

Proper Grounding Techniques for Two-Wire Decoder Systems

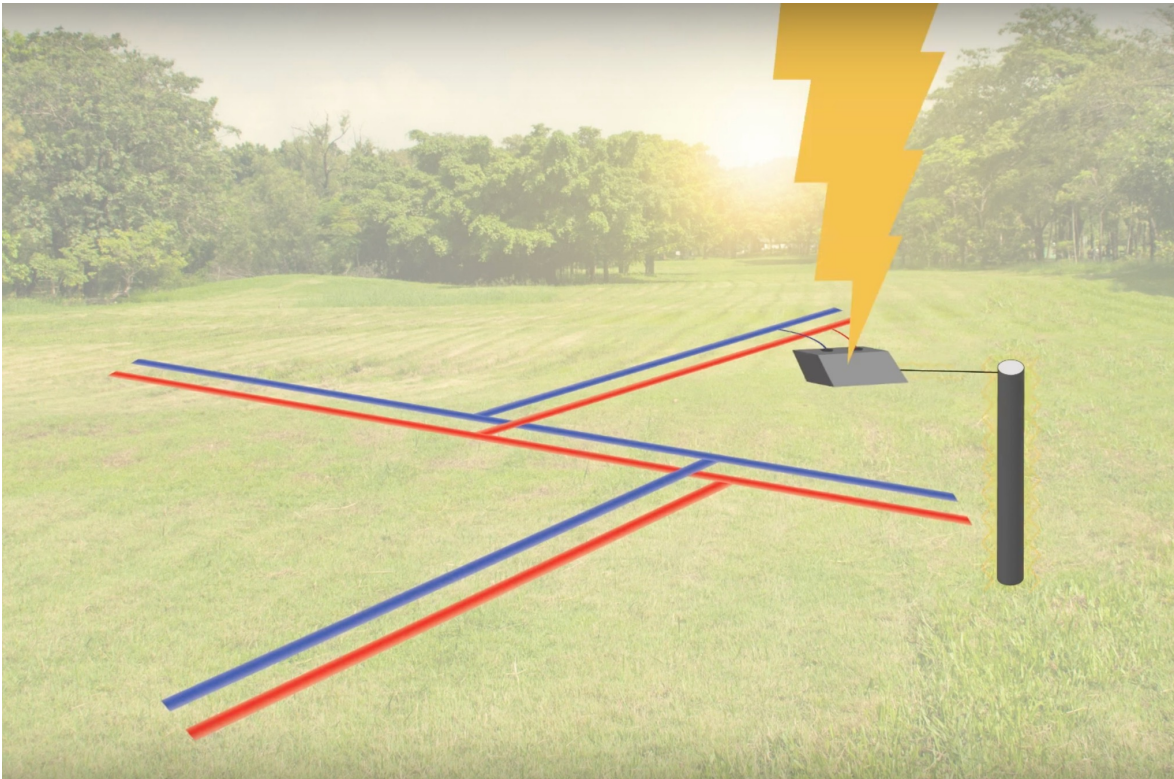


[Why is grounding so important?

Lightning Strikes

- ▶ 10,000 Amps
- ▶ 100,000,000 Volts
- ▶ Roughly 50 strikes every second worldwide
- ▶ Surge can severely damage equipment

How Grounding Works



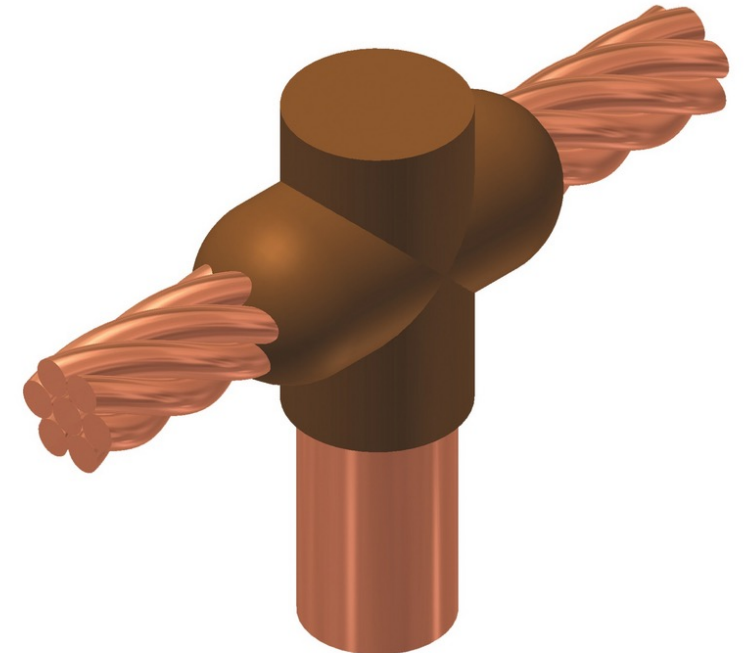
- ▶ Creating a path to ground provides an outlet for the surge
- ▶ Protects equipment from damage, prevents downtime and customer complaints

Equipment Warranty Voided by Surge

- ▶ Lightning strikes
- ▶ Unconditioned power supplies
- ▶ Improper grounding
- ▶ Failure to inspect and maintain grounding equipment
- ▶ Improper installation of grounding equipment
- ▶ Poor wire splicing

Grounding Techniques

- ▶ Most common: grounding rods
 - ▶ 5/8" rods come in 8', 10' and 12' sizes
 - ▶ A fully buried 10' grounding rod will provide 230 square inches of ground contact
 - ▶ More ground contact = lower impedance of the grounding circuit
 - ▶ Installed at least 10' from wiring network
 - ▶ Connection of grounding wire to grounding rod can be with a ground clamp or CAD weld connector



Product Name	Part Number	Min. Packaging
Ground Rod Clamps	GRE58	1/EA

CAD Weld Connection



Required for permanent installation



Permanently welded with a cap connector fused with an exothermic chemical reaction



CAD weld ignitor is required



Different types of connectors are available for different types and quantities of grounding wires



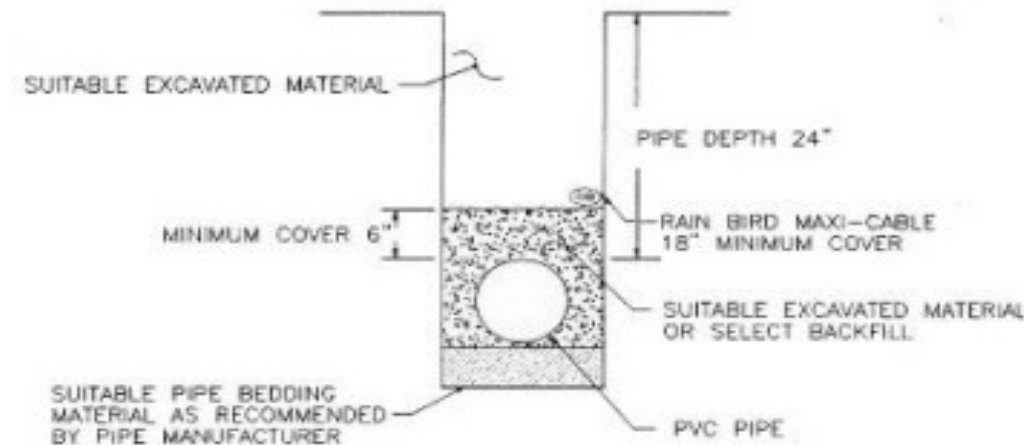
Ground Plates

- ▶ More often used with decoder systems
- ▶ 4" x 96" ground plates - 780 square inches of ground contact
 - ▶ 3 times inductance of 10' grounding rod

Ground Plate Installation

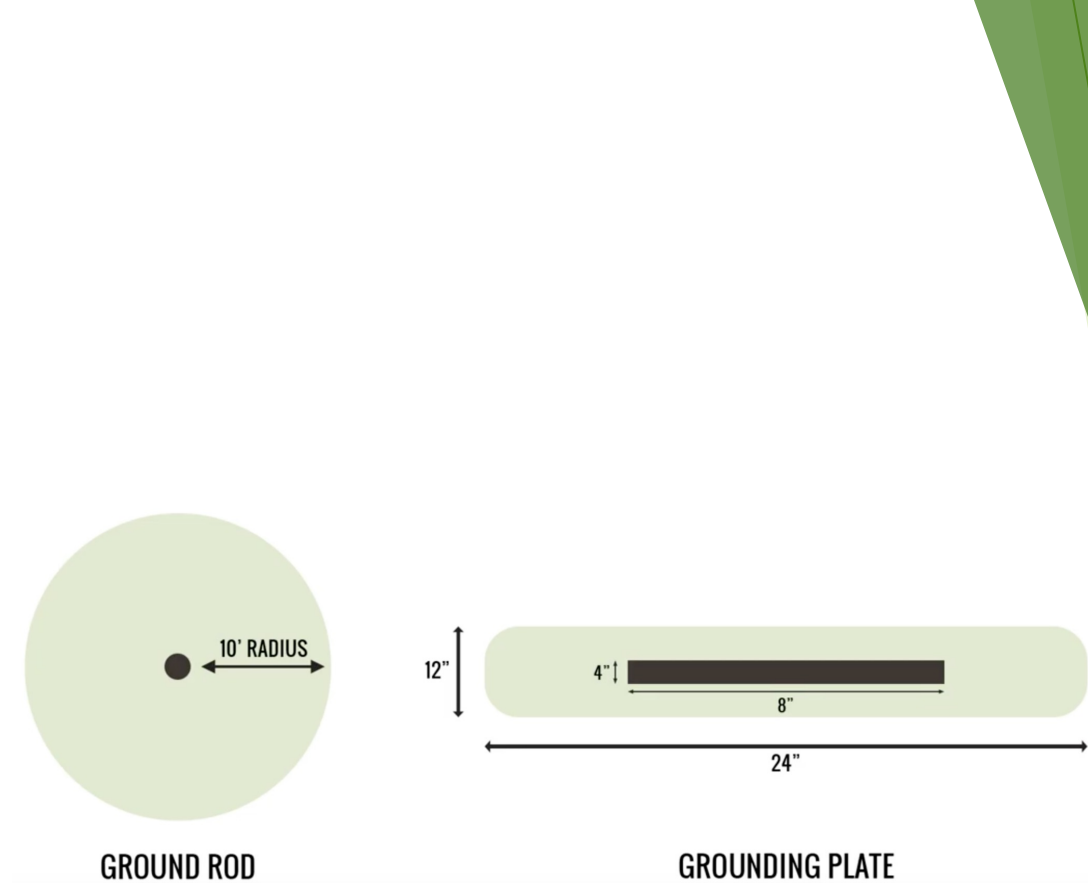
- ▶ Installed in a mechanically dug trench
- ▶ Regency ground enhancing backfill material enhances ground conductivity
 - ▶ Porous or rocky soils often require ground enhancing material
 - ▶ GEM maintains constant resistance for life of system
 - ▶ Contact factory for calculation information
- ▶ Install components in straight lines away from and perpendicular to two-wire path
- ▶ If bends are required, electrical sweep L allows for gradual bends

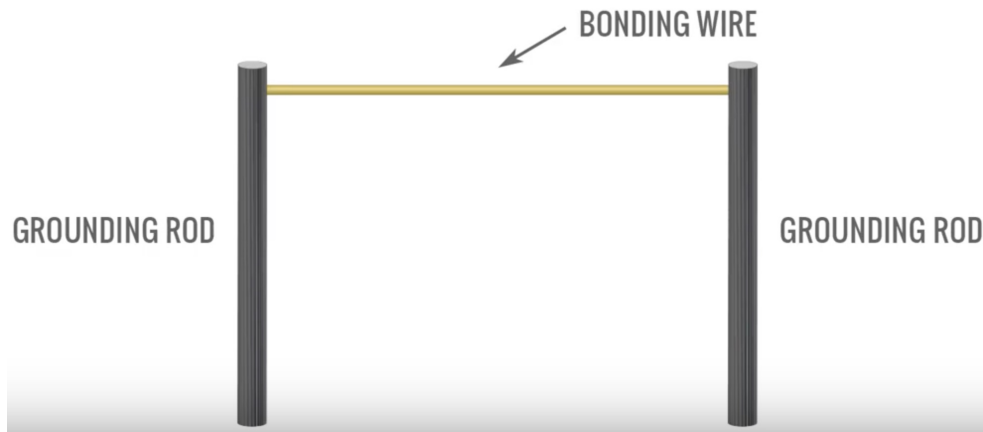
Trench Detail



Sphere of Influence

- ▶ Avoid installing grounding devices where they share the same soil to dissipate surges
- ▶ Follow manufacturer guidelines for spacing devices from two-wire path and distance from other grounding devices
- ▶ Installing grounding equipment in irrigated area is recommended
 - ▶ Moist soil provides uniform conductivity





Bonding

- ▶ Recommended when multiple ground points are interconnected with a bare copper conductor
- ▶ Enhances strength and unity of grounding network

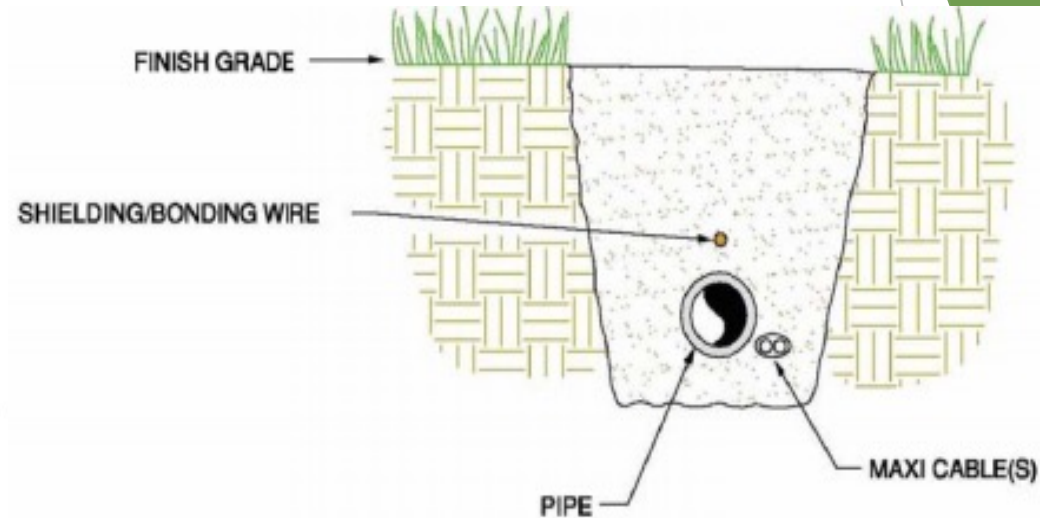
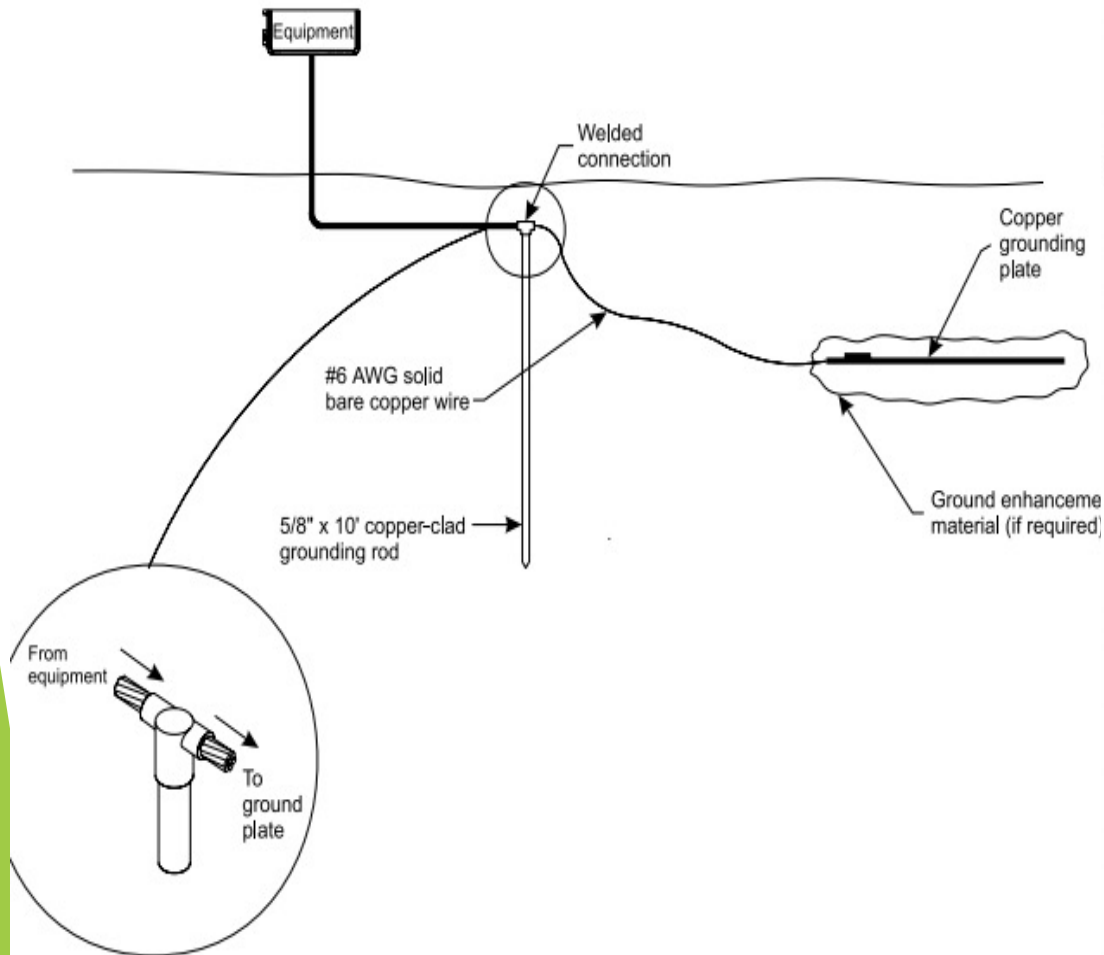
Shielding

- ▶ Installation of shallowly installed bare copper conductor
- ▶ Limit spread of surge in a system where decoders do not have onboard surge protection
- ▶ Some manufacturers recommend lightning arrestors with decoder systems
- ▶ Do NOT mistake these as a substitute for grounding systems

Testing the System

- ▶ Immediate testing is not reliable
- ▶ Wait 4-6 weeks before testing to allow for soil settling
- ▶ Most manufacturers recommend maximum resistance of 25 ohms
- ▶ Use a Megger meter to measure resistance of each grounding device
- ▶ Test systems annually or after major repairs

Rain Bird Two Wire Grounding and Shielding

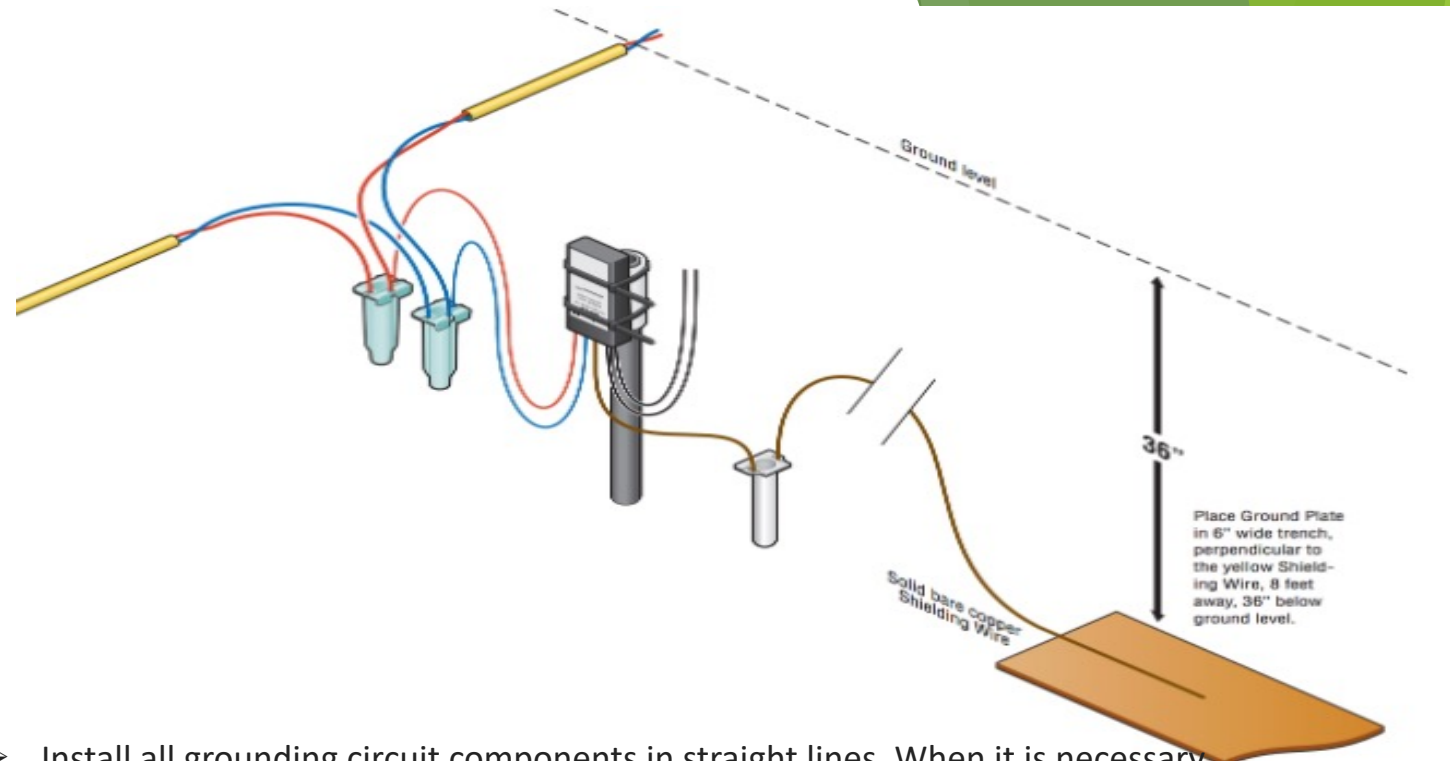


1. THE SHIELD/BOND WIRE SHALL BE A #10 AWG SOLID CORE BARE COPPER WIRE.
2. THE SHIELD/BOND WIRE SHALL BE LAID IN THE TRENCH AS STRAIGHT AS POSSIBLE AND POSITIONED APPROXIMATELY FOUR INCHES (4") ABOVE THE PIPE AND TWELVE TO EIGHTEEN INCHES (12" TO 18") BELOW GRADE.
3. ALL BENDS SHALL BE MADE AS A GENTLE SWEEP THEREBY REDUCING IMPEDANCE. THE SHIELD/BOND WIRE SHALL BE CONNECTED TO ALL ICSD SURGE PROTECTORS USING A RAIN BIRD DB SERIES SPLICE KIT. CONNECTIONS TO A GROUND ROD SHALL BE MADE WITH A UL LISTED ACORN CLAMP.
4. GROUND RODS OR GROUND PLATES SHALL BE INSTALLED PER RAIN BIRD RECOMMENDATIONS OF ONE (1) ROD OR PLATE EVERY 500 FEET OR 15 ICM'S (WHICHEVER IS LESS) WITH 45 OHMS OR LESS OF GROUND RESISTANCE.

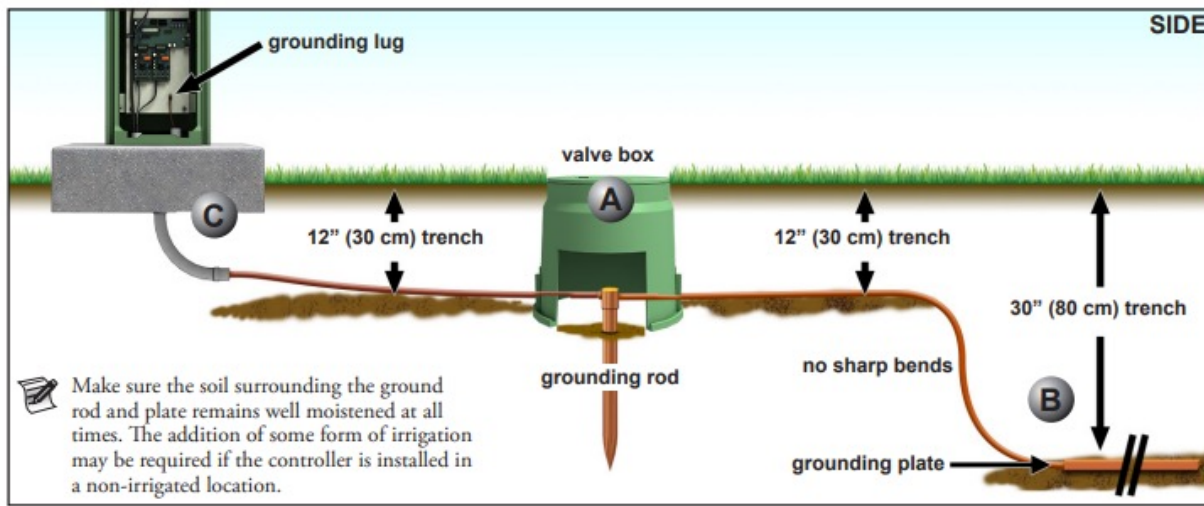
Hunter Two Wire Grounding and Shielding

At the very minimum, the grounding circuit for a decoder will include a copper ground plate and may also include 50 pounds/22 kg of earth contact material, as defined below and per the following detail.

The copper grounding plate assemblies must meet the minimum requirements of section 250 of the NEC. They are to be made of a copper alloy intended for grounding applications and will have minimum dimensions of 4" x 36" x 0.0625" (100 mm x 1.2 m x 1.58 mm). A 10-foot/3 m continuous length (no splices allowed unless using exothermic welding process) of 10 AWG/5 mm² solid bare copper wire is to be attached to the plate using an approved welding process. This wire is to be connected to the decoder's ground wire and 10 AWG/5 mm² bare copper "shielding wire" as shown in wiring details. A 50-pound/22 kg bag of earth contact material must be spread so that it surrounds the copper plate evenly along its length within a 6"/15 cm wide trench per detail below. Salts, fertilizers and other chemicals are not to be used in an attempt to improve soil conductivity because these materials are corrosive and will cause the copper conductors and electrodes to erode and become less effective with time.



- Install all grounding circuit components in straight lines. When it is necessary to make bends, do not make sharp turns. To prevent the electrode-discharged energy from re-entering the underground cables, all electrodes shall be installed 6 to 8 feet/2 to 2.5 m away from said cables, and at right angles to the two-wire path. If more than one electrode is used to achieve lower resistance, the spacing between any two electrodes shall be 15 to 20 feet/4.5 to 6 m, so that they don't compete for the same soil.
- The earth-to-ground resistance of this circuit is to be no more than 10 ohms. If the resistance is more than 10 ohms, then additional ground plates and earth contact material are to be installed in the direction of an irrigated area. It is required that the soil surrounding copper electrodes be kept at a minimum moisture level of 15% at all times by dedicating an irrigation station at each controller location.



1. Drive a 5/8" by 8' (17mm x 2.5m) copper clad steel rod (Regency part # GR588) into well moistened soil not less than 8' (2.5m) or not more than 12' (3.7m) from the controller cabinet (Figure 1). For 2-Wire systems, install the ground rod adjacent to the communication cable (Figure 2). The top of the ground rod should be flush with or below ground level, and should be protected from damage using a valve box (A).

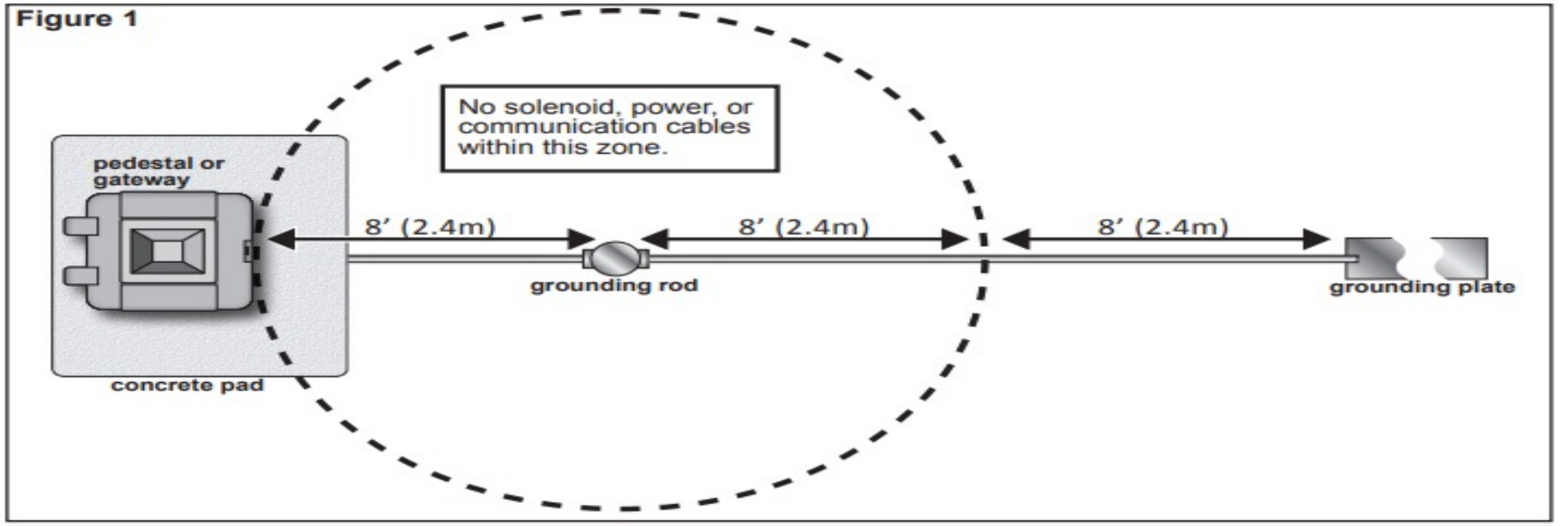
2. Install a 4" by 96" (10cm x 2.5m) copper ground plate (Regency part #GRPL4X96). The plate should be at least .06" thick (1.5mm) and should have a 6 AWG x 12' (10mm² x 4m) solid copper, insulated wire welded to the plate. The plate should go into a trench that is at least 30" (80cm) deep (B). Use ground enhancement material (GEM) per the manufacturer's directions. Regency # GEM25LB

3. Using a 5/8" (17mm) clamp or exothermic-weld fastener (Regency part #CGT1161G - PLUS), attach an 8 AWG (10mm²) solid copper wire (Regency part #0811S1) near the top of the ground rod.

4. Route the wire through conduit and into the controller cabinet, avoiding wire bends of less than 8" (20cm) radius and more than 90° (C). Secure the wire to the copper ground lug in the controller.

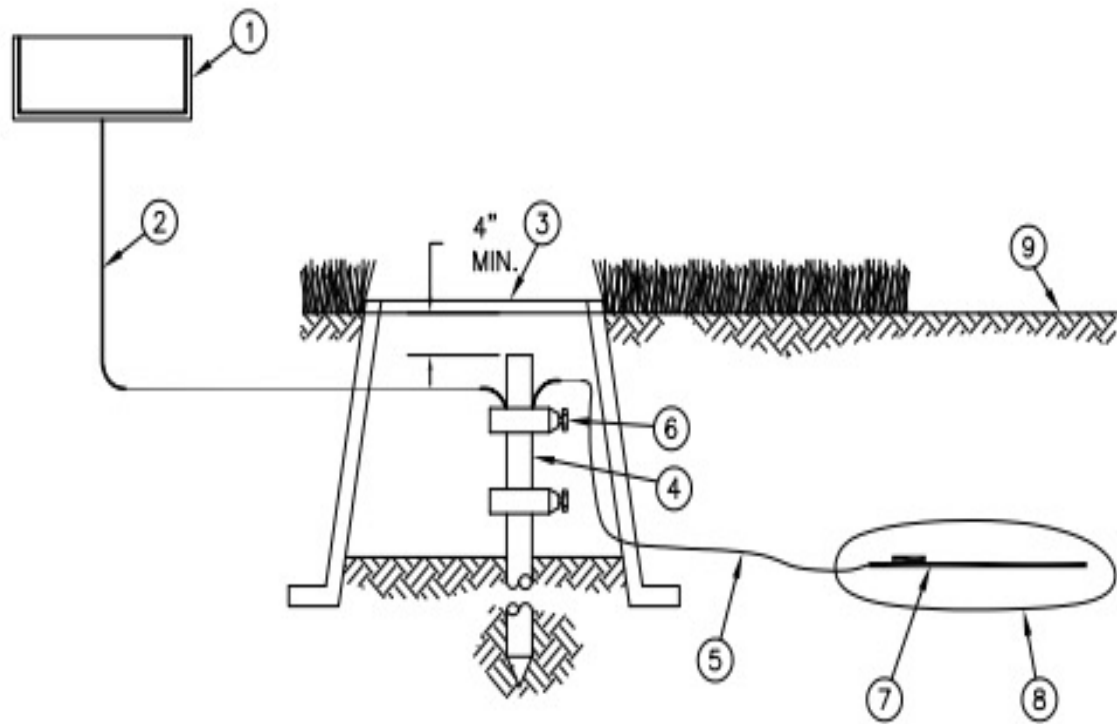
5. Measure the ground resistance per the instructions provided with the ground test instrument. A reading of 10 ohms or less is recommended.

Toro Residential Grounding and Shielding



Hunter Residential Grounding

- ▶ At the very minimum, the grounding circuit for controllers will include a copper clad steel ground rod, a copper ground plate and 100 pounds/45 kg of PowerSet® earth contact material, as defined below and per the following detail.
- ▶ Ground rods are to have a minimum diameter of 5/8"/1.5 cm and a minimum length of 10 ft/3 m. These are to be driven into the ground in a vertical position or an oblique angle not to exceed 45 degrees at a location 8 to 10 ft/2.4 to 3 m from the electronic equipment or the wires and cables connected to it, and at right angles to the two-wire path. It is to be stamped as UL listed.
- ▶ The copper grounding plate assemblies must meet the minimum requirements of section 250 of the NEC. They are to be made of a copper alloy intended for grounding applications and will have minimum dimensions of 4" x 96" x 0.0625" (100 mm x 1.2 m x 1.58 mm). A 25-foot (8 m) continuous length (no splices allowed unless using exothermic welding process) of **6 AWG solid bare copper wire** is to be attached to the plate using an approved welding process. The wires are to be installed in as straight a line as possible, and if it is necessary to make a turn or a bend it shall be done in a sweeping curve with a minimum radius of 8" and a minimum included angle of 90°. Mechanical clamps shall be permitted temporarily during the resistance test process, but shall be replaced with Cadweld "One-Shot" kits immediately thereafter. The ground plate is to be installed to a minimum depth of 30"/75 cm, or below the frost line if it is lower than 30"/75 cm at a location 15 to 20 feet/4.5 to 6 m from the ground rod, electronic equipment and wires and cables. Two 50-pound/22 kg bags of earth contact material must be spread so that it surrounds the copper plate evenly along its length within a 6"/15 cm wide trench. The use of salts, fertilizers and other chemicals are not to be used to improve soil conductivity because these materials are corrosive and will cause the copper electrodes to erode and become less effective with time.
- ▶ Install all grounding circuit components in straight lines. When it is necessary to make bends, do not make sharp turns. To prevent the electrode-discharged energy from re-entering the underground wires and cables, all electrodes shall be installed away from said wires and cables. The spacing between any two electrodes shall be 15 to 20 feet/4.5 to 6 m, so that they don't compete for the same soil.
- ▶ The earth-to-ground resistance of this circuit is to be measured, and the reading is to be no more than 10 ohms. If the resistance is more than 10 ohms, then additional ground plates and earth contact material are to be installed in the direction of an irrigated area. It is required that the soil surrounding copper electrodes be kept at a minimum moisture level of 15% at all times by dedicating an irrigation station at each controller location.



- ① RAIN BIRD CONTROLLER
- ② SOLID BARE COPPER WIRE (#10 AWG) FROM GROUNDING ROD TO CONTROLLER. MAKE WIRE AS SHORT AND STRAIGHT AS POSSIBLE
- ③ COVER GROUNDING ROD WITH 10-INCH ROUND VALVE BOX AS SHOWN
- ④ 5/8-INCH X 10 FT COPPER CLAD GROUNDING ROD OR GROUNDING PLATE. INSTALL RODS IN SOIL IN A TRIANGULAR PATTERN SPACED A MINIMUM OF 16 FT APART FROM EACH OTHER. GROUNDING GRID TO HAVE A RESISTANCE OF TEN (10) OHMS OR LESS
- ⑤ BARE COPPER WIRE (#6 AWG MIN.) BETWEEN GROUNDING ROD AND GROUNDING PLATE
- ⑥ GROUND ROD CLAMP OR WELDS
- ⑦ COPPER GROUNDING PLATE
- ⑧ GROUND ENHANCEMENT MATERIAL (IF REQUIRED)
- ⑨ FINISH GRADE

Rain Bird Residential Grounding

Accessories Guidebook



Product Name	Part Number	Min. Packaging
DBR/Y-6	3MDBRY6BK	100

Product Name	Part Number	Min. Packaging
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5/8" x 8' Ground Rods	GR588	1/EA
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5/8" x 10' Ground Rods	GR5810	1/EA
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Product Name	Part Number	Min. Packaging
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25# Bags	GEM25LB	1/EA
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Product Name	Part Number	Min. Packaging
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4" x 36"	GRPL4X36-25	1/EA
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4" x 96"	GRPL4X96	1/EA
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12" x 36"	GRPL12X36	1/EA
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Thank You