# LP1501 Intelligent Controller

with Paired Reader Interface for One Physical Barrier

Installation and Specifications:

## 1. General:

The LP1501 intelligent controller provides decision making, event reporting and database storage for the Mercury hardware platform. Two reader interfaces configured as paired or alternate readers provide control for one physical barrier.

Host communication is via the on-board 10-BaseT/100Base-TX Ethernet port.
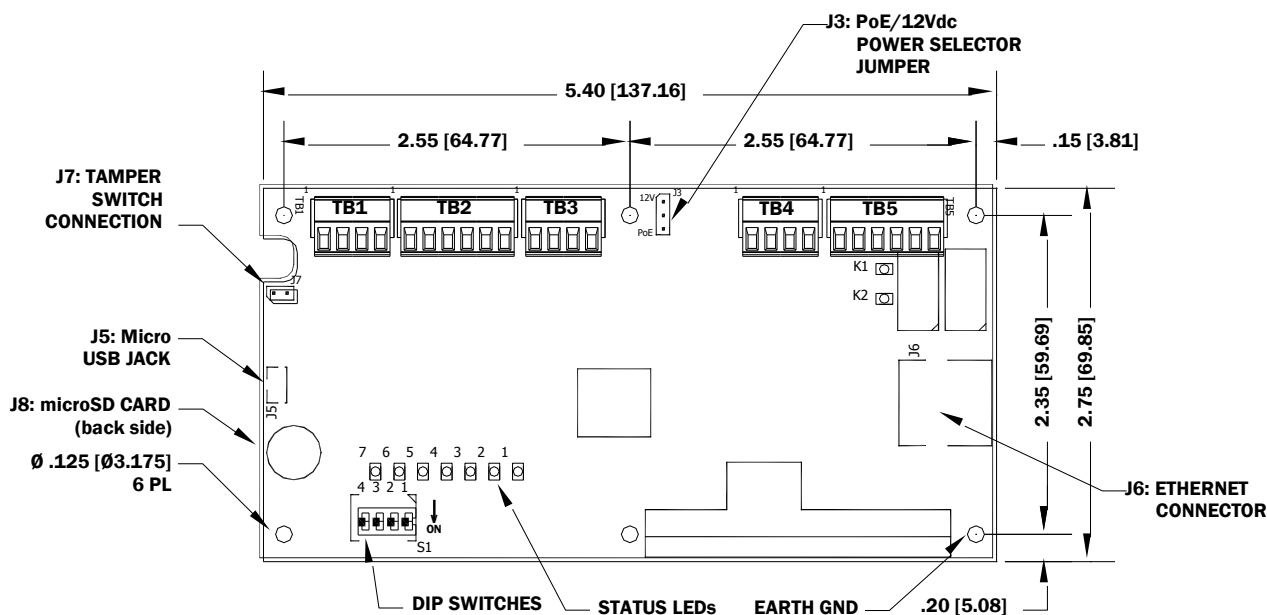
⚠ Note: For UL compliance, the Power Sourcing Equipment (PSE) such as a PoE or PoE+ enabled network switch and/or PoE or PoE+ power injectors must be UL Listed under UL294B.

Reader port 1 can accommodate a reader that utilizes TTL (D1/D0, Clock/Data), F/2F, or 2-wire RS-485 device signaling (for example an OSDP reader), also provides tri-state LED control, and buzzer control (one wire LED mode only). This port can also utilize multiple 2-wire RS-485 multi-dropped devices, such as up to two OSDP readers or up to eight remote serial I/O devices.

Reader port 2 can accommodate a reader that utilizes TTL (D1/D0, Clock/Data), or F/2F signaling, also provides tri-state LED control, and buzzer control (one wire LED mode only). Two Form-C contact relay outputs may be used for door strike control or alarm signaling. The relay contacts are rated at 2 A @ 30 Vdc, dry contact configuration. Two inputs are provided that may be used for monitoring the door contact, exit push button or alarm contact. Input circuits can be configured as unsupervised or supervised. The LP1501 requires Power over Ethernet (PoE or PoE+) or 12 Vdc for power. The LP1501 may be mounted in a 3-gang switch box; a mounting plate is supplied with the unit, or may be mounted in an enclosure; the supplied mounting plate has mounting holes that match the MR50 mounting footprint.

## 2. LP1501 Hardware:



**LP1501 Layout**

Information Subject to Change Without Notice

### 3. LP1501 Wiring and Setup:

| LP1501 CONNECTIONS | | |
|---|---|---|
| TB1-1 | IN1 | Input 1 |
| TB1-2 | IN1 | |
| TB1-3 | IN2 | Input 2 |
| TB1-4 | IN2 | |
| TB2-1 | VO | Reader 1 Power Output – 12 Vdc |
| TB2-2 | LED | Reader 1 LED Output |
| TB2-3 | BZR | Reader 1 Buzzer Output |
| TB2-4 | CLK | Reader 1 CLK/Data 1/TR+ (B) See note 1 |
| TB2-5 | DAT | Reader 1 DAT/Data 0/TR- (A) See note 1 |
| TB2-6 | GND | Reader 1 Ground |
| TB3-1 | LED | Reader 2 LED Output |
| TB3-2 | BZR | Reader 2 Buzzer Output |
| TB3-3 | CLK | Reader 2 CLK/Data 1 Input |
| TB3-4 | DAT | Reader 2 DAT/Data 0 Input |
| TB4-1 | VO | Auxiliary Power Output – 12 Vdc |
| TB4-2 | GND | Auxiliary Power Output Ground |
| TB4-3 | VIN | Input Power – 12 Vdc (from local power supply) |
| TB4-4 | GND | Input Power Ground |
| TB5-1 | NO | Relay K1 – Normally Open Contact |
| TB5-2 | 1-C | Relay K1 – Common Contact |
| TB5-3 | NC | Relay K1 – Normally Closed Contact |
| TB5-4 | NO | Relay K2 – Normally Open Contact |
| TB5-5 | 2-C | Relay K2 – Common Contact |
| TB5-6 | NC | Relay K2 – Normally Closed Contact |

**Note 1:** Terms A & B are from the RS-485 standard

**Jumpers:**

| JUMPERS | SET AT | DESCRIPTION |
|---|---|---|
| J1 | N/A | Factory Use Only |
| J3 | PoE | LP1501 powered from the Ethernet connection |
| | 12V | LP1501 powered from an local 12 Vdc power source connected to TB4-3 (VIN), TB4-4 (GND) |
| J4 | N/A | Factory Use Only |
| J5 | N/A | Micro USB  port (2.0) |
| J6 | N/A | 10-Base-T/100Base-TX Ethernet Connection |
| J7 | | Cabinet Tamper Switch Input: short = tamper secure |
| J8 | N/A | microSD Card |

**DIP Switches:**
The four switches on S1 DIP switch configure the operating mode of the LP1501 processor. DIP switches are read on power-up except where noted.

| 1 | 2 | 3 | 4 | Definitions |
|---|---|---|---|---|
| OFF | OFF | OFF | OFF | Normal operating mode. |
| ON | X | X | X | After initialization, enable default User Name (admin) and Password (password). The switch is read on the fly, no need to re-boot. See IT Security section for additional information. |
| OFF | ON | X | OFF | Use factory default communication parameters. |
| ON | ON | X | OFF | Use OEM default communication parameters. Contact system manufacture for details. See Bulk Erase section below. |
| ON | ON | OFF | OFF | Bulk Erase prompt mode at power up. See Bulk Erase below. |
| X | X | X | ON | Makes the LP1501 report and function like an EP1501. To be used in situations where the host software has not been updated to support the LP series product line. |

All other switch settings are unassigned and reserved for future use.

**Factory Default Communication Parameters:**
**Interface 1 (NIC1)**
Network: static IP address: 192.168.0.251
Subnet Mask: 255.255.0.0
Default Gateway: 192.168.0.1
DNS Server: 192.168.0.1
Primary Host port: IP server, Data Security: TLS if Available, port 3001, communication address: 0
Alternate Host Port: Disabled

## 4. Bulk Erase Configuration Memory:

The bulk erase function can be used for the following purposes:
➢ Erase all configuration and cardholder database (sanitize board)
➢ Update OEM default parameters after OEM code has been changed
➢ Recover from database corruption causing LP1501 board to continuously reboot

If clearing the memory does not correct the initialization problem, contact technical support.

Bulk Erase Steps:   **Do not remove power during steps 1-8.**

1. Set S1 DIP switches to: 1 & 2 "ON", 3 & 4 "OFF".
2. Apply power to the LP1501 board. LED 1 on for about 15 seconds while LP1501 boots up.
3. After the LP1501 boots up, watch for LEDs 1 & 2 and 3 & 4 to alternately flash at a 0.5 second rate.
4. Within 10 seconds after the above pattern starts, change switches 1 or 2 to "OFF". If these switches are not changed, the LP1501 board will power up using the OEM default communication parameters.
5. LED 2 will flash indicating that the configuration memory is being erased.
6. Full memory erase takes up to 60 seconds, usually a lot less.
7. When complete, only LEDs 1 & 4 will flash for about 3 seconds.
8. The LP1501 board will complete its initialization in 2 seconds after LEDs 1 & 4 stop flashing.

## 5. Input Power:

The LP1501 is powered by one of two ways (jumper selected, J3):
➢ Power is supplied via the Ethernet connection using PoE or PoE+
➢ Or local 12 Vdc power supply, TB4-3 (VIN), TB4-4 (GND)

## 6. Communication Wiring:

The LP1501 controller communicates to the host via the on-board 10-BaseT/100Base-TX Ethernet interface.

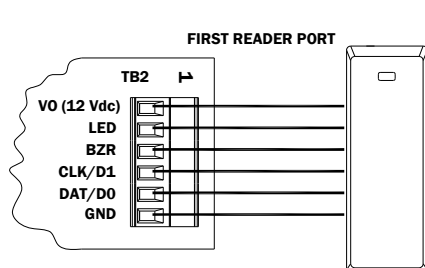## 7. Reader/Serial I/O Device Wiring:

Reader port 1 supports TTL (D1/D0, Clock/Data), F/2F, or 2-wire RS-485 device(s).  Reader port 2 supports TTL (D1/D0, Clock/Data), or F/2F.  Power to reader port 1 is 12 Vdc at 300 mA maximum.  The reader connected to reader port 2 may be powered from the 12 Vdc auxiliary power supply output; TB4-1 and TB4-2.  Readers that require different voltage or have high current requirements should be powered separately.  Refer to the reader manufacture specifications for cabling requirements.  In the 2-wire LED mode, the buzzer output is used to drive the second LED.  Reader port configuration is set via the host software.

Reader port 1 can support up to eight 2-wire RS-485 remote serial I/O devices using MSP1 protocol or up to two OSDP devices.  If two OSDP devices are used, reader port 2 will not support a third reader.  If only one OSDP device is configured, then reader port 2 is available for a second reader.  The maximum cable length is 2000 ft. (610 m).  Do not terminate any RS-485 devices connected to reader port 1.

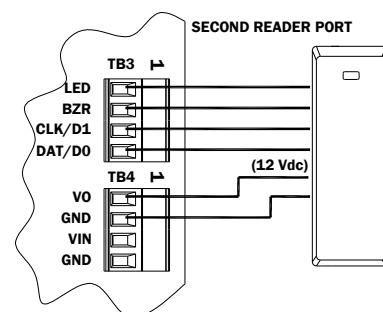⚠ When powering remote device(s) from the LP1501, be cautious not to exceed the maximum current limit. Cable gauge must also be evaluated.  See specifications section for details.

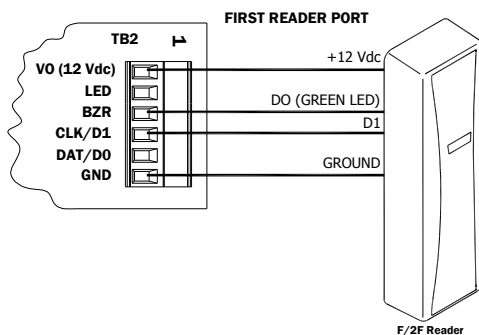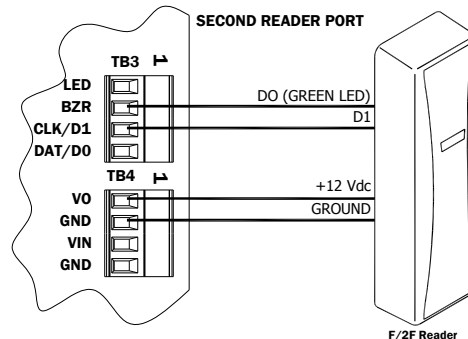**Reader Wiring Diagrams:**



**Reader Port 1**
**Typical D1/D0 or Clock/Data Reader**

**Reader Port 2**
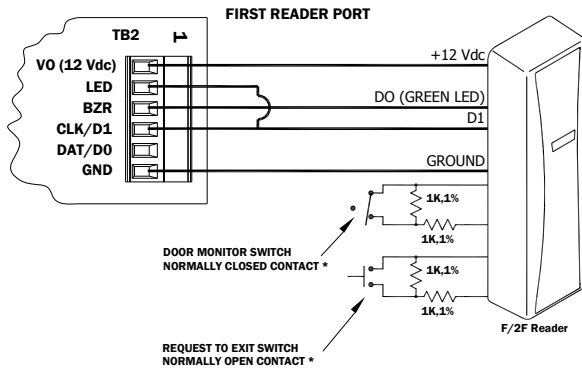**Typical D1/D0 or Clock/Data Reader**
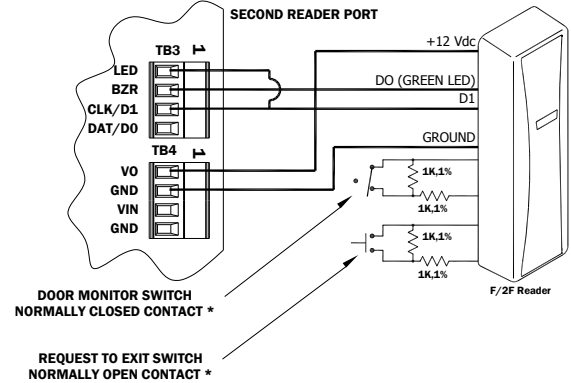
**Reader Port 1**
**Typical Unsupervised F/2F Reader**

**Reader Port 2**
**Typical Unsupervised F/2F Reader**

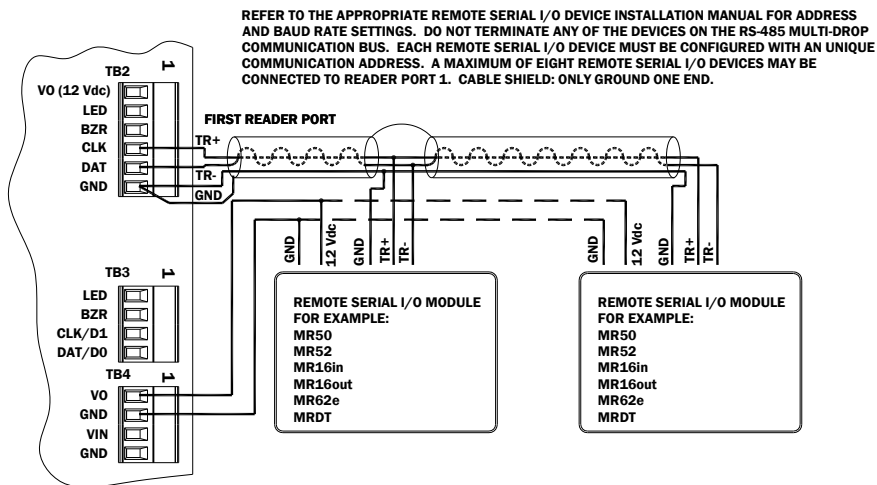\* Inputs on supervised F/2F readers may be unsupervised or supervised (supervised shown).

**FIRST READER PORT**

**TB2**

| | |
|---|---|
| V0 (12 Vdc) | +12 Vdc |
| LED | |
| BZR | DO (GREEN LED) |
| CLK/D1 | D1 |
| DAT/D0 | |
| GND | GROUND |

1K,1%
1K,1%

**DOOR MONITOR SWITCH**
**NORMALLY CLOSED CONTACT** \*

1K,1%
1K,1%

**REQUEST TO EXIT SWITCH**
**NORMALLY OPEN CONTACT** \*

**F/2F Reader**

**SECOND READER PORT**

**TB3**

| | |
|---|---|
| LED | +12 Vdc |
| BZR | DO (GREEN LED) |
| CLK/D1 | D1 |
| DAT/D0 | |

**TB4**

| | |
|---|---|
| V0 | GROUND |
| GND | |
| VIN | |
| GND | |

1K,1%
1K,1%

1K,1%
1K,1%

**DOOR MONITOR SWITCH**
**NORMALLY CLOSED CONTACT** \*

**REQUEST TO EXIT SWITCH**
**NORMALLY OPEN CONTACT** \*

**F/2F Reader**

**Reader Port 1**
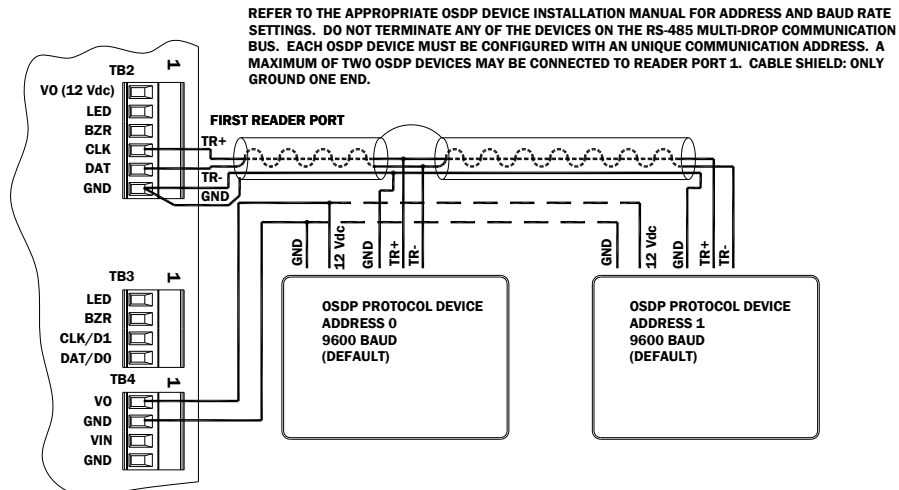**Typical Supervised F/2F Reader**

**Reader Port 2**
**Typical Supervised F/2F Reader**

⚠ Jumper D1 and LED on supervised F/2F readers

REFER TO THE APPROPRIATE REMOTE SERIAL I/O DEVICE INSTALLATION MANUAL FOR ADDRESS AND BAUD RATE SETTINGS. DO NOT TERMINATE ANY OF THE DEVICES ON THE RS-485 MULTI-DROP COMMUNICATION BUS. EACH REMOTE SERIAL I/O DEVICE MUST BE CONFIGURED WITH AN UNIQUE COMMUNICATION ADDRESS. A MAXIMUM OF EIGHT REMOTE SERIAL I/O DEVICES MAY BE CONNECTED TO READER PORT 1. CABLE SHIELD: ONLY GROUND ONE END.

**TB2**

| | |
|---|---|
| V0 (12 Vdc) | |
| LED | **FIRST READER PORT** |
| BZR | |
| CLK | TR+ |
| DAT | TR- |
| GND | GND |

GND | 12 Vdc | GND | TR+ | TR-
GND | 12 Vdc | GND | TR+ | TR-

**TB3**

| | |
|---|---|
| LED | |
| BZR | |
| CLK/D1 | |
| DAT/D0 | |

**TB4**

| | |
|---|---|
| V0 | |
| GND | |
| VIN | |
| GND | |

**REMOTE SERIAL I/O MODULE**
**FOR EXAMPLE:**
**MR50**
**MR52**
**MR16in**
**MR16out**
**MR62e**
**MRDT**

**REMOTE SERIAL I/O MODULE**
**FOR EXAMPLE:**
**MR50**
**MR52**
**MR16in**
**MR16out**
**MR62e**
**MRDT**

**Reader Port 1 - Remote Serial I/O Devices using MSP1 Protocol (2-Wire RS485)**

REFER TO THE APPROPRIATE OSDP DEVICE INSTALLATION MANUAL FOR ADDRESS AND BAUD RATE SETTINGS. DO NOT TERMINATE ANY OF THE DEVICES ON THE RS-485 MULTI-DROP COMMUNICATION BUS. EACH OSDP DEVICE MUST BE CONFIGURED WITH AN UNIQUE COMMUNICATION ADDRESS. A MAXIMUM OF TWO OSDP DEVICES MAY BE CONNECTED TO READER PORT 1. CABLE SHIELD: ONLY GROUND ONE END.

**TB2**

| | |
|---|---|
| V0 (12 Vdc) | |
| LED | **FIRST READER PORT** |
| BZR | |
| CLK | TR+ |
| DAT | TR- |
| GND | GND |

GND | 12 Vdc | GND | TR+ | TR-
GND | 12 Vdc | GND | TR+ | TR-

**TB3**

| | |
|---|---|
| LED | |
| BZR | |
| CLK/D1 | |
| DAT/D0 | |

**TB4**

| | |
|---|---|
| V0 | |
| GND | |
| VIN | |
| GND | |

**OSDP PROTOCOL DEVICE**
**ADDRESS 0**
**9600 BAUD**
**(DEFAULT)**

**OSDP PROTOCOL DEVICE**
**ADDRESS 1**
**9600 BAUD**
**(DEFAULT)**

**Reader Port 1 - OSDP Protocol Devices (2-Wire RS-485)**

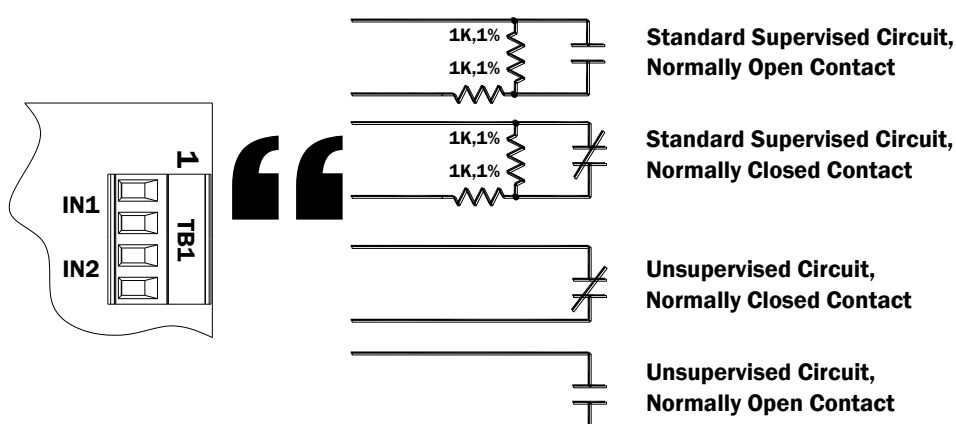Information Subject to Change Without Notice

## 8. Input Circuit Wiring:

Typically, these inputs are used to monitor door position, request to exit, or alarm contacts. Input circuits can be configured as unsupervised or supervised. When unsupervised, reporting consists of only the open or closed states.

When configured as supervised, the input circuit will report not only open and closed, but also open circuit, shorted, grounded*, and foreign voltage*. A supervised input circuit requires two resistors be added to the circuit to facilitate proper reporting. The standard supervised circuit requires 1k ohm, 1% resistors and should be located as close to the sensor as possible. Custom end of line (EOL) resistances may be configured via the host software.

* Grounded and foreign voltage states are not a requirement of UL 294 and therefore not verified by UL.

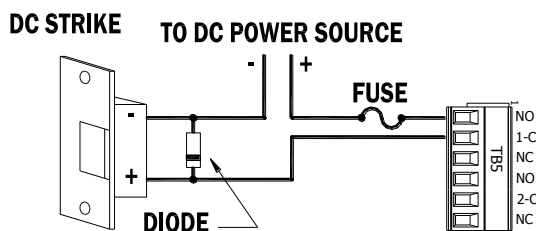The input circuit wiring configurations shown are supported but may not be typical:



## 9. Relay Circuit Wiring:

Two Form-C contact relays are provided for controlling door lock mechanisms or alarm signaling devices. The relay contacts are rated at 2 A @ 30 Vdc, dry contact configuration. Each relay has a Common pole (C), a Normally Open pole (NO) and a Normally Closed pole (NC). When you are controlling the delivery of power to the door strike, the Normally Open and Common poles are used. When momentarily removing power to unlock the door, as with a mag lock, the Normally Closed and Common poles are used. Check with local building codes for proper egress door installation.

Door lock mechanisms can generate EMF feedback to the relay circuit that can cause damage and premature failure of the relay plus affect the operation of the LP1501. For this reason, it is recommended that either a diode or MOV (metal oxide varistor) be used to protect the relay. Wire should be of sufficient gauge to avoid voltage loss.

⚠ From the Auxiliary output, the LP1501 can provide 12 Vdc power for external devices provided that the maximum current is not exceeded. See the specifications section for details. If a local power supply is used, it must be UL Listed Class 2 rated.



**Diode Selection:**

Diode current rating: 1x strike current
Diode breakdown voltage: 4x strike voltage
For 12 Vdc or 24 Vdc strike, diode 1N4002
(100V/1A) typical.

## 10. Memory Backup Battery:

The SRAM is backed up by a rechargeable battery when input power is removed.  This battery should retain the data for a minimum of 3 days.  If data in the SRAM is determined to be corrupt after power up, all data, including flash memory, is considered invalid and is erased.  All configuration data must be re-downloaded.

⚠️ **Note:**  The initial charge of the battery may take up to 48 hours to be fully charged.

## 11. Status LEDs:

**Power-up:** All LED's **OFF**.

**Initialization**:  After power is applied, LED 1 is ON for about 15 seconds, then LED's 2 through 7 are flashed once at the beginning of initialization.  LEDs 5, 6 and 7 are turned ON for approximately 1 second after the hardware initialization has completed, then the application code is initialized.  The amount of time the application takes to initialize depends on the size of the database, about 1 second without a card database. Each 10,000 cards will add about 2 seconds to the application initialization.  When LED's 1 through 4 flash at the same time, data is being read from or written to flash memory, do not cycle power when in this state. If the sequence stops or repeats, perform the bulk erase procedure, see section 4.  If clearing the memory does not correct the initialization problem, contact technical support.

**Running:**
After initialization is complete, the LEDs have the following meanings:

| LED | DESCRIPTION |
|---|---|
| 1 | Off-Line / On-Line: Off-Line = 20 % ON, On-Line = 80 % ON |
| 2 | Host Communication Activity |
| 3 | Readers (combined):<br>Clock/Data or D1/D0 Mode = Flashes when Data is Received, Either Input.<br>RS-485 Mode = Flashes when Transmitting Data<br>F/2F Mode = Flashes when Data/Acknowledgment is Received |
| 4 | Input IN1 Status: OFF = Inactive, ON = Active, Flash = Fault   See Note 1 |
| 5 | Input IN2 Status: OFF = Inactive, ON = Active, Flash = Fault   See Note 1 |
| 6 | Cabinet Tamper |
| 7 | Reserved for Future Use |
| D9 | Relay K1: ON = Energized |
| D10 | Relay K2: ON = Energized |
| YEL | Ethernet Speed: OFF = 10 Mb/S, ON = 100 Mb/S |
| GRN | OFF = No Link, ON = Good Link, Flashing = Ethernet Activity |

Note 1:  If this input is defined, every three seconds the LED is pulsed to its opposite state for 0.1 seconds, otherwise, the LED is off.

## 12. IT Security

When installing the LP1501, it is important to ensure that it is done in a secure manner.

Upon installation, the user accounts to the web configuration page should be created with secure passwords, and that all DIP switches are in the off position for the normal operating mode.  The LP1501 is shipped from the factory with a default login account, which is enabled when DIP 1 is moved from OFF to ON.  The default login user name and password will be available for five minutes once enabled.  Therefore, it is important that at least one user account is defined, and the DIP switches are set to OFF before the LP1501 is commissioned.  It is also highly recommended not to configure the LP1501 with an IP address that is accessible from the public Internet.

To further enhance network security, options are available to disable SNMP, Zeroconf discovery, as well as the web configuration module itself.  Additionally, data encryption can also be enabled over the host communication port.

## 13. Specifications:

The interface is for use in low voltage, Class 2 circuits only.

The installation of this device must comply with all local fire and electrical codes.

| | |
|---|---|
| Primary Power: | PoE (12.95 W), compliant to IEEE 802.3af<br>or<br>PoE+ (25 W), compliant to IEEE 802.3at<br>or<br>12 Vdc $\pm$ 10 %, 1.8 A maximum |
| Power Output: | PoE: 12 Vdc @ 625 mA including reader and Auxiliary Power output * |
| Power Output: | PoE+ or external 12 Vdc: 12 Vdc @ 1.25 A including reader and Auxiliary Power output * |
| Micro USB Port: | 5 Vdc maximum (deduct 270 mA from reader and Auxiliary Power output) |

* Excluding micro USB port

⚠ PoE power is to be supplied by a Listed ITE or Access Control System Unit (ALVY), power limited, PoE+ injector or PoE+ Ethernet switch providing 42.5 – 57 Vdc, 25.5W for maximum output.

| | |
|---|---|
| SRAM Backup Battery: | Rechargeable battery |
| microSD Card | Format: microSD or microSDHC; 2GB to 8GB. |
| Host Communication: | Ethernet: 10-BaseT/100Base-TX and Micro USB port (2.0) with optional adapter: pluggable model USB2-OTGE100 |
| Inputs: | Two unsupervised/supervised, Programmable End of Line resistors, 1k/1k ohm, 1 %, ¼ watt standard<br>One unsupervised input dedicated for cabinet tamper |
| Outputs: | Two relays: Form-C contacts: 2 A @ 30 Vdc, resistive |
| Reader Interface: | |
|     Power: | 12 Vdc $\pm$ 10 %: PoE, PoE+ or local power supply, 300 mA maximum |
|     Data Inputs: | Reader port 1: TTL compatible, F/2F or 2-wire RS-485<br>Reader port 2: TTL compatible or F/2F |
|     LED Output: | TTL compatible, high > 3 V, low < 0.5 V, 5 mA source/sink maximum |
|     Buzzer Output: | Open collector, 12 Vdc open circuit maximum, 40 mA sink maximum |
| Cable Requirements: | |
|     Power: | 1 twisted pair, 18 AWG (when using local 12 Vdc power supply) |
|     Ethernet: | CAT-5, minimum |
|     Reader data (TTL): | 6-conductor, 18 AWG, 500 ft. (152 m) maximum |
|     Reader data (F/2F): | 4-conductor, 18 AWG, 500 ft. (152 m) maximum |
|     Reader data (RS-485): | 1 twisted pair, shielded.  24 AWG, 120 ohm impedance, 2000 ft. (610 m) maximum |
|     Alarm Input: | 1 twisted pair per input, 30 ohm maximum |
|     Outputs: | As required for the load |
| Environmental: | |
|     Temperature: | Storage    -55 to +85 °C<br>Operating    0 to +70 °C |

| | |
|---|---|
| Humidity: | 5 to 95 % RHNC |

Mechanical:

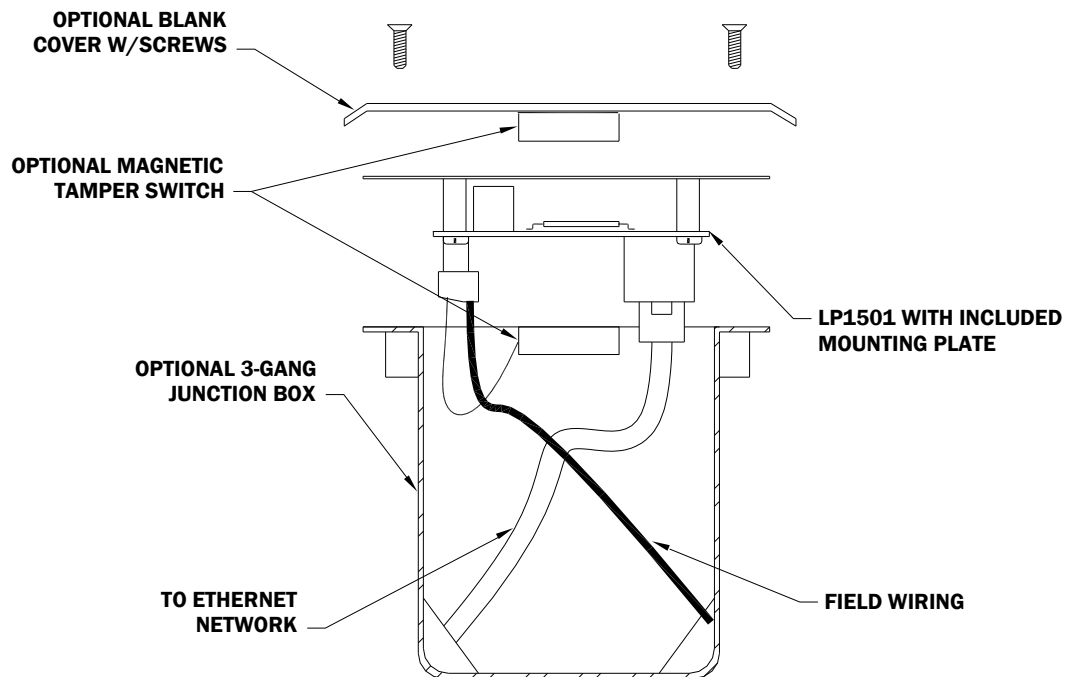| | |
|---|---|
| Dimension: | 5.5 in. (140 mm) W x 2.75 in. (70 mm) L x 0.96 in. (24 mm) H without bracket<br>5.5 in. (140 mm) W x 3.63 in. (92 mm) L x 1.33 in. (34 mm) H with bracket |
| Weight: | 3.6 oz. (103 g) without bracket<br>4.43 oz. (125.5 g) with bracket |

UL294, 6th edition Performance Levels:

| Feature | Level |
|---|---|
| Standby Power | I |
| Endurance | IV |
| Line Security | I |
| Destructive Attack | I |

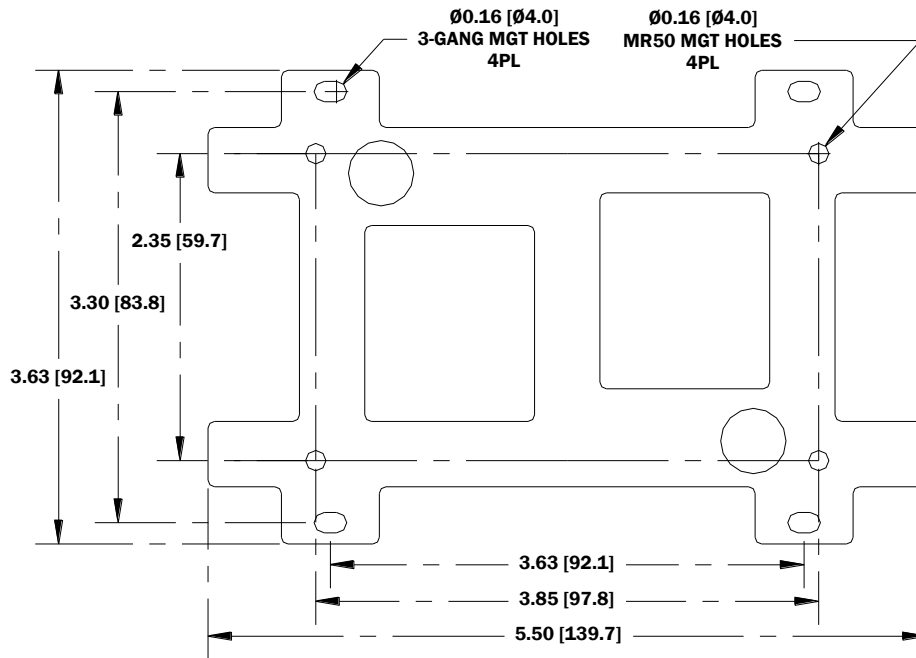These specifications are subject to change without notice

## 14. Additional Mounting Information:

Sources for the optional items shown below:

- 3-gang stainless steel blank cover.  Available from:
  Leviton: part number 84033-40
  Graybar: part number 88158404

- Magnetic switch set: G.R.I. part number: 505

**Mounting Plate Dimensions:**

Ø0.16 [Ø4.0]
3-GANG MGT HOLES
4PL

Ø0.16 [Ø4.0]
MR50 MGT HOLES
4PL

2.35 [59.7]

3.30 [83.8]

3.63 [92.1]

3.63 [92.1]

3.85 [97.8]

5.50 [139.7]

### Warranty

Mercury Security warrants the product is free from defects in material and workmanship under normal use and service with proper maintenance for one year from the date of factory shipment. Mercury Security assumes no responsibility for products damaged by improper handling or installation. This warranty is limited to the repair or replacement of the defective unit.

There are no expressed warranties other than set forth herein. Mercury Security does not make, nor intends, nor does it authorize any agent or representative to make any other warranties, or implied warranties, and expressly excludes and disclaims all implied warranties of merchantability or fitness for a particular purpose.

Returns must be accompanied by a Return Material Authorization (RMA) number obtained from customer service, and prepaid postage and insurance.

### Liability

The Interface should only be used to control exits from areas where an alternative method for exit is available. This product is not intended for, nor is rated for operation in life-critical control applications. Mercury Security is not liable under any circumstances for loss or damage caused by or partially caused by the misapplication or malfunction of the product. Mercury Security's liability does not extend beyond the purchase price of the product.