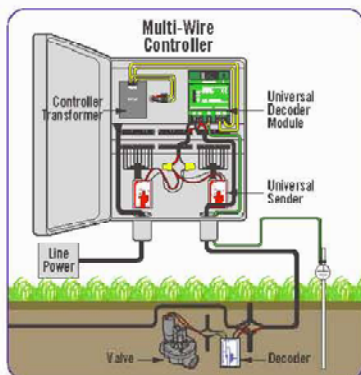


Underhill™ 2WIRE

Universal Decoder Installation Instructions

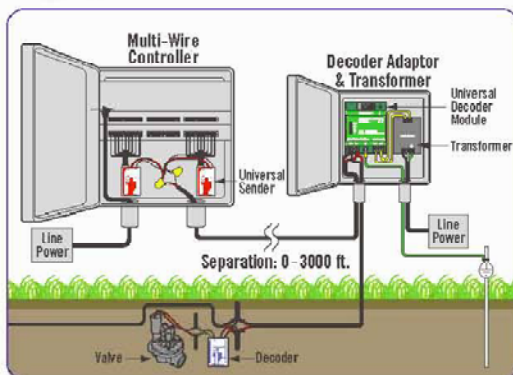
1 to 63 Stations

The Underhill™ 2WIRE™ Universal Decoder is designed to give **any controller** the superior features of decoder technology. It installs neatly inside your favorite controller (internal mount), or in a separate enclosure (external mount) **anywhere** along the two wire path (up to 3,000 feet away from the controller!)



Internal Mounting

Connect the Universal Decoder Module to the controller transformer (24V-32V), 2-wire branch, and Ground. Set the station addresses of the Universal Senders, connect them to the controller terminal strips and the Universal Decoder Module.



External Mounting

Connect anywhere along the 2-wire path (within 3000 feet of controller) where AC power is available. Connect the transformer to AC power, and run a 2-wire branch to the controller. Set the station addresses of the Universal Senders and then connect them to the controller terminal strips and the 2-wire path.

Benefits to Contractors

- **Significant Cost Savings**
On projects with more than 300 feet (91 m) of mainlines or 1/2 acre (2000 m²) (including buildings and hardscapes)
- **"Portable" Controller**
During construction, quickly splice any controller and the Universal Decoder Module into any branch (permanent or temporary) anywhere along the 2-wire path where AC power is available. And move it from phase to phase as needed.
- **Undersized Conduits**
- **Simpler Grounding**
Only the controller requires a ground.
Decoders along the 2-wire path do not require grounding.
- **Simpler Change Orders / Future Expansions**
- **Phased Jobs Easily Facilitated**
- **3,500 ft. (1,000 m) and Longer Wire Runs**
Contact us or refer to instruction manual for longer runs.

Call (1-866-UNDERHILL) or email us (sales@underhill.us) for an estimate of how much you can save. We'll only need a few details of your project like: total length of pressurized mainlines, the distance from the controller to the mainline, your preferred controller, etc. An Underhill™ 2WIRE™ specialist will send you a savings estimate.



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The Universal Decoder Adaptor system consists of 3 different items.

1. The Senders. These can number from 1 to 8 and are fitted to the host controller to sense activation of each solenoid output.
2. The Adaptor. This receives information from the Sender(s) as to which outputs are on and then signals the corresponding Decoder.
3. The Decoders. These are connected to the 2 wire cable and each contains a pre-programmed number. When that number is transmitted down the 2 wire cable, it turns on the solenoid to which it is attached.

Function of the Indicators:

"?" flashes when a Sender is being interrogated. Approximately once per second. Interrogates potentially 8 Senders, so each Sender is interrogated once in 8 seconds.

"_/" flashes when a Decoder is being signaled on or off. If successful, will signal just once. If unsuccessful, will signal every time its corresponding Sender has just been interrogated.

"!" Illuminates when a zone (station or Decoder) fails to turn on or off. This remains flashing after the host controller has finished with that zone. Flashing is cleared by holding down the pushbutton.

"OK" Illuminates if the internal processor is working correctly. It extinguishes briefly each time a message is successfully received from a Sender. It extinguishes twice in quick succession if the Sender's message contains an instruction to turn on a Decoder.



The Adaptor can be snapped onto 'Top Hat' DIN rail. Alternatively, by pulling out the two tabs a little way, mounting holes are revealed so the enclosure can be screwed to a panel.

The Adaptor is not waterproof and if outside, must be housed in a weatherproof box. This same box can house the transformer if the one in the host controller is not accessible. Obey safety codes if line power (115V/230V) is involved.

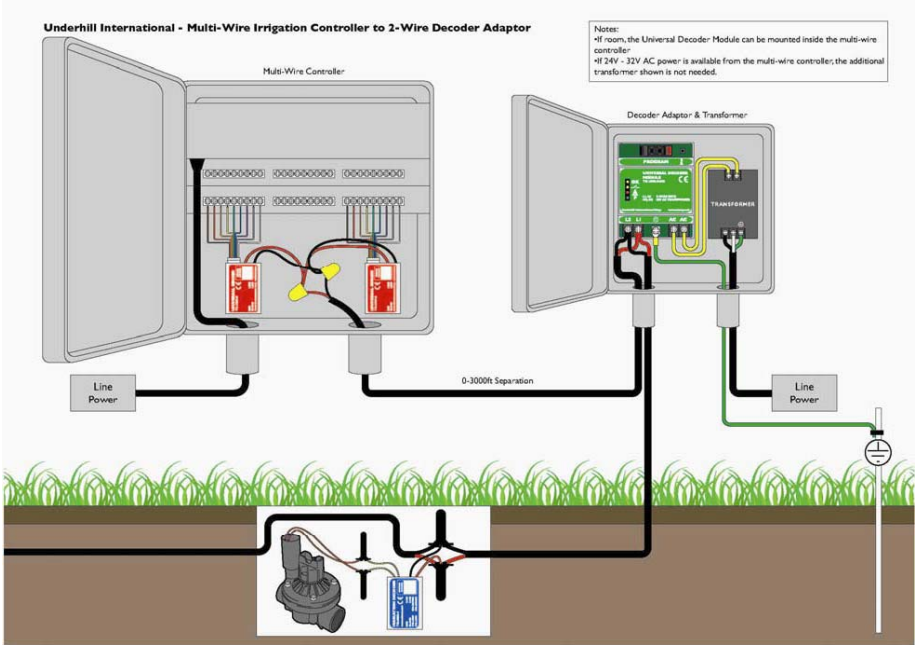
Avoid poking any object into the oval slot on the bottom left hand side of the front panel. It is reserved for the engineering connector.

Connections to the Adaptor:

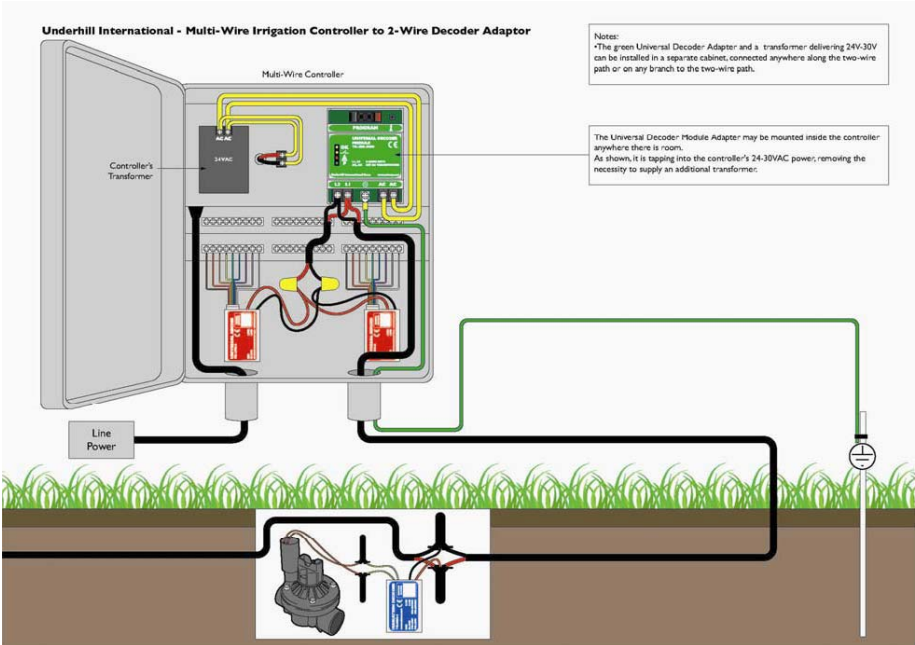


- **L1/L2** - The 2 wire path. For distances greater than 1000m, use at least 2.5mm² cored cable. Connect the RED wires of the Decoders and Senders to L1 and the BLACK to L2. See sizing charts on page 9.
- **EARTH** - Use a fork or ring crimp on 4mm² cable to an adequate earth stake or stakes.
- **AC AC** - Connect 24V-34V AC, 50 or 60Hz to power the system and Decoders. Limit the transformer to 50VA or 75VA maximum. If accessible, the AC in the host controller may also be used,. Polarity of connection is not important.

The Universal may be mounted externally from the controller. If far away, an external transformer will be needed to supply the 24V AC. In the drawing below, an optional weather-proof enclosure is being used.



Alternatively, if space exists, it may be mounted inside the controller. It is then possible to use the controller's 24V AC power, as shown in the drawing below.



The Sender:

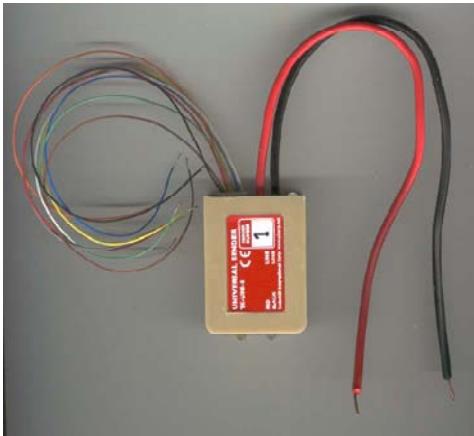


Table of Decoders Operated by Sender Number & Wire Color								
Color	Sender1	Sender2	Sender3	Sender4	Sender5	Sender6	Sender7	Sender8
Black	1	9	17	25	33	41	49	57
Brown	2	10	18	26	34	42	50	58
Red	3	11	19	27	35	43	51	59
Orange	4	12	20	28	36	44	52	60
Yellow	5	13	21	29	37	45	53	61
Green	6	14	22	30	38	46	54	62
Blue	7	15	23	31	39	47	55	63
Grey	8	16	24	32	40	48	56	N/A
White	Common	Common	Common	Common	Common	Common	Common	Common

- The cable assembly unplugs from the Sender, which helps with wiring up.
- Connect the white wire from each Sender to the host controller's 'Solenoid Common'.
- The Sender's inputs will take AC or DC, min TBD, nominal 24V, max 32V
- The Sender's inputs and common are isolated from the 2 wire path, so phasing of the input common with the 2 wire path is unimportant.
- The input wires are Teflon coated and very difficult to strip with side cutters.
- Connect the Sender's thick red wire to the Adaptor's L1 and the thick black to the Adaptor's L2. If more than one Sender, parallel up their red and black wires (but make sure they are set to different Sender addresses!)
- HINT: Connect up the thick wires first before plugging in the little connector to avoid straining their wires
- The Adaptor and Senders need not be co-located. Possibly up to 1000m apart (TDB). However the Sender(s) needs to be inside or within a few feet of the host controller.
- There is a red LED embedded into the bottom of the Sender. This will flash on power-up and every time the Sender is addressed by Adaptor.

To Program a Sender:

Each sender must be set to a base address in the range 1-8. See the table above.

1. Attach a decoder to the terminals of the Underhill Programmer/tester. Ensure a connection of its yellow solenoid wires into the yellow topped terminals of the tester.

2. Plug the red and black wires of the Sender in parallel with the red and black wires of the decoder.

3. Set the sender's address on the programmer's LEDs (value 1-8) and press the red button.

4. The LED in the bottom of the Sender will flash the same number of times as the address programmed.

5. Write the Sender number onto the little white box on its label with an indelible pen.



Commissioning the System: Program the Senders

1. Touch each Sender's thick Red and Black wires between 'Solenoid Common' and 'Test' terminals in the host controller. Ensure the number of flashes on the Sender's LED correspond to the address you thought you programmed into it.

2. Wire the Senders into the host controller. Attach the thick red and black wires to the 2-wire cable and position the Senders in the controller's enclosure before plugging in the 9 way miniature connectors, to avoid straining their wires.

3. On the Adaptor, connect the red wire side of the 2-wire cable to L1 and the black side to L2.

4. Connect a 24V-34V AC power source to 'AC AC'.

5. Connect an earth stake or earth system to the central earth terminal. Use a ring or fork crimp to the terminal. Use 4mm² wire. Do not use the building earth, use a separate earth system.

6. Connect a decoder to L1 and L2. Temporarily wire a solenoid to the yellow wires of the decoder. Ensure it turns on when the host controller runs the corresponding zone (station, output). *See 'Troubleshooting' if it does not.

7. Program the addresses into the Decoders, marking each with its address using an indelible pen in the little white box on the label.

8. Fit the Decoders to the 2 wire cable using waterproof connectors. Make sure the red wires go on the side of the 2 wire cable that goes to L1 and the black to L2.

9. Test each station, taking into account that it may take 8-10 seconds before the decoder responds.

Troubleshooting:

The various LEDs give a good indication of system operation.

The Adaptor on its own, with no Senders attached, will have a “?” yellow LED flashing about once a second and a steady green LED on “OK”

When a Sender is attached to L1 and L2, it will flash its LED every time it is addressed.

When a Sender replies with a message, the Adaptor's “OK” LED will blink off.

The “OK” LED will blink off twice in quick succession if the Sender, just addressed, has any one of its inputs active. Try putting a Sender input wire onto the ‘Test’ terminal of the host controller. If there is no decoder at that number, the red “!” (fault) LED will illuminate.

If the LEDs follow the pattern just mentioned, then the Adaptor's ability to signal decoders is tested.

If the red “!” LED illuminates immediately 2 wire cable with the decoders is attached; there is a short circuit on the 2 wire cable.

If the red “!” LED illuminates only after a decoder is signaled; that decoder has not responded.

When the run time is terminated on the faulty station, the “!” LED will change from steady to flashing. This can be cleared by holding down the pushbutton.

Signaling a decoder is indicated by a single flash of the Adaptor's “_/_” yellow LED (signaling), once for decoder on and once for off.

If the station is faulty, the “_/_” LED will flash every time the Sender is addressed (every 8 seconds)

Ensure that all 9 wires on the Sender's little connector are bared and correctly connected into the host controller's terminals. The white wire goes to the host controller's ‘solenoid common’ All Senders need their white wires so connected.

If decoders are not operating as expected, check the Sender has the correct address. Remove the Sender from the system and touch the Sender's thick Red and Black wires between ‘Solenoid Common’ and ‘Test’ terminals in the host controller. Ensure the number of flashes on the Sender's LED correspond to the address set in it.

Mapping Host Controller Outputs to Decoders:

The table below, repeated, explains which decoder address is operated, depending on the Sender address and wire color. The decoder address need not be the same as the host controller's zone (station, output) number. *For example: 1 Sender, programmed with address 2, has its brown wire attached to the host controller's zone (station, output) 26. When the controller's 26 becomes active, decoder with address 10 will operate.*

Table of Decoders Operated by Sender Number & Wire Color

Color	Sender1	Sender2	Sender3	Sender4	Sender5	Sender6	Sender7	Sender8
Black	1	9	17	25	33	41	49	57
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Grey	8	16	24	32	40	48	56	N/A
White	Common	Common	Common	Common	Common	Common	Common	Common

Specifications:

Decoder

Minimum operating voltage* 13V ac

*Most solenoids require a minimum of 19V ac to operate

Maximum continuous solenoid current from decoder 0.6A (600mA)

Decoder standby current 2.8mA (typical)

Station (zone) number range 1 - 63 (inclusive)

Universal Decoder Adaptor Module

Maximum ac input voltage 34V ac

Maximum continuous 2-wire main cable current 1.2A ac

Maximum stations (zones) active together 5 (60Hz), 6 (50Hz)

Maximum solenoid surge current* 1A (1000mA)

*To avoid the Adaptor registering a shorted solenoid

Sender

Input voltage to register a station (zone) active 12V-30V AC or DC

Isolation between Sender inputs/common and L1/L2 1000V peak

Minimum voltage on L1/L2 of Sender 20V AC

Maximum voltage on L1/L2 of Sender 34V AC

Wire Sizing Guide

It is important to ensure the solenoids have enough power to pull in their plungers at maximum water pressure. The Universal Decoder Adaptor with decoders has to share solenoid power between a maximum of six solenoids on a common two-wire cable.

The following two charts (English or Metric) give guidance in choosing the size of the two-wire cable.

Basic Assumptions:

Voltage output at the Universal Decoder Adaptor output 27V ac

Minimum voltage to operate a solenoid 19V ac

Solenoid type Hunter Heavy Duty

Mains Frequency (the worst case) 50Hz

Instructions for Using the Charts:

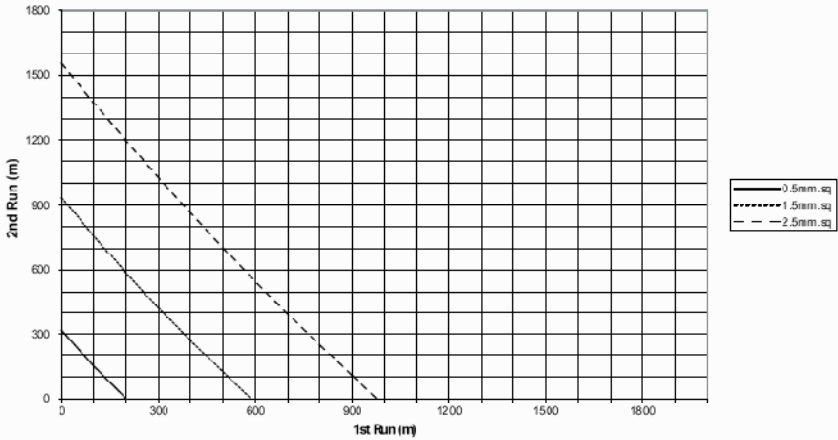
For 2 solenoids running simultaneously

1. Identify a station that is furthest from the controller that might run concurrently with an even more distant one.
2. Measure off the cable distance from controller to the station on the horizontal axis ('1st Run').
3. Move vertically from there until you intersect a cable line.
4. Move left from the intersection until you reach the vertical axis ('2nd Run').
5. This is the maximum cable length of the second, most distant, station from the first to ensure its successful turn-on.

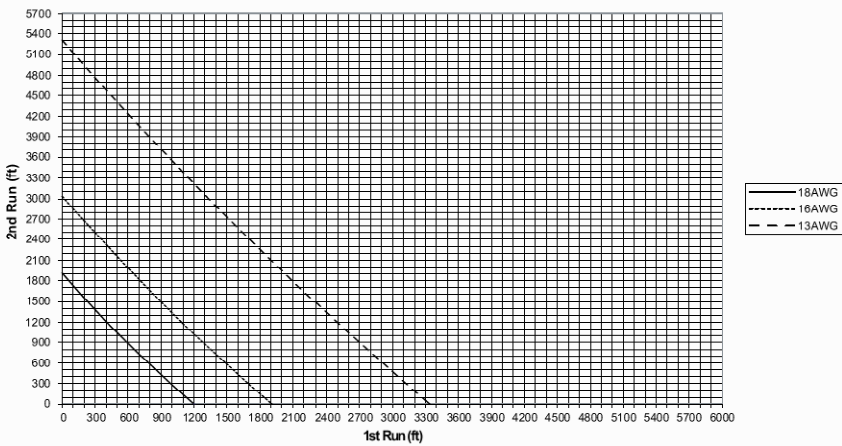
For just one solenoid running alone

1. At '1stRun' = 0, measure off the cable distance vertically up '2nd Run' of the furthest station.
2. If this point lies above the intersection of a cable line with '2nd Run', then that cable is too small.

2 Solenoids, Metric, Meters



2 Solenoids, AWG, ft.



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. 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 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 post paid).

CERTIFICATE OF CONFORMITY TO EUROPEAN DIRECTIVES

We certify that the Universal Decoder Adaptor and the Landscape-Decoder conform to the European Directive 89/336/EEC

J.A. Ware

Universal Decoder Installation Instructions-B09