Novo™

2WIRE Converter

O P E R A T I O N   M A N U A L

Underhill®

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Introduction

Congratulations on the purchase of Underhill International's Novo™ 2Wire Converter offering ease of installation and operation for large estate, light to medium commercial irrigation applications, golf and AG applications.

Product Benefits

The Novo™ 2Wire Converter is easy to install and operate offering a number of benefits of 2Wire systems;

- Simple – Compact design for faster and easier mounting to an interior wall or within a wall mount or pedestal-type enclosure for outdoor applications.

- Flexible and Easy to Expand – The Novo is intended to operate up to initially 32 stations on a 2Wire system using any host conventional multi-wire irrigation controller with "open" or un-used stations. See "System Overview" on next page.

  An additional 31 stations in 8-station increments for a total of 63 stations can also be managed by installing Underhill's Universal 8-station Senders. See Product Overview on the page 3.

- Proven – Install with a high level of trust knowing that Underhill has more than 300,000 decoders installed worldwide in a wide variety of applications and environments.

- Adaptability – The Novo can operate using existing field wire when retrofitting a multi-wire system. It uses pure AC power to the decoders so no electrolytic destruction of field wiring occurs.

- Ease of Installation - No additional grounding is required along the 2Wire path typical of competitive 2Wire products, except at the Novo.

- Versatility - No special shielded communication wire is needed for the 2-Wire path that can simply be 12, 14, or 18 AWG irrigation wire commonly found at most irrigation suppliers that can save costs compared to other 2Wire systems.

- Reliable – Superior resiliency to lightning protection.

- Integrated Solution – All of the components necessary to provide up to 32 stations in one package.

- Great Value – The Novo comes standard with an external transformer in either 120 volts, 60 Hz or 230 volts, 50 Hz electrical applications. The Novo also has the ability to program or test decoders or 8-stations Senders as a built-in feature thus eliminating the need for a portable programmer. The versatility of a 2Wire systems with all of components needed as one complete package, Underhill, Products that work…..smart.™

System Overview

How does it Work?

The following two diagrams represent typical installations of the Novo™ depending on how many stations need to be managed. The Novo allows any conventional, multi-wire, irrigation controller to manage a 2Wire system with Underhill decoders. This is accomplished by mounting the Novo to a vertical surface and connecting the included color-coded wire to a host controller's station outputs. When the host controller sends a 24 VAC signal to a specific station whether it's from a scheduled start time, manual or remote command the signal is received by the Novo that in turn converts signals to the 2Wire communication path to individual station valves with decoders. The Novo does not require any programming and is simply a pass-thru of commands from a host controller.

The Novo is powered from an external AC adapter connected to a 120-volt or 220-volt power source. This is the same requirement whether the Novo is wall-mounted indoors or outdoors in a weather-resistant pedestal-style enclosure.
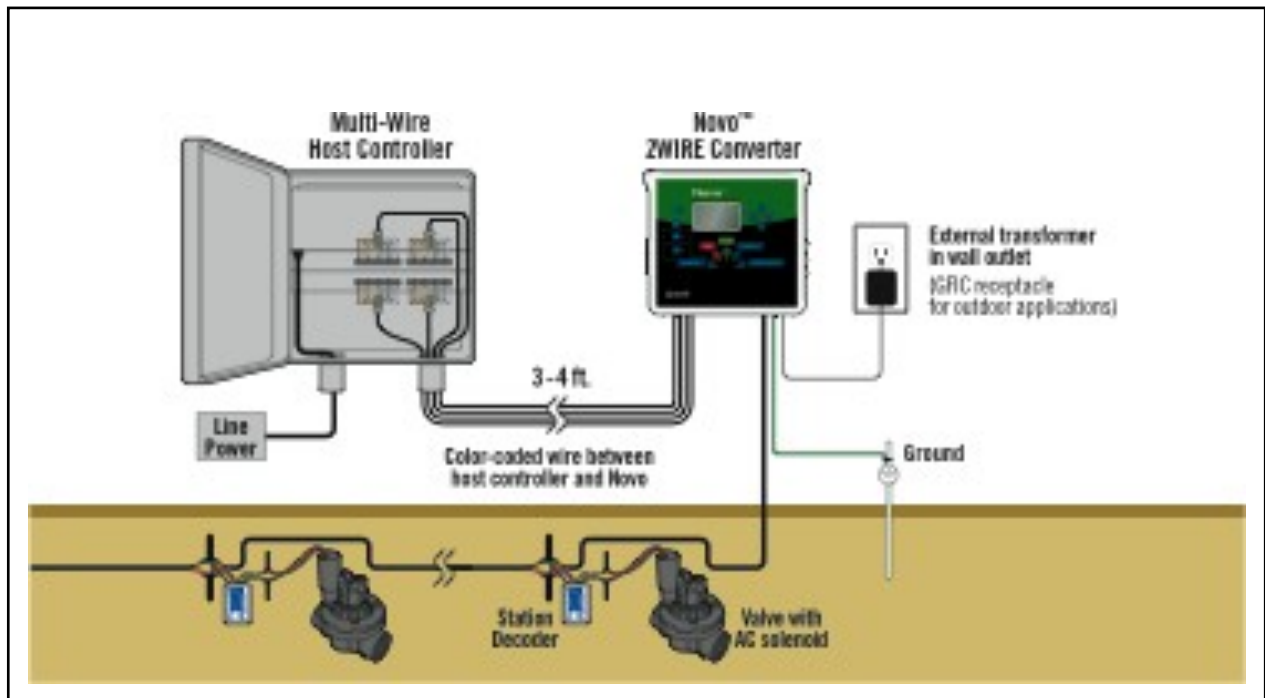
⚠️ Note: Underhill external transformers p/n's TW-34VA-115V or TW-34VA-220v come standard with this product only.

Figure 2-1 depicts the Novo with a host controller managing up to 32-stations.

⚠️ Assumes host controller can manage up to 32 stations.

**Managing up to 32
Stations Figure 2-1**

Figure 3-1 depicts the Novo with a host controller managing up to 63 stations by adding 8-station Senders for station counts above 32.
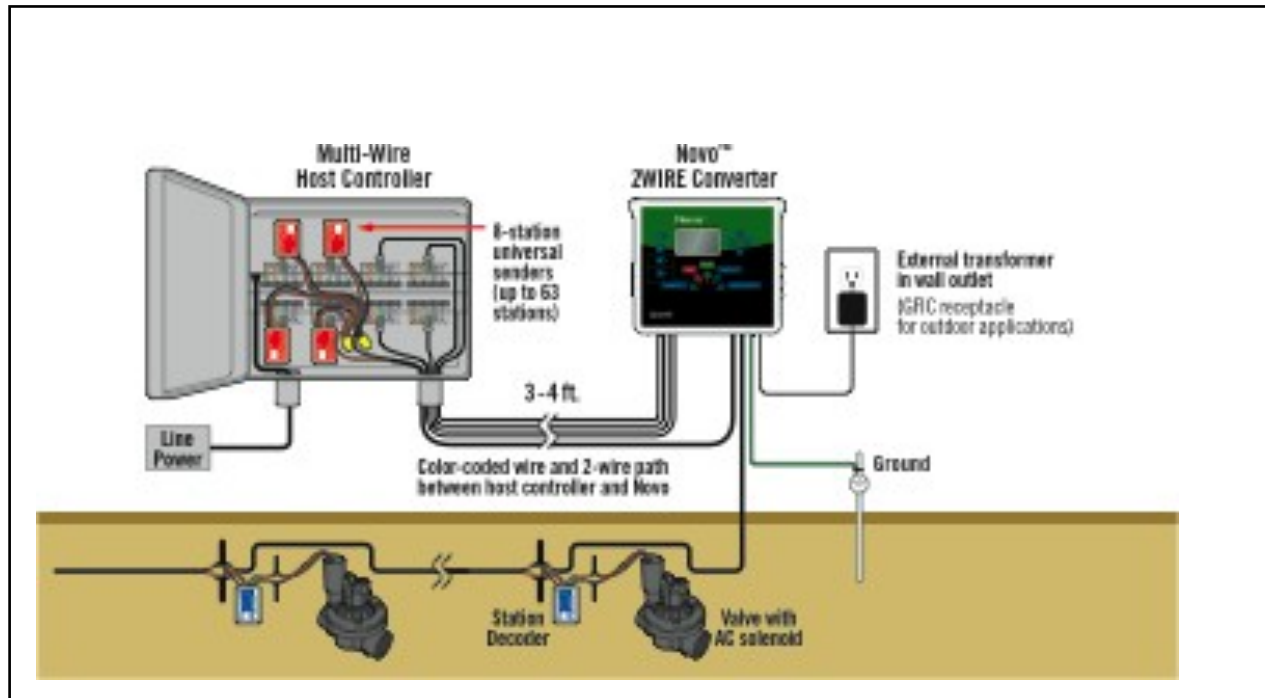
**Managing up to 63
Stations Figure 3-1**

⚠ Note: Assumes the host controller must have sufficient stations to manage 63 stations.

⚠ Note: The Novo can only manage as many available or "open" stations on the host controller

⚠ **Note: If the Novo is installed in close proximity to a pump station or shares the same electrical feed to a pump station there is potential for electro-magnetic frequency (EMF) to disrupt information down the 2Wire path. The symptoms can be erratic station operation outside of scheduled start times as a result of dirty power being transmitted down the AC power line that feeds the Novo. Underhill offers two different models of Power Surge Kits depending on the number of simultaneous station operation and/or the length and size of the 2Wire communication wire.**

Mounting and Installation

Installing the Novo

The Novo installs to any vertical surface by using the upper 2(qty) keyholes and two lower holes (accessible inside the product) located on the back of the case. See Figure 4-1.

2 (qty) keyhole upper mounts

2 (qty) Lower thru-holes
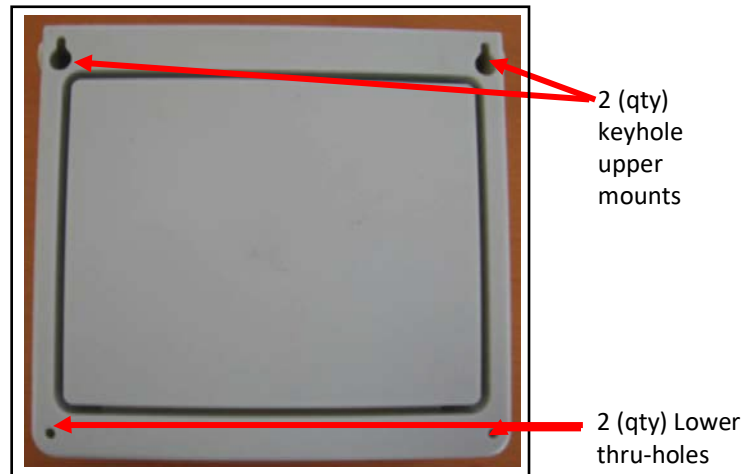
Mounting Keyholes on the Back Case of the Novo
Figure 4-1

⚠ Note: The Novo is not intended for outdoor applications without protection from a weather-resistant enclosure.

⚠ Note: If replacing an ICC controller w/ a 2Wire Decoder module, you can simply remove the internal components of the Hunter controller to re-use the existing enclosure.

⚠ Note: Installing a Novo on an existing Underhill 2Wire system does not require the existing decoders to be reprogrammed.

1. Confirm the Novo is level horizontally. Locate and mark the center point of the upper mounting holes. Drill 2 (qty) ¼" x ½" deep holes. Tighten the fasteners so that approximately 1/8" of threads remain exposed. Hang the Novo 2Wire Converter and confirm it is secure. Locate and drill the lower mounting holes, then securing w/ 2 additional #6 fasteners.

Wiring the Novo

1. Opening the Case

Press the two left and right thumb tabs located on the underside of the Novo case. The case will swing upward revealing several terminal blocks.

2. Connecting the Novo to a Host Controller

The Novo comes with 4 (qty) pre-wired, 9-conductor, multiple-colored cables representing stations 1-32. These are to be terminated in the "host-controller's" terminal outputs for each station that receives a decoder.

The 9th conductor is white and represents the valve common wire for that specific terminal block only. All common wires need to be tied together as shown in Figures 6-1 & 6-2

Locate the four terminal blocks underneath the display cover of the Novo, See Figures 5-1 and 5-2.

Upper Left – Stations 9-16
Upper Right – Stations 25-32

Lower Left – Stations 1-8-
Lower Right – Stations 17-24
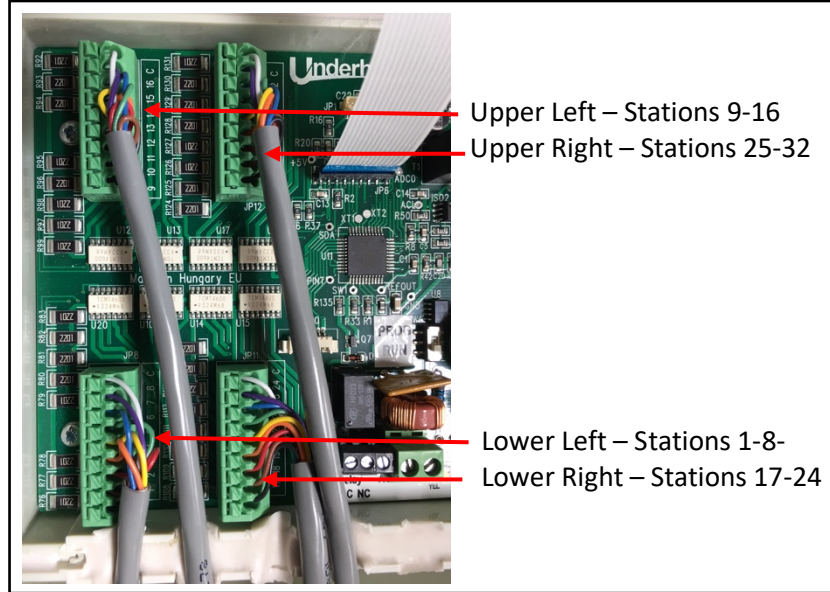
Novo Station Input Terminals
Figure 6-1

If fewer stations are required, a cable assembly can be removed by pressing down on the square button next to the terminal hole with a small flat-bladed screwdriver and pulling on the individual wire at the same time.

"C" = Valve Common

Lowest station number on the
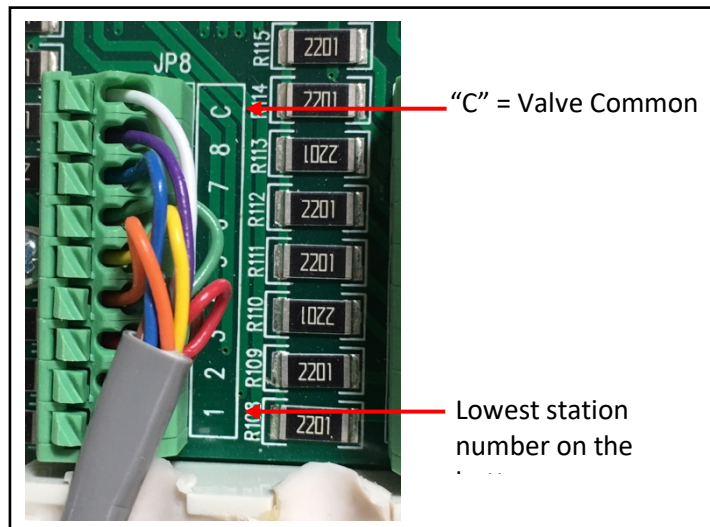
Valve Sequencing
Figure 56-2

Table 1 below provides the wire color-coding on each of the four terminal blocks for the Novo for stations 1-32. Confirm these wires are connected to a host controller's station outputs accordingly.

Table 1
Novo Station Wire Terminations

Terminal Block Location			Terminal Block Location			Terminal Block Location			Terminal Block Location		
Lower Left			Upper Left			Lower Right			Upper Right		
Term Blk	Sta #	Sender Wire Color	Term Blk	Sta #	Sender Wire Color	Term Blk	Sta #	Sender Wire Color	Term Blk	Sta #	Sender Wire Color
JP8/9	Com	White	JP9/9	Com	White	JP11/9	Com	White	JP12/9	Com	White
JP8/8	8	Violet	JP9/8	16	Violet	JP11/8	24	Violet	JP12/8	32	Violet
JP8/7	7	Blue	JP9/7	15	Blue	JP11/7	23	Blue	JP12/7	31	Blue
JP8/6	6	Green	JP9/6	14	Green	JP11/6	22	Green	JP12/6	30	Green
JP8/5	5	Yellow	JP9/5	13	Yellow	JP11/5	21	Yellow	JP12/5	29	Yellow
JP8/4	4	Orange	JP9/4	12	Orange	JP11/4	20	Orange	JP12/4	28	Orange
JP8/3	3	Red	JP9/3	11	Red	JP11/3	19	Red	JP12/3	27	Red
JP8/2	2	Brown	JP9/2	10	Brown	JP11/2	18	Brown	JP12/2	26	Brown
JP8/1	1	Black	JP9/1	9	Black	JP11/1	17	Black	JP12/1	25	Black

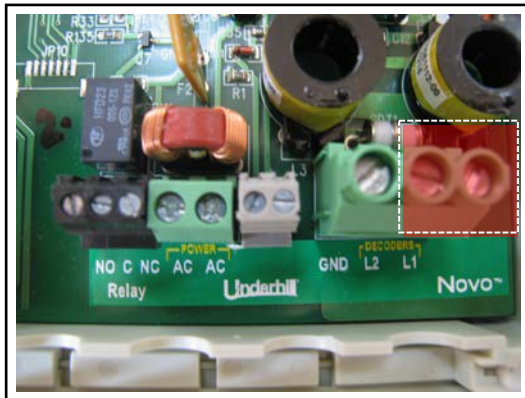Strip back approximately 3/8-1/2" of wire insulation and terminate in the appropriate station outputs of the host controller, then zip-tie the multi-conductor cable assemblies together. Be certain to follow the same color-coding in the table above.

3. Connecting to the 2Wire Communication Path

Locate the three large, green-colored terminal blocks labeled L1, L2 and "GND". See Figure 7-1.

**2Wire Inputs a L1 / L2 and Ground
Terminals Figure 7-1**

Remove approximately 3/8" to ½" of wire insulation of the 2Wire communication cable. Terminate a colored wire of the 2Wire path into the terminal labeled "L2" and another colored wire into the terminal labeled "L1".

4. Installing a Ground Wire (lightning protection) to a Ground Rod

Locate the "Gnd" terminal block shown in Figure 8-1. Insert a bare #14 copper ground wire into this location. Connect the opposing end to a 5/8" diameter x 8' long ground rod or ground plate a minimum of 10 feet away from this location in accordance with the American Society of Irrigation Consultants grounding specifications.
http://www.asic.org/uploads/assets/011007_121320_ASIC_GROUNDING_GUIDELINES.doc

⚠️ Note: Avoid sharp bends in the ground wire where a surge can jump to other conductors when a surge occurs.

Two additional grounding functions that will prolong the consistent operation of a Novo are listed as follows:

1. Connect a #14 AWG gauge wire from the Novo's grounding terminals to the earth ground of the "host "controller. Figures 8-1 shows the location of the grounding terminal for the Novo

Grounding Terminals for the Novo 2Wire Converter
Figure 8-1

Figure 8-2 shows a typical earth ground lug for a host controller such as a Toro Sentinel controller as shown.
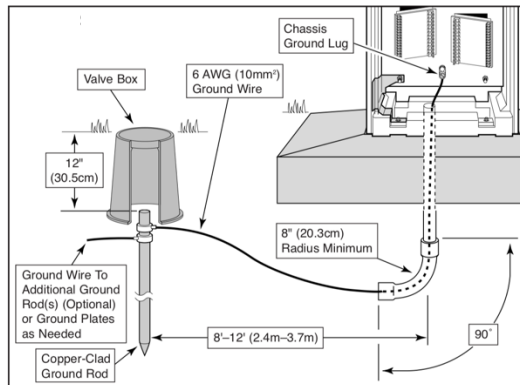
Host's Controller's Ground Lug
Figure 8-2

Connect a #14 AWG wire from the L2 terminal on the Novo to the "host" controller's "valve common" terminal. See Figure 1-1 for the L2 terminal location on the Novo. Figure 9-1 shows a typical valve common (C or VC) input for a "host" controller.
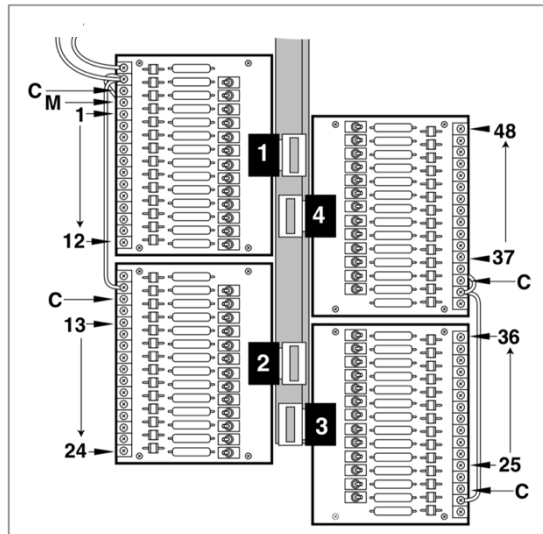
Valve Common Location on a Host Controller
Figure 9-1

Verify the AC/AC input to the Novo is "floating", by using the external transformer provided or Underhill's Line Conditioner kit.

⚠️ Do not use the host controller's 24 VAC auxiliary output typically used for a rain or flow sensor. These outputs commonly have little or no surge protection.

5. Connecting the Novo to an AC Power Source
    Connect the Novo to a 120 or 230-volt, 50 or 60Hz power source using an Underhill external transformer part number TW-34VA-115v or TW-34VA-230v models.

⚠️ Note: Make the wire connections to the Novo terminal block <u>first</u> then plug the opposing end of the transformer into the appropriate power source.

Locate the two, terminal block labeled as "AC" on the Novo terminal block shown in Figure 9-2 below.
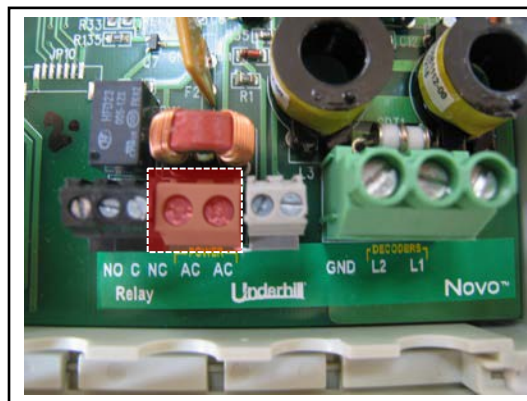
AC Inputs
Figure 9-2

These are non-polarized terminals meaning either wire from the transformer can be terminated in either one of the two terminals. Tighten with a small screwdriver. Plug outward once the wire is tightened to confirm it is properly secured.

⚠️ Note there is a gray set of terminals for a future feature not offered in this unit's software version.

6. More than 32 Stations
The Novo can manage up to 63 stations, given a host controller has this capability.

⚠️ Note: The Sender(s) must be programmed prior to wiring into a host controller.

To add more than 32 stations, install Underhill "Senders" p/n TW-SEN-8 in 8-station increments (see Figure 10-1). Connect the thick red and black Sender wire to the 2Wire path (L1 & L2) as it exits the Novo (see Figure 7-1.
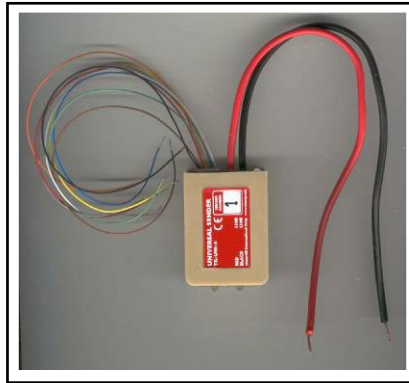
8-Station Sender
Figure 10-1

Program the 8-Station Senders in ascending numerical order starting w/ Sender #5. The black and red wire are to be connected into the 2Wire path parallel to the Novo as shown in Figure 11-1. Using a 12-position, double-sided terminal block will make for a professional looking installation but more importantly will make troubleshooting in the future much faster and easier.

"HOST CONTROLLER'S"
24 VAC STATION TERMINALS

VC 1 2 3 4 5 6 7 8   9 10 11 12 13 14 15 16

33 34 35 36 37 38 39 40   41 42 43 44 45 46 47 48

4–COLOR–CODED
CABLE ASSEMBLIES
COME W/ THE NOVO
FOR STATIONS 1–32

EXTERNAL
POWER
SUPPLY

Novo ™
2WIRE CONVERTER

Underhill

L1 / L2 GND

8–STATION SENDERS
W/ COLOR–CODED
CABLE ASSEMBLIES

5
STATIONS
33–40

6
STATIONS
41–48

7
STATIONS
49–56

8
STATIONS
57–63

8–POSITION
DOUBLE–
SIDED
TERMINAL
BLOCK
(CUT DOWN
FROM 12–POSITION)

2WIRE PATH
OUT TO
FIELD

EARTH
GRND

Novo Wiring Diagram for Stations in Excess of 32 Stations
Figure 11-1

Programming a Decoder

The Novo 2Wire Converter has the ability to program or test a Decoder or 8-Station Sender without the need of a portable programmer. This is a 3-step process but is easily accomplished.

Step 1 – Locate the 4 (qty) thru-holes in the printed circuit board between the AC and 2Wire Com Path terminals as shown in Figure 12-1. Stab the black and red wires of an 8-Station Sender or 4 color-coded wires of a Decoder into these holes.
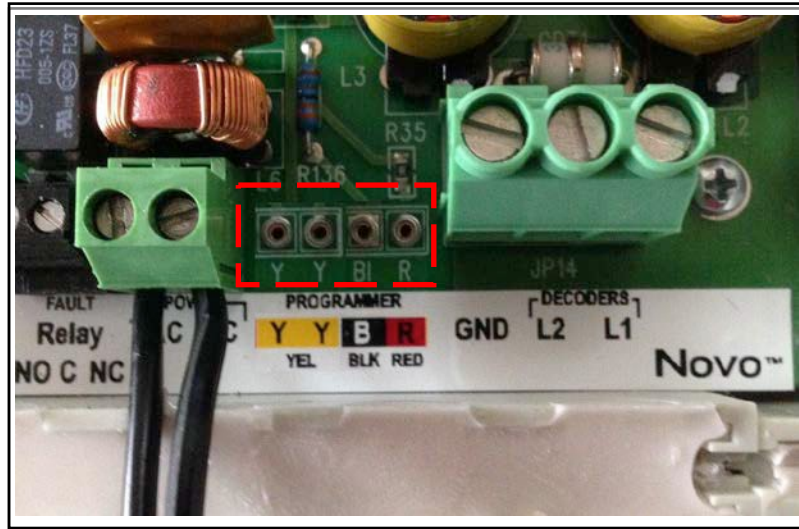
**Programming Terminal on
the Novo Figure 12-1**

Step 2 – Locate the slide switch above the AC terminal block. Slide the switch in the "up" or "PROG" position as shown in Figure 11-2.

**Slide Switc to PROG
Figure 11-2**

Step 3 - Locate and press the "Programmer" menu button located at about 4 o'clock on the Novo keypad. Press the "Next/OK" Button to display several choices listed as:

- Program a Decoder
- Test a Decoder
- Program a Sender
- Test a Sender

Figures 13-1 show both upper level and subsequent submenu w/ selectable choices.
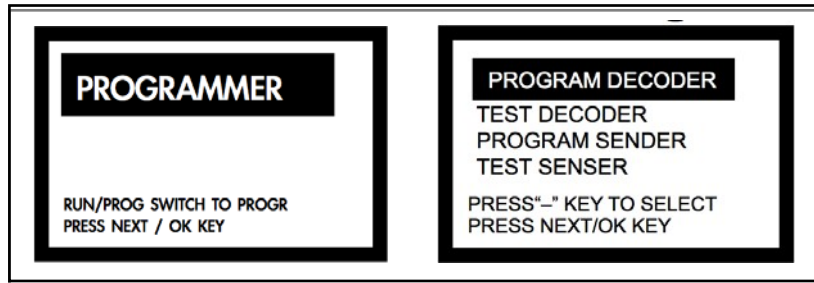
Programming Menu
Figure 13-1

The programming or testing sequence for either a decoder or 8-Station Sender is shown in Figure 13-2 below.
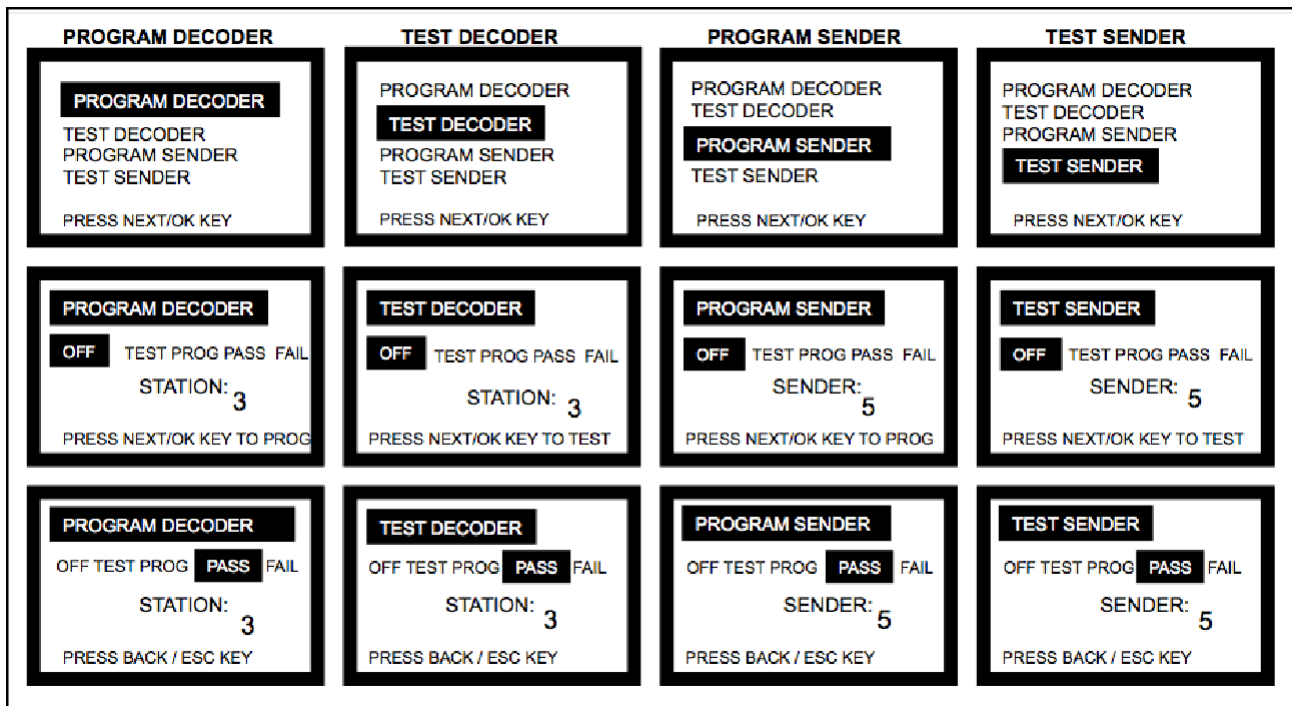
Programming / Testing
Sequence Figure 13-2

An Underhill Portable Programmer p/n DEC-PROG-115 or DEC-PROG-230 can also be used to program a Decoder or 8-Station Sender, see Figure 14-1.
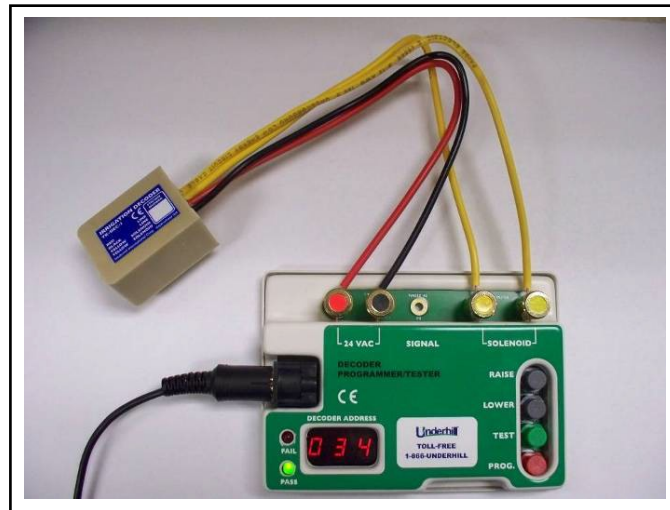
**Portable Programmer for
Decoders Figure 14-1**

To program a Decoder complete the following steps;

1. Plug the red and black wires of the Decoder into the Programmer's red and black push terminals.
2. Plug the two yellow wires of the Decoder into the Programmer's yellow terminals. These are non-polarized so it makes no difference which yellow wire is connected to a yellow terminal.
3. Set the decoders station number by pressing one of the gray "Raise or Lower" buttons.
4. Press the red "Program" button to enter the station number.
5. Press the Green "Test" button to confirm the entered value has been saved. If saved the green "Pass" LED will illuminate and the Decoder's programmed number will display on the LED's. If the red "Fail" LED illuminates re-try programming the decoder with the same or a different station number. Be sure to retest before disconnecting from the Programmer.
6. Write the programmed Decoder number with an indelible pen in the little white box on its label.

Wiring a Decoder to a Valve Solenoid

Once all decoders are programmed and labeled, they can be wired to corresponding valves in the field. The two yellow wires are connected the valve solenoid wires (see Figure 15-1). The red wire lead should be connected to the 2Wire path or L1. The black wire lead should be connected to a black wire representing the 2Wire path or L2. Your 2Wire communication wire color may vary.

⚠️ Note: A pair of DBYR waterproof wire connectors is included with each Underhill Decoder. These are for the 2Wire communication wire where a waterproof connection ensures consistent performance over a longer period of time.
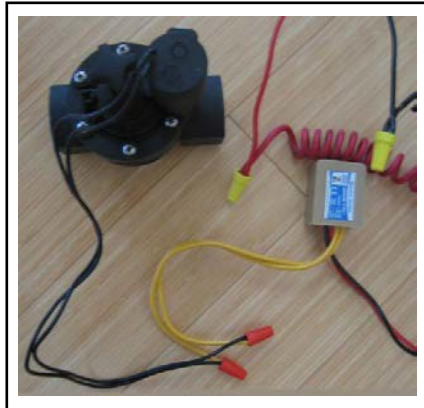
Decoder Wired to a Valve Solenoid
Figure 15-1

Connecting 8-Station Senders to a Host Controller (Beyond 32 Stations)

Connect the small, color-coded wires from the Sender to the host controller's station outputs starting with station 33. Table 2 below identifies the wire color-coding for Senders above 33-63.

Table 2
Universal Sender Wire Color Code

Universal Sender #5		Universal Sender #6		Universal Sender #7		Universal Sender #8	
Sta #	Sender Wire Color	Sta #	Sender Wire Color	Sta #	Sender Wire Color	Sta #	Sender Wire Color
33	Black	41	Black	49	Black	57	Black
34	Brown	42	Brown	50	Brown	58	Brown
35	Red	43	Red	51	Red	59	Red
36	Orange	44	Orange	52	Orange	60	Orange
37	Yellow	45	Yellow	53	Yellow	61	Yellow
38	Green	46	Green	54	Green	62	Green
39	Blue	47	Blue	55	Blue	63	Blue
40	Grey	48	Grey	56	Grey	X	Grey
Com	White	Com	White	Com	White	Com	White

Key Functions

The Novo offers several key functions for periodic normal operation, maintenance or fast and easy troubleshooting.
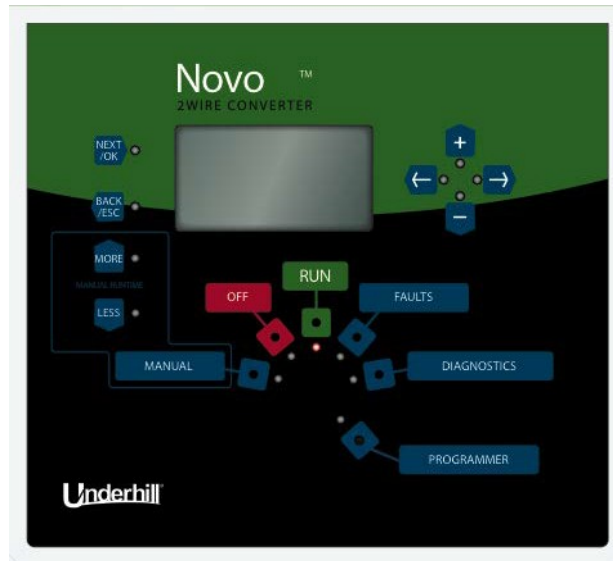
Saves a change that has been edited Moves to a highlighted menu Returns to the top of the menu

Undoes a change made to a value Returns from a submenu to the previous menu Undoes any changes edited
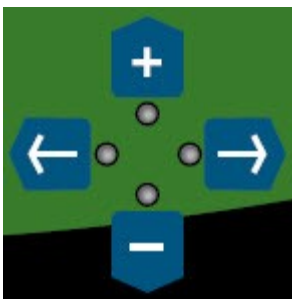
The "left and right" arrow buttons move a highlighted value from left to right or increases or decreases a station number

The "+" or "-" buttons increases or decreases a highlighted value. In manual mode, turns a station "On" (+) or "Off" (-)

Increases or decreases a station's runtime in minutes or seconds

The Novo has five main menus that can be selected similar to a rotary dial by simply pressing the corresponding menu button. When a button is pressed, a small red LED will illuminate providing confirmation of the selected menu.

RUN

This is the primary position when operating decoders from a host controller. The screen will display any station(s) currently operating and the total current draw of all stations operating in milliamps (mA).

⚠ Note: Many host irrigation controllers only operate 2 stations at one time.

⚠ Note: The Novo cannot operate stations automatically from the host controller <u>and</u> a station manually at the same time.

FAULTS

The Faults menu commonly identifies a problem with:
- The 2Wire path such as a nick in the wire or broken wire
- A solenoid that is drawing too much current
- A decoder that has failed or hasn't been addressed with a corresponding station number.

Posted "Faults" can be cleared as a secondary function to verify a repair has been corrected.

DIAGNOSTICS

The Diagnostics menu helps w/ two separate tasks:
- Troubleshoots wire connectivity between the host controller and the Novo or the host controller and 8-Station Senders
- Allows a user to reset decoder threshold settings. See the Troubleshooting section for more details.

PROGRAMMER

The Programming menu enables decoders or 8-Station Senders to be programmed or tested.

OFF
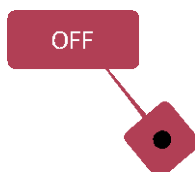
The Off menu is used typically for "winterization" or if the 2Wire path is being extended or repaired. When selected power down the 2Wire path is de-energized and scheduled irrigation commands from the host controller will not operate.

MORE
MANUAL RUNTIME
LESS
MANUAL
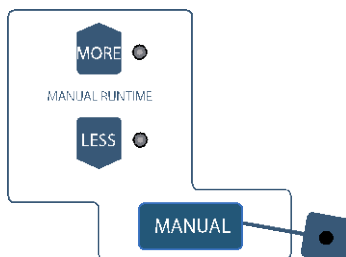
The Manual menu allows the Novo to operate any station with a decoder independent of the host controller. This can be a useful troubleshooting tool. The default run time is 2 minutes but can be increased or decreased using the "More or Less" button.

Example Screens & Their Keys

The Novo uses buttons to select menus.

RUN

RUN

The RUN menu will display any one of the following 3 display screens depending on the task currently being executed:

1. Pressing the RUN button puts the Novo into "automatic mode" to accept commands from a host controller. When in RUN mode, the 2Wire path is energized. See Figure 18-1.

This example will be displayed when a station or stations are operating from a host controller during scheduled irrigation, see Figure 18-2.

| RUN | 0mA |
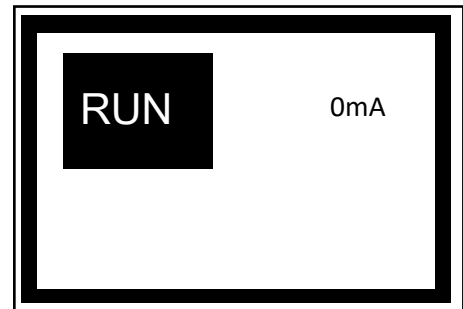
Figure 18-1 is the default screen when the Novo is connected to a "host" controller when irrigation is <u>not</u> operating

| RUN | 462 mA Faults! 2 12 |
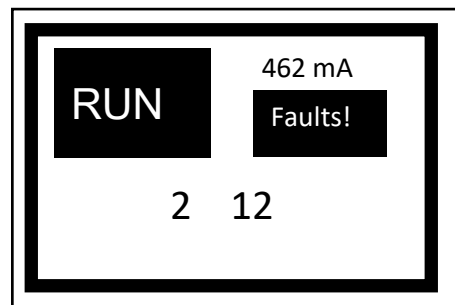
Figure 18-2 shows stations 2 and 12 are operating. The current draw on the 2Wire path is approximately 462mA (0.462A), which is the sum of all:
- Decoders (3mA per decoder)
- Any external Senders (3mA)
- The current taken by the 2 operating valve solenoids (in this example 228mA per solenoid).

This screen will be displayed when a decoder does not respond to a host controller command and "FAULTS" appears, see Figure 18-3.
1. Pressing the **FAULTS** menu button will display faulty station(s) and whether it failed to turn "On" or failed to turn "Off".
2. Pressing the **RUN** button will return to the above RUN screen, with the "Fault" message removed automatically.

| RUN | 462 mA Faults! |
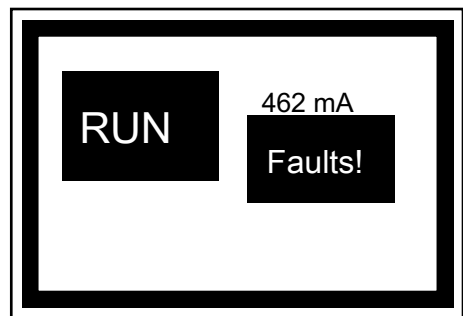
Figure 18-3 indicates a "Fault" that can be any one of the following issues:
- A field wiring issue between the host controller and Novo terminal blocks,
- A decoder that is not programmed correctly,
- A break in the 2Wire communication.

⚠️ Note: When in the **RUN** mode, there may can an 8-10 second delay from the time the command is entered in the host controller before a station will operate. When operating a station from the Novo in MANUAL mode, the delay is 1-2 seconds.

FAULTS

FAULTS

Pressing the FAULTS button will display stations that have failed to turn "**On**", for a maximum of 7 stations per display screen. See Figure 19-1.

```
STN    FAILURE
1      FAIL TURN OFF
2      FAIL TURN OFF
3      FAIL TURN OFF
4      FAIL TURN OFF
5      FAILTURN OFF
6      FAIL TURN OFF
7      FAIL TURN OFF
```

View Faults

1. Pressing the **"Down"(-)** button will display the next 7 stations up to the total number of station wired into the host controller.
2. Pressing the **"Up" (+)** button will scroll back up to the previous 7 stations.

Figure 19-1 Indicates:
- Stations 1, 2, 3, 4, 5, 6 and 7 have failed to turn off, (if a station fails but sequentially starts working again, it will be excluded from this list).

⚠️ Note: The Novo does not display the time or date of when a failure occurs.

3. Pressing the "**NEXT/OK**" button will navigate back to the top of the "Faults" list.
4. If a station fails in (RUN) or (MANUAL) modes it will be displayed in the FAULTS menu.

Clear Posted Faults

Faults will automatically cleared at the next scheduled start time or can be manually cleared to verify that a field repair has been fixed.

To "**Clear Displayed Faults**", press the "**Down**" (**-**) button to highlight the submenu as shown in Figure 19-2. Then press the **"NEXT/OK"** button to select.

```
VIEW FAULTS LIST
CLEAR  DISPLAYED FAULTS
```
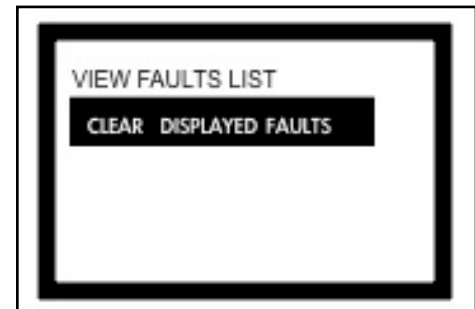
Figure 19-2. To clear a "Fault' press the "-" button to highlight this task.

Pressing the **"NEXT/OK"** button a second time will clear all displayed faults and the following screen will appear providing confirmation. See Figure 19-3.

```
SAVED OK
```

Figure 19-3. Press the "Next/Ok" button confirmation of clear message is displayed.

DIAGNOSTICS

The DIAGNOSTICS menu can perform two separate functions;

- Confirms if commands between the Novo and a host controller are being received.
- Provides a method to change the factory default threshold values of decoders under certain field conditions.

Figure 20-1 shows the top level of the Diagnostics Menu. Pressing the "Next / OK" button will display the screen below.

1. Press the **DIAGNOSTICS** button to display the following screen see Figure 20-1.
2. Press the **NEXT/OK** button to "View Sender Commands" shown in Figure 20-2.

View Sender Commands

In this display the Novo verifies there is a wired connection to the host controller.

1) Pressing the **NEXT / OK** button will show the following in Figure 20-3.
2) Pressing the **Down** "**-**" button will select the lower submenu.

Figure 20-2 displays two Diagnostic menus. Pressing the "Next / Ok" button will display the "View Sender Commands" screen while pressing the "-" button will select the lower menu, "Edit Decoder Setup"

⚠ Note: Any row displayed with a "+" is "On" even if the decoder has failed to operate. This is useful in determining whether a non-operating station is actually receiving information from the host controller (through the Novo or an external Sender(s).

3) When the host controller turns on a station, the corresponding station position will be displayed as an **"+"** symbol.
4) Other stations not turned "On" will be displayed as a "**-**".
5) A row of "-" indicates the Sender is note connected to the 2Wire path, or is programmed incorrectly or is faulty.
6) If a station is displaying a "+" symbol and the corresponding decoder hasn't come on, then refer to the Troubleshooting Section. If a "_" or "." Is displayed, then it is not being asked to turn "On". Verify the Novo station wiring or Sender (if installed) wiring color and order on the host controller

Figure 20-3 Displays stations 1-32 as available. Stations 33-63 are available when 8-Station Senders are installed.

⚠ Note: Station 64, although displayed is not usable and will always be a "." Or "-" even if Sender #8 is connected to a host controller.

View Decoder Setup

To select the "View Decoder Setup" menu, press the **Down "-"** button to highlight the title, then press the **NEXT/OK** button to view additional information in this submenu. See Figure 21-1.

1. This function allows the user to alter default decoder thresholds only when the Novo fails to keep a station running during a scheduled start time or manual operation. The high and low decoder threshold settings can be changed if very low holding current valves are in use or if two stations are tied to a single decoder.
2. This operation is a value-added feature of the Novo to accommodate rare field conditions. See Figure 21-2.

```
VIEW SENDER

EDIT DECODER SETUP
```
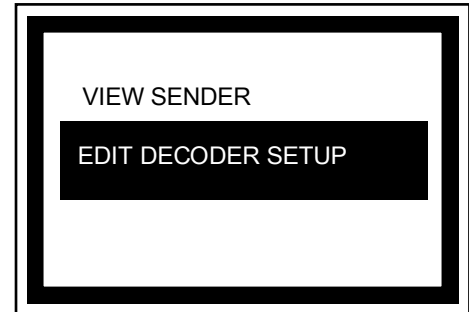
Figure 21-1 Press the "-" button to select "Edit Decoder Setup", then press the "Next / OK" button to move to the next screen.

```
DECODER SETUP

OK – SAVE, ESC- REJECT

LOW mA    HIGH ma    DWELL mS

  67        945        100
```
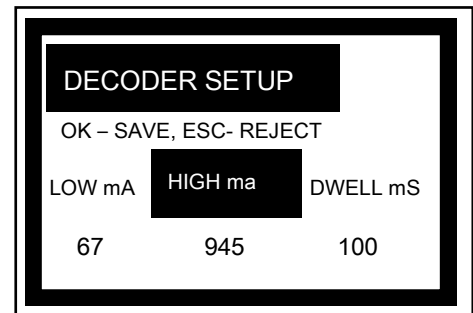
Figure 21-2 shows the factory default settings for decoder thresholds for "Low, High and Dwell" time values. See the "Troubleshooting" section for more details.

PROGRAMMER

When selected the Programmer menu can test or program a decoder or an 8-Station Sender depending on the number of stations to be managed via 2Wire.

To test or program a Decoder or 8-Station Sender refer to page 13.

OFF
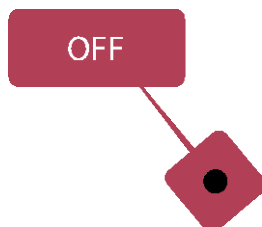
Pressing the OFF button, immediately stops any currently operating irrigation and <u>turns off power to the 2Wire path to decoders.</u> The Novo is turned off until the "Run" menu is selected. See Figure 22-1.

SYSTEM OFF
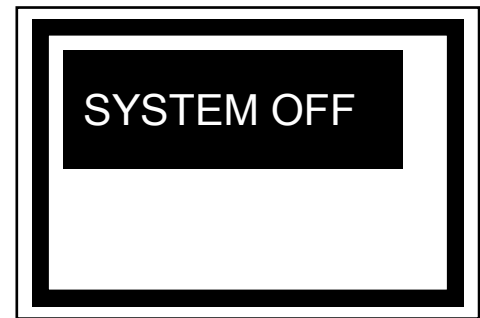
Figure 22-1 shows the display once the "OFF" button has been selected.

MANUAL
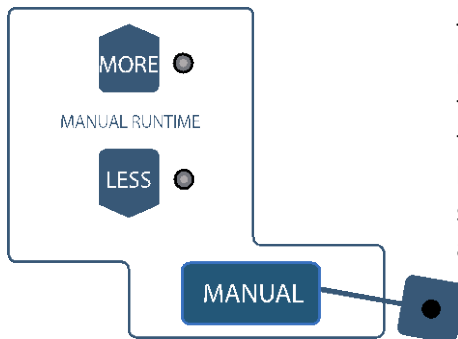
The MANUAL menu can be used for testing and troubleshooting to isolate a field issue independent of a host controller allowing a single station to be operated at one time.

MAN. ON/OFF   0mA

PRESS + ON, - OFF

STATION: **1** READY 0:02:00

Figure 22-2 shows station 01 running for 2 minutes.

1. The default runtime is 2-minutes but additional time can be added by pressing the "**More**" button up to 9 hours. See Figure 22-2

⚠   Note: When entering this menu, automatic operation from the host controller is suspended.

2. To advance to the desired station press the **RIGHT** or **LEFT** buttons.
3. When a station is running, the screen display will change from "READY" to "RUNNING", with the station number and time left displayed underneath the station currently selected.
4. To turn the station "**On**", press the **Up** "**+**" green button. The station run time is shown next to 'RUNNING', shown as h:mm:ss and displays remaining time once the station is started.
5. To turn the station "**Off**," press the green button **Down** "**-**" button
6. To select the next desired station, press the **RIGHT** or the **LEFT** buttons.
7. The default runtime is 2 minutes. To select a shorter runtime press, the "Less" button to the left of the Manual menu button.

⚠   Note: Approximately1-2 seconds will elapse before the next station turns on.

Advanced Features

The Novo can be used with PLC or SCADA-type host products that can monitor and alert when a decoder fails to turn "on" or "off." There are 3 relay terminals, Normally Open (NO), Common (COM) and Normally Closed (NC) available, see Figure 23-1 to locate these terminals. This requires a hardwire path between the Novo and a PLC or SCADA product for this advanced feature to operate.

When connected to a PLC or SCADA product and a faulty station is being operated, the NO and COM are connected.
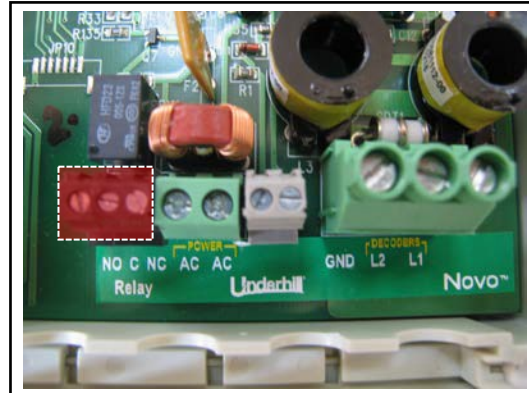
Advanced NO / NC
Inputs Figure 23-1

2Wire Communication Path & Maximum Wire Distances

The 2Wire communication path can be 18, 16 or 14 AWG, solid-core, 600 volts UF specifically for direct burial applications. It is recommended that a continuous wire length (meaning no wire splices) between the Novo and the first decoder or between decoders is maintained whenever possible. If wire splices are required, these should be located in a 6" round valve box and spliced with "3M DBYR" connectors and no other approved equal.

⚠️ Note: Failure to make waterproof connections on the 2Wire path can lead to shorts and loss of operation to all decoders downstream of the failed splice.

The maximum length of 2Wire for 14 AWG is 4000' from the Novo to the furthest decoder operating one valve at a time. See Figure 24-1.
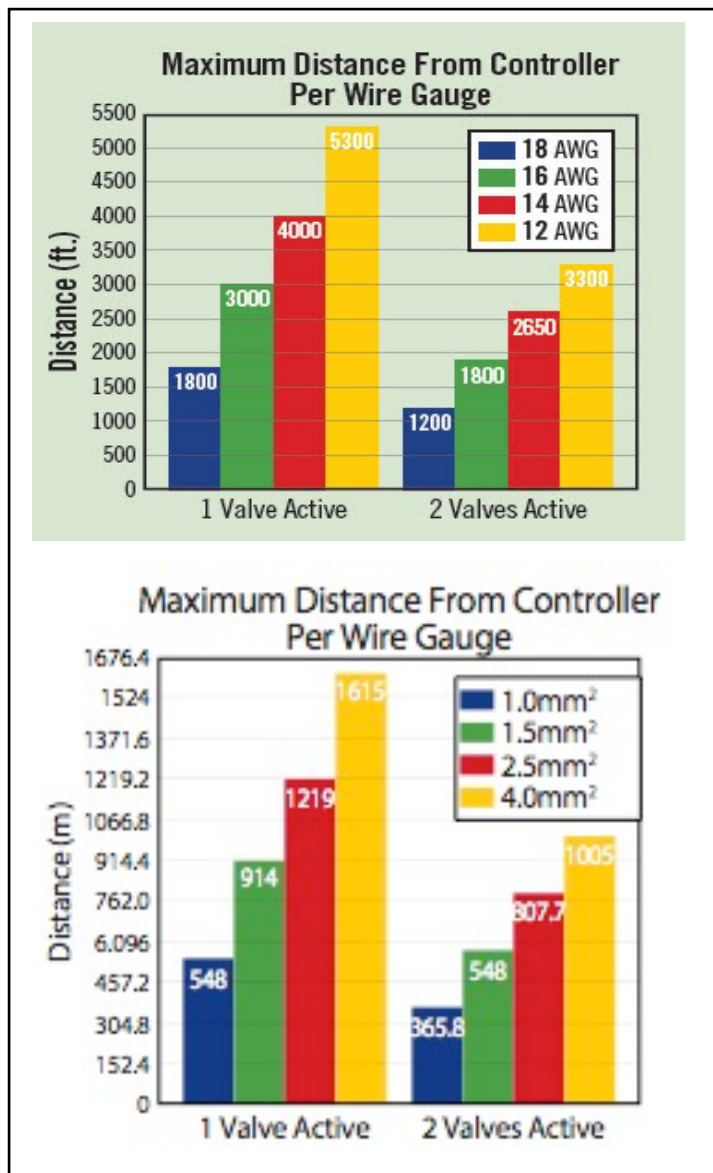
Maximum Distance from Controller per Wire Gauge Figure 24-1

Troubleshooting

The following table identifies possible field conditions that might be encountered, possible root causes and troubleshooting techniques to remedy the issue.

Problem	Possible Cause	Possible Solutions
No stations will operate from the host controller.	The Novo is not powered. The display is not backlit.	Use a multi-meter and verify the incoming AC/AC terminals have 24-32VAC. If no power can be measured than verify if 120v or 230v is being delivered to electrical circuit on the plug side of the transformer.
	The station wires between the host controller and the Novo are not connected properly.	Use the "Diagnostics\View Sender Commands" screen to view whether messages are being received from the host controller. (i) Operate the host controller in manual mode and observe if the sender input screen display changes from a "-" to a "+" when the host's station output is live. (ii) If the screen remains "-", then check the color-coded wire connections between the host controller and the Novo. If using an 8-Station Sender verify the color-coding and verify the wire connection is on the conductor and not the wire insulation.
	The 2Wire path is broken or shorted.	Use the 'Manual' screen to operate a station. Observe the total current draw in mA displayed on the screen. Too low means the 2Wire path is broken, too high means a short circuit somewhere. (i) Correct current: When no stations are running: (no. of decoders x 3mA) When a station is running: (no. of decoders x 3mA) + Solenoid's current {typically 250mA}

Problem	Possible Cause	Possible Solution
A single station is not operating.	If the station number is not displayed in the "Faults" screen then:	The first step is to check for issues between the Novo and the host controller. • Press the 'Diagnostics" menu button and then select "View Sender Commands" screen. • Operate the host controller in manual and observe if the display for the station number changes from "-" to a "+". • If a "-" is displayed, verify the station wire between the Novo and host controller is the correct color (see Table 1) and if its terminated in the correct station output of the host controller.
	If the "Faults" screen displays a "fail turn on" for a specific station:	The second step checks for issues downstream of the Novo down the 2Wire path to decoders. • Verify the decoder's address is incorrect. Remove and test the decoder using the Novo. • A wire connection between the decoder and the 2Wire path is broken. Locate and repair as needed. • A wire connection between the decoder and the solenoid is broken. Repair the wire connection. • There is a short circuit in the solenoid. Verify using a multi-meter set to Ohms resistance. If the Ohm value is higher than 65 Ohm, replace the solenoid. • The decoder is faulty. Replace the decoder and program a new decoder with the corresponding station number.

Problem	Possible Cause	Possible Solutions
Several stations above 32 (stations) are not operating when using external Senders.	If several stations above 32 are **not** displayed in the "Faults" screen then:	The first step is to check between the external Sender(s) and the host controller. • Press the 'Diagnostics" menu button and then select "View Sender Commands" screen. • Operate the host controller in manual and observe if the display for the station numbers change from "-" to a "+". • If a "-" is displayed, check the Sender input wires in the host controller are properly connected. • If there is row of "." then the Sender red and black wires are not connected to the 2Wire path. • The Sender has not been programmed between 5-8. Verify using the portable programmer. • The Sender is defective and should be replaced, (remember to program with the right Sender number using the portable programmer).
	If the "Faults" screen displays a "fail turn on" for a group of stations:	The second step checks for issues downstream of the Senders down the 2Wire path to decoders. • The decoder's address is incorrect. Remove and reprogram. • A wire connection between the Sender and the 2Wire path is downstream of the Novo is broken. Locate and repair as needed. • A wire connection between the decoder and the solenoid is broken. Repair the wire connection. • There is a short circuit in the solenoid. Replace the solenoid.

Problem	Possible Cause	Possible Solutions
A station(s) will begin to operate but then immediately turns off.	The increase in current of the decoder/ station solenoid exceeds or is below the factory default settings in the Novo. (This is an extremely rare occurrence).	Use the "Diagnostics\Edit Decoder Setup" to change these values. Do not attempt this without calling Underhill for additional technical assistance.
While in the RUN menu, a message appears at the bottom of the display saying "RUN/PROG".	If testing or programming a Decoder or 8-Station Sender, the slide switch is in the "RUN" position.	Open the Novo clamshell and locate the slide switch above the AC terminals. Push the switch into the "PROG" position.
	If operating the Novo under normal conditions and it won't respond to some menu commands	If operating the Novo under normal operation, confirm the slide switch is in the "RUN" position
A Decoder or 8-Station Sender cannot be programmed	The slide switch is in the "RUN" position	Move the slide switch into the "PROG" position to test or program a Decoder or 8-Station Sender
The Novo display is blank (it's on but no visible characters"	The transformer wire is not adequately secured to the AC terminal block.	Verify the wire connections are tight. Remake the connections only after the transformer is unplugged from a power source. Verify the power source is delivering 120 or 230 volts AC.
	The Novo has been damaged from a power surge or lighting strike	If there is a strong odor of burnt electronics or scorch marks observed on the printed circuit boards or components, then replace the Novo. Verify the Novo is properly grounded. There is a ground lug to the left of the L1/L2 terminal positions. Proper grounding does not guarantee complete protection against a lighting strike or power surge.

Electrical Specifications

Novo 2Wire Converter

Maximum AC input voltage	32V ac
Maximum continuous 2Wire main path current	1 .2A AC
Maximum stations (zones) active together	6
Maximum solenoid continuous current*	1A
(1000mA) Operating Ambient Temperature Range (full power)	+5 -
+40degC	
High Temperature Operation	Derate linearly from 1.2A at 40^{0}C to 0.6A at 70^{0}C

Humidity 5%-90% non-condensing

*To avoid the Adapter registering a shorted solenoid. Can be adjusted in DIAGNOSTICS, view High/Lo Threshold Dwell screen.

Waterproof to NEMA 4, IP65 (when cables correctly clamped into case)

Novo Terminal Blocks **(JP8, 9, 11, 12)**

Input voltage to register a station (zone) active	12V-30V
AC or DC Isolation between Sender inputs/common and L1/L2	1000V
peak Isolation from JP8, 9, 11, 12 terminals valve common to AC/DC valve common	100V

Individual Station Decoders

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

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

8-Station Universal Senders

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 (no stations operating)	20 VAC
Maximum voltage on L1/L2 of Sender	32 Volts
Sender sense standard wires length	9" (230mm)
Sender common standard wire length (white wire)	12" (300mm)

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 Novo 2Wire Converter and the Station Decoder conforms to the European Directive 89/336/EEC

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