Paige®
WATER & OUTDOOR
A GCG COMPANY

# TECHNICAL GUIDE

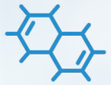
# Delivering 65+ years of innovative wire and cable solutions.

Water is a precious resource. But, for something so fragile, it must overcome extreme conditions to get to where it needs to go. That's where we come in.

Paige engineers high performance water management and optimization solutions for the toughest environments. Our products are the most trusted because they're the most tested. With Paige® Water & Outdoor, no barriers will stand in your way.

Temperature

Weather



Chemicals/Fertilizer Treatments

Water Pressure

***Paige delivers cable and wiring solutions, including custom cable and value-added assemblies for:***

- Agricultural Irrigation
- Surface and Submersible Pumps
- Commercial and Golf Irrigation
- Residential Irrigation
- Landscape Lighting, Sound, Invisible Fence and Tracer

## Need help?


Chat with us online: paigewater.com

Give us a call: (908) 687-7810

Send us a message: team@paigewater.com


Paige® WATER & OUTDOOR
A GCG COMPANY

# Table of Contents

# IRRIGATION WIRES & CABLES

## INSTALLATION TIPS FOR WIRE & CABLE

**Wire and cable burial depth is dictated by the National Electrical Code®. Temperature changes cause wires and cables to expand and contract as much as 1% of the length. And high voltage power lines create large electro-magnetic fields that cause interference and corrupt signals in communication lines. It is therefore necessary to take certain precautions when installing these products.**

Wires and cables carrying up to 30 volts should be installed at a minimum burial depth of 6". If mechanical equipment, such as aerifiers and shovels, is expected to disturb the area, then the wires and cables should be installed at a minimum depth of 12". For wires and cables carrying more than 30 volts and less than 600 volts, the minimum burial should be 24".

For irrigation controller output cables carrying more than 30 volts, where the controller is listed as a "Power Limited Power Source" (Class 2 or Class 3), the burial depth is elective, although a minimum of 12" is recommended.

When installing wires and cables in a trench, they must be "snaked" so that some slack is created. At points along the trench where there are sharp bends, a loop of 12" to 24" shall be created to allow shrinkage. When communication cables are in the same trench as power wires, there shall be a minimum separation between them of 12".

## POWER WIRES

**For 120 VAC or 240 VAC Single Phase power sources to irrigation controllers. (Choose one of the following:)**

**SINGLE CONDUCTORS, TYPE UF** – This type of wire is a general purpose, direct burial, product that is widely used on all kinds of irrigation systems. Available from 14 AWG up to 1/0 AWG. See specification number P7001D for available colors and stripes. Detailed color code requirements are available from the American Society of Irrigation Consultants, ASIC Guideline 102-2004 (www.asic.org, "Design Guides").

All branch circuit wires shall be type UF and sized according to the irrigation system plans. They are to be UL® listed for direct burial, and rated at 600 volts. The copper conductors shall be insulated with PVC and colored as follows:

| 120-volt system | |
|---|---|
| Hot | Black |
| Neutral | White |
| Equipment ground | Green |

| 240-volt system | |
|---|---|
| Hot (Line 1) | Black |
| Hot (Line 2) | Red |
| Equipment ground | Green |

Paige Water & Outdoor specification number **P7001D**

**SINGLE CONDUCTORS, TYPE THWN** – This type of wire is used in applications where the end user requires a high degree of safety and it must be installed in conduit. Available from 14 AWG up to 1000MCM AWG. See specification number P7316 for available colors. Detailed color code requirements are available form the American Society of Irrigation Consultants, ASIC Guideline 102-2004 (www.asic.org, "Design Guides").

All branch circuit wires shall be type THWN and sized according to the irrigation system plans. These wires must be installed in conduit. The wires shall not occupy more than 40% of the cross-sectional area of the inner diameter of the conduit. They are to be UL® listed for in-conduit installations in wet applications, and rated at 600 volts. The copper conductors shall be insulated with PVC/Nylon and colored as follows:

| 120-volt system | |
|---|---|
| Hot | Black |
| Neutral | White |
| Equipment ground | Green |

| 240-volt system | |
|---|---|
| Hot (Line 1) | Black |
| Hot (Line 2) | Red |
| Equipment ground | Green |

Paige Water & Outdoor specification number **P7316**

photo: courtesy Hunter Industries

**TYPE UF-B CABLE (120 VAC SYSTEMS ONLY)** – This type of cable facilitates installation since the three conductors are installed within an outer jacket, which gives the cable more robust qualities. Available from 14 AWG/2c-with ground up to 6 AWG/2c-with ground.

All branch circuit power cables shall be type UF-B. They are to be UL® listed for direct burial, and rated at 600 volts. The cable shall include "three conductors". The inner copper conductors shall be insulated with high dielectric PVC and Nylon. The outer jacket will be gray PVC and is to be sunlight resistant. The inner conductors are colored black, white, and bare copper.

Paige Water & Outdoor specification number **P7295D**


photo: courtesy Hunter Industries

**TYPE TRAY CABLE** – This type of cable is widely used on large projects such as golf courses, parks, schools, commercial and industrial sites, cemeteries, etc., because of its ease of installation and toughness at a reasonable price. Available from 14 AWG/3c up to 4/0 AWG/3c. Detailed color code requirements are available form the American Society of Irrigation Consultants, ASIC Guideline 102-2004 (www.asic.org, "Design Guides").

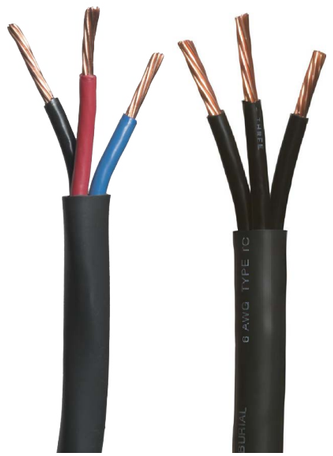
All branch circuit power cables shall be type Tray Cable. They are to be UL® listed for direct burial, and rated at 600 volts. The cable shall include "three conductors" (for 120 or 240 volt circuits). The inner copper conductors shall be insulated with high dielectric PVC and Nylon. The outer jacket will be black PVC and is to be sunlight resistant. The inner conductors are colored (usually blue, red, and black) or numbered (1, 2, and 3). Inner conductors shall be color-coded at every splice and termination using Vinyl Electrical Color Coding Tape (3M #35) to National Electrical Code® and electrical industry standards, as per the chart below:

For cables with colored inner conductors, color coding shall be executed as follows *(note that color coding is different for 120-volt and 240-volt systems):*

| Conductor Color | Branch Circuit | |
|---|---|---|
| | 120-volt | 240-volt |
| | Tape Color | |
| Black | None | None |
| Red | White | None |
| Blue | Green | Green |

For cables with numbered inner conductors, color coding shall be executed as follows *(note that color coding is different for 120-volt and 240-volt systems):*

| Conductor Color | Branch Circuit | |
|---|---|---|
| | 120-volt | 240-volt |
| | Tape Color | |
| Black (1) | None | None |
| Red (2) | White | Red |
| Blue (3) | Green | Green |



Paige Water & Outdoor specification number **P7266D** for 10 AWG and smaller and specification number **P7267D** for 8 AWG and larger.

## CONTROL VALVE WIRES

### For 24 VAC (nominal) circuits. (Choose one of the following:)

**SINGLE CONDUCTORS, TYPE UF/TWU –** This type of wire is a general purpose, direct burial, product that is widely used on all kinds of irrigation systems. Available from 14 AWG up to 1/0 AWG. See specification number P7001D for available colors and stripes.

Wires connecting the remote control valves to the irrigation controller shall be single conductors, type UF/TWU. Its construction incorporates a solid copper conductor and PVC insulation. The wires shall be listed for direct burial in irrigation systems and be rated at a minimum of 30 VAC. Wire sizes and colors are defined in the irrigation plans and other specifications.

Paige Water & Outdoor specification number **P7001D**

*Note: White wires (or white with different color stripes) should be used only as the "common". Green wire should not be used since this color is strictly reserved for the "equipment ground" of the power source. All other colors can be used as common or hot.*

**SINGLE CONDUCTORS, TYPE PE** – This type of wire, listed as Golf Course Sprinkler wire, was specifically designed for the harsh conditions of landscape projects where chemicals such as fertilizers, herbicides, pesticides, and fungicides are frequently applied. This product is excellent for these applications. See specification number P7079D for available colors and stripes.

Wires connecting the remote control valves to the irrigation controller shall be single conductors, type PE. Its construction incorporates a solid copper conductor and polyethylene (PE) insulation. The wires shall be listed for direct burial in irrigation systems and be rated at a minimum of 30 VAC. Wire sizes and colors are defined in the irrigation plans and other specifications.

Paige Water & Outdoor specification number **P7079D**

*Note: White wires (or white with different color stripes) should be used only as the "common". Green wire should not be used since this color is strictly reserved for the "equipment ground" of the power source. All other colors can be used as common or hot.*

**"18-MULTI"** – This direct burial cable is available with varying numbers of 18 AWG conductors, ranging from 2 to 25. It is used primarily in residential and small commercial irrigation projects.

The irrigation cable shall incorporate enough wires to accommodate all the valves it is designed to control, plus some spares for future expansion. For example, if the cable will activate 6 valves, then the number of wires needed is: 6 hot + 1 common + 2 spares = 9 wires. This cable would be called out as 18 AWG/9c. The construction shall include insulated solid copper conductors and an overall PE jacket. The cable shall be listed as Underground Low Energy Circuit Cable.

Paige Water & Outdoor specification number **P7183D**

## COMMUNICATION CABLES

Compatible with **TORO SYSTEMS** – Typically uses a 16 AWG/1-pair cable. It is available as shielded or shielded/armored. The latter is rodent and lightning resistant.
(Choose one of the following:)

**SHIELDED** – The communication cable shall be 16 AWG/1-pair. The construction shall include tin coated copper conductors, an aluminum shield to prevent cross-talk, a drain wire for grounding the cable, and an overall PE jacket. The cable shall be listed for direct burial.

Paige Water & Outdoor specification number **P7162D**

**SHIELDED AND ARMORED** - The communication cable shall be 16 AWG/1-pair. The construction shall include tin coated copper conductors, an aluminum shield to prevent cross-talk, a drain wire for grounding the cable, a stainless steel tape (also to be grounded) helically wrapped around the pair of wires, and an overall PVC jacket. The cable shall be listed for direct burial.

Paige Water & Outdoor specification number **P7162D-A**

Compatible with **RAIN BIRD SYSTEMS** – Typically uses a 14 AWG/2c or 12 AWG/2c "Maxi" cable, or 19 AWG/multi-pair cable for "Maxicom" systems. Rain Bird allows MAXICOM cable to be any of the following types: PE-39, PE-54, or PE-89. See specification number P7072D for available outer jacket colors of Maxi cable.

**MAXI SYSTEMS** - The communication cable shall be 14 AWG/2c or 12 AWG/2c, as shown on the irrigation plans and specifications. The cable shall include two type UF/TWU wires with a PE outer jacket. The colors of the outer jacket shall be as called-for in the irrigation plans and specifications.

Paige Water & Outdoor specification number **P7072D**

**MAXICOM SYSTEMS** - The communication cable shall be 19 AWG with a minimum of 3-pairs (or 6-pairs or 12-pairs, etc.) The cable construction shall be type PE-39 or PE-54 or PE-89.

Paige Water & Outdoor specification number **P7315D** (for PE-39, & PE-54, or PE-89)

Compatible with **HUNTER SYSTEMS, WEATHER STATIONS, SENSORS, TELEPHONE LINES, ETC** – Typically use an 18 AWG/2-pair cable. It is available as shielded or shielded/armored. The latter is rodent and lightning resistant. (Choose one of the following:)

**SHIELDED** – The communication cable shall be 18 AWG/2-pair. The construction shall include tin coated copper conductors, an aluminum shield to prevent cross-talk, a drain wire for grounding the cable, and an overall PE jacket. The cable shall be listed for direct burial.

Paige Water & Outdoor specification number **P7171D**

**SHIELDED AND ARMORED** - The communication cable shall be 18 AWG/2-pair. The construction shall include tin coated copper conductors, an aluminum shield to prevent cross-talk, a drain wire for grounding the cable, a stainless steel tape (also to be grounded) helically wrapped around the pairs of wires, and an overall PVC jacket. The cable shall be listed for direct burial.

Paige Water & Outdoor specification number **P7171D-A**



## DECODER AND 2-WIRE/2-CORE CABLES (DIRECT BURIAL)

**Custom cables have been designed by Paige Water & Outdoor for various manufacturers of decoder systems, each somewhat different. (Choose one of the following:)**

Compatible with **TORO SYSTEMS** – These cables feature 2 twisted wires, so that they stay together during the installation process and offer some opposition to electrical flow during lightning strikes. These twisted pairs are available in 9 different color combinations.

They are also available with a tough High Density Polyethylene outer jacket for additional mechanical strength. The outer jacket is a loose tube that slides off easily when being removed and is available in 6 different colors per size to facilitate circuit identification. This cable is specifically designed for the harsh conditions of landscape projects where chemicals such as fertilizers, herbicides, pesticides, and fungicides are frequently applied. Available in 14 AWG/2c and 12AWG/2c constructions.

**WITHOUT OUTER JACKET** - The decoder cable shall consist of 2 wires, twisted together. Its construction shall incorporate solid copper conductors with an extra-thick PE insulation with a minimum wall thickness of 0.075".

Paige Water & Outdoor specification number **P7389D**

**WITH OUTER JACKET** - The decoder cable shall consist of 2 wires, twisted together. Its construction shall incorporate solid copper conductors with PE insulation. A loose tube-High Density Polyethylene jacket shall cover the twisted wires. The jacket colors shall be such as to facilitate the identification of the various zones.

Paige Water & Outdoor specification number **P7350D**

Compatible with **RAIN BIRD, BASELINE, AND UNDERHILL SYSTEMS** – These decoder systems utilize 14 AWG/2c or 12 AWG/2c cable. See specification number P7072D for available outer jacket colors.The decoder cable shall be 14 AWG/2c or 12 AWG/2c cable as shown on the irrigation plans and specifications. The cable shall include two type UF/TWU wires with a PE outer jacket. The colors of the outer jacket shall be as called-for in the irrigation plans and specifications.

Paige Water & Outdoor specification number **P7072D**

Compatible with **HUNTER SYSTEMS** – These cables feature 2 twisted wires, so that they stay together during the installation process and offer some opposition to electrical flow during lightning strikes. They are also available with a tough High Density Polyethylene outer jacket for additional mechanical strength. The outer jacket is a loose tube that slides off easily when being removed and is available in 6 different colors per size to facilitate circuit identification. This cable is specifically designed for the harsh conditions of landscape projects where chemicals such as fertilizers, herbicides, pesticides, and fungicides are frequently applied. Available in 14 AWG/2c and 12 AWG/2c constructions.

**WITHOUT OUTER JACKET** - The decoder cable shall consist of 2 wires, twisted together. Its construction shall incorporate solid copper conductors with an extra-thick PE insulation with a minimum wall thickness of 0.060".

Paige Water & Outdoor specification number **P7313D**

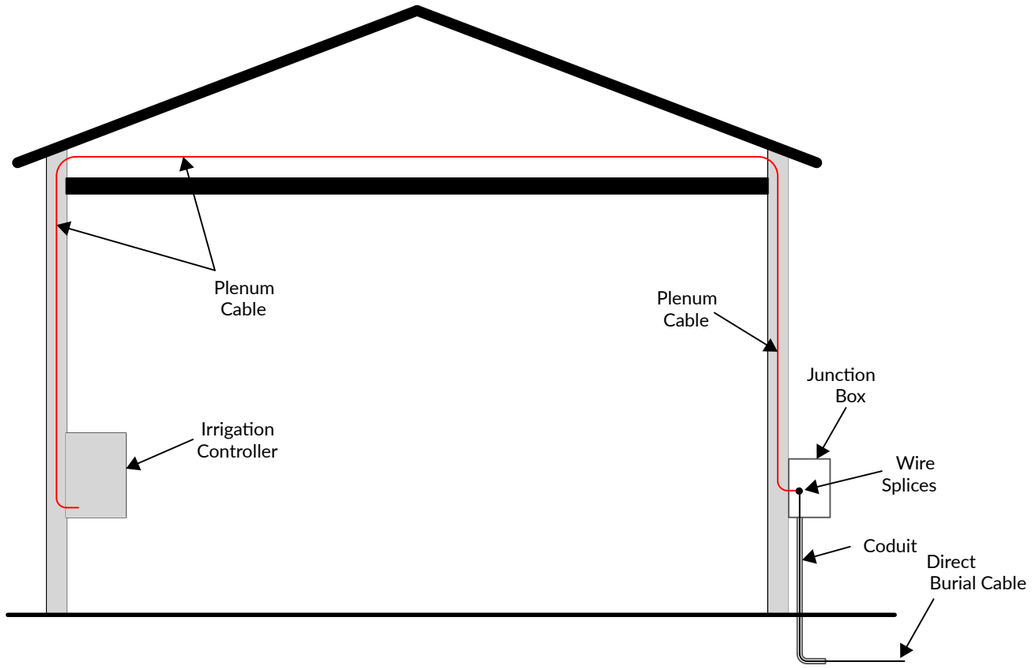
**WITH OUTER JACKET** - The decoder cable shall consist of 2 wires, twisted together. Its construction shall incorporate solid copper conductors with PE insulation. A loose tube-High Density Polyethylene jacket shall cover the twisted wires. The jacket colors shall be such as to facilitate the identification of the various zones.

Paige Water & Outdoor specification number **P7354D**

Rain Bird, Maxi and MAXICOM are trademarks of Rain Bird Corporation; Toro is a trademark of The Toro Company; Hunter is a trademark of Hunter Industries Inc.

## PLENUM RATED CABLES FOR INDOOR APPLICATIONS

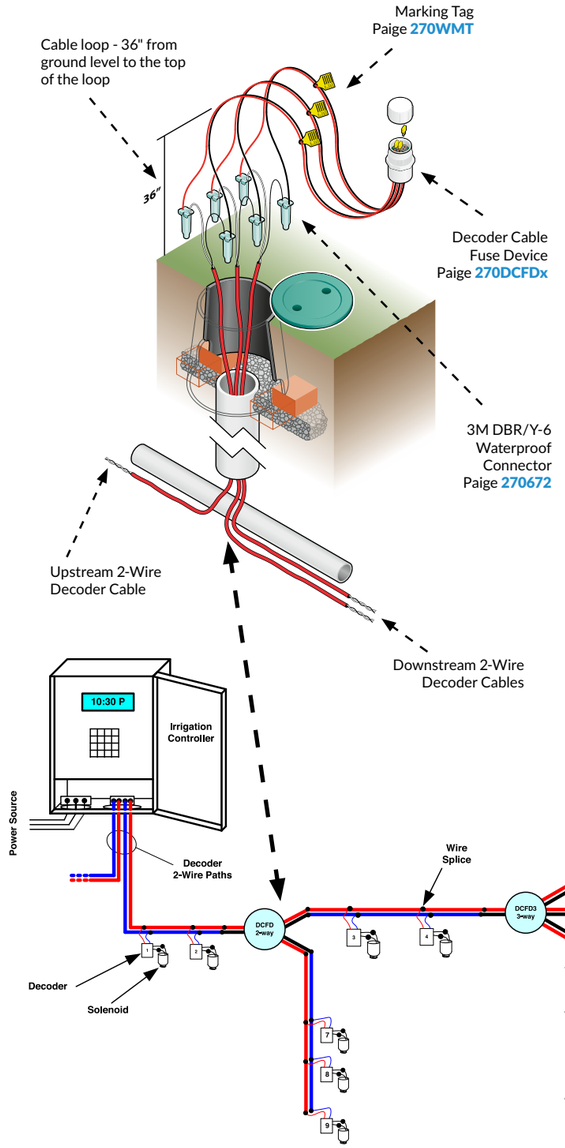
When it is necessary to run cables for an irrigation or lighting system inside a building/structure, plenum rated cable must be used. Here is a typical application.




| Paige Part No. | Description | |
|---|---|---|
| 2U18042B1 |  | 18AWG/4 conductors |
| 2U18062B1 | | 18AWG/6 conductors |
| 454692AWH | | 18AWG/8 conductors |
| 454696AWH |  | 14AWG/2 conductors |
| 454698AWH | | 12AWG/2 conductors |
| 2S18022B1 |  | 18AWG/1 pair communication |

## DECODER CABLE FUSE DEVICES (DCFD)™, WITHOUT LIGHTNING PROTECTION

These products were specifically designed as electrical isolation devices to help with troubleshooting of damaged or non-functioning 2-Wire irrigation systems. Single or multiple sections of the electrical circuit can be disconnected or isolated by simply removing a fuse, without cutting wires or undoing splices/joints. Patent Pending.




| Paige Part No. | Description |
|---|---|
| 270DCFD1 | Decoder Cable Fuse Device (inline) |
| 270DCFD | Decoder Cable Fuse Device (2-way) |
| 270DCFD3 | Decoder Cable Fuse Device (3-way) |
| 270DCFD1L | Decoder Cable Fuse Device (inline) with Lightning Protection |
| 270DCFDL | Decoder Cable Fuse Device (2-way) with Lightning Protection |
| 270DCFD3L | Decoder Cable Fuse Device (3-way) with Lightning Protection |

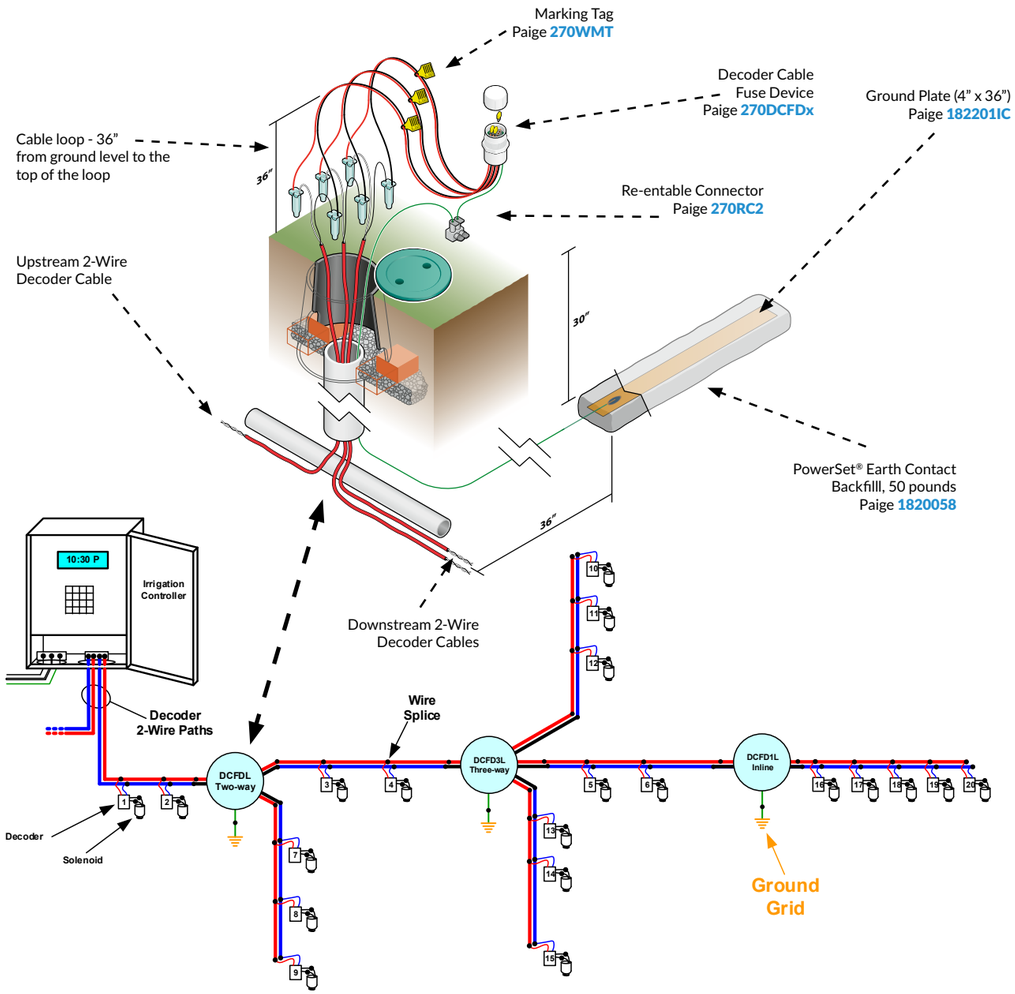
Paige Water & Outdoor specification number **DCFD**

## DECODER CABLE FUSE DEVICES (DCFD)™, WITH LIGHTNING PROTECTION

These devices incorporate high surge current lighting arrester on the input and each of the output wires. This protects the DCFD and electronic equipment upstream and downstream.

**Ratings for the surge arresters:**

- DC sparkover trigger voltage of 75V
- 400 strikes at 1,000 amps, or
- 10 strikes at 20,000 amps, or
- 1 strike at 40,000 amps




Paige Water & Outdoor specification number **DCFD**

# GROUNDING SYSTEMS

## PROTECTING ELECTRONIC EQUIPMENT FROM LIGHTNING AND POWER SURGES

**Electronic irrigation equipment should be grounded to the earth, and bonded, in accordance with the requirements of the NEC®. Bonding wires should be installed so that they act as a shield to protect the wires in the trench from lightning strikes. Lightning arresters should be incorporated into the electronic equipment if not already supplied by its manufacturer. Below are specific details and recommendations from Paige Water & Outdoor.**

## LIGHTNING ARRESTERS

**Most irrigation controllers are supplied with lightning protection on the secondary circuits, but not on the incoming power wires.**

The Paige Water & Outdoor 250090LED arrester can be used to protect the controller from surges coming from the 120 or 240 Vac wires. This arrester incorporates a visible green LED to indicate that the unit is ready to fire in case of a power or lightning surge. It should be replaced when the LED is not lit.

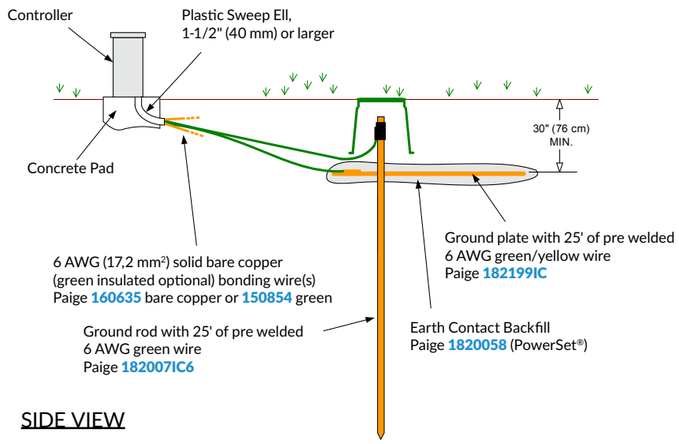
The Paige Water & Outdoor 270SSG Surge Guard arrester is designed to protect irrigation decoder two-wire paths and solenoids from power and lightning surges. It can also be used to protect landscape lighting fixtures.

## GROUNDING CONTROLLERS

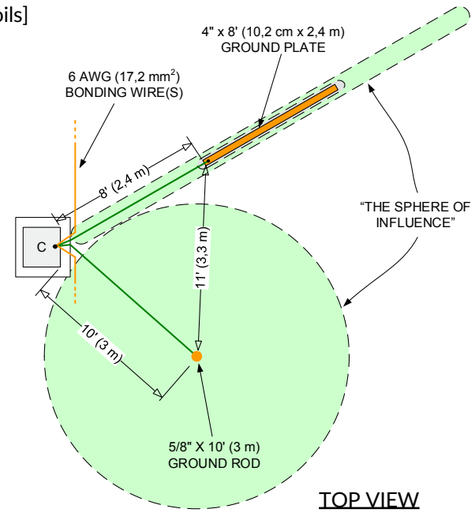
The following details are the minimum requirement for supplementary grounding and bonding of any irrigation controller, weather station, interface, etc. Other details, for a multitude of field situations, are available from the American Society of Irrigation Consultants, ASIC Guideline 100-2002 (www.asic.org, “Design Guides”).

**The grounding/bonding circuit includes:**

- A copper clad steel ground rod
- A solid copper ground plate
- Two 50-pound bags of Earth Contact Material [PowerSet® for loose soils or PowerFill® (lower cost) for clay soils]
- 6 AWG solid bare copper (or green insulated) bonding wires



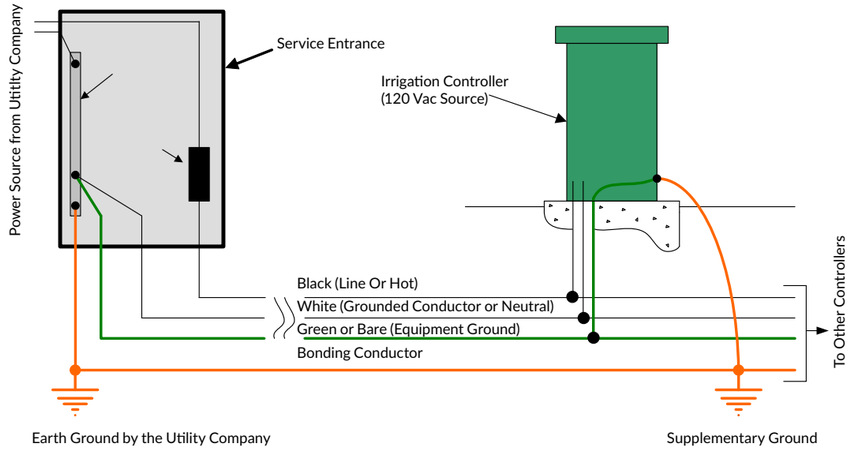

SIDE VIEW




TOP VIEW

## BONDING CONTROLLERS

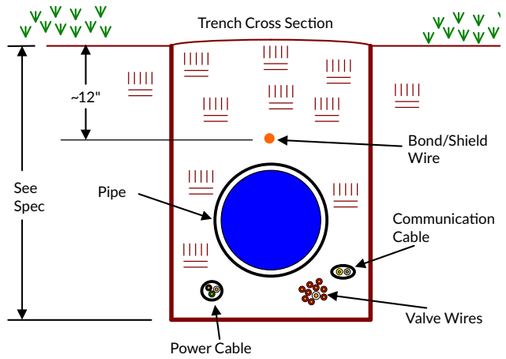
**The grounding of an irrigation controller is referred to by NEC® the as "Supplementary or Auxiliary grounding." And for safety reasons, the NEC® requires that all supplementary grounds be "bonded" to each other and to the service entrance ground (power source) as shown below.**




This is also a "recommended practice" of The Institute of Electrical and Electronics Engineers (IEEE Standard 1100-1999). Note that the bonding wires are in addition to the equipment ground, which is commonly referred to as "the green wire." For 120 Vac power sources, the wires are Black, White and Green. For 240 Vac power sources, the wires are black, red, and green. Power wires must always be kept together in a trench, conduit, tray, etc. The bonding conductors are required to be 6 AWG solid bare copper, unless the system power conductors are larger than 1/0 AWG, in which case the bonding wires are to be 4 AWG solid bare copper.

## SHIELDING UNDERGROUND WIRES AND CABLES

**The conductors that bond the controller ground grids to each other and their power source entrance can be installed so they also act as shielding conductors. This minimizes the induced voltages onto the wires in the trench, which protects the wires from lightning damage and reduces the possibility of damage to electronic equipment.**




This becomes a network of solid bare copper wire over all the main bundles of other wires and cables as shown in the detail. The bare copper wire is to be installed as close to the surface as possible, yet being sufficiently below the ground level as to prevent damage from maintenance equipment such as aerifiers. And it must be placed above all other valve, power, and communication wires and cables, and installed in all trenches as shown on the electrical plan drawings. It is not necessary to install this conductor over short wire runs (less than 150 feet) away from the main wire bundles. The conductor is laid in as straight a line as possible, and when necessary to make bends, do so in a sweeping motion as defined in the Installation section below. The shield network is to be connected to the service entrance earth ground, to all electronic equipment ground lugs, and all equipment supplementary grounding electrodes. One such network is necessary for each power source.

**DO NOT INTERCONNECT THE EQUIPMENT GROUND WIRES FROM DIFFERENT POWER SOURCE SERVICE ENTRANCES.**

## GROUNDING DECODER CIRCUITS

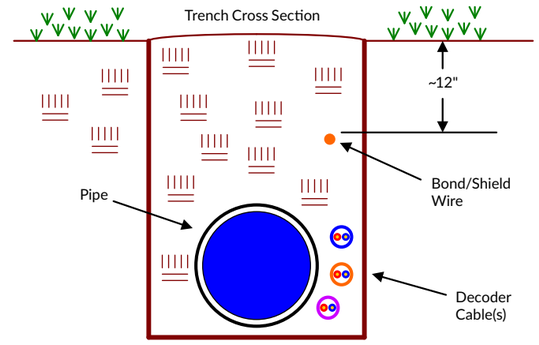
**In decoder systems, the lightning protection/arresters are either built into the decoder or they are wired externally, depending on the manufacturer. Without lightning arresters, the decoders are vulnerable to lightning damage. In order for these arresters to discharge lightning energy efficiently, they must be grounded.**

## BONDING & SHIELDING DECODER CIRCUITS

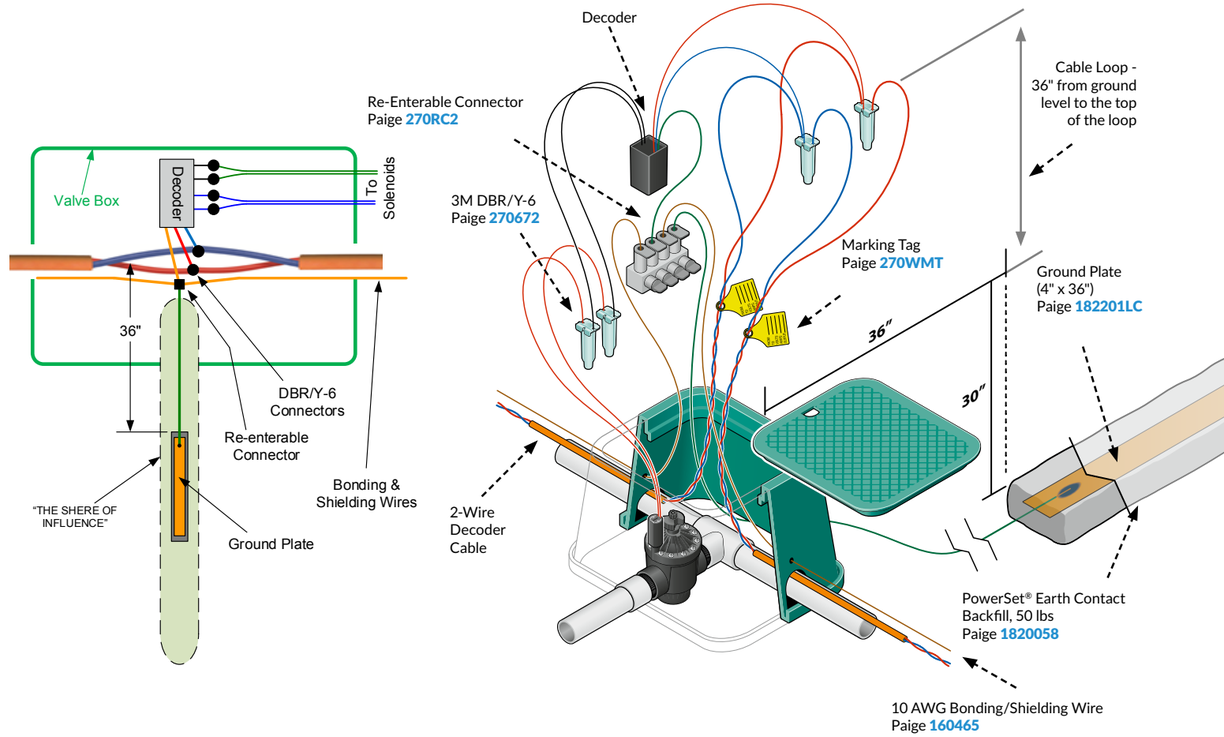
**It is important to maintain the same voltage at all points of the two wire path in order to minimize lightning damage.**

The technique known as "bonding" is used to accomplish this by using a 10 AWG solid bare copper wire to interconnect all the decoder ground grids. This bonding wire can be used to "shield" the two wire paths from lightning energy by placing it directly (and centered) above all the cables in the trench.

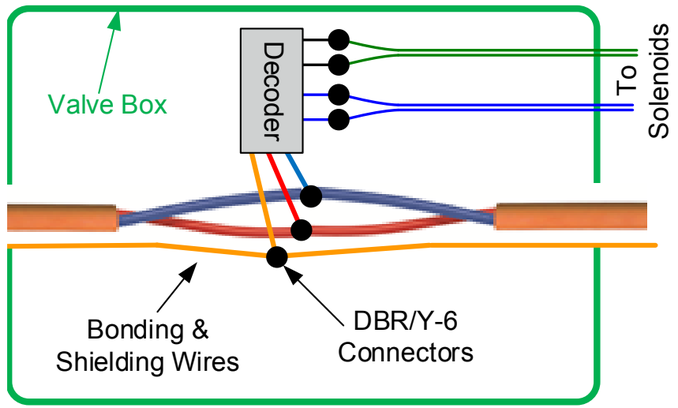
Here are typical recommended grounding grids for decoder and 2-Wire/2-Core systems, with internal and external lightning arresters:

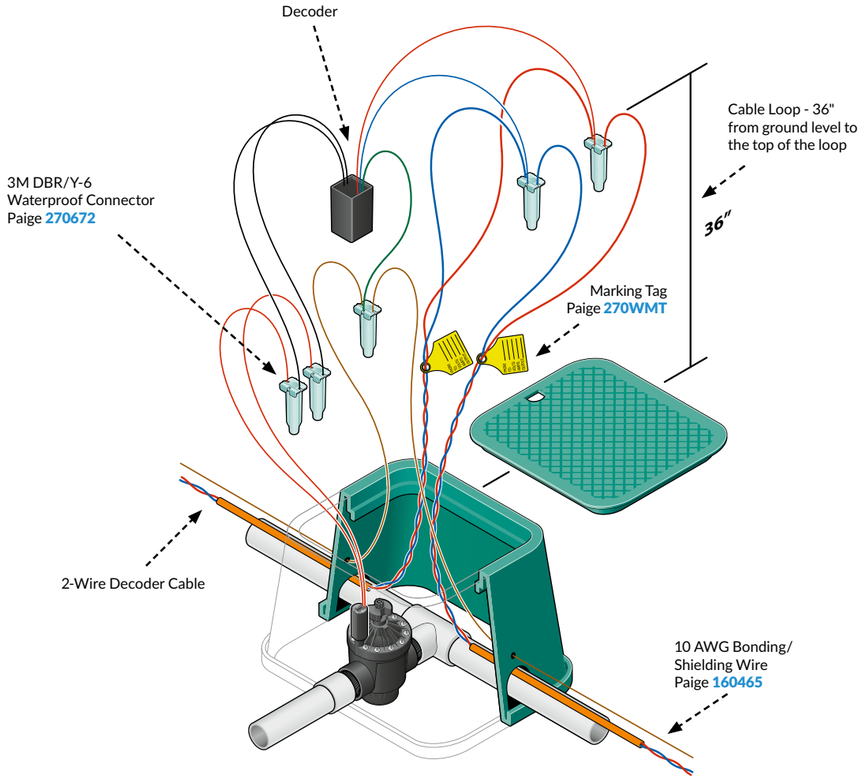



**DECODERS WITH GROUND WIRES & INTERNAL LIGHTNING ARRESTER, GROUNDED:**

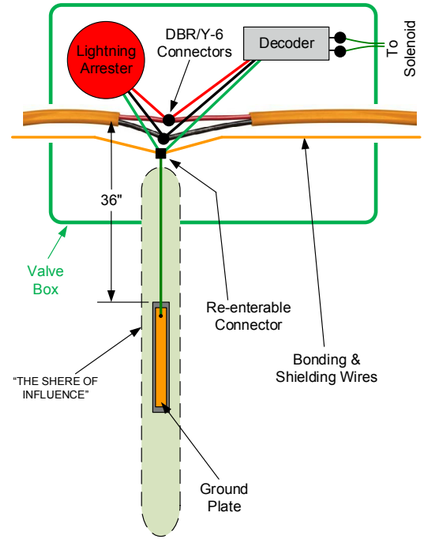


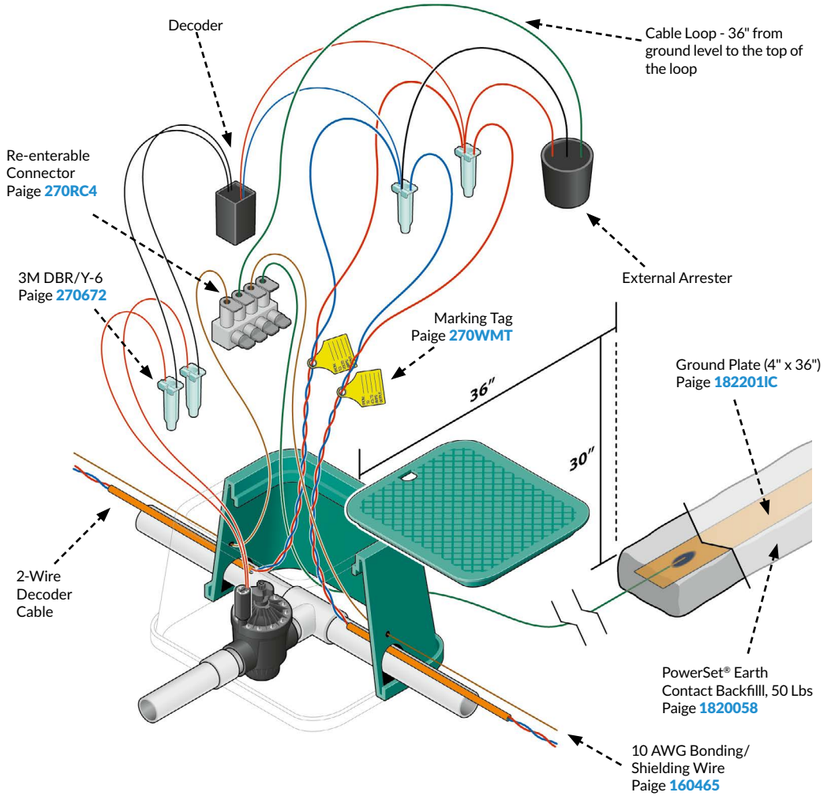
**DECODERS WITH GROUND WIRES & INTERNAL LIGHTNING ARRESTER, NOT GROUNDED:**



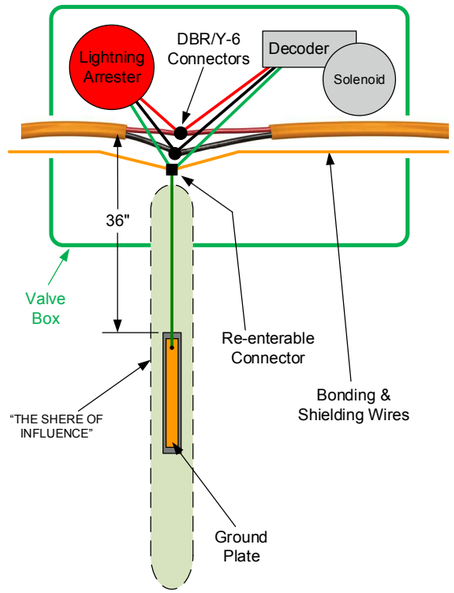



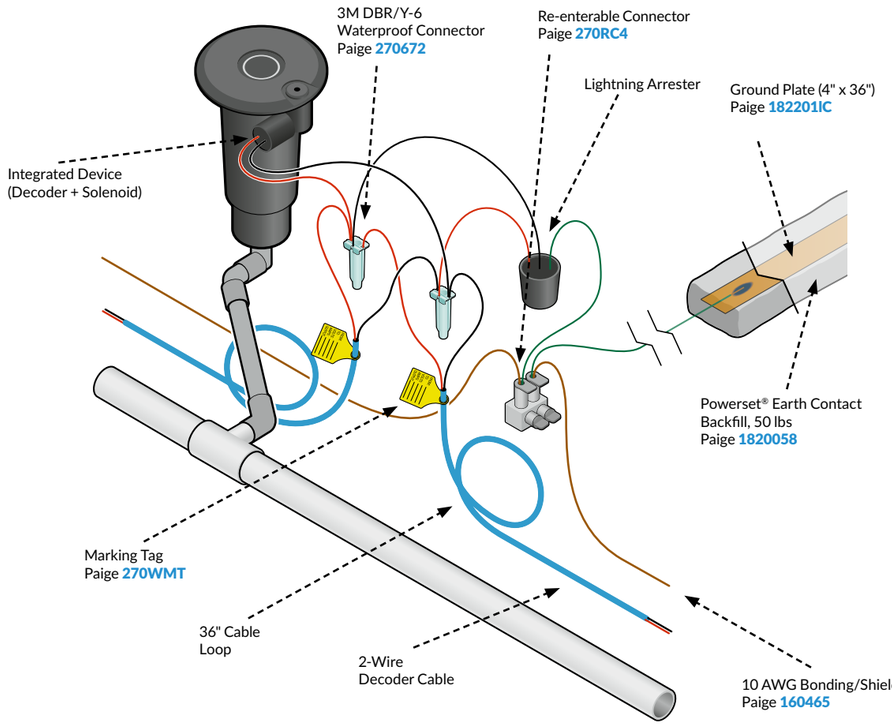

**DECODERS PROTECTED BY EXTERNAL LIGHTNING ARRESTER:**



## 2-WIRE/2-CORE SYSTEMS WITH INTEGRATED DECODER & SOLENOID



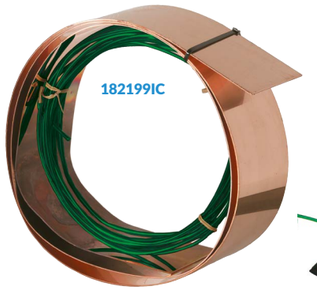

## GROUNDING/BONDING/SHIELDING COMPONENTS

| Part No. | Description |
|---|---|
| 250090LED | Lightning arrester with LED indicator |
| 182199IC | 4" x 96" x 0.064" ground plate for controllers with 25' of 6 AWG insulated green wire with yellow stripe |
| 182201IC | 4" x 36" x 0.064" ground plate for 2-Wire/2-Core circuits with 15' of 10 AWG insulated green wire with yellow stripe |
| 182000 | 5/8" diameter x 8' long ground rod |
| 182007 | 5/8" diameter x 10' long ground rod |
| 182005 | 5/8" ground rod clamp |
| 182000IC10 | 5/8" diameter x 8' long ground rod with 15' of 10 AWG insulated green wire |
| 182000IC6 | 5/8" diameter x 8' long ground rod with 15' of 6 AWG insulated green wire |
| 182007IC6 | 5/8" diameter x 10' long ground rod with 25' of 6 AWG insulated green wire |
| 160465 | 10 AWG solid bare copper wire |
| 160635 | 6 AWG solid bare copper wire |
| 150854 | 6 AWG solid copper, green ground wire |
| 1820058 | PowerSet® Earth Contact Material |
| 1820059 | PowerFill® Earth Contact Material |
| 1820037P | Cadweld connector for one 6 or 8 AWG joint to a ground rod |
| 1820074P | Cadweld connector for up to four 6 or 8 AWG bonding wires |
| 1820040CU | Control Unit for igniting Cadweld |

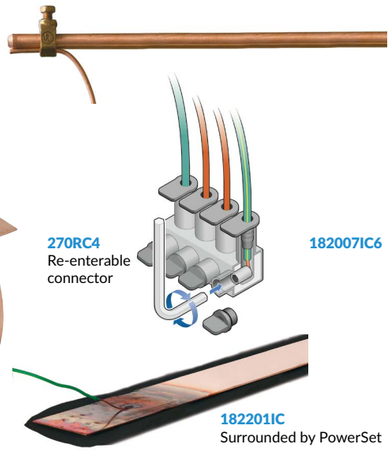

1820058



1820040CU



182199IC



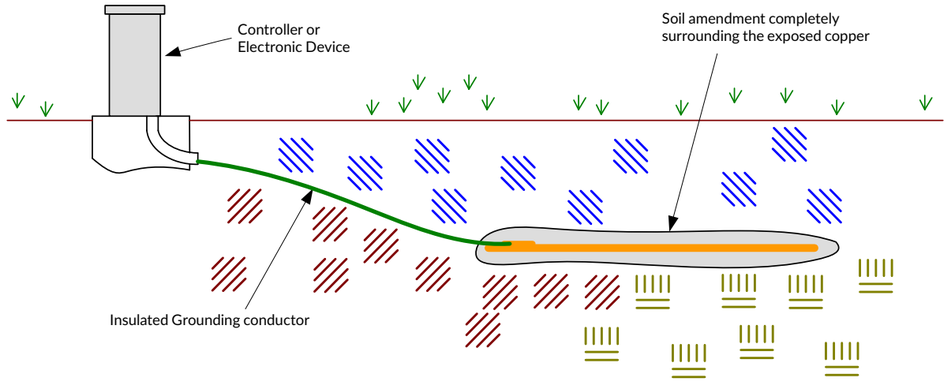
270RC4
Re-enterable connector

182007IC6

182201IC
Surrounded by PowerSet

# INSTALLATION TIPS FOR GROUNDING, BONDING, AND SHIELDING

**Proper installation and maintenance of grounding, bonding, and shielding components is a critical part of the effectiveness of the grid in order to protect electronic equipment from lightning and power surges.**




The ground grid components shall be installed with the dimensional relationships shown in the details above. WIRES, CABLES, AND ELECTRONIC EQUIPMENT MUST BE INSTALLED OUTSIDE “THE SPHERE OF INFLUENCE” OF THE GROUNDING ELECTRODES.

All underground splices to ground rods and bonding conductors are to be made using Cadweld “One-Shot” kits or Re-enterable connectors (2, 3, 4, or 6 positions).

The ground rod has a minimum diameter of 5/8" (16 mm) and a minimum length of 10 feet (3,05 m). A 25-foot (7,62 m) continuous length of 6 AWG, green insulated, solid bare copper wire is pre welded to the ground rod. Heavy-duty adhesive-lined shrink tubing shall cover the weld joint to minimize corrosion and maintain the weld during the installation process. These are to be driven into the ground in a vertical position, or at a angle of up to 45 degrees.

Paige Water & Outdoor specification number **182007IC6**.

**Copper ground plates are made of a copper alloy intended for grounding applications and have minimum dimensions as follows:**

**FOR GROUNDING CONTROLLERS** - 4" x 8' x 0.0625" (101,6 mm x 2,44 m x 1,6 mm.) A 25-foot (7,62 m) continuous length of 6 AWG, green insulated, with extruded yellow stripe, solid bare copper wire is welded to the plate.

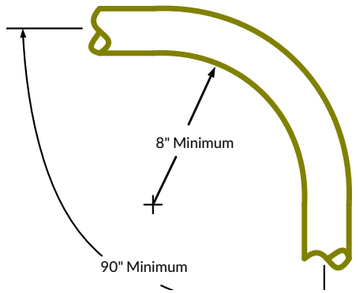
Paige Water & Outdoor specification number **182199IC**

**FOR GROUNDING DECODERS AND 2-WIRE/2-CORE CIRCUITS** - 4" x 3' x 0.0625" (101,6 mm x 2,44 m x 0.9 mm). A 15-foot (4,57 m) continuous length of 10 AWG, green insulated, with extruded yellow stripe, solid bare copper wire is welded to the plate.

Paige Water & Outdoor specification number **182201IC**

The ground plates are to be installed to a minimum depth of 30" (76 cm), or below the frost line if it is lower than 30".

Two 50-pound bags of PowerSet® [Part number 1820058] “Earth Contact Material” must be spread so that it surrounds the 8-foot copper plate evenly along its length within a 6" (152 mm) wide trench. Use one bag only for the installation of 3-foot ground plates. Salts, fertilizers, bentonite clay, cement, coke, carbon, 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. It is important that the Earth Contact Material completely surrounds the ground plate and 6" (152 mm) of the insulation of the green wire, as shown in the detail, in order to minimize corrosion.

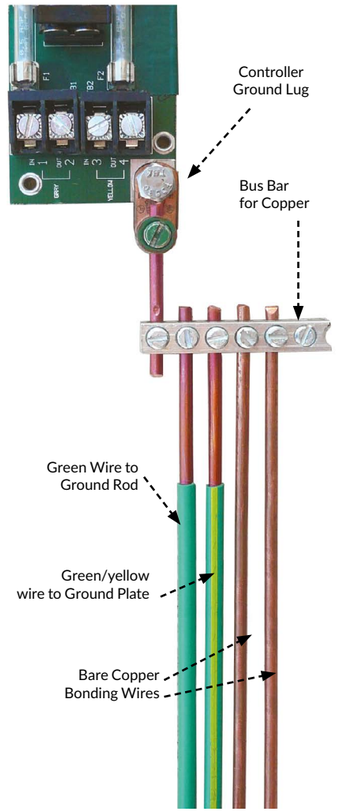



Install all grounding circuit components in straight lines and simple geometry. When necessary to bend wires, make sweeping turns as shown. All grounding and bonding wires of electronic equipment must be fed through a dedicated 1.5" (38,1 mm) plastic sweep ell. “Sweep bends” must follow the guidelines shown here. The 6 AWG bare copper 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" (203,2 mm) and a minimum included angle of 90°.

A convenient way to make connections to the controller ground lug is shown here. This type of installation, which utilizes a multi-position bus bar, allows for rapid connecting and disconnecting of desired wires in order to periodically take earth resistance readings of the individual grounding electrodes.

The earth-to-ground resistance should be measured at the time of installation using a “Megger”, or other similar instrument, and the reading is to be no more than 10 ohms. If the resistance is more than 10 ohms, additional ground plates and PowerSet® are to be installed using ASIC Guidelines 100-2002 (www.asic.org, “Design Guides”). It is required that the soil surrounding copper electrodes, within the Sphere of Influence, be kept at a minimum moisture level of 15% (by weight) at all times as dry soil does not conduct electricity.

ALL GROUNDING COMPONENTS MUST BE CONNECTED TO THE EQUIPMENT BEFORE ANY OTHER CONNECTION IS MADE.

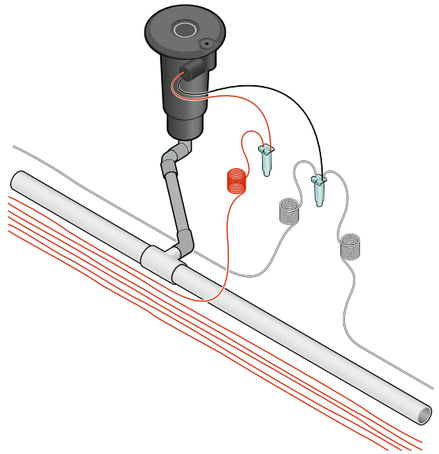



United States Patent No.: 8,081,451 B2.

# SPLICE ACCESSORIES

## IRRIGATION WIRE & CABLE SPLICES

**Connections (splices/joints) are the weak link of any electrical circuit. These must be made properly, with appropriate products, in order to ensure long term system reliability. This is particularly important in Decoder, 2-Wire, and 2-Core systems.**



All electrical connections should incorporate:

1. A solid mechanical connection of the copper conductors using a UL-listed device (twist-on connector, split bolt, butt connector, insulation displacement connector, etc).
2. Electrical insulation of the mechanical connection, if not part of the mechanical connector.
3. A means to waterproof the insulated connection.
4. “Strain relief” to prevent the connection from coming apart when wires/cables are pulled upon.
5. A design that is forgiving of human error.

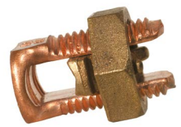
## MECHANICAL CONNECTORS

These connectors are for above ground installations, in a dry environment. They can also be immersed in waterproof resins or gels for underground installations.

O/B+ T/R+ R/Y+ B/G+

**TWIST-ON CONNECTORS (AKA WIRE NUTS )** – The new 3M™ Performance Plus™ Connectors have an incredible bite. They grab the wires quickly and twist them together with ease. The wings make it easy on the fingers!

**SPLIT BOLTS** – This type of connector is usually used when making electrical connections for irrigation power wires. They are then wrapped with electrical or rubber tape before immersion into a waterproof resin bag (3M #4) or resin-filled plastic tube (3M 82A Series.)

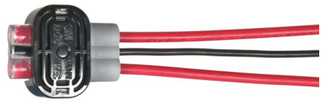





## WATERPROOF CONNECTORS FOR IRRIGATION SYSTEMS

These gel-filled connectors are used for above or below grade applications, in damp or wet environments.

**DBR/Y-6 AND DBO/B-6** – These new connectors from 3M incorporates the great features of a “Performance Plus” wire nut with the proven reliability of the DBY/DBR series that was the backbone of the irrigation industry for over 20 years. These UL-listed products (Direct Burial, file E102356) can be used with confidence on any irrigation system, especially 2-Wire/2-Core.



**316IR & MGC** - These UL-listed products (Wire Connectors and Soldering Lugs, file E23438) are a low cost solution for reliable connections/joints of “valve wires” to the solenoids of conventional irrigation systems. There is no stripping of the wires required, which means lower labor costs.

## SILICONE FILLED WIRE CONNECTORS

This family of UL and CSA listed silicone-filled wire connectors was specifically designed for use in professionally installed irrigation control and landscape lighting systems. These connectors provide a secure electrical connection for two or more pre–stripped copper wires and seal the connection for use in damp/wet locations or direct bury applications. Connected and protected in one easy, time-saving process.

**WEATHERPROOF™ WIRE CONNECTORS** - For installation in dry or damp locations.

| | | Part Numbers and Description | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | |  | | | |  | | | |  | | | |
| | | Gray/Orange | | | | Gray/Red | | | | Gray/Dark Blue | | | |
| Wire Range | AWG | 22-14 | | | | 18-8 | | | | 16-6 | | | |
| | $mm^2$ | 0.34 to 2.5 | | | | 0.75 to 10 | | | | 1.5 to 16 | | | |
| Replaces King | | Black/White, Gray/Gray, Aqua/Orange, Blue/Blue | | | | Black/Gray, Aqua/Red, Tan | | | | Black/Blue, Aqua/Blue | | | |
| Packaging Details | | Pack | Case Qty | Paige # | Ideal # | Pack | Case Qty | Paige # | Ideal # | Pack | Case Qty | Paige # | Ideal # |
| | | Card of 25 | 125 | 270i61B | 30-1161 | Card of 20 | 100 | 270i62B | 30-1162 | Card of 15 | 75 | 270i63B | 30-1163 |
| | | Jar of 150 | 900 | 270i61J | 30-1261J | Jar of 100 | 600 | 270i62J | 30-1262J | Jar of 50 | 300 | 270i63J | 30-1263J |
| | | Box of 1000 | 1,000 | 270i61D | 30-1361 | Box of 1000 | 1,000 | 270i62D | 30-1362 | Box of 1000 | 1,000 | 270i63D | 30-1363 |

## RESINS

Resin kits use a two-part epoxy especially designed to waterproof wires that have been mechanically joined using wire nuts, split bolts, etc.

**3570GN AND 4N SERIES** - This 3M™ Scotchcast™ resin is a two-part epoxy insulating and encapsulating resin packaged in several sizes

**82-AN SERIES AND 82-B1N** - Use the 3M Scotchcast 82-AN and 82-B1N series kits to insulate and seal single wire and cable splices. The 82-AN Series is for inline splices and the 82-B1N is for “wye” splices. Each kit contains:

- A snap-together mold body
- 2 Funnels
- Rubber tape for sealing mold ends and connector area
- Scotchcast 4N electrical insulating resin


## MISCELLANEOUS ACCESSORIES

### CABLE STRIPPING TOOLS

| Part No. | For removing cable outer jackets of: |
|---|---|
| 270004 | Any round cable with 0.18" to 10.0"  |
| 2700041 | • Rain Bird 2-Wire and Maxi systems<br>• Type UF-B  |



Paige Water & Outdoor specification number **TKTKT**

### SCOTCHKOTE™ ELECTRICAL COATING

3M™ Scotchkote™ Electrical Coating FD is a fast-drying sealant and bonding compound designed to improve weather resistance of taped splices. For direct burial, direct water immersion or above-ground applications.


Paige Water & Outdoor specification number **270388**

### POWER CORDS

| Part No. | Description |
|---|---|
| 090082ODST | 6' Straight Plug |
| 090082OD | 6' Right Angle Plug |
| 090081OD | 8' Right Angle Plug |

| Part No. | Description |
|---|---|
| 090082SG | 6' Straight Plug, with waterproof gland |
| 090082AG | 6' Right Angle Plug, with waterproof gland |
| 090081AG | 8' Right Angle Plug, with waterproof gland |





### WIRE MARKING TAGS & PENS

These Wire Marking Tags are intended to be used for identifying irrigation wires and cables in order to facilitate troubleshooting of systems. These tags can be used to record information on wires, decoders, Decoder Cable Fuse Devices, etc.

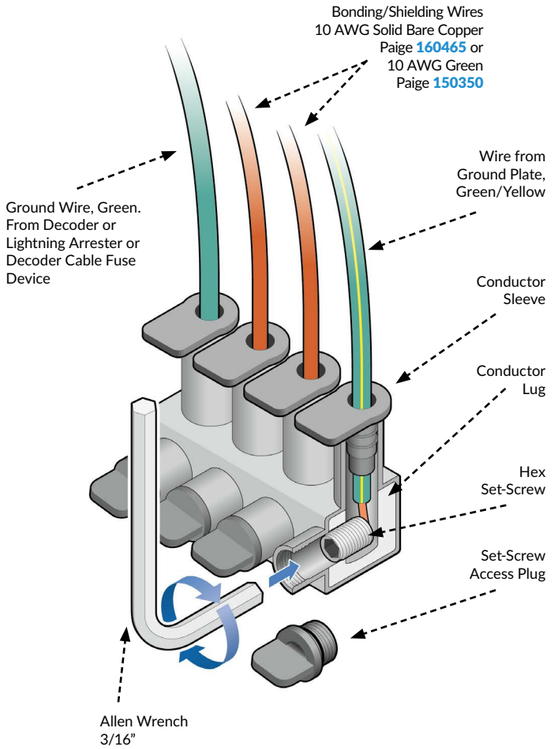


Paige Water & Outdoor specification number **270WMT** (tag) and **270WMP** (pen)

## RE-ENTERABLE CONNECTORS

These connectors were designed for installations in wet or damp locations, and are re-enterable. The connector can be installed underground, in a valve box, in concrete or direct buried in earth. It can also be continually submerged in water to a maximum depth of 6 feet.

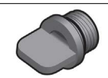
The Re-enterable connector can be used in conjunction with Decoders or Lightning Arresters or Decoder Cable Fuse Devices, or multiple wire connections.



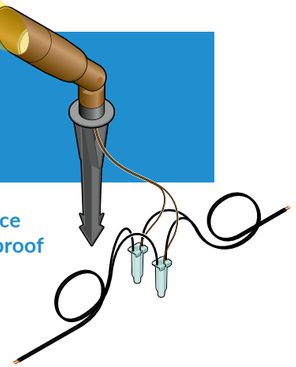

### THE CONNECTORS ARE AVAILABLE AS FOLLOWS:

| Part No. | No of positions |
|---|---|
| 270RC2 | 2 |
| 270RC3 | 3 |
| 270RC4 | 4 (illustrated) |
| 270RC6 | 6 |

### REPLACEMENT PARTS:

| Part No. | Photo | Description | Packaging |
|---|---|---|---|
| 270RCSLEEV |  | Conductor Sleeve | Each |
| 270RCPLUG |  | Set Screw<br>Access Sleeve | Each |
| 270RCGRS |  | Silicone Lubricating<br>Grease (8 ounces) | Each |

# LANDSCAPE LIGHTING



**Low Voltage Lighting systems utilize a number of products with varying quality and price points. These include transformers, light fixtures, cables, timers, photo controls, waterproof connectors, etc. Paige Water & Outdoor offers many of these products to: Original Equipment Manufacturers, irrigation distributors, and lighting equipment suppliers.**

## LOW VOLTAGE LIGHTING CABLES

Cables used for Professional Low Voltage Lighting applications are designed for direct burial and are sunlight resistant. Paige Water & Outdoor offers many types of constructions for light fixture manufacturing and system installations. Available in a two conductor zip cord construction from 18 AWG/2c to 8 AWG/2c.

Paige Water & Outdoor specification number **P7190D**

## TIMERS

**MECHANICAL TIMERS** are used in conjunction with Photo Controls. The photo control ensures that the lights only come on when it's dark, while the timer determines the on and off time. Paige Water & Outdoor offers the only known UL-recognized timer for this specific application (270TN111RM).

270TN111RM

270403BN

| | |
|---|---|
| 270TN111RM | Intermatic Outdoor Mechanical Timer, Black, Right outlet, 2 prong |
| 270402B | Tork Intdoor Mechanical Timer, White, Right outlet, 3 prong |
| 270403BN | Tork Intdoor Mechanical Timer, White, Right outlet |

270402B

**DIGITAL "ASTRONOMIC" TIMERS** have the ability to determine sunrise and sunset for every day of the year. And, once you program the timer with information on your location, they can turn the lights on and off using any combination of sunrise, sunset, and specific on/off times. For example, the timer can be set to turn on the lights at sunset and turn them off at 11:00 PM. It could also be programmed to come back on at 5:00 AM and off at sunrise. These are available in indoor and outdoor models and are UL-listed for those applications.

HB880R

| | |
|---|---|
| 270DT200LT | Intermatic Indoor Digital Timer, Astronomic, dual outlets (left & right), easy programming |
| 270DT620CL | Intermatic Indoor Digital Timer, Astronomic, dual outlets (left & right) |
| 270HB880R | Intermatic Outdoor Digital Timer, Astronomic, dual outlets, bottom |

270DT620CL

DT200LT

## PHOTO CONTROLS

These devices are used in conjunction with Low Voltage Lighting transformers and timers to ensure lights are only on when it's dark. Paige Water & Outdoor photo controls feature extra long wire leads to facilitate wiring in virtually all situations.

Paige Water & Outdoor specification **2704221P**

| Paige Part Number | Transformer Manufacturer | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | VISTA | Unique Lighting | Cast Lighting | Kichler | Fx | Fx Model EX-150 | Hinkley | HADCO | Universal Lighting | Alliance |
| 270TN111RM "OUTDOOR" MECHANICAL TIMER (inside transformer), Black, Right outlet | ✓ | ✓ | ? | ✓ | ✓ | ✓ | ✓ | ✓ | ? | ? |
| 270403B INDOOR MECHANICAL TIMER, White, Bottom outlet | ? | ✓* | ? | ? | ? | ? | ? | ? | ? | ✓ |
| 270422A Indoor Mechanical Timer, White, Right Outlet | ✓ | ✓ | ? | ✓ | ? | ? | ? | ? | ? | ? |
| 270DT200LT Indoor Digital Astronomic Timer, Simplified Programming | ✓ | ✗ | ? | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ? |
| 270DT620CL Indoor Digital Timer, Astronomic Timing | ✓ | ✗ | ? | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ? |
| 270457Z Indoor Digital Timer, Astronomic Timing | ✓ | ✓* | ✓ | ✓ | ✓† | ✗ | ? | ? | ? | ✗ |
| 270HB800RC Outdoor Electronic Timer With Dual Outlets, Astronomic Timing | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Please verify this information as transformer designs are constantly changing.

*Fits all Unique lighting transformers except I-Force.
†Fits old and new Fx transformers, with different receptacle locations, except model ES-150.

## WATERPROOF CONNECTORS FOR LOW VOLTAGE LIGHTING

**Wire splices/joints are the weak link of any electrical circuit. Paige Water & Outdoor offers professional grade connectors for both conventional and hub/spider lighting systems.**

### MOISTURE GUARD CONNECTORS (MGC)

The MGC is an Insulation Displacement Connector (IDC). It is ideal for splicing wires and cables in Low Voltage Lighting systems. The proven 3M concept allows the splices to be made without stripping the insulation from the wires. Just insert the unstripped wires into the holes and squeeze!

### DBR/Y-6 AND DBO/B-6 CONNECTORS

The 3M™ Direct Bury Splice Kits are used to electrically connect two or more pre–stripped copper wires and moisture seal the connection for direct burial. It is ideal for splicing a wide range of wires and cables in Low Voltage Lighting systems, from 18 to 8 AWG.

### SILICONE-FILLED WIRE CONNECTORS

This family of UL and CSA listed silicone-filled wire connectors was specifically designed for use in professionally installed irrigation control and landscape lighting systems. These connectors provide a secure electrical connection for two or more pre–stripped copper wires and seal the connection for use in damp/wet locations or direct bury applications. Connected and protected in one easy, time-saving process.

| | | Part Numbers and Description | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | |  | | | |  | | | |  | | | |
| | | Gray/Orange | | | | Gray/Red | | | | Gray/Dark Blue | | | |
| Wire Range | AWG | 22-14 | | | | 18-8 | | | | 16-6 | | | |
| | $mm^2$ | 0.34 to 2.5 | | | | 0.75 to 10 | | | | 1.5 to 16 | | | |
| Replaces King | | Black/White, Gray/Gray, Aqua/Orange, Blue/Blue | | | | Black/Gray, Aqua/Red, Tan | | | | Black/Blue, Aqua/Blue | | | |
| Packaging Details | | **Pack** | **Case Qty** | **Paige #** | **Ideal #** | **Pack** | **Case Qty** | **Paige #** | **Ideal #** | **Pack** | **Case Qty** | **Paige #** | **Ideal #** |
| | | Card of 25 | 125 | 270i61B | 30-1161 | Card of 20 | 100 | 270i62B | 30-1162 | Card of 15 | 75 | 270i63B | 30-1163 |
| | | Jar of 150 | 900 | 270i61J | 30-1261J | Jar of 100 | 600 | 270i62J | 30-1262J | Jar of 50 | 300 | 270i63J | 30-1263J |
| | | Box of 1000 | 1,000 | 270i61D | 30-1361 | Box of 1000 | 1,000 | 270i62D | 30-1362 | Box of 1000 | 1,000 | 270i63D | 30-1363 |



## LOW VOLTAGE LIGHTING COMPONENTS

| Paige Part No. | Description |
|---|---|
| 180xxx | Low Voltage lighting cables, 18 to 8 AWG, 2-conductors (zipped) |
| 270TN111RM | Intermatic Outdoor Mechanical Timer, Black, Right outlet, 2 prong |
| 270402B | Tork Indoor Mechanical Timer, White, Bottom outlet, 3 prong |
| 270403BN | Tork Indoor Mechanical Timer, White, Bottom outlet, 2 prong |
| 270457Z | Tork Indoor Digital Timer, Astronomic, low cost, dual outlets (left & bottom) |
| 270DT620CL | Intermatic Indoor Digital Timer, Astronomic, dual outlets (left & right) |
| 270HB800RC | Intermatic Outdoor Digital Timer, Astronomic, dual outlets, bottom |
| 270K4221 | Photo Control, swivel mount |
| 270672 | DBR/Y-6 waterproof connectors, 18 to 10 AWG |
| 270MGC | Moisture Guard waterproof connectors, 14 to 12 AWG |
| 270iXXX | Silicone-filled Twist-on Connectors, 18 to 8 AWG |
| 270MH14BCX | 3M Crimp-n-Shrink™, water-resistant butt connector 18-14 AWG |
| 270MH10BCX | 3M Crimp-n-Shrink™, water-resistant butt connector 18-10 AWG |
| 270WMT | Wire Marking Tag |
| 270WMP | Wire Marking Pen |

## DISCLAIMER

Paige Electric has made every effort to ensure that the information and recommendations contained within are correct. However, neither Paige Electric nor any of its employees warrants nor accepts any liability for the use of this information. National and local electrical codes should always be followed. Wiring, grounding, shielding, and bonding irrigation system components often require competent engineering judgement on a case-by-case basis. Competent engineering assistance should be sought from firms specializing in this field.

## PAIGE ELECTRIC WARRANTY

Paige Electric Company, L.P. (“Paige”) warrants that it owns all intellectual property rights, title and interest or has the right to license such rights to each of the product(s) sold by it (“Product(s)”) and warrants to the Purchaser that each Product is free from defects in material and workmanship and conforms to any applicable specifications required by Purchaser and which are attached to this Warranty.

Purchaser can make no claim against Paige based on the sale of the Product(s) subject to this Warranty unless the facts giving rise to such claim(s) are discovered or could reasonably have been discovered by diligent inquiry within twelve (12) months of shipment from Paige and Purchaser provides written notice to Paige within thirty (30) days of discovery. The Warranty stated in this paragraph is exclusive of all other warranties, written or oral, statutory, express or implied, none of which shall apply to the sale of the Products. Paige expressly disclaims any warranty of merchantability or fitness of the Product for a particular purpose.

This Warranty shall not apply to any Product that has been subject to misuse, mishandling, accident, alteration, neglect, unauthorized repair or installation. Furthermore, this Warranty shall not apply to the use of Products in an application or environment that is inconsistent with its specifications or in the event of any act, error, neglect or default of Purchaser.

PURCHASER’S SOLE REMEDY WITH RESPECT TO ANY BREACH OF THIS WARRANTY SHALL BE THE REPAIR OR REPLACEMENT OF THE PRODUCT(S). PAIGE IS NOT RESPONSIBLE FOR DIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY BREACH OF WARRANTY OR UNDER ANY OTHER LEGAL THEORY INCLUDING, BUT NOT LIMITED TO, LOST PROFITS, DOWNTIME, GOODWILL, DAMAGE TO OR REPLACEMENT OF EQUIPMENT AND PROPERTY.

THE LAW OF THE STATE OF NEW JERSEY, USA SHALL APPLY TO ANY CLAIMS REGARDING PRODUCTS COVERED BY THIS WARRANTY AND THE EXCLUSIVE JURISDICTION FOR ANY SUCH CLAIMS SHALL BE THE STATE AND FEDERAL COURTS OF NEW JERSEY.

Lengths of cable, which have been replaced by Paige in accordance with the foregoing, shall become the property of Paige and shall be returned to it by the Purchaser, F.O.B. point of shipment.

The warranty for products produced by companies other than Paige (3M, IDEAL, Intermatic, LORESCO International, ERICO, etc.) is often stated in its product literature, which is usually available on their websites. For assistance in this matter, please contact Paige Electric.



## Download a digital copy of this guide

Keep your Paige Technical Guide close at hand by downloading a copy and saving to your device.

Scan the QR code or visit **paigewater.com** and find the latest Technical Guide under *"Resources."*



# NOTES


Paige®
WATER & OUTDOOR
A GCG COMPANY