5 Controller Operation

This Chapter describes the menus and submenus used to operate the *CHEMTROL*® PC controllers. For an overview, refer to the Menu Tree (Section 5.5).

5.1 Control Panel

The Chemtrol Controller has an eight line display and a 16 button key pad. The active line in the display is shown by a reverse-video line (dark characters on a light background). The active line may be moved up and down by the up and down arrow buttons. The operator navigates through all the menus and submenus with four directional arrow keys: UP, DOWN, LEFT, and RIGHT.

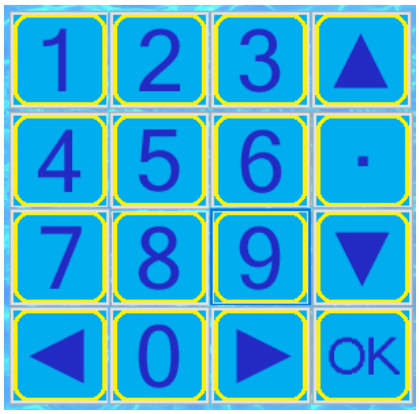


Figure 57. Key Pad

The brightness of the display screen is adjusted at the factory before shipping. If required, it can be re-adjusted at any time with the potentiometer marked R39.on the main board (**Figure 10**) inside the cabinet.

Note:

After a parameter is changed you can return to the previous menu via the right arrow. If you have entered in a numeric setup item, you must press OK to accept the item and progress to the next item.

5.2 Welcome Screen

When power is applied to the controller, the *CHEMTROL®* PC displays the Welcome Screen shown:

Figure 58. Welcome Screen (Typical)

The welcome screen includes the version of operating software installed on the controller and the numbers for Technical Support from the factory by phone 805-683-8833 or by fax 805-683-1893. In the USA and Canada, technical support is also available toll-free at 800-621-2279.

After a short time the Main Display appears. The welcome screen can also be accessed at from the Main Display by pressing the LEFT ARROW key.

5.3 Main Display Readings

A sample main screen is shown below:

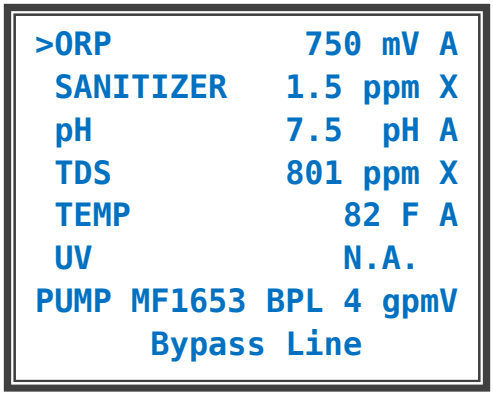


Figure 59. Main Screen

Here the active line is the date and time line (it is highlighted). Any line that may be flashing indicates an alarm condition.

Figure 59. Main Screenshows a typical operation of the pool controller. This screen indicates:

- Line 1 shows an **ORP reading of 750 mV** with the feed pump in Automatic feed mode (A) and running (>).
- Line 2 shows a **Sanitizer level of 1.5 ppm** with the feed mode OFF (X).
- Line 3 shows a **pH reading of 7.5** with the Acid feed mode in Automatic (A) and the pump not running (no >).
- Line 4 shows the **Total Dissolved Solids (TDS) at** 801 ppm and bleed valve control OFF (X).
- Line 5 shows a **Temperature reading of 82 F** with the heater control on Automatic (A).
- Line 6 shows **Flow Rates of 1653 and 4 gpm** in the Bypass line and Main line and the Pump in Manual mode (M).
- Line 7 Blank
- Line 8 shows the **Date and Time** and an indication that the **water saturation index is OK**. The line is highlighted to give access to the Configuration Menu.

Each line displays operational information on five columns, from left to right:

1. Operational status (ON or OFF) with a small caret ">" indicating outlet activation. If the caret is flashing it indicates that the outlet is pausing before activating again.
2. Function identification: ORP, SANITIZER, pH, CONDUCTIVITY, TEMPERATURE, PUMP
3. Sensor readings
4. Units of measurement (US or metric)

The operational mode is represented by a single letter:

A for automatic control,

M for manual operation,

P for proportional control

T for timer control,

X for OFF.

Alarm conditions are shown in two ways: operational parameters that are over or above limits are shown by flashing the corresponding line in the main display ORP, sanitizer, pH, TDS, temperature, pump). Other alarm conditions are shown by flashing text in the lower right corner of the display (Probe failure, out-of-range, overfeed)

- Probe Indicates a probe has failed
- LSI OK Indicates the Langlier Saturation Index (LSI)within limits
- Scale The LSI is above the set limit indicating a scaling condition
- Corr The LSI is below the set limit indicating as corrosion condition

If the display shows an alarm condition, press the UP or DOWN arrow keys to select the flashing line and enter the submenu with the RIGHT ARROW key to determine the cause of alarm. Press the LEFT ARROW key to exit from any submenu

5.4 Default Setup

The controller is initially loaded with standard default values that allow it to start operating normally. It is therefore not required to initialize it in order to operate the controller, as it defaults automatically to standard setup values:

- “English” language,
- “U.S. Units”,
- “No password”,
- Standard set points and alarm values.

The operator can change the original default settings at any time to suit preferences. If needed, the original default values can also be restored through the Reset menu. They will always be automatically restored in case of complete loss of power, including backup battery power.

The main menu is the gateway to the setup and configuration menus. The menus vary from model to model and upon the various options ordered with each unit.

A typical menu is shown below. Press the left arrow to bring up the version screen. The version screen identifies the unit and is necessary for accurate diagnosos and trouble shooting.

The setup and operational menus are accessed by moving the selection bar to the desired parameter using the up/down arrows then pressing the right arrow.

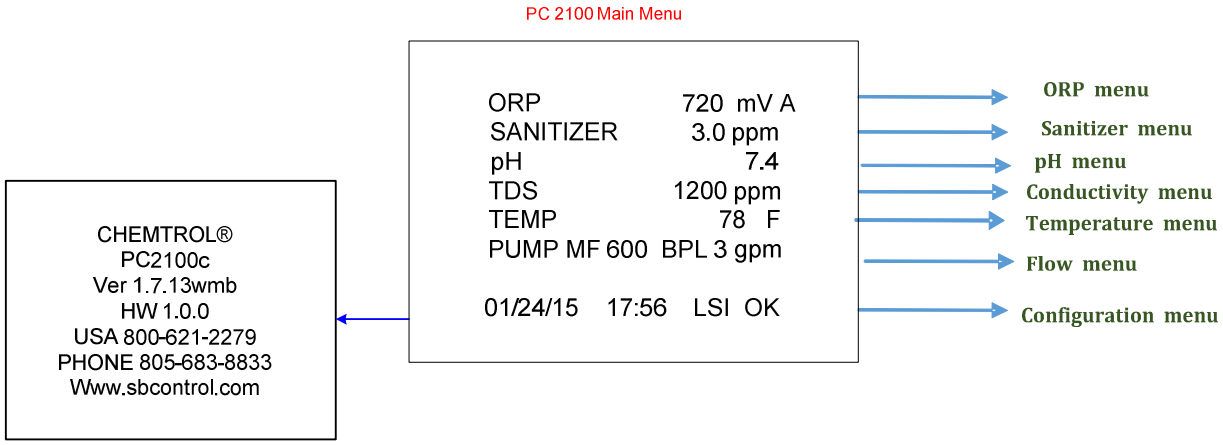


Figure 60. Typical Main Menu for PC 2100 series controllers

Each of the menus is described in the following sections.

5.5 Configuration Main Menu

The Configuration Menu is used for Initial Setup, Operations, and Communications.

To access the Configuration Menu, use the UP and DOWN ARROW keys on the Main Menu screen to highlight the time/date line (the bottom line) and then press the RIGHT ARROW key to enter the Configuration menu.

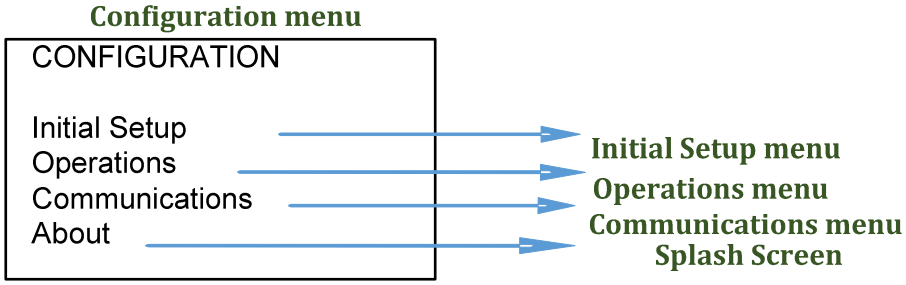


Figure 61. Configuration Menu

5.6 Initial Setup

The Initial Setup menu is used to specify basic operating conditions of the *CHEMTROL*® PC. Access the Initial Setup menu from the configuration menu by positioning the highlight bar over the Initial Setup line and pressing the right arrow.

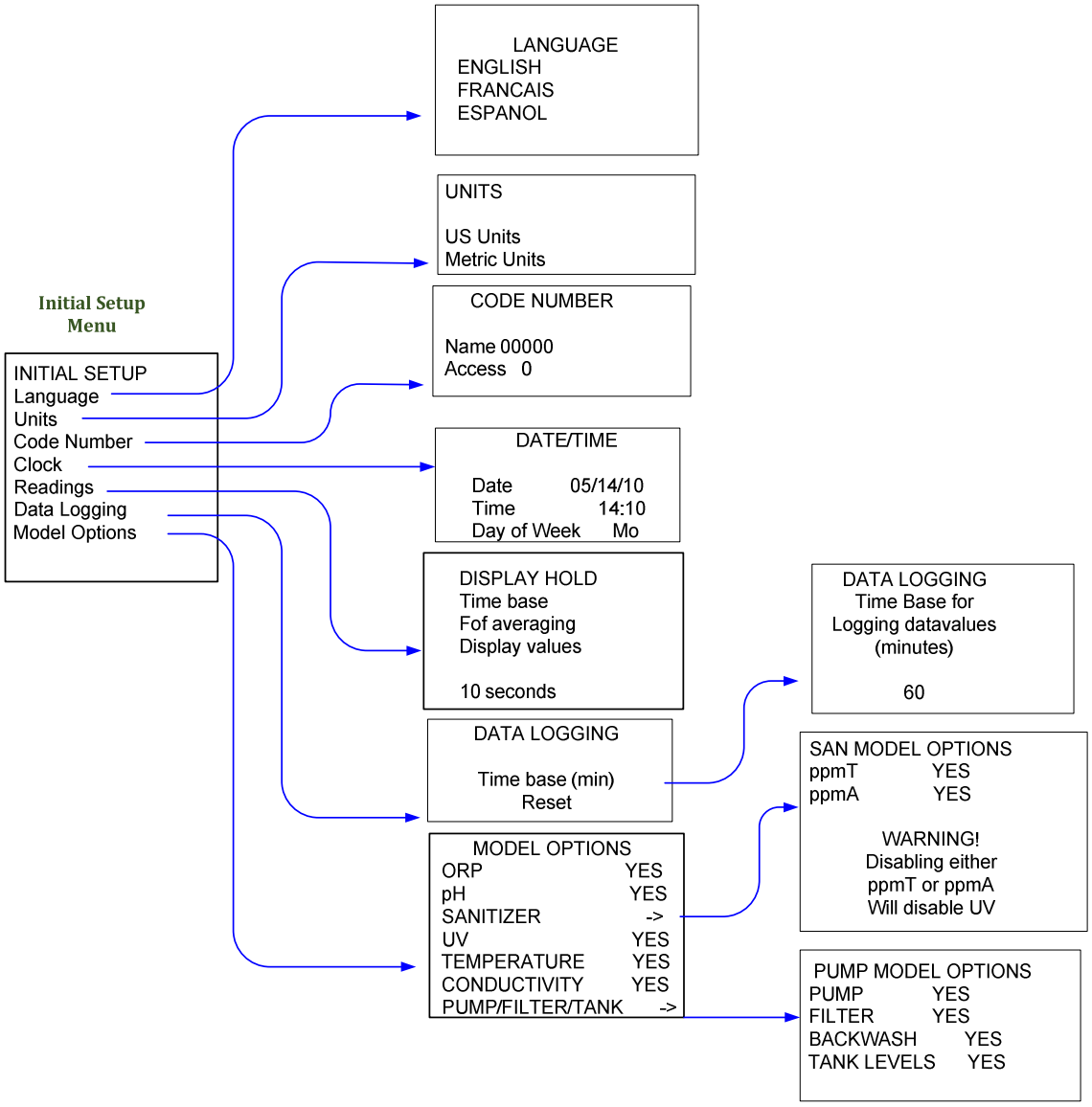


Figure 62. Initial Setup

5.6.1 Measurement Units

The unit equivalencies are:

	US	Metric
ORP	mV	mV
Sanitizer	ppm	mg/l
pH	pH	pH
Conductivity	µ S	µ S
TDS	ppm	mg/l
Temperature	F	C
Pressure	psi	kPa
Flow Rate	gpm	l/m
Flow	Mga	m3

Table 7. Unit Equivalencies

5.6.2 Code Numbers

The Code Number Submenu is used to define operator access levels. Code numbers may be required for access at key points in the program.

Up to ten Code NUMBERS (of one to five digits each - no letters) may be entered, along with an associated access level from one to three. Make sure to select an easy to remember number, such as a familiar name on a standard telephone keypad.

The following access levels are available:

- Level 0: Delete Access Number
- Level 1: View only,
- Level 2: Calibration,
- Level 3: All functions.

Once a Code Number has been acknowledged, it remains valid for an hour of continuous operation so that the operator does not have to re-enter it constantly. If necessary, it can changed by returning to the Welcome screen.

Entering Access codes

1. Using the arrow keys, navigate to the Code Number submenu.

2. Highlight the Name line and press right arrow. Only the Name numbers should be highlighted.
3. Enter the Code name (e. g. 333).
4. Press OK. (**You must press OK to enter the number. Pressing the right arrow will not make any changes**)
5. Press the down arrow and move the highlighted line to the Access line.
6. Press the right arrow (only the Access code should be highlighted)
7. Press desired access level (1, 2, or 3)
8. Press OK to enter the access code. The entire line will highlight)
9. Press the left arrow four times to activate the code.

When entering codes, be sure to enter your level 3 code name first. (Otherwise, you will be locked out.) Enter all the access level three codes first, followed by the access level two and one codes.

When deleting codes (setting the access level to 0) delete the level 3 codes last.

If some codes have been forgotten and you need to delete them, you must do a complete reset and reenter all parameters.

5.6.3 Clock Setup

The clock/calendar is used for programming of daily and weekly schedules. It keeps track of odd months and leap years. In case of power shutdown, the backup battery maintains power to the board. The clock needs to be reset only in case of complete power shutoff with loss of battery power.

The date display uses the MM/DD/YY (Month/Day/Year) format and the time display uses the 24:00 hour format (00:00 to 23:59).

5.6.4 Readings Setup

The Readings menu sets the DISPLAY HOLD parameters. It is used to stabilize the readings by averaging and increase the stability. It specifies the time interval over which the sensor data is averaged before the screen is updated. It can be set between 1 and 60 seconds with a default value of 10 seconds.

5.6.5 Data Logging

The DATA LOGGING screen selects the time interval for storing test data in the controller memory. Intervals can be between 1 to 999 minutes, with a default value of 60 minutes.

The memory of the controller chip can store up to 999 readings. When full, the oldest readings are overwritten by the newer ones. Therefore the greater the interval is, the more data can be kept in the controller. For instance, an interval of 60 minutes (one hour) fills the memory in about 41 days. If data logging is set to every four hours, the controller will holds 5 ½ months of data.

To avoid losing test data, remember to download it to a computer or the SDchip before the memory is full (Print Reports). After data download is completed, the Reset function in can be used to remove all data and start with a clean slate.

Set the time base by moving the highlight bar to the time base line and press the right arrow. Enter the desired time base followed by the OK button.

The Reset option in is used to reset the controller setup parameters.

5.6.6 Model Options

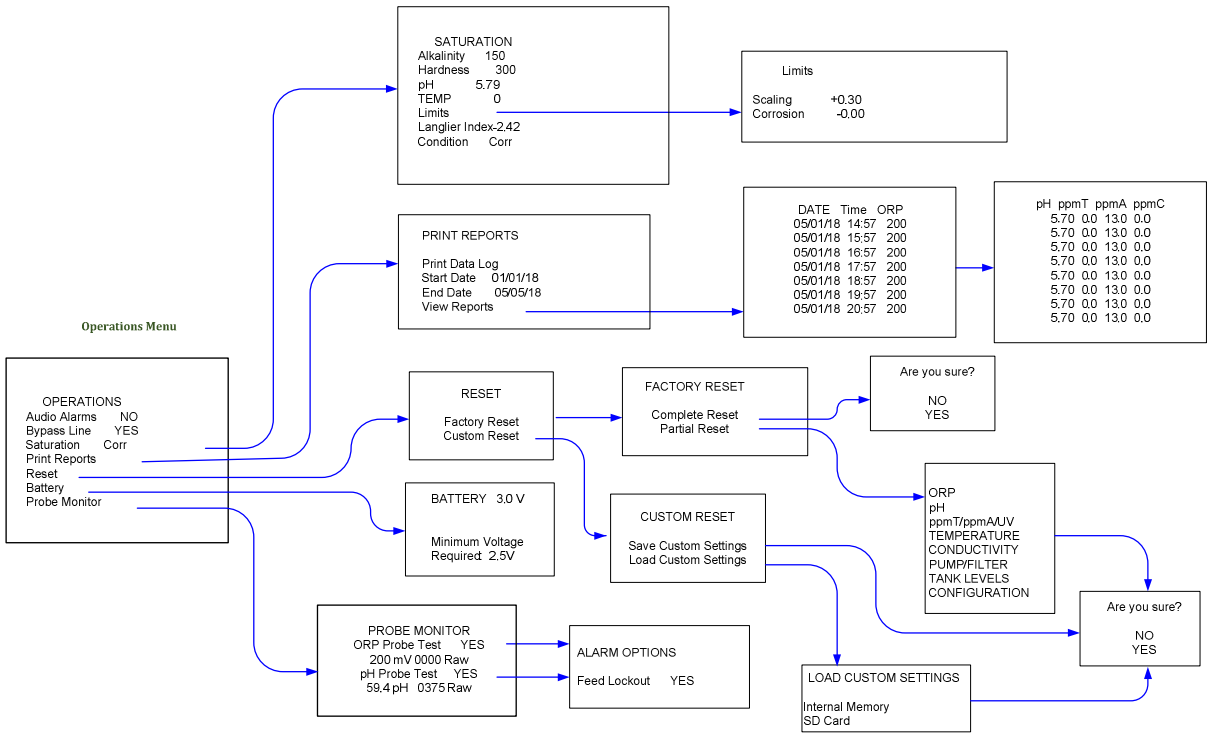
The Model Options Submenu is used to specify the functions that are actually installed on the controller. Non-installed functions should be set to "NO". The Main Display Screen will then show N/A for that function.

For demonstration purposes, it is possible to access any function and review its features even if that feature is not actually installed on the controller, by selecting "YES" for that option. Model Options are ORP, pH, Sanitizer, UV, temperature, conductivity, and pump options.

Each of the options may be selected or deselected by move the Highlight bar to the corresponding line and pressing RIGHT ARROW. Press LEFT ARROW to return to the previous menu.

5.7 Operations Menu

The Operations Menu allows the operator to access and change operating conditions during normal operation. Access the Operations menu from the configuration menu by positioning the highlight bar over the Operations line and pressing the right arrow.



5.7.1 Bypass Line Submenu

The bypass line is a recommended feature installation on large recirculation lines, i.e. over 2 inches in diameter. It is included with all PC controllers.

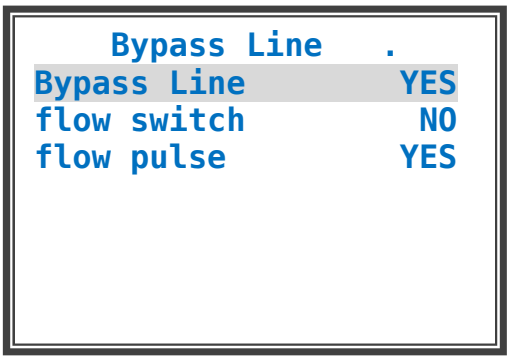


Figure 63. Bypass Menu

A Safety Flow Switch is used to prevent operation when there is insufficient water flow in the bypass line. This can occur particularly when the bypass line is shut down for maintenance.

In addition, units have the ability to accept a secondary blade or continuity flow switch. This can be installed on the main line so that either flow switch can disable chemical feed.

WARNING:

Feeding chemicals when there is no water running in the bypass line may cause dangerous chemical reactions.

The standard flow switch provided with the *CHEMTROL*® PC is a rotary flow meter with a paddle wheel. The shutoff is set at 1 gpm (about 4 l/m).

The Bypass Line Protection option should always be set to YES, indicating that the alarm is active and will cause the interruption of all feed events.

If the flow switch is defective or temporarily disabled, the bypass alarm can be overridden by setting the Bypass option to NO. **This override should be used with extreme caution.**

5.7.2 Saturation Menu

The Saturation Menu is used to configure the saturation parameters for the Langelier Saturation Index (LSI). The LSI is used for monitoring the development of corrosive or scaling tendencies in water.

The LSI is calculated from the formula:

$$LSI = pH + TF + AF + CF - 12.1$$

where:

- pH = pH sensor reading or keyboard input,
- TF = Temperature factor calculated from sensor input or keyboard input,
- AF = Alkalinity factor from data table,

- CF = Calcium Hardness factor from data table.

Alkalinity is measured with a test kit and the result entered into the Alkalinity line. Move the highlight bar to the Alkalinity line and press the right arrow. Enter the total alkalinity and press OK.

Similarly, hardness is measured with a test kit and the result entered into the Hardness line. Move the highlight bar to the Hardness line and press the right arrow. Enter the Hardness in ppm and press OK.

To access the Limits sub menu, move the highlight bar to the Limits line and press the right arrow.

pH and temperature is taken from the respective probes and the resulting LSI is displayed. The condition is also displayed based on the limits set in the Limits submenu. The conditions may be

Condition		Typical Limits
"OK"		0 to 0.30
"CORR"	Below Corrosion Limit	0
"SCALE"	Above Scaling Limit	0.3

Table 8. Corrosion / Scaling Limits

Langelier Limits Menu

The controller calculates the factors TF, AF and CF from the input for temperature (degrees), alkalinity (ppm) and hardness (ppm).

The limits for the Langelier Index re entered in the Limits submenu. To set the Scaling limits, move the highlight bar to the Scaling line and press the right arrow. The numeric sign (plus or minus) will highlight. Use the up down arrows to select the desired sign then press the right arrow. The number value will highlight, indicating that you can enter in a number. Enter the number (with decimal point) and press OK to finalize the entry.

If an alarm condition develops, the Main Display Screen alerts it with flashing characters in the bottom row.

5.7.3 Print Reports

The Print Reports menu is used to either view or download the test data that has been collected by the controller.

The range the data to be saved or viewed is from the Start Date to the End Date. To set these dates, move the highlight bar to the desired line (Start date or end date) and press the right arrow. Enter all six digits (including leading zeroes) and press the OK button.

The data is saved in memory in standard ASCII format. It can be download to the microSD memory chip by selecting the Backup Data Log and pressing the right arrow. The data will be stored on the SDchip in a file called datalog.bin. (This name may change.) The file may be renamed datalog.txt and displayed, edited and printed in text format using a text editor, such as *Windows Notepad*, *Microsoft Word*, or *Microsoft Excel.*

A maximum number of 999 sets of test data can be stored in the controller. Therefore, it is recommended to download the data periodically. Downloading the data does not erase it from the controller. To erase all data in memory, use Data Logging and select Reset.

For direct download to a computer, use the ChemComm program to connect to the controller either through the serial port or over the Ethernet connection.

5.7.4 Reset Menu

The Reset menu is accessed from the Operations Menu. Starting from the Operations menu, move the highlight bar to Reset on the Operations menu and press the right arrow.

The Reset menu has two choices: Factory Reset and Custom Reset.

The Factory Reset return the controller to the factory state: all system parameters are returned to their default values, all calibration parameters are reset, all alarms are reset, and all code numbers are removed.

Partial Reset allows resetting of individual functions, such as ORP, Sanitizer, pH, etc.

To perform a factory reset, move the highlight bar to the Factory reset line and press the right arrow. The Factory reset menu will appear. Select either Complete reset or Partial reset and press the right arrow. If Factory reset is selected a confirmation screen will appear. Select yes then press the right arrow.

To perform a Partial reset, move the highlight bar to the Partial reset line and press the right arrow. The Partial Reset menu will appear.

Move the highlight bar to the desired parameter and press the right arrow. A confirmation screen will appear, select yes or no, and press the right arrow. Press the left arrow to return to the Factory Reset menu, and once more to return to the Configuration menu.\

For each item, the reset option

1. Clears alarms and resets the alarm levels to factory default
2. Resets calibration to factory default
3. Resets run time to zero

5.7.5 Battery

The Battery screen shows the state of the internal battery. Replace the internal battery when the voltage drops below 2.5 V

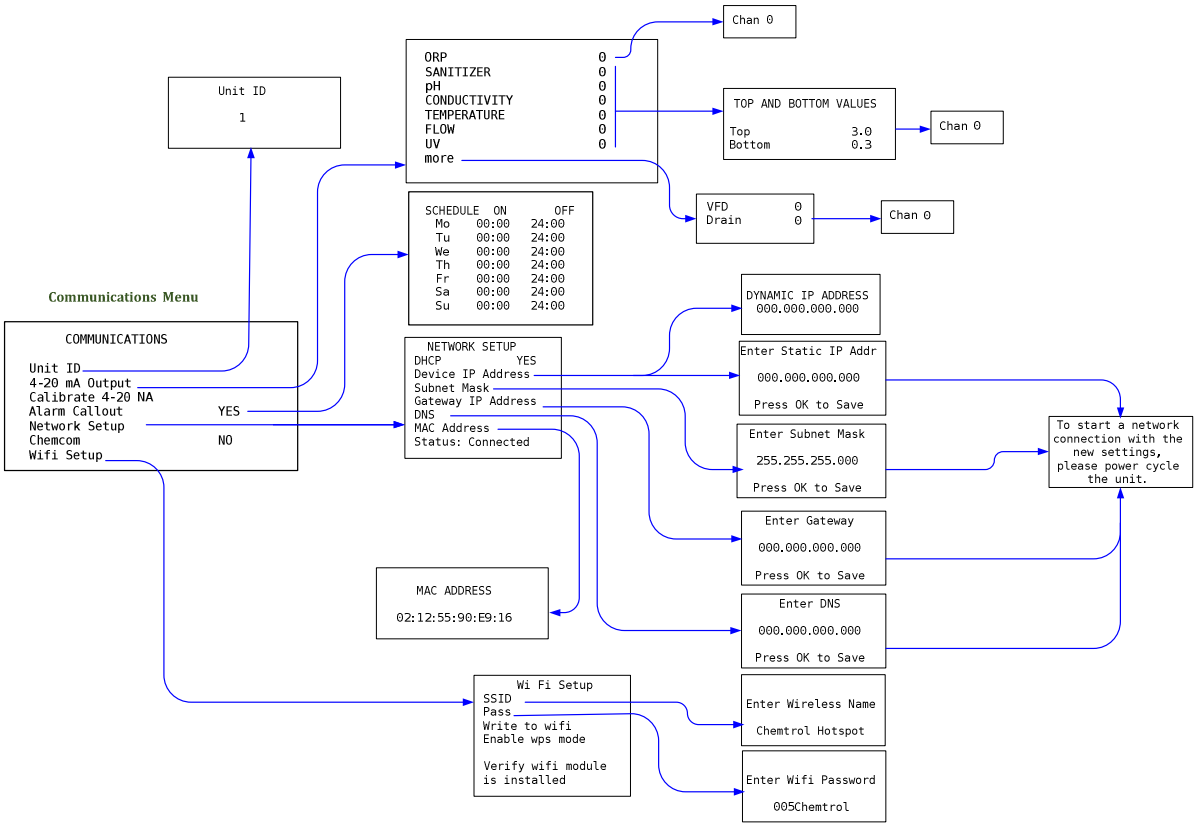
5.7.6 Probe Monitor

The Probe Monitor menu is accessed from the Operations menu by moving the highlight bar to the Probe Monitor line and pressing the right arrow. The Probe Monitor menu will appear.

The Probe Monitor menu shows the data for the ORP and pH probes. To perform a test, move the highlight bar to the desired Probe Test line and press the right arrow. Press the right arrow once more to access the Alarm Options Feed Lockout menu. Press the right arrow to toggle the Feed Lockout between yes and no. Press the left arrow to return to the Probe monitor menu. Now, press the right arrow once to change the probe test from yes to no (or no to yes). Press the left arrow to return to the Operations menu.

5.8 Communications Menu

The Communications menu is accessed from the Configuration menu by moving the highlight bar to the Communications line and pressing the right arrow.



The Communications menu is used to set the Unit ID, 4-20 mA calibration, Alarm callout schedule, Network setup and Wifi setup.

Unit ID

The unit identification number is used to identify individual controllers in RS-422 multi-drop systems. If the controller is in an Ethernet system, the Unit ID must be set to 1 to interact with the Chemtrol Web.

4-20 mA Output

The 4-20 mA Output is used to scale the 4-20mA outputs. This menu is accessed by moving the highlight bar to the 4-20 mA Output line in the Communications menu and pressing the right arrow. The 4-20 mA selection menu shown below and permits selection of one of eight outputs.

Move the highlight bar to the desired output and press the right arrow. The Top and Bottom Values menu will appear. Select either the Top or Bottom line, press the right arrow and enter in the target numeric output for top (20 mA) and bottom (4 mA).

Calibrate 4-20 (Input)

The calibrate 4-20 mA inputs sets up the scaling for the 4-20mA inputs. Set the Calibrate 4-20 line in the Communications menu and press the right arrow button. The **Select 4-20 Channel** menu will appear. Select the desired channel by using the up arrow and down arrow keys. After the desired channel has been selected, press the right arrow. The Calibrate 4-20 #x menu will appear (x is the channel number). Use the highlight bar to select 20ma line or the 4ma line and press the right arrow key. Enter the numeric input that 4ma and 20 mA represents on the respective line. Press OK to finalize the value and left arrow to return to the previous menus.

5.8.1 Network Setup

The Network setup menu sets up and displays the DHCP, Device IP address, Subnet Mask, Gateway IP Address, DNS, MAC Address, and status.

DHCP

Move the highlight bar to DHCP and press enter. Select yes or no using the UP and DOWN arrow keys. Press the RIGHT ARROW to return to the previous menu.

Device IP address

Move the highlight bar to Device IP Address and press enter. If DHCP had been selected, the assigned IP address will be shown (after cycling the power). Otherwise enter the IP address as 12 digits followed by the OK key.

Subnet Mask

Move the highlight bar to Subnet Mask and press enter. Enter the mask address as 12 digits followed by the OK key.

Gateway IP Address,

Move the highlight bar to Gateway IP and press enter. Enter the mask address as 12 digits followed by the OK key.

DNS

Move the highlight bar to DNS and press enter. Enter the mask address as 12 digits followed by the OK key.

MAC Address

Move the highlight bar to MAC Address and press enter. The MAC address is shown. It cannot be changed.

Status

The Status line shows the status of the Network connection. When connectrd it also shows the numeric ID of the Chemtrol webserver.

WiFi Setup

The WiFi menu setup the WiFi Connection to the controller. The controller must have the WiFi option installed.

SSID

The controller will show the default SSID with the cursor at the left end. Enter each letter of the new SSID using the UP and DOWN ARROWS then move to the next character position using the RIGHT ARROW. When completed, press OK.

Pass

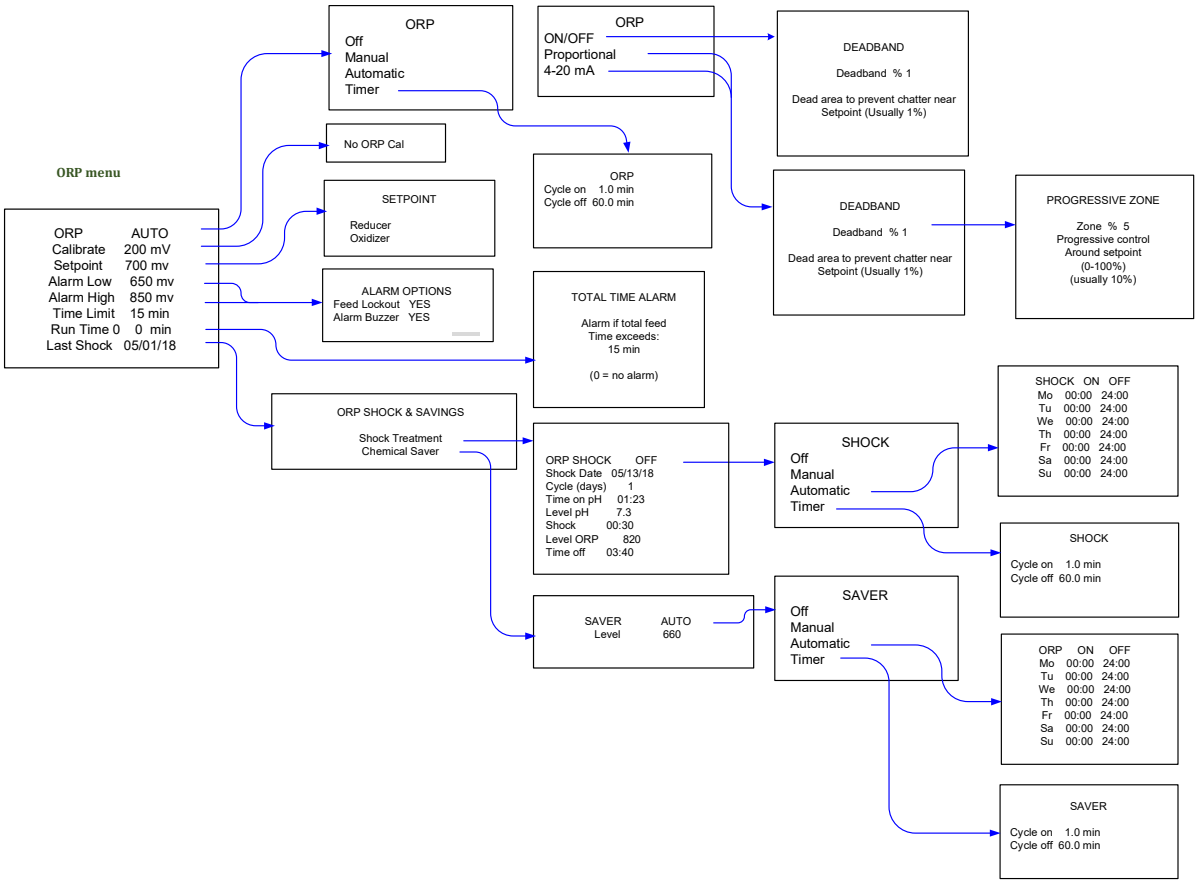
The controller will show the default Password with the cursor at the left end. Enter each letter of the new password using the UP and DOWN ARROWS then move to the next character position using the RIGHT ARROW. When completed, press OK.

Write to wifi

After the SSID and Pass have been setup, place the highlight bar on the Write to wifi line and press the RIGHT ARROW. The SSID and Pass will be written to the WiFi module and the WiFi communications will be enabled.

5.9 ORP Menu

The ORP menu is used to set up the ORP sensor



5.9.1 Calibrate

This line displays the current reading of the ORP sensor in mV. There is no calibration menu for ORP since there are no readily available calibration solutions in the range of operation for water treatment.

5.9.2 Time Limit

The TIME LIMIT sets the maximum allowed time (in minutes) for continuous oxidizer feed. This acts as a safety feature to prevent overfeeding in case of malfunction of the chemical feeder or as an alarm if the feed tank runs empty. The standard (default) value for ORP is 15 minutes.

When in alarm, Time Limit is reset by highlighting the value and pressing OK. To defeat the safety timer, enter zero (0).

5.9.3 Run Time

The RUN TIME line displays two separate values: the amount of running time in minutes for each current activation event and the total run time since last reset to zero.

To reset the cumulative run time, enter zero in the far right column. To reset only the current run time, highlight Time Limit value and press OK. The Total Time Alarm will appear.

5.9.4 Total Time Alarm

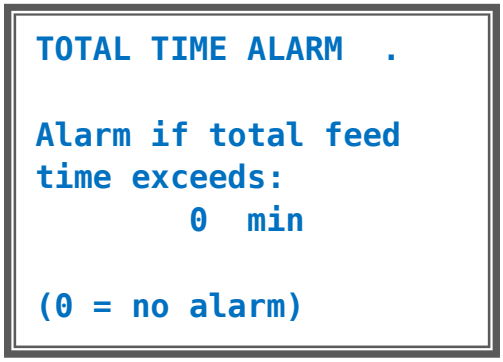
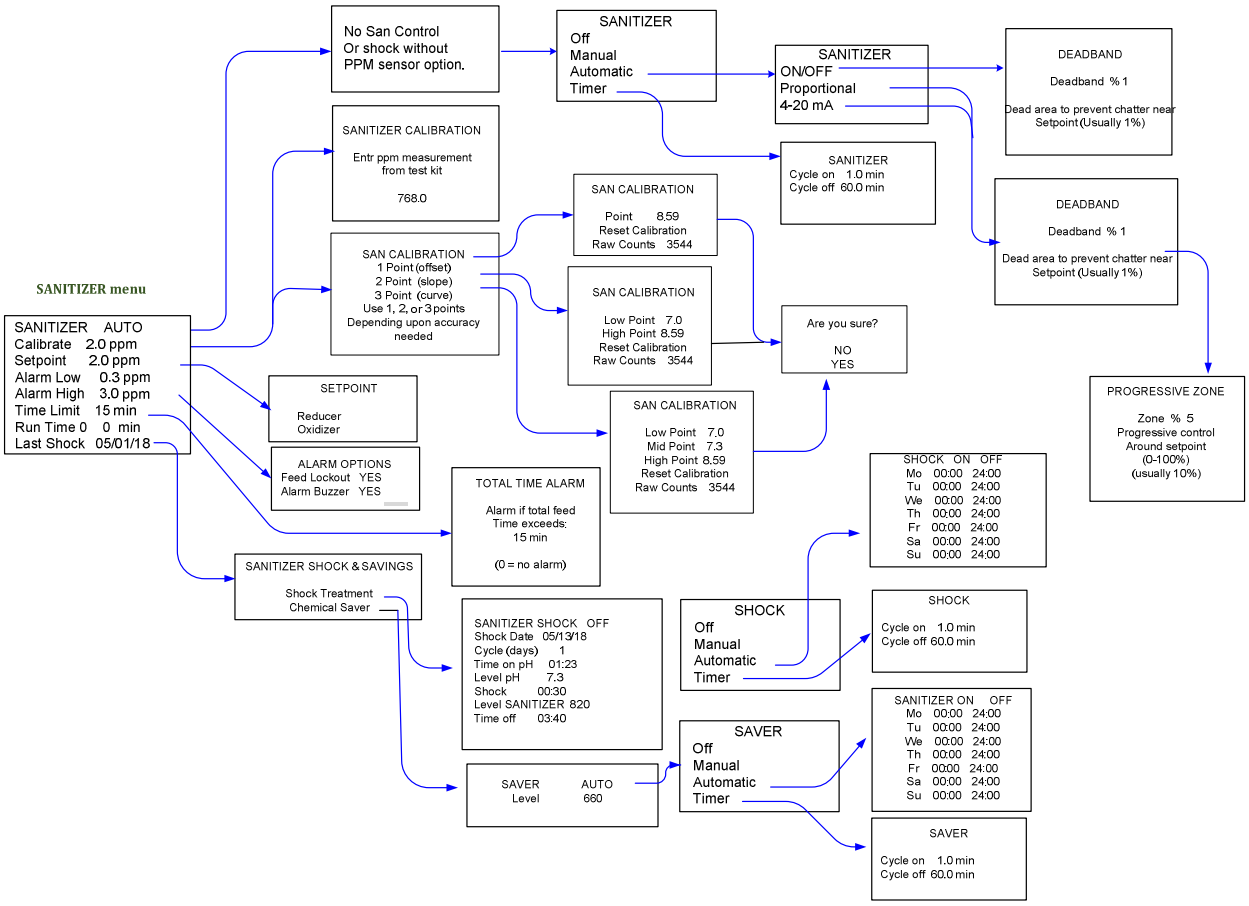


Figure 64. ORP Total Time Alarm

The ORP Total Feed Time menu is used to show the feed time from a chemical tank since last reset to zero. Knowing the pump feed rate, it can be used to monitor the emptying of the tank and set a low-level alarm. This feature is particularly useful for remote monitoring of the chemical tanks.

5.10 SANITIZER MENU OPTION

The SANITIZER function is used to monitor the concentration of chlorine (or bromine) using either Free Chlorine sensor input probe or values calculated from ORP and pH inputs



Sanitizer level may also be calculated using a *CHEMTROL*® proprietary algorithm. The algorithm is most accurate with clean water and can be affected by the presence of organic and inorganic contaminants including cyanuric acid. In general, clean water shows higher ORP values at lower ppm values. Thus, as the contaminant level increases, an increased level of sanitizer (ppm) is required to obtain the same ORP level. If it becomes excessive, shock treatment or water replacement is required.

This option sets up the control parameters for the 4-20 mA output. A deadband menu followed by a progressive zone menus are presented. Here the deadband and progressive zone margin are setup to enhance the stability and accuracy of the 4-20 mA output.

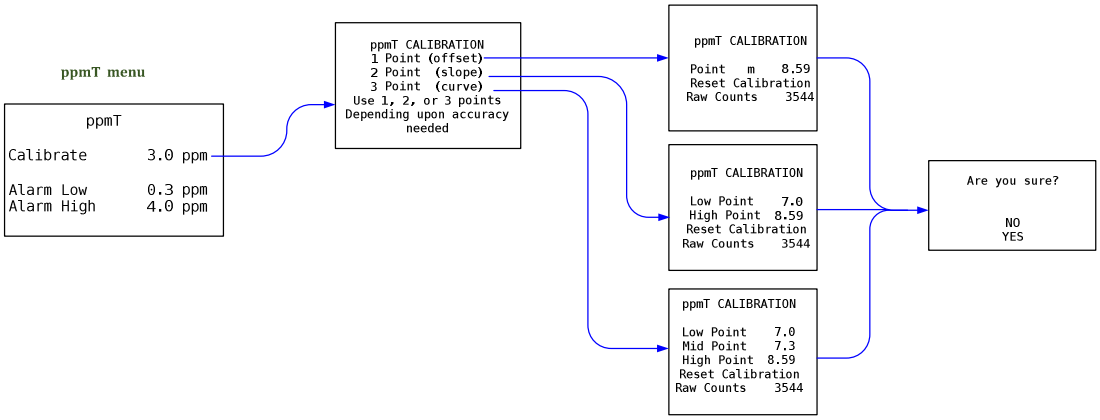
> **NOTE**: Before recalibration, always do a partial reset of PPM readings using the Operations Menu.

For a pH of 7.5, the calibration algorithm assumes a baseline default value of 635 mV of ORP for 0 ppm.

For heavily contaminated water, the baseline can be readjusted to lower values. For instance, if the controller readings are too low by 1 to 2 ppm, a baseline value of 600 mV gives better results. For more than 2 ppm, use 575 mV.

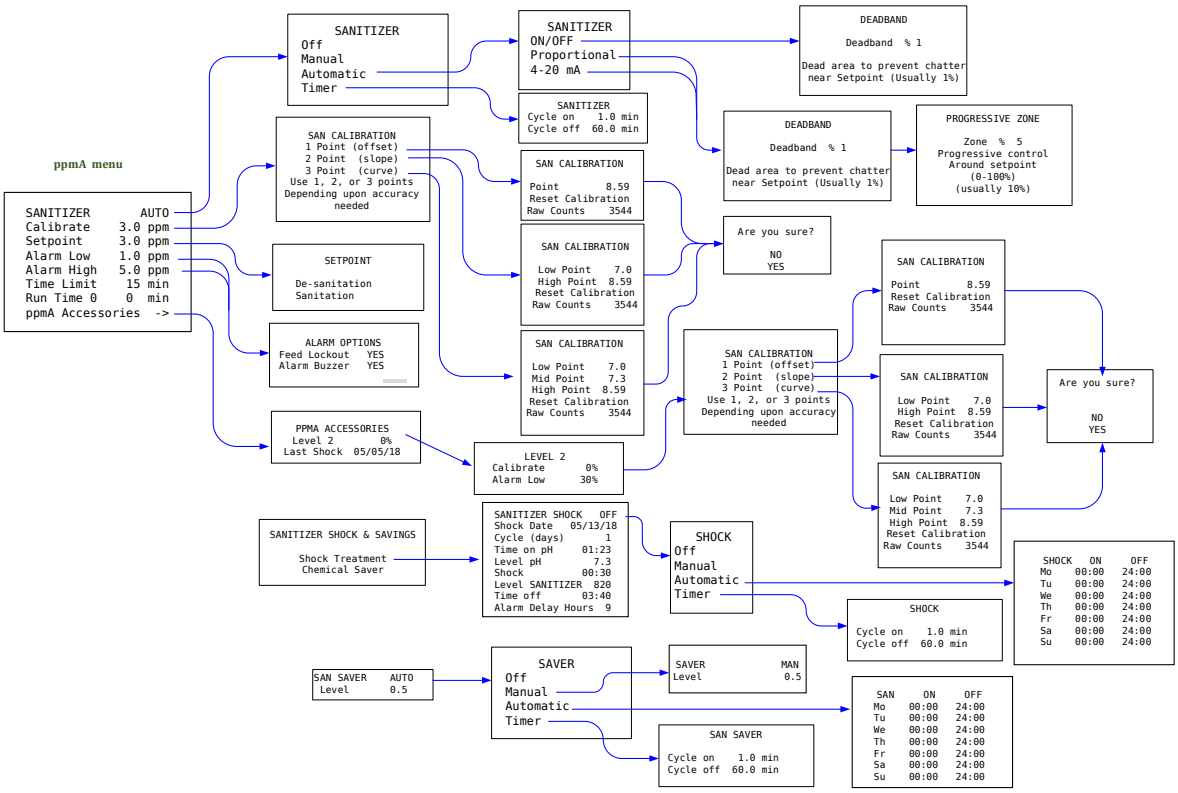
5.11 ppmT Menu

The ppmT or Total chlorine menu is used to calibrate the Total Chlorine sensor. A one, two or three point calibration may be selected.



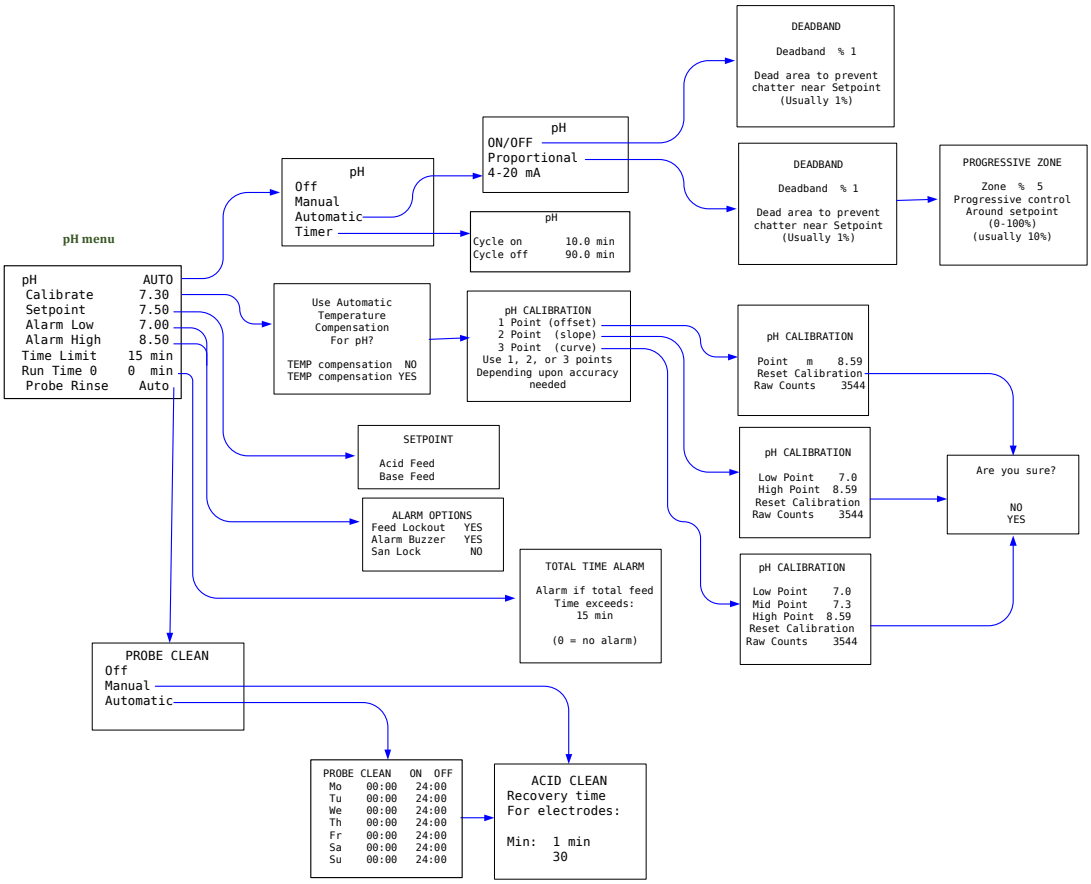
5.12 ppmA Menu

The ppmA or Active chlorine is used to both measure the active chlorine present and to control the chemical feed of the sanitizer being used, to set alarm levels, set the type of control used (manual, automatic, or proportional), and set other parameters.



5.13 pH MENU

The pH Menu screen is used to access all the pH submenus for Control Mode, sensor calibration, set point and alarm settings.



It also displays the actual run time for individual feed events and the cumulative run time since last reset to zero.

The pH function is used to monitor the acid –base status of the water.

The pH menus are accessed from the main menu (Section 5.3) by moving the highlight bar to the third row (pH) and pressing the RIGHT ARROW. If the pH is not setup as YES , i. e. present, the pH row will read NA and the pH menus will be unavailable.

5.14 TDS / Conductivity Menu (Total Dissolved Solids / Conductivity)

The TDS/COND sensor is used to monitor and control a TDS/COND, like chlorine or bromine, or a true oxidizer like ozone. The TDS/Cond menu shown in Figure 61

The Conductivity sensor monitors the concentration of Total Dissolved Solids (TDS) in the water. The conductivity of the water in microsiemens per centimeter (µS/cm) may be converted into ppm or mg/l of TDS with a conversion factor that depends on the type of ionic species that are present in the water. Normally, a value of 0.5 is used for water solutions containing different species of carbonate and chloride ions.

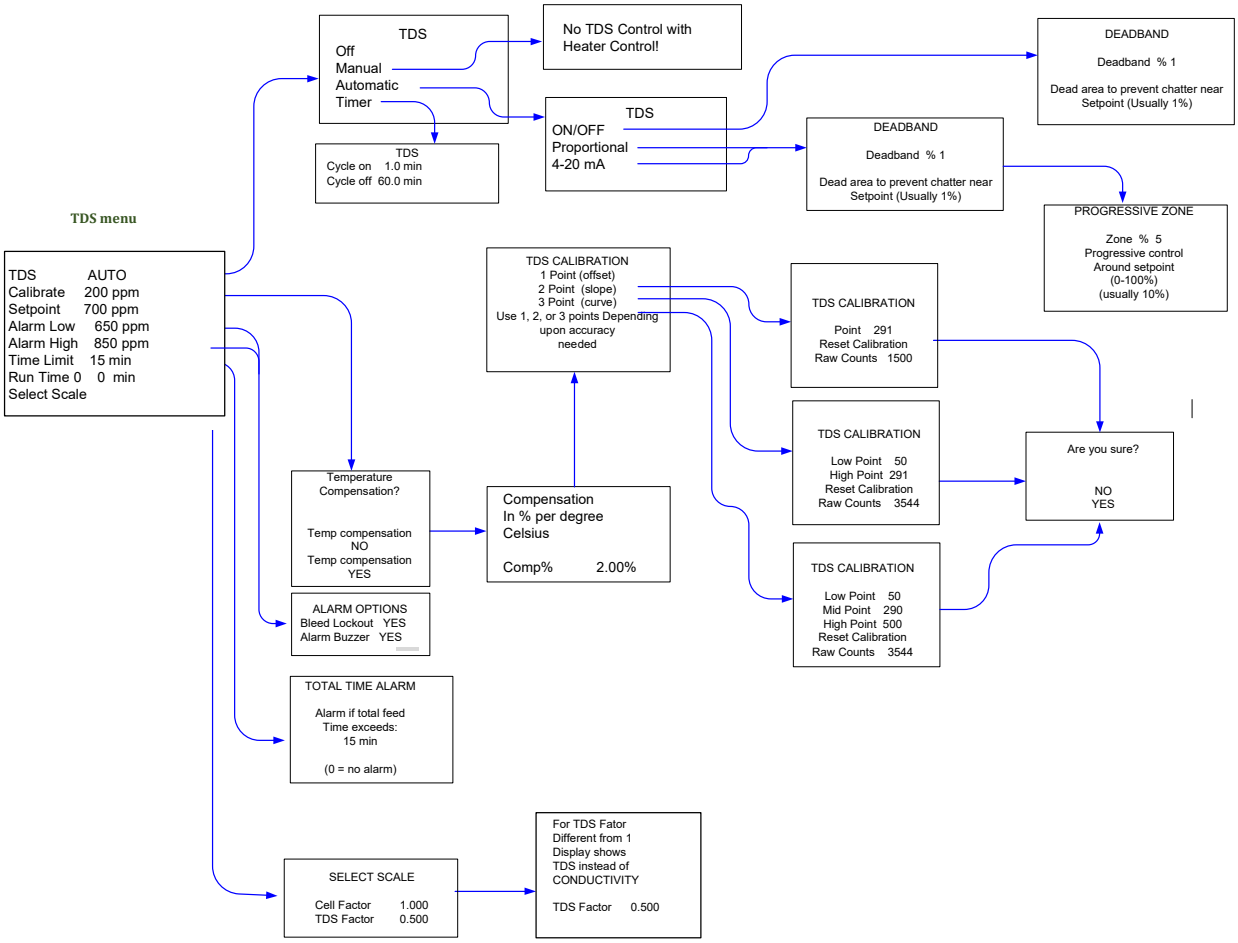


Figure 65. TDS Menu

Conductivity or TDS can be controlled in two different directions:

- downward (decrease) to bleed water when the TDS level gets too high, or
- upward (increase) to add a salt brine solution for an electrolytic generator when the TDS level gets too low.

IMPORTANT NOTE:

Conductivity control is available only when Probe Clean control is OFF. It activates the relay labeled "Acid Clean" located on the Power board.

Depending on the application, it may be customary to control either conductivity or TDS. Both displays are available in the two systems, as shown on the sample screens.

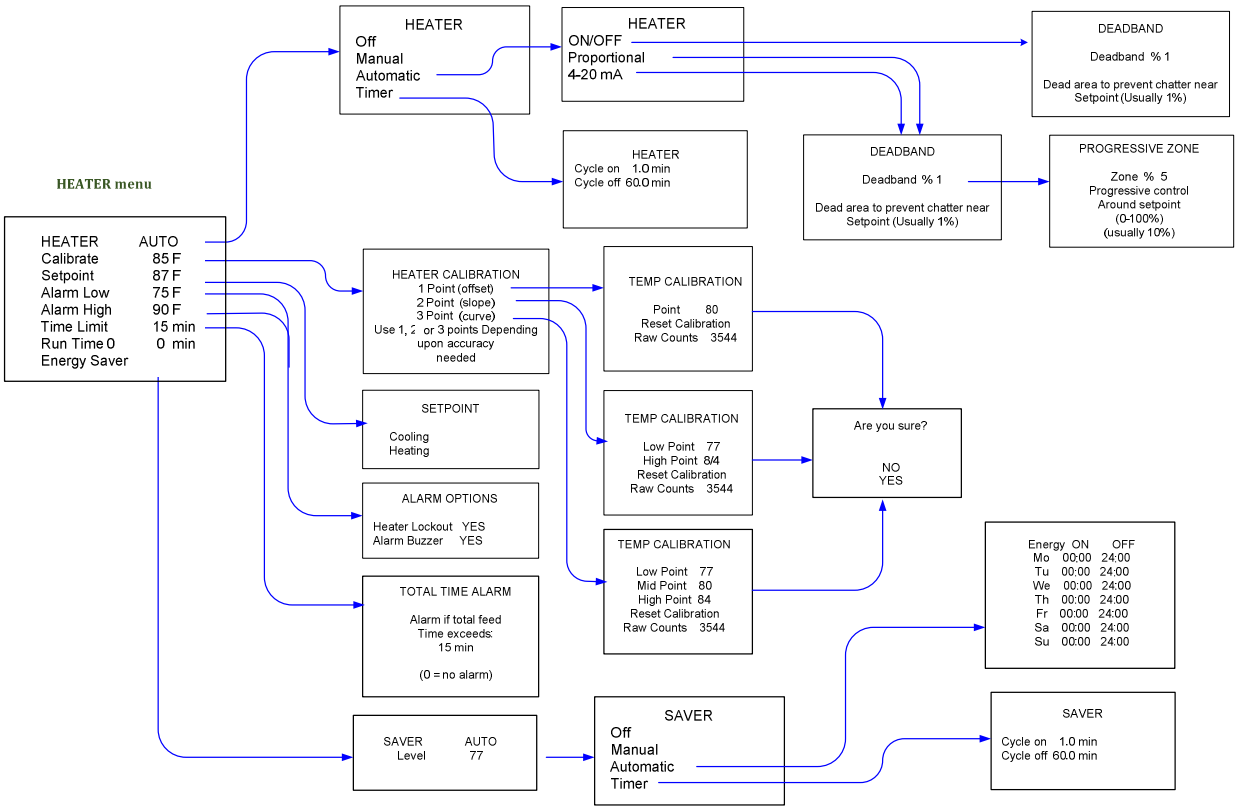
To change the displays from conductivity to TDS, enter a TDS factor different from 1 in the Select Scale menu (more below) menu If the TDS Factor is 1, the display shows Conductivity (COND) in µS/cm. If different from 1, it shows TDS in ppm or mg/l.

The TDS Menu screen is used to access all the TDS submenus for Control Mode, sensor calibration, set point and alarm settings. It also displays the actual run time for individual feed events and the cumulative run time since last reset to zero.

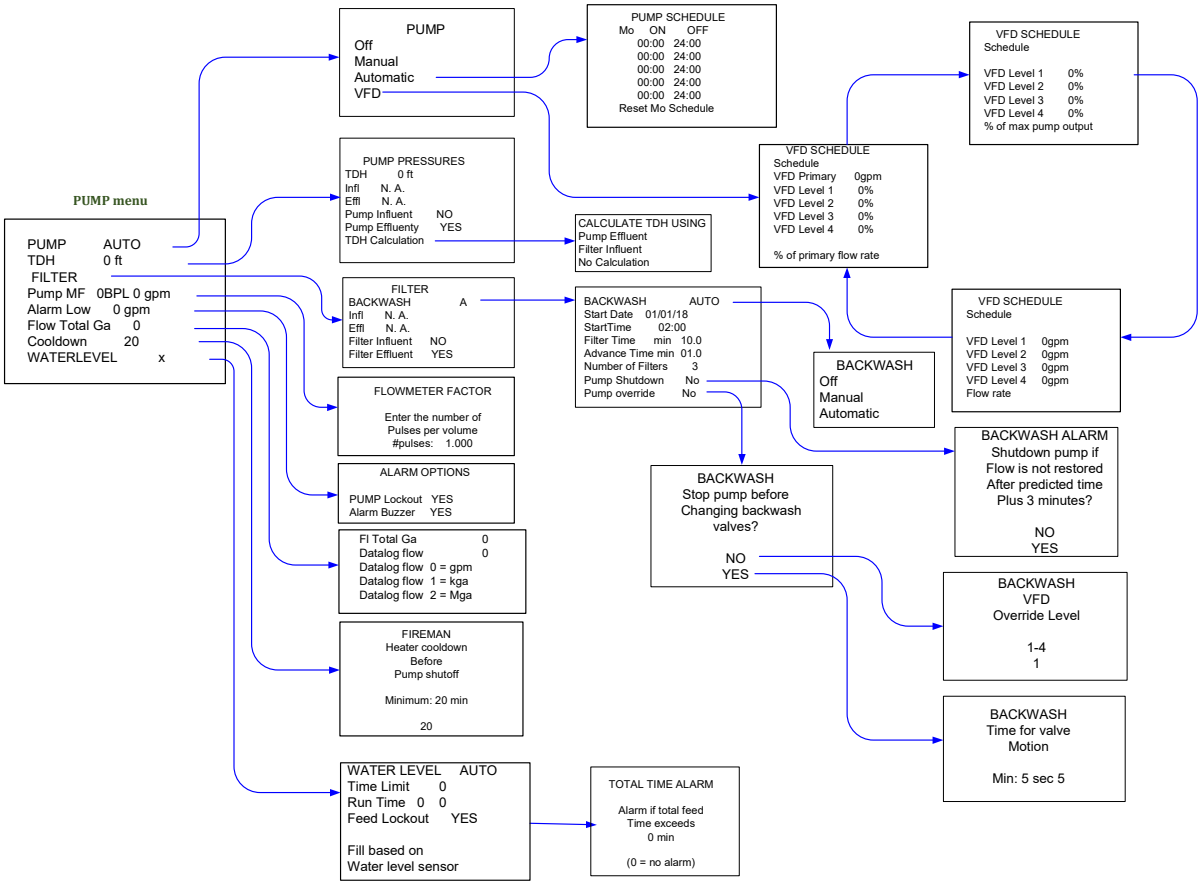
The TDS menus are accessed from the main menu 1by moving the highlight bar to the fourth row (TDS or COND) and pressing the RIGHT ARROW. This will bring up the TDS/COND menu. If the TDS is not setup as YES in the system configuration i. e. not present, the TDS/COND row will read NA and the TDS/COND menus will be unavailable. The menus shown will be for TDS where COND would be for conductivity measurements.

5.15 TEMPERATURE CONTROL

The Temperature Menu, or Heater Menu, is used to control the operation of the heater with the temperature sensor. All displays can be shown in either degrees Fahrenheit or Celsius.



5.16 Pump Menu



The flow meter factor is calibrated by entering the K-factor provided by the sensor manufacturer. These values correspond to the number of pulses per unit of volume in gallons or liters, which are given by the sensor manufacturer.

5.17 Backwash Auto Menu

The unit contains several combinations for determining backwash initiation.