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Find the *Acromag BusWorks XT1211-000* at our website: ***Click HERE***

BusWorks® XT Series Accessory
Model XTA-120V-6 AC/DC Input Interface Board
Six Channel Active-Low Analog or Digital Inputs
Six Open-Drain Outputs (Active-Low)

USER'S MANUAL



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8500-961J

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ALL TRADEMARKS ARE THE PROPERTY OF THEIR RESPECTIVE OWNERS.

IMPORTANT SAFETY CONSIDERATIONS

You must consider the possible negative effects of power, wiring, component, sensor, or software failure in the design of any type of control or monitoring system. This is very important where property loss or human life is involved. It is important that you perform satisfactory overall system design and it is agreed between you and Acromag, that this is your responsibility.

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GETTING STARTED

DESCRIPTION

Symbols on equipment:



Means "Refer to User's Manual (this manual) for additional information".

The XTA-120V-6 is a six channel AC/DC Voltage input module with six analog high-level voltage sensing inputs that drive six open-drain (sinking) outputs, allowing it to interface with BusWorks XT, active-low, digital input models, or other digital input modules, for the purpose of safely sensing the presence of high-level AC (and DC) voltages. The channel output drain is pulled low when its input drops below its threshold. Inputs are individually isolated from each other, power, and the outputs.

Key Features

- **CE Approved, UL/cUL Class I, Division 2 Approved.**
- **High-Density 22.5mm wide package with pluggable, front-facing terminals.**
- **Designed and Manufactured with High Quality/High Reliability with AS9100 (Aerospace Quality)/ISO9001.**
- **Supports both DC and AC voltage inputs up to 130VAC or ± 130VDC.**
- **Built-in hysteresis optimized for Mains Power at $120V_{RMS}$.**
- **High 1500VAC isolation between each Input and Input to Power/Output.**
- **Bus power for clean wiring along the DIN rail, or for redundant power.**
- **Discrete open-drain outputs switch up to 32VDC and sink 150mA each.**
- **Input, Output and Power terminals are transient protected.**
- **Outputs include 1KΩ pull-ups to +5.3VDC.**
- **Wide-range power input from 12–32VDC.**
- **Wide ambient temperature operation from –40°C to +70°C.**
- **Hardened for harsh environments – Tested for reliable operation in harsh industrial environments. Includes protection from RFI, EMI, ESD, EFT, and surges, in addition to low radiated emissions per CE requirements.**
- **Model XTA-120V-6 is ATEX Certified for Explosive Atmospheres.**
  Ex II 3 G Ex nA IIC T4 Gc -40°C ≤ Ta ≤ +70°C
  DEMKO 15 ATEX 1561X

Application

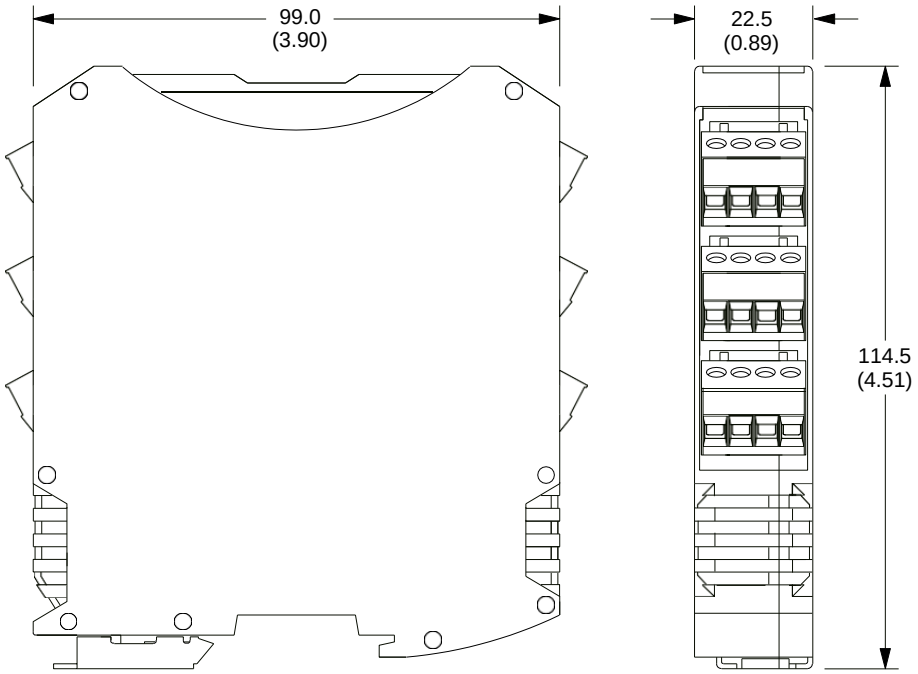
The XTA-120V-6 is designed as an interim interface between high level 120VAC/DC voltage and the lower-level DC inputs of BusWorks DIN-rail mounted DIO models, or other active-low digital input devices. This module has six voltage input channels, each controlling an isolated, open-drain, output. It is typically used to sense high/low voltage levels of MAINS power supplies for AC/DC voltages up to 130V AC or DC. Its open-drain outputs are turned on (pulled-low) when its input drops below the threshold voltage.

This module is designed for high-density mounting on 35mm, T-type DIN rails. Modules may be mounted side-by-side on 22.5mm centers and connected together for modular expansion and shared power along the DIN rail.

Mechanical Dimensions

Modules may be mounted to 35mm "T" type DIN rail (35mm, type EN50022), and side-by-side on 22.5mm (0.9-inch) centers.

WARNING: *IEC Safety Standards may require that this device be mounted within an approved metal enclosure or sub-system, particularly for applications with exposure to voltages greater than or equal to 75VDC or 50VAC.*



DIMENSIONS ARE IN MILLIMETERS (INCHES)

DIN Rail Mounting and Removal

Refer to the following figure for mounting and removing a module from the DIN rail.

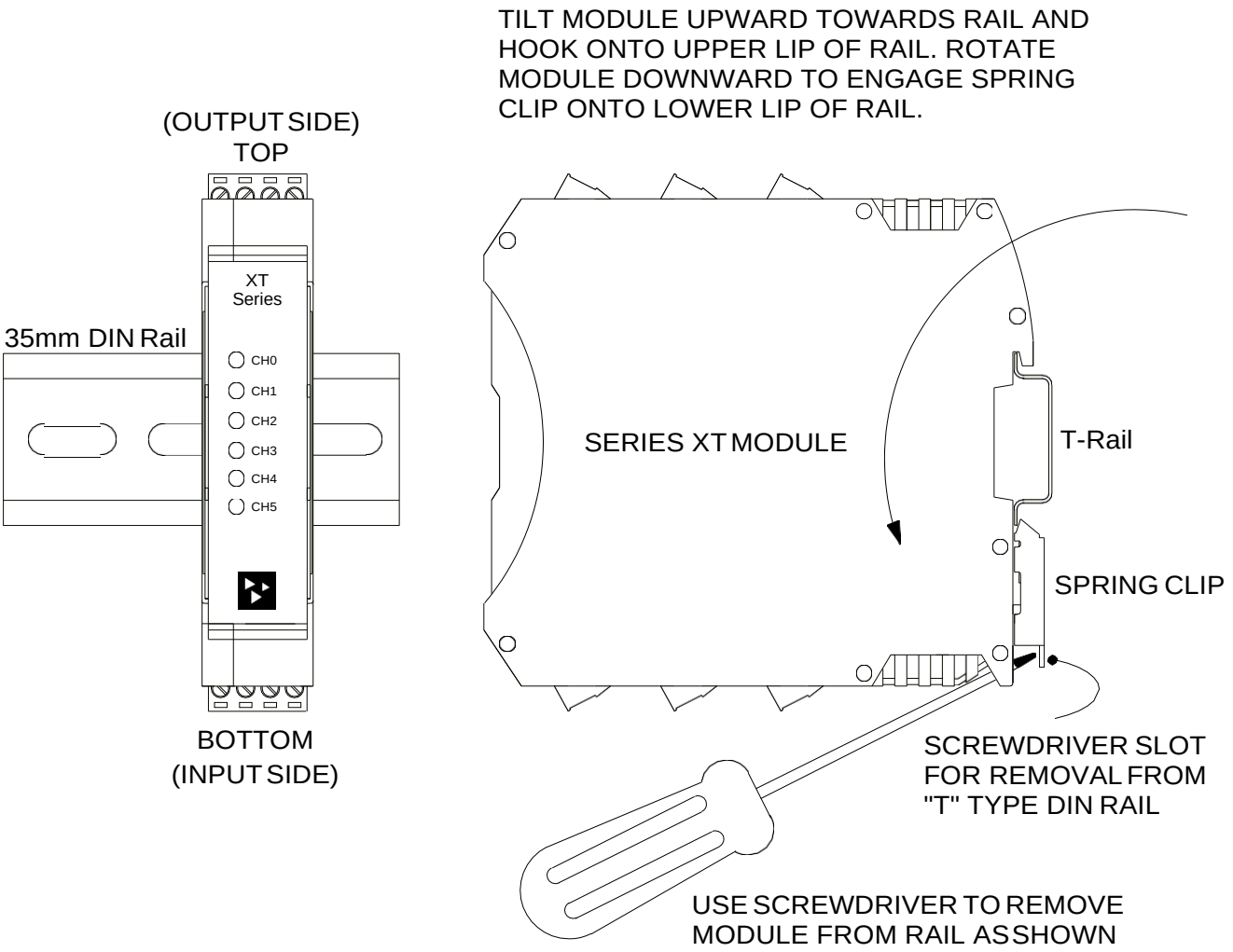
Mounting

A spring loaded DIN clip is located on the input side bottom. The rounded edge of the output side bottom allows the module to tilt upward so that it may be lifted from the rail when prying the spring clip back with a screwdriver. To attach a module to T-type DIN rail, angle the top of the module towards the rail and place the top groove of the module over the upper lip of the DIN rail. Firmly push the module downward towards the rail until it snaps into place.

Removal

To remove a module from the DIN rail, first separate the input terminal blocks from the bottom side of the module to create a clearance to the DIN mounting area. A screwdriver can be used to pry the pluggable terminals out of their sockets. While holding the module in place from above, insert a screwdriver into the lower path of the bottom of the module to the DIN rail clip and use it as a lever to force the DIN rail spring clip down while pulling the bottom of the module outward until it disengages from the rail. Tilt the module upward to lift it from the rail.

SERIES XT MODULE DIN RAIL MOUNTING AND REMOVAL



ELECTRICAL CONNECTIONS

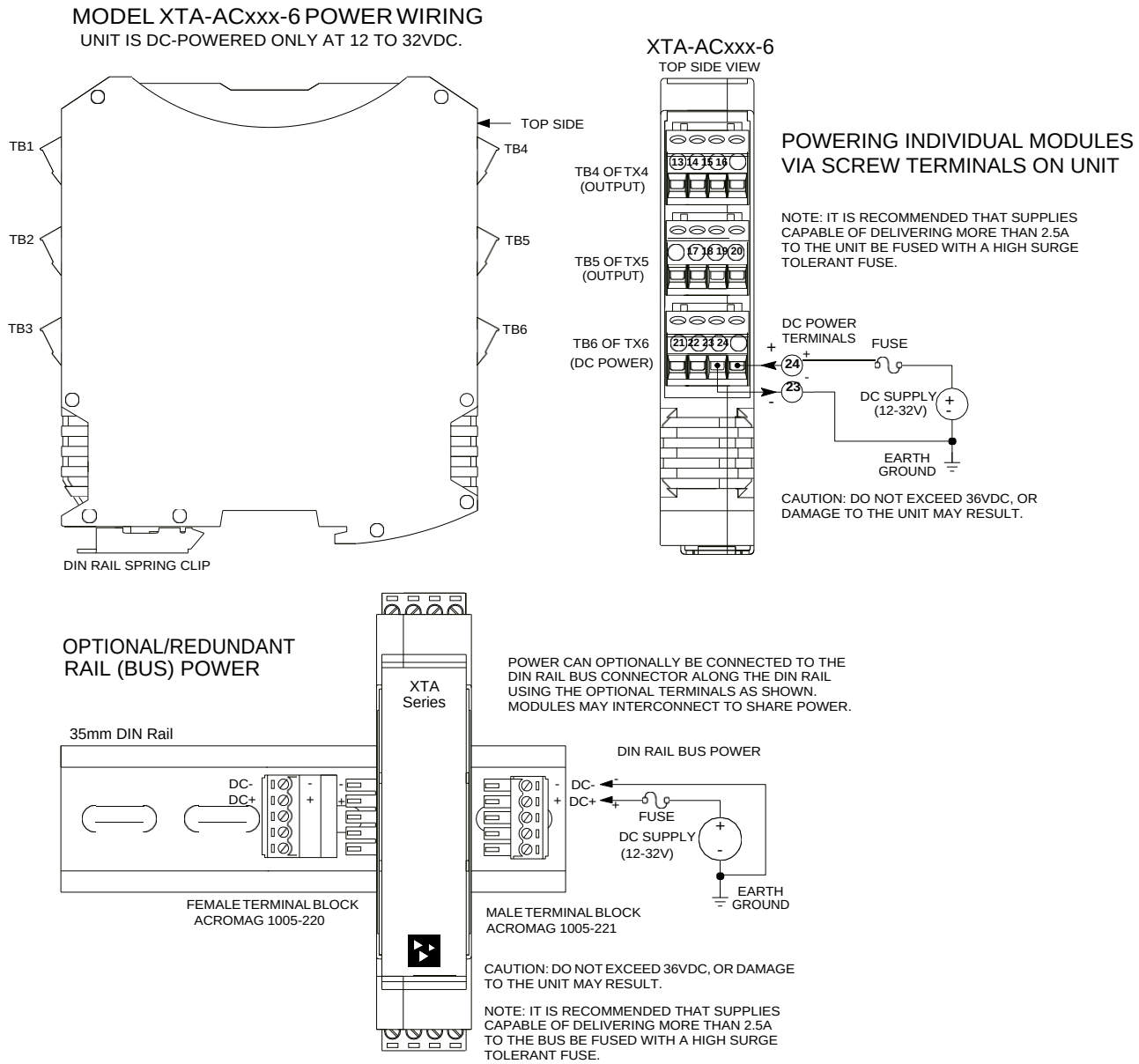
WARNING – EXPLOSION HAZARD – Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous.
WARNING – EXPLOSION HAZARD – Substitution of any components may impair suitability for Class I, Division 2.
WARNING – EXPLOSION HAZARD – The area must be known to be non-hazardous before servicing/replacing the unit and before installing.

Wire terminals can accommodate 14–26 AWG (2.08–0.13mm^2) solid or stranded wire with a minimum temperature rating of 85°C. I/O wiring may be shielded or unshielded type. Terminals are pluggable and can be removed from their sockets by prying outward from the top with a flat-head screwdriver blade. Strip back wire insulation 0.25-inch on each lead and insert the wire ends into the cage clamp connector of the terminal block. Use a screwdriver to tighten the screw by turning it in a clockwise direction to secure the wire (use 0.5-0.6nM torque). Since common mode voltages can exist on I/O wiring, adequate wire insulation should be used and proper wiring practices followed. As a rule, I/O wires are normally separated from power and network wiring for safety, as well as for low noise pickup.

Power Connections

This module is powered from 12–32VDC (36VDC peak) by connecting power as indicated in the drawing below. This module can be optionally powered (or redundantly powered) via the DIN rail bus when coupled to the DIN rail bus connector (Acromag Model 1005-063) and a bus terminal block (Acromag 1005-220 or 1005-221). This optional method can allow several modules to share a single power supply without wiring to each individually.

IMPORTANT – External Fuse: If the module is powered from a supply capable of delivering more than 2.5A to the module, it is recommended that this current be limited via a high surge tolerant fuse rated for a maximum current of 2.5A or less (for example, see Bel Fuse MJS or RJS fuse types).



Power Connections…

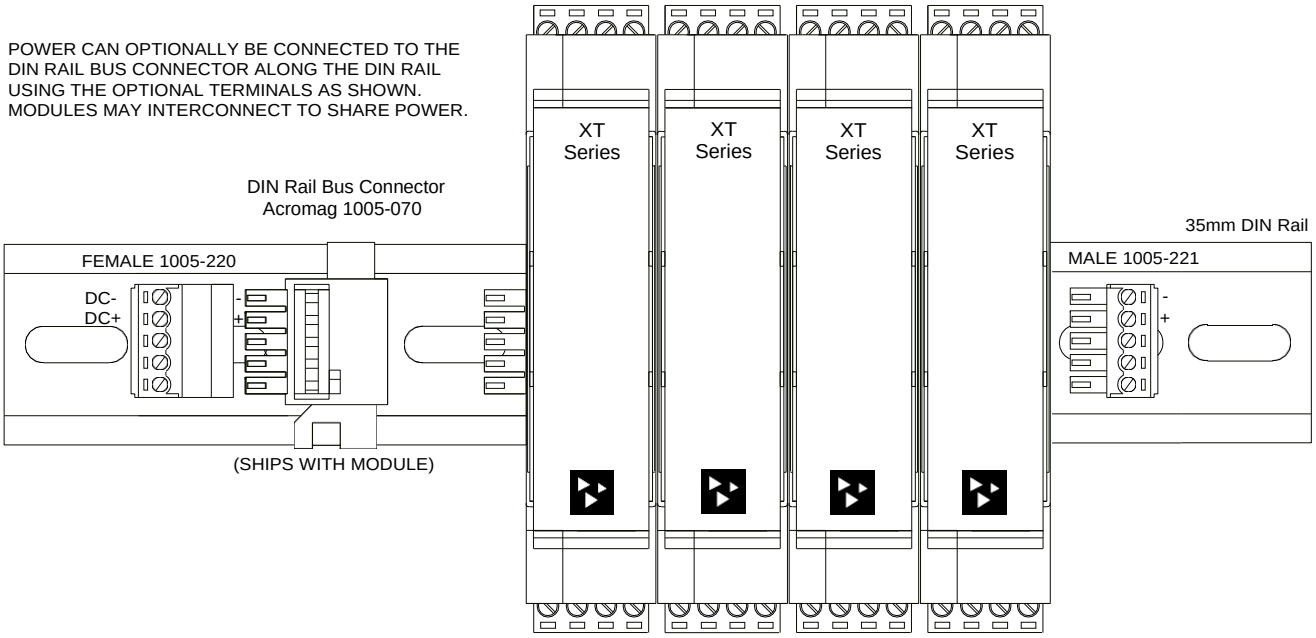
Power is normally connected to the TB6 power terminals of the module as shown on the previous page. However, this module is equipped to be optionally powered via its DIN rail bus connector provided (Acromag 1005-070), when mated to an optional plug-in terminal block (Acromag 1005-220 or 1005-221). Power input via the bus connector terminal is diode-coupled to the same point as power connected at TB6 power.

Important – End Stops: If this module uses the optionally powered (or redundantly powered) via the DIN rail bus for hazardous location installations (Class I, Division 2 or ATEX Zone 2) it must use two end stops (Acromag 1027-222) to secure the terminal block and module (not shown).

Multiple modules may be powered by snapping them together along the DIN rail bus, then using the mating terminal block shown (select a Left or Right side connector). While the intent of the bus power connector is to allow several modules to conveniently share a single supply, the bus power connector may also be used to redundantly power modules, allowing a backup supply to maintain power to the module(s) should the main supply at TB6 fail.

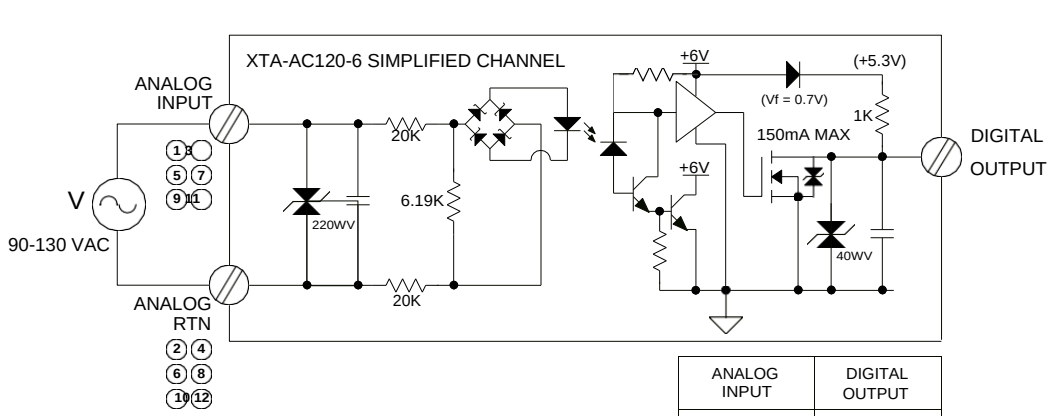
This module comes equipped with the bus connector 1005-070 shown below. This connector allows modules to snap together, side-by-side, along the DIN rail and share these connections. To complete connection to power, an optional bus terminal block is needed. Order Acromag XTBUS-KIT, which includes Acromag 1005-220 for left-side, 1005-221 for right-side connections, and two Acromag 1027-222 End Stops. Refer to the figure on the previous page which shows how to wire power to the optional bus connector using these connectors.

XT MODEL OPTIONAL BUS POWER WIRING

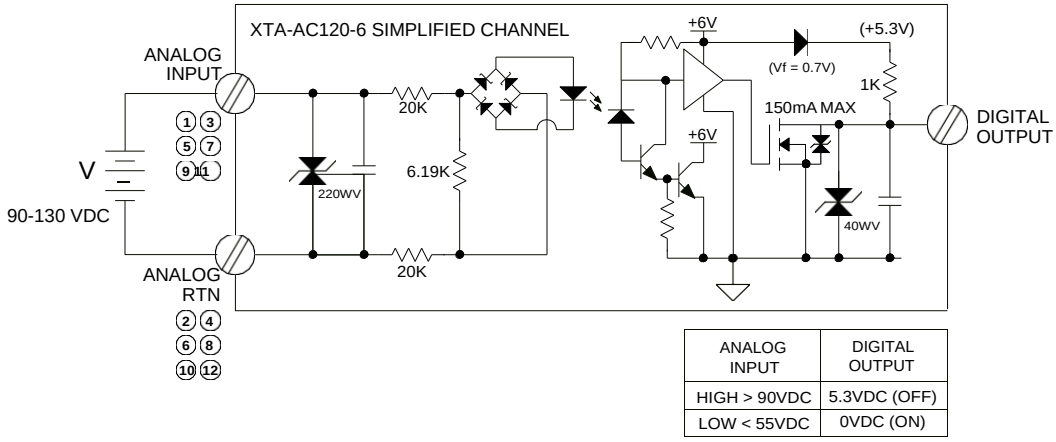


Analog Input Connections

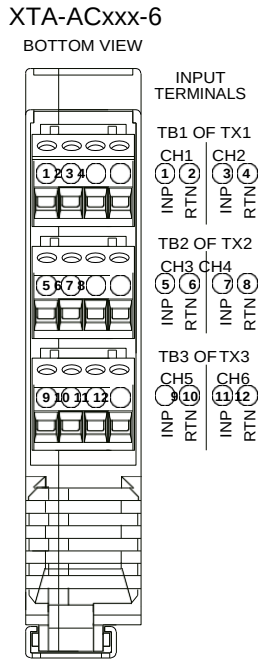
Each of the 6 inputs of this module is individually isolated from each other and from Power/Output. Inputs are polarity insensitive and accept DC and AC voltage up to $130V_{RMS}$, or ± 130VDC. Refer to the following figures to wire the inputs of this module.



ANALOG INPUT	DIGITAL OUTPUT
HIGH > 90VAC	5.3VDC (OFF)
LOW < 60VAC	0VDC (ON)



ANALOG INPUT	DIGITAL OUTPUT
HIGH > 90VDC	5.3VDC (OFF)
LOW < 55VDC	0VDC (ON)

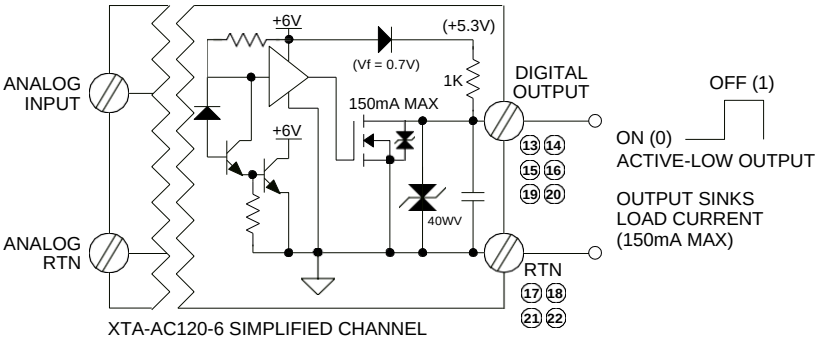


Digital Output Connections

The six outputs of this module are open-drain, low-side switches, between the load and ground (return), and include 1K pull-ups to +6VDC. Outputs will switch loads up to 32VDC and 150mA each. Observe proper polarity when making output connections. Refer to the following figures to wire the outputs of this module.

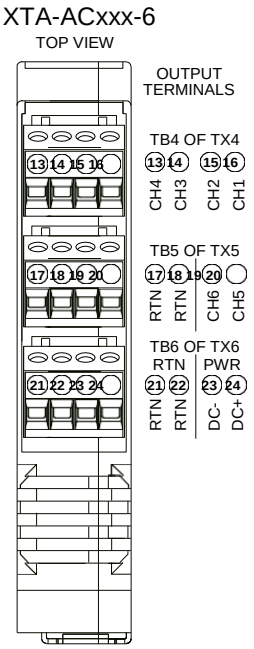
Digital Output Connections…

LOGICAL OUTPUT OPERATION

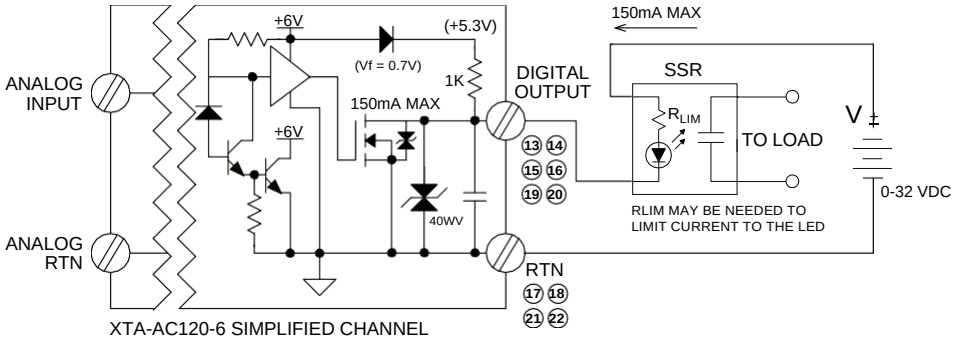


XTA-AC120-6 SIMPLIFIED CHANNEL

XTA-ACxxx-6

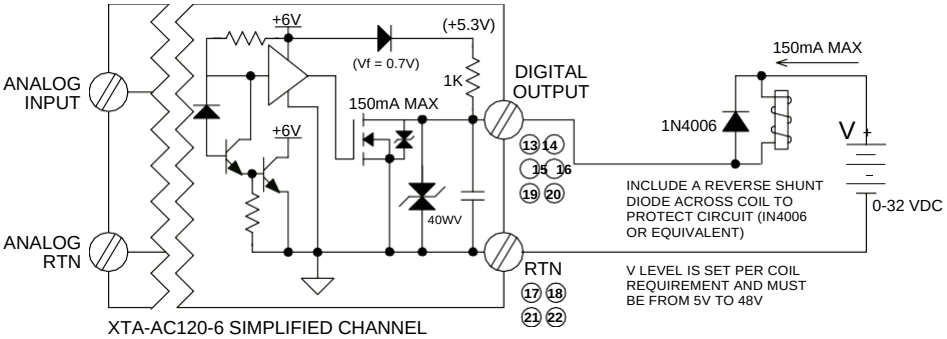


SSR (SOLID-STATE RELAY) OR LED DRIVER



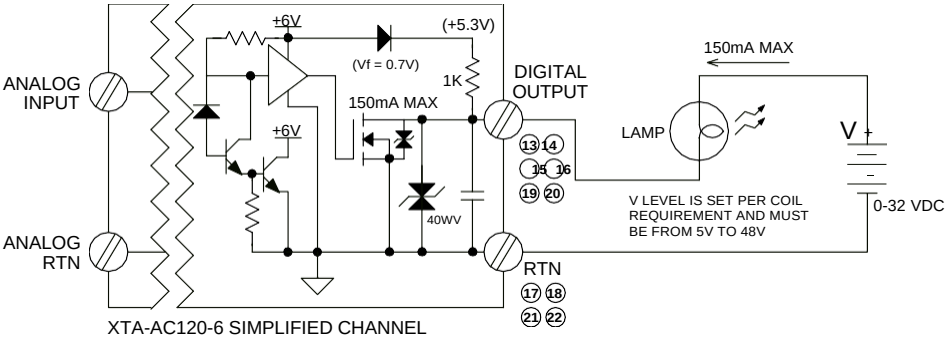
XTA-AC120-6 SIMPLIFIED CHANNEL

RELAY COIL OR SOLENOID DRIVER



XTA-AC120-6 SIMPLIFIED CHANNEL

INCANDESCENT LAMP CONTROL



XTA-AC120-6 SIMPLIFIED CHANNEL

Digital Output Connections…

IMPORTANT – Add Protection with Inductive Loads: Outputs do include integrated reverse-bias shunt diodes to help protect the output switch from damage due to high reverse-bias voltages generated when switching inductive loads, however external protection near the inductive load should be added to prevent these transients from being sent along the connection wires. Place a diode (1N4006 or equivalent) across an inductive load with the cathode to (+) and the anode to (-).

For greater drive capability or for switching AC loads, it is common to use an appropriately rated interposing relay. Add protection local to the relay as noted above when driving inductive relay coils.

Per UL, when the outputs are used to drive interposing relays for switching AC or DC devices of higher voltage/current, the coil ratings for the interposing relay shall not exceed 24VDC, 100mA.

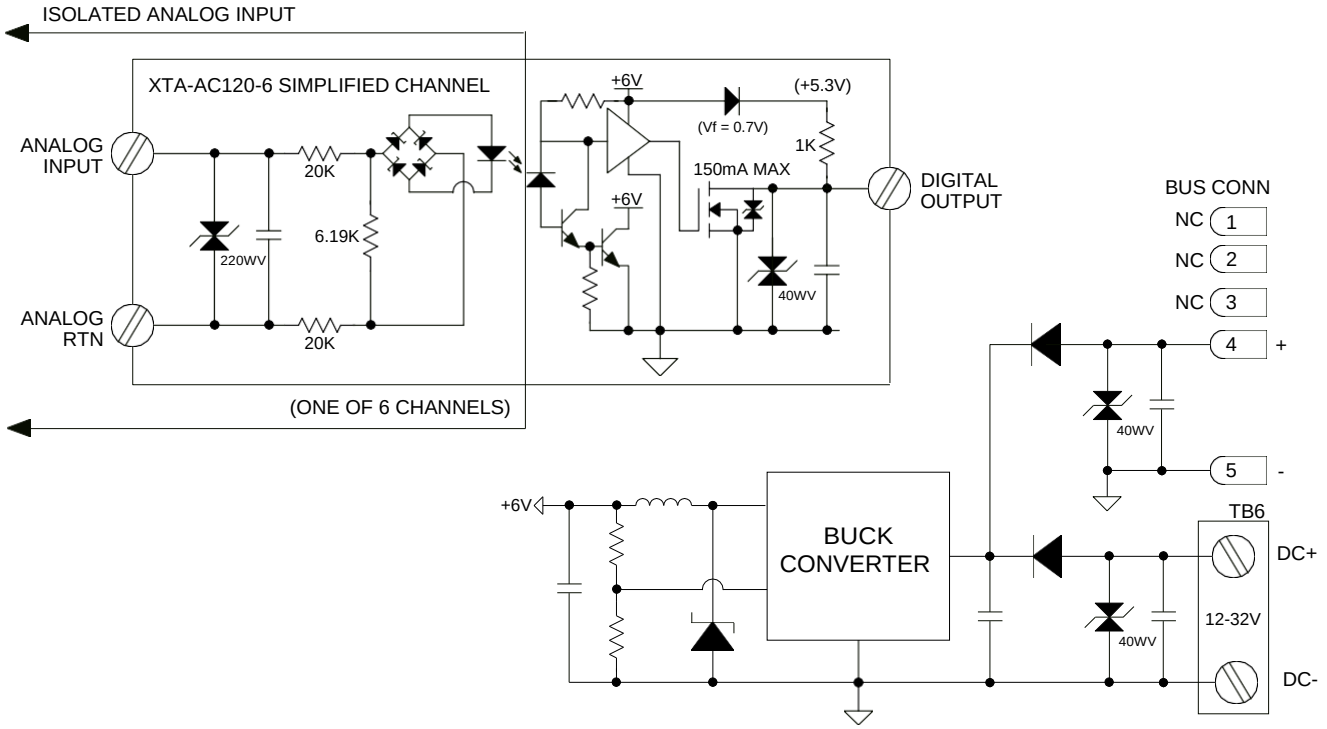
Earth Ground Connections

The module housing is plastic and does not require an earth ground connection. If the module is mounted in a metal housing, an earth ground wire connection to the metal housing's ground terminal (green screw) is usually required using suitable wire per applicable codes. Circuits wired to power and I/O should be earth grounded as reflected in the connection diagrams. The ground connections noted are recommended for best results and help protect the unit by giving it a low impedance path to ground for shunting destructive transient energy. See the Electrical Connections Drawings for I/O and power ground connections.

Avoid inadvertent connections to earth ground at other points than those indicated, as this could drive ground loops and negatively affect operation.

TECHNICAL REFERENCE

BLOCK DIAGRAM



How It Works

Key Points of Operation

- DC Powered
- Inputs isolated from each other and from Power/Output

The XTA-120V-6 utilizes 6 high-efficiency optocouplers for sensing DC and AC voltage levels. Inputs are isolated from each other and from Power/Output. Inputs support both DC and AC voltages and are polarity insensitive by virtue of a diode bridge. The input channel thresholds are designed to make monitoring AC Mains Power convenient, with low-to-high and high-to-low thresholds at 90VAC and 60VAC respectively.

The output of each optopcoupler controls a Darlington transistor that switches voltage to a buffer. The buffer adds noise immunity and provides a push-pull output that controls a mosfet which interfaces with the channel output. Each channel output includes a 1KΩ pull-up to 5.3V and is over-voltage/transient-voltage protected by virtue of a blocking diode and a 40WV TVS. The output mosfets include circuit protection from transients and are capable of sinking current up to 150mA at voltages 0–32VDC.

Power for the output circuit is provided via a non-isolated buck regulator that operates from 12–32VDC. A bus connector is provided to allow optional/redundant power. Bus power and terminal power connections are diode coupled to allow simultaneous powering. TVS diodes and bypass capacitors protect the input, output, and power circuits from high voltage transients.

TROUBLESHOOTING

Diagnostics Table

Before attempting repair or replacement, be sure that all installation procedures have been followed and that the unit is wired properly. If the problem still exists after checking the power and wiring and reviewing this information, or if other evidence points to another problem with the unit, an effective and convenient fault diagnosis method is to exchange the questionable unit with a known good unit. Acromag's Application Engineers can provide further technical assistance if required. Repair services are also available from Acromag.

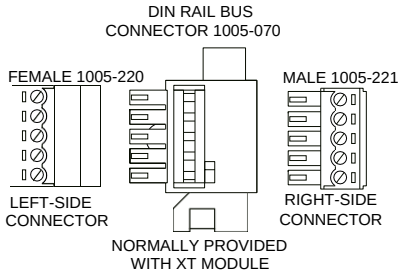
POSSIBLE CAUSE	POSSIBLE FIX
No change in digital output	
Power supply voltage is too low.	Verify that at least 12VDC is being supplied to the module.
Input voltage is not crossing threshold.	Verify that the voltage to the input channel is crossing the 60V/90V thresholds.
Digital output is erratic	
Missing earth ground connection.	Connect earth ground to power minus terminal at TB6-23,22,21.

Service & Repair Assistance

This module contains solid-state components and requires no maintenance, except for periodic cleaning. The Surface Mounted Technology (SMT) board contained within this enclosure is difficult to repair. It is highly recommended that a non-functioning module be returned to Acromag for repair, or replacement. Acromag has automated test equipment that thoroughly checks and verifies the performance of each module. Please refer to Acromag's Service Policy and Warranty Bulletins on our web site, or contact Acromag for complete details on how to obtain repair or replacement.

ACCESSORIES

DIN Rail Bus Connector Kit



Din Rail Bus Connector Kit – Order XTBUS-KIT

- DIN Rail Bus Connector 1005-070 for 22.5mm XT Modules.
- Left Side terminal block, female connector 1005-220.
- Right Side terminal block, male connector 1005-221.
- Two End Stops for 35 mm DIN Rails 1027-222 (not shown).

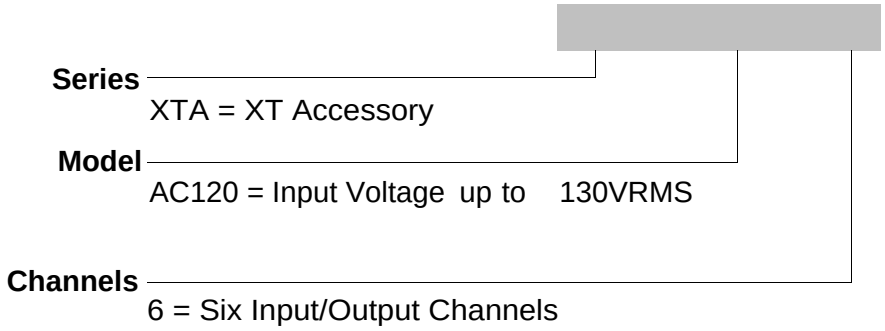
This module was shipped with the first item included in this kit, DIN Rail Bus Connector 1005-070, and this kit offers a spare. Left and right side terminal blocks that mate directly to the bus connector are included in this kit. These terminals are used to optionally (or redundantly) drive power to the modules via their DIN rail bus connector. This allows modules to neatly and conveniently share connections to Power. Two end stops 1027-222, used to secure the terminal block and module for hazardous location installations.

SPECIFICATIONS

Model Number

Model XTA-120V-6

- Input Voltage up to $130V_{RMS}$
- Isolated Analog Input
- 6 Input/Output Channels
- DC-Powered
- CE Approved



Analog Inputs

Six individually isolated voltage inputs interface voltage levels up to 130VRMS. Built-in hysteresis provides a convenient sensing threshold for monitoring Mains Power. Inputs include transient suppression. Input channels are connected to terminals TB1, TB2, and TB3.

Input Signal Voltage Range: 0 to $130V_{RMS}$, or ± 130VDC.
Input Signal Threshold: Low–to–High threshold: 90VAC / 90VDC, typical.
High–to–Low threshold: 60VAC / 55VDC, typical.
Input Hysteresis: 30V, typical.
Input Impedance: 46KΩ, typical.
Input Response Time: See Output Response Time.
Input Over–Voltage Protection: Input channels include Metal Oxide Varistors. Rated Continuous Voltage: 130VAC, 130VDC. Rated Max Clamping Voltage: 340VDC. Input channels also include capacitive filtering, and series resistance.

Digital Outputs

Six open-drain mosfet switches with a common source connection at output return (RTN). This model provides low-side (sinking) switching between the load and return for DC voltage and current–sinking applications. Outputs include 1KΩ pull-up resistors to 5.3VDC. Output channels are connected to terminals TB4 and TB5.

Output "OFF" Voltage Range: 0 to 32VDC. Limit voltage to less than 38V peak, or damage to the module may result. Use voltage protection when switching inductive loads (place a reverse shunt diode across inductive loads to dissipate energy that develops during switching).
Output "OFF" Leakage Current: 1µA typical, 50µA maximum (mosfet only, 25°C, 32VDC).

Digital Outputs...

Output "ON" Current Range: Sinks 0 to 150mA DC, continuous, per channel.
Output R_{ds} On Resistance: 2.5Ω maximum (150mA, 85°C).
Output Response Time: 45ms, 0% to 98% for a step-change in input, typical.
Output Pull-ups: Output channels include 1KΩ pull-ups to 5.3VDC.

Note: Per UL, when the outputs are used to control interposing relays for switching AC and DC devices of higher voltage/current, the coil ratings for the interposing relay shall not exceed 24VDC, 100mA.

Power

Power Supply (Connect at TB6 Connectors 24 & 23, and/or via DIN Rail Bus): 12–32V DC SELV (Safety Extra Low Voltage). Observe proper polarity. Module can be redundantly powered by connected power to both the power terminals on the module (TB6) and the DIN railbus (these inputs are diode-coupled to the same point). Current draw varies with power voltage as follows (current indicated is with all outputs ON).

SUPPLY	XTA-120V-6 CURRENT
12V	23mA Typical / 25mA Max
15V	19mA Typical / 21mA Max
24V	13mA Typical / 15mA Max
32V	11mA Typical / 12mA Max

CAUTION: Do not exceed 36VDC peak to avoid damage to the module. Terminal voltage at or above 12V minimum must be maintained to the unit during operation.
Power Supply Effect: Less than ±0.001% of output span effect per volt DC of supply change.

Enclosure & Physical

General purpose plastic enclosure for mounting on 35mm "T-type" DIN rail.
Dimensions: Width = 22.5mm (0.9 inches), Length = 114.5mm (4.51 inches), Depth = 99.0mm (3.90 inches). Refer to Mechanical Dimensions drawing.
I/O Connectors: Removable plug-in type terminal blocks rated for 12A/250V; AWG #26-12, stranded or solid copper wire.
Case Material: Self-extinguishing polyamide, UL94 V-0 rated, color light gray. General purpose NEMA Type 1 enclosure.
Circuit Board: Military grade fire-retardant epoxy glass per IPC-4101/98.
DIN-Rail Mounting: Unit is normally mounted to 35x15mm, T-type DIN rails. Refer to the DIN Rail Mounting & Removal section for more details.
Shipping Weight: 0.5 pounds (0.22 Kg) packed.

Environmental

These limits represent the minimum requirements of the applicable standard, but this product has typically been tested to comply with higher standards in some cases.

Operating Temperature: -40°C to +70°C (-40°F to +158°F).

Storage Temperature: -40°C to +85°C (-40°F to +185°F).

Relative Humidity: 5 to 95%, non-condensing.

Isolation: Input channels are isolated from each other for common-mode voltages up to 250VAC, or 354V DC off DC power ground, on a continuous basis (will withstand 1500VAC dielectric strength test for one minute without breakdown). Complies with test requirements of ANSI/ISA-82.01-1988 for voltage rating specified.

Installation Category: Suitable for installation in a Pollution Degree 2 environment with an Installation Category (Over-voltage Category) II rating per IEC 1010-1 (1990).

Shock & Vibration Immunity: Conforms to: IEC 60068-2-6: 10-500 Hz, 4G, 2 Hours/axis, for sinusoidal vibration; IEC 60068-2-64: 10-500 Hz, 4G-rms, 2 Hours/axis , for random vibration, and IEC 60068-2-27: 25G, 11ms half-sine, 18 shocks at 6 orientations, for mechanical shock.

Electromagnetic Compatibility (EMC)

- **Immunity per BS EN 61000-6-1**

1. Electrostatic Discharge Immunity (ESD), per IEC 61000-4-2
2. Radiated Field Immunity (RFI), per IEC 61000-4-3
3. Electrical Fast Transient Immunity (EFT), per IEC 61000-4-4
4. Surge Immunity, per IEC 61000-4-5
5. Conducted RF Immunity (CRFI), per IEC 61000-4-6

- **Emissions per BS EN 61000-6-3**

1. Enclosure Port, per CISPR 16
2. Low Voltage AC Mains Port, per CISPR 14, 16
3. DC Power Port, per CISPR 16

Note: This is a Class B product.

Agency Approvals

Electromagnetic Compatibility (EMC): CE marked, per EMC Directive 2004/108/EC. Consult factory.

Safety Approvals: UL Listed (USA & Canada). Hazardous Locations – Class I, Division 2, Groups A, B, C, D Hazardous Location or Nonhazardous Locations only. These devices are open-type devices that are to be installed in an enclosure suitable for the environment. Consult Factory.

ATEX Certified: Model XTA-120V-6 is ATEX Certified for Explosive Atmospheres per ATEX Directive 94/9/EC which complies with standards BS EN 60079-0:2012 & BS EN 60079-15:2010.

Ex II 3 G Ex nA IIC T4 Gc -40°C ≤ Ta ≤ +70°C

DEMKO 15 ATEX 1561X

X = Special Conditions

1) The equipment shall only be used in an area of not more than pollution degree 2, as defined in EN 60664-1.
2) The equipment shall be installed in an enclosure that provides a degree of protection not less than IP 54 and only accessible with the use of a tool in accordance with EN 60079-15.

3) Transient protection shall be provided that is set at a level not exceeding 140 % of the peak rated voltage value at the supply terminals to the equipment.

Reliability Prediction

MTBF (Mean Time Between Failure): MTBF in hours using MIL-HDBK-217F, FN2. *Per MIL-HDBK-217, Ground Benign, Controlled,* $G_B G_C$

Temperature	MTBF (Hours)	MTBF (Years)	Failure Rate (FIT)
25°C	371,939	42.5	2,689
40°C	315,576	36.0	3,169

Revision History

The following table details the revision history for this document:

Release Date	Version	EGR/DOC	Description of Revision
15-APRIL-13	A	TPH/KLK	Initial Acromag release.
22-JULY-13	B	CAP/ARP	Added CE Mark to this model (removed pending). Also, refer to ECN #13G015 for additional information.
22-NOV-2013	C	JMO/KLK	• Page 3 Description/Application (revised) • Page 3 Key Features (Pull-up was +6VDC) • Page 6 Power Connections (Diagram terminals TB3 & TB5 were missing) • Page 7 Power Connections (revised) • Page 8 Analog Input Connections (Channel input was incorrect resistance. Channel output was +7V, was missing mosfet, was labeled as TTL logic, logic tables were active-high) • Page 9 Digital Output Connections (Channel output was +7V, was missing mosfet, was labeled as TTL logic) • Page 11 Block Diagram (Channel input was incorrect resistance. Channel output was +7V, was missing mosfet, was labeled as TTL logic, logic tables were active-high) • Page 11 How It Works (revised) • Page 13 Model Number (240V model removed) • Page 13 Analog Inputs (Input Signal Voltage was 60-130VRMS, Input Hysteresis was 42 VDC) • Page 13 Digital Outputs (Description was +6V) • Page 14 Digital Outputs (Output Pull-ups was +6VDC) • Page 15 Environmental (Storage Temperature was -40°C to +70°C) • Page 15 Reliability Prediction (MTBF / FIT was TBD)

21-FEB-2014	D	CAP/ARP	Added cULus Mark to this model (removed pending).
31-JUL-2014	E	CAP/ARP	Added UL caution symbols / statements.
15-OCT-2015	F	CAP/ARP	Added ATEX symbols / statements.
21-JUL-2016	G	CAP/MJO	Corrected Input Voltage Specifications.
22-AUG-2016	H	CAP/MJO	Corrected “Circuit Board” specification.
23 MAR 2017	J	CAP/MJO	Removed reference to XTA-240-6 under the “Getting Started Description”, as there is no such model.

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