

LAKWOOD INSTRUMENTS

MODEL 2250e

MICROPROCESSOR-BASED BOILER CONDUCTIVITY CONTROLLER

INSTALLATION & OPERATION MANUAL

SERIAL #: _____



Lakewood Instruments

7838 North Faulkner Road, Milwaukee, Wisconsin 53224 USA

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

<http://www.lakewoodinstruments.com>

Lakewood Instruments™ Model 2250e Controller

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 (side of cooling tower, etc). This can cause water to condense inside the enclosure.
2. Install water meters, chemical pumps, plumbing assemblies and the conductivity sensor (see drawing on back for Boilers).
3. Install the provided strain reliefs with nuts, if necessary, by removing the attached black plugs and inserting strain relief through hole. Wire the conductivity sensor, water meters and 4-20 mA output; if applicable (see drawing on back). Ensure wiring connections are correct or damage may occur.
4. Wire pumps and/or valves directly to the terminals. If using a motorized ball valve, wire as per wiring instructions. Refer to the instruction manual for more details.
5. Apply power to the model 2250e controller, press "**CLR**" twice, press "**7**" System setup, press "**2**" Initialization, press "**2**" Whole controller, press "**1**" Yes. After initialization, press the "**CLR**" key several times until you get to the main menu.
6. Press "**1**" Process, Press "**ENT**". This screen allows manual control of the relay outputs to test the chemical pumps and valves. Press "**CLR**" to return to the Process screen.
7. To calibrate the conductivity take a sample with a handheld conductivity meter, press the "**PRO**" button and type in the conductivity value, press "**ENT**". If the sample/cycle method is used, energize the blow relay, if necessary. See instruction manual for more details.
8. Program the model 2250e relays for conductivity control and chemical feed schemes. See instruction manual for more details.

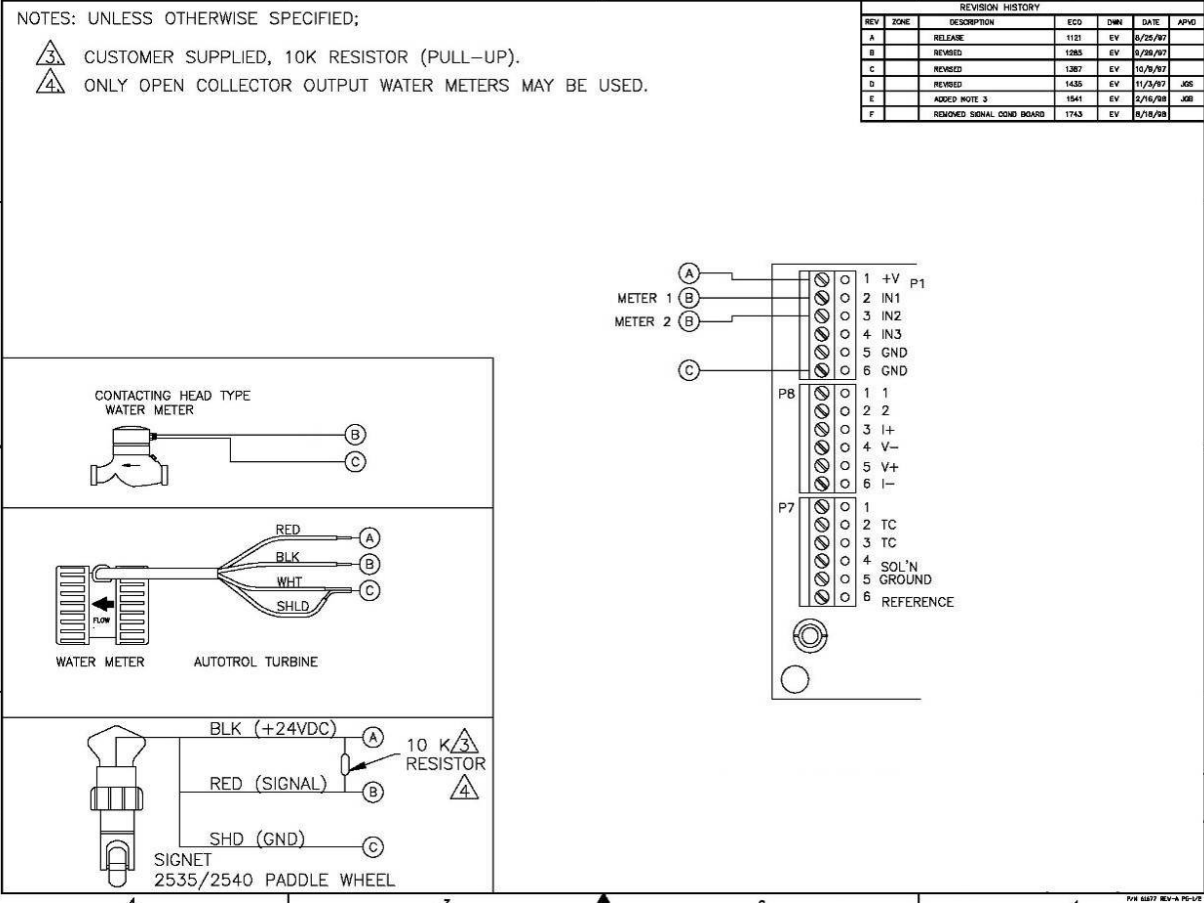
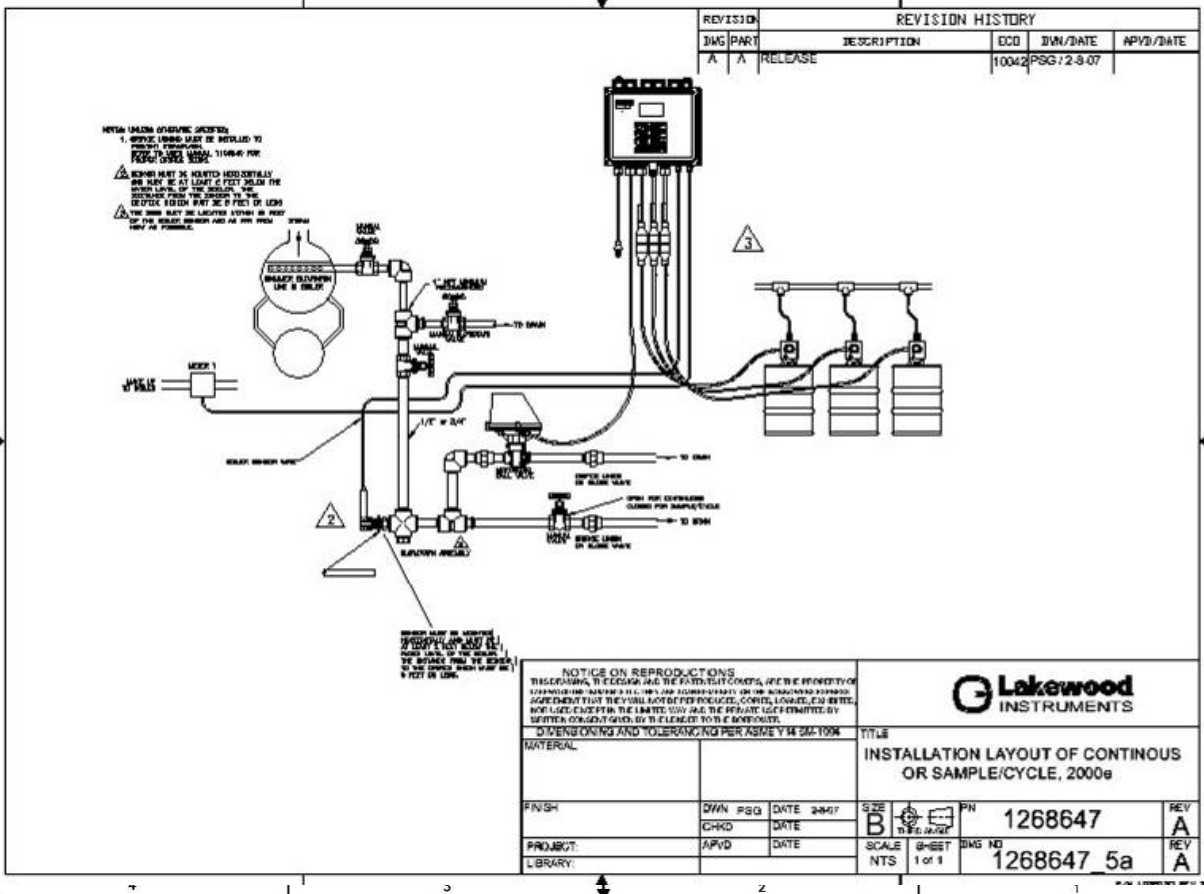


FIGURE A

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 faxing (414) 355-3508, Monday through Friday, 7:30 a.m. - 5:00 p.m. CST. Our E-mail address is csd@lakewoodinstruments.com.**

 **Mail should be sent to:**

**Lakewood Instruments
7838 North Faulkner Road
Milwaukee, WI 53224 USA**

MODEL 2250e

Table of Contents

1.0 Introduction	8
2.0 Features, Benefits and Specifications	9
2.1 Features	10
2.2 Benefits	10
2.3 Specifications	11
2.4 Ordering Information.....	12
3.0 Unpacking, Mounting and Installation	13
3.1 Unpacking	13
3.2 Mounting the Enclosure.....	13
3.3 Plumbing Installation	14
3.3.1 Sample/Cycle plumbing Installation with SR2 sensor	15
3.3.2 Sample/Cycle plumbing Installation with SR4 sensor	16
3.3.3 Continuous Sample plumbing Installation with SR2 sensor	16
3.3.4 Continuous Sample plumbing Installation with SR4 sensor	17
3.3.5 Plumbing Installation for Sample/Cycle and Continuous Sample.....	17
3.3.6 Blowdown Valve Sizing.....	18
3.4 Electrical Installation	19
3.4.1 Incoming power 115/230 VAC	19
3.4.2 Relay Outputs	19
3.4.3 Flow Switch Wiring.....	20
3.4.4 Water Meter Wiring	20
3.4.5 4-20 mA Output Wiring.....	20
3.4.6 Sensor Wiring.....	21
3.4.7 Node Wiring	21
4.0 Functional Overview.....	22
4.1 Display.....	22
4.2 Keypad	22
4.3 Menu	22
4.4 Security Levels	23
5.0 Starting Up the Controller.....	23
6.0 Operation of Controller	24
6.1 Process Screen	24
6.2 Manual Operation of the Relays	25
6.3 Calibration of CONDUCTIVITY	26
6.3.1 Calibration	26
6.3.1.1 Calibration in the continuous sample mode.....	26
6.3.1.2 Calibration in the sample/cycle mode.....	26
6.3.2 Calibration Check in Buffer Solutions	27
6.3.3 Conductivity vs. ppm	28
6.4 Main Menu.....	29

6.5 Configuring the Relays	30
6.5.1 Configuring the Blowdown Relay.....	30
6.5.1.1 Setpoint.....	30
6.5.1.1.1 Setpoint	31
6.5.1.1.2 Deadband.....	31
6.5.1.1.3 Blowdown Timeout	31
6.5.1.1.4 When to Activate	32
6.5.1.2 Boiler Options	32
6.5.1.2.1 Setting up for Sample/Cycle Control	33
6.5.1.2.2 Setting up for Continuous Sample Control	34
6.5.1.3 Change My Name	34
6.5.2 Configuring Relays 2, 3, 4	35
6.5.2.1 Disabled	35
6.5.2.2 By Setpoint.....	35
6.5.2.2.1 Setpoint.....	36
6.5.2.2.2 Deadband	36
6.5.2.2.3 Overfeed Time	36
6.5.2.2.4 When to Activate	37
6.5.2.3 By Water Meter	37
6.5.2.4 By Percent of Blowdown	37
6.5.2.5 By Percent of Time.....	38
6.5.2.6 By Feed Schedule.....	39
6.5.2.7 As an Alarm Relay	39
6.5.2.8 Change My Name	40
6.5.3 Setting up the Feed Schedule.....	41
6.5.4 Alarms	43
6.5.5 Water Meters	44
6.5.6 4-20 mA Outputs.....	45
6.5.6.1 Setup of the 4-20 mA Output	45
6.5.6.1.1 Set the 4-20 mA Range.....	46
6.5.6.1.2 Calibrate	46
6.5.6.1.3 Which Process?	46
6.5.6.1.4 Manual Control	47
6.5.6.1.5 Change My Name	47
6.5.7 The System Setup Menu	47
6.5.7.1 Process Parameters.....	47
6.5.7.1.1 Change My Name	47
6.5.7.1.2 Anti-Steam Flash.....	44
6.5.7.1.3 Preamp Setup	44
6.5.7.1.4 Temp Compensation	44
6.5.7.1.5 Cell Constant.....	44
6.5.7.2 Initialization	49
6.5.7.3 Digital Inputs	49
6.5.7.4 Firmware Versions	50
6.5.7.5 Change the Security Passwords	50
6.5.7.6 Diagnostics	50

6.5.7.7 Communications	51
6.5.7.7.1 Com Port Setup.....	51
6.5.7.7.2 Initialize Modem	52
6.5.7.7.3 Remote Password.....	52
6.5.7.8 Node Installation	52
6.5.8 Setting the Clock.....	53
6.5.9 Changing the Security Levels	54
7.0 Maintenance.....	55
7.1 Sensor Maintenance.....	55
7.2 Replacing the Fuse	55
8.0 Troubleshooting	56
8.1 Error Messages	56
9.0 Factory Service	58
10.0 Drawings	
10.1 Plumbing Diagram Sample/Cycle.....	1268648-2a
10.2 Plumbing Diagram Continuous.....	1268648-3a
10.3 Plumbing Diagram Continuous or Sample Cycle	1268647-5a
10.4 Wiring Diagram, Sensor Wiring	67909
10.5 Wiring diagram for water meter inputs	1104607
10.6 Electrical Schematic.....	1268647-1a
10.7 Electrical Schematic.....	1268647-2a
10.8 Wiring Diagram RS2L Option	1169899
10.9 Wiring Diagram RS2L Option.....	1169900
10.10 Wiring Diagram 4-20 mA output, 35L.....	69954
10.11 Wiring Diagram NIN Option.....	04263

1.0 INTRODUCTION

The Model 2250e is a LONWORKS Technology, microprocessor based, menu driven, conductivity water treatment controller designed for use in boilers. The Model 2250e provides for conductivity tracking and control, flow monitoring and chemical injection. The Model 2250e is CSA and ANSI/UL approved.

The Model 2250e uses the latest in microprocessor capability, giving the user a high level of application flexibility. A large illuminated graphics screen, multiple inputs, and an intuitive menu characterize this new technology.

Security features allow full access to programming features or restrict access to viewing only. An operator password can help ensure that only authorized personnel will operate the system.

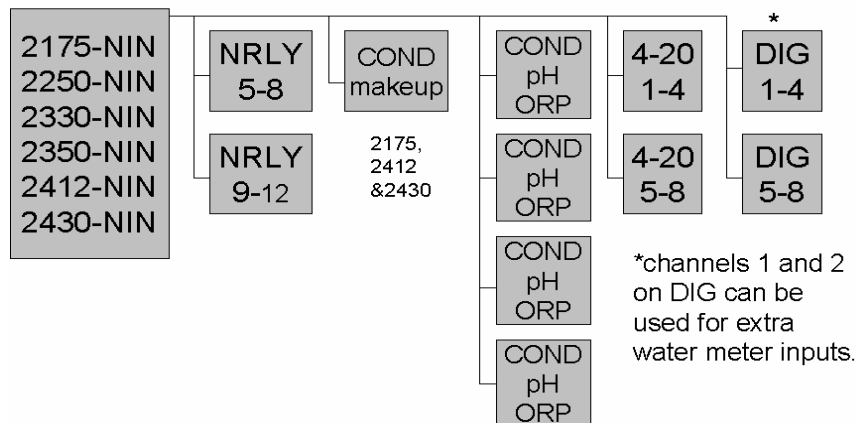
The Model 2250e is user-friendly with a graphical screen and 16-key numeric keypad. It accepts multiple inputs and is easily configured. This controller can easily be upgraded in the field. It's a combination of reliability, accuracy, security and simplicity.

LONWORKS Technology gives you a high level of flexibility with the capability of adding nodes, additional inputs and outputs, for monitoring and control. These nodes have functions such as extra relay outputs, drum level inputs, pH inputs, conductivity inputs, ORP inputs, 4-20 mA inputs and water meter inputs.

Nodes are added, using the –NIN option, according to a mapped network. The mapped network shows the full node addition capability of the LonWorks based 2000 series controllers.

The mapped network for the model 2250e shows that any or all of the following nodes can be added; two relay nodes, two 4-20 mA input nodes, two digital input nodes, four remote sensor nodes (any combination of pH, conductivity, or ORP), and one makeup conductivity node.

The complete mapped network is shown below.



2.0 Features, Benefits, Specifications



LOCK SCREWS

The lock screws keep your circuit boards secure and provide easy access for wiring and setup. Simply turn the lock screw and pull open the front panel.

16-BUTTON KEYPAD

ENT = for Menu selection and/or acceptance of selected values.

CLR = to exit a Menu selection and/or skip input options.

DSP = to change languages.

PRO = to program a Menu selection.

ENCLOSURE

A sturdy NEMA 4X rated enclosure protects your controller. Make sure it is properly mounted (SEE: **INSTALLATION; Mounting**). The power cord and receptacles can be removed so that the controller can be hardwired through $\frac{1}{2}$ " conduit knockouts.

Figure 1: **Model 2250e**

2.1 FEATURES

- Sample/cycle or continuous conductivity control of blowdown.
- Steam flashing detector and compensation.
- Two (2) water meter inputs. Records both makeup (**MTR1**) and Blowdown (**MTR2**) water meter total gallons.
- Configure Blowdown water meter (**MTR2**) as second makeup meter.
- One relay configured for blow down and three user configurable relays for conductivity control and chemical addition. These relays can be configured in multiple ways including scheduled feed for biocide addition
- Blowdown Relay options:
 - Bleed x gallons for every x gallons makeup
 - Bleed x minutes for every x gallons of makeup
 - Bleed by setpoint
- User-selectable relay options:
 - Feed by setpoint, direct or reverse
 - Water meter actuated feed. **MTR1**, **MTR2** or the sum of the two
 - Percent of blowdown time
 - Percent of Time feed
 - Feed Schedule timer
 - General alarm
- Three security levels: View only, operator, technician
- 4-20 mA output available as an option.
- Remote communications available as an option.
- 16-key numeric keypad and illuminated graphical display allow for quick and easy programming.
- The Model 2250e controller 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 2250e includes a battery backup device to retain information such as water meter totals, and clock and calendar information. Battery life is approximately 3 months if no power is applied to the controller.

2.2 BENEFITS

- Multiple control options in a single economical package.
- Very accurate control of chemical feed and boiler conductivity.
- Control results in fuel savings by preventing excessive blowdown.
- Prevents carryover due to excessive conductivity.
- Very low maintenance.
- Tolerant to power surges and brownouts.
- There is plenty of protected room inside the enclosure for electrician wiring.
- Two water meter inputs provided.
- Has expansion slots to add additional control, such as additional relay outputs, 4-20 mA outputs, remote sensor inputs, digital inputs, and 4-20 mA inputs.

2.3 Specifications

Conductivity range

0-8000 μ S

Conductivity Accuracy

\pm 40 μ S

Conductivity Resolution

10 μ S

Accuracy & Repeatability

\pm 1.0% of scale

Deadband/Setpoint

User programmable

Auto/Manual outputs

Menu selectable

Keypad

16 - key push buttons

Display

Illuminated 128 x 64
pixel LCD

Water meter inputs (2)

Contact head, paddle wheel or turbine

Timer

Relay run time exceeded.

Output relays

1 Blowdown

3 selectable use

Relay ratings

3A each, 10A total

Power

120/240 VAC 50/60 Hz 6W

Ambiant temp

32° - 158°F (0 - 70°C)

Storage temp

32° - 158°F (0 - 70°C)

SR2 Boiler Sensor Ratings

Pressure - 600 psi

Max. Temperature - 486°F

Body - Carbon Steel

Electrodes - 416 S.S.

Insulator - PEEK

Languages

Selectable:

English, plus one of:

Spanish

German

French

Enclosure

NEMA 4X

2.4 Ordering Information

2250e LONWORKS Technology-based cycle/sample or continuous blowdown conductivity controller. Range is 0-8,000 μ S, has HIGH/LOW alarms, water meter inputs and chemical feed relays. Requires SR2 or SR4, below, and PL5 or PL6 is recommended.

CONTROLLER OPTIONS

- 35L Two 4-20 mA outputs configurable for remote data acquisition of Conductivity
- RS2L Communications node with shareware software
- NIN Network interface node. Allows 2 **NRLY**, 1 **Makeup NCON**, 4 sensor nodes (**NpH** or **NCON**), 2 **N420I** and/or 2 **NDIG** to be added.

SENSOR OPTIONS (recommended, select one below)

- SR2 Boiler water sensor, $\frac{3}{4}$ inch NPT, and elbow. Rated to 486°F @ 600 psi (cannot be used after a sample cooler).
- SR4 4-electrode sensor, $\frac{3}{4}$ inch NPT. Rated to 392°F @ 250 psi. For use with a sample cooler.

LANGUAGE OPTIONS (optional, choose one, English and Spanish Standard)

- EF English and French.
- EG English and German.

REMOTE NODE OPTIONS (optional, MUST purchase -NIN Option)

- NRLY Four additional relays with enclosure (2 allowed per 2000 Series Controller).
- NpH pH/ORP node for a pH or ORP sensor.
- N420I 4-20 ma input node for up to 4 4-20 ma inputs.
- NDIG Digital input node for up to 4 digital inputs.
- NCON Conductivity node for makeup water or closed loop control (node only).
- NCKT Conductivity node for makeup water or closed loop control with PVC sensor, tee and enclosure. Maximum water pressure is 140 psi @ 100 °F. Maximum temperature is 140°F.

NOTE: NOT FOR USE WITH MULTIPLE COOLING TOWERS.

SOFTWARE AND EXTERNAL MODEMS

- LRWS *Windows*-based software for computer to communicate with 2000 Series Controllers
- MD4X High-Baud modem in NEMA 4X enclosure ready to power
- MD High-Baud modem for use with 2000 Series Controllers

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 Model 2250e controller is started up.

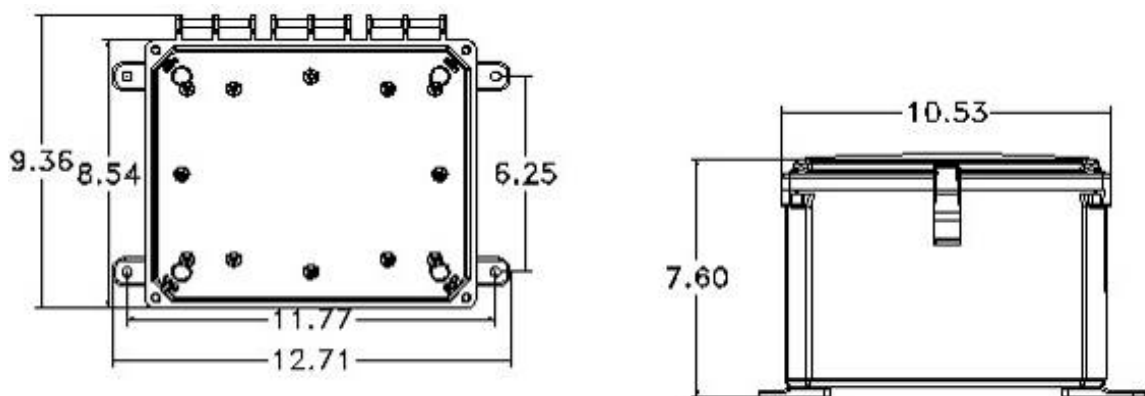
☎ If shipping damage has occurred, call the Lakewood Instruments Customer Service Department at (800) 228-0839 and return the controller to the factory in the original carton.

3.2 Mounting the Enclosure

The Model 2250e is supplied with four mounting feet. The Model 2250e 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 dimensions of the enclosure in inches are:



The model 2250e has a shipping weight of about 8 lbs.

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

3.3 Plumbing Installation

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

The model 2250e can be used for either sample/cycle control or continuous sample control of the conductivity in the boiler. 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, continuous sample, and a method that covers both methods of control.

For each method of blowdown control, the controller can use either the model SR2 boiler sensor for hot (>200°F) samples or the model SR4 temperature compensated boiler sensor for cooled (<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 controller and the sensor is 20 ft.

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 down stream 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 3.3.6 for the orifice sizing chart

3.3.1 Sample/Cycle plumbing Installation with SR2 sensor

To use the model 2250e boiler controller in the sample/cycle 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 SR2 boiler sensor with a sample cooler. The SR2 does not have temperature compensation and requires a temperature >200°F for proper operation.

Description of sample/cycle plumbing installation:

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

3.3.2 Sample/Cycle plumbing Installation with SR4 boiler sensor

The model 2250e can be used with the model SR4 temperature compensated boiler sensor. The SR4 sensor should be mounted down stream of a sample cooler. The temperature compensation is limited to about 200°F.

Note: For proper operation, the sample cooler should have adequate flow to ensure a constant output temperature of <200°F.

Description of sample/cycle plumbing installation:

The sample line should come out of the surface blowdown line and go to the sample cooler and then the boiler sensor. The sensor should be mounted horizontally. Down stream of the sensor on a horizontal pipe should be mounted the blowdown valve and then the flow restriction device (orifice union and plate, or globe valve). The flow restriction device should be mounted within 5 feet of the sensor. Down stream of the flow restriction device is the blowdown receiver or drain.

3.3.3 Continuous Sample plumbing Installation with SR2 boiler sensor

To use the model 2250e boiler controller in the continuous sample mode, the plumbing installation must be done in accordance with the suggested installation drawing in the back of this manual. It is very important to complete the plumbing installation exactly as it is shown in the drawing because improper installation can cause steam flash to occur which will cause erratic conductivity readings. It is recommended that the Lakewood Instruments model PL6 or PL675 plumbing assembly be used.

Description of continuous sample plumbing installation:

The sample line should come out of the surface blowdown line and drop straight down to at least 2 to 3 feet below the water level of the boiler. At the bottom of that line the sensor should be mounted horizontally. Down stream 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. Down stream 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.

3.3.4 Continuous Sample plumbing Installation with SR4 boiler sensor

The model 2250e can be used with the model SR4 temperature compensated boiler sensor. The SR4 sensor should be mounted down stream of a sample cooler. The temperature compensation is limited to about 200°F.

Note: For proper operation, the sample cooler should have adequate flow to ensure a constant output temperature of <200°F.

Description of continuous sample plumbing installation:

The sample line should come out of the surface blowdown line and go to the sample cooler and then the boiler sensor. The sensor should be mounted horizontally. Down stream 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. Down stream 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.

3.3.5 Plumbing Installation for Sample/Cycle and Continuous Sample

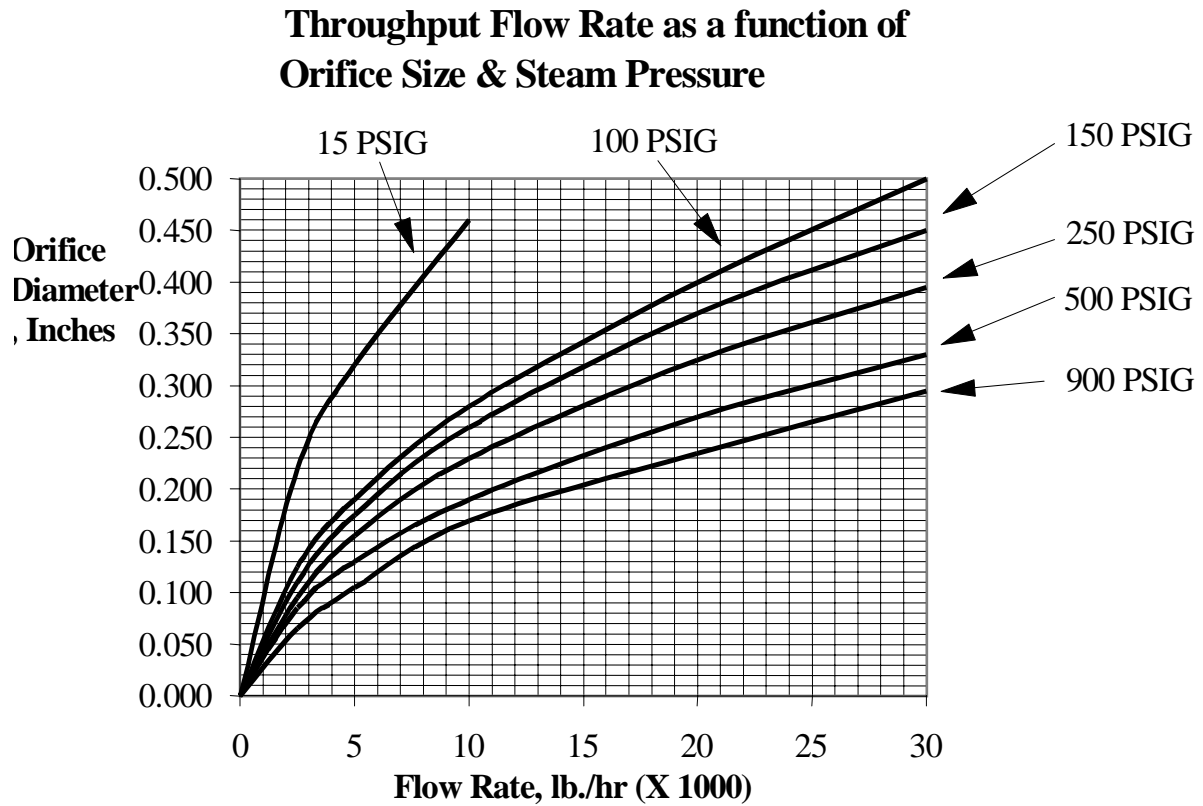
Sometimes it is necessary to switch the controller from sample/cycle to continuous sample mode or vice versa due to steaming loads. This method of plumbing allows the operator to change modes of operation by changing the position of just one valve and setting up the controller for the appropriate mode of operation. The description below is for use with the SR2 boiler sensor but, it can be modified for use with the SR4 boiler sensor.

Description of plumbing:

The sample line should come out of the surface blowdown line and drop straight down to at least 2 to 3 feet below the water level of the boiler. At the bottom of that line the sensor should be mounted horizontally. Down stream 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. Down stream 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. Down stream of the flow restriction device is the blowdown receiver or drain.

3.3.6 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 Model 2250e can be powered from either 115 VAC or 230 VAC at 50/60 Hz. The Model 2250e controller comes with a power cord and receptacles. The power cord and receptacles are rated for 115VAC. If the controller will be powered by 230 VAC, the power cord and receptacles will need to be removed and the incoming power and the relay outputs will need to be hard-wired.

The incoming power is connected to terminal block TA at the bottom right corner of the power supply board. There is a hot or line input (terminal 4), a neutral input (terminals 2 and 3) and an earth ground input (terminal 1). The hot is wired to the fuse holder located on the bottom of the enclosure. The neutrals are wired directly to terminals 2 and 3 of terminal block TA. Refer to the drawing in the back of this manual for wiring instructions.

3.4.2 Relay Outputs

The relay outputs are of the same voltage as the power input. 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 receptacle on the far left is relay #1 and the receptacle on the far right is relay #4. On the power supply board, relay #4 is on the far left and relay #1 is on the far right. Relay #1, 2, 3, and 4 are identified as K1, K2, K3 and K4 respectively on the power supply shield. If 115 VAC is used simply plug your devices into the molded receptacles. If 230 VAC is used, remove the receptacles and hard-wire your devices to the relay outputs.

Relay #1 is dedicated as the blowdown relay and should be used to control the boiler blowdown valve. Relay #1 is the only relay that has the boiler timing functions for sample/cycle control.

Relay #1 and #2 have both a normally open and normally closed contact. 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. The other two relays only have a normally open contact. Each relay output requires a neutral connection and an earth ground connection for proper operation.

Refer to the drawing in the back of this manual for wiring instructions.

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

WARNING! DO NOT CONNECT 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 THE -HR OPTION WITH 25-AMP-RATED INTERPOSING RELAYS. CONTACT LAKEWOOD INSTRUMENTS FOR SPECIAL INSTRUCTIONS.

3.4.3 Flow Switch Wiring

The model 2250e has a flow switch input. The purpose of the flow switch input is to disable the relay outputs when activation is not desired. The flow switch input requires a dry digital contact. Any dry digital contact rated for 24 VDC and 500 mA may be used, such as a manual switch or an auxiliary contact from the boiler control system.

If a flow switch is not used then a jumper must be installed across the flow switch connections. Refer to the drawings in the back of this manual for wiring instructions.

3.4.4 Water Meters

The Model 2250e will accept two water meter inputs. These inputs can be configured for make-up, make-up Second Source, or blow down. Refer to the water meter manufacturer's manual for plumbing information.

The 2250e series controllers will work directly with the following types of meters: dry contacting head meters, Seametrics open collector output meters, Signet 2535, 2536 and 2540 paddle wheel meters, and the Autotrol 1 inch and 2 inch meters. Contact Lakewood Instruments for other types of water meters. The water meters are wired to terminal block P1 which is the top terminal block on the I/O board.

Refer to the drawing in the back of this manual for wiring instructions.

3.4.5 4-20 mA Output Wiring

If the -35L option is ordered, the model 2250e has two channels of 4-20 mA output. This output can be isolated (externally powered) or non-isolated (internally powered). The 4-20 mA outputs are wired directly to the -35L option card.

Refer to the drawing in the back of this manual for wiring instructions.

3.4.6 Sensor Wiring

The model 2250e can be used with the 2-electrode boiler sensor for hot (>200°F) samples, or with the 4-electrode boiler sensor for cooled (<200°F) samples.

The 2-electrode boiler sensor uses four wires between the sensor and the controller. Two wires are connected to each electrode. The sensor wires are connected to terminal block P8 terminals 3, 4, 5, and 6. Refer to the drawing in the back of this manual for specific wiring instructions.

The 4-electrode boiler sensor uses six wires between the sensor and the controller. One wire is connected to each electrode and two wires are used for the temperature compensation. The sensor electrode wires are connected to terminal block P8 terminals 3, 4, 5, and 6. The temperature compensation wires are connected to terminal P7 terminals 2 and 3. Refer to the drawing in the back of this manual for specific wiring instructions.

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

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

3.4.7 Node Wiring

If the –NIN option is ordered with any external nodes (NpH, NCON, NRLY, NDIG, or N420I) they must be wired to the controller before installation and programming can take place. Nodes require +24 VDC for operation and twisted pair wire for data transmission. The NIN option card can provide the +24 VDC for up to two nodes using non-twisted pair wire. If using three or more nodes an external +24 VDC power supply run in parallel is recommended.

Recommended twisted pair 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.

Nodes are wired directly to the NIN card inside the controller enclosure.

Please refer to the diagram in the back of this manual for wiring instructions.

4.0 Functional Overview

4.1 Display

The model 2250e uses an illuminated 128x64-pixel LCD digital display for ease of viewing. It has multiple lines to display information such as the conductivity reading, alarms, relay status, relay configuration, clock, flow totals for both water meters, and menu selections.

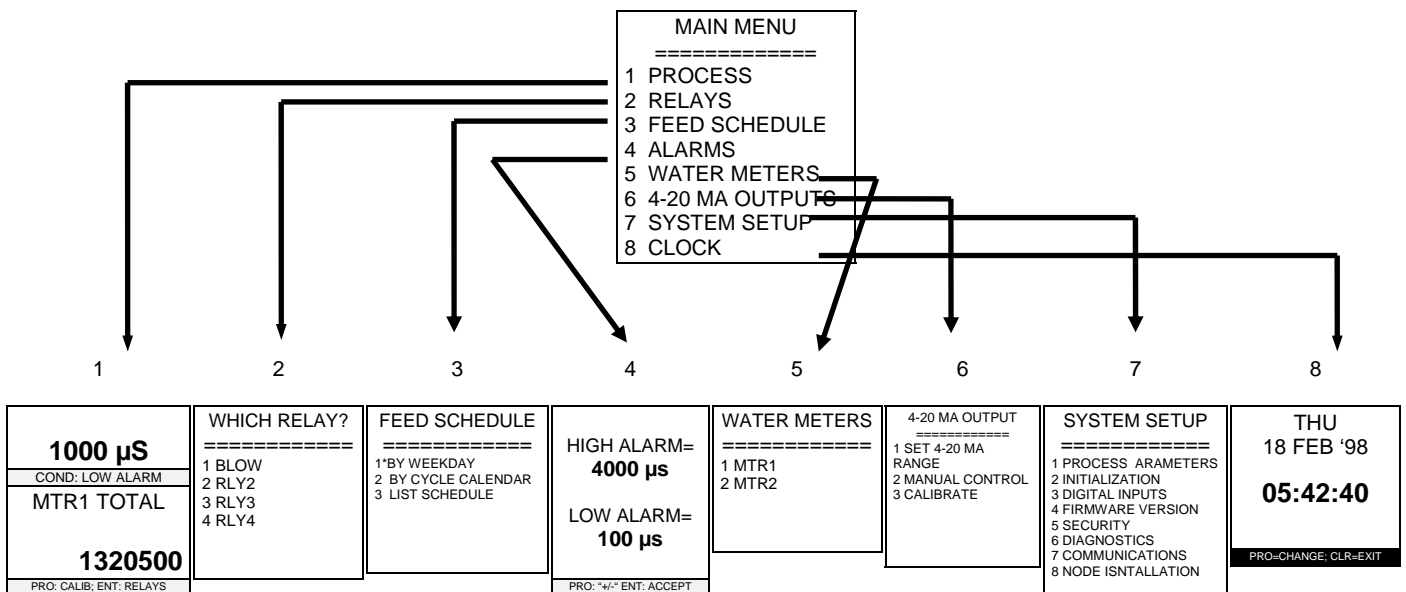
4.2 Keypad

The model 2250e uses a 16-key numeric keypad for ease of programming. The keys have the following functions:

ENT	To accept a setting or to enter a screen.
CLR	To exit a screen or to access the main menu.
PRO	To calibrate the controller.
DSP	To change languages.
UP arrow	To move about in the menu.
DOWN arrow	To move about in a menu.
Number keys	To input a value or to select a menu item.

4.3 Menu

The model 2250e is programmed and calibrated by the use of a menu. The complete **Main Menu** has 8 available options that can be accessed in the **Technician Level**. However, a list of only six options can be viewed at one time. Use the **↑** and **↓** keys to scroll through the options. As an introduction, here is a graphic overview of the first level of each option in the **Main Menu** to see how it operates. Complete details of each option are provided later in this manual.



4.4 Security Levels

The model 2250e has a security levels to prevent tampering of the controller. The Model 2250e offers three (3) security levels: 1) **View Only**, 2) **Operator** and 3) **Technician**. When the controller is in the **View Only** or **Operator** security level, the menu is locked out. In **View Only**, access is limited to manual operation of the relays, and viewing all of the process screens. In the **Operator** mode the user can operate the relays manually, view the process screens, and calibrate the controller. He cannot change any other settings. In the **Technician** mode the operator has full access to all of the menus.

A password is required to change from a tight security level to a less restrictive security level. Each level has its own factory-preset password (2222 for Technician, 1111 for Operator). If the controller is in the **View Only** or **Operator** mode just press the appropriate password on the keypad to change to a less restrictive security mode.

The passwords can be changed to personalized passwords from the **Technician Level Menu**.

NOTE: IF YOU USE PERSONALIZED PASSWORDS, MAKE SURE THEY ARE RECORDED IN A SAFE AND SECURE PLACE.

5.0 Starting Up the Controller

Once the 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 turning on the circuit breaker.

It is best to initialize the whole controller to remove any settings that may be in the memory before programming the controller. Refer to section 6.5.7.2 of this manual to initialize the controller.

If applicable, install each node in software.

Set the clock by following section 6.5.8.

Set the high and low conductivity alarms by following section 6.5.4.

Configure the relays for operation by following section 6.5.

Calibrate the conductivity by following section 6.3

Verify operation of the controller before leaving the area.

6.0 Operation of the Controller

6.1 Process Screen

The screen that is used the most in the 2250e controller is the Process Screen. Below are the process screen views. The process screen has three sections. The top section shows the Conductivity reading. The alarm bar is the middle section and appears between the top and bottom sections. It is solid in appearance and flashes showing the current active alarms in sequence if there are multiple alarms. The bottom section has user selectable readings as shown below.

1 - DATE SCREEN <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">ALARM BAR</p> <p style="text-align: center;">3 MAR '98</p> <p style="text-align: center;">11:55:04</p> <p style="text-align: center;">PRO=CALIB; ENT=RELAYS</p> </div> <ul style="list-style-type: none"> • There are many different screens available in the PROCESS screen. These screens allow you to view the unit's settings (incl. time setting, relay set-ups, total flow, etc.) without the danger of altering them. Access these screens by using the \uparrow and \downarrow keys to scroll through the available screens. • Press "ENT" to manually enable a relay for testing or troubleshooting purposes. • Press "PRO" to calibrate the conductivity. • Press "CLR" to access the main menu. 		
2 - ALL RELAY SCREEN <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">NO FLOW</p> <p style="text-align: center;">BLOW RLY2 RLY3 RLY4</p> <p style="text-align: center;"> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </p> <p style="text-align: center;">PRO=CALIB; ENT=RELAYS</p> </div>	5 - RELAY 1,2,3,4 SETTINGS <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">COND: LOW ALARM</p> <p style="text-align: center;">RLY4:</p> <p style="text-align: center;">DISABLED</p> <p style="text-align: center;"> <input type="checkbox"/> </p> <p style="text-align: center;">PRO=CALIB; ENT=RELAYS</p> </div>	BLOW RELAY IN SAMPLE MODE <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">COND: LOW ALARM</p> <p style="text-align: center;">BLOW : SAMPLE MODE</p> <p style="text-align: center;">00 : 00 : 45</p> <p style="text-align: center;">PRO=CALIB; ENT=RELAYS</p> </div>
3 - BLOW SETPOINT SCREEN <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">OPENED TC</p> <p style="text-align: center;">BLOW: COND SETPOINT=</p> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">PRO=CALIB; ENT=RELAYS</p> </div>	6 - MTR1 TOTAL FLOW <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">COND: HIGH ALARM</p> <p style="text-align: center;">MTR1 TOTAL FLOW=</p> <p style="text-align: center;">0</p> <p style="text-align: center;">PRO=CALIB; ENT=RELAYS</p> </div>	BLOW RELAY IN CYCLE MODE <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">COND: HIGH ALARM</p> <p style="text-align: center;">BLOW : CYCLE MODE</p> <p style="text-align: center;">00 : 05 : 35</p> <p style="text-align: center;">PRO=CALIB; ENT=RELAYS</p> </div>
4 - RELAY 2 SETTINGS <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">RLY1 TIMEOUT</p> <p style="text-align: center;">RLY2: BY MTR2 METER FEED AFTER GALS/LTRS= 0 FOR 00:00 MM:SS</p> <p style="text-align: center;">PRO=CALIB; ENT=RELAYS</p> </div>	7 - MTR2 TOTAL FLOW <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">1000 μS</p> <p style="text-align: center;">SHORTED TC</p> <p style="text-align: center;">MTR2 TOTAL FLOW=</p> <p style="text-align: center;">0</p> <p style="text-align: center;">PRO=CALIB; ENT=RELAYS</p> </div>	<p>If nodes are installed there will be additional screens for the additional inputs or outputs. Please see your specific node manual for more information.</p>

6.2 Manual Operation of the Relays

All four of the relays can be operated manually. To manually operate the relays:

Go to the **Process** screen. Press “**ENT**”. You will be taken to a screen that looks like:

AUTO-MANUAL (5 MINS.)	
(1) BLOW	<input checked="" type="checkbox"/>
(2) RLY2	<input type="checkbox"/>
(3) RLY3	<input type="checkbox"/>
(4) RLY4	<input type="checkbox"/>
Press 1-4; CLR=EXIT	

Press “1-4 “ to manually change the state of that particular relay. If the relay is already on, pressing that number will turn it off. A five-minute countdown timer will start. After five minutes has expired the relay will return to automatic control. A relay that is in manual control will stay in manual control until the five minutes expires even if this screen is exited. The five-minute timer helps to prevent damage to the system if a relay is left in manual. **WARNING: Manual control overrides everything including the flow switch input. Use care when operating relays manually with no flow in the system.**

6.3 Calibration of CONDUCTIVITY

6.3.1 CALIBRATION

The conductivity requires periodic calibration. Calibration is usually required after cleaning the sensor.

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 6.3.3 and convert the ppm to an approximate conductivity value.

The model 2250e controller uses a single point calibration. A two point calibration is not necessary if using a Lakewood Instruments conductivity sensor.

6.3.1.1 CALIBRATION IN THE CONTINUOUS SAMPLE MODE

In the continuous sample mode, the boiler is continuously being blown down.

- Ensure that the controller is operating with good flow past the sensor.
- Take a sample of the water and measure with a hand-held conductivity tester.
- From the **PROCESS** screen, press “**PRO**” to enter the calibration screen. Use the keypad to input the conductivity reading from the hand-held. Press “**ENT**”.
- Take another hand-held sample to verify calibration.

6.3.1.2 CALIBRATION IN THE SAMPLE/CYCLE MODE

In the sample/cycle mode, the model 2250e controller takes a sample periodically based on time and setpoint.

- Ensure that the controller is in the **SAMPLE** mode by going to the manual relay control screen and energizing the **BLOW** relay if necessary.
- Ensure that there is good flow past the sensor.
- Take a sample of the water and measure with a hand-held conductivity tester.
- From the **PROCESS** screen, press “**PRO**” to enter the calibration screen. Use the keypad to input the conductivity reading from the hand-held. Press “**ENT**”.
- Take another hand-held sample to verify calibration.

6.3.2 CALIBRATION CHECK IN BUFFER SOLUTIONS

This check can be performed with the 4-electrode (SR4) boiler sensor only. This check is not valid with the 2-electrode boiler sensor (SR2) because the SR2 requires a hot sample (>200°F) to read properly.

To check the calibration of the sensor in buffer solutions, the sensor is placed in a container of the buffer solution. Ensure that the sensor tips are centered in the container away from the edges and the bottom of the container. The conductivity values displayed can vary depending on the position of the conductivity sensor in the container of buffer solution.

Perform the calibration check as follows:

- Shut the isolation valves in the boiler blow down line.
- Remove the conductivity sensor and place it in the buffer solutions.
- Verify calibrations in at least two buffer solutions.
- Re-install the sensor into the plumbing.
- Open the isolation valves to the blow down line.

6.3.3 Conductivity vs. ppm

The model 2250e 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

6.4 Main Menu

The **MAIN MENU** of the 2250e looks like this:

```
          MAIN MENU
          =====
1 PROCESS
2 RELAYS
3 FEED SCHEDULE
4 ALARMS
5 WATER METERS
6 4-20 MA OUTPUTS
7 SYSTEM SETUP
8 CLOCK
```

The **MAIN MENU** can be accessed from the **PROCESS** screen by pressing “**CLR**”. If “**CLR**” is pressed and the **MAIN MENU** does not appear, the controller is probably in the **VIEW ONLY** or **OPERATOR** security mode. If the controller is in the **VIEW ONLY** or **OPERATOR** security mode, enter the **TECHNICIAN** security password to be able to access the **MAIN MENU**.

To move about in the menu screen use the **↑** and **↓** keys to highlight the desired option and press “**ENT**” or simply press the number key for the desired option.

Use the “**ENT**” key to accept a setting or to enter a screen. Use the “**CLR**” key to reject a setting or to exit a screen. From anywhere in the menu, pressing “**CLR**” will take you one step closer to the **MAIN MENU**.

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 configured.

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

6.5 Configuring the Relays

To access the relay configuration screen from the **MAIN MENU**, press “2” or highlight **RELAYS** and press “**ENT**”. The following screen will appear.

WHICH RELAY? =====
1 BLOW
2 RLY2
3 RLY3
4 RLY4

Select the relay that you want to program.

6.5.1 Configuring the Blowdown Relay

Below is the **RELAY OPTIONS** screen.

The blowdown relay can be configured to operate based on a setpoint. When the blowdown relay is selected for programming the following screen will appear.

BLOW =====
1 SETPOINT
2 BOILER OPTIONS
3 CHANGE MY NAME

6.5.1.1 SETPOINT

When Setpoint is selected the following screen will appear.

SETPOINT= 1000 μS
DEADBAND= 10 μS

6.5.1.1.1 SETPOINT

In the **SETPOINT** screen you will set the **SETPOINT**, the **DEADBAND**, the **BLOWDOWN TIMEOUT** alarm, and setup the blowdown relay for a direct or reverse setpoint.

The **SETPOINT** is the conductivity value that you are trying to maintain. Check with your water treatment engineer to determine the conductivity setpoint for your system needs.

Follow these instructions to establish the controller's setpoint:

- Use the keypad numbers to enter the proper conductivity setpoint and press **"ENT"**. When finished, you will automatically be moved down to the deadband.

6.5.1.1.2 DEADBAND

After the setpoint is established, the controller's deadband must also be set. **"Deadband"** refers to the amount of conductivity above and below the setpoint—a range within which the controller will not react. Due to continuous fluctuations in the conductivity level, it is necessary to have this deadband range or stable readings will be difficult to maintain. 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 example, a conductivity setpoint of 1000 μS with a deadband of 20 μS would result in the relay turning on at 1010 μS and turning off at 990 μS .

- Use the keypad numbers to enter the proper deadband setpoint and press **"ENT"**. When finished, you will automatically be switched to the **BLOWDOWN TIMEOUT** alarm screen.

6.5.1.1.3 BLOWDOWN TIMEOUT

The **BLOWDOWN TIMEOUT** alarm is designed to notify the operator of a problem in the blowdown system such as, a clogged orifice, or the blowdown valve failed to open. The **BLOWDOWN TIMEOUT** function will display a visual alarm on the display, but it will **NOT** turn off the relay. If a relay is configured as an alarm relay, the **BLOWDOWN TIMEOUT** alarm will energize the alarm relay. To disable this function set the **BLOWDOWN TIMEOUT** time to 0:00.

- Use the keypad numbers to enter the time in hours and minutes before this alarm will appear and press **"ENT"**. Maximum setting is 17 hours and 59 minutes. After pressing ENT you will be taken to the **"WHEN TO ACTIVATE"** screen.

6.5.1.1.4 WHEN TO ACTIVATE

After configuring the SETPOINT, the DEADBAND, and the BLOWDOWN TIMEOUT alarm, the controller will automatically move to the **WHEN TO ACTIVATE** screen. To set up to blow down on a rising conductivity value set the relay to activate *above* the setpoint. To set up to blow down on a falling conductivity value set the relay to activate *below* the setpoint.

```
WHEN TO ACTIVATE
=====
1 *ABOVE SETPOINT
2 BELOW SETPOINT
```

- Select “**1**” **ABOVE SETPOINT** to turn on the relay when the conductivity rises above the conductivity setpoint, or select “**2**” **BELOW SETPOINT** to turn on the relay when the conductivity falls below the conductivity setpoint. The asterisk (*) indicates the current configuration.

6.5.1.2 BOILER OPTIONS

The Boiler Options screen is used to set up the controller for Sample/Cycle or Continuous sample control of conductivity.

When Boiler Options is selected the following screen will appear.

```
TIMES IN HOURS:MINS
SAMPLE TIME = 0:00
CYCLE TIME = 00:00

FOR CONTINUOUS
CONTROL SET BOTH
TIMES TO ZERO
PRO: +/- ENT=ACCEPT
```

6.5.1.2.1 SETTING UP FOR SAMPLE/CYCLE CONTROL

In sample/cycle control, the controller only reads conductivity while it is blowing down in the Sample mode. The controller will open the blowdown valve for a specified amount of time (**Sample Time**) to periodically blow down the boiler; once the sample time expires the controller compares the conductivity reading to the **Setpoint**. If the reading is greater than the setpoint the controller will keep the blowdown valve open until the conductivity drops below the setpoint. If the reading is less than the setpoint the controller will immediately shut the blowdown valve and go into a waiting period (**Cycle Time**). The **Sample Time** is the amount of time that the blowdown valve is open. **Cycle Time** is the amount of time in between samples when the blowdown valve is shut.

The Sample Time should be set to a small amount of time because the controller will be blowing down for the entire Sample Time. If a long amount of time is set, the controller will blow down longer than is necessary and will result in wasted heat and water. A longer period of time is not required because if the conductivity is greater than the setpoint the valve will stay open until the setpoint is satisfied.

The Cycle Time will need to be set for your specific system. The Cycle Time is the amount of time in between samples when the blowdown valve is shut. While the blowdown valve is shut the conductivity will rise in the boiler. If the cycle time is too long, the conductivity will rise much higher than the setpoint and this could cause problems for the boiler. Conversely, if the cycle time is set too short, the conductivity will never raise high enough to hit the setpoint. This will result in a waste of heat and water because the controller is blowing down when it is not necessary.

Once the Sample Time is set it should never have to be adjusted again. The Cycle Time is the one that will need to be adjusted to the specifics of the application. If the steaming load or the make-up water quality changes the cycle time may need to be adjusted. If the conductivity is always too low the cycle time should be set to a longer period of time. If the conductivity is always too high the cycle time should be set to a shorter period of time.

To set the controller for Sample/Cycle control in the **Boiler Options** screen:

- Use the number keys to input a sample time. The minimum amount of time is one minute. Press **“ENT”**.
- Use the number keys to input a cycle time. The minimum amount of time is one minute. Press **“ENT”**.

When the controller is set up for sample/cycle control, the process screen will show one of the three screens shown below when the blow relay is selected. The screen will count down the amount of sample time or cycle time, and will display the conductivity setpoint after the sample time has expired and the conductivity is still above the conductivity setpoint.

BLOW RELAY IN SAMPLE MODE	BLOW RELAY IN CYCLE MODE	BLOW SETPOINT SCREEN
1000 μS	1000 μS	1100 μS
COND: HIGH ALARM	COND: HIGH ALARM	OPENED TC
BLOW : SAMPLE MODE	BLOW : CYCLE MODE	BLOW: COND SETPOINT=
00 : 00 : 45	00 : 05 : 35	1000 μS
PRO=CALIB; ENT=RELAYS	PRO=CALIB; ENT=RELAYS	PRO=CALIB; ENT=RELAYS

6.5.1.2.2 SETTING UP FOR CONTINUOUS SAMPLE CONTROL

In continuous sample control, there is continuous blowdown occurring. The controller will activate the blowdown valve based on setpoint to increase the blowdown rate to maintain conductivity.

To set the controller for Continuous sample control in the **Boiler Options** screen:

- Use the number keys to input a sample time of **0:00**. Press “**ENT**”.
- Use the number keys to input a cycle time of **0:00**. Press “**ENT**”.

6.5.1.3 CHANGE MY NAME

The name of each individual relay can be changed to any 4-character name. This is useful to designate the chemical name for each relay. Use the arrow keys to change the character and the ENT key to move to the next character.

OLD NAME= BLOW
NEW NAME= RLY1
<UP><DOWN>ENT: ACCEPT

- From the **BLOWDOWN RELAY OPTIONS** screen press “**3**” **CHANGE MY NAME**.

6.5.2 Configuring Relays 2,3,4

Below is the **RELAY OPTIONS** screen. The asterisk (*) next to one of the options tells you how that relay is configured. Relays 2, 3, and 4 can be programmed in each of the methods shown on the **RELAY OPTIONS** screen.

```
          RLY2
          =====
1*DISABLED
2 SETPOINT
3 WATER METER
4 PERCENT BLOWDOWN
5 PERCENT OF TIME
6 FEED SCHEDULE
7 ALARM RELAY
8 CHANGE MY NAME
```

6.5.2.1 Disabled

Relays 2, 3, and 4 can be disabled. When a relay is disabled, it will not energize automatically.

- From the **RELAY OPTIONS** screen press “1” **Disabled** to disable the relay.

6.5.2.2 By Setpoint

Relays 2, 3, and 4 can be configured to operate based on a setpoint.

To set up the relay to operate based on a setpoint, select **SETPOINT** in the RELAY OPTIONS screen. The following screen will appear.

```
          SETPOINT=
          1000 µs

          DEADBAND=
          20 µs
          PRO: +/-  ENT: ACCEPT
```

6.5.2.2.1 SETPOINT

In the **SETPOINT** screen you will set the **SETPOINT**, the **DEADBAND** and the **OVERFEED TIME** alarm.

The **SETPOINT** is the conductivity value that you are trying to maintain. Check with your water treatment engineer to determine the conductivity setpoint for your system needs.

Follow these instructions to establish the controller's setpoint:

- Use the keypad numbers to enter the proper conductivity setpoint and press "**ENT**". When finished, you will automatically be moved down to the deadband.

6.5.2.2.2 DEADBAND

After the setpoint is established, the controller's deadband must also be set. "**Deadband**" refers to the amount of conductivity above and below the setpoint—a range within which the controller will not react. Due to continuous fluctuations in the conductivity level, it is necessary to have this deadband range or stable readings will be difficult to obtain. 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 example, a conductivity setpoint of 1000 μS with a deadband of 20 μS would result in the relay turning on at 1010 μS and turning off at 990 μS .

- Use the keypad numbers to enter the proper deadband setpoint and press "**ENT**". When finished, you will automatically be switched to the **OVERFEED TIME** alarm screen.

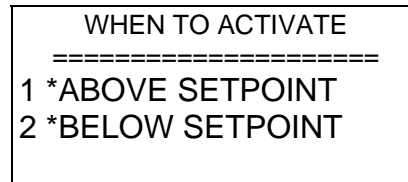
6.5.2.2.3 OVERFEED TIME

The **OVERFEED TIME** 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 does not display a change in actual Conductivity. The **OVERFEED** timeout function will display a visual alarm on the display and **it will turn off the relay**. If a relay is configured as an alarm relay, the **OVERFEED TIME** alarm will energize the alarm relay. To disable this function set the **OVERFEED** time to 0:00.

- Use the keypad numbers to enter the time in hours and minutes before this alarm will appear and press "**ENT**". Maximum setting is 17 hours and 59 minutes.

6.5.2.2.4 WHEN TO ACTIVATE

After configuring the SETPOINT, the DEADBAND, and the OVERFEED alarm, the controller will automatically move to the **WHEN TO ACTIVATE** screen. To set up to feed on a rising conductivity value set the relay to activate *above* the setpoint. To set up to feed on a falling conductivity value set the relay to activate *below* the setpoint.



- Select “**1**” **ABOVE SETPOINT** to turn on the relay when the conductivity rises above the conductivity setpoint, or select “**2**” **BELOW SETPOINT** to turn on the relay when the conductivity falls below the conductivity setpoint.

6.5.2.3 By Water Meter

Relays 2, 3, and 4 can be configured to operate for a specified amount of time based on a specified amount of flow through the water meter inputs. **MTR1**, **MTR2** or the sum of **BOTH** water meter inputs can activate the relay.

- From the **RELAY OPTIONS** screen press “**3**” **WATER METER**.
- Select either **MTR1** or **MTR2** or **BOTH** as the trigger for the relay.
- Use the keypad to enter the amount of flow before the relay is activated. Press “**ENT**”.
- Enter the amount of time that the relay will be activated. Press “**ENT**”.

6.5.2.4 By Percent of Blowdown

Relays 2, 3, and 4 can be configured to operate for a percentage of the amount of time that the blowdown relay was in operation. Once the blowdown relay turns off, the configured relay will turn on for the specified percent of time that the blow relay was on. For instance, if 50% was set and the blow relay was on for 6 minutes, the relay will turn on for 3 minutes after the blow relay turns off.

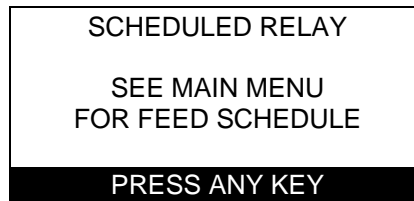
- From the **RELAY OPTIONS** screen press “**4**” **PERCENT BLOWDOWN**.
- Use the keypad to enter the percent of blowdown time for the relay to be activated. Press “**ENT**”.

6.5.2.6 By Feed Schedule

The feed schedule is used to feed chemicals such as biocides on a time of day basis. Setting up the feed schedule is a two-part process. The first part is to configure the relay so that it will operate by feed schedule. The second part of the process is to configure the feed schedule. The feed schedule is covered in section 6.5.3.

- From the **RELAY OPTIONS** screen press "5" **FEED SCHEDULE**.

The controller will respond with the following screen.

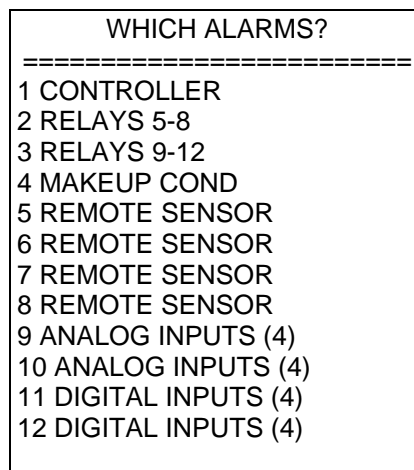


The relay has been configured to operate based on a feed schedule but, the relay will not activate because the feed schedule has not been programmed yet.

6.5.2.7 As an Alarm Relay

Relays 2, 3, and 4 can be configured as alarm relays. The alarms that will cause the relay to activate are selectable from the controller alarms or from any node input alarms. The controller alarms include: **HIGH CONDUCTIVITY, LOW CONDUCTIVITY, FOULED CONDUCTIVITY SENSOR, SHORTED TC, OPENED TC, MAX BD TIME EXCEEDED, FEED SEQUENCE ACTIVE, RELAY #2 TIME EXCEEDED, RELAY #3 TIME EXCEEDED, RELAY #4 TIME EXCEEDED**, and the **NO FLOW** alarm.

- From the **RELAY OPTIONS** screen press "6" **ALARM RELAY**. The controller will respond with the following screen.



- Select the alarms from this menu that will activate the relay.

6.5.2.8 Change My Name

The name of each individual relay can be changed to any 4-character name. This is useful to designate the chemical name for each relay. Use the arrow keys to change the character and the ENT key to move to the next character.

<p>OLD NAME= RLY2</p> <p>NEW NAME= INH</p>
<UP><DOWN>ENT: ACCEPT

- From the **RELAY OPTIONS** screen press "7" **CHANGE MY NAME.**

6.5.3 Setting up the Feed Schedule

Refer to section 6.5.2.5 to configure a relay to feed based on the feed schedule before continuing with this section.

To get to the feed schedule menu:

- From the **MAIN MENU** press "3" **FEED SCHEDULE**. You will see the following screen:

```
FEED SCHEDULE
=====
1*BY WEEKDAY
2 BY CYCLE CALENDAR
3 LIST SCHEDULE
```

The feed schedule can be programmed to feed chemicals by either **WEEKDAY** or by a **CYCLE CALENDAR** basis.

BY WEEKDAY is used to feed chemicals by the weekday name, i.e. Monday, Tuesday, Wednesday etc. This is a seven-day schedule. At the end of the week, the schedule starts over again. To configure the feed schedule to feed by weekday:

- From the **FEED SCHEDULE** screen, press "1" **BY WEEKDAY**.

BY CYCLE CALENDAR is used to feed chemicals by a schedule other than one that is seven days long. **BY CYCLE CALENDAR** can be used to feed the same chemical every day or up to 28 days between feedings. The operator specifies the number of days in the cycle calendar. After the cycle calendar is completed, the schedule starts over again. This method of feeding is particularly useful when feeding two biocides on alternating weekly basis. To configure the feed schedule to feed by cycle calendar:

- From the **FEED SCHEDULE** screen, press "2" **BY CYCLE CALENDAR**.
- Use the keypad to enter the number of days in your cycle then press "ENT". Remember the maximum number of days allowed is 28.
- Use the keypad to enter which day today is in your cycle, e.g. today is day number 5 in my 14 day cycle, then press "ENT".

After selecting whether the feed schedule will be fed by **WEEKDAY** or by **CYCLE CALENDAR** it is time to actually program the schedule. To enter the actual feed schedule or to edit the feed schedule from the feed schedule screen above:

- Press "3" **LIST SCHEDULE**. This will take you to a list of all scheduled feeds as shown in the screen on the next page.

NOTE: The maximum number of scheduled feeds is 16 (sixteen) total.

FEED SCHEDULE			
=====			
1	01	03:00	RLY2
2	00	00:00	
3	00	00:00	
4	00	00:00	
5	00	00:00	
6	00	00:00	

- If there are no scheduled feeds, select the first schedule and press "ENT". If you are editing the schedule, select the schedule that you want to edit and press "ENT".

Below is an example screen for programming a chemical feed. **Before programming a chemical feed, you need to configure Relay 2, 3, or 4 to be a feed schedule relay.**

RELAY (ARROWS): NONE
CYCLE DAY : 0
START TIME : 00:00
COND SETPOINT : 0
BLOW DURATION : 00:00
FEED DURATION : 00:00
LOCKOUT TIME : 00:00
<UP><DOWN>ENT: ACCEPT

- To program the schedule use the keypad to enter the values in the above screen. Press "ENT" to move to the next item.

RELAY is which relay you want to program (you must configure a relay to be a feed schedule relay first). Use the arrow keys to select the available relays. Only relays that have been configured as feed schedule relays will appear.

CYCLE DAY or DAY is the day you wish to actuate the feed schedule relay.

START TIME is the time you want to start the feed schedule sequence. This start time uses the 24 hour clock or military time. **06:00:00** is 6 a.m. **18:00:00** is 6 p.m.

COND SETPOINT is a pre-bleed setpoint. This would typically be lower than the normal conductivity setpoint. Because the bleed valve may be disabled during a scheduled feed, a pre-bleed will help prevent a build up of tower conductivity. 0 μ S will disable this feature.

BLOW DURATION if the COND SETPOINT is not met within this time, the blowdown will stop and the feed schedule relay will be actuated. **If conductivity is disabled, this is the amount of time the controller will blow down during the pre-bleed sequence.** Inputting 0:00 will disable this feature. Lakewood Instruments recommends that some time be entered if pre-bleed is used.

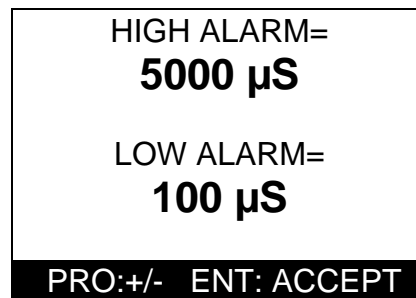
FEED DURATION is the amount of time the feed schedule relay will be on.

LOCKOUT TIME after the feed duration is completed, an additional lockout time for **RLY 1, 2, 3, and 4** relays can be programmed. The lockout time prevents the other relays from operating until this time expires. **Setting this time to 0:00 will disable this feature.**

6.5.4 Alarms

The Model 2250e is equipped with both high and low conductivity alarms. This menu option allows you to program the specific values for these alarms. When a conductivity alarm is received, it will appear as a flashing message in the middle of the display and any configured alarm relays will be activated. **The high conductivity alarm will override the blowdown relay and force a blowdown to occur.** Consult your water treatment specialist when determining the proper High and Low Alarm values for your system.

To set the alarm setpoints:



HIGH ALARM=
5000 µS

LOW ALARM=
100 µS

PRO:+/- ENT: ACCEPT

- From the **MAIN MENU** press "4" **ALARMS**. Use the keypad to enter a value for the high alarm. Press "ENT".
- Use the keypad to enter a value for the low alarm and press "ENT".
- Use the keypad to enter a value for the deadband and press "ENT". Refer to section 6.5.1.2.2 for a discussion on deadband.

6.5.5 Water Meters

The 2250e series controllers will work directly with the following types of meters: dry contacting head meters, Seametrics open collector output meters, Signet 2535 and 2540 paddle wheel meters, and the Autotrol 1 inch and 2 inch meters. Contact Lakewood Instruments for other types of water meters.

Both water meter inputs are programmed in the same manner.

To get to the water meter configuration screen:

- From the **main menu**, press "5" **WATER METERS**. This will take you to the **WHICH WATER METER SCREEN**.
- Press "1" for **MTR1** or press "2" for **MTR2**.
- This will take you to the **WATER METER TYPES** screen as shown.

WATER METER TYPES	
=====	
1	CONTACTING HEAD
2	PADDLE WHEEL
3	DATA INDUSTRIAL
4	SIGNET
5	AUTOTROL TURB 1 IN.
6	AUTOTROL TURB 2 IN.
7	CHANGE MY NAME

- Use the keypad to select the type of water meter that you are using.

The next screen is the **UNITS OF VOLUME** screen.

- The water meters can be configured for gallons or liters. Press "1" for **GALLONS** or press "2" for **LITERS**.

If **CONTACTING HEAD** was selected:

- You will be taken to the **GALLONS OR LITERS PER CONTACT** screen. Use the keypad to enter the number of gallons or liters per contact for your specific meter then press "ENT". You will then be asked if you want to reset the total count for that meter to zero. Press "1" for **YES** or press "2" for **NO**.

If **PADDLE WHEEL** was selected:

- You will be taken to the **PULSES PER GAL/LITER** screen. Use the keypad to enter the pulses per gal/liter for your particular water meter then press "ENT". You will then be asked if you want to reset the total count for that meter to zero. Press "1" for **YES** or press "2" for **NO**.

If **DATA INDUSTRIAL** was selected:

- You will be taken to the **SLOPE VALUE** screen. Use the keypad to enter the K factor and offset values for your particular water meter then press "**ENT**". You will then be asked if you want to reset the total count for that meter to zero. Press "**1**" for **YES** or press "**2**" for **NO**.

If **SIGNET** was selected:

- You will be taken to the **K-FACTOR** screen. Use the keypad to enter the K-factor for your particular water meter then press "**ENT**". You will then be asked if you want to reset the total count for that meter to zero. Press "**1**" for **YES** or press "**2**" for **NO**.

If **AUTOTROL TURB 1 IN.** was selected:

- The controller will confirm that the **AUTOTROL TURB 1 IN.** has been selected and you will be asked if you want to reset the total count for that meter to zero. Press "**1**" for **YES** or press "**2**" for **NO**.

If the **AUTOTROL TURB 2 IN.** is selected:

- The controller will confirm that the **AUTOTROL TURB 2 IN.** has been selected and you will be asked if you want to reset the total count for that meter to zero. Press "**1**" for **YES** or press "**2**" for **NO**.

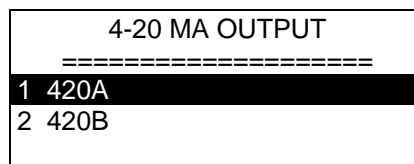
6.5.6 4-20 mA OUTPUTS

If the -35L option is ordered the model 2250e has two channels of 4-20 mA output. The -35L is an option card that can be added in the field.

6.5.6.1 Set Up of the 4-20 mA Output

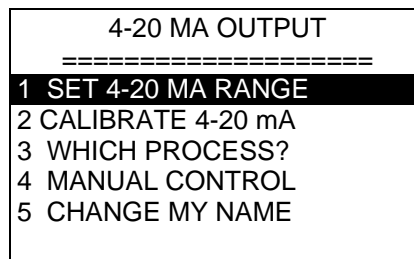
To set up the 4-20 mA output:

- From the **Main Menu**, press "**6**" **4-20 mA OUTPUTS**



- Press "**1**" For **channel A** 4-20 mA OUT SETUP. Press "**2**" For **channel B** 4-20 mA OUT SETUP

The **4-20 mA Out Setup** screen allows the user to set the 4-20 mA range, calibrate the 4-20 mA output, select which process the 4-20 mA channel will respond to, take manual control of the 4-20 mA output, and change the name of the output. Below is the **4-20 mA Setup** screen.



6.5.6.1.1 Set the 4-20 mA Range

The 4-20 mA output range must be set for the output to be useful.

- From the **4-20 mA Setup** screen, press "1" **Set the 4-20 mA RANGE**.
- Use the keypad to enter a conductivity value for the 4-mA point. Press "ENT".
- Use the keypad to enter a conductivity value for the 20-mA point. Press "ENT".

6.5.6.1.2 Calibrate

The 4-20 mA needs to be calibrated to the actual output to be accurate. A milliamp meter is necessary to calibrate the 4-20 mA output. Connect the milliamp meter in-line with one leg of the 4-20 mA output. Refer to the drawing in the back of this manual for wiring instructions.

- From the **4-20 mA Setup** screen, press "2" **CALIBRATE**.
- Use the keypad to enter the milliamp reading from the milliamp meter for the 4-mA point. Press "ENT".
- Use the keypad to enter the milliamp reading from the milliamp meter for the 20-mA point. Press "ENT".

6.5.6.1.3 Which Process?

If the model 2250e has any remote sensor nodes attached, the 4-20 mA channel can be configured to operate based on that input.

- From the **4-20 mA Setup** screen, press "3" **WHICH PROCESS?**
- Use the up and down arrow keys to select the process that will control the 4-20 mA output. Press "ENT".

6.5.6.1.4 Manual Control

Manual control is used to temporarily change the 4-20 mA output.

- From the **4-20 mA Setup** screen, press "4" **MANUAL CONTROL**.
- Use the up and down arrow keys to raise or lower the 4-20 mA output. To exit this screen press "**CLR**".

6.5.6.1.5 Change My Name

The name of the 4-20 mA output can be changed by the operator.

- From the **4-20 mA Setup** screen, press "5" **CHANGE MY NAME**.
- Use the arrow keys to change the characters, use the ENT key to move the cursor to the next character.

6.5.7 The System Setup Menu

The system setup menu is used to set up the temperature compensation, damping, initialize the controller, digital inputs, check the firmware version, change the security passwords, check the diagnostics, set up the communications, and node installation.

6.5.7.1 Process Parameters

The process parameters screen is used to change the name of the conductivity process, set up anti-steam flash, set the preamplifier settings, set up the temperature compensation, and set the cell constant.

6.5.7.1.1 Change My Name

The name of the process can be changed from **COND** to a different 4-character name.

To change the name of the process:

- From the Main Menu press "7" **SYSTEM SETUP**.
- Press "1" **PROCESS PARAMETERS**.
- Press "1" **CHANGE MY NAME**
- Use the arrow keys to change the characters, use the ENT key to move the cursor to the next character.

6.5.7.1.2 ANTI-STEAM FLASH

The anti-steam flash menu item is used to dampen out fluctuations in conductivity due to the occurrence of steam flash.

To set up anti-steam flash:

- From the Main Menu press "7" **SYSTEM SETUP**.
- Press "1" **PROCESS PARAMETERS**.
- Press "1" **ANTI-STEAM FLASH**

Use the keypad to change the anti-steam flash time. The larger the time the greater amount of anti-steam flash. Press "**ENT**" to accept.

6.5.7.1.3 PREAMP SETUP

The preamp setup menu is used to set up the preamplifier for the conductivity sensor that is used. The three fields are voltage gain, sample resistor, and the drive frequency.

For the 2-electrode boiler sensor the settings are:

Voltage gain	10
Sample R	20
Drive freq	500 Hz

For the 4-electrode boiler sensor the settings are:

Voltage gain	10
Sample R	200
Drive freq	500 Hz

Use the arrows to change the setting and hit "**ENT**" after each entry.

6.5.7.1.4 TEMP COMPENSATION

The model 2250e has the ability to use temperature compensated conductivity sensors. The 2-electrode boiler sensor is **not** temperature compensated. The 4-electrode **is** temperature compensated up to about 200°F.

For the 2-electrode boiler sensor, select "**NONE**" for the temperature compensation.

For the 4-electrode boiler sensor, select "**4k NTC**" for the temperature compensation.

6.5.7.1.5 CELL CONSTANT

The cell constant is used to set the default calibration readings close to actual for the sensor that is used.

The cell constant for the 2-electrode boiler sensor is **0.108**.

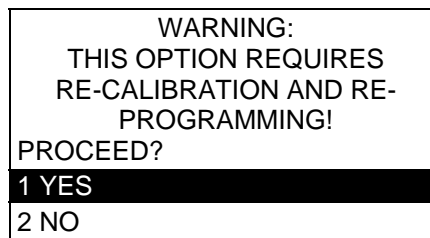
The sensor for the 4-electrode boiler sensor is **0.300**.

Use the keypad to input the cell constant for your sensor. Press **"ENT"**.

6.5.7.2 Initialization

Initialization restores the factory default settings to the controller. The whole controller can be initialized or just the calibration. It is suggested that you initialize the whole controller before you program the controller. This will clear any random settings that may be in the controller. To do so, follow these instructions:

- From the **Main Menu**, press **"7" SYSTEM SETUP**.
- Press **"2" INITIALIZATION**.
- Press **"2" WHOLE CONTROLLER** and press **"ENT"**. A warning will appear on the screen (see below). Press **"1"** to proceed, **"2"** to cancel.



To initialize just the calibration:

- Press **"1" CALIBRATIONS** instead of **"2" WHOLE CONTROLLER** in the procedure above. The same warning screen will appear.

6.5.7.3 Digital Inputs

If the model 2250e controller has a digital input node (NDIG) installed the inputs are configured from this screen. If a NDIG is not installed there is no access to this menu item. Configuration of the digital inputs is covered in the NDIG manual.

6.5.7.4 Firmware Versions

Sometimes it is necessary to verify the firmware version of the controller for troubleshooting purposes. To obtain the firmware versions:

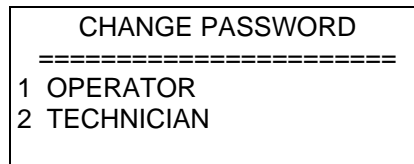
- From the **Main Menu**, press **"7"** **SYSTEM SETUP**.
- Press **"4"** **FIRMWARE VERSION**.
- The firmware versions will be displayed. Use the arrow keys to see all firmware versions. To exit this screen, press **"CLR"**.

6.5.7.5 Change the Security Passwords

The security password can be changed from the factory default settings to any four-digit value of your choice.

To change the security passwords:

- From the **Main Menu**, press **"7"** **SYSTEM SETUP**.
- Press **"5"** **SECURITY**.



- Press **"1"** **OPERATOR** to change the operator password or Press **"2"** **TECHNICIAN** to change the technician password.
- Use the keypad to enter the old password. If the password has not been changed before, the old password for **OPERATOR** is **1111** and the password for **TECHNICIAN** is **2222**.
- Use the keypad to enter the new password.
- Use the keypad to enter the new password a second time for verification

If you lose your password, contact Lakewood Instruments for assistance.

6.5.7.6 Diagnostics

The diagnostics screen is used for troubleshooting purposes. Contact Lakewood Instruments for assistance.

6.5.7.7 Communications

The model 2250e has an option for remote communications, the –RS2L option. If this option is installed the communications option is configured from this screen. This screen is used to set up the com port, initialize the modem, and set the remote password.

To set up the communications option:

- From the **Main Menu**, press "7" **SYSTEM SETUP**.
- Press "7" **COMMUNICATIONS**.

```
COMMUNICATIONS
=====
1 COM PORT SETUP
2 INITIALIZE MODEM
3 REMOTE PASSWORD
```

6.5.7.7.1 Com Port Setup

Com port setup is used to set up the com port for use with a modem or direct connect.

- To set up the com port press "1" **COM PORT SETUP**

```
COM PORT PARAMETERS
=====
BAUD RATE:  19200
DATA BITS:  8
STOP BITS:  1
PARITY      :  NONE
<UP><DOWN> ENT: ACCEPT
```

- Use the arrow keys to change the baud rate. If using the direct connect method of communicating, ensure that the baud rate at the controller and the baud rate in the LRWS software match.
- The standard values for the **DATA BITS** is 8, **STOP BITS** is 1, and **PARITY** is NONE. Normally these will not need to be changed.

6.5.7.7.2 Initialize Modem

Before a modem can be used by the controller it must be initialized. The initialization screen gives four choices of modems.

To initialize the modem:

- From the Communications menu, press “**2**” **INITIALIZE MODEM**

```
INITIALIZE MODEM
=====
1 HAYES ACCURA
2 U.S. ROBOTICS
3 ZOOM
4 OTHER MODEM
```

- Select your modem from the list. If your modem is not listed and you select **OTHER MODEM** use the keypad to enter the initialization string for your modem.
- If the modem fails to initialize, check the 25-pin connector, the phone cable, the modem, and the –RS2L option card.

6.5.7.7.3 Remote Password

Remote communications to the Lakewood Instruments 2000 series controllers is protected with an 8-digit password. The remote password is required to make changes to the model 2250e controller using the communications option card.

The remote password screen in the communications menu is used to change the remote password. The remote password can only be changed at the controller.

To change the remote password:

- From the communications menu, press “**3**” **REMOTE PASSWORD**.
- Use the keypad to enter the old password. Enter the new password. Repeat the new password again for verification. **NOTE: The default password is 12345678.**
- Set the remote password in the LRWS program to match the new password for this controller.

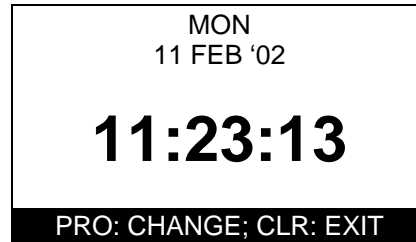
6.5.7.8 Node Installation

The node installation menu is used to install new nodes and to de-install installed nodes. Please refer to your node manual for information on node installation.

6.5.8 Setting the Clock

The clock uses the 24 hour or military time. **06:00:00** is 6 a.m. **18:00:00** is 6 p.m.
To set the clock:

- From the **Main Menu** press **"8"** **CLOCK**. The following screen will appear:



- Press **"PRO"** to change the clock settings.
- Use the up and down arrow keys to change the day of the week. Press **"ENT"**.
- Use the number keys to change the date. Press **"ENT"**.
- Use the arrow keys to change the month. Press **"ENT"**.
- Use the number keys to change the year. Press **"ENT"**.
- Use the number keys to change the hour. Press **"ENT"**.
- Use the number keys to change the minutes. Press **"ENT"**.
- Use the number keys to change the seconds. Press **"ENT"**.
- Press **"CLR"** to exit this screen.

You must press **"ENT"** all the way through this menu for the settings to take affect.

6.5.9 Changing the Security Levels

The security level can be change to prevent any unwanted tampering of the controller. To change the security level from **Technician** to **Operator** or **View-Only**:

- From the **Main Menu**, press “0”. (*Note that “0” does not appear on the menu screen.*)

CHANGE LEVEL TO OPERATOR ? WARNING:YOU SHOULD KNOW THE PASSWORD. 1 YES 2 NO

- Select **YES** to change the security level to a more restrictive level.

The controller menu now functions at the new security level.

To return to the **Technician** security level:

- Press the numeric password from the **Process** screen:

TECHNICIAN PRESS ANY KEY

Remember that following the first power-up the Technician password is 2222 and the Operator password is 1111. You may change the passwords in the SYSTEM SETUP menu.

7.0 Maintenance

Periodic maintenance is required to ensure trouble free operation of the model 2250e controller. 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. 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 isolation valves to the sensor.
- Remove the sensor from its plumbing.
- Clean the electrodes with a wire brush. A soft steel brush is preferable to 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.

7.2 Replacing the Fuse

The Model 2250e contains a 10A, 250V fuse. The fuse holder is located on the bottom of the enclosure. It is accessible from the outside of the box. Replacement fuses must be a fast blow type. If the fuse is blown, the display will be blank and the four power supply lights inside the controller enclosure will be dark when the unit is connected to power. Refer to the troubleshooting section of this manual for more information about blank displays.

8.0 Troubleshooting

8.1 Error Messages

This section discusses some of the more common questions with the Model 2250e. 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
{Alarm Flashing} “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 blowdown valve is not stuck closed or the line is restricted.
{Alarm Flashing} “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. Approximately 24 volts DC should be present at the input terminal when the water meter contact is closed. That should change to zero VDC when the contact opens. Check these voltages and for correct wiring. 2. Is the controller configured for your type of water meter?
{Alarm Flashing} “FEED SEQUENCE ACTIVE”.	This simply indicates that a feed schedule relay is active.	No action necessary.
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 NEUTRAL on TA, call Lakewood Instruments Technical Service for more information.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
{Alarm Flashing} “RLY: TIME EXCEEDED”.	This indicates that the controller has been trying to 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.
“NO FLOW” alarm.	Flow input switch is not closed.	<ol style="list-style-type: none"> 1. If the flow switch input is not used, insert a jumper wire across terminals 4 and 5 of terminal block P1. 2. The device used as the flow switch input may be bad. Check the operation with an OHM meter. <p>If no flow switch is used, a jumper wire should be installed across the flow switch input. Removing the jumper disables all relay outputs.</p>
Bleed valve relay is closed above setpoint.	Controller may be in feed schedule.	Check feed schedule.
Bleed valve relay is open below setpoint.	<p>High conductivity alarm will force the bleed valve to open.</p> <p>Controller may be doing a pre-bleed before feeding biocide.</p> <p>The controller may be in the sample mode if using sample/cycle control.</p>	<ol style="list-style-type: none"> 1. Check High conductivity alarm setpoint. Change setpoint if necessary. 2. Check feed schedule. Adjust as necessary. 3. No action is necessary if sample time is correct.
“SENSOR READS ZERO”	You are trying to perform a span calibration of the conductivity and the conductivity sensor reads zero.	<ol style="list-style-type: none"> 1. Check wiring. 2. Ensure sensor is full immersed in water. 3. The model 2250e will not accept a span calibration below about 200 μS. Cycle conductivity higher and re-calibrate.
{ALARM FLASHING} “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.

9.0 Factory Service



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

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



Mail and returns should be sent to:

**Lakewood Instruments
7838 North Faulkner Road
Milwaukee, WI 53224 USA**

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

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

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

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

**ANY ITEMS SENT BACK TO THE FACTORY
WITHOUT AN 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.

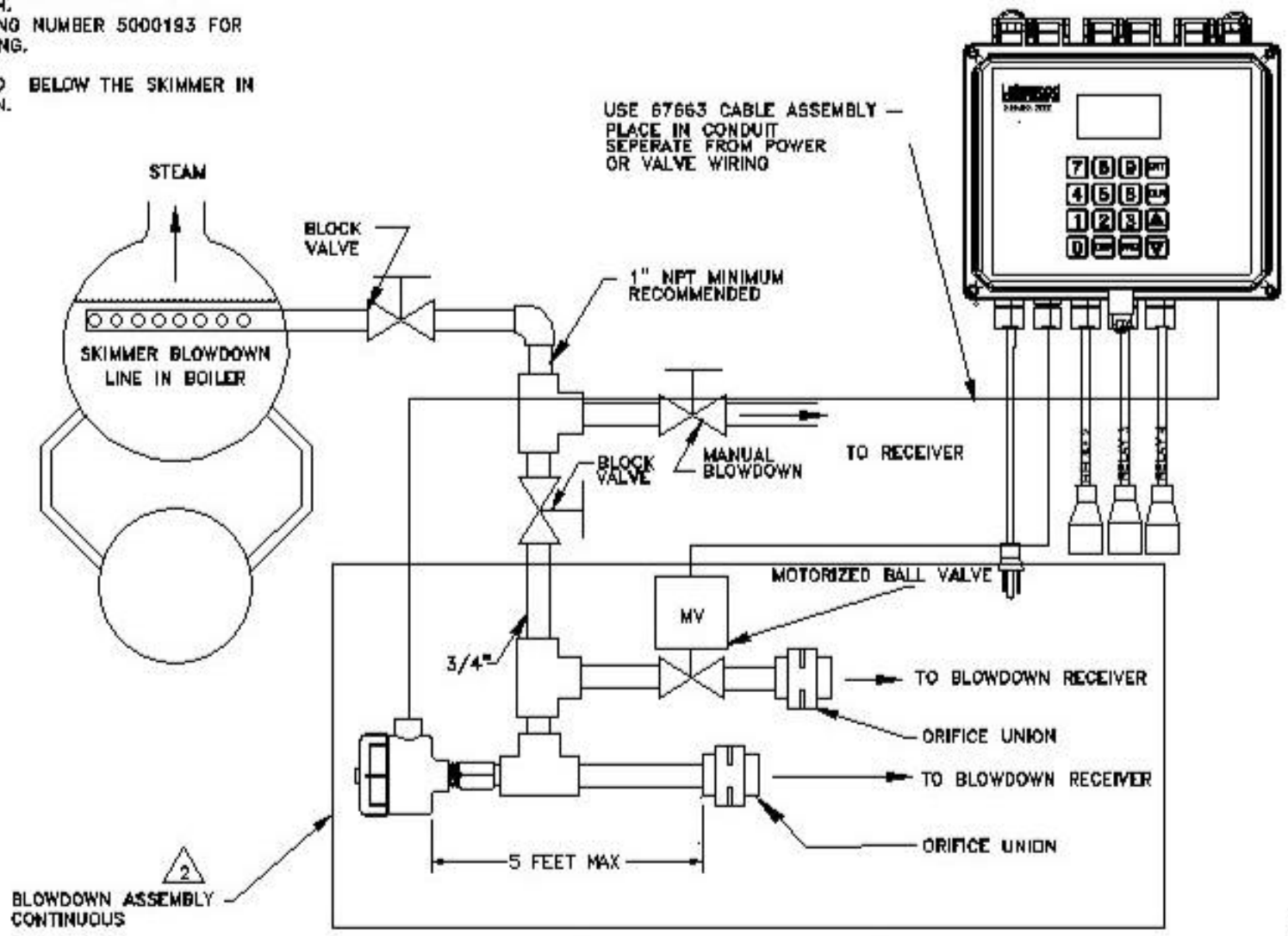
Model Number:

Serial Number:

Firmware Version:

10.0 Drawings

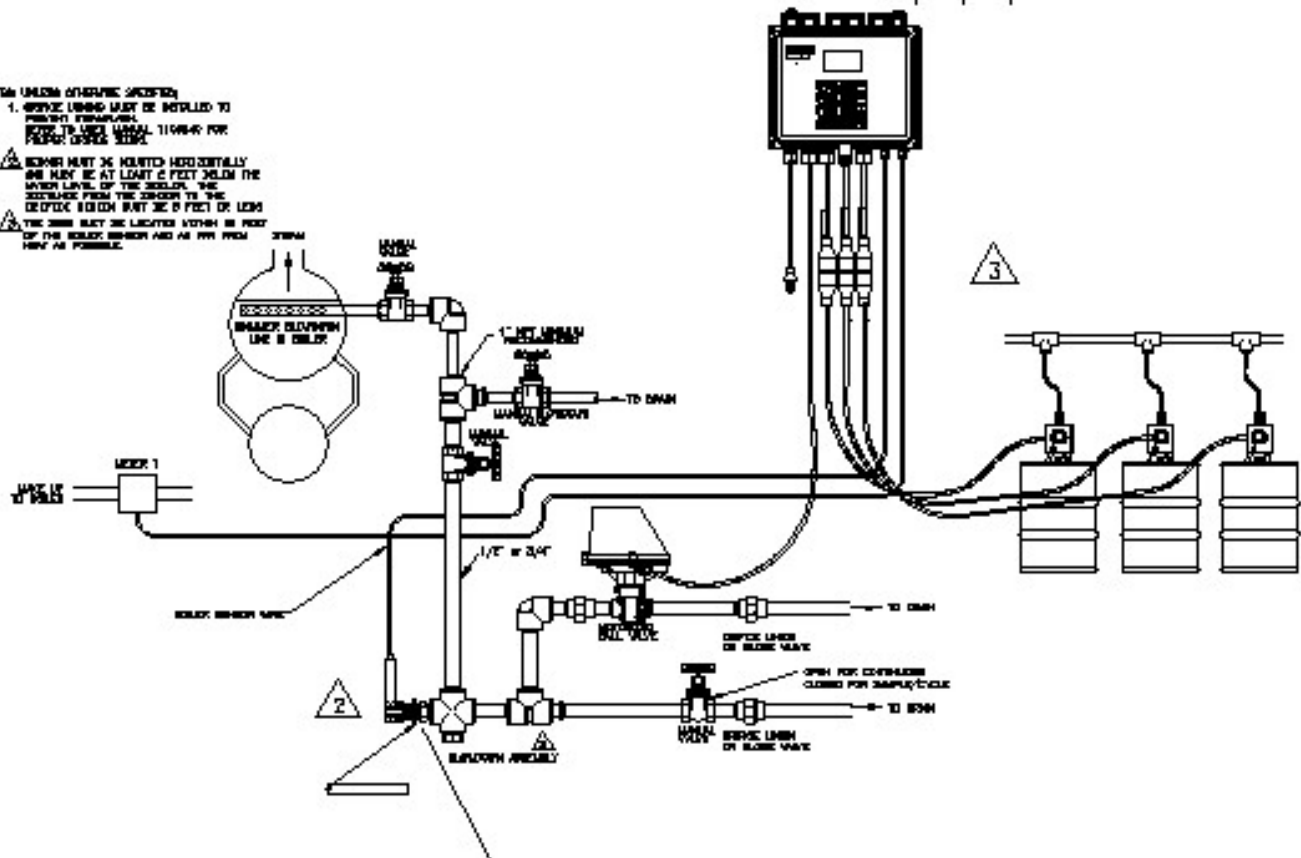
NOTES: UNLESS OTHERWISE SPECIFIED;
 1. ORIFICE UNIONS MUST BE INSTALLED TO PREVENT STEAMFLASH.
 REFER TO DRAWING NUMBER 5000193 FOR PROPER ORIFICE SIZING.
 2. MUST BE LOCATED BELOW THE SKIMMER IN THE POSITION SHOWN.



3 JOK JOK		PS DESIGN 8-7-07		Lohmeyer MODEL 2250 CONTINUOUS	
NEXT AVAIL. USED IN		APPLICATION		A 1268648 3a A	
				NONE 2250 2 OF 2	

REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECD	DWN/DATE	APVD/DATE
A	A	RELEASE	10042	PSG / 2-9-07	

- NOTES UNLESS OTHERWISE SPECIFIED:
1. SERVICE LINES MUST BE INSTALLED TO PREVENT OVERSAMPLING. REFER TO USER MANUAL 1100840 FOR FURTHER DETAILS.
- ⚠️ SENSORS MUST BE MOUNTED HORIZONTALLY AND MUST BE AT LEAST 6 FEET BELOW THE WATER LEVEL OF THE SENSORS. THE DISTANCE FROM THE SENSOR TO THE DEPTHCOR SENSOR MUST BE 6 FEET OR LESS.
 - ⚠️ THE SENSORS MUST BE LOCATED WITHIN 10 FEET OF THE SENSORS AND AS FAR FROM EACH OTHER AS POSSIBLE.



SENSORS MUST BE MOUNTED HORIZONTALLY AND MUST BE AT LEAST 6 FEET BELOW THE WATER LEVEL OF THE SENSORS. THE DISTANCE FROM THE SENSOR TO THE DEPTHCOR SENSOR MUST BE 6 FEET OR LESS.

NOTICE ON REPRODUCTIONS
 THIS DRAWING, THE DESIGN AND THE PATENT RIGHTS COVERED, ARE THE PROPERTY OF LAKWOOD INSTRUMENTS. THEY ARE LOANED TO YOU ON THE UNDERSTANDING AND AGREEMENT THAT THEY WILL NOT BE REPRODUCED, COPIED, LOANED, EXHIBITED, NOR USED EXCEPT IN THE LIMITED WAY AND THE PRIVATE USE PERMITTED BY WRITTEN CONSENT GIVEN BY THE LENDER TO THE BORROWER.



DIMENSIONS AND TOLERANCING PER ASME Y14.5M-1994

MATERIAL:	
FINISH:	DWN PSG DATE 2-9-07 CHKD DATE APVD DATE
PROJECT:	
LIBRARY:	

TITLE		PN		REV
INSTALLATION LAYOUT OF CONTINUOUS OR SAMPLE/CYCLE, 2000e		1268647		A
SIZE	SCALE	G-SHEET	DWG NO	REV
B	NTS	1 of 1	1268647 5a	A

NOTES

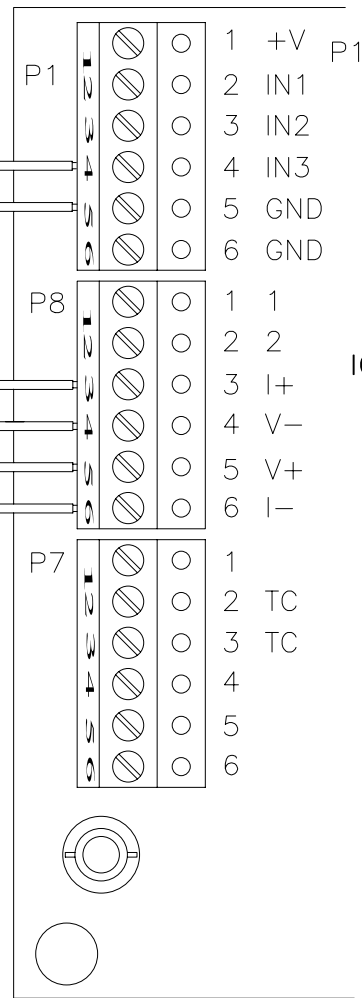
Ⓐ JUMPER 3-5 AND 4-6 WITH 22 AWG WIRE ON P8

JUMPER 22 AWG

Ⓐ
RED
BLACK

RED BLACK

BOILER SENSOR



REVISION HISTORY					
REV	DESCRIPTION	ECO	DWN	DATE	APVD
A	RELEASE	0121	MLM	3/95	
B	REVISED	1121	EV	8/25/97	
C	CHANGED CABLE TO 2 WIRE	10127	PSG	5/3/11	

IONODE

NOTICE ON REPRODUCTIONS THIS DRAWING, THE DESIGN AND THE PATENTS IT COVERS ARE THE PROPERTY OF OSMONICS INC. THEY ARE LOANED MERELY AND ON THE BORROWER'S EXPRESS AGREEMENT THAT THEY WILL NOT BE REPRODUCED, COPIED, LOANED, EXHIBITED, NOR USED EXCEPT IN THE LIMITED WAY AND THE PRIVATE USE PERMITTED BY WRITTEN CONSENT GIVEN BY THE LENDER TO THE BORROWER.					
MATERIAL	TOLERANCES UNLESS NOTED				
FINISH	FRAC	DECIMALS	ANGLES		
		.X ± .1			
		.XX ± .03			
	±1/16	.XXX ± .010	±.5°		
ORDER NO.	DWN	EV	DATE 3/95		
CUSTOMER	CHKD	DATE			
CUSTOMER LOC.	APVD	DDR	DATE 4/95		
DO NOT SCALE		APVD	DATE		



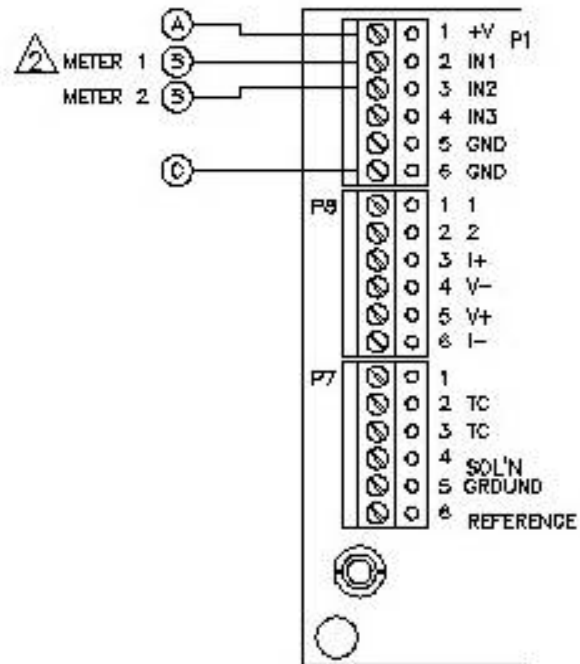
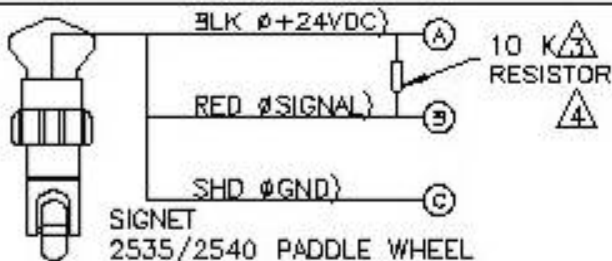
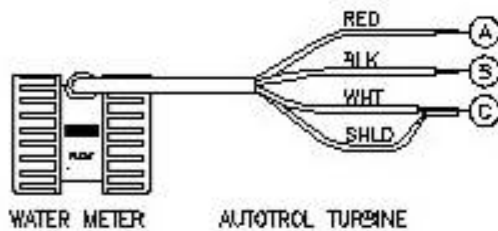
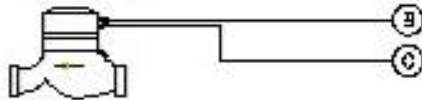
TITLE				REV
WIRING DIAGRAM				C
SENSOR WIRE, LOW POWER M2250				
SIZE	DWG NO/PN			
B	1227210_4c			
SCALE	FILE TYPE	SHEET 1 OF 1		
NONE	.DWG			

NOTES: UNLESS OTHERWISE SPECIFIED;

- 1 2450: CANNOT BE USED WITH CONTACTING HEAD METER.
- 2 2450: METER 1 IS PERMEATE, METER 2 IS CONCENTRATE.
- 3 CUSTOMER SUPPLIED, 10K RESISTOR (PULL-UP).
- 4 ONLY OPEN COLLECTOR OUTPUT WATER METERS MAY BE USED.

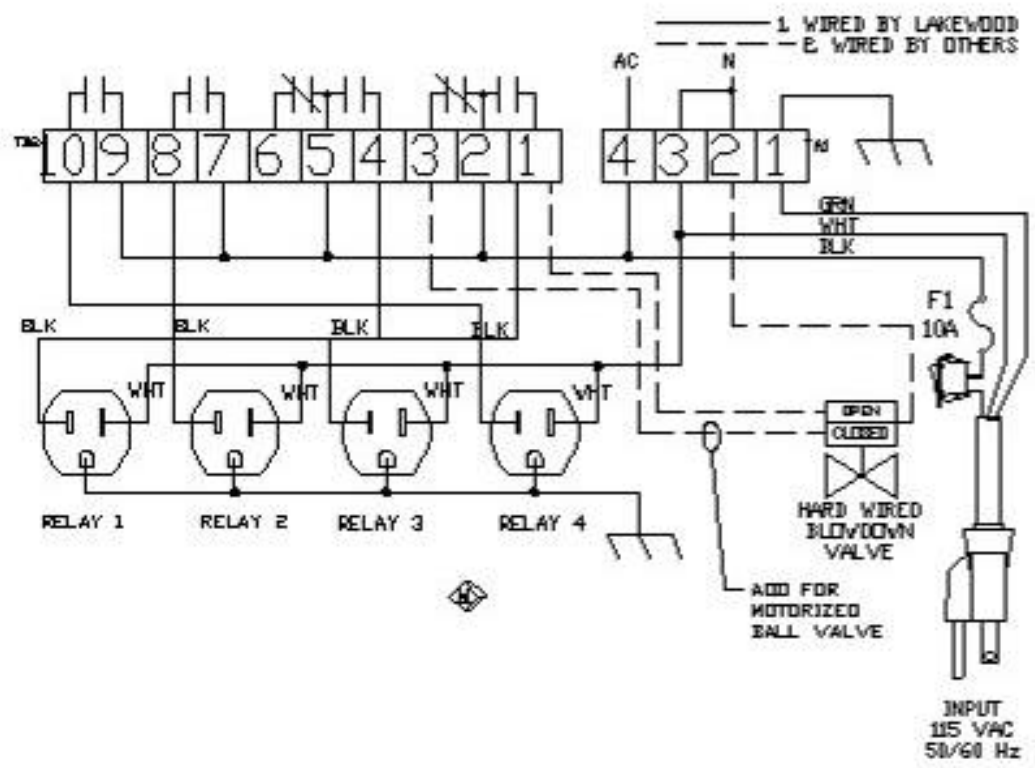
REVISION HISTORY						
REV	DATE	DESCRIPTION	BY	APP	DATE	APPD
A		RELEASE	1121	EV	01/20/97	
B		RELEASE	020	EV	01/20/97	
D		RELEASE	1267	EV	10/13/97	
D		RELEASE	1482	EV	11/20/97	-JSD
E		ADDED NOTE 3	1241	EV	01/18/98	-JSD
F		REMOVED HEAD, 6-PIN BOARD	1743	EV	01/18/98	

CONTACTING HEAD TYPE WATER METER



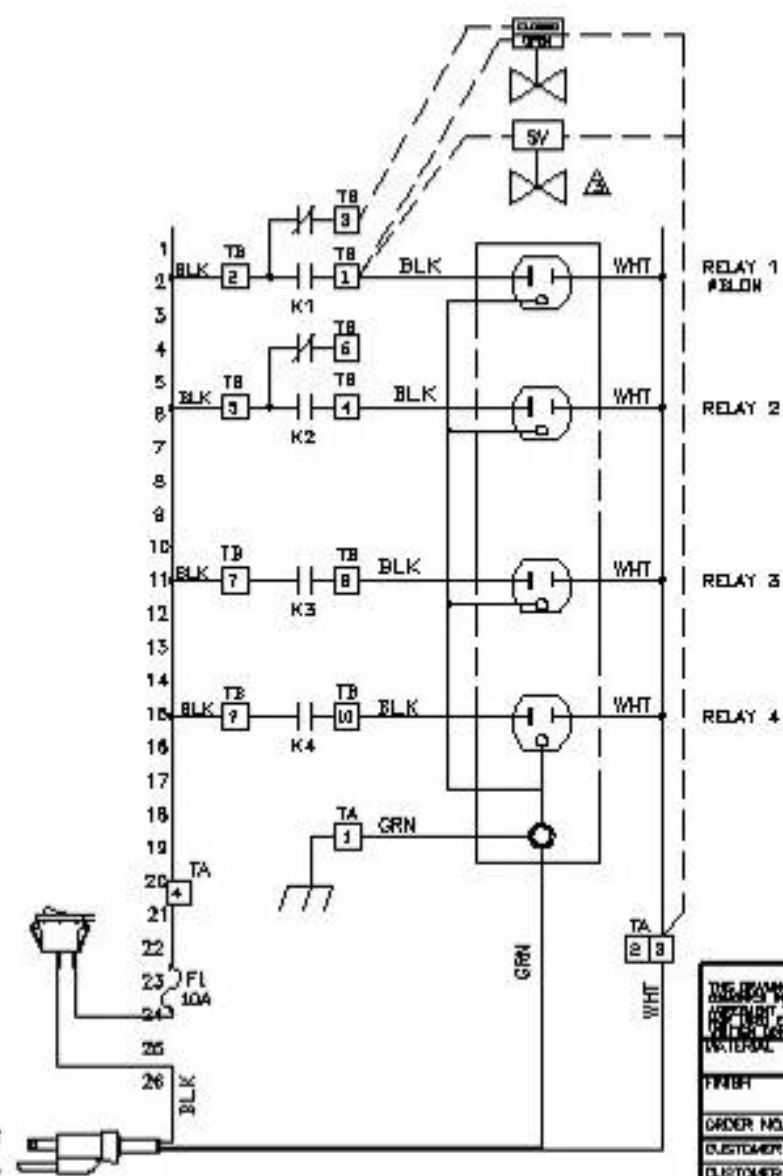
TITLE OF INSTRUMENT				Lakewood INSTRUMENTS	
DATE	REV	DESCRIPTION	BY	APP	DATE
01/20/97	1	RELEASE	1121	EV	01/20/97
01/20/97	2	RELEASE	020	EV	01/20/97
10/13/97	4	RELEASE	1267	EV	10/13/97
11/20/97	5	RELEASE	1482	EV	11/20/97
01/18/98	6	ADDED NOTE 3	1241	EV	01/18/98
01/18/98	7	REMOVED HEAD, 6-PIN BOARD	1743	EV	01/18/98
DO NOT SCALE	REV	DATE	SCALE	BY	DATE
TITLE				REV	
WIRING DIAGRAM				F	
WATER METER INPUTS, W-2000 SERIES				1109544-24	
SCALE				BY	
NONE				DATE	
DATE				BY	
01/18/98				EV	

REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APV/DATE
A	A	RELEASE	10042	PSG/ 5-3-06	LRS/ 7-28-06



NOTICE ON REPRODUCTIONS								
THIS DRAWING, THE DESIGN AND THE PATENTS IT COVERS ARE THE PROPERTY OF LAKEWOOD INSTRUMENTS (L.I.). THEY ARE LOANED MERELY ON THE NON-EXCLUSIVE PRESS AGREEMENT THAT THEY WILL NOT BE REPRODUCED, COPIED, LOANED, EXHIBITED, NOT USED EXCEPT IN THE LIMITED WAY AND THE PRIVATE USE PERMITTED BY WRITTEN CONSENT GIVEN BY THE LENDER TO THE BORROWER.								
DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994						WIRING DIAGRAM, 2000 SERIES NEMA ENCLOSURE		
MATERIAL	TOLERANCES UNLESS NOTED		FINISH		DWN PSG DATE 5-3-06 CHKD RCL DATE 7-28-06 APVD LRS DATE 7-28-06			
	DIMEN'S ± XX ± XXX ±		FINISH ± ±				SIZE A TO FIG. 24/25	PN 1268647
PROJECT:	APVD LRS		DATE 7-28-06		SCALE NTS	SHEET 1	DWG NO 1268647-1a	REV A
LIBRARY:	VERSION							

REVISION HISTORY					
REV	DESCRIPTION	EGG	D/WN	DATE	APVD
A	RELEASE	10342	PSD	1-16-08	



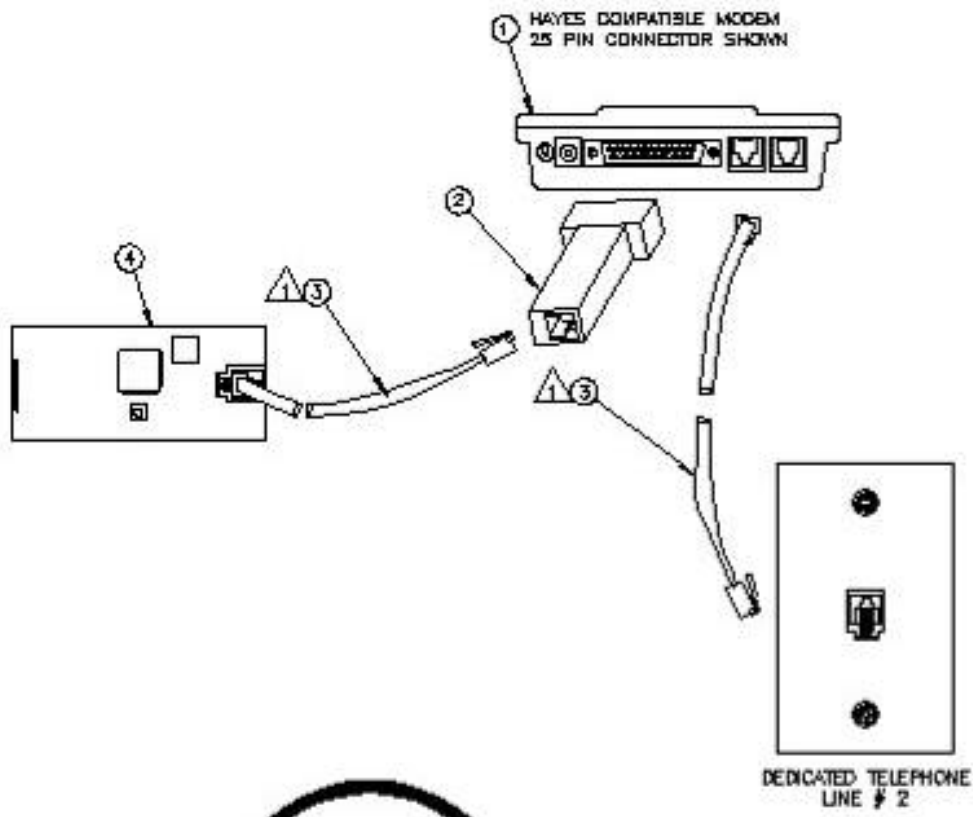
1. WIRING BY LAKEWOOD _____
2. WIRING BY OTHERS - - - - -
- ⚠ IF RECEPTACLE NOT USED, WIRE BLOWDOWN VALVE BETWEEN TB1 AND TA5
4. RELAY CONTACTS RATED 10A / 250 VAC, 1/3HP / 240 VAC

INPUT
115 VAC
50 / 60 Hz

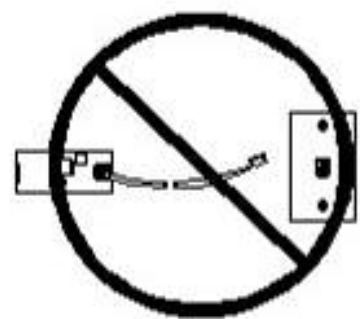
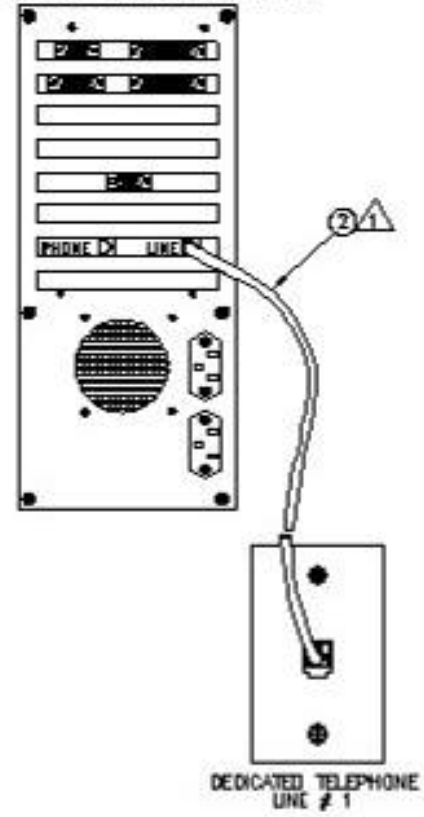
<p>NOTICE ON REPRODUCTIONS</p> <p>THIS DRAWING IS THE PROPERTY OF LAKEWOOD INSTRUMENTS. IT IS TO BE USED ONLY FOR THE PROJECT AND SITE SPECIFICALLY IDENTIFIED HEREIN. ANY REUSE OR MODIFICATION OF THIS DRAWING WITHOUT THE WRITTEN PERMISSION OF LAKEWOOD INSTRUMENTS IS STRICTLY PROHIBITED.</p>			
<p>DATE: 05/16</p> <p>SCALE: .001 ± .001</p>		<p>TITLE: ELECTRICAL SCHEMATIC</p> <p>2000 SERIES, NEMA ENCLOSURE</p>	
<p>ORDER NO.</p> <p>CUSTOMER</p> <p>CUSTOMER LOC.</p>	<p>DATE: 11-16-08</p> <p>DATE</p> <p>DATE</p>	<p>SIZE: B</p> <p>THERM. TABLE</p>	<p>DWG NO./REV: 1268647-20</p> <p>REV: A</p>
<p>DO NOT SCALE</p>		<p>SCALE: NONE</p>	<p>FILE TYPE: DWG</p> <p>SHEET 1 OF 1</p>

NOTES: UNLESS OTHERWISE SPECIFIED:
 ⚠ STANDARD FOUR CONDUCTOR TELEPHONE CABLE
 UP TO 50 FEET IN LENGTH MAY BE SUBSTITUTED.

REVISION HISTORY					
REV	DATE	DESCRIPTION	BY	CHKD	APPD
A		RELEASE	DMT	MLM	1/88
B		DESIGN	DMT	MLM	8/95
C		REWORK	DMT	ML	12/97
D		REWORK	DMT	ML	12/98/01



PERSONAL COMPUTER WITH MODEM



DO NOT PLUG RJ21 DIRECTLY INTO TELEPHONE LINES

1	REEL	REEL, COM. NODE	ASSEMBLED PCB, M-2000	4
1	66336	CABLE, RJ21, 25 FT.		3
1	67760	ADAPTER	25 P MALE D CONN TO RJ21 DTE	2
1	67740	MODEM	HAYES COMPATIBLE	1

DATE SHIP

WORK IN PROGRESS

Labrador INSTRUMENTS

INSTALLATION LAYOUT
 OGINODE TD 25P DTE, SER 2000, REEL

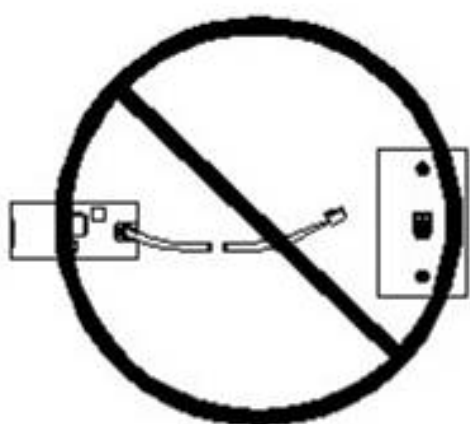
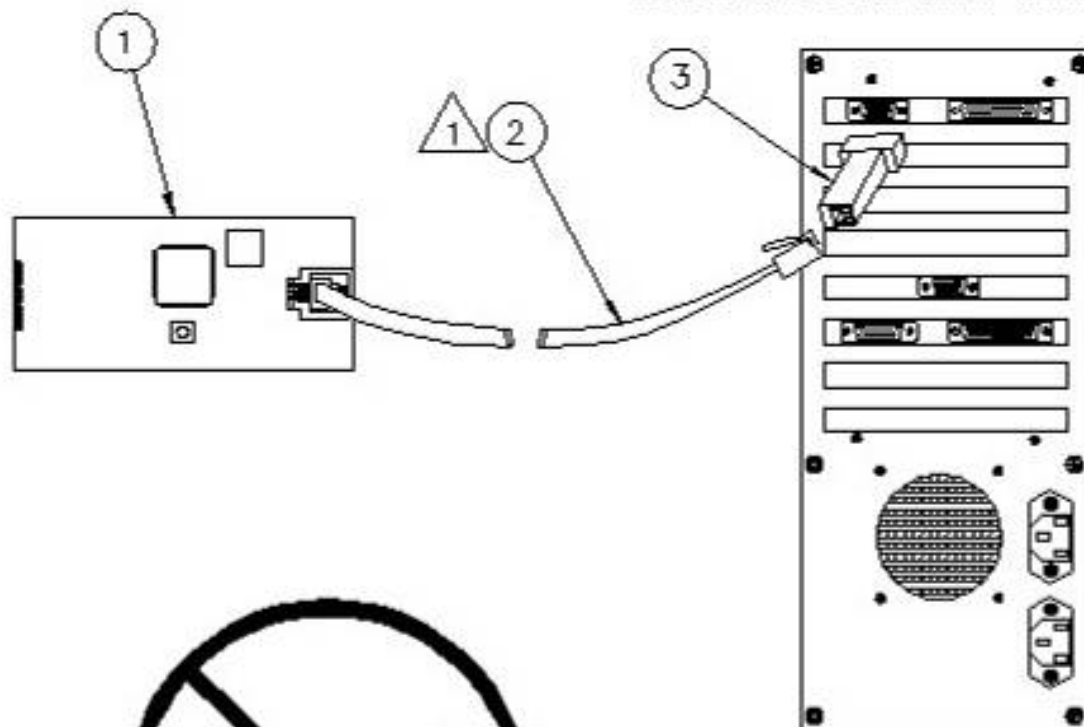
REV D

1109706-1-d

NOTES: UNLESS OTHERWISE SPECIFIED;
 1. STANDARD FOUR CONDUCTOR TELEPHONE CABLE UP TO 50 FEET IN LENGTH MAY BE SUBSTITUTED.

REVISION HISTORY						
REV	DATE	DESCRIPTION	BY	APP	DATE	APP
A	REL/MS	RELEASE	1387	07	10/2/97	
B	REL/MS	RELEASE	1387	07	10/2/97	
C	REL/MS	RELEASE	1485	07	11/24/97	MS

PERSONAL COMPUTER WITH MODEM

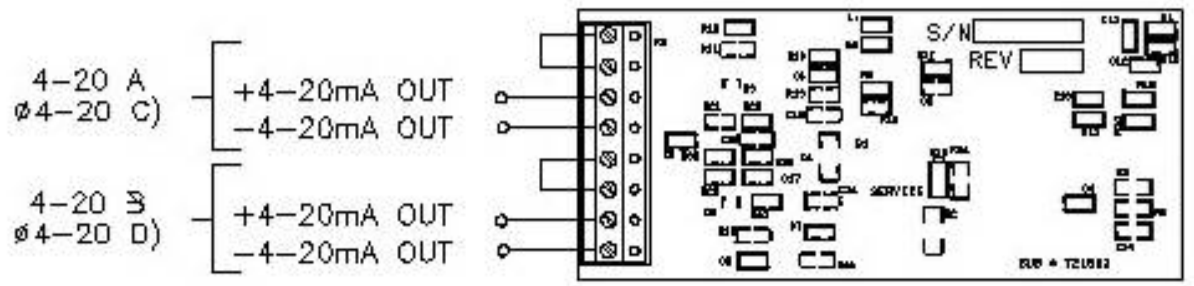


DO NOT PLUG RS2L DIRECTLY INTO TELEPHONE LINES

1	87309	ADAPTER, 8 PIN	MALE CONN TO RJ11 DTE	3
1	88336	CABLE, 8 FT	25 FT	2
1	RS2L	RS2L COM MODULE	ASSEMBLED PCB, M-2000	1
SUPPLY LIST				
NAME OF REPRESENTATIVE				
ADDRESS				
CITY				
STATE				
ZIP				
PHONE				
FAX				
E-MAIL				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY				
CHECKED				
APPROVED				
SIGNATURE				
TITLE				
PART NUMBER				
REV				
DATE				
BY</				

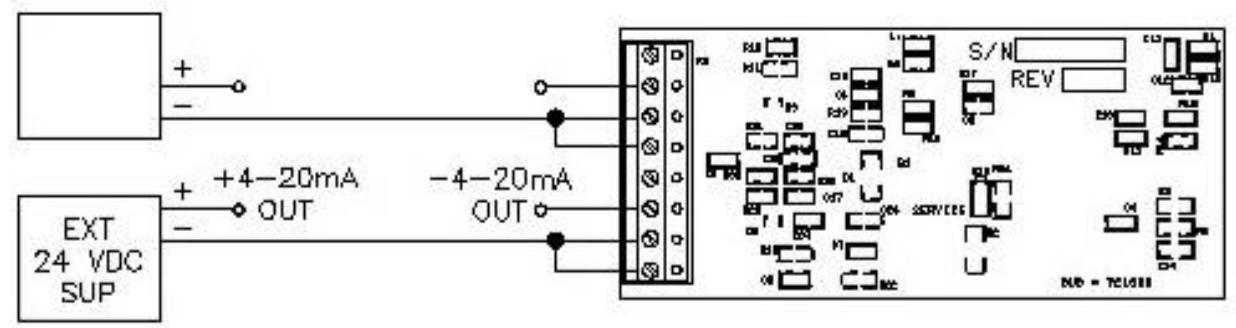
NOTES: UNLESS OTHERWISE SPECIFIED;
 1. LOADS MUST BE LESS THAN 600Ω

REVISION HISTORY						
REV	DATE	DESCRIPTION	BY	CHK	DATE	APP'D
A		RELEASE	8767	5/	8/88	
B		REVISED	587	5/	10/9/87	



INTERNAL POWER

OPTIONAL EXTERNAL 24 VDC SUPPLY



BLOCK OF IDENTIFICATION				Lakewood INSTRUMENTS	
DATE	REV	DESCRIPTION	BY	CHK	DATE
POWER NO.	REV	MAN	DATE/08	TITLE	1109707-1b
DO NOT SCALE	APP'D	DATE	SCALE	NAME	FILE TYPE: A3X



WIRING DIAGRAM
 POWER SUPPLY, 24VDC, 4 TO 20 mA

1109707-1b

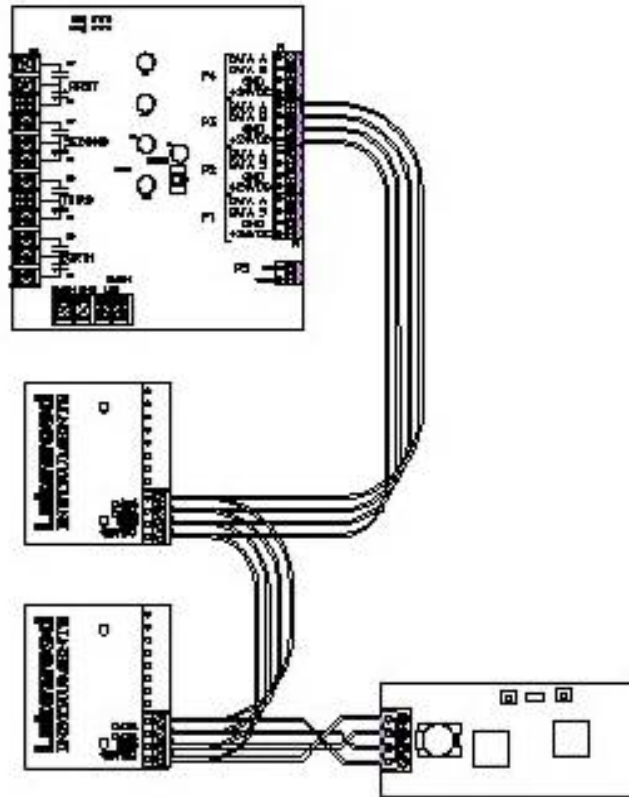
REV B

SHEET 1 OF 1

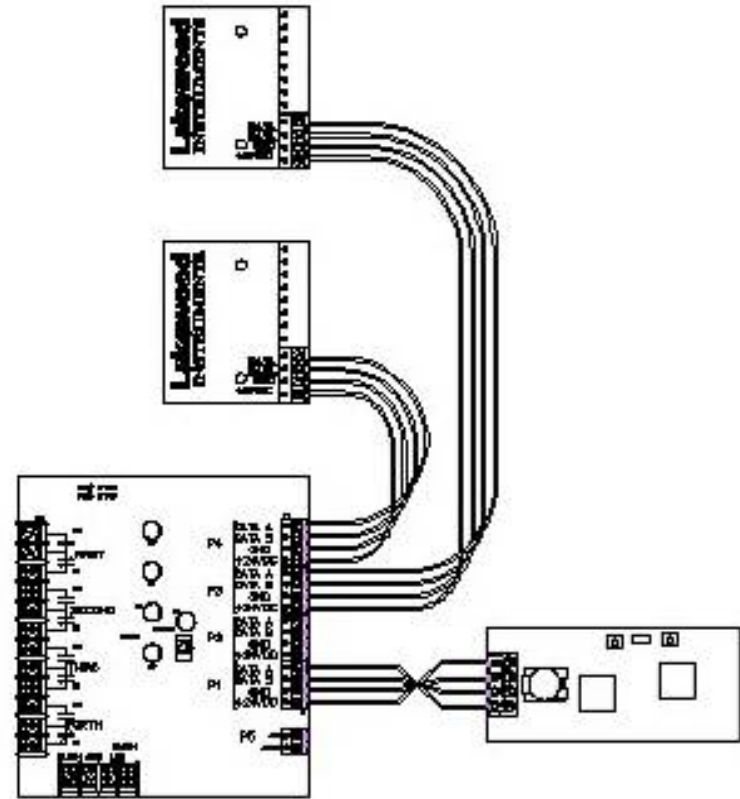
NOTES: UNLESS OTHERWISE SPECIFIED;

1. NN OPTION PROVIDES +24 VDC TO ALL NODES. IF USING MORE THAN 3 NODES AN EXTERNAL +24 VDC POWER SUPPLY IN PARALLEL IS RECOMMENDED.

REVISION HISTORY					
REV	CHK	DESCRIPTION	ED	BY	DATE
A		RELEASE	YMS	EV	5/8/87



OR



<p>Labwood INSTRUMENTS</p>		<p>INSTALLATION DRAWING NN OPTION</p>	
<p>1187805-10</p>		<p>REV A</p>	
<p>DO NOT SCALE</p>		<p>ONE OF TWO SHEET 1 OF 1</p>	

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

Manufactured in the USA

Lakewood Instruments

7838 North Faulkner Road, Milwaukee, WI 53224 USA

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

<http://www.lakewoodinstruments.com>