

LAKWOOD INSTRUMENTS

NexSys™

**COLOR TOUCH SCREEN
CONTROL SYSTEM**

INSTALLATION & OPERATION MANUAL



Lakewood Instruments

7838 North Faulkner Road, Milwaukee, Wisconsin 53224 USA

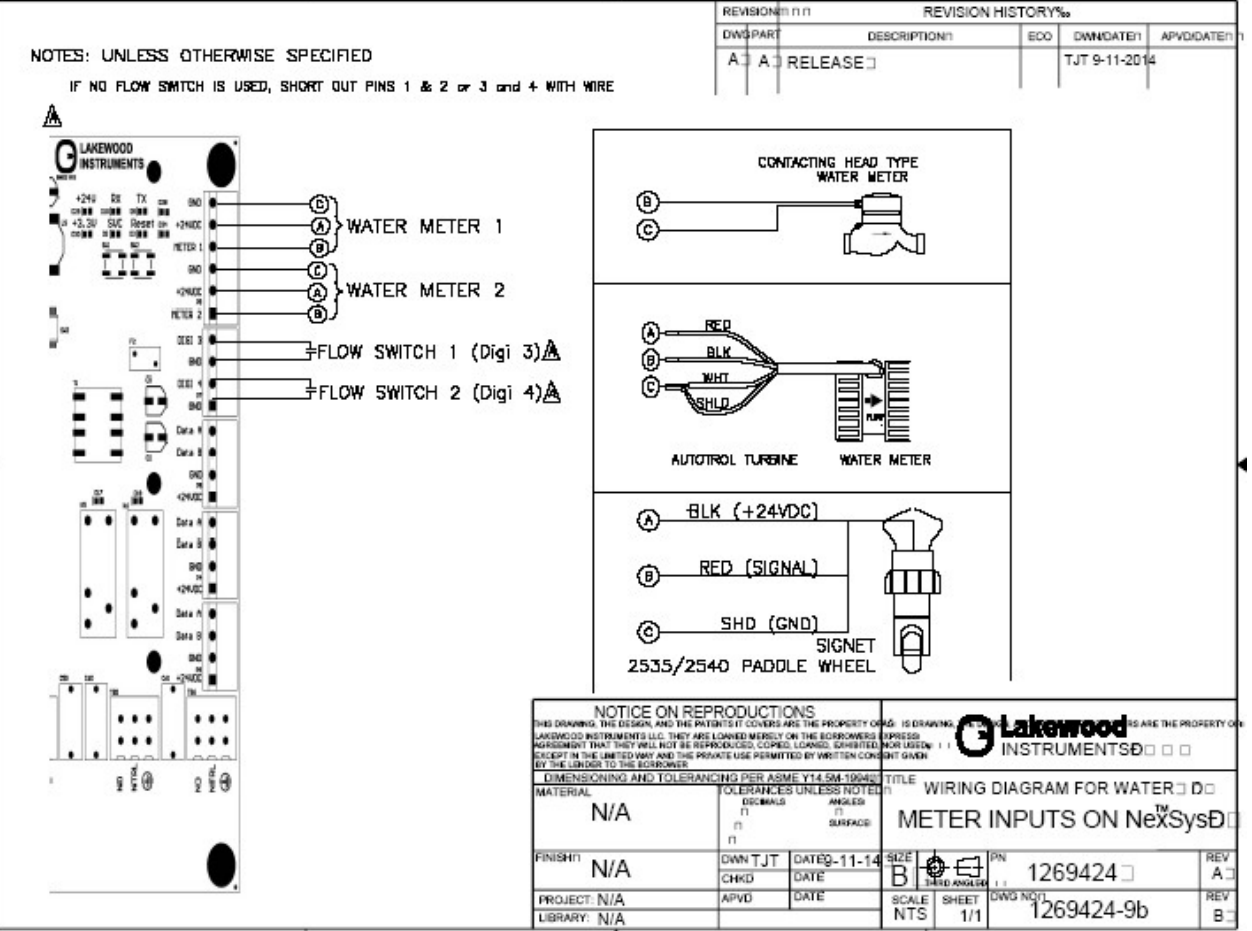
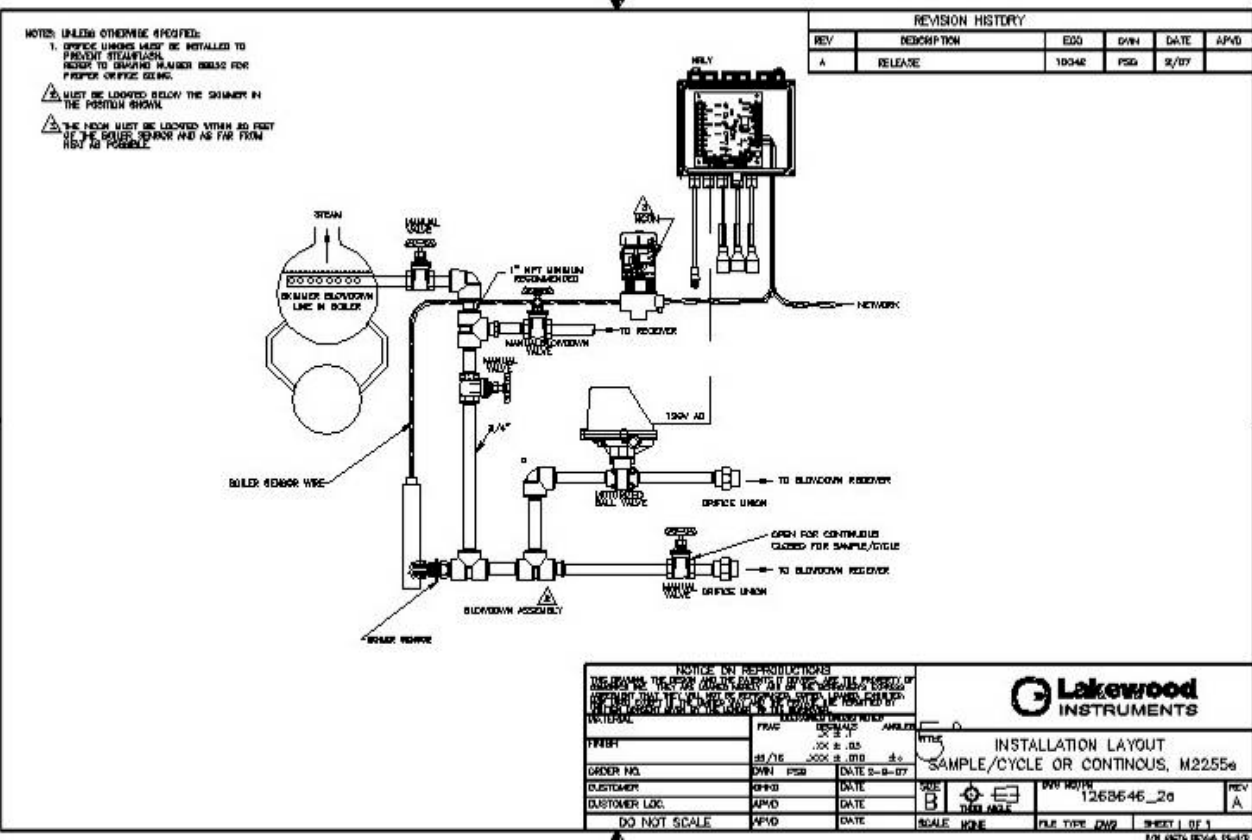
Phone (800) 228-0839 • Fax (414) 355-3508

<http://www.lakewoodinstruments.com>

Lakewood Instruments™ NexSys®

Quick Installation Sheet

1. Attach the four (4) supplied mounting feet to the back of the controller enclosure either vertically or horizontally. Install the controller on a flat, non-vibrating surface. Do not mount the controller to a steel object that has a large temperature change. This can cause water to condense inside the enclosure.
2. Install water meters, chemical pumps, plumbing assemblies, and sensors as per the suggested installation.
3. Install the provided strain reliefs with nuts, if necessary, by removing the attached black plugs and inserting the strain relief through the hole. If you are using an Ethernet connection install the RJ45 connector as per the instructions included with the connector.
4. Wire sensors, flow switches, water meters, 4-20 mA inputs to the appropriate node. Ensure wiring connections are correct or damage may occur.
5. If doing a conduit installation or using a motorized ball valve, remove receptacles and wire pumps and valves directly to the terminals. Otherwise, plug in chemical pumps and valves to controller.
6. Apply power and allow the NexSys® Control System to boot up. On-board installation drawings and instructions can be accessed from Main Menu, Documentation.
7. Test the relay outputs by manual operation and verify proper operation of the chemical pumps and valves.
8. Configure the sensor inputs, water meter inputs, and 4-20 mA inputs, if necessary, under System Parameters, Process Parameters.
9. Change the names of component inputs and relays as desired under System Parameters, Component Name Change.
10. Calibrate the sensor and 4-20 mA inputs in the calibration screens.
11. Program the relay outputs, water meter inputs, 4-20 mA inputs and digital inputs.



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.

Lakewood Instruments

We thank you for your selection and purchase of a Lakewood Instruments product.

With proper care and maintenance, this device should give you many years of trouble-free service. Please take the time to read and understand this Installation and Operation Manual, paying special attention to the sections on **OPERATION** and **MAINTENANCE**.

If, in the future, any parts or repairs are required, we strongly recommend that only original replacement parts be used. Our Customer Service Department is happy to assist you with your parts or service requests.

 **Lakewood Instruments Customer Service and Technical Support Departments can be reached by calling (800) 228-0839 or (414) 355-2807, or faxing (414) 355-3508, or by emailing csd@lakewoodinstruments.com, Monday through Friday, 7:30 a.m. - 5:00 p.m. Central Time.**

 **Mail should be sent to:**

**Lakewood Instruments
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NexSys[®] Control System

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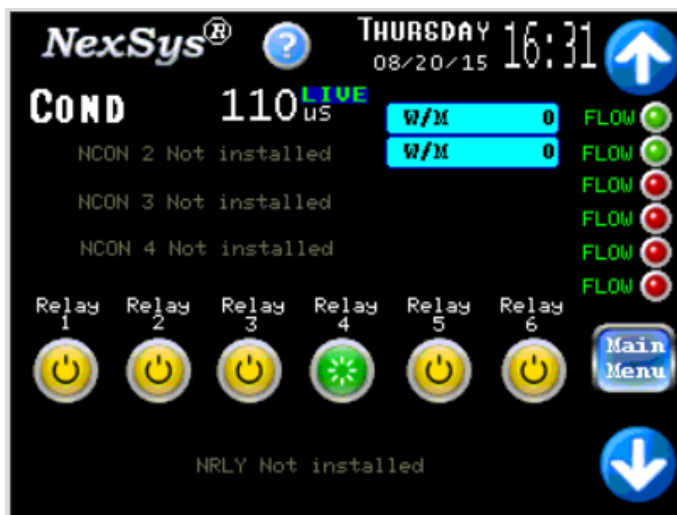
1.0 INTRODUCTION

The **NexSys**[®] control system is the latest in a long line of reliable, easy to use controllers from Lakewood Instruments. The **NexSys**[®] control system uses the latest in microprocessor technology with a 5.7" **Color Touch Screen** interface for a high level of application flexibility.

All features, parameters, settings, and functional requirements to operate, program, and monitor the **NexSys**[®] control system are accessible from the touch screen and DO NOT require the use of an external input, PC or device to operate or access. The **NexSys**[®] control system even includes On-Board Help Screens with wiring, programming, and maintenance instructions.

The **NexSys**[®] control system comes **standard** with the following system interfaces and DMX outputs: LON EIA 709 FTT10, BACnet IP, and MODbus TCP. The unit comes from the factory ready to integrate readings into a BAS, including: The state of any installed relay (On/Off), water meter readings, conductivity readings, additional sensor readings (pH, ORP), sensor alarms, additional 4-20mA input readings, flow condition, and other digital inputs.

The **NexSys**[®] control system comes standard with Ethernet capability through a browser (HTML5) interface that allows 100% access to all features and control parameters of the controller.



The boiler version of the **NexSys**[®] control system comes with the ability to control the conductivity of up to four boilers. It includes six or ten relay outputs, two water meter inputs, and the ability to add up to two pH inputs, two ORP inputs, and up to eight 4-20mA inputs. The relay outputs can be controlled by up to six separate flow switch inputs allowing for greater control flexibility.

Because the **NexSys**[®] control system uses LonWorks technology, all inputs can be located up to 400 meters away from the controller enclosure. This provides for the greatest amount of flexibility in the placement of system components.

2.0 Features, Benefits, Specifications



NEMA 4X Enclosure	Color Touch Screen	LonWorks, Ethernet, MODbus, and BACnet
<p>The enclosure is rated NEMA 4X, with the cover closed and latched, and includes six receptacles, an eight foot power cord, four ¼” connectors for routing of sensor wiring. The power cord and receptacles are removable for conduit installation with ½” conduit. There are four ¼” connectors for sensor wiring. All connectors are designed to maintain NEMA 4X rating.</p>	<p>The NexSys® includes a 5.7” color touch screen that is easily removable for remote mounting in a wall or panel. There is a 15” color touch screen available as an option. Each NexSys® is able to accept two displays for display and control.</p>	<p>The NexSys® includes LonWorks, Ethernet, Modbus, and BACnet as standard features. The Ethernet is via HTML 5.</p>

2.1 FEATURES

The **NexSys**[®] control system has an astounding array of built-in features such as:

- Color TFT Touch screen user interface
- LonWorks, MODbus, and BACnet communications interface
- Ethernet capability through an HTML 5 interface
- 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
- Up to eight active sensor inputs: 4 conductivities, 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.
- 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 with field expansion capability to six.
- Ability to add up to eight 4-20mA input readings
- Ability to mount **every** sensor input up to 400 meters away from the controller via 4-wire twisted pair.
- Ability to control the blowdown of up to four boilers at the same time.
- Six relay outputs expandable to ten relay outputs for user configurable operations such as:
 - Boiler blowdown by Continuous setpoint, Sample/Cycle, or Sample/Hold
 - Direct or Reverse Setpoint Control
 - By Water Meter Total
 - By Percent On-Time
 - Feed by Percent of Blowdown Time
 - Trace Chemistry Control
- On-board Help Screens with wiring, programming, and maintenance instructions.
- 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 rechargeable 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.

2.2 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.
- Able to feed chemical after blowdown.
- Very low maintenance.
- Tolerant to power surges and brownouts.
- Power cord, plug receptacles and detachable sensors 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, remote sensor inputs, digital inputs, and 4-20 mA inputs.

2.3 Specifications

Touch Screen Interface:

5.7" diagonal viewing area

Display size: 115X86 mm

Pixel: 320X240

Color: TFT 65536

Backlight: LED or CCFL

Power: 120/240 VAC 50/60 Hz

Relay ratings: 120VAC 3A per relay 15A total

Enclosure: NEMA 4X



Conductivity range: 0-8000uS

Conductivity Resolution: 100uS

Conductivity accuracy: $\pm 40 \mu\text{S}$

Accuracy and repeatability: $\pm 1.0\%$ of scale

Boiler sensor ratings:

Pressure and temperature: 600psi at 486°F

Boiler sensor materials:

Body: 316SS

Electrodes: 416SS

Insulator: PEEK

Setpoints and deadbands: User programmable

Water meter inputs: 2; contacting head, paddle wheel, turbine

2.4 Ordering Information

NexSys™ The Next Generation in Reliable Controllers

	Price	Type	1-4 / A, B or XX	1-4 / A, B or XX	1-4 / A, B or XX	1-4 / A, B or XX	1-4 or X	T, H or X	I, R or X	S, L or X	S, D or X	S, D or X	4, 8 or X	4, 8 or X	S, L or X	XX
NexSys™ Boiler System Config		NXB	-		-	-					-		-		-	
Boiler Systems																
Boiler Probe Kit (1-4/ A = STD, B = HD) (Max 4 Cond sensors per system incl Condensate)																
Sample Cycle Plumbing (1-4/ A = .50, B = .75)																
Continuous Sample Plumbing (1-4/ A = .50, B = .75)																
Motorized Ball Valve (1-4/ A = .50, B = .75)																
Condensate Probe Kit (INCLUDES k.1, inline, 10 inch sensor) (Max 4 Cond sensors per system incl Boiler)																
Condensate Cell Constant (T = 0.10 or H = 0.01)																
Condensate Fitting (I = Insert or R = Retract)																
Condensate Sensor Length (S = 10" or L = 18")																
Relays (S = 6 or D = 10)																
Water Meters Inputs (S = 2 D = 4)																
4-20MA Input (4 or 8)																
4-20mA Output (4 or 8)																
2nd Remote Display (S = 5.7" L = 15")																
Custom Designator (-XX)																

X = No Option Needed

Pricing is for each.

All items are code W except 2nd remote display which is a code D

EXAMPLE:

A system that would include 1 boiler using sample/cycle control with 1/2" plumbing and motorized ball valve, and 1 condensate system with conductivity between 10-100uS using a 10" insertion sensor, would look like:

NXB 1A - 1A XX - 1A - 1 T I S - D S - X X - X - XX

3.0 Unpacking, Mounting and Installation

3.1 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.

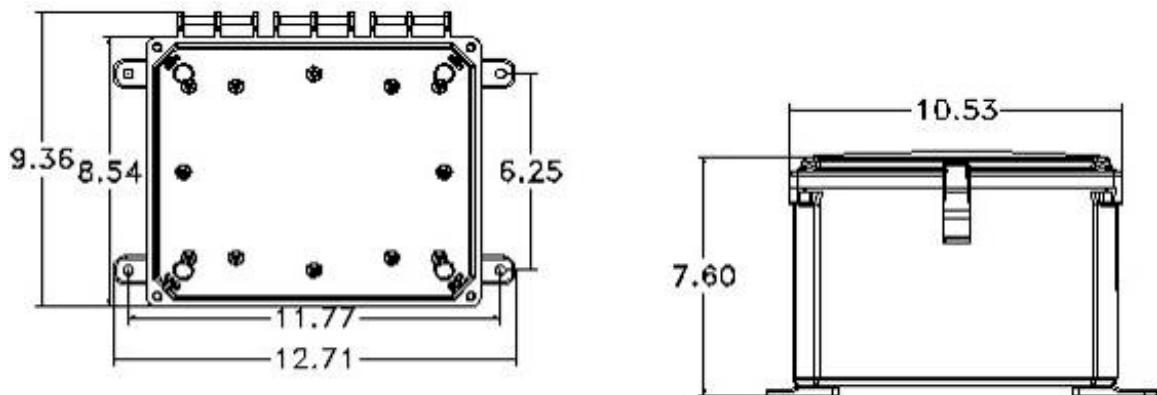
☎ If shipping damage has occurred, call the Lakewood Instruments Customer Service Department at (800) 228-0839 and return the controller to the factory in the original carton.

3.2 Mounting the Enclosure

The NexSys® control system 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.
- Dimensions indicated as inches (millimeters).
- 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 NexSys® has a shipping weight of approximately 12 lbs.

The dimensions of the enclosure in inches are:



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.

3.3 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 in the back of this manual 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 drawing in the back of the manual 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.
- Refer to section 3.3.4 for the orifice sizing chart

3.3.1 Sample/Cycle, 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 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 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 (refer to drawing at the back of this manual):

The sample line should come out of the surface blowdown line and drop straight down to at least 2 feet below the water level of the boiler. At the bottom of that line the sensor should be mounted horizontally. Downstream of the sensor, the blowdown valve should be mounted on a horizontal pipe followed by 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.

3.3.2 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 (refer to drawing at the back of this manual):

The sample line should come out of the surface blowdown line and drop straight down to at least 2 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.

3.3.3 Plumbing Installation for Sample/Cycle/Hold and Continuous Sample

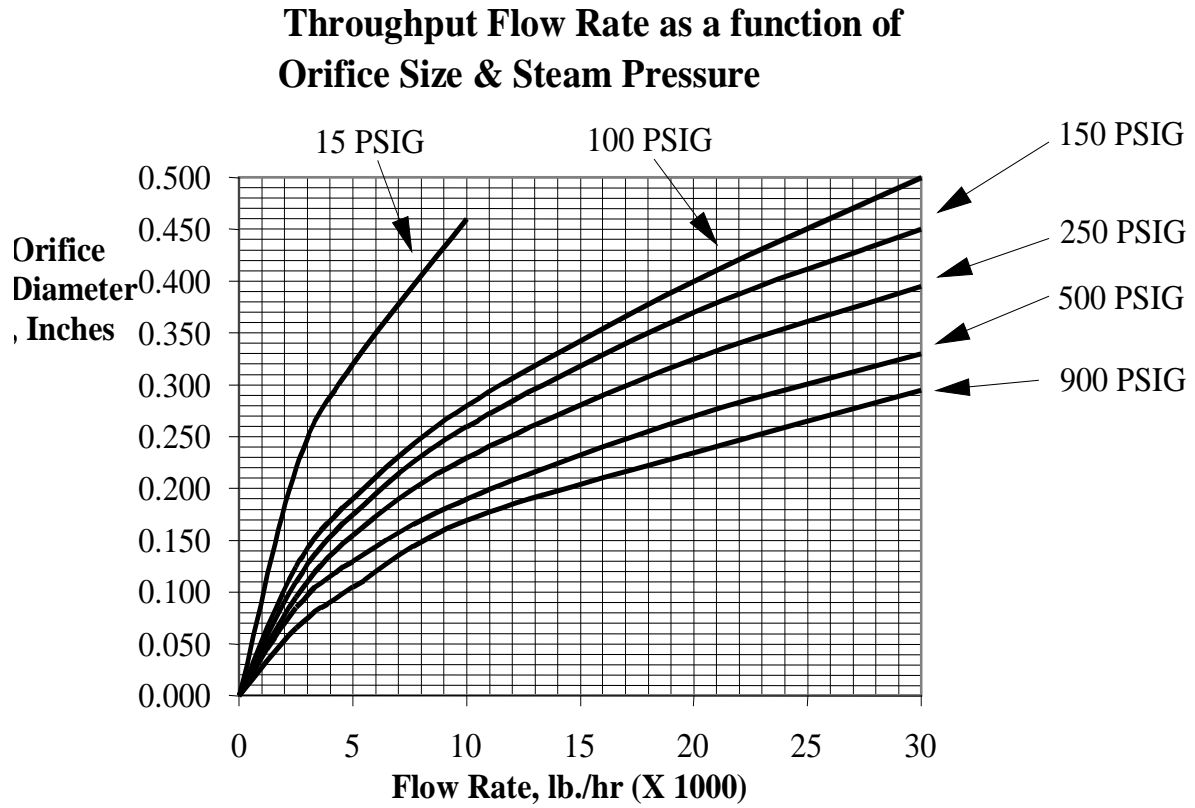
Sometimes it is necessary to switch the controller from sample/cycle or sample/hold to continuous sample mode or vice versa due to steaming loads. This method of plumbing allows the operator to change modes of operation by changing the position of just one valve and setting up the controller for the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

Description of plumbing (refer to drawing at the back of this manual):

The sample line should come out of the surface blowdown line and drop straight down to at least 2 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.

3.3.4 Orifice Sizing Chart

Refer to the chart below to determine the orifice size that is required for a specific flow rate.

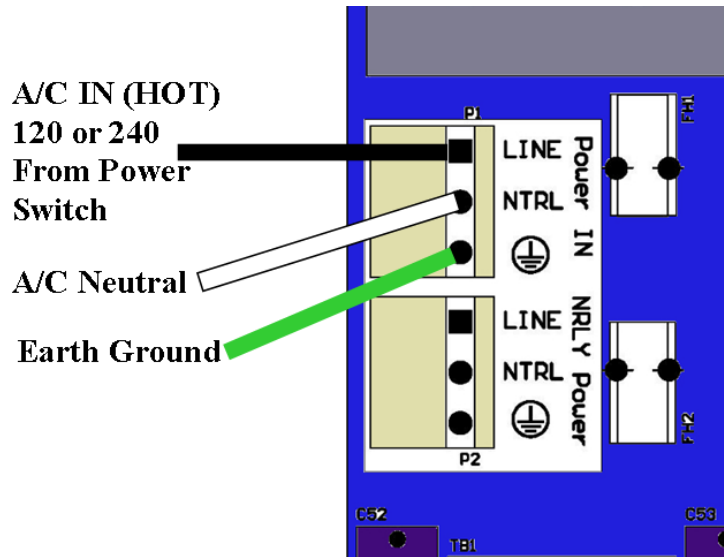


3.4 Electrical Installation

3.4.1 Incoming Power 115/230 VAC

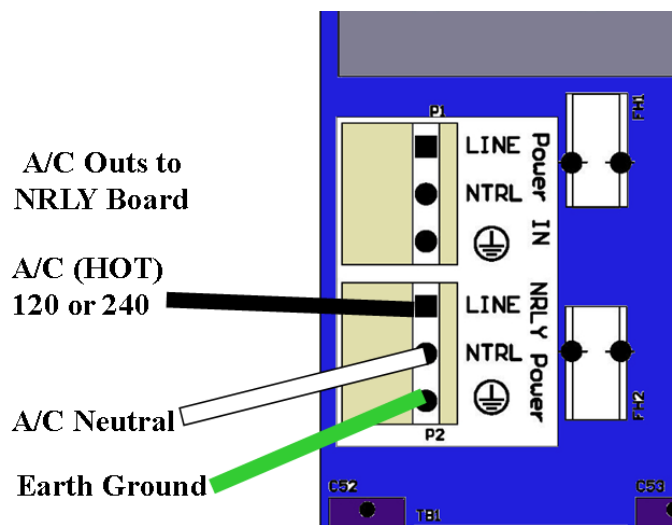
The NexSys® can be powered from 115/230 VAC at 50/60 Hz. The NexSys® controller comes with a power cord and receptacles. The power cord and receptacles are rated for 115VAC. For 230 VAC operation, the power cord and receptacles must be removed.

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 (terminal 2) and an **Earth Ground** input (terminal 3). The hot is fuse protected with a 15 amp fuse located next to the power terminal block P1.



3.4.2 Incoming Power 115/230 VAC to Optional Relay Node

The optional Relay Node board (NRLY) 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.

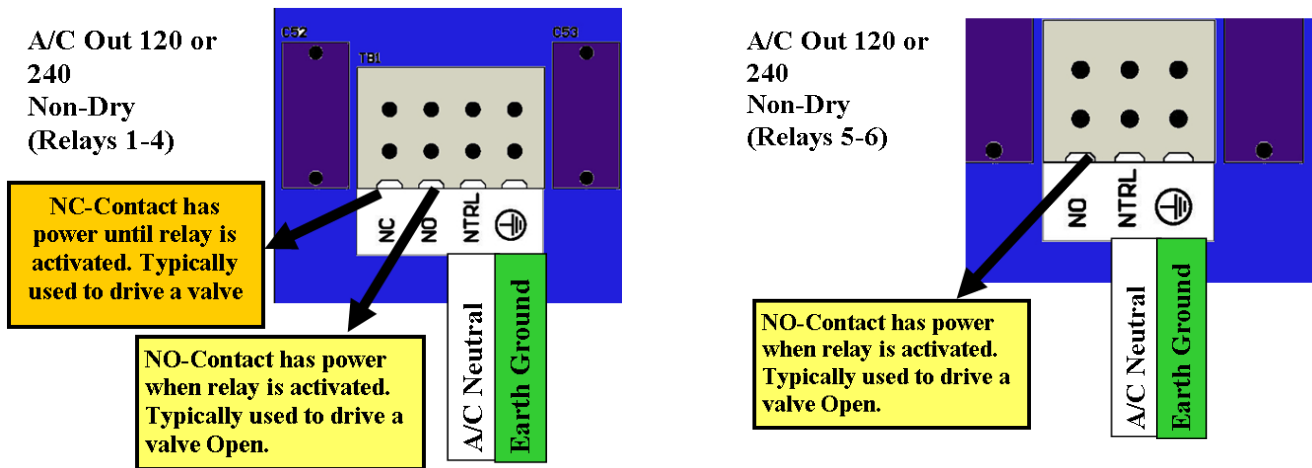


3.4.3 Relay Outputs

There are six (or 10 with optional Relay Node) user configurable relay outputs. 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 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.

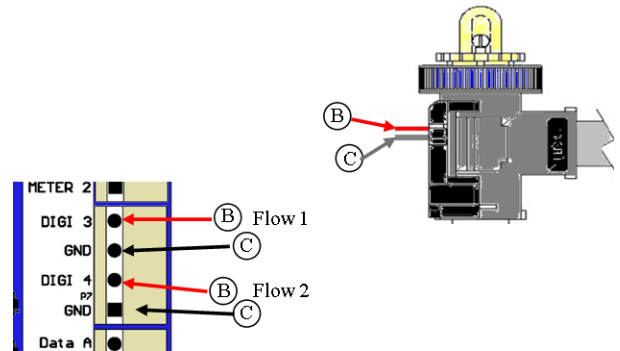


WARNING! DO NOT PLUG IN CHEMICAL PUMPS THAT ARE LARGER THAN 1/6 HORSEPOWER. THE CONTROL RELAYS ARE INTENDED FOR ELECTRONIC OR SMALL MOTOR-DRIVEN CHEMICAL PUMPS. LARGER PUMPS REQUIRE AN INTERPOSING RELAY. CONTACT LAKEWOOD INSTRUMENTS FOR SPECIAL INSTRUCTIONS.

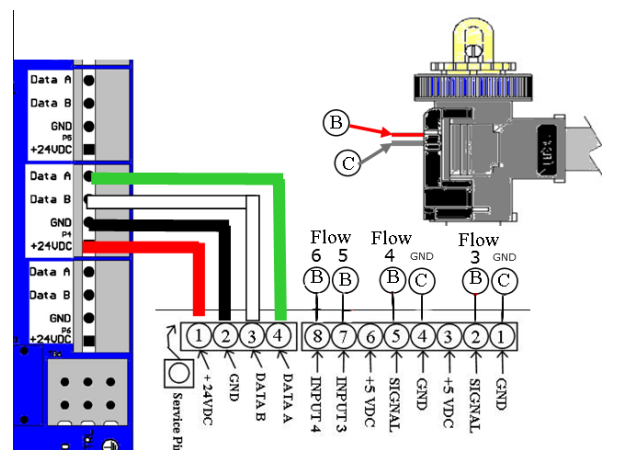
3.4.4 Flow Switch Wiring

The NexSys® Control System has two flow switch inputs standard with the option of up to four more with a 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 dry digital contact. Any digital contact rated for 24 VDC and 500 mA may be used, such as a relay driven by the recirculation pump or a manual switch. The user is able to select the flow switch input that will control the individual relays 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 other four flow switches are wired to a Digital Input Node (NDIG). Flow switch #3 (terminals 1 and 2 on a digital input node) is labeled GND and SIGNAL. Flow switch #4 (terminals 4 and 5 on a digital input node) is labeled GND and SIGNAL. Flow switch #5 (terminals 4 and 7 on a digital input node) is labeled GND and INPUT 3. Flow switch #6 (terminals 4 and 8 on a digital input node) is labeled GND and INPUT 4.



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

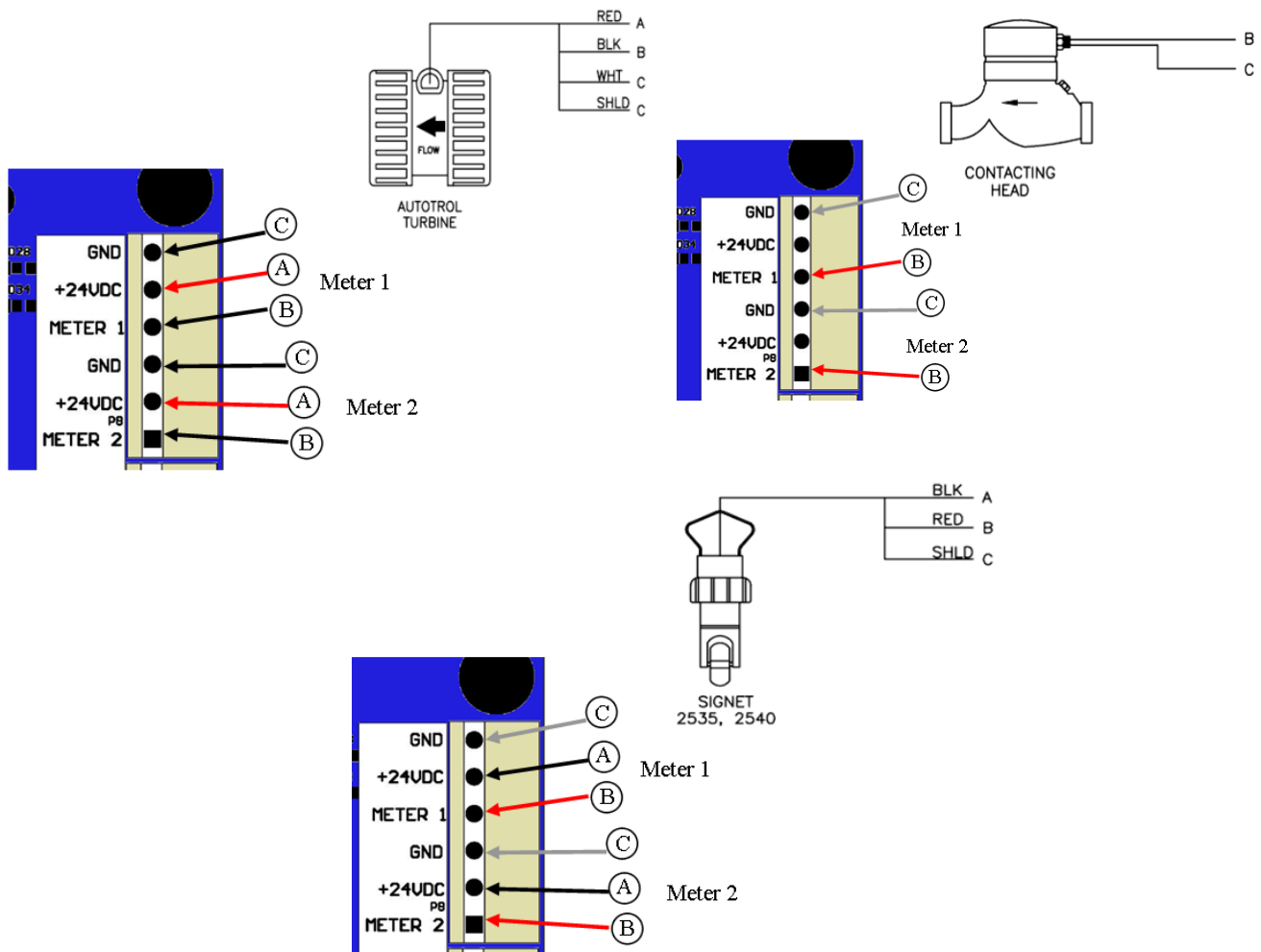
3.4.5 Water Meters

The NexSys® Control System will accept two water meter inputs standard.

The relays can be configured to operate based on either 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 2536 and 2540, and the Autotrol 1 inch and 2 inch meters. Contact Lakewood Instruments for other types of water meters.

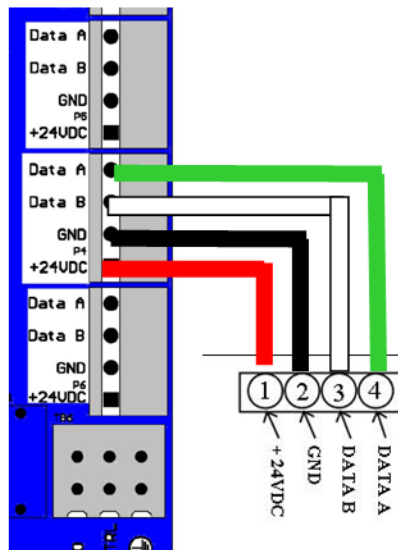
The first two water meters are wired to terminal block P8 which is the top terminal block on the on the right hand side of the power supply board inside the NexSys® Control System. Water meter #1 uses terminals #4, 5, and 6. Water meter #2 uses terminals #1, 2, and 3.



3.4.6 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 may 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, nonplenum.

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.

3.4.7 Sensor Wiring

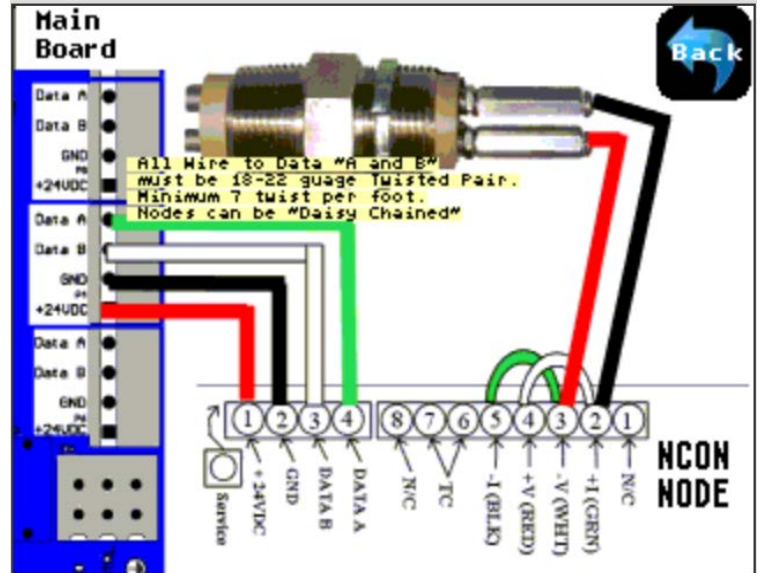
All sensors are wired to nodes. There is a conductivity node (NCON) and a pH node (NpH). The pH node is used as either a pH or ORP input.

Conductivity Sensor

The conductivity sensor has two electrodes with two Phillip's head screws used to attach the wiring to the sensor. It does not matter which wire goes to which screw. **NOTE: Do not over-tightened the screws.**

The two wires from the sensor are wired to the 8-section terminal block on the conductivity node (NCON). One wire goes to terminal #2 and one wire goes to terminal #3.

Two jumper wires must be attached to the 8-section terminal block. One jumper is attached between terminal #2 and terminal #4, and the other is attached between terminal #3 and terminal #5.

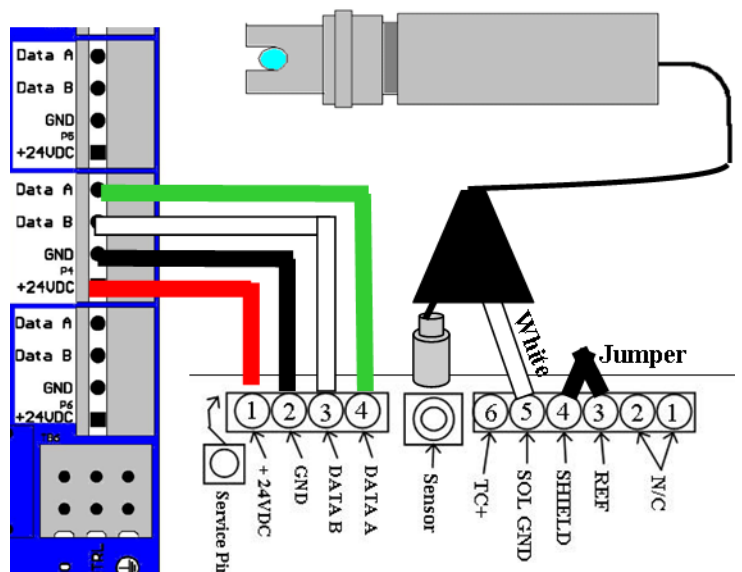


NOTE: DO NOT RUN THE SENSOR OR NODE WIRING IN THE SAME CONDUIT AS THE MOTORIZED VALVE WIRING.

NOTE: THE MAXIMUM ALLOWED WIRE DISTANCE BETWEEN THE CONDUCTIVITY SENSOR AND THE NODE IS 20 FT.

pH and ORP

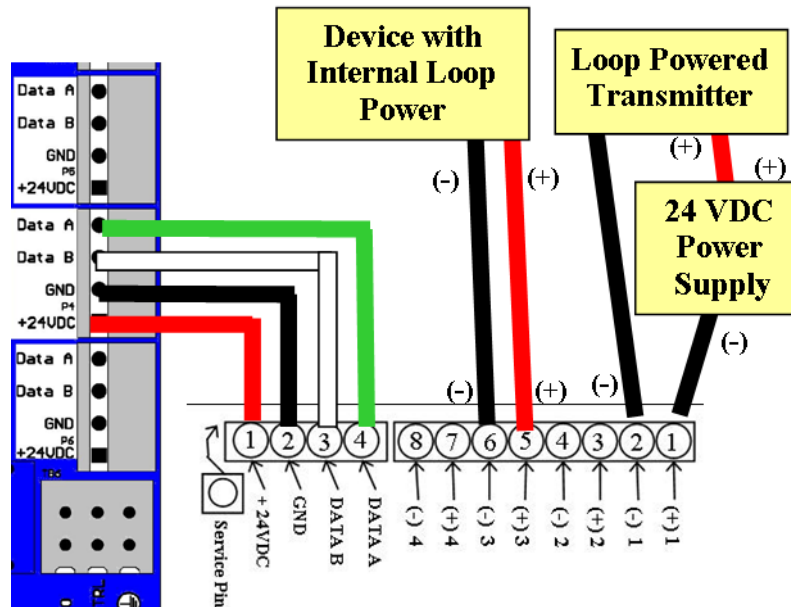
The pH and ORP cooling tower sensors have an SMB style connector and a White Solution Ground wire. The SMB connector is connected to the SMB connector on the NpH and the White wire is connected to the six-section terminal block, terminal #5 Sol. GND. There is a jumper wire attached to terminals #3 and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



3.4.8 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.



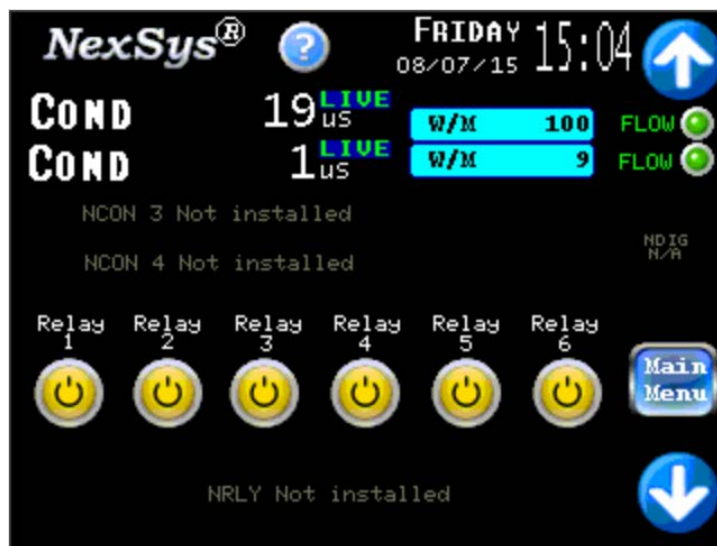
4.0 Functional Overview

4.1 Display

The NexSys® Control System uses a 5.7" TFT, color touch screen display.

It has multiple lines and screens to display information such as the sensor readings, alarms, relay status, relay configuration, date/time, flow totals from the water meters, menu selections, 4-20 mA input readings, graphs, a system notes screen, and documentation screens.

A second display can be connected to the system for remote monitoring and control. The second display may be located up to 400 meters from the controller. A 15 inch display is available as an option.




4.2 Touch Screen Operation

The NexSys® Control System uses a color touch screen for ease of operation. Buttons are used to navigate between the available screens and to enter values. To use these buttons, touch and hold for a moment until the screen responds.

UP arrow	To change to the next screen.
DOWN arrow	To change to the next screen.
LEFT arrow	To switch between back up to the previous screen.
RIGHT arrow	To switch to the next screen.
HOME button	To return to the System screens.
Main Menu button	To switch to the Main Menu screen.
MISC buttons	To select that feature.

4.3 Help Screens

There are multiple help screens available to assist the operator located throughout the NexSys® Control System. Touch the blue question mark  to access the help screen for the menu screen currently displayed.

4.4 System Home Screens

The home screens consist of:

The System screen showing the conductivity values and relay status.

Two Alarm screens showing the status of all alarms.

Graphing screens.

An All Sensor Inputs screen showing the current readings of all inputs

A System Notes screen

The different Home Screens are accessed by pressing the up or down arrow buttons on the Home Screens.

4.5 Main Menu

The NexSys® Control System makes use of multiple screens to view system parameters, program the controller, install/de-install nodes, calibrate the readings, set the alarms, and view documentation.

The main menu is reached by touching the Main Menu button on any of the System Home screens. A security password can be enabled to prevent unauthorized access. If the security is enabled, the password must be entered in order to access the main menu. The password enables access for 5 minutes at a time.

The main menu has buttons for:

- Relay Configuration
- Water Meter Configuration
- Node Install or De-install
- Calibration Screens
- Alarm Configuration
- Set the Clock and Date
- Set System Parameters
- Documentation
- Custom Graphs



4.5.1 Relays

The Relay button in the Main Menu allows the operator to set up the relays for operation. The NexSys® Control System includes 6 relays standard with an option for another 4 relays. Relays 7-10 are accessed by touching the down arrow.



All relays can be configured for each of the methods indicated with the exceptions that relays 1-4 have an additional option to be configured as BLOWDOWN relays because they physically have a normally open contact and a normally closed contact for operation of motorized ball valves, and relays 1-4 cannot be configured as Percent Blowdown feed relays.

To configure a relay for operation, a method is selected and the relay is then tied to a user selectable flow switch input. The NexSys® Control System includes 2 flow switch inputs standard with an option for up to 4 additional flow switch inputs with the installation of the Digital Input Node (NDIG).

NOTE: Relays 1-4 should be configured to flow switch inputs 1-4 respectively, i.e. 1 to 1, 2 to 2, etc.

The available methods of operation are: DISABLE, SETPOINT, FEED BY WATER METER, PERCENT TIME, and PERCENT BLOWDOWN. Each of these methods is discussed later in this manual.



4.5.2 Water Meters

The Water Meters button in the Main Menu allows the operator to set up the water meters for operation. The NexSys® Control System includes 2 water meter inputs standard.

Each of the water meter inputs can be configured for: Contacting Head, Paddle Wheel, Autotrol 1 Inch, and Autotrol 2 Inch. They can be configured for gallons or liters.

4.5.3 Node Install/De-Install

All sensor inputs to the NexSys® Control System make use of nodes. Nodes are mini CPUs that have programming for specific functions, such as a pH, conductivity, or ORP sensor input, relay outputs, 4-20 mA inputs, or digital inputs.

The Node Install/De-Install button in the Main Menu allows the operator to install or de-install nodes in the system. 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 four additional flow switch inputs, or two additional water meter inputs and two additional flow switch inputs), and one relay node with four additional relay outputs.

Nodes are installed in the system through an install procedure which basically consists of telling the controller which node you are installing, pressing the service pin on the node, and touching the display to complete the procedure.

Nodes are de-installed by touching a button on the screen to tell the controller to de-install the node.

4.5.4 Set the Clock and Date

The Clock-Date Settings button in the Main Menu allows the operator to set the date and time. A drop-down keypad appears when either the set time button or the set date button is touched.

4.5.5 Alarms

The Alarms button in the Main Menu allows the operator to view alarm history, and set alarm settings and notifications. The alarm functions can also be accessed through the Process Parameters button under System Parameters in the Main Menu.

The screen of the NexSys® Control System will flash red and a beep sound will occur when an alarm occurs that has been set up in the notifications. The alarm will be displayed in a bar at the bottom of all screens. The screen will not flash, beep, or appear in the alarm bar if the alarm has not been selected in the alarm notification menu.

All selected alarms require operator acknowledgement to clear the alarm. The NexSys® Control System will log when the selected alarm occurs, when it is acknowledged, and when the alarm clears.

Current un-acknowledged alarms are displayed in the bar at the bottom of all screens. The current status of all alarms is viewed in the two Alarm Home screens.

Email addresses for alarm notifications are set using the TouchMaker Lite software program.

4.5.6 System Parameters

The System Parameters button in the Main Menu allows the operator access to: Process parameters screens, Component name change, Reset the display, Change the password, Set up the Email Alarm Notifications, and View system usage information.

4.5.6.1 Process Parameters

The Process Parameters button in the System Parameters Menu allows the operator access to: Configure the sensor inputs including setting the sensor high and low alarm points, Configure the 4-20 mA inputs including setting the high and low alarm points and ranges, and Configure the water meter inputs.

4.5.6.2 Component Name Change

The Component Name Change button in the System Parameters Menu allows the operator access to: Change the name of the sensor inputs, digital inputs, 4-20 mA inputs, and the Relay outputs. The units of measure for the 4-20 mA inputs are set in this screen.

4.5.6.3 Reset Display

The Reset Display button in the System Parameters Menu allows the operator access to Reset the Display without resetting any user configurable parameters.

4.5.6.4 Change 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. The Change Password button in the System Parameters Menu allows the operator access to Change the password and enable the security mode. The default password is 0000.

4.5.6.5 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, and Mail Error code. 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.

4.5.7 Documentation

The Documentation button allows the operator to view information about the care and operation of the controller and sensor inputs. This includes sensor cleaning procedures, calibration procedures, system wiring, blue locking ring replacement procedures, and part numbers for replacement parts.

4.5.8 Calibration Screens

The Calibration Screens button allows the operator to calibrate the sensor inputs. This includes all sensor inputs including any 4-20 mA inputs that may be installed.

The calibration screens can be accessed either from the Main Menu by way of the **CALIBRATION SCREENS** button, or from the All Sensor Inputs screen by way of the **Go To Calibrate** button.

To calibrate the conductivity sensor inputs touch the CON CAL button, to calibrate the pH sensor inputs touch the pH CAL button, to calibrate the ORP inputs touch the ORP CAL button, and to access the 4-20 mA input calibrations touch the Down arrow at the bottom right of the screen and touch the 4-20 CAL button.

4.5.9 Security

The NexSys® Control System has a security function to limit access to the Main Menu. 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 **300 seconds** before returning to the security mode. The default password is 0000.

To disable the security mode, change the password back to 0000.

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.

5.0 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 (-).

If applicable, install each node in the Install/De-install Nodes menu section 6.7.

Rename the inputs by following section 6.10.2.

Set the date and time by following section 6.9.

Set the high and low alarms for all inputs by following section 6.10.

Set the alarm notifications by following section 6.8.

Configure the BLOWDOWN relays for operation by following section 6.5.2.2.

Calibrate the inputs by following section 6.3

Configure the rest of the relays for operation by following section 6.5.

Enable the E-mail if applicable by following section 6.11.

Configure the Ethernet if applicable by following section 6.11.


Change the remote access password if applicable by following section 6.11.

Set up the security mode if applicable by following section 6.10.4.

Verify operation of the controller before leaving the area.

6.0 Operation of the Controller

6.1 Home Screens

The main Home screen is the System screen. Touching the Home button  will always return the NexSys® Control System to the System 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 System screen.

6.1.1 System Screens

The System screens include information such as the Date/Day/Time, the conductivity sensor input readings, water meter readings, flow switch status, the relay status, manual relay operation, and **access to the Main Menu**.

The System Screen includes all four conductivity sensor inputs, the status of the conductivity sensor readings, the relay status and manual relay operation of relays 1-6 and 7-10 if installed, water meter inputs 1 and 2, status of flow switch inputs 1-2 and 3-6 if installed. All other sensor inputs are displayed in the All Installed Sensor Readings screen.

A System Screen looks like:



The conductivity sensor readings have an indicator next to them indicating if the reading is **LIVE**, or if the reading is **LAST** reading that the controller saw before it went into the cycle mode.

If the word **LIVE** is next to a conductivity reading, that reading is the current conductivity value of the boiler blowdown water.

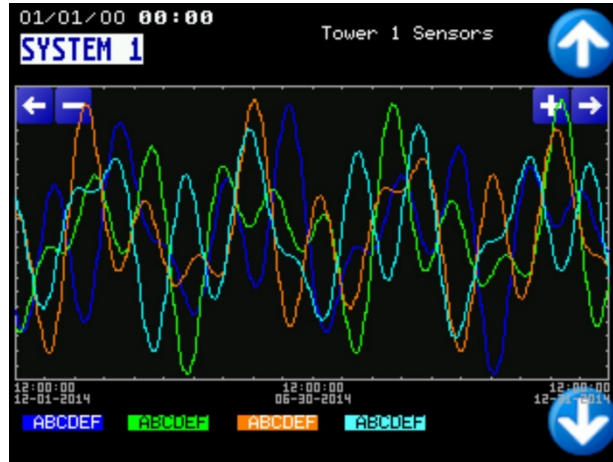
If the word **LAST** is next to the conductivity reading, that reading is the last conductivity value that was indicated before the blowdown relay went into the cycle mode and may not be a good indication of the current conductivity value.

If the nodes for the inputs/outputs are not installed, the display will indicate that the input/output node is not installed.

6.1.2 Graphing Screens

There are two graphing screens. The first graphing screen shows the boiler conductivity sensor inputs over time. The second graphing screen shows the status of the relays over time.

To access the graphing screen, use the up or down arrow buttons on the system screens.



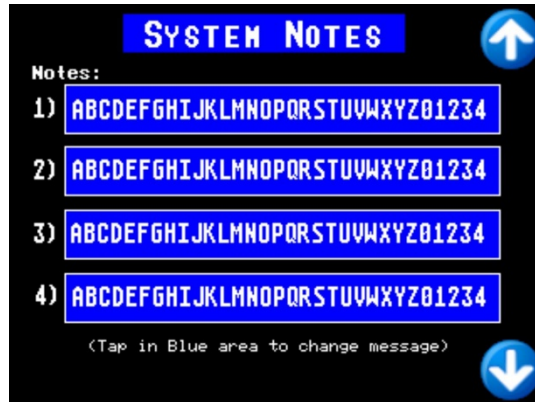
6.1.3 All Sensor Inputs Screen

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 Calibrate button at the top right of the screen.



6.1.4 System Notes Screen

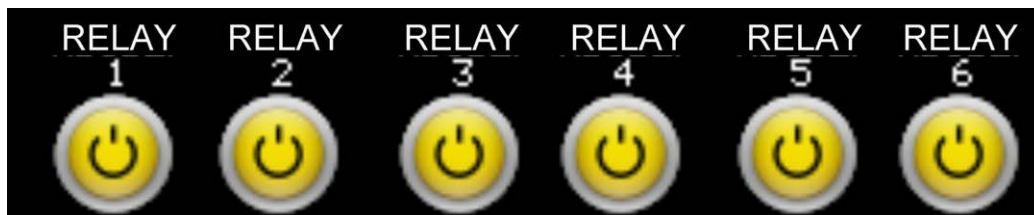
The System Notes screen provides a place for the operator to enter notes into the controller. There is space for four separate notes of 31 characters each. This is useful for reminders, or providing a telephone number to call for service. To enter a note, touch in one of the Blue areas and a keypad will appear. Enter your note and touch OK.



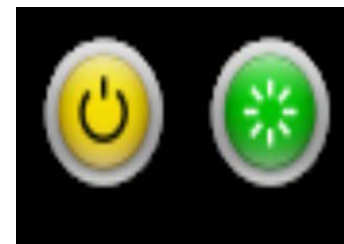
6.2 Manual Operation of the Relays

All six (ten with optional relay node) of the relays can be operated manually. The relays buttons are displayed on the System Home Screen. Relays 1-6 are displayed above relays 7-10. If relays 7-10 are not installed the screen will indicate that the NRLY is not installed.

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 control.



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

6.3 Calibration of Conductivity, ORP, and pH

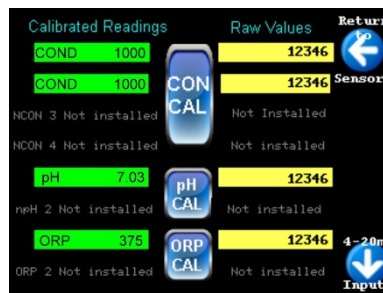
6.3.1 CALIBRATION of CONDUCTIVITY

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 in section 6.3.2 and convert the ppm to an approximate conductivity value.

6.3.1.1 CALIBRATION of CONDUCTIVITY IN CONTINUOUS SAMPLE MODE

The NexSys® Control System uses a single point calibration.

- Ensure that the controller is operating with flow lined up to the conductivity sensor.
- Take a sample of the water and measure with a hand-held conductivity tester.
- From the Main Menu, touch the Calibration Screens button.
- Touch the CON CAL button.



- Ensure that all alarms are clear for the conductivity input. 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 CON CAL button.
- Touch the button for the desired boiler conductivity.



- The NexSys® control system will go through a sequence to obtain a good conductivity reading. Once the stop light turns green the operator will have 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.



- Touch the ENTER SPAN VALUE button and use the touch pad to input the conductivity 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.

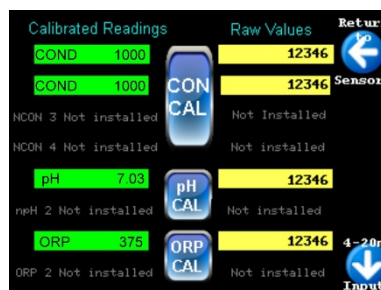
6.3.1.2 CALIBRATION of CONDUCTIVITY IN SAMPLE/CYCLE MODE

The NexSys® Control System uses a single point calibration.

- Ensure that the controller is operating with flow lined up to the sensor.
- Take a sample of the water and measure with a hand-held conductivity tester.
- From the Main Menu, touch the Calibration Screens button.



- Touch the CON CAL button.



- Ensure that all alarms are clear for the conductivity input. 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 CON CAL button.

- Touch the button for the desired boiler conductivity.



- 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 Sample/Cycle time sequence. At the end of the sample time, the stop light will turn green and the operator will have 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.



- Touch the ENTER SPAN VALUE button and use the touch pad to input the conductivity 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.

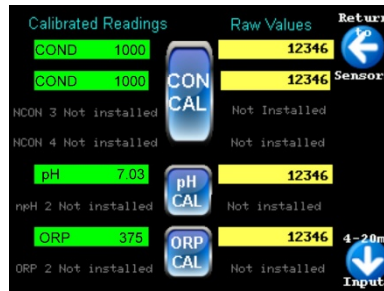
6.3.1.3 CALIBRATION of CONDUCTIVITY IN SAMPLE/HOLD MODE

The NexSys® Control System uses a single point calibration.

- Ensure that the controller is operating with flow lined up to the sensor.
- Take a sample of the water and measure with a hand-held conductivity tester.
- From the Main Menu, touch the Calibration Screens button.



- Touch the CON CAL button.



- Ensure that all alarms are clear for the conductivity input. 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 CON CAL button.



- Touch the button for the desired boiler conductivity.



- The NexSys® control system will go through the sample and hold time sequence to obtain a good conductivity reading. This time is equal to the sample time and the hold time that is programmed into the the Sample/Hold time sequence. At the end of the hold time, the stop light will turn green and the operator will have 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.



- Touch the ENTER SPAN VALUE button and use the touch pad to input the conductivity 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.

6.3.2 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

$\mu\text{S/cm}$	ppm	$\mu\text{S/cm}$	ppm	$\mu\text{S/cm}$	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

6.3.3 CALIBRATION OF ORP

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.

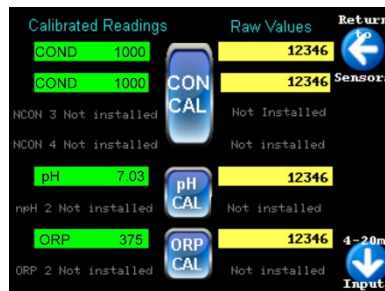
We recommend that the ORP calibrations only be performed with the ORP sensor mounted as it will be used in the system. Buffers can be used to check calibrations but should not be used for calibration purposes (see below).

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.

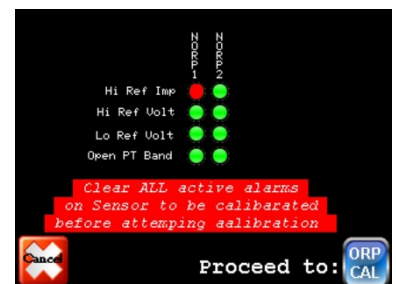
- Ensure that the controller is operating with good flow past the sensor.
- Take a sample of the water and measure with a hand-held ORP tester.
- From the Main Menu, touch the Calibration Screens button.



- Touch the ORP CAL 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.

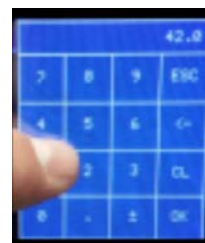


- Touch the Proceed to ORP CAL button.

- 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.

6.3.4 CALIBRATION CHECK OF ORP IN BUFFER SOLUTIONS

A calibration check can be performed in buffer solutions. Use two solutions that are at least 300 mV apart. Perform the calibration check as follows:

- Shut the isolation valves to the controller plumbing assembly.
- Remove the ORP sensor and place it in the buffer solution.
- Verify calibrations in at least two buffer solutions at least 300 mV apart.
- Re-install the sensor into the plumbing. Ensure locking ring is locked.
- Restore flow to plumbing assembly
- If the values are not tracking, clean the sensor and perform a calibration.

6.3.5 CALIBRATION OF pH

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.

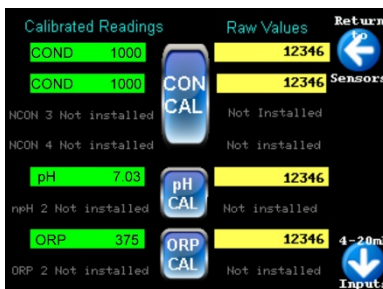
We recommend that a single point pH calibration only be performed with the pH sensor mounted as it will be used in the system. Buffers can be used to check calibrations but should not be used for calibration purposes (see below), with the exception of performing a two-point calibration.

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.

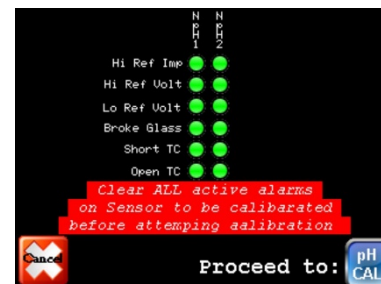
- Ensure that the controller is operating with good flow past the sensor.
- Take a sample of the water and measure with a hand-held pH tester.
- From the Main Menu, touch the Calibration Screens button.



- Touch the pH CAL button.

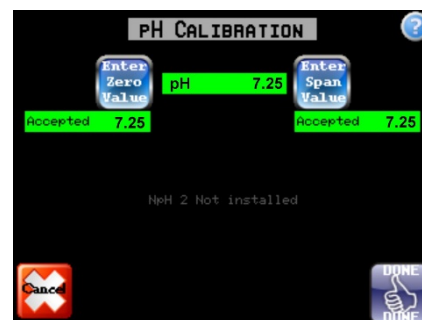


- Ensure that all alarms are clear for the pH input. The node checks for a valid input for calibration. If there is a High Reference Impedance, High Reference Voltage, Low Reference Voltage, or Broken Glass, Open TC, or Shorted TC alarm a good calibration cannot be achieved.

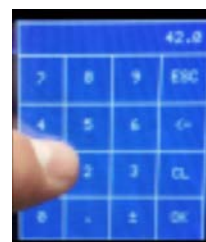


- Touch the Proceed to pH CAL button.
- Touch the Enter SPAN Value button for the desired pH sensor input.

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.

6.3.6 pH CALIBRATION ZERO or SPAN?

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 **SPAN** value should be used for all pH values.

For **Two-point calibrations**, both the **ZERO** value and the **SPAN** values are used. The **ZERO** value should **only** be performed at a 4.0 pH value and the **SPAN** value should be performed at a pH value that is greater than 6.0 pH. The ZERO and SPAN calibration values must be at least 2.0 pH apart.

6.3.7 pH CALIBRATION ERRORS

To perform a pH calibration, all alarms associated with that pH input must be clear or the NexSys® Control System will not allow a pH calibration to occur. A value can be entered but the indicated value will not change to the entered value.

The NexSys® Control System will not allow a pH calibration to occur if the Zero and Span values are within 2.0 pH of each other. **THE SPAN AND ZERO VALUES MUST BE AT LEAST TWO pH APART.** If a calibration is attempted where the ZERO value and the SPAN value are within 2.0 pH of each other, the indicated pH value will not change to the value that was entered during the calibration procedure. This is to prevent calibration points that are too close together to establish a good calibration curve. If this happens, it is recommended that a two-point calibration be performed.

The NexSys® Control System will not allow a pH calibration to occur if the calibration value is greater than 1.5 pH away from the indicated pH value. **THE CALIBRATION VALUE MUST BE WITHIN 1.5 pH OF THE INDICATED pH VALUE.** This is to prevent a calibration from occurring when there is an incorrect signal from the pH probe when the probe has failed, is fouled, or when there is interference in the system. If you receive this message perform a calibration check using buffer solutions.

6.3.8 CALIBRATION CHECK OF pH IN BUFFER SOLUTIONS

A calibration check can be performed in buffer solutions. Use two solutions that are at least 2.0 pH apart. Perform the calibration check as follows:

- Shut the isolation valves to the controller plumbing assembly.
- Remove the pH sensor and place it in the buffer solution.
- Verify calibrations in at least two buffer solutions at least 2 pH apart.
- Re-install the sensor into the plumbing. Ensure locking ring is locked.
- Restore flow to plumbing assembly
- If the values are not tracking, clean the sensor and perform a calibration.

6.4 Main Menu

The **MAIN MENU** of the NexSys® Control System is accessed by pressing the **MAIN MENU** button in any of the SYSTEM screens:


The main menu has buttons for:

- Relay Configuration
- Water Meter Configuration
- Node Install or De-install
- Calibration Screens
- Alarm Configuration
- Set the Clock and Date
- Set System Parameters
- Documentation
- Custom Graphs



If the NexSys® Control System is in the security mode, a password is required to access the Main Menu. A keypad will appear when the MAIN MENU button is touched. Enter the password and touch the OK button to access the Main Menu.

The Main Menu screen has buttons for: Relays, Water Meters, Node Install/De-Install, Calibration, Alarms, Clock-Date Settings, System Parameters, Documentation, and Custom Graph Screens. Touch the appropriate button to enter a desired screen.

From anywhere in the menu, pressing the left arrow button labeled “Main Menu” will return you to the **MAIN MENU**. To return to the System screens touch the Home  button.

Certain menu items are only visible if certain conditions apply, such as: nodes are installed, or other parameters are configured. If a menu item does not appear in the menu it most likely means that the option is not installed or is not configured.

Each of the **MAIN MENU** options is discussed in detail later in this manual.

6.5 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, and Percent of Time.

Relays 1-4 have the ability to be configured for boiler blowdown setpoint control via the Continuous Sample, Sample/Cycle, or Sample/Hold methods but cannot be configured for Percent of Blowdown.

Relays 5-10 cannot be configured for boiler blowdown setpoint control but they can be configured for Percent of Blowdown.

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 and Percent of Blowdown.**

NOTE: The BLOWDOWN relays must be configured before the other relays to establish the control systems for the other relays to operate. Do not configure more than one Blowdown relay to a single switch input.

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 disable a relay momentarily when changing the method of operation of that relay. This will clear the previously set parameters for that relay.

6.5.1 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.

6.5.2 By Setpoint

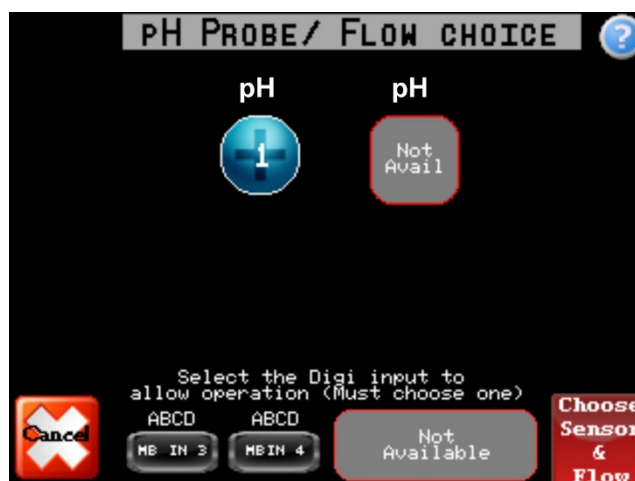
Each of the relays can be configured to operate based on Setpoint control. The setpoint can be based on a sensor type or based on a 4-20 mA input. Relays 1-4 have an additional function to control the boiler blowdown by setpoint with a Boiler Blowdown Method. The boiler Blowdown Methods are explained later in this manual.

When **Setpoint** is selected, one of the following screens will appear, depending on the relay that is selected. Relays 1-4 will display the screen on the left and relays 5-10 will display the screen on the right:



- Touch the appropriate button for the desired Sensor Type input.

The screen will display the available sensor inputs of that type. For example, if pH is selected, the screen will show something like this:



In this case, only one pH sensor is installed in the NexSys® control system.

- 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. NDIGI1 1, NDIGI1 2, NDIGI1 3, and NDIGI1 4 are located on the optional Digital Input Node.

NOTE: All relays **MUST** be linked to a flow switch input and programming cannot be continued 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 CONFIG screen.

6.5.2.1 Setpoint Config

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



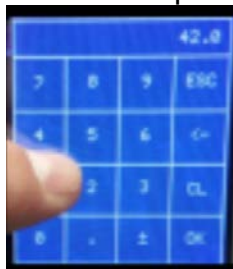
- To accept any changes touch the DONE button or to reject the changes touch the Cancel button.

6.5.2.1.1 Setpoint

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 button next to the Setpoint value and use the keypad to enter the Setpoint value. Touch the OK button to accept.



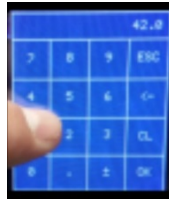
6.5.2.1.2 Deadband

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 $\frac{1}{2}$ of the deadband value and turn off at the setpoint value minus $\frac{1}{2}$ of the deadband value.

For example, a conductivity setpoint of 1000 μ S with a deadband of 20 μ S would result in the relay turning on at 1010 μ S and turning off at 990 μ S.

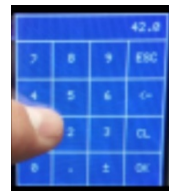
- Touch the Change button next to the Deadband value and use the keypad to enter the Deadband value. Touch the OK button to accept.



6.5.2.1.3 Timeout

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 conductivity, 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 will 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 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.

6.5.2.1.4 Setpoint Direction

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

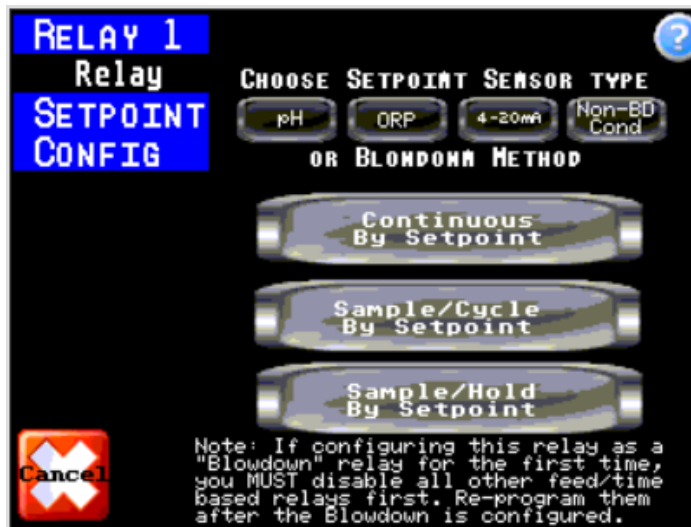
- Touch the Goes Above / Goes Below button to alternate between Goes Above and Goes Below



6.5.2.2 Relays 1-4 Blowdown Method

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

Relays 1-4 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:



6.5.2.2.1 Continuous by Setpoint

The blowdown relay (relay 1-4) can be configured to blowdown based on Continuous Sample setpoint. This means that there is continuous blowdown flow going past the sensor. When the conductivity rises above the setpoint plus $\frac{1}{2}$ 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.

In the Continuous Blowdown by Setpoint screen you will select the Conductivity input, set the **SETPOINT**, set the **DEADBAND**, set the **TIMEOUT** alarm, set the Ball Valve Delay time, and select a flow switch input.

- From the Setpoint Config Menu of the relay, select Continuous by Setpoint



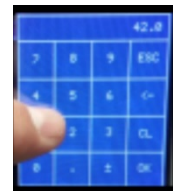
The Continuous Blowdown Setpoint can be based on any of the four available conductivity inputs. The conductivity inputs that are currently installed are shown at the top of the screen.

- Touch the appropriate conductivity sensor input. This conductivity value will control the operation of this Blowdown relay.

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 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.

The relay will turn on at the setpoint value plus $\frac{1}{2}$ of the deadband value and turn off at the setpoint value minus $\frac{1}{2}$ of the deadband value.

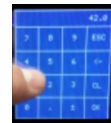
For example, a conductivity setpoint of 4000 μS with a deadband of 200 μS would result in the relay turning on at 4100 μS and turning off at 3900 μS .

- Touch the Change button next to the Deadband value and use the keypad to enter the Deadband value. Touch the OK button to accept.



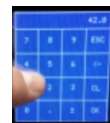
The **TIMEOUT** alarm is designed to notify the operator of a problem in the Blowdown system such as, a valve is stuck closed or a strainer is clogged. It will also help to protect the system from too much blowdown when the indicated conductivity does not display a change in value. The timeout function 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 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.



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:

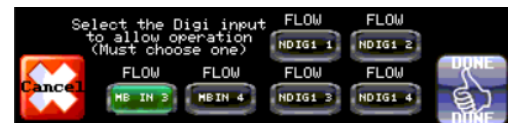
- Touch the Change button next to the Ball Valve DLY value and use the keypad to enter the Ball Valve Delay time in seconds. A typical Ball Valve takes approximately 8 seconds to cycle. Touch the OK button to accept.



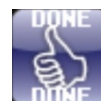
The Blowdown relay must be tied to a **flow switch** input. All relays that are tied to the same flow switch input are considered a single system and will interact with each other for Blowdowns, and Percent of Bleed.

- 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 1-4 are located on the optional Digital Input Node.

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



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



6.5.2.2.2 Sample/Cycle by Setpoint

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.

In the Sample/Cycle by Setpoint screen you will select the Conductivity input, set the **SETPOINT**, set the **DEADBAND**, set the **TIMEOUT** alarm, set the **Ball Valve Delay** time, select a flow switch input, set the **SAMPLE** time and set the **CYCLE** time.

- From the Setpoint Config Menu of the relay, select **Sample/Cycle by Setpoint**



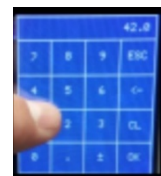
The Sample/Cycle Blowdown Setpoint can be based on any of the four available conductivity inputs. The conductivity inputs that are currently installed are shown at the top of the screen.

- Touch the appropriate conductivity sensor input. This conductivity value will control the operation of this Blowdown relay.

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 button next to the Setpoint value and use the keypad to enter the Setpoint value. Touch the OK button to accept.

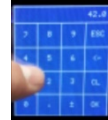


Due to continuous fluctuations in the Input level, it is necessary to have a **DEADBAND** range or stable readings will be difficult to maintain. "**Deadband**" refers to the difference between the ON point and the OFF point and it straddles the setpoint. The Deadband should be a small percentage of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

After the Sample time expires, the controller compares the conductivity reading to the setpoint. If the reading is greater than the setpoint minus ½ of the deadband, the valve will remain open until the reading drops below the setpoint minus ½ of the deadband.

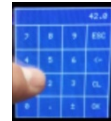
For example, a conductivity setpoint of 4000 µS with a deadband of 200 µS would result in the relay turning off at 3900 µS.

- Touch the Change button next to the Deadband value and use the keypad to enter the Deadband value. Touch the OK button to accept.



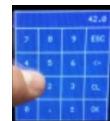
The **TIMEOUT** alarm is designed to notify the operator of a problem in the Blowdown system such as, a valve is stuck closed or a strainer is clogged. It will also help to protect the system from too much blowdown when the indicated conductivity does not display a change in value. The timeout function 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 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.



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:

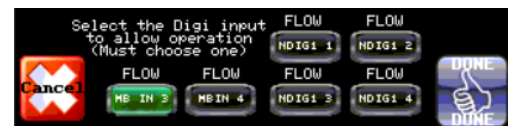
- Touch the Change button next to the Ball Valve DLY value and use the keypad to enter the Ball Valve Delay time in seconds. A typical Ball Valve takes approximately 8 seconds to cycle. Touch the OK button to accept.



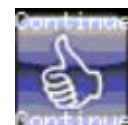
The Blowdown relay must be tied to a **flow switch** input. All relays that are tied to the same flow switch input are considered a single system and will interact with each other for Blowdowns, and Percent of Bleed.

- 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 1-4 are located on the optional Digital Input Node.

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



- Touch the Continue button to set the Sample and Cycle times.



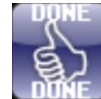
The **SAMPLE TIME** is the amount of time that the blowdown valve will be open and blowdown will occur before the controller compares the reading to the setpoint. This time needs to be long enough so that the sensor and piping have enough time to come up to operating temperature, but not too long because 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.



6.5.2.2.3 **SAMPLE/HOLD by Setpoint**

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.

In the Sample/Hold by Setpoint screen you will select the Conductivity input, set the **SETPOINT**, set the **DEADBAND**, set the **TIMEOUT** alarm, set the **Ball Valve Delay** time, select a flow switch input, set the **SAMPLE** time, set the **CYCLE** time, set the **HOLD** time, and set the **BLOW TO RESAMPLE** time.

- **From the Setpoint Config Menu of the relay, select Sample/Hold by Setpoint**



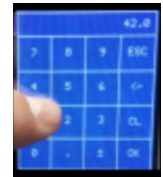
The Sample/Hold Blowdown Setpoint can be based on any of the four available conductivity inputs. The conductivity inputs that are currently installed are shown at the top of the screen.

- Touch the appropriate conductivity sensor input. This conductivity value will control the operation of this Blowdown relay.

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 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.

After the Sample and Hold times expire, the controller compares the conductivity reading to the setpoint. If the reading is greater than the setpoint minus $\frac{1}{2}$ of the deadband, the controller will perform the Blow to Resample procedure until the reading drops below the setpoint minus $\frac{1}{2}$ of the deadband.

For example, a conductivity setpoint of 4000 μS with a deadband of 200 μS would result in the controller going into the Cycle time at 3900 μS .

- Touch the Change button next to the Deadband value and use the keypad to enter the Deadband value. Touch the OK button to accept.



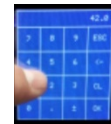
The **TIMEOUT** alarm is designed to notify the operator of a problem in the Blowdown system such as, a valve is stuck closed or a strainer is clogged. It will also help to protect the system from too much blowdown when the indicated conductivity does not display a change in value. The timeout function 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 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.



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:

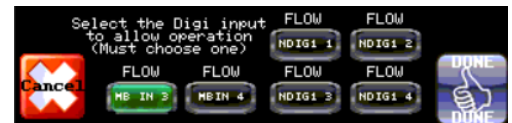
- Touch the Change button next to the Ball Valve DLY value and use the keypad to enter the Ball Valve Delay time in seconds. A typical Ball Valve takes approximately 8 seconds to cycle. Touch the OK button to accept.



The Blowdown 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, and Percent of Bleed.

- 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 1-4 are located on the optional Digital Input Node.

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



- Touch the Continue button to set the Sample, Hold, Blow to Resample, and Cycle times.



The **SAMPLE TIME** is the amount of time that the blowdown valve will be open and blowdown will occur before the controller shuts the blowdown valve and enters the Hold time. 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 **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 button next to the Hold Time value and use the keypad to enter the Hold Time in minutes and seconds. 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 button next to the Blow to Resample Time value and use the keypad to enter the Blow to Resample 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.

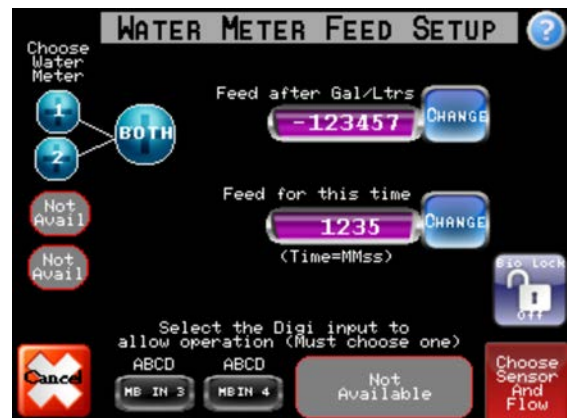
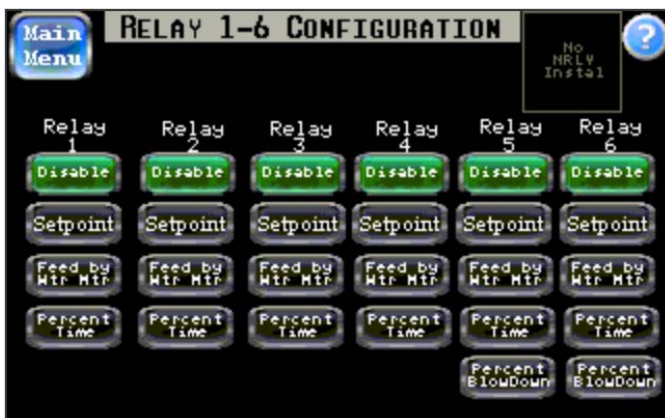
- Touch the Change button next to the Cycle Time value and use the keypad to enter the Cycle Time in hours and minutes. Touch the OK button to accept.
- To accept any changes touch the DONE button or to reject the changes touch the Cancel button.



6.5.3 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 Wtr Mtr under the desired relay.



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

- Touch the desired Water Meter input

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 contacting 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...

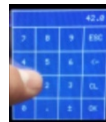
For the setup of the relay we are not concerned with the units of volume, whether it is gallons or liters because the units of volume are determined by the water meter setup.

- Touch the Change 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.

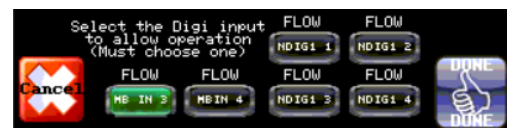
- Touch the Change button next to the Feed for this time value and use the keypad to enter the time value. This time is in minutes and seconds. Touch the OK button to accept.



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 1-4 are located on the optional Digital Input Node.

NOTE: All relays **MUST** be tied to a flow switch input and programming cannot proceed until both a water meter input and a flow switch input are selected for the relay.



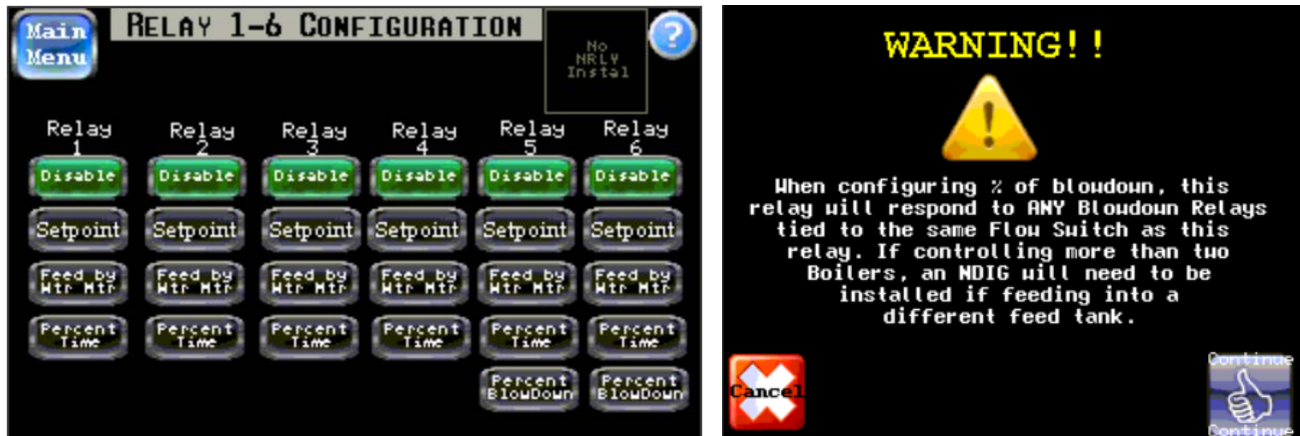
- To accept any changes touch the DONE button or to reject the changes touch the Cancel button.



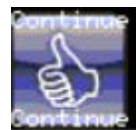
6.5.4 Feed by Percent of Blowdown

Relays 5-10 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.



- A warning will appear stating that this relay will respond to all Blowdown Relays on the same flow switch as this relay. Ensure that there is only one Blowdown relay on the same flow switch as this relay. Touch the CONTINUE button.



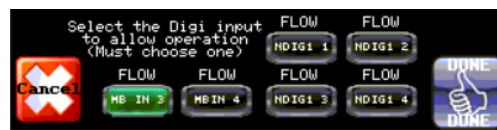
The percentage of blowdown time that the relay will be energized is set in the **Feed for this % time** field.

- Touch the Change button next to the Feed for this % time value and use the keypad to enter the percentage value. Touch the OK button to accept.



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, and Percent of Blowdown 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 1-4 are located on the optional Digital Input Node.



NOTE: All relays **MUST** be tied to a flow switch input and programming cannot proceed until a flow switch input is selected for the relay.

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



6.5.5 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.

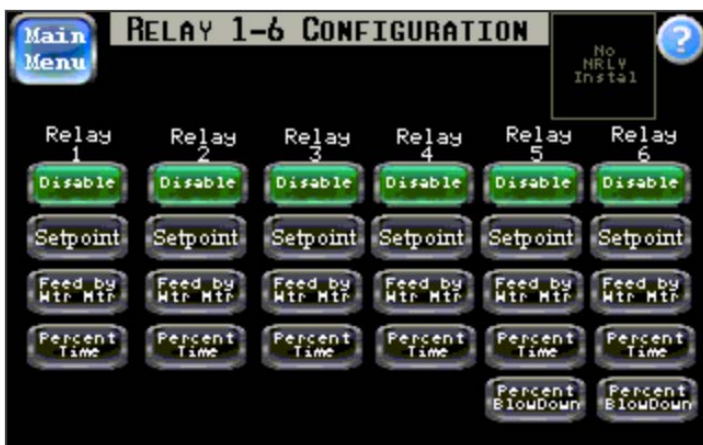
For example:

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, has flow in the system, and is not in a biocide sequence (unless configured to operate during a biocide sequence, SEE Bio Lock).

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



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

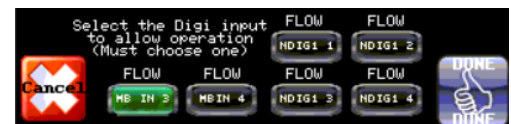
- Touch the Change button next to the % value and use the keypad to enter the time value. Touch the OK button to accept.



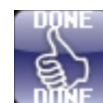
The relay must be tied to a **flow switch** input. All relays that are tied to the same flow switch input are considered a single system and will interact with each other for Blowdowns and Percent of Blowdown Feeds.

- 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 1-4 are located on the optional Digital Input Node.

NOTE: All relays **MUST** be tied to a flow switch input and programming cannot proceed until a flow switch input is selected for the relay.



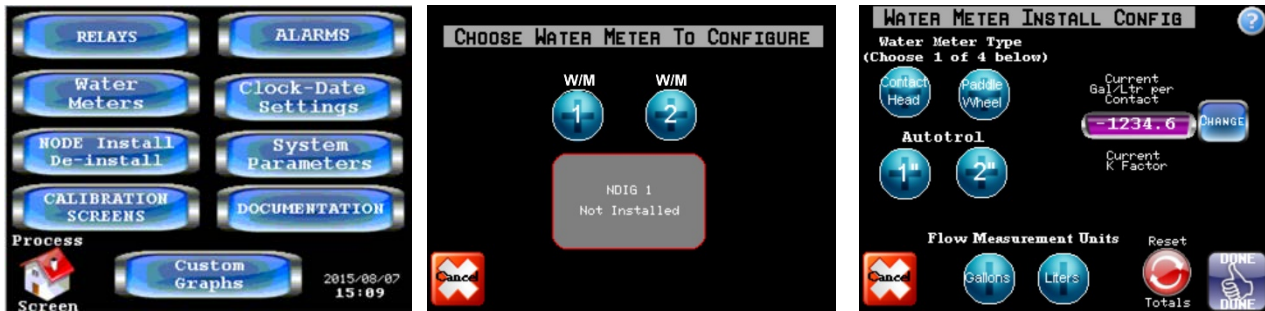
- To accept any changes touch the DONE button or to reject the changes touch the Cancel button.



6.6 Configuring the Water Meter Inputs

The NexSys® Control System will accept 2 water meter inputs standard. 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 such as the Signet model 2535 and 2540, 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 and then touch the water meter input 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 measurement, 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. For an Autotrol Turbine meter, there is no user information to enter. The NexSys® control system already has the calibration curves built into the system.

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

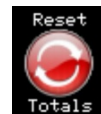


The water meter inputs are able to be displayed in gallons or liters. Note: This should agree with the water meter that is installed in the system as the NexSys® Control System does not convert the units from one to the other.

- 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.

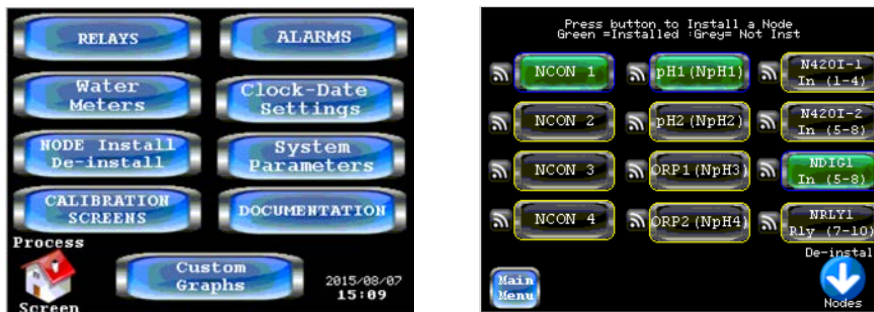


6.7 Node Install De-install

The NexSys® Control System makes use of nodes in a mapped network. Nodes are mini-CPU's 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:



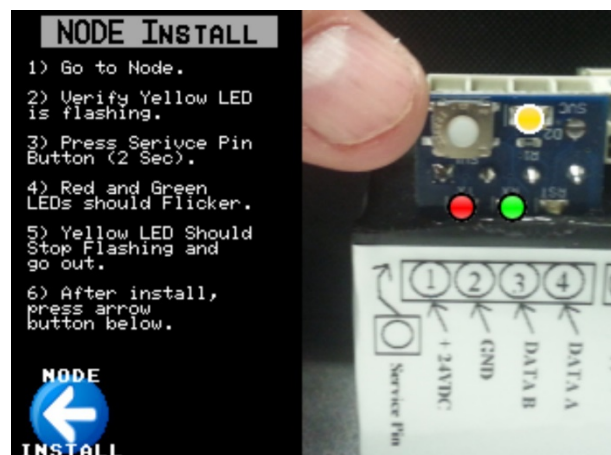
- From the Main Menu, touch the Node Install De-Install button. The Node Install screen will be shown.

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

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

The transmit indicator next to each node button  is used to indicate failed communication with an installed node. The normal status of this indicator is black, but if the node fails to communicate with the NexSys® Control System for a given period of time, the indicator will flash yellow and red to indicate that there is an issue with that node.

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



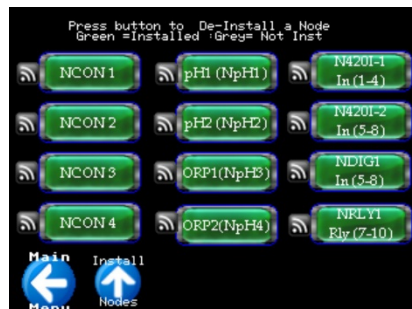
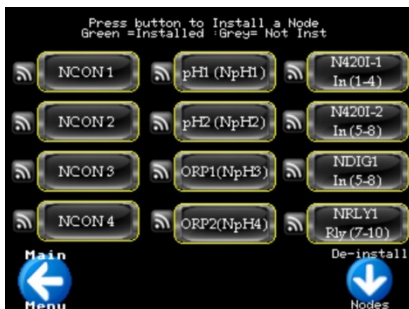
To Install a Node:

- Touch the button on the screen 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 button 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.

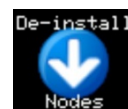


Nodes **MUST** be de-installed from the software before physically disconnecting them from the system. If they are not de-installed, they will not be able to be installed on another controller.

To De-Install a node:



- From the Main Menu, touch the Node Install De-Install button and touch the De-Install button in the bottom right corner.



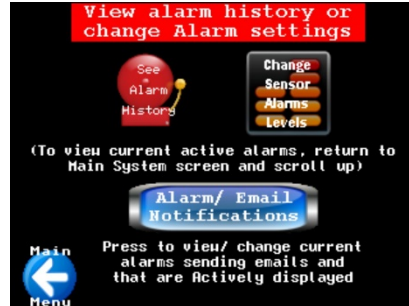
All nodes that are currently installed in the software are indicated by a green button.

- Touch the button for the node to be de-installed. 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.

6.8 Alarms

The NexSys® Control System has many alarms associated with it. There are alarms for high and low readings, alarms for relay timeouts, and alarms for sensor diagnostics.

To access the Alarm Menu from the Main Menu:



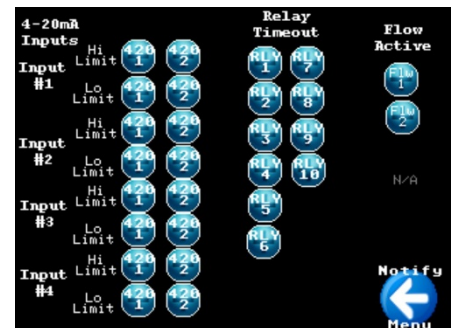
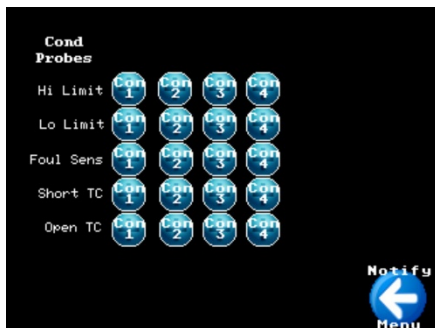
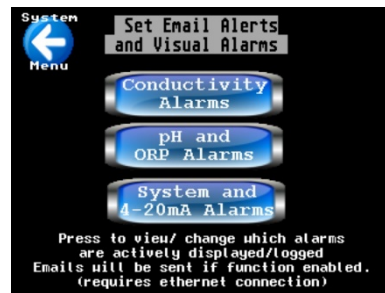
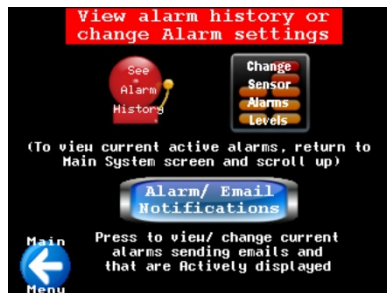
- Touch the Alarms Button.

The Alarm menu allows the operator to select the alarms that are actively displayed, view alarm history, and change sensor alarm levels.

Alarm / Email Notifications button is used to select the alarms that will give an active alarm notification. 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, acknowledged, and cleared are logged in the Alarm History. Email addresses for alarm notifications are set using the TouchMaker Lite software program. **NOTE: Email must be enabled in order to email alarms.**

To select the alarms to be actively displayed:

- Touch the Alarm/Email Notifications button and then touch the type of alarms button

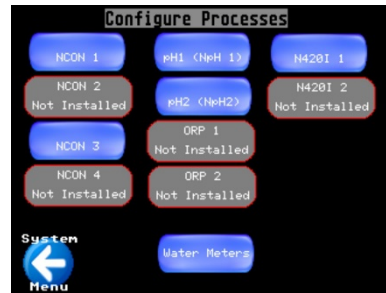
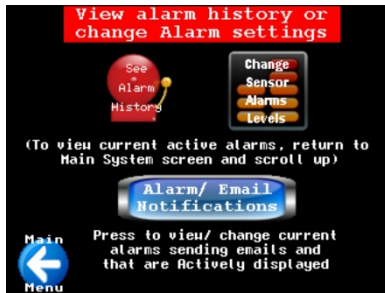


- Touch the blue buttons for the alarms to set the active notification of that alarm. The button will turn green for the selected alarms.

Note: Only the alarms that are selected in the Notifications screen will be displayed as Active Alarms, Show in the Alarm Bar, require the operator to acknowledge the alarm, and be logged in the Alarms History. All other alarms will only be displayed in the two Alarm Home screens.

Set the Sensor High and Low Level Alarms

The High and Low alarms for the sensor inputs are user settable by touching the Change Sensor Alarms levels button. The Change Sensor Alarms Levels button takes the operator to the Configure Processes screen to select the sensor input to be configured.

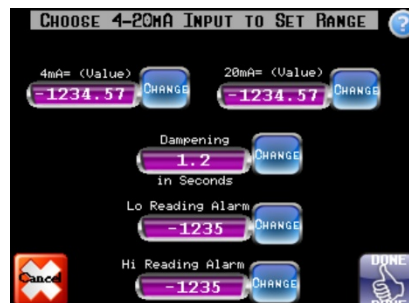
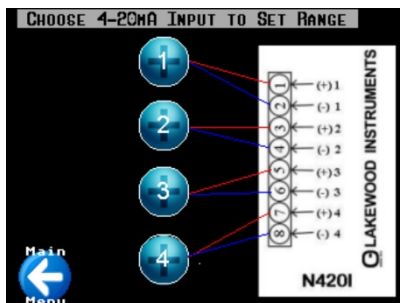
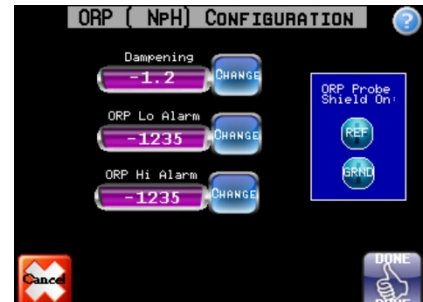
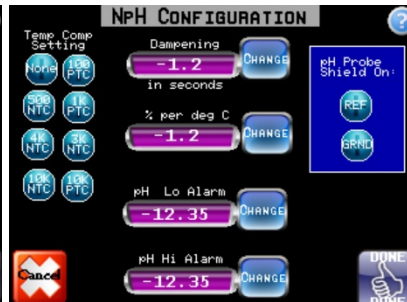


There is a configure process screen for each of the sensor input nodes. These configuration screens are used to configure the sensor input and for setting the high and low alarm levels.

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

- Touch the blue button for the desired sensor input.

Note: there is no high or low alarm associated with the Water Meter inputs.

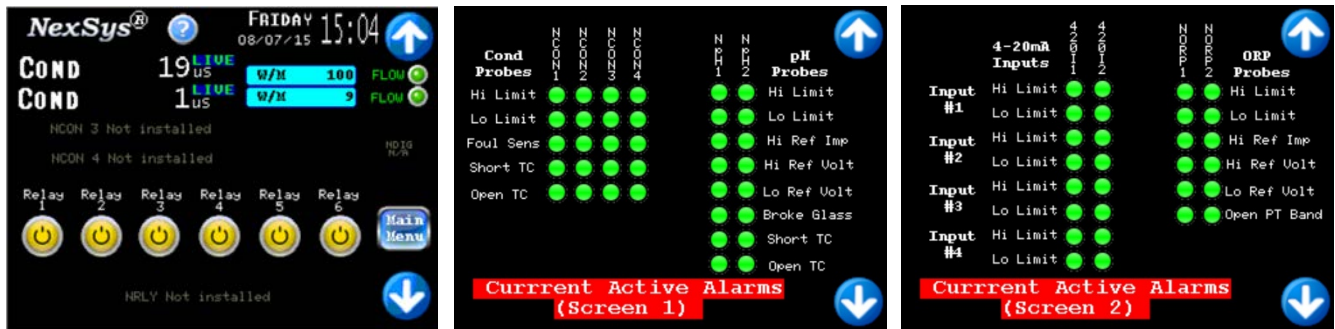


Note: For the 4-20 mA inputs you must select the channel of the input to configure.

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



The status of all alarms can be viewed from the two Active Alarm home screens. The alarm home screens are accessed by touching the up arrow from the System 1 home screen.



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

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 from 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.

pH1 and ORP1 alarms			
<- ->			
09/12/2014 15:28:58 pH1 Broken Glass Alarm			
09/12/2014 15:32:16 09/12 15:33:13			
Previous		Next	
Acknowledge		Ok	

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 Active Alarm Home screens.

6.9 Clock-Date Settings

The date and time must be set for the controller to operate properly.

To set the Date and Time:



- Touch the Set Time and/or Set Date button and use the keypad to enter the value. Touch the OK button to accept.



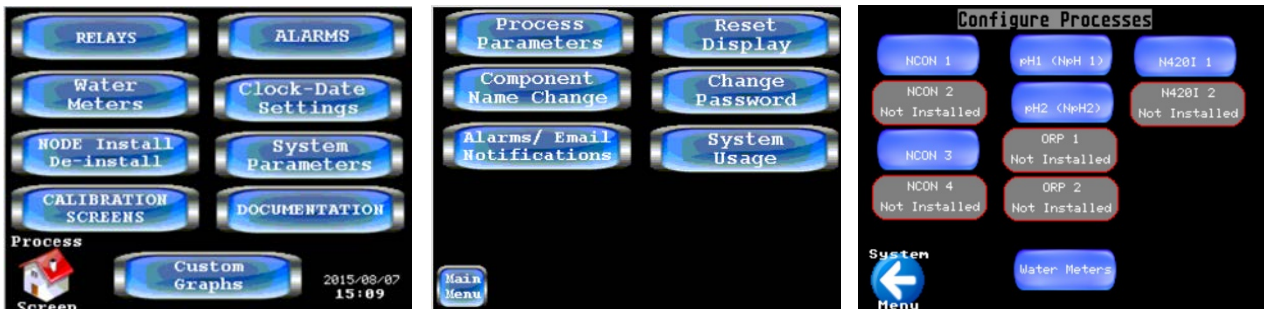
6.10 System Parameters

The System Parameters Menu provides access to: Process parameters screens, Component name change, Reset the display, Change the password, Set up the Email Alarm Notifications, and View system usage information.

6.10.1 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 points and ranges, and Configure the water meter inputs.

To Enter the Process Parameters screens:



- 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.

6.10.1.1 Configure the Conductivity Inputs

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 Configure Process screen touch the button for the desired Conductivity Input.
- To accept any changes touch the DONE button or to reject the changes touch the Cancel button.



6.10.1.1.1 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 Lakewood Instruments boiler sensors used with the NexSys® Control System are not temperature compensated. Select NONE to disable the temperature compensation.

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	
1229841.....NONE		

6.10.1.1.2 Cell Constants

The Conductivity Input is adjustable for different cell constants.

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



The Lakewood Instruments boiler sensors used with the NexSys® Control System have a cell constant of 0.108.

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	
1229841.....0.108		

6.10.1.1.3 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 button next to the Dampening field and use the keypad to enter the Dampening value. Touch the OK button to accept.



6.10.1.1.4 % 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:

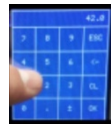
$$G_t = G_{t_{cal}} \{1 + \alpha(T - T_{cal})\}$$

where: G_t = conductivity at any temperature T in °C, $G_{t_{cal}}$ = 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 $G_{t_{cal}}$ to get α .

To set up the Percent per °C:

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

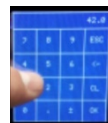


6.10.1.1.5 High and Low Alarm Settings

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

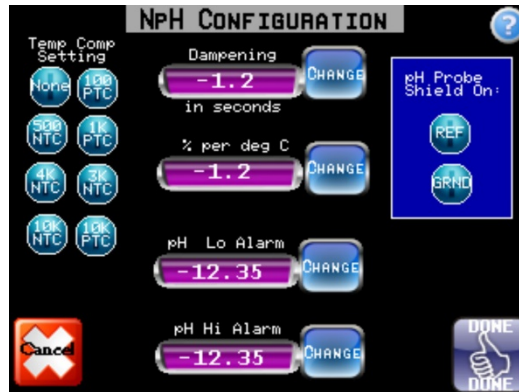
To set the high and low alarm levels for the selected sensor input:

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



6.10.1.2 Configure the pH Inputs

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



6.10.1.2.1 Temperature Compensation for pH sensor inputs

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.

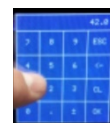
Lakewood Instruments pH sensors' temperature compensators:

1269422.....NONE	520 series.....10K PTC
1240472.....NONE	
1167155.....NONE	

6.10.1.2.2 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.

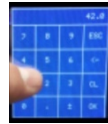
- Touch the change button next to the Dampening field and use the keypad to enter the Dampening value. Touch the OK button to accept.



6.10.1.2.3 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 button next to the Dampening field and use the keypad to enter the Dampening value. Touch the OK button to accept.



6.10.1.2.4 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.

Lakewood Instruments pH sensors' probe shield settings:

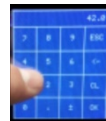
1269422.....REF	520 series.....GRND
1240472.....REF	
1167155.....REF	

6.10.1.2.5 High and Low Alarm Settings

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

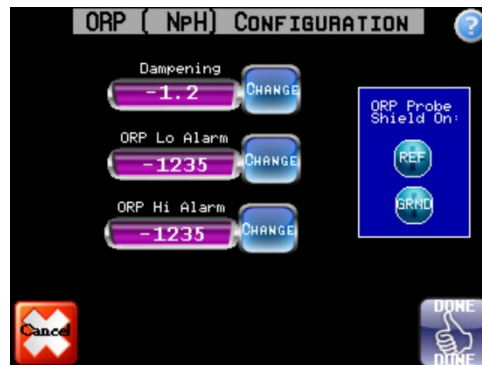
To set the high and low alarm levels for the selected sensor input:

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



6.10.1.3 Configure the ORP Inputs

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



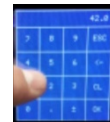
- From the Configure Processes screen touch the button for the desired ORP Input.
- To accept any changes touch the DONE button or to reject the changes touch the Cancel button.



6.10.1.3.1 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 button next to the Dampening field and use the keypad to enter the Dampening value. Touch the OK button to accept.



6.10.1.3.2 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.

Lakewood Instruments pH sensors' probe shield settings:

1269423.....REF	530 series.....GRND
1240473.....REF	
1169065.....REF	

6.10.1.3.3 High and Low Alarm Settings

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

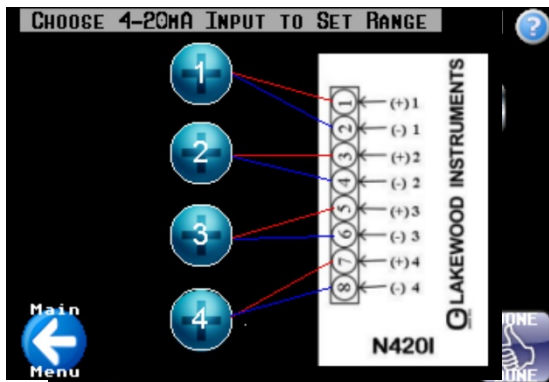
To set the high and low alarm levels for the selected sensor input:

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



6.10.1.4 Configure the 4-20 mA Inputs

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 Configure Processes screen, touch the button for the desired 4-20 mA Input node and touch the button for the desired 4-20 mA channel. There are four channels per 4-20 mA input node.
- To accept any changes touch the DONE button or to reject the changes touch the Cancel button.

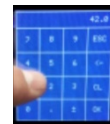


6.10.1.4.1 Set the 4-20 mA Range

The range of the 4-20 mA input must be **set to match** 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. **Note: The units of measure are set in the Component Name Change menu.**

To set the Range of the Input:

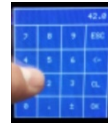
- Touch the Change button next to the 4mA value and use the keypad to enter the 4mA value. Touch the OK button to accept.
- Touch the Change button next to the 20mA value and use the keypad to enter the 20mA value. Touch the OK button to accept.



6.10.1.4.2 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 button next to the Dampening field and use the keypad to enter the Dampening value. Touch the OK button to accept.



6.10.1.4.3 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:

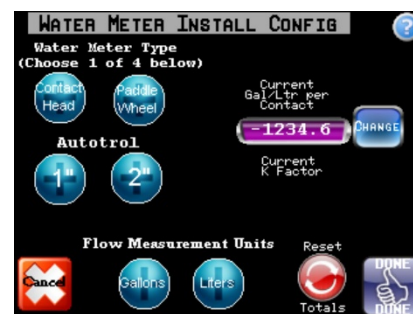
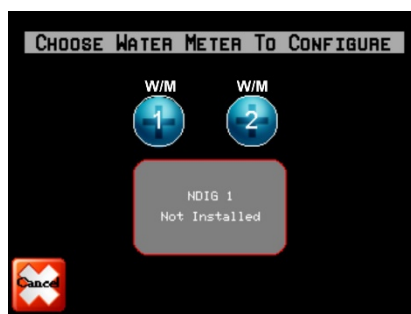
- Touch the Change button next to the Hi or Lo Alarm value and use the keypad to enter the value. Touch the OK button to accept.



6.10.1.5 Configure the Water Meter Inputs

The NexSys® Boiler Control System will accept 2 water meter inputs standard. 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 such as the Signet model 2535 and 2540, 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:



- Touch the Water Meters button and then touch the water meter input 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. For an Autotrol Turbine meter, there is no user information to enter. The NexSys® control system already has the calibration curves built into the system.

- Touch the Change 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.

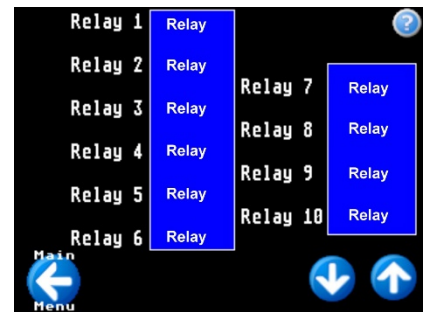
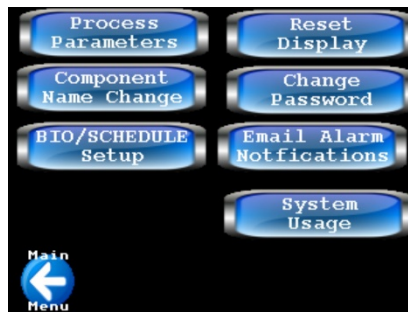
- Touch the Reset Totals button to reset the water meter input total to zero.
- To accept any changes touch the DONE button or to reject the changes touch the Cancel button.



6.10.2 Component Name Change

Changing the name of the installed components makes it easier to keep track of the inputs and outputs. In the Component Name Change menu, the names of: the relay outputs, Water Meter Inputs, Flow Switch Inputs, pH Inputs, Conductivity Inputs, ORP Inputs, 4-20 mA Inputs and 4-20 mA Inputs units of measure are changed.

To access the Component Name Change menu:

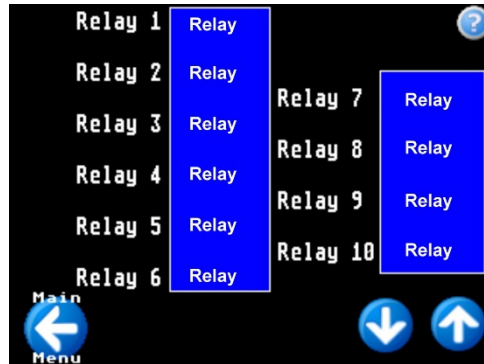


- From the Main Menu, touch the System Parameters button and then touch the Component Name Change button.

Note: Use the arrow buttons to switch between the different Name Change screens.

6.10.2.1 Relay Name Change

The names of the relay outputs can be changed to any name up to 6 characters long.



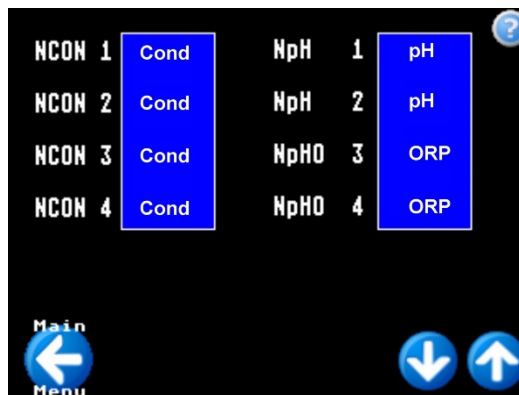
To change the name of a relay output:

- Touch the name of the relay in the blue box and use the keyboard to enter the new name. Touch the OK button to accept.



6.10.2.2 Conductivity, pH, and ORP Inputs Name Change

The names of the pH, Conductivity, and ORP inputs can be changed to any name up to 4 characters long.



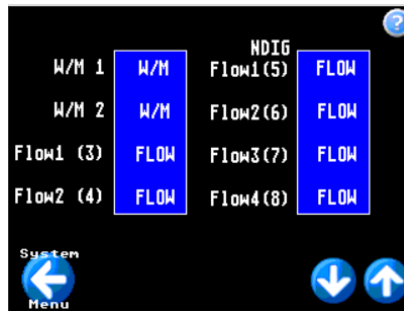
To change the name of a sensor input:

- Touch the name of the input in the blue box and use the keyboard to enter the new name. Touch the OK button to accept.



6.10.2.3 Water Meter and Flow Switch Name Change

The names of the water meter inputs can be changed to any 4 character name and the Flow Switch inputs can be changed to any 5 character name.



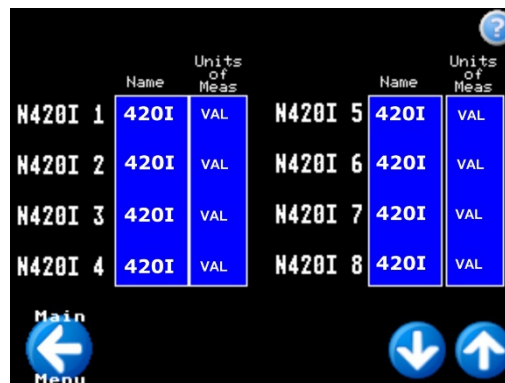
To change the name of water meter or flow switch input:

- Touch the name of the input in the blue box and use the keyboard to enter the new name. Touch the OK button to accept.



6.10.2.4 4-20 mA Inputs Name Change and Units of Measure

The names of the 4-20 mA inputs can be changed to any 4 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:

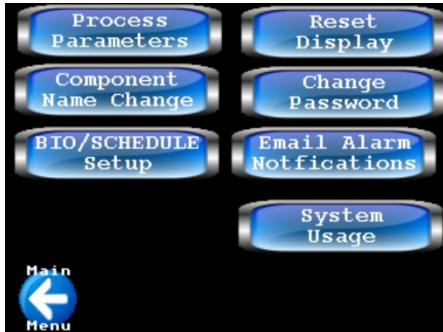
- Touch the name or units of the 4-20 mA input in the blue box and use the keyboard to enter the new name. Touch the OK button to accept.



6.10.3 Reset Display

The Reset Display button in the System Parameters menu is used to reboot the display without resetting the rest of the controller. This may be necessary if the display were to become scrambled or if a change to the display parameters is required (IP address, email enabled, etc...).

To Reboot the Display:



- 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!

6.10.4 Change Password

The NexSys® Control System has a security function to limit access to the Main Menu. 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. The default password is 0000.

To disable the security mode, change the password back to 0000.

To change the password and enable or disable the security:

- Touch the Change Password button in the System Parameters Menu 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.

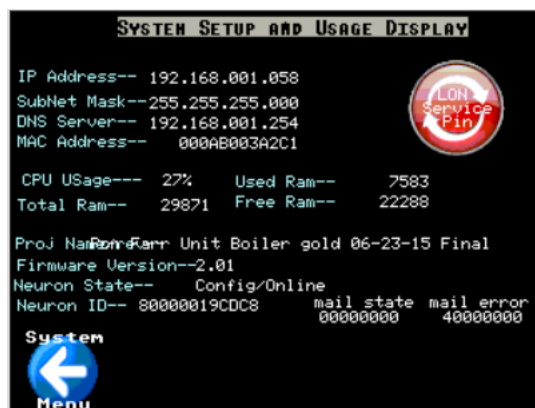
Note: When you change the password, the security mode will be enabled. Make sure you record your password and store it in a safe and secure place.

6.10.5 Alarms/Email Notifications

Alarms and Email Notifications are discussed in section 6.8.

6.10.6 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.



6.10.7 Documentation

The NexSys® Control System has most of the manual and drawings incorporated into the screens. Almost all of the screens have a help screen that is accessed by touching the question mark button on that screen.



There is additional documentation that is available by touching the Documentation button in the Main Menu.



6.11 Boot Menu

The NexSys® Control System has a Boot Menu where functions associated with the Touch Screen display are set. This includes setting the unit to automatically switch to Daylight Saving Time, Check the status of the backup battery, set the Ethernet settings, set the remote access password, enable/disable the E-mail service, recalibrate the touch screen, adjust the display brightness, and adjust the sound.

The Boot menu is accessed by cycling the power to the controller while holding your finger at the top left corner of the display as it reboots. The display will beep when it accesses the boot menu.

The **Main** Boot Menu screen looks like:

MAIN	DATE/TIME	ETHERNET	VNC/MAIL	TOUCH	DISPLAY	EXIT
<h3>Touchlon Offline Menu</h3>						
Firmware Version:					1.96	
Hardware Revision:					02	
Date/Time:		We 17.09.2014 14:75:02				
Ram Usage:					2932/13563kB	
Flash Usage:					3427/12745kB	
CPU Usage:					13%	
Screens Loaded:					137	
Fonts Loaded:					26	
Pictures Loaded:					288	
Texts Loaded:					2597	
LON NeuronID:					80000019CDAA	

It shows the operator information about the display.

The **Date/Time** Button will take the operator the to Date Time screen:

MAIN	DATE/TIME	ETHERNET	VNC/MAIL	TOUCH	DISPLAY	EXIT
<h3>Set Date and Time</h3>						
14:82		17.09.201				
Time Zone Correction (UTC):		-6h				
NTP-Server:		<input type="text"/>				
Daylight Saving:		YES		NO		
Backup Battery:		OK				

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

MAIN	DATE/TIME	ETHERNET	VNC/MAIL	TOUCH	DISPLAY	EXIT
Project IP:		172	016	000	004	
Subnet Mask:		255	255	255	000	
Gateway:		172	016	000	001	
DNS Server:		172	016	000	001	
MAC Address:		000AB003A2B2				
Offline IP:		192.168.000.082				
Subnet:		255.255.255.000 - Gateway: 192.168.000.001				

The **VNC/Mail** button will take the operator to the VNC/e-mail setup screen:

MAIN	DATE/TIME	ETHERNET	VNC/MAIL	TOUCH	DISPLAY	EXIT
VNC AccessKey		VNC Password		VNC	HTTP	
<input type="text"/>		PonFarr		5900	80	
Key Enabled		VNC Enabled		Reset Connection		
E-Mail Enabled						
More e-mail settings coming soon!						

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.

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 or internet access, disable the E-Mail access.

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

The **Touch** button will take the operator to the Touch Screen Calibration screen:

MAIN	DATE/TIME	ETHERNET	VNC/MAIL	TOUCH	DISPLAY	EXIT
<div style="border: 1px solid black; padding: 10px; width: fit-content; margin: auto;"> <p>Recalibrate Touch ?</p> <div style="display: flex; justify-content: center; gap: 20px;"> <input type="button" value="Yes"/> <input type="button" value="No"/> </div> </div>						

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

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

MAIN	DATE/TIME	ETHERNET	VNC/MAIL	TOUCH	DISPLAY	EXIT
Brightness: <input style="width: 100px;" type="text"/>						
Brightness To: <input style="width: 100px;" type="text"/> <input style="width: 50px;" type="button" value="0 sec"/>						
<hr/> Switch Screen: 0000 (Internal no.) <input style="width: 50px;" type="button" value="300"/>						
<hr/> Screensaver: < Slideshow > <input style="width: 50px;" type="button" value="0 sec"/>						
Sound Output: <input type="button" value="Yes"/> <input type="button" value="No"/>						
Sound Volume: <input style="width: 100px;" type="text"/>						
<hr/> Rotate 180°: <input type="button" value="Yes"/> <input type="button" value="No"/>						
Fade Screens: <input type="button" value="Yes"/> <input type="button" value="No"/>						

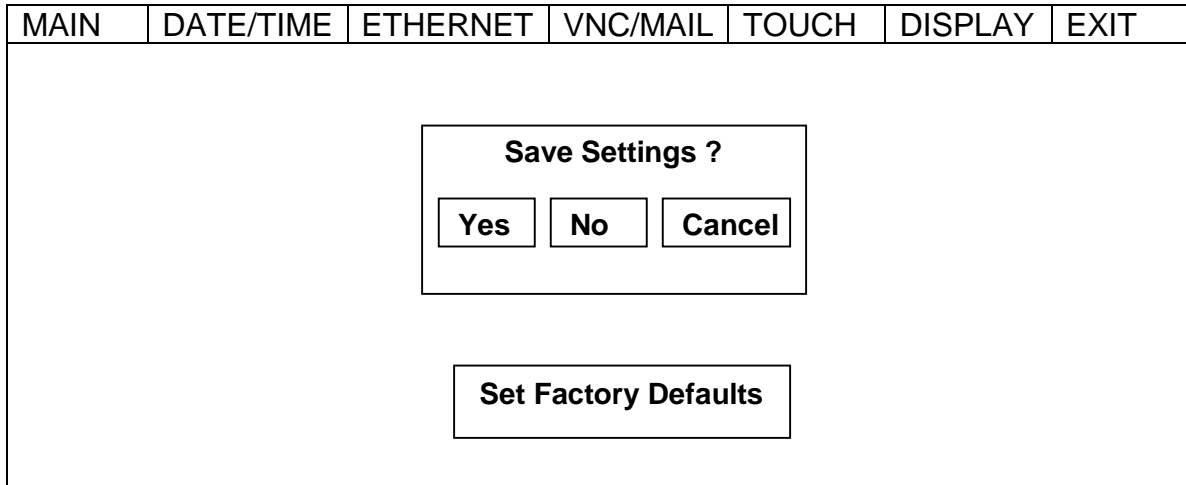
In this screen the operator can adjust the brightness of the display by touching the Brightness button. Touch on the right side of the button to increase the brightness and touch the left side of the button to decrease the brightness.

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 the touch screen makes 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.

IMPORTANT!: Do not touch the Set Factory Defaults button!

This will require reloading the software to the controller!

7.0 Maintenance

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

7.1 Sensor Maintenance

Routine maintenance is necessary in order to maximize the efficiency and accuracy of your sensor.

7.1.1 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 soft steel wire brush. Do not use 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.

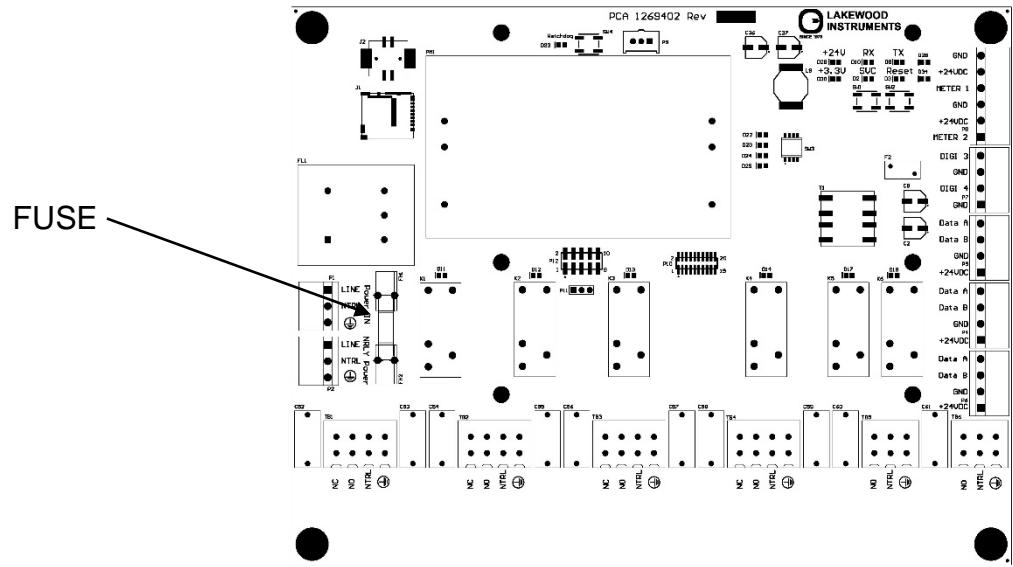
7.1.2 ORP Sensor or pH Sensor

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.

7.2 Replacing the Fuse

The NexSys® Control System contains one 15A, 250V fuse. It is a Littelfuse 0314015.HXP. 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.



8.0 Troubleshooting

8.1 Error Messages


This section discusses some of the more common questions with **The NexSys® 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.	<ol style="list-style-type: none"> 1. Check the High Alarm Value. 2. Check relay setpoints and deadbands. 3. Check operation of blowdown valve. Use the manual relay control to help. 4. Check orifice plates and globe valves.
“Conductivity: LOW ALARM”.	Conductivity is too low with respect to the low alarm setpoint.	<ol style="list-style-type: none"> 1. Check the Low Alarm Value. 2. Check relay setpoints and deadbands. 3. Check blowdown valve is not stuck open.
Water meters not accumulating.	<p>There may be a problem with the wiring or the reed switch in the meter may be bad.</p> <p>For water meters other than the contacting head type, check the manufacturer’s user manual for that particular water meter.</p>	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 1. Check operation of flow switch input by simulating a contact closure. 2. If no flow switch is used, a jumper wire should be installed across the flow switch input. Removing the jumper disables all relay outputs.
Blowdown valve is closed above setpoint.	The valve may not be receiving power or is malfunctioning.	<ol style="list-style-type: none"> 1. Check operation of flow switch input. 2. Check blowdown valve operation. 3. Check relay settings.
Bleed valve is open below setpoint.	High conductivity alarm will force the bleed valve to open.	<ol style="list-style-type: none"> 1. Check High conductivity alarm setpoint. Change setpoint if necessary. 2. Check blowdown valve operation. 3. Check relay settings.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
“COND: Fouled SENSOR”	Conductivity sensor is not reading properly.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 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.	<ol style="list-style-type: none"> 1. 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.	<ol style="list-style-type: none"> 1. See {RLY: TIME OUT}. 2. Check the Low Alarm Value. 3. Check relay setpoints and deadbands. 4. Check chemical drum levels.

9.0 Factory Service

-  Technical Support for Lakewood Instruments can be reached by calling (800) 228-0839 or (414) 355-2807 or faxing (414) 355-3508, or by email at csd@lakewoodinstruments.com Monday through Friday, 7:30 a.m. – 5.00 p.m. Central Time.

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 fill out and submit the authorization form on-line at:

<http://lakewoodinstruments.com/about-lakewood-instruments/rma-request-form/>

- 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.

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 RGA NUMBER WILL BE REFUSED
AND RETURNED TO SENDER**

Parts List and Service Guide

When calling Lakewood Instruments, please have your controller's complete model number and serial number available, together with the firmware version so that the Technician can better assist you.

Refer to the Ordering Information section of this manual for part numbered replacement parts.

Write your controller's complete model number, serial number, and firmware version here so that you will have them available if you wish to contact a Lakewood Instruments technician.

Model Number:

Serial Number:

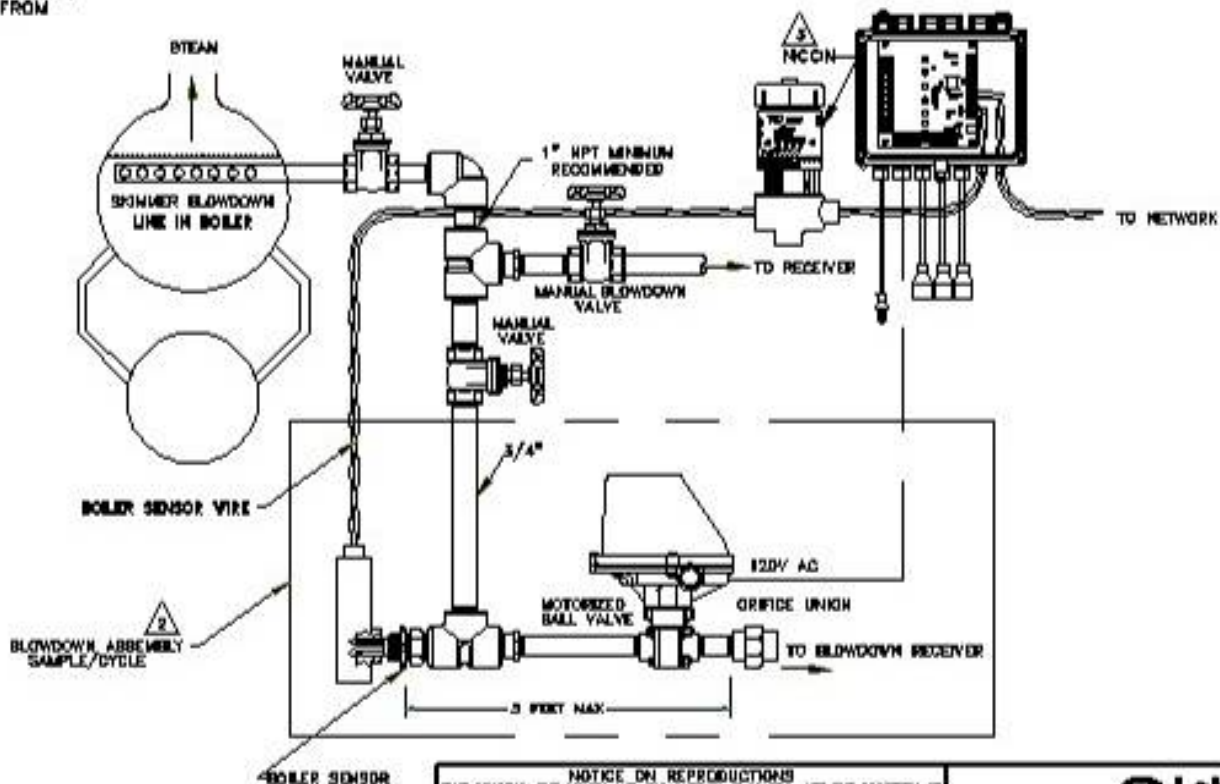
Firmware Version:

10.0 Drawings

NOTES: UNLESS OTHERWISE SPECIFIED:

1. ORIFICE UNIONS MUST BE INSTALLED TO PREVENT STEAMFLASH. REFER TO DRAWING NUMBER 08852 FOR PROPER ORIFICE SIZING.
2. MUST BE LOCATED BELOW THE SKIMMER IN THE POSITION SHOWN.
3. THE NCON MUST BE LOCATED WITHIN 20 FEET OF THE BOILER SENSOR AND AS FAR FROM HEAT AS POSSIBLE.

REVISION HISTORY					
REV	DESCRIPTION	BY	DWN	DATE	APVD
A	RELEASE	10042	PSG	2/07	



NOTICE ON REPRODUCTIONS		
WHEN DRAWING THE DESIGN AND WE MATCHED IT COVERS ARE THE PROPERTY OF		
ORIFICE UNIONS MUST BE INSTALLED TO PREVENT STEAMFLASH. REFER TO DRAWING NUMBER 08852 FOR PROPER ORIFICE SIZING.		
MATERIAL		
TELEPHONE NUMBER		
TYPICAL		
ORDER NO.		
CUSTOMER		
CUSTOMER LOC.		
DO NOT SCALE DRAWING		

Lakewood INSTRUMENTS	
DRAWING - PLUMBING DIAGRAM MODEL 2255a SAMPLE/CYCLE	
SIZE B	DESIGNED BY 1268848_6a
DATE 2/12/07	REV A
SCALE NONE	SHEET 1 OF 1

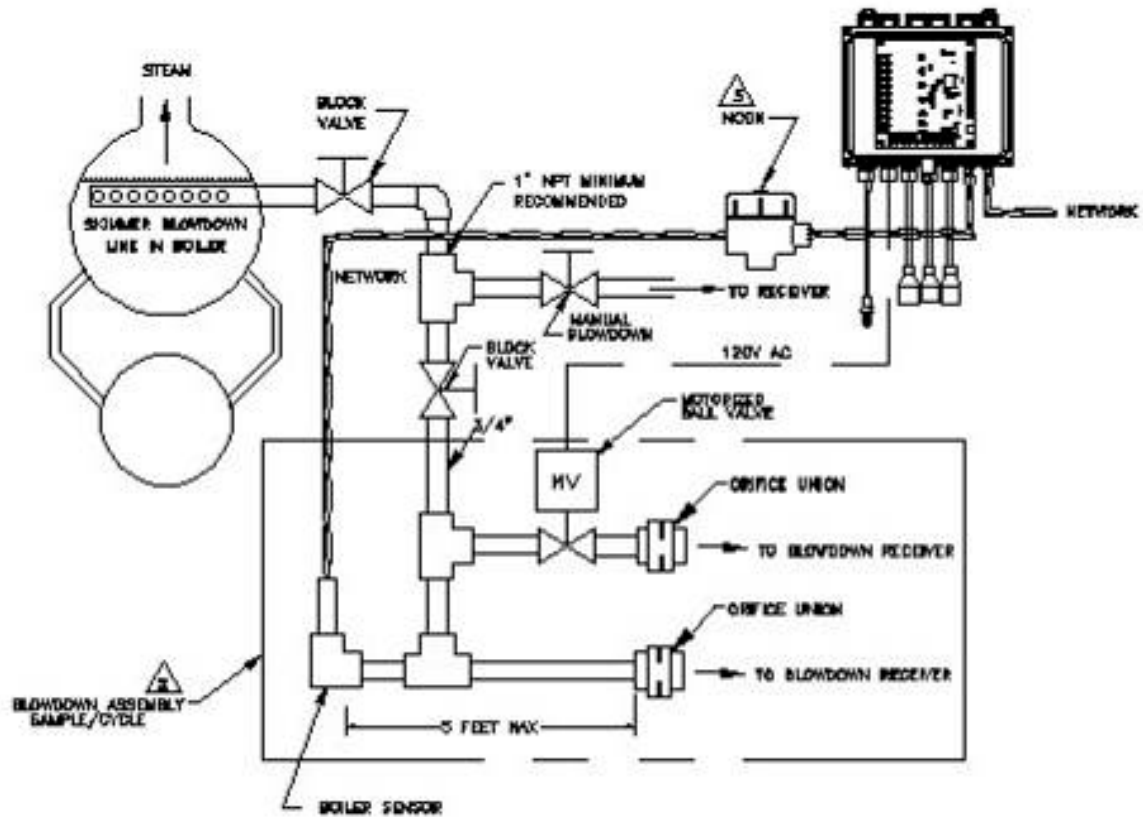
NOTES: UNLESS OTHERWISE SPECIFIED;

1. ORIFICE UNIONS MUST BE INSTALLED TO PREVENT STEAMFLASH. REFER TO DRAWING NUMBER 88952 FOR PROPER ORIFICE SIZING.

2. MUST BE LOCATED BELOW THE SHOWER IN THE POSITION SHOWN.

3. THE NCON MUST BE LOCATED WITHIN 20 FEET OF THE SENSOR AND AS FAR FROM HEAT AS POSSIBLE.

REVISION HISTORY					
REV	DESCRIPTION	BOO	DPK	DATE	APTD
A	RELEASE	1D942	PSG	2/07	



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MATERIAL	TELEPHONE NUMBER: 800-445-1111	
FINISH	SCALE: 1" = 4'-0"	
ORDER NO.	DWN P. GOSCH	DATE 2/12/07
CUSTOMER	CHD	DATE
CUSTOMER LOC.	APVD	DATE
DO NOT SCALE DRAWING	APVD	DATE



DRAWING - PLUMBING DIAGRAM
MODEL 2256
CONTINUOUS

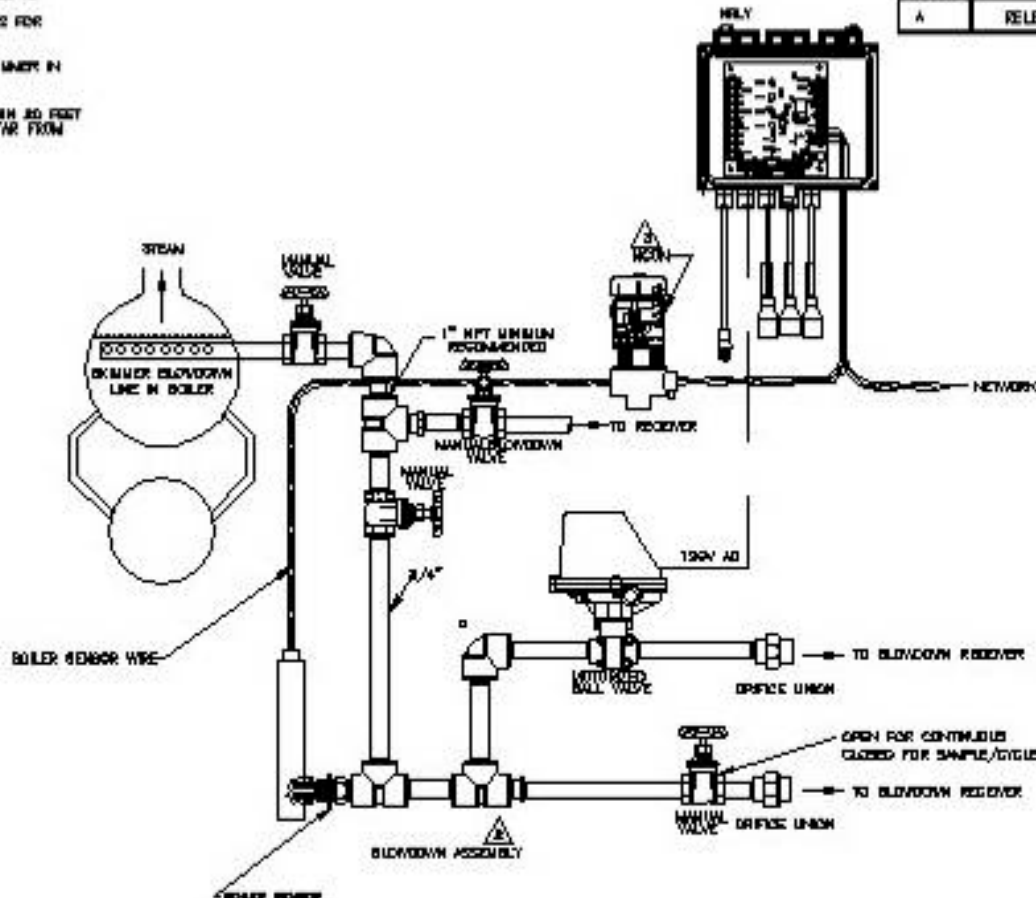
SIZE		DRAWING NUMBER	REV
B		1268646_5a	A
REFERENCE NUMBER		SHEET 1 OF 1	

NOTES: UNLESS OTHERWISE SPECIFIED:

1. ORFICE UNIONS MUST BE INSTALLED TO PREVENT STEAMFLASH. REFER TO DRAWING NUMBER 80332 FOR PROPER ORFICE SIZING.

⚠ MUST BE LOCATED BELOW THE SKIMMER IN THE POSITION SHOWN.

⚠ THE HOSE MUST BE LOCATED WITHIN 20 FEET OF THE BOILER SENSOR AND AS FAR FROM HSD AS POSSIBLE.



REVISION HISTORY					
REV	DESCRIPTION	EGG	D/W	DATE	APVD
A	RELEASE	10342	PSD	9/07	

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 STRICTLY PROHIBITED.

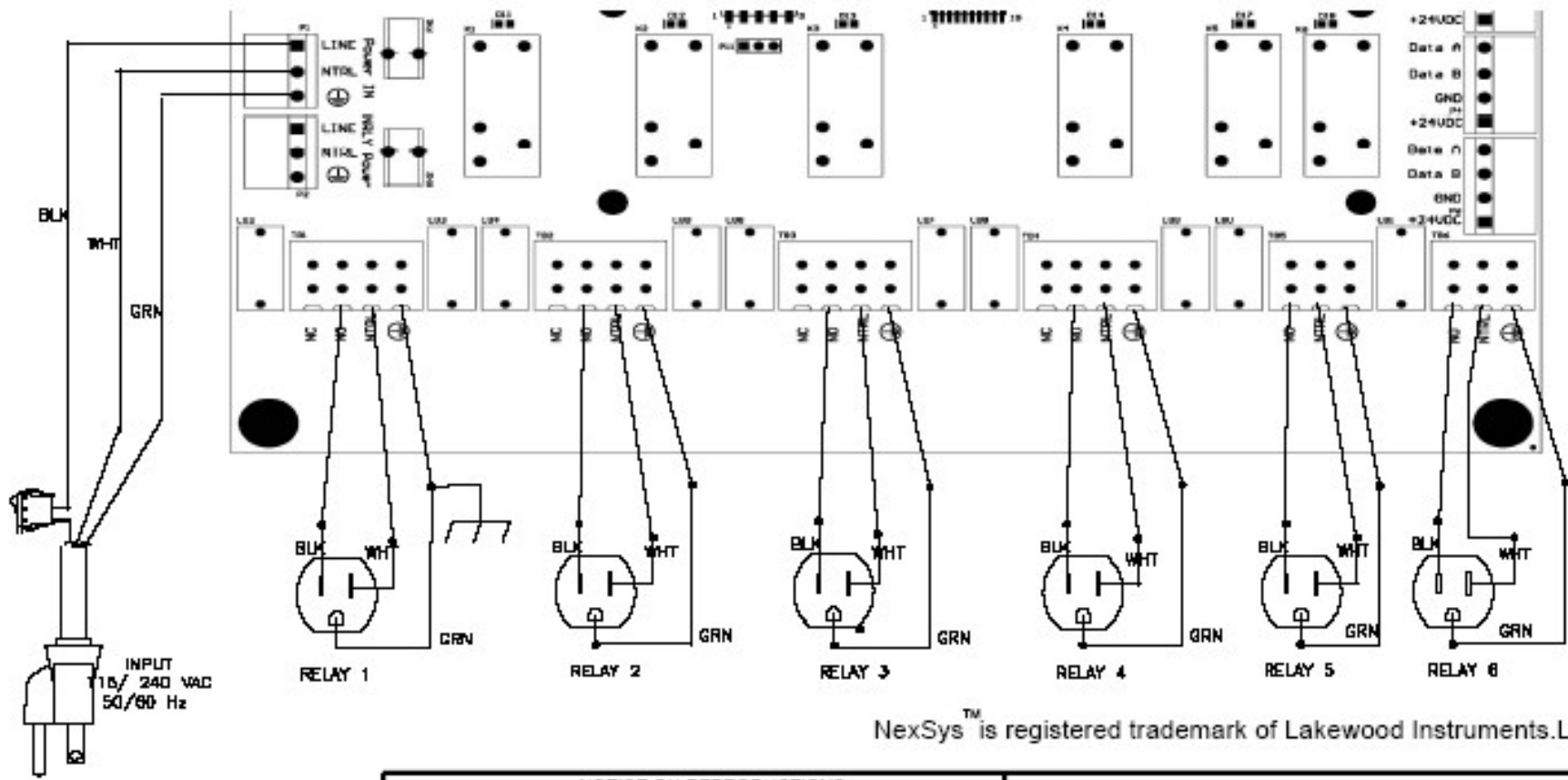


MATERIAL	FRAC	DECIMAL	AMPLIFIER
FINISH		.XX ± .05	
ORDER NO.	D/W	PSD	DATE 9-9-07
CUSTOMER	EGG	D/W	DATE
CUSTOMER LOC.	APVD	D/W	DATE
DO NOT SCALE	APVD	D/W	DATE

TITLE		INSTALLATION LAYOUT		SAMPLE/CYCLE OR CONTINUOUS, M2256	
SIZE	SCALE	DWG NO./REV	1268646_20	REV	A
B	1/8" = 1"	FILE TYPE	DWG	SHEET	1 OF 1

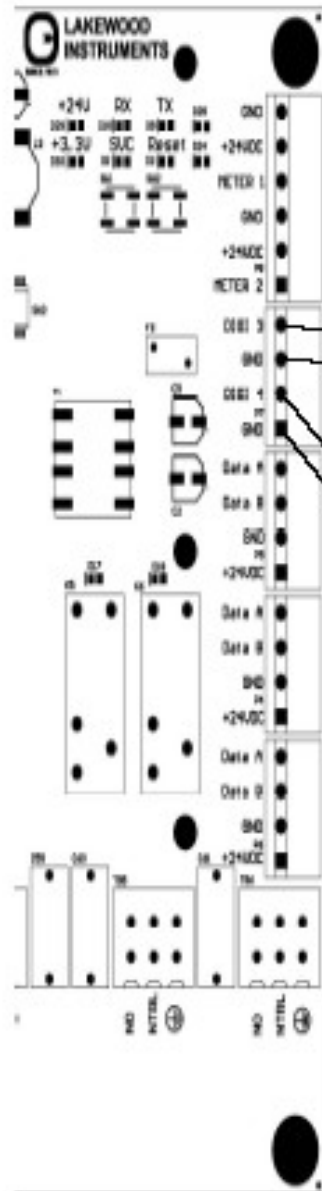
Note: "NC" terminals on relays 1-4 are used to drive motorized ball valves closed. They are powered (hot) whenever the relay is "off" and input power is provided.

REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A	A	RELEASE		TJT 0-11-14	

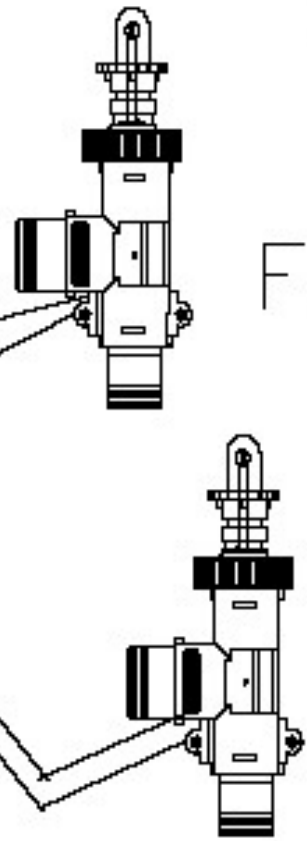


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DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994									
MATERIAL	TOLERANCES UNLESS NOTED-T		TITLE		PN		REV		
	DECIMALS	ANGLES			1269424		A		
FINISH	DWN	PSC	DATE	10-7-08	SIZE	THIRD ANGLE			
	CHKD		DATE		A				
PROJECT:	APVD		DATE		SCALE	SHEET		DWG NO	
LIBRARY:		VERSION			NTS	1		1269424_3a	
								REV	
								A	



REVISION		REVISION HISTORY			
DWG	PAR	DESCRIPTION	EDD	DWN/DATE	APVD/DATE
A	A	ISSUE		WT 8-11-14	LR 8-11-14



Flow 1

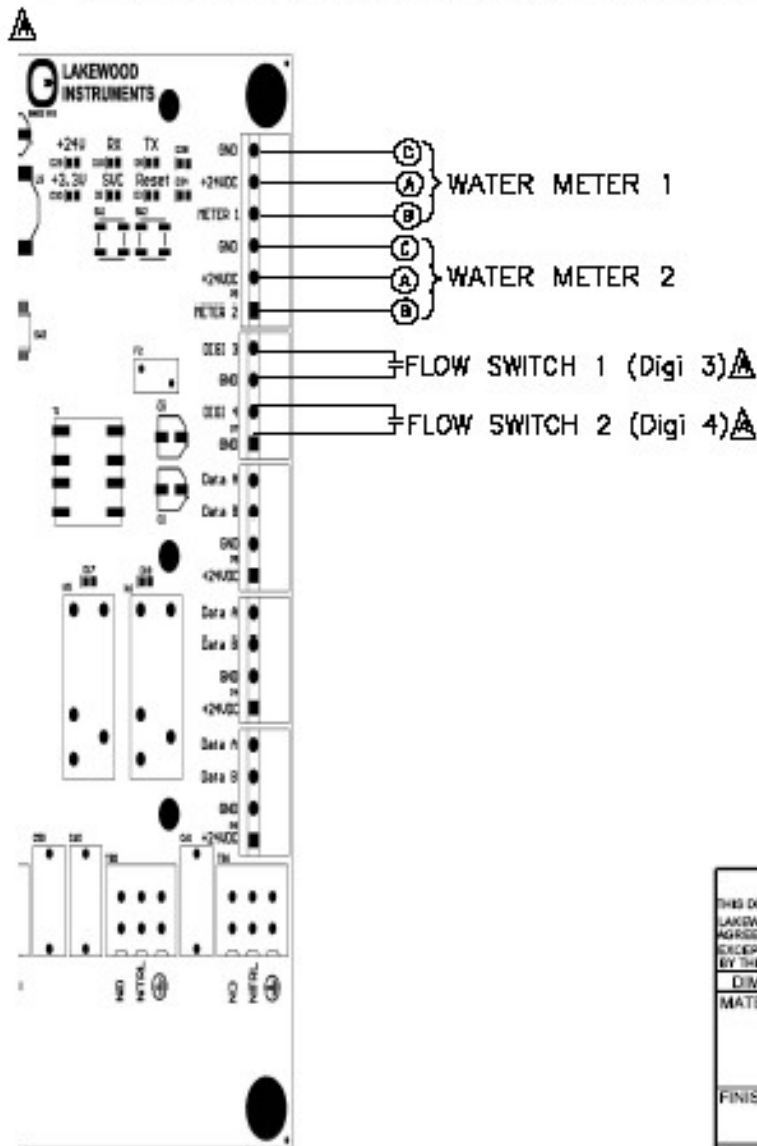
Flow 2

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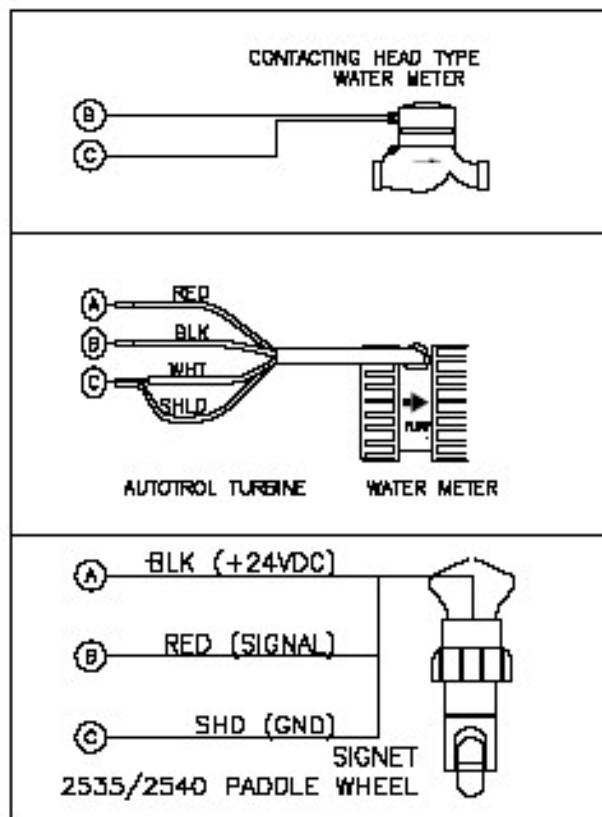
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<p>DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994</p>		<p>TOLERANCES UNLESS NOTED</p>	
MATERIAL:	DECIMALS 0.1 0.00 0.01	<p>TITLE Flow Switch Plumbing wiring NexSys Main Board</p>	
FINISH:	DWN TJT DATE 8-11-2014 CHKD DATE	<p>SIZE A</p>	<p>PN 1269424</p>
PROJECT:	APVD DATE	<p>SCALE NTS</p>	<p>SHEET 1 of 1</p>
LIBRARY:		<p>DWG NO 1269424_8e</p>	<p>REV A E</p>

NOTES: UNLESS OTHERWISE SPECIFIED

IF NO FLOW SWITCH IS USED, SHORT OUT PINS 1 & 2 or 3 and 4 WITH WIRE



REVISION		REVISION HISTORY		
DWG PART	DESCRIPTION	ECO	DWN DATE	APVD DATE
A	RELEASE		TJT 9-11-2014	



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DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994				TITLE: WIRING DIAGRAM FOR WATER METER INPUTS ON NeXSys	
MATERIAL: N/A	TOLERANCES UNLESS NOTED: DECIMALS: <input type="checkbox"/> ANGLES: <input type="checkbox"/> SURFACE: <input type="checkbox"/>	DWN: TJT	DATE: 9-11-14	SIZE: B	PN: 1269424
FINISH: N/A		CHKD:	DATE:	SCALE: NTS	SHEET: 1/1
PROJECT: N/A		APVD:	DATE:	SCALE: NTS	DWG NO: 1269424-9b
LIBRARY: N/A					REV: A
					REV: B

For more information call toll free in the USA (800) 228-0839

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