BusWorks® XT Series Accessory
Model XTA-MRNO-6 Interposing Relay Board
Six Channel Digital Inputs
Six Mechanical Relay Outputs, Normally Open

USER'S MANUAL

ACROMAG INCORPORATED
30765 South Wixom Road
Wixom, MI 48393-7037 U.S.A.

Tel: (248) 295-0880
Fax: (248) 624-9234
email: sales@acromag.com

8500-960E

Table of Contents

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.

GETTING STARTED

DESCRIPTION

Symbols on equipment:

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

The XTA-MRNO-6 is a six channel digital input board with six, normally open, isolated mechanical relay outputs for use with BusWorks XT Series DIO modules, or other digital output modules, for the purpose of driving high energy loads. This module serves as an interim digital interface for driving high voltage (up to 250VAC, 30VDC) loads at high currents (up to 5A) using digital logic (0V OFF, 4-32V ON). Each pair of output contacts are individually isolated.

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.**
- **Six channels of buffered digital inputs withstand DC logic voltages up to 32VDC and trigger on 4V thresholds.**
- **Six individually isolated, sealed, Normally Open, Form A mechanical relay contacts (SPST-NO).**
- **Outputs switch both AC and DC voltage loads up to 250VAC and 30VDC, at currents up to 5A.**
- **High 1500VAC isolation.**
- **Inputs include 10KΩ pull-downs to Return.**
- **Input and Power terminals are transient protected.**
- **Wide-range power input from 12–32VDC.**
- **Bus power ready for clean wiring along the DIN rail, and/or redundant power.**
- **Wide ambient temperature operation from –40°C to +80°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.**

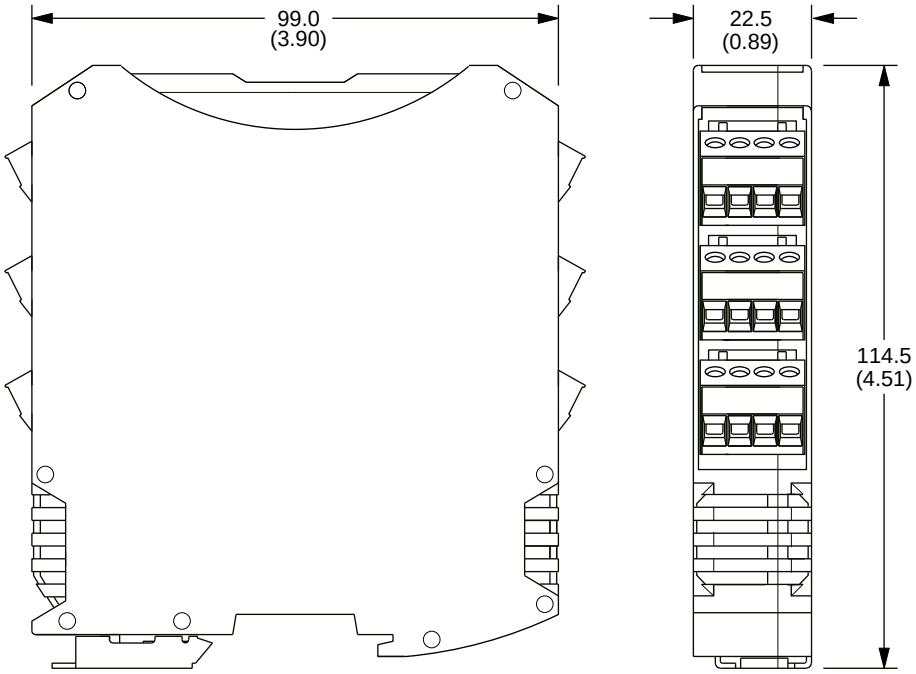
Application

The XTA-MRNO-6 is designed as an interposing interface for safely driving high voltage/current AC and DC loads with BusWorks DIN-rail mounted digital output modules, or other digital output devices. This module has six digital input channels, each controlling an isolated, SPST, normally open, mechanical relay contact pair. It is designed for high-density mounting on 35mm, T-type DIN rail. Modules may be mounted side-by-side on 22.5mm centers and optionally connect together in modular fashion with 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.

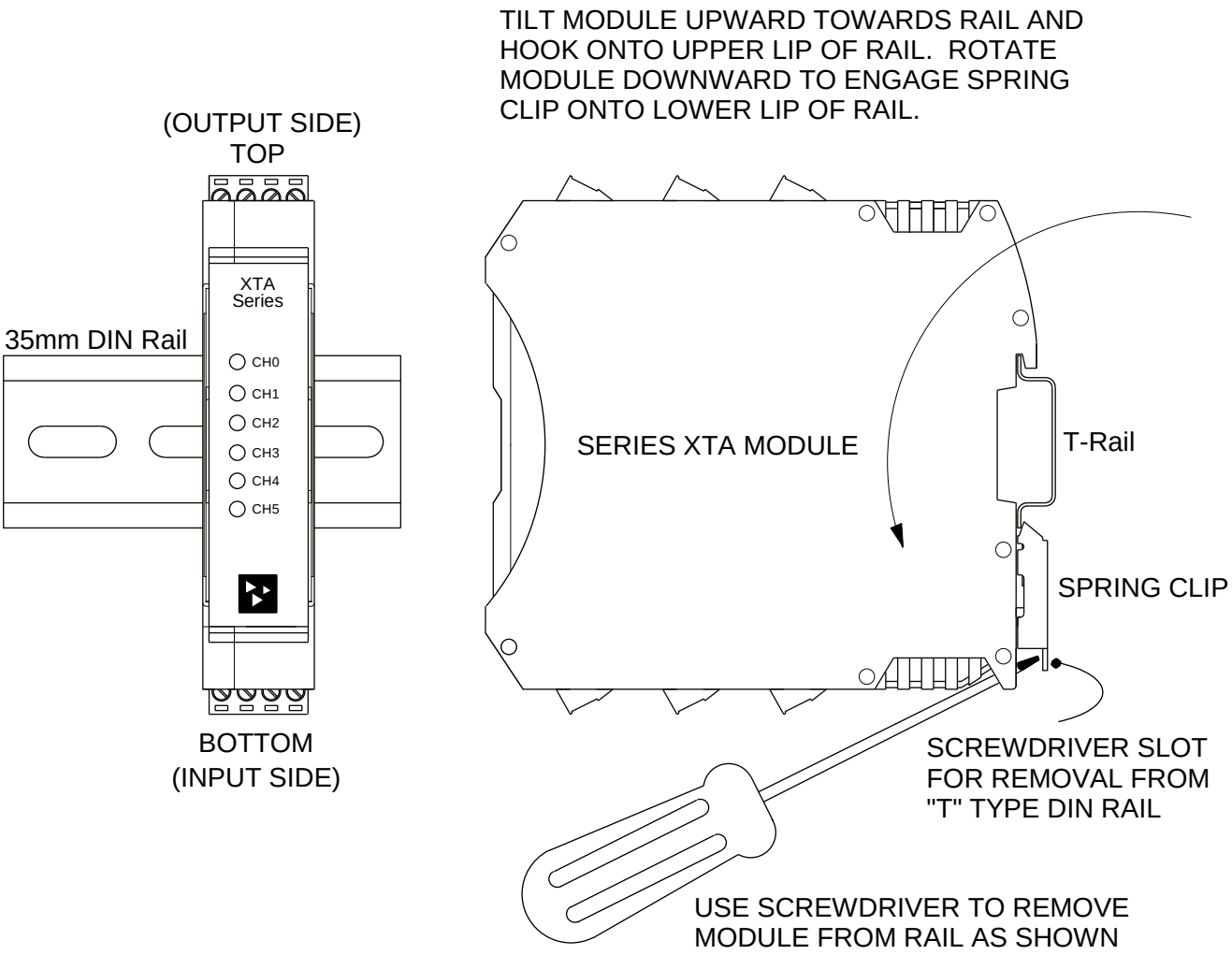
Mounting

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 XTA MODULE DIN RAIL MOUNTING AND REMOVAL



ELECTRICAL CONNECTIONS

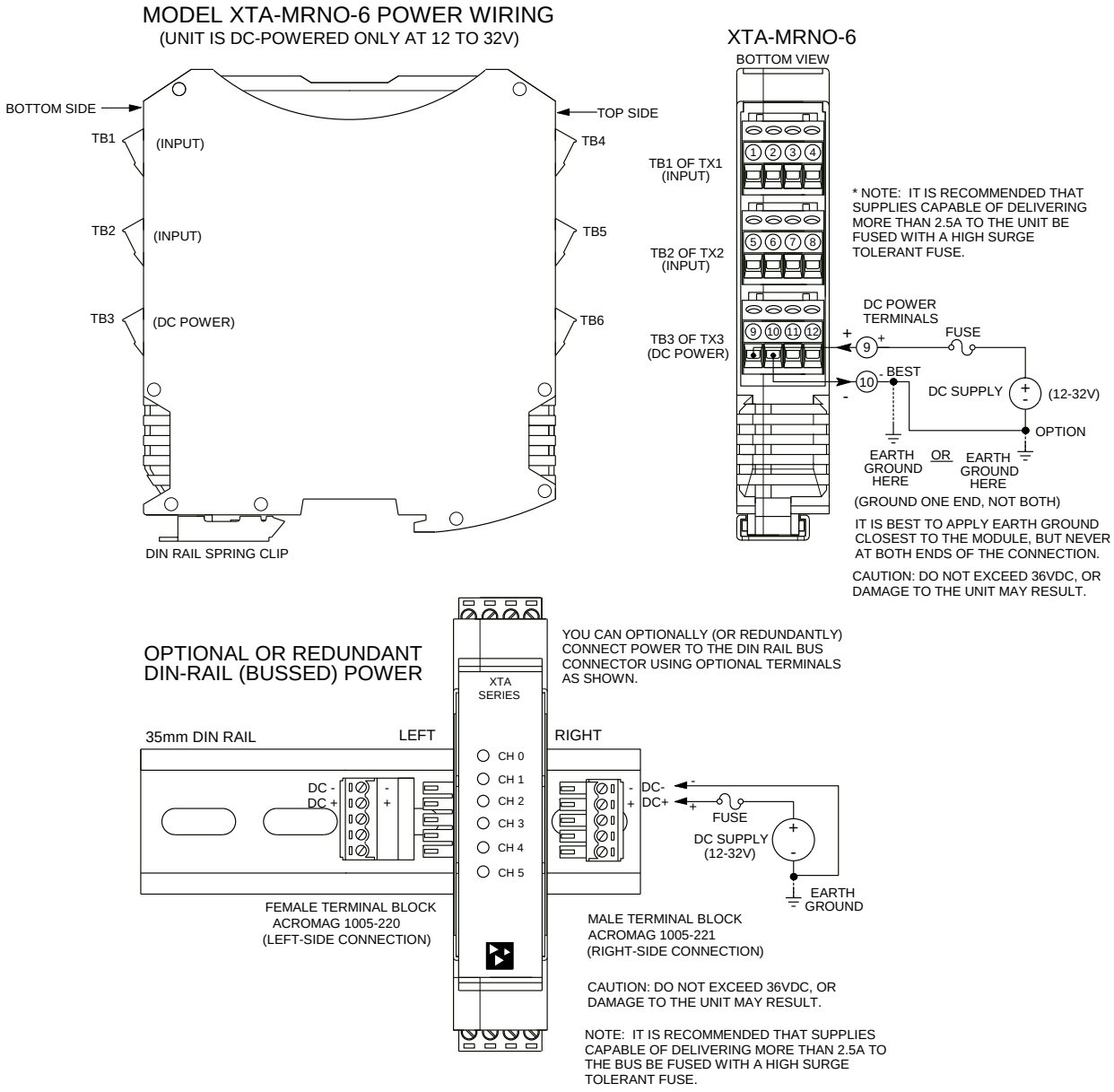
WARNING – EXPLOSION HAZARD – Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous.
WARNING – EXPLOSION HAZARD – Substitution of any components may impair suitability for Class I, Division 2.
WARNING – EXPLOSION HAZARD – The area must be known to be non-hazardous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

Wire terminals can accommodate 14-26 AWG solid or stranded wire. 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).



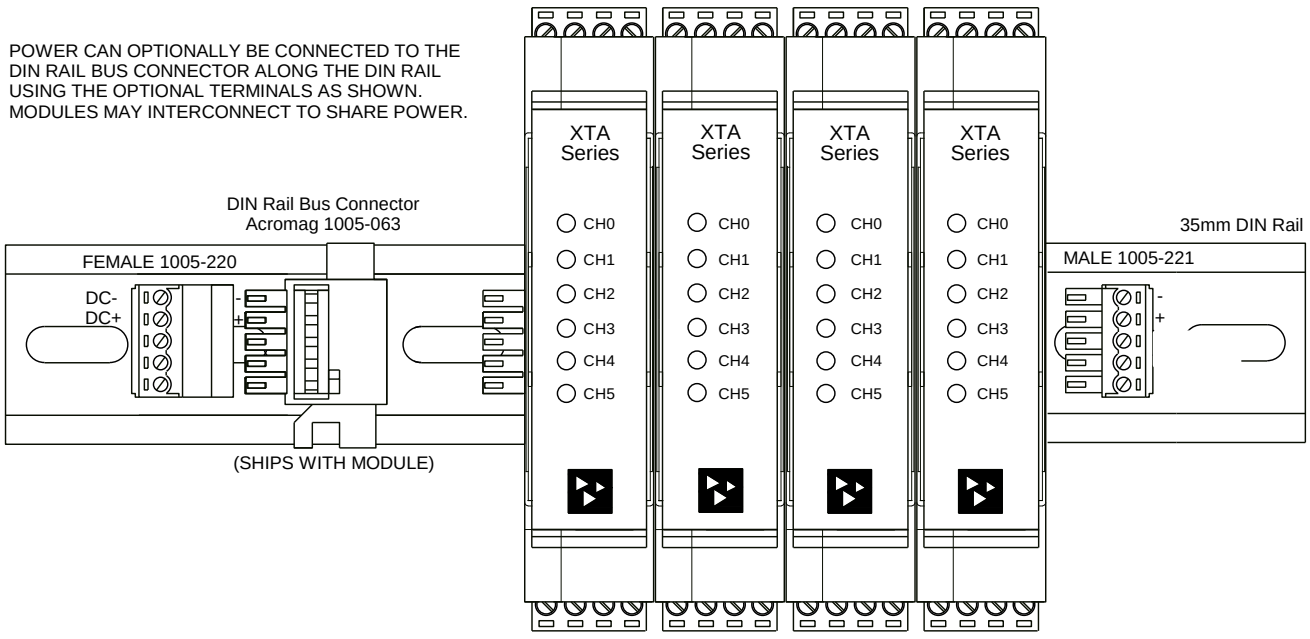
Power Connections…

Power is normally connected to the TB3 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 1005-063), 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 TB4 power.

Multiple modules may be powered by snapping them together along the DIN rail bus, then using the mating terminal block shown at left (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 TB3 fail.

This module comes equipped with the bus connector 1005-063 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 (Acromag 1005-220 for left-side, or 1005-221 for right-side connections). Refer to the figure on the previous page which shows how to wire power to the optional bus connector using these connectors.

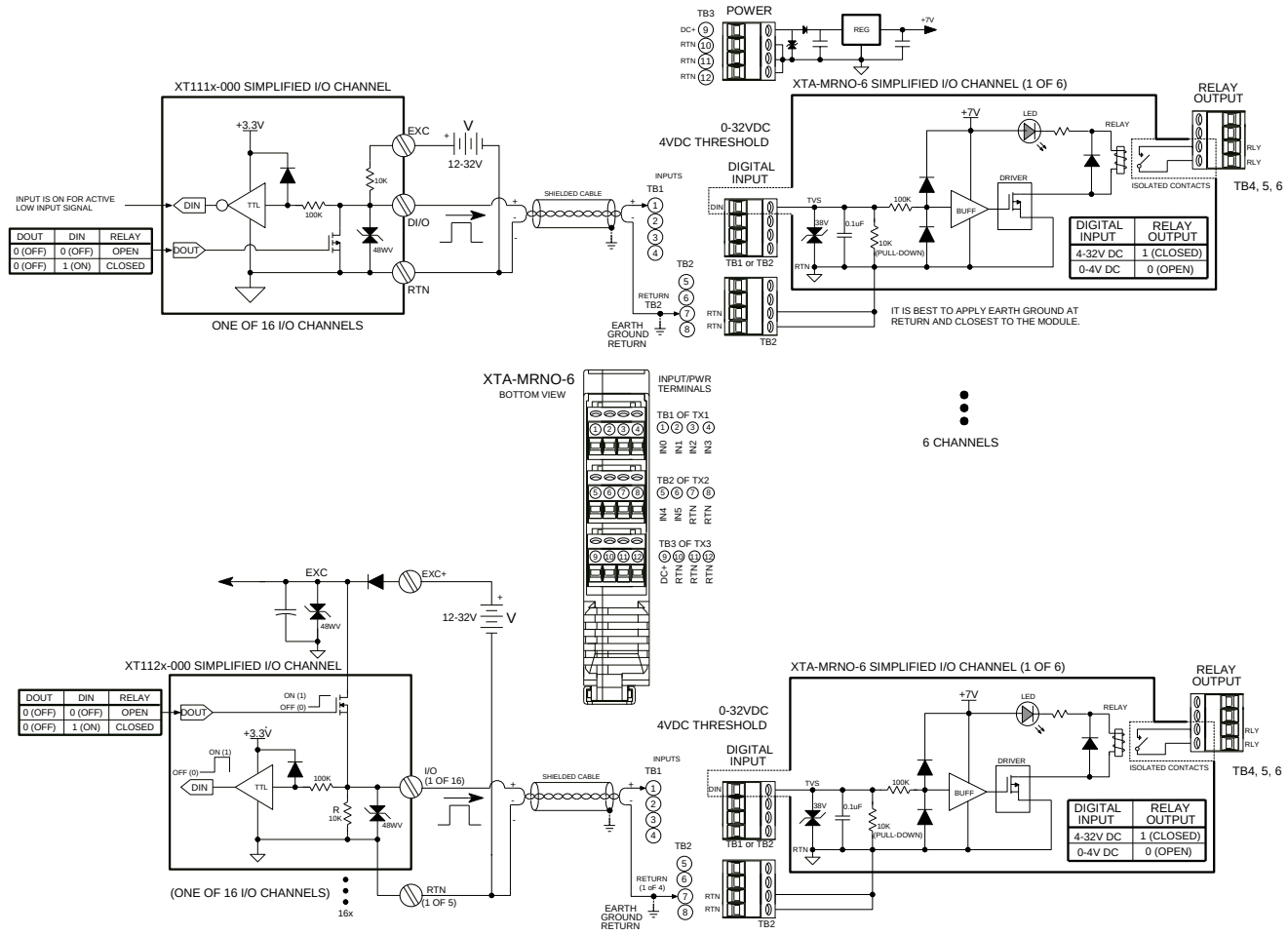
XTA MODEL OPTIONAL BUS POWER WIRING



Digital Input Connections

The six input channels of this module share return with power and are isolated from each relay output. Inputs withstand 0-32VDC, and trigger using a 4VDC threshold. Refer to the following figures to wire the inputs of this module.

INPUT CONNECTIONS OF XTA-MRNO-6 FROM DIGITAL OUTPUTS OF XT111x AND XT112x



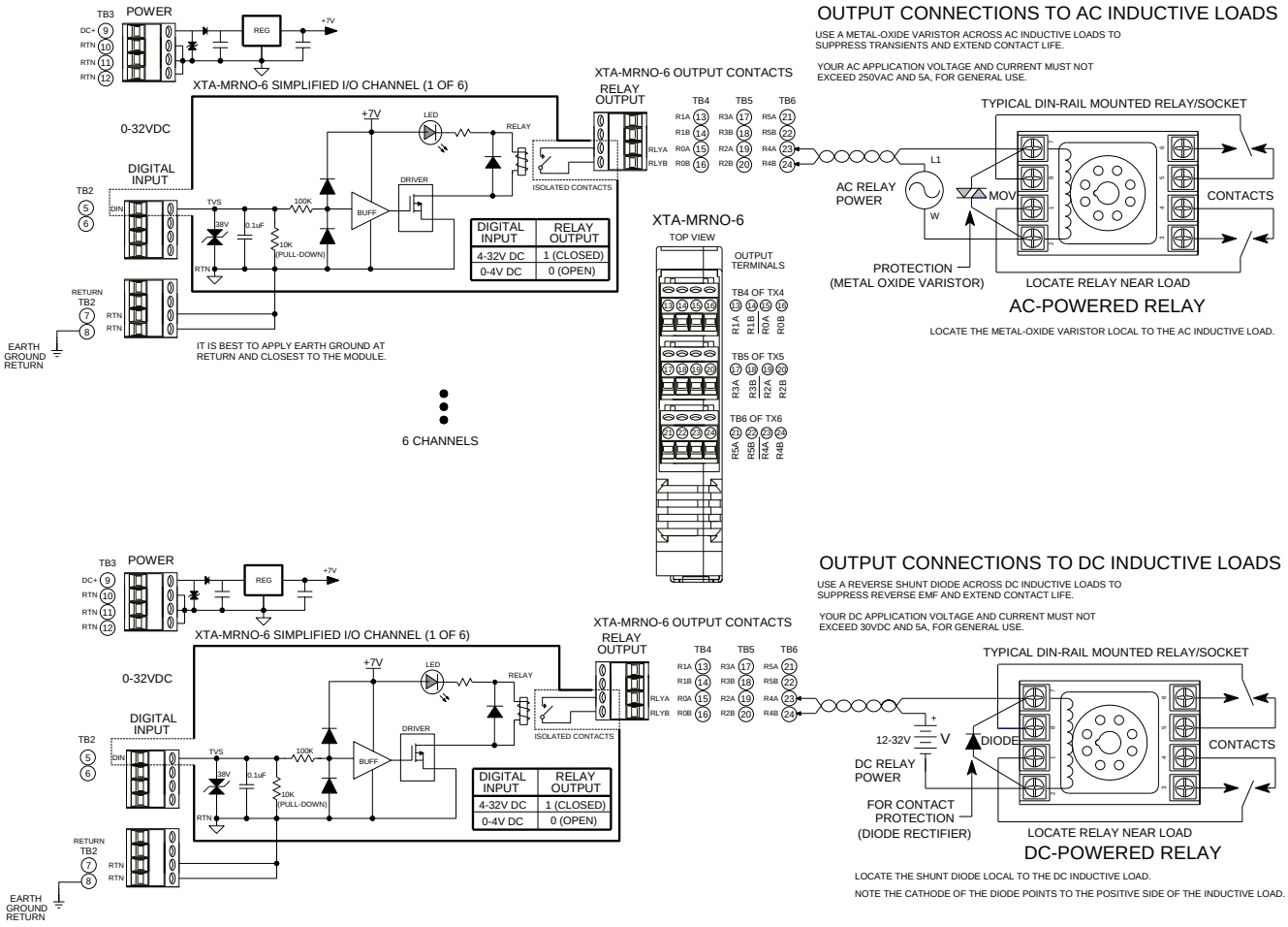
Earth Ground Connections

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 the input/power should be earth grounded as reflected in the connection diagrams. This module shunts transient energy to its ground. For this reason, earth ground should be applied closest to the module. See the Electrical Connections Drawings for input and power ground connections. The ground connections noted are recommended for best results and help protect the unit by giving it a low impedance path to earth for shunting destructive transient energy. Avoid inadvertent (extra) connections to earth ground at points other than those indicated, as this could drive ground loops and negatively affect operation.

Relay Output Connections

Each of the 6 mechanical relay output contacts (1 Form A) of the XTA-MRNO-6 will switch AC or DC loads at up to 250VAC/30VDC and 5A. Output relays of this module are energized using a 4V DC input threshold with a 0-32 VDC input range.

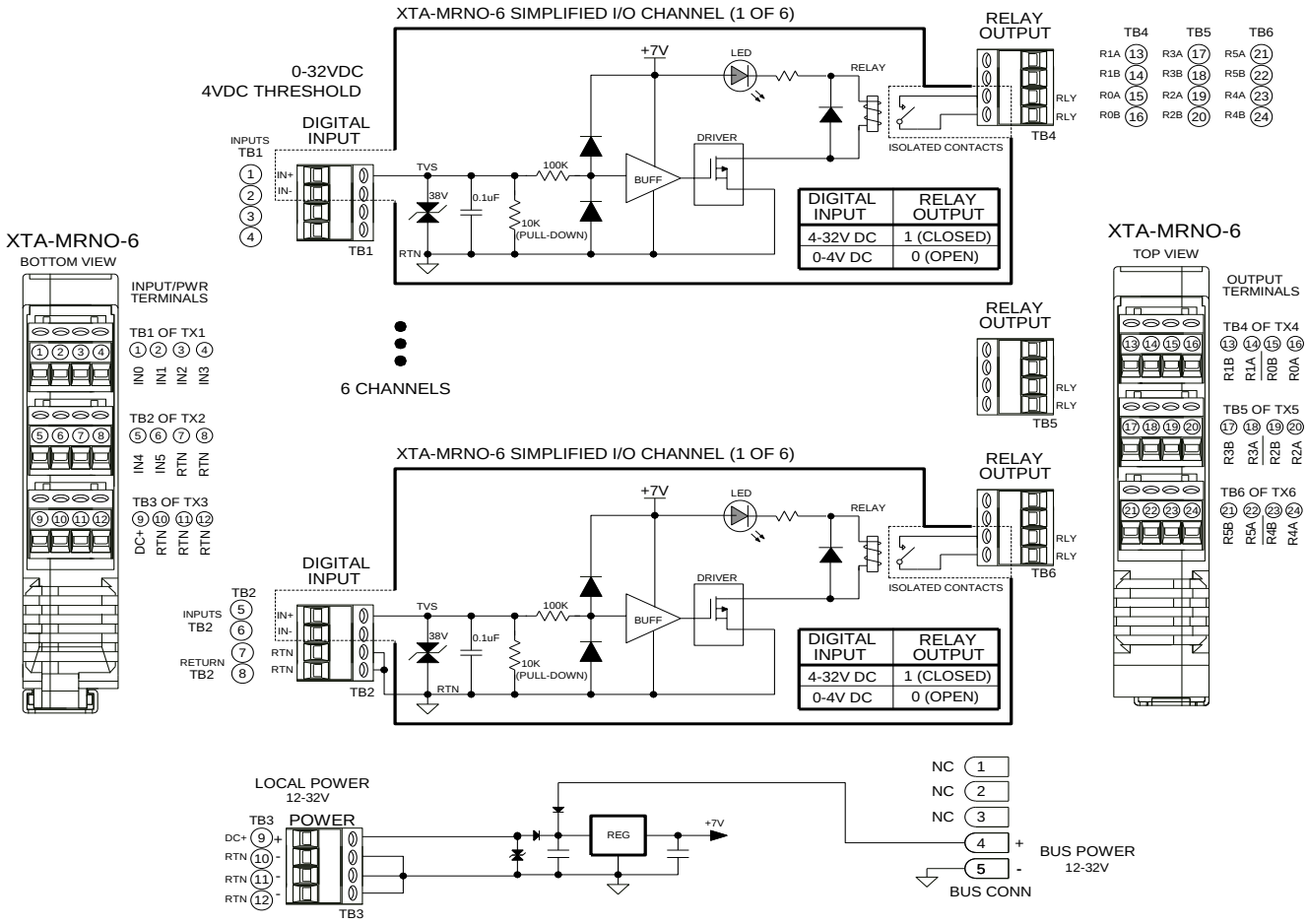
IMPORTANT: Output contact protection is required when switching inductive loads (see drawing below). DC inductive loads should have a diode placed across the load terminals with the cathode at the positive load terminal as shown. AC inductive loads require a bipolar protection scheme and should use a Metal Oxide Varistor across the load terminals. These devices will shunt the high reverse emf voltages that develop across the inductive load when power to the load is switched off, thus preventing this potentially destructive transient voltage from being conducted across the connection media and helping to extend the life of the XTA-MRNO-6 output contacts.



TECHNICAL REFERENCE

BLOCK DIAGRAM

XTA-MRNO-6 SIMPLIFIED SCHEMATIC



How It Works

Key Points of Operation

- Inputs and power share common.
- Relay Contacts are Normally Open SPST.
- Relays Contacts are individually isolated.
- Channel LED's reflect energized state.

The XTA-MRNO-6 is designed as a DIN-rail mounted, interposing mechanical relay board, for driving higher power loads with digital output models of the BusWorks I/O line. This design utilizes 6 separate buffered relay drivers for controlling 6 normally open, mechanical relays. Buffered inputs withstand DC voltages up to 32V DC and trigger at 4V thresholds. Power for the input circuitry is driven by a wide-range 12-32V, non-isolated, buck converter. LED's in series with the relay coils indicate the energized (closed) relay state. Output contacts are individually isolated and can switch high voltages up to 250VAC and 30VDC, at high currents up to 5A. The module includes an integrated bus connector that allows individual modules to snap together along the DIN rail and share a power connection using an optional terminal block. The bus power and power terminal connections are diode coupled to the same point in the circuit, allowing redundant/shared power connection. Transient voltage suppressors and bypass capacitors help protect input and power terminals from potentially damaging transient energy.

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 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.

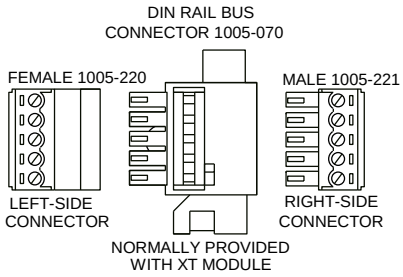
POSSIBLE CAUSE	POSSIBLE FIX
Relays do not energize or channel LEDs do not light…	
Input voltage is below 4V threshold.	You must drive the inputs above 4VDC to energize the relay.
Power supply voltage is too low.	Verify that at least 12VDC is being supplied to the module.
Internal 7V rail has failed.	Return module for repair.
Relays have worn out.	Mechanical relays have a finite contact life and are not intended for applications that require frequent, repetitive switching. Relays are a wear item and can be replaced at our factory if you suspect that they are worn out. Return module for repair.
Output is intermittent…	
Missing earth ground connection.	Connect earth ground to Return (terminal).
Output contacts chatter…	
Input signal is noisy, too low, or too near the 4V threshold.	DC input logic must cross the 4V threshold to energize the output. Inputs have about 100mV of hysteresis, but high input ripple or an input that hovers near the 4V threshold could cause the relay contacts to chatter on/off. Likewise, a missing earth ground connection at the return terminal could be driving noise on the input that affects output chatter.

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



This kit contains one each of the following terminals: (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.

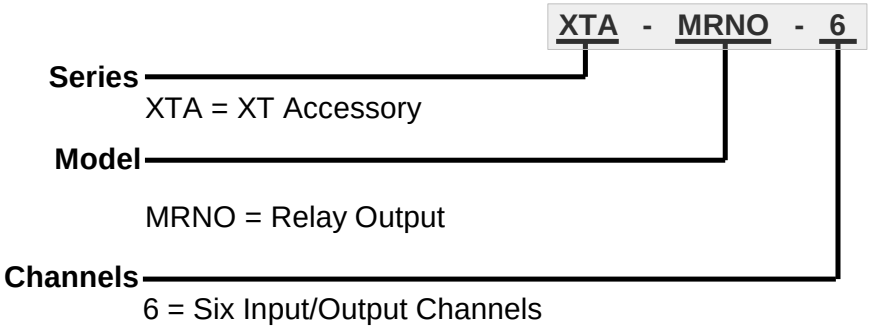
This module was shipped with the first item included in this kit, DIN Rail Bus Connector 1005-070, and this kit offers a spare. Left and right side terminal blocks that mate directly to the bus connector are also included in this kit. These terminals are used to optionally (or redundantly) drive power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

SPECIFICATIONS

Model Number

Model XTA-MRNO-6

- 6 Input/Output Channels
- Mechanical output relays switch voltage up to 250VAC and 30VDC, up to 5A.
- DC-Powered
- CE Approved



Digital Inputs

Six DC voltage inputs (at TB1 & TB2) share return with power (at TB3), withstand up to 32VDC, and trigger on 4VDC input thresholds. Inputs and power include transient filtering.

Input Signal Voltage Range: 0 to +32VDC, 36V peak.
Input Signal Threshold: 4VDC typical w/100mV hysteresis.
Input Impedance: 10KΩ typical, input includes 10KΩ pull-down to return.
Input Response Time: See Output Response Time.
Input Over-Voltage Protection: Bipolar transient voltage suppression (TVS diodes) and capacitive filtering (0.1uF) is included at every input. TVS diodes are rated for a working voltage up to 38VDC, a breakdown voltage of 72VDC, and a clamping voltage of 100VDC.
Input Current: 3.2 mA at 32VDC, typical. Inputs include 10KΩ pull-downs to return.

Relay Outputs

Six normally open, isolated, SPST, mechanical relay contacts at TB4, TB5, and TB6 are rated for loads up to 250VAC/30VDC and 5A.

Relay Manufacturer Part Number: FTR-MYAA005D
Contact Type: Form A (Six Channels), plastic-sealed contacts.
Contact Material: Gold overlay silver-Nickel alloy (Au + Ag 90 Ni 10).
Max Switching Voltage: Up to 277 VAC or 125 VDC, maximum.
Max Switching Current: 5A maximum.
Min Load: 1mA, 5VDC
Max Switching Power: Up to 1,250VA or 150W, maximum.
Contact Resistance: 1000mΩ at 500VDC, minimum (initial contact resistance).
Dielectric Strength: 750VAC (50/60Hz) for 1 minute between open contacts, 3000VAC (50/60Hz) for 1 minute from contacts to input coil.
Mechanical Life: $20x10^6$ operations, minimum. External contact protection is required for use with inductive loads.
Electrical Life: $100x10^3$ operations, minimum at 3A & 250VAC, 30VDC resistive. $50x10^3$ operations, minimum at 5A & 250VAC, 30V DC resistive w/ switching frequency at 20 times/minute.
Note: It is not recommended to switch mechanical relay contacts at high frequencies for long periods of time as this will quickly degrade the life of the relay.
Output Response Time: 5.25ms typical, 10ms maximum, no bounce measured from input trigger to corresponding output contact closure.
Note: External relay contact protection is required for use with inductive loads (see Output Connections). Failure to use adequate protection may reduce contact life or damage the unit.

Power

Non-isolated, 12-32V DC power at TB3, 0.9W, power shares return connection with inputs.

CAUTION: Terminal voltage at or above 12V minimum must be maintained to the unit during operation. Do not exceed 36VDC peak to avoid damage to the module.

Power Supply (Connect at TB3-9,10 and/or via Optional DIN Rail Bus Terminal): 12–32V DC SELV (Safety Extra Low Voltage), 0.9W. Observe proper polarity. Module can be optionally or redundantly powered by connecting power to the DIN rail bus connector (the power terminals and the DIN rail bus connections are diode-coupled to the same point in the circuit). Current draw varies with power voltage as follows (current indicated below is with all six relays energized).

Power Supply Voltage	XTA-MRNO-6 Current
12V	62mA Typical / 68mA Max
15V	50mA Typical / 55mA Max
24V	32mA Typical / 35mA Max
32V	25mA Typical / 27mA Max

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 with humi-seal conformal coating.

Enclosure & Physical…

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 +80°C (-40°F to +176°F).
Storage Temperature: -40°C to +80°C (-40°F to +176°F).
Relative Humidity: 5 to 95%, non-condensing.
Isolation: Output channels are individually isolated for common-mode voltages up to 250VAC, or 354VDC off DC power ground, on a continuous basis (will withstand 3000VAC dielectric strength test for one minute without breakdown). Complies with test requirements of ANSI/ISA-82.01-1988 for the 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.

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	931,489	106.3	1,074
40˚C	694,011	79.2	1,441

Revision History

The following table details the revision history for this document:

Release Date	Version	EGR/DOC	Description of Revision
21-FEB-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 2 Table of Contents (was missing troubleshooting section) • Page 6 Power Connections (revised) • Page 7 Power Connections (revised) • Page 13 Relay Outputs (Added relay manufacturer part number) • Page 14 Reliability Prediction (MTBF / FIT was TBD)
21-FEB-2014	D	CAP/ARP	Added cULus Mark to this model (removed pending).
21-JUL-2014	E	CAP/ARP	Added UL caution symbols / statements.