

Surge Arrestor & Grounding

Surge protection using proper grounding (rods and plates) and Baseline surge arrestors provides the best possible protection against surge damage due to lightning or other electrical surge events. Conformance to this surge suppression specification is necessary to obtain warranty protection under Baseline's extended equipment warranty terms.

Proper installation of grounding rods, grounding plates, and wire connections is essential to providing good surge suppression. All installations should conform to manufacturer's instructions and must meet or exceed the American Society of Irrigation Consultants (ASIC) Earth Grounding Electronic Equipment in Irrigation Systems—Guidelines (<http://www.asic.org>).

While there is no technology currently available that can fully protect against damage from massive surges such as those caused by direct lightning strikes, outfitting your Baseline system with grounding and surge protection as outlined in this document will protect your system from most if not all naturally occurring electrical surges.

This specification describes grounding and surge protection required for each major system component of different Baseline irrigation control solutions.

Ground Resistance

Ground resistance is the measurement of the conducting connection between the grounding system and earth.

The goal is **LOW GROUND RESISTANCE!**

After you have installed your grounding system, Baseline recommends that you measure the ground resistance at all grounding points including the two-wire and the enclosure ground. Resistance readings of 5 to 10 ohms are desirable, and a reading of no more than 25 ohms is required. You should measure the system at least once a year to ensure that the resistance readings remain constant.

Ground resistance is affected by the following factors:

- Type of grounding electrode
- Contact with the soil
- Soil resistivity
- Contact resistance
- Conductor/bonding

Soil Resistivity

Soil resistivity is a measure of how much the soil resists the flow of electricity (or inversely, a measure of the earth's ability to conduct electricity).

There is a direct relationship between ground resistance and soil resistivity, i.e., lower soil resistivity results in lower ground resistance.

Soil resistivity is the key factor that determines what the resistance of a grounding electrode system will be and to what depth the electrodes must be driven to obtain low ground resistance. The resistivity of the soil varies widely throughout the world and changes seasonally.

Soil resistivity is affected by the following environmental factors:

- Moisture content
- Electrolyte content (minerals and dissolved salts)
- Temperature

Soil resistivity testing is not always required, but it can be a very effective and cost/labor saving tool. The test can help you determine the rod or plate depth required in order to achieve your desired ground resistance.

Controller Grounding & Surge Protection

Grounding Electrodes

In all cases where it does not conflict with appropriate grounding grid design for the site in question, grounding electrodes (such as rods or plates) referred to in this specification must conform to the following standards.

Grounding Rods

- All grounding rods must be bare copper of 5/8" diameter or greater and a minimum of 8' length or longer.
- Grounding rods must be located at a minimum distance to assure that the two-wire path is outside of the electrode sphere of influence for the grounding rod. For an 8' grounding rod, this means that the grounding rod must be connected at least 8' away from the two-wire path, at a right angle to the two-wire path. See the BL-LA01 Surge Arrestor Installation Guide for details on connecting the grounding rod to the device or surge arrester.
- Install all grounding rods in a 10-inch round valve box to facilitate the use of a clamp-on ground resistance tester. If you use a smaller box, you will not be able to clamp the tester around the ground rod or the conductor.
- Drive grounding rods into the ground to a minimum of 8' in a vertical or oblique position. The angle of the rod relative to the vertical must be no more than 45°.

Grounding Plates

- All grounding plates must be a minimum of 5 square feet, as outlined in ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines.
- Grounding plates must be located a distance equal to the diagonal measurement (the distance from one corner of the grounding plate to the opposite corner) of the grounding plate from the two-wire path. The longest side of the grounding plate must run parallel to the two-wire path.
- Install grounding plates in a horizontal position a minimum of 30” below ground level and below the frost line. Position the plate flat at the bottom of the trench.

Consult the ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines for correct minimum recommended distances for different grounding rod or grounding plate sizes and grounding grid designs.

Connections to Grounding Rods & Plates

All connections to grounding rods/plates must conform to ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines and must consist of either a CADWELD® type or screw clamp type of connection. CADWELD or equivalent connections are preferred. All clamps must be suitable for direct burial or exothermic weld. The resistance reading on this connection should be less than 1milliohm.

Any wire extensions required to connect from a grounding rod to a surge arrestor or enclosure ground lug must be 6-gauge bare copper wire and must not have any sharp bends, coils, or kinks. Wire extensions connected to surge arrestors must use a split bolt connector, CADWELD connector, or screw clamp connector where the bare copper ground wire meets the green grounding wire from the surge arrestor.

Never use solder to make connections in the grounding system because it will melt during a lightning discharge.

Grounding Options

While the best option for grounding irrigation equipment is a direct physical connection to the earth, there are times when this is impossible or impractical. The following options are available for special cases. All other requirements in Baseline’s Grounding Specifications apply.

- **Controller Enclosure:** When direct physical connection to the earth is not possible, the irrigation controller’s enclosure ground can be connected to the building ground. However, DO NOT connect the two-wire surge arrestor ground to the building ground.
- **Irrigation System on a Green Roof or Green Wall:** When grounding the irrigation system on a green roof or green wall, the irrigation controller’s enclosure ground can be connected to the building ground, and it is acceptable to connect the green wire from each surge arrestor to the building system ground.

Two-Wire Grounding with Surge Arrestors

The Baseline surge arrestor (BL-LA01) is a critical part of the surge protection scheme for the two-wire path. Surge arrestors attach directly to the two-wire path and help dissipate electricity generated by nearby lightning strikes and other electromagnetic events. While two-wire components have optical isolators and other surge arresting features, the surge arrestor provides an extra measure of protection.

IMPORTANT! Surge arrestors are required for proper operation and for warranty coverage.

BL-LA01 Surge Arrestor Features

- Protects the two-wire from excessive electrical charges created by surges
- Connects directly to the two-wire path for ease of installation
- Fully sealed and submersible (direct bury) to protect all electronics

Electrical Specifications

- Requires no power from the two-wire
- Can only be connected to Baseline two-wire path

Dimensions

- Size: 2.5" x .88"
- Two-wire: red and black wires, 12"
- Ground wire: green

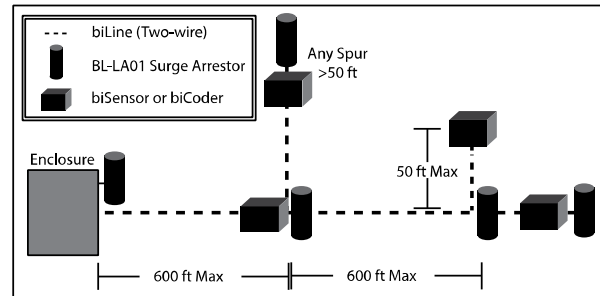
Installation

- Connects directly to the red and black wires
- Attaches to grounding rod via the green wire
- Install in a valve box
- Surge arrestors must be connected to bare copper ground wires using split bolt connectors, CADWELD connectors, or screw clamp connectors suitable for direct burial (no wire nuts of any kind are supported for grounding wires).

Two-Wire Grounding Installation

Two-wire supports a large number and variety of wiring configurations. As more wires are connected to a piece of electronic equipment, more lightning energy enters the equipment, and a more substantial grounding grid must be used. Consult the Baseline Two-Wire Specification for more details. The two-wire must have properly installed surge arrestors as outlined in the Baseline Surge Arrestor Install Guide and elsewhere in this document. Surge arrestors must be installed as outlined below:

- The first surge arrestor on the two-wire path must be within 25' of the controller. This grounding point must be separate from the irrigation controller's enclosure grounding point.
- Place a surge arrestor every 600' on the two-wire path. Each surge arrestor protects a 300 foot radius of the two-wire path.
- In lightning prone regions, consider grounding every 300' rather than going out to the maximum distance.
- There must be a surge arrestor at the end of the two-wire that is the maximum distance from the controller or if looped at the point of maximum distance from the controller.
- Any branch of the two-wire that exceeds 50' must have a surge arrestor at the end.
- On an uninterrupted run of more than 600', it is acceptable to have a surge arrestor at each end.



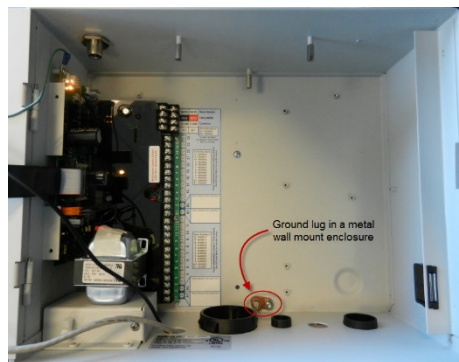
Note: On any wire run with no splices, do not cut the wire to install a surge arrestor, just place one at the end.

Controllers in Metal Wall Mount Enclosures

The following applies to all BaseStation 3200™ controllers, BaseStation 1000™ controllers, FlowStations™, SubStations™, and BL-5200-R Series Powered biCoders™.

If the controller is on or within an existing building, the unit must be grounded as outlined below:

The ground lug, located in the interior in the lower-right region of the BaseStation enclosure, must be connected directly to the building ground using a bare copper wire of 6 AWG or larger, as outlined in article 250 of the National Electric Code (NEC), so that a single point of connection with the building ground is achieved.



If the controller is mounted at a remote location more than 25' away from the building or grounded AC power source, the unit must be grounded as outlined below:

A bare copper grounding wire of 6 AWG or larger must be connected from the ground lug to an appropriate grounding rod as outlined in the previous sections of this document.

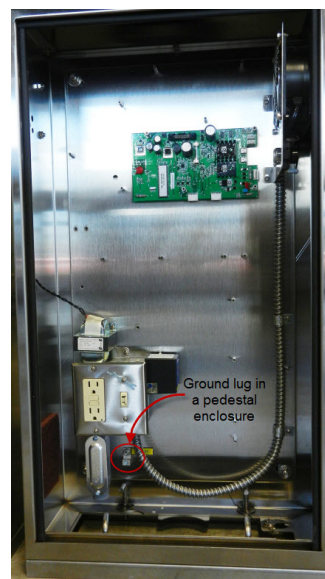
Controllers in Stainless Steel Pedestals

If the controller is within 25' of an existing building, and is connected to the AC power system within that building, the unit must be grounded as outlined below:

The ground lug, located in the interior on the back panel in the lower-left corner under the AC power box in the pedestal enclosure, must be connected directly to the building ground using a bare copper wire of 6 AWG or larger, as outlined in article 250 of the National Electric Code (NEC), so that a single point of connection with the building ground is achieved.

If the controller is mounted at a remote location more than 25' away from a building or grounded AC power source, the unit must be grounded as outlined below:

A bare copper grounding wire of 6 AWG or larger must be connected from the ground lug to an appropriate grounding rod as outlined in the previous sections, and in conformance with the ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines.



IMPORTANT! All clamps used to connect the 6 AWG wire to the grounding electrode must be suitable for direct burial or exothermic weld.