Surge and Lightning Protection

Electro-magnetic-pulses (EMP) originate from lightning strikes (LEMP) or from nuclear explosions (NEMP). These fast rising electrical fields induce high voltage pulses in unprotected coaxial cables, antennas, data communication cables, or power cables from where they can be directly transmitted to the input of electronic equipment.

Lightning protection is essential for permanent station implementation, and proper system grounding is essential for any lightning protection to work. UNAVCO provides a grounding terminal in its enclosure design that, when connected to an 8 foot grounding rod, provides protection for permanent station equipment.

N-type Surge Arrester

UNAVCO recommends replacing standard bulkhead connectors for modems (radio or cellular) with protected connectors on all permanent station enclosures. This in-line lightning protection helps isolate the equipment in the enclosure by shunting power surges to ground. Proper system grounding is essential for this protection to work.

UNAVCO has tested EMP protectors for use with GPS antenna cables to ensure data quality. See the [Effects of LEMP Protection on GPS Signals test report](#) for detailed information.

The following table lists the items needed to replace a single bulkhead connector.

<table>
<thead>
<tr>
<th>Items</th>
<th>Manufacturer/Vendor</th>
<th>Part No.</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMP Protector</td>
<td>HUBER+SUHNER, Inc.</td>
<td>3402.17.K</td>
<td>See table below.</td>
</tr>
<tr>
<td>Surge Arrester (N-type)</td>
<td>One Allen Martin Dr.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P.O. Box 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Essex, VT 05451</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(802) 878-0555</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surge Arrester Capsule</td>
<td>HUBER+SUHNER, Inc.</td>
<td>73 Z-0-0-48</td>
<td></td>
</tr>
<tr>
<td>(gas filled)</td>
<td>One Allen Martin Dr.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P.O. Box 400</td>
<td></td>
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<td></td>
<td>(802) 878-0555</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6” of Encapsulating Shrink Tube</td>
<td>Alpha / Newark Electronics</td>
<td>FIT-750-1-1/2 (1.5” dim)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(800) 463-9275</td>
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</tbody>
</table>

The following table shows the bulkhead connector specifications. To see an image enlarged, right-click and select ‘View Image.’

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Series 3402.17.K EMP Protector" /></td>
<td><img src="image" alt="Surge Arrester Capsule (for use with 3402.17.K EMP Protector)" /></td>
</tr>
</tbody>
</table>

Definitions for the Surge Arrester Capsule table specs

Outline Drawing of the 3402.17.K EMP Protector in mm

Mounting Hole Dimensions in mm

![Mounting Hole Dimensions in mm](image)

Note: Mounted properly the surge arrester capsule will be up.
Installation Instructions

Grounded Enclosure

1. Turn off modem and disconnect modem cables from bulkhead connector.
2. Remove bulkhead connector.
3. Insert EMP protector with nut on the inside of the enclosure (make sure that the star washer makes good contact, i.e., electrical continuity, with the enclosure).
4. Slide shrink tube over the antenna cable end. (Alternatively, use self-sticking rubber tape or other weatherproof sealant when finished.)
5. Connect antenna cable and the modem's pigtail to the EMP protector.
6. Slide shrink tube over the area where the antenna cable and EMP Protector meet, covering the EMP Protector and the antenna cable end completely.
7. Heat the shrink tube to seal (encapsulate) the connection.

Non-Grounded Enclosure

- See installation diagram:

Serial Port Protectors

UNAVCO recommends using surge protection for RS232 data connections to protect / isolate equipment from power fluctuations, spikes, induced transient and other surges, or nearby lightning strikes.

The following table lists the recommended item needed to protect data connections.

<table>
<thead>
<tr>
<th>Items</th>
<th>Manufacturer/Vendor</th>
<th>Part No.</th>
<th>Specifications</th>
</tr>
</thead>
</table>
| RS232 Surge Protector | Black Box Corporation | SP361A-R2  | ✦ Protects all 9 wires  
|                 | P.O. Box 12800              |            | ✦ Connectors: DB9 (M) and DB9 (F)  
|                 | Pittsburgh, PA 15241        |            | ✦ Clamp Voltage: 18V                |

Solar Array Protection

UNAVCO recommends using low voltage-high current DC lightning arrestors to protect/isolate solar powered equipment from nearby lightning strikes.

The following table lists the recommended item needed to protect solar powered equipment.

<table>
<thead>
<tr>
<th>Items</th>
<th>Manufacturer/Vendor</th>
<th>Part No.</th>
<th>Specifications</th>
</tr>
</thead>
</table>
| DC Lightning Arrester | RMS Electric Inc.   | LA 302 DC  | ✦ Type: Silicon Oxide Varistor  
|                 | 2560 28th Street             |            | ✦ Clamp Voltage: 100V                                   
|                 | Donna                        |            | ✦ Max. Current: 50,000 Amps                            
|                 |                               |            | ✦ Max. Energy: 750 Joules                              
|                 |                               |            | ✦ Number of Surges: Unlimited                          
|                 |                               |            | ✦ Response time: Clamps 10,000 Amps in 10 ns           
|                 |                               |            | ✦ Common Mode and Differential Protection               
|                 |                               |            | ✦ For negative, positive and floating ground systems    |
Phone Line / Telecommunications

UNAVCO recommends using lightning sponges to protect/isolate telecommunication equipment from nearby lightning strikes. The following table lists the recommended item needed to protect telecommunications equipment.

<table>
<thead>
<tr>
<th>Items</th>
<th>Manufacturer/Vendor</th>
<th>Part No.</th>
<th>Specifications</th>
</tr>
</thead>
</table>
| Lightning Sponge    | Telebyte Technology, Inc | 22PX (discontinued) | - Signals Protected: Two, Tip & Ring
- Stages of Protection: 3, including gas tubes, avalanche diodes and MOV thyristors
- Maximum Output Voltage: 180 Volts
- Power Per Signal: 500 Watts
- Reaction Time: Less than 5 ns
- Line Connectors: RJ-11
- Ground Connector: #4 screw
- Mounting: Screw
- Size: 4.5"W (114mm) x 1.8"D (46mm) x 1.5"H (38mm)
- Environment: 0°C to 50°C, 0% to 95% RH. |

AC Power Surge Protection

UNAVCO uses the following Uninterruptable Power Supplies at Permanent GPS Stations

- Back UPS Pro 280 - United States
  Part No. 30723 - Manufacturer APC - Mfr. Part No. BP280S - Price: $110.00
  (discontinued)
- International Back UPS Pro 280

Power Monitoring Software

- PowerAlert Software and How to configure PowerAlert on Linux with the APC BackUPS Pro 280V

Posted by: Beth Bartel - Tue, Aug 17, 2010 at 1:44 PM. This article has been viewed 47683 times.

Online URL: https://kb.unavco.org/kb/article/power-surge-and-lightning-protection-462.html