# ADD4AD4DA User Guide

Updated 3/29/10

## Overview

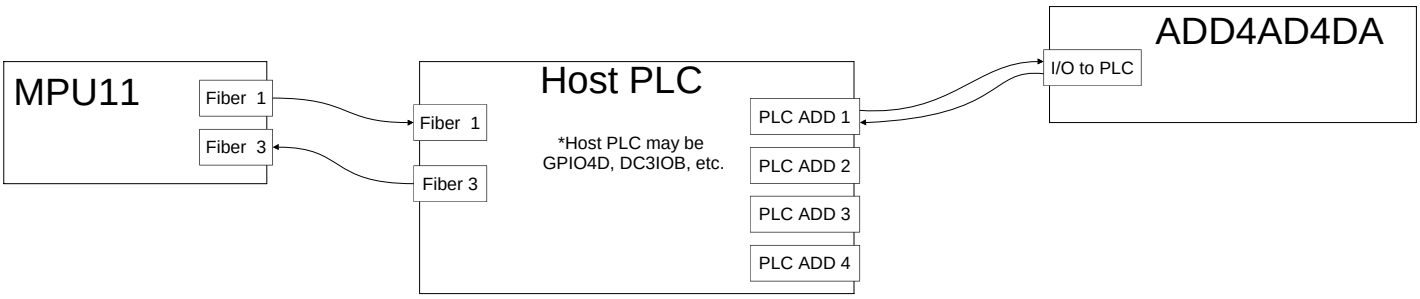
The ADD4AD4DA is a PLC expansion board used to add analog inputs and outputs to a compatible host PLC. The ADD4AD4DA has 4 analog outputs and 4 analog inputs.

### ADD4AD4DA Features

| | |
|---|---|
| Application: | PLC Expansion Board |
| Analog Inputs: | 4 |
| Input Resolution: | 12 bits |
| Analog Outputs: | 4 |
| Output Resolution: | 16 bits |
| Control Interface: | Shielded, twisted pair cable to host PLC |
| Update Rate: | 2000 Hz |
| Dimensions (W*D*H): | 9.8 * 3 * 0.6 inches |

### ADD4AD4DA Connection Overview

The ADD4AD4DA communicates with a host PLC through a cable connection to an expansion port. The host PLC may have up to 16 PLC expansion ports, labeled “PLC ADD 1” through “PLC ADD 16”. The ADD4AD4DA may connect to any available expansion port.



# Analog Outputs

Four voltage output ranges are available on each analog output. Each analog output has a block of five DIP switches that must be set according to the following chart to get the desired output range.

## Analog Output Range Selection

| Voltage Range | Switch Number | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 0 TO 5 | OFF | ON | ON | ON | ON |
| 0 TO 10 | OFF | ON | OFF | ON | OFF |
| -5 TO 5 | ON | ON | OFF | ON | OFF |
| -10 TO 10 | ON | OFF | OFF | OFF | OFF |

## Analog Output Calculations

Analog outputs use a 16 bit digital to analog converter (DAC) to generate analog from the DAC request sent from the PLC program. The 16 bit value allows a DAC request of 0 to 65535, which corresponds to 0 to 9.9998 volts in the 0 to 10V range.

0 to 5V Range

$$\text{output voltage} = \frac{\text{DAC Request}}{65536} * 5$$

-5 to 5V Range

$$\text{output voltage} = \left(\frac{\text{DAC Request}}{65536} * 10\right) - 5$$

0 to 10V Range

$$\text{output voltage} = \frac{\text{DAC Request}}{65536} * 10$$

-10 to 10V Range

$$\text{output voltage} = \left(\frac{\text{DAC Request}}{65536} * 20\right) - 10$$

## Analog Output Wiring

Analog outputs should be wired using a shielded twisted pair for best results. Each analog output terminal is paired with a common terminal for direct wiring of the signal, common, and shield. In most cases, it is best to connect the shield to the common only at the ADD4AD4DA. Routing analog cables away from power wires and other noise sources is also critical for good performance. See “ADD4AD4DA Connections and Mounting Dimensions” section for terminal locations.

## Analog Output Trim

Analog outputs are factory trimmed for the 0 to 10V scale. If a different output range is used, it will be necessary to trim the output for best results. The following procedure is used to trim the analog outputs:

1. Request 0V
2. Adjust offset POT until 0V is output
3. Request maximum output
4. Adjust gain POT until maximum is output (depends on range)
5. Repeat steps 1-4 until readings are consistent and correct

# Analog Inputs

Like the analog outputs, the inputs have four ranges available. Set the corresponding block of five DIP switches according to the following chart to accept the required input range.

## Analog Input Range Selection

| Voltage Range | Switch Number | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 0 TO 5 | OFF | OFF | OFF | X | X |
| 0 TO 10 | OFF | ON | OFF | X | X |
| -5 TO 5 | ON | ON | OFF | X | X |
| -10 TO 10 | ON | ON | ON | X | X |

X = don't care

## Analog Input Calculations

Analog inputs use a 12 bit analog to digital converter (ADC) to generate a digital ADC result for the PLC from an analog signal. The 12 bit result allows an ADC result of 0 to 4095, which corresponds to 0 to 9.9975 volts in the 0 to 10V range.

0 to 5V Range

$$\text{ADC result} = \frac{4096 * \text{Input Voltage}}{5}$$

-5 to 5V Range

$$\text{ADC result} = \left(\frac{4096 * \text{Input Voltage}}{10}\right) + 2048$$

0 to 10V Range

$$\text{ADC result} = \frac{4096 * \text{Input Voltage}}{10}$$

-10 to 10V Range

$$\text{ADC result} = \left(\frac{4096 * \text{Input Voltage}}{20}\right) + 2048$$

## Analog Input Wiring

Analog inputs should be wired using a shielded twisted pair for best results. Each analog input terminal is paired with a common terminal for direct wiring of the signal, common, and shield. In most cases, it is best to connect the shield to the common only at the ADD4AD4DA. Routing analog cables away from power wires and other noise sources is also critical for good performance. See "ADD4AD4DA Connections and Mounting Dimensions" section for terminal locations.

## Analog Input Trim

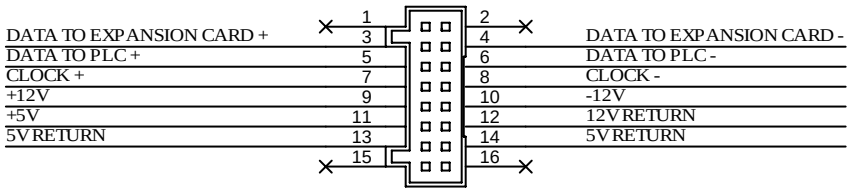
Analog inputs are factory trimmed for the 0 to 10V scale. If a different input range is used, it will be necessary to trim the input for best results. The following procedure is used to trim the analog inputs:

1. Input 0V in bipolar modes, or slightly above 0V in unipolar modes
2. Adjust offset POT until the reported voltage matches the actual voltage
3. Input a voltage slightly below the maximum (depends on range)
4. Adjust gain POT until the reported voltage matches the actual voltage
5. Repeat steps 1-4 until readings are consistent and correct

# PLC Communication

Communication with the host PLC is performed through H2 "I/O TO PLC" connector. See the host PLC's documentation to determine where I/O from the ADD4AD4DA will be located. ADD4AD4DA requires four slots of input and output space in the group I/O section (slots 15-47). Communication update rate is 2000 times per second or once every 500us. Total update time will be longer based on PLC program scan time and analog filtering. With a standard PLC stage (50 times / second), analog inputs will report correct voltage in less than 50ms, and analog outputs will update in less than 30ms.

I/O TO PLC Connector (H2) Pinout

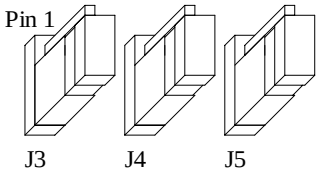



# ADD4AD4DA Power

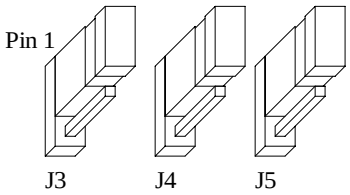
The ADD4AD4DA may operate from the host PLC's +5, +12, and -12 VDC through the "I/O TO PLC" connector H2. However, care must be taken not to overload the power supply when adding expansion boards to a PLC. Refer to the specifications for each device and the power supply to make sure the supply can handle the addition of the ADD4AD4DA.

If the host PLC's supply can not support powering the ADD4AD4DA, jumper J3, J4, and J5 may be changed to use power from header H4. This setting allows another power supply to be used to provide +5, +12, and -12 VDC to the ADD4AD4DA.

Jumper Setting to Use Host PLC Power from H2




Jumper Setting to Use External +5V from H4




# ADD4AD4DA I/O Map

## Input Map

| Input Specification | | | Input Location | |
|---|---|---|---|---|
| Number | Function | Type | Connector | Pin |
| 1-12 | General Purpose | Analog | H3 | 8 |
| 13-16 | Forced to 0 | - | - | - |
| 17-28 | General Purpose | Analog | H3 | 6 |
| 29-32 | Forced to 0 | - | - | - |
| 33-44 | General Purpose | Analog | H3 | 3 |
| 44-48 | Forced to 0 | - | - | - |
| 49-60 | General Purpose | Analog | H3 | 1 |
| 61-64 | Forced to 0 | - | - | - |

## Output Map

| Output Specification | | | Output Location | |
|---|---|---|---|---|
| Number | Function | Type | Connector | Pin |
| 1-16 | General Purpose | Analog | H1 | 1 |
| 17-32 | General Purpose | Analog | H1 | 3 |
| 33-48 | General Purpose | Analog | H1 | 5 |
| 49-64 | General Purpose | Analog | H1 | 7 |

# ADD4AD4DA Troubleshooting

| Symptom | Possible Cause | Corrective Action |
|---|---|---|
| +5V, +12V, or -12V LED out | Power source set incorrectly | Set J3, J4, and J5 to get power from H2 or H4 as appropriate |
| | Power supply overloaded | If several expansion boards are powered from one supply, the current demands could be too much. Add or change power supplies to provide at least as much current as the expansion board ratings call out. |
| PLC OK LED out, +5V LED lit | Host PLC Offline | Troubleshoot host PLC |
| | Faulty cable to main PLC | Check or replace cable connnected to H2 "I/O to PLC" header |

# ADD4AD4DA Specifications

| Characteristic | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|
| 5 Volt Supply Voltage | 4.5 | 5 | 5.5 | V |
| 12 Volt Supply Voltage | 11.5 | 12 | 12.5 | V |
| -12 Volt Supply Voltage | -12.5 | -12 | -11.5 | V |
| 5 Volt Supply Current | 0.2 | - | - | A |
| 12 Volt Supply Current | 0.15 | - | - | A |
| -12 Volt Supply Current | 0.15 | - | - | A |
| Analog Output Current | 0 | 1 | 10 | mA |
| Analog Output Voltage | -10 | - | 10 | V |
| Analog Output Resolution | - | 16 | - | bits |
| Analog Output Error | - | < 0.1 | - | % |
| Analog Input Current | - | - | 1 | mA |
| Analog Input Voltage | -10 | - | 10 | V |
| Analog Input Resolution | - | 12 | - | bits |
| Analog Input Error | - | < 0.1 | - | % |
| Size: 9.8 * 3 * 0.6 (W*D*H) | | | | Inches |

# ADD4AD4DA Connections and Mounting Dimensions