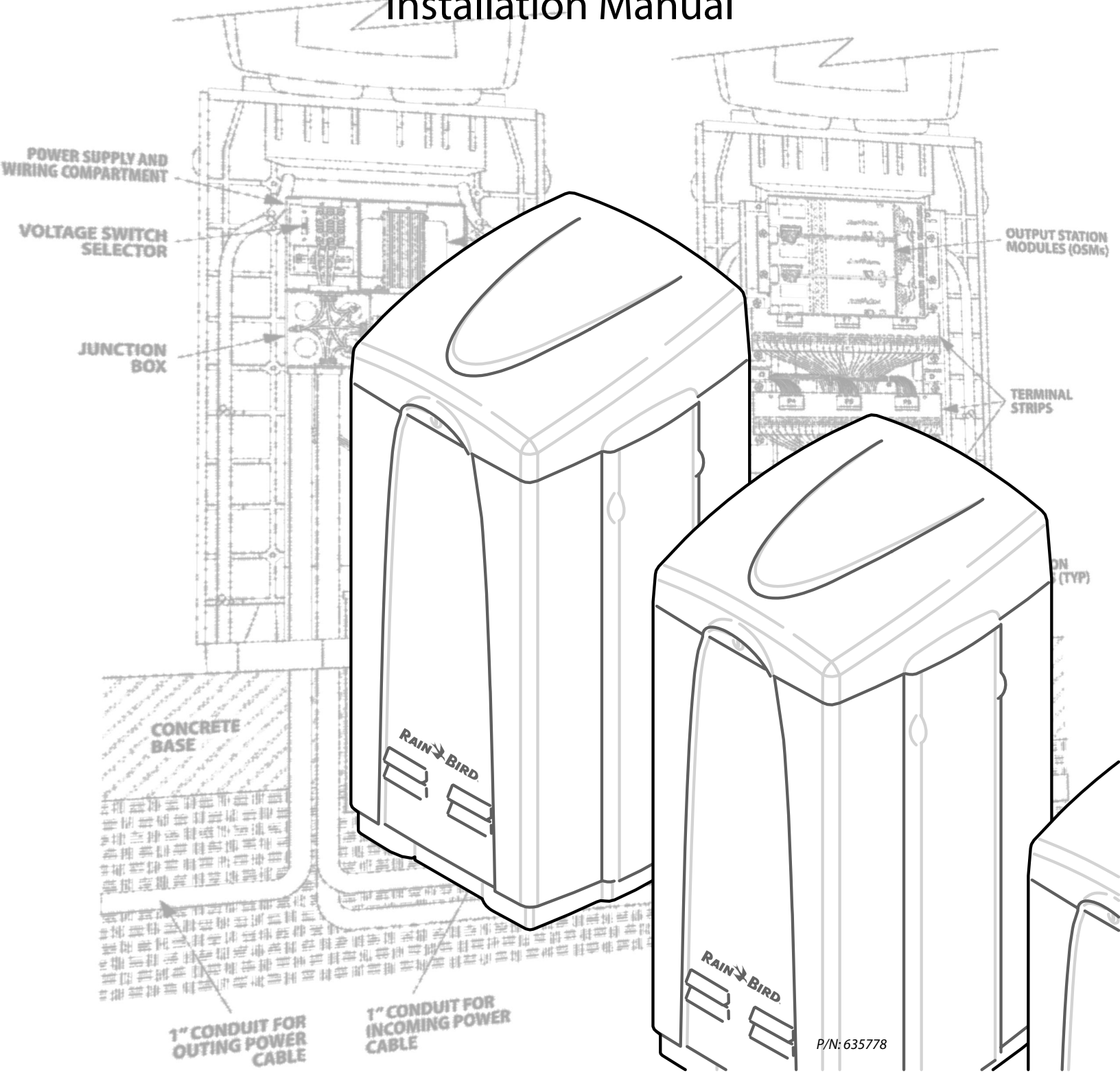


RAIN BIRD®

PAR+ES Controller

Installation Manual





PAR+ES Controller

Installation Manual

Contents

Introduction	1	Install The LINK Radio/Modem Kit	8
System Configuration	1	LINK Power Transformer Installation & Connection	8
Parts List and Tools Required	1	LINK Interface Board Installation	8
Installation Checklist	1	Antenna Panel and Radio Modem Kit Installation	9
Mount Controller Pedestal on Poured-In-Place Concrete Pad	2	CAM Link Installation Flow Chart.....	11
Install L-Bolts in Mounting Template(s)	2	Basic PAR+ES Field Wiring.....	12
Concrete Pad Requirements.....	2	Decoder Controller	13
Before Pouring Concrete Pad	3	Decoder Design	13
Pour the Concrete Pad and Mount the Pedestal....	3	General Installation Instructions.....	14
Install Power Wiring (120, 220 or 240 VAC)	4	Decoder Controller Installation.....	14
Install Junction Box.....	4	Field Surge Protection for Decoders.....	15
Surge Arrestor Installation	4	Install an Additional Output Station Module (OSM)	16
Connect AC Power Supply.....	5	Upgrade Kit Installation.....	17
Connect AC Power	5	Sensor Installation	18
Connect Power Wires and Surge Arrestor Wires.....	5	Appendix	
Controller to Controller Connections Overview	6	Controller Grounding System Installation	19
Install IFX 2-Wire Interface Board.....	7	Ground Resistance	19
Cable Connections.....	7	Installation Requirements	19
2-Wire Path Connections	7	Grounding System Designs	20
		Enhanced Ground System.....	21

Introduction

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

System Configuration

PAR+ES 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.

Every Model is available with Output Station Modules (Standard Controllers) or with Decoder Interconnect Board (Decoder Controllers). Standard controllers output directly to the solenoid or remote control valves. Decoder controllers output to decoders which in turn activate solenoids or remote control valves.

Parts List and Tools Required

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

Parts

- PAR+ES controller Installation Manual
- PAR+ES 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)
- 1", 1 1/2" and 4" non-metallic conduit, sweep ells, and appropriate fittings for routing power wires, communication wires, valve wires and ground 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; one for each controller being installed (recommended) if single, or one per cluster
- Metal junction box (4" x 4" x 1 1/2"); 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+ES controller, we recommend that you complete the following steps in order:

- Choose location and prepare to pour to concrete pad..... Page 2
- Mount controller pedestal on concrete pad..... Page 3
- Install junction box..... Page 4
- Install surge arrestor..... Page 4
- Connect AC power supply..... Page 5
- Connect power wiring..... Page 5
- Connect decoders (only required on Decoder Controllers)..... Page 12

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. Avoid installing the controller in the direct path of a sprinkler head. If the controller is in the direct path of a sprinkler, place the pedestal with hinge (back) side facing the sprinkler.

Install L-Bolts in Mounting Template(s)

1. Screw four of the 5/16" stainless steel nuts onto the L-bolts (see Figure 1).
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).

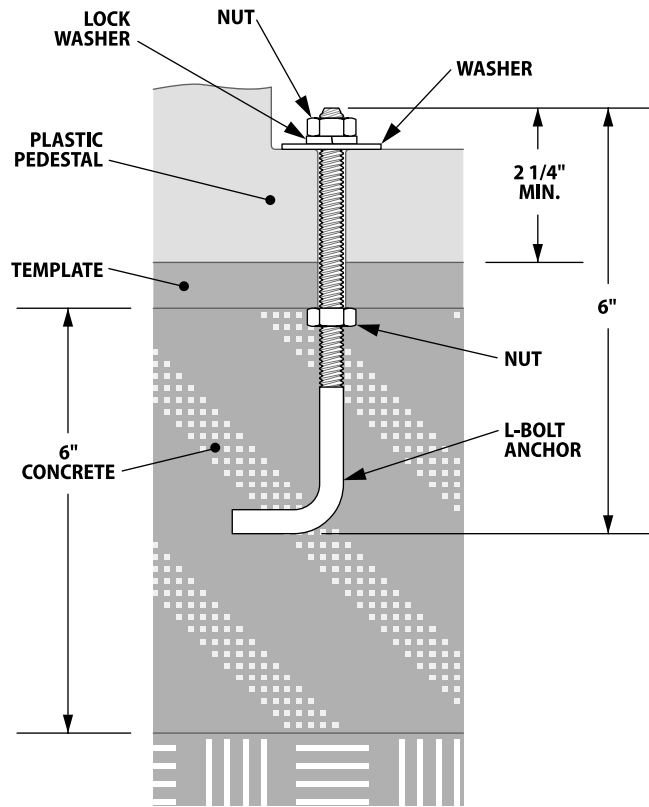


Figure 1

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

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. Install pad 1" above grade.

- **Size** - 20" x 20" minimum. If mounting multiple controllers on the same pad, size the pad to allow at least 6" clearance between controllers (see Figure 2).
- **Thickness** - 6" minimum.

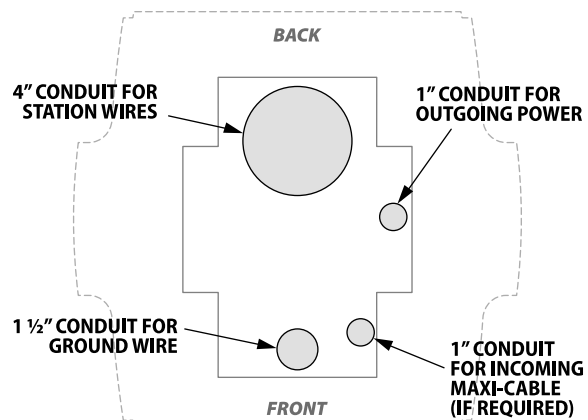


Figure X

Typical single controller sweeps detail.

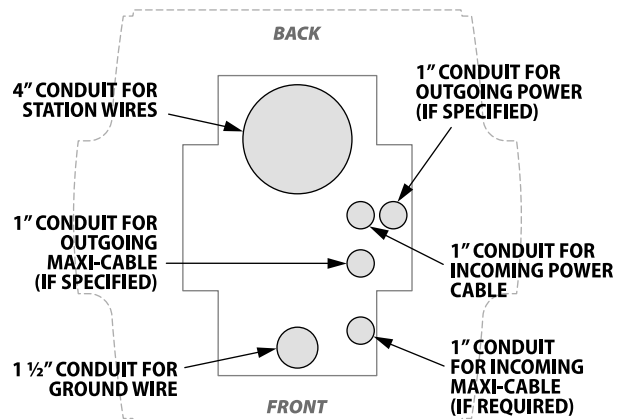



Figure Y

Typical multiple controller sweeps detail.

Before Pouring Concrete Pad

1. Position a 1" sweep "ell" for the 120, 220, or 240 volt power wires. If installing multiple controllers on the same pad, position another 1" sweep ell to carry power wires to the other controllers (see Figures X and Y for proper sweep details).
 2. Position a 1" sweep ell for the 2-wire communication wires (for 2-wire systems only). If installing multiple controllers on the same pad, place another 1" sweep ell to carry communication wires to the other controllers.
 3. Position one 4" ell for the valve output wiring, valve common wires, Maxi Wire (decoder controller installation), master valve wiring, etc.
-  **NOTE:** Decoder Controllers only require a 1 1/2" sweep ell for valve wire path(s), 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 as shown in Figure 2. Make sure the template is level and properly oriented before setting it into concrete at concrete's grade. 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 6" 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 bolt the controller pedestal securely to the concrete pad.

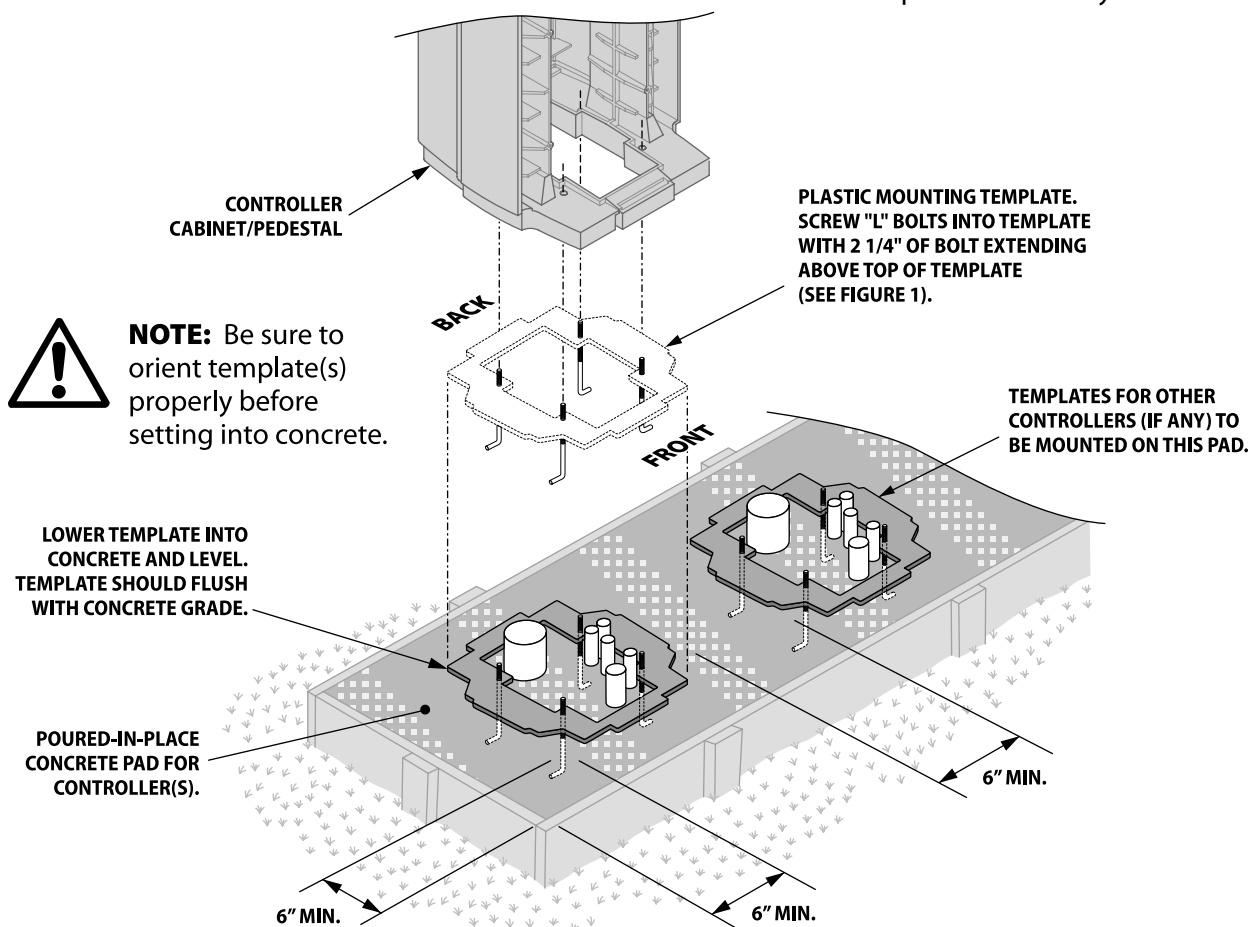


Figure 2
Proper template orientation on concrete pad.

Install Power Wiring (120, 220 or 240 VAC)

Install Junction Box

PAR+ES 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 1" 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 3.
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).

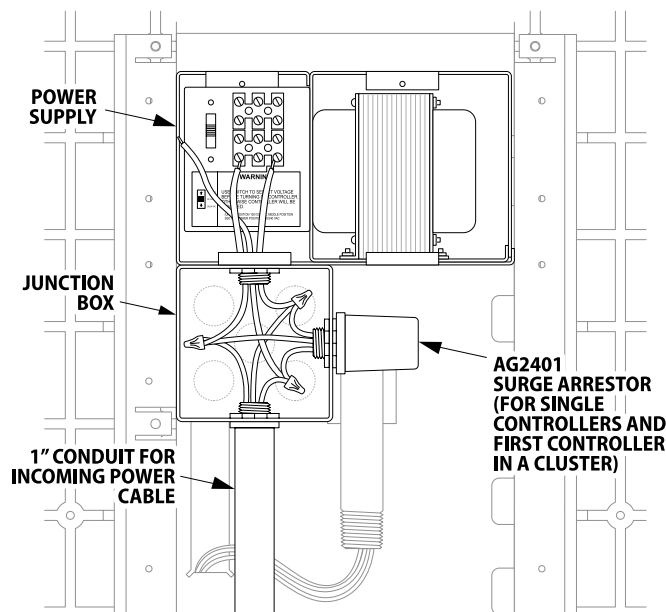


Figure 3

**Detail of junction box installation position.
120/220/240 VAC Power Wiring Detail.**

Last Controller in the Cluster

1. 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.
2. Run the 1" conduit directly to the controller wiring compartment and use an appropriate fitting to connect the conduit to the wiring compartment.

Surge Arrester Installation

Rain Bird recommends installing a surge arrester to protect the controller's power wiring circuits from voltage fluctuations. Recommended surge arrester models include the Intermatic AG-2401 (or 1G2401LA1).

Install Surge Arrester

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

Install Surge Arrester (Alternate Location)

For stand-alone and 2-wire installations, you may choose to install the surge arrester 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 arrester into the knockout hole.
 3. Connect the surge arrester wires to the controller's power wires (see Connect Power Wires and Surge Arrester Wires).
 4. Replace the controller's power supply access panel.
- **To order a surge arrester, contact Intermatic, Inc. at (815) 675-2321.**

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 from the power supply compartment down into the junction box (green, black and white for 120 VAC installations; green black and red or other appropriately identified hot-wire for 220-240 VAC installation).
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 4).
5. Connect the utility ground to the ground lug on the left side of the wiring compartment (see Figure 5).
6. Use the 3-position selector switch to choose correct voltage option for your installation (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.



NOTE: In 240 VAC the power wire are colored red/black or red/blue.

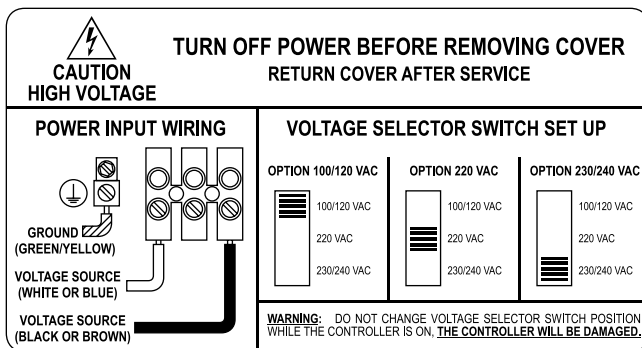


Figure 4

Modular AC power supply compartment connections.

Connect Power Wires and Surge Arrestor Wires

1. In the junction box, connect the AC power wires (black, white, and green) as shown in Figure 3.
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+ES wiring connections.

3. Connect the other black surge arrestor lead wire to the NEUTRAL (white) power wire.



NOTE: If using a 220/240 volt system, the other black surge arrestor lead should go to the other HOT (red or blue) power wire.

4. Connect the white surge arrestor ground wire to one of the controller's copper grounding lugs.

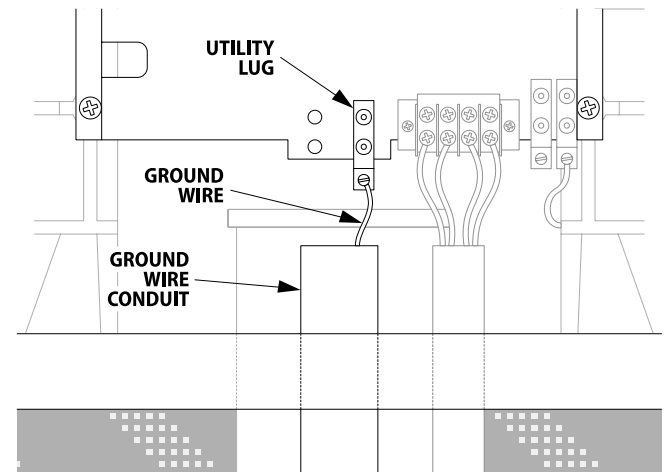


Figure 5
Ground Wire Connection



NOTE: Each controller location or cluster of controllers requires a **Controller Grounding System** to protect your controller(s) from lightning damage. Refer to the manual Appendix for details on installing an appropriate grounding system for your location.

Controller to Controller Connections Overview

➤ Figure 6 shows overview of how power and communication wiring connects from controller to controller in a cluster.

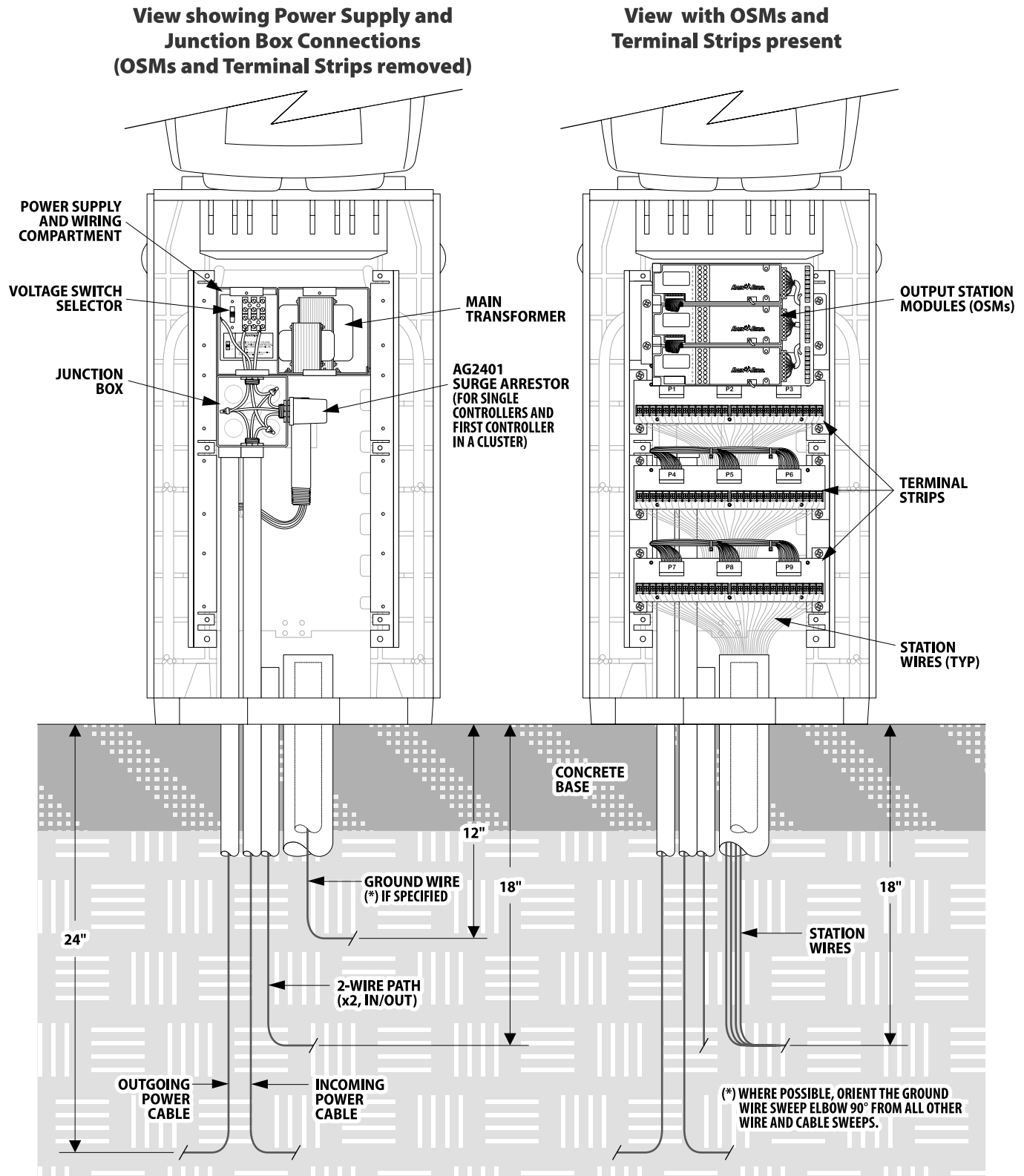


Figure 6

Overview of Controller Cluster showing power, and communication wiring connections.

Install IFX 2-Wire Interface Board



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

The IFX 2-wire board mounts under the control module (face panel) of the basic PAR+ES 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 2-Wire module to the bottom of the control module, as shown in Figure 7.

Cable Connections

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

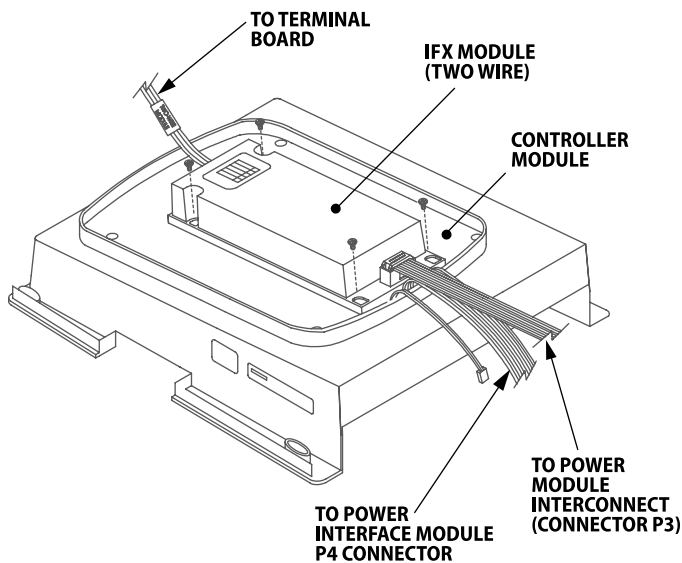


Figure 7
2-wire module attachment detail.

2-Wire Path Connections

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

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



NOTE: If sharing only one MSP-1 among a cluster of controllers, then splice the black and red wires on the EQUIP side of the MSP-1. Connect one set of wires to the green plug that connects to the 2-wire interface board. Connect the other set of wires to the 4-terminal connecting block of the second controller.

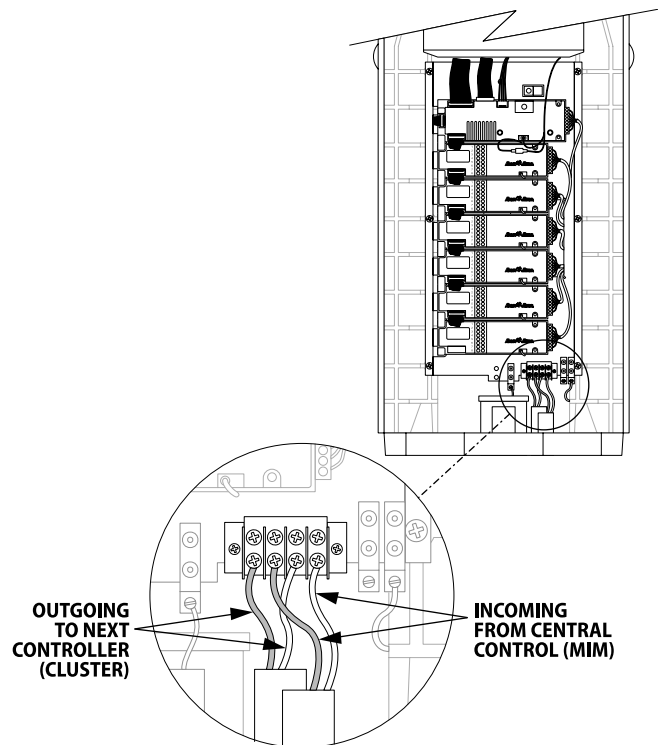


Figure 8
Controller 2-wire Communication Wiring

* Compatible with all PAR+ES, MSC+ and PAR+ satellites with version -42 or later firmware.

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+ES 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.

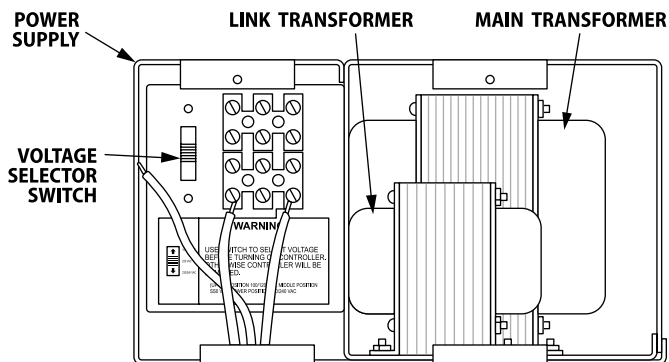


Figure 9
Location of Link Transformer

9. Replace the power supply in the controller and secure it with its screws.
10. Reattach all power connections.

LINK Interface Board Installation

The LINK Interface Board mounts under the control module (face panel) of the basic PAR+ES 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 (see 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 opening between the bezel tray and the plastic pedestal itself.
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.

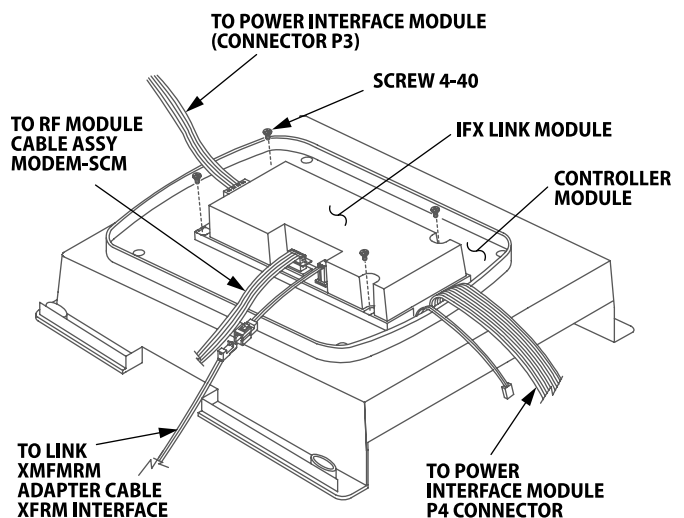


Figure 10
LINK Interface Board
Installation and Connection

Antenna Panel and Radio Modem Kit Installation

1. Insert metal tabs at the base of the antenna panel into the slots in the controller lid. Make sure that the antenna cable is properly routed through the notch in the lower-right corner of the antenna panel. Secure the antenna panel to the lid using two Philips head screws (see Fig. 11A).
2. Remove the four screws securing the controller's faceplate to the pedestal, then carefully disconnect the cable connectors leading to the faceplate. Keep the ribbon cable attached to the LINK Interface Board under the faceplate.
3. Mount two clip-on ferrites around the power cable to LINK Interface board (note that one ferrite is already mounted on the power cable at the factory); then mount one ferrite around the Modem/LINK Interface Board ribbon cable



NOTE: To install the ferrite, first lay the cable in the ferrite channel then wrap around. The power cable should be wrapped twice around the ferrite before closing and latching. The Modem/LINK Interface Board ribbon cable should only be wrapped around once.

4. Route the antenna cable and Modem/LINK Interface Board ribbon cable through gap in pedestal leading to the transformer enclosure, until both have cleared the gap.
5. Reposition the faceplate and secure to pedestal using the previously removed screws.

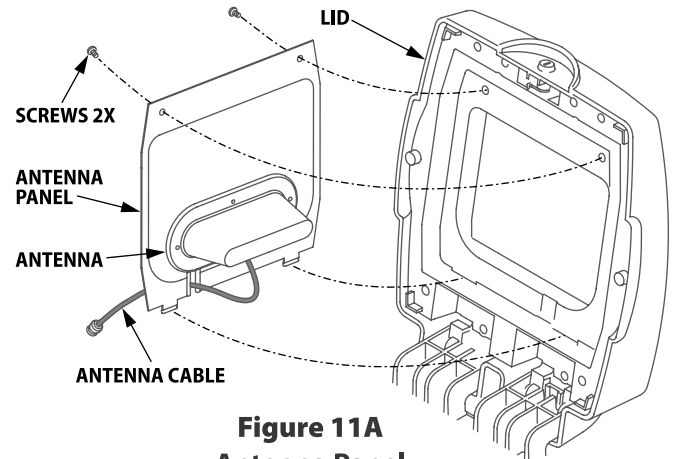


Figure 11A
Antenna Panel
Installation

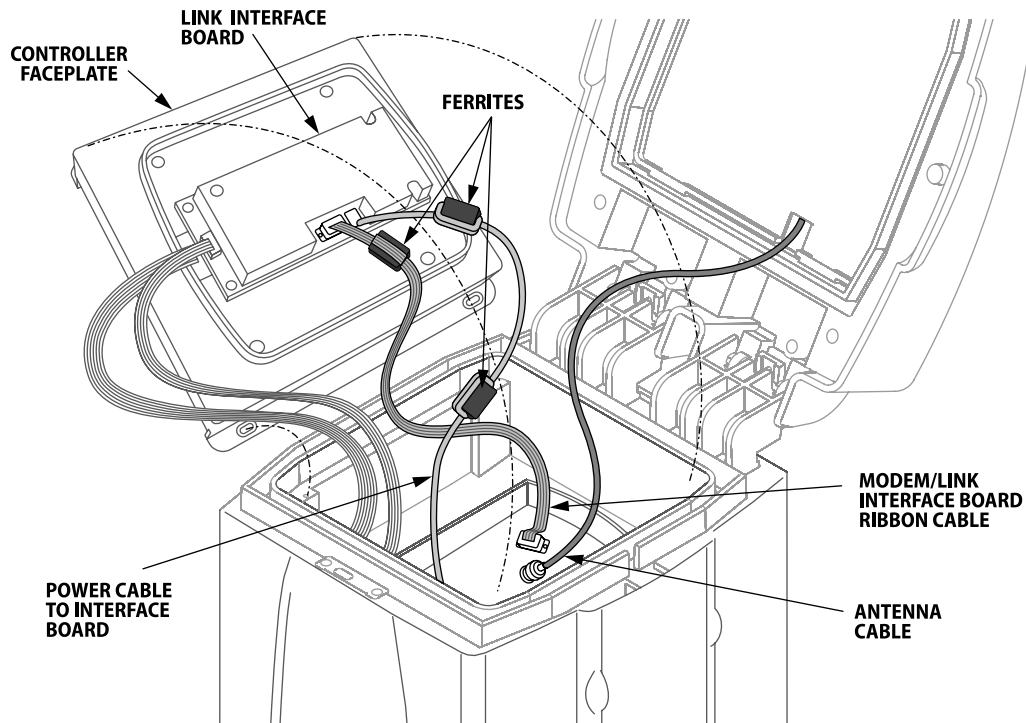


Figure 11B
Radio Modem Kit Installation

Radio Modem Kit Installation cont.

6. Remove the rear door of the pedestal.
7. Locate the radio/modem bracket assembly. Attach the antenna cable to the radio antenna connector; then attach the LINK Interface Board ribbon cable to the modem card (see Fig. 11 C).
8. Remove the adhesive protector strip from the velcro on the bottom of the radio/modem bracket. Position to the right-side on top the transformer enclosure and press the radio/modem bracket to secure it into place (see Fig. 11 D).
9. Power the pedestal ON; then re-install the rear door and close the lid.

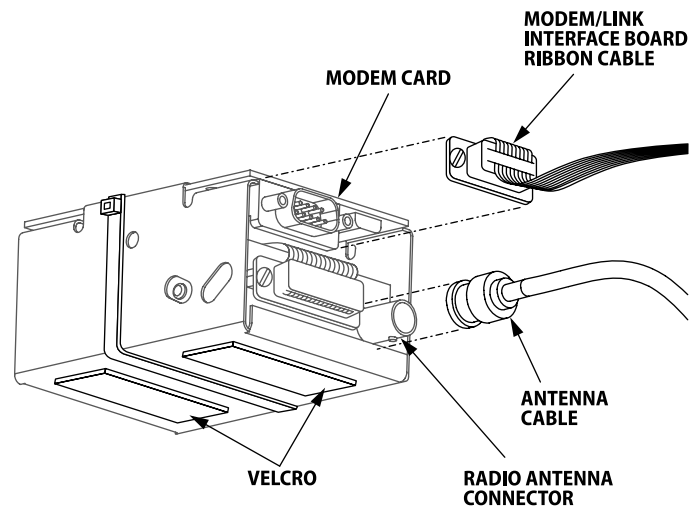


Figure 11C
Radio/Modem Bracket Assembly

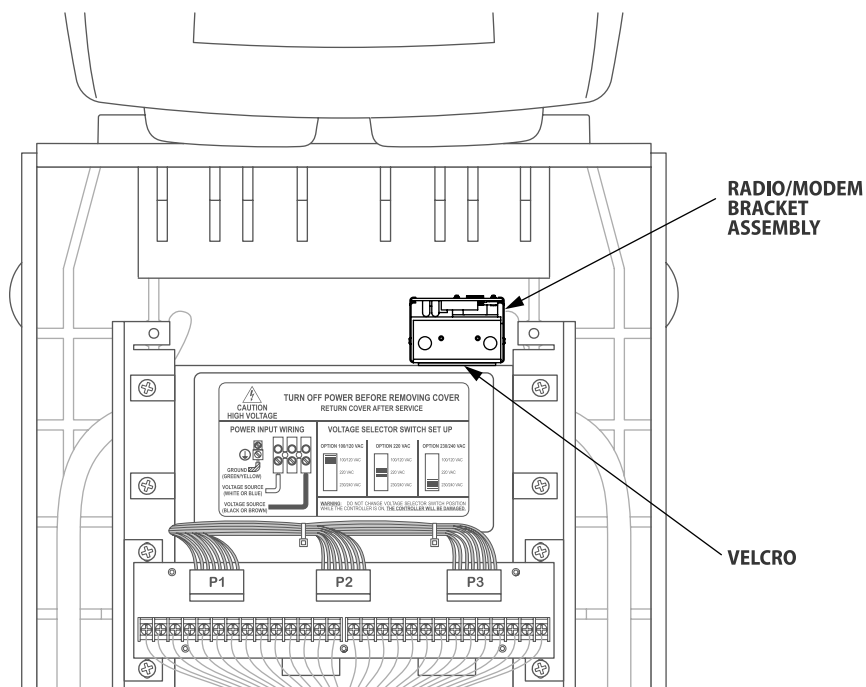


Figure 11D
Radio/Modem Bracket Assembly Mounted

CAM Link Installation Flow Chart

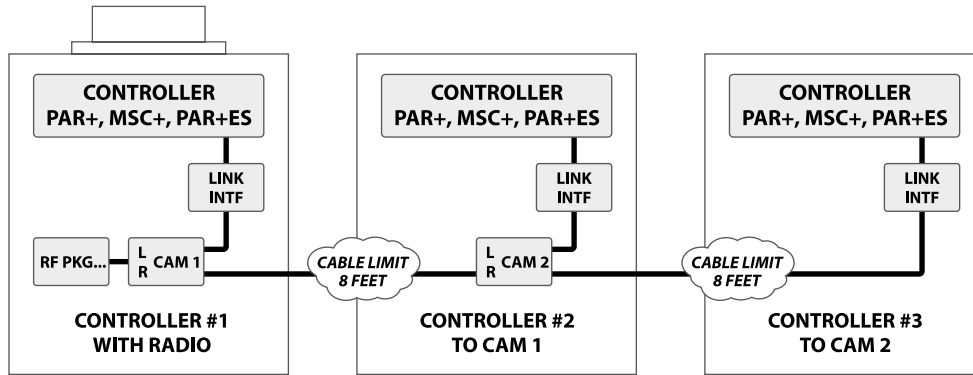
Up to four controllers can share one Radio/Modem kit. Figure 12 shows how to connect the different CAM Link modules.

Controller #1 has 1st CAM and must have Radio Modem Package.

Controller #2 has 2nd CAM with output to CAM 1 "Remote" input.

Controller #3 no CAM, with Link Interface to CAM 2 "Remote" input.

(If no Controller #3 then CAM 2 is not needed. Link Interface output would go to CAM 1 "Remote" input)



If 4th Controller added:
3rd CAM installed in Controller #3 with Interface to Local and #4 to "Remote" input.

Figure 12
Typical CAM link configuration flow-chart.



NOTE: Cables provided with CAM Link are not suitable for direct burial and need to be in either a waterproof conduit underground from controller 1 to 2 and so on, or in a waterproof conduit above ground, at pad level, between controllers.

Basic PAR+ES Field Wiring

1. 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.

2. 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.

3. A harness cable connects the OSMs to the corresponding stations on the terminal strip.

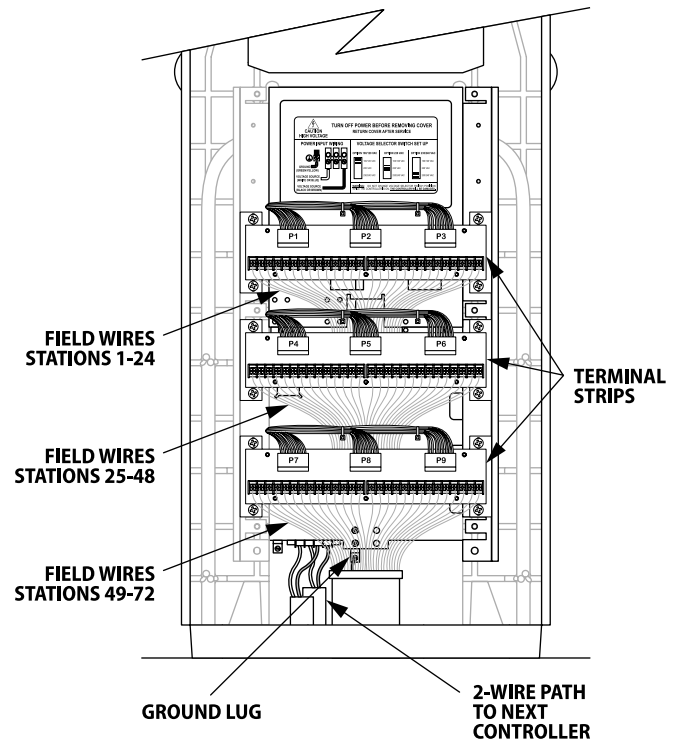


Figure 13
Controller Field Wiring Diagram

Decoder Controller



NOTE: For additional information about decoders, please refer to Rain Bird Decoder System Manual.

Decoder Design

There are design specifications limiting the length of the wire path between the controller and decoders and the decoders and solenoids/valves. The distance between the decoder and the controller is the Primary Path and the maximum length depends on the layout. The distance between the decoder and the solenoid/valve is the Secondary Path and the maximum length depends on the wire size. Following are two options for the wire path layout as well as a breakdown of the wire path lengths for various wire sizes.

Primary Path

There are two types of layouts for the wire path between the controller and the decoders, the Star configuration and the Loop configuration. The Star configuration is a design where the wire path is branched throughout the course but where it is not looped back to the controller.

The Loop configuration is a design where the wire path is looped back to the controller at the farthest reach of the layout. The Star configuration is the recommended layout for the wire path for its ease of troubleshooting. Only use the Loop configurations when the wire path length of the Star configuration is not sufficient to meet your needs.



NOTE: If a Loop configuration is necessary, install a valve box near the center of the Loop configuration for ease of troubleshooting.

In a Star configuration, the primary path is the distance between the controller and the farthest decoder. In a Loop configuration, the length is measured by following the wire path around the loop out to the farthest decoder and back to the controller. The maximum allowable primary path lengths depend on the layout as well as the size of wires. Table 1 lists the maximum allowable primary path lengths for several wire sizes.

Maximum Primary Path		
Wire Size	Star · Miles/km	Loop · Miles/km
14 AWG	2.4 / 3.8	9.6 / 15.2
12 AWG	3.8 / 6.1	15.2 / 24.4
10 AWG	6.1 / 9.8	24.4 / 39.2
2.5 mm ²	1.8 / 3.0	7.5 / 12.0

Table 1

Secondary Path

The secondary path is the distance between the decoder output and the solenoid on the valve-in-head sprinkler(s) or the remote control valve. The maximum lengths for the secondary path for several wire sizes are shown in Table 2.

Maximum Secondary Path		
Wire Size	Feet	Meters
16 AWG	289	88
14 AWG	456	139
12 AWG	720	220
1.5 mm ²	328	100
2.0 mm ²	436	133
2.5 mm ²	545	166

Table 2



NOTE: If two solenoids are connected to one decoder, the total length is the distance from the decoder to the first solenoid plus the distance again from the decoder to the second solenoid.

Decoder Address

All the decoders connected to one controller must have a unique four or five digit address code. The controller uses the address codes to activate each decoder individually. Setup instructions for the decoder addresses are included in the PAR+ES Operation Manual.

General Installation Instructions

It is very important that the decoders be installed properly since most of the system will be underground and therefore not easy to access should any alterations or repairs be required. Refer to instructions below for proper installation techniques.

Stripping The Maxi Wire



NOTE: Use only a U.F. safety stripper tool as manufactured by King Safety Products to remove the outer PE jacket on the Maxi wire. It is the only tool that will remove the outer jacket of the Maxi wire while minimizing potential damage to the insulation on the inner conductors.

1. Slide 4" to 6" of the Maxi wire out through the hole in the back of the safety stripper.
2. Make sure the cable is on it's edge and gently apply even pressure with your thumb on top of the tool.
3. Firmly draw the tool back along the cable in one motion while maintaining light pressure with your thumb.
4. Turn the cable on it's opposite edge and repeat the process.
5. Clip off the loose outer pieces of PE jacket with linesman's pliers.
6. Remove the inner insulation with a properly sized wire stripper for the gauge cable you are working with to make the Maxi wire splice, Red to Red and Black to Black.



NOTE: It is advisable to test the above method on a small piece of scrap Maxi wire to familiarize yourself with the amount of pressure to apply consistently remove a very thin strip of the jacket in one motion without damaging the inner insulation.

Wire Splices

1. Gently twist two wires together using linesman's pliers. No more than four twists are required.



NOTE: Twisting the wires in excess can fracture the conductors.

2. Firmly hand-tighten the appropriate size wire nut onto the twisted wire and push it into the direct burial splice connector as far as possible.
3. Snap the cap securely.

Valve Boxes at Splices

1. Place splices in a 12" x 18" rectangular valve box.
2. Provide three to four feet of excess wire in the valve box so that splices may easily be brought above ground for troubleshooting.
3. Clearly mark all wire splices with their routing direction or the holes they feed.

Decoder Controller Installation

Decoder Wiring Procedure - Primary Path

1. Connect red wire of Equip side of MSP-1 to terminal 1A of DIB.
2. Connect black wire of Equip side of MSP-1 to terminal 1B of DIB.
3. Connect red wire of Line side of MSP-1 to red wire of Primary path.
4. Connect black wire of Line side of MSP-1 to black wire of Primary path.



NOTE: Color coding of the wires can be an invaluable troubleshooting tool in the future.

5. Connect the other end of the red wire of the Primary path to one (1) of the blue decoder wires.
6. Connect the other end of the black wire of the Primary path wire to the other blue decoder wire.



NOTE: If you are continuing the wire path to another decoder, then connect a new wire to the decoder in steps 5-6 and run the other end of the new wire to the next decoder.

Decoder Wiring Procedure - Secondary Path

- 1.** Connect the two (2) white decoder wires to the two (2) solenoid coils of the valve-in-head rotor or remote control valve.
- 2.** Record the decoder address and following the instructions in the PAR+ES Operation Manual, add the decoder address to the appropriate station at the controller.
- 3.** Connect the two blue decoder wires to the wire path from the controller, one to the red wire and the other to the black wire.

Field Surge Protection for Decoders

LSP-1 surge arrestors are required for surge protection of decoders and solenoids. The LSP-1 surge arrestors consist of several surge arrestor devices potted in a cylindrical yellow plastic case. The LSP-1 has two blue wires and two green wires.

Install LSP-1s in the following locations:

- Install LSP-1s so that there is no more than eight decoders between two LSP-1s or so that there is no more than 500 feet between LSPs, whichever is less.
 - Install LSP-1s at the last decoder in a dead end of a wire path.
- 1.** Connect the two blue wires to the primary path wire, one to the black and one to the red wire.
 - 2.** Connect the green wire that has the closed eye spade securely to the core tube of the solenoid on the valve-in-head rotor or to a remote control valve by using a stainless steel nut threaded onto the core tube.
 - 3.** Connect the green wire to a ground rod on a grounding grid using a brass clamp.



NOTE: A resistance of 50 ohms or less is required for the LSP-1 surge arrestor to be effective.

- 4.** If the decoder is not located next to the solenoid, install the LSP-1 near the decoder and connect both green wires to the grounding grid using separate brass clamps.

Install an Additional Output Station Module (OSM)

The basic PAR+ES controller comes with a minimum of two OSMs (Output Station Modules) already installed. The OSMs are mounted at the top of the power-board 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 seven additional OSM boards, expanding the controller's capacity to a maximum of 72 stations.

Installing Additional Output Station Modules

1. To install the new OSM(s), slide the left end of the OSM under the mounting tabs on the left side of the power-board mounting plate.
2. Secure the right side of the OSM to the mounting plate with two #6-32 machine screws. OSMs for stations 49-72 should be installed on swing out of bracket. Refer to "Upgrade Kit Installation" for instructions.
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.

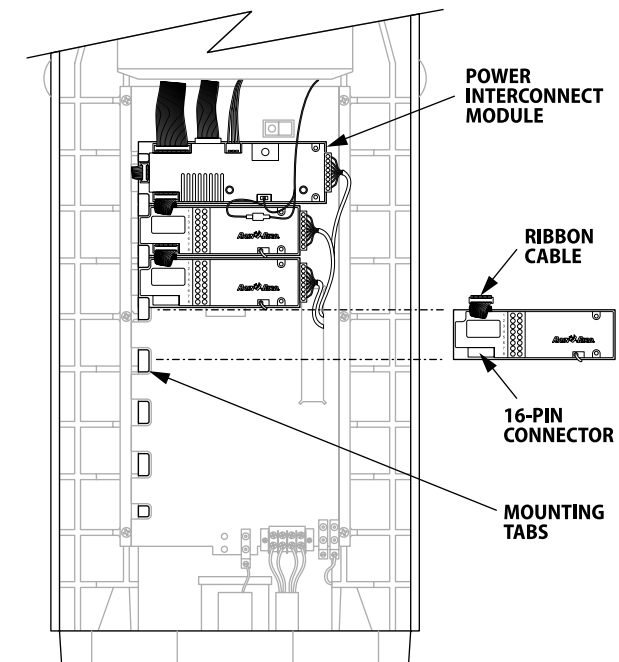


Figure 14
You can expand controller capacity to a maximum of 72 Stations by installing additional Output Station Modules (OSMs)

Upgrade Kit Installation

For controllers ordered with more than 48 stations, a swing out bracket (where three 3" additional OSMs can be installed), terminal strip, power and communication cables and the appropriate OSMs are pre-installed. If ordered with fewer than 48 stations, an Upgrade Kit will be required for the expansion of the PAR+ES controller to 72 stations (see Figure 15). The Upgrade Kit includes a swing-out bracket, terminal strip, power and communication cables.

Installation of Swing-out Bracket

1. To install the swing-out bracket, using two #10-32 screws, attach to the left rail, just above the first terminal strip.
2. Once in place, attach the OSM(s) as described below.

Installation of Power and Ribbon Cables (for OSM for stations 49-56)

1. Disconnect power cable between PIB (Power Interconnect Board) and first OSM.
2. Connect "Y" cable to power cable of first OSM.
3. Connect short end of "Y" cable to the PIB, at the bottom end.
4. Connect the long end of the "Y" cable to the first OSM installed on the swing-out bracket.
5. Connect the ribbon cable to the top left opening in the PIB board. Connect the other end of the ribbon cable to the first OSM on the swing-out bracket by attaching to ribbon cable located at the top left.

For second and third OSMs installed on swing-out bracket (for stations 57-72):

6. Insert the 16-wire ribbon cable coming from the top of the OSM into the 16-pin connector on the bottom left of the OSM above it.
7. Repeat Step 6 to connect the ribbon cable for the last OSM being installed.
8. Insert the power cable coming from the top right of the bottom OSM to the bottom right of the OSM above it.
9. Repeat Step 8 to connect power cable for last OSM being installed.

Terminal Strip Installation

1. Install the third terminal strip just below the second terminal strip by using four #10-32 screws (two at each end) and attaching to the rails.
2. Connect one end of harness cable (green plugs) to the corresponding OSMs for stations 49-72.
3. Connect the other end of harness cable to third terminal strip in the following order from left to right (P7, P8, P9).
4. Connect each station valve wire to its appropriate terminal on the controller's third terminal strips (i.e., station 49 to terminal #1, station 50 to terminal #2, etc.) Each station can control up to four valves.

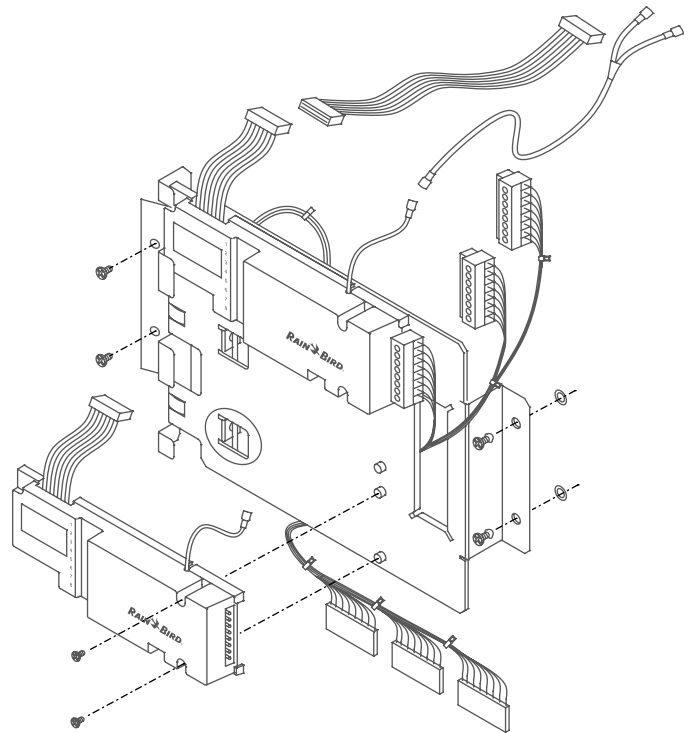


Figure 15
PAR+ES Upgrade Kit with OSMs

Sensor Installation

Connect a rain or moisture sensor to your PAR+ES controller and automatically shut off irrigation when the sensor activates. You can connect a local sensor normally open (NO) or normally closed (NC). You cannot connect a sensor decoder for Central Control.

In a Decoder Controller

(see Figure 16)

1. Connect one sensor wire to sensor terminal #1 of the DIB (Decoder Interconnect Board).
2. Connect the other wire to the second sensor terminal #1 of the DIB.
3. Setup the sensor (setup instructions in PAR+ES Operation Manual).

In a Standard Controller

(see Figure 17)

4. Connect one sensor wire to terminal #3 of the first terminal board.
5. Connect the other sensor wire to a common terminal.
6. Setup the sensor (setup instructions in PAR+ES Operation Manual).

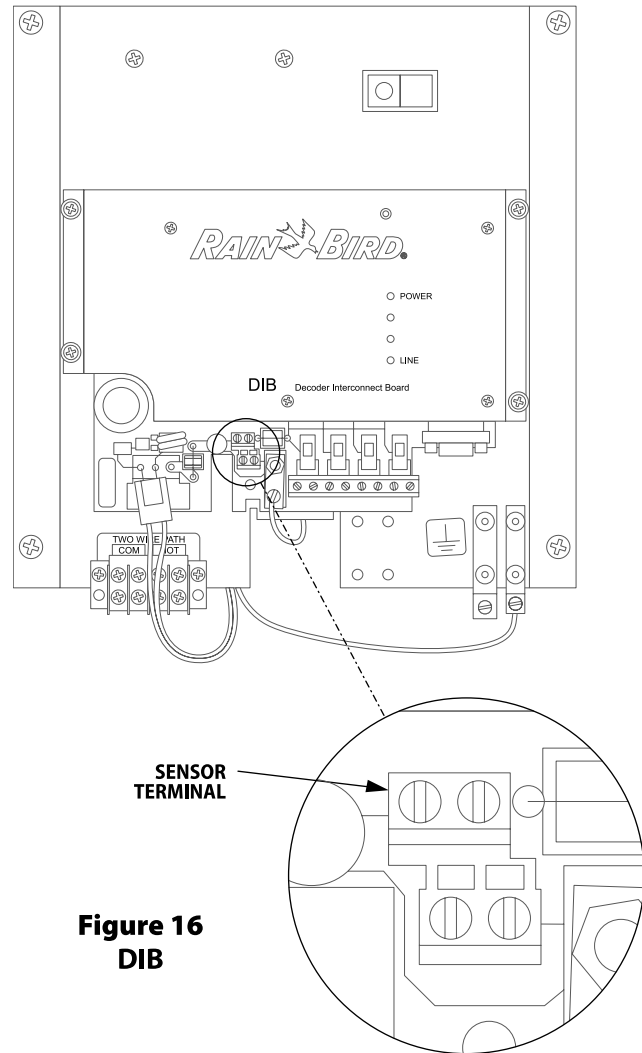


Figure 16
DIB

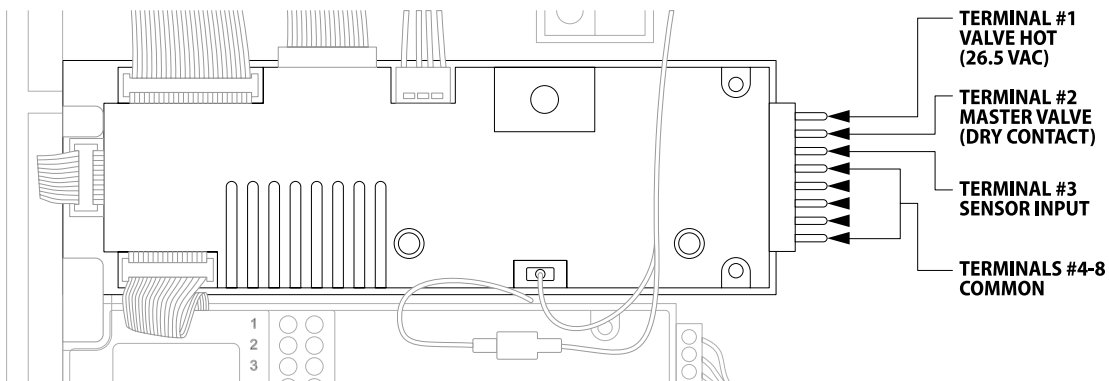


Figure 17
PIB

Appendix - Controller 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" (Ω).

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 18 shows points where grounding systems can develop resistance.

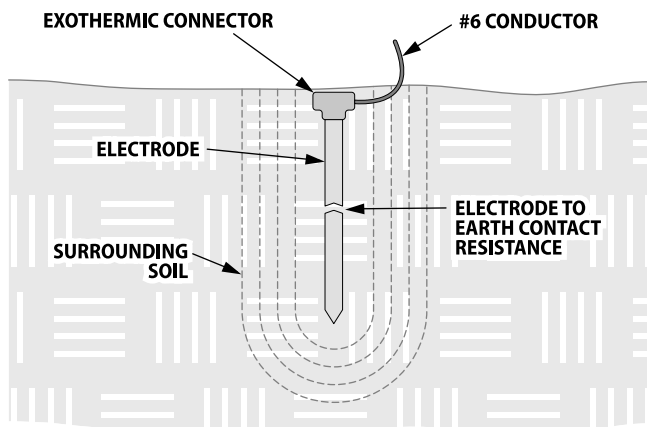


Figure 18
Grounding systems can develop resistance at many points.

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

A good grounding system should maintain a ground with a resistance of 10 ohms or less. Anything 15 ohms or greater offers little protection to the controller's electronic circuits.

If you are unable to reach a resistance of 10 ohms or less, you can enhance the ground network with additional ground electrodes or plates.

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 8" 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.

Grounding System Designs

Basic Ground System - 1 rod

The single ground rod design consists of a 10' ground rod with a Caldwell Connection located at least 10' from the equipment (see Figure 19).

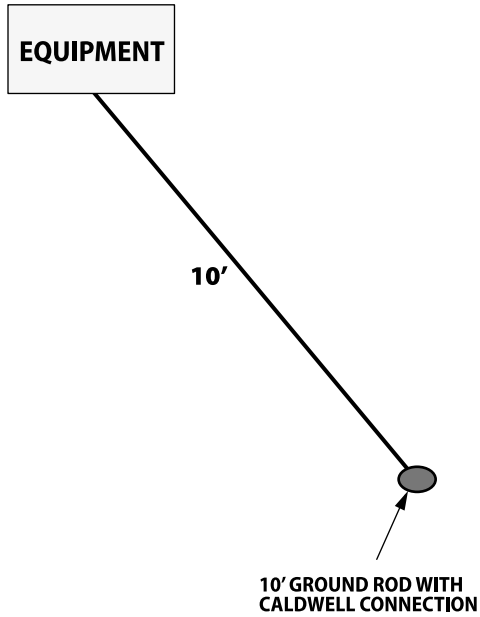


Figure 19

Enhanced Ground System

Option A:

Add a second 10' ground rod, positioned 10' from the controller and 20' from the first rod.

Option B:

The "Grounding Plate" design (see Figure 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. Encase ground plate in 100 lbs. of ground enhancement material.

Option C:

Enhanced ground in poor soils (in lieu of rods); Position 2 ground plates 8' from the controller and 20' from one another. Encase each ground plate in 100 lbs. of ground enhancement material.

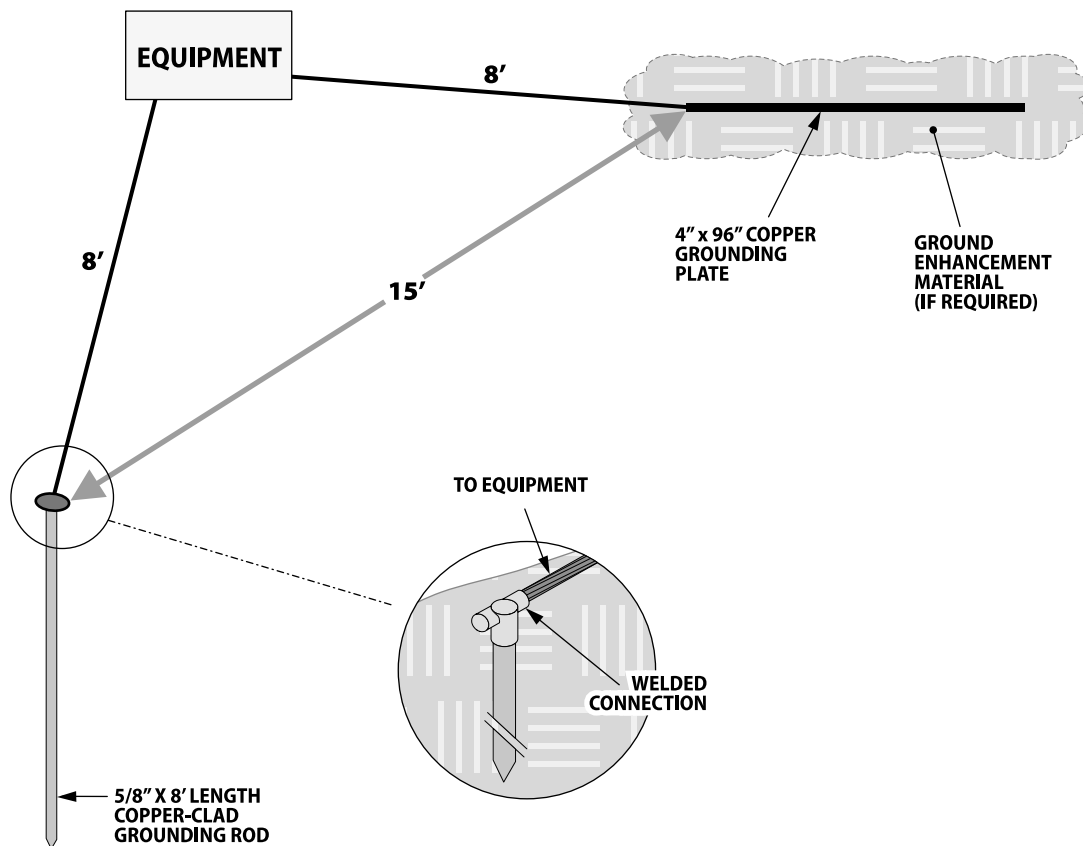


Figure 20

The "Enhanced Ground System" design uses one Copper-clad grounding rod and a rectangular grounding plate. Depending on site conditions, this design can be used with or without ground enhancement material.

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 Corporation could void the user's authority to operate the equipment.



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