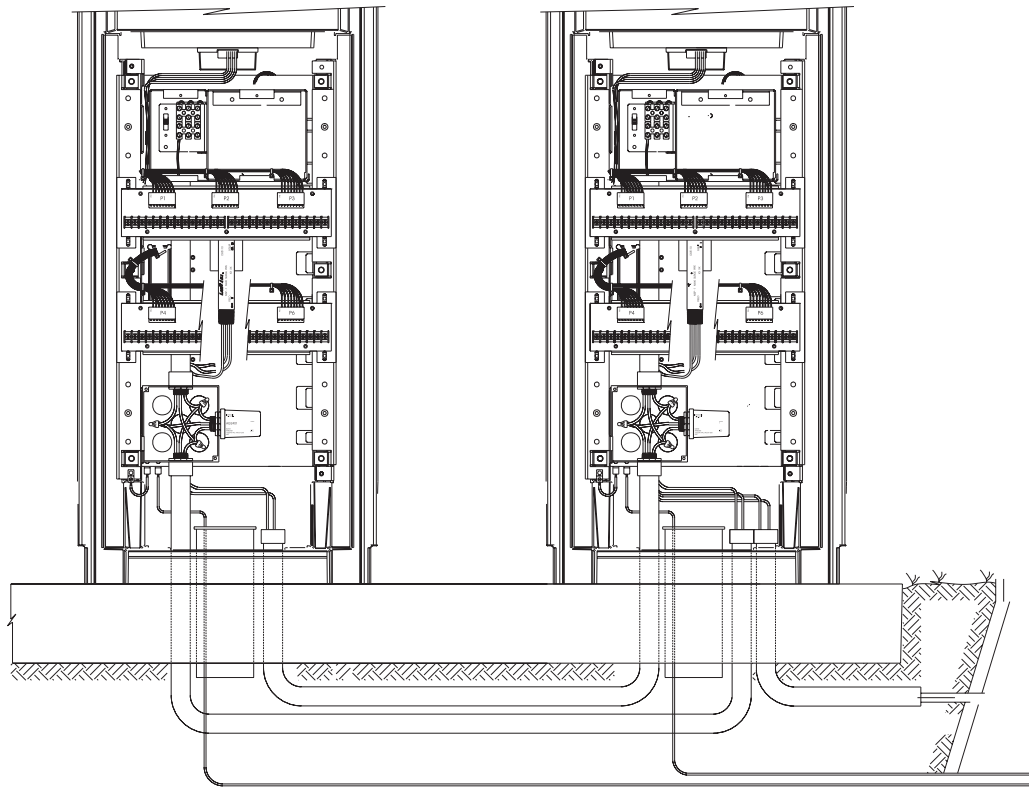


## **PAR+ & MSC+ Controller** **Installation Manual**



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# PAR+ & MSC+ Controller Installation Manual

## Introduction

This manual shows how to install your new PAR+ or MSC+ irrigation controller. Refer to the controller's Operation Manual for instructions on programming and operating your controller.

### System Configuration

PAR+ and MSC+ controllers may be installed in three different configurations:

- Stand-Alone Models — Controller operates independently and is not connected to a central control system.
- Two-Wire Models — Controller is hard-wired to a central control system through a 2-wire connection.
- Wireless (LINK) Models — Controller is connected to a central control system via a wireless radio/modem unit.

### Parts List and Tools Required for Installation

Before beginning installation, make sure you have the following parts and required tools and materials.

#### Parts

- PAR+ & MSC+ Controller Installation Manual
- PAR+ or MSC+ controller
- Plastic controller mounting template
- Four L-bolts
- Eight stainless steel nuts
- Four large washers
- Four small split-ring washers

#### Tools and Materials

- Hammer, nails, framing lumber, concrete, trowel, etc. (for concrete pad)
- Half-inch and four-inch non-metallic conduit, sweep ells, and appropriate fittings for routing power wires, communication wires, and valve wires

- Conduit cutting tool
- Adjustable wrench or pliers
- Phillips screwdriver
- Small flat blade screwdriver
- Level
- Tape measure
- Electrical wire
- Wire cutters/strippers
- Wire nuts (or other code-approved wire connectors)
- Intermatic AG-2401 Surge Arrestor (recommended)
- Metal junction box (4" x 4" x 1½") — One for each controller being installed (except last controller in a cluster)
- Grounding grid installation materials (Recommended; see Appendix 1)

### Installation Checklist

To install your PAR+ or MSC+ controller, we recommend that you complete the following steps in order.

- Choose location and pour concrete pad ..... Page 2
- Mount controller pedestal on concrete pad ..... Page 3
- Install junction box ..... Page 4
- Install surge arrestor ..... Page 5
- Connect AC power supply ..... Page 6
- Connect power wiring ..... Page 6
- Install MAXI 2-wire interface board ... Page 7
- Install +LINK Radio/Modem kit (for wireless models without Radio/Modem Kit pre-installed) ..... Page 9

## Mount Controller Pedestal on Poured-In-Place Concrete Pad

Mount the controller on a poured-in-place concrete pad. Orient the pad to provide easy access of electrical conduit into the front of the controller. Make sure the pad is flat and level to allow the controller's doors and lid to open and close properly.

### Concrete Pad Requirements

**Location** — Any convenient outdoor location with access to AC power.



**NOTE:** Do not locate the concrete pad in low-lying areas that may flood during heavy rains.

**Size** — 20" x 20" minimum (If mounting multiple controllers on the same pad, size the pad to allow at least eight inches clearance between controllers).

**Thickness** — Two inches (minimum).

### Install L-Bolts in Mounting Template(s)

1. Slip a large washer over each L-bolt and screw four of the 5/16" stainless steel nuts onto the L-bolts.
2. Insert the L-bolts into the threaded holes in the plastic mounting template.
3. Screw another stainless steel nut onto each L-bolt to hold it in place.
4. Repeat steps 1-3 with templates for other controllers (if installing multiple controllers).

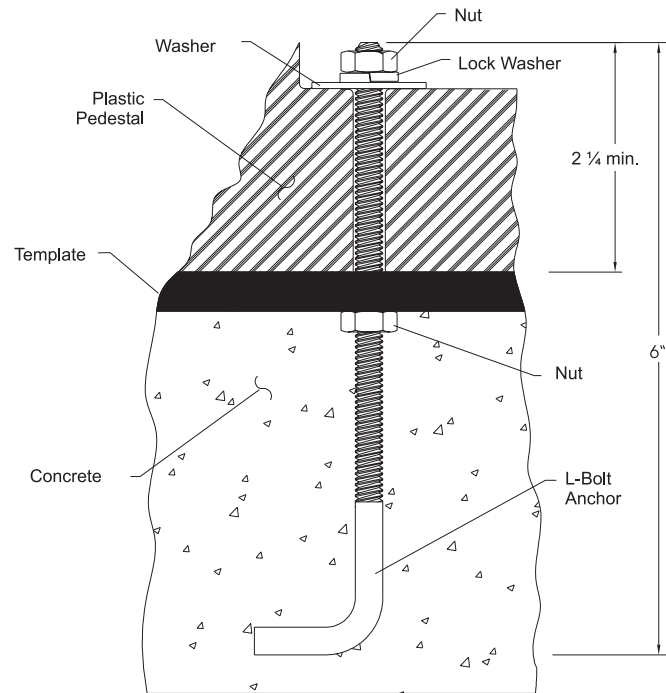


Figure 1: Detail of proper L-bolt / washer configuration in final mounted installation.

## Before Pouring Concrete Pad

1. Position a ½-inch sweep “ell” for the 120-, 220-, or 240-volt power wires. Position another ½-inch sweep ell to carry power wires to other controllers (if installing multiple controllers on the same pad). Refer to Figure 2.
2. Position a ½-inch sweep ell for the 2-wire communication wires (for 2-wire systems only). Place another ½-inch sweep ell to carry communication wires to other controllers (if installing multiple controllers on the same pad).
3. Position a 4-inch ell for the valve output wiring, valve common wires, master valve wiring, ground wire, etc.
4. Run all power wires, communication wires, and field wiring through their appropriate conduits.

## Pour the Concrete Pad and Mount the Pedestal

1. Pour the concrete pad around the properly positioned sweep ells.
2. Lower the mounting template onto the pad, setting the L-bolts into concrete. Make sure the template is level and properly oriented before setting it into concrete. Make sure the L-bolts extend true vertical from the pad.
3. If installing multiple controllers, position the mounting templates for the other controllers. Make sure to maintain a *minimum* 8-inch clearance distance between controllers.
4. After the concrete hardens, remove the four exposed nuts from the L-bolts.
5. Lower the controller pedestal onto the L-bolts in the template. Place a split-ring washer on each bolt and use the stainless steel nuts to securely bolt the controller pedestal to the concrete pad.

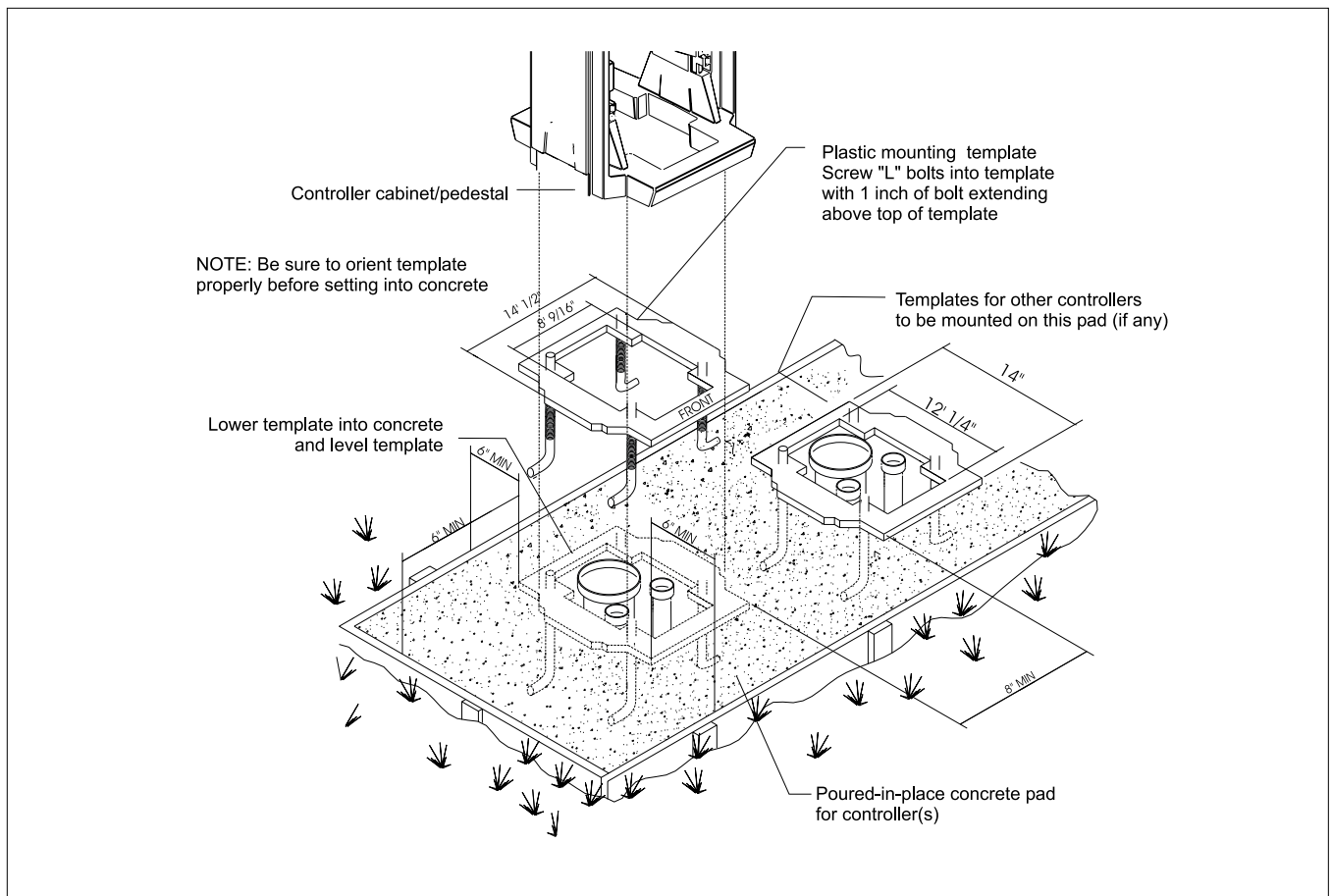


Figure 2: Proper conduit position and template orientation on concrete pad

## Install Power Wiring (120, 220, or 240 VAC)

### Install Junction Box

Refer to figure 3 for an overview of how power and communication wiring connects from controller to controller in a cluster.

PAR+ and MSC+ controllers must have a metal junction box installed on the bottom of the controller's wiring compartment. The first controller in a cluster (and any other controller(s) feeding power to another controller) must be equipped with a junction box.



**CAUTION:** To avoid a serious shock hazard, make sure the primary AC power source to the controller is OFF before installing power wiring.

### First Controller(s) in the Cluster

1. Punch out a junction box knockout and attach the box to the half-inch power wire conduit. Route the hot (black), neutral (white), and green (ground) power wires into the junction box.

2. Secure the junction box to the conduit using a short nipple and the required fittings (as shown in Figure 4).
3. Punch out one of the knockouts in the side of the junction box and use the hole to install the recommended Intermatic model AG-2401 surge arrester (see "Surge Arrester Installation.")

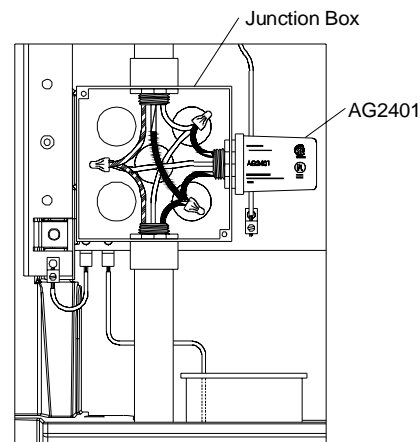


Figure 3: Detail of junction box installation position

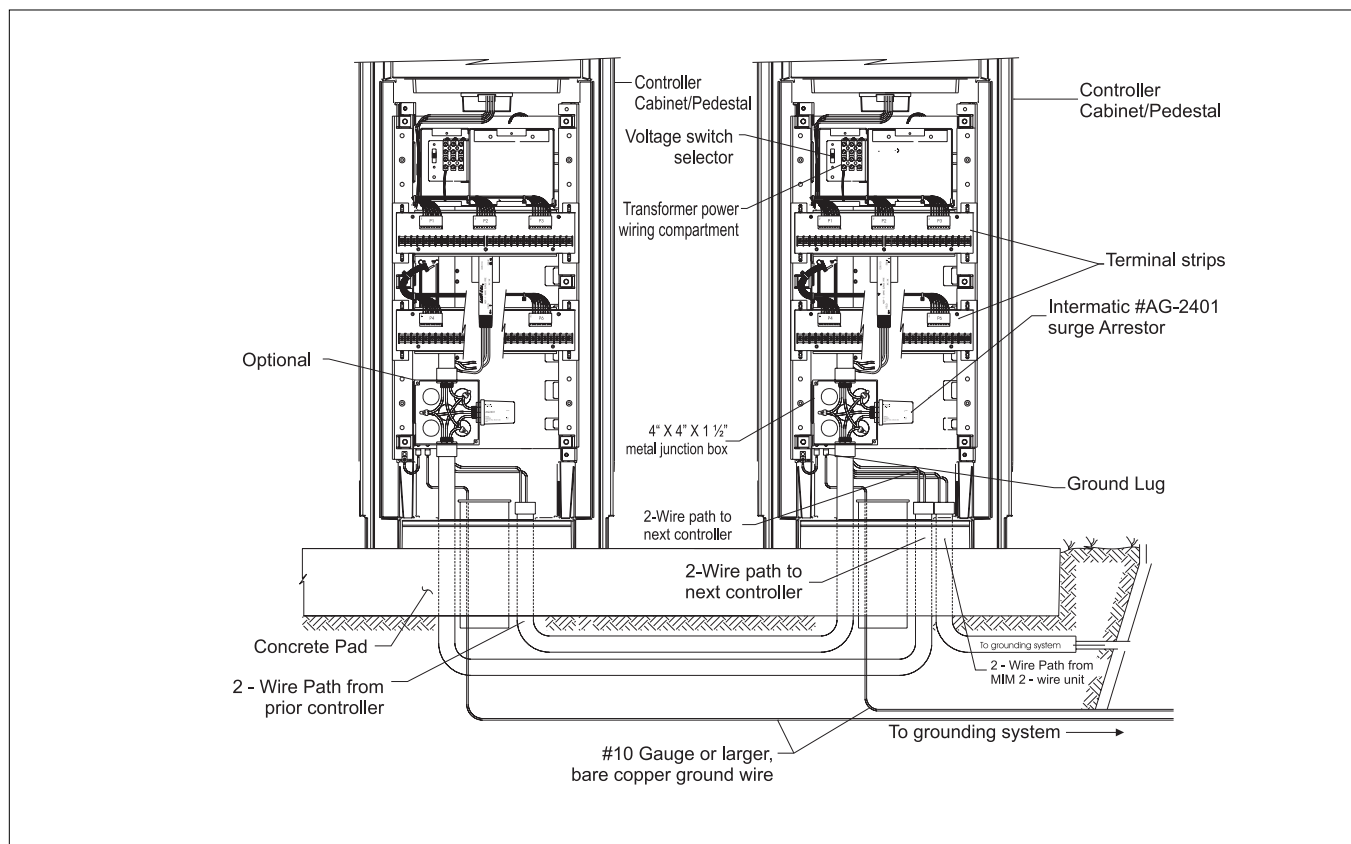


Figure 4: Overview of controller cluster power wiring and communication wiring

## *Last Controller in the Cluster*

No electrical junction box is required for the last controller in the cluster (or for a stand-alone model that does not feed power to another controller).

Run the half-inch conduit directly to the controller wiring compartment and use an appropriate fitting to connect the conduit to the wiring compartment.

## **Surge Arrestor Installation (Recommended)**

Rain Bird recommends installing a surge arrestor to protect the controller's power wiring circuits from voltage fluctuations. Recommended surge arrestor models include the Intermatic AG-2401 (or 1G2401LA1), and the Joslyn Surgitron (model 1250-33).

To order a surge arrestor, contact Intermatic, Inc. at (815) 675-2321; or Joslyn Electronic Systems at (800) 752-6068.

### *Install Surge Arrestor*

1. Knockout a hole in the side (left or right) of the metal junction box and mount the surge arrestor in the knockout hole.
2. Extend the surge arrestor wires (two black, one white) into the junction box with the AC power wires.

### *Install Surge Arrestor (Alternate Location)*

For stand-alone and 2-wire installations, you may choose to install the surge arrestor in the vacant compartment designed for the wireless transformer.

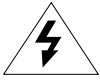


**CAUTION:** To avoid a serious shock hazard, make sure the primary AC power source to the controller is OFF.

1. Remove the power supply access panel.
2. Punch out the bottom left knockout hole in the power supply compartment. Mount the surge arrestor into the knockout hole.
3. Connect the surge arrestor wires to the controller's power wires as described in "Connect Power Wires and Surge Arrestor Wires."
4. Replace the controller's power supply access panel.

## Connect AC Power Supply

### Connect AC Power



**CAUTION:** To avoid a serious shock hazard, make sure the primary AC power source to the controller is OFF.

1. Punch out a knockout hole in the top of the junction box and run a length of conduit from the junction box to the controller's power supply compartment.
2. Use appropriate fittings to connect the conduit to the junction box and the power supply compartment.
3. Run three power wires (black, white, and green) from the power supply compartment down into the junction box.
4. Attach the power wires to the modular snap-in connector in the power supply compartment, as shown in the diagram on the power supply access cover (see Figure 5).
5. Use the 3-position selector switch to choose correct voltage option for your installation (The default voltage setting is 220 VAC).



**NOTE:** Select the correct voltage before turning on AC power. If the switch position is changed after applying power, the controller will be damaged.

### Connect Power Wires and Surge Suppressor Wires

1. In the junction box, connect the AC power wires (black, white, and green) as shown in Figure 6.
2. Wire the two black surge arrestor lead wires into the controller's 120, 220, or 240 VAC power wiring. Connect one of the two black surge arrestor lead wires to the HOT (black) power wire.



**NOTE:** Use only double-crimp style wire nuts approved by local regulations for all PAR+ and MSC+ wiring connections.

3. Connect the other black surge arrestor lead wire to the NEUTRAL (white) power wire.
4. Connect the white surge arrestor ground wire to one of the controller's brass ground-ing lugs.

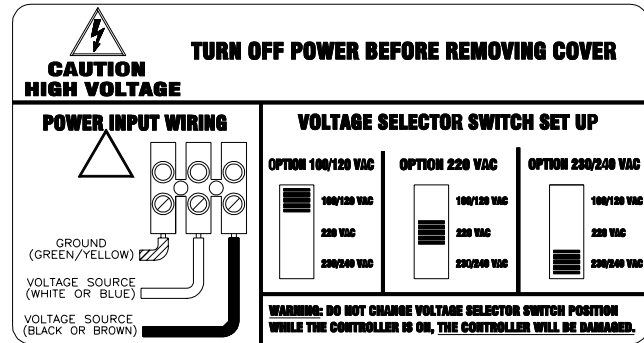


Figure 5: Modular AC power supply compartment connections

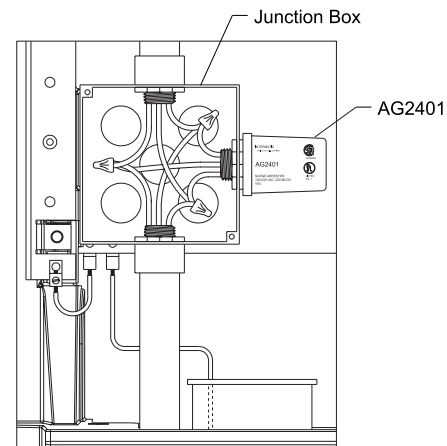


Figure 6: 120 / 220/ 240 VAC power wiring detail

## Controller Grounding System

Each controller location, or cluster of controllers, requires a grounding system to protect your controller(s) from lightning damage.

The grounding system should maintain a ground resistance of ten ohms or less. Anything 15 ohms or greater offers little protection to the controller's electronic circuits.

Refer to Appendix 1 for details on installing an appropriate grounding system for your location.

## Install MAXI 2-Wire Interface Board



**NOTE:** Follow this procedure only for 2-wire installations.

The Maxi 2-wire board mounts under the control module (face panel) of the basic PAR+ or MSC+ controller.

1. Remove the four screws from the face panel bezel (not the interior face panel screws) and lift out the control module.
2. Use four #4-40 machine screws to attach the MAXI 2-Wire module to the bottom of the control module, as shown in Figure 9.

### Cable Connections

Connect the 10-pin ribbon cable from the connector on the left end of the MAXI 2-Wire board to the 10-pin connector on the left end of the Power Interconnect Module.

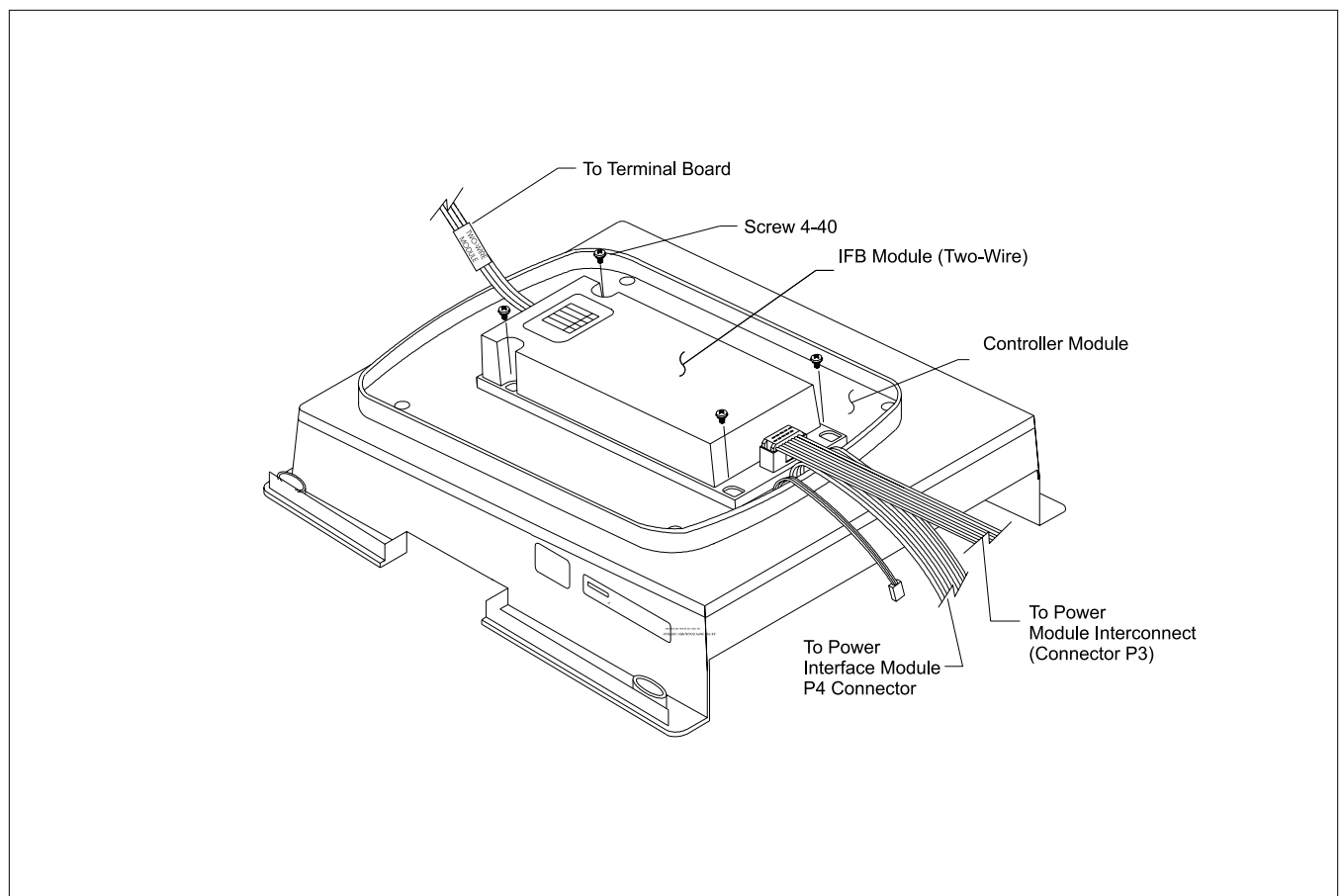


Figure 7: MAXI 2-Wire installation

## 2-Wire Path Connections

On the lower front of the controller is a 4-terminal connection block (as shown in Figure 8).

1. Connect the HOT (red) wire of the 2-wire communication path to terminal #1 (lower left terminal).
2. Connect the COM (black) wire of the 2-Wire communication path to terminal #2.
3. Connect the HOT (red) wire of the 2-Wire communication path going to the next controller in this cluster (if any) to terminal #3.
4. Connect the COM (black) wire of the 2-Wire communication path going to the next controller in this cluster to terminal #4 (bottom right terminal).

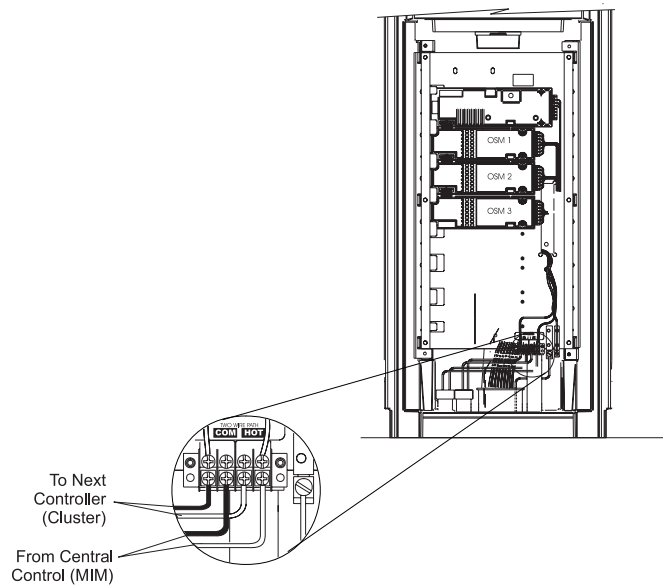


Figure 8: Controller 2-wire communication wiring

## Install the +LINK Radio/Modem Kit

### +LINK Power Transformer Installation & Connection



**NOTE:** Follow this procedure only for wireless systems without a Radio/Modem Kit (RMK) pre-installed.



**CAUTION:** To avoid a serious shock hazard, make sure the primary AC power source to the controller is OFF.

Install the +LINK Power Transformer (P/N 633254) in the transformer wiring compartment in the space to the left of the main PAR+/MSC+ Power Transformer. (See Figure 9).

1. Remove the two screws securing the Power Supply Access Cover.
2. Remove the two screws from the reverse side of the power supply and the one screw from the bottom of the power supply.
3. Remove the secondary power connector from the power interface board.
4. Remove the main AC power connector from the snap-in terminal block.
5. Insert the +LINK transformer into the power supply and run the orange wires through the hole in the top of the compartment.
6. Feed the wires through the power supply hole and secure the transformer using the nuts provided.
7. Attach the green ground wire to the grounding post.
8. Plug the +LINK transformer's white male connector into the free white female power supply connector.
9. Replace the power supply in the controller and secure it with its screws.
10. Reattach all power connections.

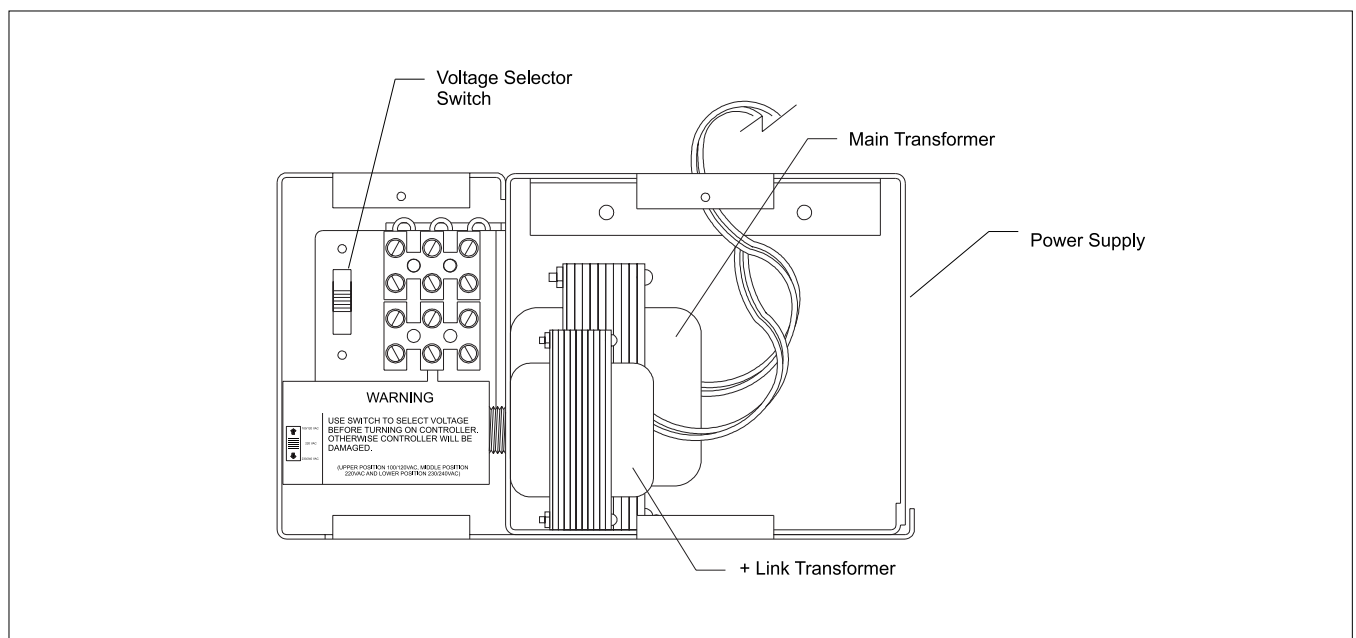


Figure 9: Location of +Link Transformer

## +LINK Interface Board Installation

The +LINK Interface Board mounts under the control module (face panel) of the basic PAR+ or MSC+ controller

1. Remove the four screws from the face panel bezel (not the interior face panel screws) and lift out the control module.
2. Use four #4-40 machine screws to attach the +LINK Interface Board module to the bottom of the control module, as shown in Figure 10.
3. Attach the 10-pin ribbon cable from the connector on the left end of the +LINK Board to the 10-pin connector on the left end of the Power Interconnect Board.
4. Attach the nine-pin Radio/Modem data cable into the connector on the bottom of the +LINK Board. Pass the cable through the lower right hole in the bottom of the pedestal.
5. Plug the other end of the nine-pin cable into the Radio/Modem link module.
6. Plug the link transformer power Wire Connector in the two-pin connector.
7. Replace the Control Panel Assembly and continue with the installation.

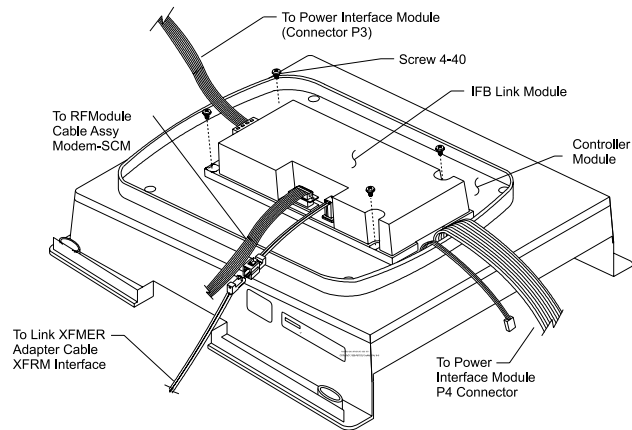


Figure 10: +LINK Interface Board installation and connection

## Radio Modem Kit and Antenna Panel Installation

1. Slide the radio unit into its mounting bracket on the antenna panel, as shown in Figure 11.
2. Attach the modem board to the antenna panel using the four screws provided.
3. Plug the connector cable from the modem board into the radio unit.
4. Plug the connector from the antenna into the radio unit.
5. Insert the metal tabs on the base of the antenna panel into the slots in the controller lid and use the two snap-in connectors to secure the antenna panel inside the lid.

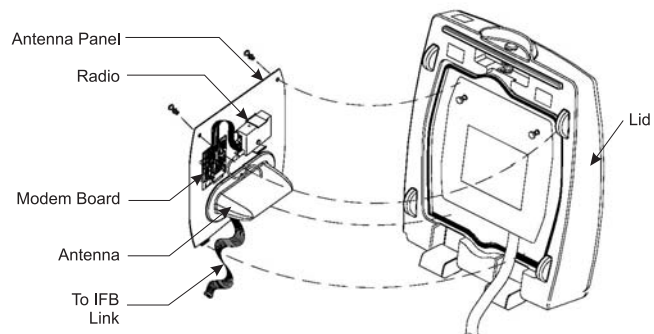


Figure 11: +LINK Radio Modem installation

## Basic PAR+ and MSC+ Field Wiring

On the right end of each Output Station Module (OSM) board is an 8-terminal station output terminal block. Run the station HOT wire from each appropriate terminal out to the Valve-in-Head sprinklers or Remote Control Valves in the field.

Terminal #1 on the first OSM board controls station #1. Terminal #2 controls station #2, and so on.

On the second OSM, terminal #1 controls station #9, terminal #2 controls station #10, etc. Each succeeding OSM picks up with terminal #1 controlling the next numerical station after the last station on the preceding OSM.

Connect each station valve wire to its appropriate terminal on the controller's terminal strips (i.e., station 1 to terminal #1, station 2 to terminal #2, etc.) Each station can control up to four valves.



**NOTE:** It may be necessary to splice station valve wires together to make them fit into the terminal strip connectors.

Connect a “common” wire to one of the leads on each valve. Connect the other end of the common wire to the “VLV COM” terminal on the controller's terminal strip.



**NOTE:** Wire used to connect the valves must be code-approved for underground installation.

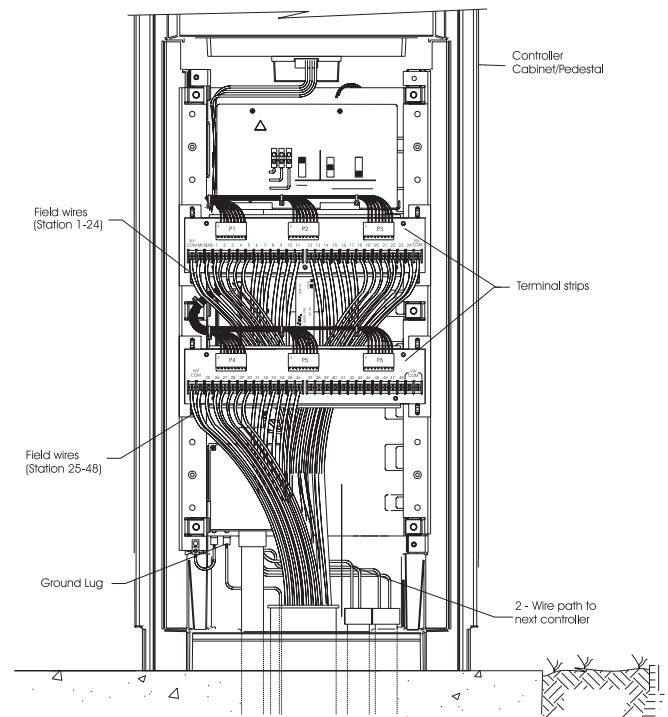


Figure 12: Controller field wiring diagram

## Appendix 1

### **Grounding System Installation**

To prevent lightning damage to your equipment, Rain Bird recommends installing a grounding system for the equipment (including controllers, weather stations, and central control systems).

The grounding system discharges lightning-induced electrical current into the earth rather than allow the surge to pass through power wires or field wires to your equipment's electronic components.

### **Ground Resistance**

Ground resistance occurs when grounding system components, or the soil itself, oppose the flow of electricity into the earth. Ground resistance is measured in units called "ohms" ( $\Omega$ ).

The higher the ground resistance (higher ohm readings), the less chance the surge will be shunted to ground rather than to the equipment's electronic components.

Figure 13 shows points where grounding systems can develop resistance.

To decrease ground resistance, Rain Bird recommends irrigating the soil around the grounding system. Each grounding system should have a dedicated irrigation zone with sprinkler heads and its own watering program to maintain soil moisture around the grounding system.

A properly installed grounding system should maintain a maximum ground resistance of 10 ohms, or less.

If you are unable to reach a resistance of 10 ohms or less, you can decrease resistance by surrounding the grounding rods or plates with ground enhancement material, such as POWER SET from Paige Electric Corporation (P/N 1820058), or GEM from ERICO (P/N GEM-25A).

If ground resistance still measures higher than 10 ohms, you can extend the ground rod length as described in "Ground Rod Stacking," or use additional grounding rods, as shown in grounding system design "Y" (Alternate).

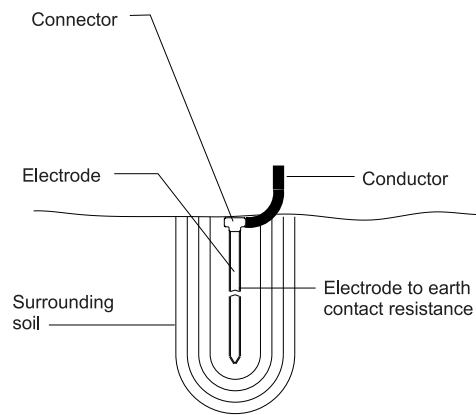


Figure 13: Grounding systems can develop resistance at many points.

## Installation Requirements

The following requirements apply to all grounding system designs (design “Y” and the “Grounding Plate” design).

All grounding rods or plates must be connected together below grade with #6 AWG or larger solid bare copper wire.

Install the connecting wire in as straight a line as possible. If you must make a turn or bend in the wire, make the turn in a sweeping curve with a minimum radius of eight inches and a minimum included angle of 90°.

To minimize resistance, the copper wire must be pre-welded to the grounding rods/plates, or welded to the rods/plates using an exothermic welding process at the site.

Make sure all welds are secure before burying the grounding rods. Rods and plates with welded joints do not need periodic visual inspection and can be fully buried (no valve box required).

Measure the ground resistance around the grounding system after installation, and once every year after that.



**NOTE:** The ground wire from the equipment to the grounding system should be as short as possible and have no bends, kinks, or coils in the wire.

Inspect the grounding system’s clamped connections to the equipment (not the welded grounding system connections) once a year to make sure they are secure and corrosion-free.

## Ground Rod Stacking

Threaded couplers (shown in Figure 14) are ground rod splices.

If a single grounding rod fails to produce 10-ohm ground resistance (maximum), threaded couplers can be used to “stack” grounding rods.



**NOTE:** Use threaded couplers made of the same material as your grounding rods.

Stacking ground rods increases the total effective rod length, decreasing ground resistance.

Joining the rods together with threaded couplers forms a secure connection so the grounding rods can be assembled quickly and easily.

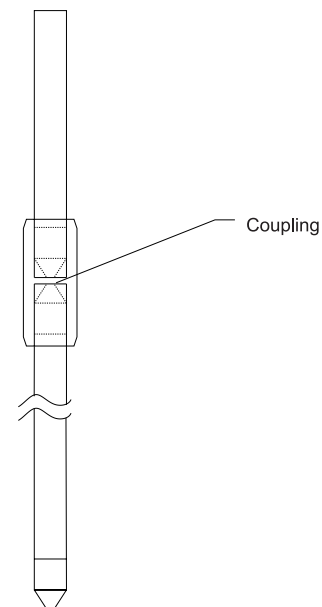


Figure 14: Stacking grounding rods with threaded couplers can help decrease ground resistance.

## Grounding System Designs

### Design "Y"

Design "Y" (shown in Figures 15 and 16) consists of three, 5/8"-diameter x 8-foot-long, copper-clad grounding rods. Install the rods in a radial 120° star ("Y") configuration.

Each rod must be installed in a true vertical position, at least 16 feet from the equipment.



**NOTE:** All grounding system diagrams are not to exact scale.

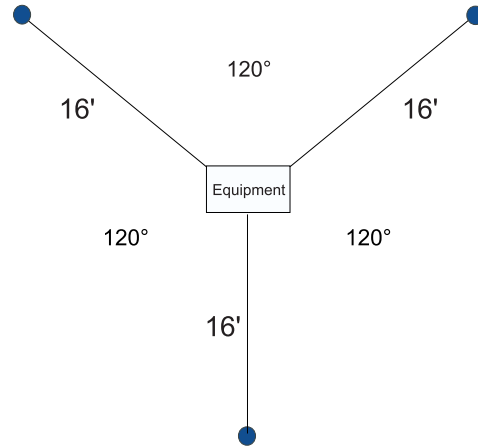


Figure 15: Design "Y" uses three grounding rods installed in a radial 120° "Y-shaped" configuration.

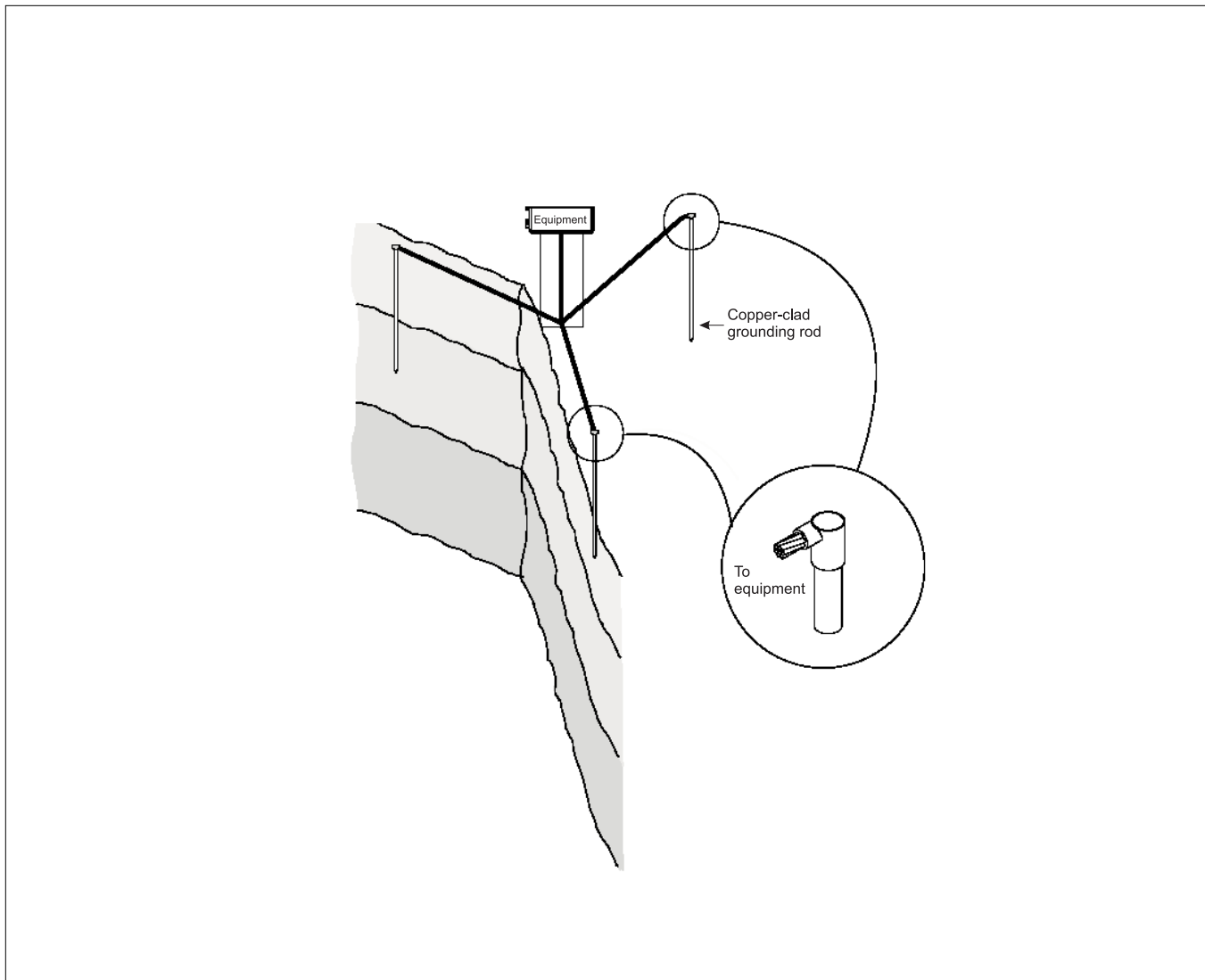


Figure 16: Grounding system design "Y" can be installed as shown, or with ground enhancement material to further reduce ground resistance.

## Design "Y" (Alternate)

An alternate design "Y" (shown in Figures 17 and 19) uses three radials in a 120° star ("Y") arrangement. Each radial consists of three, 5/8"-diameter x 8-foot long copper-clad grounding rods.

The first rod in each radial must be at least eight feet from the equipment. The rest of the rods must be at least 16 feet from any other rod.

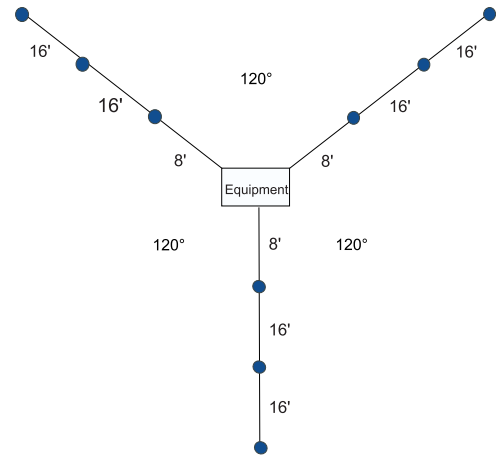


Figure 17: Design "Y" (Alternate) uses nine copper-clad grounding rods installed in a 120° star configuration.

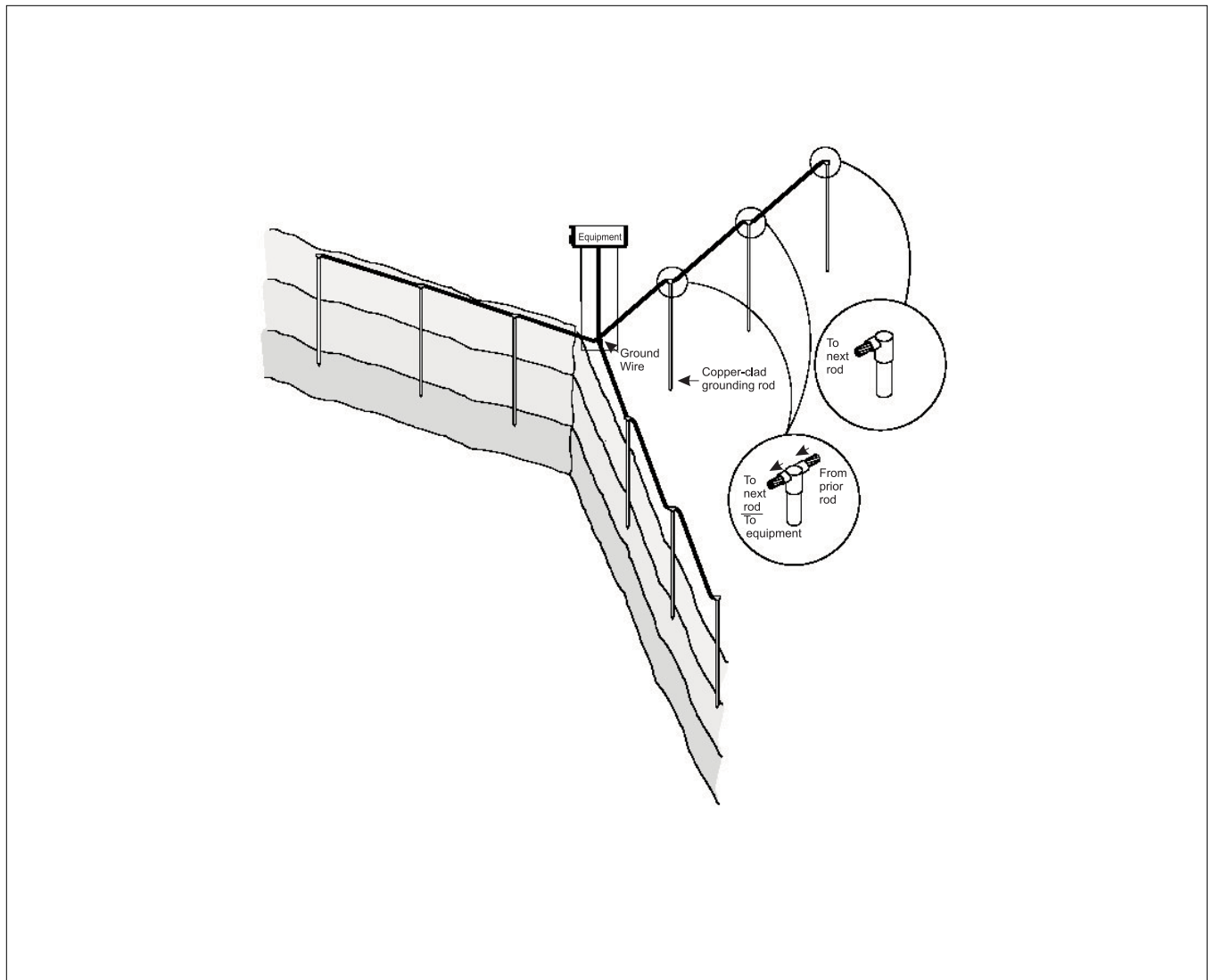


Figure 18: The alternate version of grounding system design "Y" uses nine grounding rods to reduce ground resistance.

## Grounding Plate Design

The “Grounding Plate” design (shown in Figures 19 and 20) consists of one vertical 8-foot copper-clad grounding rod at least eight feet from the equipment, and a copper grounding plate (minimum dimensions 4" x 96" x .0625"). Install the grounding plate horizontally, three feet deep and 15 feet from the grounding rod.

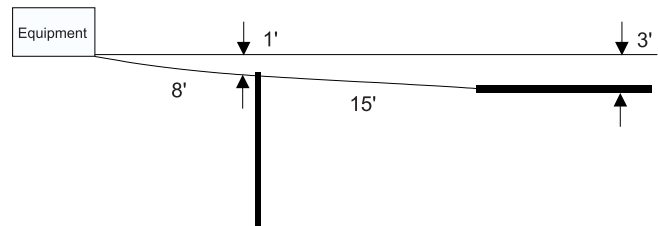


Figure 19: The “Grounding Plate” design uses one copper-clad grounding rod and a rectangular copper grounding plate.

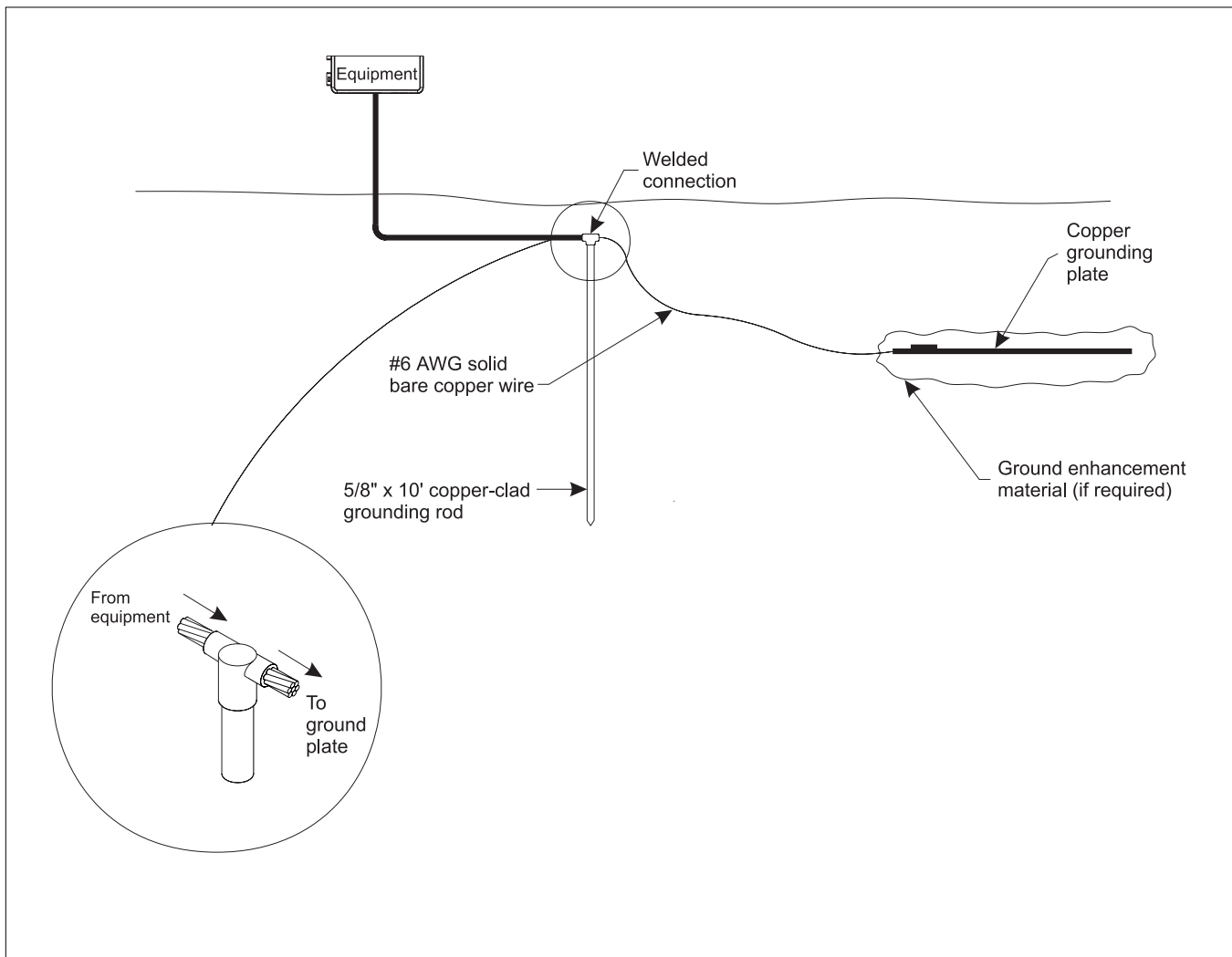


Figure 20: The “Grounding Plate” design may be used with or without ground enhancement material, depending on site conditions.

## Appendix 2

### ***Install an Additional Output Station Module (OSM)***

The basic PAR+ & MSC+ controller comes with a minimum of two OSMs (Output Station Modules) already installed. The OSMs are mounted at the top of the powerboard mounting plate, just below the Power Interconnect Module.

OSMs are held in place by two tabs on the left side of the mounting plate, and by two screws on the right side of the OSM board.

Each OSM can control up to eight stations, so the basic 2-OSM configuration can control a total of 16 stations (each station can control up to four remote- control valves).

You can install a maximum of four additional OSM boards, expanding the controller's capacity to a maximum of 48 stations.

1. To install the new OSM(s), slide the left end of the OSM under the mounting tabs on the left side of the powerboard mounting plate.
2. Secure the right side of the OSM to the mounting plate with two #6-32 machine screws.
3. Repeat Steps 1 and 2 for each additional OSM.

### *Ribbon Cable Connections*

1. Insert the 16-wire ribbon cable coming from the top left of the new OSM into the 16-pin connector on the bottom left of the OSM above it.
2. Repeat Step 1 to connect the ribbon cable for any other OSM(s) being installed.

### *Field Wire Connections*

On the right end of each OSM board is an eight-pin terminal station output connector.

Each station wire bundle is labeled with the numbers of the stations it controls. Connect the bundled station wires to the OSMs as follows:

1. Insert the appropriate eight-wire terminal block into the eight-pin connector on the right side of the new OSM. For example, for OSM 3, insert the field wire bundle labeled "Stations 17 - 24."

2. Repeat Step 1 to connect the field wires for any other OSM(s) being installed.

Remember, each OSM controls eight station. (OSM 1 controls stations 1 - 8, OSM 2 controls stations 9 - 16, OSM 3 controls stations 17 - 24, and so on.)

Make sure to connect the correct labeled field wire bundle to the correct OSM.

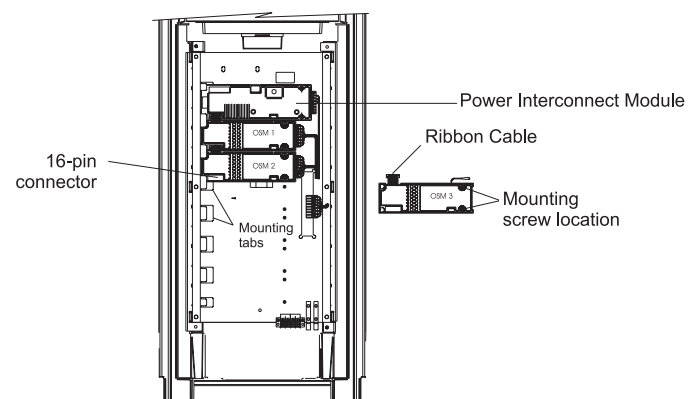


Figure 21: You can expand controller capacity to a maximum of 48 stations by installing additional Output Station Modules (OSMs).

**Warning:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause

harmful interference in which case the user will be required to correct the interference at their own expense.

Changes or modifications not expressly approved by Rain Bird Irrigation Corp. could void the user's authority to operate the equipment.



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