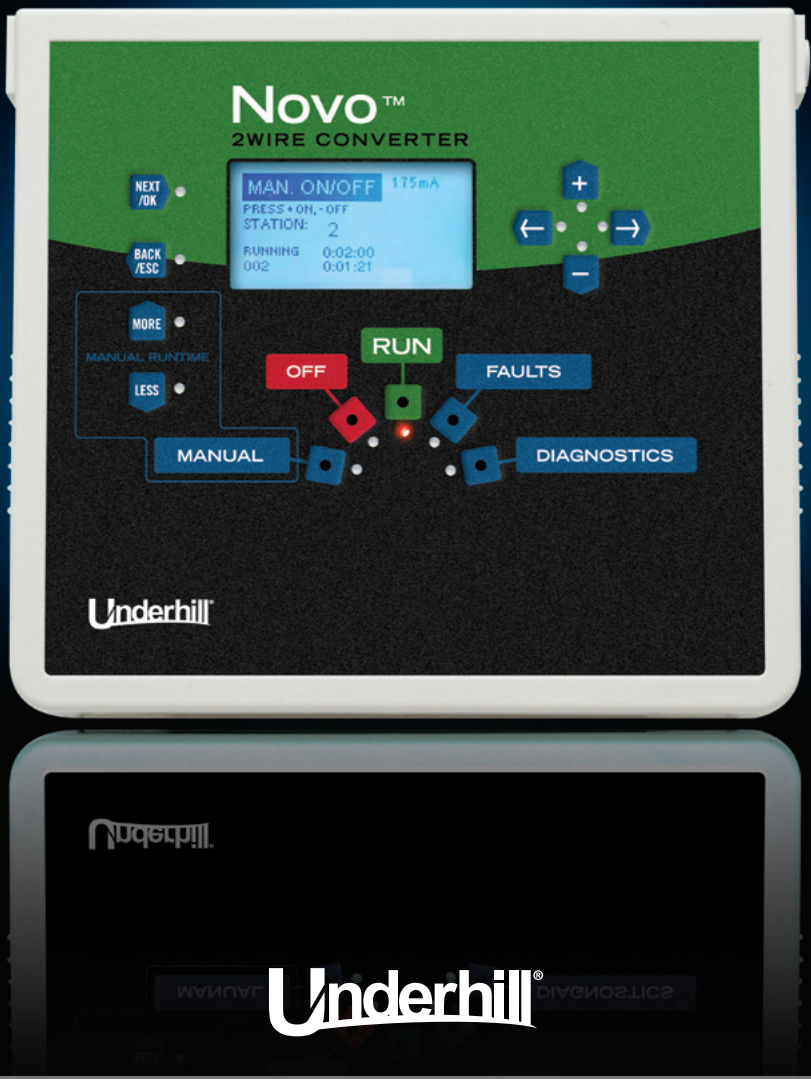
Novo™

63-Station 2Wire Converter

OPERATION MANUAL



Underhill®

Products that work…smart.™

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INTRODUCTION

Congratulations on the purchase of Underhill International's Novo™ product offering ease of installation and operation for large estate and light to medium commercial irrigation applications.

Product Benefits

The Novo™ is easy to install and operate offering a number of customer benefits that also reduces field troubleshooting when needed.

- 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 32 stations on a 2Wire system using any host conventional multi-wire irrigation controller. 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 Senders. See Product Overview on the page 3.
- Proven – Install with a high level of trust knowing that Underhill has more than 200,000 station decoders installed worldwide.
- Will operate with poorly insulated wire when retrofitting a multi-wire system. Uses pure AC power to the decoders so no electrolytic destruction of field wiring occurs.
- No additional grounding is required along the 2Wire path, except at the Novo.
- No special shielded communication wire is needed for the 2-Wire path which 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.

SYSTEM OVERVIEW

How does it Work?

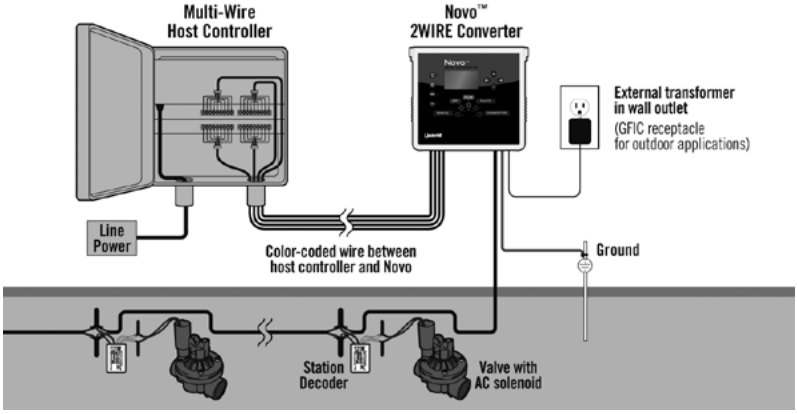
The following two diagrams represent typical installations of the Novo™ depending on how many stations need to be managed. The Novo allows any conventional, multi-wire, irrigation controller to manage a 2Wire system with Underhill decoders. This is accomplished by mounting the Novo to a vertical surface and connecting the included color-coded wire to a host controller's station outputs. The Novo in turn converts signals to the 2Wire communication path to individual station valves with decoders.

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-35VA-115V or TW-35VA-220v are compatible with this product only.

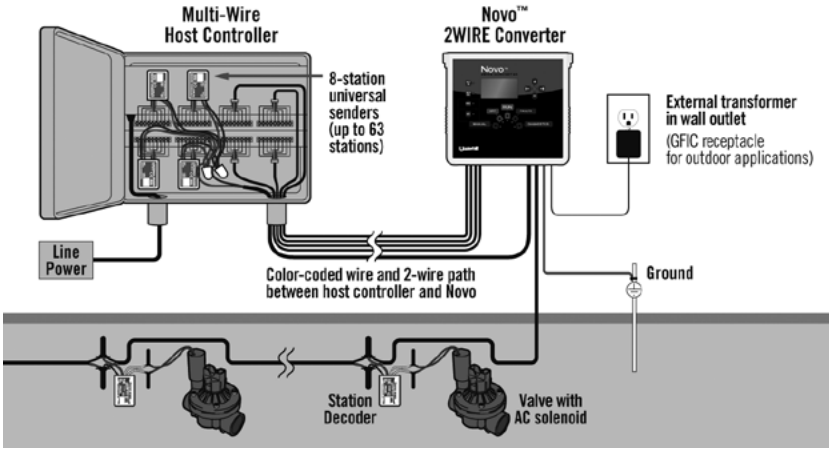
Figure 2-1 depicts the Novo with a host controller managing up to 32-stations.

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.



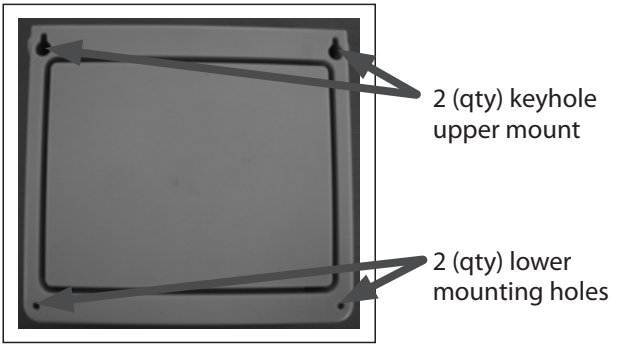
MANAGING UP TO 63 STATIONS
Figure 3-1

Note: Assumes the host controller must have sufficient stations to manage 63 stations or if two stations are combined to a single decoder using a controller with fewer stations.

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.



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. An outdoor enclosure to accommodate the Novo and transformer can be ordered separately p/n TW3-PLC.

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.

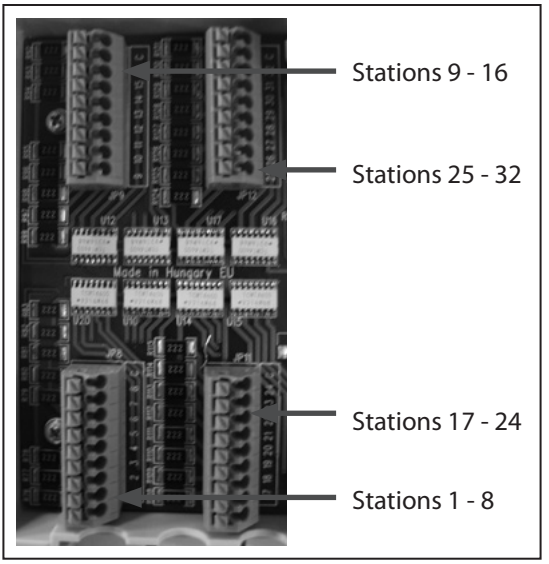
Wiring the Novo

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.

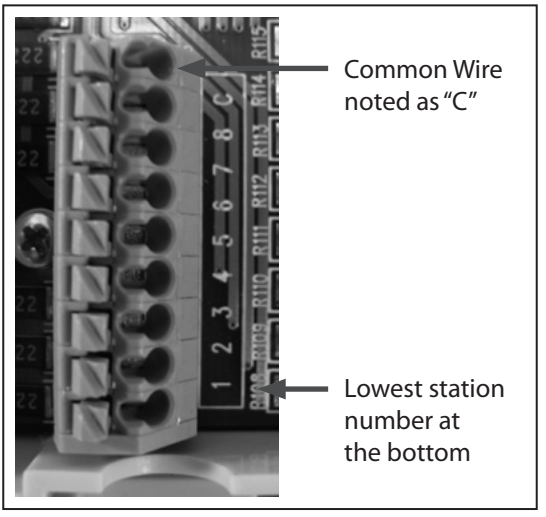
2. Connecting the Novo to a Host Controller
   Locate the 9-conductor, multiple-colored wire that is included with the Novo. Four (qty) x 36" lengths of wire are included providing connection between a host controller and the Novo for up to 32 stations.

   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 2-1 & 3-1.

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



NOVO FIELD WIRE TERMINAL BLOCKS
Figure 5-1



VALVE STATION SEQUENCING
Figure 5-2

The Novo comes with four sets of color-coded, pre-installed cable assemblies but 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.

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

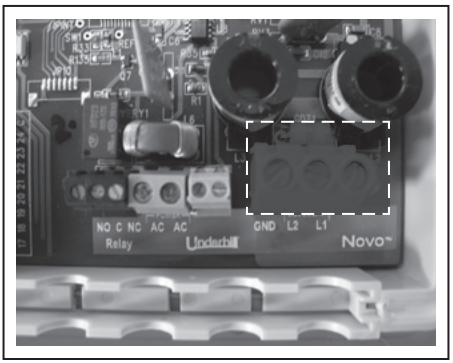
Table 1

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

Zip-tie the multi-conductor cable assemblies together. Strip back approximately 3/8-1/2" of wire insulation and terminate in the appropriate station outputs of the host controller. 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 6-1.



2WIRE INPUTS AND GROUND TERMINALS

Figure 6-1

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 6-1. Insert a bare #14 copper ground wire into this location. Connect the opposing end to a 5/8" diameter x 8' long ground rod 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

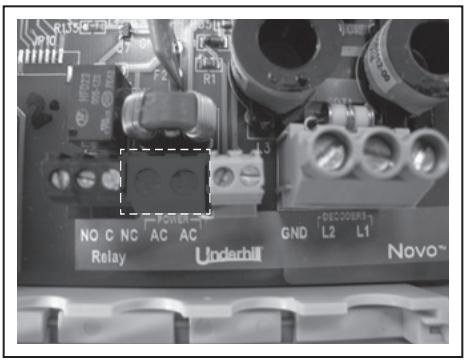
Note: Avoid sharp bends in the ground wire where a surge can jump to other conductors when a surge occurs.

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-35VA-115v or TW-35VA-230v models.

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

Locate the two small terminal block labeled as "AC" on the Novo terminal block shown in Figure 7-1 below.



AC INPUTS
Figure 7-1

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.

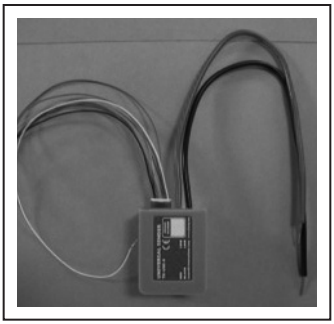
Note there is a gray set of terminals for a future feature not offered in this unit's software version.

6. Adding 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 8-1). Connect the thick red and black Sender wire to the 2Wire path (L1 & L2) as it exits the Novo (see Figure 3-1).



8-STATION SENDER
Figure 8-1

PROGRAMMING A DECODER

An Underhill Decoder p/n TW-TK-DEC-1 is connected to each valve solenoid to be operated from the Novo and a host controller. Each decoder must be programmed using the Underhill Portable Programmer p/n DEC-PROG-115 or DEC-PROG-230 with the corresponding valve station number. See Figure 8-2.

PORTABLE PROGRAMMER FOR DECODERS
Figure 8-2

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 9-1). 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**.

DECODER WIRED TO A VALVE SOLENOID
Figure 9-1

PROGRAMMING AN EXTERNAL SENDER

For applications **above** 32 stations, Underhill 8-station External Sender's p/n TW-SEN-8 can be used up to manage up to 63 stations. These are programmed using the same portable programmer. The Sender addresses must be programmed from 5-8. For example, stations 33-40 is activated with the Sender address 5, while stations 41-48 addressed as 6.

The following are steps to program a Sender. See Figure 9-2 shows a Sender connected to a Portable Programmer.

1. Plug the red and black wires of the Sender into the programmer's red and black push terminals.
2. To set the Sender's address on the programmer's LEDS (value 5-8) by using the "Raise or Lower" buttons, then press the red "Prog." button.
3. The programmer will display CH0, CH1, CH2, CH3, then SN1, SN2... until it finds the Sender's existing number, then will program the new number into it. If successful, the **Green** pass LED will come on and the Sender's new number will display on the LED's. Immediately after programming, the LED in the bottom of the Sender will flash the same number of times as the address programmed.
4. Write the Sender base address with an indelible pen in the little white box on its label.

PROGRAMMING A UNIVERSAL SENDER
Figure 9-2

CONNECTING SENDERS TO A HOST CONTROLLER

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	
Sta #	Sender Wire Color
33	Black
34	Brown
35	Red
36	Orange
37	Yellow
38	Green
39	Blue
40	Grey
Com	White

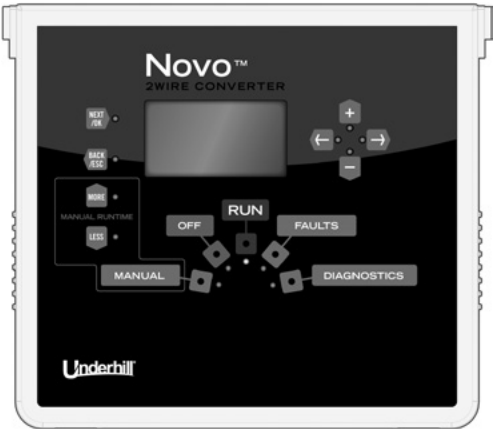
Universal Sender #6	
Sta #	Sender Wire Color
41	Black
42	Brown
43	Red
44	Orange
45	Yellow
46	Green
47	Blue
48	Grey
Com	White

Universal Sender #7	
Sta #	Sender Wire Color
49	Black
50	Brown
51	Red
52	Orange
53	Yellow
54	Green
55	Blue
56	Grey
Com	White

Universal Sender #8	
Sta #	Sender Wire Color
57	Black
58	Brown
59	Red
60	Orange
61	Yellow
62	Green
63	Blue
X	Grey
Com	White

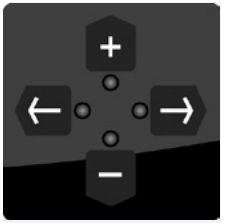
KEY FUNCTIONS

The Novo offers several key functions for periodic 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



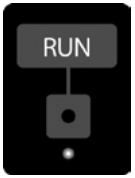
The "left and right" arrow buttons move a highlighted value from left to right or increases or decreases a station number

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

DIAL POSITIONS

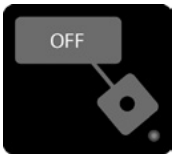
The Novo has five main menus that can be selected similar to a rotary dial by simply pressing the corresponding menu button. When a button is pressed, a small red LED will illuminate providing confirmation of the selected menu.



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 and a station manually at the same time.



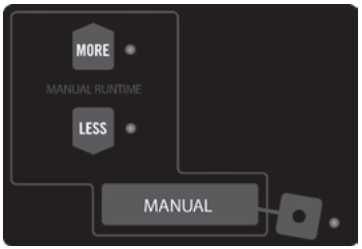
This menu is commonly used when the system is shut-off typically associated with "winterization" or if repairing or extending the 2Wire path. In this mode scheduled irrigation commands from the host controller will not operate and AC power to the 2Wire path is de-energized.

Faults identifies when a station is not working. The problem may be the

- 2Wire path,
- A decoder,
- A station solenoid.

The Diagnostics menu provides two separate functions:

- Determines if a command is received between the Novo and a host controller.
- Allows a user to reset decoder threshold settings. See the Troubleshooting section for more details.



The Manual menu allows the Novo to operate any station independently from a host controller.

EXAMPLE SCREENS & THEIR KEYS

The Novo uses buttons to select menus.

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

Figure 13-1 shows when the Novo is connected to a host controller when irrigation is not operating.

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 13-1.

This example will be displayed when a station or stations are operating from a host controller during scheduled irrigation, see Figure 13-2.

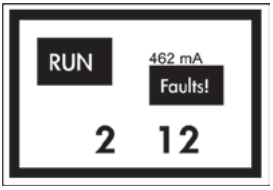


Figure 13-2 shows stations 2 and 12 are operating. The current draw on the 2Wire path is approximately 462mA (0.462A), which is the sum of all:

- *Decoders (3mA per decoder)*
- *Any external Senders (3mA per Sender) and,*
- *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 14-1.

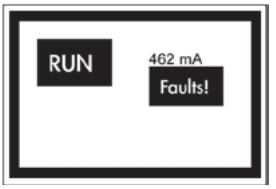


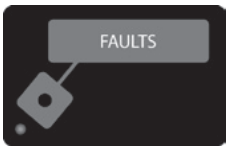
Figure 14-1 indicates a "Fault" that can be any one of the following issues:

- *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. path.*

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.

Note: When in the* RUN *mode, there may be a 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.



Pressing the FAULTS button will display stations that have failed to turn "On", for a maximum of 7 stations per display screen. See Figure 14-2.

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

Figure 14-2 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).*

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.

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

Pressing the "**NEXT/OK"** button will navigate back to the top of the "Faults" list.

If a station fails in (**RUN**) or (**MANUAL**) modes it will be displayed in the FAULTS menu.

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.

1. Press the **DIAGNOSTICS** button to display the following screen see Figure 15-1.
2. Press the **NEXT**/**OK** button to "View Sender Commands" shown in Figure 15-2.

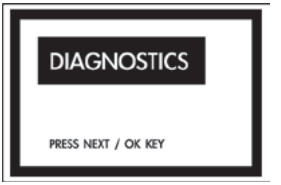


Figure 15-1 shows the top level of the Diagnostics Menu. Pressing the "Next / OK" button will display the screen below.

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 15-3.
2. Pressing the **Down** "**-**" button will select the lower submenu.

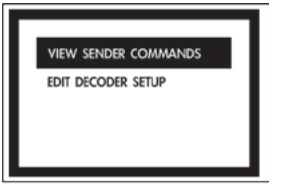


Figure 15-2 displays two Diagnostic menus. Pressing the "Next / Ok" button will display the "View Sender Commands" screen while pressing the "-" button will select the lower menu, "Edit Decoder Setup"

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 "**-**".

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

5. If a station is displaying a "**+**" symbol and the corresponding decoder has not 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 on the host controller. A row of "." indicates the Sender is not connected to the 2Wire path or is programmed incorrectly or is faulty.

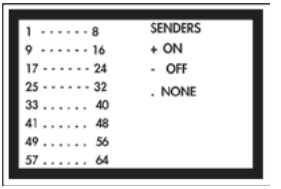


Figure 15-3 displays stations 1-32 are available and stations 33-64 do not have Senders currently connected

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 16-1.

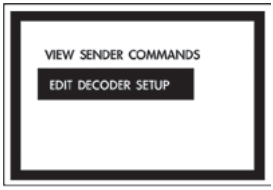


Figure 16-1 Press the "-" button to select "Edit Decoder Setup", then press the "Next / OK" button to move to the next screen.

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 16-2.

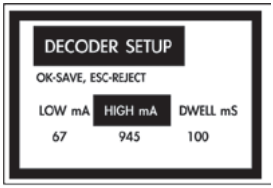
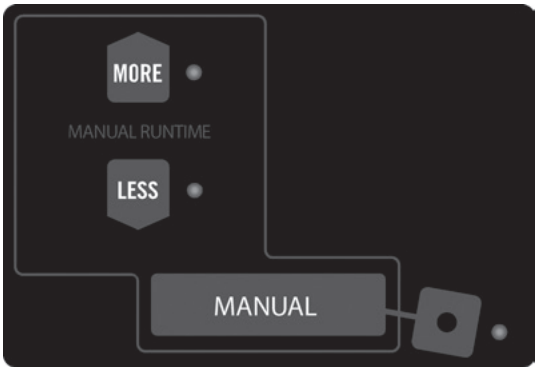


Figure 16-2 shows the factory default settings for decoder thresholds for "Low, High and Dwell" time values. See the "Troubleshooting" section for more details.



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.

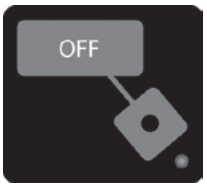
1. The default runtime is 2 minutes but additional time can be added by pressing the "**More**" button up to 9 hours. See Figure 16-3.

Figure 16-3 shows station 01 running for 2 minutes.

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: Approximately 1-2 seconds will elapse before the next station turns on.

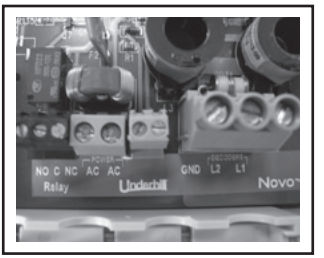


Pressing the OFF button, immediately stops any currently operating irrigation and **turns off power to the 2Wire path to decoders**.
The Novo is turned off until the "Run" menu is selected.
See Figure 19-1.

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 17-2 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.



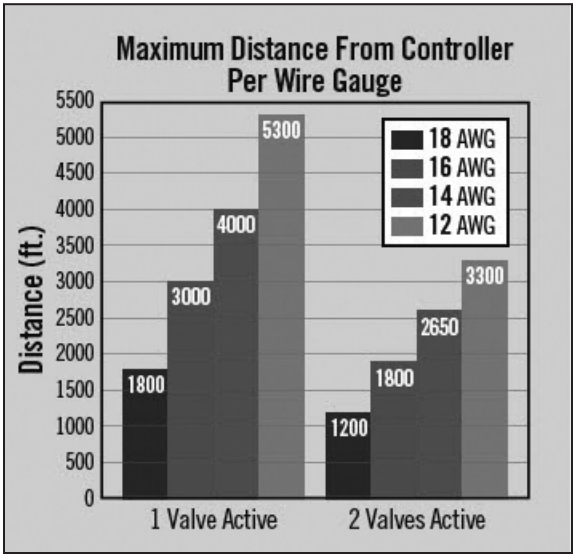
ADVANCED NO / NC INPUTS
Figure 17-2

2WIRE COMMUNICATION PATH & MAXIMUM WIRE DISTANCES

The 2Wire communication path can be 18, 16, 14 or 12 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 18-1.



MAXIMUM DISTANCE FROM CONTROLLER PER WIRE GAUGE
Figure 18-1

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 on the screen goes 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.
	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}
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 reprogram the decoder using the portable programmer. • 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. 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.
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.

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 valve common	100V AC/DC

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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WARRANTY

Underhill International Corporation (Underhill) warrants its trade customers that its products will be free from original defects in material and workmanship for a period of two years (commencing on the date of original sale to the trade customer) as follows:

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