Tech Note For Homeworks Devices

Total Protection Solutions

Lightning/Surge Protection for HomeWorks® Devices

Overview

Lightning strikes may cause permanent damage to household electrical equipment, including HomeWorks System components. Lightning strike-damaged equipment is not covered by Lutron's Warranty and should be reported to the homeowner's insurance company.

All *HomeWorks* products are designed with integrated surge suppression devices. Section 8.6.3 of IEEE Std.1100-2005, Recommended Practice for Powering and Grounding Electronic Equipment, recommends that service entrance electrical panels be equipped with effective Category C surge protection units. The Lutron integrated suppression should be effective for preventing damage in most installations. Despite this fact, high-risk homes that are located in lightning-prone locations may experience surge levels that are capable of damaging *HomeWorks* devices, particularly in the case of a direct lightning strike on the property. Areas of the country with dirty and unreliable power from the utility company should also be considered high risk areas. Accordingly, both Total Protection Solutions and IEEE recommend surge protection units for upstream breaker panels. (For additional information on lightning-prone areas of the U.S. and abroad, see the maps at the end of this application note.) Although this type of damage is typically covered by Homeowner's insurance (less any deductible), there is inconvenience involved in getting equipment replaced and/or having non-functional products. Many installers and homeowners are interested in adding additional protection hardware to their systems to minimize the risk of this sort of disruption. This application note was written to address these interests.

The devices recommended in this document are the most rugged and cost-effective protection devices available. Although installing these devices will provide an added degree of protection, in the most extreme circumstances damage is still a possibility. The likelihood of damage occurring will be greatly reduced when surge protectors are used.

Recommendations

Installation Based Recommendations

- Protect all electrical breaker panels feeding *Homeworks* and shade processors, and additionally protect all electrical panels feeding dimming panels. A panel mounted surge suppression unit with enhanced filtering will protect equipment from catastrophic events, clean the power, and suppress internally generated transients that can lockup electronics, necessitate reprogramming of controls, and gradually deteriorate sensitive electronics. See Section 3.4.3, IEEE Std.1100-2005.

- Protect all RS232 ports with permanently connected third party equipment (typically other processors that are part of integration systems). The processor's RS232 port provides a vital connection with third party equipment. Without this link, system integration will be lost. While RS232 communication wire runs are themselves short, all of the equipment and wire runs that are connected to the third-party equipment provide an electrical path to conduct damaging surges. Damage most often occurs because the ground referencing between the two systems can become separated during a surge. This creates high voltages that damage the RS232 ports, and is the most common type of port failure.

Recommendations—continued

Installation Based Recommendations - continued

- Protect any link or bus that travels between buildings regardless of geographical location. Damage may occur because the ground referencing between buildings can become separated during a lightning strike. Consideration should be given to using fiber optic communication between buildings in extremely high-risk applications. Using fiber cable breaks the electrical connection (by using light rather than current carrying conductors) and will minimize damage if one building gets struck. Refer to "RS485 Communication Using Fiber Optics Modem FAQ" on the *HomeWorks* Resource Website.

- Protect Links/Busses that have wire runs over 500' long even if they are contained within a single building. A long wire run is susceptible to high levels of capacitively coupled surge energy as it travels along side other wires and through the buildings' structure and mechanicals.

Geographical Based Recommendations

Refer to the lightning strike maps at the end of this document.

- Protect all breaker panels feeding lighting system from internal and external surges.
- Protect 120 circuits leaving dimming modules going outside (such as to landscape lighting) in areas that are determined to be at high risk, such as those at high elevations, and those in close proximity to water..
- Protect all links/busses for installations in orange and red areas. In the US, for example, this would include Florida, the Southeast, and portions of the Midwest.
- Protect all links/busses for installations in areas that are determined to be at high risk, such as those at high elevations, and those in close proximity to water.

* Note: The lightning strike maps in this application note are best viewed in color. Please view on computer or print out in color.

Breaker Panel Protection

The following surge protection equipment may be used to protect the *HomeWorks* processors in addition to lighting panels and all dimming and graphic eye controls. The following suppression unit will protect the electrical system from external transients entering the system through the power lines. The filtering part of the unit will clean the power, and suppress internally generated transients that can lockup electronics, necessitate reprogramming of controls, and gradually deteriorate sensitive electronics. See Section 3.4.3, IEEE Std.1100-2005.

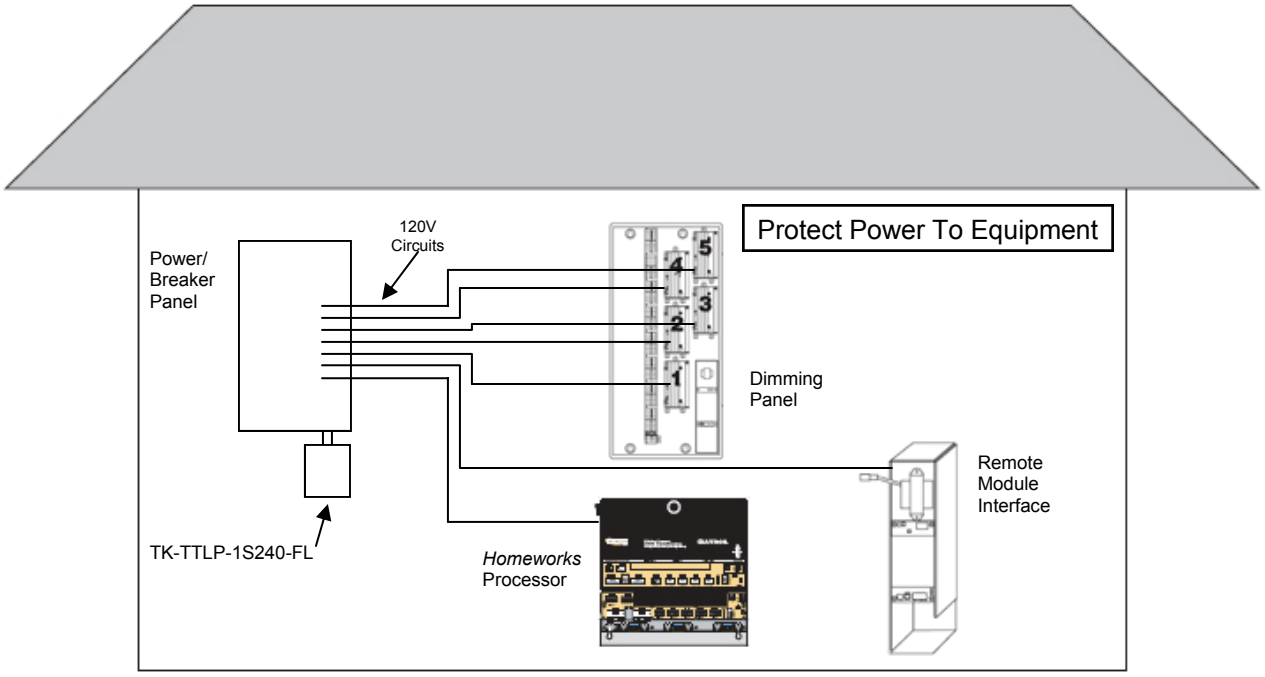
Breaker Panel Protection
Manufacturer: Total Protection Solutions, LLC.
Model Number: TK-TTLP-1S240-FL

Photograph courtesy of
Total Protection Solutions, LLC.

Breaker Panel - Equipment Placement

Example 1- Connection to breaker panel.

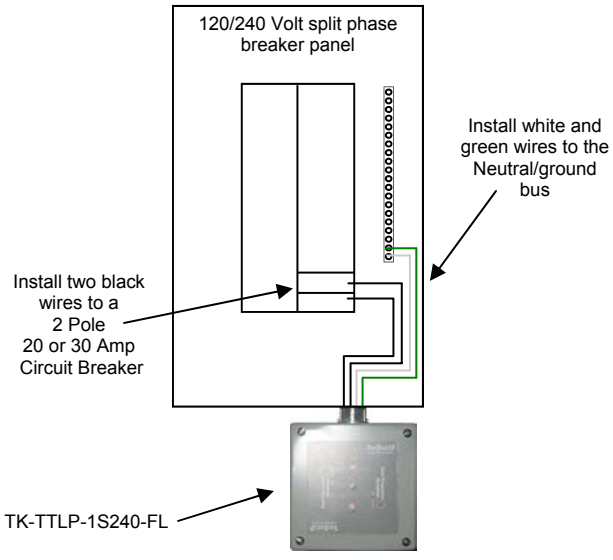
Locate and install one TK-TTLP-1S240-FL at each breaker panel feeding Homeworks processors, dimming modules and remote monitoring interface.



Breaker Panel - Wiring Detail

Installation Based Recommendations

• Install on all breaker panels powering Lutron equipment.



Photograph courtesy of
Total Protection Solutions, LLC.

Photograph courtesy of
Total Protection Solutions, LLC.

Total Protection Solutions
Lightning/Surge Protection for ***HomeWorks*** Devices - ***continued***

Dimming Module Protection

The following surge protection equipment may be used to protect dimming modules. The suppression unit will protect the electrical system from external transients entering the system from the load side of the dimming modules (such as landscape lighting) and destroying the dimming modules.

Module Protection
Manufacturer: Total Protection Solutions, LLC.
Model Number: TK-LT120-15A-DIN2 (For 15 Amp Max Circuits)
Model Number: TK-LT120-20A-DIN2 (For 20 Amp Max Circuits)

Model Numbers:
TK-LT120-15A-DIN2

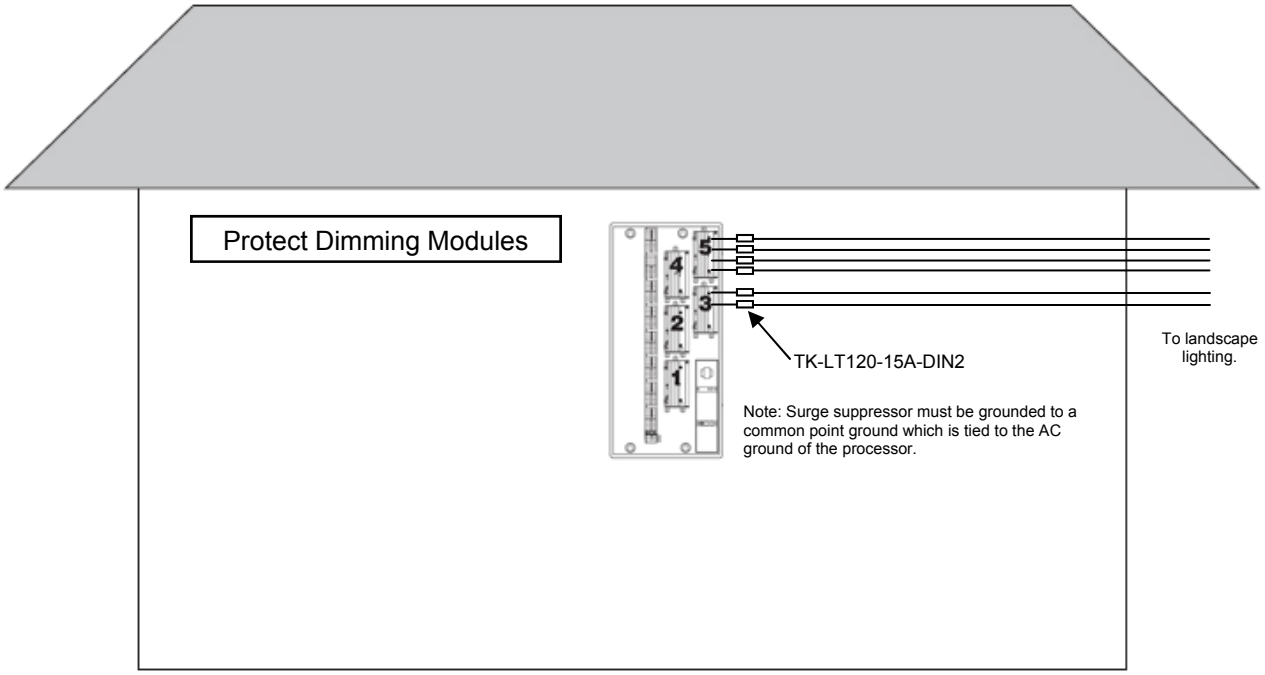
Photograph courtesy of
Total Protection Solutions, LLC.

Model Numbers:
TK-LT120-20A-DIN2

Photograph courtesy of
Total Protection Solutions, LLC.

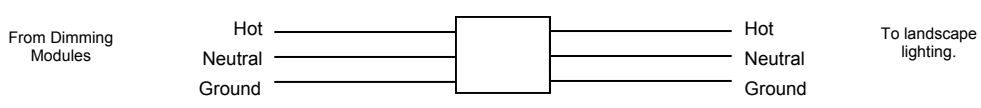
Dimming Module - Equipment Placement

Example 2- Connection to 120 volt landscape lighting.



Dimming Module - Wiring Detail

Installation Based Recommendations



RS232 Protection

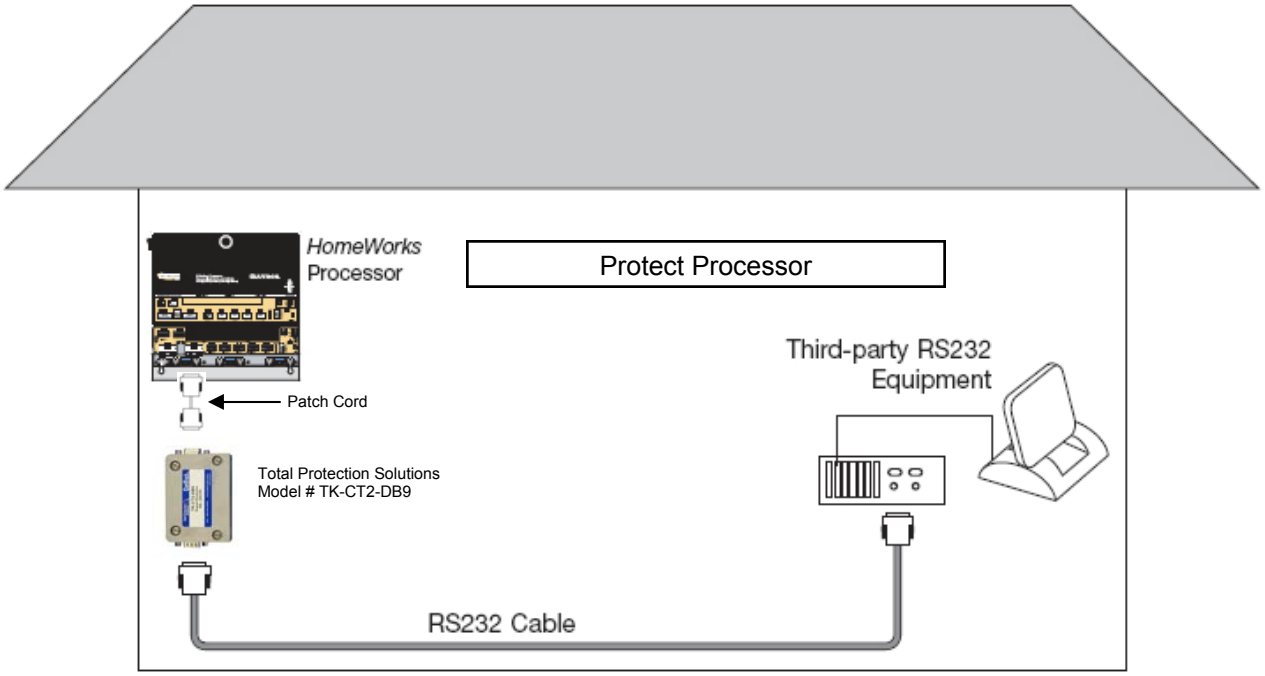
The following surge protection equipment may be used to protect the *HomeWorks* RS232 ports (links 3 & 7):

RS232 Surge Protection
Manufacturer: Total Protection Solutions, LLC.
Model Number: TK-CT2-DB9
Website: www.SurgePack.com

Photograph courtesy of
Total Protection Solutions, LLC.

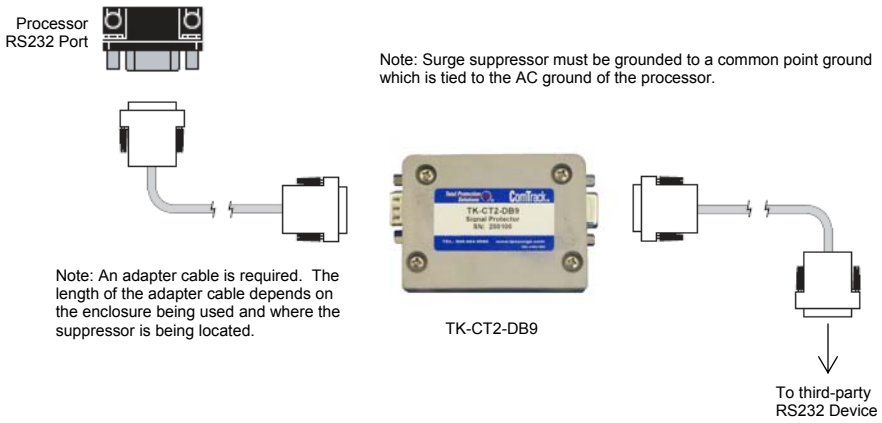
RS232 Equipment Placement

Example 2 - Connection to third-party RS232 equipment



RS232 Component Wiring Detail

DD9-24V with third-party RS232 equipment



RS485 Protection

The following surge protection equipment may be used to protect the *HomeWorks* RS485 links:

- Module Interface Link (Link 1)
- Inter-Processor Link (Link 2)
- Configurable Links (Link4/5/6):
  - Dimmer/Shad Interface Link
  - GRAFIK Eye® Link
  - Keypad Link
- Configurable/Hybrid Repeater Link (Link 8):

RS485 Surge Protection
Manufacturer: Total Protection Solutions, LLC.
Model Number: TK-CT2-LIT24
Model Number: TK-CT2-LIT12
Model Number: TK-CT2-LIT4
Website: www.SurgePack.com

Note: 24-Terminal (12-pair), 12-terminal (6-pair) and 4-terminal (2-pair) devices are available. Choose model based on the number of links and dimming busses to be protected. Same unit can be used for both dimming busses and links.

Model Numbers:
TK-CT2-LIT24 (12 pair)

Photograph courtesy of
Total Protection Solutions, LLC.

Model Numbers:
TK-CT2-LIT12 (6 pair)

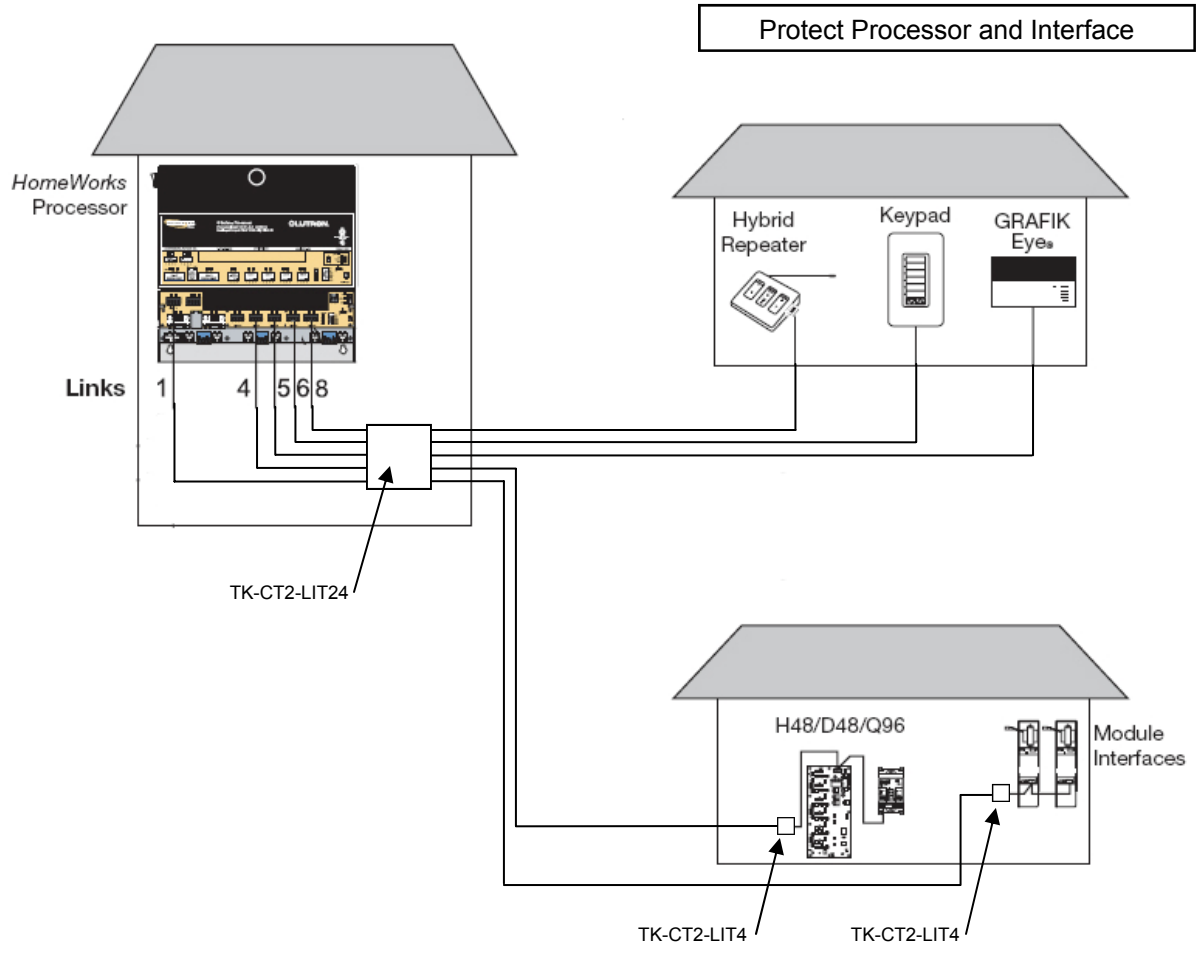
Photograph courtesy of
Total Protection Solutions, LLC.

Model Numbers:
TK-CT2-LIT4 (2 pair)

Photograph courtesy of
Total Protection Solutions, LLC.

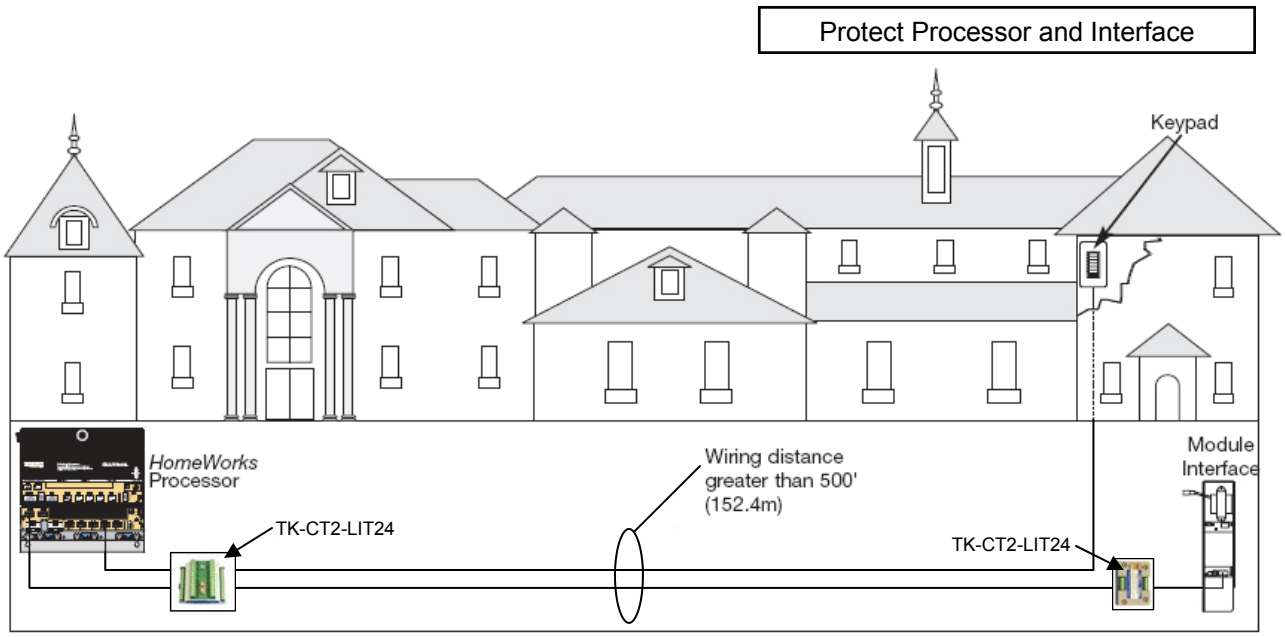
RS485 Equipment Placement

Example 3 - HomeWorks systems with low-voltage wire runs outside or between buildings



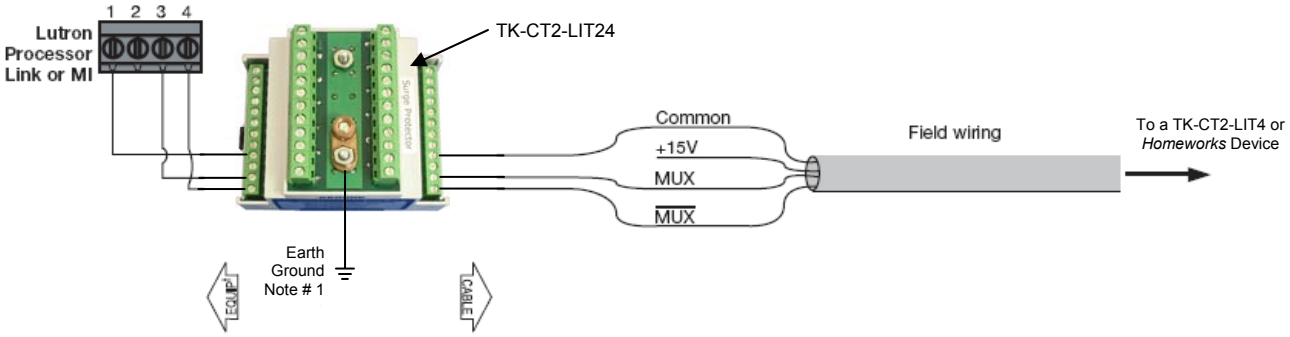
RS485 Equipment Placement - continued

Example 3—System components that are wired greater than 500’ (152.4m) from the processor:

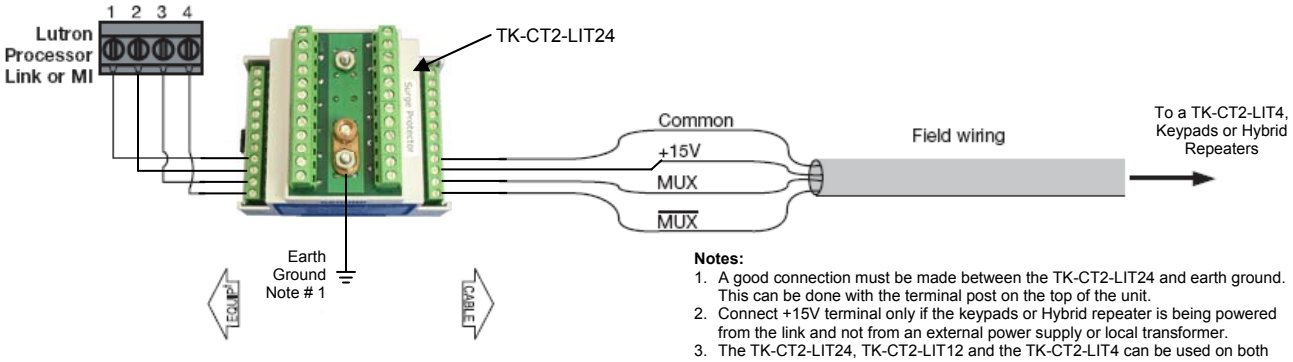


RS485 Component Wiring Detail

Total Protection Solutions TK-CT2-LIT24 with Inter-Processor Link, Module Interface Link, GRAFIK Eye® Link, Shade Interface, Dimmer Interface not powered by Processor



Total Protection Solutions TK-CT2-LIT24 with Keypad Link, Hybrid Repeater Link



Notes:

1. A good connection must be made between the TK-CT2-LIT24 and earth ground. This can be done with the terminal post on the top of the unit.
2. Connect +15V terminal only if the keypads or Hybrid repeater is being powered from the link and not from an external power supply or local transformer.
3. The TK-CT2-LIT24, TK-CT2-LIT12 and the TK-CT2-LIT4 can be used on both Dimming busses and RS485 links.

H48/D48 Interface Protection

The following surge protection equipment may be used to protect the *HomeWorks* H48/D48 Interface Dimmer busses:

RS485 Surge Protection
Manufacturer: Total Protection Solutions, LLC.
Model Number: TK-CT2-LIT24
Model Number: TK-CT2-LIT12
Website: www.SurgePack.com

Note: 24-Terminal (12-pair) and 12-terminal (6-pair) devices are available. Choose model based on the total number of busses and links to be protected. Same unit can be used for both links and dimming busses.

Model Numbers:
TK-CT2-LIT24 (12 pair)

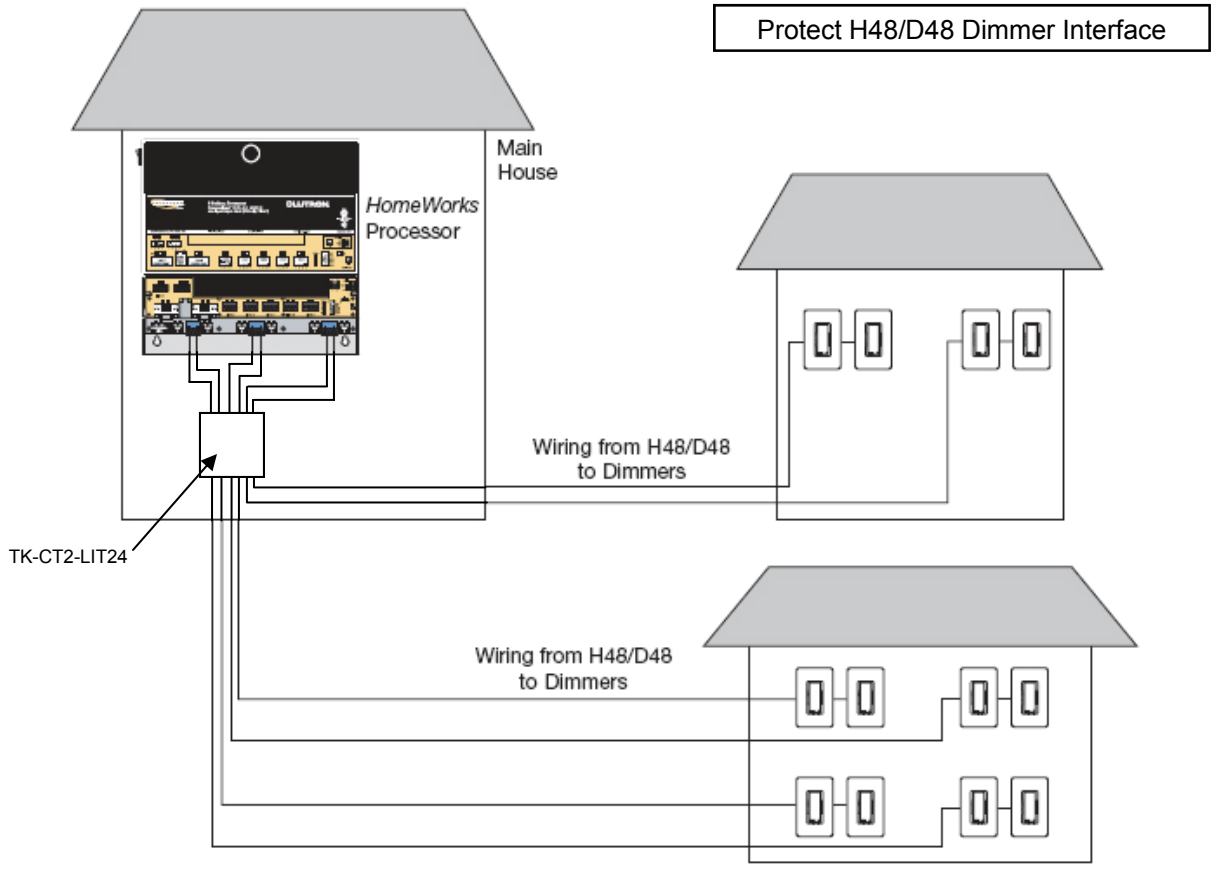
Photograph courtesy of
Total Protection Solutions, LLC.

Model Numbers:
TK-CT2-LIT12 (6 pair)

Photograph courtesy of
Total Protection Solutions, LLC.

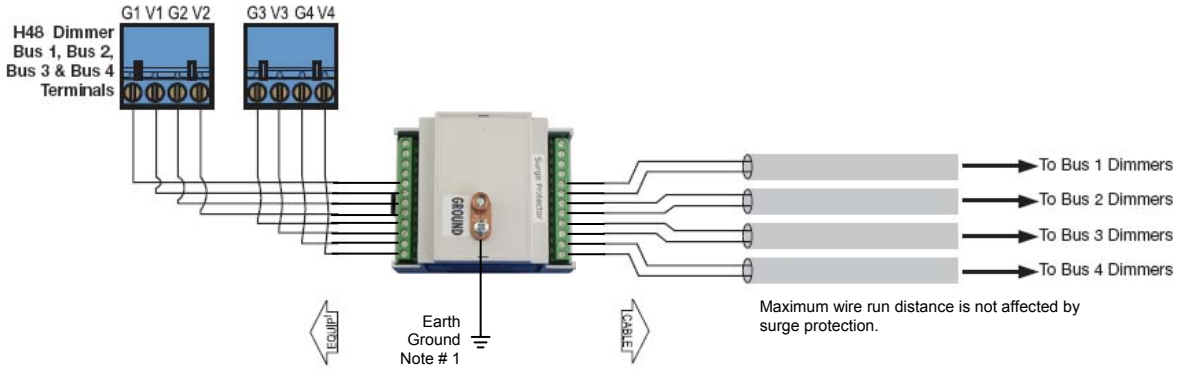
RS485 Equipment Placement

Example 3 - HomeWorks systems with low-voltage wire runs outside or between buildings

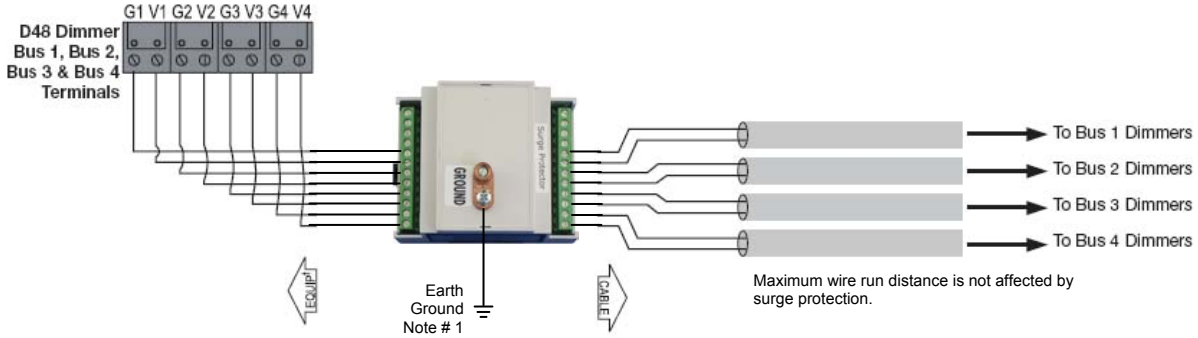


H48/D48 Component Wiring Detail

Total Protection Solutions TK-CT2-LIT12 with H48 Dimmer Busses



Total Protection Solutions TK-CT2-LIT12 with Keypad Link, Hybrid Repeater Link

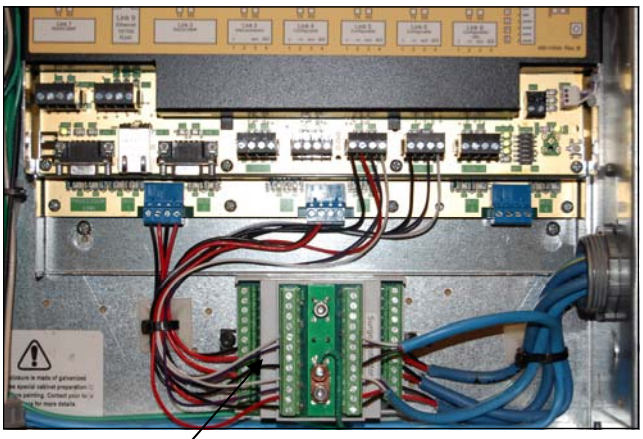


Notes:
1. A good connection must be made between the TK-CT2-LIT12 and earth ground. This can be done with the terminal post on the top of the unit.
2. To protect an entire H48 Interface use (1) TK-CT2-LIT12 or use TK-CT2-LIT24 for both dimming busses and RS485 links.
3. To protect an entire D48 Interface use (1) TK-CT2-LIT24 or use (2) TK-CT2-LIT12.
4. The TK-CT2-LIT24, TK-CT2-LIT12 and the TK-CT2-LIT4 can be used on both Dimming busses and RS485 links.

Combination H48/D48 & RS485 Component Wiring Detail

Total Protection Solutions TK-CT2-LIT24 with Inter-Processor Link, Module Interface Link, GRAFIK Eye® Link, Shade Interface, Dimmer Interface, Keypad Link & Hybrid Repeater Link

Install Note: The TK-CT2-LIT24, TK-CT2-LIT12 and the TK-CT2-LIT4 can be used on both Dimming busses and RS485 links.



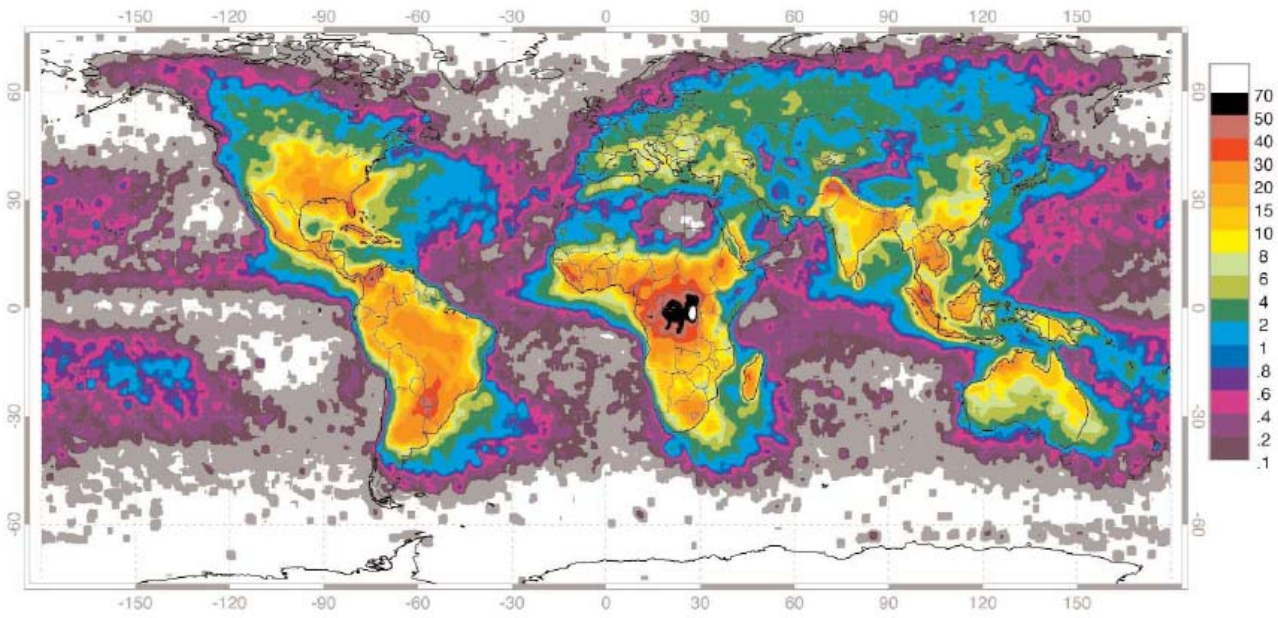
Lightning Strike Information

Lighting Protection Resources:

National Lightning Safety Institute
www.lightningsafety.com

Lightning Protection Institute
www.lightning.org

Global lightning distribution map

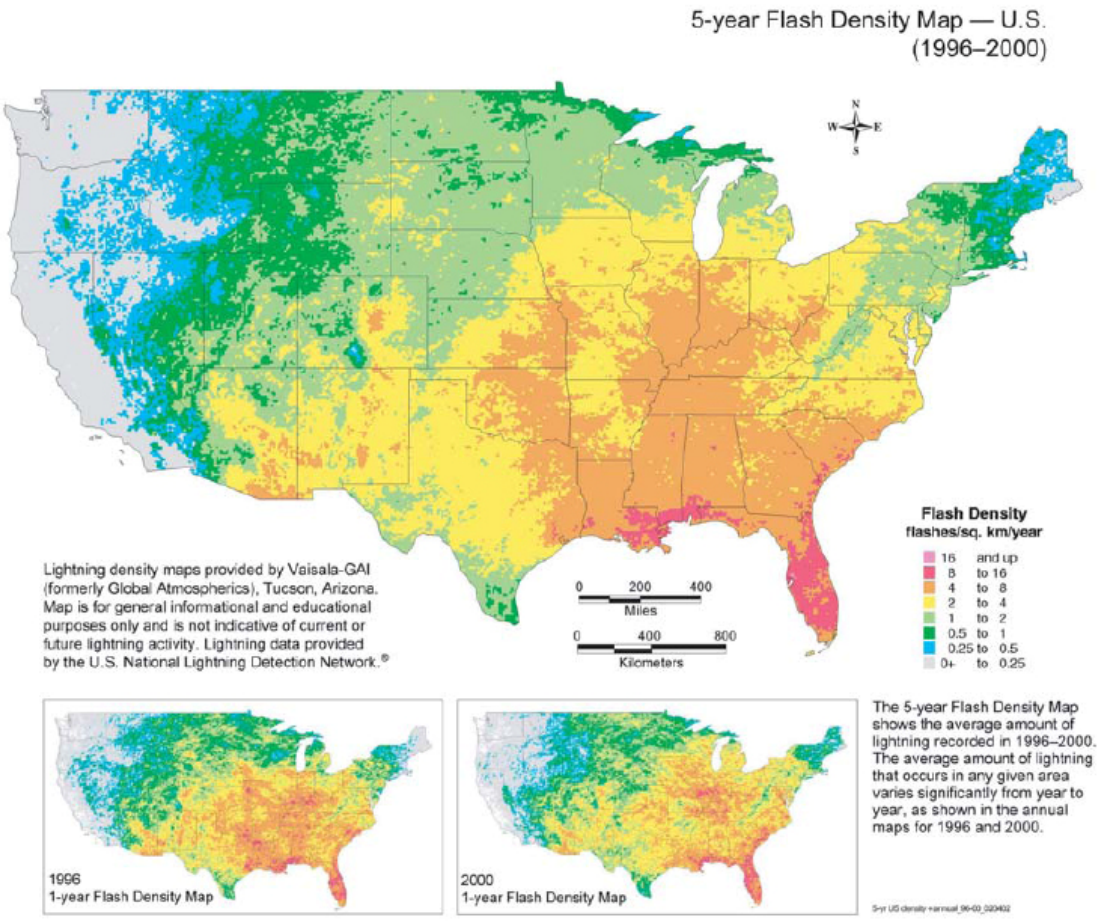


Low Resolution Full Climatology Annual Flash Rate

Global distribution of lightning April 1995 - February 2003 from the combined Observations of the NASA OTD (4/95-3/00) and LIS (1/98-2/03) instruments.

Lightning Strike Information - continued

U.S. lightning distribution map



Additional Information

Total Protection Solutions, LLC.
4366 L.B. McLeod, FL 32811
Phone: +1.800.836.2305
Fax: +1.717.436.8675
Web: www.TPSsurge.com
Sales Email: sales@TPSsurge.com
Technical Support Email: support@TPSsurge.com

Parts List

Breaker Panel Protection

TK-TTLP-1S240-FL	Unlimited Amperage

Module Protection

TK-LT120-20A-DIN2	Max 20 Amp Circuit
TK-LT120-15A-DIN2	Max 15 Amp Circuit

RS485 & H48/D48 Dimmer Interface Protection

TK-CT2-LIT24	24 Wire (12 pair)
TK-CT2-LIT12	12 Wire (6 pair)
TK-CT2-LIT4	4 Wire (2 pair)

RS232 Protection

TK-CT2-DB9	RS232 DB9 Connection