NOP-IO168S / BLU-I16 / BLU-O8 Hardware Manual

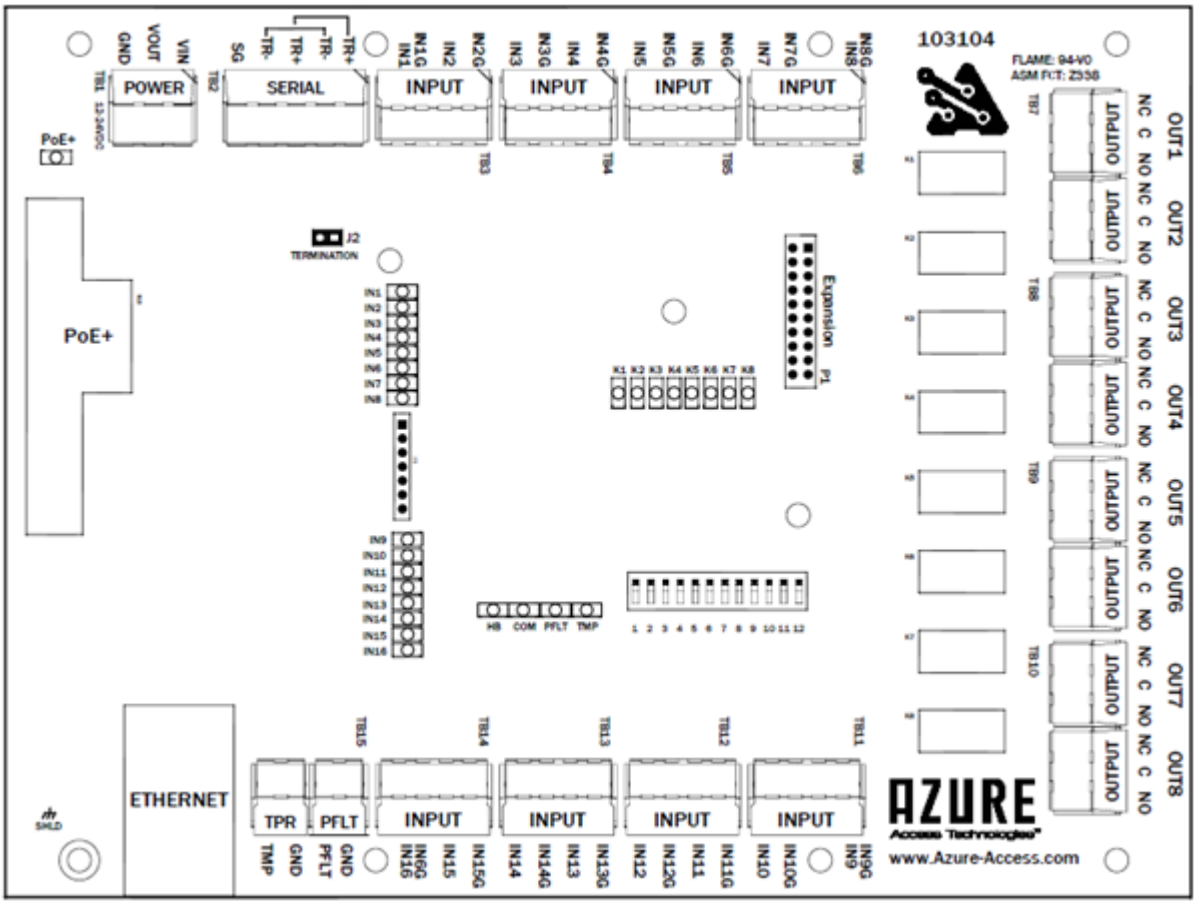
PCB Revision C & later

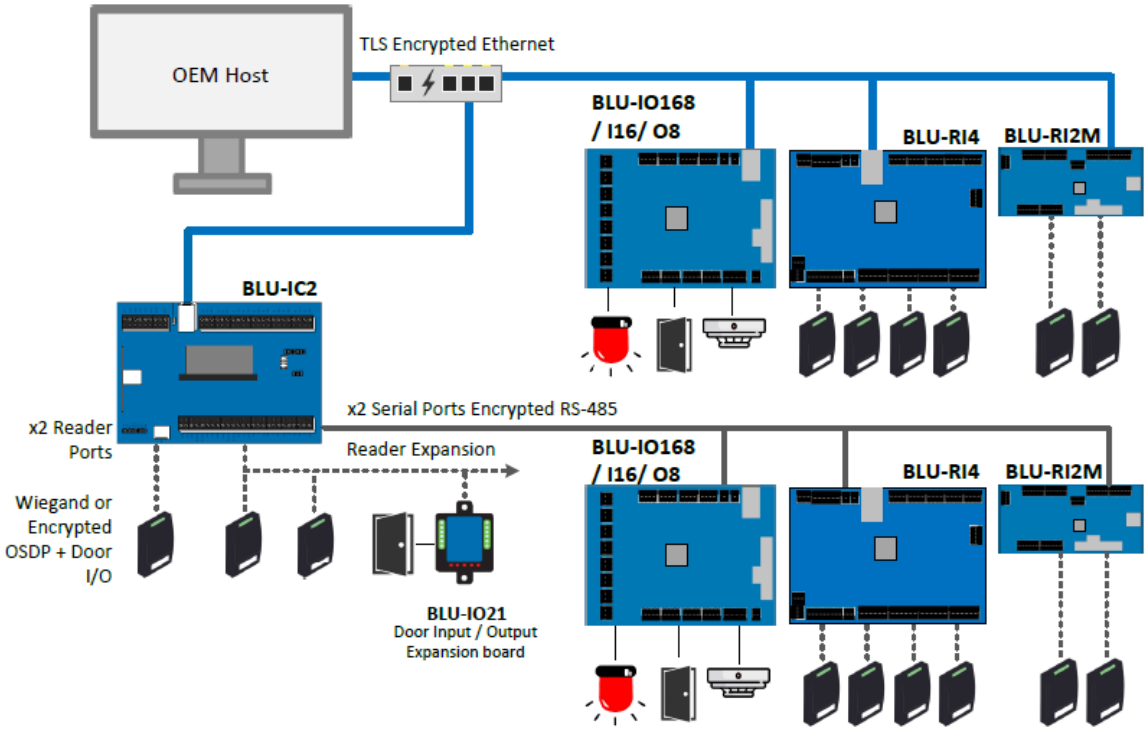
Revision B3
August *, 2025**

NOP-IO168S Hardware Manual

Downstream Input / Output Panel

by Azure Access Technology





IMPORTANT INFORMATION

W A R N I N G
HIGH VOLTAGE, AC MAIN POWER SHOULD ONLY BE CONNECTED BY QUALIFIED, LICENSED ELECTRICIANS. ALL APPLICABLE LAWS AND CODES MUST BE FOLLOWED. IF THIS PRECAUTION IS NOT OBSERVED, PERSONAL INJURY OR DEATH COULD OCCUR

Power should not be applied to the system until after the installation has been completed. If this precaution is not observed, personal injury or death could occur, and the equipment could be damaged beyond repair.
-Verify that the external circuit breaker which supplies power to the device power supply is turned off prior to installation.
-Verify that the output voltage of the power supply is within specifications prior to connection to the device.

C A U T I O N
Several important procedures should be followed to prevent electro-static discharge (ESD) damage to sensitive CMOS integrated circuits and modules.

-All transport of electronic components, including completed reader assemblies, should be in static shield packaging and containers.
-Handle all ESD sensitive components at an approved static controlled work station. These work stations consist of a desk mat, floor mat and an ESD wrist strap. Work stations are available from various vendors including the 3M company.

FCC Compliant
This device complies with Part 15 of FCC Rules. 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.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this device in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense. The user is advised that any equipment changes or modifications not expressly approved by the party responsible for compliance would void the compliance to FCC regulations and therefore, the user's authority to operate the equipment.

CE Compliant

UL & ULC Recognized
- UL294
- UL294B
- UL1076 & ULC/ORD 1076
- UL2610

OSDP Verified – Secure Profile (as of firmware ver 1.26.0)

Table of Contents

Part I
Introduction

1 Introduction

The NOP-IO168S Alarm Panel provides 16 supervised alarm inputs and 8 relays. It is a downstream, serial or network device that requires communication with a controller (NOP-IC series) to fully function. The board runs an enhanced version of OSDP protocol to communicate with the controller. Panel configuration is performed through the DIP switches and Host software; either manually or configuration commands or scripts.

Alarm inputs can be configured to be supervised or unsupervised. Supervised inputs are monitored for alarm/no alarm and for line-fault conditions. Changes in states are reported to the controller which then reports to the Host. Outputs can be used to control door strikes, sirens, strobes, or any other electrical device. The large number of IO interfaces makes the NOP-IO168S an optimum choice for elevator control. Dedicated, unsupervised inputs on the NOP-IO168S also monitor for cabinet tamper and power fault statuses.

1.1 General Features

- 16 Supervised or Unsupervised Inputs
  - Configurable termination-resistor values
- 8 Form-C, dry-contact relay outputs
- Cabinet Tamper Input
- Power Fault Input
- Status/Activity LEDs for inputs, outputs, and communications
- Configuration DIP switches
- Communication: One 2-wire RS-485 & one 10/100 Ethernet port
  - Serial and network communications are encrypted
- 12-24 Vdc
- Supports expansion module adding 8 more relays

1.2 BLU-I16 (Inputs-only) & BLU-O8 (Outputs-only) Variants

This manual and the NOP-IO168S PCB also applies to the BLU-I16 and BLU-O8 product variants. The BLU-I16 is an input-only board that has the relay output components excluded. The BLU-O8 is an output-only board that has the supervised input components excluded.

Part II
Hardware Layout

2 Hardware Layout

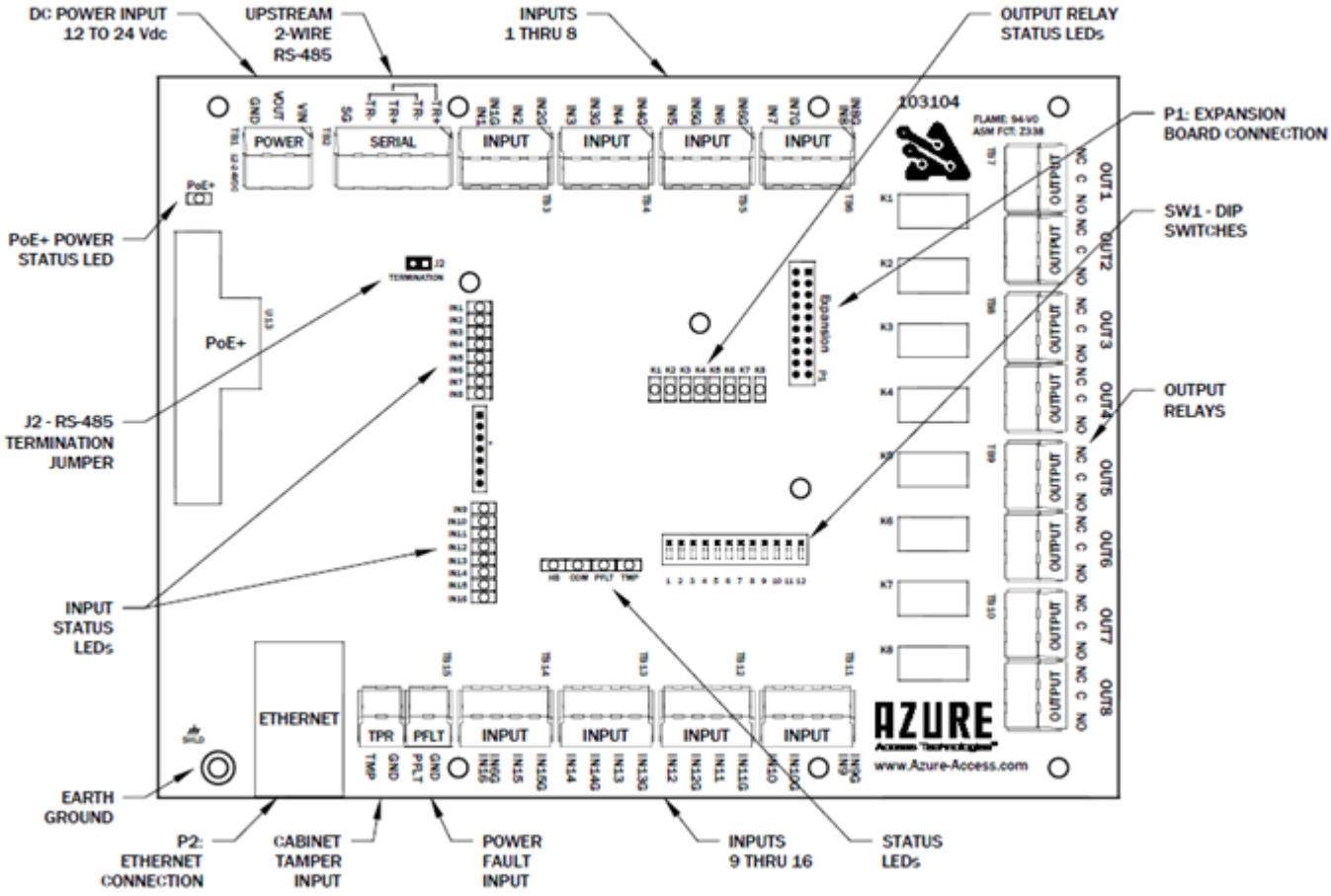


Figure 2.1: Hardware Layout

2.1 Terminal Connectors

The IO168 has 16 terminal blocks for connecting power, communications, and I/O connections. The connection terminals are factory equipped with removable screw-down quick connectors which are easily removed from the panel by firmly grasping the connector and pulling away from the panel. If pliers are used to remove the connectors, they should be of the rubber-tipped type. Take care in using any tools near the panel not to damage on-board components. The proper location of the quick connectors is outlined in white text on the panel.

Terminal Block Wiring Connections			
Location	**Type**	**Label**	**Function**
Power			
TB1-1	Input Power	VIN	Power 12 to 24VDC AUX VOUT is VIN passthrough
TB1-2	AUX Output Power	VOUT	
TB1-3	Ground	GND	
Serial Port			
TB2-1	Transmit / Receive Data (+)	TR+	Serial 2-wire RS-485 TB2-1 & TB2-3 are bridged and TB2-2 & TB2-4 are bridged for easy daisy-chain wiring
TB2-2	Transmit / Receive Data (-)	TR-	
TB2-3	Transmit / Receive Data (+)	TR+	
TB2-4	Transmit / Receive Data (-)	TR-	
TB2-5	Ground	SG	Signal Ground
Supervised Inputs			
TB3-4	Input 1	IN1	Input 1
TB3-3	Input 1 Return	IN1G	
TB3-2	Input 2	IN2	Input 2
TB3-1	Input 2 Return	IN2G	
TB4-4	Input 3	IN3	Input 3
TB4-3	Input 3 Return	IN3G	
TB4-2	Input 4	IN4	Input 4
TB4-1	Input 4 Return	IN4G	
TB5-4	Input 5	IN5	Input 5
TB5-3	Input 5 Return	IN5G	
TB5-2	Input 6	IN6	Input 6
TB5-1	Input 6 Return	IN6G	
TB6-4	Input 7	IN7	Input 7
TB6-3	Input 7 Return	IN7G	
TB6-2	Input 8	IN8	Input 8
TB6-1	Input 8 Return	IN8G	
TB11-4	Input 9 Return	IN9G	Input 9
TB11-3	Input 9	IN9	
TB11-2	Input 10 Return	IN10G	Input 10
TB11-1	Input 10	IN10	
TB12-4	Input 11 Return	IN11G	Input 11
TB12-3	Input 11	IN11	
TB12-2	Input 12 Return	IN12G	Input 12
TB12-1	Input 12	IN12	
TB13-4	Input 13 Return	IN13G	Input 13
TB13-3	Input 13	IN13	

TB13-2	Input 14 Return	IN14G	Input 14
TB13-1	Input 14	IN14	
TB14-4	Input 15 Return	IN15G	Input 15
TB14-3	Input 15	IN15	
TB14-2	Input 16 Return	IN16G	Input 16
TB14-1	Input 16	IN16	
Tamper & Power Fault Inputs			
TB15-1	Power Fault	PFLT	Power Supply Fault Unsupervised Input
TB15-2	Ground	GND	
TB15-3	Cabinet Tamper	TMP	Cabinet Tamper Unsupervised Input
TB15-4	Ground	GND	
Output Relays			
TB7-6	Normally Closed	NC	Relay OUT 1
TB7-5	Common	C	
TB7-4	Normally Open	NO	
TB7-3	Normally Closed	NC	Relay OUT 2
TB7-2	Common	C	
TB7-1	Normally Open	NO	
TB8-6	Normally Closed	NC	Relay OUT 3
TB8-5	Common	C	
TB8-4	Normally Open	NO	
TB8-3	Normally Closed	NC	Relay OUT 4
TB8-2	Common	C	
TB8-1	Normally Open	NO	
TB9-6	Normally Closed	NC	Relay OUT 5
TB9-5	Common	C	
TB9-4	Normally Open	NO	
TB9-3	Normally Closed	NC	Relay OUT 6
TB9-2	Common	C	
TB9-1	Normally Open	NO	
TB10-6	Normally Closed	NC	Relay OUT 7
TB10-5	Common	C	
TB10-4	Normally Open	NO	
TB10-3	Normally Closed	NC	Relay OUT 8
TB10-2	Common	C	
TB10-1	Normally Open	NO	

Figure 2.2: Terminal Connections

2.2 Jumpers

JUMPER	SETTING	DESCRIPTION
J1	None	Factory Use Only
J2	ON/OFF	RS-485 termination located next to TB2. Install jumper only if the board is at the end of the serial bus.

2.3 Plug-in Expansion Module (P1)

This connector is used for installing the BLU-OX8 relay expansion board (SKU: 801400). This expansion board adds 8 more relays to the IO168 or BLU-O8.

2.4 LEDs

There are 29 LEDs for monitoring panel function.

Status LEDs	
HB	Heartbeat Offline – 200ms ON, 800ms OFF Online – 800ms ON, 200ms OFF
COM	RS-485 Serial Port – Flashes when data is received
TMP	Cabinet Tamper & Power Supply Fault – See Note 1 ON = Alarm OFF = Secure • When running in the bootloader, TMP & PFLT will alternate flashing on/off
PFLT	
Alarm Zone Inputs LEDs	
IN1 – IN16	Supervised Input 1-16 Statuses – See Note 1 ON = Alarm OFF = Secure Flash = Fault
Output Relays	
K1 – K8	Relay OUT 1-8 (K1 through K8) ON = Energized OFF = De-Energized
Ethernet (P2)	
Speed (left side)	ON = 100Mbps network connection
Link (right side)	Flashing = Network activity present

PoE+ Power	
PoE PWR	ON = PoE+ power active (Power over Ethernet)

Figure 2.3: Terminal Connections

Note 1: Every 4 seconds the LED is pulsed to its opposite state for 0.1 seconds

2.5 DIP Switches

There are 12 DIP switches for setting various configuration options. All DIP switch settings, except Factory Reset, do not require a power cycle to take effect.

DIP Switch Functions

Communications Address Sets this device's physical address on the RS-485 bus or network port. This number must be unique for each device on a single bus or port.					
1	**2**	**3**	**4**	**5**	Address
OFF	OFF	OFF	OFF	OFF	0
ON	OFF	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	OFF	2
ON	ON	OFF	OFF	OFF	3
OFF	OFF	ON	OFF	OFF	4
ON	OFF	ON	OFF	OFF	5
OFF	ON	ON	OFF	OFF	6
ON	ON	ON	OFF	OFF	7
OFF	OFF	OFF	ON	OFF	8
ON	OFF	OFF	ON	OFF	9
OFF	ON	OFF	ON	OFF	10
ON	ON	OFF	ON	OFF	11
OFF	OFF	ON	ON	OFF	12
ON	OFF	ON	ON	OFF	13
OFF	ON	ON	ON	OFF	14
ON	ON	ON	ON	OFF	15
OFF	OFF	OFF	OFF	ON	16
ON	OFF	OFF	OFF	ON	17
OFF	ON	OFF	OFF	ON	18
ON	ON	OFF	OFF	ON	19
OFF	OFF	ON	OFF	ON	20
ON	OFF	ON	OFF	ON	21
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ON	ON	ON	OFF	ON	23
OFF	OFF	OFF	ON	ON	24
ON	OFF	OFF	ON	ON	25
OFF	ON	OFF	ON	ON	26
ON	ON	OFF	ON	ON	27
OFF	OFF	ON	ON	ON	28
ON	OFF	ON	ON	ON	29
OFF	ON	ON	ON	ON	30
ON	ON	ON	ON	ON	31

Baud Rate (Upstream RS-485 Port) **Note:** The baud rate must be the same for every device on this port.	**6**	**7**
9600 Baud	OFF	OFF
38400 Baud	ON	OFF
57600 Baud	OFF	ON
115200 Baud	ON	ON
230400 Baud (Software-set ONLY)	-	-

DIP RS485 Config Override Select if OSDP cmds are accepted to set baud and address	**8**
Accept OSDP cmds to set baud/address. DIP switch settings for address and baud rate are ignored. **Note:** After a Factory Reset, DIP switch address and baud settings are used until new config is sent.	OFF
Address and baud rate are set with DIP switches. OSDP commands to set address or baud rate will be ignored and the reply to the command, which lists the address in baud in use, will reflect the DIP switch set values. **Note:** An address and/or baud rate previously set by software is still retained.	ON
Network Configuration	**9**
Use user config	OFF
Use default config	ON
Default Network Login	**10**
Disable default login	OFF
Enable default login	ON
FACT/OSDP Key Reset	**11**
Power up board with switch ON and all LEDs blink rapidly for 3 seconds. If the switch is turned OFF within the 3 seconds, the board performs factory reset including wiping out custom OSDP keys. After the 3 seconds, if the switch has not been turned OFF, the board will run normally. Toggling this DIP switch during normal operation or after the 3 seconds does nothing.	Toggle
Reserved	**12**
X	OFF

Figure 2.4: DIP Switch Settings

2.6 Mounting

Eight holes are provided for mounting. Mount at least 0.25 inches above the surface if conductive. Two plated mounting-holes are for connecting to Chassis (Earth) ground.

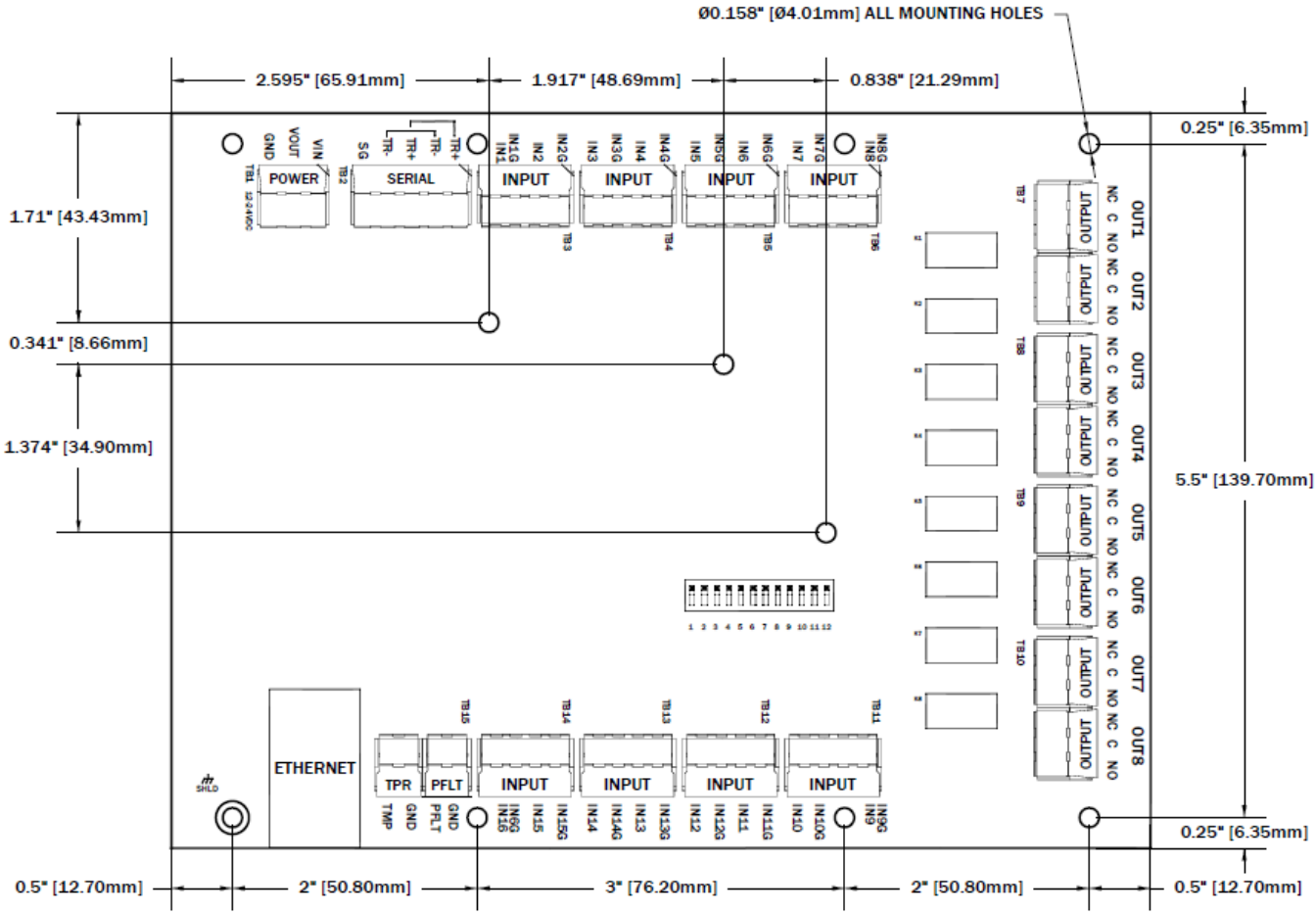


Figure 2.5: Mounting Holes

Part III
System Wiring & Setup

3 System Wiring & Setup

This section will provide installation and wiring instructions as well as hardware interface information as it applies to the access control system. To guard personal safety and avoid damaging equipment, full understanding of best-practices and safety for wiring electrical systems. The following sections provide general guidelines, but are not a substitute for formal training in safely handling electrical systems!

3.1 Power (TB1)

DC/DC Power

The IO168S can be powered by a 12-24VDC power supply. In the case of over-current, solid-state fuses integrated on the board will 'trip' to protect the components of the panel. In many cases, the solid-state fuses will reset automatically when normal current resumes, however it may be necessary to interrupt the supply of power to allow the fuses to reset.

Take care when selecting a power supply. Most power supplies in the market today provide good input/output isolation, however those which do not provide isolation (or have high leakage capacitance), coupled with accidental AC power lines interchange, present serious ground fault problems for installers. With ground fault, the signal reference between subsystems may be 115 Vac (230 Vac) apart. If these subsystems are interconnected, the large potential difference will cause equipment damage or personal injury. Azure recommends the use of isolated continuous power supplies only. Wire with 18 AWG minimum.

DC Ground

This is typically the minus (-) side of the DC output of the power supply. All devices powered by the supply must connect to the same supply's DC Ground (-). Never connect to Safety (Earth) Ground on the AC side.

AC Ground ("Safety" / "Earth" / "Chassis" Ground)

To avoid ground loop current, there must be only ONE point at which the AC ground connects to the DC ground (usually through the DC/DC power supply). The plated, "chassis" mounting hole should be electrically connected the conductive surface of the mounting plate or enclosure.

3.2 Upstream RS-485 Serial Port (TB2)

RS-485 is an electrical interface standard for multi-point communication on bus transmission lines. It allows high speed data transfer over extended distance (4000ft, 1219m). An RS-485 Serial Bus is a typical connection for downstream devices to a controller. Downstream boards are slave device on the bus that responds to communications from the controller (master).

Device Wiring

The serial port is a 2-wire RS485 bus topology. Make sure to match polarities of your wiring connection; positive (+) to positive and negative (-) to negative. Wiring recommendation of 24 AWG, shielded twisted-pair. Wiring requirements satisfied by Belden 9841/9842 or equivalent. TR+ and TR- have two connection points for easy multi-drop wiring.

2-wire RS-485 consists of three wires; TR+, TR-, & SG (signal ground). Both TX and RX are done on the same pair of wires. The NOP-IC2 serial port interface is 2-wire and is wired as "Standard 2-Wire Bus" shown in the Figure below.

The BLU-IC4 has a 4-wire interface that can be converted to 2-wire but shorting both TX+ & RX+ together and TX- & RX- together. See “Mixed 2-Wire Bus” in Figure below…

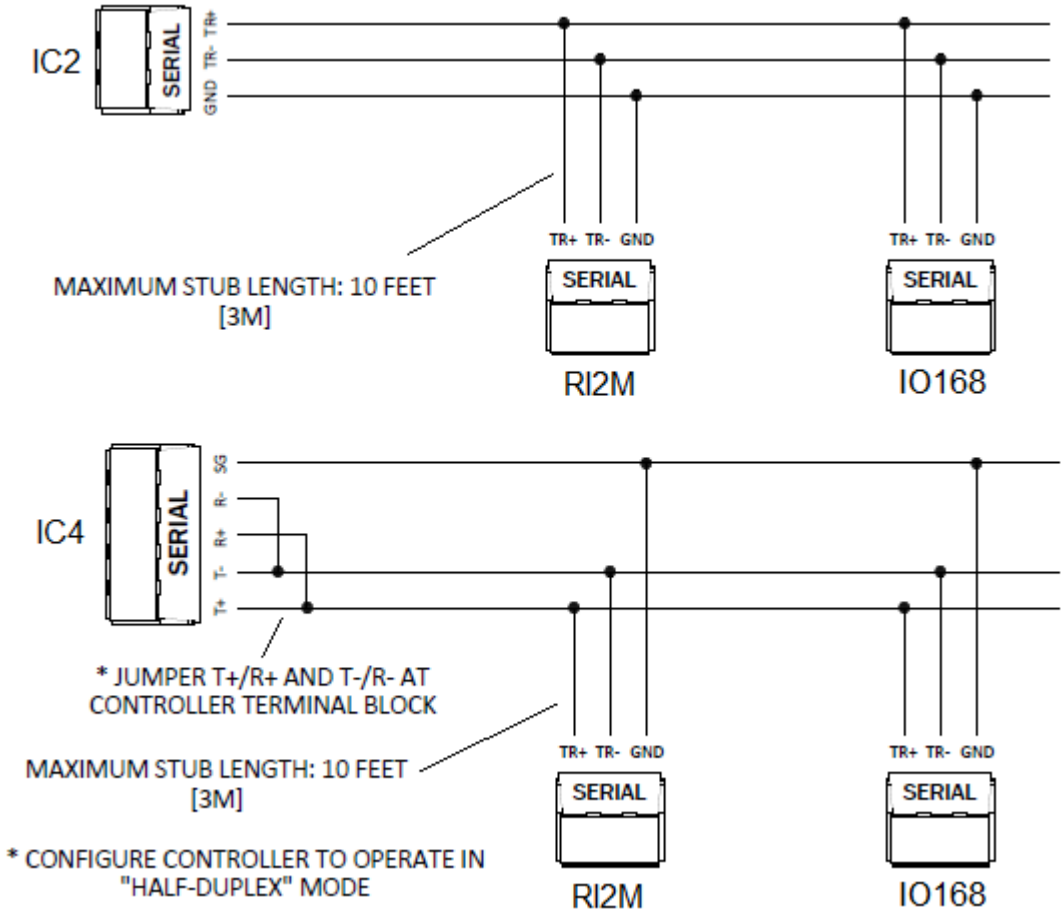
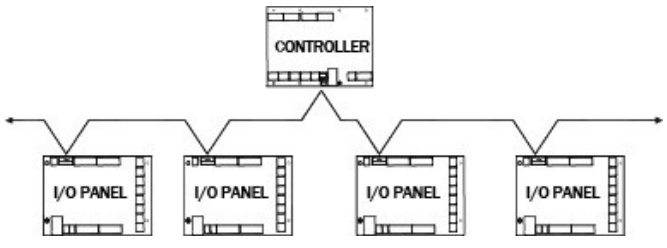


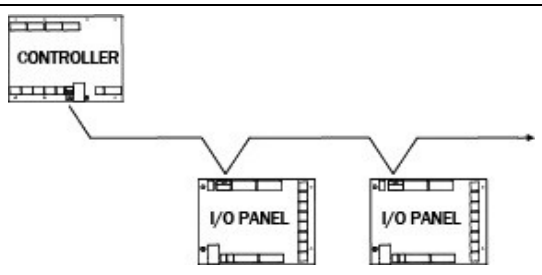
Figure 3.1 RS-485 Device Connections

Bus Configuration

The maximum number of field devices on one RS-485 communications bus is 32. Communication cables for RS-485 should be laid out in a "multi-drop topology". This means that there should only be two ends to the line and devices should be located directly along this line. The NOP-IC2 controller can be located at any point along the line. Long stubs (T connection) and Star Topology will cause communication problems and must be avoided. Each field device must have a unique address, and all the devices must use the same baud rate (both are set by the device’s DIP switches or SDK commands, and should have the same corresponding settings in the Host software). All devices on the RS-485 bus must be communicating with the same protocol.



Correct – controller in middle of the serial bus



Correct – controller at end of serial bus

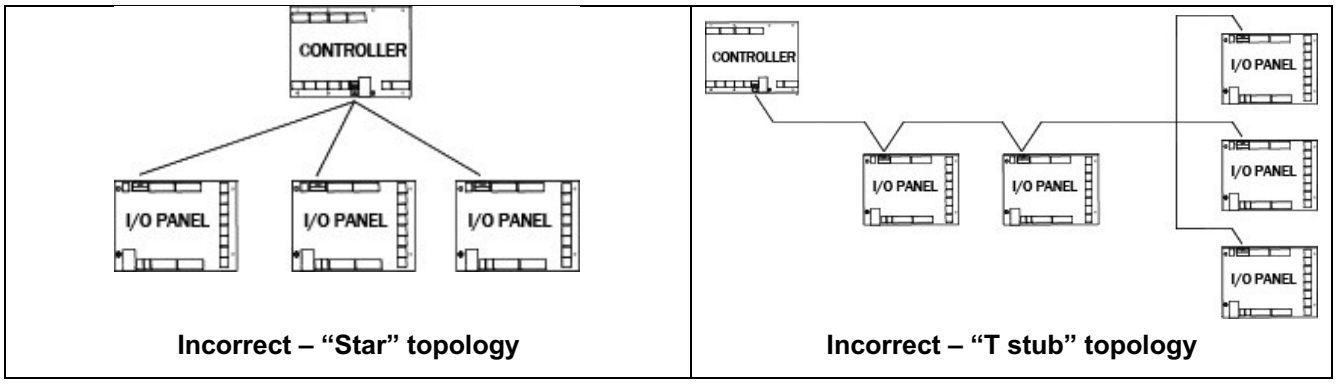


Figure 3.2: RS-485 Bus Topologies

Termination

For the most reliable communications, the RS-485 bus must be terminated at both ends. The terminator is integrated on the board and is engaged via a user installed jumper. Never engage termination of devices in the middle of the communication bus.

Signal Ground (SG)

When devices are powered from different power supplies, a common ground reference must be established on the RS-485 bus. This is the ground (GND) connection on the Serial port connector. Failure to have a common ground between devices may cause communication errors. If connecting the RS-485 bus with shielded wire, the shielding can be used as the signal ground connection. Or, if the environment is known to be electrically noisy, the wire's shield can be connected to safety/chassis/Earth ground and a separate wire can be used for signal ground.

Grounding Potential Difference Checks Before Connecting

Before a device is connected to an RS-485 subsystem, it must be checked for ground fault. Ground faults can damage all devices connected to the RS-485 communication line. To check if there is ground fault for a new unit, follow the steps below:

1. Apply power to all devices already successfully connected to the RS-485 line.
2. Power up the new unit, but DO NOT connect it to the RS-485 line.
3. Connect the signal ground (SG) of the RS-485 line through a 10k limiting resistor.
4. Measure the AC and DC voltage across the resistor. There should NOT be more than 1 volt across the resistor. Otherwise find and clear the fault.
5. Connect the new unit to the RS-485 line only if no ground fault is found.

3.3 Unsupervised Cabinet Tamper & Power Fault (TB15 & TB16)

There are two dedicated, unsupervised alarm inputs; cabinet tamper and power fault. Use a twisted pair of 24 AWG wires. These are typically Normally Closed inputs. When not in use, a jumper wire should be used to short the contacts together created a closed circuit. This will prevent inadvertent alarms being reported to the Host.

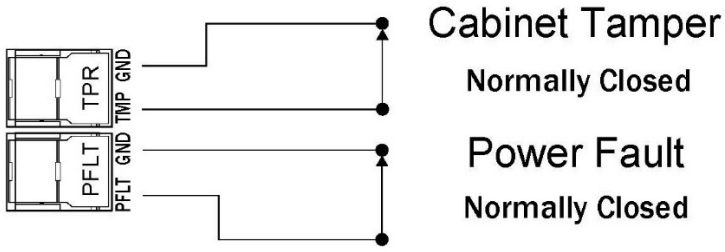


Figure 3.3: Cabinet Tamper and Power Fault Input Wiring

Cabinet Tamper – This input is designed to be connected to the system's enclosure door and will send an

alarm signal when the enclosure is opened/tampered with.

Power Fault – This input is designed to be connected to an output on a power supply that supports power fault alerts. When a power supply problem is detected, the output signal will become “Open”. A power fault alarm should activate any backup power available.

3.4 Supervised Alarm Inputs (TB3, TB4, TB13, & TB14)

There are 16 Supervised Alarm Inputs. These inputs are multi-purpose and are configured with the Host software. Any input can be assigned as a door contact, REX, or auxiliary sensor input (i.e., motion or glass-break sensors). Usually, these inputs will be used for monitoring external alarm points such as motion detectors or glass break detectors. An added feature is the ability to use these inputs’ changing of states as triggers for things such as relay output activation/deactivation.

The inputs are monitored to detect a change of state. The inputs can be set to be “Normally Open” or “Normally Closed”. There are two input modes…

Supervised: With the use of end-of-line termination resistors, the alarms are monitored for not only secure and alarm states, but also the detection of fault conditions from tampering or accidental damage.

Unsupervised: Two states (alarm and secure) are monitored by checking for an open or closed-circuit input signal. Because tampering or damage can go undetected, this is the least secure input configuration and should not be used for important sensors. See Figure 3.6 for wiring example.

See the Specifications section for wiring recommendations.

3.4.1 End of Line (EOL) Termination Resistors

Using two End-of-Line (EOL) termination resistors, the Supervised mode can detect fault conditions resulting from accidental damage or tampering. Fault conditions will not be confused with valid secure or alarm conditions. For maximum security, the end-of-line termination resistors should be placed at the END of the cable, farthest away from the board. See the Specifications section for wiring recommendations.

There are multiple EOL options, ranging from ready-made terminal block connectors to individual, hand-placed resistors. The EOL resistor values is configured in the Host software. The pre-defined EOL options are as follows…

- 300 / 10K Ohms
- 1K / 2K Ohms
- 3.4K / 4K Ohms

The following wiring diagram shows some of the pre-defined termination resistor configurations. For ease of installation, pre-assembled resistor packs for termination are available; the ATM-30 is 300/10K Ohms & ATM-3D is 3K/4.5K Ohms.

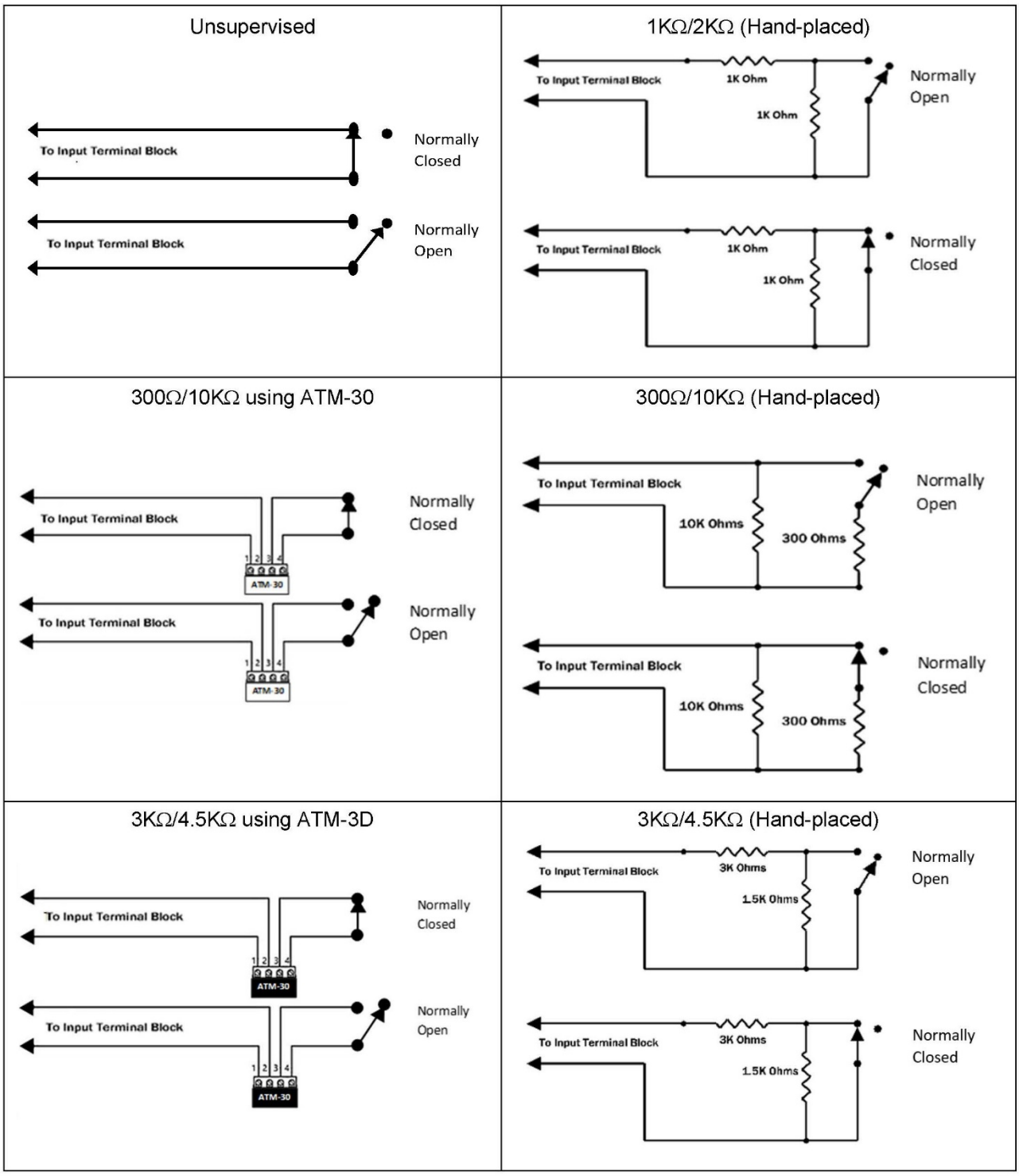


Figure 3.4: Input Supervision wiring examples

3.5 Output Relays (TB8 – TB12)

There are 8 output relays with the ability to add 8 more with a plug-in expansion module. These relays can either control a door strike (lock) or other electrical device connections or other miscellaneous output control. Relay functions are defined in the Host software. The onboard relays can switch up to 2A @ 30VDC or 0.5A @ 120VAC.

3.5.1 Door Strike Wiring

A typical electric door strike (lock) will require around 250mA (0.25 Amps) to operate. If the locking device requires more than 2 Amps to control, another external power-switching device/relay of adequate power rating must be used. Some strikes such as magnetic strikes are inductive loads, in which case is recommended to derate the relay's rated current by 50%.

Wiring between the strike power supply, strike relay (internal or external) and the electric lock should be of sufficient gauge (16 to 18 AWG recommended) to prevent excessive voltage drop under all circumstances.

The strike can be wired in a fail-safe (door unlocks on power outage) or fail-secure (door locks on power outage) manner by using either the Normally Closed (NC) or Normally Open (NO) relay contacts.

3.5.2 Auxiliary Output Relay

Aside from controlling door strikes, relay outputs can be used for controlling other audible and visual devices. Auxiliary relay functionality is configured via the Host software.

3.5.3 Voltage Spike Suppression

Due to inductive nature of a door strike, energizing and deenergizing of the relay can cause voltage spikes across the relay contacts. If no suppression is used to defend against these voltage spikes, communication problems and permanent damage to the hardware may occur.

Strike Type	Suppression Method
DC Strike	Reverse-biased DIODE with a continuous current rating of at least 1x the strike current and a breakdown voltage (Vbr) rating of at least 2x the strike voltage. Usually a 1N4001 – 1N4006 will work.
AC Strike	A Metal Oxide Varistor (MOV) will usually be included with the strike. If a MOV does not come with the strike, contact the strike manufacturer for the appropriate MOV ratings. Be sure to use a UL approved MOV.

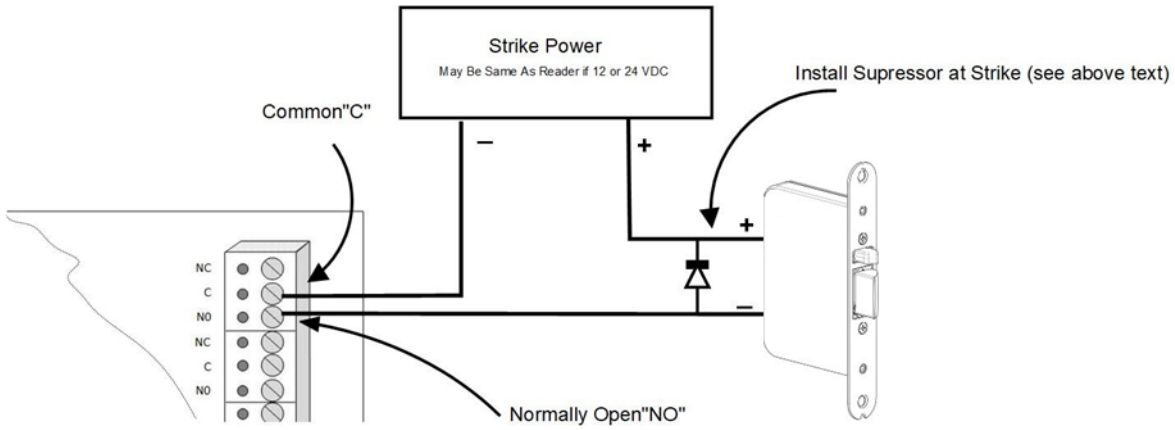


Figure 3.5: Strike Wiring Diagram (DC w/ Diode)

Both DC or AC suppression components are placed across the output device's electrical terminals.

Part IV
Operation

4 Operation

4.1 Firmware

Firmware can be updated in the field via the Host and controller, or with the “Debug Tool” desktop application.

4.1.1 Gen2 vs Gen3

The firmware file that can be loaded to the board depends on the “Generation” of the board which is related to the board revision. Board revisions A through C are considered Gen 2 and board revisions D and later are considered Gen 3. The board Generation is reported in the “Model” field in the ID Report. If the incorrect Generation firmware is sent, it will be rejected. Firmware features are consistent for both generations.

Gen 2 – Does not support TLS or HTTPS and must rely on OSDP Secure Channel for encrypted coms

4.1.2 Bootloader

Underneath the application firmware is the bootloader that handles firmware updates. When the board is running in the bootloader, the TMP and PFLT LEDs will alternate blinking. If a firmware download fails, the board will continue running in the bootloader until firmware can successfully be downloaded and applied.

As of bootloader version 1.25, baud and address set during application runtime will persist in the bootloader.

4.2 Serial COM Configuration

The address and baud rate can be set with DIP switches or with OSDP commands via software. DIP switch 8 turned OFF will use OSDP command settings, and DIP 8 ON will use the DIP switch settings.

As of firmware version 1.25 the baud rate of 230400 is supported, but can only be set with software command, not DIP switches.

DIP switches 1-5 to set the Physical Address and 6 & 7 to set the Baud Rate. After switching to DIP switch-set address and baud rate, a previous software-set address and baud rate will be retained and used if DIP switch 8 is turned back OFF (see DIP function table in section 2.5).

Note: All devices on the serial bus must use the same baud rate. Each device needs to have a unique address.

4.2.1 Serial COM Encryption

Serial communications can be encrypted using OSDP Secure Channel (AES). Both default keys and custom keys are supported. Once an encryption key is sent to the device, encrypted communications are automatically enabled.

If communication is broken due to a controller resetting and losing the encryption key, the encryption key can be cleared using DIP switch 11 (see DIP function table in section 2.5).

4.3 Offline Mode (Firmware 1.22)

When the IO168S cannot communicate with the controller, it can still operate in “Offline Mode” with limited access control functionality. Offline Mode is configurable and uses local hardware interfaces that are linked together.

4.3.1 Offline Events

Events that occur locally while the IO168 is not communicating with the controller are stored and then reported to the controller when communications are restored. Events are stored in non-volatile memory, so loss of power to the board will result in a loss of the stored offline events.

4.3.2 Configurable Offline Modes

UNLOCK or LOCK MODE: A strike can be configured to be permanently locked or unlocked when offline.

REX UNLOCK: Activating the “REX” input will unlock the assigned strike locally on the board.

Part V
Troubleshooting

5 Troubleshooting

5.1 Serial RS-485

- Verify DIP switch setting for baud rate and communication address:
  - All devices on the communication port MUST use the same baud rate
  - Each device on the communication port MUST have a unique address
- Check proper voltage on the RS-485 line (-7 to +12VDC). If values are out of range, check termination and grounding.
- If a serial communication encryption key has been sent, automatically encrypting communications, losing the communication key on the controller will require clearing the encryption key with the DIP switch on the board (see section 2.5). Very few messages can be received unencrypted when encryption is activated.

5.2 Alarm Device Input

If zones report fault (in supervised mode), check the resistance of the line. The resistance should not exceed +/- 15% of the EOL value used. The entire loop wiring resistance must not exceed 30 ohms. Improper wire gauge may create increased resistance and therefore false faults on the line.

5.3 Output Relays

If the device attached to the relay is producing the opposite result than expected (e.g., siren turns off when should turn on), wire the device to the opposite pole than which it is currently connected (NC to NO). If relays are not switching properly, check the power load which is not to exceed 2A @ 30Vdc. Check the polarity of the suppression diode.

Part VI
Specifications

6 Specifications

Specifications are subject to change without notice.

Primary Power (VIN)	**DC/DC:** 12 to 24VDC ± 10% ● 12VDC board operating current: 240mA max ● 12VDC board + relay expansion module current: 350mA max ● 24VDC board operating current: 130mA max ● 24VDC board + relay expansion module current: 185mA max
Network Com (x1)	10BaseT/100Base-TX Ethernet
Upstream Serial Com (x1)	RS-485; 2-wire (half-duplex), 9600 to 115200 baud; 32 available addresses
Tamper & Power Fault	Unsupervised digital inputs for cabinet tamper and power supply failure
Supervised Inputs (x16)	Unsupervised or Supervised, configurable End-Of-Line resistor values. 1K/2K, 3K/4.5K, 300/10K are default, custom values available. Use 1%, ¼ Watt resistors
Output Relays (x4)	Dry, Form-C contacts; 2A @ 30VDC / 0.5A @ 120VAC max **Note:** When connecting an inductive load like a magnetic strike, it is recommended to derate the relay's current rating by 50%
Cable Requirements	**DC Power:** 18 AWG minimum; 1 twisted pair **Ethernet/PoE+:** Cat 5 minimum **RS-485:** 24 AWG; 1 shielded twisted pair; 4000 ft. (1,219m) max @ 9600 baud; Belden 9841 or equivalent cable **Inputs:** 1 twisted pair; 30 Ω max loop resistance; 24 AWG for 0-500ft loop, 22 AWG for 500-1000ft, 20 AWG for 1000-2000ft **Relay outputs:** 16 to 18 AWG. Use sufficient gauge to avoid voltage loss.
Environmental	**Temperature:** -40 to 85ºC operating and storage; Indoors **Humidity:** 5 to 95% RHNC
Mechanical	**Dim:** 8 in. (203.2 mm) W x 6 in. (152.4 mm) L x .75 in. (19.05 mm) H **Weight:** 0.4 lbs. (181 grams)

Part VII
UL Compliance

7 UL Compliance as Recognized Product

- For UL installations using PoE+, the following must be observed:
  - Compliance with IEEE 802.3 (at or af) specifications was not verified as part of UL 294.
  - Locations and wiring methods which shall be in accordance with the National Electrical Code, ANSI/NFPA 70.
  - This product is not intended for outside wiring as covered by Article 800 in the National Electrical Code, NFPA 70.
  - Category 5e, cabling is the minimum performance category recommended.
  - The minimum conductor gauge permitted to connect between the PSE or power injector and the PD shall be 26 AWG (0.13 mm_2) for patch cords; 24 AWG (0.21 mm_2) for horizontal or riser cable.
  - Connected through standard eight-pin RJ-45 connectors.
  - Evaluated for Mode B only.
  - PoE+ power is to be supplied by an Access Control System Unit (ALVY), Class 2 power limited, PoE+ injector (PSE) providing 42.5-52VDC and 25.5W for maximum output."
- Power to be provided by a Listed UL 294, UL 603, or UL 2610 power limited/class 2, power supply or PoE+ injector with appropriate ratings and standby power.
- 1K/2K, 300/10K, & 3K/4.5K EOL values verified.
- Supervised Inputs required for burglar applications.
- When used with a Listed system for burglar use, system is to be monitored by a Listed receiver for the standards used.
- 4-wire connection for half-duplex not evaluated
- Product evaluated as a recognized component by UL and is not suitable to be used as a Listed subassembly. Products are for user with listed access control or proprietary burglar alarm control units/system.

Part VIII
Revision History

8 Revision History

Rev	Date	Description of changes	Editor
A	1/5/2021	Initial Release	Sean C
A18	11/4/2021	New topology, table of content links and multiple updates	Sean C
A19	3/28/2022	Updated images with new board revision and added operations section	Evan Z
A20	5/18/2022	• Update images and formatting fixes • Fix Terminal Block Connections table. Fix baud rate DIP switch table.	Evan Z
A21	9/8/2022	Updated RS485 bus wiring image and other formatting changes	Evan Z

B1	8/4/2023	Release of new board revision using new MCU
		• Update serial bus device wiring diagram Fig 3.1
		• Update FACTORY RESET DIP switch operation
		• OPERATION
		  • Describe bootloader function and LED indication
		  • Specify difference between previous MCU and newer revision MCU firmware
		  • Update web server information
		  • OSDP Secure Channel
		  • Offline Mode
		  • Network encryption with OSDP Secure Channel
		  • Remove UDP Host List – no longer supported
		• TROUBLESHOOTING – recover from loss of encryption key
		• Update specifications table
			Evan Z

B2	5/8/2024	Update for firmware 1.25 • Add missing feature Offline Mode – Rex Unlock • Bootloader retains address and baud rate settings set during application runtime • Support added for the 230400 baud rate set through config command	Evan Z

B3	????	Update for firmware 1.26
		• Update topology diagram
		• OSDP Verified to Secure Profile
		• NETWORK (section 4.3)
		  • New web server layout
		  • DHCP and DNS now supported
		  • Incoming and outgoing connections
		  • Gen 3 boards support TLS 1.3 with custom certificates
		  • Gen 3 boards support HTTPS web server connections
			Evan Z