OPERATION AND
SERVICE GUIDE
O-710A
JULY 1984

pH RECORDER - CONTROLLER

MODEL 432 PRICE CODE NO. 56-0066

GENERAL INFORMATION

Model 432 is a combination pH Recorder and pH Indicator controller. It is designed for controlling the pH of waste products and recording the pH of the neutralized waste fed to a sewage system. There are a number of options possible including high/low limit controls or control/alarm for the pH measured by the recorder.

The controller is intended to turn power on or off to a pump or valve whenever the pH of the solution being monitored exceeds a set limit. Power outputs are available to turn on with either increasing or decreasing pH.

A complete installation will consist of an electrode to measure the pH of the solution being monitored. In addition, there will be the controller and the neutralization system. This will consist of a tank to hold the acid or alkaline solution. Solution flow will be controlled by a valve or pump. This solution will be mixed with the material being controlled. The mixing is usually done in a tank or pit with thorough stirring. The electrode measures the pH of this mixing tank.

The instrument is housed in a NEMA-12 case. Mounting lugs are on the rear. Access to the interior is accomplished by loosening the two knobs on the front by 3 or 4 turns and sliding the catches to the right. All of the controls are on a panel on the inside. Across the top are set point controls and space for a timer. The master power switches above the meter provide control of either the meter or the recorder as labeled. These provide power to the amplifiers and to the set points. The fuses adjacent to the master switches are for the amplifiers only. Immediately above the meter are the electrode controls. The temperature and calibration knobs on the right are for the electrode which operates the meter. The temperature and calibration knobs on the left are for the electrode which operates the recorder.

The set point knobs establish the pH at which power appears at the output terminals. Each individual set point control can be adjusted to control either acid or alkali. If a specific set point controls acid, the panel light will turn on whenever the pH is above the set point and power will appear at the terminals for that set point. If a specific set point controls alkali, the panel light will turn on whenever the pH is below the set point and power will appear at the terminals for that set point.

Two set point controls are furnished as standard. One may be used to control the neutralization solution while the other is used to actuate an alarm. If the solution being controlled may swing both acid or alkaline, two separate neutralization solutions may be added, to control the pH within a selected range. As an alternative, the two limit controller can be used to add neutralization solution at two different rates which will provide a degree of proportional control. The latter arrangement is valuable when there are large fluctuations in the amount of material to be neutralized. If this option is used with a pump which has a reversible motor driven rate control, a very wide range of neutralization solution addition rates can be accomplished while maintaining the pH in a narrow range.

Power connections are under a cover at the bottom of the cabinet. These connections are at labeled locations on a terminal block.

The instrument itself consumes 20 watts of 115 volts AC power. It will operate reliably over a range of 100 to 130 volts. The maximum load is 5 amps resistive or a 1/6 HP motor.

INSTALLATION

Using the lugs on the rear, mount the instrument on a wall or panel. Bring in power through the bottom. Connect power to the three terminals at the right end of the block marked LINE, COM, GND. In addition to the input power terminals, there are several pairs of terminals marked LINE & COM. The number of pairs will depend on the number of set point controls purchased. Each set point control applies power to the corresponding LINE OUT terminal. External devices requiring power as a result of set point action are connected to the set point LINE and COM terminals.

A set point may control the addition of either acid or alkali. When controlling acid addition, power and indicator light will turn on when pH meter or recorder is above the set point. When controlling alkali addition, power and indicator light will turn on when the pH meter or recorder is below the set point.

The set point logic has been preset at the factory to produce power output for either acid or alkaline addition. If the need ever arises to change the power output from acid to alkaline (or vice versa), it can be done by the following procedure:

1. Remove the two slotted screws at the top of the control panel allowing the panel to swing outward.
2. Located directly behind the set point control knob is a circuit board, mounted underneath a bracket. On the lower side of the circuit board is a small toggle switch. Flip this switch to the other side to change the power output. Figure 1 on the next page shows where the switch should be for acid addition or alkaline addition.

For the indicator-controller, select the optimum point for measuring the solution pH. This will be the electrode location. If a tank is being controlled, the electrode location must be typical of the composition of the entire tank. If a stream is being controlled, all of the stream or a representative portion of the stream must flow past the electrode. Successful pH control will require adequate mixing of the solution before it reaches the electrode. The addition point for the neutralization solution must be selected to provide such mixing before the solution reaches the electrode. For a tank, it is generally necessary to have a propeller type mixer or a circulating pump. The maximum rate at which neutralization material can be added will depend on the rate of mixing.

Mount the electrode so it will always have the glass electrode under the solution surface at all times. Excessive neutralization material may be injected if the electrodes are out of the solution and cannot present the correct signal to the controller. Support for the electrode should be arranged so the electrodes may be easily removed for cleaning. An extension cable is usually required. Make certain the electrode connector cannot become grounded or the pH reading will not be correct. This connector is at a slightly different voltage from ground due to the voltage generated by the reference electrode. Extension Cable is available in any length to 100 ft. which is the maximum recommended. If constructed by the user, the cable should be of RG-174/U type. If there is a separate reference electrode in the system, Part No. 56-0208 Pin Jack to Pin Plug Cable is available.

OPERATION

Make certain all connections are complete for power, pump (or valve) and electrode(s). Start the mixer for the solution to be controlled and after a few minutes turn on the instrument. Set the temperature knob to the solution temperature. Set the pH control knob to the pH at which the pump or valve should turn on.

Either of the following two procedures may be used for calibrating the electrode. The voltage produced by different electrodes at a fixed pH such as 7.00 is slightly different. Consequently, the electrodes must be calibrated against buffer solution. One procedure is to dip the electrode tip into the buffer and adjust the calibration knob until the meter reads the pH of the buffer. The other procedure is to calibrate a portable pH meter (such as Model 300 or 310) with buffer. The pH of the solution being controlled is then measured with this meter and the calibration knob of the controller is adjusted to make the controller read the pH found with the portable meter.

When a new system is first started, it will be necessary to watch the pH meter of the controller for several cycles of the control relay. The indicator light will show when the relay is on. The purpose of this monitoring is to determine the correct flow rate of the neutralization solution. The flow rate should be adjusted so the pH overshoot on either side of the control point is approximately the same. This will minimize consumption of neutralization material and produce the most consistent pH for the effluent. In some applications, it is only necessary to prevent the pH from going beyond a selected limit. For this the flow rate of neutralization material may be far more than necessary and overshoot in one direction is acceptable.

Neutralization solution may be supplied from a pump or gravity fed from a tank through a solenoid valve. In either case, it should be possible to regulate the flow if precise control of the pH is desired. Many different types of metering pumps are available which have adjustable stroke length, period between strokes or motor speed. If gravity feed is used, a needle valve should be near the solenoid valve to control the flow rate. Adjustable rate solids feeders are available from several manufacturers. If the pump or feed mechanism requires more power than this instrument is capable of handling, a heavy duty electrical contactor will be required. A simple means of neutralizing acid waste is with liquid ammonia. This may be controlled by a needle valve and a solenoid valve. Another advantage of ammonia is that it may be possible to eliminate the neutralization tank mixer because ammonia entering water causes turbulance.

A waste treatment system generally consists of a pit with dividers to promote mixing or a series of pits with dividers. The first pit or section of a pit has a motor driven stirrer and an overflow weir to the next pit or compartments. This first pit or section must be large enough to hold a several minutes supply, at maximum rate of flow, of the material to be neutralized. The larger the pit the better the pH control. The next pit or baffled section forces the solution under the baffle. The waste then flows out of the third compartment over another weir and drops into the final compartment or pit. The drain leaves through the wall of this final compartment or pit. The pH controller monitors the first pit or pit section and neutralization material is added at this point. Regulation may require a record of the waste being discharged to the sewer. The recorder provides this record. The electrode for the recorder should be located close to the point of discharge to the sewer. For some applications, a single, very large, well stirred pit is adequate for the waste treatment system.

Design of a system to control the pH of a rapidly flowing stream is more difficult. Generally, a proportional neutralizer feed system is necessary. This requires a variable flow pump or motor driven valve for a gravity system. The dual controller option will establish high and low limits for pH and drive the control system to inject the correct neutralizer flow rate.

The control system may be tested by operating the knobs in the following sequence. Once the electrodes are in solution, adjust the set point knobs to approximately the pH of the solution being tested. Slowly turn one of the Calibration knobs to swing the pointer of the corresponding instrument past the set point. The valve or pump being operated by the controller and the pilot light should turn on and off at the appropriated side of the set point for acid or alkali addition. It may be desirable to have feed to the control valve or pump turned off during these tests.

Continued on next page . . . .

ELECTRODES

There are several types of electrodes available for the controllers and recorders. A combination electrode is generally ordered with the instrument. A combination electrode has both a glass pH sensitive electrode and a reference electrode in one all glass unit. Separate glass and reference electrodes are for samples with problems such as high pressure or temperature. A combination gel filled electrode is usually supplied since it does not require filling. These are the disposable type such as Part No. 56-0301 or 56-0305 per Bulletin A301.

The glass electrode produces an output voltage dependent on the pH of the solution on the outside of the electrode. The pH sensitive portion is a thin glass membrane with a spherical surface on the end of the electrode. Inside this bulb is a silver wire coated with silver chloride and buffer solution between the wire and the thin glass bulb. The amount of voltage produced depends not only on the pH but also on the temperature. Electrical contact with the solution is through the glass membrane which constitutes a high resistance in the order of 25 to 100 megohms.

To complete the electrical circuit to the pH controller, a second electrode is required. Both silver chloride and calomel reference electrodes are available. Each has certain advantages and disadvantages. Electrical contact from the reference electrode to the solution is through a fine junction which will pass very little solution (see electrode specifications for filling solution flow rate). The junction is either an asbestos fiber or ceramic rod welded into the glass. For combination electrodes, this junction apears just above the ph bulb and on the side. For separate reference electrodes, the junction is on the bottom. It is important that this juction be kept clean, otherwise the pH reading will drift. To clean, use a wet paper towel and wipe the junction several times.

REFERENCE ELECTRODE

All reference electrodes have two openings. During shipment, these openings are covered with a cap or rubber sleeve. Before the electrode is placed in service, both covers must be removed. A problem may be encountered in that the rubber tends to attach itself to the glass. Wet the glass and rubber with water. Work the water under the rubber by lifting the edge to allow water to run under. Once water is under the rubber, it will easily slide off.

An all glass reference electrode should be kept filled with filling solution at least one inch above the level of the solution being monitored. For accurate readings, the flow must always be out of the electrode and sample should not enter the electrode. This is more important with a silver chloride electrode than with a calomel electrode. Sample entering a silver chloride reference may cause a calibration drift of up to 0.3 pH whereas the drift of a calomel would be only 1/10th of this. If the electrode is calibrated with sample on the inside, it is possible to cancel out much of the error but it will return if conditions change.

SILVER CHLORIDE REFERENCE ELECTRODE

A silver/silver chloride electrode must be kept filled with 4M potassium chloride saturated with silver chloride. Do NOT use filling solution without silver chloride or the electrode will be slowly damaged.
There are several reasons for selecting a silver chloride reference. Many types will operate at a high temperature. If through poor maintenance the filling solution is allowed to run out, there is generally less problem in establishing satisfactory operation when refilled than with calomel.

CALOMEL REFERENCE ELECTRODE

A calomel reference electrode must be kept filled with pure potassium chloride solution. Do NOT use filling solution containing silver or the electrode may be permanently damaged.
There are several reasons for selecting a calomel reference. This is the most stable type of reference available. There is little effect of flow on the junction whereas a silver reference may change its output by as much as 0.2 pH from a no flow condition to a flow rate of a few feet per second past the junction. The presence of certain materials such as proteins or heavy metal ions may cause significant calibration drift of a silver chloride reference but they have no effect on a calomel reference. If a calomel reference is allowed to run dry, a bubble may enter the calomel cell and the electrode will cease to put out a stable signal. This bubble can only be removed by pulling a vacuum on the electrode and this is a laboratory procedure.

ELECTRODE TEMPERATURE

The pH calibration of all glass electrodes is dependent on temperature. Therefore, it is necessary to compensate for temperature of the electrode. A Temperature control knob is on the front panel for this compensation. For measurements within one pH of the buffer and between 10° and 40°C, the temperature correction is below 0.1 pH. Consequently, for this type of measurement, the temperature control may be left at 25°C. For measurements at greater than one pH from the buffer and requiring accurate results, the temperature compensation knob must be adjusted. Set this knob to the temperature of the buffer when standardizing the electrode.
For best accuracy, the buffer temperature and the sample temperature must be the same. One method of accomplishing this for field work is to immerse the bottle of buffer in the sample for a few minutes.

All glass electrodes have a temperature co-efficient proportional to the absolute temperature. The voltage produced by the electrode is greater at higher temperatures. For example, if an electrode is calibrated with buffer at pH 7.00 and a temperature of 25°C, each one pH change will produce an output change of 59 millivolts. At 50°C, each one pH change will produce an electrode output change of 64 millivolts. The meter Temperature knob adjusts the number of millivolts change at the input connector required to make one pH change on meter. The instrument temperature compensation knob is essentially a slope control or, in electronic terms, an amplifier gain control.

Continued on next page . . . .

It is essential that the electrodes be periodically calibrated. The frequency will depend on the amount of oil and suspended solids in the water being controlled. Satisfactory electrode performance is dependent on good electrical contact between the electrode and the water. Accumulated deposits on the electrode surface can interfere with response to pH. One of the electrode calibration procedures described in this manual under OPERATION should be used. For a new system at first this should be daily. If it is found the calibration drift is insignificant, the period between calibration tests may be extended.

If an electrode becomes severely fouled, it is possible that the response to pH changes will be reduced. It may be possible to calibrate the electrode at one pH (for example 7.0) but not have a correct reading at a pH different from the buffer. To determine whether the electrode pH response is accurate, it is necessary to calibrate the electrode at least at two different pH values. This may be done with two different buffer solutions. Adjust the pointer to the correct value with the electrode in the first buffer, remove the buffer, rinse the electrode with pure water and then dip the electrode in the second buffer of different pH. The pointer should read correctly. If not clean the electrode. It is important that both the glass pH sensitive bulb and the reference junction be cleaned. Wipe thoroughly with a wet paper towel. Clean or replace electrode parts until the correct response is obtained. A secondary reason for incorrect response is that the temperature correction knob is out of adjustment. If the knob is set at too high a temperature, the change in instrument reading for a change in pH will be less than should occur.

If it is inconvenient to remove the electrode for immersion in buffer, the portable pH meter procedure may be used, provided there is sufficient normal swing in the water pH. Test the water pH with the portable meter when the pH is near the set point. Later test the water pH when the pH is as far as possible from the set point. The indicator or recorder should agree with the portable pH meter.

BUFFER SOLUTION

Buffer solutions for calibrating the electrode are available from your pH meter dealer, or may be prepared from the instructions provided in many chemical handbooks. For best test accuracy, the buffer pH should be as close as possible to the sample pH. Buffer solution pH may change with time due to absorption of carbon dioxide. Solution stored in plastic bottles for more than a year should be suspect and checked against fresh buffer. Deterioration is greatest for high pH buffers such as borate. All buffer solutions change pH with a change in temperature. The pH of buffer solutions available from Serfilco, Ltd. is shown below:

Temperature °C	pH 4.01 phthalate	pH 7.00 phosphate	pH 9.18 borate	Temperature °C	pH 4.01 phthalate	pH 7.00 phosphate	pH 9.18 borate
0	4.01	7.12	9.46	45	4.04	6.97	9.04
5	4.01	7.09	9.39	50	4.06	6.97	9.01
10	4.00	7.06	9.33	55	4.08	6.98	8.99
15	4.00	7.04	9.27	60	4.10	6.98	8.96
20	4.00	7.02	9.22	70	4.10	6.98	8.96
25	4.01	7.00	9.18	70	4.12	6.99	8.92
30	4.01	6.99	9.14	80	4.16	7.00	8.88
35	4.02	6.98	9.10	90	4.20	7.00	8.85
40	4.03	6.98	9.07				

Sample pH will also change with temperature depending on the composition. For accurate results, it is important that buffer and sample be at the same temperature. Conversely, if an accuracy of only 0.2 pH is required, buffer pH drift with temperature generally may be ignored.

MAINTENANCE

Gel filled electrodes do not require filling solution, otherwise the maintenance procedure is as follows:
At weekly intervals, the filling solution level in the reference electrode should be checked. If a flow or immersion assembly is being used, the filling solution level need be checked only once a month. If the sample is oily or has a large amount of suspended solids, the glass pH bulb and the junction should be thoroughly wiped with a wet paper towel.

Periodically, the temperature of the solution being neutralized should be tested to determine if the temperature compensation knob is set correctly. The change in output voltage with change in pH is temperature dependent for all pH electrodes. The effect is known with high accuracy and can be accurately compensated. If the instrument is calibrated within one pH of the set point and the temperature does not change more than 20°C, the error from temperature will be less than 0.1 pH. Consequently, for many applications careful monitoring of temperature is not necessary.
If the relay contacts become worn, it should be replaced. The relay is a standard type available from several manufacturers. A replacement unit should have a 12 volt coil with at least 75 ohms resistance. A Deltrol #101U-20068-81 is recommended. This is available from Serilco, Ltd.
If the pH set point control knob is removed, it should be returned to a position so its calibration matches the meter. With the instrument turned on, turn the knob until the relay turns on (pump or valve operates). Without turning the knob shaft, loosen the knob set screw and fasten the knob in place with the pointer at the pH on the meter.

Continued on next page . . . .

If the temperature knob is removed, returning it to the shaft requires an electrical calibration procedure. The temperature control knob determines the change in meter reading produced by a change in the input voltage. To set this knob it will be necessary to have a precise 0.414 volt source. With the instrument input shorted, set the meter to 7.00 with the calibration knob. With +0.414 volts DC injected into the BNC connector, turn the temperature control shaft until the meter reads 0.00 pH. Attach the knob so the pointer indicates 25°C.

TROUBLE SHOOTING

If the meter or recorder will not indicate the pH of the water, the first step in locating the defect is to isolate the problem to the instrument or the electrode. Disconnect the electrode BNC and short circuit the instrument BNC between the center terminal and the shell. This may be done with a bent paper clip or a 38315 shorting cap. With the Temperature Compensator Knob at 25°C, turn the Calibration Knob from one end of its travel to the other end. The meter pointer should move from approximately pH 5 to pH 9. This procedure proves that the voltage levels in the instrument are correct and the amplifier gain is normal. Disconnect the BNC short and the meter pointer will move. After the pointer has completed its first sudden move, it should drift down at a rate no more than 0.1 pH in ten seconds. This step tests the low input current of the field effect transistor.

If the above tests are satisfactory, the defect is probably in the electrode. The electrode may be tested for a short with a digital voltmeter or an ohmmeter with high resistance scale. The resistance between the electrode BNC shell and center terminal should be above 10 megohms with the electrode in water. Electrode response in two buffer solutions with different pH, will prove whether the electrode is pH sensitive. This test may be performed with the controller meter or recorder.

An electrode short may be in the electrode, or in the cable. Inspect the cable for mechanical damage which might connect to the internal wires. Inspect the BNC connector for moisture or salt deposits. A pH electrode has a resistance of approximately 50 megohms. Consequently, moisture or salts in the cable can affect the pH signal. A moisture damaged BNC can sometimes be repaired by cutting off 12 inches of cable and replacing the BNC.
If the electrode is not shorted and will not respond to pH change, the junction may be clogged. Try cleaning the junction with sandpaper, but be careful to not scratch the pH bulb. Soaking for one minute in lye solution (1 teaspoon per cup), then in vinegar may clean the electrode junction. If this is an industrial electrode with replaceable junction, junction replacement may correct the problem.

Sometimes a new electrode may be stored on shelf for a long period of time before installation. Such an electrode may produce an erratic performance in a recorder or controller. There is a treatment which often corrects the poor electrode performance. This treatment is based on the assumption that the poor performance is due to a clogged reference cell junction.

The electrode is heated to expel reference filling solution and then cooled to suck in fresh solution. The procedure for this is to place two level teaspoons of potassium chloride reagent crystals in ¼ cup of distilled water. After the crystals are dissolved, place the electrode tip in the solution to a sufficient depth to cover the reference junction. Warm the solution to between 150°F and 180°F for a period of one hour. Allow the solution to cool slowly. Once the solution is cool, remove the electrode. It should be ready for use.
The above procedure is intended to produce a solution of approximately two molar potassium chloride solution (50% of saturated or 149 grams per liter).

OPTIONS: ADJUSTABLE TIMER – PRICE CODE NO. 56-0204

This timer is intended for turning off an acid pump after a set period of time. The purpose is to prevent addition of excessive acid to a system as a result of electrode failure. A pH electrode may become damaged or covered with material and send incorrect pH voltage to the controller.
With the timer switch in the off position, the controller will operate in the normal cycle. When the timer switch is turned on, the timer will not operate if the pH is below the set point. As soon as the pH exceeds the set point, the acid injection will start and the timer will start accumulating time. If the acid injection does not stop within the time period set on the timer knob, the timer will shut off the acid power.

The timer actuates the same relay as the pH set point. When the acid power is on, the alkali power is off. When the acid power is off, the alkali power is on. The pH set point light turns on when acid power is on. Therefore the set point light will turn off when the time limit has been exceeded. The timer light turns on when the time limit has been exceeded.
The timer is reset to time zero each time the pH goes below the set point. If the time limit has been exceeded, it will be necessary to lower the pH below the set point or momentarily raise the set point above the pH to reset the timer.

SERIES SET POINTS – PRICE CODE NO. 56-0203

When this option is purchased with a Model 432, there is a control set point on the pH indicator and also one on the pH recorder. The power outputs from the indicator-controller are normal. AC power for the relay contacts of the recorder-controller is obtained from the relay power output of the indicator-controller.

Continued on next page . . . .

This arrangement makes it possible to use the recorder-controller as an emergency shut off. In practice, the set point for the indicator-controller is set at the pH at which neutralizer is to be added. The electrode for the indicator-controller is located near the point of neutralizer addition. The set point of the recorder-controller is set at a pH which would occur if too much neutralizer were added. In a waste treatment system the recorder electrode would usually be near the drain to the sewer. In a tank it could be at any place in the tank. If the indicator-controller failed to shut off neutralizer, the recorder-controller would do it.
When alkali is used as the neutralizer, preset both set points for alkaline addition (see previous pages). Set the indicator-controller (meter) set point at the pH at which addition of neutralizer is to take place. Set the recorder-controller set point at a higher pH.

When acid is used as the neutralizer, preset both set points for alkaline addition (see previous pages). Set the indicator-controller (meter) set point at the pH at which addition of neutralizer is to take place. Set the recorder-controller at a lower pH.
Connect the control valve or pump to the left pair of terminals labeled SERIES. These terminals will provide power as the indicator-controller (meter) set point calls for. However, if the pH at the recorder-controller set point is ever exceeded, power to the control pump will turn off. This will prevent dumping a tank of neutralizer in the event of electrode failure.

AUTOMATIC TEMPEPATURE COMPENSATOR - PRICE CODE NO. 56-0205
The automatic temperature compensator is an electronic substitute for the manual temperature compensator control on the front panel. The compensator is a six-inch long probe with a ½-inch NPT coupling at the top end. It may be mounted at the end of a length of ½-inch pipe. The compensator probe should be increased at least two inches into the water along side of the pH electrode.
The cable connector should be plugged into the jack adjacent to the electrode connector inside the instrument. When this is done, a switch inside the jack automatically disconnects the temperature compensator control on the front panel. Once the electrode has been calibrated with the electrode calibration knob, the automatic compensator will correct for temperature of the water.

ANTIMONY OFFSET OPTION
The instrument is offset approximately 400 mv in order to compensate for the output of an Antimony electrode. The Antimony electrode is useful where there are chemicals that would damage the standard glass electrode. Instruments equipped with the Antimony offset option will span from pH 1 to pH 5 against a shorted input.

DUAL RATE ALKALI CONTROL
In applications where the normal amount of acid waste is only a few percent of the peak rate, it may be difficult to control the pH in a narrow range. The dual rate control will actuate two valves or pumps for alkali feed. One of the two feed rates (marked A) is adjusted to a low rate for the normal acid waste rate. The second feed (marked B) is set at a high rate to control the high acid waste rate. If the system has a series control from the recorder, this will be marked high safety. Power will appear at the corresponding output whenever the pH is below the knob setting of a pH set point. The high flow and low flow feeds are controlled by the meter. The high safety is controlled by the recorder.

Adjust the high safety set point knob to a pH just above the highest normally expected at the recorder electrode. Adjust the low flow set point knob to a pH at which pH control is to be started. Adjust the high flow set point knob 0.5 to 1.5 pH below the low flow knob value. Turn on the system during a period of normal acid waste flow rate. Adjust the alkali flow rate to turn on for 20 to 50% of the time. If the alkali flow rate can be maintained in this range, there will be a minimum change in the pH.
During a period of high acid rate adjust the alkali high flow rate to prevent the pH at the recorder electrode from going below a permissable level. Try to minimize the alkali high flow rate to prevent waste and reduce the maximum pH at the recorder electrode.

INSTALLATION
Follow the normal installation instructions for the instrument. Since the system is designed for controlling alkali feed, there are no power terminals for acid. Connect the valve or pump to the terminals marked Set A and Set B. Set A will be for the low flow rate. Set B will be for the high flow rate.

SINGLE ELECTRODE MODEL 432
This instrument differs from a standard Model 432 in that there is only one pH sensor electrode for both the pH meter and the pH recorder. While the recorder provides a chart record of the pH, the meter provides a large scale for easy viewing. Both set point controls receive the same signal as the meter and recorder. Please keep this diffference in mind when reading the remainder of this manual.

SERFILCO, LTD.
1777 Shermer Road
Northbrook, IL 60062-5360
Telex: 289557 SERFC UR
708-559-1777
800-323-5431
FAX: 708-559-1995

DISTRIBUTED BY

WESTERN
5005 S. Hampton Street 213-588-0801
Los Angeles, CA 90058 FAX:213-588-6826