



EION Inc.
320 March Road, Suite 500
Ottawa, ON Canada
K2K 2E3

Lightning Protection Recommendation for EION Radio Products

Application Note Part Number: 5700-0050-00-AN (Revision 2)

Includes products LibraPlus, Ultima 3, VIP and Libra MAX.

Introduction

What is Lightning Protection?

All outdoor electronic equipment is susceptible to lightning damage whether it occurs from a direct hit or near hit. Providing the proper selection of suppression devices coupled with proper bonding and grounding (as per National and Local Electrical codes) will prevent dangerous levels of voltage and current from damaging electronic equipment. Proper Lightning protection is also necessary to prevent injury to personnel in occupied buildings.

What lightning protection is built-in the EION equipment?

All EION equipment has built-in lightning protection on both the power supply lines and the Ethernet lines. The use of TVS diodes provide protection to the IEC 61000-4-5 standard. EION Inc. uses well-design practices incorporating these devices in the EION products.

Why is additional protection recommended?

Lightning, even with the built-in protection, can still damage outdoor EION equipment. This can occur for any number of reasons such as an improperly grounded installation, or if the amount of transient energy from nearby lightning exceeds what the devices can handle.

Lightning Protection Recommendation	P/N 5700-0050-00-AN	Page 1 of 16	10/1/2008
-------------------------------------	---------------------	--------------	-----------



EION Inc.
320 March Road, Suite 500
Ottawa, ON Canada
K2K 2E3

Recommendation

Warning

The following information is provided as a general guideline for the proper protection of people and equipment, however the user is responsible to ensure that National and Local building and electrical codes are adhered to.

All outdoor equipment including cables is susceptible to direct or indirect lightning strike and the induced current may follow the path of any cable to either end in order to connect to a ground. Human safety requires the control of the lightning current to be blocked before entering any building occupied by people. Similarly the outdoor radio equipment will need to be protected to minimize downtime including costs associated with equipment repair, removal and installation costs and system downtime losses.

This recommendation describes the procedure for placing Ethernet CAT5 protection devices at the entrance to the building and as close to possible to the radio equipment. The protection devices when properly installed will divert the built up electrical current to a ground connection.

The combination of proper installation of the protection devices, proper use of shield of the cable and a proper ground connection all work together to maximize human safety and maximize system up time. An additional benefit to proper bonding, grounding and proper use of shields will reduce interference and data errors.

This recommendation also includes procedures for adding IF and RF protection devices on coaxial cables for the EION products that use external non-integrated antennas or RF outdoor units connected via IF cables to an Indoor unit.

Shielding (CAT5 – Ethernet Cable)

Shielding of the CAT5 cable is very important and must be done correctly. Benefits include the reduction of data errors caused by nearby interference. It is very important that the shield be connected only at one end of the cable. This is required to eliminate ground loops whereby current flows between the indoor equipment and outdoor unit because they may have a different ground level connections. Such currents can damage equipment at either end or induce noise that will interfere with the user traffic on the cable. This should be avoided by ensuring that shielded connectors are only installed at the end which connects into the building via the Huber-Suhner Data Line Protector (EION PN 1220-0042). The other end of the CAT 5 cable will connect into the Transtector device (EION PN 1220-0041) where the shield is not connected. The shielded Ethernet Cable (PN 6010-142X) is available from EION.

Lightning Protection Recommendation	P/N 5700-0050-00-AN	Page 2 of 16	10/1/2008
-------------------------------------	---------------------	--------------	-----------



EION Inc.
320 March Road, Suite 500
Ottawa, ON Canada
K2K 2E3

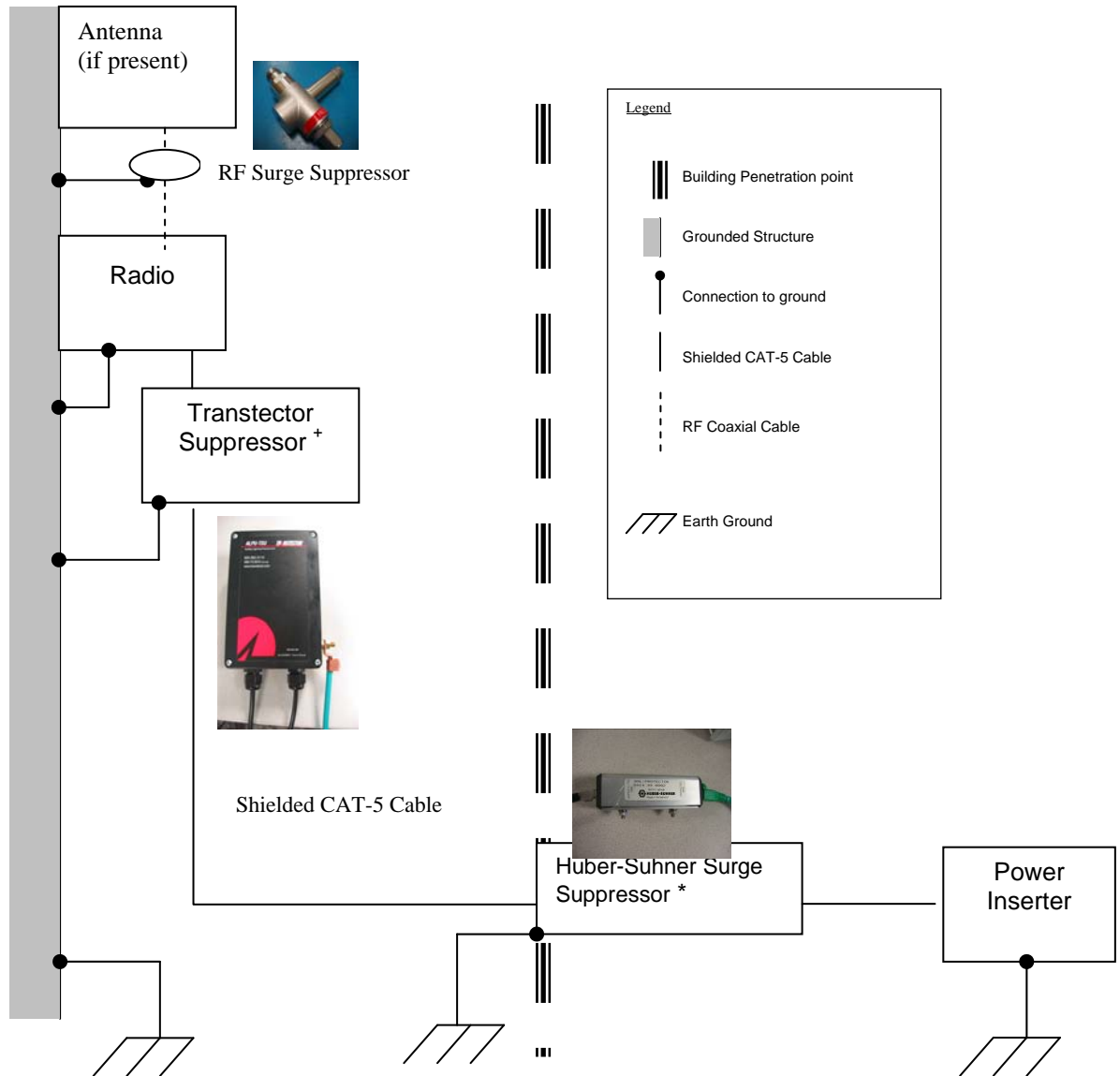
Grounding (Outdoor Equipment)

For the protection devices to work correctly they require a low impedance path to Earth Ground. For the Transtector device (closest the radio equipment) a good ground point near the device is required, this could be the metal (unpainted) tower, connection to metal structure of the building or when no ground point is available then a ground riser (copper cable with a minimum size of 6 gauge) must be provided to earth ground via a ground rod or ground plate (as per applicable electrical code). On this ground riser the ground cable from the Transtector, RF Surge suppressor (radios with non-integrated antennas) and a ground from the chassis of the radio must be properly bonded. Ground lugs on the radios are described in EION Application Note (5700-0049-00-AN).

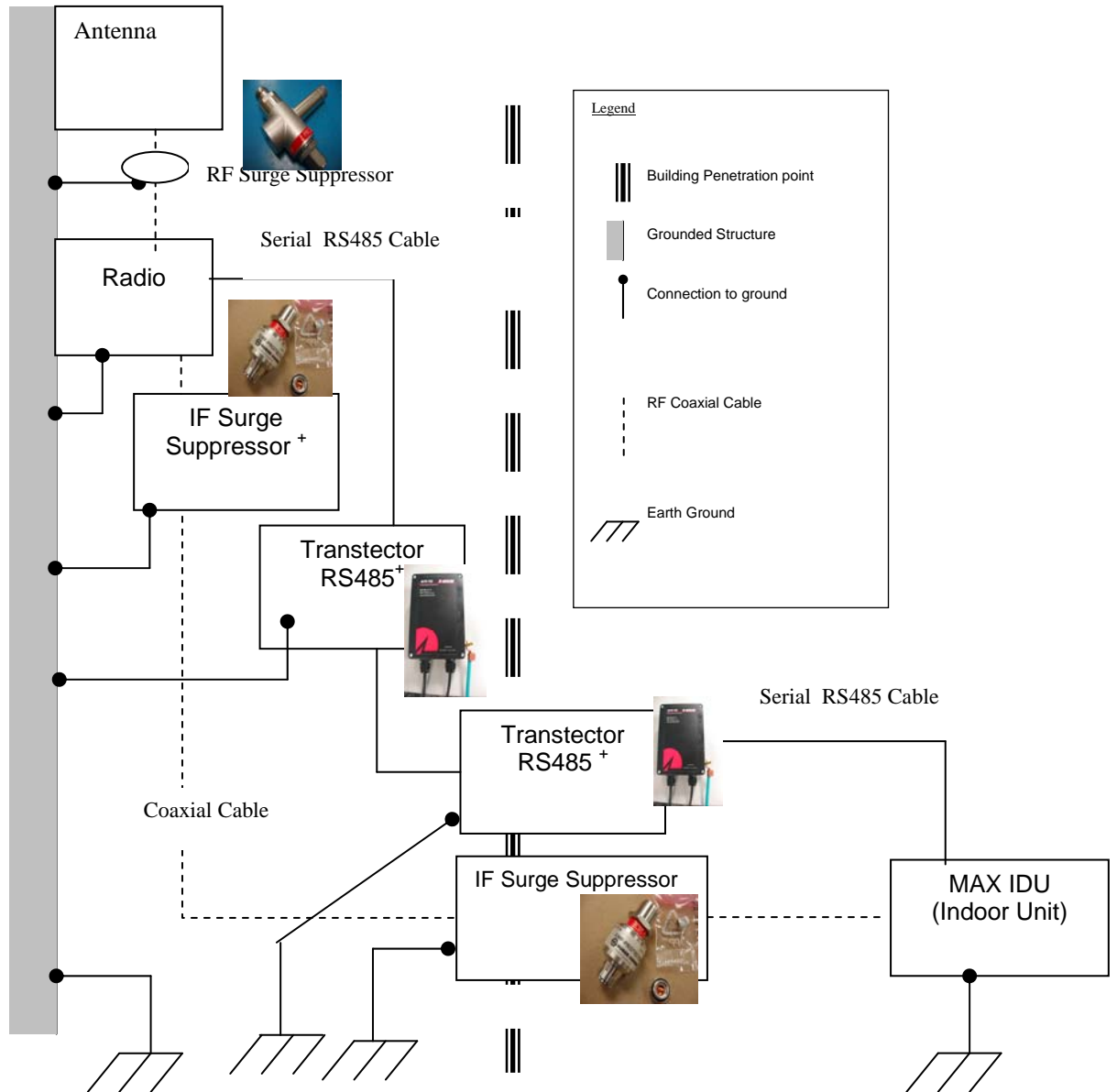
The Huber-Suhner device at the building entrance must also be bonded to a proper ground this can be via a cable to an external ground point or bonded to a ground bar, which in turn is properly grounded.

Lightning Protection Recommendation	P/N 5700-0050-00-AN	Page 3 of 16	10/1/2008
-------------------------------------	---------------------	--------------	-----------

LibraPlus, Libra MAX SS, VIP and Ultima-3, MAX-Lite and MAX-RBS



Libra MAX Chassis Base System

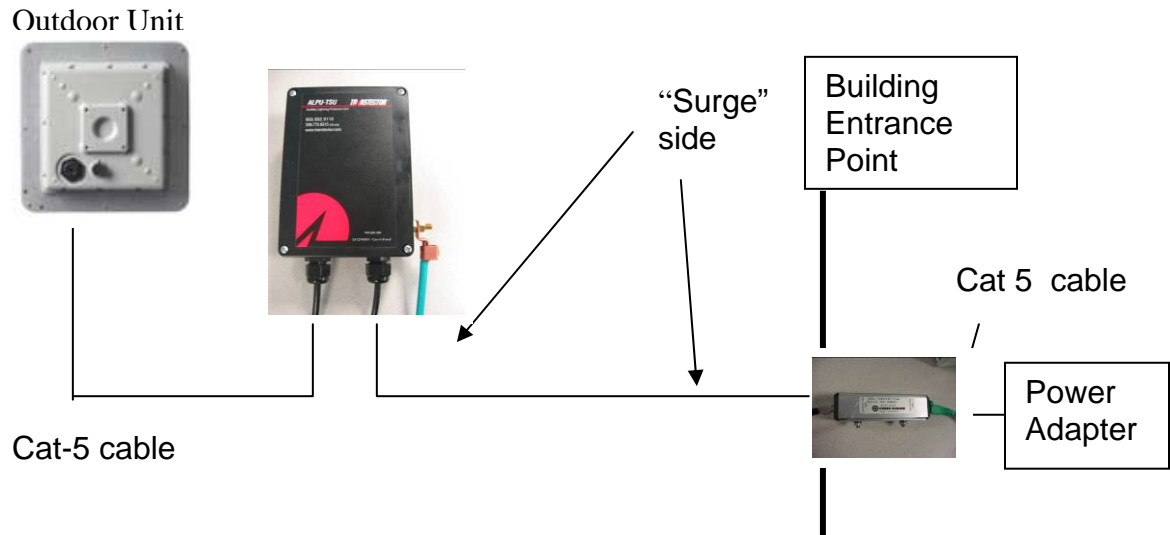


How are the Lightning protection units connected to the Cat 5 cable?

The lightning protection units recommended are designed to be installed in-line onto the CAT-5 cable that connect the outdoor EION unit and the indoor power adapter.

The lightning protection device has a “Surge” or cable-facing side, and a “Equipment” – facing side. The “Equipment” side faces the outdoor EION unit or the indoor power adapter. The “Surge” side faces the long length of cable; when installing two lightning protection units, each unit’s “Surge” side face one another.

Installation details appear over the next few pages.



Where to locate the Protection Units

At least one unit should be installed near every outdoor EION unit. General guidelines are:

- a) Locate Transtector unit as close to the outdoor EION unit as possible, where the lightning protection unit can be securely mounted to a flat surface and grounded properly. Ideally, this should be no further than 5 ft. away from the outdoor unit.
- b) Locate Huber-Suhner unit at the building penetration point, inside, and connect the ground cable preferably to an outside ground point.

Details

Huber + Suhner Ethernet CAT-5 inline protector.

This protection device located at the entrance to the building provides two RJ45 jacks. One will connect to the cable leading to the outdoor equipment while the second attaches to the customers indoor equipment (power inserter).

Shielded Ethernet connection to outdoor equipment



Indoor connection

Connect to proper ground via supplied cable or optionally to vendor provided ground plate.

Transtector CAT5 Ethernet Protection Device (Weather Resistant).

The Transtector is mounted as close to the outdoor equipment as possible. The device may be mounted to a flat surface using provided screws or may be installed to a round member using the optional clamp as illustrated in below.

The device must be mounted such that the cables are orientated downward to prevent any water entry.



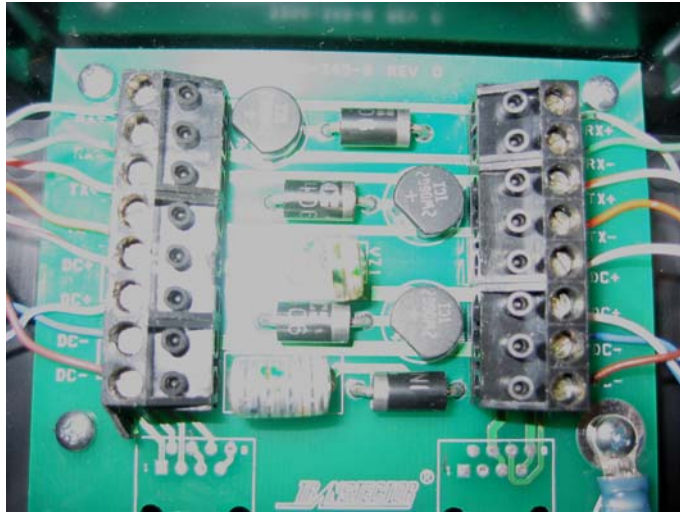


Detail for optional clamp mounting of Transtector

The Transtector internal connections are made to terminal blocks. The easiest method is to purchase the correct length CAT5 cable with connectors for the EION specific radio then cut the cable at the appropriate distance back from the radio side

Warning....Only cut the Ethernet cable when it is confirmed that the cable is NOT connected to a Power Inserter.

Feed the cut ends into the two watertight connectors at the bottom of the Transtector and strip and terminate the cables to the terminal block (using the table in this section as a reference). The two cables (radio side and building side) may be connected to either terminal block. Tighten the two cable connectors' collars so the Ethernet cable fits snug into the connector (gently tug on the cable to make sure it is properly secured – no movement).



Inside view of Transtector

Warning

The wiring code listed on the backside of the Transtector cover may not reflect the actual connection scheme of the Ethernet cable, for this reason the following table should be used.

Transtector	Ultima3/VIP Cable	LibraPlus and Libra MAX SS Cable	RJ45 Plug Standard Pin-out
RX+	White with green stripe	White with orange stripe	3
RX-	Green	Orange	6
TX+	White with orange stripe	White with Green Stripe	1
TX-	Orange	Green	2
DC+	White with Brown Stripe	White with Blue Stripe	4
DC+	White with Blue Stripe	Blue	5
DC-	Blue	White with Brown Stripe	7
DC-	Brown	Brown	8

Transtector Connections for Ethernet

Important note: connect all eight wires as per the first two columns; even the unused cables should be terminated

RF Protection Devices

The following section describes general installation of coaxial suppression devices for IF and RF levels used by some of the EION radios. Any radio that uses an external antenna must use the appropriate suppression device.

5.8 GHZ Suppressor (PN 1220-0025)

This in-line Suppressor is installed between the radio unit and the antenna. Use the included lug, star washer and nut to secure a ground cable to the suppressor. The ground wire must be connected to a proper ground connection (unpainted tower or structure) or clamped to a ground riser cable using a short as cable as possible. It is very important that this suppressor is properly sealed to prevent water entry, this requires the proper use of rubber and butyl tapes. Secure the unit to a structure such that no stress is placed on the cables attached.



IF Surge Suppressor with Gas Capsule (1220-0033)

This bulkhead mount protection device uses gas capsules (included) and connects between the IDU and ODU at IF frequencies. The gas capsule will provide a path between the center conductor and ground when the surge current reaches a certain voltage level. When the pulse has dissipated the gas capsule opens and normal operation resumes. This device allows passing of DC current needed to power the tower mounted equipment.

Warning The GAS capsule must be installed into the protector, it may NOT be pre-installed. Failure to complete this action will result in no protection to equipment or personnel. The side marked protected must connect to either the radio (if located at the radio side) or the IDU when it is installed at the building entrance.

Follow the vendor installation instructions included with the protector.



3.5 GHz Suppressor (1220-0031)

This RF protection device is a bulkhead mount unit which uses a $\frac{1}{4}$ wave shorting stub, no gas capsules are required. This device is installed between the ODU and Antenna. The shorting stub is tuned to the bandpass of choice and will pass these frequencies, lightning or EMI is at a considerably lower frequency and will see the $\frac{1}{4}$ shorting stub as a direct connection to ground. Follow the vendor installation instructions. This unit must be secured to the structure via clamps or straps and must not rely on the connected cables for support. The side marked "PROTECTED" must connect to the radio equipment. The preferred grounding method is to use a bulkhead plate however if this is not possible a grounding wire can be connected via ring terminal installed between the star washer and nut.



2.4 GHz Suppressor (1220-0029)

This suppressor device mounts directly to the VIP radio and the antenna cable will connect to this device. The suppressor must be grounded as per manufacturers instructions.





EION Inc.
 320 March Road, Suite 500
 Ottawa, ON Canada
 K2K 2E3

EION Part Numbers

Product	Description	EION Part Number	Quantity
LibraPlus			
	RF Surge Suppressor @ 5.8 GHz.	1220-0025	1 if unit does not have integrated Antenna
	Ethernet Surge Suppressor (outdoor unit)	1220-0041	1
	Ethernet Surge Suppressor (indoor unit)	1220-0042	1
Libra MAX Subscriber			
	RF Surge protector 3.5 GHz (Between ODU and Antenna)	1220-0031	1 if unit does NOT have integrated Antenna
	Ethernet Surge Suppressor (outdoor unit)	1220-0041	1
	Ethernet Surge Suppressor (indoor unit)	1220-0042	1
Libra MAX Base			
	IF-RF suppressor including gas capsule	1220-0033	2/sector
	RF Surge protector 3.5 GHz (Between ODU and Antenna)	1220-0031	1/sector
	RS485 Surge Suppressor (outdoor unit)	1220-0041	2/sector
Ultima 3			
	Surge Suppressor @ 5.8 GHz	1220-0025	1 if unit does not have integrated Antenna



EION Inc.
320 March Road, Suite 500
Ottawa, ON Canada
K2K 2E3

	Ethernet Surge Suppressor (outdoor unit)	1220-0041	1
	Ethernet Surge Suppressor (indoor unit)	1220-0042	1
VIP			
	Surge Suppressor @ 2.4GHz	1220-0029	1
	Ethernet Surge Suppressor (outdoor unit)	1220-0041	1
	Ethernet Surge Suppressor (indoor unit)	1220-0042	1