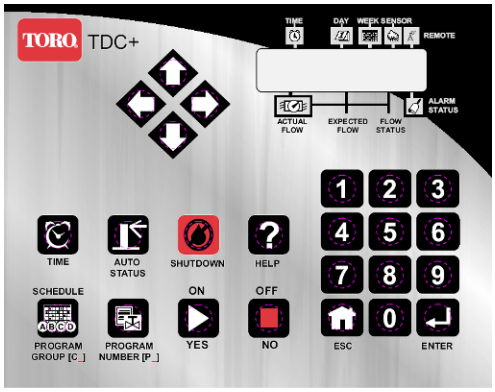
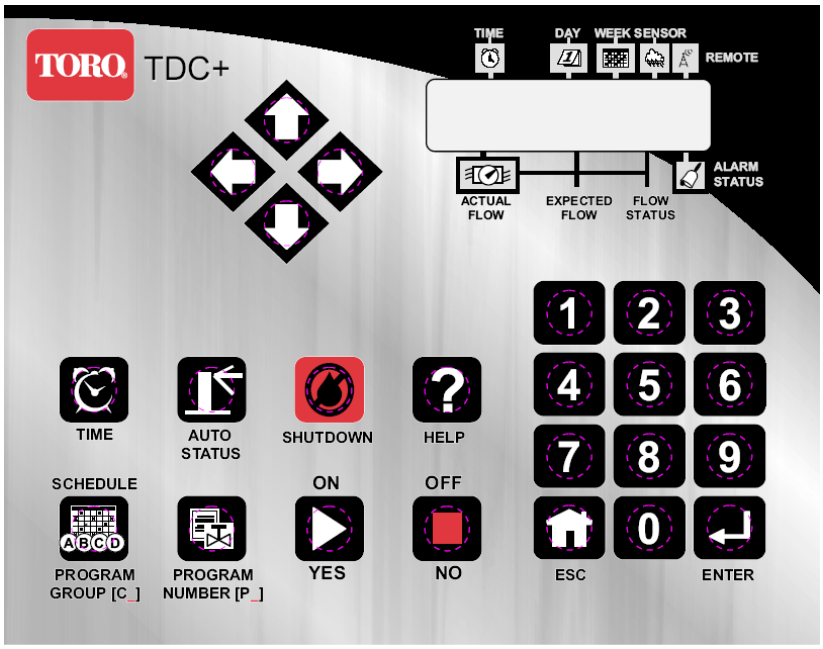
Count on it.

TORO® TDC+ 2-WIRE STARTUP GUIDE



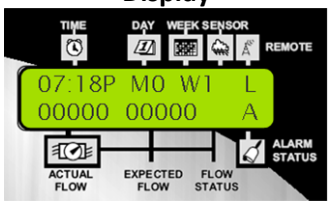
Version: 6-4-2010

CHAPTER 1: TDC+ CONTROL MODULE OVERVIEW

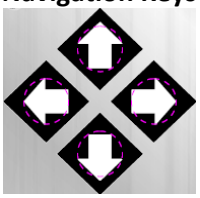


Your TDC+ Controller Interface has three main elements to use throughout the programming process. These are:

Display



Navigation Keys



Keypad

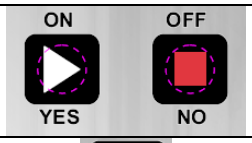
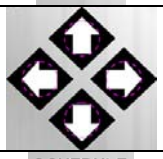
Programming as covered in this User's Guide will be through the Keypad, Navigation Keys, Display, and Central Software.

USER INTERFACE OVERVIEW (KEYPAD & DISPLAY)

TDC+ Control Module Keypad

The TDC+ Control Module has 24 button keys for use as the programming interface:

This keypad includes numeric buttons 1 – 9 and 0 used for numeric data entry. Also used in programming and operations are:

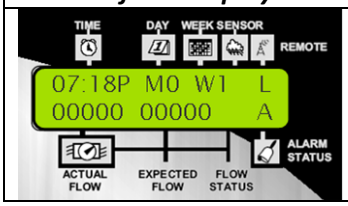
ON/YES & **OFF/NO** Keys		Used for manual operations as well as entering ON / OFF or YES / NO in programming.
ESC (Escape) Key		Used for exiting menus or Edit Mode and returning to normal operations (default screen)
ENTER Key		Used for functions like entering a selected submenu or saving information.
Arrow (Navigation) Keys		Used for navigating in Menus, Submenus, and Edit Modes, as well an incrementing values in programming.
SCHEDULE / PROGRAM GROUP Key		Used for selecting Program Groups or Schedules (run days) when programming.
PROGRAM NUMBER Key		This button will be described in more detail in later pars of this guide. Used for selecting the Program (1-4) associated with a Program Group when programming.

Also included - four function keys are provided on the control module keypad to conveniently perform the following functions:

	TIME Key - Displays the time (Returns to Default Main Screen)		SHUTDOWN Key- Shuts down anything that is running (panic button). *IMPORTANT: The SHUTDOWN key is not functional while in the Edit mode.*
	AUTO STATUS Key - Displays the status of the automatic programs		HELP Key - Displays context sensitive help while in the Edit mode.

TDC+ Control Module Display

The TDC+ Controller has a two-line LCD for display of information. When you first walk up to your Sentinel controller, the display should be in its standard mode showing current time, day, week (of schedule), actual flow (if anything running) and expected flow. This display should look something like the following:

Default Display	***Upper Line***	***Lower Line***
	Time – 07:18 P (7:18 PM) Day – MO (Monday) Week (of schedule) – W1 (Week 1) Sensor – No current sensor indication Remote – L (Locked)	Actual Flow – 00000 (0 GPM) Expected Flow – 00000 (0 GPM) Flow Status – No current flow indicator Alarm Status – A (Alarm Exists)

The standard indicators in the display are as follows:

TIME	**HH:MM**	Hours : Minutes (12-hour format)
	A or **P**	AM or PM
DAY	**SU, MO, TU, WE, TH, FR, SA,** or **SU**	Two-letter Designation of Day of Week
WEEK	**W1 to W6**	Week 1 (one) of Schedule up to Week 6 (six) of Schedule
SENSOR	**1**	Sensor Activated - Switch sensor is in alternate of its Normal condition. E.g. If Normally Open, then 1 = Sensor Closed.
	O	Dry contact (switch) sensor is Open
	C	Dry contact (switch) sensor is Closed
REMOTE	**L**	Field Unit is in remote **"Locked"** mode. Hand held radio will not activate watering functions within this unit.
	A	Field Unit is programmed for **"All Call"** handheld radio operation. Controller will respond to any and all handheld commands transmitted.
	S	Field Unit is programmed for **"Secure"** handheld radio operation. Controller will respond only to handheld commands addressed to its unit code.
ACTUAL FLOW	**00000**	5-digit numeric indicator of current flow through connected flow sensor
EXPECTED FLOW	**00000**	5-digit numeric indicator of expected flow based on current stations operating and their expected flows.
FLOW STATUS	**+**	Actual > Expected (Overflow)
	--	Actual < Expected (Underflow)
	:)	Actual = Expected (Flow is happy)
	A	Flow Alarm Exists
ALARM STATUS	**A**	Alarm Exists – Blank Otherwise

PROGRAMMING OVERVIEW & NAVIGATION

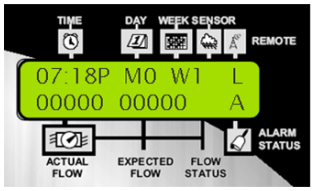
Main Menu & Submenus

The TDC+ Controller is programmed by navigating through a Main Menu which includes seven options: ***Operations, Utility, Alarms, Flow, Schedule Data, Program Data***, and ***Zone/ET Data***. Each of these Main Menu options has a Submenu for entering and changing data. This structure is detailed below as well as being shown on the Program Instructions Card on the control module itself.

MENU 	SUBMENU   To Select	
OPERATIONS	• Manual • Auto Slot / Station • Rain Off Days	• All Manuals Off • All Autos Off • Station Days Off
UTILITY	• Time & Day • Day Change Hour • Unit Code • Station Count	• Program Clear • N/O Master • Two-Wire / Irritrol Mode
ALARMS	• Master Minimum • Unexpected Flow • Over Flows • Over Currents	• Clear Flow Alarms • Clear Fuse Alarms • Clear Map Alarms • Clear Power Fail
FLOW	• K Factor • Offset Factor • Current Flow • Expected Flows	• Maximum Flows • Flow Processing • Read Flow Totals
SCHEDULE DATA	• Run Days • Schedule Length • Clear Schedule	
PROGRAM DATA	• Start Times • Slot-Station-Time • Percent Scale • Repeats	• Repeat Delay time • Continuous Run • Water Window • Assigned Schedule
ZONE / ET DATA	• Plant Factor • Precipitation Rate • Default ET • Program ET Toggle	• Maximum ET • Station Type • Map Stations

Navigation

The controller normal mode (default) screen looks like:



- To enter the Main Menu from this default screen, you need to hit any of the arrow keys on the keypad: This will bring up the **OPERATIONS** option of the Main menu.
- To navigate through the Main Menu, use the right or left arrow keys.
- To enter a submenu for any of the Main menu options, use the up or down arrow keys.
- When the desired submenu is reached, press the enter key to view or change data in the submenu.

IMPORTANT: When entering data into one of the submenus, the controller is in the Edit Mode. The controller will not begin any scheduled operation until you have exited the Edit Mode. Programs that are running prior to entering the Edit Mode will continue running. Any time you enter or change any data, you must press the ENTER key to save the data. Otherwise, the newly entered data will not be saved.

To exit the Edit Mode, press the ESC (Escape) key once or twice as necessary to return to normal mode (default) screen. If you forget to press the ESC key, the controller will automatically revert to normal mode after two minutes.

CHAPTER 2: QUICK START STEPS

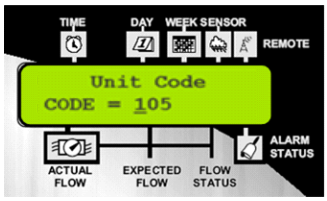
This guide is designed to show you the minimum initial steps to program a TDC+ controller using the Sentinel Lite software so irrigation occurs. The primary steps we will be following in the quick start process are:

Where	Section	Function	Action
Controller	UTILITY Menu	Unit Code	**Set Unit Code**
Software	SETUP	Database	**Create New Database**
Software	MANAGE	Master List	**Create Unit**
Software – Satellite	Setup Directory	Special Data – Comm Settings	**Setup Communications Method**
Software – Satellite	Setup Directory	Special Data – General	**Receive Satellite Firmware**
Software – Satellite	Setup Directory	Time & Day	**Synchronize Time**
Software – Satellite	Setup Directory	Special Data & Zone Data	**Two-Wire Setup (if needed)**
Software – Satellite	Programming Directory	Automatic Operations	**Setup Irrigation Program**
Software – Satellite	Programming Directory	Unsent Changes	**Send Changes to Satellite**

SETTING CONTROLLER UNIT CODE

IMPORTANT: *The unit code is required for Software Programming. All other controller settings can be made from the Sentinel Lite Software.*

1. From the default screen (press ESC twice to reach screen if not in it), press the **Right Arrow Key** on the controller keypad until **UTILITY** is displayed in the screen.
2. Press the **Down Arrow Key** until **Unit Code** is displayed in the screen
3. Press the **Enter Key** to view the Unit Code entry screen.
4. Position the cursor using the Right and Left Arrow Keys under the digit being edited. Use the numeric keys on the keypad to enter digits. **Enter a unique three-digit Unit Code from 001-999**.
5. Press **ENTER Key** to Save Unit code.
6. Pres **ESC Key** twice to return to Default screen. You have finished in field programming.
7. Repeat at each controller.

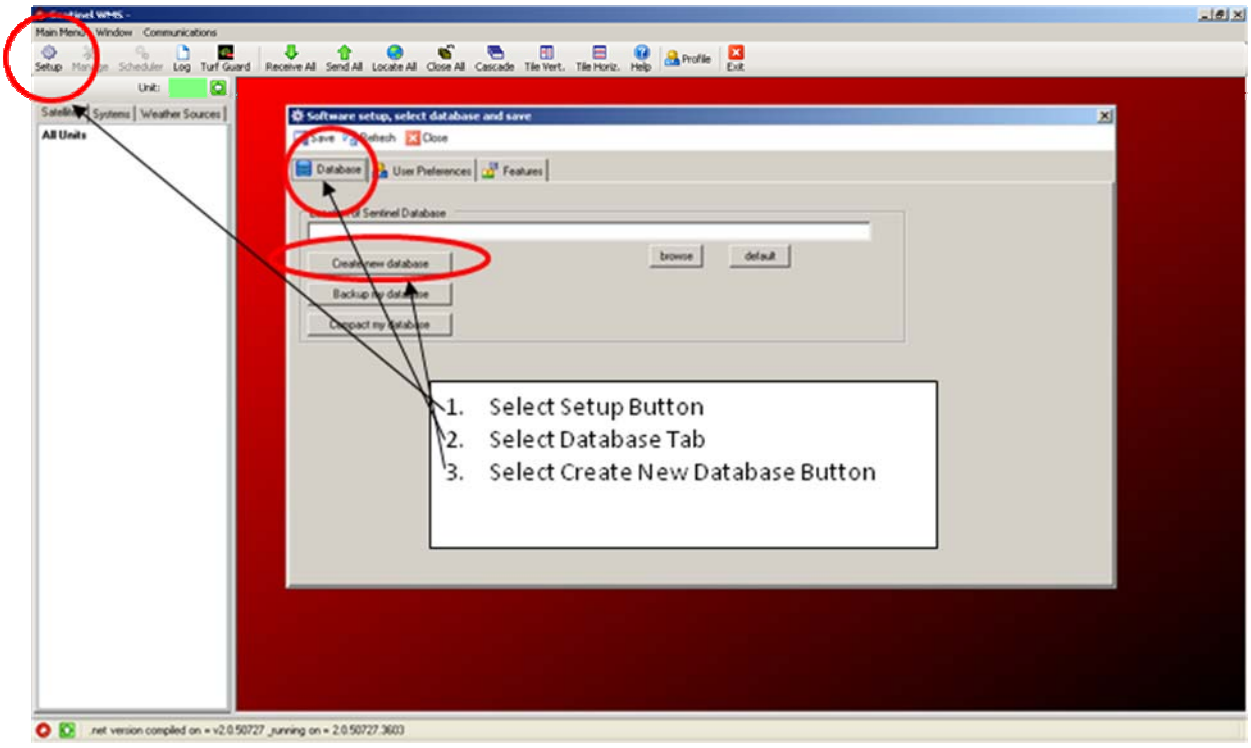


SOFTWARE & DATABASE SETUP

1. Verify that Sentinel Lite is properly installed on your computer.
2. Double Click on the Sentinel Icon (identified as a Red Clock) on your desktop to **open the Sentinel Lite interface**.

   Note: *Be patient, Sentinel opens slowly. If you double again, you will open a second application – check your taskbar to insure only one Sentinel application (red clock icon) is running.*

3. Left Click on **SETUP** in the left hand side of the upper tool bar.
4. In the Software Setup Window that opens, click on the **Database Tab**.
5. Select **Create new database.**
6. **Name and save your database** wherever you want your database files to be kept. Database will be saved as a .mdb (Microsoft database) file.
7. You should get a confirmation that database has been created. Click **OK**.
8. Click **Save** in upper left of window to select this database as your current operational database.
9. You will get a warning regarding database changes. Click **Yes**. The "Location Of Sentinel Database" area will now display the saved location of your database
10. You may now close the Setup Menu by clicking **Close**.



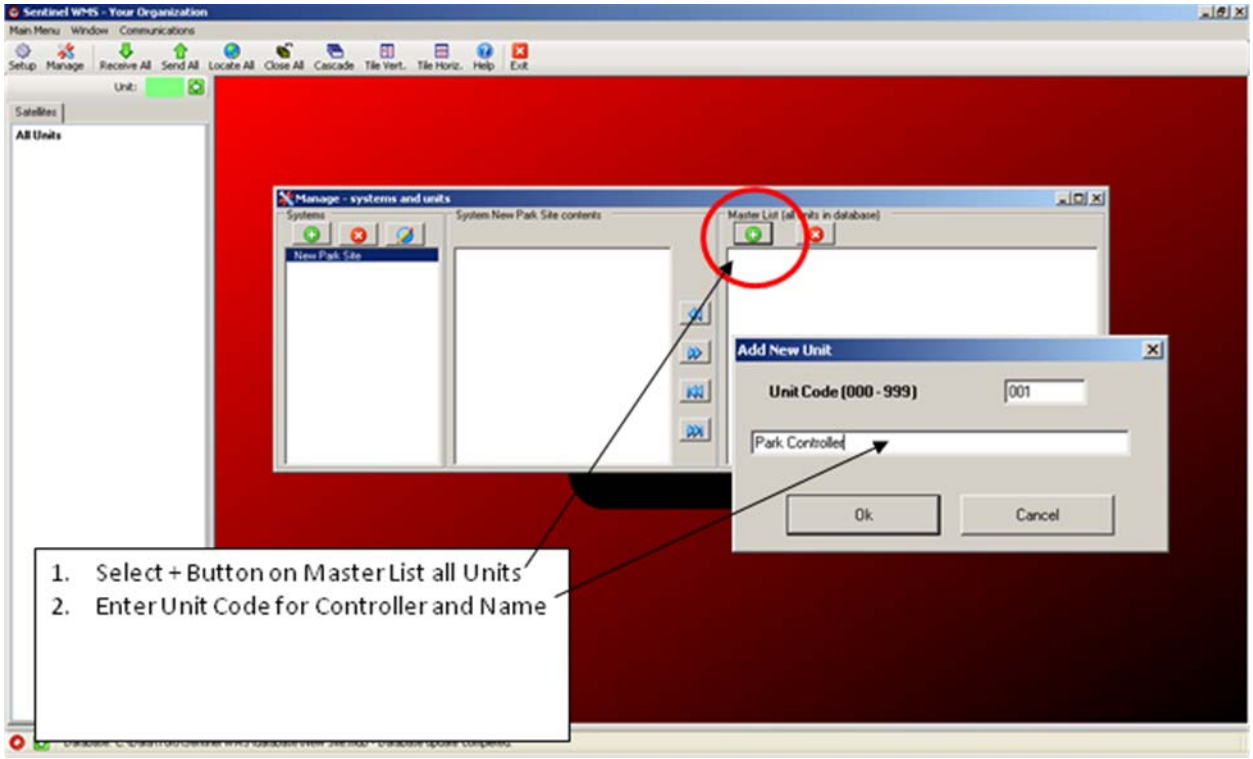
UNIT CREATION

You must now create your Field Units in the Sentinel Software.

1. Left Click on **MANAGE** in the left hand side of the upper tool bar.
2. In the Manage Window, click "+" (**Plus Sign**) on the right hand side under **Master List (all units in database)**.
3. A popup screen will appear allowing you to enter a Unit Code and Description for the controller. You must **enter the same unit code(s) as you entered in the field.** You may enter a unit description (location, etc) at this time, or do it later in the process.
4. Click **OK** once Unit Code and Description are entered.
5. This unit should now be created in the Master List and visible in the Left-hand Navigation Tree of the Software Interface.

   Note: *This screen also gives you the ability to create "Systems." Systems are sets of multiple controllers that allow shared adjustment, rain days, etc. Creation of a system is not required for irrigation.*

6. You may now close the Manage Window by clicking **Close**.



UNIT CONNECTION

These steps indicate how to direct-connect your computer to your TDC+ Control Module.

1. Identify Serial Comm Port location (9 pin male connection) on your computer
2. If there are no Comm Ports then use a USB connection (requires a USB to 9 pin adapter – (can be purchased at local electronics store)
3. Connect grey serial cable included with TDC+ Controller to Serial Comm Port on the computer and the Serial Port on the back of the TDC+ Control Module.

CAUTION: It is ***highly recommended*** to use an optical isolator in the serial connection between the laptop and the Sentinel. If you are not using an isolator you should always run your laptop on battery when connecting to the Sentinel, and do not allow any metal parts on the laptop or cable to come in contact with the cabinet of the Sentinel.

IMPORTANT: Control Module Must Be Powered to Complete Programming Steps.

UNIT SETUP

1. Go to the **Left Side Navigation Tree**, **Satellites Tab**.
2. **Click on the Satellite Unit** just created. This should expand the unit menu tree.
3. Under the **Setup** Directory, click on **Special Data**.

   Note: *When the Special Data window opens you will see it opens on the "General" Tab and that the Controller Firmware Version is grayed out. We need to "receive" this firmware version from the controller so Sentinel knows the capabilities of the controller. But first, we need to set up our communications method.*

4. In the **Special Data Window**, click on the **Comm Settings Tab**.

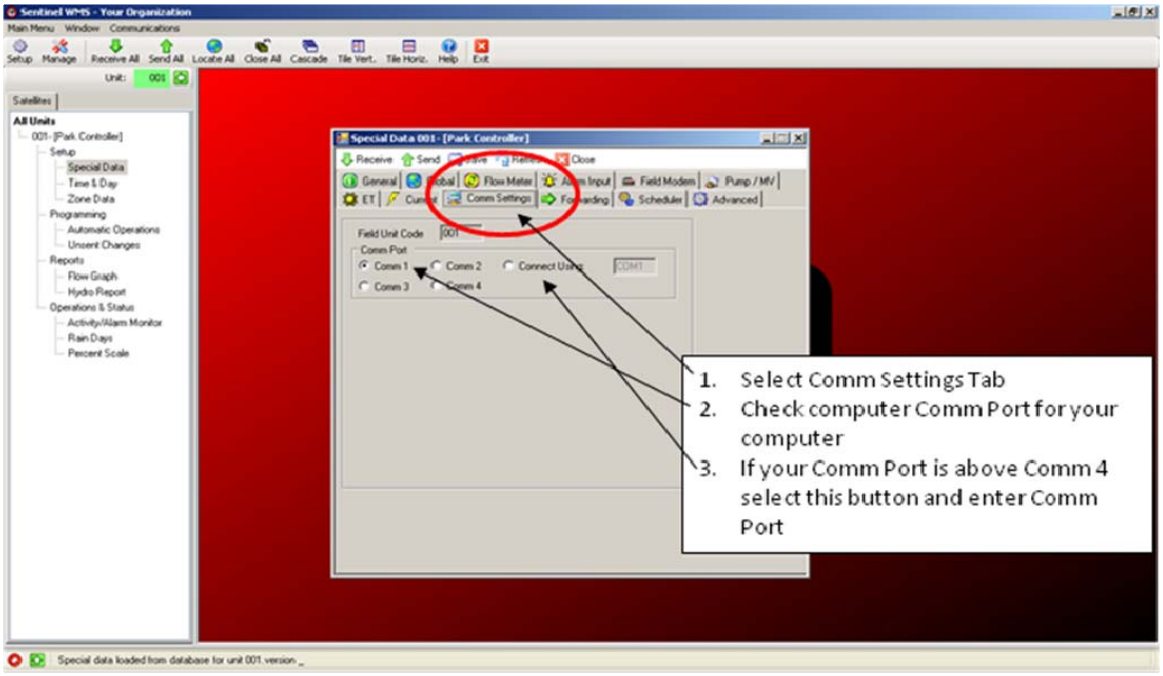
In the Comm Settings menu, you need to set up how you will communicate to the target field controller. In newer version of Sentinel Software, you can select the "**Profile**" of the communications method you are using and fields that do not apply are disabled.

Setup Communication Parameters

In the **Comm Settings** tab:

Communication Method	Settings
Direct Connection (Serial Cable)	1. Choose the communication (Comm) port of the phone modem, central interface, or satellite (if connected directly). If the Comm port number is higher than 4, select the **Connect Using** option and enter the Comm Port number; i.e., COM6.

2. Choose **Save** to enter the selections.



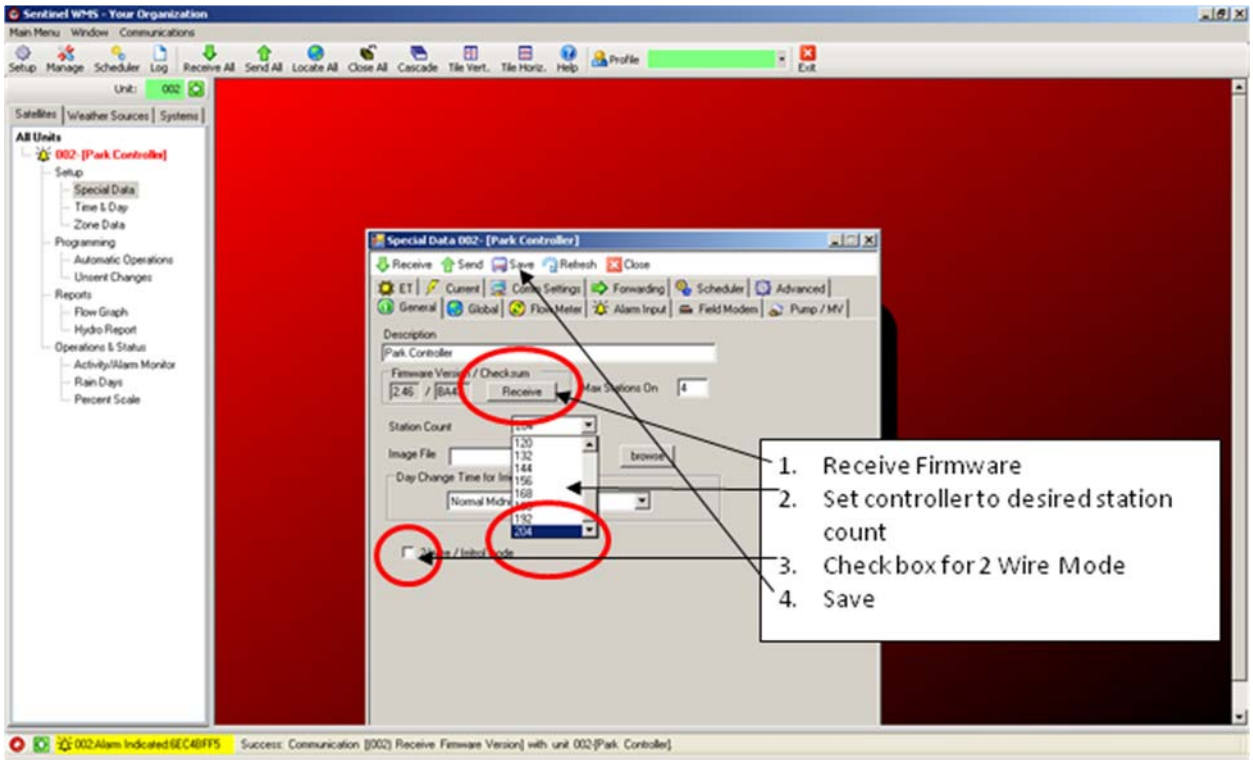
Receiving Satellite Firmware Version

This procedure will establish two-way communications as well as ensure that the Sentinel WMS software will function properly with the current satellite firmware version.

1. Choose the **General** tab. The **Firmware Version** and **Checksum** data fields will be blank.
2. Choose the **Receive** button next to these fields to initiate the upload process from the satellite.
3. Upon receiving the firmware data from the satellite, choose **Save** to continue.
4. Select the **Max Stations On** number based on the number of satellite station outputs that can be operated simultaneously without exceeding the hydraulics of the system or the electrical capacity of the satellite.

   Note: *Exceeding the satellite capacity can trigger an alarm condition.*

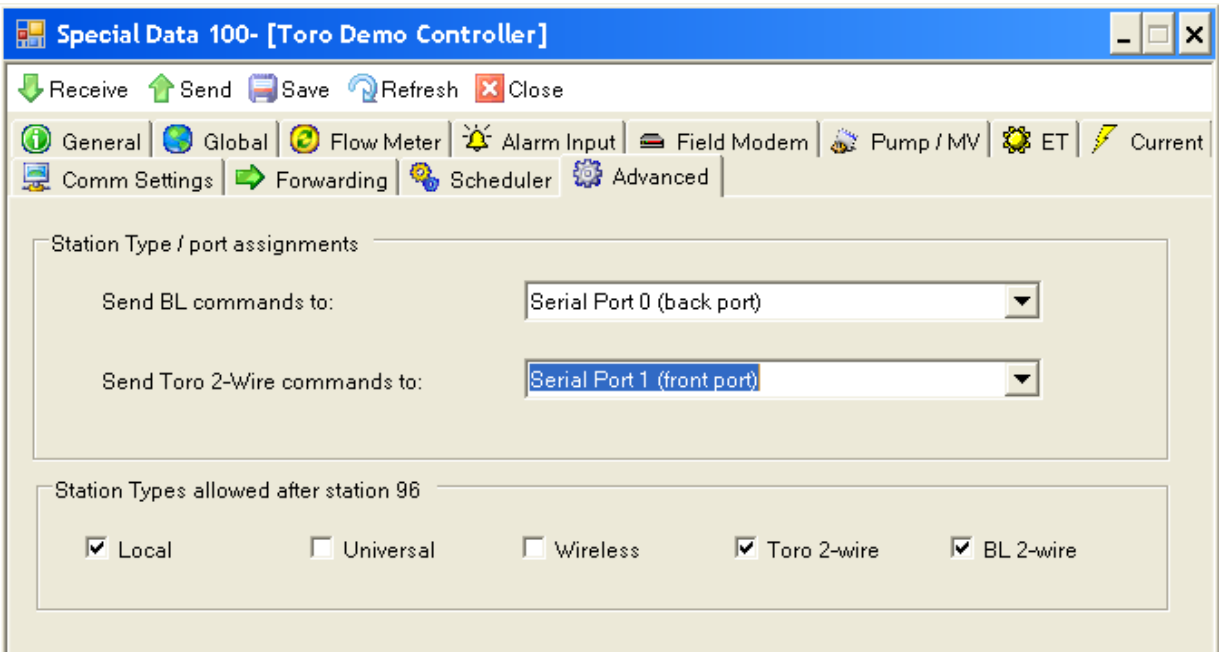
5. Choose the physical **Station Count** of the satellite.
6. Click on **2-Wire / Irritrol Mode**.
7. Choose **Save** to enter the selections



Assigning Control Module Serial Port & Completing Setup

This procedure will designate which serial communication port on the TDC+ Control Module will talk to the Two-Wire Gateway (output boards). On a TDC+, it is recommended that you designate and utilize the "front" serial port, because computer programming occurs through the "back port".

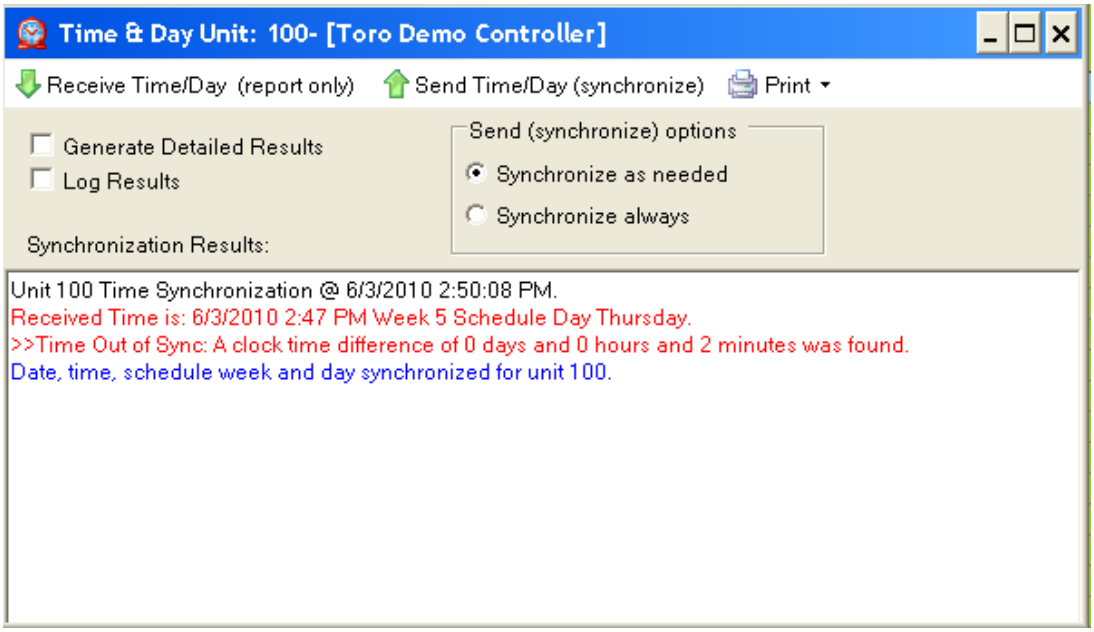
8. Choose the **Advanced** tab.
9. Under Station Type / port assignments: For "Send Toro 2-Wire commands to:" select **Serial Port 1 (front port)**.
10. Under "Station Types allowed after 96," select **Toro 2-wire**.
11. **SAVE** all Changes and Close Special Data Window.



TIME & DAY SETUP

Both the PC running the Sentinel WMS software and the satellite controllers have time-keeping registers that must remain synchronized at all times to maintain scheduled operations. The Time & Day window provides setup options for the time/day synchronization feature.

1. Click on **Time & Day** under the **Setup** directory of the Navigation Tree.
2. Select the **Send (synchronize)** option as Synchronize Always. This option enables synchronization to occur regardless of time variation.
3. Select the **Log Results** option to record all synchronization results.
4. Choose **Send Time/Day (synchronize)** to synchronize the satellite with the Sentinel WMS software.
5. Basic results of the synchronization process will be displayed in the text window. Select the Generate Detailed Results check box to display the results in full detail.
6. **Close** Time & Day Window



SETUP FOR TWO-WIRE OPERATIONS (Important)

For proper operation of a TDC+ Two-Wire Decoder System, there are some additional steps that need to be completed:

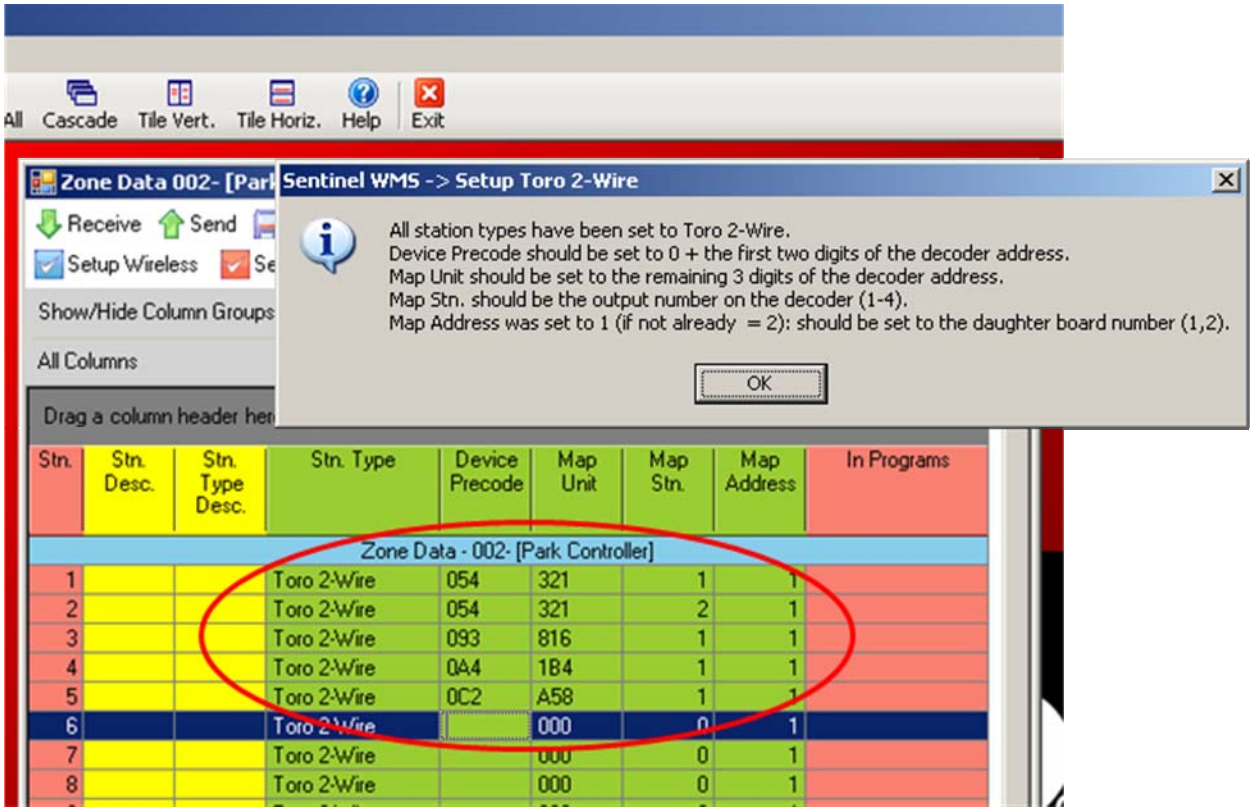
1. Under the **Setup** Directory, Click on **Zone Data**.

   Note: *The Zone Data Screen shows a spreadsheet-like detail on individual station information. You can enter a Type and Description for each station to aid identification, but it is not required.*

2. On the Top of Zone Data Select **Setup Toro 2-Wire.** This sets all stations as Toro 2-Wire stations.

For Each Two-Wire Station

3. For each station, you must enter the 6-digit alphanumeric address of the decoder as:
   a. **Device Precode** = First 3 Characters of Decoder Address
   b. **Map Unit** = Last 3 Characters of Decoder Address
4. Decoders can have 1, 2, or 4 Outputs. Assign a station to Decoder Output # of the decoder by setting **Map Station = #** (where # = 1, 2, 3, or 4, corresponding to the decoder output).

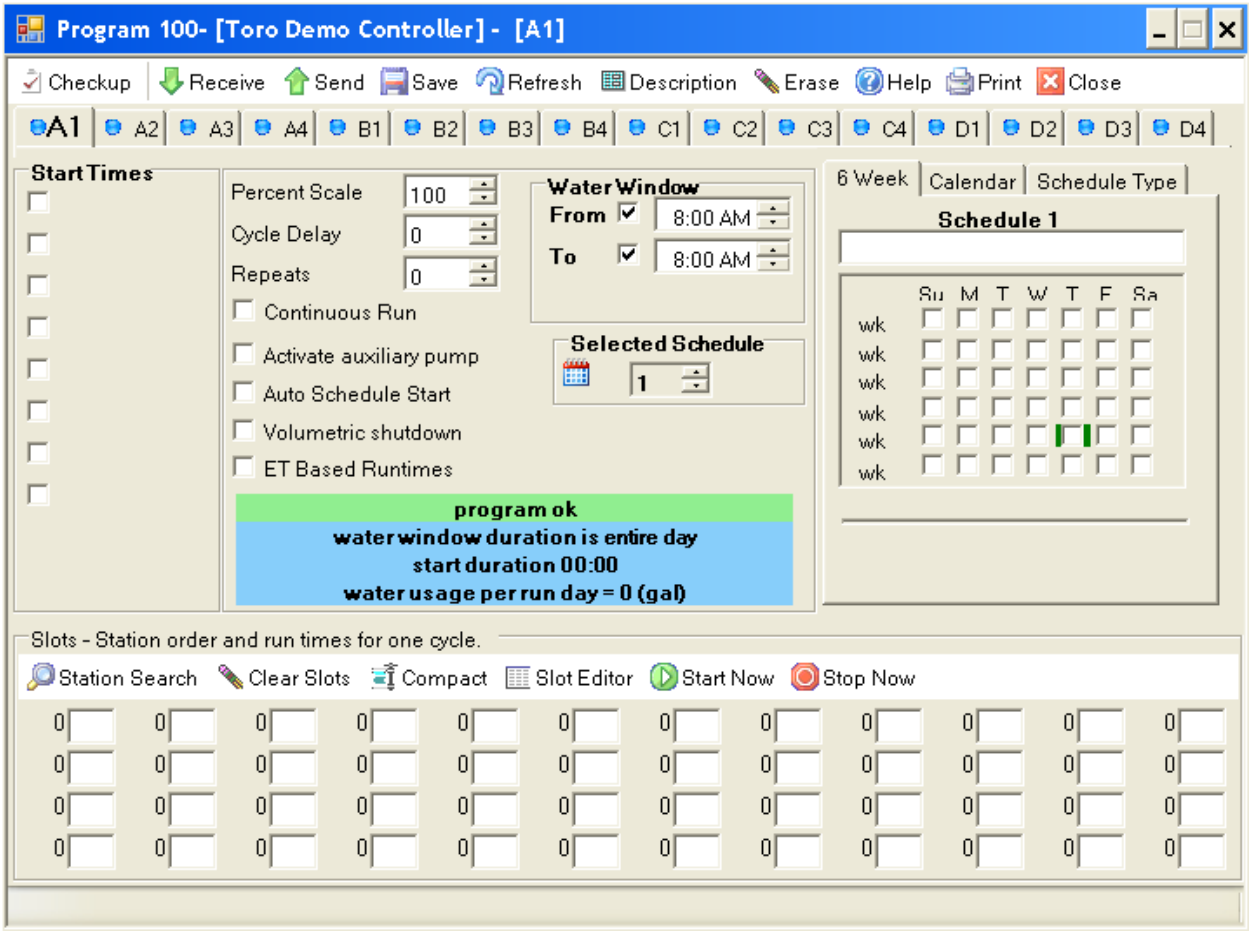


PROGRAMMING FOR AUTOMATIC OPERATIONS

1. Click the **Automatic Operations** under the **Programming** directory to open the Automatic Operations Window.

   Note: Each satellite is capable of having 16 individual irrigation programs. The programs are organized in groups of four, called Clusters, with four programs assigned to each Cluster. Clusters are identified as A, B C, and D. Programs within the cluster are identified as 1, 2, 3 and 4. The Program window provides a separate tabbed page for each program.

2. Click on Program **A1 Tab**



Start times

1. To begin, select a **Start Time** check box. The selection box with a default time will appear.
2. Highlight the portion of the time display to be adjusted.
3. Use the scroll bars or enter the preferred time.
4. When finished editing the Start Times, choose **Save**.

Watering Days (Schedule)

Up to 16 unique watering day schedules can be defined. For identification, each schedule has a number assignment ranging from 1–16. To assign the program to one of the schedules, simply enter or scroll to the corresponding number in the "Selected Schedule" box.

1. In the **Selected Schedule Box**, select **Schedule 1.**
2. **Click on the Days to Water** in 6 Week schedule Displayed. Enter days individually in the check boxes, or complete Rows or Columns can be selected by clicking on the Week or Day label.
3. To name the schedule, enter a brief description in the text box above the schedule.
4. When finished editing the Schedule, choose **Save**.

Note: *To assign this schedule to another program (tab), simply select the number in the Select Schedule Box during program setup.*

Station Run Times

One of the most unique and powerful programming features of the Sentinel WMS software is the method used to organize and control satellite station outputs within each irrigation program. This method is referred to as "Program Slots."

Program Slots are organized in a sequential matrix at the bottom of a Program Window, defined by 4 rows of 12 Slots, for a total of 48 slot positions. The program cycle operating sequence begins at the first Slot in row 1, and ends at the last Slot in row 4.

The station number is assigned to the label to the left of a slot and a run time duration ranging from 0 to 255 minutes is entered in the slot. Station numbers range from 0 (inactive) to 96. Stations can be assigned to slots in any order and as many times as preferred. If more than 48 Slots are required; i.e., for a 96-station satellite, an additional program must be used to assign the remaining 48 stations.

When an irrigation program is running, any slot with 0 (or blank) run time is ignored. A slot with an assigned run time duration ≥1 minute, but without a station assignment, will create a pause in the watering cycle for the assigned duration.

Note: *A key to using the Slots programming method, is to remember that the number next to each slot is the assigned* ***Station*** *number,* ***not the slot*** *number.*

1. **Select a Slot** by highlighting its label to the left.
2. **Enter a Station Number.** Multiple stations can be entered into a program using the Select stations option above the slots.
3. **Enter a Run Time** in the Slot
4. Repeat with additional Slots for all Stations in the Program.
5. When finished entering Stations & Run Times, choose **Save**.

Additional Program Parameters

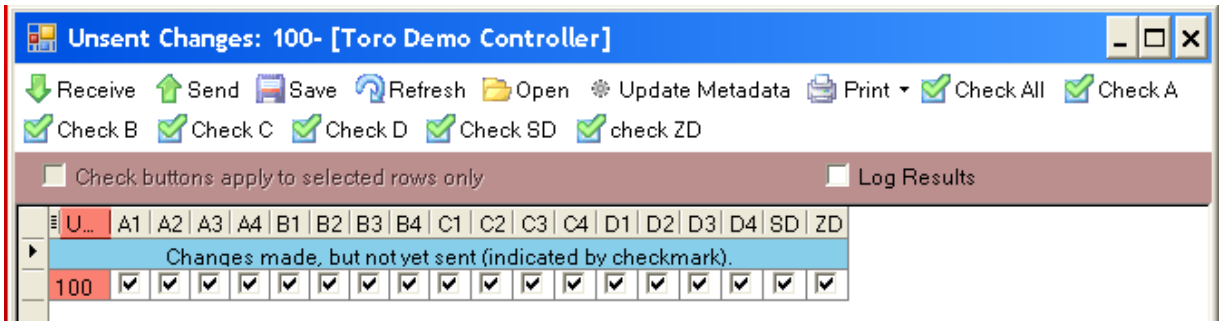
The various settings within this portion of the Program window enable each program to be modified as needed for optimum control. As settings are made, the program setup status information will be displayed in the colored panel. Green and Blue indicate the selected parameters are acceptable. When an error or conflict is found, the cause/resolution will be flagged in Red.

- **Percent Scale -** Adjusts the run time of all stations assigned to the program by percentage ranging from 0 to 255% (100% = no change).
- **Cycle Delay -** Places a delay period, ranging from 0 to 255 minutes, between repeat watering cycles.
- **Repeats -** Enables the watering cycle to be repeated from 1 to 250 times per start time.
- **Water Window -** The Water Window is the period of time in a 24-hour day that automatic watering can occur. Selecting a **From** and **To** time defines the Water Window start time, duration and end time. A program that is running at the end of the Water Window is automatically terminated.
- **Continuous Run -** Selecting Continuous Run will automatically repeat the program cycle continuously for the defined Water Window duration.
- **Activate Auxiliary Pump -** Select this option to activate the auxiliary output (designated in the **Special Data** window) at the beginning of the watering cycle.

SENDING PROGRAMMING TO CONTROLLER

As edits are made to primary programming screens that affect the satellite (Auto Program, Special Data (SD), Zone Data (ZD), the Sentinel WMS program flags the edits as they are made, then clears the flag when the changes are successfully sent to the satellite. A quick and efficient way to verify the results of the data transmissions is by opening the **Unsent Changes** window.

1. Choose the **Unsent Changes** window from the **Programming** directory. Unsent changes are indicated by a check mark in the box under the associated Program Tab.
2. Select **Check All** p to select all programming to be sent to the controller.
3. Choose **Send** to update the satellite and generate a report in the **Results** pane.



This Completes Quick Start Programming. Irrigation Will Occur. You may disconnect your computer from the controller.

CHAPTER 3: SETUP CHECK & TROUBLESHOOTING

TORO 2-WIRE SETUP QUICK CHECK LIST:

1. Gateway may be connected to either front or back serial port, but you must specify which port you are using in central software, special data -> advanced tab. Note that for stand-alone Sentinel TDC (TDC+) controllers you must connect your laptop to the serial port on the back of the satellite, so it is best to use the front port for the connection to the 2-wire gateway.
2. Black switch on Gateway should be set to "fiber" position. Cable from the Sentinel to the Gateway should be a straight 3-wire cable provided by Toro.
3. 2-Wire / Irritrol mode should be on, Set in central software, special data-> advanced tab. If it was off, turn it on, and power down the Sentinel and Gateway, wait 30 seconds, and power back up.
4. Each station must be set up in zone data, use the Setup Toro 2-wire button on the top of the zone data screen to set station types and view instructions. You will be setting station type, decoder address, decoder station, and daughter board number for each station. You must set decoder addresses from the central, there is no way to input the alpha-characters from the keypad, although you can review the decoder addresses from the keypad on the Sentinel.

CAUTION: It is ***highly recommended*** to use an optical isolator in the serial connection between the laptop and the Sentinel. If you are not using an isolator you should always run your laptop on battery when connecting to the Sentinel, and don't allow any metal parts on the laptop or cable to come in contact with the cabinet of the Sentinel.

IF DECODER IS NOT OPERATING:

1. After making sure all the above settings are correct, power down the Sentinel and Gateway, wait 30 seconds, and power back up. The power LED on the sentinel gateway should be the only one on.
2. Just to the right of the Gateway's power LED is the PC Connection LED. It should light and stay on the first time the Sentinel talks to the Gateway. If this is not happening, check the Special data -> advanced tab setting for Toro-2 wire. If it is correct try moving to the other serial port to test for a bad serial port on the Sentinel. To make the Sentinel talk the Gateway, turn a decoder station on, or off and then back on.
3. The Rx and Tx LED's will light momentarily as the Sentinel is communicating, but these can be difficult to see in bright conditions.
4. If some decoders are working, but one is not, double check the decoder address, decoder station, and daughter board numbers on zone data. Be sure station type is set to Toro - wire. If this is all correct try testing decoder at gateway or use a know good decoder at that location.

MIMINUM RECOMMENDED VERSIONS:

Sentinel WMS Software:

3.1.0.9 and later

TDC+ Control Module Firmware:

Version 2.46 Checksum ba47 or
Version 2.46 Checksum 22D5
Version 2.47 (any Checksum) and up