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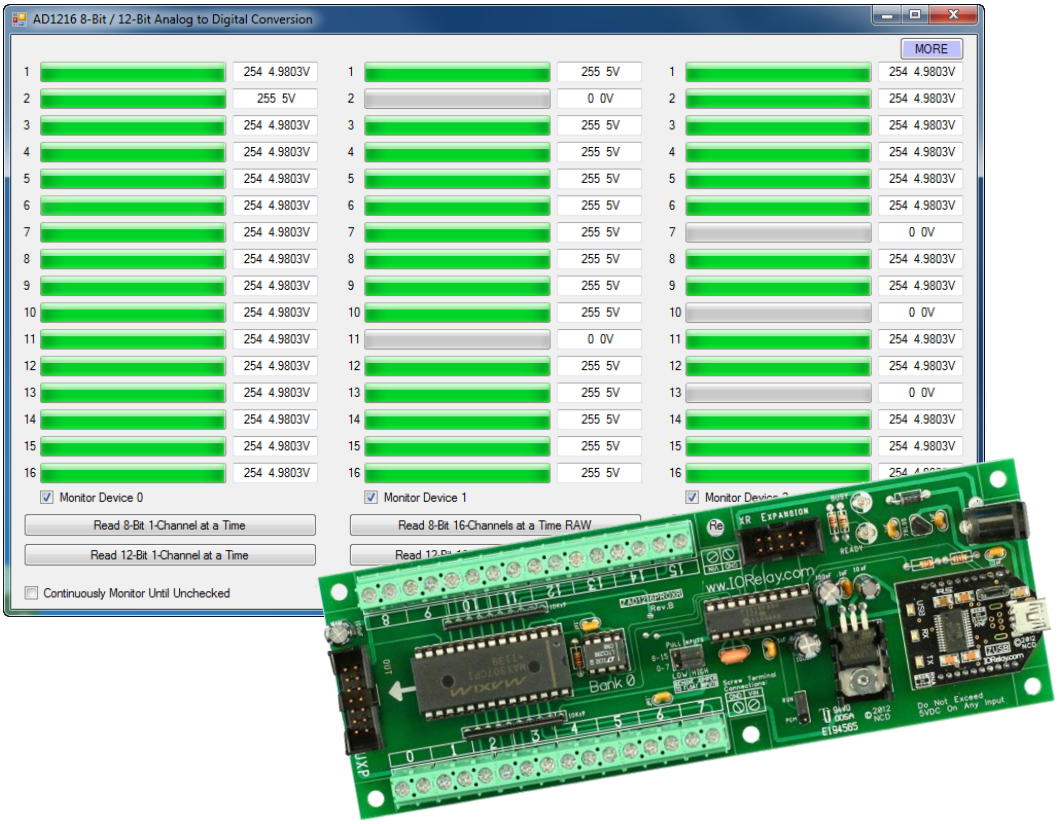
NATIONAL CONTROL DEVICES

AD1216 Quick Start Guide



Analog to Digital Conversion Command Set

NATIONAL CONTROL DEVICES

AD1216 Quick Start Guide

Analog to Digital Conversion Command Set

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Chapter 1

AD1216 Hardware:

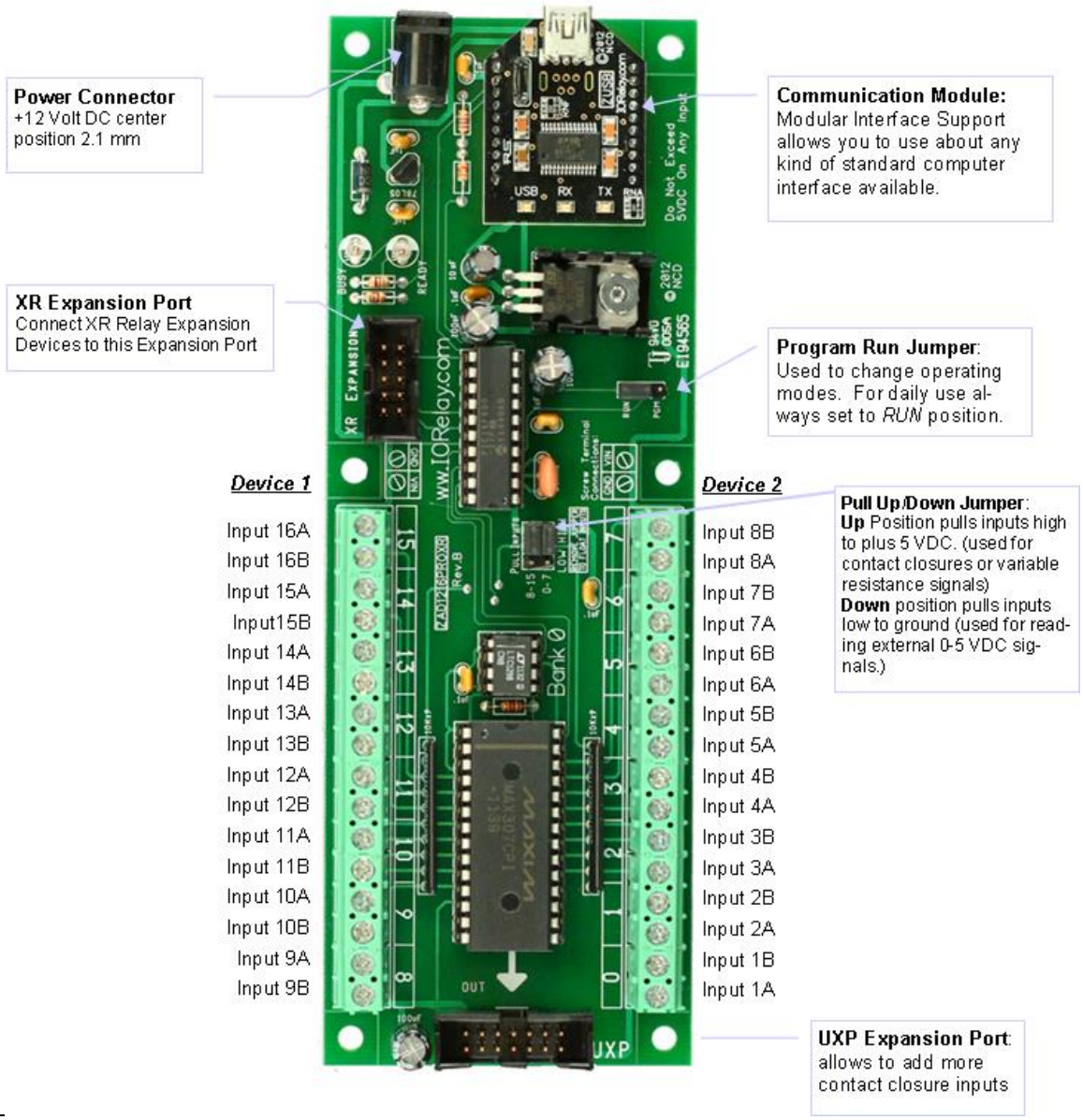
WARNING:
A/D Inputs can accept a voltage from 0 to 5VDC. You should NEVER exceed this voltage range. Negative voltages will damage the A/D inputs. Power the controller BEFORE applying voltages
to these inputs. Applying voltages to these inputs while the controller is powered down may result in permanent damage to the CPU.

USB ProXR Control with Analog to Digital Conversion 16-Channel

USB 16-Channel 8-Bit/12-Bit Analog to Digital Converter + XR Expansion Port
Product Code: ZAD1216ProXR_USB

NOTE:

All Inputs Labeled "A" are GROUND Inputs.
All Inputs Labeled "B" are 0-5VDC Analog Inputs.
NEVER APPLY A VOLTAGE TO A/D INPUT WHILE THE DEVICE IS POWERED OFF!

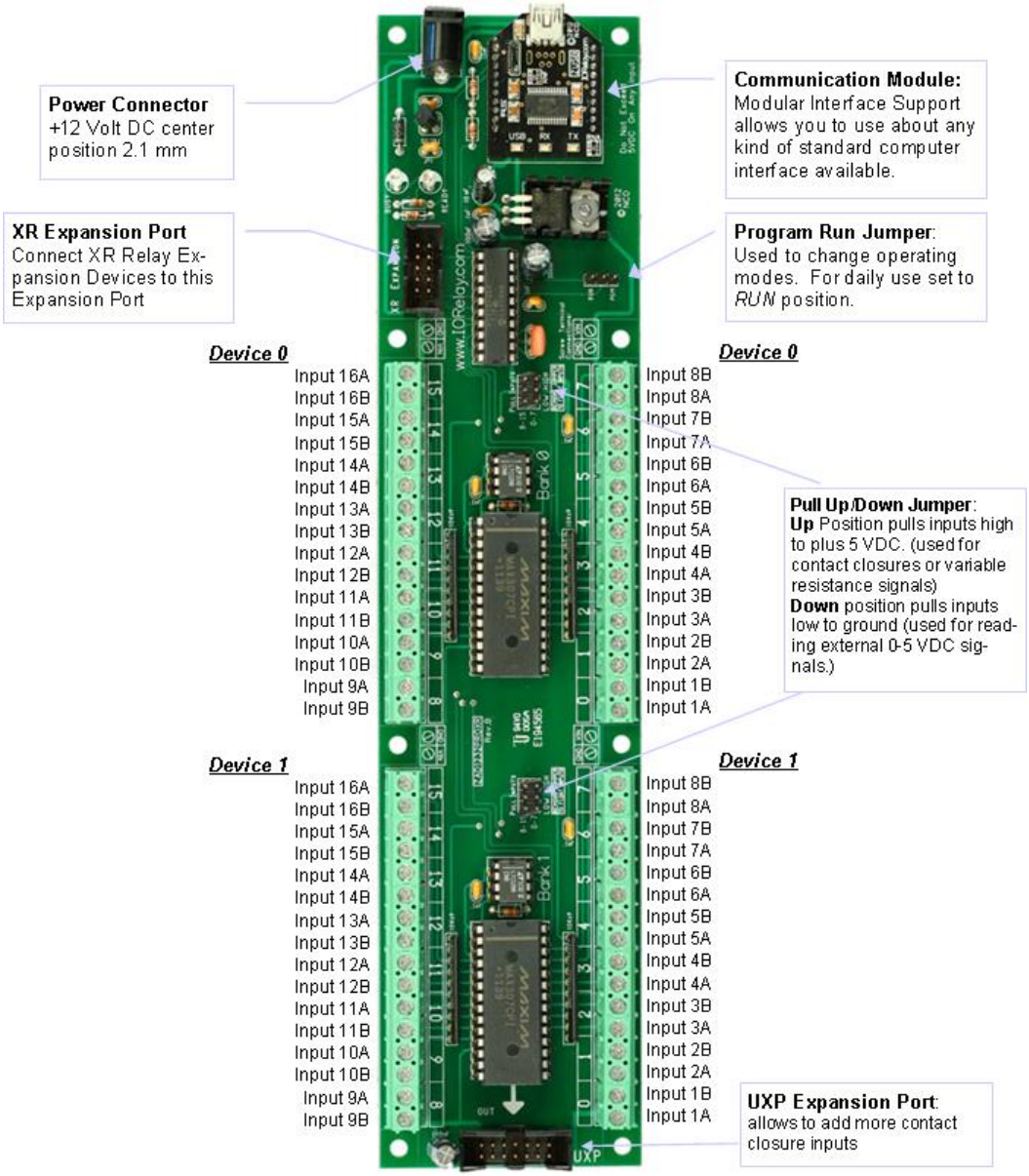


USB ProXR Control with Analog to Digital Conversion 32 Channel

USB **32-Channel** 8-Bit/12-Bit Analog to Digital Converter + XR Expansion Port. Product Code: ZAD1232ProXR_USB

NOTE:

All Inputs Labeled "A" are GROUND Inputs.
All Inputs Labeled "B" are 0-5VDC Analog Inputs.
NEVER APPLY A VOLTAGE TO A/D INPUT WHILE THE DEVICE IS POWERED OFF!

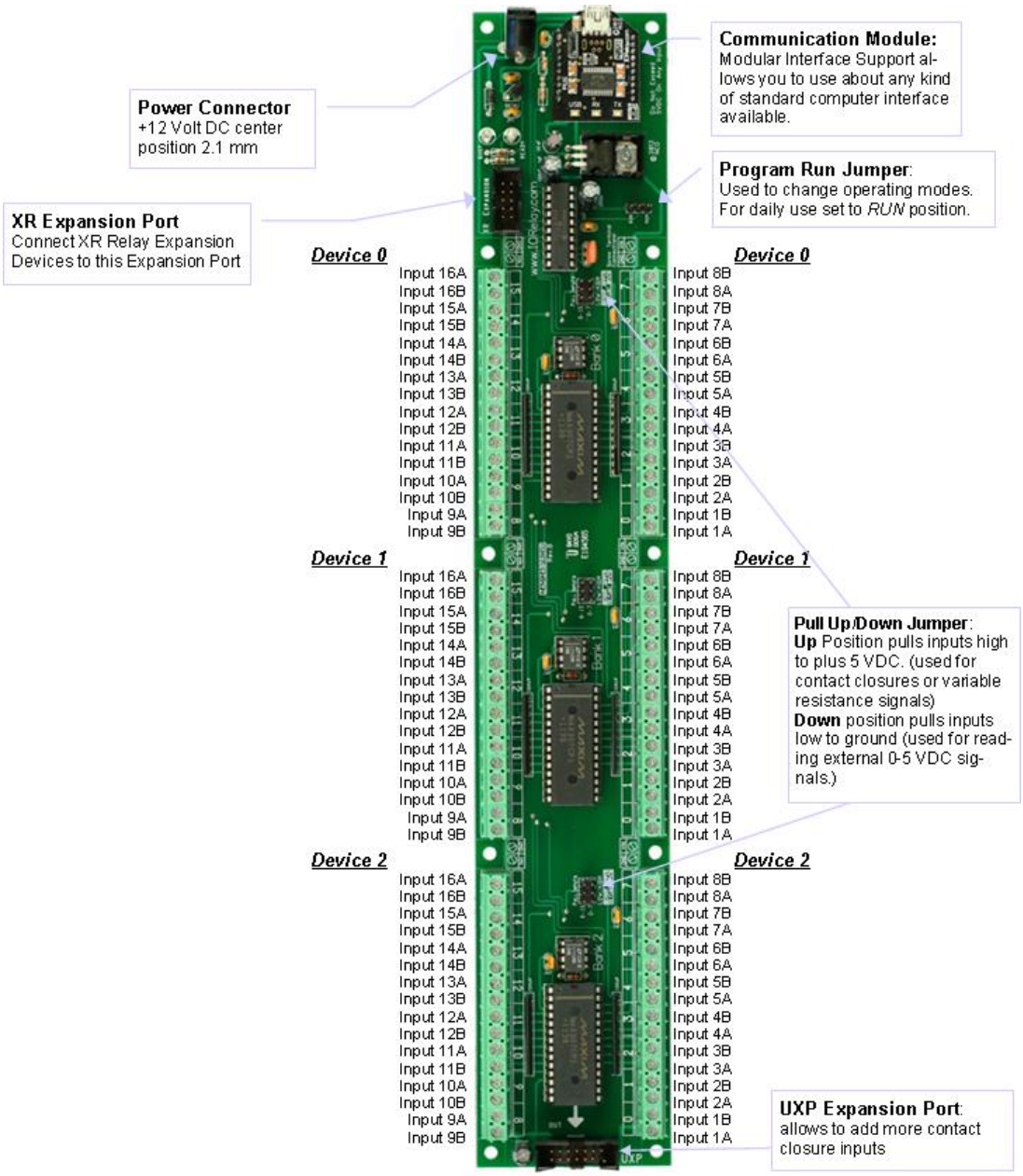


USB ProXR Control with Analog to Digital Conversion 48 Channel

USB **48-Channel** 8-Bit/12-Bit Analog to Digital Converter + XR Expansion Port. Product Code: ZAD1248ProXR_USB

NOTE:

All Inputs Labeled "A" are GROUND Inputs.
All Inputs Labeled "B" are 0-5VDC Analog Inputs.
NEVER APPLY A VOLTAGE TO A/D INPUT WHILE THE DEVICE IS POWERED OFF!



Chapter 2

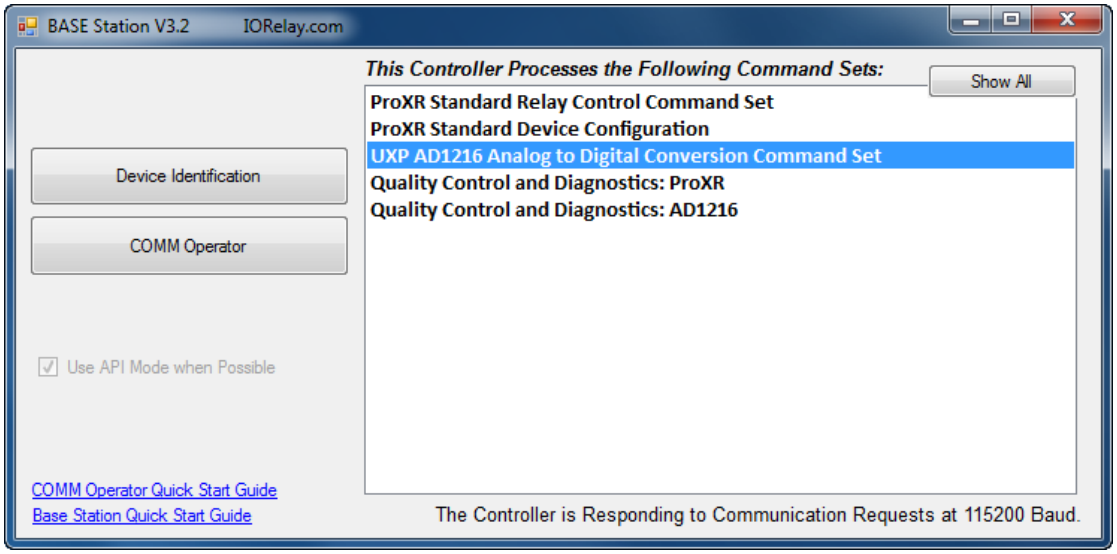
Base Station Software

The AD1216 Command Set is used to acquire up to 16-Channels of 8-Bit or 12-Bit Analog to Digital Conversion using a single query to the device.

In order to communicate with the AD1216 device, run the NCD Base Station software.

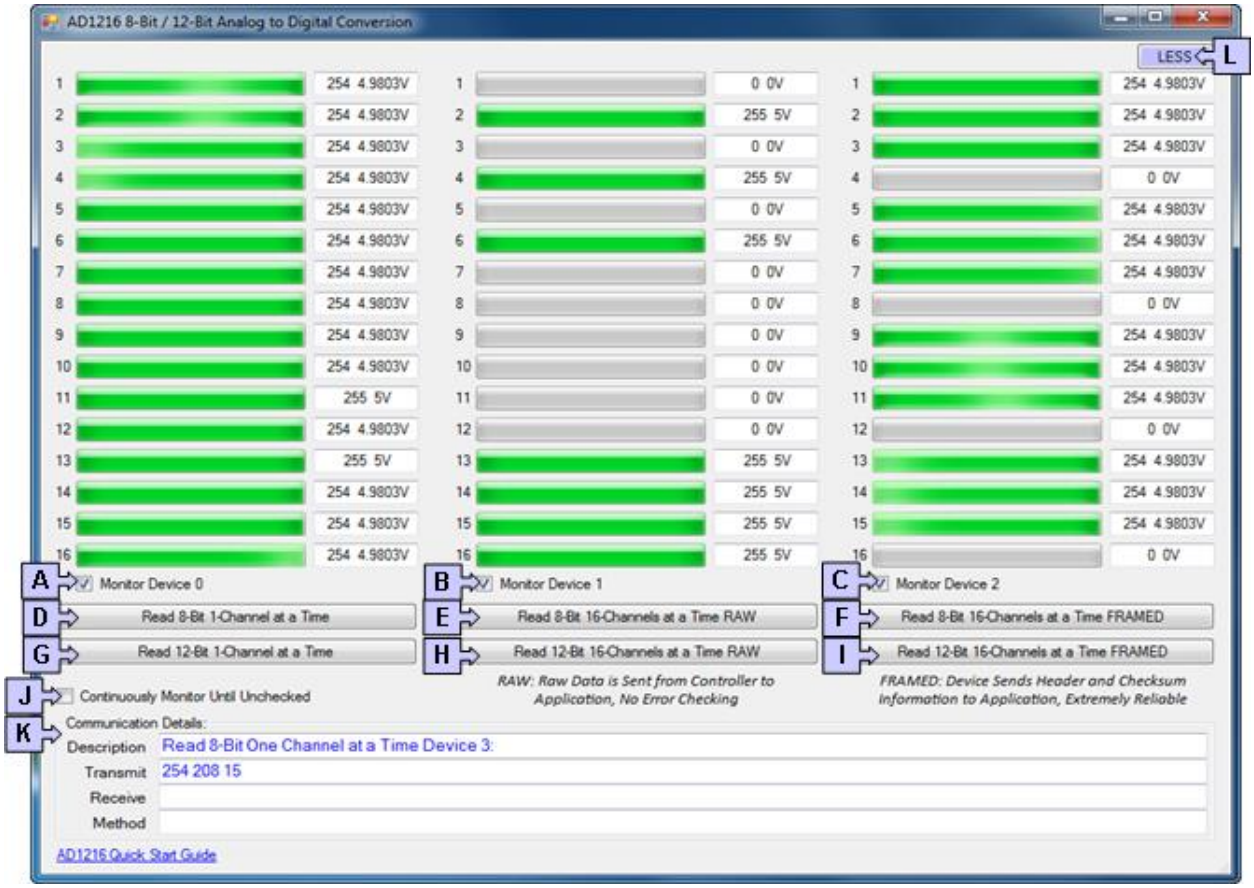
- Connect controller to computer using your favorite interface technology.
- Run the NCD Base Station software.
- Select the appropriate COM port or IP Address and click OK.

When the dialog box appears, choose *'UXP AD1216 Analog to Digital Conversion Command Set'* as shown in the screen shot below.



Reading Analog Inputs with Base Station Software

A. Check this box to monitor the first analog inputs.
B. Check this box to monitor the second group of 16-anlog inputs (on devices with 32 or more channels).
C. Check this box to monitor the third group of 16-anlog inputs (on devices with 48 channels).
D. Read 8-Bit Resolution 1-Channel at a time (this is a little slow).
E. Dumps 16 Raw Bytes of Data from the controller to the software without error checking (very fast, but no error checking in the communication protocol).
F. Dumps 32-Bytes of Data with a Header Byte and a Checksum to ensure error free communications.
G. Read 12-Bit Resolution 1-Channel at a time (this is twice as fast as 8-Bit Resolution).
H. Dumps 32 Raw Bytes of Data from the controller to the software without error checking (very fast, but no error checking in communication protocol).
I. Dumps 32-Bytes of Data with a Header Byte and Checksum to ensure error free communications.
J. Check this box to enable constant monitoring of inputs. Analog inputs will constantly change but the user interface will "freeze" until this option is unchecked.
K. Communication Details. The portion of the interface is visible when the MORE option is selected in section L of diagram.
L. MORE or LESS. More option expands the window to include the communication details of the device in section K of diagram. Less option shrinks the window to exclude section K.



Chapter 3

AD1216 Command Set

The AD1216 Command Set is used to acquire up to 16-Channels of 8-Bit or 12-Bit Analog to Digital Conversion using a single query to the device. This command set is compatible with all ProXR controllers with a UXP Expansion Port. This command set may also be used with part numbers that contain AD1216, AD1232, and AD1248.

Analog to Digital Conversion is the process of converting a voltage to a numeric value. This is useful for reading many kinds of sensors. A/D Conversion Commands convert a voltage from 0 to 5VDC to a 8-Bit Number from 0-255 or a 12-Bit Number from 0-4095.

If you request a 12-Bit Value, the controller will send 2 bytes of data, which must be mathematically processed to reconstruct the 12-Bit value. The formula for converting a 12-Bit Number to a Analog value is: Value = (MSB*256)+LSB

LSB is the Least Significant Byte and *MSB* is the Most Significant Byte.

This command set remains unchanged from previous versions of ProXR Standard controllers.

Note: While a controller may have 48 Analog Input Channels, each Channel Capable of Reading Voltages from 0 to 5VDC, every channel shares a common ground, as there is no isolation between channels.

Read a Single Channel as 8-Bit Value

This command will read a single channel as an 8-Bit value for devices 0 to 2 and requires one parameter indicating a channel to read from 0 to 15.

Send Bytes:	***Byte 1:***	***Byte 2:***	***Byte 3:***
Function:	Command	Device 0-2	Parameter (Channel 0-15)
Decimal Values:	254	195, 203, 208	0-15
Hex Values	0xFE	0xC3, 0xCB, 0xD0	0x00-0x0F

Receive Byte:		
	Decimal:	0-255
	Hex:	0x00-0xFF

Comm Operator Examples:

254 195	Read a Single Channel as an 8-Bit Value Device 0
254 203	Read a Single Channel as an 8-Bit Value Device 1
254 208	Read a Single Channel as an 8-Bit Value Device 2

NCD Component Library Command Method:

Not Yet Implemented

Read a Single Channel as 12-Bit Value

This command will read a single channel as a 12-Bit value for devices 0 to 2 and requires one parameter indicating a channel to read from 0 to 15.

Two bytes are returned by this command, LSB then MSB.
The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB

Send Bytes:	**Byte 1:**	***Byte 2:***	***Byte 3:***
Function:	Command	Device 0-2	Parameter (Channel 0-15)
Decimal Values:	254	199, 207, 209	0-15
Hex Values	0xFE	0xC7, 0xCF, 0xD1	0x00-0x0F

Receive Byte:			
	Decimal:	0-255 (LSB)	0-255 (MSB)
	Hex:	0x00-0xFF	0x00-0xFF

Comm Operator Examples:

254 199	Read a Single Channel as an 12-Bit Value Device 0
254 207	Read a Single Channel as an 12-Bit Value Device 1
254 209	Read a Single Channel as an 12-Bit Value Device 2

NCD Component Library Command Method:

Not Yet Implemented

Read All Channels, 12-Bit Resolution

This command will read all 16 channels at a time as a 12-bit resolution for devices 0 to 2 and returns 32 bytes in order of Channel 0-15. Two bytes are returned for each channel using this command, LSB then MSB.

The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Device 0-2
Decimal Values:	254	196-198
Hex Values	0xFE	0xC4-0xC6

Receive Bytes:	Decimal:	0-255 (LSB)	0-255 (MSB)
	Hex:	0x00-0xFF	0x00-0xFF

Comm Operator Examples:

254 196	Read All 16 Channels at a Time, 12-Bit Resolution, Device 0
254 197	Read All 16 Channels at a Time, 12-Bit Resolution, Device 1
254 198	Read All 16 Channels at a Time, 12-Bit Resolution, Device 2

NCD Component Library Command Method:

Not Yet Implemented

Read All Channels, 8-Bit A/D

This command will read all 16 channels at a time as an 8-bit A/D value for devices 0 to 2 and returns 18 bytes of data in order: Header Byte, Channels 0-15, Checksum Byte at end of packet. The Checksum Value always equals the sum of all bytes sent, including the header. The Checksum Value is always 8-Bits. You Should Extract the Lower 8 Bits from the Checksum to Return a Matched Value. Use This Formula:

CheckSumTest = Sum of All Bytes Sent from Controller except Checksum
CheckSum = Last Byte Sent from Controller
(CheckSumTest AND 255) MUST Equal CheckSum

The AND Function Used in the above formula is a mathematical function that returns (in this case) the lower 8 bits of the CheckSumTest. AND is supported by most programming languages.

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Device 0-2
Decimal Values:	254	200-202
Hex Values	0xFE	0xC8-0xCA

Receive Bytes:				
	Decimal:	254	0-255 (AD0-AD15)	0-255
	Hex:	0xFE	0x00-0xFF	0x00-0xFF

Comm Operator Examples:

254 200	Read All 16 Channels at a Time, 8-Bit A/D Device 0
254 201	Read All 16 Channels at a Time, 8-Bit A/D Device 1
254 202	Read All 16 Channels at a Time, 8-Bit A/D Device 2

NCD Component Library Command Method:

Not Yet Implemented

Read All Channels, 12-Bit A/D

This command will read all 16 channels at a time as a 12-bit A/D value for devices 0 to 2 and returns 34 bytes of data in order: Header Byte, Channels 0-15, Checksum Byte at end of packet.

The Checksum Value always equals the sum of all bytes sent, including the header. The Checksum Value is always 8 bits. You should extract the lower 8 bits from the Checksum to return a matched value. Use this formula:

CheckSumTest = Sum of All Bytes Sent from Controller Except Checksum
CheckSum = Last Byte Sent from Controller
(CheckSumTest AND 255) MUST Equal CheckSum

The AND function used in the above formula is a mathematical function that returns (in this case) the lower 8 bits of the CheckSumTest. AND is supported by Most Programming Languages.

The A/D Value of each channel is Re-Assembled using: Value = (MSB*256)+LSB

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Device 0-2
Decimal Values:	254	204-206
Hex Values	0xFE	0xCC-0xCE

Receive Bytes:

Dec.:	254 (header)	0-255 (AD0-AD15 LSB)	0-255 (AD0-AD15 MSB)	0-255(CheckSum)
Hex:	0xFE	0x00-0xFF	0x00-0xFF	0x00-0xFF

Comm Operator Examples:

254 204	Read All 16 Channels at a Time, 12-Bit A/D Device 0
254 205	Read All 16 Channels at a Time, 12-Bit A/D Device 1
254 206	Read All 16 Channels at a Time, 12-Bit A/D Device 2

NCD Component Library Command Method:

Not Yet Implemented

Accessing Port 2 with Fusion Controller

Fusion Series controllers support 8-bit digital input/output, allowing users to read and control 5V digital signals using Port 2. In the command set below Byte 4 has been added and set to 2 for Fusion Controllers.

Read a Single Channel as 8-Bit Value (Fusion Port 2)

This command will read a single channel as an 8-Bit value for devices 0 to 2 and requires one parameter indicating a channel to read from 0 to 15. This command example accesses Port 2 on the Fusion Series Controllers if available.

Send Bytes:	***Byte 1:***	***Byte 2:***	***Byte 3:***	***Byte 4:***
Function:	Command	Device 0-2	Parameter (Channel 0-15)	Port 2
Decimal Values:	254	195, 203, 208	0-15	2
Hex Values	0xFE	0xC3, 0xCB, 0xD0	0x00-0x0F	0x02

Receive Byte:	Decimal:	0-255
	Hex:	0x00-0xFF

Comm Operator Examples:

254 195 2	Read a Single Channel as an 8-Bit Value Device 0
254 203 2	Read a Single Channel as an 8-Bit Value Device 1
254 208 2	Read a Single Channel as an 8-Bit Value Device 2

NCD Component Library Command Method:

Not Yet Implemented

Read a Single Channel as 12-Bit Value (Fusion Port 2)

This command will read a single channel as a 12-bit value for devices 0 to 2 and requires one parameter indicating a channel to read from 0 to 15. This command example accesses Port 2 on the Fusion Series Controllers if available.

Two bytes are returned by this command, LSB then MSB.
The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB

Send Bytes:	**Byte 1:**	***Byte 2:***	***Byte 3:***	***Byte 4:***
Function:	Command	Device 0-2	Parameter (Channel 0-15)	Port 2
Decimal Values:	254	199, 207, 209	0-15	2
Hex Values	0xFE	0xC7, 0xCF, 0xD1	0x00-0x0F	0x02

Receive Byte:			
	Decimal:	0-255 (LSB)	0-255 (MSB)
	Hex:	0x00-0xFF	0x00-0xFF

Comm Operator Examples:

254 199	Read a Single Channel as an 12-Bit Value Device 0
254 207	Read a Single Channel as an 12-Bit Value Device 1
254 209	Read a Single Channel as an 12-Bit Value Device 2

NCD Component Library Command Method:

Not Yet Implemented

Read All Channels, 12-Bit Resolution (Fusion Port 2)

This command will read all 16 channels at a time as a 12-bit resolution for devices 0 to 2 and returns 32 bytes in order of Channel 0-15. Two bytes are returned for each channel using this command, LSB then MSB. This command example accesses Port 2 on the Fusion Series Controllers if available.

The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**
Function:	Command	Device 0-2	Port 2
Decimal Values:	254	196-198	2
Hex Values	0xFE	0xC4-0xC6	0x02

Receive Bytes:	Decimal:	0-255 (LSB)	0-255 (MSB)
	Hex:	0x00-0xFF	0x00-0xFF

Comm Operator Examples:

254 196	Read All 16 Channels at a Time, 12-Bit Resolution, Device 0
254 197	Read All 16 Channels at a Time, 12-Bit Resolution, Device 1
254 198	Read All 16 Channels at a Time, 12-Bit Resolution, Device 2

NCD Component Library Command Method:

Not Yet Implemented

Read All Channels, 8-Bit A/D (Fusion Port 2)

This command will read all 16 channels at a time as an 8-bit A/D value for devices 0 to 2 and returns 18 bytes of data in order: Header Byte, Channels 0-15, Checksum Byte at end of packet. The Checksum Value always equals the sum of all bytes sent, including the header. The Checksum Value is always 8-Bits. You Should Extract the Lower 8 Bits from the Checksum to Return a Matched Value. Use This Formula:

CheckSumTest = Sum of All Bytes Sent from Controller Except Checksum
CheckSum = Last Byte Sent from Controller
(CheckSumTest AND 255) MUST Equal CheckSum

The AND Function Used in the above formula is a mathematical function that returns (in this case) the lower 8 bits of the CheckSumTest. AND is supported by Most Programming Languages. This command example accesses Port 2 on the Fusion Series Controllers if available.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**
Function:	Command	Device 0-2	Port 2
Decimal Values:	254	200-202	2
Hex Values	0xFE	0xC8-0xCA	0x02

Receive Bytes:				
	Decimal:	254	0-255 (AD0-AD15)	0-255
	Hex:	0xFE	0x00-0xFF	0x00-0xFF

Comm Operator Examples:

254 200	Read All 16 Channels at a Time, 8-Bit A/D Device 0
254 201	Read All 16 Channels at a Time, 8-Bit A/D Device 1
254 202	Read All 16 Channels at a Time, 8-Bit A/D Device 2

NCD Component Library Command Method:

Not Yet Implemented

Read All Channels, 12-Bit A/D (Fusion Port 2)

This command will read all 16 channels at a time as a 12-bit A/D value for devices 0 to 2 and returns 34 bytes of data in order: Header Byte, Channels 0-15, Checksum Byte at end of packet.

The Checksum Value always equals the sum of all bytes sent, including the header. The Checksum Value is always 8 bits. You should extract the lower 8 bits from the Checksum to return a matched value. Use this formula:

CheckSumTest = Sum of All Bytes Sent from Controller Except Checksum
CheckSum = Last Byte Sent from Controller
(CheckSumTest AND 255) MUST Equal CheckSum

The AND function used in the above formula is a mathematical function that returns (in this case) the lower 8 bits of the CheckSumTest. AND is supported by Most Programming Languages. This command example accesses Port 2 on the Fusion Series Controllers if available.

The A/D Value of each channel is Re-Assembled using: Value = (MSB*256)+LSB

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3**
Function:	Command	Device 0-2	Port 2
Decimal Values:	254	204-206	2
Hex Values	0xFE	0xCC-0xCE	0x02

Receive Bytes:

Dec.:	254 (header)	0-255 (AD0-AD15 LSB)	0-255 (AD0-AD15 MSB)	0-255(CheckSum)
Hex:	0xFE	0x00-0xFF	0x00-0xFF	0x00-0xFF

Comm Operator Examples:

254 204	Read All 16 Channels at a Time, 12-Bit A/D Device 0
254 205	Read All 16 Channels at a Time, 12-Bit A/D Device 1
254 206	Read All 16 Channels at a Time, 12-Bit A/D Device 2

NCD Component Library Command Method:

Not Yet Implemented

Chapter 4

AD1216 Command Summary

Transmit	Command Description	Receive
254 195 0-15	Read a Single Channel as an 8-Bit Value Device 0 This Command Requires One Parameter indicating a Channel to Read from 0 to 15.	0-255
254 203 0-15	Read a Single Channel as an 8-Bit Value Device 1 This Command Requires One Parameter indicating a Channel to Read from 0 to 15.	0-255
254 208 0-15	Read a Single Channel as an 8-Bit Value Device 2 This Command Requires One Parameter indicating a Channel to Read from 0 to 15.	0-255
254 199 0-15	Read a Single Channel as an 12-Bit Value Device 0 This Command Requires One Parameter indicating a Channel to Read from 0 to 15. Two bytes are returned by this command, LSB then MSB. The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB	0-255 (LSB) 0-255 (MSB)
254 207 0-15	Read a Single Channel as an 12-Bit Value Device 1 This Command Requires One Parameter indicating a Channel to Read from 0 to 15. Two bytes are returned by this command, LSB then MSB. The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB	0-255 (LSB) 0-255 (MSB)
254 209 0-15	Read a Single Channel as an 12-Bit Value Device 2 This Command Requires One Parameter indicating a Channel to Read from 0 to 15. Two bytes are returned by this command, LSB then MSB. The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB	0-255 (LSB) 0-255 (MSB)

254 192	Read All 16 Channels at a Time, 8-Bit Resolution, Device 0. This Command Returns 16 Bytes in Order of Channel 0-15.	16 Byte Returned Channels 0-15
254 193	Read All 16 Channels at a Time, 8-Bit Resolution, Device 1. This Command Returns 16 Bytes in Order of Channel 0-15.	16 Byte Returned Channels 0-15
254 194	Read All 16 Channels at a Time, 8-Bit Resolution, Device 2. This Command Returns 16 Bytes in Order of Channel 0-15.	16 Byte Returned Channels 0-15
254 196	Read All 16 Channels at a Time, 12-Bit Resolution, Device 0. This Command Returns 32 Bytes in Order of Channel 0-15. Two bytes are returned for each channel using this command, LSB then MSB. The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB	32 Byte Returned Channels 0-15 0-255 (LSB) 0-255 (MSB)
254 197	Read All 16 Channels at a Time, 12-Bit Resolution, Device 1. This Command Returns 32 Bytes in Order of Channel 0-15. Two bytes are returned for each channel using this command, LSB then MSB. The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB	32 Byte Returned Channels 0-15 0-255 (LSB) 0-255 (MSB)
254 198	Read All 16 Channels at a Time, 12-Bit Resolution, Device 2. This Command Returns 32 Bytes in Order of Channel 0-15. Two bytes are returned for each channel using this command, LSB then MSB. The A/D Value is Re-Assembled using: Value = (MSB*256)+LSB	32 Byte Returned Channels 0-15 0-255 (LSB) 0-255 (MSB)

Transmit	Command Description	Receive
254 200	Read All 16 Channels at a Time, 8-Bit A/D Device 0. This command returns 18 bytes of data in Order: Header Byte, Channels 0-15, Checksum Byte at End of Packet. Checksum Value Always Equals the Sum of All Bytes Sent, Including the Header. The Checksum Value is Always 8-Bits. You Should Extract the Lower 8 Bits from the Checksum to Return a Matched Value. Use This Formula: CheckSumTest = Sum of All Bytes Sent from Controller Except Checksum CheckSum = Last Byte Sent from Controller (CheckSumTest AND 255) MUST Equal CheckSum The AND Function Used in the Above Formula is a Mathematical Function that Returns (in this case) the Lower 8 Bits of the CheckSumTest. AND is supported by Most Programming Languages.	Header Byte 254 AD0(0-255) AD1(0-255) AD2(0-255) AD3(0-255) AD4(0-255) AD5(0-255) AD6(0-255) AD7(0-255) AD8(0-255) AD9(0-255) AD10(0-255) AD11(0-255) AD12(0-255) AD13(0-255) AD14(0-255) AD15(0-255) Checksum(0-255)
254 201	Read All 16 Channels at a Time, 8-Bit A/D Device 1. This command returns 18 bytes of data in Order: Header Byte, Channels 0-15, Checksum Byte at End of Packet. Checksum Value Always Equals the Sum of All Bytes Sent, Including the Header. The Checksum Value is Always 8-Bits. You Should Extract the Lower 8 Bits from the Checksum to Return a Matched Value. Use This Formula: CheckSumTest = Sum of All Bytes Sent from Controller Except Checksum CheckSum = Last Byte Sent from Controller (CheckSumTest AND 255) MUST Equal CheckSum The AND Function Used in the Above Formula is a Mathematical Function that Returns (in this case) the Lower 8 Bits of the CheckSumTest. AND is supported by Most Programming Languages.	Header Byte 254 AD0(0-255) AD1(0-255) AD2(0-255) AD3(0-255) AD4(0-255) AD5(0-255) AD6(0-255) AD7(0-255) AD8(0-255) AD9(0-255) AD10(0-255) AD11(0-255) AD12(0-255) AD13(0-255) AD14(0-255) AD15(0-255) Checksum(0-255)

Transmit	Command Description	Receive
254 202	Read All 16 Channels at a Time, 8-Bit A/D Device 2. This command returns 18 bytes of data in Order: Header Byte, Channels 0-15, Checksum Byte at End of Packet. Checksum Value Always Equals the Sum of All Bytes Sent, Including the Header. The Checksum Value is Always 8-Bits. You Should Extract the Lower 8 Bits from the Checksum to Return a Matched Value. Use This Formula: CheckSumTest = Sum of All Bytes Sent from Controller Except Checksum CheckSum = Last Byte Sent from Controller (CheckSumTest AND 255) MUST Equal CheckSum The AND Function Used in the Above Formula is a Mathematical Function that Returns (in this case) the Lower 8 Bits of the CheckSumTest. AND is supported by Most Programming Languages.	Header Byte 254 AD0(0-255) AD1(0-255) AD2(0-255) AD3(0-255) AD4(0-255) AD5(0-255) AD6(0-255) AD7(0-255) AD8(0-255) AD9(0-255) AD10(0-255) AD11(0-255) AD12(0-255) AD13(0-255) AD14(0-255) AD15(0-255) Checksum(0-255)

Transmit	Command Description	Receive
254 204	Read All 16 Channels at a Time, 12-Bit A/D Device 0. This command returns 34 bytes of data in Order: Header Byte, Channels 0-15, Checksum Byte at End of Packet. Checksum Value Always Equals the Sum of All Bytes Sent, Including the Header. The Checksum Value is Always 8-Bits. You Should Extract the Lower 8 Bits from the Checksum to Return a Matched Value. Use This Formula: CheckSumTest = Sum of All Bytes Sent from Controller Except Checksum CheckSum = Last Byte Sent from Controller (CheckSumTest AND 255) MUST Equal CheckSum The AND Function Used in the Above Formula is a Mathematical Function that Returns (in this case) the Lower 8 Bits of the CheckSumTest. AND is supported by Most Programming Languages. The A/D Value of each channel is Re-Assembled using: Value = (MSB*256)+LSB	Header Byte 254 AD0-LSB(0-255) AD0-MSB(0-255) AD1-LSB(0-255) AD1-MSB(0-255) AD2-LSB(0-255) AD2-MSB(0-255) AD3-LSB(0-255) AD3-MSB(0-255) AD4-LSB(0-255) AD4-MSB(0-255) AD5-LSB(0-255) AD5-MSB(0-255) AD6-LSB(0-255) AD6-MSB(0-255) AD7-LSB(0-255) AD7-MSB(0-255) AD8-LSB(0-255) AD8-MSB(0-255) AD9-LSB(0-255) AD9-MSB(0-255) AD10-LSB(0-255) AD10-MSB(0-255) AD11-LSB(0-255) AD11-MSB(0-255) AD12-LSB(0-255) AD12-MSB(0-255) AD13-LSB(0-255) AD13-MSB(0-255) AD14-LSB(0-255) AD14-MSB(0-255) AD15-LSB(0-255) AD15-MSB(0-255) Checksum(0-255)

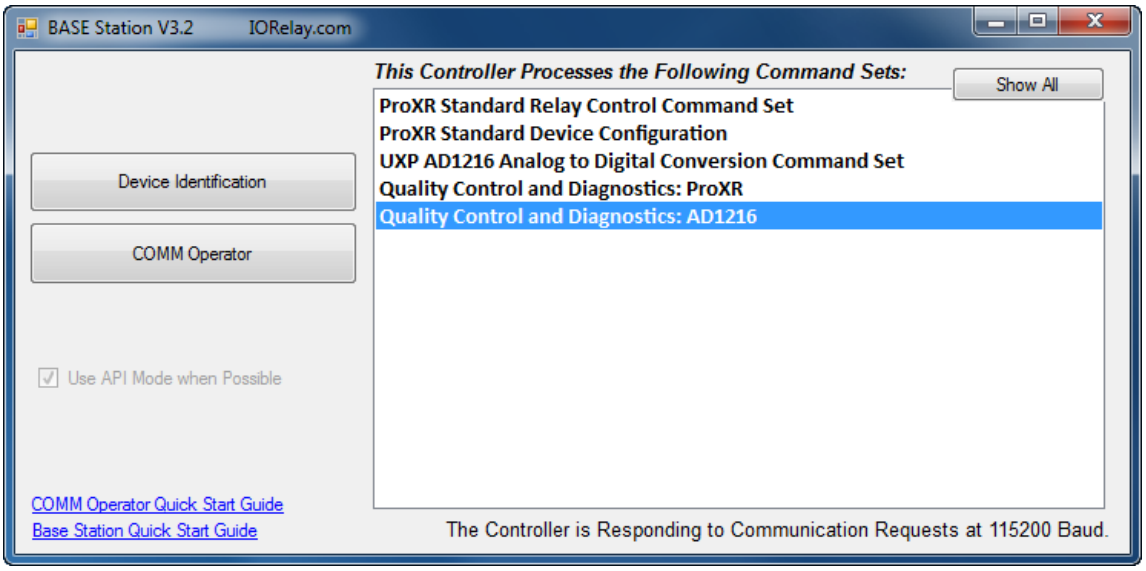
Transmit	Command Description	Receive
254 205	Read All 16 Channels at a Time, 12-Bit A/D Device 1. This command returns 34 bytes of data in Order: Header Byte, Channels 0-15, Checksum Byte at End of Packet. Checksum Value Always Equals the Sum of All Bytes Sent, Including the Header. The Checksum Value is Always 8-Bits. You Should Extract the Lower 8 Bits from the Checksum to Return a Matched Value. Use This Formula: CheckSumTest = Sum of All Bytes Sent from Controller Except Checksum CheckSum = Last Byte Sent from Controller (CheckSumTest AND 255) MUST Equal CheckSum The AND Function Used in the Above Formula is a Mathematical Function that Returns (in this case) the Lower 8 Bits of the CheckSumTest. AND is supported by Most Programming Languages. The A/D Value of each channel is Re-Assembled using: Value = (MSB*256)+LSB	Header Byte 254 AD0-LSB(0-255) AD0-MSB(0-255) AD1-LSB(0-255) AD1-MSB(0-255) AD2-LSB(0-255) AD2-MSB(0-255) AD3-LSB(0-255) AD3-MSB(0-255) AD4-LSB(0-255) AD4-MSB(0-255) AD5-LSB(0-255) AD5-MSB(0-255) AD6-LSB(0-255) AD6-MSB(0-255) AD7-LSB(0-255) AD7-MSB(0-255) AD8-LSB(0-255) AD8-MSB(0-255) AD9-LSB(0-255) AD9-MSB(0-255) AD10-LSB(0-255) AD10-MSB(0-255) AD11-LSB(0-255) AD11-MSB(0-255) AD12-LSB(0-255) AD12-MSB(0-255) AD13-LSB(0-255) AD13-MSB(0-255) AD14-LSB(0-255) AD14-MSB(0-255) AD15-LSB(0-255) AD15-MSB(0-255) Checksum(0-255)

Transmit	Command Description	Receive
254 206	Read All 16 Channels at a Time, 12-Bit A/D Device 2. This command returns 34 bytes of data in Order: Header Byte, Channels 0-15, Checksum Byte at End of Packet. Checksum Value Always Equals the Sum of All Bytes Sent, Including the Header. The Checksum Value is Always 8-Bits. You Should Extract the Lower 8 Bits from the Checksum to Return a Matched Value. Use This Formula: CheckSumTest = Sum of All Bytes Sent from Controller Except Checksum CheckSum = Last Byte Sent from Controller (CheckSumTest AND 255) MUST Equal CheckSum The AND Function Used in the Above Formula is a Mathematical Function that Returns (in this case) the Lower 8 Bits of the CheckSumTest. AND is supported by Most Programming Languages. The A/D Value of each channel is Re-Assembled using: Value = (MSB*256)+LSB	Header Byte 254 AD0-LSB(0-255) AD0-MSB(0-255) AD1-LSB(0-255) AD1-MSB(0-255) AD2-LSB(0-255) AD2-MSB(0-255) AD3-LSB(0-255) AD3-MSB(0-255) AD4-LSB(0-255) AD4-MSB(0-255) AD5-LSB(0-255) AD5-MSB(0-255) AD6-LSB(0-255) AD6-MSB(0-255) AD7-LSB(0-255) AD7-MSB(0-255) AD8-LSB(0-255) AD8-MSB(0-255) AD9-LSB(0-255) AD9-MSB(0-255) AD10-LSB(0-255) AD10-MSB(0-255) AD11-LSB(0-255) AD11-MSB(0-255) AD12-LSB(0-255) AD12-MSB(0-255) AD13-LSB(0-255) AD13-MSB(0-255) AD14-LSB(0-255) AD14-MSB(0-255) AD15-LSB(0-255) AD15-MSB(0-255) Checksum(0-255)

Chapter 5

Troubleshooting

Run the NCD Base Station Software to diagnose controller problems. Choose "*Quality Control and Diagnostic: AD1216*".



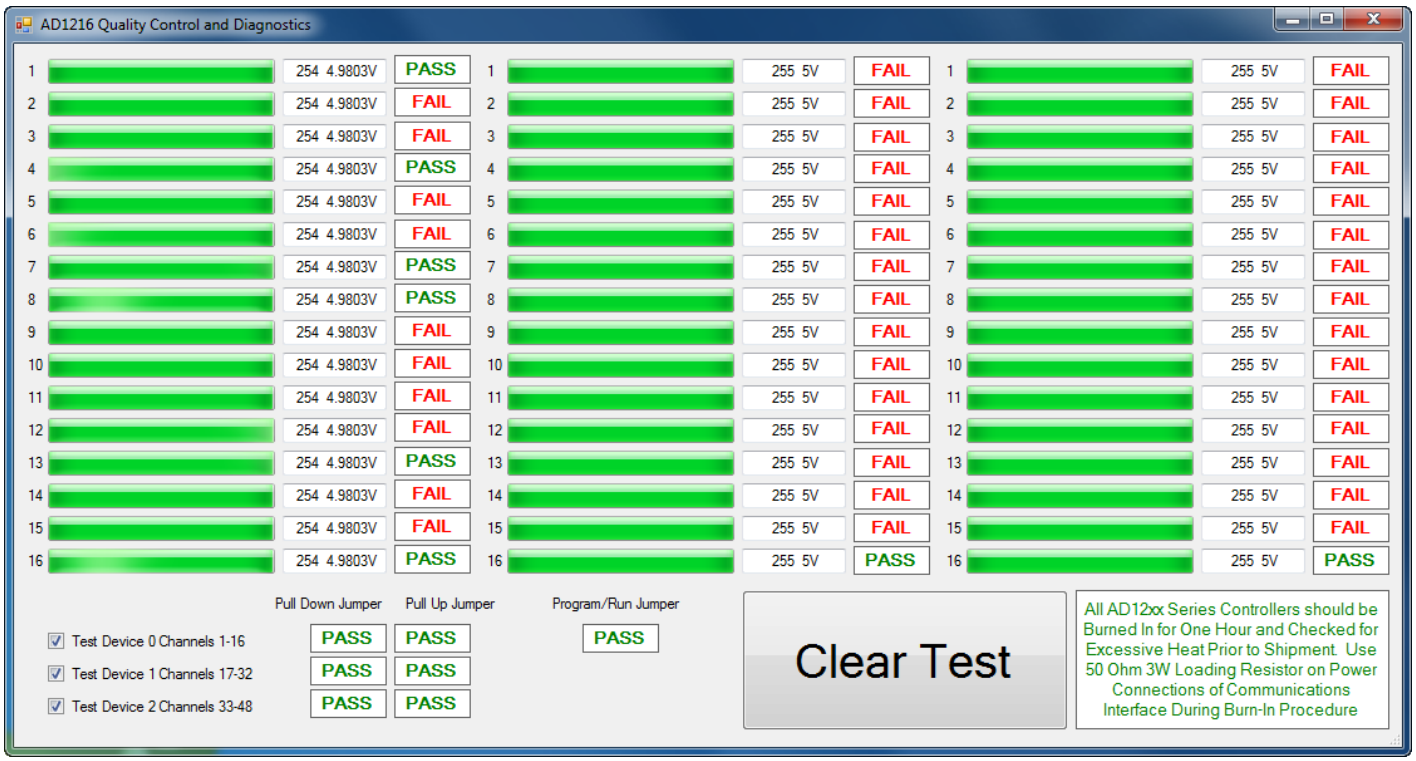
If you experience problems with any AD1216 series device, you may use this diagnostics interface to help determine if there is a hardware problem. Many portions of this user interface will be hidden. In order to view all elements, it is necessary to check the number of analog devices you will be testing (lower left corner of the interface).

Next, you MUST test the Up/Down Jumpers BEFORE you are allowed to test individual input channels.

Once the Up/Down test has passed (by moving the up/down jumper into each position), move the Up/Down jumper to the UP position. Next, connect each analog input channel to ground (individually) using a jumper wire. It may take 1-5 seconds to test each input. An audible tone will indicate a "PASS" condition and you may move to the next analog input.

Test each analog input individually to pass the testing procedure.

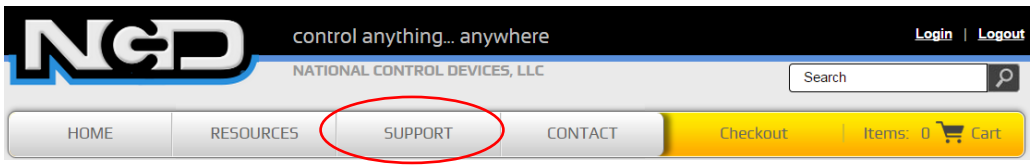
If you need to test another controller, click the "Clear Test" button.



Chapter 6

Technical Support

Technical support is available through our website, controlanything.com. **Support** is the way we connect NCD engineers to our customers.



*Click on the **Support** tab at the top of any page on our website to be taken to the **Forum** page. Here you can publicly post or review problems that customers have had, and learn about our recommended solutions.*

Our engineers monitor questions and respond continually throughout the day. Before requesting telephone technical support, we ask that customers please try to resolve their problems through **Support** first. However, for persistent problems, NCD technical support engineers will schedule a phone consultation.

Contact Information

National Control Devices, LLC
PO Box 455
Osceola, MO 64776
417-646-5644 phone
866-562-0406 fax
Open 9 a.m. - 4 p.m. CST

Like "National Control Devices" on Facebook, and follow us on Twitter @ControlAnything.

All orders *must* be placed online at our website, www.controlanything.com

Notice:

The only authorized resellers of NCD products are

- www.controlanything.com
- www.relaycontrollers.com
- www.relaypros.com

All other websites are not authorized dealers; we have noticed some retailers offering our products fraudulently.

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