NexSys®

BOILER APPLICATION

INSTALLATION & OPERATION MANUAL

IMPORTANT NOTICE

WARNING: CHEMICAL FEED

All electromechanical devices are subject to failure from a variety of causes. These include mechanical stress, component degradation, electromagnetic fields, mishandling, improper setup, physical abuse, chemical abuse, improper installation, improper power feeds, and exposure.

While every precaution is taken to insure proper functioning, extra precautions should be taken to limit the ability of over-feeding by limiting chemical quantities available, secondary shut-downs, alarms, and redundancy or other available methods.

CAUTION: POWER SOURCE AND WIRING

Low voltage wiring and high voltage (110 plus) should not be run in the same conduit. Always run separately. Even shielded low voltage is not a guarantee of isolation.

Every precaution should be taken to insure proper grounding and elimination of shorting or Electromagnetic field (EMF) interference.

WARNING: ELECTRICAL SHOCK

To reduce the risk of electrical shock, this equipment has a grounding-type plug that has a third (grounding) pin. This plug will only fit into a grounding-type outlet. If the plug does not fit into the outlet, contact a qualified electrician to install the proper outlet. ***DO NOT*** change the plug in any way.

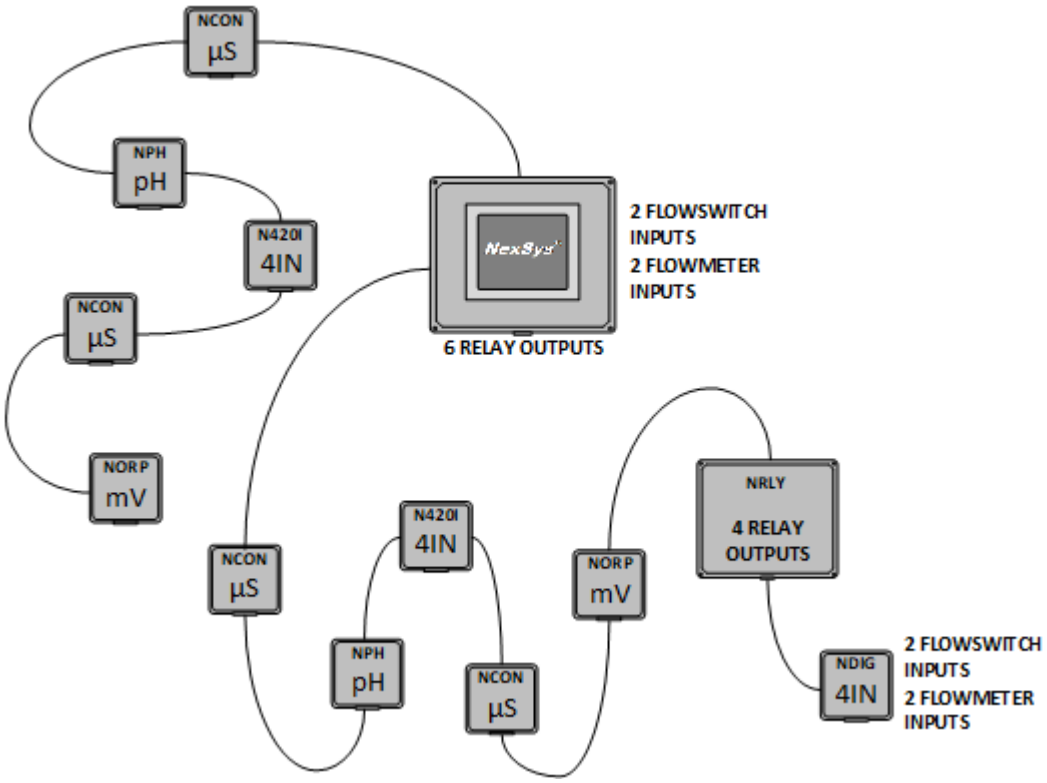
Table of Contents

Introduction

The **NexSys**™ control system is the latest in a long line of reliable, easy to use controllers from Lakewood Instruments.

All sensor inputs to the NexSys™ Control System make use of nodes. Nodes are mini CPUs with specific purposes.

The NexSys™ Control System includes the ability to add four conductivity input nodes, two pH input nodes, two ORP input nodes two 4-20 mA input nodes with four channels of input each, one digital input node (used for two flow switch inputs and two water meter inputs), and one relay node.



Features

The **NexSys**™ control system has the following features:

- Color TFT Touch screen user interface
- MODbus TCP and BACnet/IP communications capability
- Remote access through HTML5 web browsers
- The capability to send E-service reports to a subscribed service
- Email notification of alarms when they occur and when they are acknowledged
- The ability to display operating values with time and date stamps on color coded graphs with zoom and scroll features
- Ability to control 4 boiler blowdowns on one controller
- Up to eight active sensor inputs: 4 boiler conductivity, 2 pH and 2 ORP
- Up to eight active 4-20 mA inputs
- Trace chemistry capable with user definable correction factors as part of the programming
- Two water meter inputs with field expansion capability to four
- Able to configure water meter 1 and water meter 2 to sum their totals for relay operation.
- Enclosure is NEMA 4X rated
- Two flow switch inputs configurable to any relay output to lockout the relays on a loss of flow
- Ability to add up to eight 4-20mA input readings
- Ability to add four digital inputs
- Ability to mount **every** sensor input up to 400 meters away from the controller via 4-wire twisted pair
- Six relay outputs expandable to ten relay outputs for user configurable operations such as:
  - Feed by Percent of Blowdown Time
  - Direct or Reverse Setpoint Control
  - By Cycles of Concentration Setpoint
  - Bleed by Volume
  - Trace Chemistry Control
  - By Water Meter Total
  - By Percent On-Time
- Security lockout to prevent unauthorized access.
- The **NexSys**™ control system stores all setpoints, calibration values, and relay configurations in an EEPROM. An EEPROM does not require a battery to retain information, so if power is lost these values will be retained for years. The **NexSys**™ control system includes a battery backup device to retain information such as water meter totals, and clock and calendar information. Battery life is approximately 3 months if no power is applied to the controller.
- The **NexSys**™ control system includes sensor diagnostics indicating fouled sensor, broken glass or open PT band, and temperature compensation alarms. The conductivity input includes fouling compensation.

Benefits

- Able to control up to four boiler blowdowns with a single controller.
- Multiple control options in a single economical package.
- Very accurate control of chemical feed and cycles of concentration.
- Feeds chemical after blowdown.
- Very low maintenance.
- Tolerant to power surges and brownouts.
- Power cord, plug outlets and detached plumbing make installation easy. There is plenty of protected room inside the enclosure for electrician wiring.
- Very accurate monitoring of the evaporated water.
- Able to add additional control, such as additional relay outputs and remote sensor inputs.

Specifications

Conductivity Range
0-5000 µS

Conductivity Accuracy
± 40 µS

Conductivity Resolution
10 µS

ORP Range
-1000 to + 1000 mV

ORP Accuracy
± 5.0 mV

ORP Resolution
1 mV

pH Range
2-12 pH

pH Accuracy
± 0.05 pH

pH Resolution
0.01 pH

Accuracy & Repeatability
± 1.0% of scale

Water Meter Inputs (2)
Contact head, paddle wheel or turbine
-Expandable to 4

Output relays (6)
Fully Configurable
-Expandable to 10

Relay ratings
3A each, 15A total

Power
120/240 VAC 50/60 Hz 6W

Ambient Temperature Limits
32° - 158°F (0 - 70°C)

Storage Temperature Limits
32° - 158°F (0 - 70°C)

Maximum Water Temperature
140°F

Maximum Water Pressure
140 psi @ 100°F

Enclosure Rating
NEMA 4X

Unpacking, Mounting and Installation

Unpacking

Inspect the shipping carton for obvious external damage. Note on the carrier's bill-of-lading the extent of the damage, if any, and ***notify the carrier***. Save the shipping carton until your NexSys™ controller is started up.

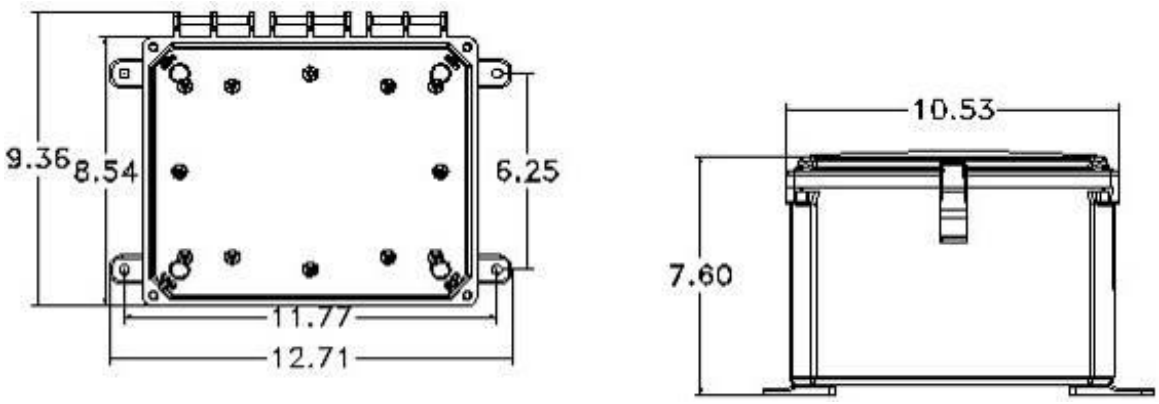
☎ **If shipping damage has occurred, call the Lakewood Instruments Customer Service Department at (800) 228-0839 and return the controller to the factory in the original carton.**

Mounting the Enclosure

The NexSys™ controller is supplied with four mounting feet. The NexSys™ can be mounted to a panel or to a flat non-vibrating wall.

- Attach the four mounting feet to the back of the controller enclosure.
- Install on smooth surface to prevent stress on the mounting feet.
- Do not install on vibrating wall.
- If enclosure is installed in corrosive environments, consider purging.
- The enclosure material is PVC.
- Use #10 mounting screws (4).
- Avoid drilling or punching additional holes in the controller enclosure. Damage incurred as a result of any alteration to the enclosure is not covered under the Lakewood Instruments product warranty.

The dimensions of the enclosure in inches are:



The NexSys™ has a shipping weight of approximately 12 lbs.

NOTE: EXCESSIVE HEAT AND/OR DIRECT SUNLIGHT EXPOSURE WILL DARKEN THE TOUCH SCREEN, MAKING IT DIFFICULT TO READ, AND MAY SHORTEN THE LIFE OF OTHER ELECTRONIC COMPONENTS.

Plumbing Installation

There are three methods of automatic control of the conductivity in a boiler; continuous sample, sample/cycle and sample/hold. In the continuous sample method, boiler water is continuously being blown down past the boiler sensor. In the sample/cycle and sample/hold methods, boiler water is periodically blown down past the sensor based on time.

It is critically important that the blowdown piping is plumbed appropriately for the type of control method that you will use. If the piping is not plumbed correctly the controller will not be able to control conductivity.

The boiler blowdown rate requirement is used to determine the method of control (continuous sample or sample/cycle) you should use. If your boiler requires greater than 1000 pounds per hour of blowdown to maintain conductivity then the continuous sample method should be used. If your blowdown requirement is less than 1000 pounds per hour, the sample/cycle or sample/hold methods are appropriate. If your blowdown rate requirement changes above and below 1000 pounds per hour based on steam load then you may have to switch between sample/cycle or sample/hold control and continuous sample control.

The NexSys® control system can be used for either sample/cycle control, sample/hold, or continuous sample control of the conductivity in the boilers. The blowdown piping is the limiting factor. The installation drawings on the following pages show how to plumb the boiler sample line for sample/cycle, sample/hold, and continuous sample, and a method that covers all three methods of control.

For each method of blowdown control, the controller will use the Lakewood Instruments boiler sensor for hot (>200°F) samples.

To prevent steam flashing and damage to the controller refer to the installation drawings and notes below.

- Use piping from the boiler skimmer line as the sample and blowdown line.

NOTE: DO NOT USE THE BOTTOM BLOWDOWN OUTLET AS THE SAMPLE OR AUTOMATIC BLOWDOWN LINE.

- The maximum allowed wire distance between the Conductivity Node (NCON) and the sensor is 20 ft. The maximum distance between the NCON and the controller is 400 meters.

NOTE: DO NOT RUN THE SENSOR WIRING IN THE SAME CONDUIT AS THE MOTORIZED VALVE WIRING.

- If using conduit between the sensor and controller, allow a place for water to escape if the sensor leaks. This will help prevent water damage to the controller.

- Use orifice plates or globe valves downstream of the sensor to prevent steam flash. The orifice plates or the globe valve should be mounted within 5 feet of the sensor. Orifice plates (or globe valve) and the sensor must be installed horizontally (as shown in the drawing).

- The sensor should be located at least two feet **below** the water level in the boiler.

- Ensure that there are no restrictions between the skimmer line and the orifice plates (or globe valve) and all valves upstream of the boiler sensor are fully open.

- Be sure to provide isolation valves in the sample line to allow for maintenance of the sensor.

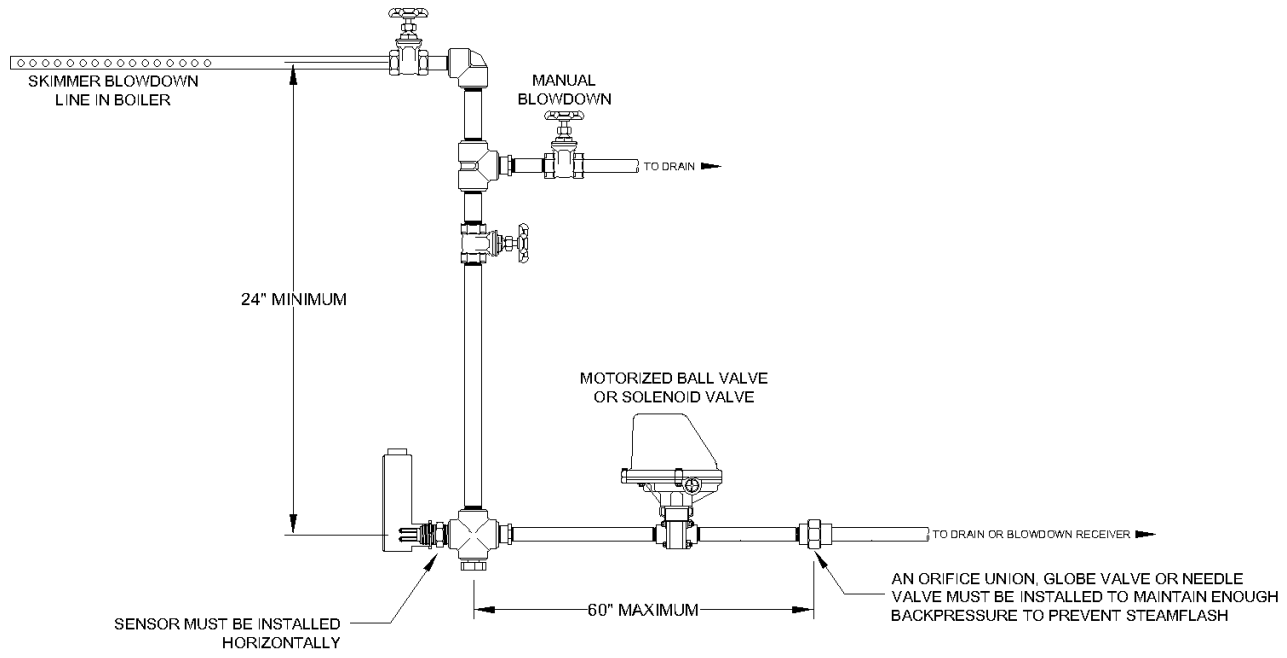
Sample/Cycle and Sample/Hold Plumbing Installation

To use the NexSys® control system in the sample/cycle or sample/hold mode, the plumbing installation must be done in accordance with the suggested installation shown below. It is very important to complete the plumbing installation exactly as it is shown. Improper installation can cause steam flash to occur which will cause erratic conductivity readings. It is recommended that the Lakewood Instruments model PL5 or PL575 plumbing assembly be used.

Note: Do not use the Lakewood Instruments boiler sensor with a sample cooler. The sensor does not have temperature compensation and requires a temperature >200°F for proper operation.

Description of sample/cycle, sample/hold plumbing installation:

The sample line should come out of the surface blowdown line and drop straight down to at least 2 to 3 feet below the water level of the boiler. At the bottom of that line the sensor should be mounted horizontally. Downstream of the sensor on a horizontal pipe should be mounted the blowdown valve and then the flow restriction device (orifice union and plate, or globe valve). The flow restriction device should be mounted within 5 feet of the sensor. Downstream of the flow restriction device is the blowdown receiver or drain.

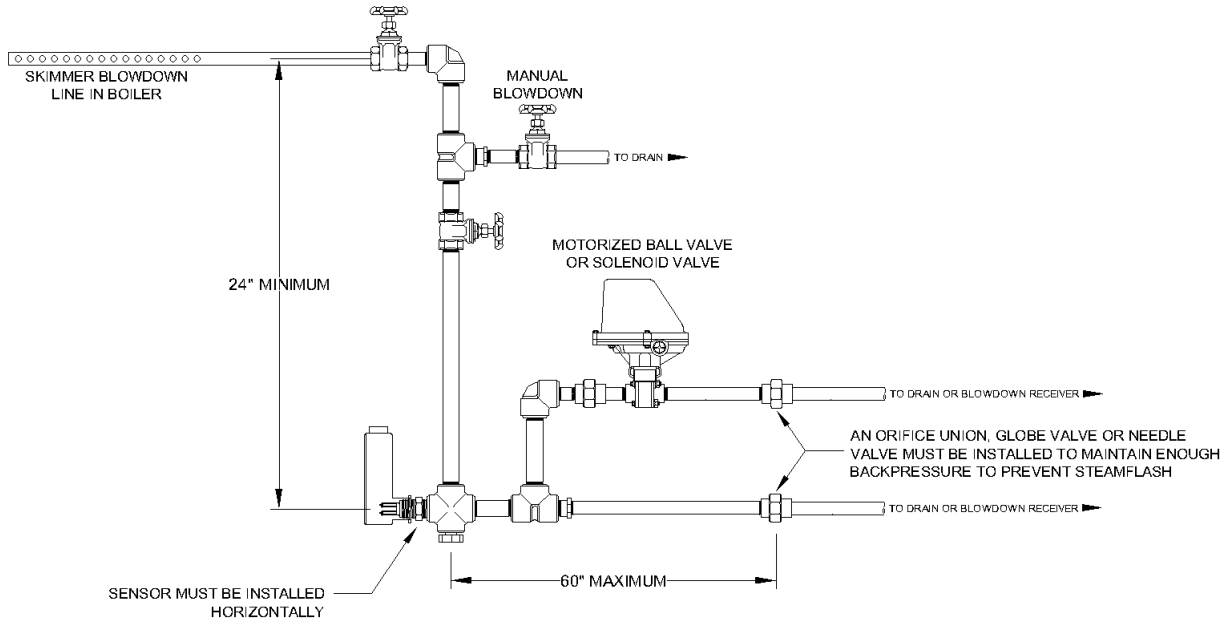


Continuous Sample Plumbing Installation

To use the NexSys® control system in the continuous sample mode, the plumbing installation must be done in accordance with the suggested installation drawing in the back of this manual. It is very important to complete the plumbing installation exactly as it is shown in the drawing because improper installation can cause steam flash to occur which will cause erratic conductivity readings. It is recommended that the Lakewood Instruments model PL6 or PL675 plumbing assembly be used.

Description of continuous sample plumbing installation:

The sample line should come out of the surface blowdown line and drop straight down to at least 2 to 3 feet below the water level of the boiler. At the bottom of that line the sensor should be mounted horizontally. Downstream of the sensor on a horizontal pipe should be mounted the flow restriction device (orifice union and plate, or globe valve). The flow restriction device should be mounted within 5 feet of the sensor. Downstream of the flow restriction device is the blowdown receiver or drain. A second line should tap off of the sample line either before or after the sensor but before the flow restriction device in the sample line. This second line is used for the automatic blowdown valve. The line with the blowdown valve must have a flow restriction device.

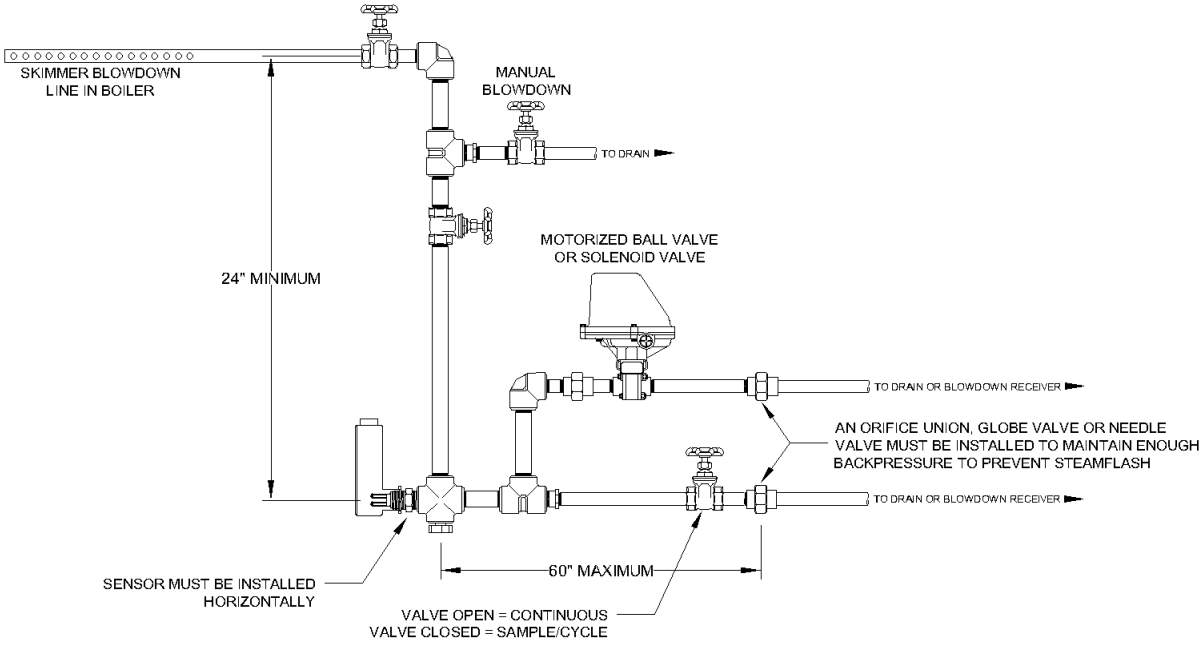


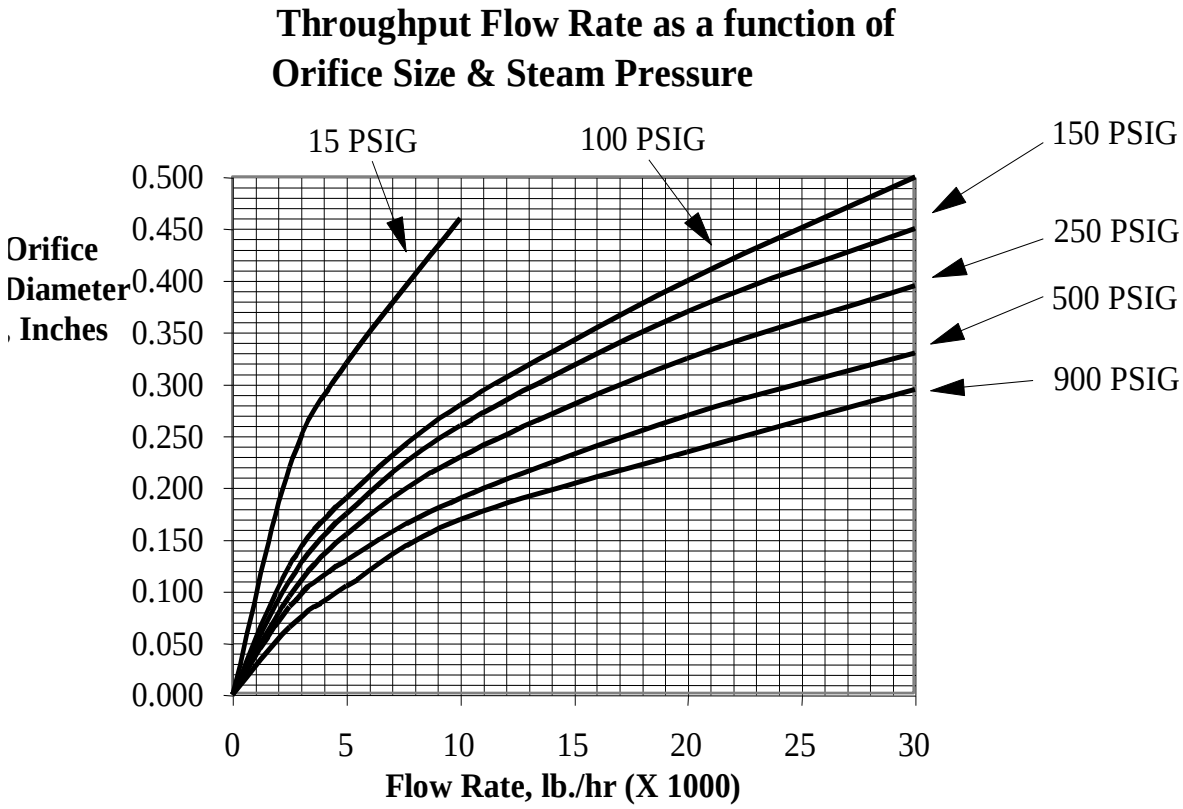
Plumbing Installation for Sample/Cycle/Hold and Continuous Sample

Sometimes it is necessary to switch the controller from sample/cycle or sample/hold to continuous sample mode or vice versa due to steaming loads. This method of plumbing allows the operator to change modes of operation by changing the position of just one valve and setting up the controller for the appropriate mode of operation. The description below is for use with the Lakewood Instruments boiler sensor.

Description of plumbing:

The sample line should come out of the surface blowdown line and drop straight down to at least 2 to 3 feet below the water level of the boiler. At the bottom of that line the sensor should be mounted horizontally. Downstream of the sensor on a horizontal pipe should be mounted an isolation valve and a flow restriction device (orifice union and plate, or globe valve). The flow restriction device should be mounted within 5 feet of the sensor. Downstream of the flow restriction device is the blowdown receiver or drain. A second line should tap off of the sample line after the sensor but before the isolation valve in the sample line. This second line will have an automatic blowdown valve and a flow restriction device. Downstream of the flow restriction device is the blowdown receiver or drain.



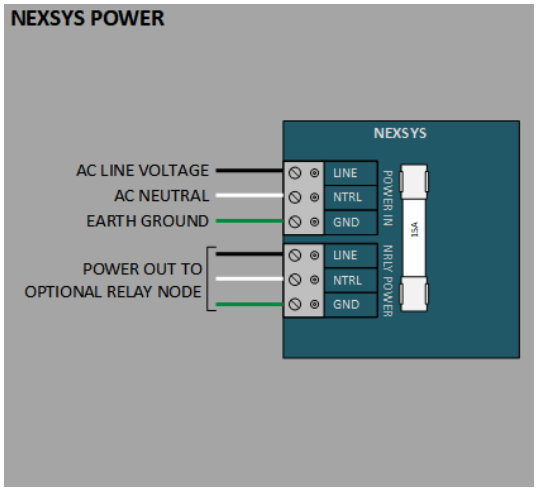

Throughput Flow Rate as a function of
Orifice Size & Steam Pressure
15 PSIG
100 PSIG
150 PSIG
250 PSIG
500 PSIG
900 PSIG
Orifice
Diameter
, Inches
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
0
5
10
15
20
25
30
Flow Rate, lb./hr (X 1000)

Electrical Installation

Incoming Power to NexSys™

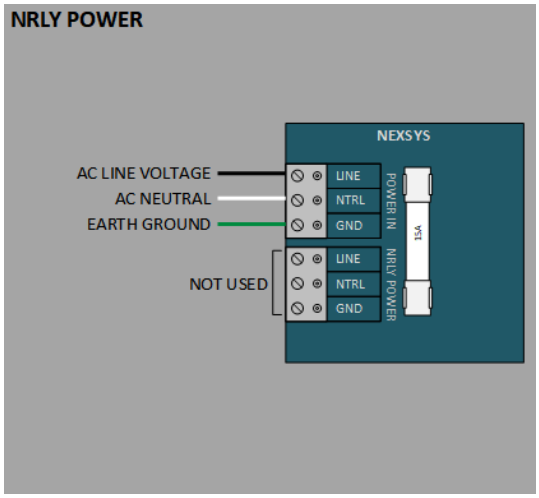
The NexSys™ can be powered from 115/230 VAC at 50/60 Hz. The NexSys™ controller comes with a power cord and receptacles. The power cord and receptacles are rated for 115VAC. For 230 VAC operation, the power cord and receptacles must be removed.

The incoming power is connected to terminal block P1 at the bottom left corner of the power supply board. There is a hot or line input (terminal 1), a neutral input (terminals 2) and an earth ground input (terminals 3). The hot is fuse protected with a 15 amp fuse located next to the power terminal block P1.



Incoming Power to Optional Relay Node

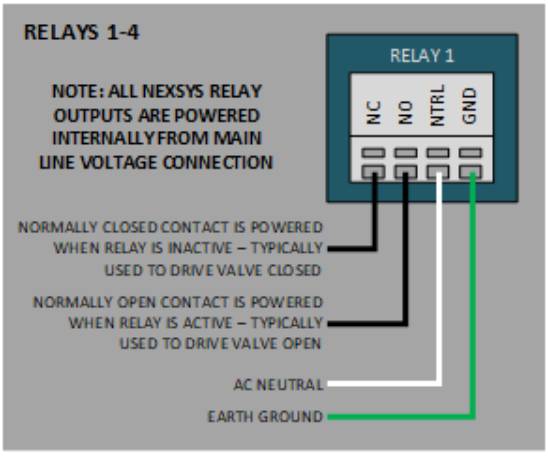
The optional Relay Node board relays can be powered with 115/230 VAC at 50/60 Hz from the NexSys™. A small section of wire is used to connect the Relay Node to terminal block P2 located at the bottom left corner of the power supply board. It is labeled NRLY POWER. There is a hot or line input (terminal 1), a neutral input (terminals 2) and an earth ground input (terminals 3). The hot is fuse protected with a 15 amp fuse located next to the power terminal block P1.



Relay Outputs

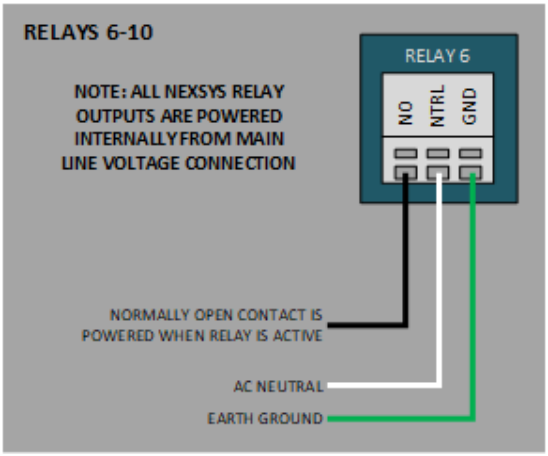
There six (or 10 with optional Relay Node) user configurable relay output. The relay outputs are of the same voltage as the power input. Each relay is rated at 3 Amps. Ensure that the devices that are to be connected to the relay outputs are of the same voltage rating or damage will occur.

The relay outputs are wired to the receptacles. The receptacles are numbered with the receptacle on the far left as relay #1 and the receptacle on the far right as relay #6 (or #9 if the optional Relay Node is installed). Relay #1 through #4 have both a normally open and normally closed contacts. This is designed for use with motorized valves. The normally



open (NO) contact is connected to the open connection of the valve and the normally closed (NC) contact is connected to the close connection of the valve.
Relays #5 and #6 only have a normally open contact. Each relay output requires a neutral connection and an earth ground connection for proper operation.

WARNING! DO NOT plug in chemical pumps that are larger than 1/6 horsepower. The control relays are intended for electronic or small motor-driven chemical pumps. Larger pumps require AN interposing relay. Contact Lakewood Instruments for special instructions.



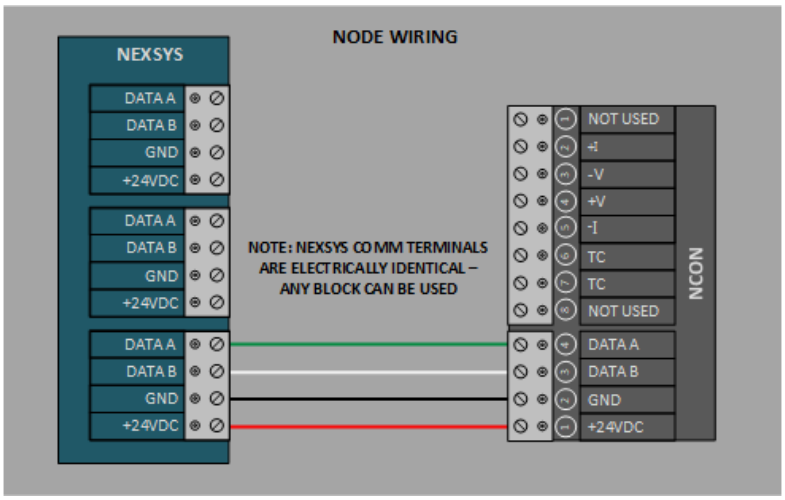
Node Wiring

Nodes (NpH, NCON, NRLY, NDIG, or N420I) must be wired to the controller before installation and programming can take place. These nodes can be located **up to 400 meters** away from the controller and can be daisy-chained.

Nodes require +24 VDC for operation and twisted pair wire for data transmission. The NexSys™ Control System can provide the +24 VDC for node operation. Nodes are wired directly to the power supply board inside the controller enclosure to any of terminal blocks P4, P5, and P6, which are the bottom three terminal blocks on the right hand side of the board. Terminal #1 is the +24VDC, terminal #2 is the GND, terminal #3 is DATA B, and terminal #4 is DATA A.

Recommended twisted pair (min of 7 twists/ft) wire types for data specifications are:

Beldon 85102, single twisted pair, stranded 9/29, unshielded, plenum.
Beldon 8471, single twisted pair, stranded 9/29, unshielded, non-plenum.
JY (ST) Y 2 X 2 X .8, UL Level IV 22 AWG, twisted pair, typically solid and unshielded.
Four wire helical twist, solid, shielded. If shielded cable is used, the shield should be connected to earth ground via a 470K ohm, .25 watt, metal film resistor to prevent static charge buildup.

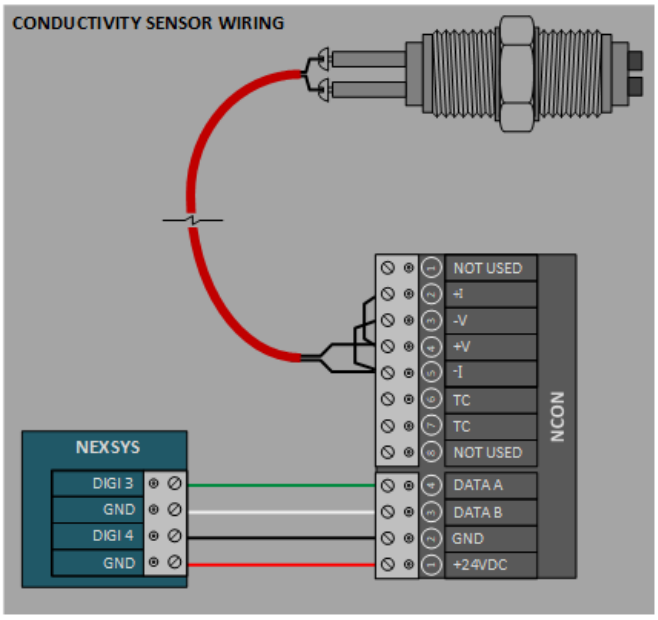


Sensor Wiring

Conductivity Sensor

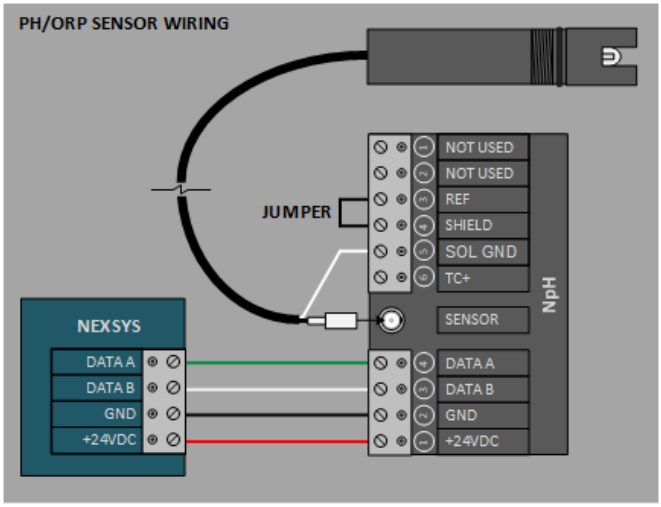
The conductivity Sensor has four electrodes and six wires, a Red, White, Green, and three Black wires. Two of the Black wires are tied together by a small piece of shrink tube to indicate that they are the Temperature Compensation wires. The third Black wire, along with the Red, White, and Green wires, are attached to one of the four electrodes.

The Green wire is connected to terminal #2, the White wire is connected to terminal #3, the Red wire is connected to terminal #4, and the single black wire is connected to terminal #5. The two Black wires that are shrink-tubed together are connected to terminals #6 and #7.



pH and ORP

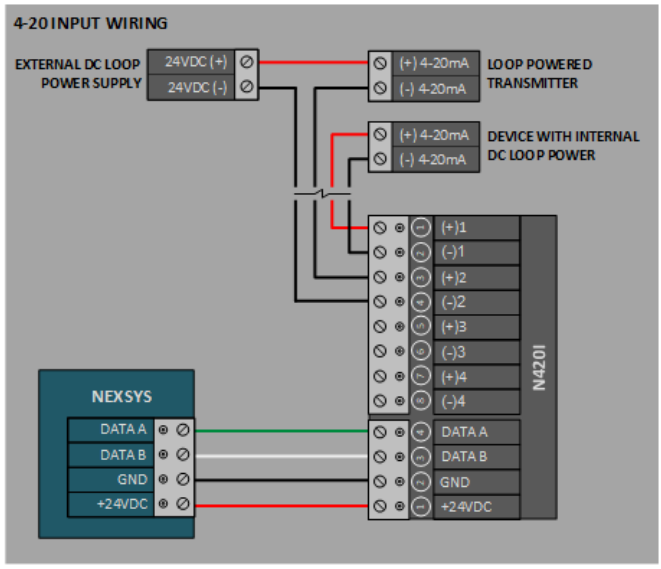
The pH and ORP cooling tower sensors have an SMB style connector and a White Solution Ground wire. The SMB connector is connected to the SMB connector on the NpH and the White wire is connected to the six-section terminal block, terminal #5 Sol. GND. There is a jumper wire attached to terminals #3 and #4 that should not be removed.



4-20 mA Input Wiring

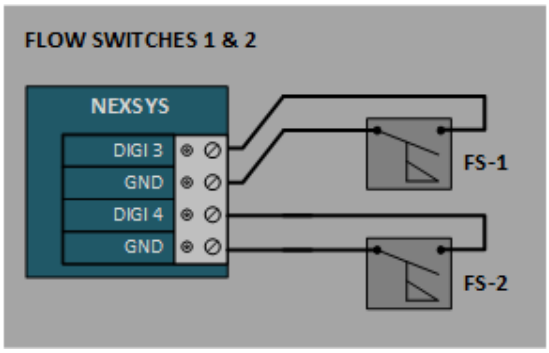
The NexSys™ Control System will accept up to two 4-20 Input nodes (N420I). Each node has 4 channels of 4-20 mA input. Terminals #1 and 2 are the first channel of that node, Terminals # 3 and 4 are the second channel, terminals #5 and 6 are the third channel, and terminals #7 and 8 are the fourth channel of that node.

Each input loop must be powered by +24 VDC. These inputs can be Internally Loop Powered, meaning that the +24 VDC to power the 4-20 mA loop comes from the 4-20 mA transmitter, or they can use an external +24 VDC power supply. Both methods of powering the loop are shown on the diagram below.



Flow Switch Wiring

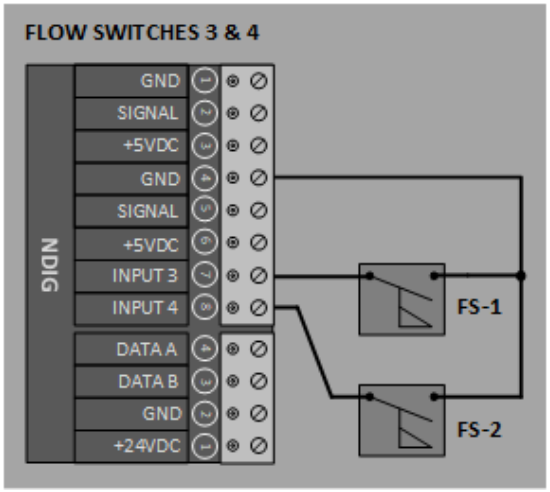
The NexSys™ Control System has two flow switch inputs standard with the option of two more with the Digital Input Node. The purpose of the flow switch input is to disable the relay outputs on a loss of flow in the system. The flow switch inputs require a digital contact. Any digital contact rated for 24 VDC and 500 mA may be used, such as a relay driven by the recirculation pump. Lakewood Instruments manufactures a flow switch plumbing assemblies for use with the NexSys™ Control System. The user is able to tie individual relays to each of the flow switch inputs in the software.



The first two flow switches are wired to terminal block P7, which is the second terminal block down on the right hand side of the power supply board. Flow switch #1 (terminals 3 and 4) is labeled DIGI 3, and flow switch #2 (terminals 1 and 2) is labeled DIGI 4.

The second two flow switches are wired to the Digital Input Node. Flow switch #3 (terminals 4 and 7 on the digital input node) is labeled Input 3 and GND. Flow switch #4 (terminals 4 and 8 on the digital input node) is labeled Input 4 and GND.

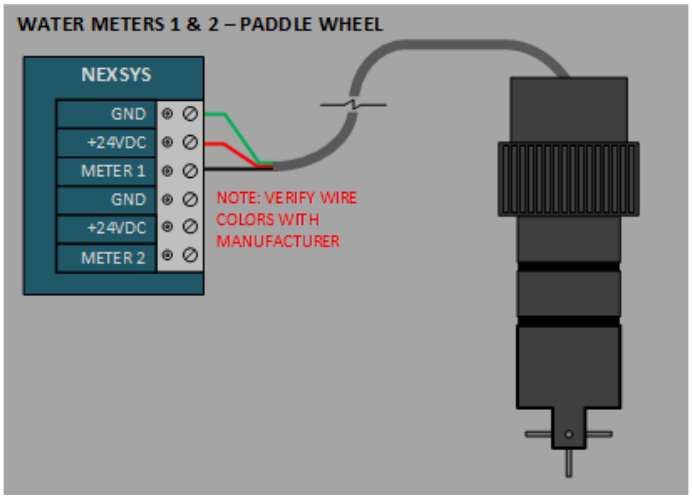
Note: If a flow switch is not used then a jumper must be installed across the flow switch connections of any flow switch input that is tied to any relays.

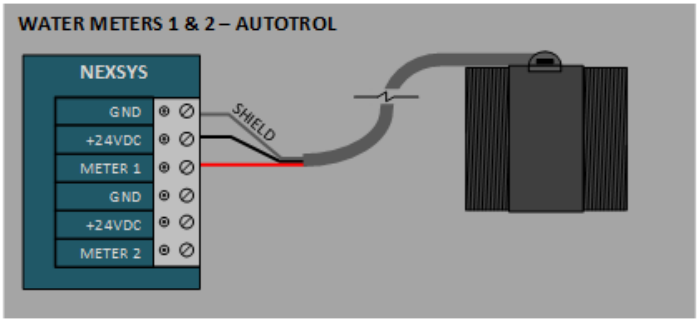


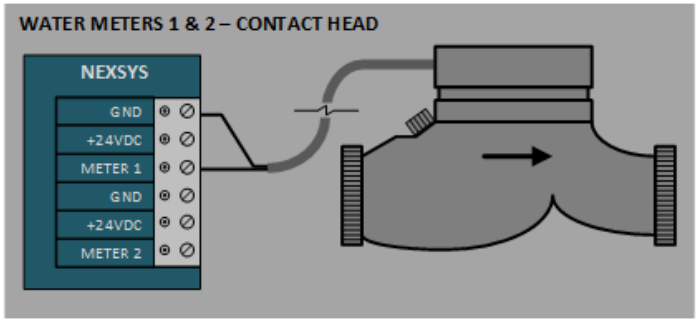
Water Meter Wiring

The NexSys™ Control System will accept two water meter inputs with the option of adding two additional water meter inputs with the Digital Input Node. The relays can be configured to operate based on any of the water meter inputs and the sum of the first two water meter inputs can be used operate relays. This is useful when there are two different sources of makeup water. Blowdown by water meter is a special function and is explained in the blowdown section of this manual. Refer to the water meter manufacturer's manual for plumbing information.

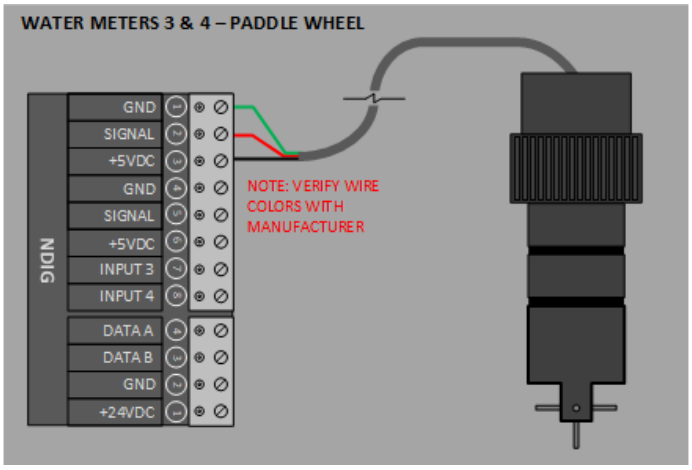
The NexSys™ Control System will work directly with open collector output type water meters such as the following types of meters: dry contacting head meters, paddle wheel meters such as the Signet model 2535 and 2540, and the Autotrol 1 inch and 2 inch meters. The first two water meters are wired to terminal block P8 which is the top terminal block on the on the right hand side of the power supply board inside the NexSys™ Control System. Water meter #1 uses terminals #4, 5, and 6. Water meter #2 uses terminals #1, 2, and 3.

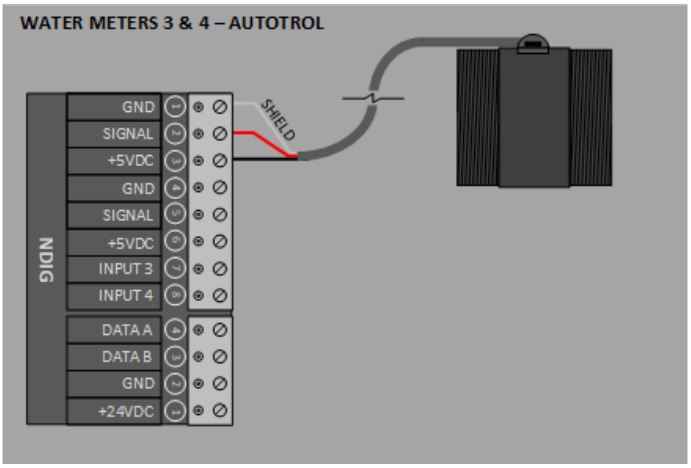




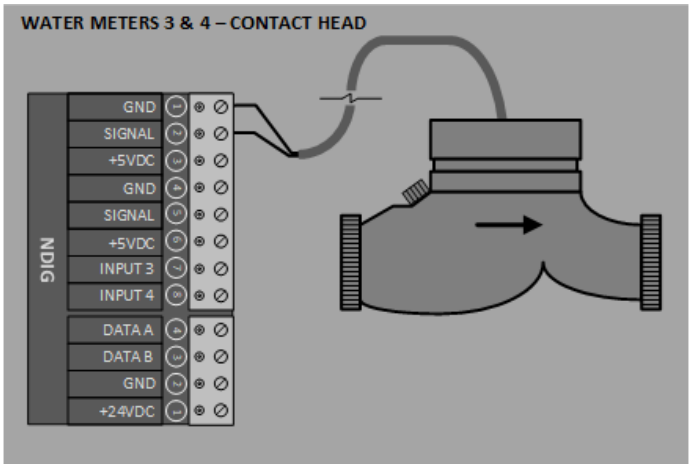


The second two water meter inputs are wired to the Digital Input Node. Water meter #3 is wired to terminals #1, 2, and 3 on the Digital Input Node. Water meter #4 is wired to terminals #4, 5, and 6 on the Digital Input Node.





Contact Lakewood Instruments for information on using other types of water meters.



Starting Up the Controller

Once the physical installation is complete it is time to start up the controller.

Initiate sample flow to the controller by opening the sample line isolation valves. Check for leakage.

Power up the controller by either turning on the circuit breaker or plugging the power cord into a 120 VAC receptacle and toggle the on/off switch to on (-).

Install nodes if applicable.

Set date and time.

Configure BLOWDOWN relays for required operation.

Calibrate sensor inputs.

Configure other relays for required operation.

Set high and low sensor alarm limits.

Set alarm notifications.

Enable E-mail if applicable.

Configure Ethernet if applicable.

Change the remote access password if applicable.

Set up the security mode if applicable.

Verify operation of the controller before leaving the area.

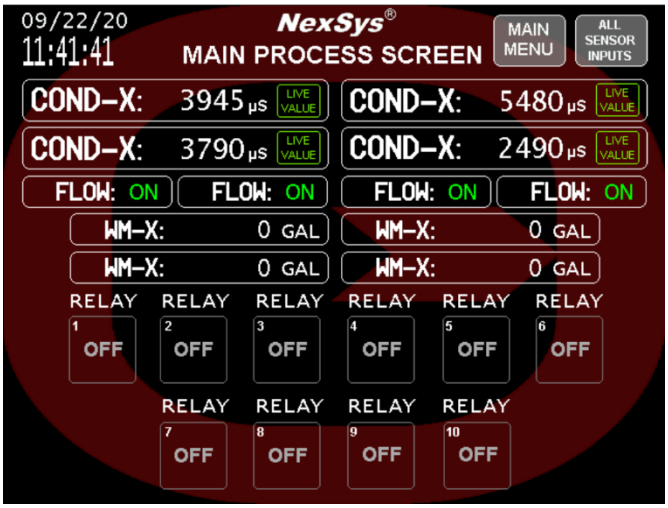
Operation of the Controller

Home Screen

The main Home screen is Main Process screen. Touching the Home button will always return the NexSys™ Control System to the Main Process screen. Also, if the controller is in any other screen for more than about 5 minutes, the NexSys™ Control System will automatically return to the Maion Process screen.

Main Process Screen

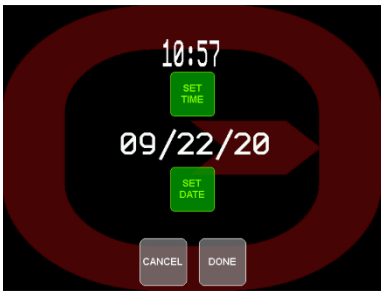
The Main Process Screen includes the all installed conductivity sensor inputs, the relay status and manual relay operation of relays, water meter inputs, and status of flow switch inputs.

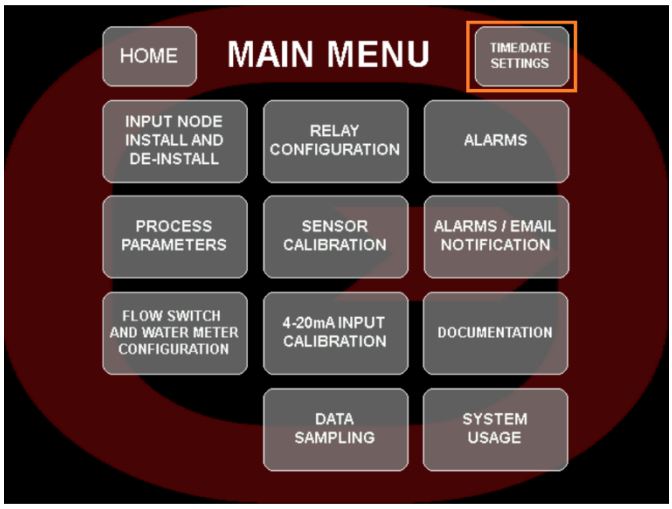


Main Menu

The Main Menu allows access to all configuration and informational screens, as well as Date/Time adjustment.

The time format is 24hr (Time shown is 2:56 PM).





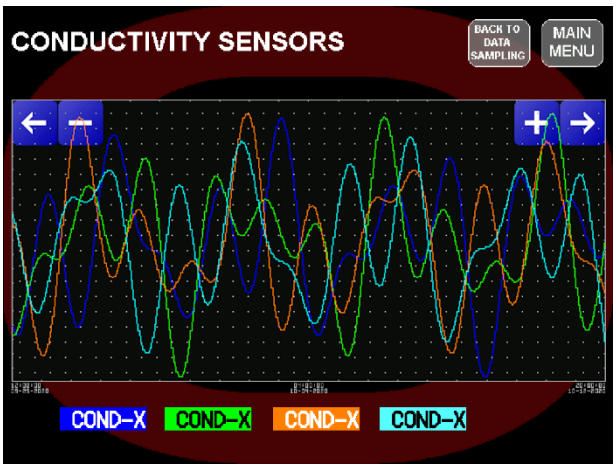
Graphing Screens

There are graphing screens for the following points:

- Conductivity Inputs
- Flow Switch Inputs
- Relay Statuses

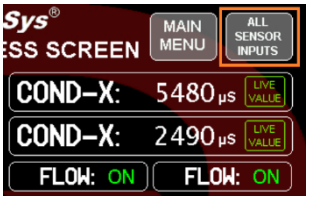
The graphing screen shows the status of the inputs over time in 5 minute intervals.

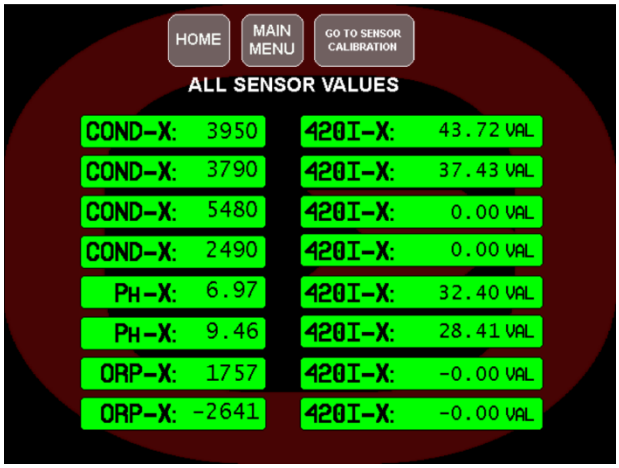
Graphs are accessed by touching the "DATA SAMPLING" button on the main menu.



All Sensor Inputs Screen

The "ALL SENSOR INPUTS" screen shows the current readings from all sensor inputs in one location. This includes all four conductivity inputs, both pH inputs, both ORP inputs, and all eight possible 4-20 mA inputs. From this screen it is also possible to access the Calibrations Screens by touching the "GO TO SENSOR CALIBRATION" button at the top of the screen.





Manual Operation of the Relays

All six (ten with optional relay node) of the relays can be operated manually. Relays 1-6 are displayed on the System 1 screen. Relays 7-10 are displayed on the System 2 screen.

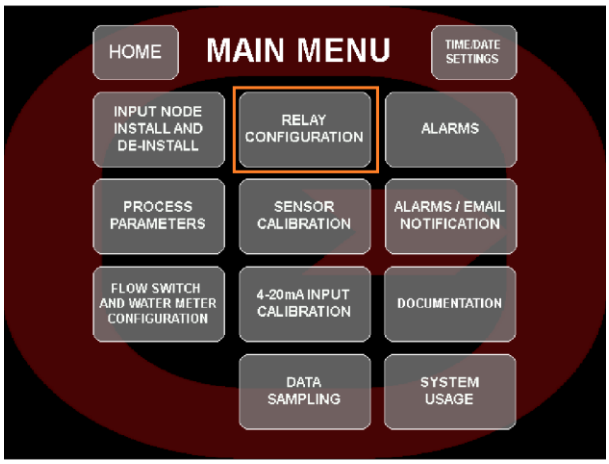
To manually operate the relays, simply touch the button for the desired relay.

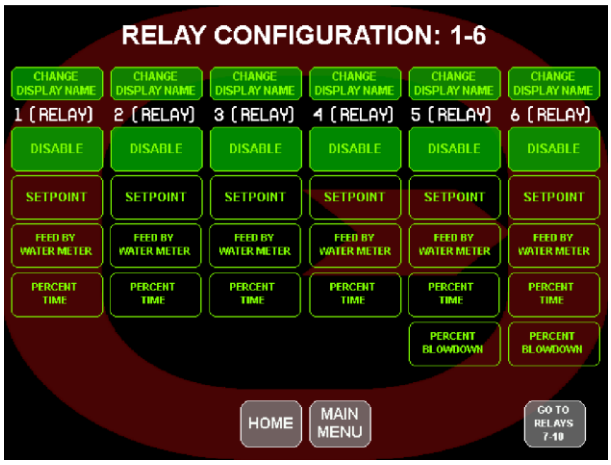
Touch a relay button to manually change the state of that particular relay. If the relay is already on, touching that relay button will turn it off. A relay indicator that is green indicates that the relay is energized. A yellow indicator indicates that the relay is de-energized. The relay will remain in manual operation for five minutes unless that relay button is touched again. After five minutes has expired the relay will return to automatic control. A relay that is in manual control will stay in manual control until the five minutes expires even if this screen is exited. The five-minute timer helps to prevent damage to the system if a relay is left in manual.

WARNING: Manual control overrides everything including the flow switch input. Use care when operating relays manually with no flow in the system.

Configuring the Relays

To access the relay configuration screens from the one of the two system screens**,** touch the Main Menu button. Then touch the RELAYS button. The following screen will appear.





The relay configuration screen is set up to show the current configurations of the first six relays on one screen and the current configurations of relays 7 through 10 on a second screen. To switch between relays 1 through 6 and relays 7 through 10 touch the arrow buttons located at the top right of the screen.

All of the possible configurations for each relay are shown in a vertical row under that relay number. The current configuration will be indicated by the green color of the button. To configure a relay touch the desired button for that relay and the configuration screen will appear.

The possible configurations are: Disabled, Setpoint, Feed by Water Meter, Percent of Blowdown, Percent of Time, and Schedule Feed.

Each of the relays can be configured for each of the methods shown. Relays 1-4 and relay 7 can be configured as blowdown relays and have additional methods of control in the setpoint screens.

All relays must be configured to operate with a flow switch input. That flow switch will override the relay function when there is no flow. **All relays that are tied to the same flow switch input are considered a single system and will interact with each other for Blowdowns, Biocide Lockouts, Percent of Bleed, and Schedule Feeds.**

NOTE: The BLOWDOWN relays must be configured before the other relays to establish the control systems for the other relays to operate.

Relays that are configured to operate based on setpoint must be configured to operate based on a sensor input as well as a flow switch input.

NOTE: It is recommended to set a relay to disabled momentarily when changing the method of operation of that relay.

Disabled

The relay can be disabled. When a relay is disabled, it will not energize automatically, although it can still be operated manually.

- From the **RELAY Configuration** screen touch **Disable** to disable the relay. The DISABLE button will turn green indicating that the relay is disabled.

By Setpoint

Each of the relays can be configured to operate based on Setpoint control. The setpoint can be based on a sensor type or based on a 4-20 mA input.

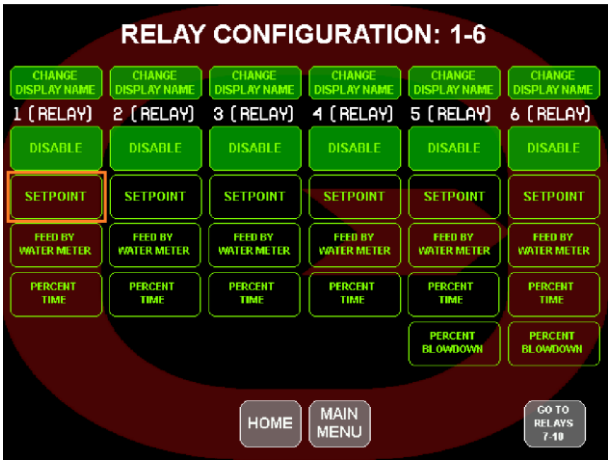
When **Setpoint** is selected the following will appear on the screen:

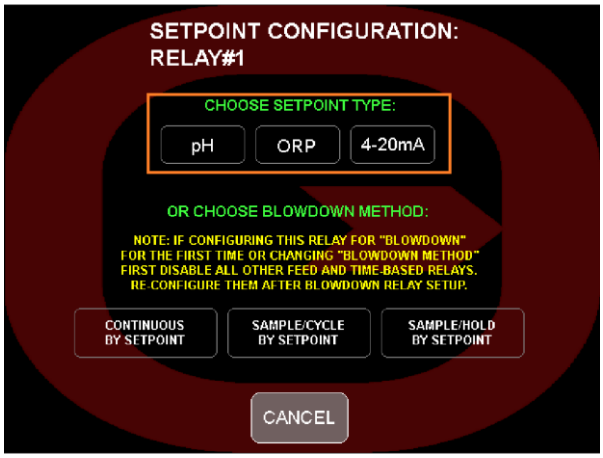
- Touch the appropriate button for the desired Sensor Type input. Touch the button for the appropriate sensor.
- Touch the button for the desired flow switch input. MB IN 3 and MB IN 4 are located inside the NexSys™ Control System enclosure. NDIGI 3 and NDIGI 4 are located on the optional Digital Input Node.

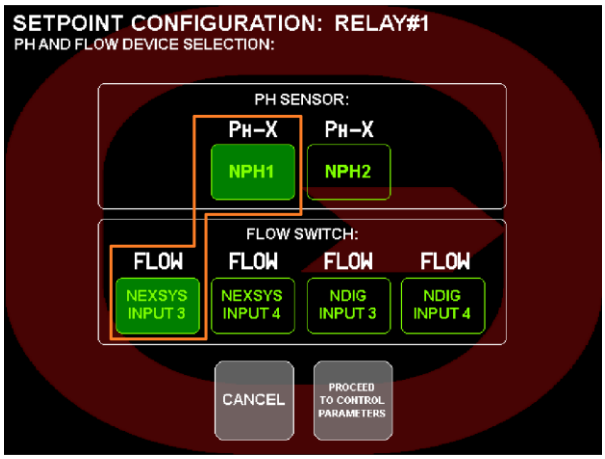
NOTE: All relays MUST be tied to a flow switch input and programming cannot continue until both a sensor input and a flow switch input are selected for each relay.

NOTE: All relays **MUST** be tied to a flow switch input and programming cannot continue until both a sensor input and a flow switch input are selected.

- Once a sensor input and a flow switch input are selected, touch the Continue button in the bottom right corner of the screen. The NexSys™ Control System will display the "SETPOINT CONFIGURATION" screen.



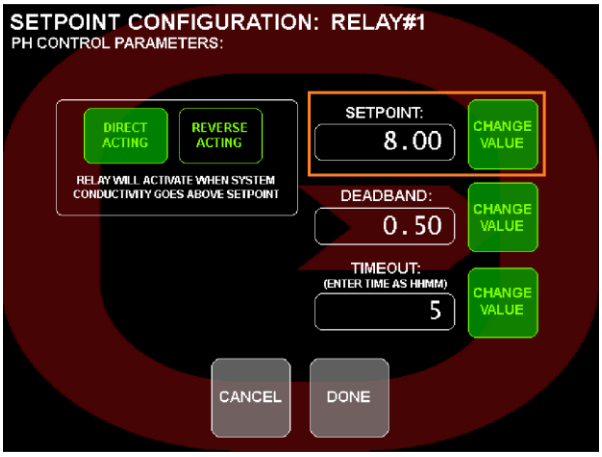




Setpoint Config

In the **SETPOINT CONFIG** screen you will set the **SETPOINT**, the **DEADBAND,** the **TIMEOUT** alarm, the **SETPOINT DIRECTION**, and the **BIOCIDE LOCKOUT**.

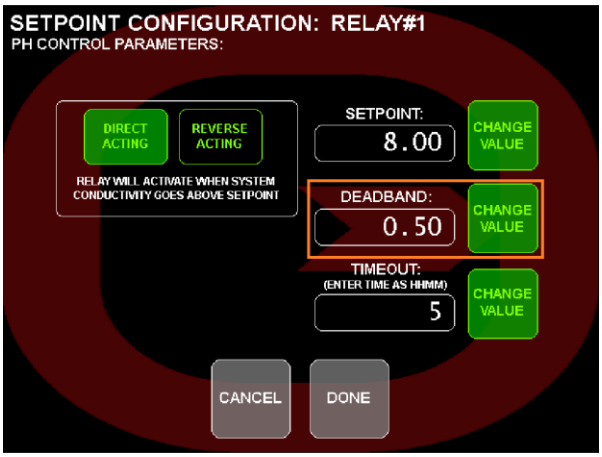
The **SETPOINT** is the Input value that you are trying to maintain.



Check with your water treatment engineer to determine the setpoint for your system needs.

- Touch the "CHANGE VALUE" button next to the Setpoint value and use the keypad to enter the Setpoint value. Touch the OK button to accept.

Due to continuous fluctuations in the Input level, it is necessary to have a **DEADBAND** range or stable readings will be difficult to maintain. **"Deadband"** refers to the difference between the ON point and the OFF point and it straddles the setpoint. The Deadband should be a small percentage of the setpoint. Half the deadband amount will be automatically put above the setpoint, and the other half below it.

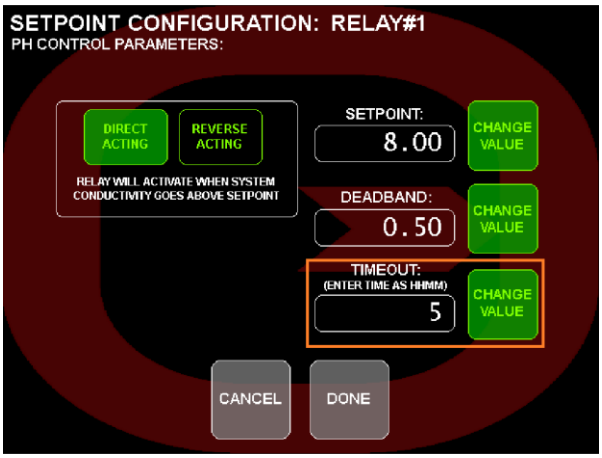


For a relay configured to operate when the reading goes above the setpoint, the relay will turn on at the setpoint value plus ½ of the deadband value and turn off at the setpoint value minus ½ of the deadband value.

For example, a pH setpoint of 8 with a deadband of .5 would result in the relay turning on at 8.25 and turning off at 7.25.

- Touch the "CHANGE VALUE" button next to the Deadband value and use the keypad to enter the Deadband value. Touch the OK button to accept.

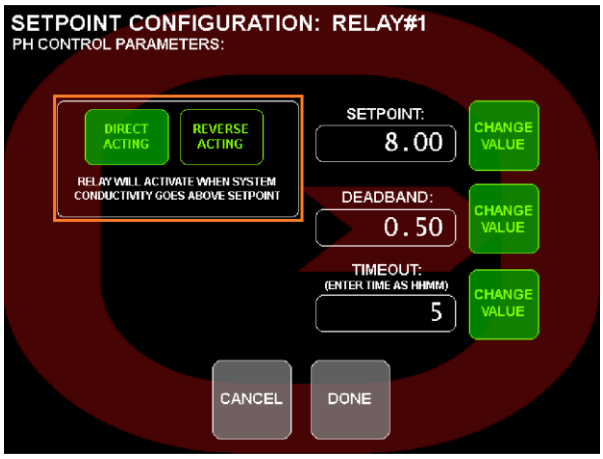
The **TIMEOUT** alarm is designed to notify the operator of a problem in the chemical feed system such as, a pump has lost its prime or there is no chemical in the drum. It will also protect the system from overfeeding chemical when the indicated ORP, pH, or other input does not display a change in actual value of that input. The timeout function will display a visual alarm on the display and **it <u>will</u> turn off the relay**. This time is displayed in Hours and Minutes. The maximum time allowed is 17 hours and 59 minutes. To disable this function set the **Timeout** time to 0.



- Touch the "CHANGE VALUE" button next to the Timeout value and use the keypad to enter the Timeout value in hours and minutes. Touch the OK button to accept.

NOTE: The TIMEOUT alarm does **<u>not</u>** turn off the relay when using one of the BLOWDOWN options for relays 1-4 and relay 7.

The relays can be configured to activate when the reading **Goes Above** the setpoint (DIRECT ACTING) or when the reading **Goes Below** the setpoint (REVERSE ACTING). To set up the relay to energize on a rising Input, set the relay to DIRECT ACTING. To set up to feed on a falling Input, set the relay to REVERSE ACTING.



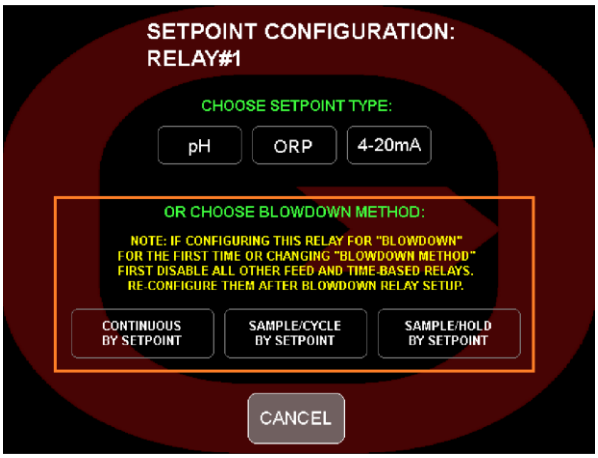
- Select relay action.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.

Blowdown Methods

NOTE: Set up the Blowdown relays before setting the other relays.

Relays 1-4 and relay 7 have additional features for Blowdown because they have both a normally open and a normally closed contact. When **Setpoint** is selected for relays 1-4 the following will appear on the screen**:**

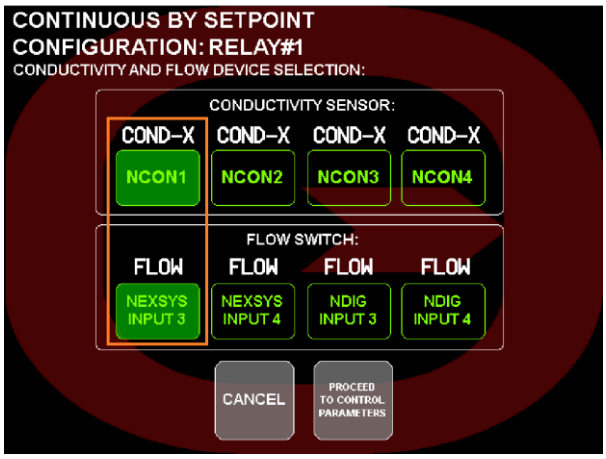


Each method is discussed in detail in the following pages.

Continuous Sample

The blowdown relays (1-4) can be configured to blowdown based on a Continuous Sample setpoint. This means that there is continuous blowdown flow going past the sensor. When the conductivity rises above the setpoint plus ½ of the deadband, the controller will open a blowdown valve to increase the blowdown rate. This method of blowdown is typically used on large boilers (>1000hp) where the blowdown rate requirement is greater than 1000 lbm/hr.

The Blowdown Setpoint can be based on any of the four available conductivity inputs. The conductivity inputs that are currently installed are shown at the top of the screen.

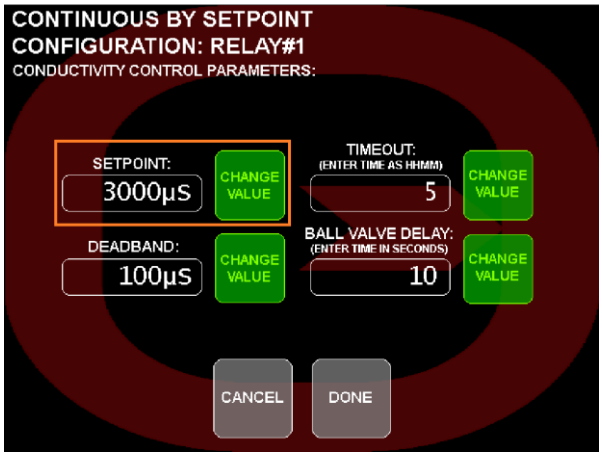


- Touch the appropriate conductivity sensor input. This conductivity value will control the operation of this Blowdown relay.
- Touch the button for the desired flow switch input. MB IN 3 and MB IN 4 are located inside the NexSys™ Control System enclosure. NDIGI 3 and NDIGI 4 are located on the optional Digital Input Node

NOTE: All relays MUST be tied to a flow switch input and programming cannot continue until both a sensor input and a flow switch input are selected for each relay.

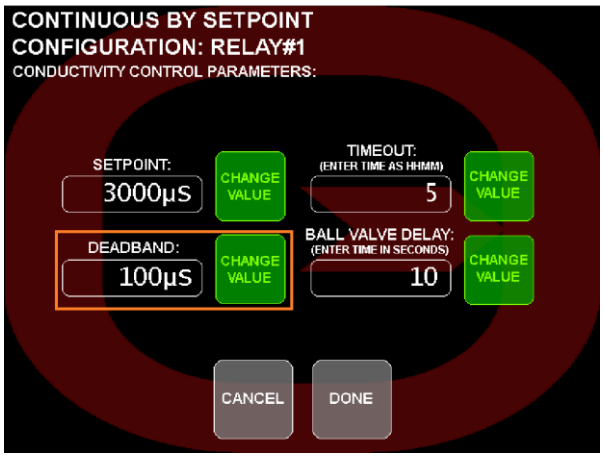
The **SETPOINT** is the Input value that you are trying to maintain.

Check with your water treatment engineer to determine the setpoint for your system needs.



- Touch the "CHANGE VALUE" button next to the Setpoint value and use the keypad to enter the Setpoint value. Touch the OK button to accept.

Due to continuous fluctuations in the Input level, it is necessary to have a **DEADBAND** range or stable readings will be difficult to maintain. **"Deadband"** refers to the difference between the ON point and the OFF point and it straddles the setpoint. The Deadband should be a small percentage of the setpoint. Half the deadband amount will be automatically put above the setpoint, and the other half below it.

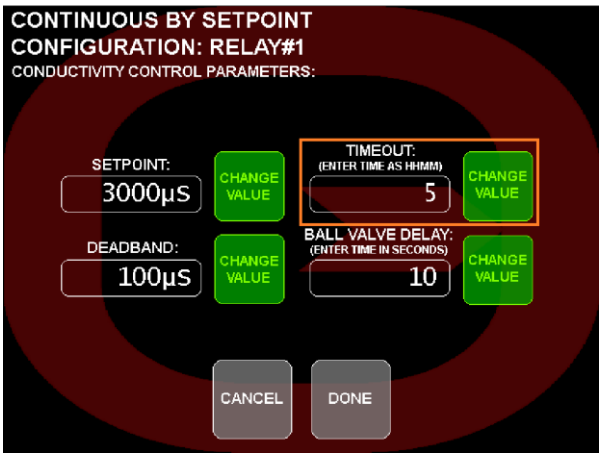


For a relay configured to operate when the reading goes above the setpoint, the relay will turn on at the setpoint value plus ½ of the deadband value and turn off at the setpoint value minus ½ of the deadband value.

For example, a conductivity setpoint of 3000 µS with a deadband of 100 µS would result in the relay turning on at 3050 µS and turning off at 2950 µS.

- Touch the "CHANGE VALUE" button next to the Deadband value and use the keypad to enter the Deadband value. Touch the OK button to accept.

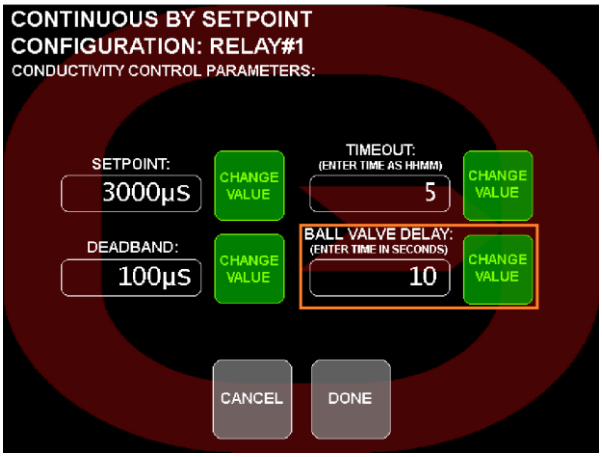
The **TIMEOUT** alarm is designed to notify the operator of a problem in the Blowdown system such as, a valve is stuck closed or a strainer is clogged. It will also help to protect the system from over bleeding when the indicated conductivity does not display a change in value. The timeout function will display a visual alarm on the display but **it will NOT turn off the relay**. This time is displayed in Hours and Minutes. The maximum time allowed is 17 hours and 59 minutes. To disable this function set the Timeout time to 0.



- Touch the "CHANGE VALUE" button next to the Timeout value and use the keypad to enter the Timeout value in hours and minutes. Touch the OK button to accept.

NOTE: The TIMEOUT alarm does **not** turn off the relay when using one of the BLOWDOWN options for relays 1-4 and relay 7.

The **BALL VALVE DELAY** time is used to prevent a motorized valve from getting stuck in a partially open state. If there is a sudden change in conductivity, the relay would change state and interrupt power to the motorized valve causing it to become stuck in a partially open state. The ball valve delay time prevents the relay from changing state until the ball valve delay time has passed since the last operation of the blowdown relay. This time should be set to a time that is slightly greater than the amount of time it takes to fully open or close the motorized valve, whichever is longer. To set the Ball Valve Delay time:



- Touch the "CHANGE VALUE" button and use the keypad to enter the Ball Valve Delay time in seconds. A typical Ball Valve takes approximately 8 seconds to cycle. Touch the OK button to accept.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.

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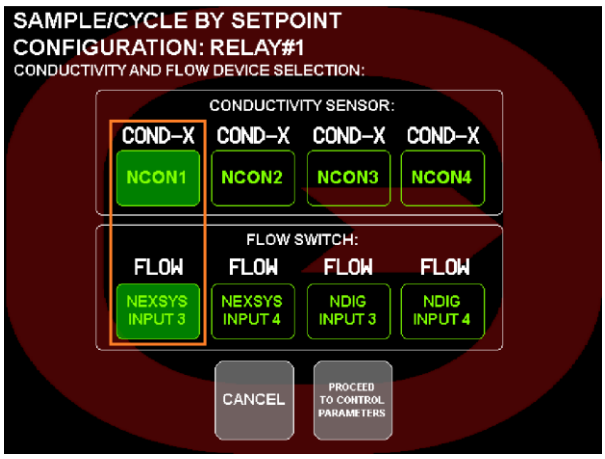
Sample/Cycle

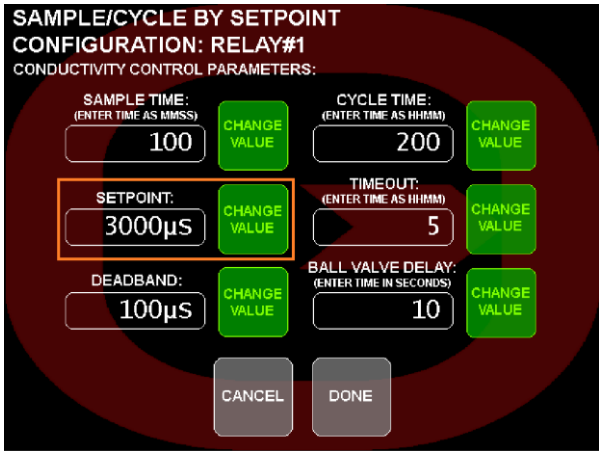
The blowdown relay (relay 1-4) can be configured to blowdown based on Sample/Cycle setpoint. This means that the controller will open the blowdown valve for the sample time. At the end of the sample time, the controller compares the conductivity reading to the setpoint. If the conductivity reading is above the setpoint, it keeps the blowdown valve open until it satisfies the setpoint. If the reading is below the setpoint, the controller shuts the blowdown valve and goes into the cycle time. The cycle time is the amount of time between samples. At the end of the cycle time the controller repeats the sample process. This method of blowdown is typically used on smaller boilers (< 400hp) where the blowdown rate requirement is less than 1000 lbm/hr.



The Blowdown Setpoint can be based on any of the four available conductivity inputs. The conductivity inputs that are currently installed are shown at the top of the screen.

- Touch the appropriate conductivity sensor input. This conductivity value will control the operation of this Blowdown relay.
- Touch the button for the desired flow switch input. MB IN 3 and MB IN 4 are located inside the NexSys™ Control System enclosure. NDIGI 3 and NDIGI 4 are located on the optional Digital Input Node

NOTE: All relays MUST be tied to a flow switch input and programming cannot continue until both a sensor input and a flow switch input are selected for each relay.

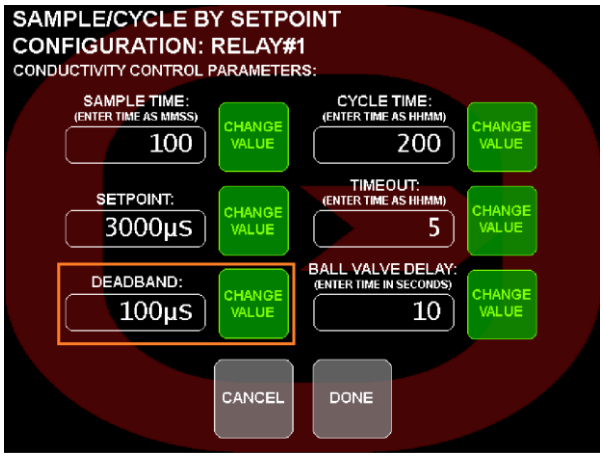


The **SETPOINT** is the Input value that you are trying to maintain.

Check with your water treatment engineer to determine the setpoint for your system needs.

- Touch the "CHANGE VALUE" button next to the Setpoint value and use the keypad to enter the Setpoint value. Touch the OK button to accept.

Due to continuous fluctuations in the Input level, it is necessary to have a **DEADBAND** range or stable readings will be difficult to maintain. **"Deadband"** refers to the difference between the ON point and the OFF point and it straddles the setpoint. The Deadband should be a small percentage of the setpoint. Half the deadband amount will be automatically put above the setpoint, and the other half below it.

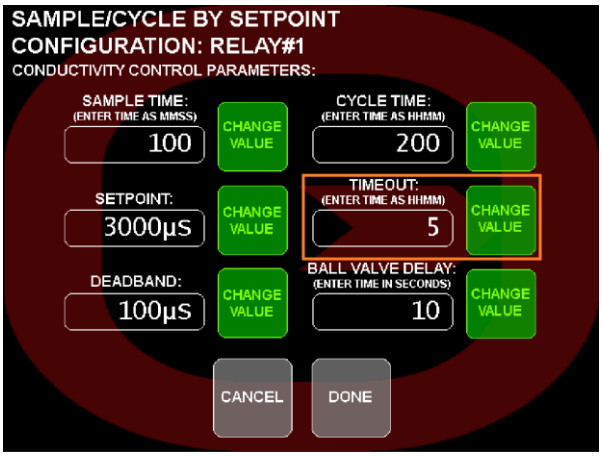


For a relay configured to operate when the reading goes above the setpoint, the relay will turn on at the setpoint value plus ½ of the deadband value and turn off at the setpoint value minus ½ of the deadband value.

For example, a conductivity setpoint of 3000 µS with a deadband of 100 µS would result in the relay turning on at 3050 µS and turning off at 2950 µS.

- Touch the "CHANGE VALUE" button next to the Deadband value and use the keypad to enter the Deadband value. Touch the OK button to accept.

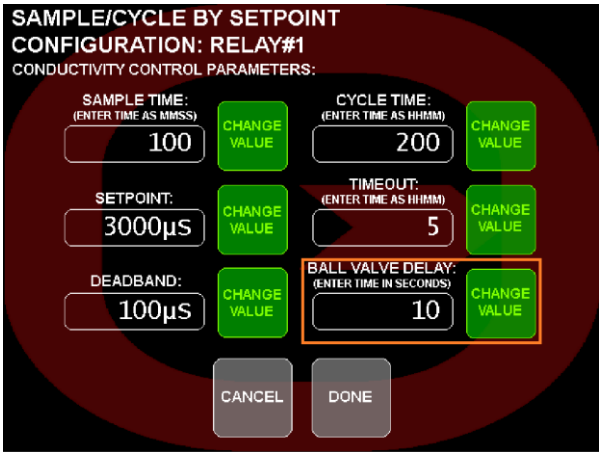
The **TIMEOUT** alarm is designed to notify the operator of a problem in the Blowdown system such as, a valve is stuck closed or a strainer is clogged. It will also help to protect the system from over bleeding when the indicated conductivity does not display a change in value. The timeout function will display a visual alarm on the display but **it will NOT turn off the relay**. This time is displayed in Hours and Minutes. The maximum time allowed is 17 hours and 59 minutes. To disable this function set the Timeout time to 0.



- Touch the "CHANGE VALUE" button next to the Timeout value and use the keypad to enter the Timeout value in hours and minutes. Touch the OK button to accept.

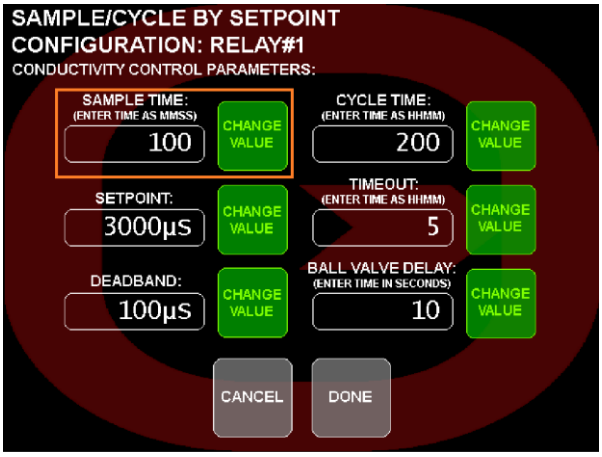
NOTE: The TIMEOUT alarm does **not** turn off the relay when using one of the BLOWDOWN options for relays 1-4 and relay 7.

The **BALL VALVE DELAY** time is used to prevent a motorized valve from getting stuck in a partially open state. If there is a sudden change in conductivity, the relay would change state and interrupt power to the motorized valve causing it to become stuck in a partially open state. The ball valve delay time prevents the relay from changing state until the ball valve delay time has passed since the last operation of the blowdown relay. This time should be set to a time that is slightly greater than the amount of time it takes to fully open or close the motorized valve, whichever is longer. To set the Ball Valve Delay time:



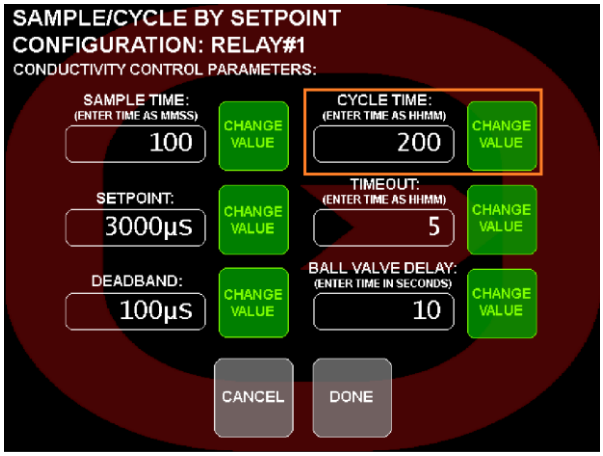
- Touch the "CHANGE VALUE" button and use the keypad to enter the Ball Valve Delay time in seconds. A typical Ball Valve takes approximately 8 seconds to cycle. Touch the OK button to accept.

The **SAMPLE TIME** is the amount of time that the blowdown valve will be open and blowdown will occur before the controller compares the reading to the setpoint. This time needs to be long enough so that the sensor and piping have enough time to come up to operating temperature, but not too long because the boiler will blow down for this amount of time, every time it blows down. This value is in minutes and seconds. Typical times are about 1-2 minutes.



- Touch the Change button next to the Sample Time value and use the keypad to enter the Sample Time in minutes and seconds. Touch the OK button to accept.

The **CYCLE TIME** is the amount of time that the blowdown valve is closed in between samples. This time needs to long enough so that your conductivity value is able to cycle up but not too long so that the conductivity exceeds any high limits. The Cycle time value will vary depending on the specific application. This value is in hours and minutes. The maximum time setting is 17 hours and 59 minutes.



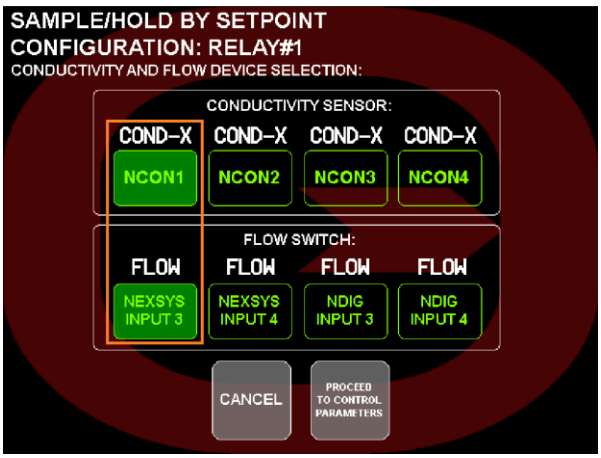
- Touch the Change button next to the Cycle Time value and use the keypad to enter the Cycle Time in hours and minutes. Touch the OK button to accept.

- To accept any changes touch the DONE button or to reject the changes touch the Cancel button.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.

Sample/Hold

The blowdown relay (relay 1-4) can be configured to blowdown based on Sample/Hold setpoint. This means that the controller will open the blowdown valve for the sample time. At the end of the sample time, the controller shuts the blowdown valve and waits a hold time to ensure that steam flash is not occurring before comparing the conductivity reading to the setpoint. If the conductivity reading is above the setpoint, it opens the blowdown valve for a Blow to Resample time. At the end of the Blow to Resample time, the controller shuts the blowdown valve and goes into the Hold time again. If the conductivity is still above the setpoint it repeats the Blow to Resample and Hold times until the setpoint is satisfied. If the conductivity reading is below the setpoint, the controller keeps the blowdown valve shut and goes into the cycle time. The cycle time is the amount of time between samples. At the end of the cycle time the controller repeats the sample and hold process. This method of blowdown is typically used on smaller boilers (< 400hp) where the blowdown rate requirement is less than 1000 lbm/hr.

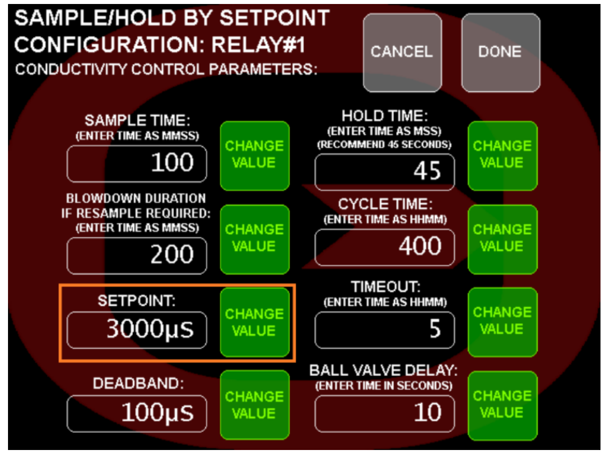


The Blowdown Setpoint can be based on any of the four available conductivity inputs. The conductivity inputs that are currently installed are shown at the top of the screen.

- Touch the appropriate conductivity sensor input. This conductivity value will control the operation of this Blowdown relay.
- Touch the button for the desired flow switch input. MB IN 3 and MB IN 4 are located inside the NexSys™ Control System enclosure. NDIGI 3 and NDIGI 4 are located on the optional Digital Input Node.

NOTE: All relays MUST be tied to a flow switch input and programming cannot continue until both a sensor input and a flow switch input are selected for each relay.

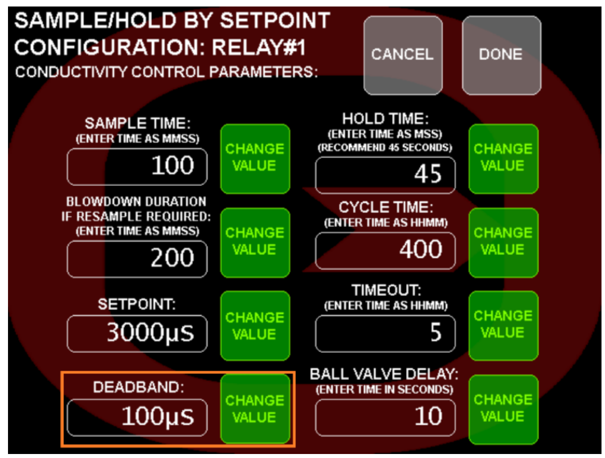
The **SETPOINT** is the Input value that you are trying to maintain.



Check with your water treatment engineer to determine the setpoint for your system needs.

- Touch the "CHANGE VALUE" button next to the Setpoint value and use the keypad to enter the Setpoint value. Touch the OK button to accept.

Due to continuous fluctuations in the Input level, it is necessary to have a **DEADBAND** range or stable readings will be difficult to maintain. **"Deadband"** refers to the difference between the ON point and the OFF point and it straddles the setpoint. The Deadband should be a small percentage of the setpoint. Half the deadband amount will be automatically put above the setpoint, and the other half below it.

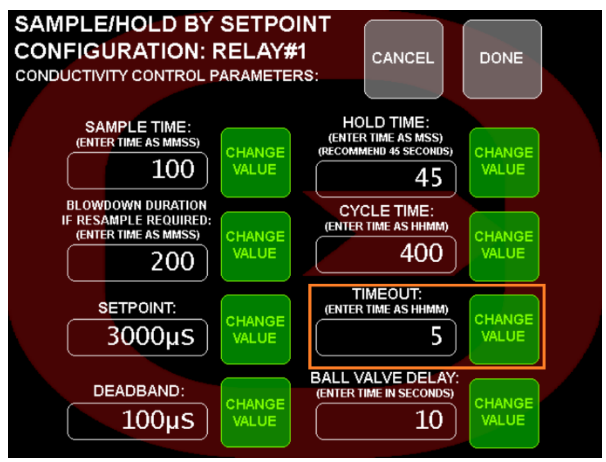


For a relay configured to operate when the reading goes above the setpoint, the relay will turn on at the setpoint value plus ½ of the deadband value and turn off at the setpoint value minus ½ of the deadband value.

For example, a conductivity setpoint of 3000 µS with a deadband of 100 µS would result in the relay turning on at 3050 µS and turning off at 2950 µS.

- Touch the "CHANGE VALUE" and use the keypad to enter the Deadband value. Touch the OK button to accept.

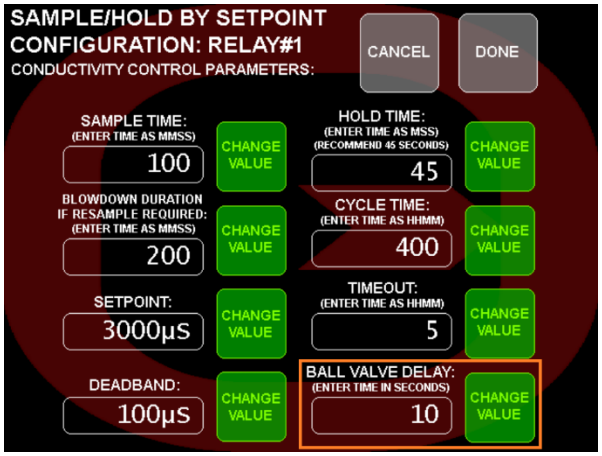
The **TIMEOUT** alarm is designed to notify the operator of a problem in the Blowdown system such as, a valve is stuck closed or a strainer is clogged. It will also help to protect the system from over bleeding when the indicated conductivity does not display a change in value. The timeout function will display a visual alarm on the display but **it will <u>NOT</u> turn off the relay**. This time is displayed in Hours and Minutes. The maximum time allowed is 17 hours and 59 minutes. To disable this function set the Timeout time to 0.



- Touch the "CHANGE VALUE" button and use the keypad to enter the Timeout value in hours and minutes. Touch the OK button to accept.

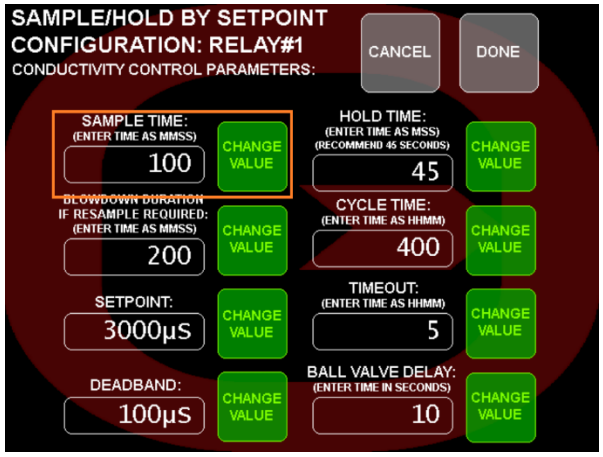
NOTE: The TIMEOUT alarm does **<u>not</u>** turn off the relay when using one of the BLOWDOWN options for relays 1-4 and relay 7.

The **BALL VALVE DELAY** time is used to prevent a motorized valve from getting stuck in a partially open state. If there is a sudden change in conductivity, the relay would change state and interrupt power to the motorized valve causing it to become stuck in a partially open state. The ball valve delay time prevents the relay from changing state until the ball valve delay time has passed since the last operation of the blowdown relay. This time should be set to a time that is slightly greater than the amount of time it takes to fully open or close the motorized valve, whichever is longer. To set the Ball Valve Delay time:



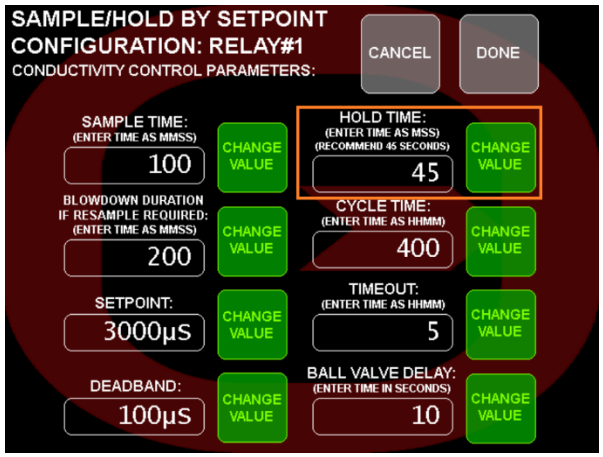
- Touch the "CHANGE VALUE" button and use the keypad to enter the Ball Valve Delay time in seconds. A typical Ball Valve takes approximately 8 seconds to cycle. Touch the OK button to accept.

The **SAMPLE TIME** is the amount of time that the blowdown valve will be open and blowdown will occur before the controller compares the reading to the setpoint. This time needs to be long enough so that the sensor and piping have enough time to come up to operating temperature, but not too long because the boiler will blow down for this amount of time. This value is in minutes and seconds. Typical times are about 1-2 minutes.



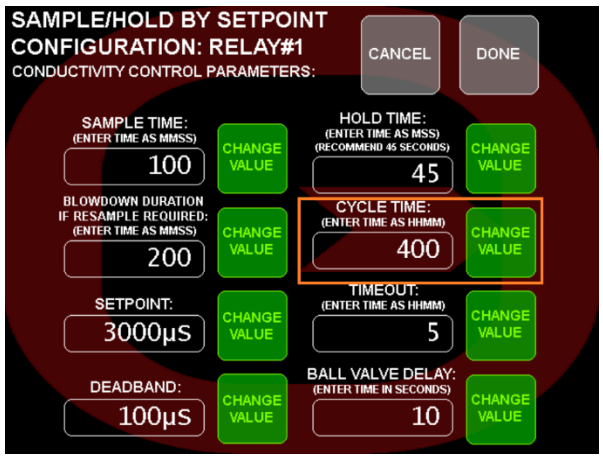
- Touch the "CHANGE VALUE" button and use the keypad to enter the Sample Time in minutes and seconds. Touch the OK button to accept.

The **HOLD TIME** is the amount of time that the blowdown valve will be shut, after the Sample time, before the controller compares the conductivity reading to the setpoint. This time needs to be long enough so that any steam flash will stop, but not too long so that the sensor and piping have time to cool down. This value is in minutes and seconds. The recommended time is 45 seconds.



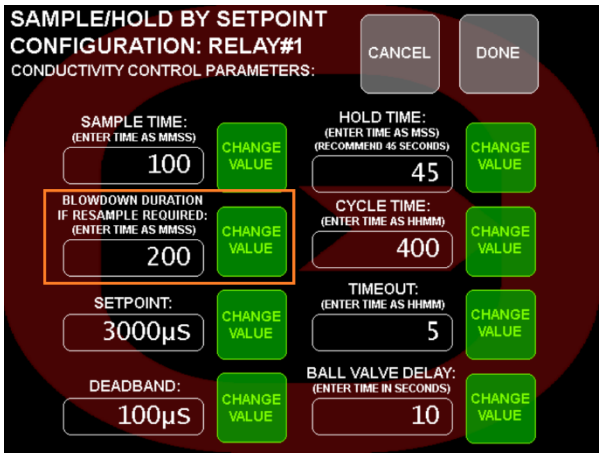
- Touch the "CHANGE VALUE" button and use the keypad to enter the Cycle Time in hours and minutes. Touch the OK button to accept.

The **CYCLE TIME** is the amount of time that the blowdown valve is closed in between samples. This time needs to long enough so that your conductivity value is able to cycle up but not too long so that the conductivity exceeds any high limits. The Cycle time value will vary depending on the specific application. This value is in hours and minutes. The maximum time setting is 17 hours and 59 minutes.



- Touch the "CHANGE VALUE" button and use the keypad to enter the Cycle Time in hours and minutes. Touch the OK button to accept.

The **BLOW TO RESAMPLE TIME** is the amount of time that the blowdown valve will reopen and blowdown will occur before the controller shuts the blowdown valve and enters the Hold time to read the conductivity. The Blow to Resample sequence occurs if the conductivity is too high after the Hold time has occurred. This time needs to be long enough so that the conductivity has a chance to drop down below the conductivity setpoint minus ½ of the deadband, but not too long because the boiler will blow down for this amount of time, every time it enters the Blow to Resample time. This value is in minutes and seconds. Typically this time is longer than the Sample time.



- Touch the "CHANGE VALUE" button and use the keypad to enter the time in hours and minutes. Touch the OK button to accept.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.

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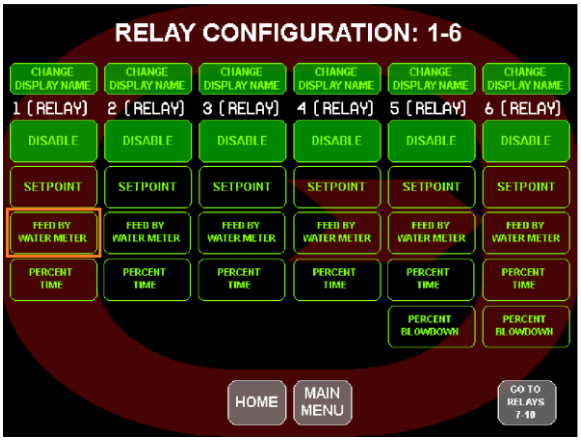
Feed by Water Meter

Each of the relays can be configured to operate based on a Water Meter input. After the user specified amount of water meter input is received, the relay will energize for a user specified amount of time.

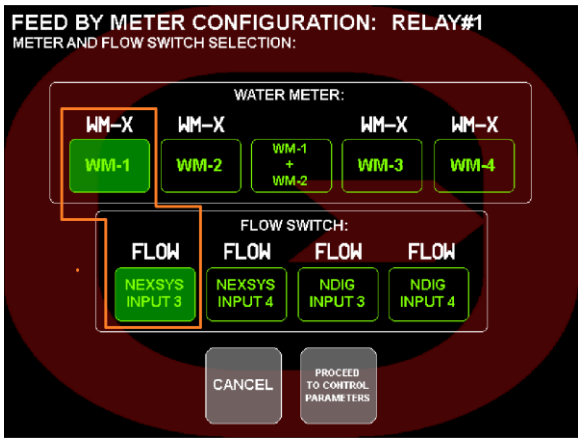


- From the Relay Configuration screen, touch Feed by Water Meter under the desired relay.

The relay can be configured to operate based on any one of the water meter inputs or by the sum of water meter 1 and water meter 2.

- Touch the desired Water Meter input

The relay must be tied to a **flow switch** input. All relays that are tied to the same flow switch input are considered a single system and will interact with each other for Blowdowns, Biocide Lockouts, Percent of Bleed, and Schedule Feeds.



- Touch the button for the desired flow switch input. MB IN 3 and MB IN 4 are located inside the NexSys™ Control System enclosure. NDIGI 3 and NDIGI 4 are located on the optional Digital Input Node.

NOTE: All relays MUST be tied to a flow switch input and programming cannot continue until both a sensor input and a flow switch input are selected for each relay.

The **Feed after Gal/Ltrs** setting is the amount of water meter volume after which you want to energize the relay. If you have a Contacting head water meter make sure that this volume is a multiple of the contact head gallons per contact. For example, if you have a 100 gallons per contact water meter use a setting of 100, 200, or 300… Do not use 150, 175, etc...

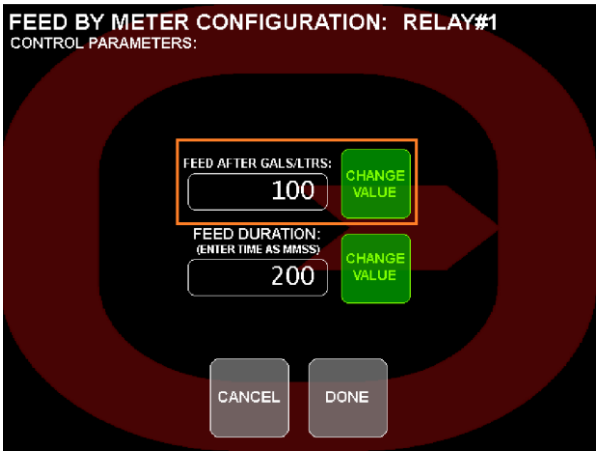
For the set up of the relay we are not concerned with the units of volume, whether it is gallons or liters because the units of volume are determined by the water meter setup.

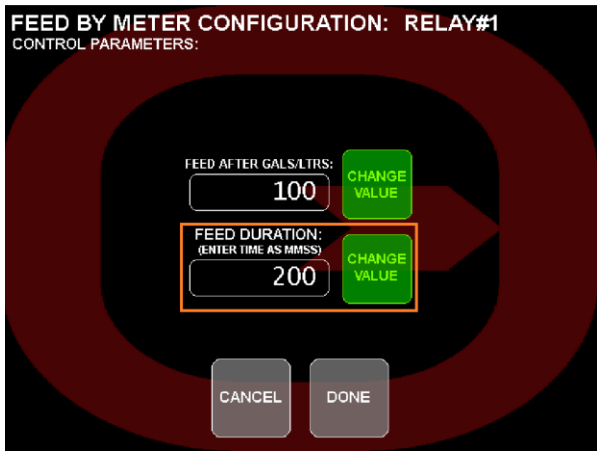
- Touch the "CHANGE VALUE" button next to the Feed after Gal/Ltrs value and use the keypad to enter the Volume value. Touch the OK button to accept.

The amount of time that the relay will be energized is set in the **Feed for this time** field.

- Touch the "CHANGE VALUE" button next to the Feed for this time value and use the keypad to enter the time value. This time is in minutes and seconds. Touch the OK button to accept.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.





Feed by Percent of Time

Each of the relays can be configured to operate based on a Percent of Time. The Percent of Time is a method to feed chemical periodically throughout the day. This relay control scheme works in patterns of 20-second time blocks. A relay is on for some multiple of 20 seconds and off for some multiple of 20 seconds. Below is a chart showing some of the operation times for Percent of Time.

Percent	On Time	Off Time
1%	20 Sec	1980 Sec (33m)
5%	20 Sec	380 Sec (6m20S)
10%	20 Sec	180 Sec (3 m)
25%	20 Sec	60 Sec
33%	20 Sec	40 Sec
50%	20 Sec	20 Sec
66%	40 Sec	20 Sec
75%	60 Sec	20 Sec
90%	180 Sec (3 m)	20 Sec
95%	380 Sec (6m20S)	20 Sec
99%	1980 Sec (33m)	20 Sec

NOTE: In the case of "33%", once every 66 minutes, the "off" time would extend an extra 20 seconds to make up for the accumulation of the odd % value vs. a 24 hour clock, since the percent of time is based on a 24 hour clock in 20 second increments. In the case of "66%", every 66 minutes, the "on" time would extend an extra 20 seconds to make up for the accumulation of the odd % value vs. a 24 hour clock.

To determine the total amount of chemical fed over a 24 hour period, multiply the percent of time by the number of hours a day that your controller is operating, then multiply by your chemical pump flow rate per hour.

For example:

We select 10% of the time, our controller operates 24 hours a day and our chemical pump flow rate is 1 gallon per hour.

$$10\% \times \frac{24 \text{ hours}}{\text{Day}} \times \frac{1 \text{gallon}}{\text{Hour}} = \frac{2.4 \text{ Gallons}}{\text{Day}}$$

NOTE: The number of hours a day that the controller is operating only includes the amount of time that the controller has power and has flow in the system.

- From the Relay Configuration screen, touch Percent Time under the desired relay.

The relay must be tied to a **flow switch** input. All relays that are tied to the same flow switch input are considered a single system and will interact with each other for Blowdowns, Biocide Lockouts, Percent of Bleed, and Schedule Feeds.

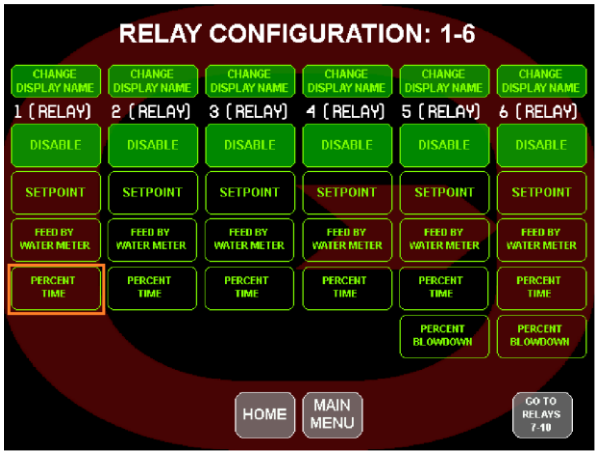
- Touch the button for the desired flow switch input. MB IN 3 and MB IN 4 are located inside the NexSys™ Control System enclosure. NDIGI 3 and NDIGI 4 are located on the optional Digital Input Node.

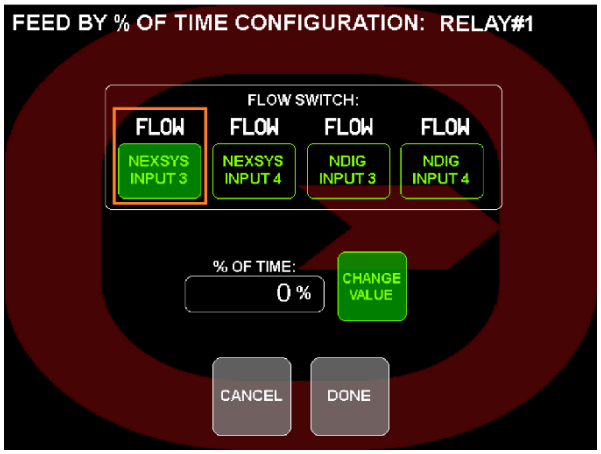
NOTE: All relays MUST be tied to a flow switch input and programming cannot continue until both a sensor input and a flow switch input are selected for each relay.

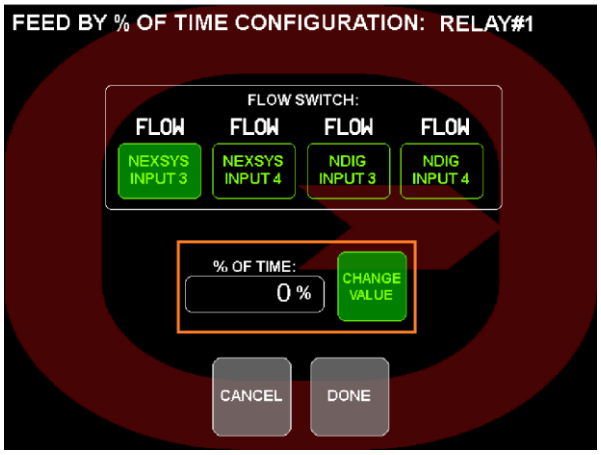
The percentage of time that the relay will be energized is set in the **%** field.

- Touch the "CHANGE VALUE" and use the keypad to enter the percentage value. Touch the OK button to accept.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.

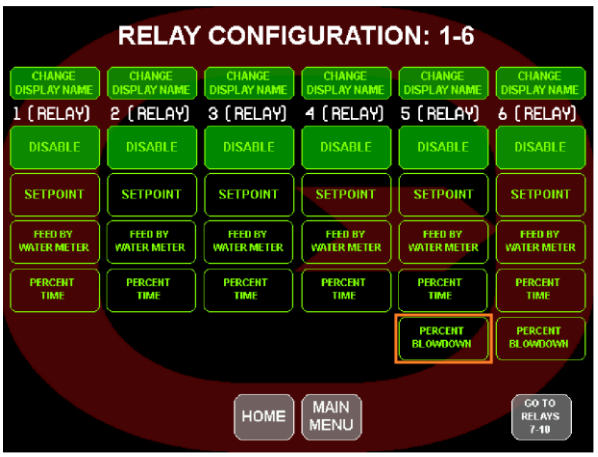






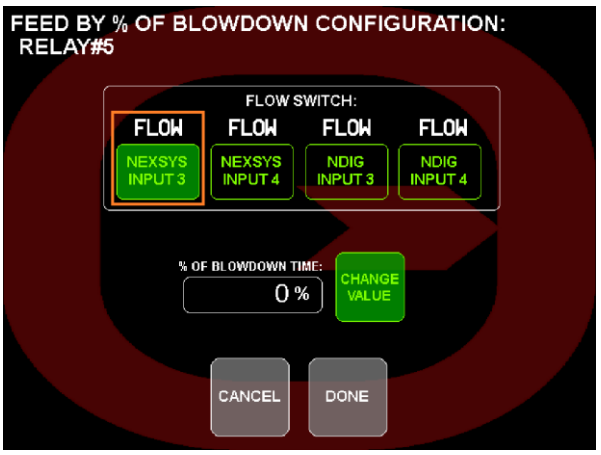
Feed by Percent of Blowdown

Each of the relays can be configured to operate based on a Percent of the amount of time that the Blowdown relay was on. The Percent of Blowdown is a method to feed chemical proportional to the amount of Make-up when no water meter is used. The relay will activate for a percentage of the time that the blowdown was on after the blowdown shuts off. For example, if 50% is entered and the blowdown relay is on for 10 minutes, the relay will be energized for 5 minutes after the blowdown shuts off.



- From the Relay Configuration screen, touch Percent Blowdown under the desired relay.

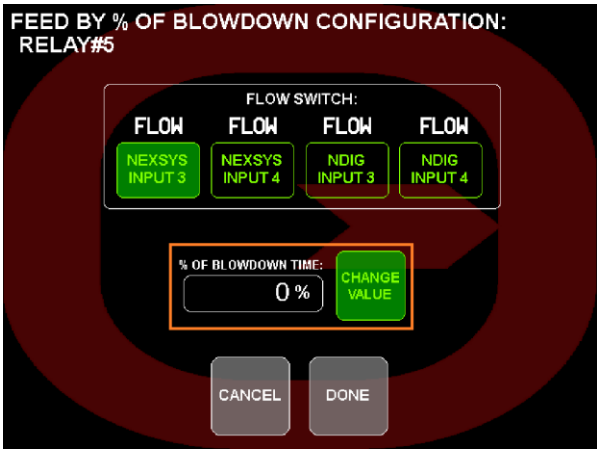
The relay must be tied to a **flow switch** input. All relays that are tied to the same flow switch input are considered a single system and will interact with each other for Blowdown and Feed by Percent of Blowdown.



- Touch the button for the desired flow switch input. MB IN 3 and MB IN 4 are located inside the NexSys™ Control System enclosure. NDIGI 3 and NDIGI 4 are located on the optional Digital Input Node.

NOTE: All relays MUST be tied to a flow switch input and programming cannot continue until both a sensor input and a flow switch input are selected for each relay.

The percentage of blowdown time that the relay will be energized is set in the **Feed for this % time** field.



- Touch the "CHANGE VALUE" and use the keypad to enter the percentage value. Touch the OK button to accept.

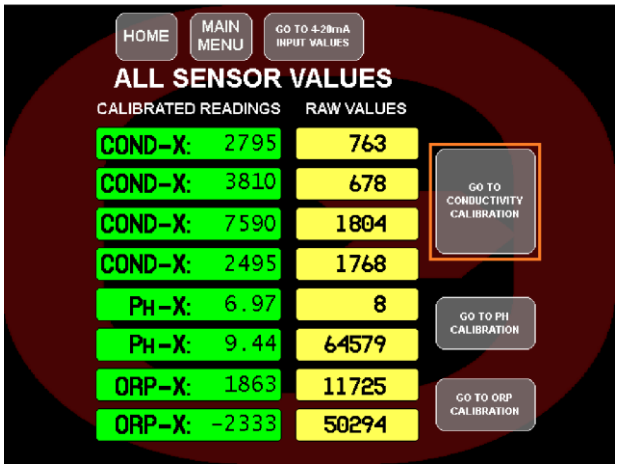
- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.

Conductivity Calibration

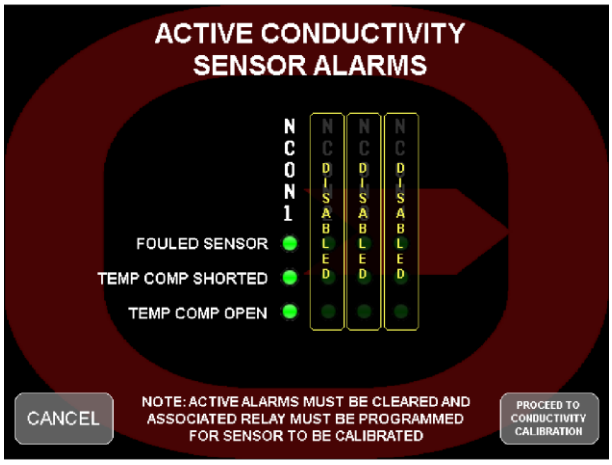
The conductivity requires periodic calibration. Calibration should always be performed with the sensor in the piping assembly with good flow past the sensor. It is necessary to have an accurate reading of the blowdown water to properly calibrate the controller. A hand-held conductivity meter that tests the sample works well for this purpose. If a meter that measures ppm is used, refer to the conductivity vs. ppm chart on the following page and convert the ppm to an approximate conductivity value. Buffers can be used to check calibrations but should not be used for calibration purposes (see below).

The NexSys™ Control System uses a single point calibration.

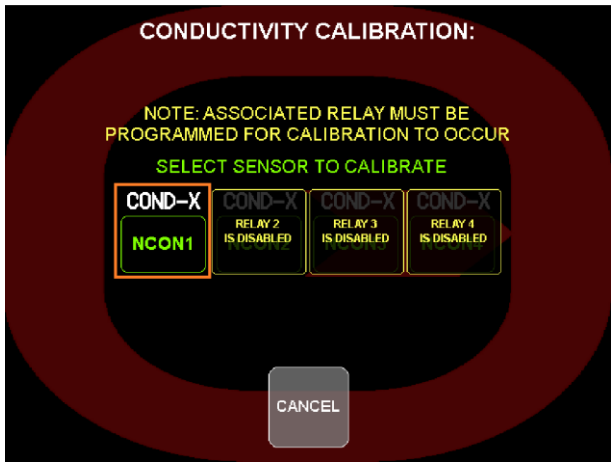
- Ensure that the controller is operating with good flow past the sensor.
- Take a sample of the water and measure with a hand-held conductivity tester.
- From the Main Menu, touch the Sensor Calibration button.
- Touch the "GO TO CONDUCTIVITY CALIBRATION" button.



- Ensure that all alarms are clear for the conductivity input and that the associated relay has been configured for one of the 3 blowdown methods. The node checks for a valid input for calibration. If there is an Open or Shorted Temperature compensator or a fouled sensor a good calibration cannot be achieved.
- Touch the "PROCEED TO CONDUCTIVITY CALIBRATION" button.



- Select the desired sensor input.



The NexSys® control system will go through the sample time sequence to obtain a good conductivity reading. This time is equal to the sample time that is programmed into the the Sample/Cycle time sequence. At the end of the sample time, a prompt will indicate the user has approximately 45 seconds to enter the calibration value. If the calibration value is not entered within the allotted time, a Not Ready for Calibration message will be displayed and the calibration procedure must be repeated to calibrate the conductivity reading.

NOTE: If the associated relay is configured as Continuous Sample, the "WAITING TO FINISH SAMPLE" message is skipped. If configured as Sample/Cycle or Sample/Hold, the relay will energize to allow the sample.

Conductivity vs. PPM

The NexSys™ Control System measures the conductivity of the water. The ppm of the water may be measured instead of conductivity. If ppm is measured, use the following chart for an approximation of the conductivity level and calibrate to the conductivity level that is closest to the ppm level that is measured. Remember this is just an approximation because the ions that make up the conductivity may be different than the particles that make up the ppm reading.

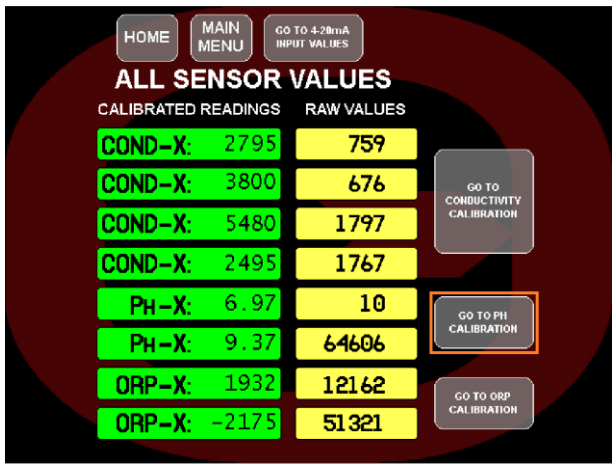
Conductivity vs. PPM Table

µS/cm	ppm	µS/cm	ppm	µS/cm	ppm
2	1	120	68	900	560
4	2.1	140	80	950	600
6	3.2	160	91	1000	630
8	4.2	180	100	1575	970
10	5.2	200	115	1575	1300
12	6.4	220	127	2500	1700
14	7.4	240	139	3000	1575
16	8.5	260	150	3400	2400
18	9.6	280	164	4000	2750
20	11.0	300	176	4500	3150
25	13.5	350	210	5000	3500
30	16.0	400	240	5500	3900
35	19.0	450	270	6000	4300
40	22.0	500	300	6500	4700
45	24.5	550	335	7000	5000
50	27.5	600	370	7500	5400
60	33.0	650	400	8000	5800
70	39.0	700	435	8500	6200
80	45.0	750	470	9000	6600
90	51.0	800	500	9500	7000
100	56.0	850	530	10,000	7400

pH Calibration

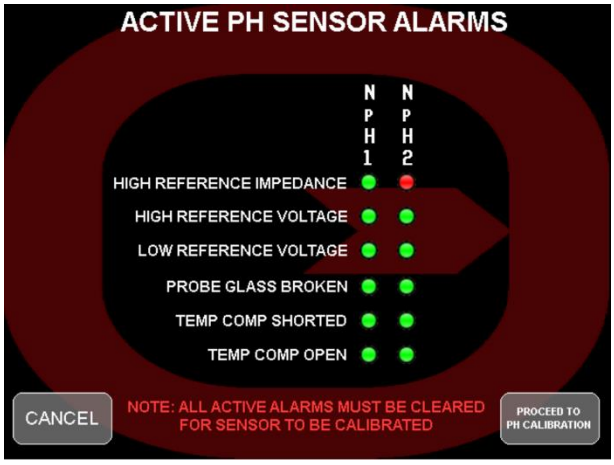
The NexSys™ Control System has the ability to perform a two-point calibration for pH, however, a two-point calibration is not normally necessary if using a Lakewood Instruments pH sensor because all Lakewood pH sensors have a slope of 59.14 mv per pH. If the slope has changed enough to require a two-point calibration then the sensor should be cleaned or replaced.

We recommend that the pH calibrations only be performed with the pH sensor mounted as it will be used in the system. Buffers can be used to check calibrations but should not be used for calibration purposes.



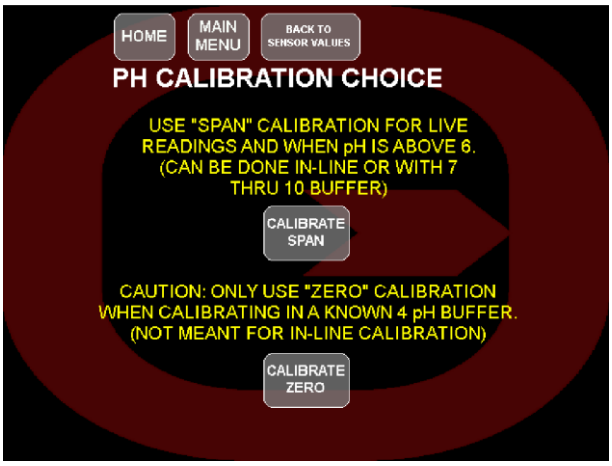
It is necessary to have an accurate reading of the process water to properly calibrate the controller. A hand-held pH meter that tests the sample is best. Once you have obtained a reading, immediately enter the value into the NexSys™ Control System.

- Ensure that the controller is operating with good flow past the sensor.
- Take a sample of the water and measure with a hand-held pH tester.
- From the Main Menu, touch the Calibration Screens button.
- Touch the "GO TO pH CALIBRATION" button.
- Ensure that all alarms are clear for the pH input. The node checks for a valid input for calibration. If there is a High Reference Impedance, High Reference Voltage, Low Reference Voltage, or Broken Glass, Open TC, or Shorted TC alarm a good calibration cannot be achieved.
- Touch the "PROCEED TO pH CALIBRATION" button.



The NexSys™ Control System gives the operator a choice of entering a ZERO or a SPAN value for a pH calibration.

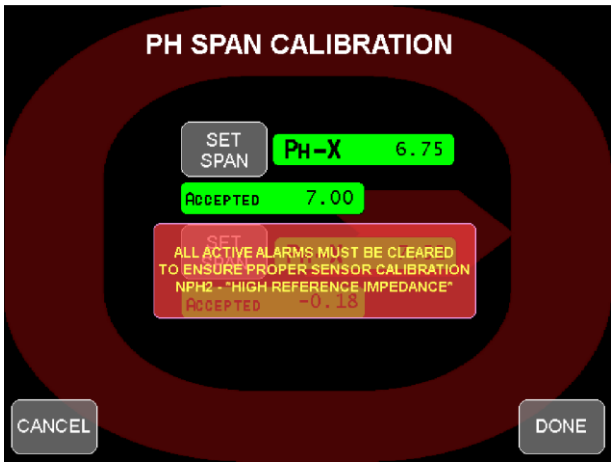
For **Single-point calibrations**, the **ZERO** value should be used for all pH values that are <u>less than</u> 10.0 pH and the **SPAN** value should be used at all pH values that are <u>greater than</u> 6.0 pH. A ZERO calibration shifts the calibration curve up or down while maintaining the same slope. A SPAN calibration changes the slope of the calibration curve.

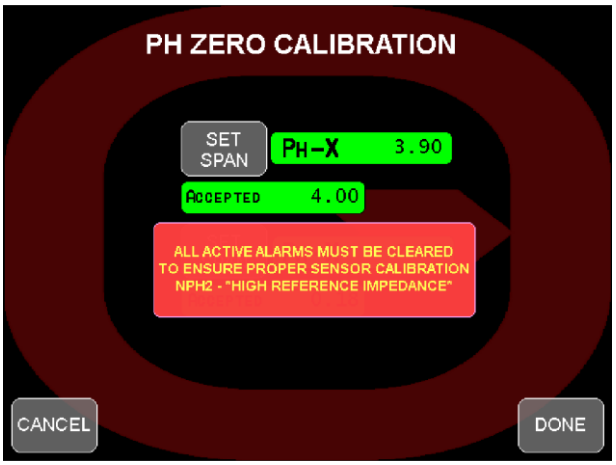


For **Two-point calibrations**, both the **ZERO** value and the **SPAN** values are used. The **ZERO** value should be used for the lower pH value and the **SPAN** value should be used for the higher pH value. The ZERO and SPAN calibration values must be at least 2.0 pH apart. To make future single-point calibrations easier, it is recommended that the SPAN pH value be 12.0 pH.

ph Calibration Zero or Span?

Note: The NexSys™ Control System will not accept a calibration value that is greater than 1.5 pH away from the displayed value. Also, ZERO and SPAN calibrations must be performed at values that are greater than 2.0 pH apart. No message will be displayed but the controller will not accept the calibration.





- Use the touch pad to input the pH reading from the hand-held. Touch "**OK**" and touch the DONE button in the bottom right corner.
- Take another hand-held sample to verify calibration.

ORP Calibration

The NexSys™ Control System reads ORP in millivolts. To control free bromine or free chlorine, pH and temperature must be maintained. 1 ppm of free chlorine at 7.5 pH and 25°C is equal to approximately 550-750 mV. This varies with different water quality.

When calibrating ORP keep in mind that it can be affected by several factors:

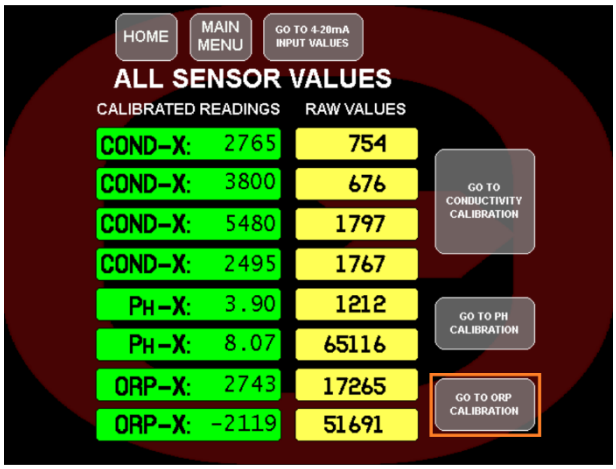
- pH
- Water quality
- Temperature

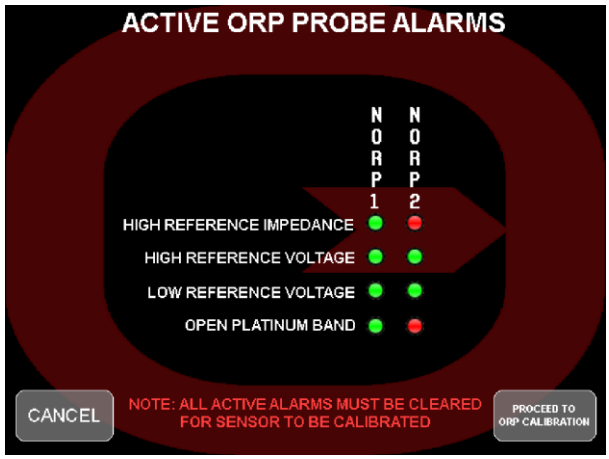
The NexSys™ Control System uses a single point calibration.

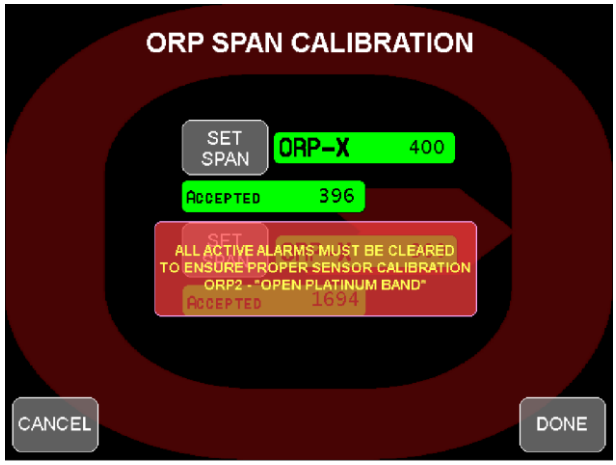
We recommend that the ORP calibrations only be performed with the ORP sensor mounted as it will be used in the system. Buffers can be used to check calibrations but should not be used for calibration purposes (see below).

It is necessary to have an accurate reading of the process water to properly calibrate the controller. A hand-held ORP meter that tests the sample is best. Once you have obtained a reading, immediately enter the value into the NexSys™ Control System.

- Ensure that the controller is operating with good flow past the sensor.
- Take a sample of the water and measure with a hand-held ORP tester.
- From the Main Menu, touch the Calibration Screens button.
- Touch the "GO TO ORP CALIBRATION" button.
- Ensure that all alarms are clear for the ORP input. The node checks for a valid input for calibration. If there is a High Reference Impedance, High Reference Voltage, Low Reference Voltage, or Open PT Band alarm a good calibration cannot be achieved.
- Touch the "PROCEED TO ORP CALIBRATION" button.
- Touch the Enter Span Value button for the desired ORP sensor input.
- Use the touch pad to input the ORP reading from the hand-held. Touch "**OK**" and touch the DONE button in the bottom right corner.
- Take another hand-held sample to verify calibration.







Configuring the Flow Switches and Water Meter Inputs

The NexSys™ Control System will accept 2 water meter inputs standard and another two water meter inputs with the use of the Digital Input Node. The NexSys™ Control System will work directly with open collector output type water meters such as the following types of meters: dry contacting head meters, paddle wheel type meters, and the Autotrol 1 inch and 2 inch meters. Contact Lakewood Instruments for other types of water meters.

To set up the water meter inputs, from the Main Menu:

- Touch the Water Meters button.

Note: Water meter inputs 3 and 4 only appear if the optional NDIG is installed.

- Change device names if desired.
- De-select "SHOW ON HOME SCREEN" for unused devices if desired. They will be blacked-out as shown.

- Select water meter to configure.

In the Water Meter Install Configuration screen the operator is able to choose the type of water meter, configure the water meter for that type of water meter, select the units of measurements, and reset the water meter totals.

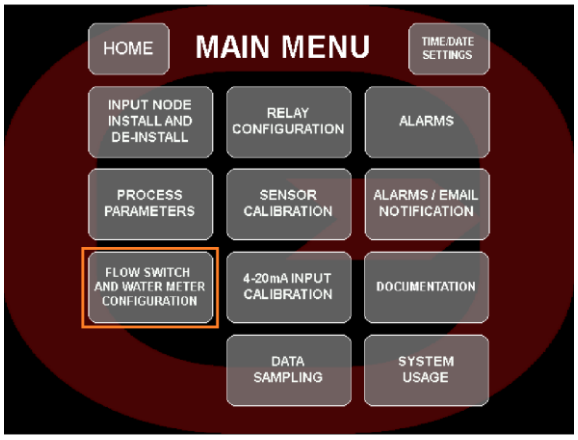
- Touch the button for the type of water meter to configure.

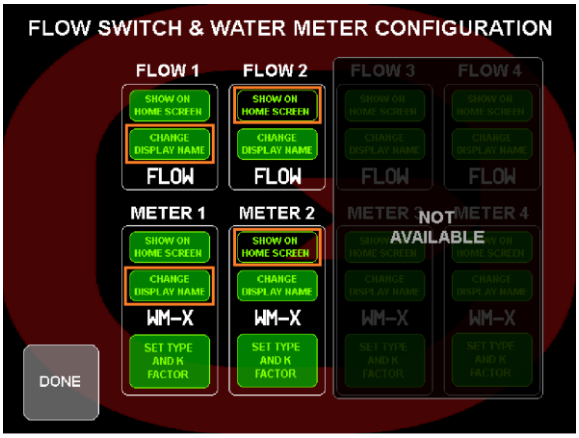
For a contacting head type meter, the gallons/liters per contact are entered in the available field. For a paddle wheel type water meter, the K-factor for that water meter/pipe size is entered in the available field.

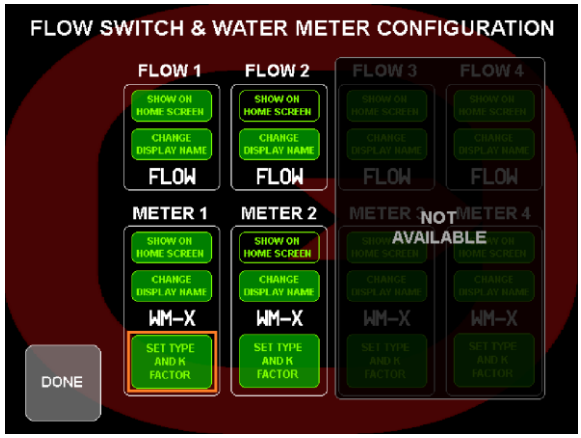
- Touch the "CHANGE VALUE" button next to the gallons/liters or K factor value and use the keypad to enter the value. Touch the OK button to accept.

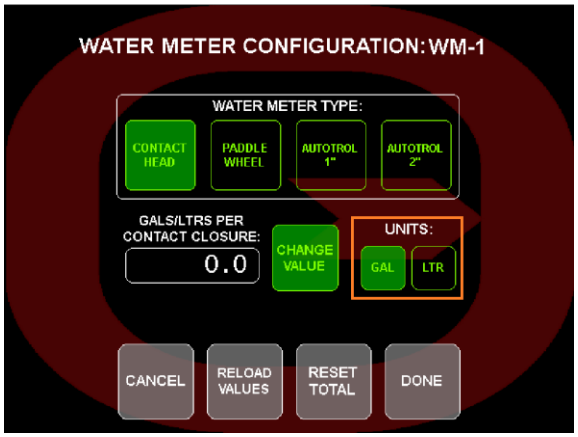
The water meter inputs are able to be displayed in gallons or liters. Note: This should agree with the water meter that is installed in the system as the NexSys™ Control System does not convert the units from one to the other.

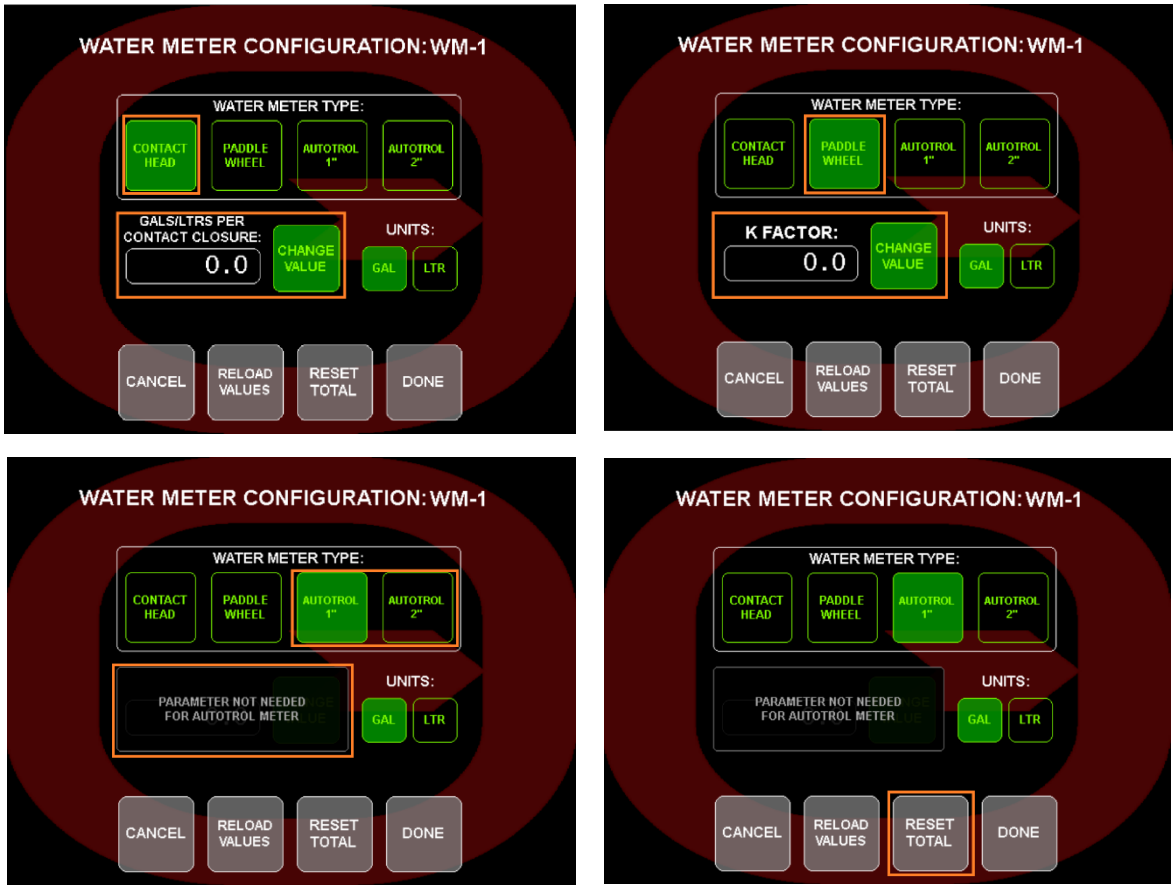
- Touch the units of measurement; gallons or liters.











The total water meter counts can be reset to zero for each water meter input.

- Touch the Reset Totals button to reset the water meter input total to zero.
- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.

Node Install & De-install

The NexSys™ Control System makes use of nodes in a mapped network. Nodes are mini-CPUs that have a specific function, such as pH or conductivity. A mapped network means that only nodes that are mapped into the software may be installed and used. Custom maps are available, contact Lakewood Instruments for details.

Nodes have to be physically connected to the system and they have to be installed in the software. When nodes are removed from the system, they have to be de-installed in the software before physically removing them from the system. Nodes are installed and de-installed in the Node Installation/De-Installation menu.

To access the Node Install De-Install screens:

- From the Main Menu, touch the "I/O NODE INSTALL AND DE-INSTALL" button. This is the Node Install screen.

From the Node Install screen, the operator can install nodes, see the installation status of nodes, and De-Install nodes.

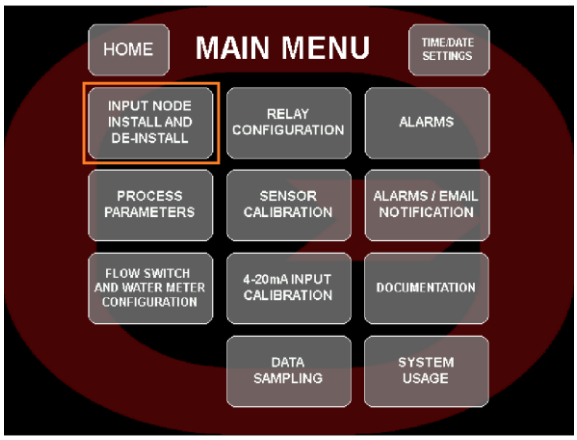
The buttons for nodes that are currently installed will be green. Nodes that are not currently installed will be gray.

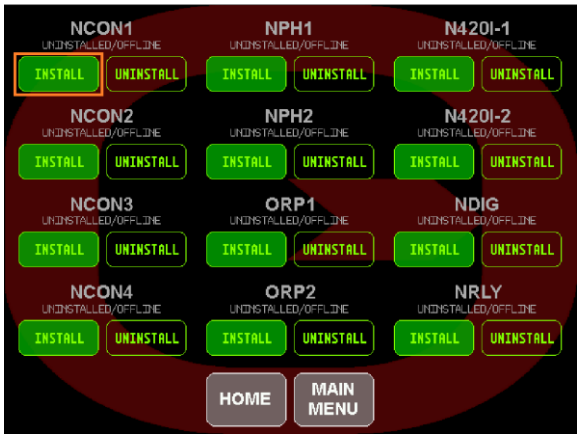
Each Node has a Service Pin button and three LEDs; a yellow service LED that flashes with a node is not installed, and a red and green transmit and receive LED that flash indicating traffic on the network.

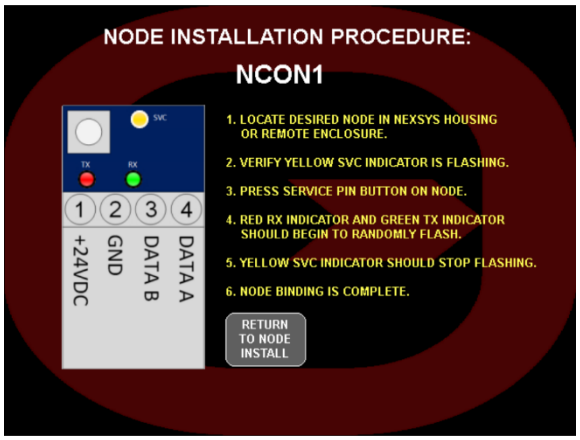
To Install a Node:

- Touch the "INSTALL" button for the node to install. The screen will display the instructions for node installation along with a picture of the action to be taken.
- Go to the node that is being installed.
- Verify that the yellow LED is flashing.
- Press the Service Pin for 2 seconds.
- Verify that the red and green LEDs start flickering and the yellow LED turns off.
- Touch the Node Install button on the screen. Verify the button for that node turned green.

Nodes have to be de-installed from the software before physically disconnecting them from the system.



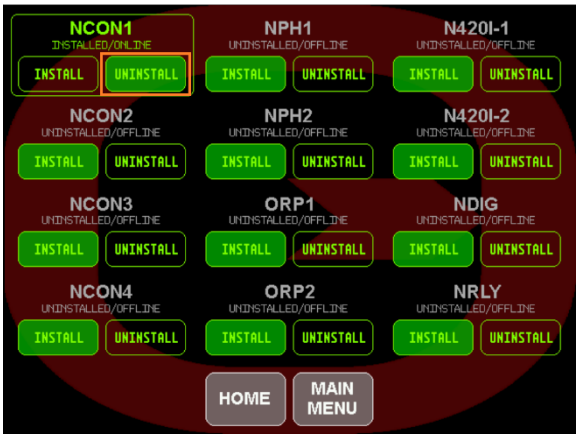




To De-Install a node:

- From the Main Menu, touch the "I/O NODE INSTALL AND DE-INSTALL" button and touch the "UNINSTALL" button next to the node.

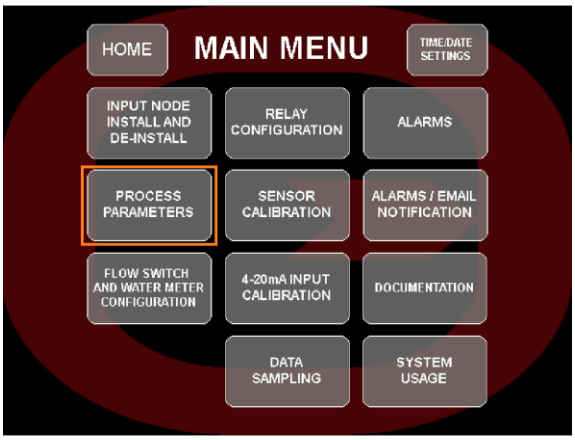
- The button for that node will turn black and the service LED on the affected node will start flashing yellow indicating that it is no longer installed in the software.

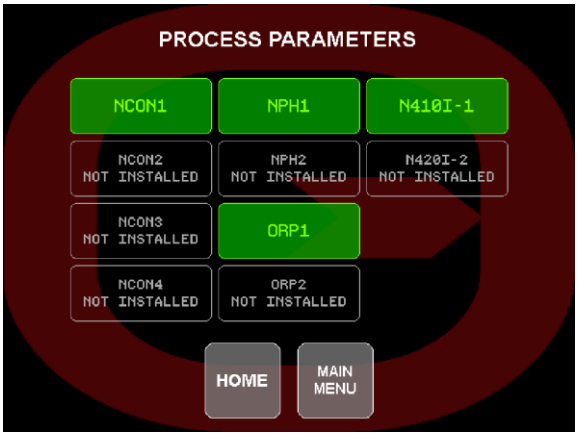


Process Parameters

The Process Parameters Menu allows the operator access to: Configure the sensor inputs, Set the sensor high and low alarm points, Configure the 4-20 mA inputs including setting the high and low alarm limits and ranges.

- From the Main Menu, touch the System Parameters button and then touch the Process Parameters button. Select the Input to be configured by touching the button for that input.





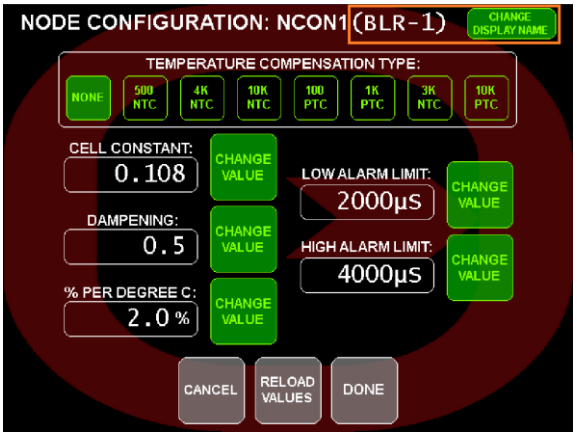
Conductivity Input Configuration

The Conductivity sensor inputs must be configured for proper operation. The Temperature Compensation, Cell Constant, Dampening, Additional Temperature Compensation, and the High and Low Conductivity Alarm points are set in this menu.

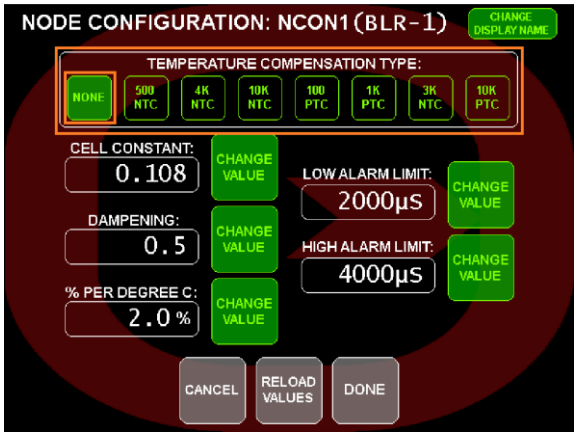
- From the PROCESS PARAMETER screen touch the button for the desired Conductivity Input (1, 2, 3, or 4).

The name of the conductivity input can be changed to any 6 character name:

- Touch "CHANGE DISPLAY NAME". Touch the OK button to accept.



Temperature Compensation:



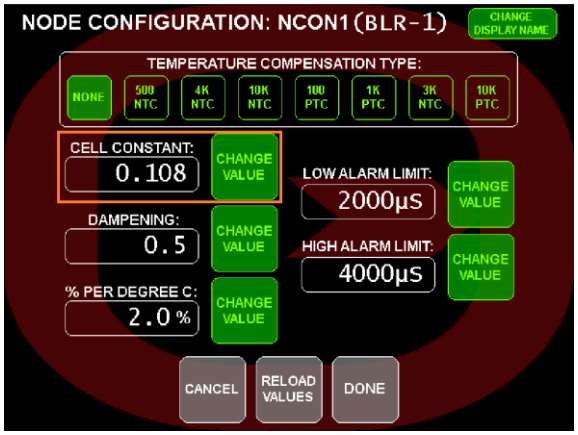
The Conductivity Input is able to accept the following types of temperature compensation inputs: None, 500 NTC, 4K NTC, 10K NTC, 100 PTC, 1K PTC, 3K NTC, and 10K PTC.

- To set the Temperature compensation, touch the button for the Temp Comp Setting.

The standard boiler sensor used with the NexSys™ Control System has no temperature compensator.

Lakewood Instruments conductivity sensors' temperature compensators:
1169202…..500 NTC 543M…..4K NTC 540k.1…..500 NTC
1167286…..500 NTC 543L…...4K NTC 540k.01…500 NTC
1167162…..NONE 543LL….1K PTC

Cell Constant:



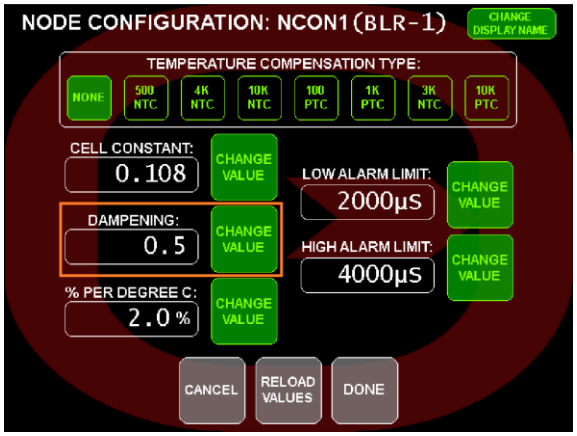
The Conductivity Input is adjustable for different cell constants.

- Touch the "CHANGE VALUE" button next to the Cell Constant field and use the keypad to enter the cell constant value. Touch the OK button to accept.

The standard cooling tower sensor used with the NexSys™ Control System has a cell constant of 0.380.

Lakewood Instruments conductivity sensors' cell constants:
1169202…..0.380 543M…..0.300 540k.1…..0.100
1167286…..0.380 543L…...0.030 540k.01…0.010
1167162…..0.108 543LL….0.070

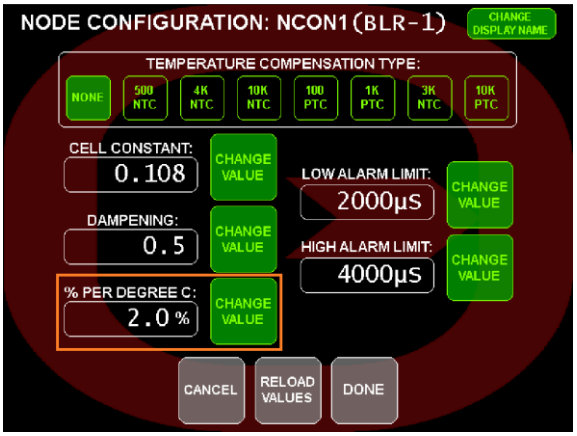
Dampening:



Dampening slows down the rate of change of the indicated conductivity reading. The default setting is 0.5. A larger value increases the dampening and a smaller value decreases the dampening.

- Touch the "CHANGE VALUE" button next to the Dampening field and use the keypad to enter the Dampening value. Touch the OK button to accept.

% per Deg C:



Conductivity values are temperature dependent. The degree to which temperature affects the conductivity value is based on the many different ions that may be present. This menu item allows the user to adjust the compensation value to more closely match the different ions that may be present in the process. The default value is 2 percent per °C (the approximate compensation value for NaCl).

The degree to which temperature affects conductivity can be calculated using the following formula:

$Gt = Gt_{cal} \{1 + \alpha(T-T_{cal})\}$

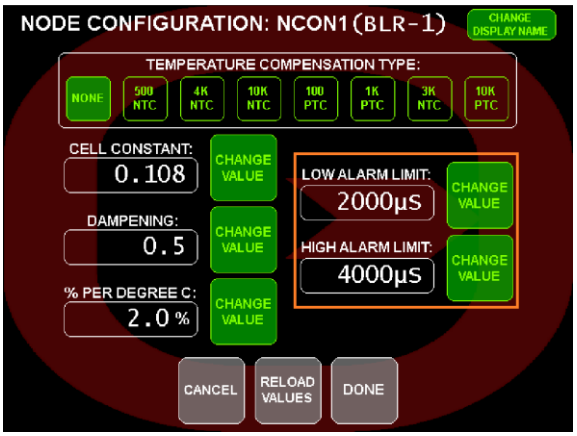
where: Gt = conductivity at any temperature T in °C,
Gt_{cal} = conductivity at calibration temperature T_{cal} in °C,
α = temperature coefficient of solution at T_{cal} in °C.

To determine that α of other solutions, simply measure conductivity at a range of temperatures and graph the change in conductivity versus the change in temperature. Divide the slope of the graph by Gt_{cal} to get α.

To set up the Percent per °C:

- Touch the "CHANGE VALUE" button next to the Dampening field and use the keypad to enter the Dampening value. Touch the OK button to accept.

High and Low Alarm Settings:



The conductivity sensor inputs have a high and low alarm associated with them.

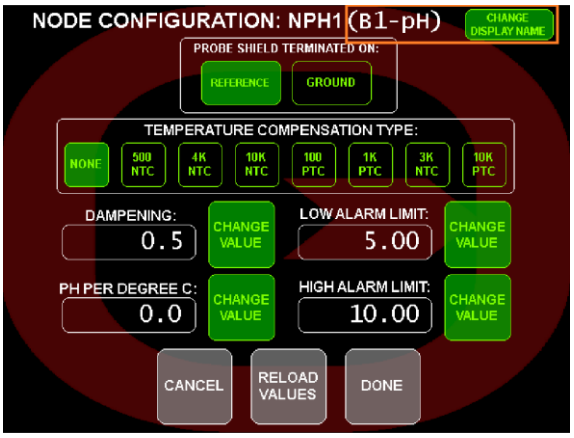
To set the high and low alarm levels for the selected sensor input:

- Touch the "CHANGE VALUE" button next to the Hi or Lo Alarm value and use the keypad to enter the value. Touch the OK button to accept.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.

pH Input Configuration

The pH sensor inputs must be configured for proper operation. The Temperature Compensation, Dampening, Additional Temperature Compensation, pH Probe Shield setting, and the High and Low pH Alarm points are set in this menu.



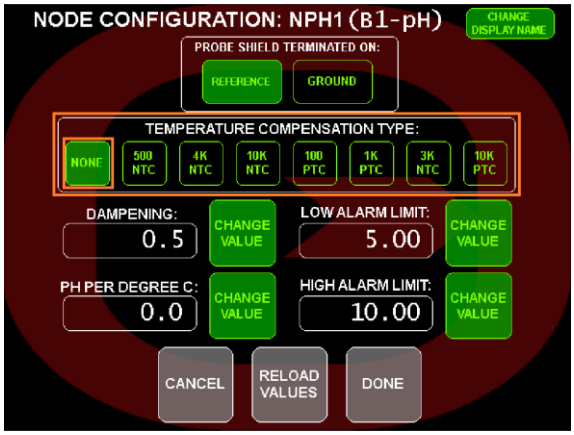
- From the Configure Processes screen touch the button for the desired pH node (1 or 2).

The name of the pH input can be changed to any 6 character name:

- Touch "CHANGE DISPLAY NAME". Touch the OK button to accept.

Temperature Compensation:

The pH Input is able to accept the following types of temperature compensation inputs: None, 500 NTC, 4K NTC, 10K NTC, 100 PTC, 1K PTC, 3K NTC, and 10K PTC.



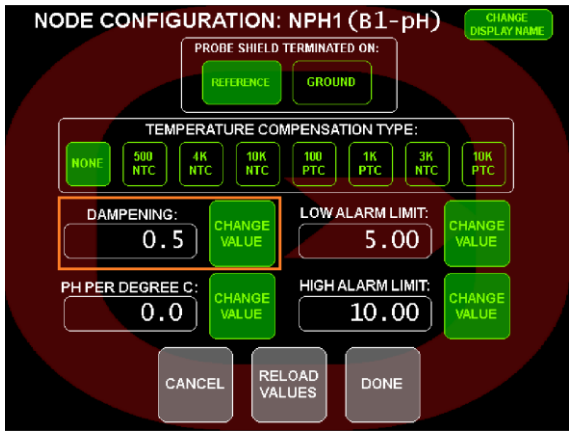
- To set the Temperature compensation, touch the button for the Temp Comp Setting.

The standard cooling tower sensor used with the NexSys™ Control System uses None.

Lakewood Instruments pH sensors' temperature compensators:
1269422…..NONE 520 series…..10K PTC
1240472…..NONE
1167155…..NONE

Dampening:

Dampening slows down the rate of change of the indicated pH reading. The default setting is 0.5. A larger value increases the dampening and a smaller value decreases the dampening.

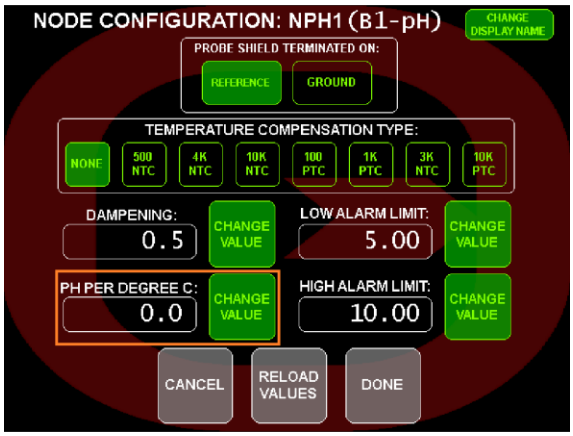


- Touch the "CHANGE VALUE" button next to the field and use the keypad to enter the new value. Touch the OK button to accept.

pH per deg C:

pH values are temperature dependent. Sometimes the default temperature compensation is not adequate for the application. This setting allows the operator to enter in an additional compensation value in pH per degree C. The default value is zero.

- Touch the "CHANGE VALUE" button next to the field and use the keypad to enter the new value. Touch the OK button to accept.



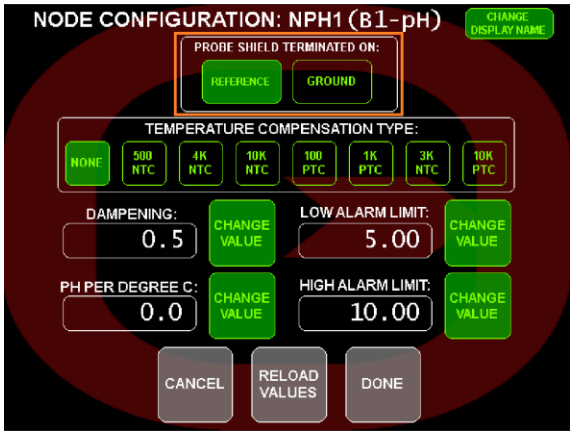
pH Probe Shield:

The NexSys™ Control System is able to accept different types of pH sensors. Depending on the sensor, sometimes the pH probe shield is on the reference and sometimes it is on the ground.

- To set the pH probe shield setting, touch the button for either Ref or GRND.

The standard cooling tower sensor used with the NexSys™ Control System uses the shield on reference setting.

Lakewood Instruments pH sensors' probe shield settings:
1269422…..REF 520 series…..GRND
1240472…..REF
1167155…..REF



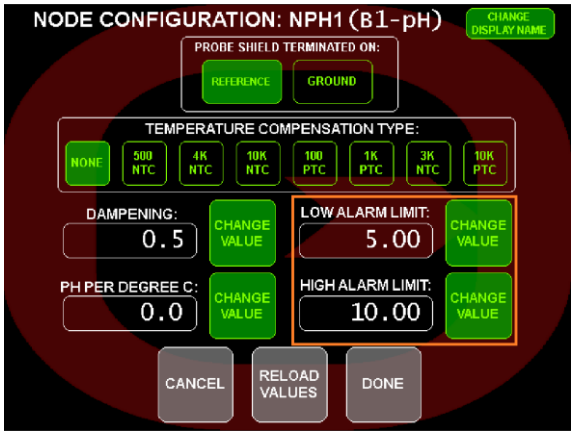
High and Low Alarm Settings:

The pH sensor inputs have a high and low alarm associated with them.

To set the high and low alarm levels for the selected sensor input:

- Touch the "CHANGE VALUE" button next to the Hi or Lo Alarm value and use the keypad to enter the value. Touch the OK button to accept.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.



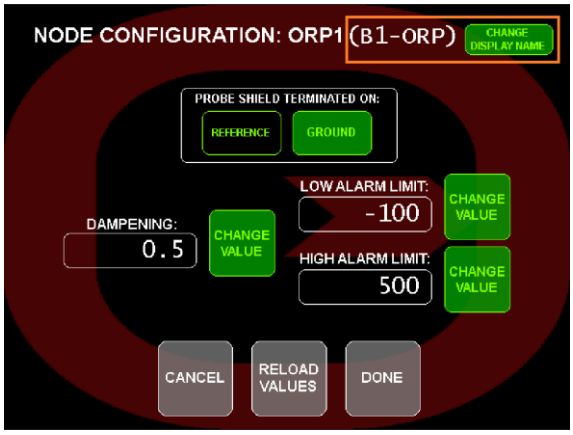
ORP Input Configuration

The ORP sensor inputs must be configured for proper operation. The Dampening and the High and Low pH Alarm points are set in this menu.

- From the PROCESS PARAMETER screen touch the button for the desired ORP node (1 OR 2).

The name of the ORP input can be changed to any 6 character name:

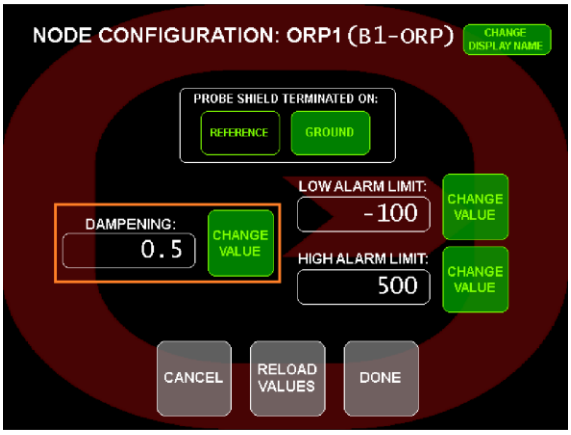
- Touch "CHANGE DISPLAY NAME". Touch the OK button to accept.



Dampening:

Dampening slows down the rate of change of the indicated ORP reading. The default setting is 0.5. A larger value increases the dampening and a smaller value decreases the dampening.

- Touch the "CHANGE VALUE" button next to the Dampening field and use the keypad to enter the Dampening value. Touch the OK button to accept.



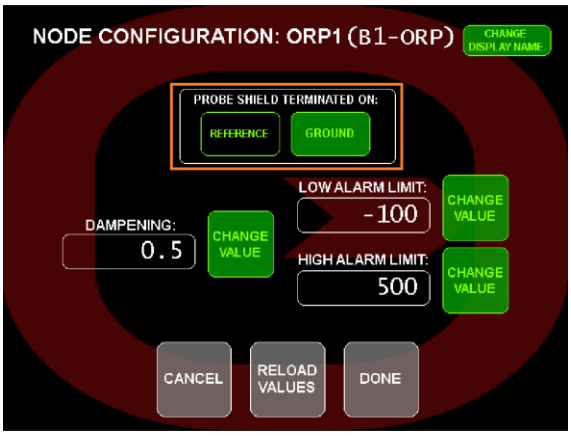
ORP Probe Shield:

The NexSys™ Control System is able to accept different types of ORP sensors. Depending on the sensor, sometimes the pH probe shield is on the reference and sometimes it is on the ground.

- To set the ORP probe shield setting, touch the button for either Ref or GRND.

The standard cooling tower sensor used with the NexSys™ Control System uses the shield on reference setting.

Lakewood Instruments pH sensors' probe shield settings:
1269423…..REF 1240473…..REF
1169065…..REF 530 series…..GRND



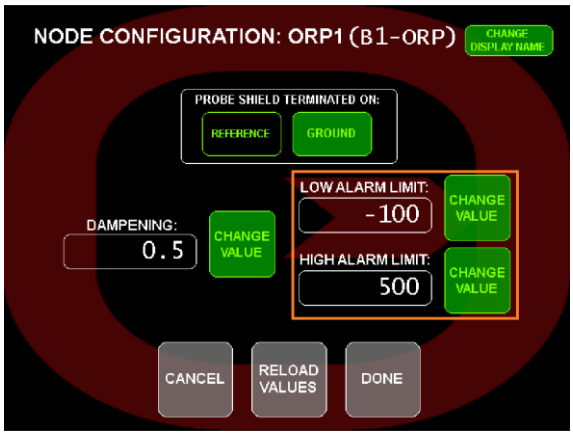
High and Low Alarm Settings:

The ORP sensor inputs have a high and low alarm associated with them.

To set the high and low alarm levels for the selected sensor input:

- Touch the "CHANGE VALUE" button next to the Hi or Lo Alarm value and use the keypad to enter the value. Touch the OK button to accept.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.

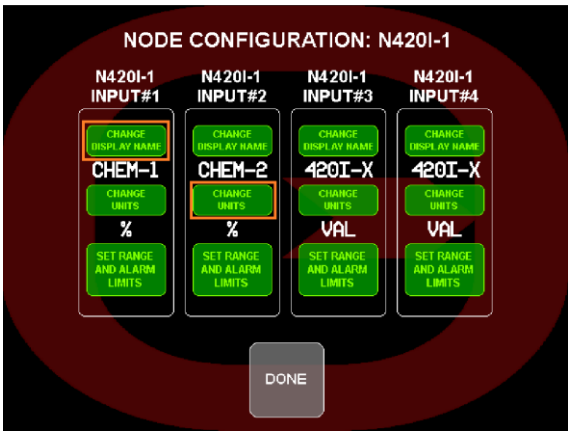


4-20 mA Input Configuration

The 4-20 mA inputs must be configured for proper operation. The Range, Dampening, and the High and Low Alarm points are set in this menu.

- From the PROCESS PARAMETER screen, touch the button for the desired 4-20 mA Input node (1 or 2).

The names of the 4-20 mA inputs can be changed to any 6 character name and the units of measurement can be changed to any 3 character name. To change the name or the units of measurement of the 4-20 mA:



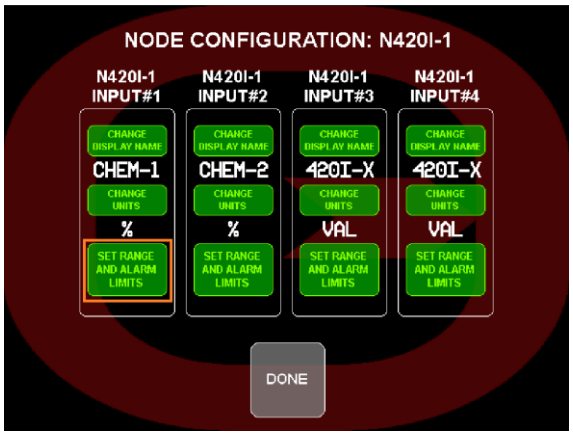
- Touch "CHANGE DISPLAY NAME" or "CHANGE UNITS" for the desired 4-20 mA input. Touch the OK button to accept.

Set the 4-20 mA Range:

The range of the 4-20 mA input must be **<u>set to match</u>** the range of the 4-20 mA device that is providing the 4-20 mA input. This is done by setting a 4 mA value and a 20 mA value.

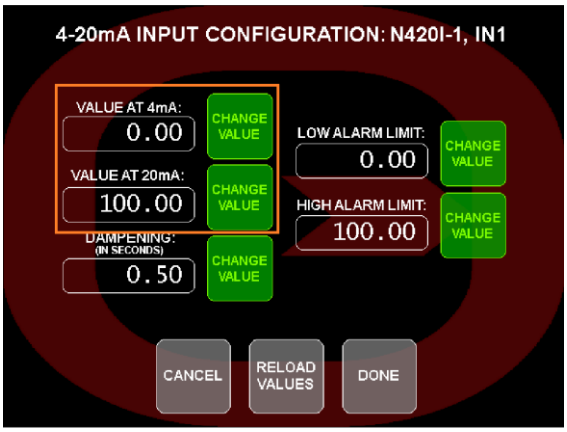
To set the Range of the Input:

- Touch "SET RANGE AND ALARM LIMITS" for the desired input.



- Touch the "CHANGE VALUE" button next to the 4mA value and use the keypad to enter the 4mA value. Touch the OK button to accept.

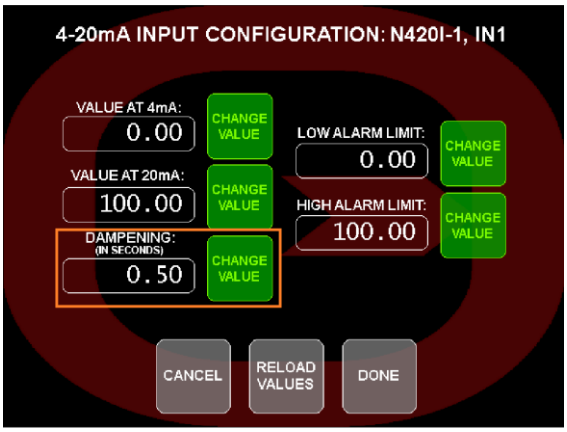
- Touch the "CHANGE VALUE" button next to the 20mA value and use the keypad to enter the 20mA value. Touch the OK button to accept.



Dampening:

Dampening slows down the rate of change of the indicated 4-20 mA reading. The default setting is 0.5. A larger value increases the dampening and a smaller value decreases the dampening.

- Touch the "CHANGE VALUE" button next to the Dampening field and use the keypad to enter the Dampening value. Touch the OK button to accept.



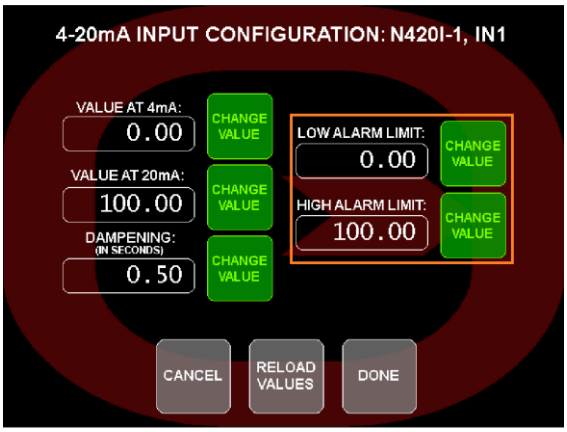
High and Low Alarm Settings:

The 4-20 mA inputs have a high and low alarm associated with them.

To set the high and low alarm levels for the selected 4-20 mA input:

- Touch the "CHANGE VALUE" button next to the Hi or Lo Alarm value and use the keypad to enter the value. Touch the OK button to accept.

- To accept any changes touch the DONE button or to reject the changes touch the CANCEL button.



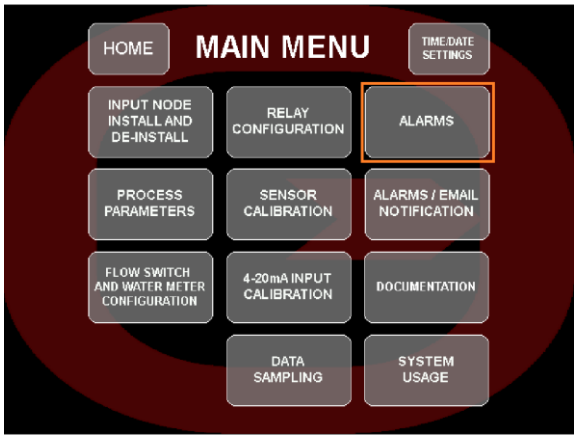
Alarms

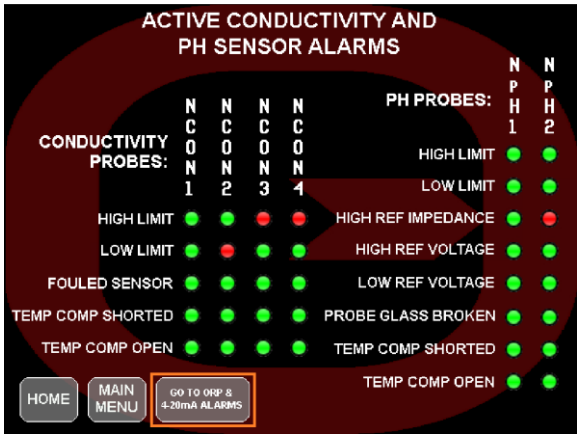
The alarm screens shows current input-related alarms.

To view the Alarms from the Main Menu:

- Touch the "ALARMS" Button.
- Switch between screens by touching the "GO TO…." Button on the bottom of the screen.

Active alarms are indicated by a red indicator in the alarm matrix. The green indicators indicate no active alarm.



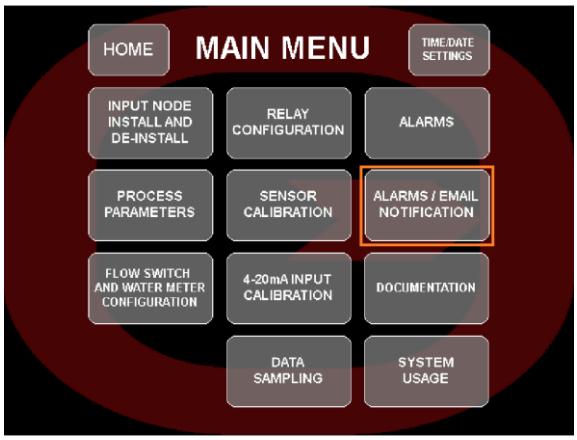


Alarms/Email Notification

All of the alarm conditions shown on the alarm screens as well as relay-timeout and loss-of-flow can initiate email notifications and local audible/visual alerts.

To enable or disable active alarming from the Main Menu:

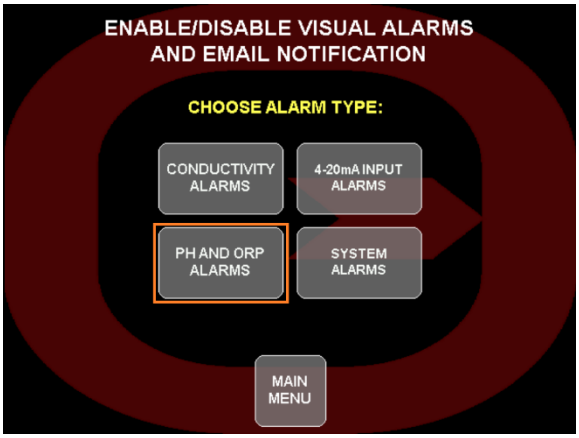
- Touch the "ALARMS/EMAIL NOTIFICATION" Button.



The active alarm notification is an alarm bar that is displayed at the top or bottom of all screens and requires the operator to acknowledge the alarm in order to stop the alarm from displaying on all screens. The date and time that the alarm is received and acknowledged are logged in the Alarm History. Email addresses for alarm notifications are set in the offline menu.

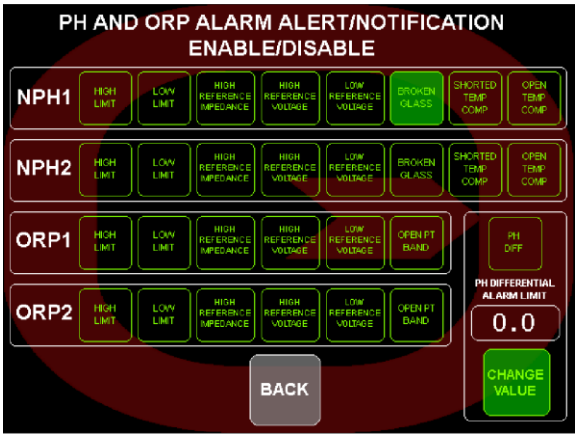
To select the alarms to be actively displayed:

- Select desired alarm type.



- Select or de-select individual alarms. The button will turn green for the enabled alarms.

Note: Only the alarms that are selected in these screens will trigger emails, be shown in the Alarm Bar, require operator acknowledgment, and be logged in Alarm History.

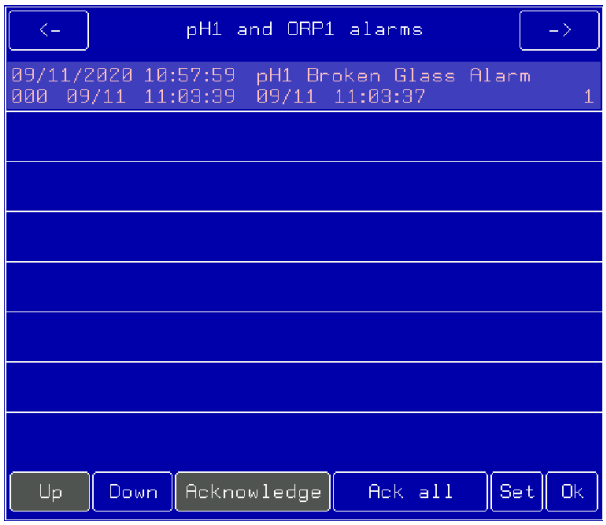


Alarm Bar:
All active unacknowledged alarms are indicated in an alarm bar at the top or bottom of each screen. The alarm must be acknowledged to remove it from the Alarm Bar.

The Alarm Bar indicates the active alarm and has two buttons; an Alarm Bar Location button (<>), and an Acknowledge button (i).

The Alarm Bar Location button (<>) switches the alarm bar location form the bottom of the screen to the top of the screen.

The Acknowledge button (i) takes the operator to the Alarm Acknowledge screen. The Alarm Acknowledge screen allows the operator to acknowledge the alarm and logs the date and time that each alarm occurs, the date and time that the operator acknowledges the alarm, and the date and time that the alarm clears.



The Alarm Acknowledge screen has a left and right arrow at the top of the screen to allow the operator to scroll through all of the Alarm Acknowledge screens. There are screens for Relay Overfeed Alarms, Conductivity sensor 1 and 2, Conductivity sensor 3 and 4, pH1 and ORP1, pH2 and ORP2, and 4-20 mA.

In the example above, the NexSys™ Control System logs the date and time and description of the alarm on the top line. It logs the date and time that the alarm was acknowledged and then the date and time that the alarm condition cleared on the bottom line.

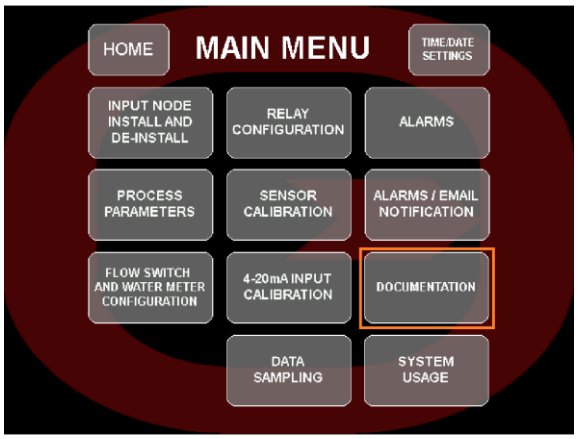
To acknowledge an alarm:

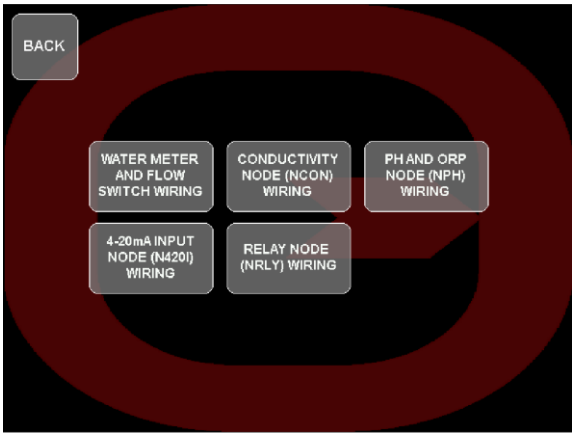
- Touch the Acknowledge button for each active alarm. If there are multiple alarms, touch the Next button to scroll to the next alarm and touch the Acknowledge button.

Once an alarm is acknowledged, it no longer appears on the alarm bar at the top or bottom of each screen but will still show in the alarm screens.

Documentation

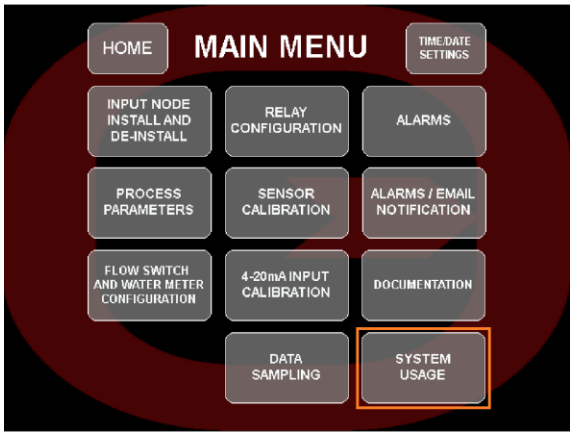
Various wiring diagrams are available by touching the Documentation button in the Main Menu.





System Usage

The System Usage button in the System Parameters Menu allows the operator to view the System Usage information. The System Usage information includes items such as: communications information, CPU usage, Memory usage, Firmware Version, Mail State, Mail Error code, and the Lon Service Pin for the display. The Mail State and Mail Error are diagnostic tools to troubleshoot email errors. As an email is being processed the Mail State will count up and when completed will reset to all zeros. If an error is encountered the Mail State will lock in on a number and the Mail Error will display a code.



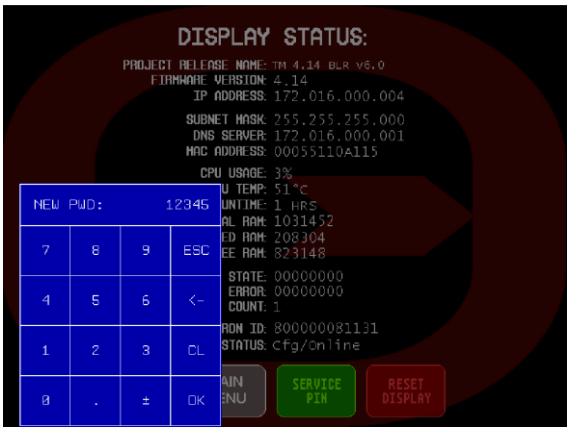
Reset Display:

The Reset Display button on the System Usage screen is used to reboot the display without rebooting the rest of the controller. This may be necessary if the display were to become scrambled.

- Touch the Reset Display button in the System Parameters screen and touch the red Reset Display button on the next screen.

Note: If the Reset Display button is touched, the Display will reboot!

Change Password:



The NexSys™ Control System has a security function to limit access to the Main Menu. The default password is 00000. The Change Password button in the System Parameters Menu allows the operator access to change the password. Changing the password places the NexSys™ Control System into the security mode and will require the operator to enter the password to access the main menu. When the password is entered, the operator will have access to the Main Menu for approximately **300 seconds** before returning to the security mode.

To disable the security mode, change the password back to 00000.

To change the password and enable or disable the security:

- Touch the Change Password button on the System Usage screen and use the keypad to enter the new password. Touch the OK button to accept.

The security mode only prevents access to the Main Menu. The operator will still have access to the Home screens, the Calibration screens, and manual relay operation.

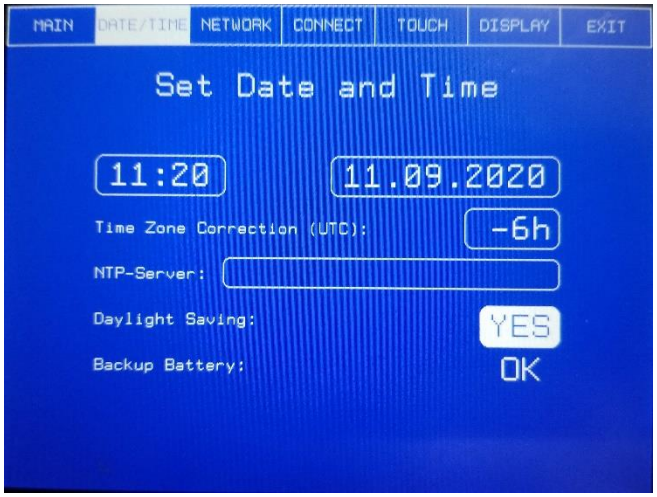
Note: When you change the password, the security mode will be enabled. Make sure you record your password and store it in a safe and secure place.

Boot Menu

The NexSys™ Control System has a Boot Menu where functions associated with the Touch Screen display are set. The Boot menu is accessed by cycling power to the controller while holding your finger at the top left corner of the touchscreen as it reboots. The display will beep when it accesses the main boot menu, shown below.

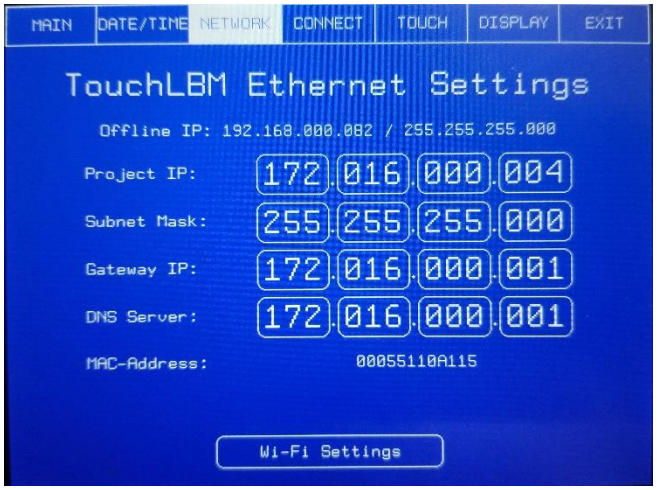
This screen displays various information about the display. The "Project Description" and "Firmware Version" are the only relevant pieces of information and may be requested by Tech Support for the purposes of troubleshooting.

The **DATE/TIME** button will take the operator the to the following screen:



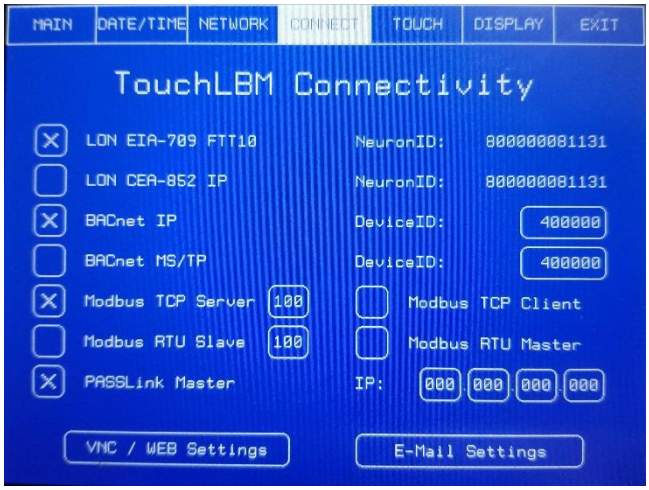
In this screen the time can be set to automatically adjust for daylight savings time and the status of the battery backup is displayed.

The **NETWORK** button will take the operator to the Ethernet setup screen:



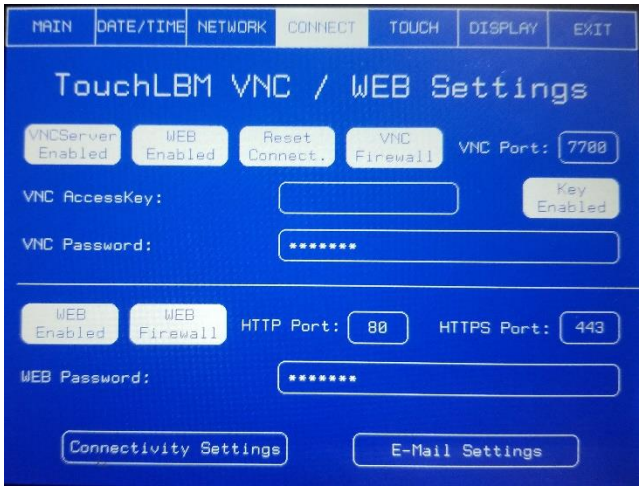
In this screen the IP settings can be changed per site requirements. This is usually only required for building automation system integration and if email notification via site intranet is required.

The **CONNECT** button will take the operator to the following screen:



In this screen various communication protocols can be enabled or disabled and devices ID's can be changed. This is usually only required for building automation system integration via Modbus or Bacnet/IP.

The **VNC/WEB SETTINGS** button will take the operator to the following screen:

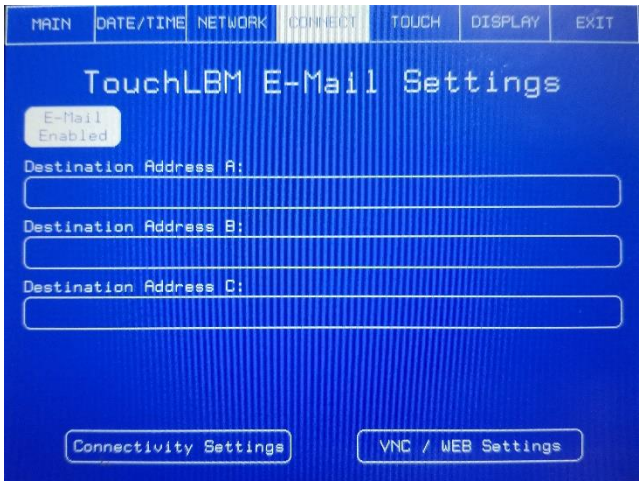


The **Remote Access Password** is set in the VNC password field. The password can be up to 16 characters long. The default remote password is PonFarr.

In this screen various web services can be enabled or disabled and port numbers can be changed. This is usually only required for uncommon applications or for higher level IT security.

Note: Do NOT change the VNC settings without contacting Lakewood Instruments First!

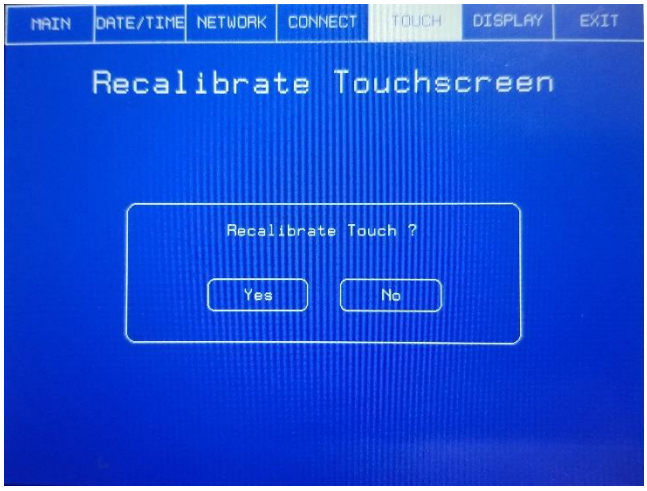
The **EMAIL** button will take the operator to the following screen:



The e-mail access is enabled/disabled in this screen with the E-Mail button.

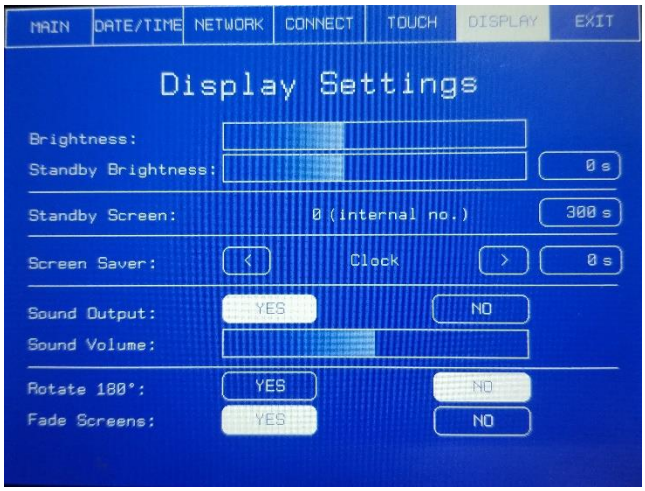
Note: If the NexSys™ Control System does not have Ethernet access, disable the E-Mail access.

The **Touch** button will take the operator to the following screen:



This will allow the operator to recalibrate the touch points of the display.

The **Display** button will take the operator to the following screen:



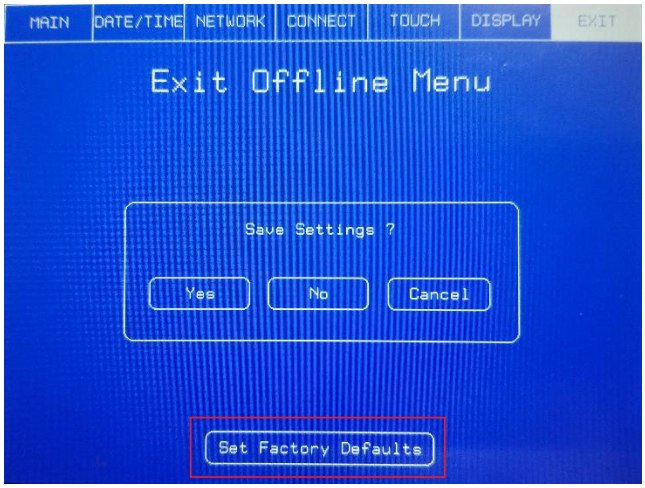
In this screen the operator can adjust the brightness of the display by touching the Brightness button. Touch on the right side of the button to increase the brightness and touch the left side of the button to decrease the brightness.

The brightness can also be set to automatically adjust after a user specified period of time with no activity on the touch screen.

The NexSys™ Control System has the ability to display a screensaver after a user specified amount of time with no activity on the touch screen. Contact Lakewood Instruments for details!

The sound touch screen for alarms can be enabled/disabled and has a volume adjust button. Touch on the right side of the button to increase the sound level and touch the left side of the button to decrease the sound level.

To **Exit** the Boot Menu, touch the Exit button:



The operator will be prompted to save the changes to the settings. Touch Yes to save the changes and exit the menu, touch No to exit the menu without saving the settings, or touch CANCEL to return to the Boot Menu.

Note: Never touch the Set Factory Defaults button. The unit will become inoperable and require factory service.

Building Management System Integration

All possible input/output values on a NexSys™ Control System are available as BACnet/IP server objects or Modbus TCP/IP points. The following sections cover the procedures and communication settings to integrate data to a supervisory system.

BACnet/IP:

The screenshot below shows how a NexSys™ Controller System with default settings (port 47808) appears through the "auto-discovery" feature on most building management systems:

[400000] {0, X'AC100004BAC0'} Device

Date loaded: Friday, September 25, 2020

DeviceId.InstN:	400000	BACnet address:	172.16.0.4:47808
Name:	NexSys Controller	Description:	NexSys Display Interface
Model Name:	TouchLBM	Vendor Name:	PASStec Industrie-Elektronik GmbH

Objects: 35

Obj.Type	Object Id	Obj.Name	Value	Description
Device	400000	NexSys Controller		NexSys Display Interface
AnalogValue	2295	BNS1CondA	2645	Conductivity Sensor #1
AnalogValue	2296	BNS2CondA	3790	Conductivity Sensor #2
AnalogValue	2297	BNS3CondA	5480	Conductivity Sensor #3
AnalogValue	2298	BNS4CondA	2490	Conductivity Sensor #4
AnalogValue	2299	BNS1pHA	6.96	pH Sensor #1
AnalogValue	2300	BNS2pHA	7.64	pH Sensor #2
AnalogValue	2301	BNS1ORPA	1632	ORP Sensor #1
AnalogValue	2302	BNS2ORPA	-1	ORP Sensor #2
AnalogValue	2303	BNS1420A	43.75	4-20 mA Node-1, Input #1
AnalogValue	2304	BNS2420A	37.45	4-20 mA Node-1, Input #2
AnalogValue	2305	BNS3420A	0	4-20 mA Node-1, Input #3
AnalogValue	2306	BNS4420A	0	4-20 mA Node-1, Input #4
AnalogValue	2307	BNS5420A	32.37	4-20 mA Node-2, Input #1
AnalogValue	2308	BNS6420A	28.38	4-20 mA Node-2, Input #2
AnalogValue	2309	BNS7420A	-50.3	4-20 mA Node-2, Input #3
AnalogValue	2310	BNS8420A	-50.3	4-20 mA Node-2, Input #4
AnalogValue	2311	BNWMT1A	0	Total Flow-Water Meter#1
AnalogValue	2312	BNWMT2A	0	Total Flow-Water Meter#2
BinaryValue	2313	BNRly1A	active	Status-Relay#1
BinaryValue	2314	BNRly2A	active	Status-Relay#2
BinaryValue	2315	BNRly3A	active	Status-Relay#3
BinaryValue	2316	BNRly4A	active	Status-Relay#4
BinaryValue	2317	BNRly5A	inactive	Status-Relay#5
BinaryValue	2318	BNRly6A	inactive	Status-Relay#6
BinaryValue	2319	BNRly7A	inactive	Status-Relay#7
BinaryValue	2320	BNRly8A	inactive	Status-Relay#8
BinaryValue	2321	BNRly9A	inactive	Status-Relay#9
BinaryValue	2322	BNRly10A	inactive	Status-Relay#10
AnalogValue	2323	BNWMT3A	0	Total Flow-Water Meter#3
AnalogValue	2324	BNWMT4A	0	Total Flow-Water Meter#4
BinaryValue	2337	BNflow1A	active	Status-Flow Switch#1
BinaryValue	2338	BNflow2A	active	Status-Flow Switch#2
BinaryValue	2339	BNflow3A	active	Status-Flow Switch#3
BinaryValue	2340	BNflow4A	active	Status-Flow Switch#4

Objects can also be added manually using the Device ID (default=400000) and Object ID, sometimes referred to as "Object Instance". The Device ID can be changed in the Boot Menu, under the "CONNECT" heading.

Modbus TCP/IP:

The Modbus registers for all possible values in a NexSys™ Control System are shown below:

Modbus TCP Points				
Register	Name	Type	Description	Range
0	MBS1COND	Float	Conductivity Sensor 1	0-10,000µ
2	MBS2COND	Float	Conductivity Sensor 2	0-10,000µ
4	MBS3COND	Float	Conductivity Sensor 3	0-10,000µ
6	MBS4COND	Float	Conductivity Sensor 4	0-10,000µ
8	MBS1ORP	Float	ORP Sensor 1	-1000mv - 1000mv
10	MBS2ORP	Float	ORP Sensor 2	-1000mv - 1000mv
12	MB1pH	Float	pH Sensor 1	0-14
14	MB2pH	Float	pH Sensor 2	0-14
16	MBS1420	Float	4-20mA Input 1	-9999.99 - 9999.99
18	MBS2420	Float	4-20mA Input 2	-9999.99 - 9999.99
20	MBS3420	Float	4-20mA Input 3	-9999.99 - 9999.99
22	MBS4420	Float	4-20mA Input 4	-9999.99 - 9999.99
24	MBS5420	Float	4-20mA Input 5	-9999.99 - 9999.99
26	MBS6420	Float	4-20mA Input 6	-9999.99 - 9999.99
28	MBS7420	Float	4-20mA Input 7	-9999.99 - 9999.99
30	MBS8420	Float	4-20mA Input 8	-9999.99 - 9999.99
32	MBRLY1	Float	Relay 1 Status	0=OFF, 4=ON
34	MBRLY2	Float	Relay 2 Status	0=OFF, 4=ON
36	MBRLY3	Float	Relay 3 Status	0=OFF, 4=ON
38	MBRLY4	Float	Relay 4 Status	0=OFF, 4=ON
40	MBRLY5	Float	Relay 5 Status	0=OFF, 4=ON
42	MBRLY6	Float	Relay 6 Status	0=OFF, 4=ON
44	MBRLY7	Float	Relay 7 Status	0=OFF, 4=ON
46	MBRLY8	Float	Relay 8 Status	0=OFF, 4=ON
48	MBRLY9	Float	Relay 9 Status	0=OFF, 4=ON
50	MBRLY10	Float	Relay 10 Status	0=OFF, 4=ON
52	MBWMT1	Float	Water Meter 1 Total	0-10,000,000 Gal/Ltr
54	MBWMT2	Float	Water Meter 2 Total	0-10,000,000 Gal/Ltr
56	MBWMT3	Float	Water Meter 3 Total	0-10,000,000 Gal/Ltr
58	MBWMT4	Float	Water Meter 4 Total	0-10,000,000 Gal/Ltr
60	MBFLOW1	Float	Flow Switch 1 Status	0=OFF, 4=ON
62	MBFLOW2	Float	Flow Switch 2 Status	0=OFF, 4=ON
64	MBFLOW3	Float	Flow Switch 3 Status	0=OFF, 4=ON
66	MBFLOW4	Float	Flow Switch 4 Status	0=OFF, 4=ON

The default server port number is 502. Imported objects should be formatted to display as "32 Bit Float" values.

Maintenance

Periodic maintenance is required to ensure trouble free operation of the NexSys™ Control System. The following sections cover the required maintenance.

Conductivity Sensor:

Clean the electrode end of the Conductivity sensor at least once per month. Cleaning of the Conductivity sensor may need to be performed more frequently if it is in a high fouling environment.

- Remove power from the controller and shut the inlet and outlet valves.
- Remove the sensor from its plumbing.
- Clean the electrodes with a wire brush. A soft steel brush is preferable over a brass brush. Do not use cloth to clean the electrodes. Cloth has oils that will foul the sensor.
- If there is oil on the sensor tips, use isopropyl alcohol to clean the electrode.
- It is recommended that you use a 10% Muriatic or HCL acid to clean the sensor if necessary.
- Wash the sensor off with tap water.
- Install the sensor in its plumbing.
- Restore sample flow and check for leaks.
- Restore power to the controller.
- Perform a calibration of the Conductivity.

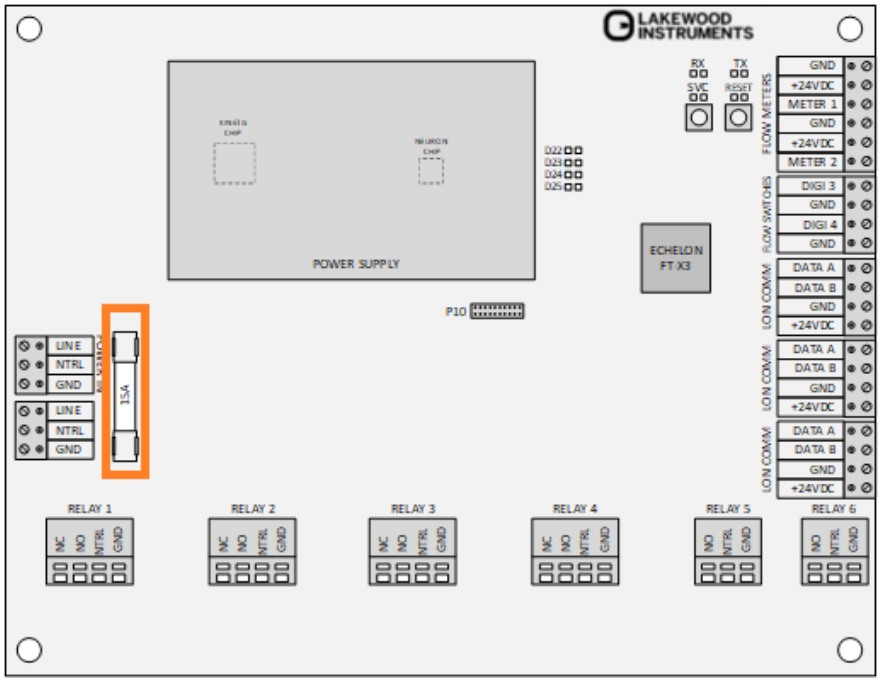
ORP Sensor or pH Sensor:

Clean the electrode end of the ORP or pH sensor at least once per month. Cleaning of the ORP or pH sensor may need to be performed more frequently if it is in a high fouling environment.

- Remove power from the controller and shut the inlet and outlet valves.
- Remove the sensor from its plumbing.
- Be careful not to touch the glass electrode. Do not use cloth to clean the electrode. Cloth has oils that will foul the sensor.
- If there is oil on the sensor glass, use 90% isopropyl alcohol to clean the electrode.
- It is recommended that you use a 10% Muriatic or HCL acid to clean the sensor.
- Wash the sensor off with tap water.
- Install the sensor in its plumbing.
- Restore sample flow and check for leaks.
- Restore power to the controller.
- Allow the reading to stabilize for approximately 30 minutes.
- Perform a calibration of the ORP or pH.

Replacing the Fuse

The NexSys™ Control System contains one 15A, 250V fuse (Littlefuse EF15AL250VP). The fuse holder is located at the left-hand side of the power supply board inside of the enclosure. It is accessible by opening the outer door and inner door of the enclosure. Replacement fuses must be a fast blow type. If a fuse is blown, the display may be blank and the indicator lights inside the enclosure may be dark when the unit is connected to power.



Troubleshooting

This section discusses some of the more common questions with The NexSysTM Control System. These notes are not intended to be all-inclusive—only to cover the most common situations. If you have other questions or are need support, contact the Lakewood Instruments Technical Service Department toll free at (800) 228-0839.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
"Conductivity: HIGH ALARM".	Conductivity is too high with respect to the high alarm setpoint.	1. Check the High Alarm Value. 2. Check relay setpoints and deadbands. 3. Check operation of bleed-off valve. Use the manual relay control to help. 4. Check blowdown valve is not stuck closed or the line is restricted.
"Conductivity: LOW ALARM".	Conductivity is too low with respect to the low alarm setpoint.	1. Check the Low Alarm Value. 2. Check relay setpoints and deadbands. 3. Check blowdown valve is not stuck open. 4. Check that the system is not overflowing.
Water meters not accumulating.	There may be a problem with the wiring or the reed switch in the meter may be bad. For water meters other than the contacting head type, check the manufacturer's user manual for that particular water meter.	1. Is the controller configured for your type of water meter? 2. Try simulating a water meter input.
Display is blank.	There may be a problem with the incoming power, the fuse or the circuit board. Open the front panel to troubleshoot.	1. Check the fuse. Replace if blown. 2. Does the unit have power? Verify with volt meter. 3. If there is power to terminals LINE and NTRL on the Power In terminal block, call Lakewood Instruments Technical Service for more information.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
Timeout Alarm	This indicates that the controller has been trying to blow down or feed chemical for longer than the user-programmed time and is unable to reach the setpoint.	1. Check for proper operation of pump or valve. Use the manual relay control to help. 2. Check that the chemical drum is not empty. 3. Check for power to the chemical pump. 4. Verify the relay timeout time is properly set for your application (see RELAYS in MAIN menu). 5. To reset this alarm, momentarily turn off flow to the controller to get the no flow alarm.
FLOW OFF	Flow input switch is not closed.	1. The flow switch float may be stuck or no flow is present. 2. Flow switch may be bad. Replace reed switch in plumbing assembly. 3. If no flow switch is used, a jumper wire should be installed across the flow switch input. Removing the jumper disables all relay outputs.
Bleed valve relay is closed above setpoint.	Controller may be in biocide schedule.	Check feed schedule.
Bleed valve relay is open below setpoint.	High conductivity alarm will force the bleed valve to open. Controller may be doing a pre-bleed before feeding biocide.	1. Check High conductivity alarm setpoint. Change setpoint if necessary. 2. Check feed schedule. Adjust as necessary.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
"COND: Fouled SENSOR"	Conductivity sensor is not reading properly.	1. Clean sensor. 2. Check wiring. Verify that all connectors are fully mated. 3. Replace conductivity sensor.
"ORP: HIGH ALARM".	ORP is too high with respect to the high alarm setpoint.	1. See {RLY: TIME OUT}. 2. Check the High Alarm Value. 3. Check relay setpoints and deadbands. 4. Check chemical drum levels. 5. Check proper operation of chemical pumps.
"ORP: LOW ALARM".	ORP is too low with respect to the low alarm setpoint.	1. See {RLY: TIME OUT}. 2. Check the Low Alarm Value. 3. Check relay setpoints and deadbands. 4. Check chemical drum levels.
"pH: HIGH ALARM".	pH is too high with respect to the high alarm setpoint.	2. See {RLY: TIME OUT}. 2. Check the High Alarm Value. 3. Check relay setpoints and deadbands. 4. Check chemical drum levels. 6. Check proper operation of chemical pumps.
"pH: LOW ALARM".	pH is too low with respect to the low alarm setpoint.	1. See {RLY: TIME OUT}. 2. Check the Low Alarm Value. 3. Check relay setpoints and deadbands. 4. Check chemical drum levels.

Factory Service

☎ **Technical Support for Lakewood Instruments can be reached by calling (800) 228-0839 or faxing (414) 355-3508, Monday through Friday, 7:30 a.m. – 5.00 p.m. CST.**

NOTE: IF YOU CALL FOR TROUBLESHOOTING HELP, PLEASE HAVE THE MODEL NUMBER, SERIAL NUMBER, AND ANY OPTIONS PERTAINING TO YOUR UNIT AVAILABLE FOR REFERENCE.

Mail and returns should be sent to:

Lakewood Instruments
7838 North Faulkner Road
Milwaukee, WI 53224 USA

When any merchandise is to be returned to the factory, please call and obtain a Return Material Authorization (RMA) number and have the following information available:

- Customer's name, address, telephone and fax numbers (shipping and billing).
- A hard copy purchase order number for cases where repairs or parts are required that are not under warranty.
- A contact person's name and telephone number to call if the equipment is beyond repair or to discuss any other warranty matter.
- Equipment model and serial numbers.
- Reason for return, e.g., repair, warranty, incorrect part, etc.

We will then fax to your attention an RGA form that must accompany the returned item.

NOTE: THE RGA NUMBER MUST BE CLEARLY WRITTEN ON THE OUTSIDE OF THE PACKAGE(S) BEING RETURNED.

ANY ITEMS SENT BACK TO THE FACTORY WITHOUT AN RMA NUMBER WILL BE REFUSED AND RETURNED TO SENDER

For more information call toll free in the USA (800) 228-0839
7838 North Faulkner Road, Milwaukee, WI 53224 USA
Phone (800) 228-0839 • Fax (414) 355-3508
http://www.lakewoodinstruments.com