br>14-bit = ±10 count max. (±0.06% of range)<br>16-bit = ±20 count max. (±0.06% of range)<br>Monotonic with no missing codes |
| <b>Full Scale Calibration Error (not incl. offset error)</b>                 | ±0.07% of range max.  |
| <b>Offset Calibration Error</b>  | ±0.03% of range max.  |
| <b>Rec. Fuse (external)</b>  | 0.032A, Littelfuse Series 217 fast-acting   |
| <b>Base Power Required 5VDC</b>  | 35mA  |
| <b>Output Channels per Module</b>  | 4   |
| <b>Output Range</b>  | 4 to 20mA   |
| <b>Resolution</b>  | 16-bit, 0.244 mA/bit  |
| <b>Output Type</b>   | Current sourcing at 20mA max.   |
| <b>Load Impedance</b>  | 0–750 Ω   |
| <b>Max. Inaccuracy</b>   | 0.25% of range  |
| <b>Max. Full Scale Calibration Error (not incl. offset error)</b>            | ±0.075% of range max.   |
| <b>Max. Offset Calibration Error</b>   | ±0.1% of range max.   |
| <b>Accuracy vs. Temperature</b>  | ±25ppm/ °C max. full scale calibration change (± 0.0025% of range / °C)   |
| <b>Max. Crosstalk at DC, 50/60Hz</b>   | -70dB, 1 LSB  |
| <b>Linearity Error (End to End)</b>  | ±1 count max. (±0.025% of full scale)<br>Monotonic with no missing codes  |
| <b>Output Stability and Repeatability</b>                                    | ±1 LSB after 10 min. warm-up typical  |
| <b>Output Ripple</b>   | 0.005% of full scale  |
| <b>Output Settling Time</b>  | 0.5 ms max., 5µs min. (full scale change)   |
| <b>Max. Continuous Overload</b>  | Outputs open circuit protected  |
| <b>Type of Output Protection</b>   | Electronically current limited to 20mA or less  |
| <b>Output Signal at Power-up and Power-down</b>                              | 4mA   |
| <b>Terminal Type (included)</b>  | Removable; D2-16IOCON   |
| <b>ZIPLink Module</b>  | ZL-RTB20 (Feedthrough)  |
| <b>ZIPLink Cable</b>   | ZL-D2-CBL19 (0.5 m)<br>ZL-D2-CBL19-1 (1.0 m)<br>ZL-D2-CBL19-2 (2.0 m)<br>ZL-D2-CBL19-1P (1.0 m Pigtail)<br>ZL-D2-CBL19-2P (2.0 m Pigtail)                             |

**NOTE:** Module revision B1 or newer of the F2-8AD4DA-1 (found on the product label) must be used with the Do-more PLC.



# F2-8AD4DA-1 Analog Input/Output - continued



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Note 1: A Littelfuse Series 217, 0.032A fast-acting fuse is recommended for all 4-20mA current loop inputs.  
 Note 2: Connect shields to the 0V of the module; do not connect both ends of shield.

## F2-8AD4DA-1 Analog Input/Output - continued

| F2-8AD4DA-1 X Addressing |  |
|--------------------------|--|
| Address                  | Description  |
| $Xn$                     | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. |
| $Xn+1$                   | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. |
| $Xn+2$                   | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. |
| $Xn+3$                   | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. |
| $Xn+4$                   | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. |
| $Xn+5$                   | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. |
| $Xn+6$                   | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. |
| $Xn+7$                   | On when the transmitter is broken, the external 24VDC input power is missing or terminal block is removed. |

*Xn: Starting X address assigned to this module*

| F2-8AD4DA-1 WX Addressing |  |
|---------------------------|--|
| Address                   | Description  |
| $WXn$                     | Channel 1 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+1$                   | Channel 2 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+2$                   | Channel 3 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+3$                   | Channel 4 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+4$                   | Channel 5 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+5$                   | Channel 6 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+6$                   | Channel 7 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+7$                   | Channel 8 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |

*WXn: Starting WX address assigned to this module*

The Do-more CPU module assigns the following memory addresses to this module.

The resolution of each analog input channel can be selected separately. Available resolutions are 12 bit (0 to 4095), 14 bit (0 to 16383) and 16 bit (0 to 65535). You need to use the memory address  $WYn+4$  to select the resolutions. Please refer to the next page for details.

**NOTE 1:** The data format of the WX addresses is 'Signed Word'. They store -32768 to 32767 as default. To read and write 0 to 65535 into these memory addresses, use the casting ':U' (':U' is the casting for 'Unsigned' format). For instance, if you selected the 16 bit resolution for the first analog input channel and  $WX0$  is assigned to the channel, use  $WX0:U$  to access this memory address in the ladder program and other tools in Do-more Designer.



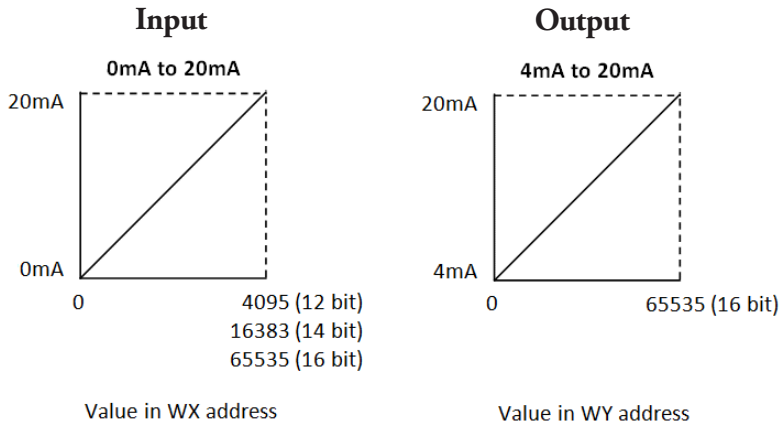
## F2-8AD4DA-1 Analog Input/Output - continued

| F2-8AD4DA-1 WY Addressing |  |
|---------------------------|--|
| Address                   | Description                                      |
| WYn                       | Channel 1 Output Data (0 to 65535 <sup>2</sup> ) |
| WYn+1                     | Channel 2 Output Data (0 to 65535 <sup>2</sup> ) |
| WYn+2                     | Channel 3 Output Data (0 to 65535 <sup>2</sup> ) |
| WYn+3                     | Channel 4 Output Data (0 to 65535 <sup>2</sup> ) |
| WYn+4                     | Input Resolution Selection                       |
| WYn+5                     | Not used   |
| WYn+6                     | Input Track and Hold Selection                   |

WYn: Starting WY address assigned to this module



**NOTE 2:** The data format of the WY addresses is 'Signed Word'. They store -32768 to 32767 as default. To read and write 0 to 65535 into these memory addresses, use the casting 'U' ('U' is the casting for 'Unsigned' format). For instance, if WY0 is assigned to the first analog output channel, use 'WY0:U' to access this memory address in the ladder program and other tools in Do-more Designer.

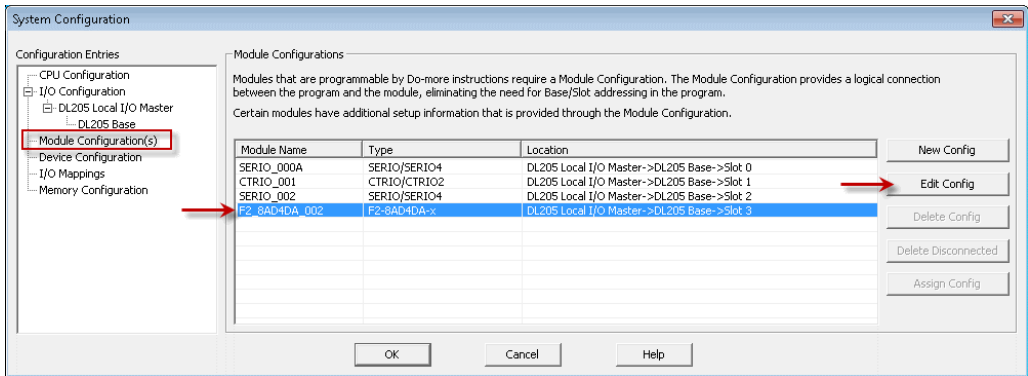


# F2-8AD4DA-1 Analog Input/Output - continued

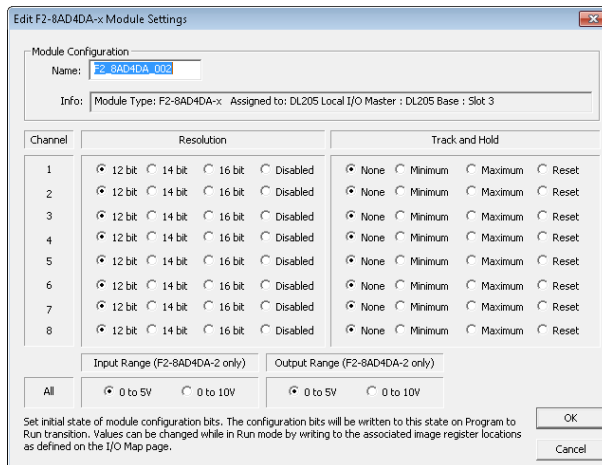
## Input Configuration Using Do-more Designer Version 1.1 or Newer

Using the Module Configurations section of the Do-more Designer System Configuration, each of the eight input channels can be individually configured for resolutions: 12, 14, or 16 bit, configured for track and hold options: None (no hold), Minimum, Maximum, or Reset held value, or each input can be individually disabled.

From the System Configurations page, select Module Configuration(s) in the tab on the left. The screen below will appear showing the modules that are pre-configurable. Select the Type F2-8AD4DA-x in the table and click the Edit Config button on the right hand side.



Once the Edit Config button is selected, the Module Settings page shown below will open. From this page each input channel can be configured with Resolution and/or Track and Hold options. Select the radial button next to the desired option for each input and select the OK button when done.



**NOTE:** The Input and Output Range selections are for the F2-8AD4DA-2 module only.

## F2-8AD4DA-1 Analog Input/Output - continued

### Input Resolution Selection (WYn+4)

If not using Do-more Designer version 1.1 or newer, each of the eight input channels can be individually configured for 12, 14, or 16 bit resolution or disabled with memory address WYn+4 (WYn: Starting WY address assigned to this module). Two (2) bits in this memory address are assigned to each analog input channel.

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 15   | 14   | 13   | 12   | 11   | 10   | 9    | 8    | 7    | 6    | 5    | 4    | 3    | 2    | 1    | 0    |
| R-8H | R-8L | R-7H | R-7L | R-6H | R-6L | R-5H | R-5L | R-4H | R-4L | R-3H | R-3L | R-2H | R-2L | R-1H | R-1L |

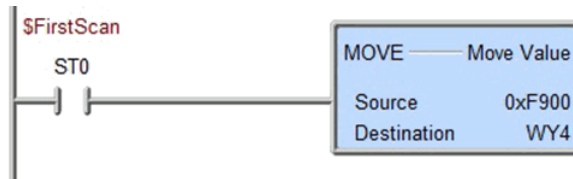
| Channel Resolution Selection Table |   |  |
|------------------------------------|---|--|
| Input Resolution                   | RnH<br>(Resolution channel n<br>High bit) | RnL<br>(Resolution channel<br>n Low bit) |
| 12 bit                             | 0   | 0  |
| 14 bit                             | 0   | 1  |
| 16 bit                             | 1   | 0  |
| Disabled                           | 1   | 1  |

The HEX data format is used to set up the input resolution as seen in the following example.

Example: An F2-8AD4DA-1 is installed in slot 0 and WY4 is used for the input resolution selection. Input channels 1-4 are 12 bit, channel 5 is 14 bit, channel 6 is 16 bit, and channels 7 and 8 are disabled. In this case, 0xF900 needs to be written into WY4.

Use the MOVE instruction to write the Hex value 0xF900 into WY4.

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 15   | 14   | 13   | 12   | 11   | 10   | 9    | 8    | 7    | 6    | 5    | 4    | 3    | 2    | 1    | 0    |
| R-8H | R-8L | R-7H | R-7L | R-6H | R-6L | R-5H | R-5L | R-4H | R-4L | R-3H | R-3L | R-2H | R-2L | R-1H | R-1L |
| 1    | 1    | 1    | 1    | 1    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| F    |      |      |      | 9    |      |      |      | 0    |      |      |      | 0    |      |      |      |



## F2-8AD4DA-1 Analog Input/Output - continued

### Input Track and Hold Selection (WYn+6)

The track and hold feature for each of the eight inputs can be individually configured for minimum, maximum, no hold, or reset held value with memory address WYn+6 (WYn: Starting WY address assigned to this module). This configuration can be changed “on the fly” while the program is running. Two (2) bits in this memory address are assigned to each analog input channel.

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 15   | 14   | 13   | 12   | 11   | 10   | 9    | 8    | 7    | 6    | 5    | 4    | 3    | 2    | 1    | 0    |
| T-8H | T-8L | T-7H | T-7L | T-6H | T-6L | T-5H | T-5L | T-4H | T-4L | T-3H | T-3L | T-2H | T-2L | T-1H | T-1L |

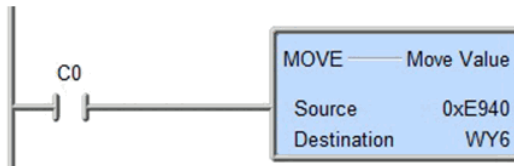
| Channel Track and Hold Selection Table |  |   |                                    |
|--|--|---|------------------------------------|
| Track and Hold Select                  | TnH<br>(Track and Hold channel n High bit) | TnL<br>(Track and Hold channel n Low bit) | Result                             |
| <i>No Track and Hold</i>               | 0  | 0   | Returns real time input value      |
| <i>Track and Hold Minimum Value</i>    | 0  | 1   | Maintains lowest measured value    |
| <i>Track and Hold Maximum Value</i>    | 1  | 0   | Maintains highest measured value   |
| <i>Reset Track and Hold Value</i>      | 1  | 1   | Resets previously held input value |

The HEX data format is used to set up the track and hold option as seen in the following example.

Example: An F2-8AD4DA-1 is installed in slot 0 and WY6 is used for the track and hold selection. Input channel track and hold settings: ch 1-3 = none, ch 4-5 = minimum, ch 6-7 = maximum, ch 8 = reset. In this case, 0xE940 needs to be written into WY6.

Use the MOVE instruction to write the Hex value 0xE940 into WY6.

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 15   | 14   | 13   | 12   | 11   | 10   | 9    | 8    | 7    | 6    | 5    | 4    | 3    | 2    | 1    | 0    |
| T-8H | T-8L | T-7H | T-7L | T-6H | T-6L | T-5H | T-5L | T-4H | T-4L | T-3H | T-3L | T-2H | T-2L | T-1H | T-1L |
| 1    | 1    | 1    | 0    | 1    | 0    | 0    | 1    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    |
| E    |      |      |      | 9    |      |      |      | 4    |      |      |      | 0    |      |      |      |

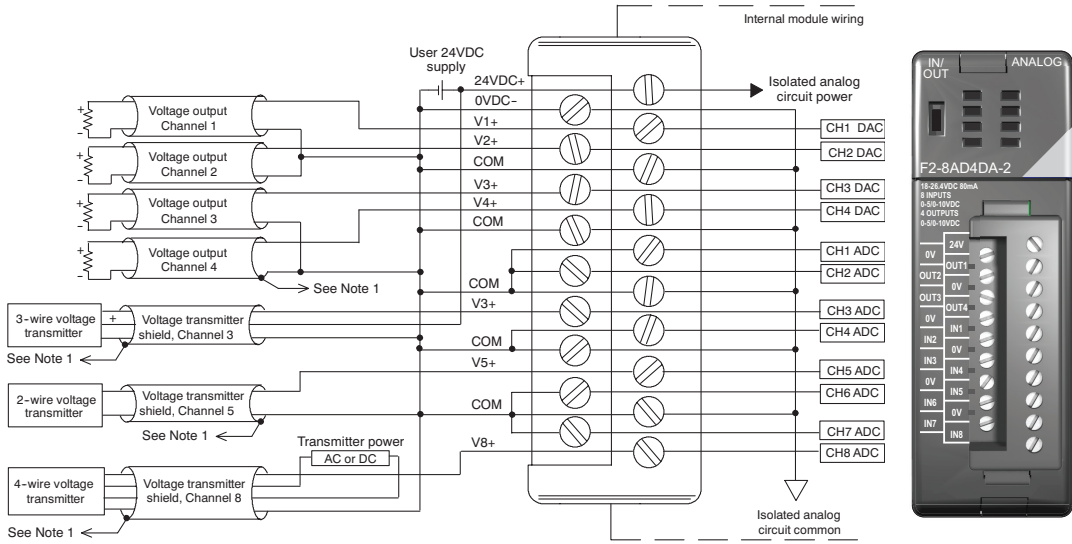


## F2-8AD4DA-2 Analog Input/Output

| <b>F2-8AD4DA-2 8-Channel Analog Voltage Input / 4-Channel Analog Voltage Output</b> |   |
|---|---|
| <b>Input Channels per Module</b>  | 8, single ended (one common)  |
| <b>Input Range</b>  | 0 to 5V, 0 to 10V   |
| <b>Resolution</b>   | 12, 14, 16-bit selectable   |
| <b>External DC Power Required</b>   | 80mA @ 18–26.4 VDC  |
| <b>Max. Continuous Overload</b>   | ±100V   |
| <b>Input Impedance</b>  | >10MΩ   |
| <b>Filter Characteristics</b>   | Active low pass, -3 dB @ 80 Hz  |
| <b>Conversion Time</b>  | 12-bit = 1.5 ms per channel<br>14-bit = 6ms per channel<br>16-bit = 25ms per channel  |
| <b>Conversion Method</b>  | Over sampling successive approximation  |
| <b>Accuracy vs. Temperature</b>   | ±50ppm / °C Max.  |
| <b>Maximim Inaccuracy</b>   | 0.1% of range   |
| <b>Linearity Error (End to End)</b>   | 12-bit = ±1 count max. (±0.025% of range)<br>14-bit = ±4 count max. (±0.025% of range)<br>16-bit = ±16 count max. (±0.025% of range)<br>Monotonic with no missing codes |
| <b>Full Scale Calibration Error (not incl. offset error)</b>                        | ±0.075% of range max.   |
| <b>Offset Calibration Error</b>   | ±0.025% of range max.   |
| <b>Base Power Required 5VDC</b>   | 35mA  |
| <b>Output Channels per Module</b>   | 4   |
| <b>Output Range</b>   | 0 to 5V, 0 to 10V   |
| <b>Resolution</b>   | 0 to 5V at 15-bit, 0 to 10V at 16-bit, 152 μV/bit   |
| <b>Output Type</b>  | Voltage sourcing/sinking at 10mA max.   |
| <b>Load Impedance</b>   | >1000Ω  |
| <b>Max. Inaccuracy</b>  | 0.15% of range  |
| <b>Max. Full Scale Calibration Error (not incl. offset error)</b>                   | ±0.075% of range max.   |
| <b>Max. Offset Calibration Error</b>  | ±0.025% of range max.   |
| <b>Accuracy vs. Temperature</b>   | ±50ppm/ °C max. full scale calibration change<br>(± 0.005% of range / °C)   |
| <b>Max. Crosstalk @ DC, 50/60Hz</b>   | -70dB, 1 LSB  |
| <b>Linearity Error (End to End)</b>   | ±1 count max. (±0.025% of full scale)<br>Monotonic with no missing codes  |
| <b>Output Stability and Repeatability</b>   | ±1 LSB after 10 minute warm-up typical  |
| <b>Output Ripple</b>  | 0.005% of full scale  |
| <b>Output Settling Time</b>   | 0.5 ms max., 5μs min. (full scale change)   |
| <b>Max. Continuous Overload</b>   | Outputs current limited to 15mA typical   |
| <b>Type of Output Protection</b>  | 1VDC peak output voltage (clamped by transient voltage suppressor)  |
| <b>Output Signal at Power-up and Power-down</b>                                     | 0V  |
| <b>Terminal Type (included)</b>   | Removable; D2-16IOCON   |
| <b>ZIPLink Module</b>   | ZL-RTB20 (Feedthrough)  |
| <b>ZIPLink Cable</b>  | ZL-D2-CBL19 (0.5 m)<br>ZL-D2-CBL19-1 (1.0 m)<br>ZL-D2-CBL19-2 (2.0 m)<br>ZL-D2-CBL19-1P (1.0 m Pigtail)<br>ZL-D2-CBL19-2P (2.0 m Pigtail)                               |

# F2-8AD4DA-2 Analog Input/Output - continued

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Note 1: Connect shields to the 0V of the module; do not connect both ends of shield.



## F2-8AD4DA-2 Analog Input/Output - continued

The Do-more CPU module assigns the following memory addresses to this module.

| F2-8AD4DA-2 X Addressing |             |
|--------------------------|-------------|
| Address                  | Description |
| $Xn$                     | Not Used    |
| $Xn+1$                   | Not Used    |
| $Xn+2$                   | Not Used    |
| $Xn+3$                   | Not Used    |
| $Xn+4$                   | Not Used    |
| $Xn+5$                   | Not Used    |
| $Xn+6$                   | Not Used    |
| $Xn+7$                   | Not Used    |

*Xn: Starting X address assigned to this module*

| F2-8AD4DA-2 WX Addressing |  |
|---------------------------|--|
| Address                   | Description  |
| $WXn$                     | Channel 1 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+1$                   | Channel 2 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+2$                   | Channel 3 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+3$                   | Channel 4 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+4$                   | Channel 5 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+5$                   | Channel 6 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+6$                   | Channel 7 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |
| $WXn+7$                   | Channel 8 Input Data (0 to 4095, 0 to 16383 or 0 to 65535 <sup>1</sup> ) |

*WXn: Starting WX address assigned to this module*

The resolution of each analog input channel can be selected separately. Available resolutions are 12 bit (0 to 4095), 14 bit (0 to 16383) and 16 bit (0 to 65535). You need to use the memory address  $WYn+4$  to select the resolutions. Please refer to the next page for details.



**NOTE 1:** The data format of the WX addresses is 'Signed Word'. They store -32768 to 32767 as default. To read and write 0 to 65535 into these memory addresses, use the casting ':U' (':U' is the casting for 'Unsigned' format). For instance, if you selected the 16 bit resolution for the first analog input channel and  $WX0$  is assigned to the channel, use ' $WX0:U$ ' to access this memory address in the ladder program and other tools in Do-more Designer.

## F2-8AD4DA-2 Analog Input/Output - continued

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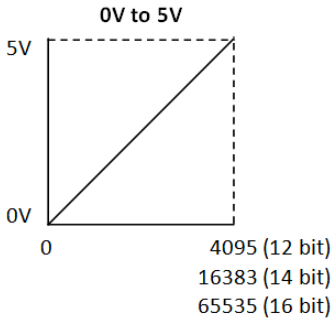
| F2-8AD4DA-2 WY Addressing |  |
|---------------------------|--|
| Address                   | Description                                      |
| WYn                       | Channel 1 Output Data (0 to 65535 <sup>2</sup> ) |
| WYn+1                     | Channel 2 Output Data (0 to 65535 <sup>2</sup> ) |
| WYn+2                     | Channel 3 Output Data (0 to 65535 <sup>2</sup> ) |
| WYn+3                     | Channel 4 Output Data (0 to 65535 <sup>2</sup> ) |
| WYn+4                     | Input Resolution Selection                       |
| WYn+5                     | Input and Output Ranges Selection                |
| WYn+6                     | Input Track and Hold Selection                   |

WYn: Starting WY address assigned to this module

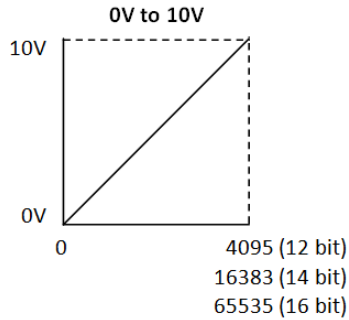


**NOTE 2:** The data format of the WY addresses is 'Signed Word'. They store -32768 to 32767 as default. To read and write 0 to 65535 into these memory addresses, use the casting 'U' ('U' is the casting for 'Unsigned' format). For instance, if WY0 is assigned to the first analog output channel, use 'WY0:U' to access this memory address in the ladder program and other tools in Do-more Designer.

### Input

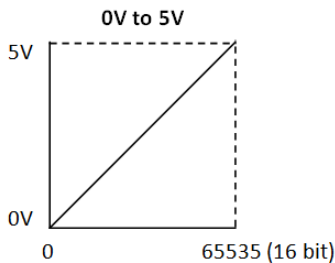


Value in WX address

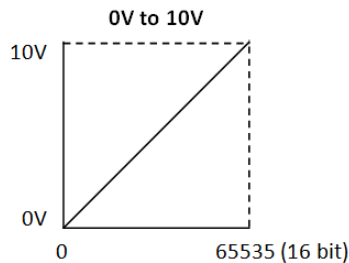


Value in WX address

### Output



Value in WY address



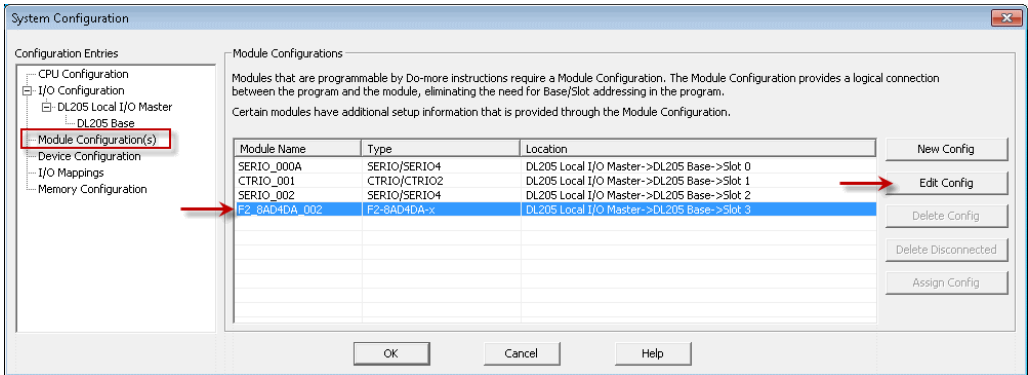
Value in WY address

## F2-8AD4DA-2 Analog Input/Output - continued

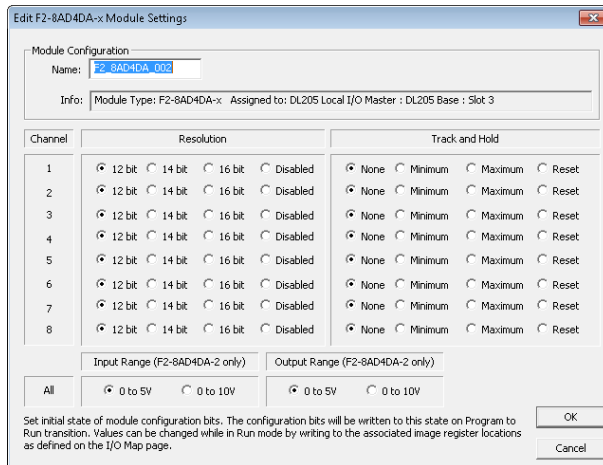
### Input Configuration Using Do-more Designer Version 1.1 or Newer

Using the Module Configurations section of the Do-more Designer System Configuration, each of the eight input channels can be individually configured for resolutions: 12, 14, or 16 bit, configured for track and hold options: None (no hold), Minimum, Maximum, or Reset held value, or each input can be individually disabled. Input and output ranges can also be configured for 0 to 5V or 0 to 10V in this section.

From the System Configurations page, select Module Configuration(s) in the tab on the left. The screen below will appear showing the modules that are pre-configurable. Select the Type F2-8AD4DA-x in the table and click the Edit Config button on the right-hand side.



Once the Edit Config button is selected, the Module Settings page shown below will open. From this page each input channel can be configured with Resolution and/or Track and Hold options. Input/output range options are also available. Select the radial button next to the desired options and select the OK button when done.



## F2-8AD4DA-2 Analog Input/Output - continued

### Input Resolution Selection (WYn+4)

If not using Do-more Designer version 1.1 or newer, each of the eight input channels can be individually configured for 12, 14, or 16 bit resolution or disabled with memory address WYn+4 (WYn: Starting WY address assigned to this module). Two (2) bits in this memory address are assigned to each analog input channel.

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 15   | 14   | 13   | 12   | 11   | 10   | 9    | 8    | 7    | 6    | 5    | 4    | 3    | 2    | 1    | 0    |
| R-8H | R-8L | R-7H | R-7L | R-6H | R-6L | R-5H | R-5L | R-4H | R-4L | R-3H | R-3L | R-2H | R-2L | R-1H | R-1L |

6

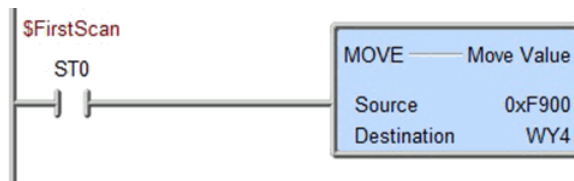
| Channel Resolution Selection Table |   |  |
|------------------------------------|---|--|
| Input Resolution                   | RnH<br>(Resolution channel n<br>High bit) | RnL<br>(Resolution channel<br>n Low bit) |
| 12 bit                             | 0   | 0  |
| 14 bit                             | 0   | 1  |
| 16 bit                             | 1   | 0  |
| Disabled                           | 1   | 1  |

The HEX data format is used to set up the input resolution as seen in the following example.

Example: An F2-8AD4DA-2 is installed in slot 0 and WY4 is used for the input resolution selection. Input channels 1-4 are 12 bit, channel 5 is 14 bit, channel 6 is 16 bit, and channels 7 and 8 are disabled. In this case, 0xF900 needs to be written into WY4.

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 15   | 14   | 13   | 12   | 11   | 10   | 9    | 8    | 7    | 6    | 5    | 4    | 3    | 2    | 1    | 0    |
| R-8H | R-8L | R-7H | R-7L | R-6H | R-6L | R-5H | R-5L | R-4H | R-4L | R-3H | R-3L | R-2H | R-2L | R-1H | R-1L |
| 1    | 1    | 1    | 1    | 1    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| F    |      |      |      | 9    |      |      |      | 0    |      |      |      | 0    |      |      |      |

Use the MOVE instruction to write the Hex value 0xF900 into WY4.



## F2-8AD4DA-2 Analog Input/Output - continued

### Input and Output Range Selection (WYn+5)

The range of the eight input channels can be collectively set for 0 to 5V or for 0 to 10V. The range of the four output channels can also be collectively set for either of the same two voltage ranges. The configuration is stored in memory address WYn+5 (WYn: Starting WY address assigned to this module). Only 2 bits in this memory address are used for the setup.

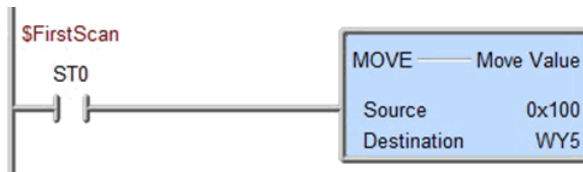
|    |    |    |    |    |    |   |    |   |   |   |   |   |   |   |    |
|----|----|----|----|----|----|---|----|---|---|---|---|---|---|---|----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8  | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0  |
| -  | -  | -  | -  | -  | -  | - | OR | - | - | - | - | - | - | - | IR |

| Input/Output Range Selection Table |                  |                   |
|------------------------------------|------------------|-------------------|
| Input/Output Range                 | IR (Input Range) | OR (Output Range) |
| 0V to 5V                           | 0                | 0                 |
| 0V to 10V                          | 1                | 1                 |

The HEX data format is used to set up the input resolution as seen in the following example. Example: An F2-8AD4DA-2 is installed in slot 0 and WY5 is used for the input and output resolution selection. Input channel range is set to 0 to 5V and output channel range is set to 0 to 10V. In this case, 0x100 needs to be written into WY5.

Use the MOVE instruction to write the Hex value 0x100 into WY5.

|    |    |    |    |    |    |   |    |   |   |   |   |   |   |   |    |
|----|----|----|----|----|----|---|----|---|---|---|---|---|---|---|----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8  | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0  |
| -  | -  | -  | -  | -  | -  | - | OR | - | - | - | - | - | - | - | IR |
| 0  | 0  | 0  | 0  | 0  | 0  | 0 | 1  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0  |
| 0  |    |    |    | 1  |    |   |    | 0 |   |   |   | 0 |   |   |    |



## F2-8AD4DA-2 Analog Input/Output - continued

### Input Track and Hold Selection (WYn+6)

The track and hold feature for each of the eight inputs can be individually configured for minimum, maximum, no hold, or reset held value with memory address WYn+6 (WYn: Starting WY address assigned to this module). This configuration can be changed “on the fly” while the program is running. Two (2) bits in this memory address are assigned to each analog input channel.

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 15   | 14   | 13   | 12   | 11   | 10   | 9    | 8    | 7    | 6    | 5    | 4    | 3    | 2    | 1    | 0    |
| T-8H | T-8L | T-7H | T-7L | T-6H | T-6L | T-5H | T-5L | T-4H | T-4L | T-3H | T-3L | T-2H | T-2L | T-1H | T-1L |

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| Channel Track and Hold Selection Table |  |   |                                    |
|--|--|---|------------------------------------|
| Track and Hold Select                  | TnH<br>(Track and Hold channel n High bit) | TnL<br>(Track and Hold channel n Low bit) | Result                             |
| <i>No Track and Hold</i>               | 0  | 0   | Returns real time input value      |
| <i>Track and Hold Minimum Value</i>    | 0  | 1   | Maintains lowest measured value    |
| <i>Track and Hold Maximum Value</i>    | 1  | 0   | Maintains highest measured value   |
| <i>Reset Track and Hold Value</i>      | 1  | 1   | Resets previously held input value |

The HEX data format is used to set up the track and hold option as seen in the following example.

Example: An F2-8AD4DA-2 is installed in slot 0 and WY6 is used for the track and hold selection. Input channel track and hold settings: ch 1-3 = none, ch 4-5 = minimum, ch 6-7 = maximum, ch 8 = reset. In this case, 0xE940 needs to be written into WY6.

Use the MOVE instruction to write the Hex value 0xE940 into WY6.

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 15   | 14   | 13   | 12   | 11   | 10   | 9    | 8    | 7    | 6    | 5    | 4    | 3    | 2    | 1    | 0    |
| T-8H | T-8L | T-7H | T-7L | T-6H | T-6L | T-5H | T-5L | T-4H | T-4L | T-3H | T-3L | T-2H | T-2L | T-1H | T-1L |
| 1    | 1    | 1    | 0    | 1    | 0    | 0    | 1    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    |
| E    |      |      |      | 9    |      |      |      | 4    |      |      |      | 0    |      |      |      |

