b•hyve PRO

HSC-6300-D
TWO-WIRE CONTROLLER

INSTRUCTION MANUAL

HYDRO-RAIN

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www.HydroRain.com

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Welcome to the Hydro-Rain® Family

Thank you for purchasing the weather-based, SMART irrigation, High Station Count Controller.

Hydro-Rain® products are designed to save time. Whether it is programming a controller, installing, or adjusting the system, Hydro-Rain® products go together faster and easier.

HSC Controller

Smart. Adaptable. Affordable.

The High Station Controller (HSC) is the latest evolution of our mission statement, To Change the Way the World Waters®. Designed to be a B-hyve® Pro connected controller, it can replace most controllers in the market and provide years of dependable service.

B-Hyve® Pro App

The B-hyve® Pro app is an advanced smarttphone app, with web management, and employee/device management tools.

The HSC requires the B-hyve Pro app to program and control it. Download the B-hyve® Pro app to program the HSC Controller from your app store or scan the relevant QR code below.

GET IT ON Google Play

Download on the App Store

Support

Contact Hydro-Rain® Product Support : 1-888-493-7672

The Hydro-Rain® Product Support team is available to help with setup, programming, and troubleshooting questions.

Key Features

- Manage up to 63 two-wire decoder stations including 2 master valves
- SMART programming, and 4 independent programs
- 4 start times per program
- 14-day predictive water calendar
- Maximum station run time: 4 hours (240 minutes)
- Programs stored in non-volatile memory
- Real Time Clock is maintained via battery back-up for 7-10 days
- Each Program has its own Water Budget, adjustable from 10 – 200%
- The SMART scheduling engine optimizes by seven factors like plant type, soil, sprinkler, sun exposure, and slope
- 2 integrated flow meter inputs, assignable by zone
- 2 dedicated master valves or pump start terminals which are programmable by zone
- 2.4 GHz Wi-Fi, 5 GHz Wi-Fi, Bluetooth®, or Ethernet connectivity
- Optional cellular connectivity available with Hydro-Rain® cellular module
- Metal enclosure that is 16-gauge, NEMA 3R, and powder-coated
- Keyhole mounting for easy installation
- Free and automatic firmware and software updates
- Includes USB charging port, and a shelf for resting a tablet or cell phone
- Web dashboard available. Set up your B-hyve® Pro account at **pro.mybhyve.com**
- Share access to the HSC through the app or dashboard
- Set permission levels on the B-hyve® Pro app or dashboard Unique AC power, Two-wire platform is more stable and as Managers or Guests
- Choose watering days from a 7- or 14-day irrigation calendar, including odd/even days or exclude days, based on local water conservation requirements
- Unique AC power, Two-wire platform is more stable and easier to troubleshoot and maintain
- No extra grounding needed along the two-wire path
- Use standard irrigation field wire for the two-wire path
- Color-coded wiring for decoders
- App and Dashboard training available at the Hydro-Rain Academy **professional.training.hydrorain.com**

Symbol Definitions

The following symbols represent safety codes specific to this product. These are noted for protection and safe operation.

DANGER — ***An immediately hazardous situation. If the hazardous situation is not avoided, death or serious injury will occur.***

WARNING — ***A potentially hazardous situation. If the hazardous situation is not avoided, death of serious injury will occur.***

CAUTION — ***A potentially hazardous situation. If the hazardous situation is not avoided, minor or moderate injury could occur.***

NOTICE — ***A property damage only hazard, meaning no personal injury is possible.***

SAFETY INSTRUCTION — ***Indicates safety related instructions, procedures, or the locations of safety equipment.***

HSC Hardware

(1) Ethernet Connection

Used for a hardwire internet connection.

(2) USB Power Port

Charge a phone or tablet.

(3) Wi-Fi, Bluetooth®, and 900 MHz Antenna

(4) Display

Shows alerts, current status, upcoming watering events, and remaining runtime.

(5) Buttons

Up, down, and select buttons. Look to the display screen to see what each button does. The function of these buttons can change based on the screen being viewed, or what the controller is doing.

(6) Cellular Antenna

(7) Status LED Lights

Indicates controller status, communication status, and cellular operation (if installed). See LEDs on page 15.

(8) On/Off Switch

Turns the controller on or off. Turn off the controller when adding or removing modules or interacting with the wire terminals.

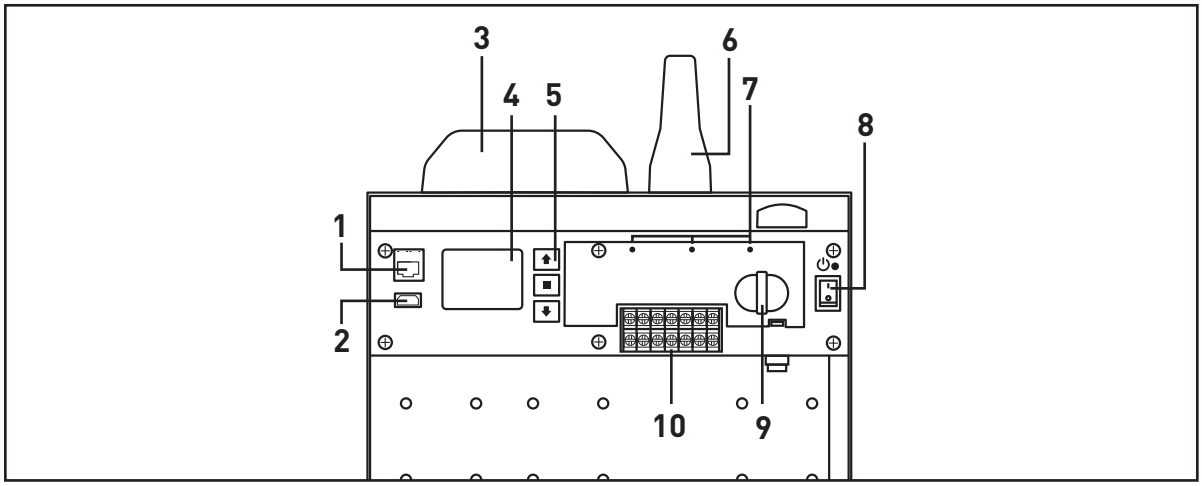
(9) Battery

A lithium, coin-cell battery saves the date and time when there is a loss of power or communication to B-hyve® servers (program settings and other data are saved in nonvolatile memory and do not require battery backup). The battery may last the controller's life but is easily replaced. Use a standard CR2032 or equivalent replacement. Be sure to place the + side of the battery correctly.

CAUTION — ***Dispose of battery in accordance with local regulations***

10) Wire Terminals

Connect 2 flow meters, 2 master valves or pump starts, 2 weather sensors, and supply power with one 24 vac output.



Getting Started

Prior to installing the new HSC-6300-D controller, take a moment to inspect the enclosure and contents of the packing (see Figure 1). It should include:

- The HSC-6300-D wall mount enclosure
- Two keys
- Three stainless steel screws
- Three plastic anchors for masonry or drywall installations
- Insctruction Manual
- CR2032 backup battery
- Two-wire module (HSC-6300-MD)

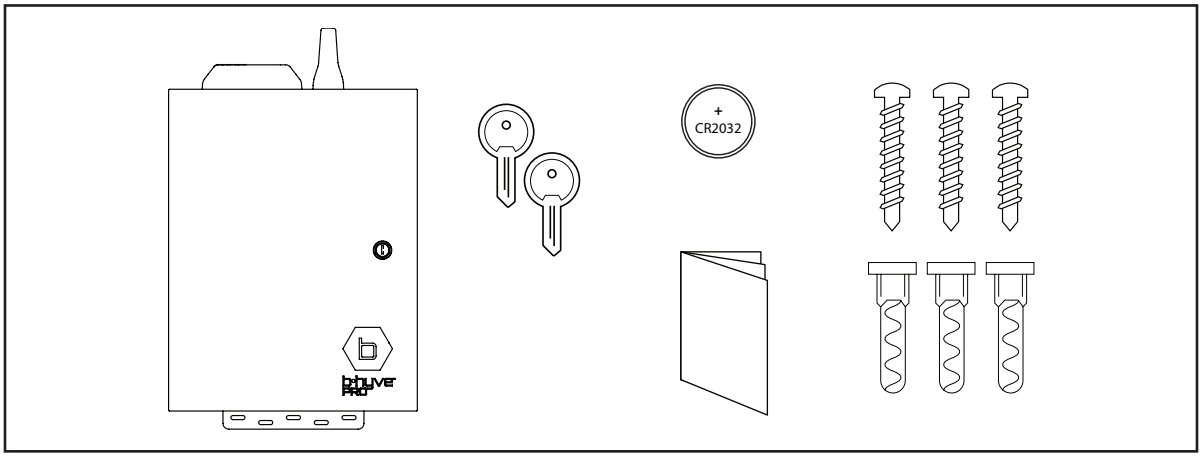


Figure 1. Image of Contents

Installing the Controller

Irrigation controllers are typically located near a 120-volt power source and where the site can be viewed when operating valves. App-based irrigation controllers eliminate the need for the second requirement. Controllers can be located indoors or outdoors, and where they are less likely to be subject to tampering or vandalism.

Install the controller at least 15 feet (4.5 m) from pumps, appliances, and other sources of electrical interference. The HSC controller should have its own dedicated 15-amp breaker and should not be on the same electrical circuit as a pump or other electrical appliances.

NOTICE **INSTALLING IRRIGATION CONTROLLERS IN FULL-SUN, HIGH-HEAT LOCATIONS MAY ADVERSELY EFFECT ELECTRONICS.**

Installing for Wi-Fi

Evaluate the Wi-Fi signal at the controller's proposed location by viewing the signal strength of the network in the device settings of a mobile phone. If the signal strength is low, consider purchasing a Wi-Fi range extender. If outdoors, Hydro-Rain® recommends an extender rated for local weather conditions.

The HSC is the only controller accommodating 2.4 or 5 GHz Wi-Fi. A 2.4 GHz connection travels farther at lower speeds, while the 5 GHz frequency provides faster speeds at a shorter range. 5 GHz, although faster, does not travel through walls as well as 2.4 GHz.

Recommended Installation Tools

- Drill
- ⅛-inch (0.32 cm) Drill bit for the screw
- 5⁄16-inch (0.79 cm) drill bit for the wall anchor (drill bit applicable for the material installed)
- Level tool
- #2 Phillips screwdriver

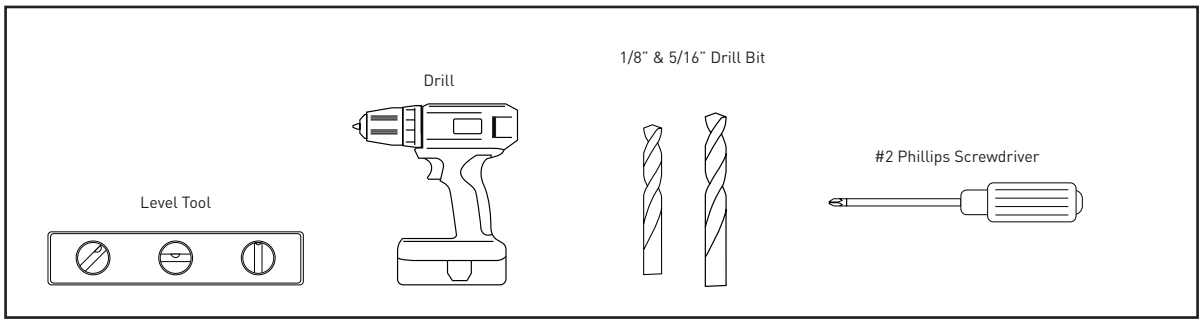


Figure 2. *Recommended Installation Tools*

Wall Mounting Instructions

Step 1 – Remove the outer door and set it aside where it won't be damaged during installation.

Step 2 – Drill the top hole first at the appropriate height, so the user can see the display. Insert the anchor, if needed, and the screw.

Step 3 - Supporting the weight of the controller, hang the HSC from the keyhole mount on the back of the enclosure.

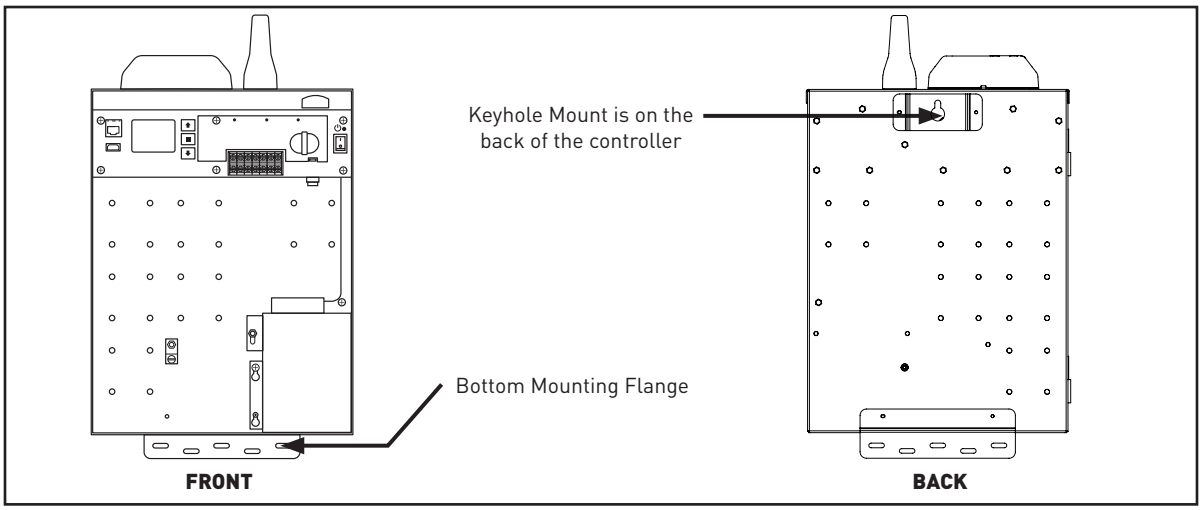


Figure 3. *Mounting The HSC Controller*

Step 4 – Place a level on the controller. Keep the controller level while marking two of the appropriate holes on the bottom mounting flange. (See Figure 3)

Step 5 – Take the controller off the Keyhole Mount.

Step 6 - Drill the bottom holes (and install anchors if needed) at the marked locations.

Step 7 - Place the controller back on the keyhole mount and install the bottom two screws through the flange.

Pedestal Mount

The HSC fits in several pedestals offered on the market. If installing inside a pedestal, use the instructions above. If installed on a top-mount pedestal, use the four holes in the bottom corners of the enclosure. Adapt as needed. Contact your local distributor or Hydro-Rain representative for sizing help and recommendations.

Wiring

The bottom of the controller enclosure has the following through-holes or knockouts shown in Figure 4.

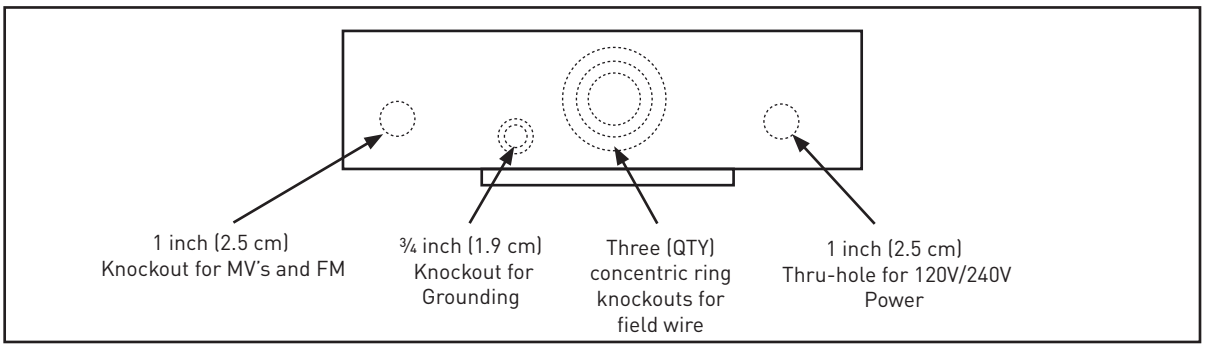


Figure 4. *Bottom of the Enclosure*

The knockouts located on the bottom of the enclosure are sized for the following conduits from left to right:

- Far left: 1-inch (2.5 cm) knockout for a ¾-inch (1.9 cm) male conduit adapter for master valves and/or flow sensors.
- Grounding: ¾-inch (1.9 cm) knockout for a ½-inch (1.3 cm) male conduit.
- Center: Three concentric knockouts used for zone wiring. The largest is 2.5-inch (6.35 cm), middle 1.5-inch (3.8 cm), and the smallest is 1-inch (2.5 cm). These are made for the following male adapters, 2-inch (5 cm), 1.25-inch (3.2 cm), ¾-inch (1.9c m).
- Far right: 1-inch (2.5 cm) knockout for a ¾-inch (1.9 cm) male adapter conduit for the transformer power inlet.

Remove the appropriately sized knockout for the field wire you have. Run the wire path in conduit until it is below grade. Hydro-Rain recommends using approved electrical conduit and watertight connectors going into the HSC enclosure.

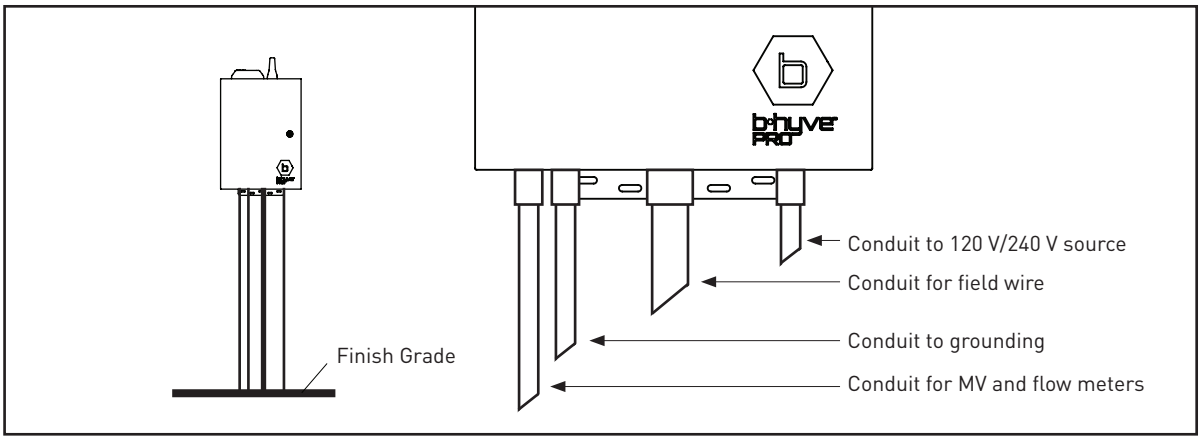


Figure 5. *HSC Typical Conduits*

Transformer

The HSC has a dual-voltage transformer behind a safety enclosure. The HSC controller's transformer is adaptable to single phase 120 and 240 voltage inputs.

WARNING: TURN OFF THE POWER TO THE CONTROLLER BEFORE WORKING WITH THE TRANSFORMER AND WIRING. TURNING THE ON/OFF SWITCH DOES NOT TURN OFF THE POWER INTO THE TRANSFORMER. ALWAYS FOLLOW APPLICABLE ELECTRICAL CODES. ELECTRICAL WORK MAY REQUIRE A LICENSED ELECTRICIAN.

Step 1 –To access the transformer, loosen the middle screw on the left side of the enclosure and pull up on the cover to loosen it from the pins holding it in place. See Figure 6.

Step 2 – For a 120-volt power connection, confirm all three conductors black (Hot), white (Neutral), and the green (Ground) are connected. Ensure the blue wire's end is safely terminated in the provided wire connector. Levered electrical connectors have been provided for ease of installation. See Figure 7.

For a 240-volt connection, connect the three conductors, blue (Hot), white (Neutral), and the green (Ground). Make sure the black wire is safely terminated in the provided wire connector.

Step 3 – Return the safety enclosure's cover in place and tighten down the middle screw.

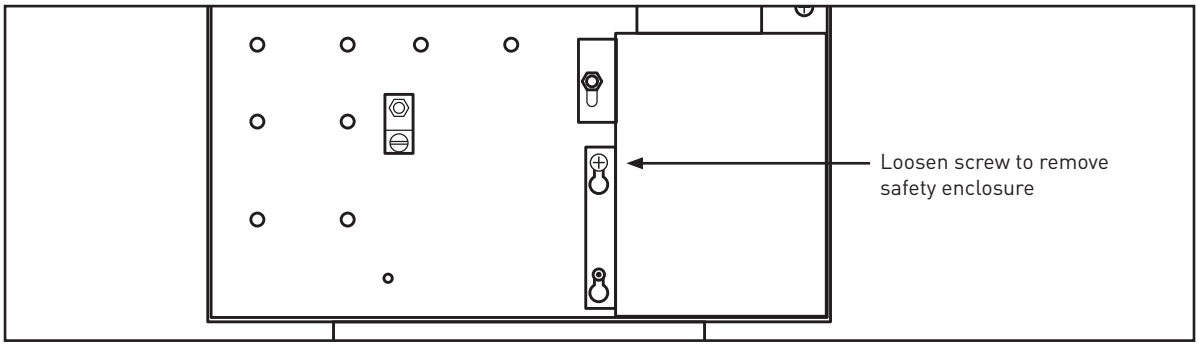


Figure 6. *Transformer Safety Enclosure*

WARNING: TO PROTECT AGAINST ELECTRICAL SHOCK, THE SAFETY ENCLOSURE MUST ALWAYS BE IN PLACE.

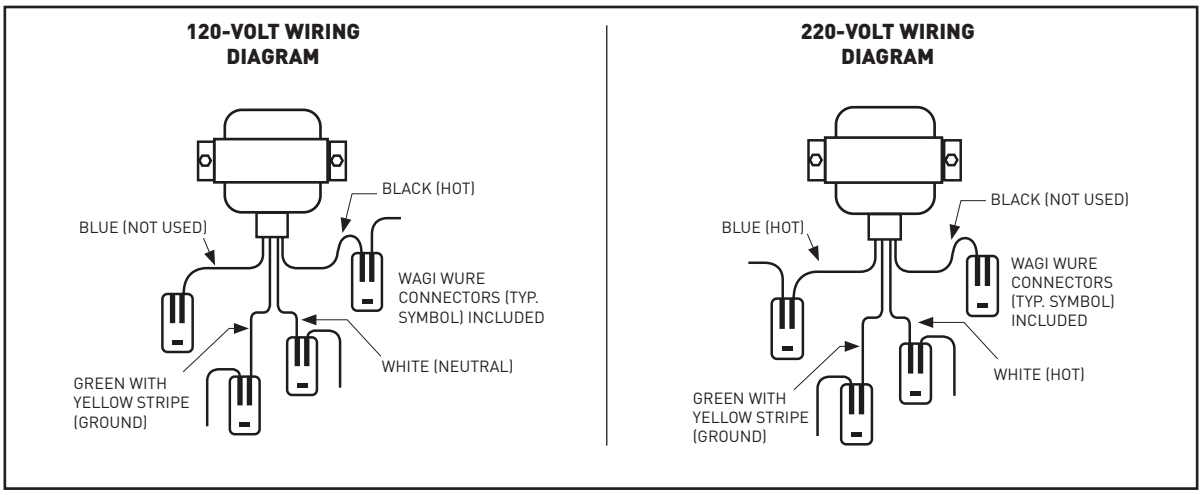


Figure 7. Transformer Wiring Diagrams

Two-Wire Module

NOTICE: BEFORE INSTALLING OR REMOVING THE TWO-WIRE MODULE, TURN THE HSC POWER OFF USING THE ON/OFF SWITCH.

DO NOT PULL THE TWO-WIRE MODULE OUT UNTIL THE RELEASE BUTTON HAS BEEN FULLY DEPRESSED. ONLY ONE (1) TWO-WIRE MODULE CAN BE USED AT A TIME.

The two-wire module is pre-installed, as shown in Figure 8 below. The module has two pairs of terminals, oriented vertically, for two separate wire paths.

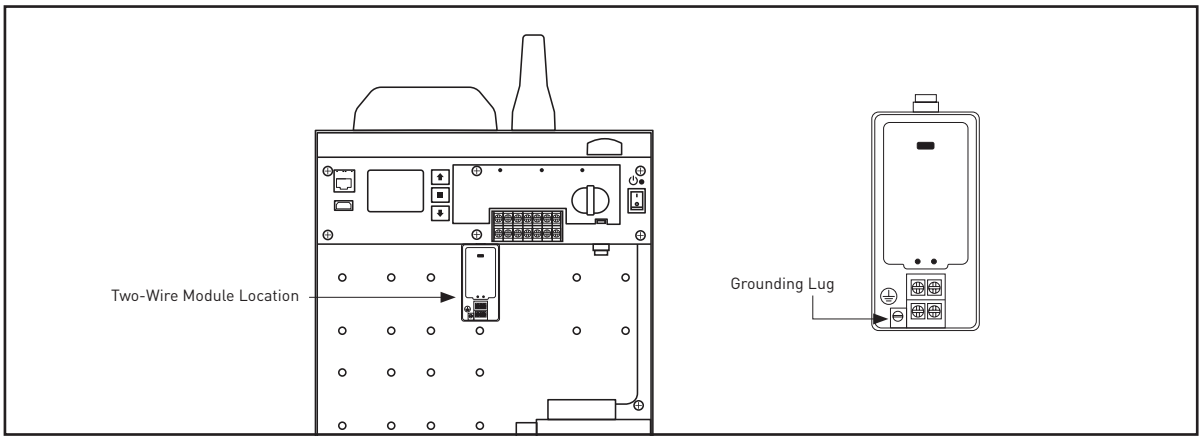


Figure 8. Two-Wire Module Location

Terminate color-coded field wire into either Leg 1 or Leg 2 and tighten the set screws firmly in place (Leg 1 and Leg 2 may be called Path 1 and Path 2 on the module).

The wire terminals are oriented vertically. Leg 1 wires should both be installed on the left. Install one wire over the other to ensure correct operation. Leg 2 wires should both be on the right. If the wires of a leg are inserted horizontally, with one wire in Leg 1 and one wire in Leg 2, the wire path will not work.

The terminals are non-polarized, so it does not matter which color wire is terminated in either output. See Figure 9.

If both pairs of two-wire terminals are used, consider alternating the wire color between each two-wire path. This will make troubleshooting easier.

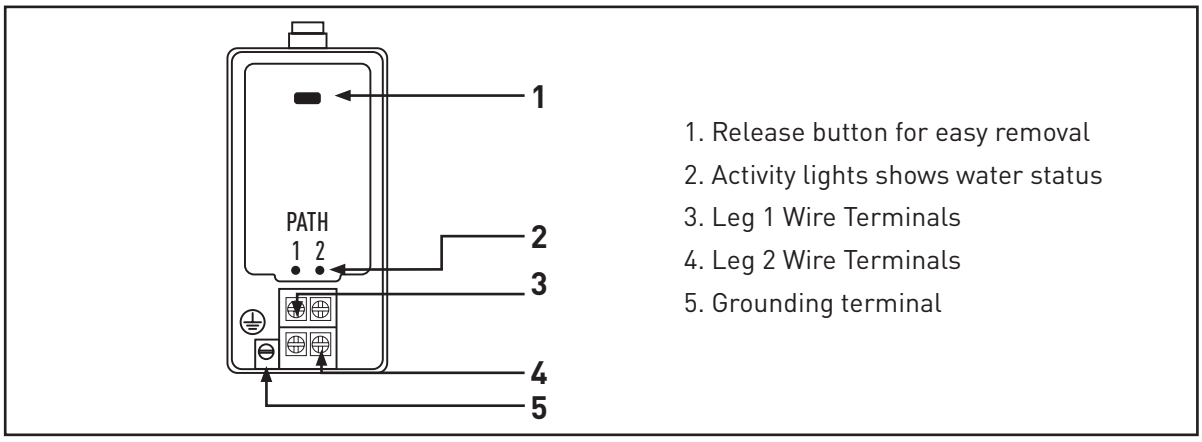


Figure 9. HSC-6300-D Decoder Module

Grounding

Grounding the controller is important to protect the electronics of the HSC. Lack of grounding may result in the failure of the two-wire module, decoder, and other electronic failures.

Step 1 – Remove the ¾-inch (1.9 cm) knockout in the bottom of the enclosure indicated in Figure 4. Install a ½-inch (1.3 cm) conduit below grade and beyond the perimeter sidewalk of the building if there is one.

Step 2 - Install a #6 AWG solid copper wire from the grounding lug in the controller to a ground rod and ground plate.

NOTICE	**FOR INDOOR INSTALLATIONS OF THE IRRIGATION CONTROLLER, LOCATE AND SECURE THE GROUND WIRE TO A COLD-WATER PIPE.**

A #6 copper conductor is stiff. Make gentle bends in the conductor by using a long radius sweep elbow and avoid sharp bends in the grounding conductor.

Step 3 – Grounding Array: The ground rod is to be located at least 10 feet (3 m) from the controller, field wire path, Incoming high voltage conductors, as well as the flow sensor and master valve path. An 8 feet (2.4 m) grounding plate should be installed at least 8 feet (2.4 m) from the HSC and 11 feet (3.35 m) from the rod. See Figure 10.

Many grounding devices specific to the irrigation industry have the ground wire already welded to a ground rod or plate. Welded grounding devices ensure consistent contact regardless of thermal expansion and contraction.

The purpose of Figure 10 is to show typical distances for safe grounding practices. Your site conditions will vary and require adaptation. Follow the distance requirements of Step 3 to keep your wire paths free from electrical interference and avoid surge from outside sources.

Step 4 – Grounding should have a resistance of approximately 10 ohms measurable with a megohmmeter.

NOTICE	**DO NOT TEST WITH A MEGOHMMETER WHILE THE TWO-WIRE MODULE IS ATTACHED BECAUSE IT CAN DAMAGE THE MODULE.**

Step 5 – After testing with a megohmmeter, attach a wire from the grounding lug in the controller to the ground position on the HSC-6300-MD module in the controller, as seen in Figure 11.

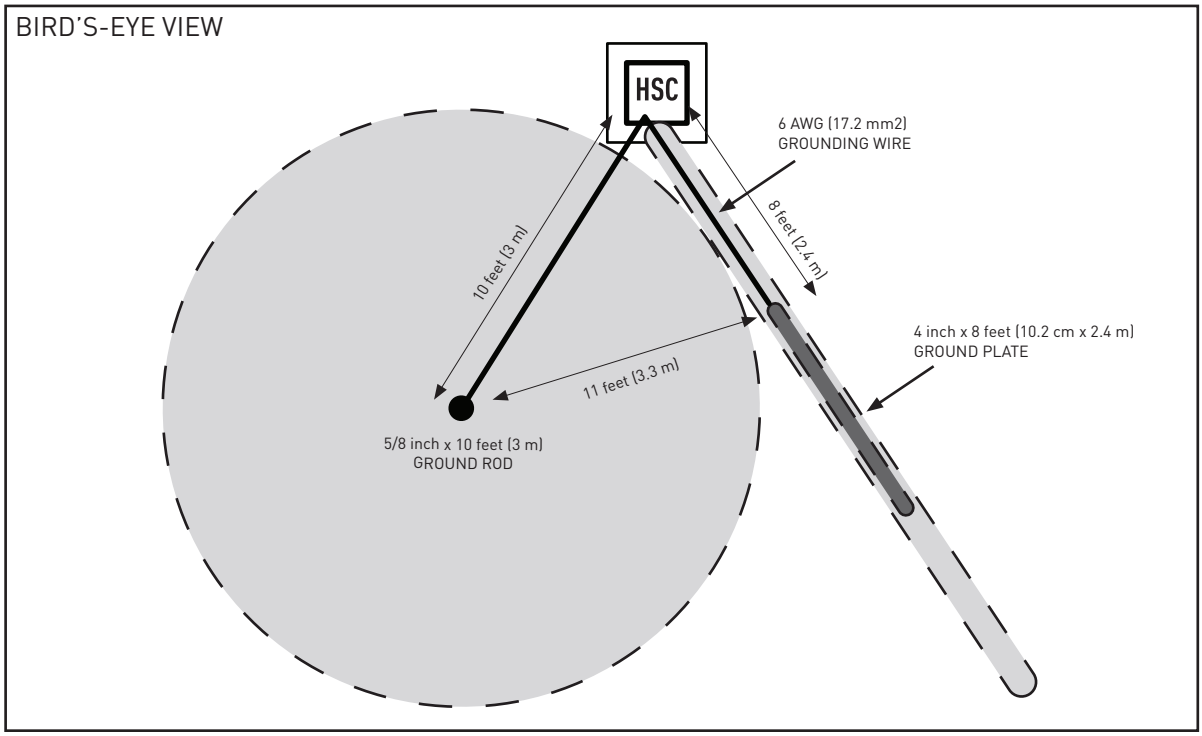


Figure 10. *Grounding Array*

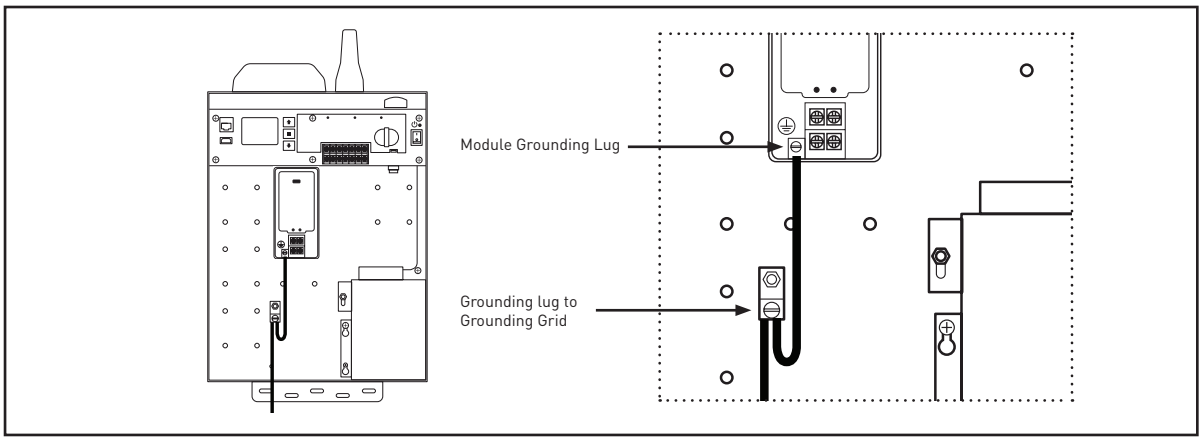


Figure 11. Ground the Module

Setup at the Controller

When the HSC first powers on, it will show the controller MAC ID, firmware version, and the display will show, "For full functionality use the B-hyve® Pro app."

The HSC controller was designed with the intention of having the phone app be the primary interface. Manual watering and other limited options are available at the controller, but the app and web dashboard are the best way to maintain the controller. See the instructions on page one to download the B-Hyve® Pro app.

Setting Date and Time

During the app's pairing and setup process, the HSC will automatically set the date and time. If the day or time needs to be adjusted, press the controller's middle button to get to the menu, scroll to Setup, then select Time or Date. Different formats are available in the Time and Date menu.

Manual Operation from the Controller

Step 1 – From the home screen select the middle Menu button then Manual Watering.
Step 2 – Choose from the following on-screen options by scrolling up or down with the arrow keys. Push the middle button to select:

Station

Select the station number then enter the length of time for the zone to run. By pressing the up arrow you can increase the time. The minutes will turn into hours the longer you hold the button down. Press **Select** to run the station immediately.

Programs

Select a Program to start. A selected program will start immediately. If the controller says, "No Valid Programs" then no irrigation programs have been entered in the app.

Test All Zones

Test will run all stations in the controller for the run time entered.

Factory Reset

CAUTION

Clears all flow data, program data, historical data, etc. Use only when absolutely necessary.

Step 1 - Press the middle Menu button
Step 2 - Select Settings
Step 3 - Select Factory Reset

The HSC will ask you to confirm your choice. If you press Confirm, the controller will revert to it's factory settings. All controller information will have to be reentered.

Troubleshooting

Common problems and how to fix them. For two-wire troubleshooting see pages 19 -26. The HSC is a computer. Like any computer, turning it off and back on again may be necessary to reset it. Taking this action may resolve issues but will also reset the communication. The controller will take time to reconnect.

Update Firmware

Make sure that the latest firmware is installed on the HSC. If the HSC uses a consistent communication method, firmware will update automatically. If you are connecting with Blu-tooth only, updates will not happen automatically. If your connection is active:

1. From the app, choose My B-hyve.
2. Tap Devices.
3. Select the device.
4. Scroll down and pick Update Firmware.
5. The app will give you the option to update or let you know that "Your device is up to date."

App Issues

If the app is not responding as expected:

1. Check that the latest app version is downloaded from the app store. If not, update the app.
2. Close the app, verify it is entirely closed, and reopen it.
3 Log out and back in.
4. Do this last: Uninstall the app and reinstall it.

Communication Problems

Like any connected device, the HSC must be reconnected if you have trouble with the router, change your Wi-Fi service, or the ethernet provider changes security settings (like firewalls). Update your settings as needed. See also Wi-Fi instructions below.

If your B-hyve Pro app says the HSC is disconnected, try the following steps to reconnect.

1. From the app, choose My B-hyve.
2. Tap Devices.
3. Select the device.
4. Scroll down, pick Reset Device Connection, and press Reset.

It may take several minutes for the device to connect. The "Disconnected" message should clear when communication is restored.

Wi-Fi

If your Wi-Fi provider, router, or password has changed, you can update your settings by following the steps below. You must be within Bluetooth range to update. Stand close to the HSC to get an accurate reading of which Wi-Fi networks are nearby.

1. From the app, choose My B-hyve.
2. Tap Devices.
3. Select the device.
4. Scroll down and pick Update Wi-Fi Settings.

Once on the Update Wi-Fi page, your app will search for nearby Wi-Fi networks. It will put the strongest signal in the top Wi-Fi Networks Found box. If you do not see the network you want to use, press inside this box, and a list of accessible networks will appear.

5. Select the network you want to use.
6. Enter the password for the Wi-Fi network.

If the update did not work, consider the following: did the location of the router change? If you cannot move the router closer to the HSC, consider getting a booster as recommended in Installing for Wi-Fi on page five.

Consider a cellular module if getting Wi-Fi in range is not possible. A cellular module is also practical for construction sites where a Wi-Fi network has yet to be available.

Hardware Issues

Rain sensor jumper wire: removing the rain sensor jumper wire when a rain sensor is not attached will cause the controller to act abnormally. Any wire connected from the negative terminal to the positive terminal (top to bottom) can function as a jumper. Hydro-Rain recommends an insulated wire so accidental shorts cannot take place.

Rain Delay Schedule Behavior

The controller stops watering when a rain delay is active on the HSC. Because some irrigation schedules are time-sensitive, when the HSC receives a rain delay, it will shut off the water but keep the schedule running. The irrigation schedule may resume if conditions allow.

Factory Reset

NOTICE

THIS SHOULD BE THE LAST OPTION FOR HSC ISSUES. FACTORY RESET WILL CLEAR THE CONTROLLER SETTINGS, HISTORY, AND SET THE HSC BACK TO FACTORY SETTINGS. YOU WILL NEED TO ONBOARD AND SET UP ALL ZONES FROM SQUARE ONE.

Follow both app and controller instructions for a complete Factory Reset.
From the app:

1. Choose My B-hyve.
2. Tap Devices.
3. Select the device.
4. Scroll to the bottom and select Remove Device.
5. The app will warn you that this will factory reset. Choose Factory Reset.

At the controller:

1. Go to Main Menu.
2. Choose Settings.
3. Select Factory Reset.
4. Tap Confirm. The timer will restart.

The HSC is now factory reset and needs to be onboarded as if it were new.

How Two-Wire Works

Two-wire communication uses one pair of wires shared between all remote-control valves in the field, and a decoder at each valve. The irrigation controller uses a signal encoder at the controller to send commands to decoders in the field. When the irrigation controller sends an On command, it encodes this message to a specific decoder. The decoders have different addresses. The decoder translates the encoded message and turns on the attached remote-control valve. While all other decoders will hear the message, they will not act upon it if their address does not correspond to the address in the encoded signal.

Conventional, multi-wire communication differs from two-wire by requiring dedicated wires to each remote-control valve; for example, 48 zones = 48 wires. A wire, known as the common, loops to every valve to close this electrical circuit (for our example, now there are 49 wires). When an On command is sent to a valve, the valve-specific wire energizes the remote-control valve.

One disadvantage of conventional multi-wire systems is the ability to add valves. Adding a valve requires a dedicated wire to the valve to operate. Extending new wire can be prohibitively expensive in sites with mature landscapes, parking lots, or sidewalks.

The advantage of two-wire communication is when additional valves are needed. The two-wire path can be extended anywhere from the nearest valve box, significantly reducing the cost and site disruption common to multi-wire systems. New decoders are addressed to correspond with any open zones on the controller. This can be done continuously if the maximum number of managed stations is not exceeded.

Troubleshooting two-wire systems can be intimidating, but after using techniques found in the Two-Wire Troubleshooting section of this manual, two-wire can become a favorite product choice.

Two-Wire Layouts

Site conditions often dictate the two-wire path between the controller and remote-control valves. Figure 12 shows several different types of wiring layouts that can be implemented.

NOTICE

WHILE LOOPED WIRING CONFIGURATIONS PROVIDE SOME FUTURE SAFETY MARGIN IN THE EVENT OF A BROKEN WIRE, IT CAN BE QUITE DIFFICULT TO TROUBLESHOOT, PARTICULARLY IF THE INSTALLER IS NOT ALSO THE SITE MAINTAINER.

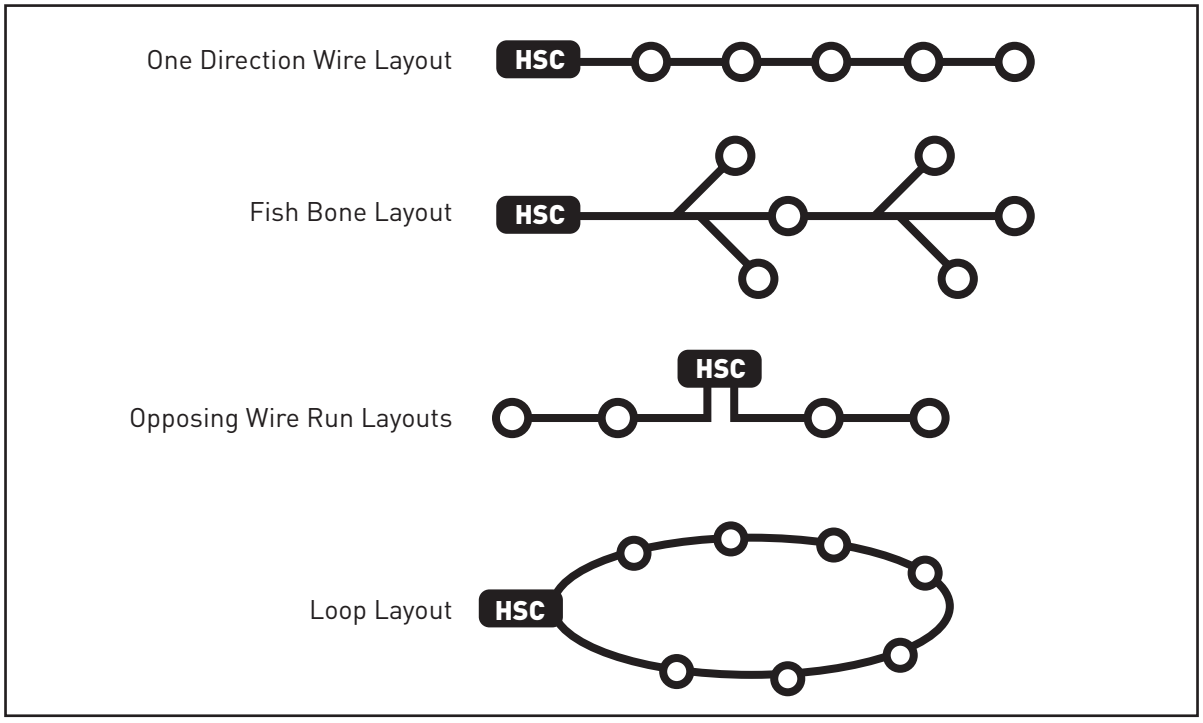


Figure 12. Typical Two-Wire Layouts

Two-Wire Path Maximum Distances

The size of the wire dictates how long the wire can extend from the irrigation controller, and the number of valves that can be operated at one time. Wire can be 18, 16, or 14 AWG, solid core. UF-rated for 600 volts and direct burial.

Wire runs work best as a continuous wire length (no wire splices) between the HSC controller and the first decoder, and between subsequent decoders. When a wire splice like a repair is required, these should be placed in a six-inch (15.3 cm) round valve box and spliced only with UF, direct bury rated connectors (like a 3M™ DBR/Y-6).

NOTICE **FAILURE TO MAKE WATERPROOF CONNECTIONS ON THE TWO-WIRE PATH CAN LEAD TO SHORTS AND LOSS OF OPERATION TO DECODERS**

The maximum length of 14 AWG wire is 4000 feet (1219 m) from the HSC to the furthest decoder when operating one valve at a time. See Figure 13 below for more information.

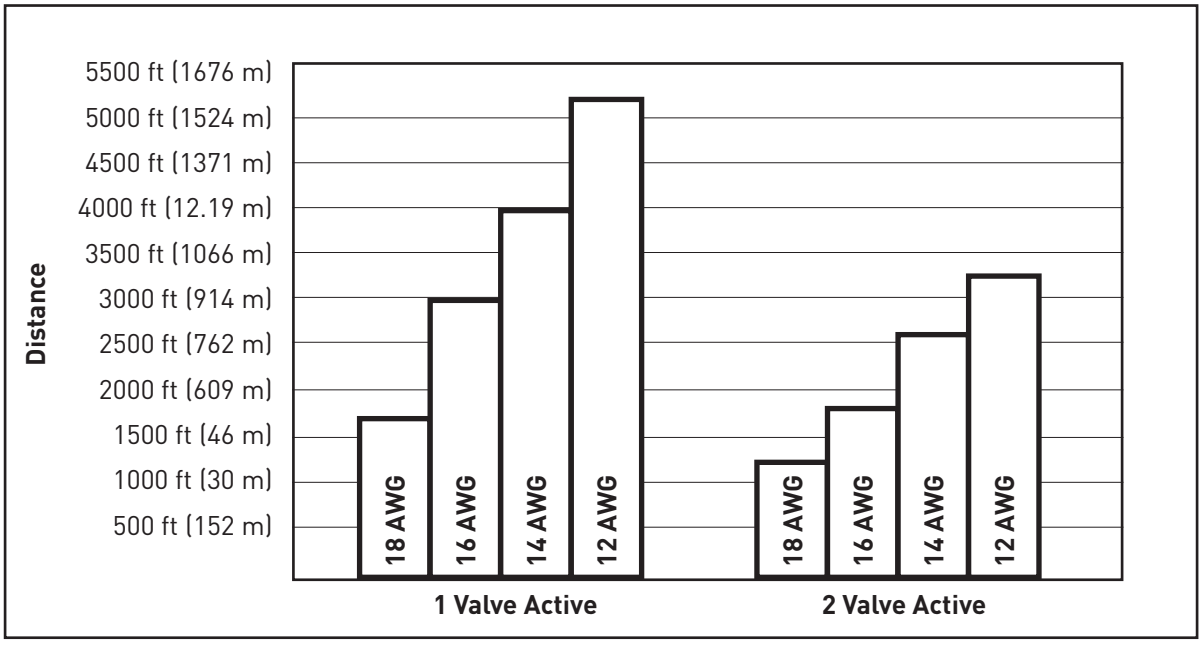


Figure 13. HSC-6300-D Two-Wire Sizing Chart

Decoder Programming

Program decoders using the Hydro-Rain® Portable Programmer (Part number HSC-DP) shown in Figure 13. To power the portable programmer on, press the ENTER button. When the display reads, "Select Address," it is ready to test or program decoders.

NOTICE **DO NOT ATTACH THE PROGRAMMER TO DECODERS CONNECTED TO THE HSC WIRE PATH. DOING SO MAY DAMAGE THE PROGRAMMER.**

To program or test a decoder, attach the color-coded clips to the corresponding decoder wires. Incorrect color-coded wiring will not harm the unit but will give error messages on the screen. See Figure 14 for specific programming instructions.

Step 1 - Press the ENTER button to power the portable programmer on.

Step 2 – Match the colors of the alligator clips to the wires of the decoder.

Step 3 - Select a zone number using the RAISE or LOWER buttons.

Step 4 - Press the PROG button to program the zone number into the decoder.

Figure 14. Portable Programmer

Before wiring decoders into the two-wire path, program each with a station number, 1 through 63, and write the station number with permanent ink on the label, as shown in Figure 15.

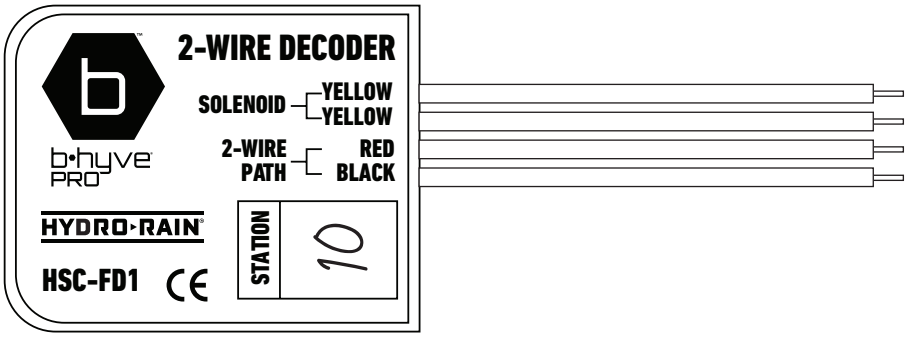


Figure 15 . HSC-FD1 Decoder

The programmer will power off automatically after a short period of inactivity.

NOTICE **IF THE PROGRAMMER HAS BEEN INACTIVE FOR THREE MONTHS, IT IS RECOMMENDED THAT THE BATTERIES BE REPLACED.**

Programmer Error Messages

SHORT! - There is a short circuit between the electrical connections. Confirm that the alligator clips or bare wires are not touching one another.

FAIL - No response from a field decoder.
- Verify the clips are making a good connection to the decoder wires.
- Check that the color coding from clips to decoder wires matches.

Tip: Decoders can be reprogrammed multiple times with different addresses.

Tip: Two decoders can be programmed with the same station number, or a single decoder can manage up to two remote control valves as long as they are within 10 FT (3 M) of one another.

Wiring Decoders

The single zone decoder (part number HSC-FD1) is waterproof with four color-coded wires. See Figure 14.

Each colored wire is connected to the following:

Red - Two-wire path
Black - Two-wire path
Yellow - Remote control valve solenoid
Yellow - Remote control valve solenoid

Two bags of wire connectors are included with each decoder. These are specifically for wire connections to the two-wire path. Attach the large ones to the two-wire path and the smaller ones to the solenoid.

Troubleshooting Two-Wire

The most common failure found on two-wire systems is a bad wire connection. Invest in the proper tools, materials, and take the time to make a solid wire connection. When troubleshooting, check the wire connection first. A bad wire connection can lead to decoder, solenoid, and other failures.

Common failures in two-wire systems:
- Poor wire connections
- Wire breaks
- Solenoids that reach end of service life
- Decoders that reach end of service life

Two-Wire Troubleshooting Tools

The list below identifies some recommended tools to consider and have when troubleshooting two-wire.

- A known working solenoid
- A new decoder
- A digital clamp meter featuring True RMS. See Figure 16
- Wire cutters
- Wire strippers
- UL listed, direct bury wire connectors (like a 3M DBYR)
- A length of 14-gauge wire
- Solenoid tester, see Figure 16

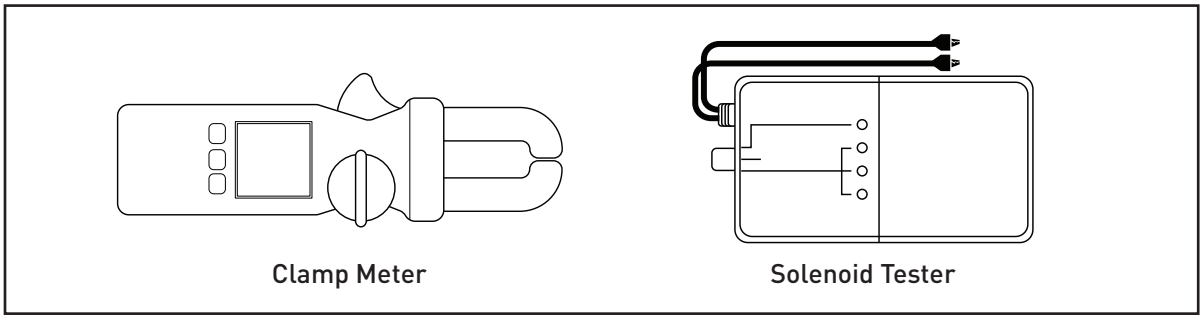


Figure 16. Digital Clamp Meter and Solenoid Tester

WARNING

UNDERGROUND CABLE TRACKERS AND OTHER ELECTRICAL TROUBLESHOOTING TOOLS SEND STRONG ELECTRICAL SIGNALS ALONG THE WIRE PATH. THE MAXIMUM VOLTAGE OF A DECODER IS 30 VAC. DISCONNECT DECODERS FROM THE PATH TO PREVENT DAMAGE IF A TOOL USES OR EXCEEDS THIS VOLTAGE.

Knowing the location of the wire path can be critical to troubleshooting a two-wire issue. Consider using an underground cable locator. Your local distributor may have one available to rent. Before using a cable locator, detach all decoders from the wire path to keep them from being harmed.

If you cannot access a cable locator, see the **Rule of Halving** below.

Two-Wire Troubleshooting Tips

1. A single decoder draws approximately 0.43 milliamps (mA) when actuated. This can be measured with a digital meter that can measure milliamps.

2. The two-wire path is fundamentally a basic electrical circuit. One wire or conductor carries voltage out to the valves, and the other conductor is the return. Therefore, voltage can only be measured on one of the two conductors in a two-wire path.

3. HSC two-wire utilizes AC volts. It is nearly identical to an electrical circuit in a house, i.e., the further away from an electrical panel, the lower the measured voltage due to resistance or current running through the wire. The smaller the wire, or the longer the wire path, the higher the resistance (or lower measured voltage).

4. By knowing the holding current of the solenoid, a quick determination can be made as to whether it is the decoder or solenoid that is faulty. Holding current is the voltage needed to hold an AC solenoid open. Holding currents vary from manufacturer to manufacturer. The chart found on page 23 identifies a few manufacturers' remote-control valves and their published holding currents to AC solenoids. These published values are reference points; they can vary as much as 15% between solenoids of the same manufacturer.

For example, a site has an HSC-6300-D controller with Rain Bird valves. When operating a station manually through the controller, a multimeter displays a holding current of 263 mA. The decoder represents 0.43 mA of this amount, and the remaining 262 mA is the solenoid holding current.

5. If the holding current observed is in the 600-800 mA range, then the solenoid needs to be replaced.

Conversely, if the holding current is less than 100 mA, the decoder must be replaced.

6. If several zones close to one another don't work (often in numerical order), chances are this is a broken wire path close to the zones. Look at the first decoder in the wire path, or for recent digging in the area.

7. If no stations operate, it could be the decoder module (part number HSC-6300-MD) in the controller. Verify it is plugged in correctly. Then check to make sure the LED lights come on when a manual water command is sent out. No lights means there is a problem at the module. Make sure the power to the controller is on. Then, try a new module.

8. The two-wire path is only energized when valves operate from scheduled start times or a manual operation command. The HSC-6300-D can power the wire path without actuating valves. The display will show a milliamp value representing the total number of decoders found.

For example, the HSC-6300-D controller powers the wire path independent of operating stations. The display multimeter shows a value of 46 mA. Dividing 46 mA by 0.43 mA =19.78. This means the controller can find approximately 18 or 19 valves. If the system has a high zone count, one or more broken wire paths exist.

Typical Two-Wire Issues and How to Fix Them

NOTICE **ALWAYS CHECK FOR BAD WIRE CONNECTIONS FIRST.**

Observed Field Condition: One station is not operating.

Possible Causes:
1) The solenoid has reached the end of life.
2) The decoder has reached the end of its life.
3) The two-wire path is broken.

Troubleshooting Steps:
Step 1 - Manually operate the station that is not working. Using a digital clamp meter set to milliamps, measure the holding current on one of the two field wires coming into the valve box. It may be a broken two-wire path if no value can be measured.

Step 2 - Manually operate the station before and after the station that does not work. Measure the holding current with a digital clamp meter, particularly the wire leading out to the station that is not working. Remake the wire splice from the valve box if no value can be measured.

Step 3 - What current is the multimeter displaying? If it is higher than 600 mA, the solenoid has reached the end of life. Disconnect the decoder from the solenoid and verify its function with a solenoid checker.

Step 4 - The decoder could be bad if the displayed holding current is less than 100 mA. Disconnect the decoder from the solenoid and two-wire path. Connect it directly to the two-wire module in the HSC-6300-D controller along with a known, working solenoid. Operate the corresponding zone manually. If the solenoid buzzes or clicks, the decoder is working, but a two-wire path is broken.

Observed Field Condition: Several stations in sequence or one area are not operating.

Possible Causes
The two-wire path in this area is more than likely broken.

Troubleshooting Steps:
Step 1 - Manually operate a station that is not working from the controller or app.

Step 2 - Using a digital clamp meter set to milliamps, measure the holding current on one of the two field wires coming into the valve box. If no value can be measured, look for a break in the two-wire path.

Step 3 -Manually operate the station before and after the station that does not work.

Step 4 - Measure the holding current with a digital clamp meter, particularly the wire leading out to the station that is not working. Remake the wire splice from the valve box if no value can be measured.

Observed Field Condition: None of the stations operate manually.

Possible Causes
1) The normally open master valve is closed. Check the master valve.
2) The decoder module in the HSC-6300-D has failed.
3) Make sure the HSC-6300-D controller is grounded to help keep this condition from happening.
4) The two-wire path is terminated improperly. This can short the controller.

Troubleshooting Steps:
Step 1 - Verify that a master valve and flow sensor are not in place and that there are no flow alarms. If Flow is enabled on the controller, this condition may not clear until the water line break is fixed and tested.

Step 2 - Connect the spare decoder and a known working solenoid to Leg 1 and 2 positions on the HSC-6300-MD module in the controller (the module may say Path 1 and 2).

Step 3 - Operate zone 1 manually from the controller or app. Check the zone 1 solenoid. If the solenoid does not click, hum, or buzz, the decoder module may need to be replaced.

Step 4 - Verify that there is grounding to the HSC controller. If no grounding exists, install one with a bare #6, solid, copper wire into the ground lug on the decoder module after Replace the decoder module (part number HSC-6300-MD).

Step 5 - Verify the two-wire path is vertical (not horizontal) in the terminal blocks on the two-wire module. Additional details in the Two-Wire Module section and Figure 9.

Observed Field Condition: Not all of the valves are operating.

If you have a condition where the wire path tests with too few milliamps at the controller for the number of valves on-site. For example, when connected to the wire path at the controller, a multimeter displays 43 mA when the wire path is energized, which is +/- 18 stations. There are 26 stations, and not all the valves can be operated.

Possible Cause
1) The wire path is broken.

Troubleshooting Steps:
Step 1 - Determine which valves work from the controller and which cannot. Look for a pattern. In this example, stations 19 and higher cannot be actuated.

Step 2 - Locate the valve box for zone 19 and turn it on manually from the app or controller.

Step 3 - Use a multimeter to connect to one of the wire conductors of the wire path to measure AC volts.

Step 4 - If no voltage can be measured, check for a wire break between stations 18 and 19.

Step 5 - Locate valve box 18. Connect to the outgoing two-wire path while station 19 is operating manually. If voltage is measured, look for a recent site disruption, a construction dig, a gopher mound, a new fence or signpost, or any disruption that might indicate the location of a broken wire.

Step 6 - If stations 18 and 19 are close, temporarily run a pair of wires above ground and connect into the two-wire path.

Step 7 - Once the above-ground wires are run, see if stations 19 and higher can be operated from the controller or app; this will confirm a wire break. In this instance, wire trackers can help locate the wire break. Installing a new wire is a suitable workaround.

Observed Field Condition: A new decoder cannot be programmed

Possible Root Causes
1) The portable programmer alligator clips aren't making a good connection to the decoder wire leads.
2) The color coding of the portable programmer alligator clips doesn't match the decoder wire color coding.
3) The decoder is defective.

Troubleshooting Steps:
Step 1 - Verify the portable programmer alligator clips are making a good connection and retry programming.

Step 2 - Attempt to program the decoder with another station number. If successful, then reprogram with the originally selected station number.

Step 3 - The decoder is defective. Return it to a distributor if it's still under warranty.

Rule of Halving

The rule of Halving is a method of isolating where a two-wire path break exists without a wire tracker.

Troubleshooting Steps:
Step 1 - Attach to the two-wire path without actuating a zone.

Step 2 - Using a clamp multimeter, clamp around one of the wires leading out of the two-wire module in the controller. If AC volts can be observed, write this value down.

Step 3 - Find the last valve box in the two-wire system and measure AC volts with the multimeter.

If no voltage can be measured, go back to the halfway point of the wire path and measure. If voltage can be measured, go halfway back to the last valve box in the two-wire system and attempt to measure voltage again.

Solenoid Holding Current Data

60 Hz

HYDRO-RAIN REMOTE CONTROL VALVE SERIES		IN-RUSH	HOLDING
SERIES	HRB-SD-RP	300 mA	300 mA
	HRJ-SDR-RP	320 mA	320 mA
	HRP-SV-RP	300 mA	300 mA
RAIN BIRD REMOTE CONTROL VALVE SERIES			
SERIES	DV / DVF	450 mA	250 mA
	PED / PESB	410 mA	140 mA
	HV / HVF	290 mA	91 mA
	PESB-R	410 mA	140 mA
	EFB-CP	410 mA	140 mA
	300-BPES	410 mA	140 mA
HUNTER REMOTE CONTROL VALVE SERIES			
SERIES	ALL MODELS	350 mA	190 mA
TORO REMOTE CONTROL VALVE SERIES			
SERIES	220		120 mA
	P-220-S		200 mA
	252		200 mA
IRRITROL REMOTE CONTROL VALVE SERIES			
SERIES	2400/2600	480 mA	200 mA
	205	480 mA	200mA
	700	960 mA	400 mA
	100	960 mA	400 mA
WEATHERMATIC REMOTE CONTROL VALVE SERIES			
SERIES	N-100	948 mA	511 mA
	7900	500 mA	230 mA
	SILVER BULLET	948 mA	511 mA
HIT PRODUCTS REMOTE CONTROL VALVE SERIES			
SERIES	200	350 mA	250 mA
	300	350 mA	250 mA
	500	350 mA	250 mA
	8400	350 mA	250 mA
GRISWOLD CONTROL VALVE SERIES			
SERIES	DWS		375 mA
BUCKNER REMOTE CONTROL VALVE SERIES			
SERIES	SDV	450 mA	200 mA
	950	450 mA	200 mA
	450	450 mA	200 mA
	1000	450 mA	200 mA
NETAFIM REMOTE CONTROL VALVE SERIES			
SERIES	80	220 mA	10 mA

LED Lights on the Controller

The LED lights on the HSC illuminate with distinct colors and flashing patterns to let you know where or when an Alert, Caution, or irrigation is taking place. These can be helpful when troubleshooting the controller.

Colors

Colors will inform users of the following conditions:

Red/Alert:	Yellow/Caution:	Green:
Shows a fault, disconnection, no water flow, or other problem that requires attention.	Delay, or other warning.	Watering, communication connected, or other operations performing as expected.

Other colors are defined in the charts below.

Patterns

LEDs may flash, fade in and out slowly, or be solid:

Flashing:	Fading in and out:	Solid:
Indicates an Alert.	Communication is connecting, or the controller is in a preparatory state.	Communication connected, or a normal operating condition. Solid red indicates a problem.

Control Panel LED's

On the HSC's control panel, there are three LEDs:

Controller Status:	Comm Status:	Cellular:
Indicates what the controller is doing.	Shows the controller's communication method and activities.	Cellular connection and activity.

Reference these charts for specifics about what the HSC controller is doing.

COLOR	PATTERN	MEANING
RED	FLASHING	Leak, Station Fault, Pump Fault, No Flow, High Flow
YELLOW	FLASHING	Weather Delay, Rain Sensor Delay when the controller is not watering
YELLOW	SOLID	Low Flow, Rain Sensor Delay during scheduled irrigation
GREEN	SOLID	Scheduled Watering Event, Manual Watering Event, Rain Sensor Delay during manual watering

Product Specifications

Enclosure Specifications

Water-resistant, NEMA 3R Wall Mount Enclosure
Height: 16 ⅜ inch (14.6 cm)
Width: 11 ¼ inch (28.6 cm)
Depth: 5 ¼ inch (13.3 cm)
Weight: 15 lbs. 6 oz. (6.97 kg)

See knockouts and through-holes on page seven and in Figure 4.

Electrical Specifications

Input Power: 120 VAC (50/60Hz) and 230/240 VAC (50/60 Hz).
Output Power: 24 VAC (50/60 Hz).
Station Output: 1.2 Amp max total station Load (on any module column or spread over columns).
Pump Start / Master Valve Output: 24 VAC, 500 mA each.
Maximum Output: 1.9 Amps (combined total station loads and pump/master valve loads).
Backup Battery: 3 VDC (Model: CR2032).

Single Station Decoders

Minimum operating voltage*: 13 VAC
Maximum continuous solenoid current from decoder: 0.6A (600mA)
Decoder standby current: 2.8mA (typical)
Station Range: 1-63

* Most AC remote-control valve solenoids require a minimum of 19 volts AC to operate.

Decoder Module Terminals

Input voltage to register a station (zone) active: 12V-30V
AC or DC isolation between L1 / L2: 100V

SITE NAME: _____

ZONE #	Zone Description/Name	SMART Settings								
		SMART or Program		Soil Sand / Sandy Loam / Clay Loam / Clay Unknown	Plant Type Cool Turf / Warm Turf / Annual Flowers / Trees / Shrubs or Perennials / Desert Plants	Sprinkler Type Spray / Rotor / Drip	Sunlight Mostly Shade / Mostly Sun	Rainfall None of the Rain / Some of the Rain / Most of the Rain	Slope Mostly Flat or On a Slope	Sprinkler Count How Many?
	20 Character Desc.	Y / N	A/B/C/D	SL / L / CL / C	CT / WT / AF / T / SP / DP	SP / RTR / DP	SHADE / SUN	NONE / SOME / MOST	FLAT / SLOPE	
1										
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Programs	Days of the Week	Start Time 1	Start Time 2	Start Time 3	Start Time 4
A	M T W TH F SAT SUN	: AM/PM	: AM/PM	: AM/PM	: AM/PM
B	M T W TH F SAT SUN	: AM/PM	: AM/PM	: AM/PM	: AM/PM
C	M T W TH F SAT SUN	: AM/PM	: AM/PM	: AM/PM	: AM/PM
D	M T W TH F SAT SUN	: AM/PM	: AM/PM	: AM/PM	: AM/PM

IN CASE OF A PROBLEM WITH THE IRRIGATION SYSTEM, PLEASE CONTACT:

NAME: _____

PHONE #: _____

SITE NAME: _____

ZONE #	Zone Description/Name	SMART Settings								
		SMART or Program		Soil Sand / Sandy Loam / Clay Loam / Clay Unknown	Plant Type Cool Turf / Warm Turf / Annual Flowers / Trees / Shrubs or Perennials / Desert Plants	Sprinkler Type Spray / Rotor / Drip	Sunlight Mostly Shade / Mostly Sun	Rainfall None of the Rain / Some of the Rain / Most of the Rain	Slope Mostly Flat or On a Slope	Sprinkler Count How Many?
	20 Character Desc.	Y / N	A/B/C/D	SL / L / CL / C	CT / WT / AF / T / SP / DP	SP / RTR / DP	SHADE / SUN	NONE / SOME / MOST	FLAT / SLOPE	
25										
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SITE NAME: _____

ZONE #	Zone Description/Name	SMART Settings								
		SMART or Program		Soil Sand / Sandy Loam / Clay Loam / Clay Unknown	Plant Type Cool Turf / Warm Turf / Annual Flowers / Trees / Shrubs or Perennials / Desert Plants	Sprinkler Type Spray / Rotor / Drip	Sunlight Mostly Shade / Mostly Sun	Rainfall None of the Rain / Some of the Rain / Most of the Rain	Slope Mostly Flat or On a Slope	Sprinkler Count How Many?
	20 Character Desc.	Y / N	A/B/C/D	SL / L / CL / C	CT / WT / AF / T / SP / DP	SP / RTR / DP	SHADE / SUN	NONE / SOME / MOST	FLAT / SLOPE	
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FCC & IC Statement

This device complies with Part 15 of the FCC Rules and Industry Canada license exempt RSS standards. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Warning: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device meets the FCC and IC requirements for RF exposure in public or controlled environments. The end user is advised to maintain a distance of 20 cm from the controller and any personnel to ensure compliance with RF exposure regulations.

This Class B digital apparatus complies with Canadian ICES-003

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by Federal Communications Commission 6 helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, D.C., Stock No. 004-000-00345 (price - $2.00 postage paid).

Déclaration de FCC et L'IC

Cet appareil est conforme à la section 15 de la Règlementation de la FCC et la norme RSS d'Industry Canada. Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne doit pas causer d'interférences nuisibles, et (2) cet appareil doit tolérer toutes les interférences, dont les interférences pouvant causer un fonctionnement non désiré.

Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003.

Remarque: cet appareil été testé et déclaré conforme aux limites d'exposition pour les appareils numériques de classe B, selon la section 15 de la Règlementation de la FCC. Ces limites sont conçus pour fournir une protection raisonnable contre les interférences nuisibles dans une installation résidentielle. Cet appareil produit, utilise et peut émettre de l'énergie radio fréquence et, si elle n'est pas installée et utilisée conformément aux instructions, peut causer des interférences nuisibles aux communications radio. Cependant, il n'est pas garantie que des interferences ne se produisent pas dans une installation particulière. Si cet appareil cause des interférences gênantes à la réception d'un signal radio ou de télévision, ce qui peut être déterminé en allumant et en éteignant l'appareil, l'utilisateur peut corriger les interférences en suivants une des mesures suivantes :
- Réorientez ou repositionnez l'antenne de réception.
- Augmentez la distance entre l'appareil et le récepteur.
- Branchez l'appareil dans une prise sur un circuit différent du circuit sur lequel le récepteur est branché.
- Consulter le revendeur ou un technicien radio/TV expérimenté pour obtenir de l'aide.

Cet appareil est conforme aux exigences de la FCC et de l'IC concernant l'exposition aux ondes dans un environnement public ou contrôlé. Il est conseillé à l'utilisateur final de maintenir une distance de 20 cm du contrôleur pour assurer la conformité aux réglementations d'exposition RF. Information de conformité pour le Canada

EU & UK Declaration of Conformity

Pro-Mark, LLC
845 Overland Rd. North Salt Lake, UT. 84054, USA
Declares under our sole responsibility, that the products:

High Station Count Controller
HSC-1600-M (Model # 04550) and HSC-6300-D (Model # 04554) comply with the following:

European Directive 2014/53/EU and
UKCA Radio Equipment Regulations 2017, SI 2017:1206 (as amended by SI 2019:696)
with reference to the following standards:

ETSI EN 300 220-1 V3.1.1 (2017-02)
ETSI EN 300 220-2 V3.2.1 (2018-06)
ETSI EN 300 328 V2.2.2 (2019-07)
ETSI EN 301 893 V2.1.1 (2017-05)
ETSI EN 300 440 V2.2.1 (2018-07)
EN and BS EN 50665:2017
ETSI EN 301 489-1 V2.2.3 (2019-11)
ETSI EN 301 489-3 V2.1.2 (2021-03)
ETSI EN 301 489-17 V3.2.4 (2020-09)
EN and BS EN 60730-1:2016
EN and BS EN 60730-2-7:2020

High Station Count Controller
Multi-wire module HSC-800-MD (Model # 04551) and
Two-wire module HSC-6300-DM (Model # 04552) comply with the following:

European Directives EMC 2014/30/EU and
UKCA Electromagnetic Compatibility Regulations 2016, SI 2016: 1091
with reference to the following standards:

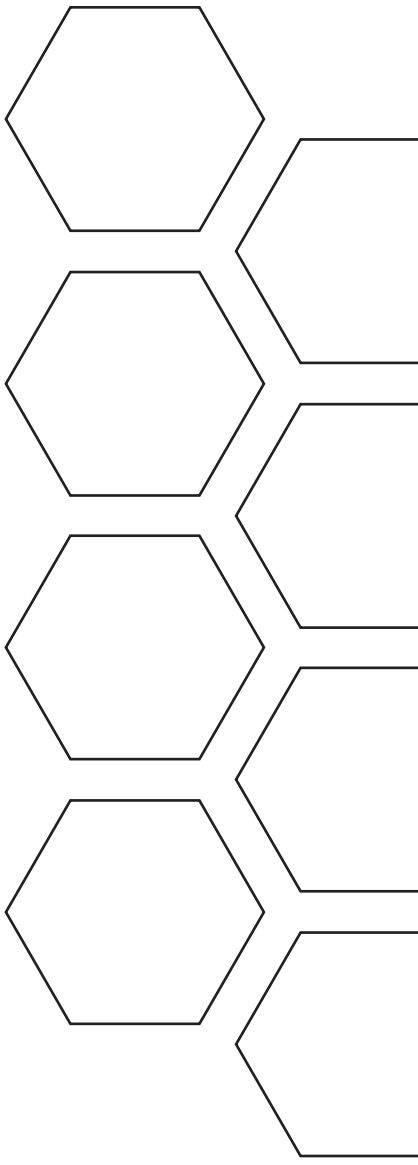
EN IEC and BS EN IEC 55014-1:2021
EN IEC and BS EN IEC 61000-3-2:2019/A1:2021
EN IEC and BS EN IEC 61000-3-3:2013/A1:2019
EN IEC and BS EN IEC 55014-2:2021

Other Cetifications

ICASA: TA-2022/ 1541
SUBTEL: 14565

TA: 2022/ 1541
APPROVED

HYDRO▸RAIN®



HYDRO▸RAIN®

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