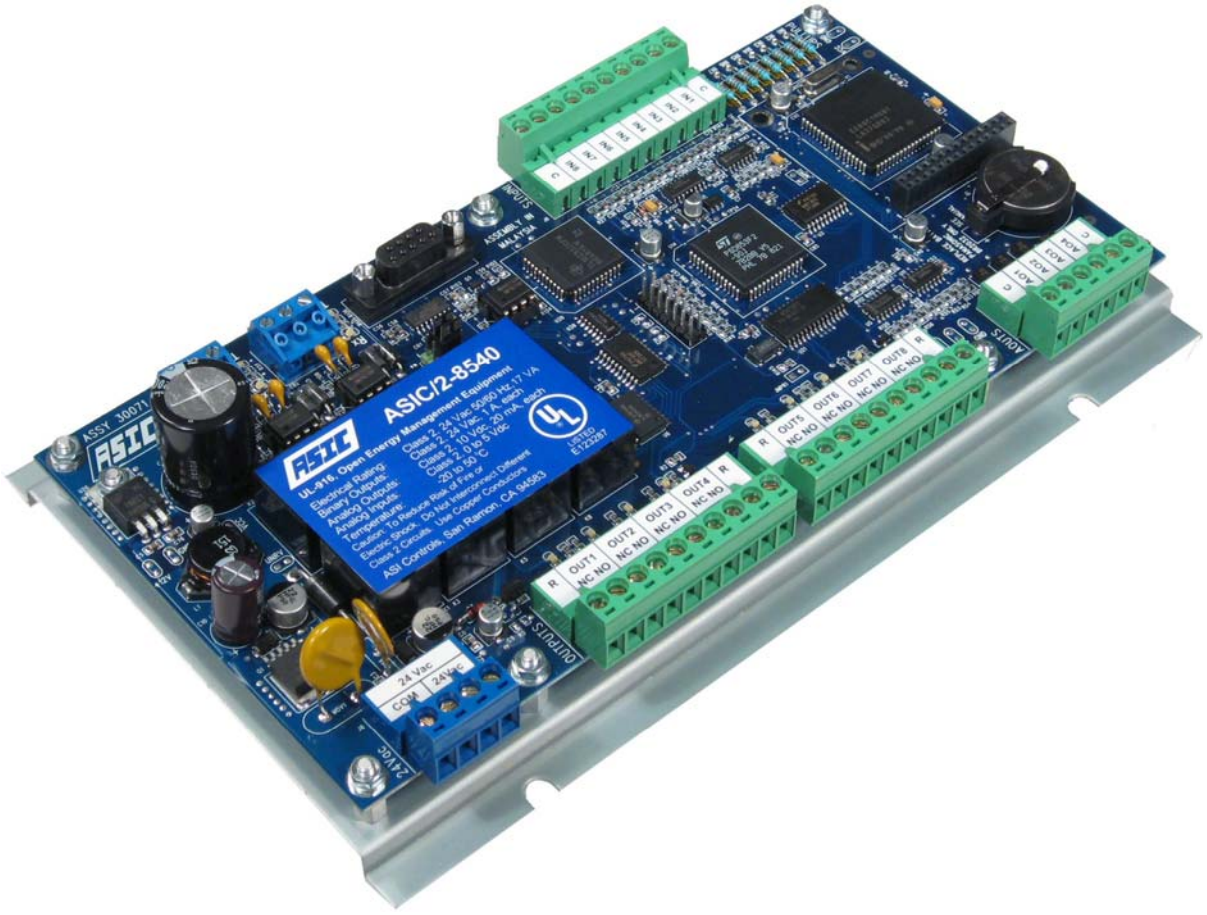
ASIC/2-8540

# Installation Manual

By ASI Controls



September 2009

Liability for products provided by ASI Controls is subject to ASI Controls' Terms and Conditions.

ASI Controls reserves the right to make changes in this Users Manual, Software, or Standard Communications Protocol at any time without notice.



For further information or for the most current release of this document contact:

ASI Controls
2202 Camino Ramon
San Ramon, CA 94583
Phone: (925) 866-8808
FAX: (925) 866-1369

Customer Support: sales@asicontrols.com

Technical Support: techsupport@asicontrols.com

Visit our Web site at http://www.asicontrols.com

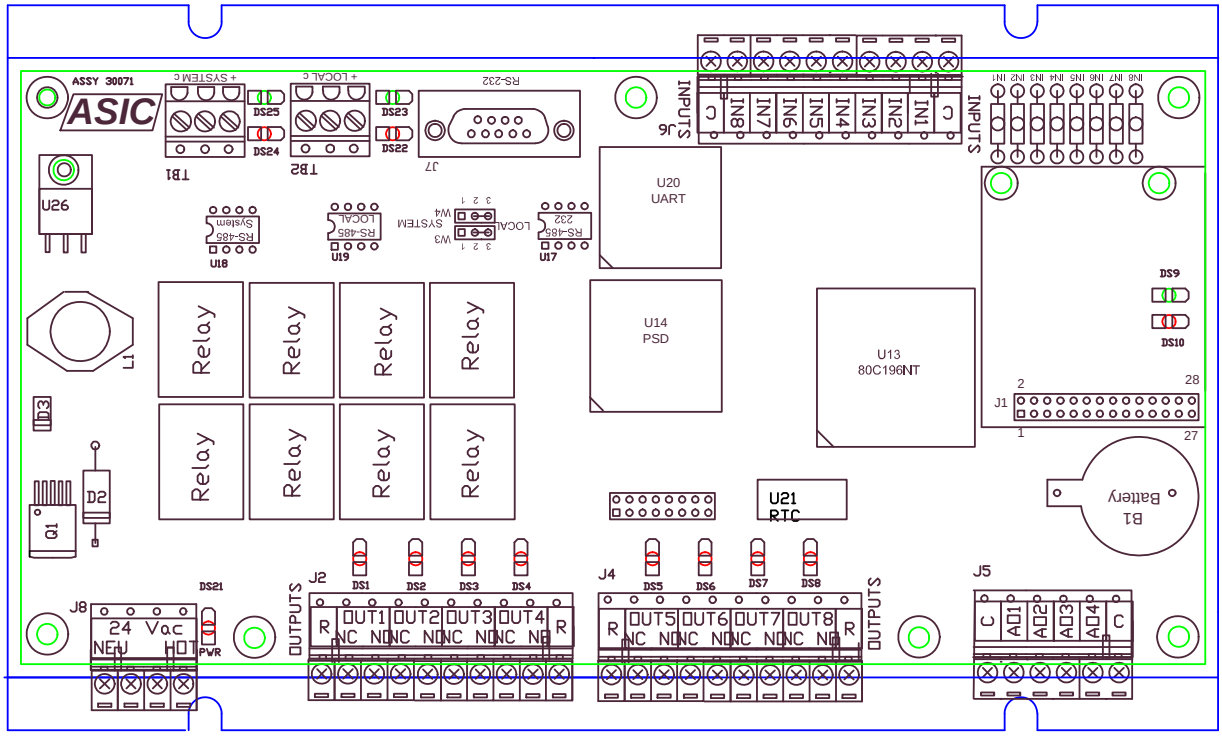
# Contents

# ASIC/2-8540 Installation

## Overview

This Installation Manual describes the mounting and wiring specifications for the ASIC/2-8540 Configurable Unitary Controller

The ASIC/2-8540 Configurable System Controller represents a new generation of communicating distributed direct digital control for unitary equipment and building systems. The ASIC/2-8540 controller is designed to be configuration compatible with the ASIC/2-8040, with the addition of Form C Relays and screw terminals.




The ASIC/2 controller uses a 16-bit microprocessor and is programmed with standard control objects such as Inputs, Outputs, Schedules, Logic Blocks, Timers, Alarms and Data Logging/Trending, etc. More advanced objects such as PID Loop Control, Electrical Demand Management, and Optimum Start are also included. The Boiler and Cooling Tower objects have been restored.

These objects are selected, configured, and linked together to customize the control sequence to the application requirement. Configuration data is stored in non-volatile NVRAM memory.

The ASIC/2-8540 has 8 relay outputs rated at 1 A @ 24 Vac for complete electrical isolation with two sets of 4 relays sharing a common return. It has 4 analog outputs for 0 to +10 Vdc capable of driving 20 mA.

The ASIC/2-8540 has 8 universal analog/binary inputs with 10 bit resolution.

Each ASIC/2 has a hardware clock for stand-alone operation. Multiple 8-day schedules allow modification of setpoints and system operation based on day of week or holiday.

Two way communications enable information to be transmitted throughout the control system providing coordination and easy access to all points. User interface communication is supported through the ASI OPC Server.

Two independent communication buses are included on each ASIC/2-8540. The local bus provides communications for direct integration of zone terminal controllers with building operations. The system bus allows for multiple controllers to share system wide data, such as fan status and outdoor temperature, in a timely manner.

The ASIC/2-8540 includes an RS-232 Monitor that can be used to communicate on the local bus or system bus depending on jumper settings.

An optional 32-bit Ethernet Adapter can be installed on the board to give Ethernet connectivity to the controller.

# ASIC/2-8540 Agency Approvals

## UL Listing

The ASIC/2-8540 is listed under UL-916, Energy Management Equipment, UL File E123287.

| | |
|---|---|
| Power Input – | Class 2, 24 Vac, 17 VA |
| Analog Input – | Class 2, 0 to 5 Vdc |
| Analog Output- | Class 2, 20 mA each |
| Binary Relay output - | 24 Vac, 1A each<br>Common Return 4A Total |

Ambient – 50 $^{o}$C (122 $^{o}$F) Maximum

Device intended to be supplied by 24 V ac, 50/60 Hz, Class 2 source.

Intended for installation in an indoor, controlled environment with a maximum ambient temperature of 50C.

Install in a UL Listed enclosure only.

CAUTION: To Reduce the Risk of Fire or Electric Shock, Do Not Interconnect The Outputs of Different Class 2 Circuits.

## CE

The ASIC/2-8540 has passed compliance testing for with CE requirements: Generic Immunity Standard when used with shielded communication wire. CISPR11:1990/EN55011:1991 Emission, Class A: Industrial, Scientific and Medical Equipment, and EN 50082-1/1996 Generic Immunity Standard when used with shielded communication wire.

## FCC

All ASI Products have been tested to be in accordance with FCC requirements, CISPR 22.. The ASIC/2-8540 complies with of the FCC Part 15 (CISPR 22) Class A.

A Class A digital device is a device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

.Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### ISO 9002

The ASIC/2-8540 is manufactured in an ISO 9002 certified facility.

# Other Information

## Grounding

ASIC/2-8540's are grounded devices and must be solidly connected to the building electrical ground through the sheet metal

WARNING: Failure to properly ground the controller may cause controller malfunction.

## Storage

Store the controllers in a clean, cool, dry environment where the temperature remains between -35 degrees F (-35C) and +180 degrees F (80 C); and the humidity remains between 5% and 95% relative humidity (non-condensing).

## Environmental Considerations

The ASIC/2-8540 controller must be installed where the temperature remains between +35 degrees F (2 C) and 122 degrees F (50 C);

The controller must be in a non-condensing environment. The maximum relative humidity is 80% up to 31 C (88 F) decreasing to 50% at 40 C (104 F).

Altitude up to 2000 m (6560 ft).

IEC 664, Pollution Degree 1, only dry, nonconductive pollution occurs.

Main supply voltage not to exceed + 15% of nominal voltage.

The controller enclosure is designed to be installed inside another enclosure that provides adequate protection from the environment.

Note: if the equipment is used in a manner not specified by ASI Controls, the protection provided by the equipment may be impaired.

## Electro-Static Discharge (ESD)

An ASI Controller is a sensitive electronic device that can be damaged by common electrostatic discharge from the person handling it. It is the phenomenon that gives you a mild shock when you walk across a carpeted floor and then touch a doorknob

Touching the circuit board can transfer electrical charge and possibly corrupt the controller, even if the controller is not powered. It is important for anyone handling the controller to ground themselves before touching the circuit board.

Static electricity is generated from friction between two materials when two materials are separated or rubbed together. Examples can be as simple as opening a common plastic bag; removing adhesive tape from a roll or container, walking across a floor, transporting controllers around on carts, or sliding a controller on a work bench.

Fortunately, preventing ESD can be relatively easy and inexpensive. Eliminate static charges from the workplace. Properly shield controllers from static fields.

Eliminating static electricity in the workplace is accomplished by grounding operators, equipment, and devices (components and computer boards). Grounding prevents static charge buildup.

Personal grounding with a wrist strap keeps constant contact with bare skin and has a cable for attaching it to the ESD ground to drain off the operator’s static charge.

A dissipative table mat should provide a controlled discharge of static voltages and must be grounded. The surface resistance is designed such that sliding a computer board or controller across its surface will not generate significant voltage.

A floor mat dissipates the static charge of personnel approaching the work bench.

Electrical field damage can be prevented keeping the metal cover on the product, or transporting products in special electrostatic shielding packages.

# ASIC/2-8540 Product History

## Flash Upgrade

The ASIC/2-8540 can be upgraded using the In-Field Flash Utility Programmer, Flash Dev, which is available for download from the ASI Website Integrator Center: http://www.asicontrols.com/integrator/asic_2_8540/ The software allows users to upgrade the firmware over the RS-485 communication bus or over Etherlink/2 Ethernet communications.

Technical Note 26, Flash Device describes how to install and use the software is also available on the website.

Consult the latest Read Me file, Read854a.txt, for firmware details.

## ASIC/2-8540 FW854A

***ASIC/2-8540 FW854a Ver 2.5j Release 2009-07-16***

- Latest Release

***ASIC/2-8540 FW854a Ver 1.5m Release 2006-05-02***

- Initial production based on ASIC/2-7540 FW754a1.5..

# About This Document

This ASIC/2-8540 Installation Manual, DOC-1661, was produced using *Doc-To-Help*®, by Component One, LCC, and was last revised on 2009-09-01. ASI Controls is always working to improve our products. Should you have any questions, or suggestions that would help our products better meet your needs, or that would help us serve you better, please call, write, or e-mail to:

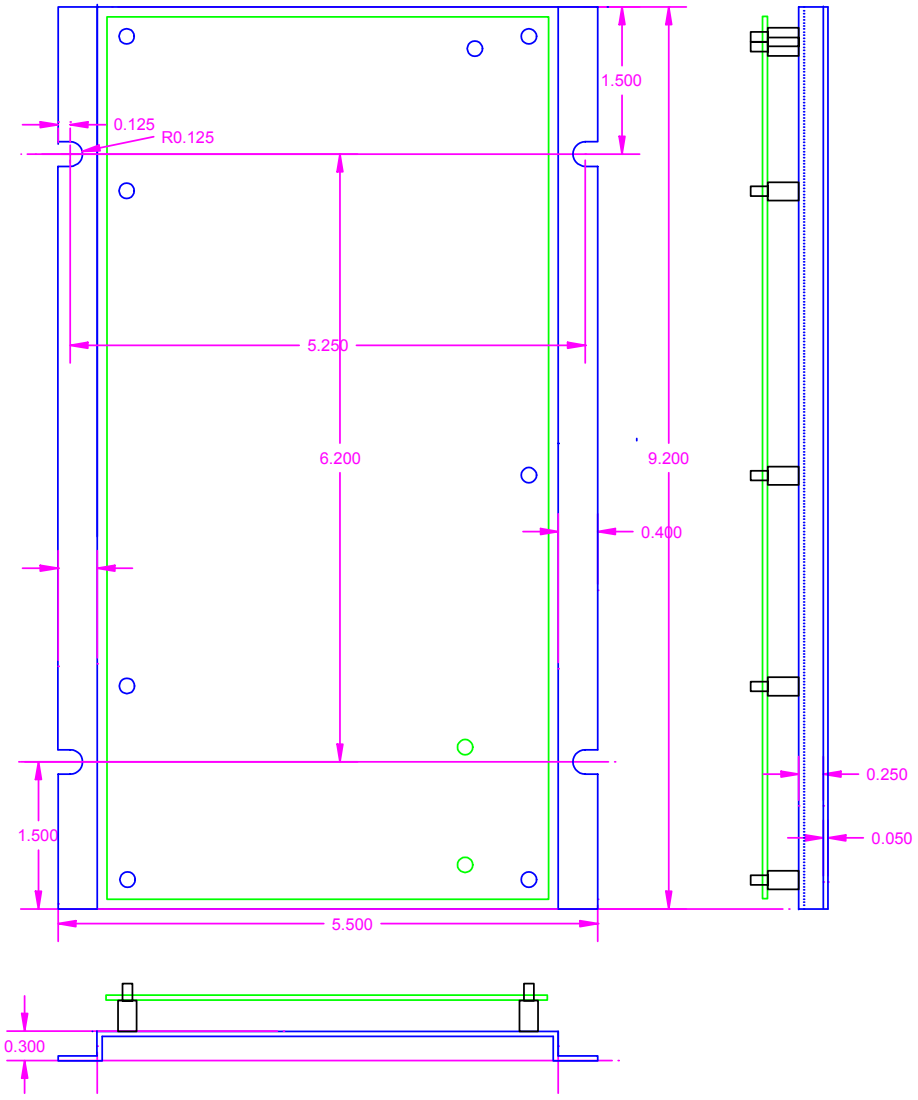

ASI Controls
2202 Camino Ramon
San Ramon, CA 94583
Phone: (925) 866-8808
FAX: (925) 866-1369

Customer Support: sales@asicontrols.com
Technical Support: techsupport@asicontrols.com
Visit our Web site at http://www.asicontrols.com

# ASIC/2-8540 Hardware

## Controller Mounting

The controller is mounted in a folded sheet metal base. The base can be mounted to either metallic or nonmetallic surfaces and should be connected to building ground.




ASIC/2-8540 Sheet Metal Base (all dimensions in inches)

To mount the controller base, follow the procedure outlined below:

- o Locate the controller where it is to be mounted.
- o Use the mounting slots as templates to mark the location of the 4 holes. Mounting centers are 5.25" by 6.20".
- o Pre-drill the mounting holes.

WARNING: Never drill mounting holes with the controller electronics inside the enclosure! Metal shavings can short out and damage the controller circuitry.

- o Install the 4 screws and tighten.

NOTE: If mounted on a non-metallic surface, be sure that the unit is properly connected to building ground.

### Dimensions

The overall dimensions of the controller are 9.20" x 5.50" x 2.0". The controller weighs 1.6 lbs (0.7 kg). .

## Controller Connections

Power, Input and Output connections are made by means of two-part screw terminals.

RS-485 connections use two part screw terminal blocks, TB1 and TB2, and DB-9 RS-232 connector J7

## Other Considerations

### Environmental Considerations

The controller must be installed where the temperature remains between 32F (0 C) and 122 F (50C), and the relative humidity remains between 10% and 95%, non-condensing.

The controller is designed to be installed inside another enclosure which provides adequate protection from the environment.

WARNING: Ambient operating conditions inside the enclosure must remain within the operating specifications.

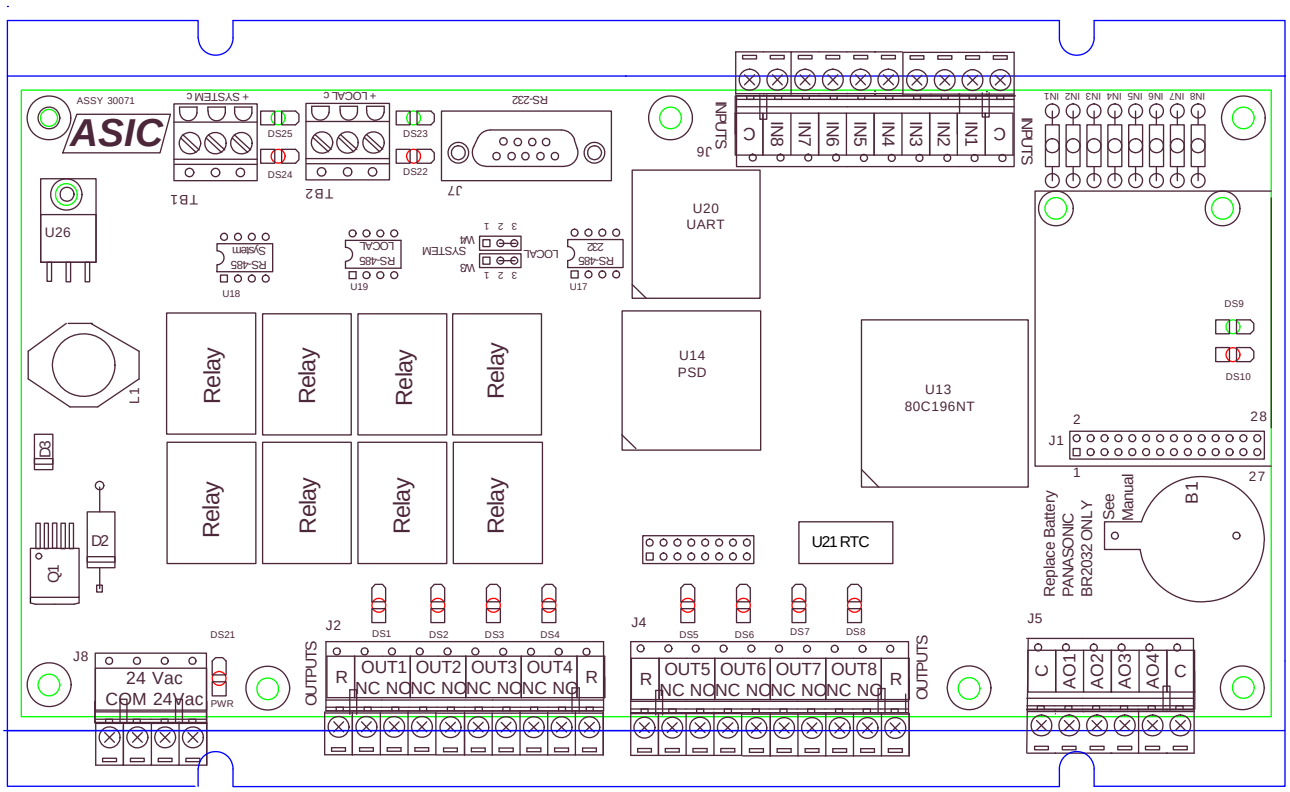
### EMI Noise Considerations

The controller is connected electrically to its base with a metal screw and support. The base is designed to shield the controller from Electro Magnetic Interference (EMI). However, whenever possible, the controller should be mounted outside of high voltage compartments and away from other sources of EMI. Common sources of EMI are high voltage devices (greater than 24 Vac) such as contactors, transformers, motors, light ballasts, and high voltage wires.

# ASIC/2-8540 Wiring

## General Wiring Considerations

This section describes controller input, output, and power wiring details. There should not be any power to the controller or any component connected to the controller when wiring it. Connecting or disconnecting wires to or from the controller while it has power can cause controller malfunction or damage the equipment that it is connected to.



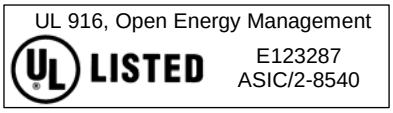

### General Concerns

Route input, output, power and communication wire neatly inside the enclosure. Avoid looping excess wire. Use tie-wraps to dress and bundle loose groups of wires.

CAUTION: Do NOT bundle communication or input wiring with output and power wiring. It can disrupt communication and/or interfere with controller input measurements.

Make sure all connections to the controller are mechanically tight. Intermittent contact of connections can cause excessive electrical noise. To reduce the possibility of excessive EMI noise, always route controller wiring separate from high voltage wiring.

The ASIC/2-8540 is Listed under UL-916, Energy Management Equipment, UL File E123287.




The following conditions should be observed:

- Device intended to be supplied by 24 V ac, 50/60 Hz, Class 2 source.
- Intended for installation in an indoor, controlled environment with a maximum ambient temperature of 50C.
- Install in a UL Listed enclosure only.

CAUTION: To Reduce the Risk of Fire or Electric Shock, Do Not Interconnect The Outputs of Different Class 2 Circuits.

## Lightning Protection

The controller has diode protection on the inputs, over-voltage protection on the 24 Vac power, and transorbs and fuse protection on communication. It is generally resistant to normal surges and dips in voltage.

Lightning is very difficult to protect against.

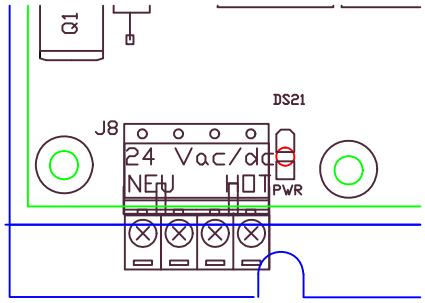
1. Surge suppressors are marginal in their capacity to protect against a true lightning strike or near strike. They have limited surge energy limits that can easily be overcome and then they are passive.
2. MOV's are slow and not intended to protect against lightning. Lightning induced energies can easily far exceed the waveforms that the protectors can clamp.
3. The only true lightning protection is a gas-tube type. These can conduct for extended periods of time, once ignited. They appear to solve the problem but they tend to be expensive.

# ASIC/2-8540 Control Power and Grounding

This section describes connection of control power and grounding of the controller. Specific examples are provided where needed.

## Power supply

The ASIC/2-8540 uses a non-isolated switching power supply using 24 Vac +/- 15% at 50 or 60 Hz with one side connected to board ground.. The 24 Vac power connections are located on the 4-position screw terminals marked 24Vac near the relays. Two positions are marked HOT, J8-3 & J8-4. Two positions are marked NEU, J8-1, J8-2, for neutral and are connected to board ground.




Note: Recommended practice is that each controller should have its own 24 Vac supply. If more than one controller is connected to the same 24 Vac transformer, then you MUST observe polarity connecting HOT to HOT and Neutral to Neutral.

## Power Terminations

The power and ground terminations should be made to terminals 24 HOT and 24 COM using wire no larger than 12 gauge and no smaller than 20 gauge stranded or solid copper wire. When making terminations with stranded wire, be particularly careful that all strands of wire are terminated inside the connector. Loose strands can cause shorted connections.

Power wiring should be routed to:

J8-1, J8-2 NEU, 24 Vac common, (board ground)
J8-3. J8-4 HOT, 24 Vac hot

Control power supply specifications:

| | |
|---|---|
| Supply Voltage: | 24 Vac +/- 15%, 50/60 Hz |
| Power Consumption: | 17 VA plus other loads |
| Under Voltage Protection: | 70% +/- 10% line voltage brownout detect. |
| Protection: | Polyswitch and MOV |

## LED indication

There is a red power LED located next to the power connection.

## Controller Power Protection

The controller incorporates a polyswitch OverCurrent Protection Device with a Radial Leaded Metalic Oxide Varistor to protect the controller circuitry from excessive voltage. If momentary overvoltage is encountered the polyswitch resets it self once the overvoltage is removed.

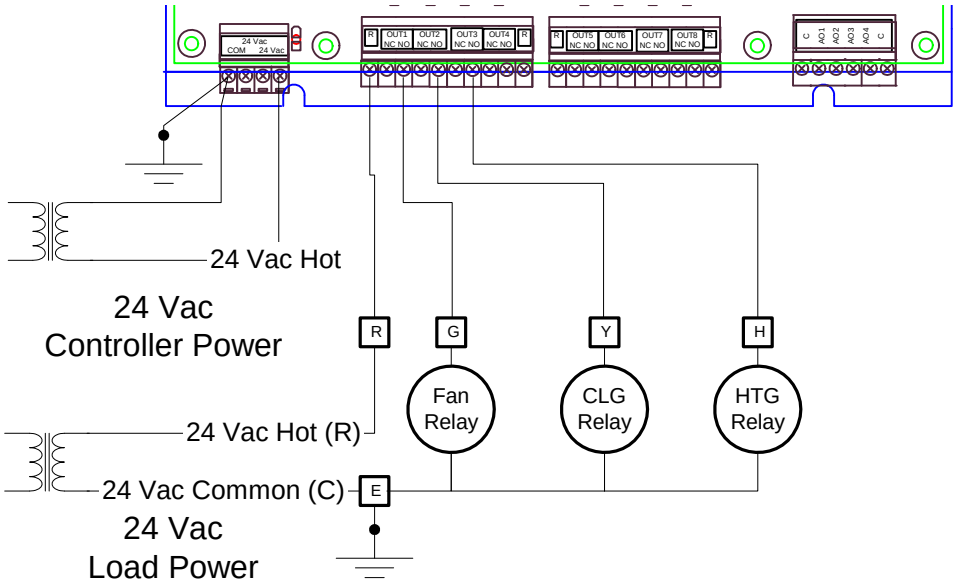
The polyswitch is located next to the 24 Vac power connections.

Specification: ASI PN14037
Type Polyswitch RayChem, RXEF135,
Rating: 1350 mA, 75 V

Power is protected from surges by a Metalic Oxide Varistor, MOV1

Specification:ASI PN 17083
Type MOV, RayChem, ROV14 -680K-S,
Rating: 68 Vdc, 40 Vac

## Controller Power




Ideally the controller should be powered from its own 24 Vac transformer. The 24 Vac controller power must be connected directly to screw terminals, J8, and must NOT share a common circuit path with any relay circuits.

Power to the controller must be free of electrical noise. The relays and contactor coils loads should be powered from a separate 24 Vac transformer, so that the relay outputs and common return, R, are isolated from the controller.

Voltage spikes are generated when an inductive load is switched off and the magnetic field collapses. When contacts open, electrical noise can also be generated and radiate along the wires. Using a separate load transformer ensures that any transients generated by the external relays are isolated from the controller.

The primary side of the 24 Vac transformer must be connected directly to the primary power source. Avoid any common circuit paths with heavy switched loads, high current fuses or long wire runs. Large inrush currents and switched load currents are characteristic of these primary circuits and can cause substantial fluctuations in voltage to the primary side of the control transformer, adversely affecting controller performance.

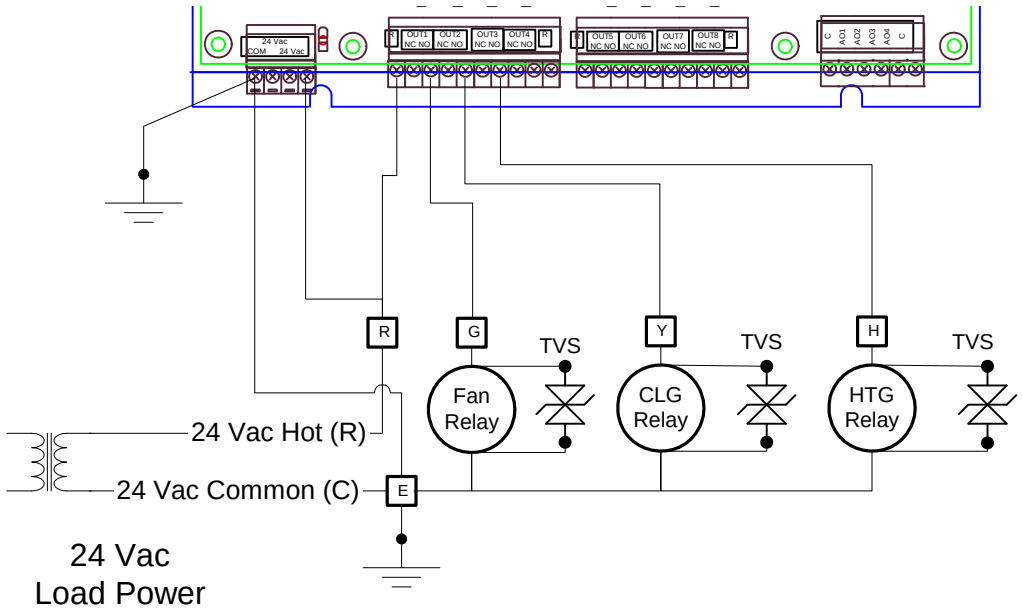
In circuits powered by a multiphase source, the preferred way to power the controller is using a 277V/24Vac transformer connected to an unused phase of the source and neutral.

If a 480V/24Vac transformer must power the controller, use the phases that experience the least amount of power drain from inductive loads. It is important to avoid phases which are on the contactor or switched side of the load.

CAUTION: Always turn power OFF before connecting or disconnecting controller power leads.

## Single Transformer

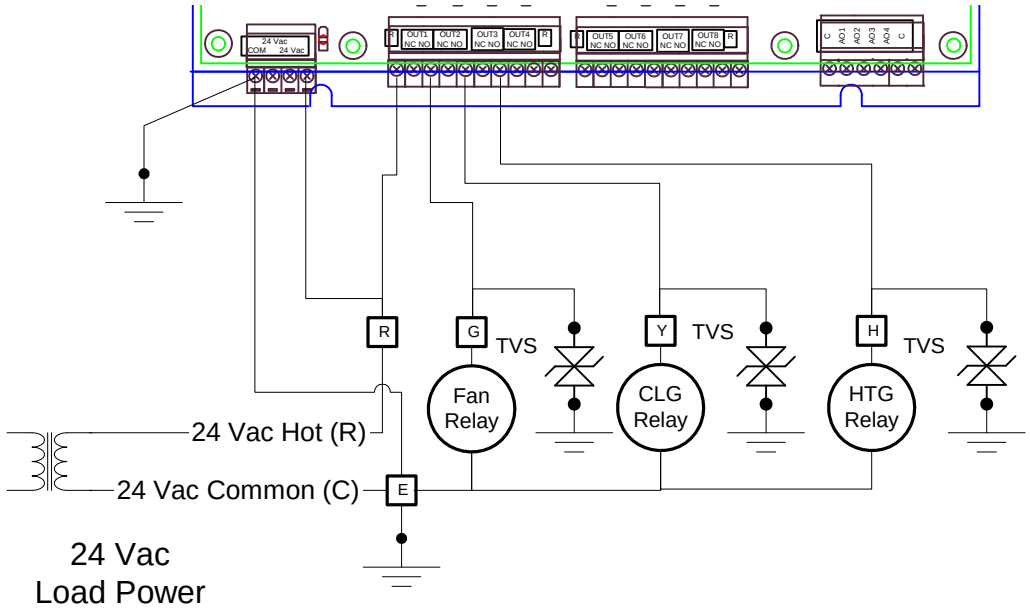
If it is not possible to use separate transformers to power the controller and the loads, then transient voltage suppressors, TVS, may be necessary to protect the controller from voltages and currents that may be induced when contactor relays open.




The controller power 24 Vac Hot and Common should be run directly to J8. The load power should be run separately. A TVS should be placed across each 24 Vac load relay. When a voltage spike appears across the relay coil, the TVS conducts and the excess energy is shunted to the return path. Induced currents are prevented from getting to the controller.

TVS, 1.5KE56CA, Voltage Protection Devices 1500W, 56Vdc Bidirectional

If it is not possible to place the TVS directly across the relay coil it may be sufficient to place the TVS from the Relay Coil to ground.



## Building Ground

The controller must be solidly connected to the building electrical ground through screw terminals 24 Vac Common (J8-1, J8-2) to ensure proper operation of the controller. The ground wire should be made of copper.

Controller grounding should adhere to Article 250 of the National Electrical Code on grounding and all local codes.

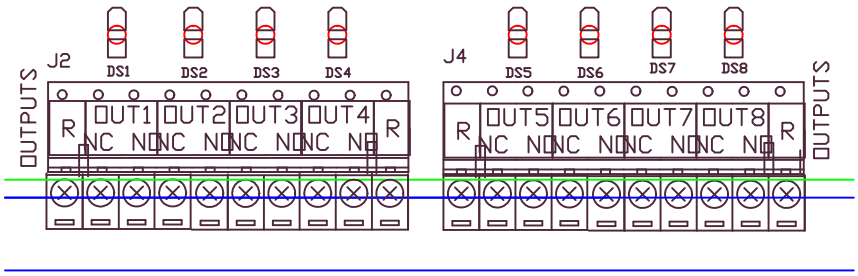
**WARNING:** Failure to properly connect the controller to building ground may cause controller malfunction.

# ASIC/2-8540 Relay Outputs

The ASIC/2-8540 has 8 isolated Form C Relay outputs that can switch 24 Vac to a common return. There are two banks of 4 relays. Each bank has an isolated common return. The common returns must be connected if a common source is used to be switched by the relays.

The relays are rated for a maximum of 1A 24 Vac each. Each relay has a normally open, NO, and normally closed, NC, contact. When the relay is not energized the NC contact is connected to the common return. Each group of 4 relays has an isolated common return. Outputs 1-4 have a common Return, (J2-1 and J2-10). Outputs 5-8 have a common Return, (J4-1 and J4-10). The common returns are not connected on the board and must be connected to your external circuit.

There are 8 red LEDs that light when the relay coils are energized. A power saver circuit energizes the relays and then decreases the holding circuit so that the LEDs will dim after initial startup.

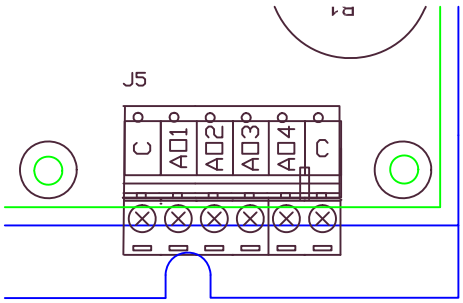



The two-part pluggable connectors are designed for 12-22 AWG wire stranded or solid copper wire. When making terminations with stranded wire, be particularly careful that all strands of wire are terminated inside the connector, as loose strands can cause shorts.

The functional operation of the binary outputs depends on the configuration of the controller.

# ASIC/2-8540 Analog Outputs

The ASIC/2-8540 has 4 analog outputs that generate 0 to 10 Vdc at up to 20 mA, which are configured in the Analog Output Object in the controller. The two-part pluggable connector J5 is designed for 12-22 AWG wire stranded or solid copper wire.




The controller provides four analog outputs with an output range of 0 to 10 Vdc.

- Analog output specifications on J5 are:
  Range: 0 to to 10 Vdc
  Resolution/Accuracy: 8 bits/0.4 % full scale
  Drive Current Rating: 20 mA at 10 V.

Each Analog Outputs is protected by Transient Voltage Suppressor, TVS 7, 8, 11, 12.

Specification: ASI PN 17082, TVS, 10.0 V, UNIDIR, 600W, SO-16
LittleFuse, SMBJ10A

The analog voltage outputs are all referenced to the board ground, J5-1. Any device that is controlled from an analog output must also share this same electrical common. For example, a transducer that is used to drive a motorized damper has a control signal on contact (X) that is referenced to a common signal on contact (T1). Contact, T1 must be connected to the 24 Vac common of the controller. :

Note: 24 Vac Neutral (J8-1, J8-2); Input common (J6-1, J6-10) and /or analog output common (J5-1, J5-6); are connected together on the circuit board.

# ASIC/2-8540 Inputs

The controller has 8 inputs which are used for analog, binary, and thermistor inputs. The input wiring have hardware selectable options including pin socketed pull-up resistors, or parallel resistors. Typical controller input wiring is shown below. The ASIC/2-8540 inputs must be configured using ASI Expert software for the specific application.

## Analog Input Specifications

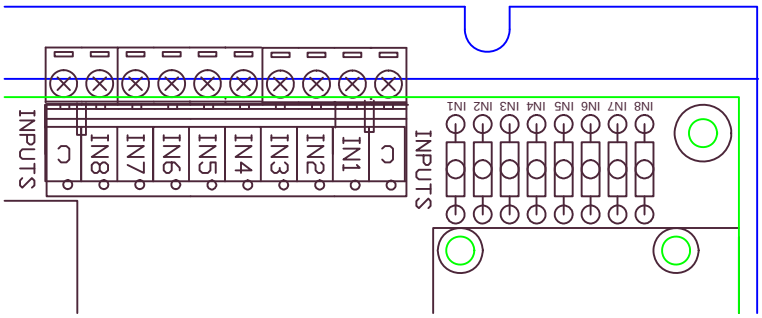
The analog input specifications are:

| | |
|---|---|
| Range: | 0 - 5 Vdc |
| Accuracy: | 10 bits 0.1% full scale, |
| Input Impedance: | 10 kohms maximum. |

The ASIC/2-8540 reads to 10 bit resolution

## Input Connections

All ASIC/2-8540 inputs are connected to two-part screw terminals, J6, marked IN1 through IN 8. There are two input common connections marked COM




The controller input connectors are designed to be used with 12 gauge to 22 gauge stranded or solid copper wire. When making terminations with stranded wire, be particularly careful that all strands of wire are terminated inside the connector.

CAUTION: The controller inputs are not fused. Connection of inputs which exceed the published specifications may cause permanent damage to the controller.

The ASIC/2-8540 controller inputs are designed to work without shielded wire. If the input wiring is run in close proximity to other AC wiring, etc., shielded cable may be required. The shield wire should be connected to the controller COM terminal. Tape back the shield at the other end of the wire, taking care to prevent shorting the shield to ground at both ends.

CAUTION: Only terminate the shield at the controller. Do NOT terminate the shield at both ends of the wire.

## Input Pull-up Resistors

The ASIC/2-8540 is provided with pin socketed resistors to configure inputs. The appropriate resistor must be placed in the pin sockets to configure the inputs.

Pull-up resistors are used to pull the input in the direction of the +5 Vdc supply voltage. Parallel resistors are used across the input to common, for example to convert a current signal of 4 to 20 mA to a 1 to 5 Vdc voltage signal.

**Factory Pull-up Resistors**

R80 = 3.32 kohm IN-01 Pull-up
R81 = 3.32 kohm IN-02 Pull-up

R82 = 3.32 kohm IN-03 Pull-up
R83 = 3.32 kohm IN-04 Pull-up
R84 = 3.32 kohm IN-05 Pull-up
R85 = 3.32 kohm IN-06 Pull-up
R86 = 3.32 kohm IN-07 Pull-up
R87 = 3.32 kohm IN-08 Pull-up

The location of the pull-up and parallel resistors and other details are shown above. At the top of the controller is a row of pull up resistors R80 through R87 that correspond to Inputs #1 through Input #8 respectively. There are three rows of pin sockets, so that the resistors can be removed and inserted without soldering.

The top row of pin sockets (closest to the edge) is the input voltage connections. The bottom row of pin sockets (furthest from to the edge) is the +Vcc connection and is used for pull-up resistors. The middle row of pin sockets is the common connection and is used for parallel resistors.

### *Changing Pull-up Resistors*

To change the configuration of an input, insert the appropriate pull-up or parallel resistor into the pin sockets.

To remove resistors:

- Turn controller power OFF.
- Identify the proper resistor.
- Grip the resistor with a pair of long nose pliers.
- Gently remove one pin of the resistor.
- Gently remove the other resistor pin.

To insert resistors:

- Turn controller power OFF.
- Identify the proper resistor.
- Grip the resistor with a pair of long nose pliers.
- Align and partially insert one pin of the resistor.
- Align and partially insert the other resistor pin.
- Confirm both pins are properly aligned.
- Using the pliers, gently work the resistor into the socket.

If more resistors are required, they can be purchased from ASI Controls or at a local electronics store. If they are purchased from a local electronics store, they must meet all stated specifications.

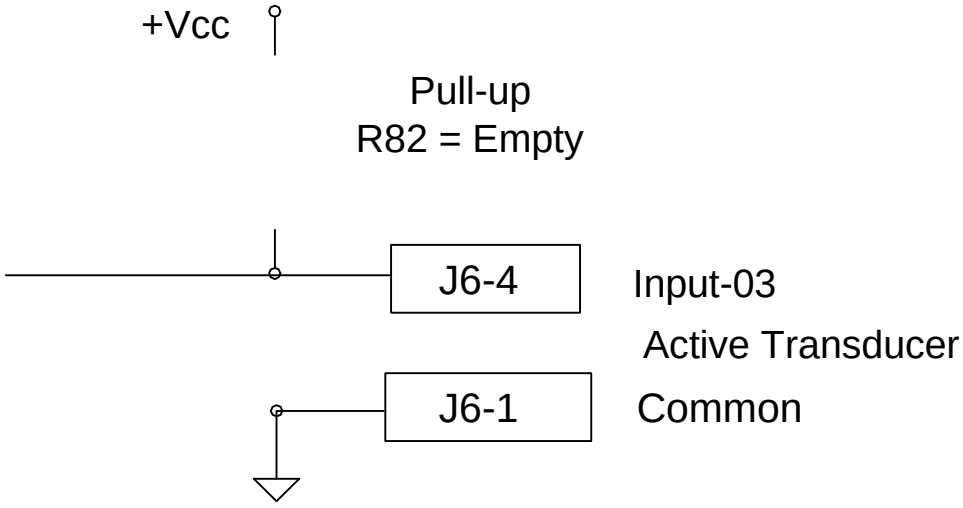
### *Required Pull-up Resistors*

The required pull-up resistor for different Input Types is shown in the table below. Active sensors require the removal of the pull-up resistor. Binary and thermistor sensors require a pull-up resistor between +Vcc and the input. 4 to 20 mA current transducers require a parallel resistor between the input and common.

| **Input Type** | **Specification** |
|---|---|
| 0 to 5 Vdc | No Pull-up |
| 4 to 20 mA | No Pull-up;<br>249 ohm to common, 0.1%, 1/4 W, MF |
| Thermistor, 3 kohm Type II | 3.32 kohm, 1%, 1/4 W, MF |
| Thermistor, 10 kohm Type II | 3.32 kohm, or 10 kohm 1%, 1/4 W, MF |
| Binary | (Typical) 1.82 kohm, 1%, 1/4 W, MF |
| Triple Binary | 511 ohm, 1%, 1/4 W, MF<br>External 1.00 kohm 1%,2.00 kohm 1%,<br>and 4.02 kohm 1%, |
| Quad Binary | 511 ohm, 0.1%, 1/4 W, MF<br>External 1.00 kohm 0.1%,2.00 kohm 0.1%,<br>4.02 kohm 0.1%, and 8.25 kohm 0.1% |

### *Input Type (0 to 5 Vdc)*

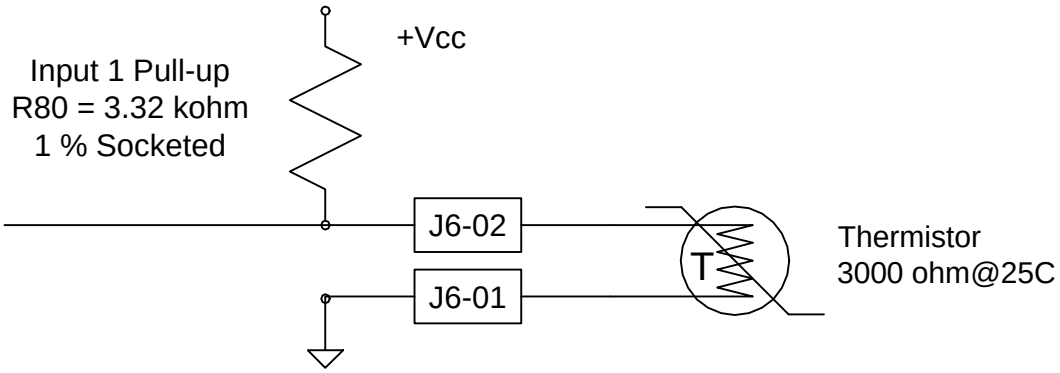
To measure voltage produced by an active input transducer, the pull-up resistor must be removed.




CAUTION: The common input connection is identical with the building ground. The common of the transducer MUST be referenced to building ground.

### *Input Type (Thermistor)*

Thermistors are sensors used for measuring temperature. The resistance of a thermistor changes with respect to temperature. As the resistance changes, the voltage measured across it by the controller changes. The controller uses a voltage divider circuit to measure the voltage across the thermistor. The pull-up resistor required depends upon the temperature range and the thermistor used.




To configure the controller to accept a thermistor input, install the appropriate pull-up resistor. Avoid long wire runs between the controller and the thermistor whenever possible.

Type II Thermistor inputs, 3000 ohm at 77 F, require either a 3.32 kohm or 1.82 kohm pull-up resistor depending on the analog conversion type.

CAUTION: The common input connection is identical with the building ground.

### *Input Type (Binary Fault)*

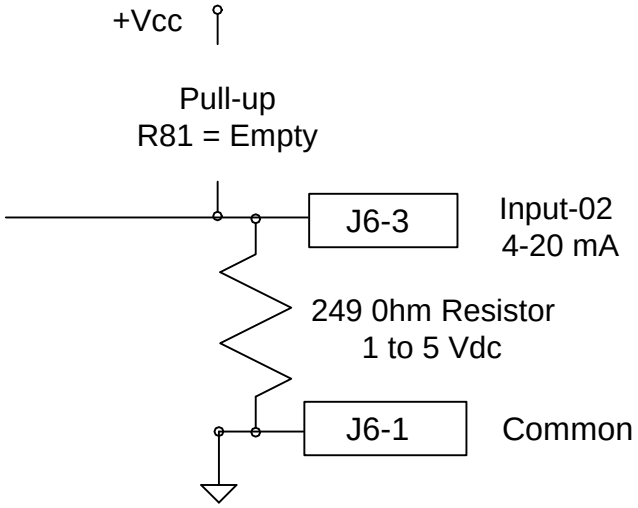
Because of the limited number of inputs of the ASIC/2, binary inputs are often implemented as switches that are placed across or in series with other sensors. The binary inputs require some pull-up resistance.

The binary input open or closed is typically sensed by the input value going outside the high and low alarm limits. The high or low alarm is enabled and the alarm bit is used to monitor the binary input status.

For example; a normally closed proof of fan switch may be placed across the same input as the Discharge Air Temperature. When the fan is off, the contact is closed and the input will read a low resistance value which indicates an abnormally high temperature. This will set the high limit alarm. When the fan starts, the contacts open and the input will read a normal Discharge Air Temperature. The high limit alarm will go away. Thus, the status of the high limit alarm may be used for proof of fan.

### *Input Type (4 to 20 mA)*

A 4 to 20 mA transducer requires the removal of the pull-up resistor and a 249 ohm resistor between the input and common. A 4 to 20 mA signal will generate a 1 Vdc to 5 Vdc input voltage.

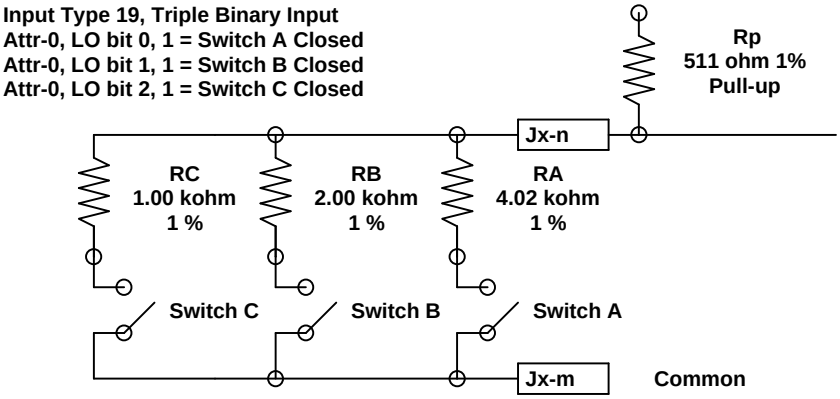



CAUTION: The common input connection is identical with the building ground. The common of the transducer MUST be referenced to building ground.

### *Triple Binary Input*

If the Input type is TRI-BI, Triple Binary Input, 19, then a bit is set depending which of three switches is closed. The three binary inputs consist of normally open switches with one side to common. It requires a pull-up resistor of 511 ohm 1%. The three inputs are:

Switch A in series with RA = 4.02 kohm, 1%, Sets Attr-0, LO bit 0
Switch B in series with RB = 2.00 kohm, 1%, Sets Attr-0, LO bit 1
Switch C in series with RC = 1.00 kohm, 1%, Sets Attr-0, LO bit 2




**Testing Triple Inputs :** Each triple input should be tested once the resistor tree is connected. There can be variation in the resistance values that could affect your results. Each combination of switch C and B should be tested with switch A open and closed. Consult the ASIC/2 input object definition for details on the operation of triple binary inputs.

### *Quad Binary Input*

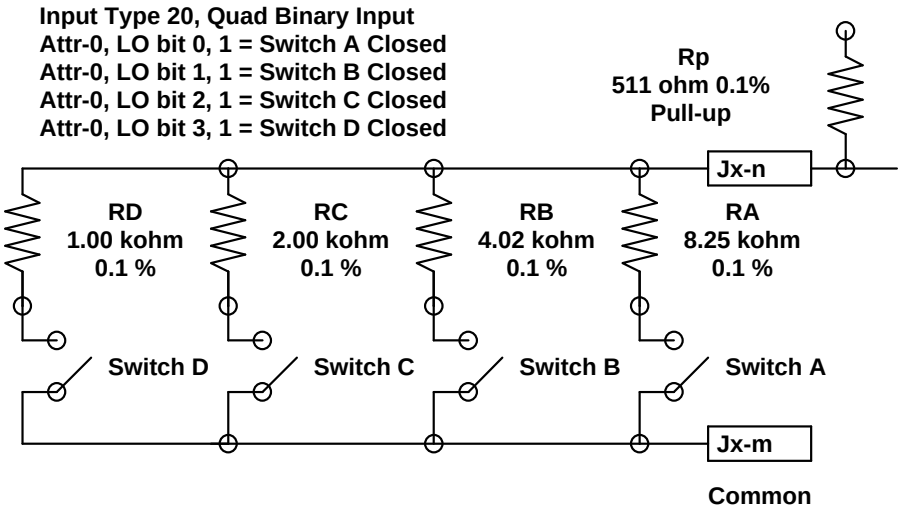
With care, the ASIC/2 can accommodate up to four binary inputs on a single input. It is designated as Input type 20, QUAD-BI, Quad Binary Input.

The quad binary inputs consist of normally open switches with one side to common. It requires a pull-up resistor of 511 ohm 0.1%. The four inputs are:

Switch A in series with RA = 8.25 kohm, 0.1%, Sets Attr-0, LO bit 0
Switch B in series with RB = 4.02 kohm, 0.1%, Sets Attr-0, LO bit 1
Switch C in series with RC = 2.00 kohm, 0.1%, Sets Attr-0, LO bit 2
Switch D in series with RD = 1.00 kohm, 0.1%, Sets Attr-0, LO bit 3

CAUTION: the voltage thresholds for each resistance value are in a narrow range. Please use 0.1% resistors and test configuration thoroughly before applying this input type.

If 0.1% resistors are un-available precision values may be obtained by using two resistors in parallel and checking the value with a precision 4 digit ohm meter.

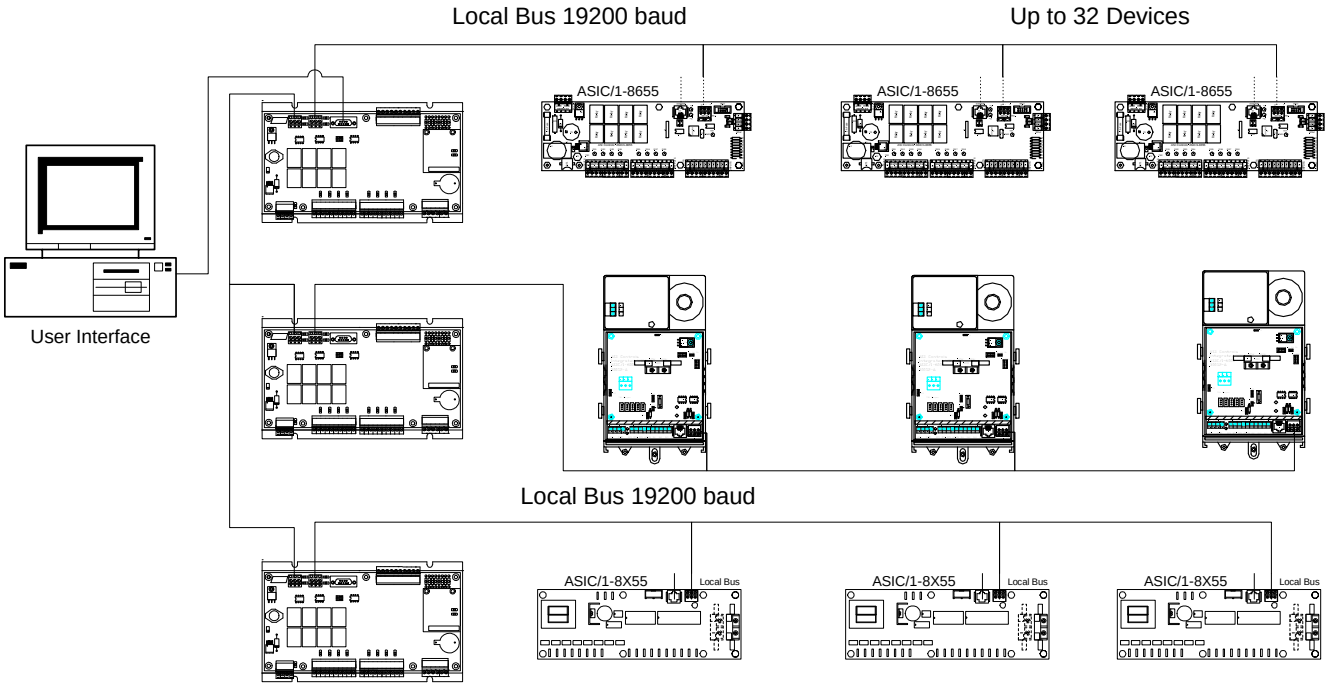



**Testing Quad Inputs :** Each quad input should be tested once the resistor tree is connected. There can be variation in the resistance values that could affect your results. Each combination of switch D, C, and B should be tested with switch A open and closed. Consult the ASIC/2 input object definition for details on the operation of quad binary inputs.

# ASIC/2-8540 Communications

## ASI Communications Network

Each controller in the ASI family is designed to give efficient operation either in a free standing, stand-alone mode, or in a network in communication with other controllers or a host user interface. Preprogrammed ASIC/1 controllers manage the operation of individual terminal or unitary equipment. ASIC/2 Controllers are configured for the unique requirements of each application. Each ASI controller has its own daily event schedule and control sequence and operates the equipment without communication or intervention.



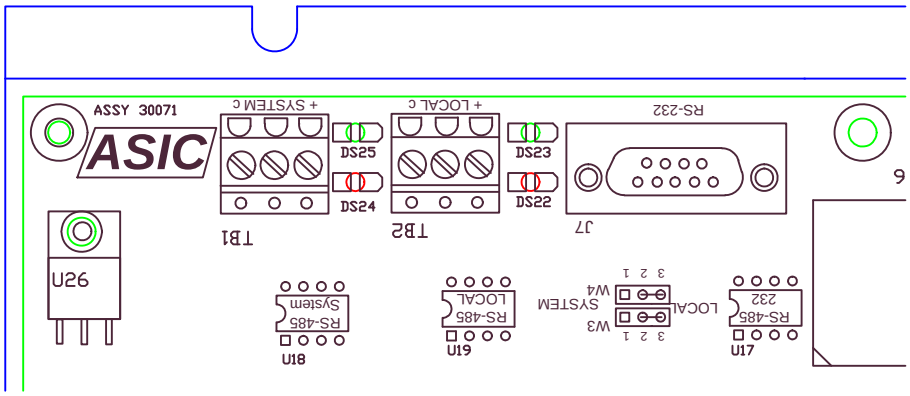

Because all configuration data is stored in non-volatile static memory, the sequence automatically restarts after a power outage. A controller with a real time clock can broadcast time to re-synchronize all controllers on the network.

Overall system performance can be improved by sharing of information between controllers throughout the network. ASI controller products can be networked together to provide as small or as large a system as needed to meet the requirements of the job. Communication access for a user interface, such as a building management system, can be made through a permanent connection or over remote dial-up modem. Access to the system enhances system performance through operator interaction.

Each ASI Controller has an operator access to allow direct communication with that controller. ASIC/1 controllers have an access jack on the WS-0XX wall sensor.

All controllers listen and respond to messages sent to their address. ASIC/1's and ASIC/2 controllers can be mixed on the single communication bus. If more than 32 controllers are used then RS-485 repeater must be used.

# ASIC/2-8540 RS-485 Wiring




Communications between ASI controllers are carried on a 2-wire RS-485 communication bus. The ASIC/2-8540 has two separate communication busses: A System bus which may be used for time, notify and remote points between ASIC/2 controllers; and a local bus which is used for polling of and broadcast to ASIC/1 controllers.

Route input, output, power and communication wire neatly inside the enclosure. Avoid looping excess wire. Use tie-wraps to dress and bundle loose groups of wires.

CAUTION: Do NOT bundle communication or input wiring with output and power wiring. It can disrupt communication and/or interfere with controller input measurements.

Make sure all connections to the controller are mechanically tight. Intermittent contact of connections can cause excessive electrical noise. Always route controller wiring separate from high voltage wiring to reduce the possibility of excessive EMI noise.

The communication connections are located on the right edge of the controller include:

- o System Bus Communication, TB1
- o Local Bus Communication, TB2
- o Communication Protection
- o RS-232 Monitor Port, J7

## System Bus Communication, TB1

The ASIC/2-8540 supports system bus baud rates of 1200, 9600, and 19,200 baud. For short wire runs it can communicate at 38,400 baud. Communication connections are located along the right edge. The two wire RS-485 System bus communication is connected to the two part three terminal block plug TB1 (TB1 -1 HI, TB1-2 LO). The Common connection, TB1-3, is available to terminate the shield if shielded communication wire is used.. The three terminal block plug TB1 is ALTECH AK-130/3, 30.303.

The screw terminals are designed to be used with 16 gauge to 24 gauge stranded or solid wire. When making terminations with stranded wire, be particularly careful that all strands of wire are terminated inside the connector. Loose strands can short out communication.

Each of the communication wires is labeled with a "+" and "-" sign indicating polarity. The "+" or HI is connected to TB1-1. The "-" or LO is connected to TB1-2 as shown. It is important that polarity of the communication wiring is maintained throughout the communication network. Maintaining consistent wiring color codes throughout the communication network helps prevent mis-wiring.

## Local Bus Communication, TB2

Each ASIC/2-8540 has a separate local communication bus and local bus address for communicating only with the local side. The ASIC/2-8540 supports local bus baud rates of 1200, 9600, and 19,200 baud. Communication on the local bus is independent of the system bus unless the ASIC/2-8540 has been configured to pass messages originating on the system bus through to the local bus. Once the local address is established, the ASI Expert software can communicate with the controller through the RS-232 port.

Communication connections are located along the top edge. The two wire RS-485 local bus communication is connected to the two part three terminal block plug TB2, (TB2 -1 HI, TB2-2 LO,). The Common connection, TB2-3, is available to terminate the shield if shielded communication wire is used.. The three terminal block plug TB2 is ASI PN 11116, ALTECH AK-130/3, 30.303.

Each of the communication wires is labeled with a "+" and "-" sign indicating polarity. The "+" or HI is connected to TB2-1. The "-" or LO is connected to TB2-2. It is important that polarity of the communication wiring is maintained throughout the communication network. Maintaining consistent wiring color codes throughout the communication network helps prevent mis-wiring.

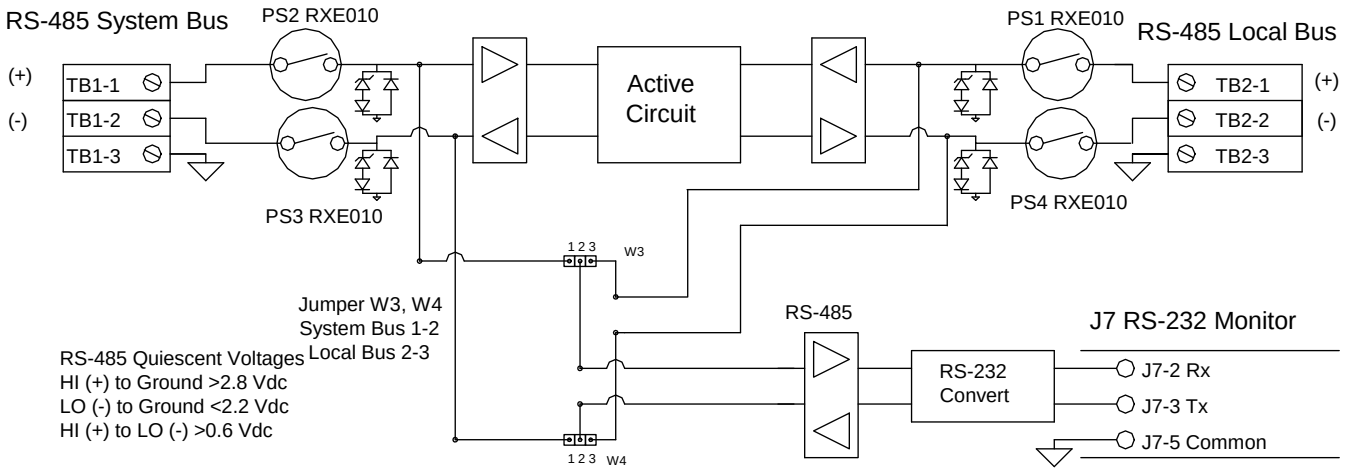
### *Local Bus Polling and Broadcast*

ASIC/2 controllers can manage system operation by polling terminal and unitary controllers on the local bus. Each of up to 32 terminal or unitary controllers on each system controller are continually interrogated for the latest status, alarm, or other information. The aggregated results of this polling process are available to the ASIC/2 System controller to modify control operation.

The ASIC/2 System Controllers can affect system operation by initiating broadcast messages on the local bus addressed to terminal and unitary controllers. Messages such as Go To Occupied State, Demand Limit, Emergency, etc. may be broadcast on the local bus, as the result of logical decisions made by the controller. Broadcast may be to group addresses, or globally to all controllers on a local bus.

## ASIC/2-8540 Communication Schematic

The figure below shows the schematic of the internal communication connections of the ASIC/2-8540 Controller



## RS-485 Communication Protection

The controller communication circuitry incorporates 100 mA self resetting polyswitches and 7 Volt Transient Voltage Suppressors to protect controller circuitry The polyswitches protect the controller against mis-wiring of communication to a power source. The TVSs protect the controller circuitry against large voltage transients.

Each RS-485 connection is protected by polyswitch , PS1, .. ,PS4.

Specification: ASI PN14021
Type Polyswitch RayChem, RXE010,
Rating: 100 mA, 60 V

Each RS-485 connection is protected by Transient Voltage Suppressor, TVS 1, .. ,TVS4.

Specification: ASI PN 17009
Type TVS, Microsemi P5KE7.0CA,
Rating: 7 V, Bipolar 500 W peak pulse 10/1000 µs waveform.

The RS-485 chips for System Bus, U18, :Local Bus, U17, and RS-232 Monitor Port, U19, are socketed so that should excessive voltage, for example by lightning, damage the chip, it can be replaced in the field. Replacements are available from ASI.

Specification: ASI PN 15004
Type RS-485, National DS3695N, 8-pin dip,
ASI Order Number: RS-485.

## RS-485 Installation Rules

RS-485 communication is highly noise resistant. However, to avoid communication problems, a few basic rules must be followed. Taking the time to make sure communication wiring is installed properly in the beginning helps avoid communication problems latter. Make sure and use the following communication installation rules:

- Install only communication cable which meets the ASI Controls stated specifications.
- If the communication wiring in run in conjunction with AC power wiring, shielded wire should be used.
- Do not physically stress the communication cables, especially when pulling the communication cable around sharp bends and over rough surfaces.
- Avoid splicing communication cables. Use continuous pieces of cable between controllers.
- If possible, keep communication wiring away from electrical noise sources such as power wiring, large power consuming or power-generating equipment, etc.. If possible cross power wiring at right angles.
- If communication cables employ modular RJ-11 jacks, use factory fabricated and tested cables. Note that there are different modular RJ-11 type jacks designed for use with stranded wire cables and modular RJ-11 type jacks designed for use with solid wire cables. The two cable/connector combinations are NOT interchangeable.
- Do NOT exceed 32 controllers on the local communication bus. If more than 32 controllers are connected together, use an RS-485 ASI Converter/Repeater to repeat the signal.

## RS-485 Communication Wire Specification

### *Shielded Wire*

Shielded communication wire is required to meet CE certification. However even if CE certification is not required, shielded wire should be used if the communication bus wiring is run in conjunction with AC power wiring or is subject to electrical noise.

Communication wire should meet the following specifications:

Shielded Pair Specification

| | |
|---|---|
| Wire: | 22-24 gage, solid/stranded |
| # of conductors: | 2, twisted pair |
| Nominal Capacitance | |
| Between Conductors: | 24 pF/ft |
| Between 1 Conductor and Shield: | 42 pF/ft |

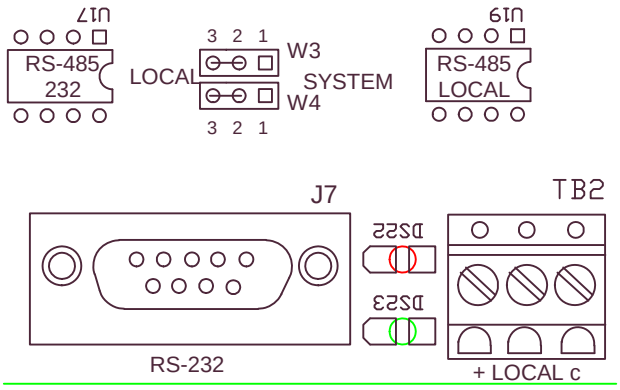
Plenum Rated Cable meets these specifications and is described as follows: Tinned copper conductors; Teflon(TM) insulated; conductors cabled; Beldfoil (TM) aluminum; polyester shield with 85% tinned copper braid shield; 150V NEC 725 Class 2 for use in air plenums; non-conduit.

Note: We do not recommend using wire with more than one pair! If communication wire has more than 1 pair, then the other wires should be terminated at ground on one end to prevent induced noise.

# RS-232 Monitor Port

7540 have an RS-232 monitor port that gives operator access to the controller to the System or Local bus, based on the settings of jumpers W3 & W4. The RS-232 port has the proper control of transmit and receive so that it may successful drive the communication bus with many controllers.

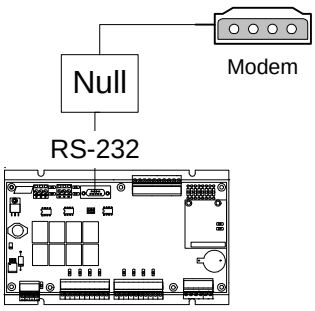
Note: the ASIC/2-7040 and ASIC/2-8040 could only talk to one or two controllers through the RS-232 monitor port.




CAUTION: Never leave an un-terminated RS-232 cable connected to the ASIC/2-8540 or ASIC/2-7540 as it will generate reflections that can interfere with system bus communication.

## Modem Access

For systems consisting of a single controller a telephone modem is directly connected to system bus through the RS-232 port of the ASIC/2-8540, using a null modem cable.



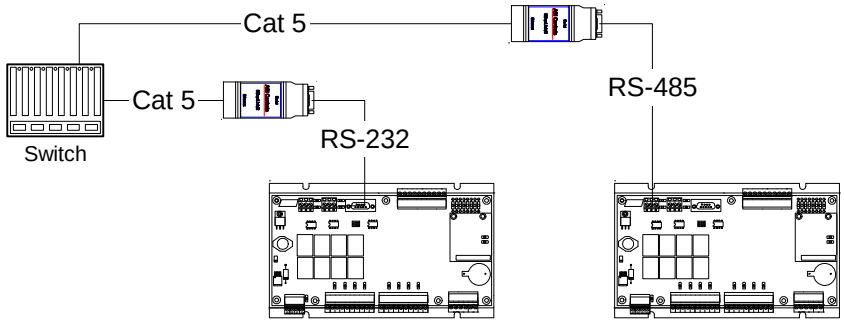

When dialing into a controller connected to a modem, and when setting up a modem to use dial out, it is important that BOTH modems are set with the correct modem AT commands. Consult the user note on the ASI Mode for the correct initialization strings.

Note: Please consult the modem Users' Manual for the correct parameters for your modem. Modem commands vary from model to model. For further information about newer modems, contact techsupport@asicontrols.com .

When an ASIC/2-8540 dials out through a modem, the destination modem that is receiving dial-out messages is typically a connected to computer running ASI Monitor software.

## EtherLink/2 Connection

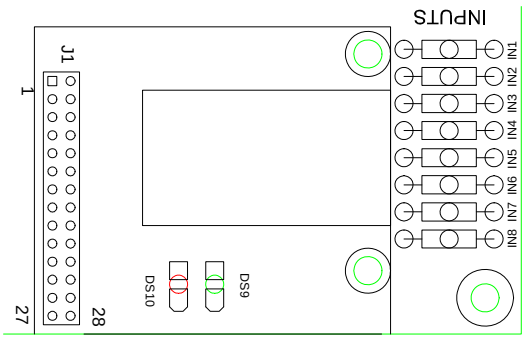
If System or Local bus pass-thru is required, then you may connect the ASIC/2-8540 using and ASI EtherLink/2 device. The EtherLink/2 has an IP Address and Port and communicates to the ASIC/2 via the RS-232 Monitor Port, or directly by RS-485 to the system bus.



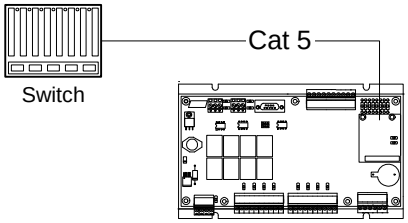

# Ethernet Connection

## Ethernet Adapter (Future)

An optional Ethernet Adapter-8540, ETH-8540, will be available to bring full Ethernet connectivity to the ASIC/2-8540. The Ethernet Adapter obtains its power and IP Address and other configuration information from the controller. It supports all of the functionality of the EtherLink/2. It is sold as a kit and comes with mounting hardware.




The Ethernet Adapter is connected to the Ethernet Switch with a standard CAT5 Ethernet cable which auto detects 10/100 Base-T Ethernet communications..

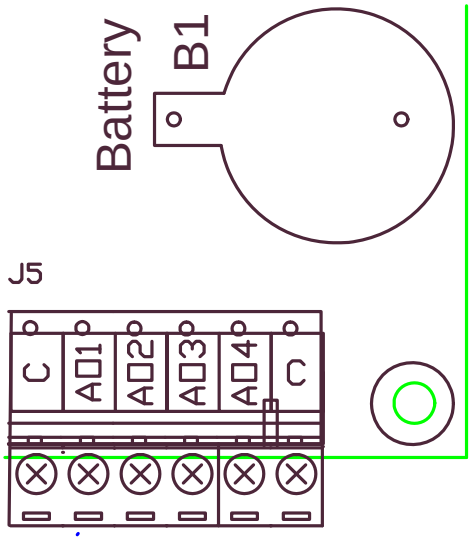



The Ethernet Adapter communicates directly to the ASIC/2-8540 independent of the System or Local RS-485 busses. The ASIC/2-8540 does NOT support ASI message pass-through to the System or Local busses.

# Battery, B1

Battery B1 is used to back-up the Real-Time Hardware Clock and the Non Volatile RAM Memory, NVRAM used to store the configuration. The battery is sized to last for 10 years or longer.

CAUTION: Do not remove the battery with power disconnected or you will loose your configuration.




Lithium batteries, even these types of coin batteries, have proven to be a serious risk of fire if a reverse current is ever applied to the battery. Due to the possibility of fire hazard Replace Battery With Matsushita (Panasonic) Part No BR2032 or with an equivalent UL Recognized Component Lithium battery rated 3 V, 5 mA max for reversing current, Only. Use of Another Battery May Present A Risk of Fire Or Explosion.

CAUTION: Battery May Explode If Mistreated. Do Not Recharge, Disassemble Or Dispose Of In Fire.