NELSON

Wireless Controls

IRRIGATION TECHNOLOGY FOR THE FUTURE

twig

User Guide

INTRO - QUICK SETUP/PROGRAM

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3. How to Setup the TWIG system
4. Programming Instructions
5. Using the Adjust function
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QUICK SETUP/PROGRAM

SETUP TD200 CONTROLLER

1. Power on then rotate the left dial to SETUP.
2. Select ‘Set Date & Time’ on the list and press ENTER. Adjust then exit.

See section 3 for details about the network setup.

PROGRAM

3. Rotate the left dial to PROGRAM.
4. Select ‘CREATE PROGRAM’ on the list and press ENTER.
5. Create a name for the new program.
6. Set initial time that each group will run. Individual group watering duration can be adjusted when defining groups.
7. Set the number of groups (groups are valves that run altogether).
8. Select the TWIGs wanted in each group.
9. SAVE the program.
10. Turn left dial to adjust, change status to ready, then you can start the program.

See section 4 for more detail about programing the TD200 and setting the network.

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1.0 INTRODUCTION TO NELSON WIRELESS CONTROLS

The Nelson wireless control basically consists of TWIG units on valves that are operated by the TD200 controller. It provides remote operation for up to 100 TWIGs used in connection with Nelson valves. In addition the TD200 provides a historical data log of the field watering events.

1.1 WIRELESS VALVE CONTROL SYSTEM COMPONENTS:

Two main components make the communication in the field: the TD200 controller and the TWIG field units. The system uses the license free 900 MHz radio band to send wireless commands to TWIG units. Radio communication is transmitting and receiving information every 20 seconds.

TWIG

VALVE

TD200 CONTROLLER

ONE TD200 CAN CONTROL UP TO 100 TWIGS.

1.2 TWIG NETWORK ESSENTIALS:

Follow this guide to assure you get the right signal to the right place and have a reliable system. Watch for the 'TWIG note' graphic that highlights tips and suggestions. 

1.2.1 CAREFULLY LOCATE THE CONTROLLER AT THE FIELD. The TD200 controller is the heart of the control system. It is best to locate it near a central place so that the distance to each TWIG is minimized. Typically, electric power is available near the pump so the TD200 is usually placed there. Antenna efficiency improves when located at a high point so keep that in mind when choosing the controller location. The controller cabinet is designed for outdoor use and is water resistant. However, it is a good idea to provide some cover to help it last longer and reduce temperature and moisture aging.

1.2.2 STAY WITHIN SIGNAL RANGE.

REMEMBER TO LOCATE THE CONTROLLER SO THAT TWO WAY COMMUNICATION IS GOOD FOR ALL TWIGS.

A common problem is to space the TWIG units too far apart and not consider obstructions that can block the signal. Be sure to check the range guide in Section 7. Weak signal strength can make a difference in battery life. That is because a weak signal may result in failed communication requiring the controller to frequently retry thus using more battery power. Batteries are an essential part of the system and effective power management has been designed-in. Remember the system is two-way and the radios will have to work harder if there are a lot of "retries" required. Keep within range to have a good, reliable system.

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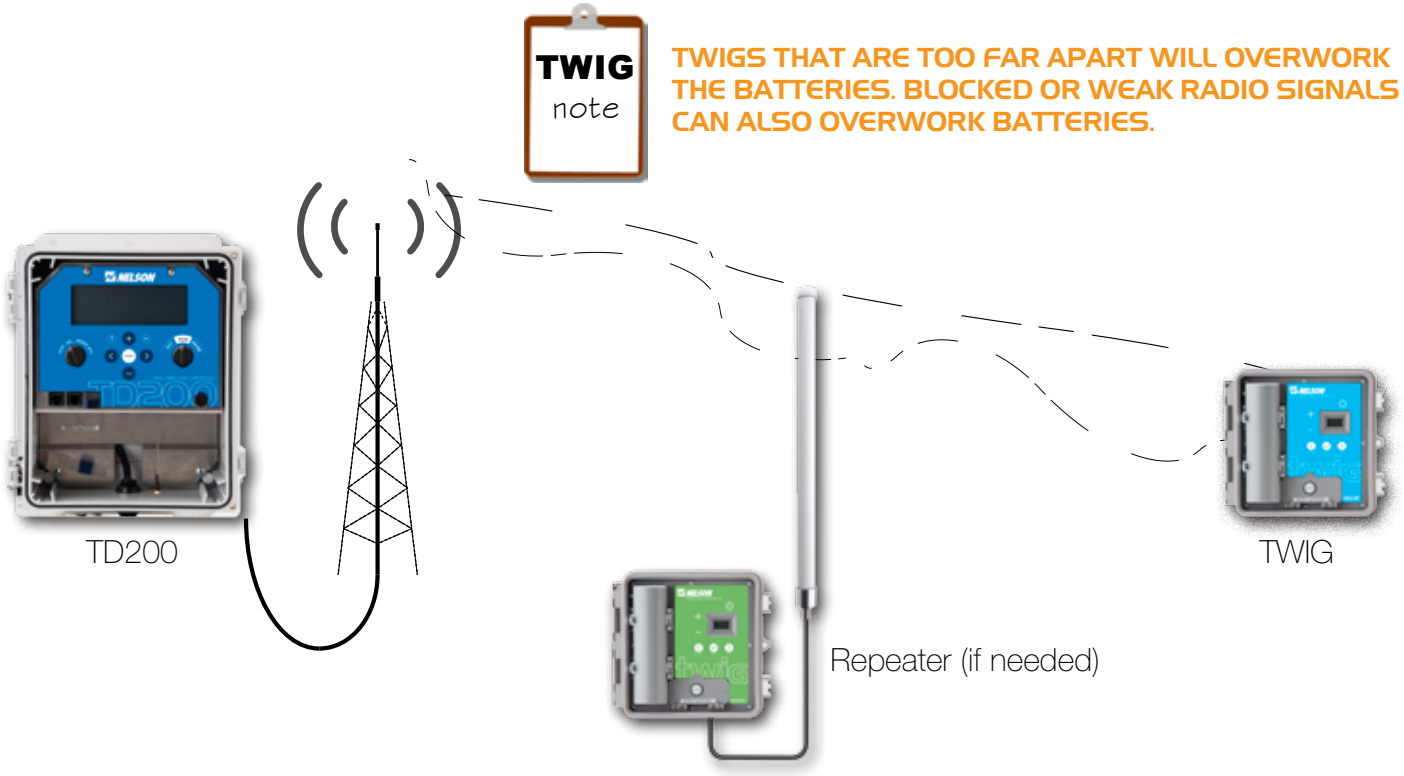
1.2.3 USE OF REPEATERS. If the distance to the valves exceeds the signal range then use a repeater to make the communication reliable. A communication chain is no better than the weakest link. The potential for a communication break increases as more repeaters are in a chain. A network that utilizes direct TD200 to TWIG communication will be more robust than one with a long repeater chain. Remember the allowable number of repeaters for one TD200 is nine.



1.3 THE TWIG LIST OF GOOD WIRELESS PRACTICES:

Following some rules of good practices will provide for successful radio communication. Operating outside of good practices may cause your communication to malfunction and stop working.

- Keep within the recommended range. Locate antennas as high as practical.
- Stay within the recommended environmental limits. Plan for crop growth so it does not block the signal and so that you can have good communication for the life of the crop.
- Never operate with any other battery or power source than specified.
- It is not allowed to co-locate (be next to each other or closer than within 12 inches) with other radios and to transmit simultaneously.
- Never operate with any other antenna than what is supplied for approved use.
- TWIG wireless control systems are pre-approved by the FCC and do not require licensing; however, installations near an airport are subject to stricter rules. Check with the local FCC for more details.
- Keep in mind that the TWIG should be accessible because they contain batteries that will need to be replaced after some period of time.

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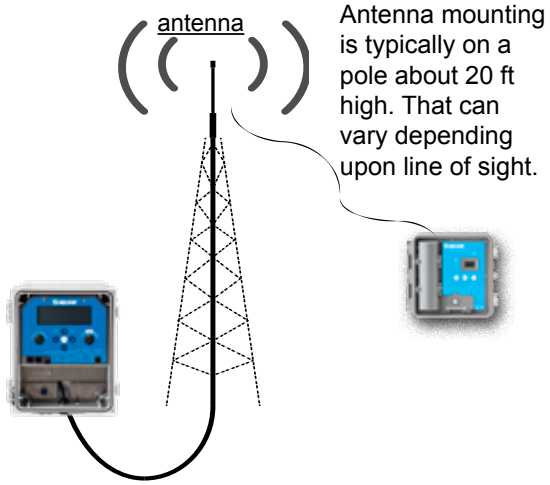
2.0 OVERVIEW OF SYSTEM COMPONENTS

The wireless control system is built with Nelson's powerful radios inside the TD200 controller and the TWIG field units. Two way communication is between the TD200 and the TWIGs. These join together to make a field network.



2.1 THE CONTROLLER ANTENNA:

The antenna for the TD200 is the communication focal point for signals to and from the field. Take great care in locating the antenna. Typical mounting elevation is 20-30' high if possible but not more than 50'. A clear line-of-sight between the TD200 and the TWIGs is essential for strong communications. The network is made when the TWIGs join up to the TD200 controller.

2.2 THE TWIG HAS INTERNAL ANTENNAS:

Each TWIG has internal antennas that send and receive. To work it must receive the TD200 signal. The TWIG has a display for configuration so it can easily be setup in the field. It is important that the TWIG box be in the upright position to get a good signal (don't lay the TWIG box on back or side). You may be able to get slightly better antenna strength if the box door latches are lined up toward the controller. More information about TWIG setup is in Section 3.

2.3 CONTROLLER SIGNAL AND VALVE RESPONSE TIME:

The TWIG system communicates every 20 seconds which provides good response time. However, radio transmissions are sent to check and confirm valve status at the top of the minute. Remember valves may take a few seconds to actually change switching open or close.

TWIG note

SAFETY PRESSURE RELIEF IS AN IMPORTANT PART OF A GOOD DESIGN AND HAVING IT IS THE FIRST RULE OF AUTOMATION.

2.4 MULTI-VALVE TWIGS CAN OPERATE MORE THAN ONE VALVE:

One advantage to having valves close together is that a multi-valve TWIG is able to operate up to four valves. A pair of wires is connected to each of the valve solenoids and the TD200 recognizes each one as an independent valve by the last digit in the TWIG ID (1,2,3 or 4). Extension wires to solenoid should be not more than 50 ft long. More information about wire connection is in Section 7.

2.5 BATTERY LIFE IS WELL MANAGED BY TWIGS:

The TWIG is designed to manage battery life using a latency (deep sleep) technology to get the longest service life. Two "D-cell" batteries in the TWIG typically work for a whole season. Standard alkaline batteries were selected because they are readily available.

TWIG note

PLAN TO REPLACE BATTERIES ANNUALLY ON A REGULAR BASIS (SOME USERS DO IT AT THE START OF THE SEASON).

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3.0 HOW TO SETUP THE TWIG SYSTEM

Start the system setup at the TD200 controller. Otherwise you may waste time because the network cannot be setup if the TD200 is not turned on. When powered on, the TD200 controller sends the radio transmission signals and permits the appropriate TWIG units to join with it. The following sequence are the steps to take for setup.

3.1 MAKE A FIELD MAP FOR WIRELESS CONTROL:

The first thing to do is get a field map. This will help you place the TD200 controller in the best place. Using the map, determine the distances from the controller to each TWIG valve. Check the line-of-sight and avoid any obstacles. Typically a TWIG-1 model will be needed at each valve. In some situations the multi-valve model can be used if the valves are separated only by a short distance (50 feet or less). Keep within the allowed range shown on the bar graphs in Section 7. Considering the crop and the elevation of the antenna, make a plan for any repeaters that will be needed. The map will be useful later to write the TWIG ID number next to each valve.

TWIG note

BEGIN YOUR SYSTEM SETUP AT THE TD200 CONTROLLER. ALWAYS MAKE A FIELD MAP BEFORE DOING A CONTROL PLAN.

3.1.1 TD200 RADIO COMMUNICATION UTILIZES A STAR NETWORK.

The “star” network is a simple route of the radio signal. The sketch below shows how a TD200 controller “star” network links to the TWIGs. Keep in mind that the radio can project in all directions at once, so very complex signal routes can be developed. The TWIG communication is directly to the controller. If a TWIG Repeater is used then the link distance can be extended.

TWIG note

THE STAR ROUTING IS UTILIZED BECAUSE IT IS EASY TO SETUP AND TO TROUBLESHOOT. TWO-WAY COMMUNICATION IS DIRECT BETWEEN TWIG AND TD200

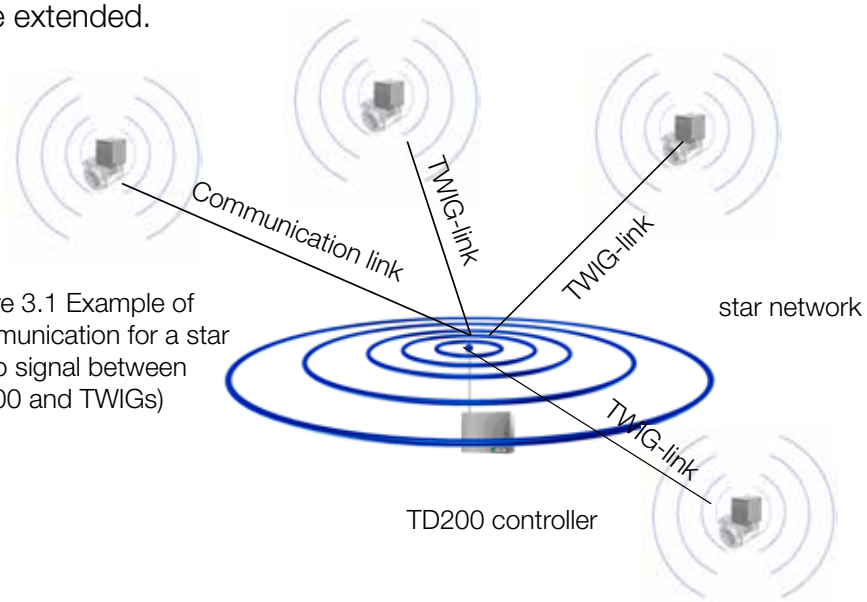

Figure 3.1 Example of communication for a star (radio signal between TD200 and TWIGs)

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3.2 THE TD200 FRONT PANEL:

Figure 3.2

Press ENTER to select line where ▶ is pointing. Then press ENTER to save a change.
Use the navigation buttons to move around and change values on the display screen.

▶ Line pointer

★ Edit or change of input

Valve open

Valve closed.

Battery level of the lowest TWIG

Radio signal strength bars

+++ Set Programs to cycle continuously.

More information available by pressing the right arrow.

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3.3 SETTING UP THE CONTROLLER

Start by setting up the TD200 date and time. This information is used for scheduling and for logging data.

3.4 SCREEN DISPLAY FOR EACH DIAL

The selections for each dial are listed here. There are four lines that show on the screen and the lower lines can be seen by using the scroll down button to show all available options.

TWIG note

PRESS THE ? BUTTON ANY TIME TO DISPLAY THE ON-SCREEN HELP. WHEN THE HELP SCREEN SHOWS, PRESS RIGHT ARROW FOR MORE INFORMATION.

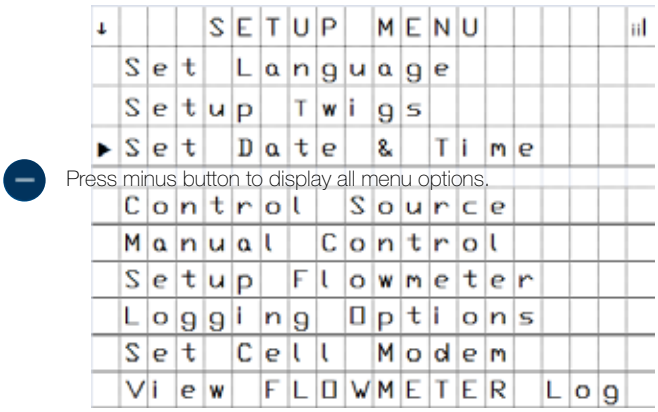

Figure 3.4.1
SETUP MENU

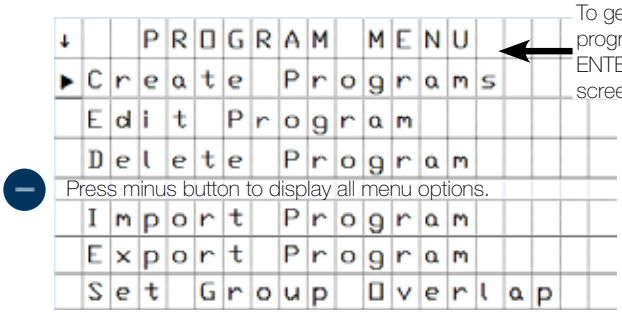

Figure 3.4.2
PROGRAM MENU

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Figure 3.4.3
ADJUST DIAL MENUS

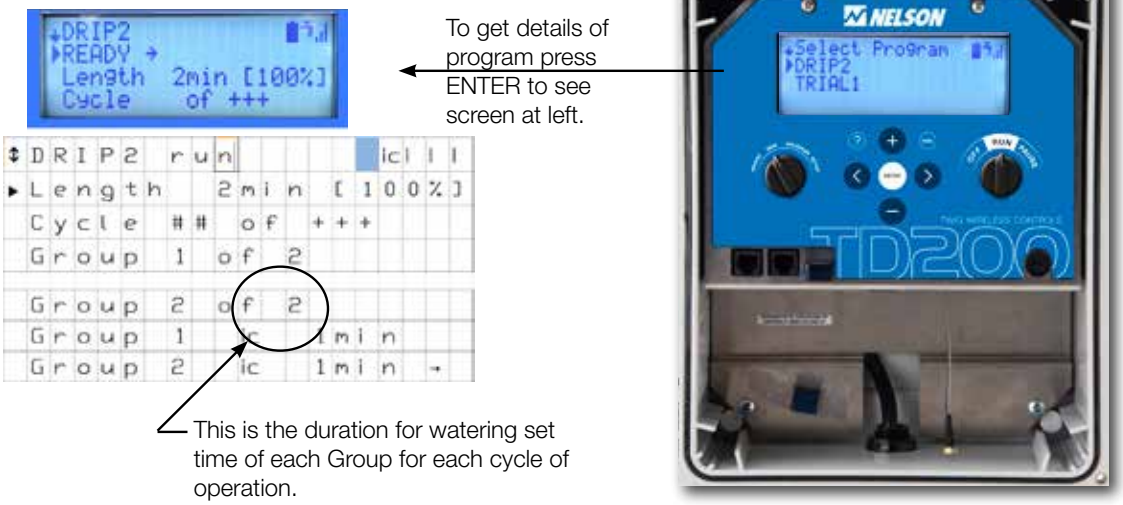

Figure 3.4.4
ADJUST (SELECT PROGRAM) MENUS

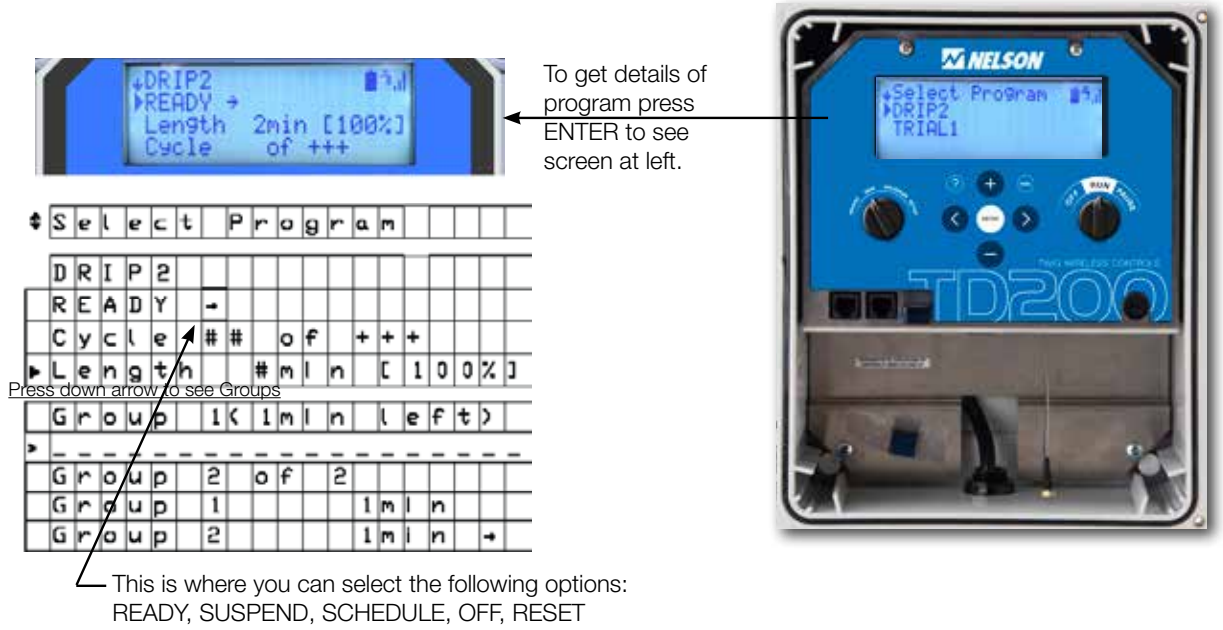

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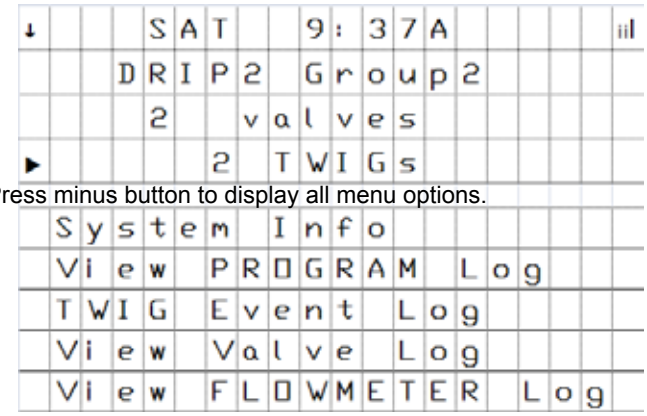
Figure 3.4.5
VIEW SCREEN



The purpose of the VIEW screen is to show the status of the programs, the watering duration and time remaining for Groups. You can rotate the dial to VIEW at any time without causing a change to operation of the programs.

3.5 TWIG MENUS:

Exploring the TWIG. When the TWIG is shipped from the factory it has its own identity number (ID). ID numbers beginning with A operate one valve, B two valves and D four valves.

Identity number (ID) is factory set.

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Press Enter to wake the display. Remember the radios are still working even when the display goes blank. If the TWIG is not in a network then 'none' will display. If the TWIG is joined into a live network, the display shows the 'S' followed by bars for radio signal. Maximum is six bars. The bars indicate how strong the radio signal is between the TWIG and the TD200 controller.

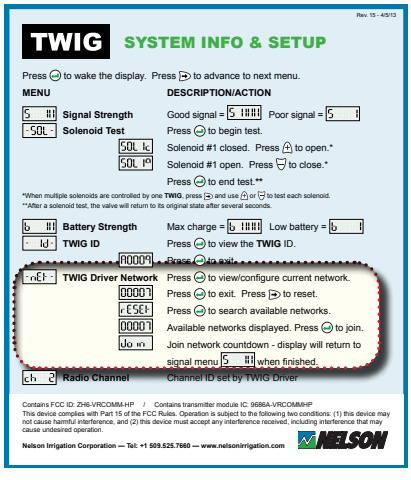
Press the right arrow and the three letters -SOL- (SOL=solenoid) and the dash marks appear. The dashes indicate an action is available. To test the solenoids, press ENTER. Arrow to the right to display the solenoid number. Press + to switch the solenoid ON and − to switch the solenoid OFF. When finished press ENTER to end test.

Press the right arrow. The bars displayed here indicate the voltage charge of the 'D' cell batteries in the TWIG. Press the right arrow to see ID. Here the dashes indicate available information. Press ENTER. The display shows the ID for this TWIG. This ID is in the TWIG memory and cannot be changed. Press ENTER again to go back. Press the right arrow to see NET. Here the dashes indicate available information. Press ENTER. The display shows the network ID.

3.6 SETTING UP THE TWIG IN A NETWORK:

Start the TWIG network process by having power to the TD200. It is best to set the display dial to VIEW. That way you can see the ID number of TWIGs that join. Go through the TWIG reset process explained on the door card (sample is shown in Figure 3.4.2). The essential part of the TWIG setup is the highlighted portion. If the display is blank then press ENTER to wake the display. Remember the radios are still working even when the display goes blank.

Press the right arrow until you see NET. Press ENTER. If the TWIG is already in a network, the ID of the networks TD200 will appear. If you want to join a new or different controller network, press the right arrow and see RESET. Then press ENTER and the TWIG will begin a search to discover available TD200 controller networks. The TWIG can join only one network at a time. If there are no networks available in the area, the word 'Find' will flash. When a TD200 is discovered then its number will be displayed on the TWIG display and remain for about 3 seconds. While the number you want is still on the display, you must immediately press ENTER. During the joining process the display will alternately flash "Join" and seconds remaining until it is done. If you happen to miss the number you want then it will cycle back in a short time so you can try again to select it. When done, the signal bars will appear on the display. The TWIG has joined a network. Now you can press and hold the plus button if you want to see the radio signal strength. The maximum signal number possible is 84 and normally a number higher than 20 is adequate.



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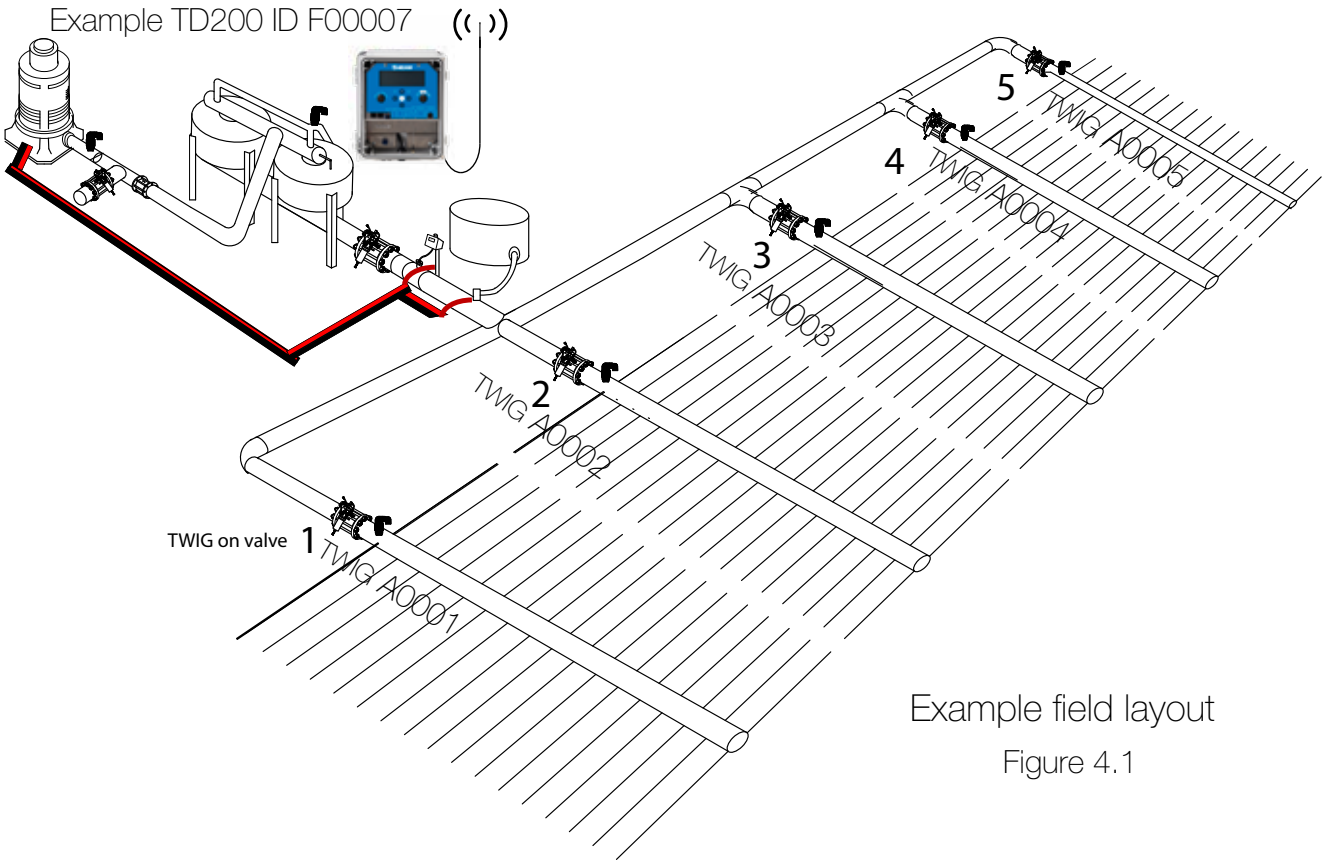
4.0 HOW TO PROGRAM THE TD200

Start the system program setup at the TD200 controller. Otherwise you may waste time because the network can not be setup. When powered on, the TD200 controller sends the command signals which permits the appropriate TWIG units to join with it. The following sequence are the steps to take for setup.

4.1 MAKE A FIELD CONTROL VALVE PLAN:

The first thing to do is get a field map! It will help you place the TD200 controller in the best place.



Example field layout

Figure 4.1

Next using the map, Go to the field to check the line-of-sight and avoid any obstacles. Keep within the allowed range shown on the bar graphs in Section 7. Then consider the crop and the elevation of the antenna, make a plan for any repeaters that will be needed. Write each TWIG ID address label onto the map.

TWIG note

CREATING A MAP THAT SHOWS THE ADDRESS OF EACH TWIG CAN SAVE A LOT OF TIME.

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4.2 SETTING UP THE TD200 CONTROLLER

THE TD200 MUST BE ON BEFORE THE NETWORK WILL WORK. TURN IT ON FIRST.

Start with the dial on SETUP. Then set the TD200 date and time. This information is used for scheduling the water and for logging data.

4.2.1 SERIAL NUMBER ADDRESS CONVENTION:

It is convenient to know the first letter in the serial number indicates the device type. 'A' is used for TWIG-1, 'B' is for TWIG-2, 'D' is for TWIG-4, 'E' is for the TWIG repeater, 'F' is for the TD200. Each TD200 ID has been assigned before leaving the factory. It is unique and can not be changed.

4.2.2 ON-SCREEN HELP

Press the ? button any time to display the On-Screen Help. When the help screen shows, press the ⊳ for more information.

4.3 EXAMPLE OF CREATING A PROGRAM

A field will have only one TD200 controller. It is generally located near the pump but may be any convenient place.

Step 1. With the marker on the CREATE PROGRAM line, you may press ENTER here if you want to give your program a special name. Move down to the next line. Press minus and then ENTER to see where you can set an amount of time that your groups of valves will water. You can adjust this later also. For this example change the time down to 5 minutes using the minus button. Press ENTER to continue.

Step 2. Suppose we want make three groups of valves to run each group following one right after the other. Next move down and set the groups to 3. Press ENTER to continue.
The line "DEFINE GROUPS" is where you enable valves to be active in the appropriate group. All the valves within a Group will water at the same time. You see the list of TWIG addresses each representing one of your valves. You select the valve you want included in the GROUP #1. Press ENTER to make + visible. Repeat for all others you want to water in GROUP 1. Notice GROUP 1 is at the top of the screen.

Next press the right arrow to enable setup for the valves active in Group 2 (notice the GROUP changed to 2) then do the same for Group 3. Be sure to make the plus sign visible for all valves to be included in each Group. When finished, press the ESC so you can see where to SAVE. You have created and saved this program into memory. It's that simple.

Step 3. Let's verify now. Rotate the dial (left) to adjust. The name of the program P2 is visible and is set "OFF".

Step 4. To use this new program you need to set the program to READY by pressing the ENTER and scroll to select "READY" then press ENTER. Now the program is ready to water when you turn the dial to "RUN". The program will start within a few seconds. Watch the seconds countdown. The seconds are visible in parenthesis. That is how you run any of your programs.

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5.0 USING THE ADJUST FUNCTION

The TWIG programs can easily be changed in the adjust menu. Programs can be set to either READY, OFF, SCHEDULED or RESET. Changes to any program can be adjusted for watering different length of time or different number of cycles.

5.1 EXAMPLE OF MAKING AN ADJUSTMENT TO WATERING TIME:

Let's do an example rotating the dial to ADJUST. The list of programs becomes visible. Scroll down the list to the line for program you want. We can adjust program times. Cycles is the number of times you want each group of valves to water before being finished.

Length is the amount of time for one complete water cycle of all groups. Group is the status of valve group in the program. The time that is shown left (or remaining time) is to complete the cycle that is running. If the program is not running anything then dashes are here.

The list shown below is for each valve Group number in order.
To demonstrate the 'Length" adjustment put the marker on the Length line and press ENTER. This adjustment can be thought of as a total time adjustment to the whole program (sometimes it is called a water budget). Change the time from 12 minutes to 6 minutes. The watering time for all groups in this program will become 50% as long. Notice the % change. Next make another adjustment, change the time for any group. Move the marker to Group 2. Press ENTER and adjust the new time to 2 minutes. This change takes effect immediately. The next time Group 2 runs, the watering time will be the new time you just set. The ability to Adjust specific events without stopping any of the programs is very useful.

TWIG note

ADJUSTING PROGRAMS ON THE FLY WITHOUT STOPPING THE WATERING PROGRAMS CAN SAVE A LOT OF TIME AND REDUCE FLOW SURGE PROBLEMS

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6.0 USING THE MANUAL CONTROL FUNCTION

Valves can be opened and closed manually by using Manual Control in the SETUP dial position. It is a good way to test & verify that all the valves work.

6.1 EXAMPLE OF MANUAL CONTROLLER OPERATION:

First make sure the watering dial is set to OFF or PAUSE otherwise Manual Control doesn't work. Also when using manual control be sure there is a good relief valve in place to keep pressure below the range that could damage the irrigation system.
Turn the display dial to SETUP and scroll down to CONTROL SOURCE and verify that it is set to TD200 otherwise the Manual Control will not appear on the menu list. Then place the marker on the Manual Control line. You then press ENTER to enable manual valve operation.
You see the list of all TWIG addresses each representing one of your valves. Select the valve you want by scrolling to the appropriate TWIG address line. Press ENTER to make the + visible. This signals the valve to open. The command will be sent after the few seconds of time has elapsed. You can watch the time until it switches on countdown on the screen.

CAUTION when doing manual control! It is essential you be familiar with your irrigation system and pumps. By using Manual Control you can turn many valves on. Be cautious! It is good to limit the flow in the system. Damage to the pump or pipes can occur if you make extreme changes to the system flow capacity. Especially be careful shutting off a lot of valves at once. If you need help be sure to ask from someone that knows your irrigation system.

Be aware! When the TD200 selector dial is rotated away from SETUP all valves that may have been turned on using Manual Control will go off!

MANUAL CONTROL IS A GREAT WAY TO TEST EACH VALVE OPERATION.

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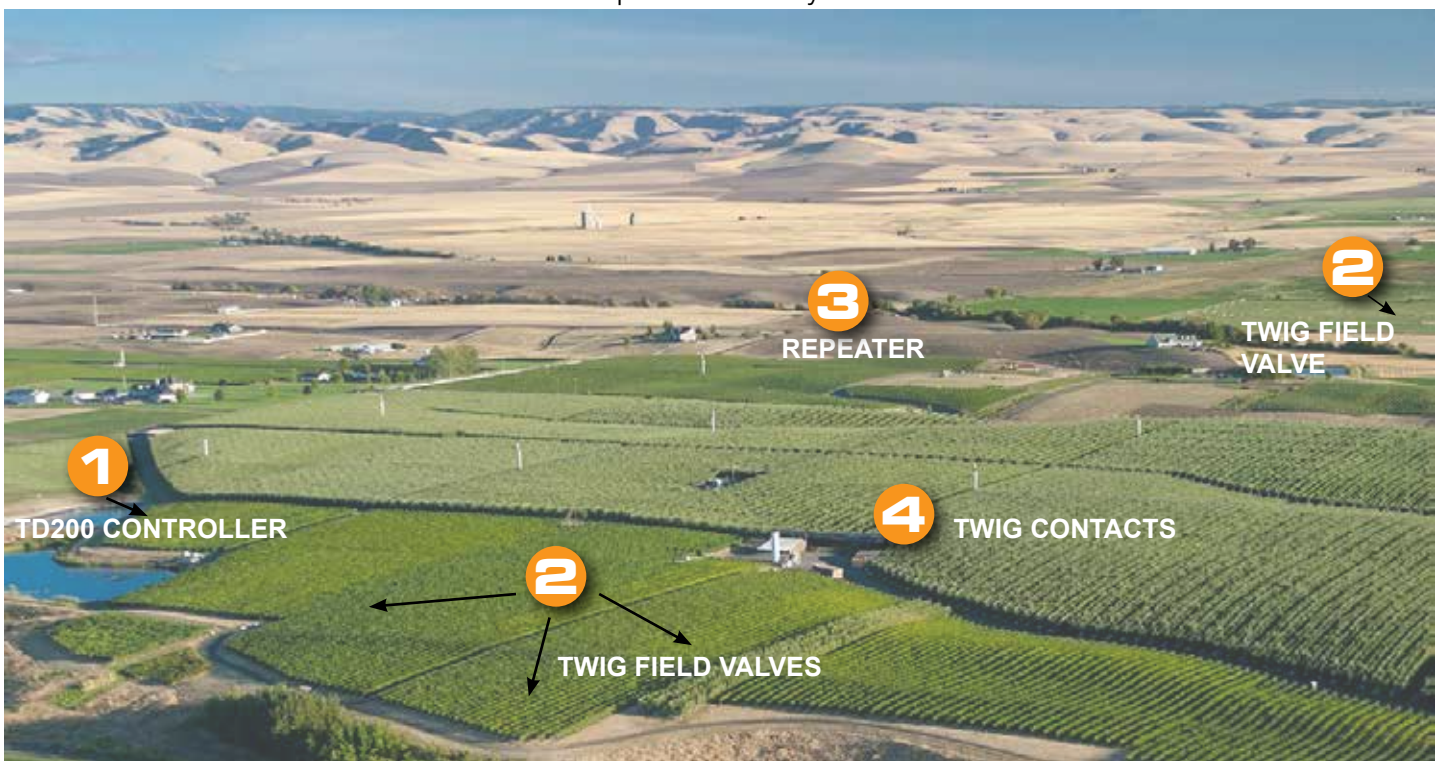
7.0 TECHNICAL SECTION (APPLICATION FACTORS)

The section provides some specific details about the Nelson wireless TWIG system technology.

7.1 ENGINEERING IDEAS BEHIND THE TWIG SYSTEM:

Engineers at Nelson Irrigation Corporation look at things from the farm point of view and make the equipment fit were it has to work. Here is an example of a field system.



Components of Nelson Wireless Controls

1 TD200 controller includes proprietary Nelson high power radio. Capable of controlling up to 100 TWIGs on valves. The TWIG network has two-way communication every 20 seconds and monitors battery and signal strength for each TWIG valve.

2 TWIGs on field valves. There are six TWIG choices available. These control one, two or up to four valves independently. Antenna options are the standard low-profile internal antennas or external Omni antennas.

3 Optional TWIG Repeaters can be used to extend the network radio signals. Self organizing radio logic works to extend the signals if needed to reach longer distances.

4 Accessories include TWIG Contacts, solar power kits and Omni antennas to work in about any farm application.

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7.2 THE ADVANTAGE OF PROPER ANTENNAS:

Strong radio power can give longer range but strong transmit power is only half the solution. Receiver power on this same antenna is the other half of the answer. Receive signal is very much affected by the noise floor present at the site (static). The source of noise in the environment ranges from all forms of digital products and other radio communications. Antennas are everywhere so look around and try to minimize the noise to the antennas for both the TWIG units and the TD200. Even weather conditions can limit communication because increased moisture in the air weakens signals.

7.3 FACTS ABOUT RELIABLE RADIO RANGE:

A frequently asked question is the distance that is good for signal range. For successful operation it is essential to stay within the range of the TWIG signal. Don't try to go out too far past the clear signal range. In order to layout a good system use the range bar graphs in this section. And remember that the distances presented in the guide are only achievable under optimum installation conditions. Radio signals have issues penetrating water and soil. These are in abundance in the field. When radio waves hit an obstacle like the soil some of the power is reflected and some of it is absorbed into the ground. In either case the signal is weakened. Normally there is a lot of water in vegetable crops which will absorb the signal. Keep in mind that for farm crops such as onions the crop changes as the season progresses. Initially the bare ground transforms into full onion tops filled with water. Stay close enough to the controller or use a repeater so that it does not become a problem.

7.3.1 USEFUL TWIG SIGNAL RANGE GRAPHS:

The range bar graphs are a simple way to look at wireless signal strength and spacing distance. These have been prepared to show the range effect on the signal. A color gradient is used varying from good (green) to poor (red). The red zone likely will have weak signal strength and poor reliability. The graphs in Figure 4.1 show the limits of spacing between the controller and TWIG units in the field. The bar graphs compare several heights using 18 inches above the ground for the TWIG as a reference. To overcome this issue two antennas are built within the TWIG box. Built-in signal strength logic continually seeks the antenna having the strongest signal. Environmental conditions can reduce the range by as much as 60%. To factor in the elevation of the TWIG radio antenna, the bar graphs have ADJUSTMENT FACTORS listed in the box. Pay attention to the reduction percentages.

Basic rules to assure wireless success:

- Do your homework up front just to make sure wireless is the best it can be for the farm.
- Be wary of background radio noise and do a site survey.
- Remember transmit and receive for TWIGs are equally important.
- Keep well within range to have a high degree of reliability.
- Be cautious of leafy green vegetation, mounds of earth and even mobile obstructions.
- Know the distance between antennas. Don't underestimate it.
- Elevate the antenna where possible. Even a short distance up helps.
- Separate two working antennas at least 2 ft. apart.
- Remote mounting requires high quality cable. Be chintzy in the length but not in cable quality.

YOU MUST SELECT AN ANTENNA LOCATION THAT IS GOOD FOR BOTH TRANSMIT AND RECEIVE.

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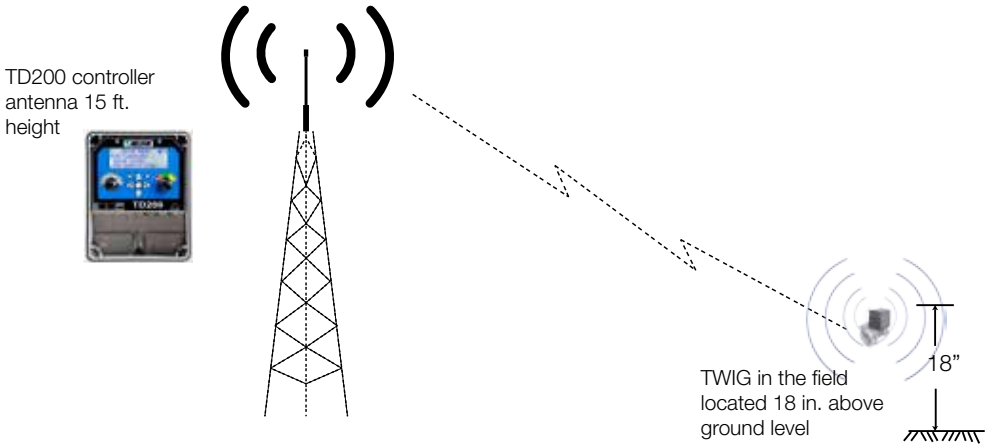
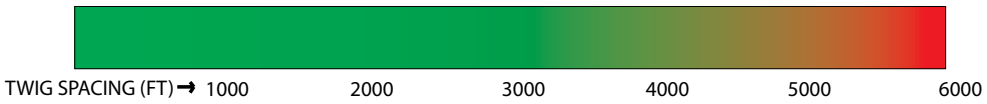
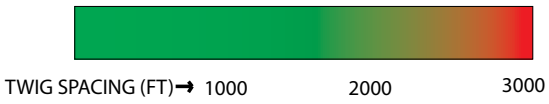


GUIDE FOR SPACING IN VARIOUS CROPS

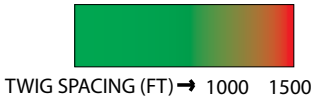
DIRECT LINE OF SIGHT



LOW GROWING ROW CROP



TRADITIONAL TREE SPACED ORCHARD



HIGH DENSITY TRELLIS ORCHARD TREE & VINE

ADJUSTMENT FACTORS

TWIG height	Adjustment to bar graph distance
On the ground surface	40% Example: Spacing limit to 40% of graph
At 18” above ground	100% of graph distance
At 6 ft. above ground	125%
At 15 ft. above ground	150% Example: Use graph distance x 1.5

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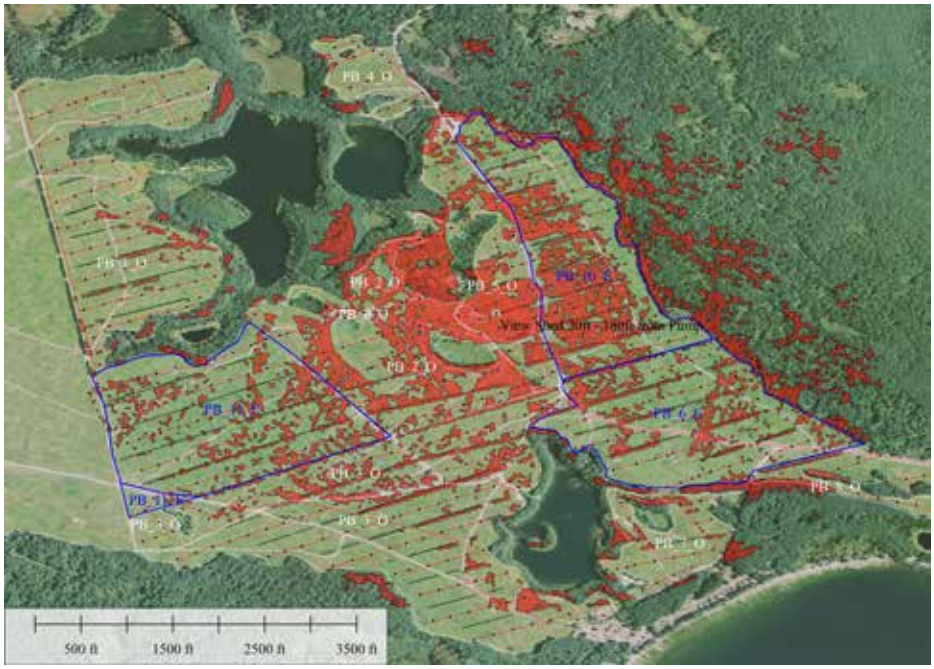
7.4 TOOLS TO ASSURE LINE-OF-SIGHT (VIEW SHED):

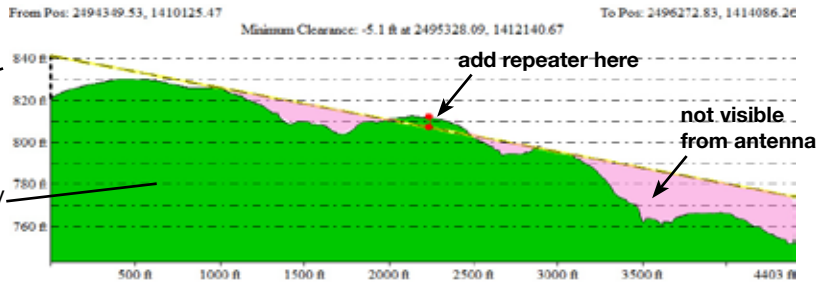
When laying out the field wireless network there are some tools that will save you time and trouble.

1) Simply take a TWIG and a controller to the field and get a signal strength reading. Look at the valve locations at the farthest distance away and check any area where the TWIG may have some signal obstructions. Be sure the TWIG signal number is 20 or more.

2) The aerial views and topographic map data can be used in good mapping programs to view areas that the antennas can see. Here are two methods:

Example of view shed: The red area is shadowed from the controller antenna and some things can be done to make that area get the signal better. Options are (a) install higher antennas (b) locate the controller and antenna at a higher site or (c) use repeaters.





Example: Here is a line-of-sight topography profile graph. Making this graph will show up the field surface area that could have radio blockage. In this example a repeater should be used at the point where the line-of-sight is blocked. The shaded region is light red and it will likely have weak signals. A solution is to add repeaters and elevate the controller antenna.

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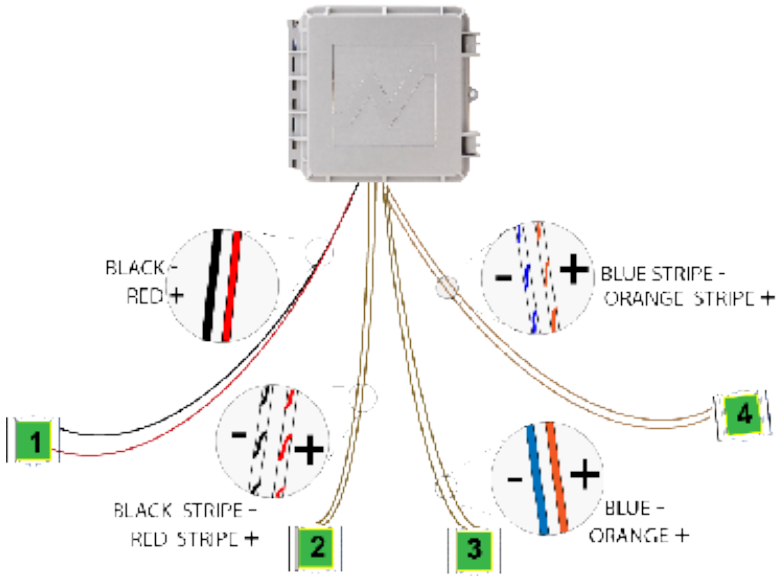
7.5 USING MULTI-VALVE TWIGS AND CONNECTING TO VALVES THAT ARE CLOSE TOGETHER:

Multi-valve TWIGs are the way to run more valves with one TWIG. The models 'TWIG-2' and TWIG-4' have the capability to hook-up to several valve solenoids. This is a cost savings since only one TWIG is needed to control each valve independently. The colored wire leads are provided. The wire color code drawing below shows the pairs of wires to use for each solenoid. These should be kept in order because mis-matched pairs won't work. Be sure to cap any unused wires. Limit the distance to the farthermost valve to less than 50 ft. (the limit of wire length from TWIG to valve).

TWIG wire color code to connect solenoids



THE MULTI-VALVE TWIGS CAN HANDLE AS MANY AS 4 VALVES. SHORT WIRES CONNECT THE VALVES AND THIS WIRE LENGTH MUST BE LIMITED TO LESS THAN THE DISTANCE OF 50 FT.

7.6 LATCH TYPE SOLENOID REQUIREMENT:

In order to minimize the battery power required to run the TWIG system, a special latch (or pulse) solenoid coil is used. The coil of the solenoid operates each pilot valve to make the Nelson valve open and close. A short electrical pulse takes extremely low power consumption from the low power battery. The latching dry coil contains a magnetic part that holds the internal plunger without any power required to keep it in place. It is designed to shift when a reverse polarity pulse of power is applied. The pulse duration is extremely short since it is less than one tenth of a second. Only the approved type of solenoid should be used. The advanced design of the TWIG has been perfectly matched to the coil pulse duration and power. Use only approved latch solenoids because others could malfunction. Nelson # E23, #E28, or #E29. Note: the Nelson QC valve has reverse polarity for the solenoid wires. That is because it takes pressure to open the valve which is the reverse of normal valves.

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8.0 SPECIFICATIONS FOR NELSON WIRELESS CONTROLS

The Nelson TWIG Wireless Control System is a radio network system. Communication is by radio in the 900 mega-Hertz frequency range. The products used in the system complies with the FCC rules and does not require a radio license. It also has received Industry Canada approval. The compliance with FCC rules has been established for the antennas provided by Nelson and those are the only antennas that are authorized to be used for the wireless TWIG system. Components in the existing product line are listed below.

8.1 TD200 CONTROLLER

Controller Enclosure:	Poly-plastic
Controller Enclosure Dimensions (no antenna):	10.2” x 11.25” x 5.5”
Controller setup for remote antenna:	SMA connection for antenna 6 dbi omni
Controller Weight (with antenna):	5.5 lbs
Enclosure NEMA Rating	4X
Power Options and (input current wireless):	110VAC (150mA), 12VDC (350 mA)
Electrical Connections:	wire leads and terminal blocks (110 VAC plug if ordered)

8.2 'TWIG-I' UNIT

Enclosure:	Fiberglass reinforced plastic
Enclosure Dimensions:	5.63”x6.88”x4.5”
Weight (with two ‘D’cell batteries):	2.94 lbs
NEMA Rating	4X
Connections:	24 inch wire leads for 1 latch solenoid
Radio Frequency:	908-922 MHz, 8 channels preselected by the TD200
Radio power	approximately 1 watt
Address identity:	factory assigned for each unit, first letter is A
Antenna options:	Dual internal antennas or SMA connection for an external antenna. (Special order).

8.3 'TWIG-2' OR 'TWIG-4' MULTI-VALVE UNIT

Enclosure:	Fiberglass Reinforced plastic
Enclosure Dimensions:	5.63”x6.88”x4.5”
Weight (with two ‘D’cell batteries):	3.04 lbs
NEMA Rating	4X
Connections:	24 inch wire leads for 2 or 4 latch solenoids
Radio Frequency:	908-922 MHz, 8 channels preselected by the TD200
Radio power	approximately 1 watt
Address identity:	factory assigned for each unit, first letter B or D
Antenna options:	Dual internal antennas or SMA connection for an external antenna. (Special order).

8.4 'TWIG REPEATER' UNIT

Enclosure:	Fiberglass reinforced plastic
Enclosure Dimensions:	5.63”x6.88”x4.5”
Weight (with no batteries provided):	2.50 lbs
NEMA Rating	4X
Connections:	Antenna connection is provided
Radio Frequency:	908-922 MHz, 8 channels preselected by the TD200
Radio power	approximately 1 watt
Address identity:	Factory assigned ID. Starts with the letter ‘E’.
Antenna options:	Dual internal antennas or SMA connection for an external antenna. (Special order).

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8.5 'TWIG CONTACT' MODULE

Enclosure:	Fiberglass reinforced plastic
Enclosure Dimensions:	10.2” x 11.25”x 5.5”
Weight (with no batteries provided):	5.5 lbs
Contacts	Four 12 VDC latch contacts, 1 amp current capacity
NEMA Rating	4X
Power Options for input:	110VAC (???mA), 12VDC (??? mA)
Connections:	SMA Antenna connector
Radio Frequency:	908-922 MHz, 8 channels preselected by the TD200
Radio power	slightly less than 1 watt
Address identity:	Factory assigned.

8.6 ANTENNA AND ACCESSORIES

Antenna (standard for TD200 and REPEATER)	6 dbi mono-pole Omni antenna
Mounting kit for standard 6 dbi	U-bolt bracket, fits 1”-1 1/2” diameter pole
Antenna for short range Contacts:	2dbi di-pole articulating antenna
Antenna connection:	SMA small connector
Antenna cable	Co-axial cable with end fittings

8.7 APPROVALS, COMPLIANCE

Approvals and compliance are based upon testing that was done with antennas that are supplied with the product The products within the TD200 system are substantially all manufactured in USA. These are the approvals to date and other approvals are pending.

8.7.1 FCC RULES

Contains FCC ID: ZH6-VRCOMM-HP / Contains transmitter module IC: 9686A-VRCOMMHP. All devices on the system complies with Part 15 Rules. Operation is subject to the following two conditions: (1)this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Normal operation as described by this guide does not require a FCC license by the owner.

8.8 APPROVED 'D' CELL BATTERIES FOR TWIG UNITS

Alkaline 1.5 volt ‘D’ cell batteries are acceptable for use. Several factors affect the service life, including the temperature and storage, depth of discharge cycles, and power voltage demand. The industry definition of the service life of a battery is the period until it drops to 60% of its rated capacity. The battery voltage is displayed as bars on the TWIG. Just remember that it is well worth using the highest quality batteries that are available and plan on replacing them at the beginning of the season.

8.9 TD200 NETWORK/PROGRAM SPECIAL FEATURES

Network setup uses a self-discovery technology. TD200 must have power. The TD200 network is made when a TWIG is placed in the setup (RESET) mode. The radios will search for available networks and display on the TWIG the networks that are found. When the number that is wanted is ENTERED the ‘join’ process takes place within about 20 seconds. The TD200 can support 100 TWIG field modules and up to 9 repeaters.

If multi-valve modules are used then it is recommended that the maximum of 200 valves be controlled by one TD200 controller. It is possible to have as many as 400 valves controlled but not recommended more than 200 valves be used due to the complexity that may occur.

8.9.1 PROGRAMS:

The TD200 controller has a large capacity able to easily handle 50 unique programs. It is very flexible because there are few limits so that any TWIG/valve can be used in any program and the programs can run concurrently or individually.

Each program can have multiple valves. The time of each one can be individually set to operate in sequence.

8.9.2 MANUAL CONTROL OPERATION:

The 'Manual Control' feature of the TD200 is useful to make a quick check of the system and to run some valves of a period of time in order to adjust soil moisture level. For running any specific valves to water for any reason.

Repeaters have advanced technology. These will reinforce the network when needed otherwise they are not in the way for direct TD200 to TWIG communication.

This wireless technology has built in redundancy of signal transmission. Due to the nature of wireless systems, transmission and reception of data can never be fully guaranteed. Although loss of signal is rare every communication in this network is double checked. The use of a pressure relief valve to protect the irrigation system pipes is essential.

WARRANTY AND DISCLAIMER

Nelson products are warranted for one year from the date of original sale to be free of defective material and workmanship when used within the working specifications for which the products were designed and under normal use and service. The manufacturer assumes no responsibility for installation, removal or unauthorized repair of defective parts and the manufacturer will not be liable for any crop or other consequential damages resulting from any defects or breach of warranty. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING the warranties of merchantability AND FITNESS FOR PARTICULAR PURPOSES AND OF ALL OTHER OBLIGATIONS OR LIABILITIES OF MANUFACTURER. No agent, employee or representative of the manufacturer has authority to waive, alter or add to the provisions of this warranty nor to make any representations or warranty not contained herein. Patent Pending.

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