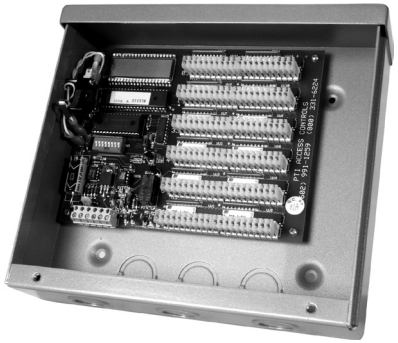
PTI

SECURITY
SYSTEMS

# Wired Door Alarm Multiplexer
# Installation Manual



*www.ptisecurity.com* *800.331.6224*

**SECURITY** **ACCESS** **CONTROL** **VIDEO**

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ETL LISTED US
Intertek

Thank you for purchasing the Wired Door Alarm Multiplexer. While every effort has been made to ensure the accuracy of the information in this document, PTI Security Systems assumes no liability for any inaccuracies contained herein. We reserve the right to change the information contained herein at any time and without notice.

NOTE: 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 in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his/her own expense, will be required to take whatever measures may be required to correct the interference.

With the RS485 communication scheme, a keypad can be located as far as 4000 feet from the controller, therefore shielded twisted pair cable with ground wire is required for optimal operation. Additionally, larger gauge wire must be used the farther the device is from the controller,

Incorrect installation of electrical components can result in damage to electronics as well as personal injury.

Cross-wiring the AC power with the DC power will damage the electronics.

Cross-Wiring the Power wires with the Data wires will damage the electronics

Cross-wiring the positive and negative on the DC part of the system will damage the electronics.

Do NOT run low voltage system wires in the same conduit as high voltage wiring

**The system will not operate properly if the voltage is below 12VDC.** Extreme care should be taken when choosing a power supply voltage and current rating. Long distance runs may require a remote power supply to be installed in line with an RB5 relay to ensure proper operation.

**Warning: The User should follow all installation, operation, and maintenance instructions.** The User is strongly advised to conduct product and systems tests at least once each week. Changes in environmental conditions, electric or electronic disruptions and tampering may cause the product to not perform as expected.

**PTI Security Systems warrants its Product to the User.** The User is responsible for exercising all due prudence and taking necessary precautions for the safety and protection of lives and property wherever PTI Security Systems products are installed. PTI Security Systems does not authorize the use of its products in applications affecting life safety.

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# Technical Specifications

**Input Power:**

| | |
|---|---|
| Voltage: | 12 - 18 VDC / VAC |
| Current: | 300mA maximum |

**Relay Specifications:**

| | |
|---|---|
| Maximum Switching Voltage*: | 30 VAC / 24VDC |
| Maximum Switching Current*: | 1A (NO / NC) |

* Resistive Load

**Environmental:**

| | |
|---|---|
| Ambient Temperature: | -40°C to +85°C<br>(-40°F to 185°F) |
| Ambient Humidity: | 0 to 85% non-condensing |

# Introduction

This installation guide is for setting up a Wired Door Alarm Multiplexer. Please read this entire document before proceeding and follow all steps in order.

PTI recommends that installation and setup of any PTI Security Systems equipment be done by a certified, licensed, qualified technician. PTI can recommend local dealers and installers, but it is the customers' responsibility to verify qualifications and negotiate any pricing or contracts (unless PTI Security Systems has been specifically contracted in writing to do so on behalf of the customer).

With any setup or installation, some troubleshooting and adjustment of the configuration may be required. This will differ with every installation due to site-specific variables. Troubleshooting and configuration may include the purchase of additional equipment. PTI Security Systems is not responsible for any damages either incidental or consequential based on these recommendations.

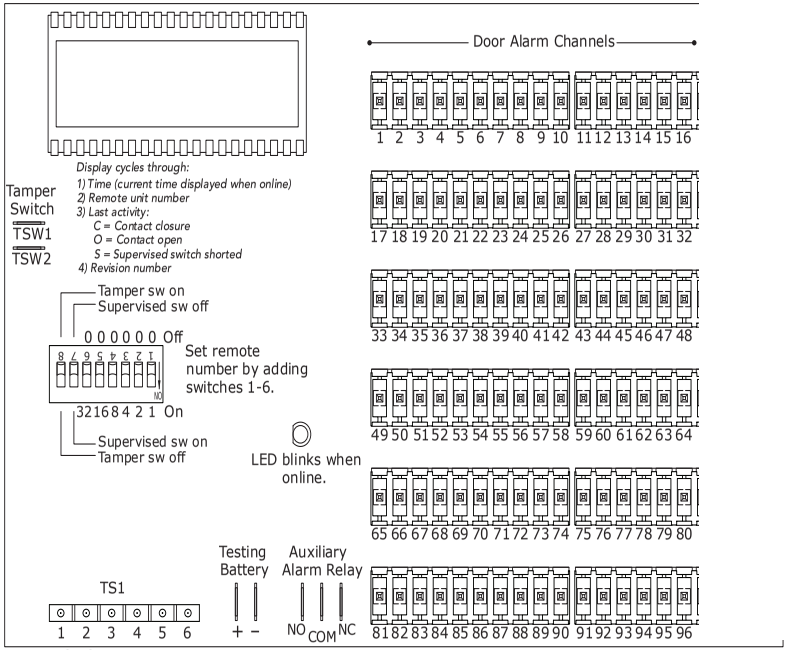
# Installation Instructions

Follow these steps, as written, to install the Wired Door Alarm Multiplexer. Do not miss any steps unless instructed.

- Install the multiplexer high on a wall in an interior hallway or office.
- Never mount the multiplexer in a rentable unit or a location that is inaccessible for future maintenance and service.
- The unit is weather-resistant and can be used on exterior installations.
- Ideally, multiplexers should be mounted near the end of a hallway so that a trunk line can be run and connected to the door and alarm areas.
- After the multiplexer location is set, note the location and purpose of the device on a site security wiring plan and keep the plan in a safe location for future maintenance and service purposes.

1 Open the multiplexer by removing the two stainless steel button head machine screws on the front of the housing using the hex key provided with the unit. The front faceplate will slide down and off the housing.

2 To read the wiring diagram on the inside of the faceplate during installation, screw the face back onto the housing upside down This will also keep the faceplate secure while work is done on the unit. The wiring diagram should look like "Drawing 1: Hardwired Mux Wiring Diagram" on page 43




*Drawing 1: Hardwired Mux Wiring Diagram*

PTI SECUR SYSTE

*Alarm Multiplex*

## Specifications

| Input Power: | | | Battery Input: | Alarm Relay Output: | | |
|---|---|---|---|---|---|---|
| Current | 500mA | Max | (For Testing Only) | Current | 2A | Max |
| Voltage | 12V DC/AC | Min | 9VDC | Voltage | 24V DC/AC | Max |
| | 18V DC/AC | Max | | | | |

This device complies with Part 15 of the FCC Rules. Operation is subject to the fo
two conditions: (1) this device may not cause harmful interference, and (2) this
accept any interference received, including interference that may cause undesire
This Class A digital apparatus complies with Canadian IDES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Can

3 Mount the case to the desired location using the four holes. If mounting the multiplexer in exterior locations, seal around the back of each screw hole with an outdoor silicone sealant.

4 Conduit wire can be run into the housing through one of three conduit knockouts in the back of the box or one of the three knockouts on the bottom of the housing. These knockouts allow for installation of ¾ inch or 1 inch conduit with compression fittings. If a larger size conduit is needed, drill the correct size hole in the housing in the bottom or lower back of the housing.

5 Place the housing against the wall and mark the wall through the four mounting holes on the rear of the housing with a pencil. Use a torpedo level to verify that the housing will be mounted level.

6 Communications and power wires must be connected from the RS485 lines connected to the controller terminal block. The wire can be connected directly to the main terminal block or to the terminal block(s) at other remote devices (e.g., keypads, relay boards, etc.). Pull the necessary wires through conduit into the housing. Each device should have the following wires:

- One 18 AWG, 4-conductor, shielded cable coming in from the controller or from the previous AI device in line.
- One 18 AWG, 4-conductor, shielded cable going out to the next AI device in line (if there is another AI device down the line).
- One earth ground wire

- One or two, 24 AWG 50-conductor solid copper telephone trunk line cables coming from the hallway doors.

- One 2-conductor cable coming from the siren (if a siren is being used).

7 **Power wires** connect to **pins 1 and 2** of **terminal block 1 (PP13)** in the lower left-hand corner of the circuit board. **Data wires** connect to **pins 4, 5**, and **6** of **PP13**. The wired door alarm mux is powered by a **minimum of 12 V to a maximum of 18 V DC or AC power.**

8 With the power disconnected, strip back the outer insulation and shield foil from both of the 18 AWG, 4-conductor, shielded cables (coming from the controller or previous AI device in line and going out to the next AI device in line), being careful not to cut the bare shield wire. Strip ¼ inch of insulation off the end of each of the individual colored conductor wires.

**If using DC:** connect the **DC+** wire to **pin 1** of **PP13**, connect the **DC–** to **pin 3** of **PP13** in the same way.

**If using AC:** connect the **AC** wire to **pin 1** of **PP13**, then connect the second **AC** wire to **pin 2**.

9 Insert both red wires into terminal slot 1 on the terminal block. Ensure that both wires are seated all the way inside the slot. Use a flathead precision screwdriver to tighten down the terminal screw. Verify that the terminal slot has tightened down on the copper wire and not on the rubber insulation.

There should be no copper wire showing outside of the terminal slot. Gently tug the wires to verify that they are tightly held inside the terminal slot. Repeat this process with each of the remaining wire connections as follows:

| Terminal Block PP13 (TS1) | | | | | |
|---|---|---|---|---|---|
| **Pin1** | **Pin 2** | **Pin 3** | **Pin 4** | **Pin 5** | **Pin 6** |
| **DC + AC (Red)** | **AC** | **DC – (Black)** | **Data + (White)** | **Ground (Shield)** | **Data – (Green)** |

10 Strip back 1/4" insulation from the end of the **Data +** and **Data –** wires. The Data Common Ground wire should be bare. Connect the **Data +** wire to **pin 4** of **PP13** by placing it in the third terminal block hole and tightening down with a precision standard screwdriver. Connect **Data Common Ground** to **pin 5** and **Data –** to **pin 6**.

11 The terminal strips along the right side of the board are the channels and grounds to connect door alarm switches. Multiplexers are available in 16, 32, 48, 64, 80, and 96 channels,. to customize the amount needed to fit the number of doors on the site.

12 It is a good practice to plan on leaving a few unused channels in each multiplexer to allow for future expansion, unit splitting, and maintenance or service. Each strip is laid out with 16 door channels and four grounds as shown in "Drawing 2: Multiplexer Channel Layout" on page 8

*Drawing 2: Multiplexer Channel Layout*

| Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Gnd | Gnd | Gnd | Gnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | | | | |

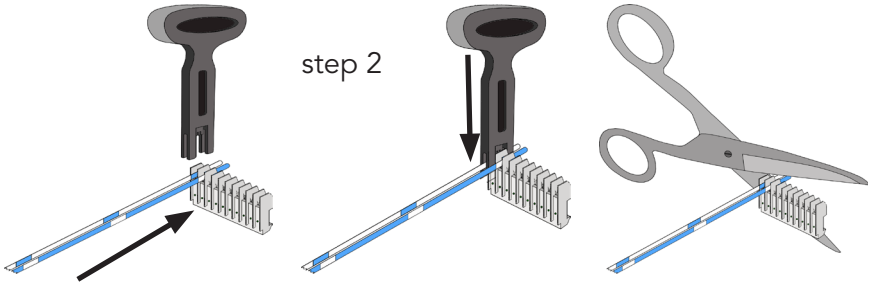
| Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Gnd | Gnd | Gnd | Gnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | | | |

| Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Gnd | Gnd | Gnd | Gnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | | | | |

| Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Gnd | Gnd | Gnd | Gnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | | | | |

| Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Gnd | Gnd | Gnd | Gnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | | | | |

| Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Ch | Gnd | Gnd | Gnd | Gnd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | | | | |




*Drawing 3: Punchdown and Trim Wires*

**Do not use a screwdriver, knife blade or telephone punchdown tool.**

**Caution: Do not punch down the wires while the strip is still attached to the relay board. The board may receive damage from flexing**

13 Punch down the wires for each relay onto the terminal strip using a Mux Punchdown Tool (PTI part # TMUXPDTOOL). If you need to order a Mux Punchdown Tool, contact PTI Sales at 800-523-9504 or sales@ptisecurity.com

14 To punch the wires down, remove the terminal strip by gently rocking it back-and-forth while pulling up and away from the board. Place the terminal strip on a hard surface and place the wires over the correct slots.

15 Use the Mux Punchdown Tool to firmly press the wires in place. There should be an audible click as the wires seat down at the bottom of the clip.

16 When all the wires are punched down, use electrician's shears or wire cutters to trim the excess wire from the back of the terminal strip. Then push the terminal strip back onto the pins in the board. "Drawing 3: Punchdown and Trim Wires" on page 9 illustrates the process.

17 Once wiring is complete and tested, slide the faceplate onto the housing and screw it back together.

18 Address the wired door alarm mux with a number between **1 – 21** or **23 – 63**. This number must not be a duplicate of any other device. To set the address, use a small screwdriver to turn on the dipswitches that apply. **Never set the address to 0 or 22 as the access control system uses these for special communications.** "Drawing 4: Addressing the Mux" on page 10 shows the description of the dipswitches.

*Drawing 4: Addressing the Mux*

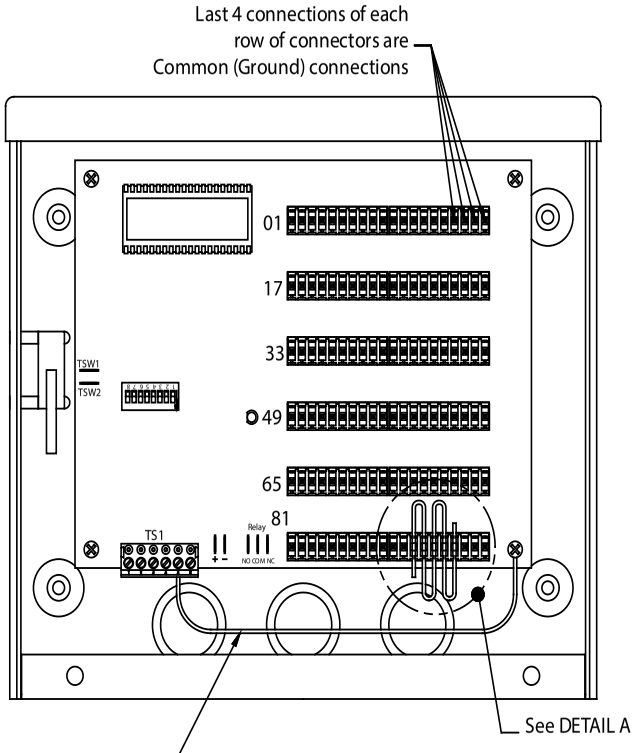
| | | |
|---|---|---|
| Switch 1: | OFF = adds zero to unit number | ON = adds one |
| Switch 2: | OFF = adds zero to unit number | ON = adds two |
| Switch 3: | OFF = adds zero to unit number | ON = adds four |
| Switch 4: | OFF = adds zero to unit number | ON = adds eight |
| Switch 5: | OFF = adds zero to unit number | ON = adds sixteen |
| Switch 6: | OFF = adds zero to unit number | ON = adds thirty-two |
| Switch 7: | OFF = Supervised Switches Off | ON = Supervised on |
| Switch 8: | OFF = Tamper Switch Enabled | ON = Tamper disabled |

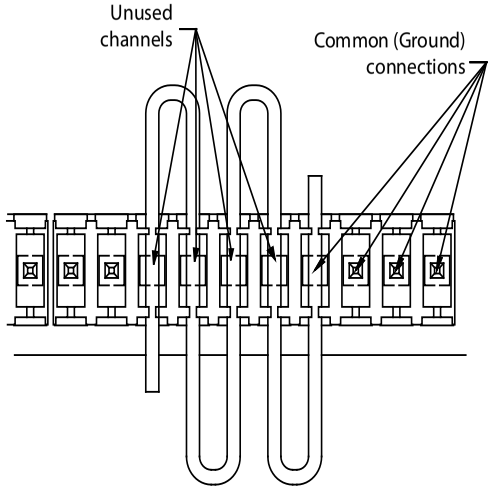
19 Dipswitch #7 turns on supervised switch monitoring. This switch is rarely used in PTI security systems, where switches are monitored by StorLogix software.

20 **Dipswitch #8** places a communication line terminating resistor across the RS485 data lines when turned on**. This switch should only be turned on if the wired door alarm mux is the last remote device on a communication line that is more than 800 feet from the base unit**

**There should only be one remote device (Keypad, APEX, Wiegand, etc) in an entire access control system with a terminating resistor turned on. In all other circumstances, this should be left off.**

21 When connecting the door alarms, make sure to connect the unused channels to ground and also remove the connectors from the board before punching down the wires for the alarm. See “Drawing 5: Grounding Unused Channels” on page 12




DETAIL A
UNUSED CHANNEL WIRING
use provided punch-down tool
to insert wire into connector(s)

*Drawing 5: Grounding Unused Channels*

**Sites often do not want an installer to rivet magnets to doors because the rivets show through the exterior of the door. As a solution, PTI recommends using Loctite PL Premium® polyurethane construction adhesive to create a long-lasting, secure join.**

## Installing the Magnets

1 On the latch side of the door, locate the position where the magnet will be placed. Be sure that the magnet is located within ½ inch of where the switch is to be installed and that it does not interfere with the door rolling up or swinging. See Installing the Door Switches, for locations by switch type.

2 Use isopropyl alcohol or acetone on a lint-free cloth to clean the magnet location of construction dust, grease, and other contaminants. Allow the spot to dry before proceeding.

3 Use a caulking gun to run a ¼ inch bead of PL Premium along the back of the magnet from one side to the other.

4 Press the magnet in place on the door, holding it tightly for 30 seconds. Use masking tape to hold the magnet in place until the adhesive is set. Remove the tape after 24 hours. The magnet may be repositioned for up to 20 minutes before the adhesive sets or will have to be reapplied.

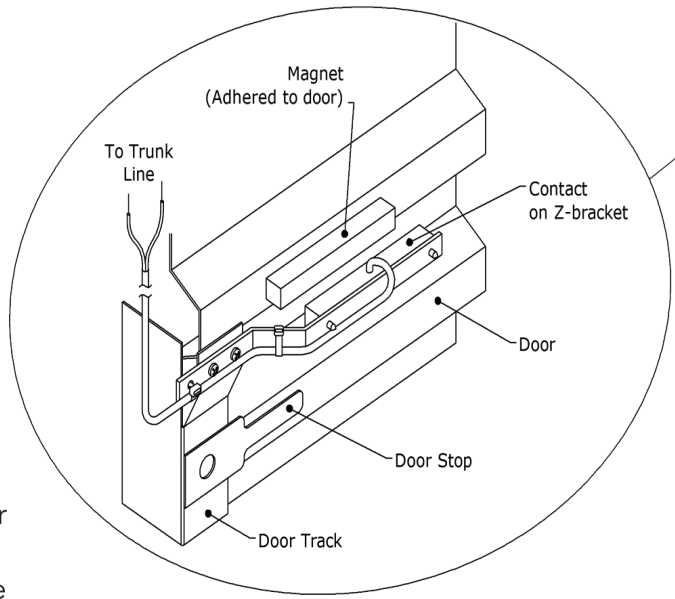
## Installing the Door Switches

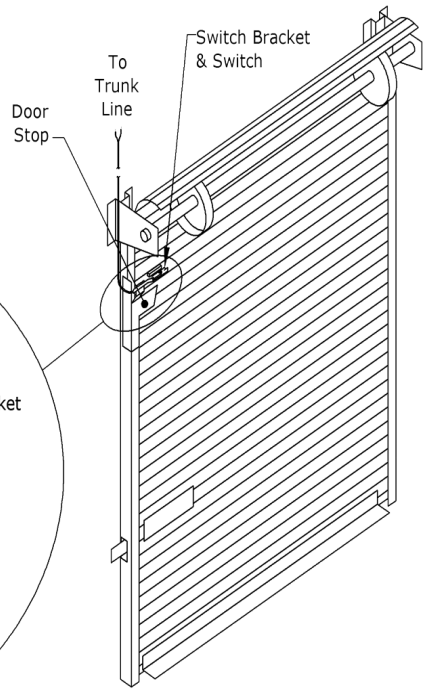
The following pages detail how to install door switches used in conjunction with the access control system. Refer to the switch manufacturer's instructions for more information.

# AMS-37LG48 Switches with Z-Bracket

This method can be used with most types of roll-up doors using AMS-37 switches, on a Z-bracket, with a 48 inch lead. Ensure that the tab at the top of the door is bent out far enough to clear the screws to hold the bracket. Install the magnet with rivets and/or glue to the inside of the door (recommended glue - PL Premium)

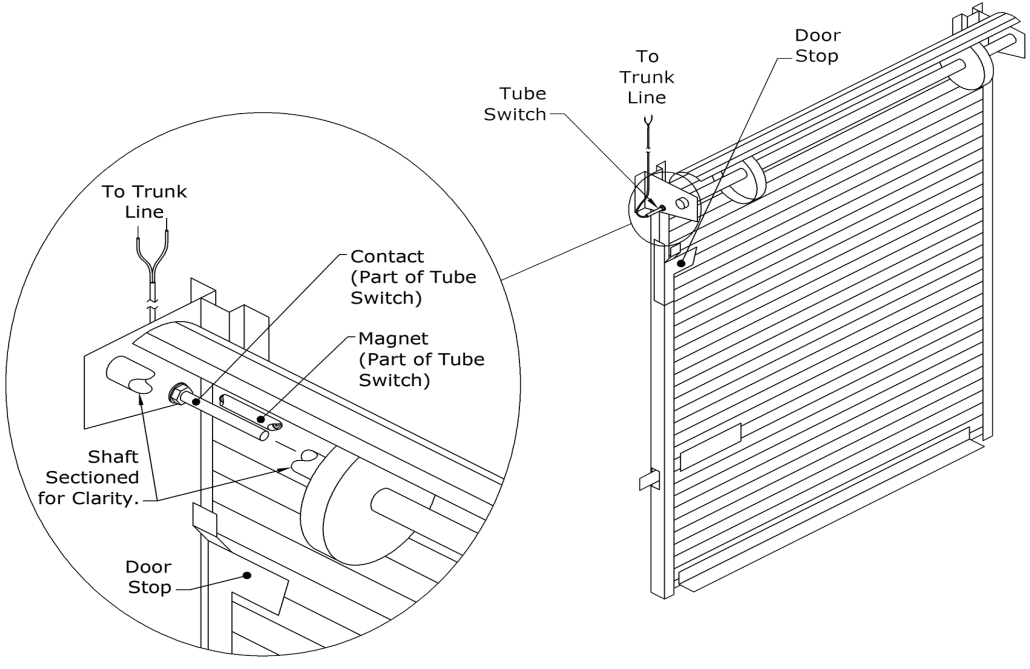
**CAUTION: DO NOT ATTACH THE BRACKET TO THE DOOR STOP!**



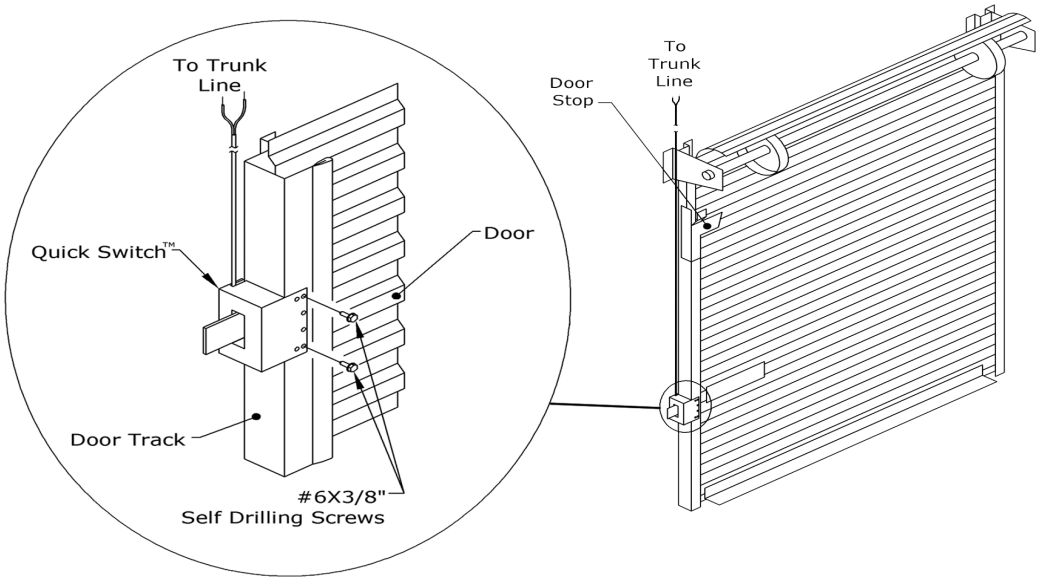
# ODC-51A
# Tube Switches

This method can be used with most types of roll-up doors using ODC-51 tube switches with a 48-inch lead. Ensure that the contact portion of the tube switch does not interfere with door movement. Use an electric drill or metal punch to make the hole in the side of the support wings for the roller shaft. Install the magnet with rivets and/ or glue to the inside of the door (recommended glue - PL Premium)



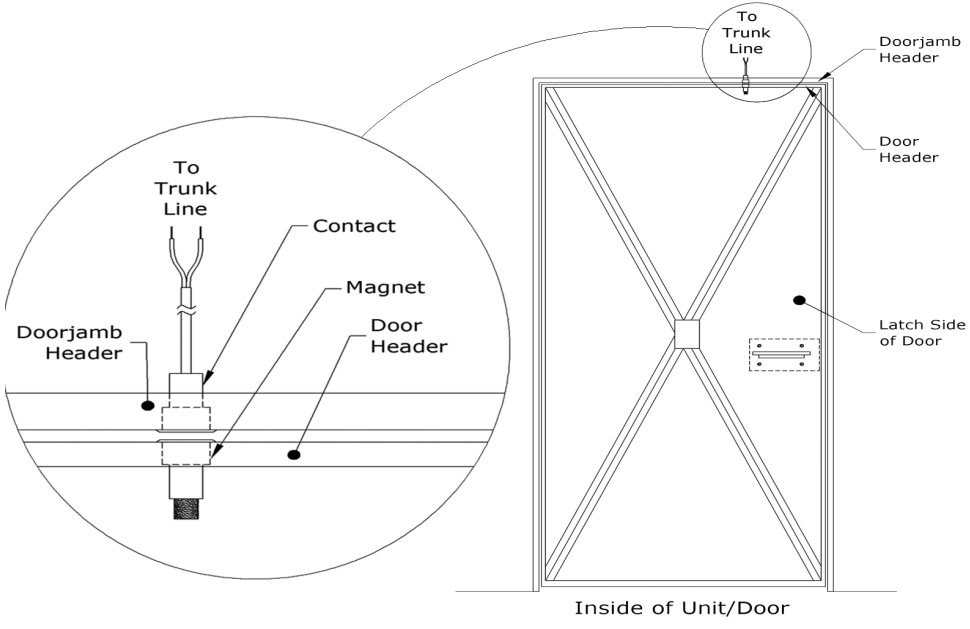
# QuickSwitch®

Ensure that the screws holding the QuickSwitch to the track do not interfere with door movement. The QuickSwitch must line up with the door latch hole and allow free movement of the door latch. The door latch must be made of ferrous metal and be long enough to go all the way through the door switch. The door latch must also be wide enough and thick enough to trigger the switch.



# Recessed Switches

Use this method to install recessed door switches on swing doors (such as AMS-21 and AMS-26). Drill a hole in the top of the door jamb sized to fit the switch and a hole in a matching position on top of the door. The holes must be on the latch side of the door approximately halfway between the middle of the door and the edge. Glue the magnet in the door and the contact in the doorjamb header using PL Premium



# Installing the Trunk Line

Following are instructions on installing the trunk line to connect the individual door alarm switches to the multiplexer. The trunk line itself should be run behind the hallway wall along the top of each door.

In most self storage applications, the trunk line sits in the red iron C-channel support and is tied down using screwhead mounting wire ties placed every 2 – 3 feet.

If there is no red iron C-channel support installed, tie the cable to the wall using screwhead mounting wire ties placed every 2 – 3 feet. The trunk line should be hidden behind the wall and above the door as to be almost invisible to the customer.

# Multiplexer Switch Wiring Methods

**Every site has unique conditions and every project is different. PTI recommends that installers consult with their client before installation to find out the challenges with the site, the anticipated traffic from tennants, and the client's priorities, before choosing an installation method.**

There are three different methods for connecting door switches to the alarm multiplexers or relay modules, each method has it benefits and drawbacks.

All three methods can be used with 25 pair multi-conductor cable. The 25-pair cable has 50 electrical conductors organized into 25 twisted differential pairs and this is standard for telecommunications cable.

For simplicity, descriptions use up to seven door switches as examples.

# Individual Pair Wiring

With the Individual pair wiring method, each pair of wires in the 25-pair multi-conductor cable is used for a separate door switch.

- This means that no more than 25 doors can be connected through the same cable.
- Each pair is cut at the point where the switch wires are attached to the trunk cable.
- The remaining length of the pair is unused and unconnected.
- Using this method means that one wire from each pair is connected to the common wire on the multiplexer. Since there are only four common connections in each row of 16 inputs, the commons share multiple wires connected off the board. Sharing is achieved with a small terminal block or common punch-down block.

**It is extremely important that the grounds are stepped down correctly.**

- Plan the site to allow for extra channels on the multiplexer and extra conductors in the trunk line for service
- CAT5 network cable can be used for smaller groups of doors with individual 22 AWG or 24 AWG, 2-conductor twisted pair cables can be used to go out to individual doors.

**Do not use CAT5 network cable anywhere else in the system (except for an Ethernet cable where required).**

# The Advantages of Individual Pairs

### ✓ *High Noise Immunity*

The individual paired wiring method has the highest immunity to voltage surges, induced EMF, and radiated emissions from other devices and other interference.

- When a door switch is open, the main conducting wire has a relatively high impedance path back to the input on the Multiplexer. With the switch open, that wire can act like an antenna and radiate any nearby radio signals, EMF voltages, etc. back to the input. This can cause erratic behavior of the input potentially causing false close and open events. When the switch is closed, these fake signals are greatly reduced.

- Since each pair of wires in the 25-pair cable are twisted together, this means that any signal induced in one wire is induced in the other wire but at the opposite polarity thus effectively canceling out induced noise. Any method that does not utilize a single twisted pair for each door will have increased susceptibility to noise and interference.

### ✓ *Increased Reliability*

- This is due to the reduced noise immunity and the fact that each pair is not used beyond the location where the door is connected.

- At the point where each door is connected to the trunk cable, the cable shield must be split and the correct wire pair located. The more connection points on a trunk cable, the higher the risk of an unrelated wire being nicked, or weakened.

- If more than one pair is located at each point, the risk of creating a future fail point doubles.

- It is not recommended to use a trunk cable to capacity; it is good practice to save one or two spare wire pairs for future repair purposes.

✓ ***Easy to locate wire pairs***

- Installing and troubleshooting this installation is easier. Each pair of wires is connected to a single switch. When you locate the wire pair you have located both wires that go to the switch. You do not need to search for another pair for the ground as with other methods.

## The Disadvantages of individual Pairs:

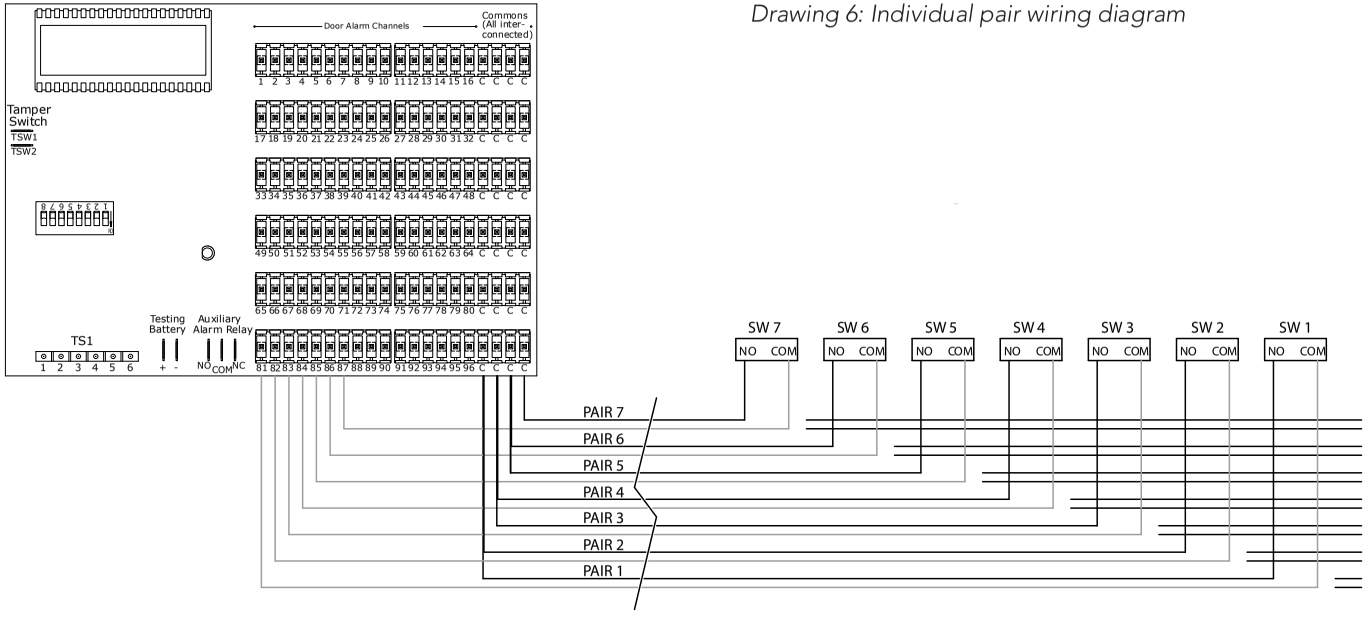
✘ ***More cable length needed***

- Because two wires from each cable are required for each door, a 25-pair cable (50 conductor total) can handle a maximum of 25 doors. A separate trunk cable must be run for every 20-25 doors.

✘ ***Number of Ground Connections***

- In each multiplexer, there are four ground connections for every 16 door switch connections. If all 16 switch inputs are to be used there will need to be an additional 12 ground connections added for each door. This can be done with external punch-down blocks or with additional wiring connections. The methods for accomplishing this are described in #3 on page 23

*Drawing 6: Individual pair wiring diagram*



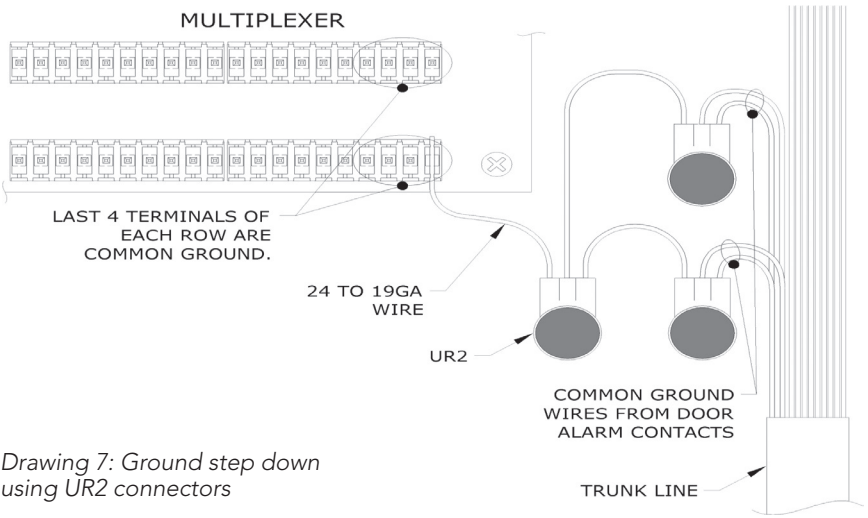
## How to Install Individual Pair

1 Run the lead cable from the door switch up to the trunk line. Use wire ties to tie a small bundle of wire near the switch for future maintenance and service.

2 Use wire ties to tie the wire bundle and the wire to the wall or to the door track every 2 feet up to the trunk line.

3 The multiplexer may not have enough ground input points for all of the ground wires, the ground wires will have to be stepped down. This can be done in one of two ways:

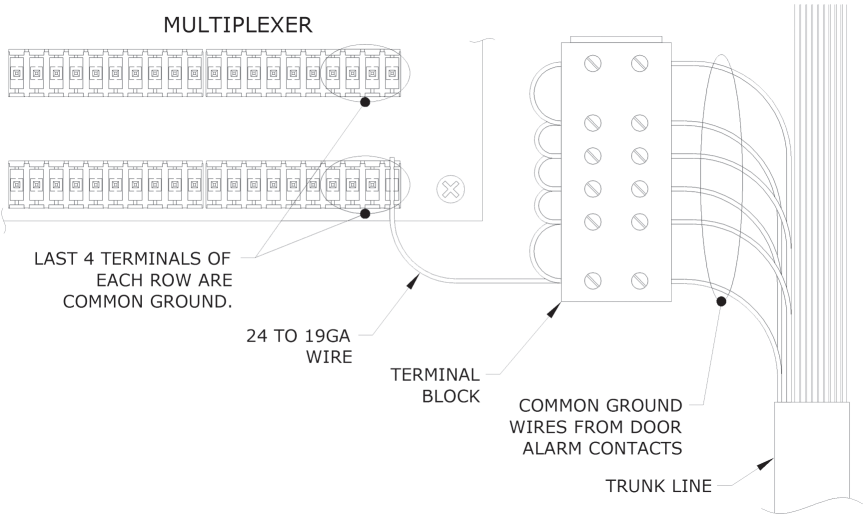
- Use 3M UR2 connectors and insert two ground wires in two of the three holes and a single ground wire coming out of the third hole, as shown in "Drawing 7: Ground step down using UR2 connectors". Do this as many times as necessary to step down to the number of grounds for which there are input points on the board.




*Drawing 7: Ground step down using UR2 connectors*

- Use a telephone terminal block and insert all of the ground wires into terminal slots and jumper all of the slots together. Then run a single ground wire out to a ground point on the multiplexer. As shown in "Drawing 8: Ground step down using a terminal block"

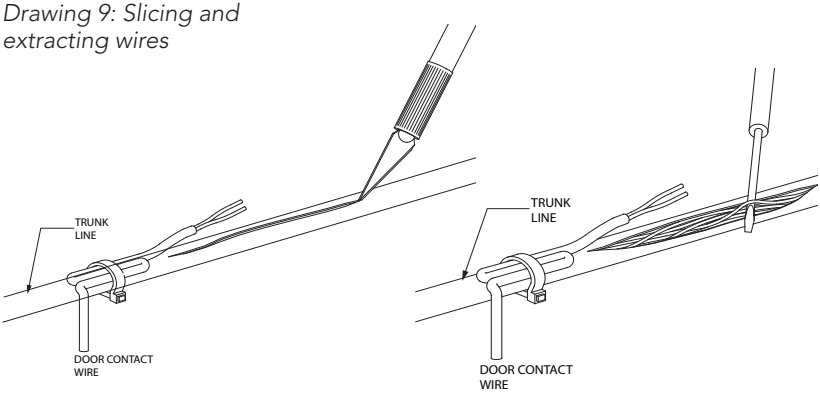
*Drawing 8: Ground step down using a terminal block*




4 At the multiplexer, punch down the door channel wires in color code order at the door channel input points. Note which door channel inputs are connected to which wires.

5 **If using individual 22 AWG or 24 AWG, 2-conductor twisted pair cables for each door, skip to page 26.**

*Drawing 9: Slicing and extracting wires*




6 If using trunk line or network cable, use a small razor knife to cut a two inch slit into the trunk line jacket on the switch side of the door. Be very careful only to cut the jacket and not the conductors underneath. As shown in "Drawing 9: Slicing and extracting wires" on page 25.

7 Spread the slit open and use a wire extractor or blunt precision screwdriver to sort through the wires to find the two correct wire colors for the signal and ground. The recommended wire color code order can be found on the Mux and Channel List chart on page page 45.

8 Use wire cutters to cut both of the wires on the side farthest from the multiplexer. When cutting in a lot of doors in a building, it can be difficult to remember which direction the multiplexer is from any given point, so be very sure before cutting the wire.

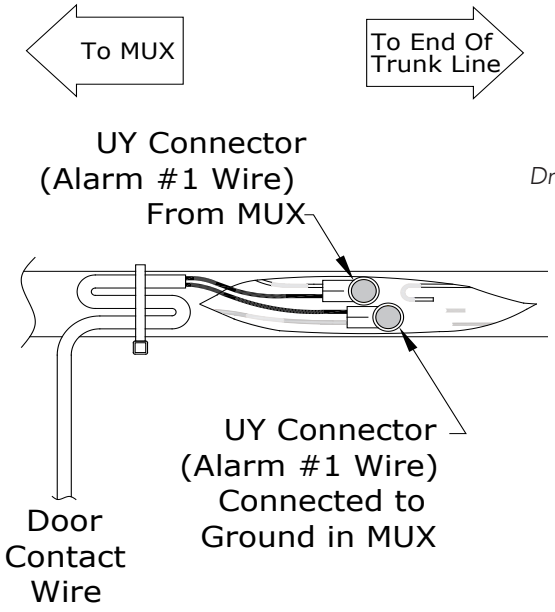
***Individual 22 AWG or 24 AWG, 2-conductor twisted pair cables***

1 Connect the signal wire from the cable with signal wire from the door switch using a 3M UY2 connector.

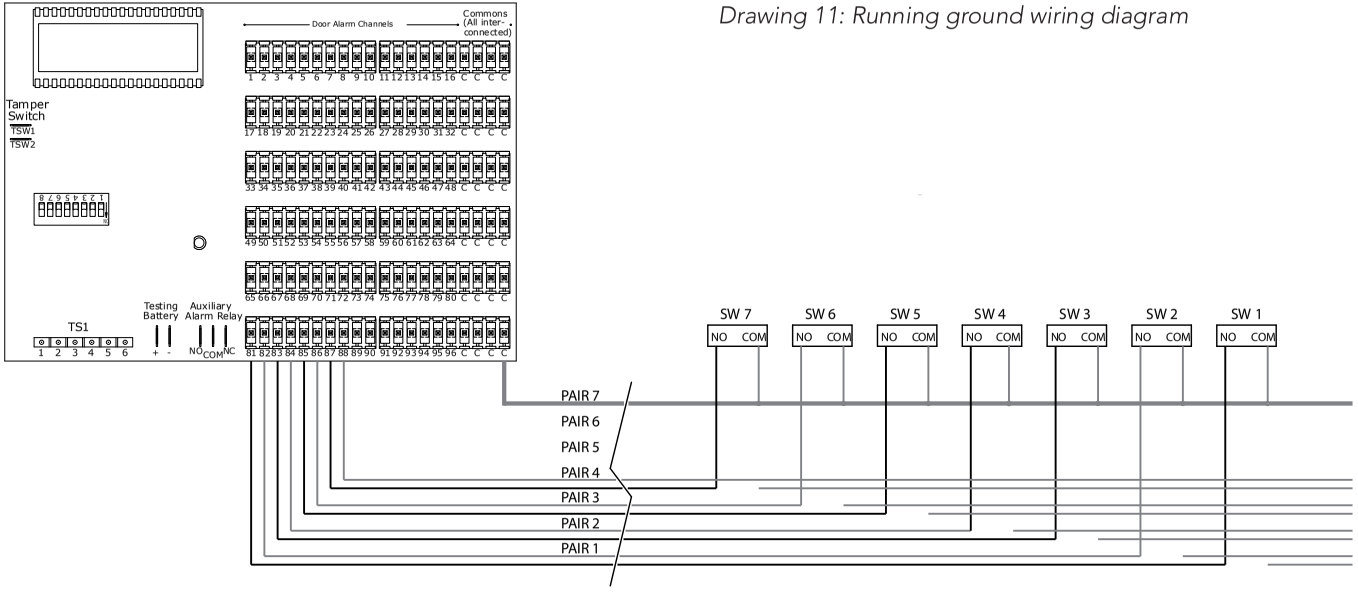
2 Connect the ground wire from the cable with ground wire from the door switch using a 3M UY2 connector. The connection should look like "Drawing 10: Individual Pair wiring inside Trunk Line" on page 26

3 Seal the splices and slit along the line with electrical tape. Any excess door switch lead cable should be secured to the trunk line using a wire tie. (This step can be done after all of the doors have been tested in case splices need to be fixed.)

4 Note which door channel inputs are connected to which wires and keep a copy for future reference. Use a reference table like the example in "Mux & Channel list - Individual Pair Wiring" on page 45.




*Drawing 10: Individual Pair wiring inside Trunk Line*




*Drawing 11: Running ground wiring diagram*

# Running Ground Wiring

The Running Ground method allows each wire to be connected to a separate door. Because at least two wires are needed for ground, this method allows up to 48 doors to be connected to a single 25-pair trunk cable.

This method uses the same amount of wire as the End-Of-Line method.

In this process, the installer must locate each individual wire for the door and the common ground wire. The door wire is cut at the point where the door connects and the remainder of the wire (to the end of the trunk cable) is abandoned. The ground wire is tapped into, not cut.

## Advantages of the Running Ground Method

✓ ***Trunk Cable Required:***

This method, like the End-Of-Line method uses less cable than the individual pair method. For more detail refer to the discussion in that section.

✓ ***Not as susceptible to noise as the End-Of-Line method:***

Each door is slightly less susceptible to noise as the End-Of-Line method because the length of each wire does not reach the end of the trunk cable. However, if you use the variation (where the door wire is not cut) the risk of noise interference is the same as End-of-Line.

## Disadvantages of the Running Ground Method:

### ✘ *Increased susceptibility to noise and radiated emissions:*

Any method that does not use a single twisted pair of wires for each door has increased susceptibility to outside interference. This was discussed in detail in the End-Of-Line method section regarding this same issue.

### ✘ *Greater risk for false open/close events:*

As with the End-Of-Line method, this method caused greater voltage drop on the ground wires. Refer to the discussion on page 30 for more information.

### ✘ *Greater risk for install errors:*

Because each wire is used from beginning to end of the 50-conductor cable, there is a greater risk of a wire getting nicked, scratched, broken, or otherwise stressed which can cause a future failure.

### ✘ *More difficulty troubleshooting problems:*

As with the End-Of-Line method finding problems in the wiring can be tedious even though only the ground wires must be checked for the full length of the trunk cable.

## How to Install Running Ground

1. Run the lead cable from the door switch to the trunk line. Use wire ties to tie a small bundle of wire near the switch for maintenance and service.

2. Use wire ties, every two feet, to tie the wire bundle and lead cable to the wall (or door track) back to the trunk line.

3. Use a small razor knife to cut a two inch slit into the trunk line jacket on the switch side of the door. Be very careful only to cut the jacket and not the conductors underneath. As shown in "Drawing 9: Slicing and extracting wires" on page 25.

4. Spread the slit open and use a wire extractor or blunt precision screwdriver and sort through the wires to find the two correct wire colors for the signal and ground. See "Mux and Channel List - End-of-line & Running Ground Method" on page 43 of the Appendix for the correct color code order.

5. Make sure the Common Ground wire runs the full length of the multiplexer

6. Use wire cutters to cut the appropriate colored **signal wire only**. Be sure to cut the line in the center. Note: the two ground wires used will be for the 48 channels connected to the trunk line.

7. Connect a wire from the door contact to the signal wire from the trunk line using a UY2 connector.

8. Connect the other wire from the door contact to the ground wire from the trunk line using a UG connector.

9 Seal the splices and the slit with electrical tape. Any excess door switch lead cable should be secured to the trunk line using a wire tie. (This step can be done after all the doors have been tested, in case splices need to be fixed).

10 At the multiplexer, punch down the door channel wires in color code order at the door channel input points using the"Mux and Channel List - End-of-line & Running Ground Method" on page 43. Connect the two ground wires to any of the ground input points.

11 Note which door channel inputs are connected to which wires and keep a copy for future reference. Use a reference table like the example in "Mux and Channel List - End-of-line & Running Ground Method" on page 43

# End-of-Line Wiring

With the End-Of-Line Wiring Method each 25-pair trunk cable can be connected to up to 48 doors.

In this method, the trunk cable is not treated as a 25-pair cable but as a 50-conductor cable. Each conductor connects to one door switch with at least two reserved for common ground.

When using this installation method, the installer must locate each color-coded wire in the pair and cut that wire. Each end is connected to a conductor from the door switch.

After all the doors are connected, the installer takes all 50 wires at the far end of the cable and connects them together. At least four of the wires must be connected to the ground or common on the multiplexer to provide the ground at the end of the trunk cable.

## Advantages of End-Of-Line wiring:

✓ ***Less cable used overall***

- The big advantage to the End-Of-Line wiring is less overall trunk cable needed. This reduces the cost of materials for installation but does not necessarily translate to overall lower cost of installation because of the additional labor required to terminate all 50 conductors at the end of each trunk cable.

## Disadvantages of End-Of-Line wiring:

✘ ***More susceptible to noise and radiated emissions:***

- Any method that does not use a single twisted pair of wires for each door has increased susceptibility to outside interference.

- The switch remains open and the wire can act like an antenna, radiating RF energy from a nearby radio station, conducted energy from nearby power lines, energy from florescent lighting, noise from electrical storms, or any other number of sources. This interference can cause false open and close events to be reported by the multiplexer.

- In addition, each door is connected to the trunk cable at different points, therefore the overall length of each door wire when the switch is open is different. This creates more varied length antennae that can be susceptible to different signals. For example, a nearby radio station may cause three or four doors to report false open/close while the door is open and others will not. It depends on the length of the wire antenna stub and the frequency of the radio station.

- The only way to prevent system interference is to use overall shielded cable, resulting in greater cost of materials. Greater risk for false open/close events:

- Another factors to consider is the overall length of the conductors. End-of-Line can have a higher risk for false open/close events that are *not* caused by noise and radiated emissions. In this example, all the doors have the same length of wire – the full length of the trunk cable. The longer the conductor, the more resistance it has to the flow of current through it, and the greater the voltage lost or dropped along its length.

  Our example only uses a few conductors to carry the common ground all the way to the end of the trunk cable. The typical recommendation is at least four ground cables. These four wires carry the current for 46 doors, so each wire is carrying the current for 12 doors.

The voltage drop across these four wires will be roughly 12 times the voltage drop on each individual door wire.

This results in the voltage at the end of the cable, and at the common connection on each door switch, being greater than the voltage on the common connection of the multiplexer.

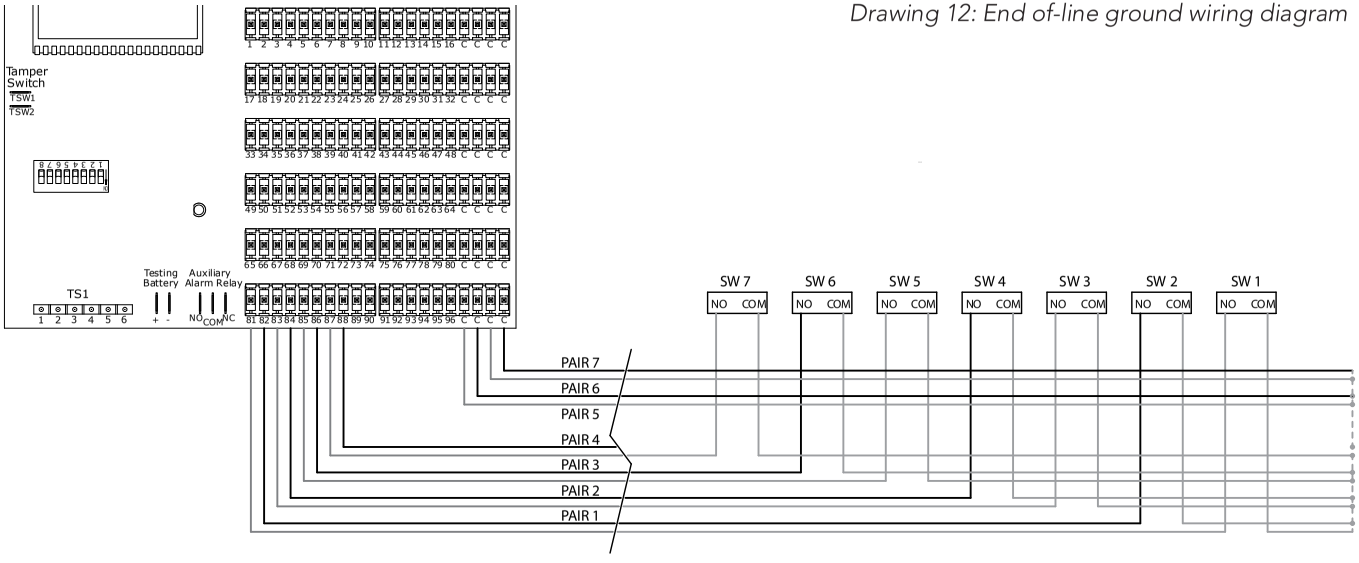
Because the multiplexer reads the voltage at each door switch to determine the state of the door this increased voltage drop in the cable can trigger false door events.

✖ ***Greater risk for install errors:***

- Because each wire is used from beginning to end of the 50-conductor cable, there is a greater risk of a wire getting nicked, scratched, broken, or otherwise stressed which can cause a future failure.

✖ ***More difficulty troubleshooting problems:***

- Because every wire is used in the trunk cable is used from one end to the other, locating and finding any potential problems can become more difficult. If a broken wire is suspected, it must be checked for the full length of the cable not just up to where the door switch attaches.




*Drawing 12: End of-line ground wiring diagram*

## How to Install End-of-Line

1 Run the lead cable from the door switch to the trunk line. Use wire ties to tie a small bundle of wire near the switch for maintenance and service.

2 Use wire ties, every two feet, to tie the wire bundle and lead cable to the wall (or door track) back to the trunk line.

3 Use a small razor knife to cut a two inch slit into the trunk line jacket on the switch side of the door. Be very careful only to cut the jacket and not the conductors underneath.

4 Spread the slit open and use a wire extractor or blunt precision screwdriver and sort through the wires to find the correct wire colors for the signal and ground. See "Mux and Channel List - End-of-line & Running Ground Method" on page 43 of the Appendix for the correct color code order.

5 Use wire cutters to cut the appropriate colored wire. Be sure to cut the line in the center.

- Connect one side of the trunk line wire with **signal wire** from the door switch using a 3M UY2 connector.
- Connect the other side of the trunk line wire to the **ground wire** from the door switch using a 3M UY2 connector. .

6 **The end of the trunk line farthest from the multiplexer must be in a junction box**. Pull at least 12 inches of trunk line into this box to allow extra cable for future servicing.

7 At the junction box end of the line

- Strip back two inches of the outside jacket of the cable.
- Strip one inch back from the insulation on each conductor.

- Solder all of the conductors together, being sure to create a solid electrical connection. It is extremely important that the end-of-line splice be made properly.

- Twist a large wire nut down over the connection and wrap the end in electrical tape.

**This splice must be carefully made and properly soldered for this method to work well.**

8 Test all doors and fix any splices that do not work the doors.

9 Seal the splices and the slit with electrical tape. Any excess door switch lead cable should be secured to the trunk line using a wire tie.

10 At the multiplexer, punch down the door channel wires in color code order at the door channel input points using the XREF as a guide. Connect the two ground wires to any of the ground input points.

11 Note which door channel inputs are connected to which wires and keep a copy for future reference. Use a reference table like the example in "Mux and Channel List - End-of-line & Running Ground Method" on page 43

# Troubleshooting Door Alarms

**Most door alarm issues need to be checked by a trained service technician.**

The following steps can be used for troubleshooting door alarms. Remember to keep a good set of notes as you troubleshoot. These notes can help for comparison to find problems, prevent confusion, and help speed things up if site service by a technician or telephone technical support are required.

1 Determine if the problem with a single door (or alarm input), or with a bank of doors. Secondly, are the units rented? For any rented units, the unit tenants may need to give you site access to the doors.

2 Check the doors in question. Are they loose, possibly moving due to wind or vibration from traffic?

3 Check each multiplexer on the site. The circuit boards, cases, and wiring should be checked for obvious damage (i.e., vandalism, burn marks from power surge/lightning, corrosion on the circuit board, water marks, insects, construction debris, etc.).

4 Check the voltage across the common and channel input points in the multiplexer that correspond to the door in question.

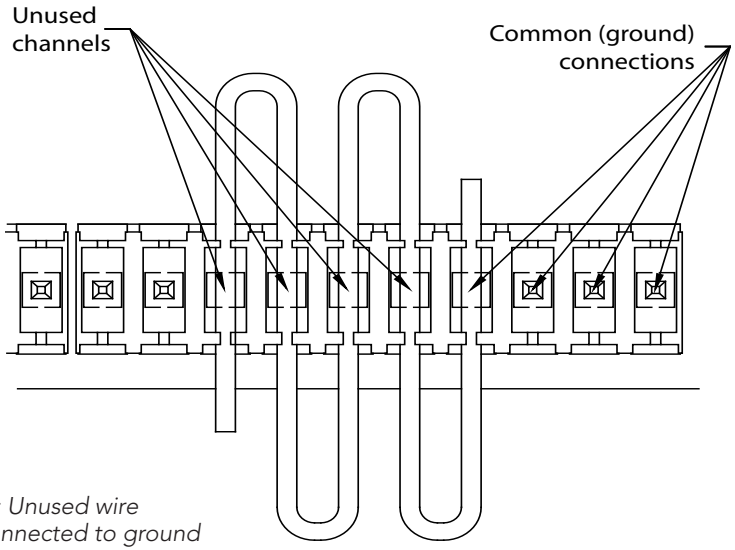
- Voltage with the door closed should be 0 VDC.
- Voltage with the door open should be 4.5 – 5 VDC.

- In case of incorrect readings, remove the punch-terminal block and re-verify incorrect readings at the pins to determine whether the problem is just an improperly punched wire. If it is, repunch the wire using a multiplexer punchdown tool (part # TMUXPDTOOL). Do not use a screwdriver, knife, or other phone system punchdown tool as they will not seat the wire correctly.

- Any other incorrect readings indicate a short in the door contact wiring, loose connection, or ground loop that needs to be investigated and fixed. Depending on the problem rewiring or replacing a door switch may be required.If the problem occurs.

**ALL channels in the multiplexer should be checked because problems with one door or wiring may affect the entire board.**
**All multiplexers on the site should be checked as problems in one unit may cause problems in another.**

- In unused channels, it may help to tie down all unused channels to common ground, as shown in "Drawing 13: Unused wire channels connected to ground" on page 39




*Drawing 13: Unused wire channels connected to ground*

5 Punch down a 24 AWG insulated solid wire through any unused door alarm channels and at least one common ground connection.

6 Connect a length of 24 AWG wire from **pin #5** of the power and data terminal block to one of the four screws that mount the circuit board to the metal case.

The metal case of the multiplexer must also be mounted directly to a grounded metal building or tied to a ground rod or grounded metal structural element of the building such as a metal water pipe or ground rod in accordance with local code.

7 If possible, both ends of the shield/ground wire should be tied to ground.

8 Check that all wire used during installation of the system is correct to PTI Security Systems specifications. 18 AWG shielded wire should be used for power and communications. 24 AWG telephone wire should be used for the door alarms.

9 Check that there are no breaks in the shield, skinned or bare wire, shorts or breaks in the wire, or splices in the wiring (other than those required for the door alarm switches).

In some cases, radio frequency interference (RFI) may also be a problem. All electronic equipment is susceptible to RFI. Radio antennas, military bases, airports, radar, power plants, certain types of lighting, cell phone towers, and communications equipment, are all examples RF generators that can cause interference problems.

PTI's equipment has protection built into it to keep it safe from most RF interference, however, extreme levels of RF interference can cause communications problems.

Humidity, temperature, and cloud cover, as well as broadcasting strength and proximity to the RF source can contribute to the problem.

As a rule, extreme levels of RF will cause the system data communications to go on and off (`data comm on/data comm off`) or cause the system to report scattered false door activity.

In these extreme cases, braided shielded telephone wire and/or RF filters on the door alarm wires may be required in addition to the recommended fixes on page 40.

## Multiple Problems

If there are multiple problems or ongoing issues, perform a full site reset. Frequently, ongoing problems are a sign of wiring issues, either from bad splices, pinched or nicked wires, radio frequency interference, water in conduit, or incorrect wire type. To reset the entire site:

1. At every multiplexer and AI device with door alarm inputs, open the housings and unplug the power and data terminal blocks.

2. Once every device on the site is unplugged, add one device back in to the system at a time.

3. Allow that device to function for an hour and then add in the next device in line.

4. Eventually, a device will be added that causes the problem to manifest. Switch this device with one that has been previously added to verify if the problem exists in the location or in the device.

# Mux and Channel List - End-of-line & Running Ground Method

Site Name:_____ Date _____

Mux # _____ Wire # _____ Number of Doors _____

| Unit Number | Input Channel | Wire Color | | Unit Number | Input Channel | Wire Color |
|---|---|---|---|---|---|---|
| | 1 | White/Blue | | | 49 | White/Blue |
| | 2 | Blue/White | | | 50 | Blue/White |
| | 3 | White/Orange | | | 51 | White/Orange |
| | 4 | Orange/White | | | 52 | Orange/White |
| | 5 | White/Green | | | 53 | White/Green |
| | 6 | Green/White | | | 54 | Green/White |
| | 7 | White/Brown | | | 55 | White/Brown |
| | 8 | Brown/White | | | 56 | Brown/White |
| | 9 | White/Slate | | | 57 | White/Slate |
| | 10 | Slate/White | | | 58 | Slate/White |
| | 11 | Red/Blue | | | 59 | Red/Blue |
| | 12 | Blue/Red | | | 60 | Blue/Red |
| | 13 | Red/Orange | | | 61 | Red/Orange |
| | 14 | Orange/Red | | | 62 | Orange/Red |
| | 15 | Red/Green | | | 63 | Red/Green |
| | 16 | Green/Red | | | 64 | Green/Red |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 16 | Green/Red |  | | 64 | Green/Red |
| | 17 | Red/Brown |  | | 65 | Red/Brown |
| | 18 | Brown/Red |  | | 66 | Brown/Red |
| | 19 | Red/Slate |  | | 67 | Red/Slate |
| | 20 | Slate/Red |  | | 68 | Slate/Red |
| | 21 | Black/Blue |  | | 69 | Black/Blue |
| | 22 | Blue/Black |  | | 70 | Blue/Black |
| | 23 | Black/Orange |  | | 71 | Black/Orange |
| | 24 | Orange/Black |  | | 72 | Orange/Black |
| | Ground | Black/Green |  | | Ground | Black/Green |
| | 25 | Black/Brown |  | | 73 | Black/Brown |
| | 26 | Brown/Black |  | | 74 | Brown/Black |
| | 27 | Black/Slate |  | | 75 | Black/Slate |
| | 28 | Slate/Black |  | | 76 | Slate/Black |
| | 29 | Yellow/Blue |  | | 77 | Yellow/Blue |
| | 30 | Blue/Yellow |  | | 78 | Blue/Yellow |
| | 31 | Yellow/Orange |  | | 79 | Yellow/Orange |
| | 32 | Orange/Yellow |  | | 80 | Orange/Yellow |
| | 33 | Yellow/Green |  | | 81 | Yellow/Green |
| | 34 | Green/Yellow |  | | 82 | Green/Yellow |
| | 35 | Yellow/Brown |  | | 83 | Yellow/Brown |
| | 36 | Brown/Yellow |  | | 84 | Brown/Yellow |

| Unit Number | Input Channel | Wire Color | | Unit Number | Input Channel | Wire Color |
|---|---|---|---|---|---|---|
| | 37 | Yellow/Slate |  | | 85 | Yellow/Slate |
| | 38 | Slate/Yellow |  | | 86 | Slate/Yellow |
| | 39 | Violet/Blue |  | | 87 | Violet/Blue |
| | 40 | Blue/Violet |  | | 88 | Blue/Violet |
| | 41 | Violet/Orange |  | | 89 | Violet/Orange |
| | 42 | Orange/Violet |  | | 90 | Orange/Violet |
| | 43 | Violet/Green |  | | 91 | Violet/Green |
| | 44 | Green/Violet |  | | 92 | Green/Violet |
| | 45 | Violet/Brown |  | | 93 | Violet/Brown |
| | 46 | Brown/Violet |  | | 94 | Brown/Violet |
| | 47 | Violet/Slate |  | | 95 | Violet/Slate |
| | 48 | Slate/Violet |  | | 96 | Slate/Violet |
| | Ground | Green/Black |  | | Ground | Green/Black |

**Color Code Notes:** The first color listed is the broad stripe. The second color listed is the narrow stripe. The first door on any mux should be spliced to the White/Blue, the second door to Blue/White and so on. Most important is that the installer be consistent throughout the site. Leave a few unused conductors in the line and a few unused channels on each mux to allow for future expansion, unit splitting, or service. Use this chart to track the door alarm wiring throughout the site. This will be used to build the alarm file.

# Mux & Channel list - Individual Pair Wiring

Site Name _____ Date _____

Mux # _____ Wire # _____ # of doors _____

| Unit # | Channel | Color | Unit # | Channel | Colore |
|---|---|---|---|---|---|
| | 01 | White/Blue | | 14 | Black/Brown |
| | C | Blue/White | | C | Brown/Black |
| | 02 | White/Orange | | 15 | Black/Slate |
| | C | Orange/White | | C | Slate/Black |
| | 03 | White/Green | | 16 | Yellow/Blue |
| | C | Green/White | | C | Blue/Yellow |
| | 04 | White/Brown | | 17 | Yellow/Orange |
| | C | Brown/White | | C | Orange/Yellow |
| | 05 | White/Slate | | 18 | Yellow/Green |
| | C | Slate/White | | C | Green/Yellow |
| | 06 | Red/Blue | | 19 | Yellow/Brown |
| | C | Blue/Red | | C | Brown/Yellow |
| | 07 | Red/Orange | | 20 | Yellow/Slate |
| | C | Orange/Red | | C | Slate Yellow |
| | 08 | Red/Green | | 21 | Violet/Blue |
| | C | Green/Red | | C | Blue/Violet |
| | 09 | Red/Brown | | 22 | Orange/Violet |
| | C | Brown/Red | | C | Violet/Orange |
| | 10 | Red/Slate | | 23 | Violet/Green |
| | C | Slate/Red | | C | Green/Violet |
| | 11 | Black/Blue | | 24 | Violet/Brown |
| | C | Blue/Black | | C | Brown/Violet |
| | 12 | Black/Orange | | 25 | Violet/Slate |
| | C | Orange/Black | | C | Slate/Violet |
| | 13 | Black/Green | | | |
| | C | Green/Black | | | |

# Warranty & Disclaimer

PTI Security Systems warrants its products and equipment to conform to its own specifications and to be free from defects in materials and workmanship, under normal use and service, for a period of one year from the date of shipment. Within the warranty period, PTI Security Systems will repair or replace, at its option, all or any part of the warranted product which fails due to materials and/or workmanship. PTI Security Systems will not be responsible for the dismantling and/or re-installation charges. To utilize this warranty, the customer must be given a Return Materials Authorization (RMA) number by PTI Security Systems. The customer must pay all shipping costs for returning the product.

This warranty does not apply in cases of improper installation, misuse, failure to follow the installation and operating instructions, alteration, abuse, accident, tampering, natural events (lightning, flooding, storms, etc.), and repair by anyone other than PTI Security Systems.

This warranty is exclusive and in lieu of all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. PTI Security Systems will not be liable to anyone for any consequential or incidental damages for breach of this warranty or any other warranties.

This warranty will not be modified or varied. PTI Security Systems does not authorize any person to act on its behalf to modify or vary this warranty. This warranty applies to PTI Security Systems products only. All other products, accessories, or attachments used in conjunction with our equipment, including batteries, will be covered solely by their own warranty, if any. PTI Security Systems will not be liable for any direct, incidental, or consequential damage or loss whatsoever, caused by the malfunction of product due to products, accessories, or attachments of other manufacturers, including batteries, used in conjunction with our products. This warranty does not cover the replacement of batteries that are used to power PTI Security Systems products.

The customer recognizes that a properly installed and maintained security system may only reduce the risk of events such as burglary, robbery, personal injury, and fire. It does not ensure or guarantee that there will be no death, personal damage, and/or damage to property as a result. PTI Security Systems does not claim that the Product may not be compromised and/or circumvented, or that the Product will prevent any death, personal and/or bodily injury and/or damage to property resulting from burglary, robbery, fire, or otherwise, or that the Product will in all cases provide adequate warning or protection.

PTI Security Systems products should only be installed by qualified installers. The customer is responsible for verifying the qualifications of the selected installer.

PTI Security Systems shall have no liability for any death, injury, or damage, however incurred, based on a claim that PTI Security Systems Products failed to function. However, if PTI Security Systems is held liable, directly or indirectly, for any loss or damage arising under this limited warranty or otherwise, PTI Security Systems's maximum liability will not in any case exceed the purchase price of the Product, which will be fixed as liquidated damages and not as a penalty, and will be the complete and exclusive remedy against PTI Security Systems

Warning: The User should follow all installation, operation, and maintenance instructions. The User is strongly advised to conduct Product and systems test at least once each week. Changes in environmental conditions, electric or electronic disruptions, and tampering may cause the Product to not perform as expected.

Warning: PTI Security Systems warrants its Product to the User. The User is responsible for exercising all due prudence and taking necessary precautions for the safety and protection of lives and property wherever PTI Security Systems Products are installed. PTI Security Systems does not authorize the use of its Products in applications affecting life safety.

Notice. Some PTI Security Systems products use 900Mhz wireless technology. Other devices at the site such as cordless telephones or alarm components may cause interference that will disrupt the operation of the system or may be interfered with by the system. PTI Security Systems assumes no liability for any problems caused by interference. It is the sole responsibility of the user to identify and correct such problems.

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