BRX Analog I/O Expansion Modules

In This Chapter...

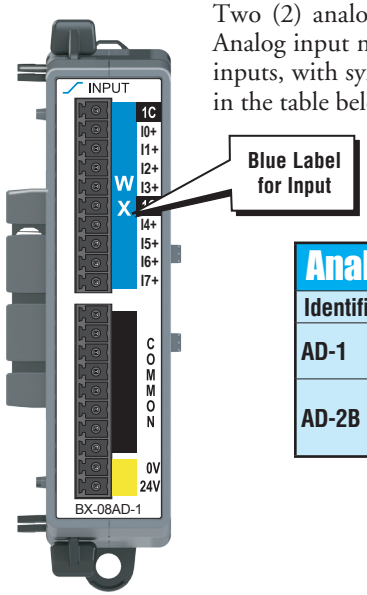
Overview

One of the unique features of the BRX platform is its ability to easily expand its capability to fit your application solution. One of the ways the BRX platform can do this is by using expansion modules that conveniently "snap-on" to the side of any BRX MPU.

The analog expansion modules give you the ability to add additional analog I/O as needed and are identified as an input module, output module or temperature input module. On the front panel of the analog I/O expansion modules a color scheme and a symbol are used to denote the module type. Analog modules are available in 8-point current inputs/outputs, 8-point unipolar or bipolar voltage inputs/outputs, and 4-point thermocouple input modules.

Module Types

Analog Input Modules

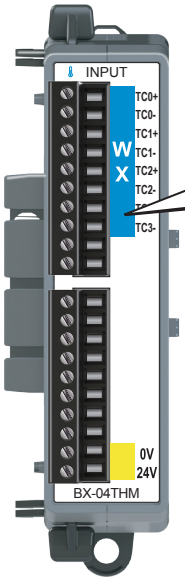


Two (2) analog input modules are available, with current or voltage inputs. Analog input module faceplates have a blue terminal bar to distinguish them as inputs, with symbols ⟋ or ◢ to signify current or voltage, respectively. Listed in the table below are the different types of input modules available.

Analog Input Modules

Identifier	Input Type	8-Point
AD-1	Current Sink 0–20mA, 4–20mA	BX-08AD-1
AD-2B	Voltage ±10VDC, ±5VDC, 0–5VDC, 0–10VDC	BX-08AD-2B

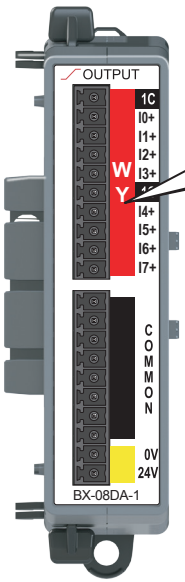
Temperature Input Module



A temperature input module is available with thermocouple inputs. The temperature input module can also be configured for millivolt-level voltage inputs. Temperature module faceplates have a blue terminal bar and symbol for easy distinction from other module types. The table below shows the temperature input module and its input type.

Temperature Input Module		
Identifier	**Type**	**4-Point**
THM	Thermocouple	BX-04THM

Analog Output Modules



Two (2) analog output modules are available, in current and voltage outputs. Analog output module faceplates have a red terminal bar to distinguish them as outputs, with symbols or to signify current or voltage, respectively. Listed in the table below are the different types of output modules available.

Analog Output Modules		
Identifier	**Type**	**8-Point**
DA-1	Current Source 0–20mA, 4–20mA	BX-08DA-1
DA-2B	Voltage ±10VDC, ±5VDC, 0–5VDC, 0–10VDC	BX-08DA-2B

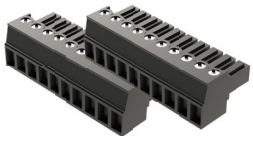
Wiring Termination Options

The BRX analog expansion modules ship without wiring terminals blocks. This allows you to select the termination style that best fits your application. There are several wiring options available, including removable screw terminal connectors, removable spring clamp terminal connectors and pre-wired ***ZIP***Link cable solutions. The BRX Temperature Input Modules include the BX-RTB10 kit. The BX-RTB10-1 or BX-RTB10-2 can also be used and can be purchased separately.

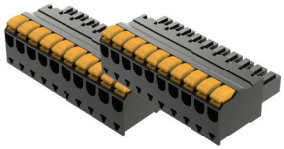
Terminal Block Connectors

The terminal block connectors are provided in kits of multiple connectors that are easily ordered as a single part number. The kits for the 8-point modules and for the 4-point thermocouple module include (2) 10-pin 3.81-mm connectors.

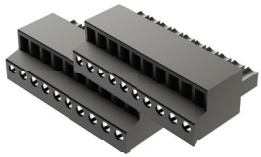
Terminal block kit part numbers and connector specifications are listed in the following table.



BX-RTB10 Kit



BX-RTB10-1 Kit



BX-RTB10-2 Kit

Terminal Block Specifications

Part Number	BX-RTB10	BX-RTB10-1	BX-RTB10-2
Connector Type	Screw Type 90 degree	Spring Clamp Type 180 degree	Screw Type 180 degree
Wire Exit	180 degree	180 degree	180 degree
Pitch	3.81 mm	3.81 mm	3.81 mm
Screw Size	M2	N/A	M2
Screw Torque Recommended	<1.77 lb·in (0.2 N·m)	N/A	<1.77 lb·in (0.2 N·m)
Screwdriver Blade Width	2.5 mm	2.5 mm	2.5 mm
Wire Gauge (Single Wire)	28–16 AWG	26–18 AWG	30–16 AWG
Wire Gauge (Dual Wire)	28–18 AWG	30–20 AWG (Dual Wire Ferrule Required)	30–18 AWG
Wire Strip Length	0.24 in (6mm)	0.35 in (9mm)	0.26 in (6.5 mm)
Equiv. Dinkle P/N	EC381V-10P-BK	ESC381V-10-BK	EC381F-10P-BK

NOTE: *BX-RTB10 terminal blocks are included with Temperature Input modules.*

*ZIP*Link Wiring System

BRX analog expansion modules can be quickly connected to convenient ***ZIP***Link remote terminal blocks for ease of wiring remote I/O devices. The following table lists the connector options. The ***ZIP***Link wiring system is not available for use with the BRX Temperature Input Module.

8-Point BRX Analog Expansion Module ZIPLink Selector

Expansion Module Part No.	*ZIP*Link Module	*ZIP*Link Module Part No.	Qty Needed	*ZIP*Link Cable Part No.*	Qty Needed
BX-08AD-1	Feedthrough	ZL-RTB20 (standard) OR ZL-RTB20-1 (compact)	1	ZL-BXEM-CBL20 ZL-BXEM-CBL20-1 ZL-BXEM-CBL20-2	1
BX-08AD-2B					
BX-08DA-1					
BX-08DA-2B					

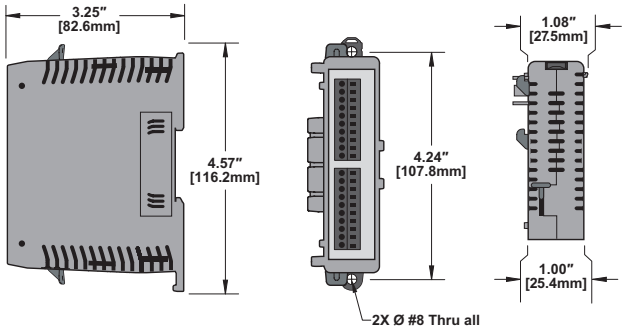
** Select the cable length: Blank = 0.5 m, -1 = 1.0 m, -2 = 2.0 m.*
Available pigtail cables: ZL-BXEM-CBL20-1P = 1.0 m, ZL-BXEM-CBL20-2P = 2.0 m.

General Specifications

All BRX analog expansion modules and temperature input modules have the same general specifications listed in the table below.

General Specifications	
Operating Temperature	0° to 45°C (32° to 113°F)
Storage Temperature	−20° to 70°C (−4° to 158°F)
Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	IEC60068-2-6 (Test Fc)
Shock	IEC60068-2-27 (Test Ea)
Enclosure Type	Open Equipment
Agency Approvals	UL 61010-2-201 File # E139594 Canada and USA CE (Safety: EN61010-2-201 and Immunity: EN61131-2: 2007)
Noise Immunity	NEMA ICS3-304
EU Directive	See the “EU Directive” topic in the BRX Help File.

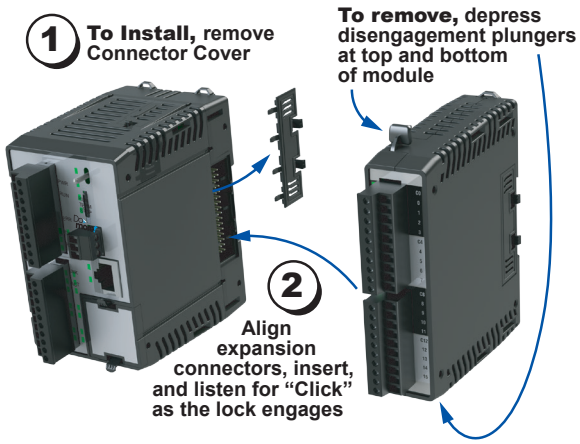
Dimensional Information



Module Installation

WARNING: Do not apply field power until the following steps are completed. The BRX expansion modules are NOT hot swappable.

To install an expansion module, remove the connector cover on the right side of the MPU or expansion module to which the new module is to be connected. Align the expansion connectors and insert the module until you hear a "click", indicating the module expansion connectors have engaged.



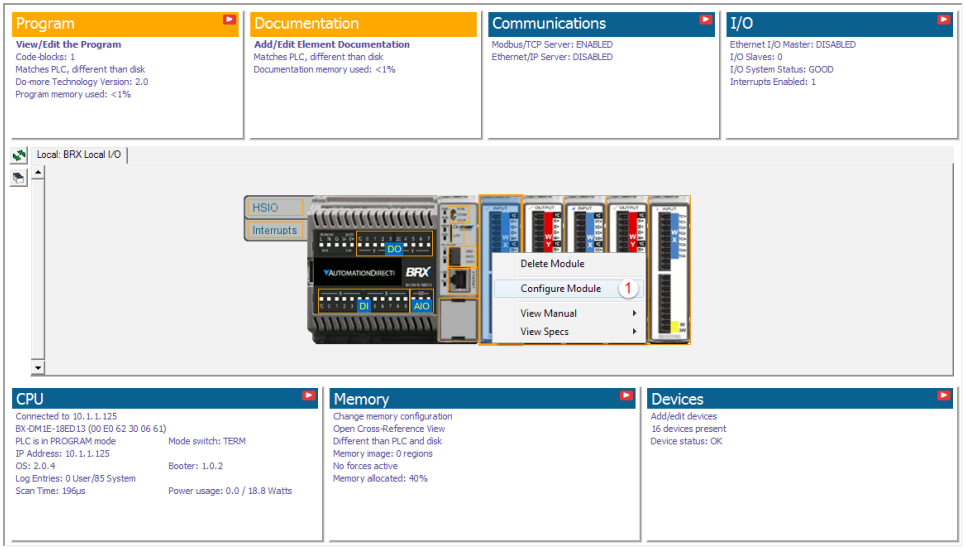
To remove an expansion module locate the two disengagement plungers. One is located at the top of the of the expansion module and a second one at the bottom of the expansion module. Depressing both plungers at the same time will release the locking mechanism and disengage the unit from the system.

NOTE: *Allow a minimum of 45mm (1.75in) to the right of MPU chassis and any subsequent expansion modules for mounting and dismounting of the modules.*

Module Configuration

Once the expansion module has snapped in place and is added to the project it instantly adds additional I/O and features to the MPU with minimal additional setup required.

To configure a newly attached module, load the Do-more! Designer software and connect to the BRX MPU, as discussed in Chapter 10. A graphical representation of the BRX unit with its attached modules is displayed in the Dashboard of the software.



To access the module configuration dialogs, left-click or right-click on the module in the Dashboard and select (1) **Configure Module**. The configuration dialogs for each module are discussed in the corresponding section of this chapter.

Analog Tips and Troubleshooting

This subsection presents common tips on selection and installation of analog hardware, as well as basic troubleshooting techniques, to maximize the performance of your analog input/output circuits.

General Tips for Analog Circuits

When selecting and installing analog devices there are a few things to consider:

- Current devices are much more tolerant to noise than voltage devices.
- Current devices can handle much longer runs of wire without signal loss.
- Shielded twisted pair wire should always be used. Analog signals are typically low power and the better your isolation the less noise you will have degrading the signal.
- If the analog signal is from a thermocouple, the appropriate thermocouple extension wire and terminal blocks must be used if needed to extend wire lengths.
- Use the shortest wiring route whenever possible.
- Do not run analog signal wiring in the same conduit or wire way as AC wiring.
- Do not run analog signal wiring next to large motors, high current switches, or transformers.
- Route the wiring through an approved cable housing to minimize the risk of accidental damage.
- Shields should be connected only at one end, to ground at the source device. Connecting both ends of a shield will create a ground loop which can increase the noise in a circuit.
- Bonding of the DC negative to ground should be considered, with the exception of Class II power supplies which should never be bonded to ground. This can help with reducing noise induced into analog circuits. Please note that consideration should be given to all devices that will utilize the power supply to insure that bonding of the negative will not cause damage or interference.
- AC power should be checked from neutral to ground. This voltage should be less than 0.1 VAC.

NOTE: *Your company may have guidelines for wiring and cable installation. If so, you should check those before you begin the installation.*

NOTE: *Check local and national codes to choose the correct method for your application.*

Reducing Electrical Noise

Electrical noise is one of the most difficult problems to diagnose. It can enter the system from a wide range of conducted or radiated sources.

Conducted noise is when the electrical interference is introduced into the system by way of an attached wire, panel connection, etc. It may enter through an I/O point, a power supply connection, the communication ground connection, or the chassis ground connection.

Radiated noise is when electrical interference is introduced into the system without a direct electrical connection, such as via radio waves.

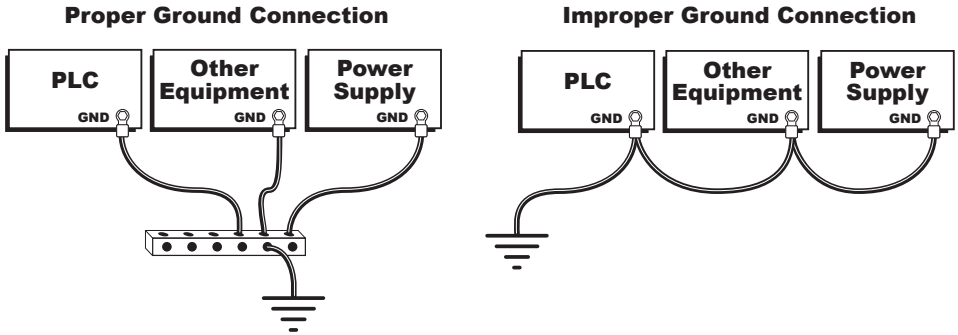
It may be difficult to determine how electrical noise is entering the system, but the corrective actions for either type of noise problem are similar.

While electrical noise cannot be eliminated completely, it can be reduced to a level that will not affect system function. Proper grounding of components and signal wiring along with proper isolation of voltages can minimize noise in the system.

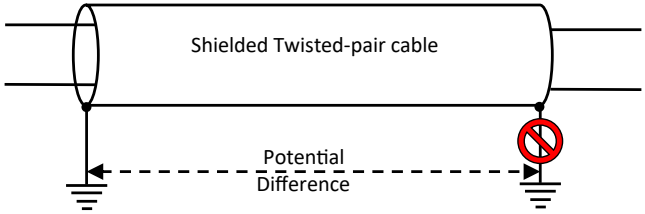
Grounding

Most noise problems result from improper grounding of the system. A good earth ground can be the single most effective way to correct noise problems. If a ground is not available, install a ground rod as close to the system as possible.

Ensure all ground wires are single point grounds and are not daisy chained from one device to another. Ground metal enclosures around the system. Loose ground wires on your devices are more susceptible to noise than the other wires in your system. A loose wire is no more than a large antenna waiting to introduce noise into the system; therefore, you should tighten all connections in your system. Review Chapter 1, "General Installation and Wiring Guidelines", if you have questions regarding how to ground your system.



Cables with shields should be grounded on only one end of the shield. This prevents ground loops and allows for any radiated noise collected by the shield to properly drain to a single ground point.



Isolation

Electrical noise can enter the system through the power source for the MPU and I/O. Installing an isolation transformer for all AC sources can correct this problem.

DC power sources should be properly grounded, except for Class II power supplies which should never be bonded to ground. Switching DC power supplies commonly generate more noise than linear supplies. Typically switching type supplies work well for analog circuits, but for some circuits where noise can be a factor, linear type supplies may be needed.

Analog wiring should be placed in separate wire ways or wiring bundles. Keep AC and DC wiring separated. Never run analog signal or communications wiring in parallel or in close proximity to high voltage wiring.

Transformers, inductors, VFDs, DC drives, welders, static generators, ultrasonic devices, radio transmitters, receivers, wiring and antennas, along with similar types of devices, generate large amounts of RF interference. DC wiring, analog wiring and communications wiring should be kept as far away from these sorts of devices and their associated input and output wiring as possible.

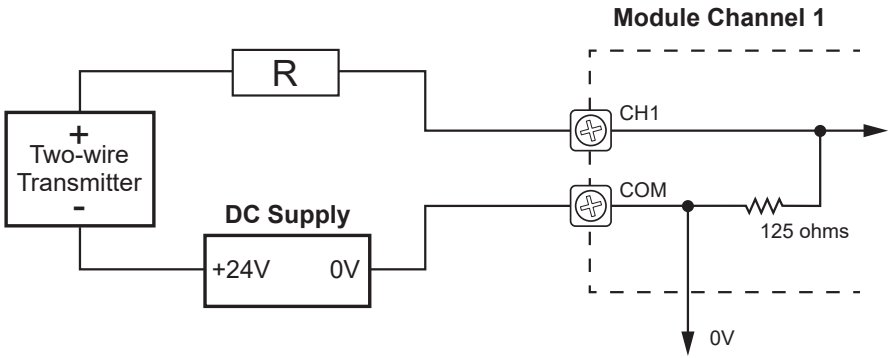
Devices that generate noise such as those listed above, along with coil driven devices such as relays, contactors, solenoids, etc., should be placed on a separate power supply from analog circuits. If this is not possible, then great care should be taken to properly suppress the transient voltage spikes from these devices turning on and off. See Chapter 1, "BRX General Installation and Wiring Guidelines" for more information on this subject.

Current Module Tips and Troubleshooting

- Use shielded twisted pair wire. Suggested ADC cables are PLTC3-18-xS-xxxx or PLTC3-18-xSS-xxxx
- Analog circuits follow Ohm's Law. As such it is important to follow the specifications for impedance in the circuit. If you allow the impedance values to go outside of the specification, damage to the module will occur.
- If your transmitter requires a load resistance higher than 125Ω, you may need to add a resistor in series with the module. Consider the following example for a transmitter being operated from a 24VDC supply with a recommended load resistance of 750 ohms. Since the module has a 125-ohm resistance, you need to add an additional resistor.

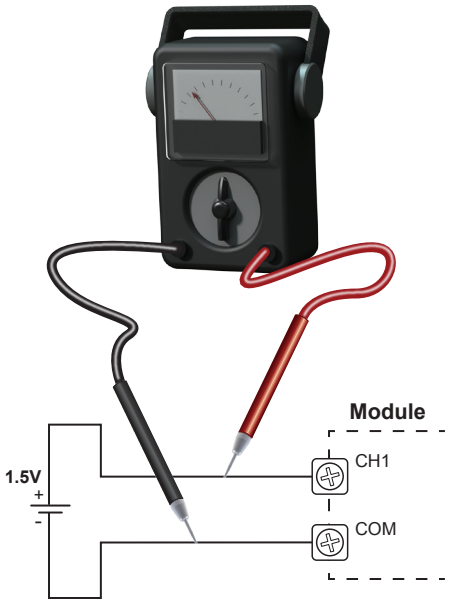
R = Tr – Mr
R = 750 – 125
R ≥ 625

R = Resistor to add
Tr = Termination Requirement
Mr = Module resistance (Internal 125 ohms)



- If you suspect an I/O error, there are several things that could be causing the problem:
  - A blown fuse.
  - A loose terminal block.
  - The 24VDC supply has failed or 24VDC has not been supplied to the I/O common.
  - The I/O point has failed.
- The DC power supply that powers the module should be checked for the negative side to ground voltage being under 0.1 V for both AC and DC. If this voltage is floating, it can cause errors and/or damage to the circuit.

- To test a current input module, use a 1.5 V battery wired across the positive and negative terminals of the channel to check for current. When applied across a current analog input point, a reading of approximately 30% of the full scale value should result.

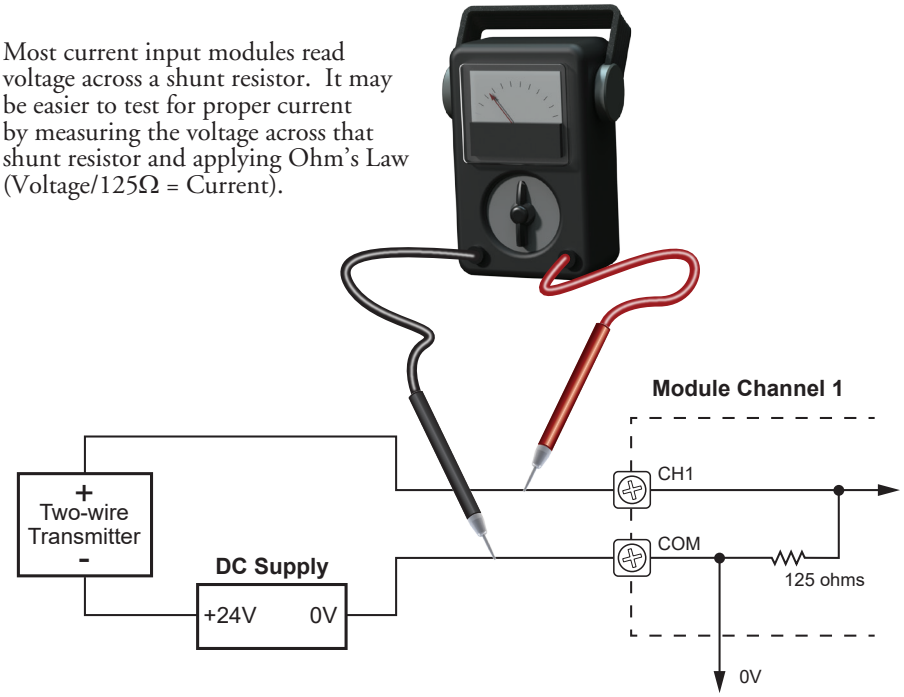


0–20mA is 0–5VDC across the input resistor

1.5V/5V=0.3

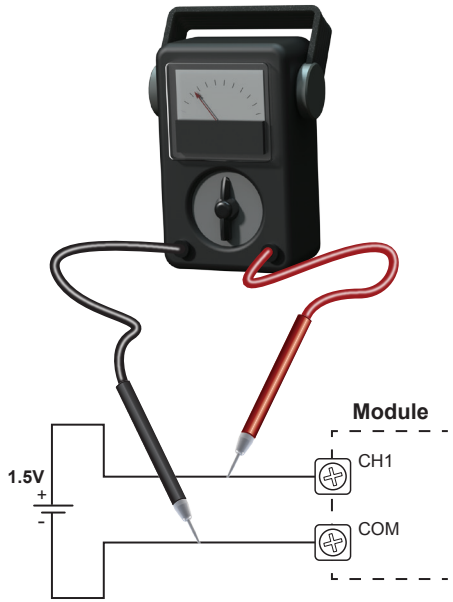
0.3*65535 = ~19660 counts or
0.3*32767=~9830 counts

- Most current input modules read voltage across a shunt resistor. It may be easier to test for proper current by measuring the voltage across that shunt resistor and applying Ohm's Law (Voltage/125Ω = Current).



Voltage Module Tips and Troubleshooting

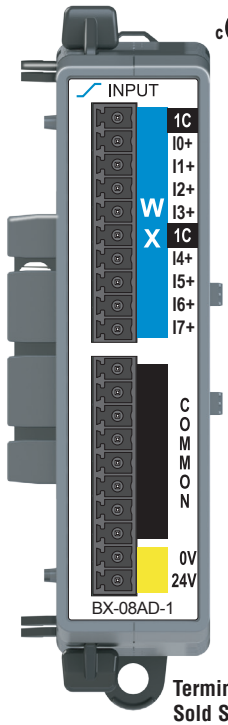
- Use shielded twisted pair wire. Suggested ADC cables are PLTC3-18-xS-xxxx or PLTC3-18-xSS-xxxx.
- Jumper the positive and negative terminals together on unused voltage input channels.
- Analog circuits follow Ohm's Law. As such it is important to follow the specifications for impedance in the circuit. If you allow the impedance values to go outside of the specification, damage to the module will occur.
- If you suspect an I/O error, there are several things that could be causing the problem:
  - A blown fuse
  - A loose terminal block
  - The 24VDC supply has failed or 24VDC has not been supplied to the I/O common.
  - The I/O point has failed.
- The DC power supply that powers the module should be checked for the negative side to ground voltage being under 0.1 V for both AC and DC. If this voltage is floating, it can cause errors and/or damage to the circuit.
- To test the voltage input module, use a 1.5 V battery wired across the positive and negative terminals of the input channel to check for voltage. When applied across a voltage analog input point, a reading of approximately 1.5 V should result.



Temperature (Thermocouple) Module Tips and Troubleshooting

- Use shielded thermocouple extension wire of the same type as the thermocouple.
- Do not use terminal blocks that are not designed for thermocouple extension wire.
- Thermocouple wires that have just been twisted to form a junction will inherently be less accurate than factory made thermocouples. The use of twist junction thermocouples is not recommended.
- Jumper each of the channel +/- connections together on the module with a short piece of copper wire. This will cause the module to return the measured terminal block temperature for that channel. Does it read the correct ambient temperature of the thermocouple module? If so there probably isn't anything wrong with the module. This temperature will be several degrees higher than the ambient air temperature of the enclosure.
- With a thermocouple simulator, you have to disable the burnout detection for the module using the module setup in the Do-more! Designer software and download the program to the PLC. This will disable the burnout circuitry, which will cause incorrect readings if left enabled. Even then, it is likely that the module will not read exactly what the simulator is putting out due to the wire differences and the terminal block on the module causing some cold junction error.
- It is possible that the module may be damaged from exceeding the common mode voltage spec which is 5 Volts. The voltage needs to be measured between each channel on both plus and minus terminals of the module on both AC and DC scales and make sure that it is under 5 Volts maximum. Preferably the voltage should be less than 0.1V.
- AC power should be checked from neutral to ground. This voltage should be less than 0.1 VAC.
- With grounded thermocouples, take precautions to prevent having a voltage potential between thermocouple tips. A voltage of 1V or greater between tips will skew measurements. For grounded thermocouples, the equipment and thermocouples must be bonded with large-gauge braided wire to the same ground as the PLC.
- The DC power supply that powers the module should be checked for the negative side to ground voltage being under 0.1V for both AC and DC. If this voltage is floating, it can cause errors and/or damage to the circuit.

BX-08AD-1 Analog Current Sinking Input



Terminal Blocks Sold Separately

We recommend using prewired ***ZIP***Link cables and connection modules. If you wish to hand-wire your module, a removable terminal block is available. See Wiring Termination Selection in this chapter for all options.

Analog Current Sinking Input Specifications	
Inputs per Module	8
Commons	1
Module Signal Input Range	0–20mA, 4–20mA (Default)
Signal Resolution	16-bit, 15-bit (Default)
Input Impedance	125Ω±0.1%, 1/10th watt
All Channel Update Rate	45ms (8 channels)
Over Current Circuit Detection Time	< 1second
Maximum Continuous Overload (Voltage)	0.5 Watts (e.g. ±100V @ 5mA)
Sample Duration Time	5µs per channel
Hardware Filter Characteristics	Low Pass 1st order, −3dB @ 144Hz
Conversion Method	Successive approximation
Linearity Error (end to end)	±0.01% of range
Input Stability and Repeatability	±0.035% of range (after 10 min. warmup)
Full Scale Calibration Error	±0.02% of range
Offset Calibration Error	±0.02% of range
Accuracy vs. Temperature	±25PPM / ºC maximum
Maximum Inaccuracy	0.1% of range (incl. Temperature Drift)
Maximum Crosstalk	−96dB, 1 LSB
Channel to Backplane Isolation	1800VAC applied for one second
Channel to Channel Isolation	None
Loop Fusing (External)	Fast-acting 0.032A recommended
Backplane Power Consumption	0.1 W
External DC Power Required	Class 2 or LPS power supply 24VDC (±20%) 25mA
Heat Dissipation	2.5 W
Weight	100g (3.5 oz)
Software Version	Do-more! Designer Programming Software version 2.1 or later

IMPORTANT!

Hot-Swapping Information
NOTE: This device cannot be Hot Swapped.

BX-08AD-1 Analog Current Sinking Input, continued

Data Range Specifications

Selection	Description	Enable 16 bit Unchecked (15 bit Resolution, Default)			Enable 16 bit Checked (16 bit Resolution)		
		Raw Counts	Casting*	µA Per Count	Raw Counts	Casting*	µA Per Count
0–20mA	unipolar 0–20mA	0–32767	–	0.61	0–65535	WXn:U	0.31
4–20mA	unipolar 4–20mA	0–32767	–	0.49	0–65535	WXn:U	0.24

** For more information on Casting refer to Help topic DMD0309 in the Do-more! Designer Software.*

The module reserves the first 24 bits of unused contiguous space in the X register, aligned to an 8-bit word boundary, for status reporting. Error flags for this module are laid out within its status register space as described in the following table.

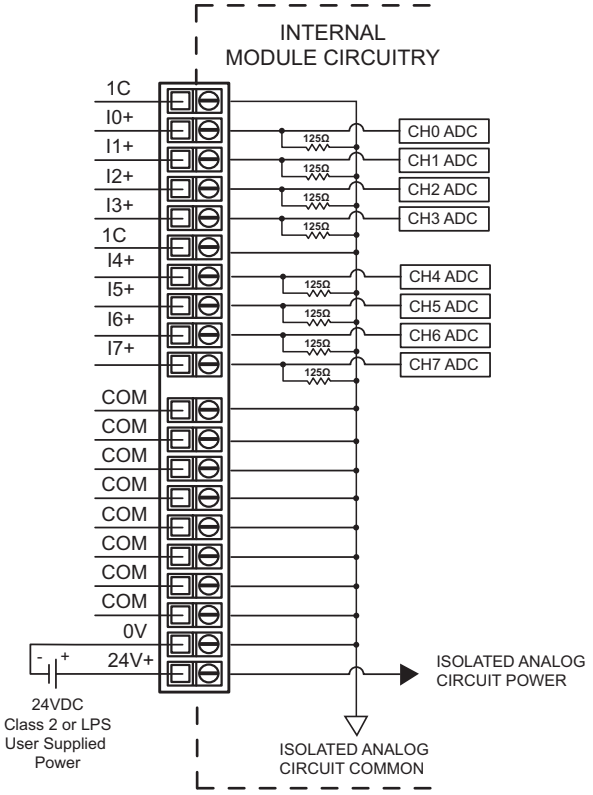
Error Flag Specifications

	MSB							LSB
1st Byte of unused X Registers								
Module Status	-	-	-	-	-	Data Not Valid	Missing 24VDC	Self Test Failed
2nd Byte of unused X Registers								
Channel Open (Broken Transmitter)*	Channel 8	Channel 7	Channel 6	Channel 5	Channel 4	Channel 3	Channel 2	Channel 1
3rd Byte of unused X Registers								
Unused	-	-	-	-	-	-	-	-

** Broken Transmitter bits will turn on below ~3.75 mA.*

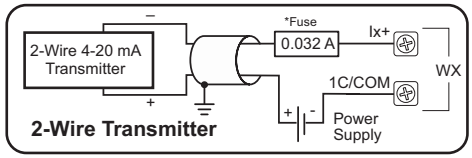
BX-08AD-1 Analog Current Sinking Input, continued

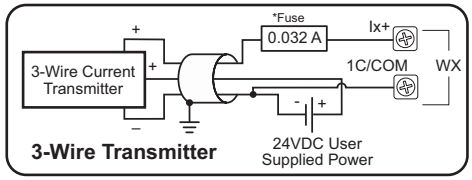
Analog Current Input Wiring

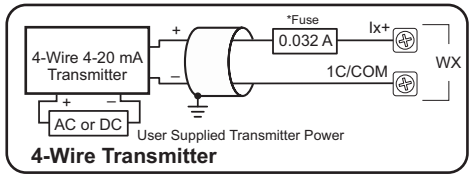


Analog Current Sinking Input Circuits

*An Edison S500-32-R 0.032 A fast-acting fuse is recommended for all analog voltage inputs, analog outputs, and current loops.





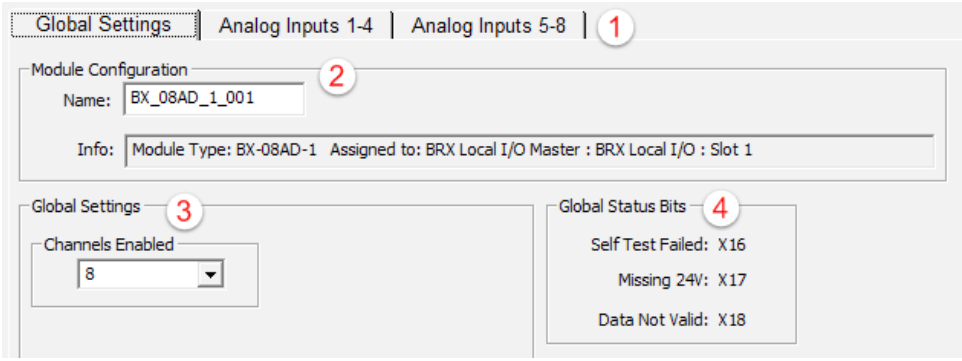


NOTE: Shield should be connected only at one end, to ground at the source device.

BX-08AD-1 Analog Current Sinking Input, continued

Software Setup

After the module is installed, open the Do-more! Designer programming software version 2.1 or later, connect to the BRX MPU and open the **Configure Module** dialog as described at the beginning of this chapter.



(1) The module options are divided into subsets across multiple tabs. Click the appropriate tab to edit the configuration.

(2) *Module Configuration*

Name – Each module comes with a default name. This may be changed by the user to better identify the module if desired.

Info – This is the system description of the module. It is static and may not be changed.

(3) *Global Settings*

Channels Enabled – Select how many channels will be used. The default is all channels. Selecting fewer channels may increase the update frequency. See the module specifications for details.

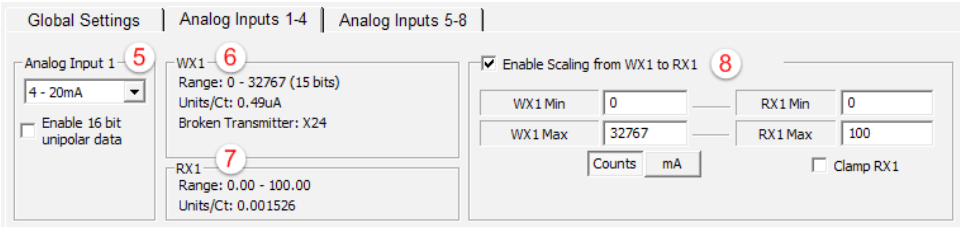
(4) *Global Status Bits*

Self Test Failed – This bit will be On if the module has failed its internal self-test. In this case the module is likely bad and should be replaced.

Missing 24V – This bit will be On if the external 24VDC power is missing. Check the 24VDC power connection on the module terminal block.

Data Not Valid – This bit will be On if the module does not have the latest configuration parameters or the module has not been configured at all. Reload the program into the CPU and power cycle.

BX-08AD-1 Analog Current Sinking Input, continued



(5) ***Analog Input x***

These settings are for each channel of the analog module.

Drop Down menu - Select the range of the analog input here.

Enable 16 bit unipolar data – Check this box to change the raw count range from a signed decimal bipolar data format to an unsigned decimal data format. This may require that Casting be used in the program in order to properly access the data. Refer to the chart of Data Range Specifications earlier in this chapter to see if the registers must be accessed with Casting.

(6) ***WXx***

Range – The number of Raw counts for the selected channel on the module

Units/Ct – The amount of current that will equal 1 raw count.

Broken Transmitter – The input register that when On will indicate that the loop is broken.

(7) ***RXx***

Range – The engineering units to which the raw counts are scaled.

Units/Ct – The number of raw counts that will equal 1 scaled engineering unit.

(8) ***Enable Scaling from WXx to RXx***

WXx Min – The minimum value of the raw counts to scale.

WXx Max – The maximum value of the raw counts to scale.

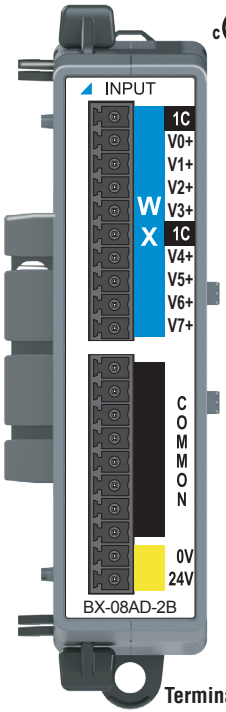
RXx Min – The minimum value of the engineering units for scaling.

RXx Max – The maximum value of the engineering units for scaling.

Counts/mA – Use these buttons to change the raw scaling to counts or milliamps.

Clamp RXx – If this box is checked, RXx will clamp at the minimum and maximum scaled values.

BX-08AD-2B Analog Voltage Input



Terminal Blocks Sold Separately

Analog Voltage Input Specifications	
Inputs per Module	8
Commons	1
Module Signal Input Range	±10 VDC, ±5 VDC, 0–5 VDC, 0–10 VDC (default)
Signal Resolution	16-bit, 15 bit (Default)
Input Impedance	>10MΩ
All Channel Update Rate	45ms (8 channels)
Sample Duration Time	5µs per channel
Hardware Filter Characteristics	Low Pass 2nd order, −3dB @ 15kHz
Conversion Method	Successive approximation
Accuracy vs. Temperature	±25PPM / °C maximum
Maximum Inaccuracy	0.15% of full range (over temp)
Linearity Error (end to end)	±0.03%
Input Stability and Repeatability	±0.06% of range (after 10 min. warmup)
Full Scale Calibration Error	±0.08% of range
Offset Calibration Error	±0.08% of range
Maximum Crosstalk	−96dB, 1 LSB
Channel to Backplane Isolation	1800VAC applied for one second
Channel to Channel Isolation	None
Loop Fusing (External)	Fast-acting 0.032A recommended
Backplane Power Consumption	0.1 W
External DC Power Required	Class 2 or LPS power supply 24VDC (±20%) 25mA
Heat Dissipation	2.5 W
Weight	100g (3.5 oz)
Software Version	Do-more! Designer Programming Software version 2.1 or later

We recommend using prewired ***ZIP***Link cables and connection modules.
If you wish to hand-wire your module, a removable terminal block is available. See Wiring Termination Selection in this chapter for all options.

IMPORTANT!

Hot-Swapping Information
NOTE: This device cannot be Hot Swapped.

BX-08AD-2B Analog Voltage Input, continued

Data Range Specifications

Selection	Description	Enable 16 bit Unchecked (15 bit Resolution, Default)[1]			Enable 16 bit Checked (16 bit Resolution)		
		Raw Counts	Casting[2]	µV Per Count	Raw Counts	Casting[2]	µV Per Count
0–10V	unipolar 10VDC	0–32767	-	305	0–65535	WXn:U	152
0–5V	unipolar 5VDC	0–32767	-	152	0–65535	WXn:U	76
±10V	bipolar 10VDC	-	-	-	−32768 to 32767	-	305
±5V	bipolar 5VDC	-	-	-	−32768 to 32767	-	152

1. Bipolar ranges default to 16-bit resolution.

2. For more information on Casting refer to Help topic DMD0309 in the Do-more! Designer Software.

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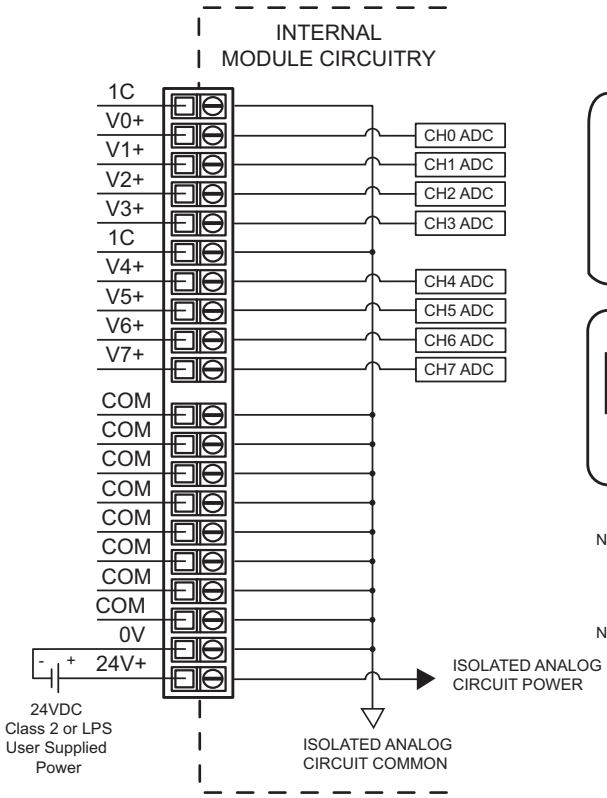
The module reserves the first 24 bits of unused contiguous space in the X register, aligned to an 8-bit word boundary, for status reporting. Error flags for this module are laid out within its status register space as described in the following table.

Error Flag Specifications

	MSB							LSB
1st Byte of unused X Registers								
Module Status	-	-	-	-	-	Data Not Valid	Missing 24VDC	Self Test Failed
2nd Byte of unused X Registers								
Channel Out of Range	Channel 8	Channel 7	Channel 6	Channel 5	Channel 4	Channel 3	Channel 2	Channel 1
3rd Byte of unused X Registers								
Unused	-	-	-	-	-	-	-	-

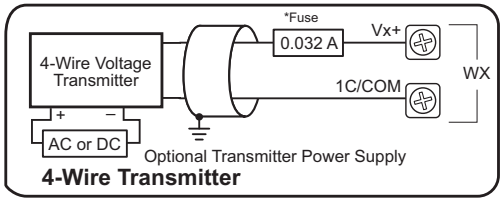
BX-08AD-2B Analog Voltage Input, continued

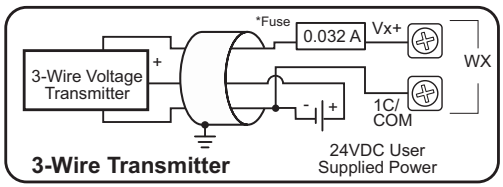
Analog Voltage Input Wiring



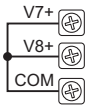
Analog Voltage Input Circuits

*An Edison S500-32-R 0.032 A fast-acting fuse is recommended for all analog voltage inputs, analog outputs, and current loops.





NOTE: For maximum accuracy: Jumper unused inputs to common.

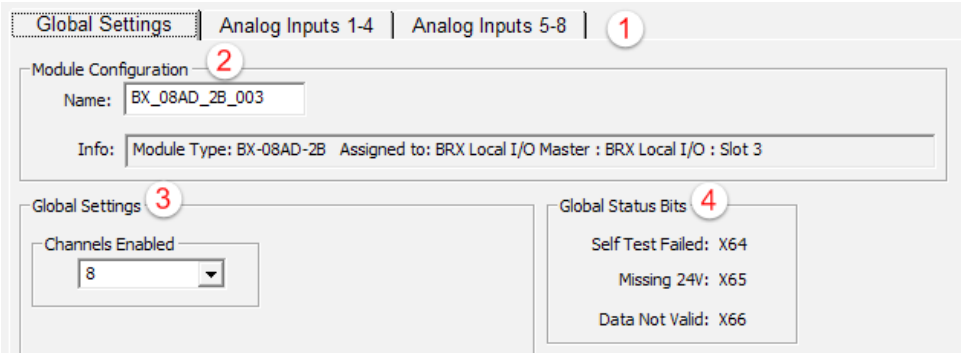


NOTE: Shield should be connected only at one end, to ground at the source device.

BX-08AD-2B Analog Voltage Input, continued

Software Setup

After the module is installed, open the Do-more! Designer programming software version 2.1 or later, connect to the BRX MPU and open the **Configure Module** dialog as described at the beginning of this chapter..



(1) The module options are divided into subsets across multiple tabs. Click the appropriate tab to edit the configuration.

(2) *Module Configuration*

Name – Each module comes with a default name. This may be changed by the user to better identify the module if desired.

Info – This is the system description of the module. This is static and may not be changed.

(3) *Global Settings*

Channels Enabled – Select how many channels will be used. The default is all channels. Selecting fewer channels may increase the update frequency. See the module specifications for details.

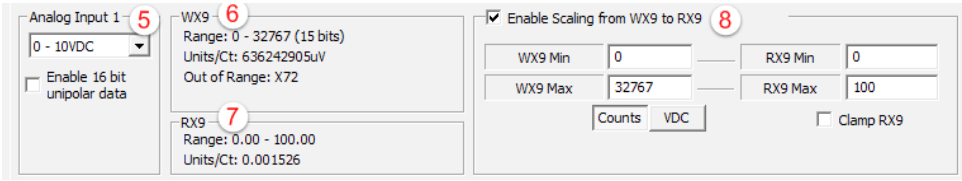
(4) *Global Status Bits*

Self Test Failed – This bit will be On if the module has failed its internal self-test. In this case the module is likely bad and should be replaced.

Missing 24V – This bit will be On if the external 24VDC power is missing. Check the 24VDC power connection on the module terminal block.

Data Not Valid – This bit will be On if the module does not have the latest configuration parameters or the module has not been configured at all. Reload the program into the CPU and power cycle.

BX-08AD-2B Analog Voltage Input, continued



(5) ***Analog Input*** x

These settings are for each channel of the analog module.

Drop Down menu - Select the range of the analog input here.

Enable 16 bit unipolar data – Check this box to change the raw count range from a signed decimal bipolar data format to an unsigned decimal data format. This may require that Casting be used in the program in order to properly access the data. Refer to the chart of Data Range Specifications earlier in this chapter to see if the registers must be accessed with Casting.

(6) ***WXx***

Range – The number of Raw counts for the selected channel on the module

Units/Ct – The amount of voltage that will equal 1 raw count.

Out of Range – The input register that when On will indicate that the voltage is outside of the selected range.

(7) ***RXx***

Range – The engineering units to which the raw counts are scaled.

Units/Ct – The number of raw counts that will equal 1 scaled engineering unit.

(8) ***Enable Scaling from WXx to RXx***

WXx Min – The minimum value of the raw counts to scale.

WXx Max – The maximum value of the raw counts to scale.

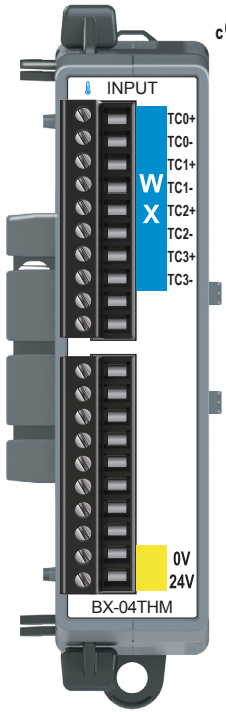
RXx Min – The minimum value of the engineering units for scaling.

RXx Max – The maximum value of the engineering units for scaling.

Counts/VDC – Use these buttons to change the raw scaling to counts or volts.

Clamp RXx – If this box is checked, RXx will clamp at the minimum and maximum scaled values.

BX-04THM Thermocouple Input



BX-RTB10 Terminal Blocks Included

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NOTE: *This device does not support ZIPLink Wiring Systems*

IMPORTANT!

Hot-Swapping Information

NOTE: This device cannot be Hot Swapped.

Thermocouple Input Specifications

Input Channels	4 Differential
Commons	0
Input Impedance	>5MΩ
Resolution	16-bit, 0.1°(C or F)
Thermocouple Input Ranges	Type J: −190° to 760°C (−310° to 1400°F) (default) 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)
Cold Junction Compensation	Automatic
Thermocouple Linearization	Automatic
Accuracy vs. Temperature	±50PPM per °C (maximum)
Linearity Error	±1°C maximum (±0.5°C typical) Monotonic with no missing codes
Maximum Inaccuracy–Temperature	±3°C maximum (excluding thermocouple error) (including temperature drift)
Linear Voltage Input Ranges	0–39mV ±39mV ±78mV 0–156mV ±156mV 0–1.25 V
Maximum Inaccuracy–Voltage	0.06% @ 25°C, 0.10% @ 0–60°C
All Channel Update Rate	2.16 s
Sample Duration Time	270ms
Open Circuit Detection Time	Within 2s
Maximum Ratings	Fault protected inputs to ±50V
Common Mode Range	0.6 V (@ 16-bit Resolution)
Common Mode Rejection	100dB @ DC and 130dB @ 60Hz
Conversion Method	Sigma-Delta
Backplane Power Consumption	0.1 W
External DC Power Required	Class 2 or LPS power supply 24VDC (±20%) 25mA
Heat Dissipation	2.5 W
Weight	100g (3.5 oz)
Software Version	Do-more! Designer Programming Software version 2.1 or later

BX-04THM Thermocouple Input, continued

Data Range Specifications

Selection	Description	Enable 16 bit Unchecked (15 bit Resolution, Default)[1]			Enable 16 bit Checked (16 bit Resolution)		
		Raw Counts	Casting[2]	µV Per Count	Raw Counts[3]	Casting[2]	µV Per Count
Type J	Type J	-	-		°C: −1900 to 7600 °F: −3100 to 14000	-	-
Type K	Type K	-	-		°C: −2100 to 10000 °F: −3460 to 18320	-	-
Type E	Type E	-	-		°C: −1500 to 13720 °F: −2380 to 25020	-	-
Type R	Type R	-	-		°C: 650 to 17680 °F: 1490 to 32140	-	-
Type S	Type S	-	-		°C: 650 to 17680 °F: 1490 to 32140	-	-
Type T	Type T	-	-		°C: −2300 to 4000 °F: −380 to 7520	-	-
Type B	Type B	-	-		°C: 5290 to 18200 °F: 9840 to 33080	- WXn:U	-
Type N	Type N	-	-		°C: −700 to 13000 °F: −940 to 23720	-	-
Type C	Type C	-	-		°C: 650 to 23200 °F: 1490 to 42080	- WXn:U	-
0–39 mVDC	Unipolar 39 mVDC	0–32767	-	1.2	0–65535	WXn:U	0.6
−39–39 mVDC	Bipolar 39 mVDC	-	-		−32768 to 32767	-	1.2
−78–78 mVDC	Bipolar 78 mVDC	-	-		−32768 to 32767	-	2.4
0–156 mVDC	Unipolar 156 mVDC	0–32767	-	4.8	0–65535	WXn:U	2.4
−156–156 mVDC	Bipolar 156 mVDC	-	-		−32768 to 32767	-	4.8
0–1.25 VDC	Unipolar 1.25 VDC	0–32767	-	38.1	0–65535	WXn:U	19.1

1. Thermocouple and bipolar ranges default to 16-bit resolution.
2. For more information on Casting refer to Help topic DMD0309 in the Do-more! Designer Software.
3. Temperatures have one implied decimal place (e.g., raw count of -1900 is -190.0°).

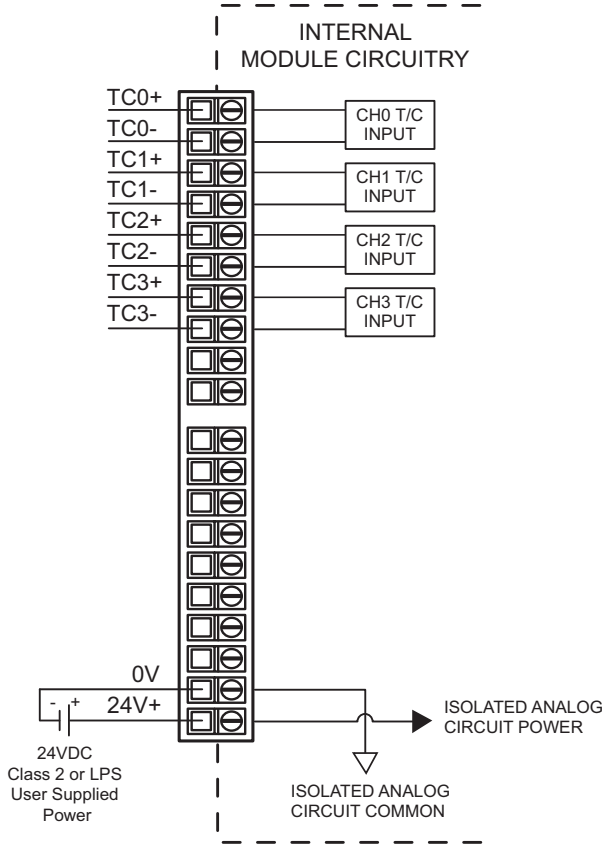
The module reserves the first 24 bits of unused contiguous space in the X register, aligned to an 8-bit word boundary, for status reporting. Error flags for this module are laid out within its status register space as described in the following table.

Error Flag Specifications

	MSB							LSB
1st Byte of unused X Registers								
Module Status	-	-	-	-	-	Data Not Valid	Missing 24VDC	Self Test Failed
2nd Byte of unused X Registers								
Channel Out of Range	-	-	-	-	Channel 4	Channel 3	Channel 2	Channel 1
3rd Byte of unused X Registers								
Channel Open (Burn Out)	-	-	-	-	Channel 4	Channel 3	Channel 2	Channel 1

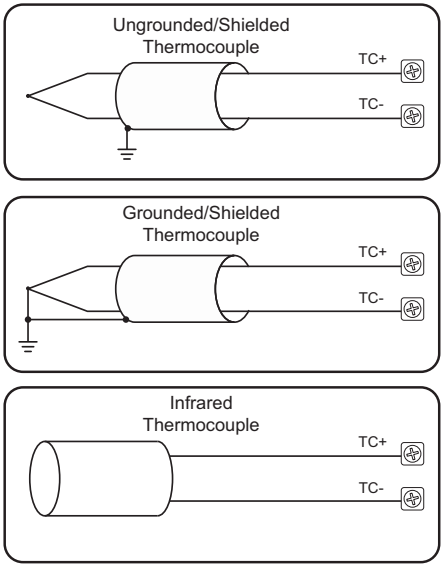
BX-04THM Thermocouple Input, continued

Analog Thermocouple/Voltage Input Wiring



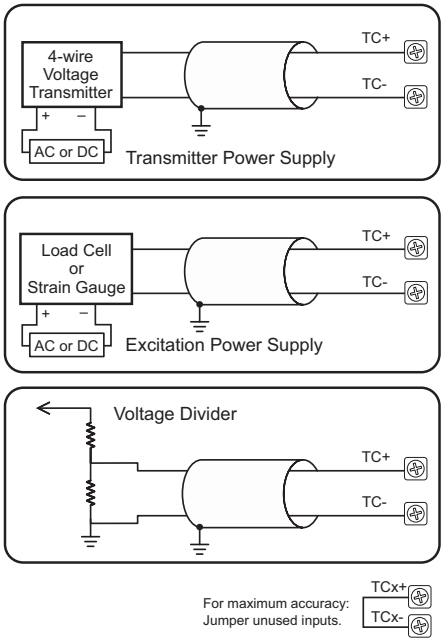
BX-04THM Thermocouple Input, continued

Thermocouple Input Circuits



NOTE: Thermocouple extension wire and proper thermocouple terminal blocks must be used to extend thermocouples. AutomationDirect thermocouple wire is recommended.

Analog Voltage Input Circuits



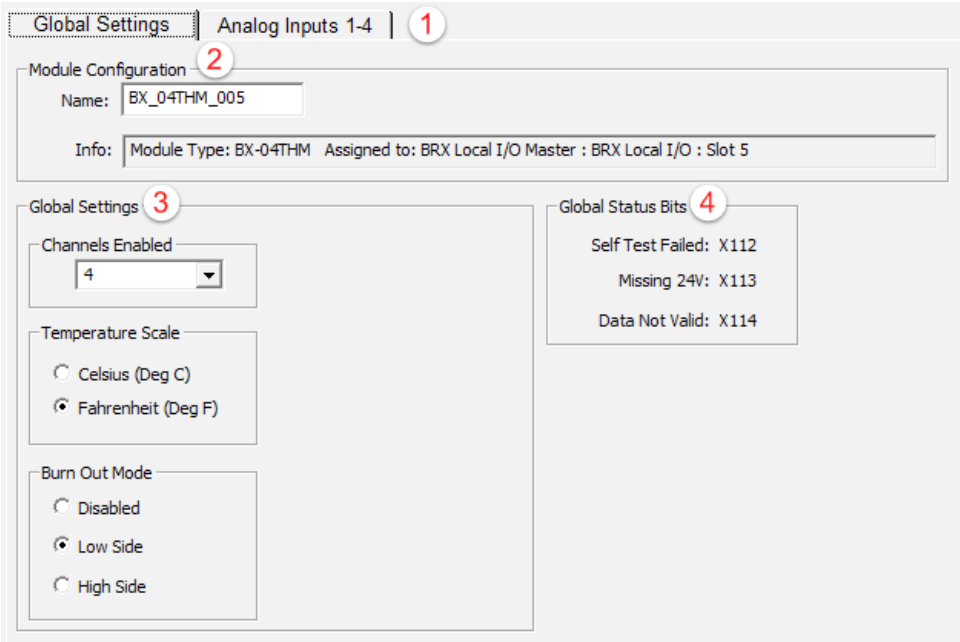
For maximum accuracy:
Jumper unused inputs.

NOTE: Shield should be connected only at one end, to ground at the source device.

BX-04THM Thermocouple Input, continued

Software Setup

After the module is installed, open the Do-more! Designer programming software version 2.1 or later, connect to the BRX MPU and open the **Configure Module** dialog as described at the beginning of this chapter..



(1) The module options are divided into subsets across multiple tabs. Click the appropriate tab to edit the configuration.

(2) *Module Configuration*

Name – Each module comes with a default name. This may be changed by the user to better identify the module if desired.

Info – This is the system description of the module. This is static and may not be changed.

(3) *Global Settings*

Channels Enabled – Select how many channels will be used. The default is all channels. Selecting fewer channels may increase the update frequency. See the module specifications for details.

Temperature Scale – Select either Celcius or Fahrenheit.

Burn Out Mode – Select if the Input register should read Low or High on burn out or if burn out detection should be disabled. Note: *Burn Out Mode* must be set to Disabled in order to use a Thermocouple Calibrator.

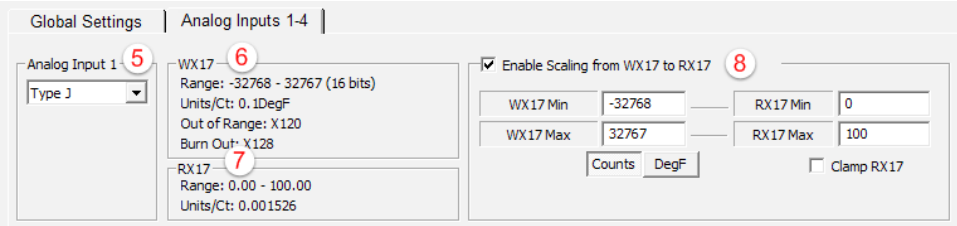
BX-04THM Thermocouple Input, continued

(4) *Global Status Bits*

Self Test Failed – This bit will be On if the module has failed its internal self-test. In this case the module is likely bad and should be replaced.

Missing 24V – This bit will be on if the external 24VDC power is missing. Check the 24VDC power connection on the module terminal block.

Data Not Valid – This bit will be on if the module does not have the latest configuration parameters or the module has not been configured at all. Reload the program into the CPU and power cycle.



(5) *Analog Input* x

These settings are for each channel of the analog module.

Drop Down menu - Select the range of the analog input here.

(6) *WXx*

Range – The number of Raw counts for the selected channel on the module

Units/Ct – The amount of temperature or voltage that will equal 1 raw count.

Out of Range – The input register that when On will indicate that the input is outside of the range selected.

Burn Out – If burn out is enabled, this register will be On when the loop is broken.

(7) *RXx*

Range – The engineering units to which the raw counts are scaled.

Units/Ct – The number of raw counts that will equal 1 scaled engineering unit.

(8) *Enable Scaling from WXx to RXx*

WXx Min – The minimum value of the raw counts to scale.

WXx Max – The maximum value of the raw counts to scale.

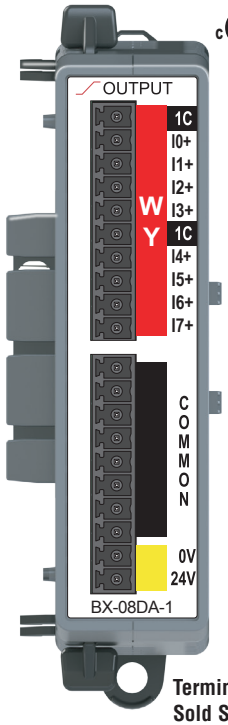
RXx Min – The minimum value of the engineering units for scaling.

RXx Max – The maximum value of the engineering units for scaling.

Counts/DegF – Use these buttons to change the raw scaling to counts or degrees (C or F).

Clamp RXx – If this box is checked, RXx will clamp at the minimum and maximum scaled values.

BX-08DA-1 Analog Current Source Output



Terminal Blocks Sold Separately

We recommend using prewired ***ZIP***Link cables and connection modules. If you wish to hand-wire your module, a removable terminal block is available. See Wiring Termination Selection in this chapter for all options.

IMPORTANT!

Hot-Swapping Information

NOTE: This device cannot be Hot Swapped.

Analog Current Source Ouput Specifications	
Outputs per Module	8
Commons	1
Module Signal Output Range	0–20mA, 4–20mA (Default)
Signal Resolution	16-bit, 15-bit (Default)
Output Type	Current Sourcing up to 22mA
Output Value in Fault Mode	~0mA
Maximum Load Impedance	700Ω
Maximum Capacitive Load	1000pF
Allowed Load Type	Grounded
Maximum Continuous Overload	30mA
All Channel Update Rate	1.5 ms per enabled channel
Maximum Inaccuracy	±0.15% of range
Maximum Full Scale Calibration Error	±0.08% of range
Maximum Offset Calibration Error	±0.06% of range
Conversion Method	Successive approximation
Accuracy vs. Temperature	±25PPM / °C maximum
Maximum Crosstalk	+10µV
Linearity Error (end to end)	±0.06% of range
Output Stability and Repeatability	±0.02% of full range after 10 minute warmup (typical)
Output Ripple	±0.01% of range/mA
Output Settling Time	200µs
Channel to Backplane Isolation	1800VAC applied for one second
Channel to Channel Isolation	None
Loop Fusing (External)	Fast-acting 0.032A recommended
Backplane Power Consumption	0.1 W
External DC Power Required	Class 2 or LPS power supply 24VDC (±20%) 250mA
Heat Dissipation	8.1 W
Weight	100g (3.5 oz)
Software Version	Do-more! Designer Programming Software version 2.1 or later

BX-08DA-1 Analog Current Source Output, continued

Data Range Specifications

Selection	Description	Enable 16 bit Unchecked (15 bit Resolution, Default)			Enable 16 bit Checked (16 bit Resolution)		
		Raw Counts	Casting*	µA Per Count	Raw Counts	Casting*	µA Per Count
0–20mA	unipolar 0–20mA	0–32767	-	0.61	0–65535	WYn:U	0.31
4–20mA	unipolar 4–20mA	0–32767	-	0.49	0–65535	WYn:U	0.24

** For more information on Casting refer to Help topic DMD0309 in the Do-more! Designer Software.*

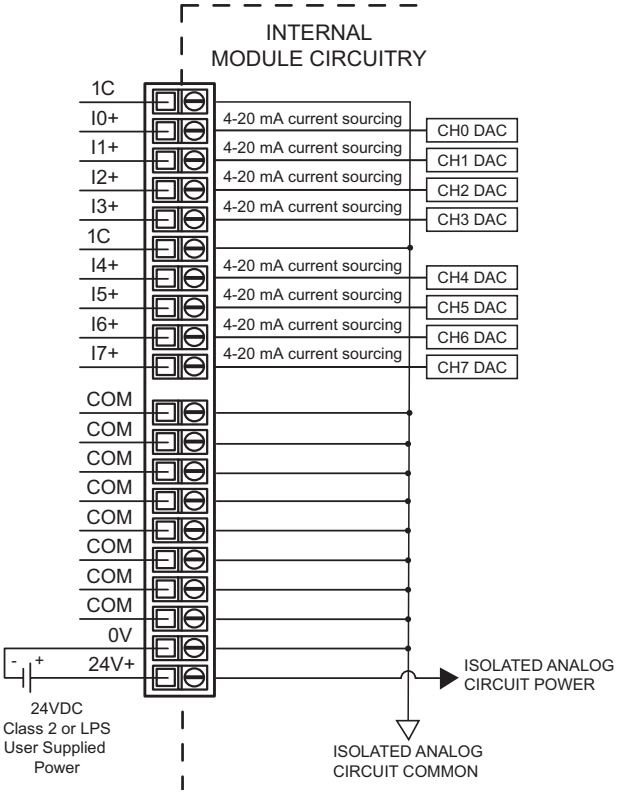
The module reserves the first 24 bits of unused contiguous space in the X register, aligned to an 8-bit word boundary, for status reporting. Error flags for this module are laid out within its status register space as described in the following table.

Error Flag Specifications

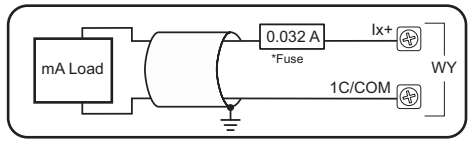
	MSB							LSB
1st Byte of unused X Registers								
Module Status	-	-	-	-	-	Data Not Valid	Missing 24VDC	Self Test Failed
2nd Byte of unused X Registers								
Unused	-	-	-	-	-	-	-	-
3rd Byte of unused X Registers								
Unused	-	-	-	-	-	-	-	-

BX-08DA-1 Analog Current Source Output, continued

Analog Current Ouput Wiring



Analog Current Source Output



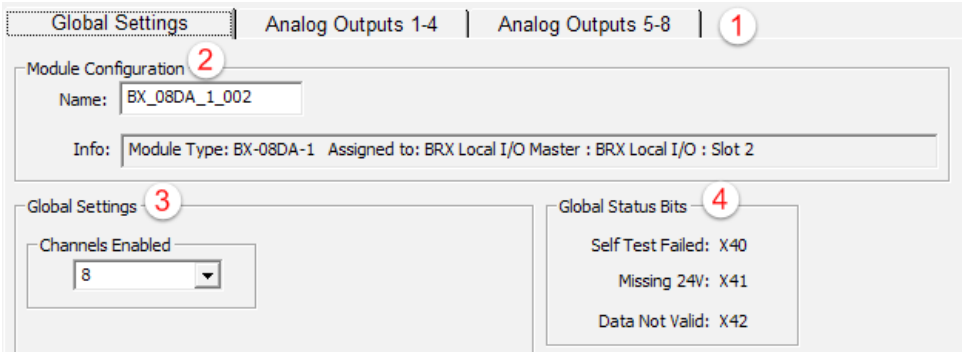
*An Edison S500-32-R 0.032 A fast-acting fuse is recommended for all analog voltage inputs, analog outputs, and current loops.

NOTE: Shield should be connected only at one end, to ground at the source device.

BX-08DA-1 Analog Current Source Output, continued

Software Setup

After the module is installed, open the Do-more! Designer programming software version 2.1 or later, connect to the BRX MPU and open the **Configure Module** dialog as described at the beginning of this chapter..



(1) The module options are divided into subsets across multiple tabs. Click the appropriate tab to edit the configuration.

(2) *Module Configuration*

Name – Each module comes with a default name. This may be changed by the user to better identify the module if desired.

Info – This is the system description of the module. This is static and may not be changed.

(3) *Global Settings*

Channels Enabled – Select how many channels will be used. The default is all channels. Selecting fewer channels may increase the update frequency. See the module specifications for details.

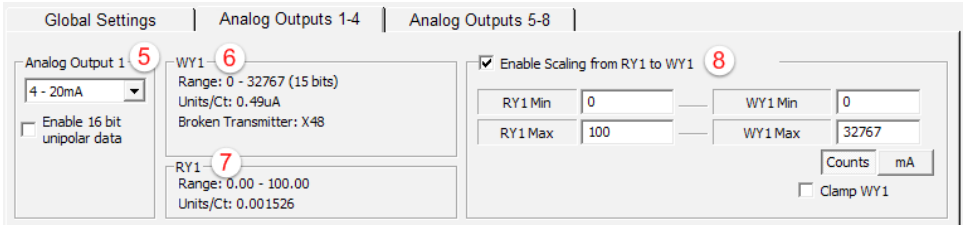
(4) *Global Status Bits*

Self Test Failed – This bit will be On if the module has failed its internal self-test. In this case the module is likely bad and should be replaced.

Missing 24V – This bit will be On if the external 24VDC power is missing. Check the 24VDC power connection on the module terminal block.

Data Not Valid – This bit will be On if the module does not have the latest configuration parameters or the module has not been configured at all. Reload the program into the CPU and power cycle.

BX-08DA-1 Analog Current Source Output, continued



(5) ***Analog Output x***

These settings are for each channel of the analog module.

Drop Down menu – Select the range of the analog output here.

Enable 16 bit unipolar data – Check this box to change the raw count range from a signed decimal bipolar data format to an unsigned decimal data format. This may require that Casting be used in the program in order to properly access the data. Refer to the chart of Data Range Specifications earlier in this chapter to see if the registers must be accessed with Casting.

(6) ***WYx***

Range – The number of Raw counts for the selected channel on the module

Units/Ct – The amount of current that will equal 1 raw count.

Broken Transmitter – The input register that when On will indicate that the loop is broken.

(7) ***RYx***

Range – The engineering units to which the raw counts are scaled.

Units/Ct – The number of raw counts that will equal 1 scaled engineering unit.

(8) ***Enable Scaling from RYx to WYx***

RYx Min – The minimum value of the engineering units for scaling.

RYx Max – The maximum value of the engineering units for scaling.

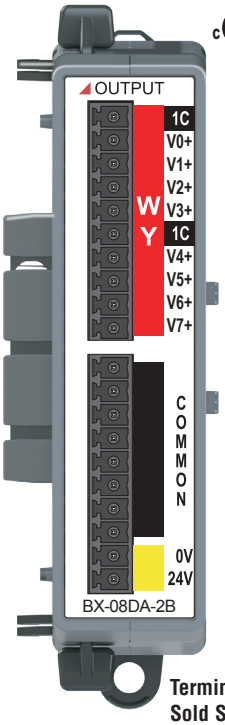
WYx Min – The minimum value of the raw counts to scale.

WYx Max – The maximum value of the raw counts to scale.

Counts/mA – Use these buttons to change the raw scaling to counts or milliamps.

Clamp WYx – If this box is checked, WYx will clamp at the minimum and maximum scaled values.

BX-08DA-2B Analog Voltage Output



Terminal Blocks Sold Separately

Do-more! Designer version 2.1 or higher required.

We recommend using prewired ***ZIP***Link cables and connection modules.
If you wish to hand-wire your module, a removable terminal block is available. See Wiring Termination Selection in this chapter for all options.

Analog Voltage Output Specifications

Outputs per Module	8
Commons	1
Module Signal Input Range	±10 VDC, ±5 VDC, 0–5 VDC, 0–10 VDC (Default)
Signal Resolution	16-bit, 15-bit (Default)
Output Type	Voltage outputs sourcing/sinking at 10mA (example 10V @ 1kΩ load).
Output Value in Fault Mode	Voltage outputs 0V (Unipolar or Bipolar)
Minimum Load Impedance	1kΩ
Maximum Capacitive Load	1000pF
Allowed Load Type	Grounded
Maximum Continuous Overload	15mA
All Channel Update Rate	3ms
Maximum Inaccuracy	0.2% of range
Maximum Full Scale Calibration Error	±0.08% of range
Maximum Offset Calibration Error	±0.04% of range
Accuracy vs. Temperature	±25PPM / °C maximum
Maximum Crosstalk	+3µV
Linearity Error (end to end)	±0.01% of range
Output Stability and Repeatability	±0.02% of full range after 10 min. warmup (typical)
Output Ripple	150 µV/mA
Output Settling Time	200µs
Channel to Backplane Isolation	1800VAC applied for one second
Channel to Channel Isolation	None
Loop Fusing (External)	Fast-acting 0.032A recommended
Backplane Power Consumption	0.1 W
External DC Power Required	Class 2 or LPS power supply 24VDC (±20%) 100mA
Heat Dissipation	3.1 W
Weight	100g (3.5 oz)
Software Version	Do-more! Designer Programming Software version 2.1 or later

IMPORTANT!

Hot-Swapping Information

NOTE: This device cannot be Hot Swapped.

BX-08DA-2B Analog Voltage Output, continued

Data Range Specifications

Selection	Description	Enable 16 bit Unchecked (15 bit Resolution, Default)[1]			Enable 16 bit Checked (16 bit Resolution)		
		Raw Counts	Casting[2]	µV Per Count	Raw Counts	Casting[2]	µV Per Count
0–10V	unipolar 10VDC	0–32767	-	305	0–65535	WYn:U	152
0–5V	unipolar 5VDC	0–32767	-	152	0–65535	WYn:U	76
±10V	bipolar 10VDC	-	-		−32768 to 32767	-	305
±5V	bipolar 5VDC	-	-		−32768 to 32767	-	152

1. Bipolar ranges default to 16-bit resolution.
2. For more information on Casting refer to Help topic DMD0309 in the Do-more! Designer Software.

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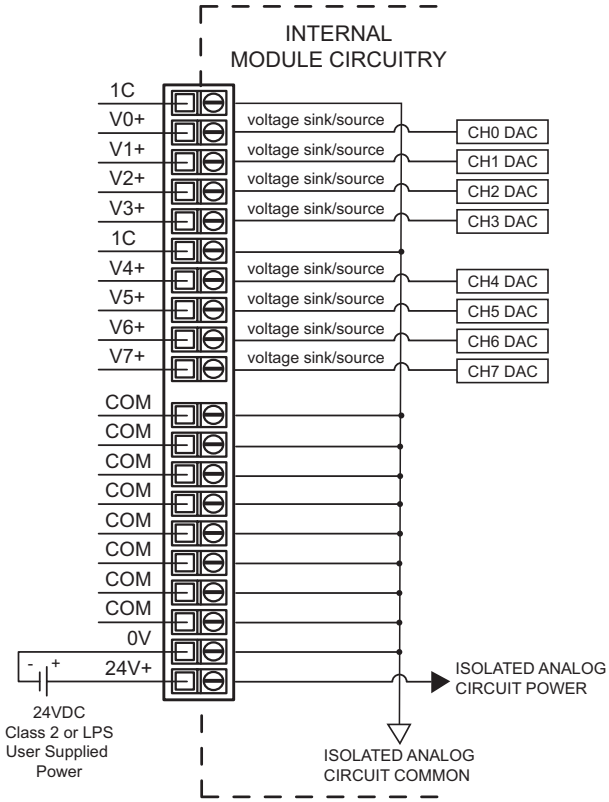
The module reserves the first 24 bits of unused contiguous space in the X register, aligned to an 8-bit word boundary, for status reporting. Error flags for this module are laid out within its status register space as described in the following table.

Error Flag Specifications

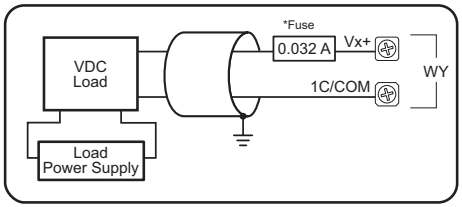
	MSB							LSB
1st Byte of unused X Registers								
Module Status	-	-	-	-	-	Data Not Valid	Missing 24VDC	Self Test Failed
2nd Byte of unused X Registers								
Unused	-	-	-	-	-	-	-	-
3rd Byte of unused X Registers								
Unused	-	-	-	-	-	-	-	-

BX-08DA-2B Analog Voltage Output, continued

Analog Voltage Output Wiring



Analog Voltage Output Circuit



*An Edison S500-32-R 0.032 A fast-acting fuse is recommended for all analog voltage inputs, analog outputs, and current loops.

NOTE: Shield should be connected only at one end, to ground at the source device.

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BX-08DA-2B Analog Voltage Output, continued

Software Setup

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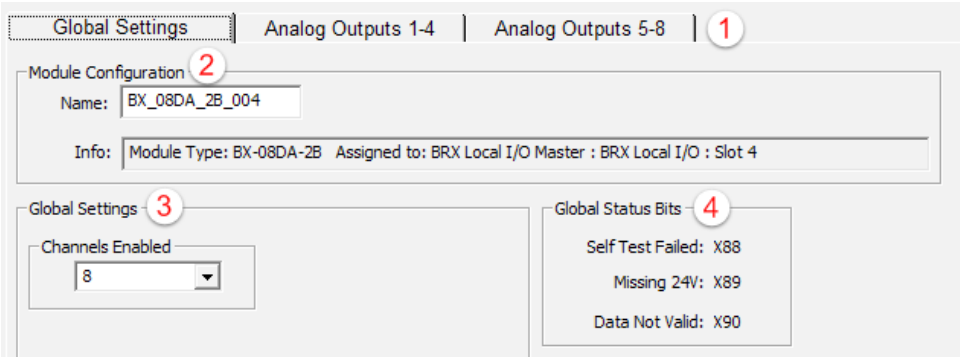

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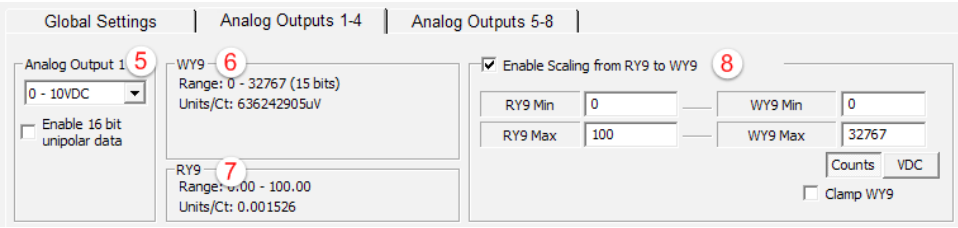
BX-08DA-2B Analog Voltage Output, continued



(5) ***Analog Output x***

These settings are for each channel of the analog module.

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(6) ***WYx***

Range – The number of Raw counts for the selected channel on the module

Units/Ct – The amount of voltage that will equal 1 raw count.

(7) ***RYx***

Range – The engineering units to which the raw counts are scaled.

Units/Ct – The number of raw counts that will equal 1 scaled engineering unit.

(8) ***Enable Scaling from RYx to WYx***

RYx Min – The minimum value of the engineering units for scaling.

RYx Max – The maximum value of the engineering units for scaling.

WYx Min – The minimum value of the raw counts to scale.

WYx Max – The maximum value of the raw counts to scale.

Counts/VDC – Use these buttons to change the raw scaling to counts or volts.

Clamp WYx – If this box is checked, WYx will clamp at the minimum and maximum scaled values.