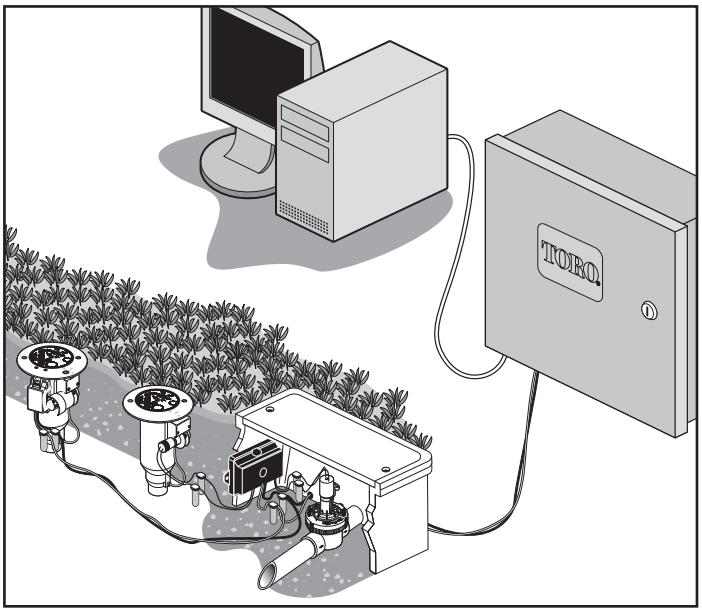
TORO Count on it.

AC Decoder Installation Instructions
PC-Driven Models

Specification

- PC-Driven Models can control up to 250 Decoder Modules per Gateway
- **Input Power Supply**: 100–240 VAC, 50/60 Hz
- **Gateway Input Current**: 1.6A/1.0A (115/230 VAC)
- **Gateway Output Voltage**: 40 VAC max.
- **Gateway Output Power**: 75 VA max.
- **Storage Temperature**: -22ºF–140ºF (-30ºC–60ºC)
- **Operating Temperature**: 32ºF–140ºF (0ºC–60ºC)
- **Cabinet Type**: Non-corrosive, lockable wall mount, indoor/outdoor installation, IP44 Rated
- Six 1" (25.4mm) conduit openings and one 1 1/2" (38mm) conduit opening



Cabinet Installation

Selecting the proper installation site for the 2-wire Gateway is essential to safe and reliable operation. The 2-wire Gateway features a weather resistant cabinet designed for indoor or outdoor installation.

The Gateway should be installed on a vertical wall or other sturdy structure near a grounded power source. Select a location that shades the gateway during the hottest hours of the day and provides as much protection from direct sunlight, rain, wind and snow as possible. DO NOT mount the gateway where it is exposed to direct spray from the irrigation system.

For easy operation and better view of the display, install the gateway so that the display is at or slightly below eye level.

Step 1 – Drill two pilot holes 6" (15.25cm) apart for the top keyholes of the gateway cabinet.

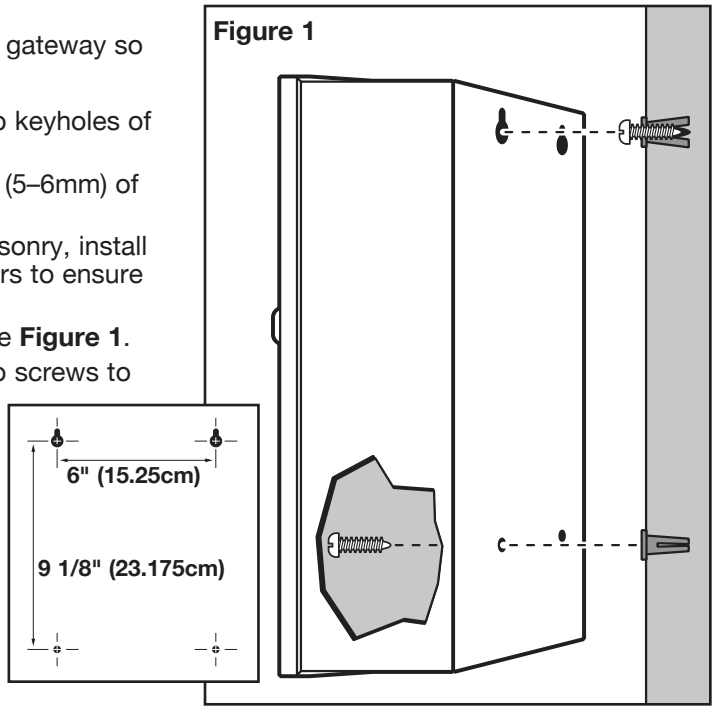
Step 2 – Install the top screws leaving approximately 1/4" (5–6mm) of exposed screw to accommodate the cabinet.

Note: If mounting the cabinet on dry wall or masonry, install the appropriate type of screw anchors or fasteners to ensure secure installation.

Step 3 – Hang the cabinet using the top keyhole slots. See **Figure 1**.

Step 4 – Open the cabinet door and install the bottom two screws to secure the cabinet.

Figure 1

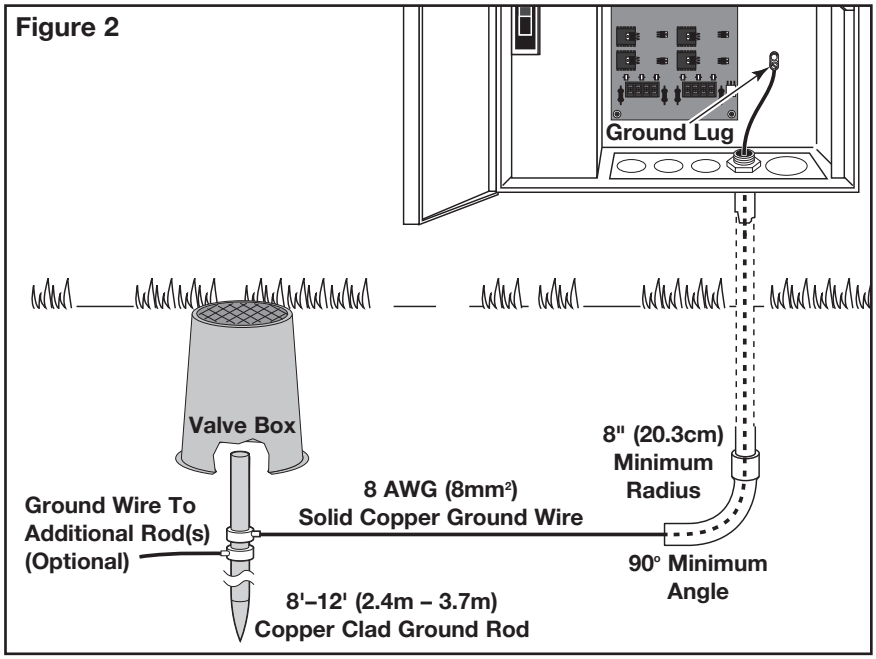


Earth Ground Installation

IMPORTANT! The Gateway's surge protection components cannot properly function unless an efficient pathway to earth ground is provided. The ground path must be as direct as possible, without sharp bends and must not exceed 30 Ohm resistance (when measured with an earth ground resistance device). All electrical components throughout the irrigation system should be grounded similarly to provide the same ground potential.

The following instructions depict one of several acceptable earth grounding methods. Due to variables in soil composition and terrain, the method shown may not be suitable for your installation site. Contact your local Toro distributor for assistance and availability of the required earth ground resistance test instrument.

Figure 2



Step 1 – Drive a 5/8" x 8' (17mm x 2.5m) copper-clad steel rod into well moistened soil not less than 8' (2.5m) or not more than 12' (3.7m) from the controller cabinet. The top of the ground rod should be flush with or below ground level, and should be protected from damage using a valve box. See **Figure 2**.

Step 2 – Using a 5/8" (17mm) clamp or "Cad weld" fastener, attach an 8 AWG (8mm²) solid copper wire near the top of the ground rod. Avoiding wire bends of less than 8" (20.3cm) radius and more than 90°, route the wire through conduit and into the cabinet. Secure the wire to the copper ground lug.

Note: Make sure the soil surrounding the ground rod(s) remains well moistened at all times. The addition of some form of irrigation may be required if the cabinet is installed in a non-irrigated location.

Step 3 – Measure the ground resistance per the instructions provided with the ground test instrument. A reading of 0.0 Ohm is optimum, up to 10 Ohm is good and 11–30 Ohm is acceptable in most cases. If the resistance exceeds the acceptable limit, additional ground rod(s) can be installed at a distance equal to twice the buried depth of the first rod; i.e., 16' (4.9m). Interconnect the ground rods using 8 AWG (8mm²) solid copper wire and test again. If the measured ground resistance continues to read above the acceptable limit, contact your local Toro distributor for further assistance and recommendations.

Note: Installing a round valve box over the ground rod enables the ground rod to be easily located as well as providing access to the ground wire connection(s).

Power Source Installation

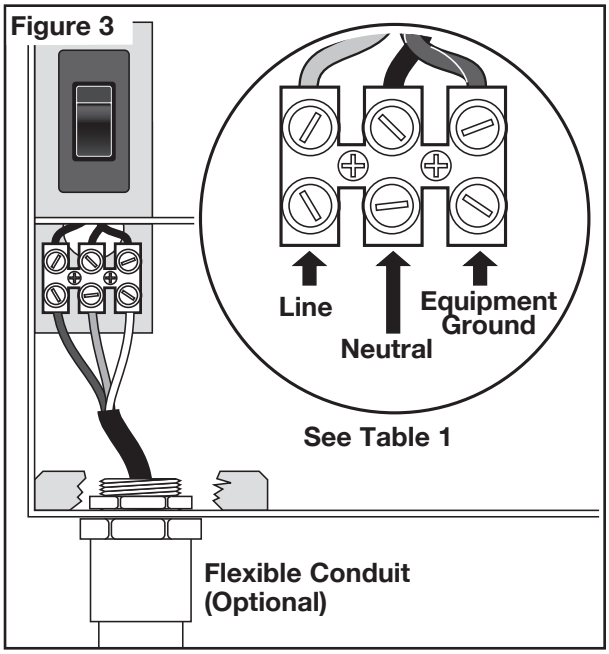
Step 1 – Turn off the power at the power source location and place the controller's power switch to OFF. Connect and route the appropriate size 3-conductor cable (14 AWG [2.5mm²] maximum) from the power source to the controller cabinet.

The provided power cable access hole can accommodate a 1" (25mm) conduit fitting. If conduit is required, install a section of flexible 1" (25mm) electrical conduit from the power source conduit box to the cabinet's access hole.

Table 1

AC Service Type	Line	Neutral	Equipment Ground
100 – 120 VAC (Domestic)	Hot (Black)	Neutral (White)	Green
220 – 240 VAC (International)	Hot (Brown)	Neutral (Blue)	Green / Yellow

Figure 3



WARNING! AC POWER WIRING MUST BE INSTALLED AND CONNECTED BY QUALIFIED PERSONNEL ONLY.

ALL ELECTRICAL COMPONENTS AND INSTALLATION PROCEDURES MUST COMPLY WITH ALL APPLICABLE LOCAL AND NATIONAL ELECTRICAL CODES. SOME CODES MAY REQUIRE A MEANS OF DISCONNECTION FROM THE AC POWER SOURCE, INSTALLED IN THE FIXED WIRING, HAVING A CONTACT SEPARATION OF AT LEAST 3mm IN THE LINE AND NEUTRAL POLES.

ENSURE THE AC POWER SOURCE IS OFF PRIOR TO SERVICING. FAILURE TO COMPLY MAY RESULT IN SERIOUS INJURY DUE TO ELECTRICAL SHOCK HAZARD.

Step 2 – Open the cabinet door and remove the two retaining screws from the power supply cover.

Step 3 – Strip the power cables and secure them to the terminal block. Reference Table 1 for the appropriate type of power connection.

Step 4 – Reinstall the power supply cover.

Step 5 – Apply power to the controller.

Mother Board Diagnostic Display

Mother Board Diagnostic Display

The Gateway features a 2-line, 16 character LCD display for quickly viewing for system diagnostic information. Use the left button below the LCD to scroll through the display lines and if needed, use the right button to scroll through the available options.

```
   Rev 2.02
   03/28/2011
```

After power up, the screen will display board's firmware version.

```
D1=0.00  D3=OFF
D2=0.00  D4=OFF
```

After the initial Revision screen, the display will show the current for both daughter boards.

```
1+=0.22 2+=0.45
1-=0.24 2-=0.43
```

```
3+=OFF 4+=OFF
3-=OFF 4-=OFF
```

The display will also show the load currents by individual wires of a two-wire communication line.

```
Rain sw  =open
Pump pres=closed
```

The display will show the Rain and Pump Pressure sensor state and will be updated in real time.

```
D1 DEC 32396
00:10:00 ON
```

The display will show the information contained in the message during transmission execution. The information will only be displayed while the transmission is being executed. The display will refresh if a different command is transmitted.

```
Display Contrast
Psh Opt to Adj
```

Scroll to this menu to adjust the display contrast. Press the right button below the LCD to adjust.

```
00:00:06:23:05
```

This is the time counter in Month:Days:Hours:Minutes:Seconds which starts upon power up.

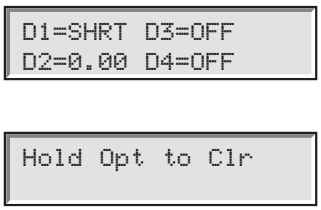
```
Flow=0.00 Hz
```

The display will show the real time pulse frequency of the flow sensor input.

Alarm Conditions

All of the Alarm Conditions, when active, toggle back and forth between the two message states below.

Short Circuit Alarm



- High current trigger on two-wire line.
- Motherboard LCD toggles between high current trigger or short on two-wire line status and how to clear alarm message.
- Affected daughter board's alarm LED blinks back and forth.

Phase Current Imbalance Alarm

- Triggered when load current of one wire is 2x higher than the opposite wire for a minimum 20 seconds.
- 20 second timer is reset when load current of one wire is no longer 2x higher.
- Does NOT shut off or disable daughter board.
- Motherboard LCD toggles between current status and how to clear alarm message.

Clear Alarm

To clear an alarm condition, simply hold down the Option button on the motherboard for three seconds.

Decoder Installation - New System or New Communication Cable

The station decoder module is available in 1-station, 2-station, 4-station configuration or a Toro golf sprinkler with an integrated 1-station decoder.

A Gateway cabinet can handle up to 250 decoders or 1000 stations. Each Gateway cabinet has a daughter board with two output circuits. Each output circuit can handle up to 125 decoder modules and 500 stations. The decoder modules can be connected in parallel anywhere on the two-wire communication line connected to the station terminals. Each station can activate up to two solenoids.

It is recommended that the decoder modules are installed in an approved valve box to provide easy access to the wiring. Use 3M DBR/Y-6 to waterproof all connectors.

Recommended Controller-to-Decoder cable: 14 AWG (2.5mm^2), solid copper, jacketed 2-conductor, direct burial. The preferred wire make and model is the Paige Irrigation Wire, Spec P7350D.

Burial Depth

Toro recommends that the Controller-to-Decoder and Decoder-to-Solenoid cables should have a minimum cover of 6" (150mm). The irrigation plan may specify additional depth to be consistent with the depth of mainline or lateral pipe work and/or soil conditioning procedures such as aeration. Installation procedures must comply with all applicable local and national electrical codes.

- Use only wire approved for direct burial if installing the wires underground without conduit.
- All field wiring splices must be accessible to facilitate troubleshooting and/or service.

Step 1 – Route communication cable from the controller to the station decoder module installation location.
Note: The maximum wire length between the controller and the decoder module is 6,800' (2072 m).

Step 2 – Secure the communication wires to terminal 1 of the Gateway output board. Black wire onto the 1st terminal and Red wire onto the second terminal. See **Figure 4**.

Step 3 – Install the decoder module in a valve box. Record the decoder module's address number found on the side label. This address number identifies the station(s) that the decoder module controls.

Step 4 – Secure the communication wires to the decoder module's black and red wires. Connect the black communication wire to the black decoder module wire. Connect the remaining communication wire (red) to the red decoder module wire. Use 3M DBR/Y-6 or similar products to properly water-proof all wire connections.

Step 5 – Route output wires from the decoder module to the solenoid.
Note: The maximum wire length between the decoder module and the solenoid are 400' (122m) for 18 AWG wire and 575' (175m) for 16 and 14 AWG wires.

Step 6 – Connect the solenoid wires to the decoder module's station wires. The station wires are color coded for easy identification (Station 1 = Violet, Station 2 = Yellow, Station 3 = White, Station 4 = Orange and Common Wire = Brown). Connect the station wire (violet, yellow, white or orange) to one of the solenoid wire. Connect the brown wire (common wire) to the remaining solenoid wire. Use 3M DBR/Y-6 or similar products to properly water-proof all wire connections.

Step 7 – Connect an additional solenoid to the station wire as necessary.
Note: Each station has a maximum load of up to two solenoids.

Step 8 – Repeat Steps 3–8 for additional decoder modules.

Decoder Installation - Upgrade of Existing System, Using Existing Wiring

Communication Cable Type

Should be 2 or 3 copper conductors, solid or stranded, with PE or PVC insulation, rated for at least 600V. For 3-conductor cables, the third conductor will not be used and any exposed ends must be capped and sealed with a DBR/Y-6 splice.

Communication Cable Length

The maximum wire run from the Gateway to the farthest decoder is 6800' (2072 meters) for 14 AWG (2.5mm^2) cable. The total amount of wire path is 14,000' (4267 meters) for 14 AWG (2.5mm^2) cable.

Resistance

The maximum resistance of the wire path with the end shorted can be 37.7 Ohms. The minimum resistance of the wire path with the end open should be 1000 Ohms.

Noise

For the wire path to be tested, disconnect from the DIU (or other controller), connect an oscilloscope across the wire path, and power up the pump and any other equipment that would be running when watering. Measure the voltage across the open wire path. It should be less than 1 V p-p.

Short Circuits

After the decoders are installed, measure the resistance across the two open wire path wires to insure that it is still greater than 1000 Ohms to insure that no shorts were introduced during the installation process.

Communication Cable to Power Cable Spacing

This recommendation applies to 2-Wire communication installation. This minimum spacing to any power cable should be maintained to minimize the possibility of electrical interference which could affect the integrity of the GDC communication to decoders. If there are power cables already installed running next to the communication cables that do not meet the minimum spacing, modification will be required to meet the minimum spacing listed in Table 2 below.

Table 2

Power Cable Circuit Rating (Minimum KVA*)	Recommended Minimum Spacing**
0–5 KVA	12 Inches (30 cm)
5–10 KVA	24 Inches (61 cm)
10–20 KVA	48 Inches (122 cm)
> 20 KVA	10 Feet (3 m)

* Maximum Voltage x Current Ratings of Circuit

** These are minimum spacing recommendations to minimize noise coupling. There may be greater separation required by safety agencies or local codes.

Decoder to Sprinkler Wires

Wire Type - Should be copper conductors, solid core, with PE or PVC insulation, rated for at least 600V

Wire Length

For 14 AWG or 2 .5mm^2 – Maximum length is 575 feet (175m)

For 16 AWG or 1.5mm^2 – Maximum length is 575 feet (175m)

For 18 AWG or 0.9mm^2 – Maximum length is 400 feet (122m)

Decoder Module Installation

Remove an old decoder by cutting out the old splices. Make sure to cut the communication wires and station wires back to remove any green or corroded copper. Strip the wires and connect a new decoder module per **Figure 4**. All splices must be made with 3M DBR/Y-6 splice kits.

Valve Compatibility

Toro — Golf VIH (Solenoid 89-1905 or 118-0248) at 150 PSI
400ft (122m) Max Solid Core, 18 AWG or 0.9mm^2 Cable 2.3 Ohms/Conductor (400ft), 1 per Output
575ft (175m) Max Solid Core, 16 AWG or 1.5mm^2 Cable 2.3 Ohms/Conductor (575ft), 2 per Output
575ft (175m) Max Solid Core, 14 AWG or 2.5mm^2 Cable 2.3 Ohms/Conductor (575ft), 2 per Output

Toro — 252 Valve (Solenoid 102-1905 or 118-0248) at 150 PSI at AC Decoder, 1 per Output

Toro — 220 Valve (Solenoid 102-0927) up to 220 PSI (passing is 150 PSI) at AC Decoder,1 per Output

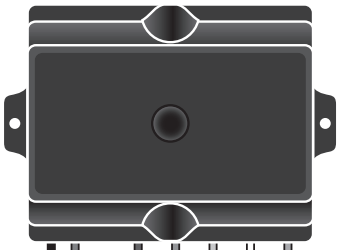
Toro — 216 Brass Valve (Solenoid 89-1673), Up to 220 PSI (passing is 150 PSI) at AC Decoder, 1 per Output

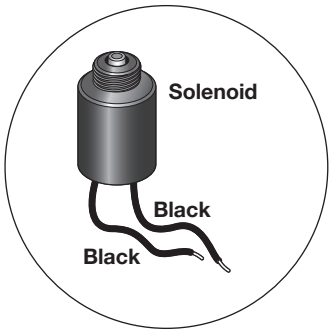
Rain Bird — Green Golf VIH Solenoid at 150 PSI
200ft Max Solid Core, 18 AWG or 0.9mm^2 Cable 1.2 Ohms/Conductor, 1 per Output
328ft Max Solid Core, 16 AWG or 1.5mm^2 Cable 1.2 Ohms/Conductor, 2 per Output

Rain Bird — DV Solenoid (Black Wires) at 150 PSI at AC Decoder, 1 per Output

Rain Bird — PGA/PESB Solenoid (White Wires) at 150 PSI at Decoder, 1 per Output

Figure 4





Station 4 - Orange Wire - Connect to one of Station 4's solenoid wires.

Station 3 - White Wire - Connect to one of Station 3's solenoid wires.

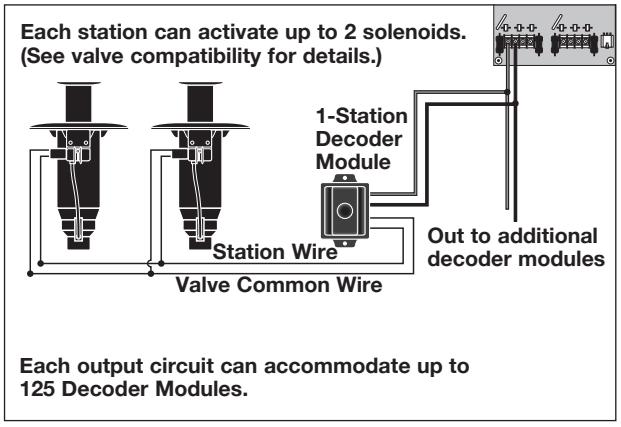
Station 2 - Yellow Wire - Connect to one of Station 2's solenoid wires.

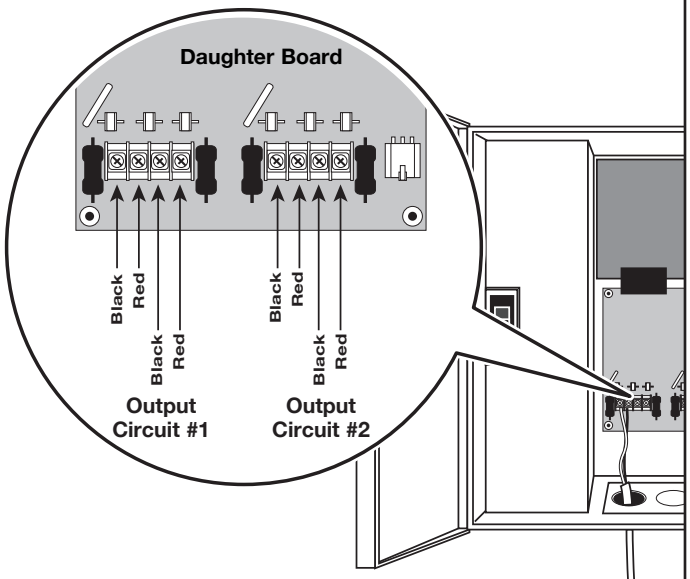
Station 1 - Violet Wire - Connect to one of Station 1's solenoid wires.

Valve Common - Brown Wire (Connect to one of the wires from each of the four solenoids.)

Red Power/Communication Wire

Black Power/Communication Wire



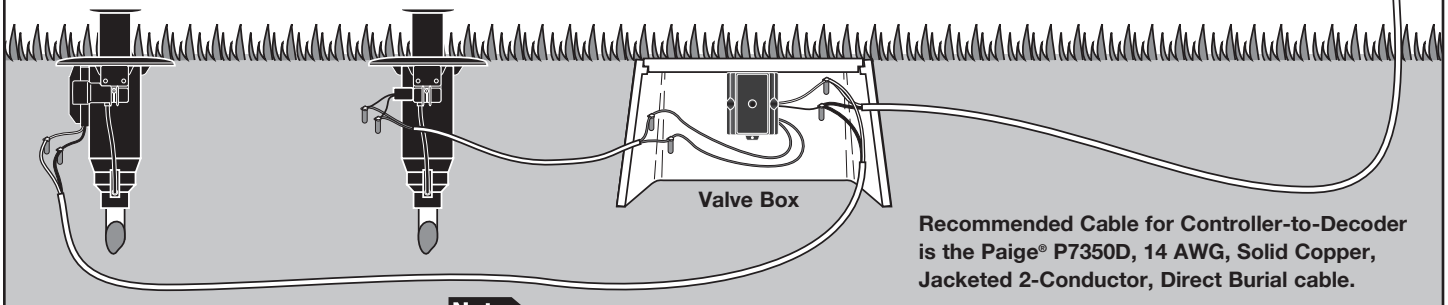


Reference the "Valve Compatibility" section for the maximum communication wire length between the decoder and the solenoid.

Recommended Cable for Decoder-to-Solenoid is a Solid Copper, 2-Conductor, Direct Burial cable.

Note: **To easily identify stations for troubleshooting, install wires with the same color code as the station wires.**

Maximum communication wire length between the controller and the farthest decoder is 2,072m (2.5mm²).



Recommended Cable for Controller-to-Decoder is the Paige® P7350D, 14 AWG, Solid Copper, Jacketed 2-Conductor, Direct Burial cable.

Note: **When possible, install the decoder module in a valve box for ease of service.**

Grounding Communication Cable

The lightning arrester (Toro P/N DEC-SG-LINE) is required to protect the decoder module from lightning. Without lightning arresters, the decoders are vulnerable to lightning damage. In order for these arrester to discharge lightning energy efficiently, they must be properly grounded. **Figure 5** illustrates the proper grounding and wiring of the arrester.

Step 1 – Locate decoder's power/communication wires (black and red wires).

Step 2 – Strip the insulation from lightning arrester's red wire and connect it to the red wires from the decoder and controller-to-decoder cable. Use 3M DBR/Y-6 or similar products to properly water-proof all wire connections. (See **Figure 5**.)

Step 3 – Strip the insulation from lightning arrester's black wire and connect it to the black wires from the decoder and controller-to-decoder cable. Use 3M DBR/Y-6 to properly water-proof all wire connections. (See **Figure 5**.)

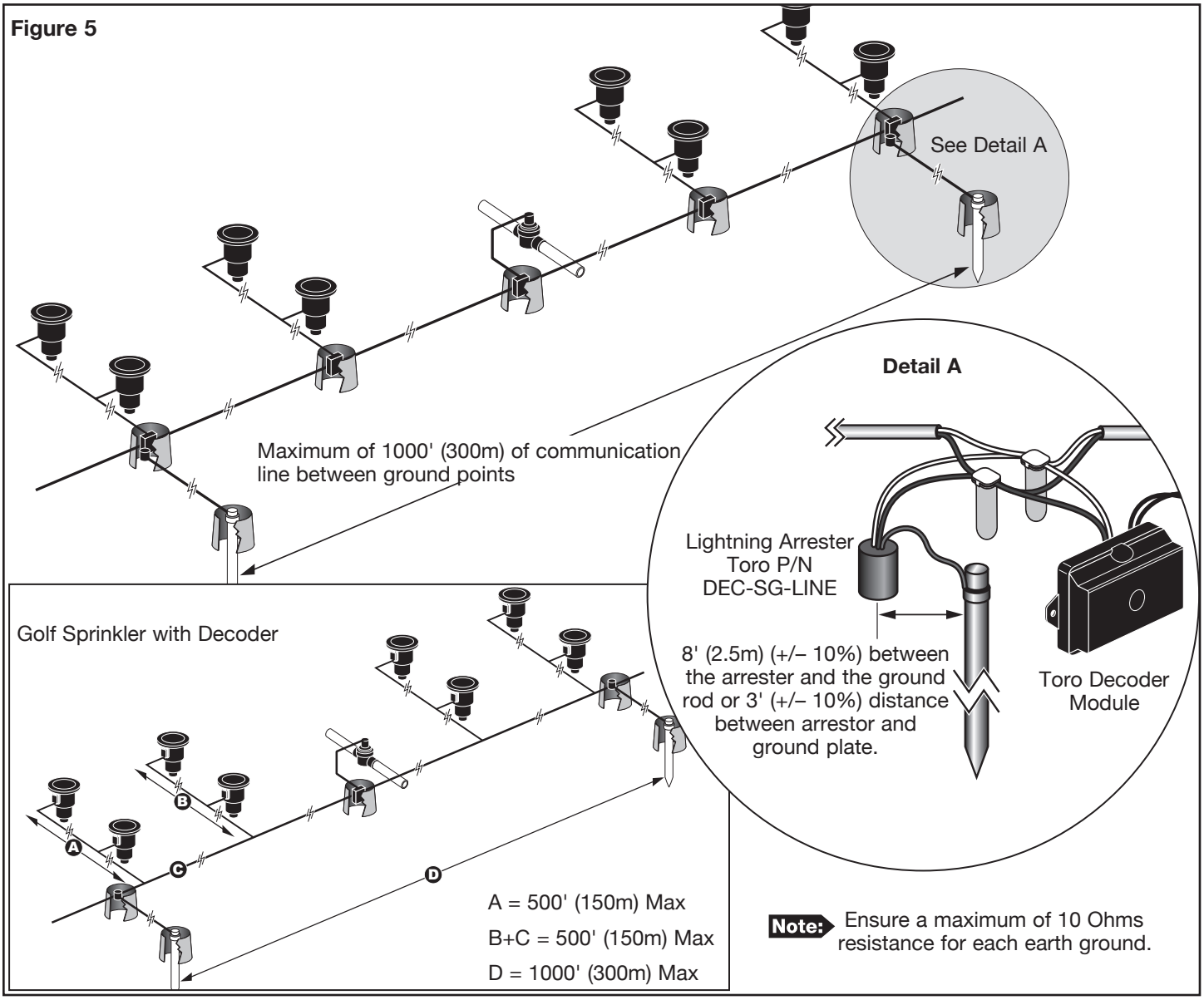
Step 4 – Connect the lightning arrester's ground wire to the ground rod or plate's wire. If the ground rod or plate is not pre-wired, use a 10 AWG bare copper wire. (See **Figure 5**.)

⚠ **IMPORTANT!** If using an 8' ground rod, verify that the straight line distance between the lightning arrester/decoders and the ground rod is 8' (2.5m) +/– 10%. If using a 3' (1m) ground plate, the straight line distance should be 3' (1m) +/– 10%.

Step 5 – If necessary, use ground enhancement material (GEM) to attain a resistance of 10 Ohms or less.

Step 6 – Check the system for proper operation.

Figure 5



For upgrades of existing systems, we recommend adding one ground point (Detail A) at the end of each main communication line.

PC Interface Installation

Step 1 – Place the Gateway's power switch to OFF.

Step 2 – Install the fiber optic modem to the Gateway mother board. See **Figure 6**.

Step 3 – Ensure that the FIBER/WIRE switch is in the FIBER position.

Step 4 – Remove the protective cover from the modem's socket and fiber optic cable. Secure the cable to the Transmit (TX) and receive (RX) ports. Ensure that both cables are locked into place. Record the TX and RX cable color for reference.

Step 5 – Route the fiber optic cable to the central computer.

Step 6 – Install the remaining fiber optic modem to the central computer's COM port.

Step 7 – Remove protective cover from the modem's socket and fiber optic cable. Connect the Gateway modem's TX to the computer modem's RX input. Connect the Gateway modem's RX to the computer modem's TX input.

Step 8 – Place the Gateway's power switch back to ON. Restart the central computer and test the system for proper operation.

Figure 6

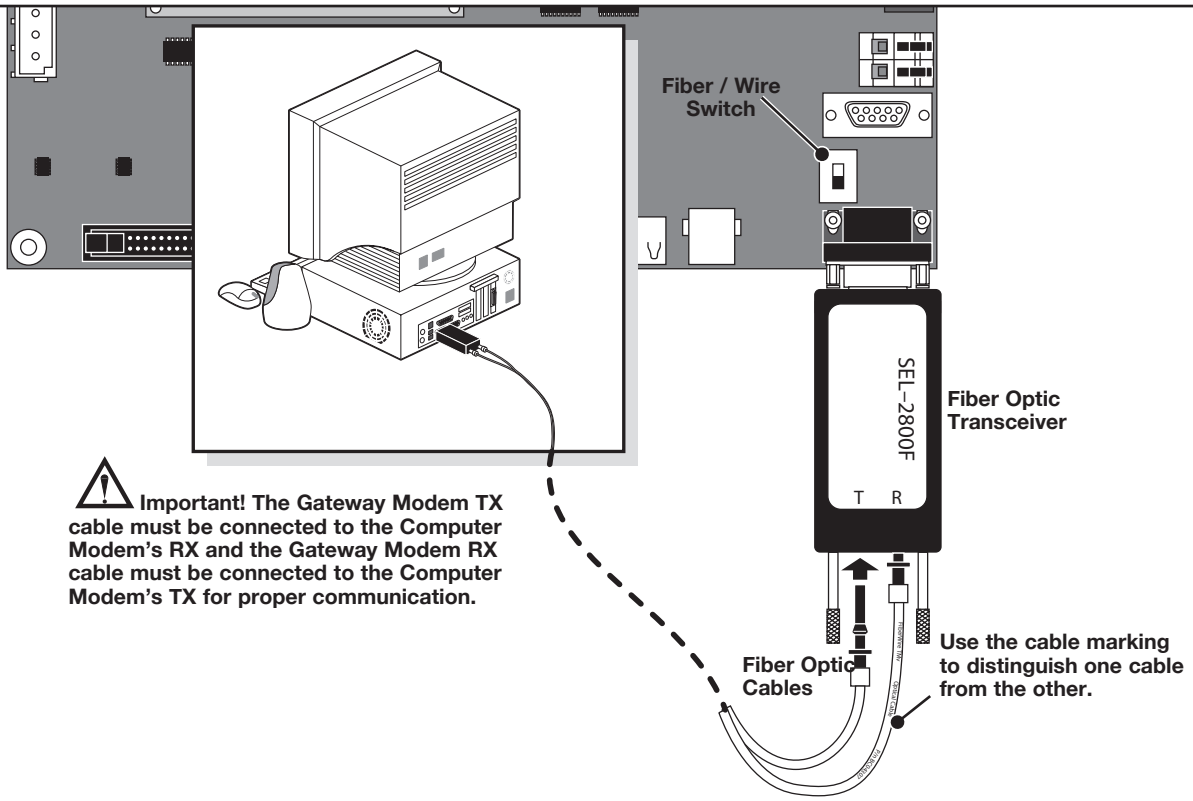
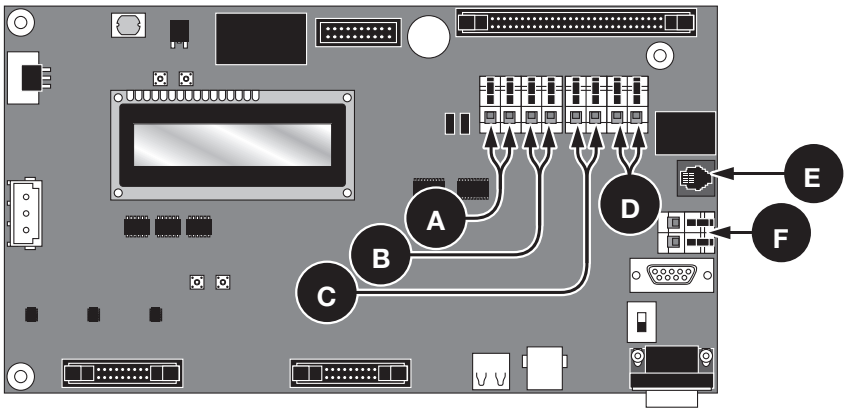


Figure 7



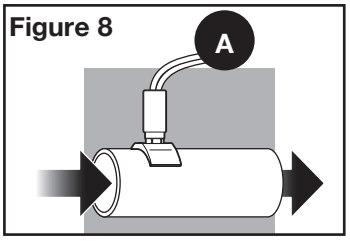
Key	
Letter	**Function**
A	Pressure sensor
B	Rain sensor
C	Flow sensor (non-operational)
D	Master valve/Pump Relay
E	Communication port for TMR/CMR remote.
F	+24 VDC (Toro Rain Sensor compatible)

Pressure Sensor Installation

The Gateway controller is designed to accept both normally-open and normally-closed pressure sensor. Set the pressure sensor model in the Gateway's preference menu.

Step 1 – Place the controller's power switch to OFF.
Step 2 – Route the pressure sensor's cable (**Figure 8**, **A**) into the controller.
Step 3 – Connect the cable wires to the Pressure Sensor Terminals (**Figure 7**, **A**).
Step 4 – Place the controller's switch to ON.

Figure 8

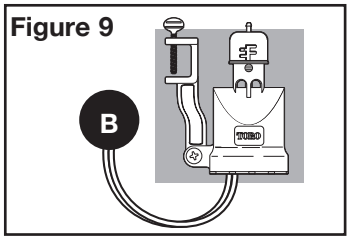


Rain Sensor Installation

The Gateway controller is designed to accept both normally-open and normally-closed rain switch. Set the rain switch model in the Gateway's preference menu.

Step 1 – Place the controller's power switch to OFF.
Step 2 – Route the rain sensor's cable (**Figure 9**, **B**) into the controller.
Step 3 – Connect the cable wires to the Rain Sensor Terminals (**Figure 7**, **B**).
Step 4 – Place the controller's switch to ON.

Figure 9

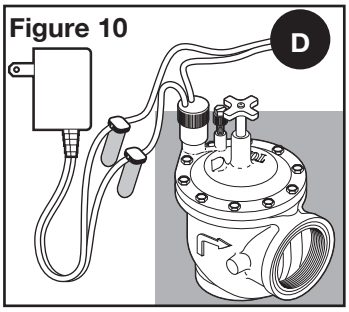


Master Valve / Pump Relay Installation

The Gateway controller provides switch terminals to control a master valve or a pump relay if the system requires it.

Step 1 – Place the controller's power switch to OFF.
Step 2 – Connect the Positive/Hot wire of the power source that controls the master valve or the pump relay to the Master valve/Pump relay switch terminal (**Figure 7**, **D**).
Step 3 – Route another wire from the Master Valve / Pump terminal and connect it to the master valve solenoid or pump relay.
Step 4 – Connect the Negative/Equipment ground wire of the power source to the master valve solenoid or pump relay.
Step 5 – Place the controller's switch to ON.

Figure 10



Gateway Synchronization

The Gateway controller must be synchronized with other Gateway controllers for proper communication.

Step 1 – Route a 2-wire cable (10' [3m] maximum length with a minimum diameter of 1.0mm^2 [18 AWG]) from the first Gateway controller to the second Gateway controller.

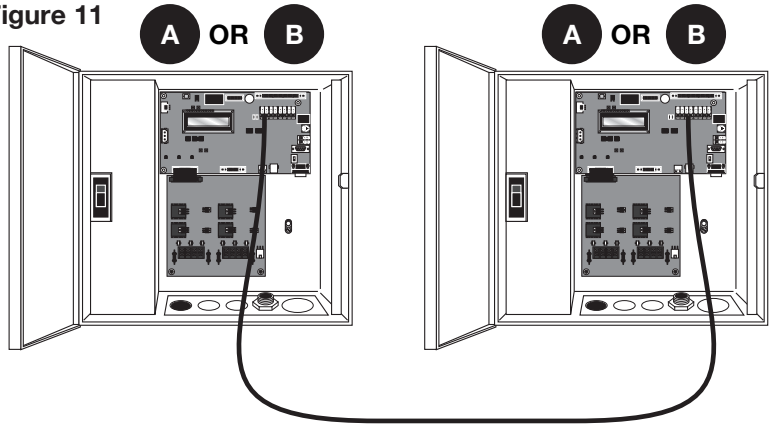
Step 2 – Connect the 2-wire cable into the Synchronization terminals of both controllers (Use either the **PUMP** or **RAIN** sensor terminals). Make sure that the wire polarity is the same (the wire connected to the left terminal on the first controller is connected to the left terminal of the second controller).

Step 3 – Activate the sensor terminals being used for Synchronization (**GW SYNC**). See **Figure 12**.

The Gateway synchronization is achieved using a shared terminal with either the **RAIN** sensor or the **PUMP PRESSURE** sensor. To enable Gateway synchronization, the **PUMP** or **RAIN** sensor terminal jumper must be placed in the **GW SYNC** position (top two terminals).

Note: Sensor function is disabled for the terminal with **GW SYNC** jumper position. If the Gateway is utilizing both **PUMP** and **RAIN** sensor terminals, disconnect one of the sensors and install in the other Gateway with an unused sensor terminals.

Figure 11



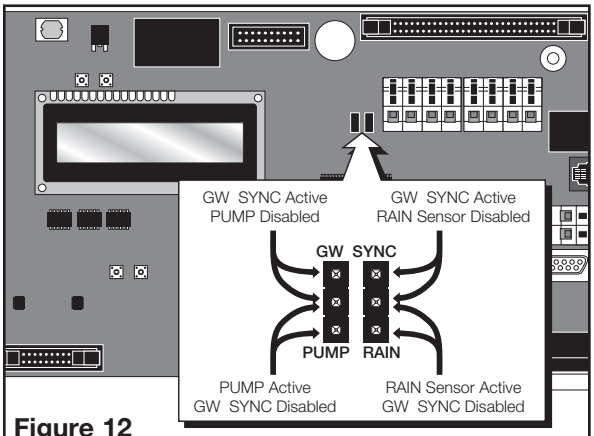


Figure 12

Gateway Expansion

The Gateway controller can be expanded (with the optional Expansion unit) to control up to 500 Decoder modules and 2000 stations.

Step 1 – Switch off the power to the Gateway and the Expansion unit.

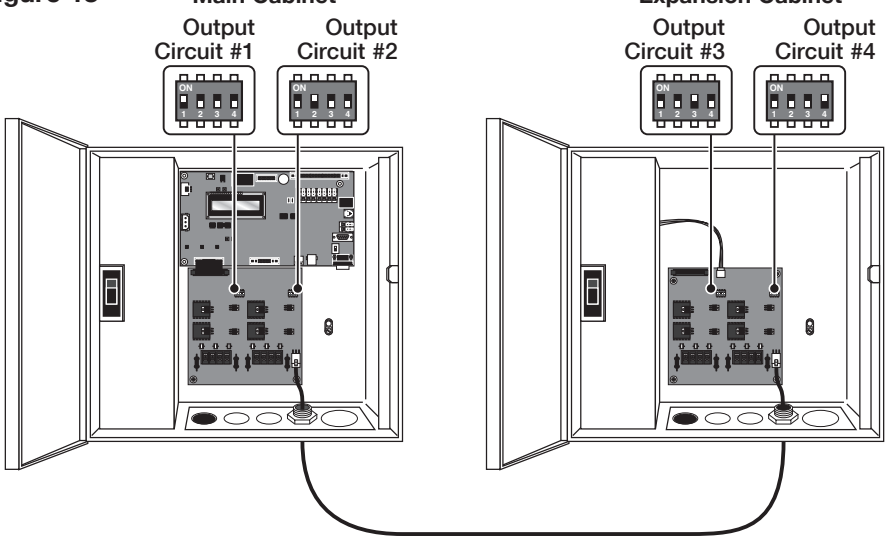
Step 2 – Route the expansion cable from the Gateway to the Expansion unit.

Step 3 – Plug one end of the cable to the Gateway's Expansion Port located on the output module and plug the other end to the Expansion Port of the Expansion unit.

Step 4 – Apply power to Gateway and Expansion unit and test for proper function.

Note: For proper function, verify that the main cabinet's daughter board's dip switches are set to 1 and 2 and the expansion board's dip switches are set to 3 and 4. See **Figure 13**.

Figure 13



Electromagnetic Compatibility

Domestic: This equipment has been tested and found to comply with the limits for a FCC Class A digit, al 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. The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the radio communications. Operation in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

International: This is a CISPR 22 Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures. Each stations can activate up to two solenoids.

This product, utilizing a Class 2 transformer tested to UL1585, satisfies the requirements of a Class 2 Power Source as defined in the NFPA 70 (NEC), Article 725.121(A)(3).