

Underhill 2WIRE

ICC 2Wire Decoder Module Installation Guide

For use with Hunter®
ICC and ICC2
Controller Series



**1st Generation ICC
2Wire Decoder Module**

**2nd Generation ICC2
2Wire Decoder Module**

Underhill International Corporation

25782 Obrero Drive, Unit C

Mission Viejo, CA

Phone (949) 305-7050 • Fax (949) 305-7051

www.underhill.us

Table of Contents

INTRODUCTION	3
KEY FEATURES	3
HOW DOES IT WORK?	3
CAUTIONARY NOTE!	3
ICC DECODER MODULE FUNCTIONS	4
DECODER MODULE POSITION FOR 2WIRE EXCLUSIVELY	4
DECODER MODULE FOR “HYBRID” APPLICATIONS	5
ICC DECODER MODULE INSTALLATION	5
INSTALLING AN ICC 2WIRE MODULE (1ST GENERATION)	6
ICC2 DECODER MODULE INSTALLATION (2ND GENERATION)	8
GROUNDING	9
PROGRAMMING DECODERS	11
PROGRAMMING DECODERS USING A PORTABLE PROGRAMMER/TESTER	11
USING THE ICC 2WIRE DECODER MODULE TO PROGRAM A DECODER	12
PROGRAMMING A DECODER USING THE 1ST GENERATION ICC	13
PROGRAMMING A DECODER USING THE ICC2 SERIES CONTROLLER	15
CONNECTING VALVES TO DECODERS	17
2WIRE PATH WIRING SIZING GUIDE	18
FREQUENTLY ASKED QUESTIONS	20
ELECTRICAL SPECIFICATIONS	22
COMPLIANCE STATEMENTS	23

Introduction

This user manual describes installation and usage of an Underhill's 2Wire Decoder Modules compatible with Hunter® ICC or ICC2 Series irrigation controllers.

Please note controller programming and operation is identical to using a Hunter® ICC series controller with multi-wire and station modules.

Key Features

- Manage up to 48 stations in a plastic or metal wall mount or metal pedestal enclosure.
- Incorporate a hand-held remote, rain sensor, Solar-synch as needed.
- Use exclusively as 2Wire or with multi-wire in a “hybrid” application.
- Expandable as site requirements change, allowing you to tap into the existing 2Wire path to expand up to 48 stations.
- Backward compatible w/ existing decoders in the field without having to re-program decoders.
- Utilize standard 14-gauge, solid-copper UF, 600-volt direct burial irrigation wire – does not require jacketed or twisted pair cables common to other 2Wire systems
- Requires a single ground rod to the 2Wire module – nowhere else along the 2Wire path.
- Operate 2 decoders with the same address or two solenoids from one decoder.
- Two solenoids and a master valve can operate at the same time.

How Does It Work?

The ICC or ICC2 2Wire Decoder Module can manage from 1-48 stations when used exclusively for 2Wire applications. Another alternative is using with an existing multi-wire system in a “hybrid” application operating both multi-wire and 2Wire up to 48 stations. This is accomplished by inserting the 2Wire Decoder Module into one of the open station module positions as needed.

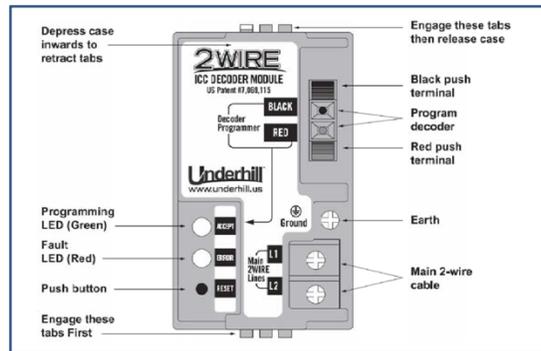
A single 2Wire path using existing or new 14-gauge, direct burial UF, 600-volt, solid conductor wire extends from the 2Wire Decoder module to all valve boxes in the field. Single station decoders are then wired between the 2Wire path and each valve solenoid. Decoders are programmed with a corresponding station address.

Cautionary Note!

When operating stations manually with the ICC2 controller series advancing stations too quickly may lead to failure to turn off the previous station. The work-around is to advance slowly.

ICC Decoder Module Functions

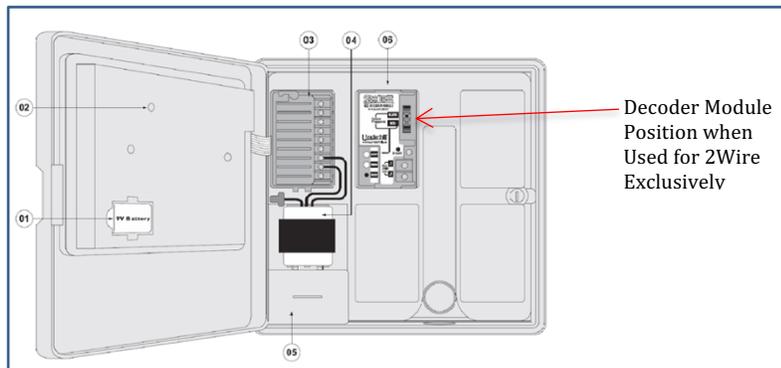
Figure 4-1 identifies the various buttons, LED's, and terminal connections of the ICC 2Wire Decoder Module.



Functions of an ICC 2Wire Decoder Module
Figure 4-1

Decoder Module Position for 2Wire Exclusively

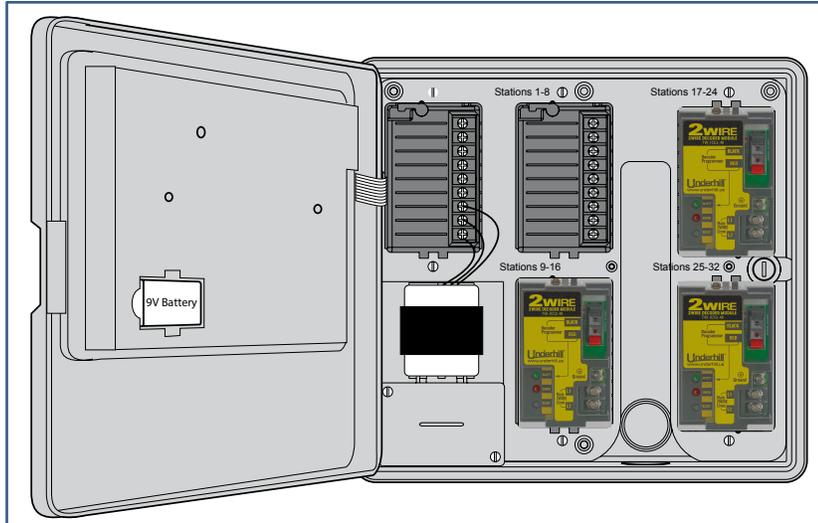
When using the ICC 2Wire Decoder Module exclusively for 2Wire, install the Decoder Module in the upper left-hand position of the Hunter ICC controller as shown in Figure 4-2.



Exclusive 2Wire Decoder Module Position
Figure 34-2

Decoder Module for “Hybrid” Applications

When used in a “hybrid” application, meaning some stations operated using the Hunter multi-wire station modules and the ICC 2Wire Decoder Module, the module can be inserted in any one of the 3 remaining positions as shown in Figure 5-1. The maximum station count still remains at 48 stations.



2Wire Decoder Positions for a “Hybrid” Application
Figure 5-1

ICC Decoder Module Installation



Note: Turn off the 120-volt power to the ICC Controller prior to installing a 2Wire Decoder Module. Do not attempt this procedure with power still connected to the controller as it may damage the ICC Decoder module that is not covered under warranty. If a 9-volt battery also exists, remove it at this time as well.

Both modules insert in a similar manner no matter the generation.



Note: There is a difference between the 1st and 2nd generation ICC 2Wire Decoder Module, see Figure 5-2. The 1st generation module has a white power cable with eyelet not found in the ICC2 Wire Decoder Module.



1st and 2nd Generation ICC 2Wire Decoder Modules
Figure 5-2

Installing an ICC 2Wire Module (1st Generation)

The 1st generation ICC 2Wire Decoder Modules includes a small white power cable assembly with an eyelet termination, see Figure 6-1.



ICC 2Wire Decoder Module w/ Power Cable
Figure 6-1

When installed, it will ensure consistent power connection between the ICC controller and the 2Wire Decoder Module. The installation requires the cable to be fished through an opening in the molded plastic recess of the ICC controller.

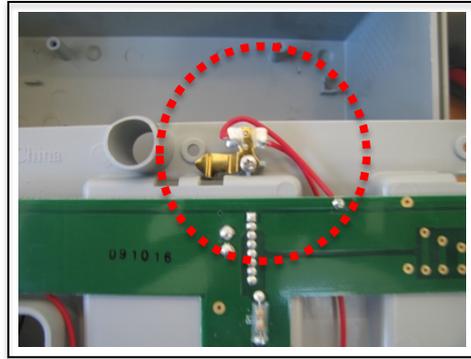
This is not a ground wire.

Locate and remove the 8 (qty) Philips head screws that secure the plastic station module panel to the ICC enclosure. See Figure 6-2.



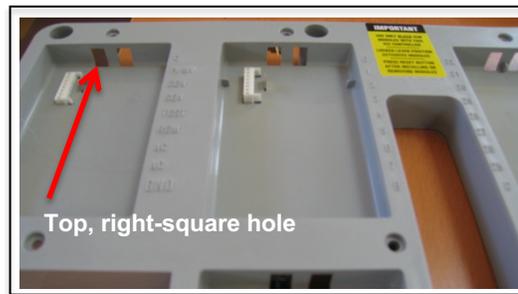
Station Module Fasteners
Figure 6-2

Turn over the plastic station module panel and locate the brass tab with a Philips head fastener (circled in red) as shown in Figure 7-1. Loosen and remove this fastener.



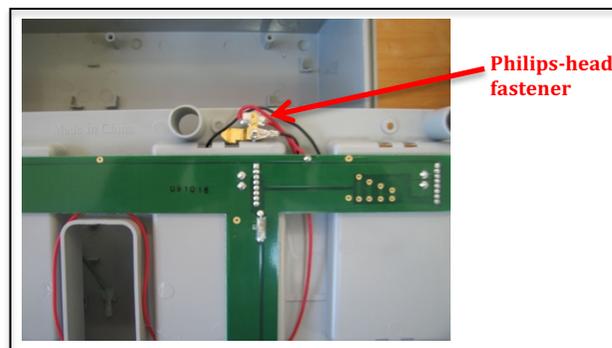
Philips-Head Fastener
Figure 7-1

Thread the Underhill Decoder Module cable from the topside (facing up) of the plastic station module panel through the right-hand square opening in the plastic station module holder, shown in Figure 7-2.



Existing Thru-hole in ICC Station Module
Figure 7-2

Locate and secure the eyelet of the ICC Decoder Module cable assembly to the Philips-head fastener shown in Figure 7-3.



Secure Cable to Brass Tab w/ Philips-Head Fastener
Figure 7-3

Insert the ICC 2Wire Decoder Module back into place.



Avoid pinching the Decoder Module cable when snapping back into place while holding the plastic station module panel.

Set the plastic Hunter station module panel back into place and secure with 2-3 (qty) previously removed Philips head fasteners for testing initially, (once testing has been verified secure with the remaining fasteners).

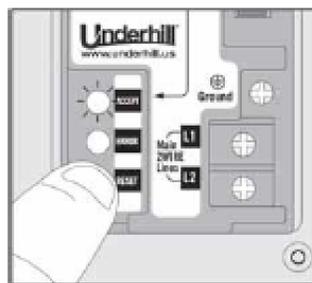


Note: Be sure not to pinch the green wire with yellow strip under the plastic station module panel.

Reattach the 2Wire communication cables to the L1/L2 terminals and the ground wire.

Replace the ICC power module so that AC power is returned to the controller. If a 9-volt battery previously existing, reinstall the battery.

Verify the Decoder Module operates by pressing and holding the “Reset” button until the “Accept” LED flashes green on/off, see Figure 8-1.



Decoder Module Reset Buttons
Figure 8-1

Finish securing the Hunter ICC plastic station panel with the remaining Philips-head fasteners.

Operate a station manually to confirm communication is being received.

ICC2 Decoder Module Installation (2nd Generation)



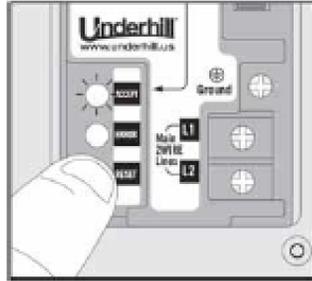
Confirm 120-volt power to the controller is “Off” before installing a new ICC2 2Wire Decoder Module. This is not a “hot-swappable” module.

When using the ICC2 controller exclusively for 2Wire applications, install the ICC2 2Wire Decoder Module in the upper left position used for multi-wire modules shown in Figure 3-1.

Insert the top of the module in first, while pushing slightly upward from the bottom to confirm it’s seated correctly.

Connect a 14-gauge solid-copper conductor wire to the ground lug located directly above the L1 terminal to a ground rod. The NEC requires this to be separate from any grounding for the ICC2 controller. Failure to do so will null and void the warranty and may foreshorten the expected life expectancy and operation of this product.

Apply 120-volt power to the ICC2 controller once installed. Verify the Decoder Module operates by pressing and holding the “Reset” button until the “Accept” LED flashes green on/off. See Figure 9-1.



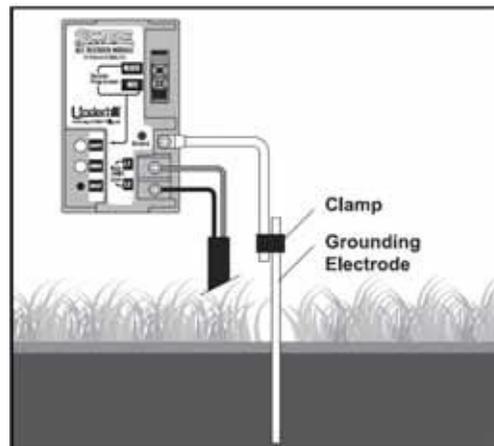
Decoder Module Reset Buttons
Figure 9-1

Grounding

Underhill 2Wire systems are the only 2Wire product that requires a single ground rod. No additional grounding at specific intervals or at the terminus of each 2Wire path is required.

Both the ICC and the ICC-Decoder Module are equipped with built-in electrical surge protection. For this system to function properly, the ICC-Decoder Module must be connected to a ground rod that is driven into the earth. It is important for protection against indirect lightning strikes that the module is grounded to ground rods or plates with less than 10 Ohms resistance. Use grounding electrodes that are U L listed or manufactured to meet the minimum requirements of the National Electrical Code (NEC). For detailed information on earth grounding of irrigation components, refer to the American Society of Irrigation Consultants Earth Grounding Guideline 100-2002 (www.asic.org).

A ground lug is located above the L1 terminal on the right side of the 2Wire Decoder Module for both part numbers. See Figure 9-2.



Ground Lug Location
Figure 9-2



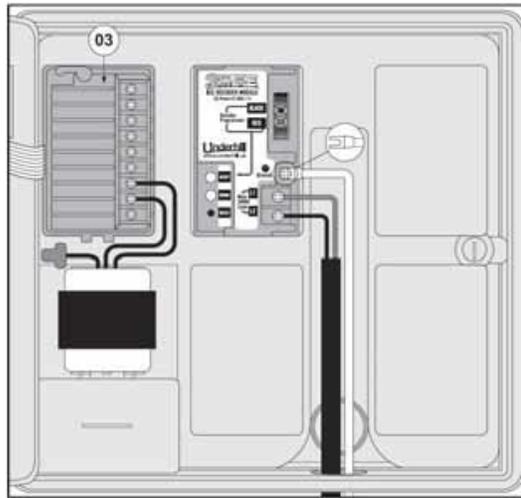
Note: Use a #10 (6 mm²) or #8 (10 mm²) bare wire to connect the controller to the ground rod. Use a standard copper clad, 5/8" (1.6 cm) diameter, 8' (2.5 m) long ground rod.

The ground terminal on the ICC- Decoder Module is located next to the main two- wire cable terminals (L1 and L2). The  symbol on the label is. For proper termination, a spade connector or eyelet should be used to connect to the earth terminal, see Figure 9-2.

For EXCLUSIVE 2Wire Decoder-ONLY SYSTEM i.e., no multi- wire station modules, route the earth wire from the ICC-Decoder Module ground terminal directly to ground rod or plate. Do not connect to the 'GND' terminal on the Hunter Power Module.

IMPORTANT

Do not connect the ground terminal on the ICC Decoder module to the building ground or place the ICC grounding electrode(s) within the 'sphere of influence' of the building's grounding system.

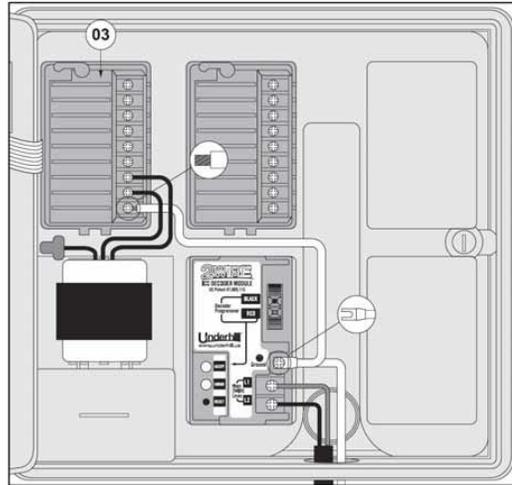


Exclusive 2Wire Grounding
Figure 10-1



DO NOT connect the green/yellow wire exiting from the transformer with the 2 yellow wires on the ICC or ICC2 power module.

For a MIXED MULTI-WIRE AND DECODER SYSTEM i.e., where some multi- wire Station Modules and some 2Wire coexist, the 'GND' terminal on the Power Module (03) and the earth terminal on the ICC-Decoder Module must be connected together and to the earth grounding system, see Figure 11-1.



Hybrid Grounding
Figure 11-1

Programming Decoders

Decoders must be set to a unique station address before installation. When the controller turns on a station, it sends +/- 28-volts AC power down the 2Wire path, along with a digital signal (an address) specific to a particular decoder. Once a decoder hears its own address, it applies voltage to the solenoid and the communication from controller to the field is complete.



Note: There is a 5-8 second time delay between the time a valve actuates once a signal is sent from the ICC controller through the ICC Decoder Module to a corresponding station.

There are two methods of programming a decoder prior to installation; 1) is to use the programming function on the ICC 2Wire Decoder Module. This allows the installer to program a station number into a decoder, without extra hardware. A second method is to connect the red and black decoder wires to the L1/L2 terminals and connecting the two yellow wires to a known working solenoid. Use the “Manual” function on the ICC2 to confirm operation for the corresponding station number.

Programming Decoders Using a Portable Programmer/Tester

Decoders can also be programmed with a corresponding station numbers using an Underhill Portable Programmer, see Figure 11-2.



Portable Programmer
Figure 11-2

To program a decoder using the Portable Programmer, connect the color-coded wires of the decoder to the corresponding color connectors on the portable programmer. Please the connector downward while inserting the exposed copper conductor only.

Press the “Raise or Lower” button to select the corresponding station number. Then press “PROG” to program. The programmer will indicate a green LED or “Pass” once programmed.

If the red LED or “Fail” illuminates, try unplugging the portable programmer from its power source for 15 seconds, then plug back in and re-try. If a “Fail” LED appears, then attempt to program the decoder with another station number. If it passes, then reprogram it to the originally desired station number. If a “Fail” LED appears continually, then the decoder is defective and cannot be used.

To test a decoder or determine its station number, insert the color-coded wires into the corresponding colored connectors. Then press the “Test” button. The programmer will run through a test sequence and will indicate the station number and the “Pass” LED will illuminate.

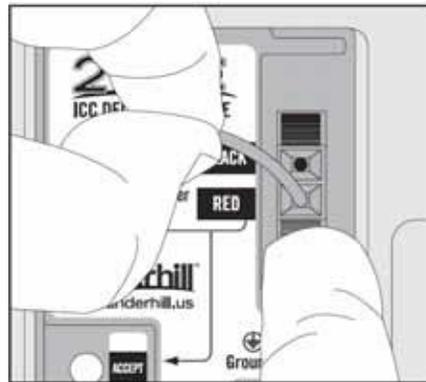
Using the ICC 2Wire Decoder Module to Program a Decoder

The following steps indicate how to program a decoder. The programming sequence is a two-step process;

Step 1 is to select the corresponding station number and receive confirmation,

Step 2 is execution of the command to program the decoder.

A decoder can be programmed with different station numbers if ever needed. The programming connector on the ICC Decoder Module is located in the upper right-hand corner of the Decoder Module and is color-coded red and black, see Figure 12-1.



Programming Connector

Figure 12-1

Press down, the levers on the connector and insert the red and black decoder wires into their respective colored connector. Release the levers, ensuring the conductor in the decoder wire is in contact with its terminal.

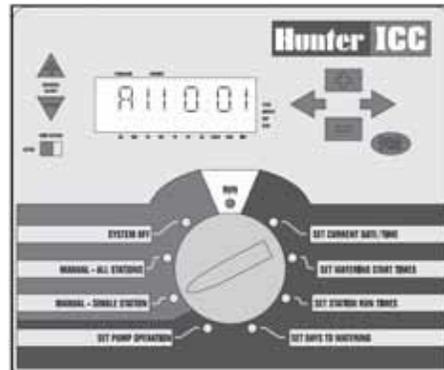


Note: The yellow decoder wires aren't used in this operation.

It is not necessary to remove the 2Wire path to decoders when programming decoders.

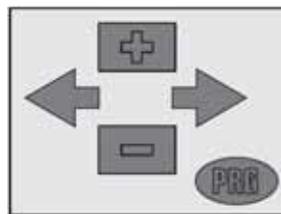
Programming a Decoder using the 1st Generation ICC

Turn the main menu knob to “MANUAL SINGLE STATION” menu position or to the “MANUAL” menu on the ICC2, see Figure 13-1.



Select Corresponding Station Number
Figure 13-1

Station run time will flash in the display. Use the right or left arrow buttons to move to the desired station number to program into the decoder, see Figure 13-2.



Using the Left and Right Arrow Buttons
Figure 12-3

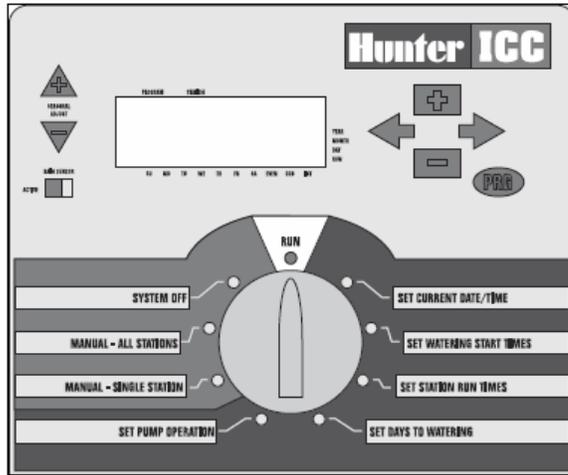
Then use the + and - buttons to select a non-zero watering time. Any non-zero time is acceptable.

Press and hold the pushbutton on the ICC Decoder Module until the green LED begins to flash slowly. Hold it down until you see at least 2 green LED flashes.

Turn the main menu knob other RUN position to program that station number into the decoder, see Figure 14-1. The green LED will flash more quickly for a few seconds and then turn a steady green when programming is complete.

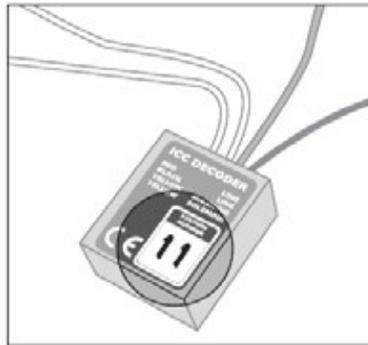
Turn the dial back to the MANUAL SINGLE STATION position to repeat. The green LED will extinguish.

Remove the programmed decoder by depressing the red and black levers on the connector.



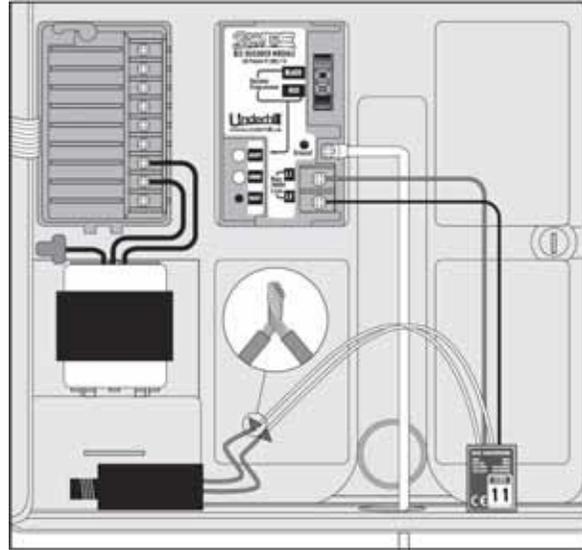
Turn Main Menu knob to RUN
Figure 14-1

Write the station number onto the decoder label and on the backside of the decoder using an indelible marker, see Figure 14-2.



Label Station Number on Decoder
Figure 14-2

The decoder can optionally be tested by attaching it to the 2Wire path with a solenoid connected to the decoder's yellow wires, see Figure 15-1. Turn the dial to the MANUAL SINGLE STATION position to select that station and say, a 1-minute time. Then turn the dial to the RUN position to see if the decoder operates the solenoid.



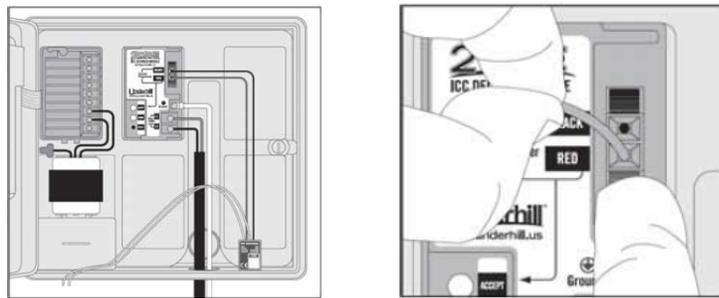
Testing a Programmed Decoder
Figure 15-1



Note: If the dial is not turned to the MANUAL-SINGLE STATION position within about 15 seconds after pressing the button on the ICC Decoder Module, the green LED will stop flashing and the module will come out of programming mode. After the decoder has been programmed, the LED will stay a steady green until either the knob is turned away from RUN, or the manual run-time has expired. As long as the green LED is flashing or steady, no run signal nor AC voltage will be sent out on the 2Wire path.

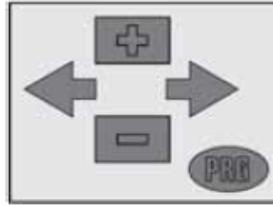
Programming a Decoder using the ICC2 Series Controller

Connect the red and black decoder wires to the corresponding red and black terminals located in the upper right-hand corner of the ICC 2Wire Decoder Module. See Figure 15-2.



Connect the Red and Black Wires from the Decoder to the Decoder Module
Figure 15-2

Turn the main menu knob on the Hunter ICC2 to “Manual”. Press the “Right” arrow button until the desired station number is displayed. See Figure 16-1.



Select the Desired Station Number Using the Right Arrow Button
Figure 16-1

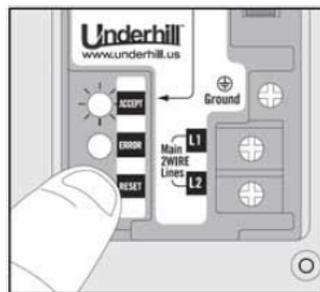
Press the “+” arrow button to enter a runtime, 1-minute minimum.

Rotate dial to the RUN position. See Figure 16-2.



Main Menu Knob of the ICC2 in the RUN Position
Figure 16-2

The red LED on the 2Wire Decoder Module will illuminate. Press the black “Reset” button for a 5-second count on the 2Wire Decoder Module to extinguish the red “Error” LED. See Figure 16-3.



Press the Black Reset Button
Figure 16-3

Press the “Reset” button a second time to complete the programming of the decoder. The green LED will flash repeatedly indicating programming has been completed.

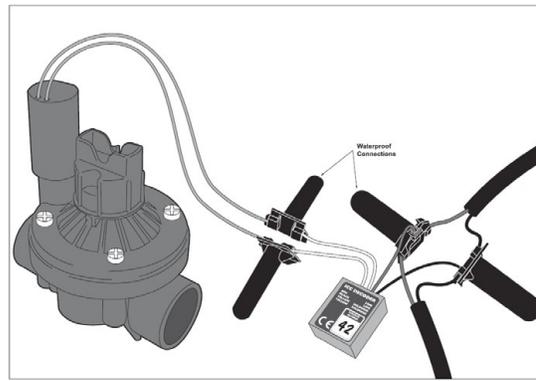
Decoder programming can be verified by moving the red and black decoder wires to the L1/L2 terminals and connecting a known working solenoid to the two yellow wires of the decoder. Use the “Manual” function on the ICC2 to confirm operation for the corresponding station number.

Connecting Valves to Decoders

The 2Wire path can be standard 14 AWG, direct-burial, 600-volt, solid-conductor wire. There is no requirement for twisted or jacketed wire typical of other 2Wire systems.

Route a pair of wires representing the 2Wire path between each remote-control valve location from the controller. If field conditions are such that a “T” or “Y” splice is needed to feed some valve locations, make sure these connections are made with in valve box and not direct buried.

In each valve box, cut the 2Wire path and strip back the outer wire insulation 4” (100mm) on each cut end. Strip each conductor ½” (13 mm). Strip the 4 wires representing on the decoder ½” (13mm). Splice the decoder red and black wires to the 2Wire path being consistent in the color connections at each valve box. Attach the 2 yellow decoder wires to the valve solenoid. All connectors should be made w/ DBYR waterproof connectors, see Figure 17-1.



Decoder Connected to a Remote-Control Valve (fig 17)

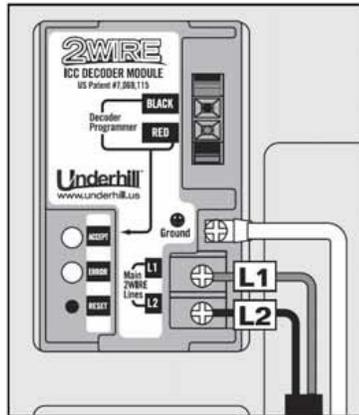
Figure 17-1

Open the hinged faceplate on the ICC controller to access the 2Wire Decoder Module. Route the 2Wire Path through the conduit and attach the conduit to the controller at the large conduit opening. The conduit opening has a multiple-knockout capable of accommodating different conduit sizes.

Strip ½” (13mm) of wire insulation back from the ends of the 2Wire path and secure to the L1/L2 terminals, see Figure 18-1.



Note: The Hunter multi-wire “test” is not compatible w/ decoder stations. Use the “Manual Run All Stations” in the Hunter User Manual.



2Wire Path Connected to a Decoder Module
Figure 18-1

2Wire Path Wiring Sizing Guide

It is important to ensure the solenoids have enough power to pull in their plungers at maximum water pressure. The ICC controller with decoders has to share solenoid power between a maximum of two solenoids on a common two-wire cable. The following two charts (Imperia I or Metric) give guidance in choosing the size of the two-wire cable.

Basic Assumptions

Voltage output at the ICC Decoder module output	27VAC
Minimum voltage to operate a solenoid	19 VAC
Solenoid type Hunter Heavy Duty	
Mains Frequency (the worst case)	50Hz

Determining the Maximum Length Run for a Given Wire Size

Refer to either the U.S. AWG wire chart or the International metric wire chart as applicable.

One Solenoid Running on a Program A, B or C and No Solenoid on Program D

At the origin = 0, move up the vertical scale to the distance that is equal to the distance to the furthest solenoid from the controller.
Select the wire/cable size that is at least as large as is indicated on the distance on the vertical axis.

Example: US Wire Size

Distance to the furthest solenoid is 2,700 ft. Wire size must be at least 16AWG

Example: Metric Wire Size

Distance to the furthest solenoid is 1,200m. Wire size must be at least 2,5 mm sq.

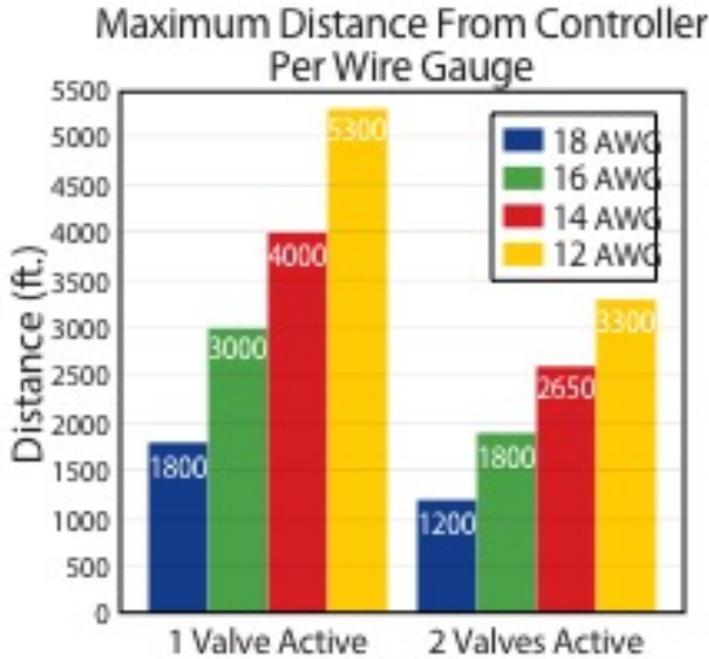
Two Solenoids Operating Simultaneously (Including a Solenoid on Program D

Identify a solenoid that is the far from the controller that might run concurrently with an even more-distant solenoid.
On the horizontal axis (1st Run), measure off the distance Move vertically from there until you intersect a wire size curve.
Move left from the intersect until you reach the vertical axis

This is the maximum length and size of the wire required to ensure successful operation of both solenoids operating at the same time.

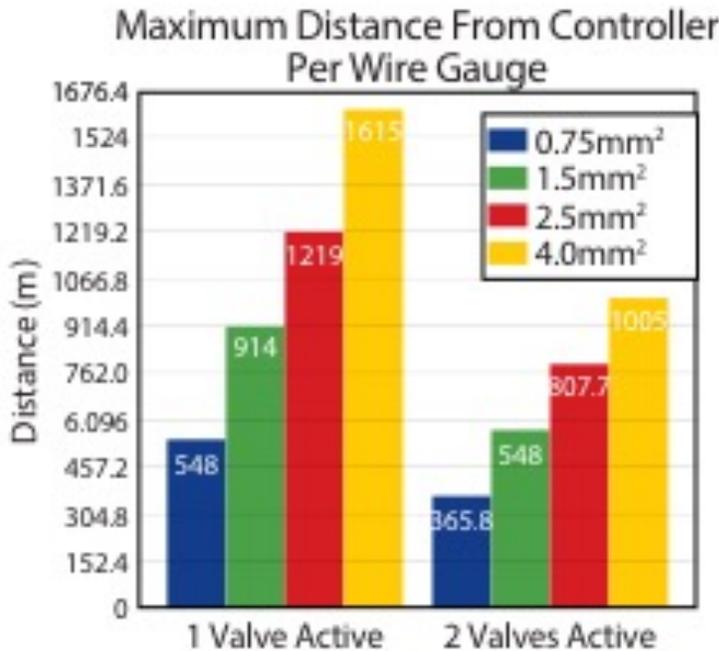
Example: US Wire Size

1500 feet distance to the solenoid from controller that might run concurrently with a solenoid a further 1500ft would require 14 AWG wire or larger.



Example: Metric Wire Size

400 meters distance to the solenoid from controller that might run concurrently with a solenoid a further 200 m from the controller would require 1.5 mm sq. cable or larger.



Frequently Asked Questions

RED LED FLASHING:

There was a station fault during a program. Use ' Test Program' (page.25) to identify the failure. Clear the flashing LED by pressing the reset button on the ICC Decoder Module.

RED LED ON WHEN RUNNING A STATION:

This station is faulty. Possible faults are:

No decoder connected to the 2Wire path, or wrong station number encoded into it.

Solenoid open circuit or short circuit.

Decoder or solenoid not wired correctly.

Solenoid surge current greater than 600 mA (multiple solenoids on one decoder?).

RED LED REMAINS ON WHEN RUNNING EVERY STATION

There is a short circuit on the 2Wire path.

THE HUNTER CONTROLLER DISPLAYS AN 'ERR' MESSAGE ON EVERY STATION

Reverse the connections on L1 & L2 of the module for the 2Wire path

Or

A noise suppression capacitor is not installed when using a hand-held remote or rain sensor.

GREEN LED STOPS FLASHING WHEN PROGRAMMING A DECODER

If the pushbutton is not pressed for at least 2 flashes of the green LED, the decoder programming mode will not be entered. After pressing the button on the ICC Decoder module, the green LED will flash for about 15 seconds. After that time, it will leave decoder programming mode. The ICC rotary switch must be turned to the RUN position before the 15 seconds is up.

The best order of operation is:

- Connect decoder to the programming socket
- Move Rotary switch to "MANUAL SINGLE STATION". Select the desired station number and a non-zero time
- Press the pushbutton on the ICC Decoder module, observe the LED continuing to flash.
- Rotate the main menu knob to the RUN position
- Watch that the green LED flashes faster for a few seconds then turns a steady green. Programming is now complete.

CANNOT OPERATE ANY DECODERS

Check operation of the ICC Decoder Module by pressing the push button and observing if the green LED starts flashing. If not, turn off the 120 AC power to the controller and remove the ICC Decoder module and make sure the pins underneath isn't bent or missing.

THE CONTROLLER RECOGNIZES SOME DECODERS, BUT OTHERS ARE MISSING

Operate a Manual Single Station to send 28 VAC power down the 2Wire path. Check cable voltage at a 'missing' station with a digital clamp meter or known working solenoid. Remove and re-program the decoder station number into the corresponding station number.

Test it on the L1/L2 2Wire terminals, with a solenoid before wiring it back into the 2Wire path in the field.

If the ICC Decoder module is not plugged into the first slot or into the next available slot then verify what station the Decoder address or station number starts with.

ICC- Decoder module is plugged in after an 8-station multi-wire module. The first 8 stations are used in for a multi-wire application and are not be usable with decoders.

Electrical Specifications

Decoders

Minimum Operating Voltage (most solenoids require a minimum of 19 VAC to operate)	13VAC
Maximum Continuous Solenoid Current (600mA)	0.6amps
Decoder Standby Current (typical)	2.8 mA
Station Number Range	1-48

ICC Decoder Module

Maximum AC Input Voltage	32 VAC
--------------------------	--------

Compliance Statements

FCC NOTICE

This controller generates radio frequency energy and may cause interference to radio and television reception. It has been tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation on. If this equipment does cause 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 or more of the following measures:

Reorient the receiving antenna

Move the controller away from the receiver

Plug the controller into a different outlet so that controller and receiver are on different branch circuits

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 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 postpaid).

CERTIFICATE OF CONFORMITY TO EUROPEAN DIRECTIVES

We certify that the ICC-Decoder Module and the ICC-Decoder conform to the European Directive 89/336/EEC Underhill International Corp. Manufactured by:
Underhill International Corp. Email to underhill@uicorp.net
For our address visit www.underhill.us.

Hunter® is a trademark of Hunter Industries Inc.

"Quick Check" is a trademark of Hunter Industries Inc.