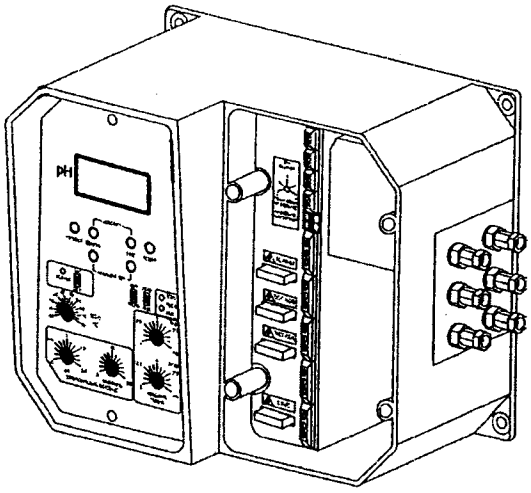
Instruction Manual

PHCN-901
PHCN-902
ORCN-901

Wall Mounted
pH & ORP
Controllers



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OMEGA will add the CE mark to every appropriate device upon certification.

Dear Customer,

Thank you for choosing an Omega Engineering product.

Please read this instruction manual carefully before using the instrument. This manual will provide you with the necessary information for a correct use of the instrument, as well as a more precise idea of its versatility.

These instruments are in compliance with the CE directives. EN 50081-1, 50082-1 and 61010-1.

TABLE OF CONTENTS

PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, notify Omega Customer Service.

Note: Save all packing materials until you are sure that the instrument functions correctly. Any defective item must be returned in the original packaging together with the supplied accessories.

IMPORTANT:

1. Read the instructions before using the instrument.
2. The instrument should be connected to a mains socket.
3. Never install the controller outdoors, in a wet or humid area or under direct sun light. Nor install the controller where liquids may be sprayed or poured on it.
4. The instrument's main power line as well as the dosage and alarm terminals are protected by separate 2A fuses. Use only 2A fuses for replacement.

GENERAL DESCRIPTION

Omega's **wall-mounted pH and ORP controllers** with proportional control are designed to meet a variety of process control requirements.

The electrodes can be installed quickly and easily. Simply plug the universal BNC connector into the socket and twist it into a secured position. Accurate measurements are displayed on a large LCD.

The controllers come equipped with relays operating at a maximum of 2A (240V).

The Omega controllers incorporate a triple contact alarm system. When activated, the alarm contacts will open or close, triggering the mechanism of your choice, whether a buzzer, light or any other electrical device.

The recorder output terminals are isolated from the controller circuitry to avoid any interference and are user-switchable between 0 to 20 mA or 4 to 20 mA.

In order to avoid electrical noise and interference all models provide for a ground probe (differential input).

These controllers are housed in a rugged, modular, fiber-reinforced ABS housing.

All models can be wired to work with 110/115V or 220/240V 50/60 Hz power supplies.

The models covered in this manual are:

PHCN-901 a single setpoint pH controller

PHCN-902 a dual setpoint pH controller, specifically designed for all those applications in which the pH value intends to oscillate both up and down

ORCN-901 ORP controller, designed for numerous industrial applications, but in particular for swimming pools and drinking water sanitation

MECHANICAL LAYOUTS

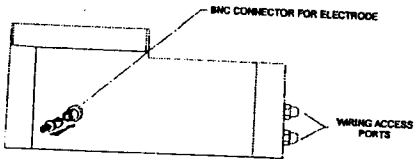


Fig. 1

Figure 1: displays the connector for electrode and the wiring access ports.

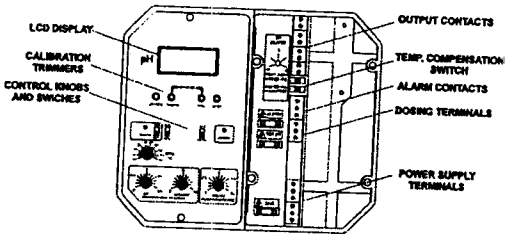


Fig. 2

Figure 2 illustrates the controls and terminals on the PHCN-901 pH controller. Layouts vary from model to model based on their features , and capabilities.

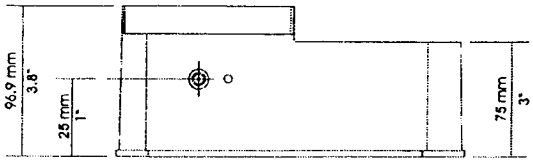


Fig. 3

Figure 3 is a dimensioned, bottom view of the wall mounted controllers. The modular design isolates the control circuitry from the contacts making it possible to make the connections and then close the compartment. Adjustments can then be made only in the control area, without having to open the contacts compartment.

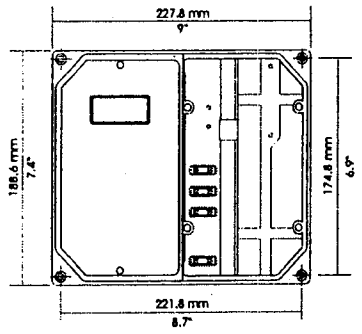
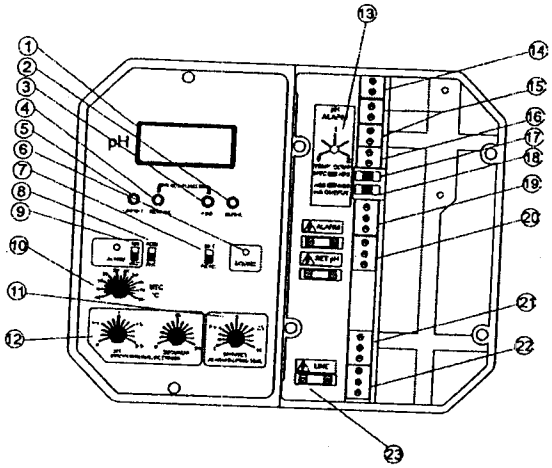


Fig. 4

Figure 4 is a dimensioned front view of the wall mounted controllers. The molded, mounting holes in the corners provide for quick and secure installation. No additional hardware is needed for mounting. All electrical connections and controls are located on the front of the instrument so that adjustment can be made without having to remove the unit.

FUNCTIONAL DIAGRAM PHCN-901
SINGLE SETPOINT, pH CONTROLLER

FRONT PANEL



Left panel

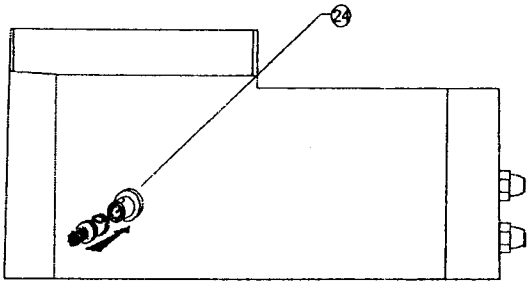
1. Liquid Crystal Display
2. Slope calibration trimmer
3. Fine setpoint trimmer
4. Coarse setpoint trimmer
5. Offset calibration trimmer
6. Dosing LED visual signal
7. READ for actual measurement and SET for setpoint adjustment
8. Acid or Alkaline Dosage selection
9. Alarm LED and switch to disable the alarm
10. Graded dial for Manual Temperature Compensation
11. Overdosage timer
12. Proportional pH band and time cycle settings

Right panel

13. pH alarm setting from 0 to 2 pH
14. Short the terminals if a ground probe is not in use, or connect the ground probe wire to the Matching Pin terminal
15. Three-wire Pt 100 plus a shield protection

16. Recorder output contacts
17. Automatic or Manual Temperature Compensation switch
18. 0 to 20 or 4 to 20 mA isolated output switch
19. Triple contact alarm in a Normally Closed (NC) or a Normally Open (NO) position.
20. Powered dosage terminals (Relay)
21. 110/115V or 220/240V power configuration
22. Incoming power terminals
23. Fuses

BOTTOM VIEW



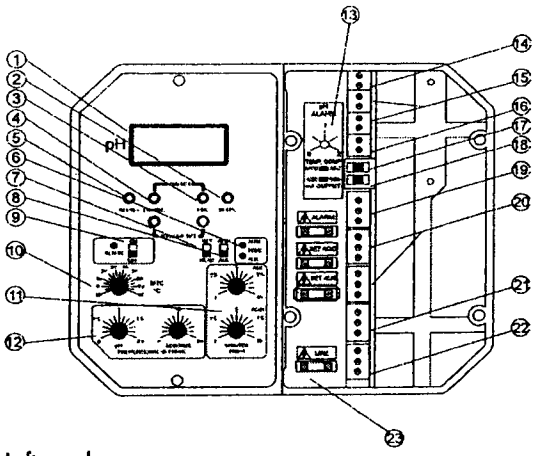
24. Female BNC socket for combination pH electrode

⚠ Unplug the instrument from the power supply before wiring and replacing the fuses.

Specifications	PHCN-901
RANGE	0.00 to 14.00 pH
RESOLUTION	0.01 pH
ACCURACY (@20°C/68°F)	±0.02 pH
TYPICAL EMC DEVIATION	±0.1 pH
mA OUTPUT	User-selectable 0 to 20 mA or 4 to 20 mA over the 0-14 pH range with isolated output
CALIBRATION	Through "OFFSET" and "SLOPE" trimmers (Max. ±1.5 pH for offset and 80% to 110% for slope)
TEMPERATURE COMPENSATION	Manual from -10 to 80°C (14 to 176°F) or automatic with a 3-wire Pt 100 probe from 0 to 50°C (32 to 122°F)
SETPOINT RANGE	From 0.00 to 14.00 pH with "COARSE" and "FINE" trimmers with "ACID" or "ALK" (alkaline) selection
PROPORTIONAL CONTROL	pH is user adjustable from 0.0 to 2.0 and time cycle from 0 to 90 seconds
ALARM CONTACT	Terminals can be configured as normally open or normally closed (isolated output Max. 2A, Max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if pH varies by more than user-selectable interval (0 to 2 pH) from setpoint or due to overdosage
DOSING TERMINALS	Relay terminals (115 to 240V, Max.2A,1,000,000 strokes) are activated when pH exceeds the setpoint with "ACID" dosage or falls below the setpoint with "ALK" selection (Alkaline dosage)
POWER SUPPLY	220/240V or110/115V at 50/60Hz
ENVIRONMENT	-10 to 50°C (14 to 122°F) max. 95% RH non-condensing
WEIGHT	1.6 Kg (3.5 lb.)
ENCLOSURE	181 x 221 x 142mm (7.1 x 8.7 x 5.6")
CASE MATERIAL	Fiber-reinforced, self-extinguishing ABS

FUNCTIONAL DIAGRAM PHCN-902
DUAL SETPOINT, pH CONTROLLER

FRONT PANEL



Left panel

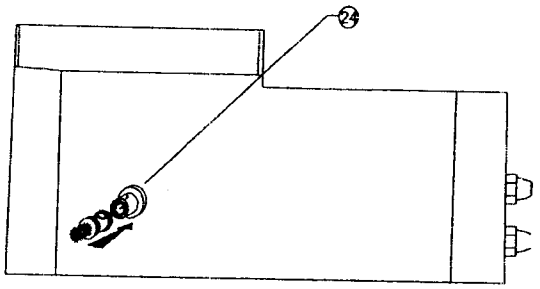
1. Liquid Crystal Display
2. Slope calibration trimmer
3. Fine setpoint trimmers for acid and alkaline feed
4. Coarse setpoint trimmers for acid and alkaline feed
5. Offset calibration trimmer
6. Dosing LED signals for acid and alkaline feed
7. READ for actual measurement and SET for setpoint adjustment
8. Acid or Alkaline selection for setpoint
9. Alarm LED and switch to disable the alarm
10. Graded dial for Manual Temperature Compensation
11. Two independent overdosage timers
12. Proportional pH band and time cycle settings

Right panel

13. pH alarm setting from 0 to 2 pH
14. Short the terminals if a ground probe is not in use, or connect the ground probe wire to the Matching Pin terminal
15. Three-wire Pt 100 plus a shield protection
16. Recorder output contacts
17. Automatic or Manual Temperature Compensation switch

18. 0 to 20 or 4 to 20 mA isolated output switch
19. Triple contact alarm in a Normally Closed (NC) or a Normally Open (NO) position.
20. Powered dosage terminals (Relays)
21. 110/115V or 220/240V power configuration
22. Incoming power terminals
23. Fuses

BOTTOM CONNECTION



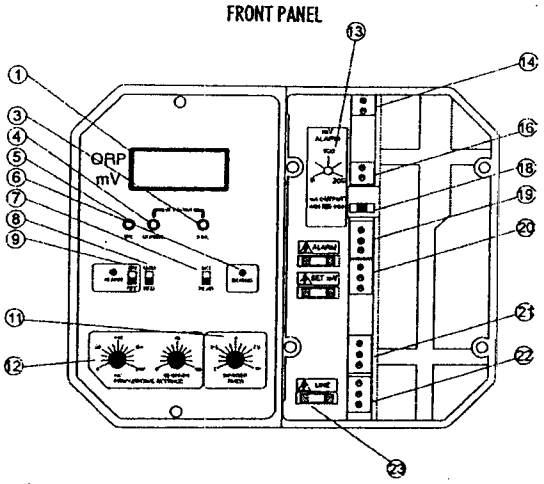
24. Female BNC socket for combination pH electrode

⚠ Unplug the instrument from the power supply before wiring and replacing the fuses.

Specifications	PHCN-902
RANGE	0.00 to 14.00 pH
RESOLUTION	0.01 pH
ACCURACY (@20°C/68°F)	±0.02 pH
TYPICAL EMC DEVIATION	±0.1 pH
mA OUTPUT	User-selectable 0 to 20 mA or 4 to 20 mA over the 0-14 pH range with isolated output
CALIBRATION	Through "OFFSET" and "SLOPE" trimmers (Max. ±1.5 pH for offset and 80% to 110% for slope)
TEMPERATURE COMPENSATION	Manual from -10 to 80°C (14 to 176°F) or automatic with 3-wire Pt 100 probe from 0 to 50°C (32 to 122°F)
SETPOINT RANGE	From 0.00 to 14.00 pH with 2 trimmers: "COARSE" for approx. regulation, "FINE" for fine tuning.
PROPORTIONAL CONTROL	pH is user adjustable from 0.0 to 2.0 and time cycle from 0 to 90 seconds
ALARM CONTACT	Terminals can be configured as normally open or normally closed (isolated output Max. 2A, Max. 240V, resistive load, 1,000,000 strokes). The alarm is activated if pH varies by more than user-selectable interval (0 to 2 pH) from setpoint or due to overdosage
DOSING TERMINALS	Two sets of independent relay terminals (115 to 240V, Max.2A, 1,000,000 strokes) are activated whenever pH exceeds the "ACID" setpoint or falls below the "ALK" setpoint (Alkaline dosage)
POWER SUPPLY	220/240V or110/115V at 50/60Hz
ENVIRONMENT	-10 to 50°C (14 to 122°F) max. 95% RH non-condensing
WEIGHT	1.6 Kg (3.5 lb.)
ENCLOSURE	181 x 221 x 142mm (7.1 x 8.7 x 5.6")
CASE MATERIAL	Fiber-reinforced, self-extinguishing ABS

FUNCTIONAL DIAGRAM ORCN-901
ORP CONTROLLER

FRONT PANEL



Left panel

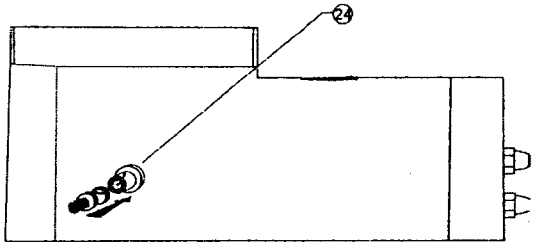
1. Liquid Crystal Display
3. Fine setpoint trimmer
4. Coarse setpoint trimmer
5. Calibration trimmer
6. Dosing LED visual signal
7. READ for actual measurement and SET for setpoint adjustment
8. Oxidization or Reduction Dosage selection
9. Alarm LED and switch to disable the alarm
11. Overdosage timer
12. Proportional ORP band and time cycle settings

Right panel

13. ORP alarm setting from 0 to 200 mV
14. Short the terminals if a ground probe is not in use, or connect the ground probe wire to the Matching Pin terminal
16. Recorder output contacts
18. 0 to 20 or 4 to 20 mA isolated output switch
19. Triple contact alarm in a normally-closed (NC) or a normally open (NO) position.

20. Powered dosage terminals (Relay)
21. 110/115V or 220/240V power configuration
22. Incoming power terminals
23. Fuses

BOTTOM CONNECTION



24. Female BNC socket for combination ORP electrode

⚠ Unplug the instrument from the power supply before wiring and replacing the fuses.

Specifications	ORCN-901
RANGE	-500 to 1500 mV
RESOLUTION	1 mV
ACCURACY (@20°C/68°F)	±5mV
TYPICAL EMC DEVIATION	±6 mV
mA OUTPUT	User-selectable 0 to 20 mA or 4 to 20 mA over the -500 to 1500 mV range with isolated output
CALIBRATION	Through "CAL" trimmer
SETPOINT RANGE	From -500 to 1500 mV with "COARSE" and "FINE" 2 trimmers with "OXID" or "RED" selection for oxidizing or reducing dosage
PROPORTIONAL CONTROL	ORP setting is adjustable from 0 to 200 mV and time cycle from 0 to 90 seconds
ALARM CONTACT	Normally open or normally closed isolated outputs (Max. 2A, Max. 240V, resistive load, 1,000,000 strokes). Terminals are activated when the ORP value varies by more than the user selectable interval (0 to 200mV) from setpoint, or due to overdosage
DOSING TERMINALS	Relay terminals (115 to 240V, Max.2A,1,000,000 strokes) are activated when mV exceeds the setpoint with "RED" dosage or when mV falls below the setpoint with "OXID" selection
POWER SUPPLY	220/240V or110/115V at 50/60Hz
ENVIRONMENT	-10 to 50°C (14 to 122°F) max. 95% RH non-condensing
WEIGHT	1.6 Kg (3.5 lb.)
ENCLOSURE	181 x 221 x 142mm (7.1 x 8.7 x 5.6")
CASE MATERIAL	Fiber-reinforced, self-extinguishing ABS

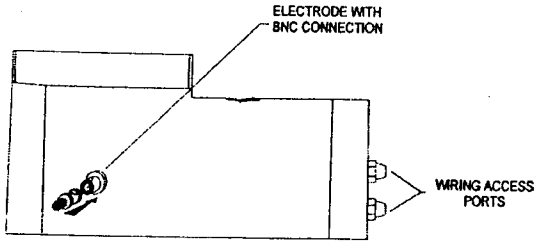
CONECTIONS & WIRING

GENERAL POINTS

- The relay terminals of the controllers are powered. This means that you can simply hook up your pumps or electrovalves directly to the controller and do not need additional power supply.
- Unscrew the 4 screws on the right hand panel and remove the cover and the gasket. Thread the wires through the access ports on the right hand side of the controller.

- ***Before*** connecting the controller to the mains, wire the controller completely and make all the connections for pumps, alarm, electrode, set the alarm threshold and adjust the settings. Upon completion, replace the cover. ***Only then*** connect the controller to the power supply.

ELECTRODE & GROUND PROBE CONNECTIONS



- Simply attach any combination **pH or ORP electrode** with a male BNC connector to the female BNC socket located on the bottom of the casing and twist it into a secure position.
- All models provide for a Ground Probe (differential input) to reduce electrical noise and interference. The controllers are shipped with the Matching Pin and Reference terminals shorted (see 14 - Functional Diagram). If you are <u>not</u> using a matching pin (ground probe), leave the terminals shorted and skip the next two paragraphs.

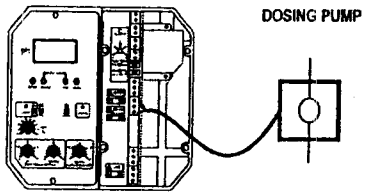
- It is recommended that only electrodes that incorporate a matching pin are utilized. In this case simply attach the 4-mm banana connector of the matching pin to the socket located next to the BNC connector on the outer casing (see 25 - Functional Diagram) and <u>remove the jumper</u> shorting the matching pin terminals.
- When using a separate probe for grounding purposes, wire it to the Matching Pin terminal on the right hand panel and <u>remove the jumper</u> (see 14 Functional Diagram).

RELAY CONNECTIONS

NOTE:

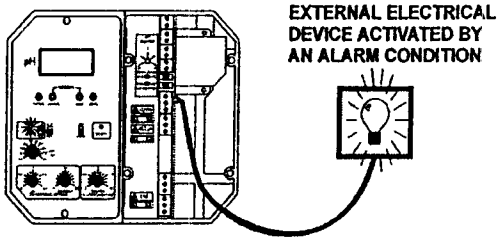
NEVER leave the jumper in when using an electrode with a matching pin. This can shorten the life of the electrode (reference) drastically.

- Wire the external device or devices (pumps or electrovalves) directly to the relay terminal strip of the controller (see 20 - Functional Diagram). The terminals are powered and hence you do not need an external power supply for the pump or electrovalve. There is one terminal strip for **PHCN-901** and **PHCN-902** and two for **ORCN-901**.



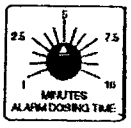
ALARM CONNECTIONS

- The operator can select an alarm threshold of 0.0 to 2.0 pH for **PHCN-901** and **PHCN-902** or 0 to 200 mV for ORCN-901 by turning the alarm knob (see 13 of Functional Diagram). If the actual measurements are above or below the setpoint by a margin greater than the user-selectable alarm threshold, the alarm terminal is activated. The alarm can be selected as normally closed ("NC") by connecting the external device to the C and NC terminals or normally open ("NO") by connecting the external device to the C and NO terminals.
- When activated, the alarm contacts will open or close, triggering the mechanism of your choice. When the alarm is activated all other terminals (such as dosing relay etc.) are disactivated. The alarm LED light also comes on.



- The alarm ON/OFF switch is only to disable the alarm terminal (e.g. the buzzer will not sound). However, all other functions such as disactivation of the dosing relay remain unvaried, i.e. the pump ceases to dose until the alarm condition is alleviated.

- The controllers provide for automatic fail-safe security by activating the alarm if there is a power failure, regardless of whether the NC or NO configurations were chosen.
- The alarm is also activated if the maximum dosage time is exceeded. The overdosage timer can be set from 1 to 10 minutes. For PHCN-902, two timers for acid and alkaline corrections can be independently selected.

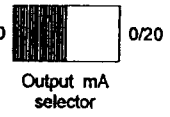


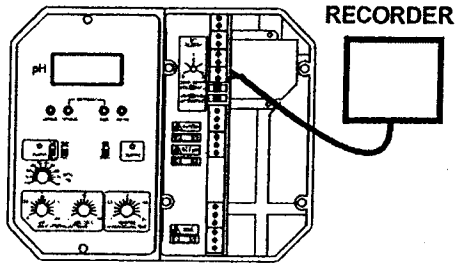
- Once in an alarm condition, the alarm contact remains activated until the switch is manually put in the off position or the measurements returns to normal values.

Model	Alarm is activated when the reading varies by :
PHCN-901	0 to 2.0 pH (selectable) above or below the setpoint
PHCN-902	0 to 2.0 pH (selectable) lower than the ALKALINE setpoint or higher than the ACID setpoint
ORCN-901	0 to 200 mV (selectable) above or below the setpoint

RECORDER OUTPUT CONNECTIONS

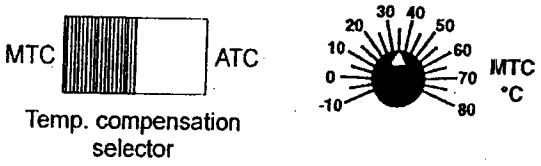
- The recorder output contacts are isolated from the controller circuitry to avoid interference. Select between 0 to 20 or 4 to 20 mA with the selector (see 18 - Functional Diagram) before wiring. The output mA value is proportional and is the pH or ORP value over the entire range. For example, when measuring pH 7, the output values are 10 mA or 12 mA based on whether the 0-20 or 4-20 output were respectively selected.



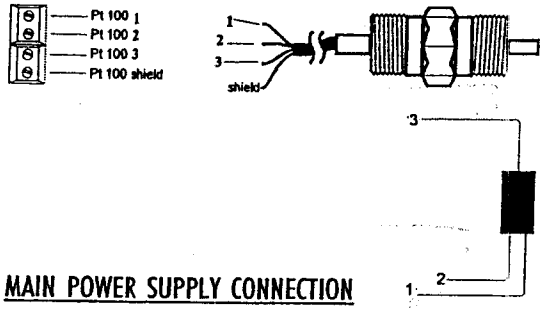


TEMPERATURE COMPENSATION (PHCN-901 AND PHCN-902)

- **Manual Temperature Compensation:** Move the selector to the MTC position (see 17-Functional Diagram). Then manually set the temperature by turning the dial (see 10 - Functional Diagram) to the correct working temperature.

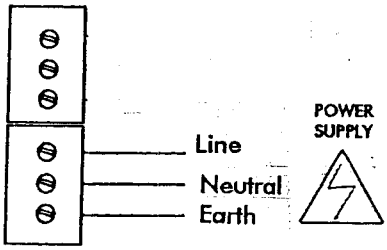


- **Automatic Temperature Compensation:** Move the selector to the ATC position (see 17-Functional Diagram). Then wire a Pt 100 probe to the controller's terminals as shown.



MAIN POWER SUPPLY CONNECTION

- Before connecting the unit to the mains, make sure that the controller is completely wired and that all connections for pump, alarm, electrode, etc. have been made.



- Replace the cover with the gasket and screw it tight with the 4 screws provided.

  Only then connect the controller to the mains.

NORMAL OPERATION and MEASUREMENT

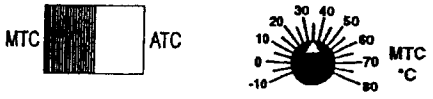
Make sure that the controller has been properly calibrated before commencing and that the pH or ORP setpoint(s) have been adjusted (see the following pages).

The pH or ORP electrodes and any ground probes must be properly connected and wired to the controller (see preceding pages). Remove the protecteive cap if it is still on the tip of the electrode.

Ensure that the electrode is properly installed and lies permanently in the solution to a depth of at least 4cm/1.5". The selector (see 7 - Functional Diagram) must be on the "READ" position.

If temperature compensation is necessary (PHCN-901 and PHCN-902), make sure that the temperature probe is also immersed in the solution and the selector is on ATC (see 17 - Functional Diagram).

For manual temperature compensation, the selector should be on MTC with the dial showing the temperature of the solution.



The actual pH or ORP value of the solution will be displayed on the LCD.

All controllers provide for a visual dosing status through an LED. With PHCN-901 and ORCN-901 the DOSING LED lights up when the controller is in the pH or ORP dosage mode and the terminals are activated.

Likewise, PHCN-902 provides for two LED's, one for ACID and another for ALK (alkaline) dosage when the appropriate terminals are activated.

pH CALIBRATION (PHCN-901 and PHCN-902)

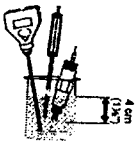
Make sure that the pH electrode and any ground probe have been properly connected and wired to the controller (see preceding pages) and that the meter is plugged to the mains.

Calibration should be ideally performed at a temperature similar to that of the liquid to be monitored.

Use an accurate thermometer as reference for temperature compensation.

Remove the electrode cap if it is still on the electrode.

During calibration, move the electrode and the separate ground probe (if in use) together from one buffer to the next.



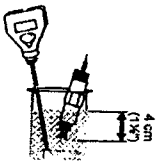
If no separate ground probe is being used, make sure that the Reference and the Matching Pin terminals are shorted (see 14 - Functional Diagram).

If the electrode incorporates a ground probe/matching pin then remove the jumper.

- Turn the switch to the "READ" position.

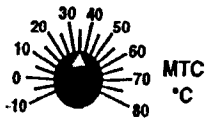
OFFSET ADJUSTMENT:

- Rinse the tip of the electrode with pH 7 solution, then dip the bottom 4 cm (1.5") of the electrode (and ground probe) in the pH 7 buffer.



- Place the thermometer in the buffer solution. Turn the dial (see 10 - Functional Diagram) to show the same temperature as that

Temp. compensation selector



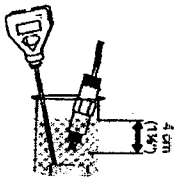
on the thermometer and make sure the selector is in the MTC position (see 17 - Functional Diagram).

- Wait for the measurement to stabilize and then adjust the "OFFSET" trimmer to display pH 7 on the LCD if the temperature of the buffer solution is at 25°C (77°F).

- If the temperature of the buffer solution is not 25°C (77°F), refer to the chart at the end of the manual for the appropriate buffer value at a given temperature and adjust the trimmer accordingly.

SLOPE ADJUSTMENT:

- Rinse the electrode (and ground probe) thoroughly with water and immerse the bottom 4 cm (1.5") in a pH 4 or a pH 10 buffer solution.



Note: Use pH 4 if you are going to be monitoring acidic solutions or pH 10 for alkaline samples.

- Stir the electrode and wait for the display to stabilize before adjusting the "SLOPE" trimmer to display pH 4 (or 10) on the LCD if the temperature of the buffer solution is at 25°C (77°F). Otherwise, refer to the chart at the end of the manual for the appropriate buffer value and adjust the trimmer accordingly.

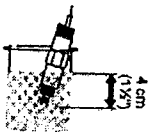
The pH calibration is now complete.

ORP CALIBRATION (ORCN-901)

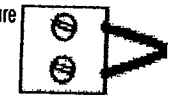
Make sure that the ORP electrode and any ground probe have been properly connected and wired to the controller (see preceding pages) and that the meter is plugged to the mains.

Remove the electrode cap if it is still on the electrode.

During calibration, introduce both the electrode and the ground probe (if in use) to the known solution. An immersion level of 4 cm (1.5") is recommended.



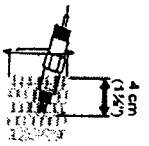
If no separate ground probe is being used, make sure that the Reference and the Matching Pin terminals are shorted (see 14 - Functional Diagram).



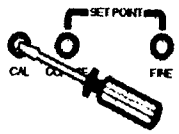
If the electrode incorporates a ground probe/matching pin then remove the jumper.

- Turn the switch to the "READ" position.

- Immerse the electrode in an ORP solution and wait for a few minutes for the reading to stabilize.



- Adjust the CAL trimmer to 230 ±20 mV (or a known value).

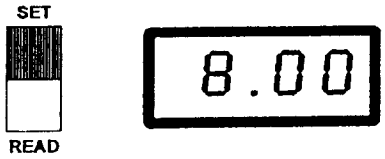


ADJUSTEMENT OF SETPOINT(S)

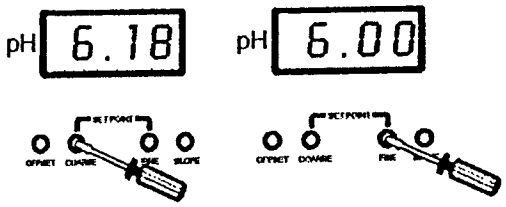
Make sure that the electrode (and any ground probe) is properly installed and calibrated (see the preceding pages).

FOR PHCN-901

Turn the switch to the "SET" position (see 7 - Functional Diagram). The display will show the previously adjusted value (e.g. pH 8.00).



Using a small screwdriver, first adjust the setpoint through the COARSE trimmer and then fine tune it to your required level with the FINE trimmer (see 3 and 4 - Functional Diagram) until the desired set value is displayed (e.g. pH 6.00).



DOSING DIRECTION

Select the direction of dosing through the "ACID"/"ALK" switch (see 8 - Functional Diagram). In order to dose acidic substances (i.e. lower the pH value) leave the selector on "ACID". When dosing base or alkaline solutions (to increase the pH) select the "ALK" position.

e.g. Dosing acidic liquids

Setpoint = pH 6.00

Measured value = pH 7.00

To reach the setpoint you need to dose acid, therefore move the switch to the "ACID" position (see 8 - Functional Diagram).

e.g. Dosing base liquids

Set point = pH 6.00

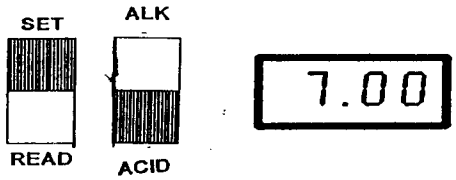
Measured value = pH 4.00

To adjust the sample stream to the setpoint, you need to dose base, therefore select "ALK".

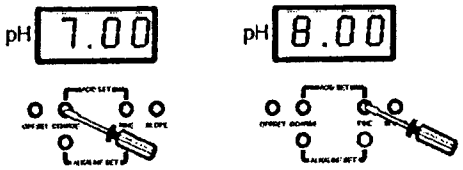
FOR PHCN-902 (DUAL-POINT ADJUSTMENT)

a) ACID SETPOINT and DOSAGE

Turn the switches to "SET" and "ACID" (see 7 and 8 - Functional Diagram) to set the upper limit and to direct the controller to *lower* the pH. The display will show the higher setpoint (e.g. pH 7.00).

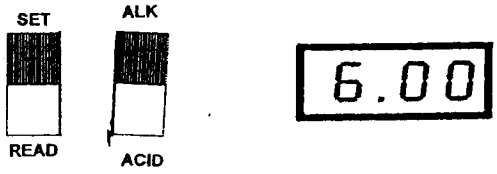


Using a small screwdriver, adjust the "ACID SET" trimmers. First adjust the "COARSE" trimmer and then fine tune with the "FINE" trimmer (see 3 and 4 - Functional Diagram) until the desired set value is displayed (e.g. pH 8.00).

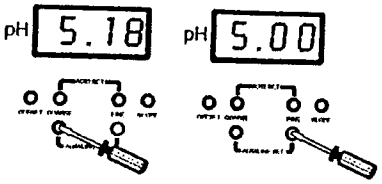


a) ALKALINE SETPOINT and DOSAGE

Turn the switches to "SET" and "ALK" (see 7/8 - Functional Diagram) to set the lower limit and to direct the controller to *increase* the pH. The display will show the lower setpoint (e.g. pH 6.00).



Using a small screwdriver, adjust the "ALKALINE SET" trimmers. First adjust the "COARSE" trimmer and then fine tune with the "FINE"



trimmer (see 3 and 4 - Functional Diagram) until the desired set value is displayed (e.g. pH 5.00).

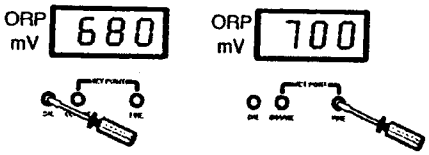
NOTE:

- The "FINE" trimmer can adjust up to ±1.5 pH.
- Should you use the **PHCN-902** for a single-point dosage, it is recommended to adjust the "ALKALINE SET" trimmers to 0.00 pH if you are dosing acid solutions to lower the pH and adjust the "ACID SET" trimmers to your desired values. Likewise, when dosing only base solutions, set the "ACID SET" trimmers to 14.00 pH and adjust the "ALKALINE SET" trimmers to your desired value.

FOR ORCN-901

Turn the switch to the "SET" position (see 7 - Functional Diagram). The display will show the previously adjusted value (e.g. mV 650).

Using a small screwdriver, first adjust the setpoint through the "COARSE" trimmer and then fine tune it with the "FINE" trimmer (see 3 and 4 - Functional Diagram) until the desired set value is displayed (e.g. mV 700).



DOSING DIRECTION

Select the direction of dosing through the "OXID"/"RED" switch (see 8 - Functional Diagram). For reducing dosage (i.e. lowering the mV value) leave the selector on "RED". Likewise, for oxidizing solutions (to increase the mV) select the "OXID" position.

e.g. Dosing reducing substances

Setpoint = mV 650

Measured value = mV 700

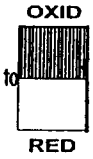
switch to the "RED" position (see 8 - Functional Diagram).

e.g. Dosing oxidizing substances

Setpoint = mV 650

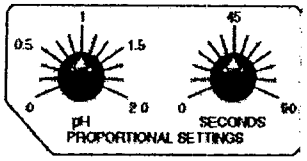
Measured value = mV 500

To adjust the sample stream to the setpoint, you need to dose oxidants, therefore select "OXID".



PROPORTIONAL CONTROL

In order to optimize the controlling process and reduce the amount of chemicals used, it is recommended to use a proportional dosage appropriate for the system.



All models allow for a proportional band (0 to 2.0 pH or 0 to 200 mV delta) as well as a time cycle (from 0 to 90 seconds) to be set. The proportional dosage is obtained by personalizing a current pulse whose height equals the pH or ORP proportional delta and the length corresponds to the selected time cycle.

The controller will enter proportional dosage at setpoint plus or minus the preselected delta. It will then keep the dosing relay activated for a period proportional to the difference between the measurement and the setpoint over the cycle.

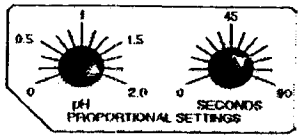
e.g. pH proportional control

Setpoint = pH 5.00

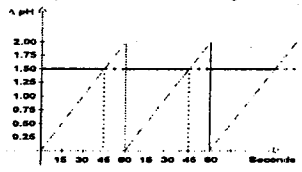
Measured value = 6.50

Delta = 6.5 - 5.0 = 1.5 pH

Proportional settings: pH set to 2 and time cycle to 60 seconds.

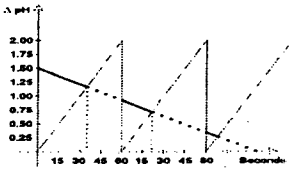


The controller will be dosing acids to reduce pH to the desired limit. Since it is 1.50/2.00 = 75% away from the ideal setting, it will keep the dosing terminals activated for 75% of the time over the predetermined 60 seconds. The relay is hence theoretically activated for 45 seconds and off for 15 seconds.

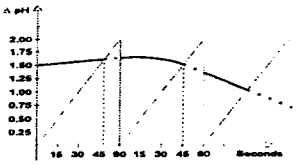


In order to avoid over dosage with fast responding samples or highly concentrated chemicals or under dosage with slow reacting or weak chemicals, the controller provides even a more accurate control.

As the graphs show, it does that by stopping the dosage as soon as the current pulse curve intersects the dosage curve.



This means shortening the dosage period if the chemicals have reacted quickly or lengthening it if the measured pH continues to drift from the ideal setpoint as can be seen from the graphs.



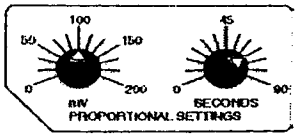
.g. ORP proportional control

Setpoint = 725 mV

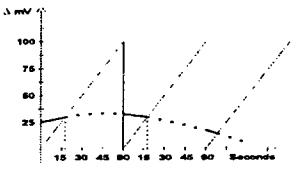
Measured value = 700 mV

Delta = 725 - 700 = 25 mV

Proportional settings = mV set to 100 and time cycle to 60 seconds.



The controller will be dosing reductants to reduce redox to the desired value. Since it is 25/100 = 25% away from the ideal setting, it will keep the dosing relay activated for 25% of the time over the predetermined 60 seconds. The terminals are hence activated for 15 seconds and off for 45 seconds until the next cycle.

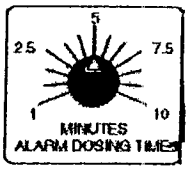


NOTE:

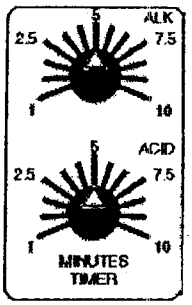
- If the setting is left at 0 pH or 0 mV, the controller will operate as an on/off control with no proportional dosage. In this case the controller will operate with a 0.1 pH or 7 mV hysteresis.
- Do not set the time cycle to zero. This causes the relay to chatter and can be detrimental to your system and pumps.

OVERDOSAGE TIMER

All models provide for an overdosage alarm system ranging from 1 to 10 minutes . The operator can set the maximum amount of time that the dosage terminals should continuously remain activated. Should this period elapse, the alarm terminals are activated (and dosage disactivated to ensure that chemicals have not run out or pumps or electrovalves have not ceased to function properly).



PHCN-902 provides for two independent such controls, one for acid dosage and another for alkaline.



pH VALUES AT VARIOUS TEMPERATURES

Please refer to the following chart for a more accurate pH calibration:

TEMP		pH VALUES		
°C	°F	4	7	10
0	32	4.01	7.13	10.32
5	41	4.00	7.10	10.24
10	50	4.00	7.07	10.18
15	59	4.00	7.04	10.12
20	68	4.00	7.03	10.06
25	77	4.01	7.01	10.01
30	86	4.02	7.00	9.96
35	95	4.03	6.99	9.92
40	104	4.04	6.98	9.88
45	113	4.05	6.98	9.85
50	122	4.06	6.98	9.82
55	131	4.07	6.98	9.79
60	140	4.09	6.98	9.77
65	149	4.11	6.99	9.76
70	158	4.12	6.99	9.75

For instance, if the buffer temperature is 25°C (77°F), calibrate the meter to read 4, 7 or 10 on the display.

If the buffer temperature is 20°C, calibrate it to 4.00, 7.03 or 10.06.

If the buffer temperature is 50°C, calibrate it to 4.06, 6.98 or 9.82.

REDOX MEASUREMENT (ORCN-901)

Redox measurements allow the quantification of the oxidizing or reducing power of a solution, and are commonly expressed in mV.

Oxidation may be defined as the process during which a molecule (or an ion) loses electrons and reduction as the process by which electrons are gained.

Oxidation is always coupled together with reduction so that as one element gets oxidized, the other is automatically reduced, therefore the term oxidation-reduction is frequently used.

Redox potentials are measured by an electrode capable of absorbing or releasing electrons without causing a chemical reaction with the elements with which it comes into contact.

The electrodes most usually available for this purpose have gold or platinum surfaces; gold possesses a higher resistance than platinum in conditions of strong oxidation such as cyanide, while platinum is preferred for the measurements of oxidizing solutions containing halides and for general use.

When a platinum electrode is immersed in an oxidizing solution a monomolecular layer of oxygen is developed on its surface. This layer does not prevent the electrode from functioning, but it increases the response time. The opposite effect is obtained when the platinum surface absorbs hydrogen in the presence of reducing mediums. This phenomenon is rough on the electrode.

To make accurate redox measurements the surface of the electrode must be clean and smooth. At certain mV and pH values, the ORP electrode requires a considerable amount of time before it reads the proper value. This is at times due to the fact that it is moving from a reducing to an oxidizing state. Once it reaches a stable condition though, it reacts rapidly to changes.

Hence when the process is first set up allow sufficient time for the ORP electrode to adapt itself to the sample stream.

As with pH electrodes, gel-filled redox electrodes are more suitable for industrial applications due to less maintenance requirements.

In the event that measurements are made in solutions containing heavy doses of sulfide or protein, the diaphragm of the reference electrode must be cleaned more often.

In order to test that the ORP electrode is functioning properly, immerse it into a ORP solution. The measured value should be

between 200 and 250 mV.

When not in use, the electrode tip should be kept moist in order for the reference junction, especially Teflon models, to respond quickly. Otherwise, soak the electrode overnight in a storage solution or allow more time upon installation for its stabilization. Also keep the electrode far from any type of mechanical stress which might cause damage.

Install the electrode in such a way that it is constantly in a well filled with the sample (stream or tank) and does not dry up.

The protective cap should also be filled with a few drops of storage solution if the electrode is not being used at all.

Note: With industrial applications, it is always good practice to keep at least one spare electrode handy. When anomalies are not resolved with a simple maintenance, change the electrode to see if the problem is alleviated.

ELECTRODE CONDITIONING & MAINTENANCE

PREPARATION

Remove the protective cap.

DO NOT BE ALARMED IF ANY SALT DEPOSITS ARE PRESENT.

This is normal with electrodes and they will disappear when rinsed with water.

During transport tiny bubbles of air may have formed inside the glass bulb (membrane). Shake down the electrode as you would do with a glass thermometer to remove these bubbles.

If the bulb and/or junction are dry, soak the electrode in a storage solution overnight.

STORAGE

To minimize clogging and assure a quick response time, the glass bulb and the junction should be kept moist and not allowed to dry out. This can be achieved by installing the electrode in such a way that it is constantly in a well filled with the sample (stream or tank).

When not in use, pour a few drops of storage solution or, in its absence, pH 7 buffer solution in the protective cap and replace it on the electrode.

Note: NEVER STORE THE ELECTRODE IN DISTILLED OR DEIONIZED WATER.

PERIODIC MAINTENANCE

Inspect the electrode and the cable. The cable used for the connection to the controller must be intact and there must be no points of broken insulation on the cable or cracks on the electrode stem or bulb.

Connectors must be perfectly clean and dry. If any scratches or cracks are present, replace the electrode. Rinse off any salt deposits with water.

CLEANING PROCEDURE

Soak in general cleaning solution for ½ hour.

For more specific cleaning procedures, refer to the electrode's instruction manual.

IMPORTANT: After performing any of the cleaning procedures rinse the electrode thoroughly with distilled water and recalibrate the controller.

TROUBLESHOOTING

Evaluate your electrode performance based on the following.

- **Noise** (Readings fluctuate up and down) could be due to a clogged/dirty junction: Refer to the Cleaning Procedure above.
- **Dry Membrane/Junction:** Soak in storage solution overnight. Check to make sure the installation is such as to create a well for the electrode bulb to constantly remain moist.
- **Low Slope:** Refer to the cleaning procedure above.
- **No Slope:** - Check the electrode for cracks in glass stem or bulb (replace the electrode if cracks are found).
  - Make sure cable and connections are not damaged from lying in a pool of water or solution.
- **Slow Response/Excessive Drift:** Soak the tip in cleaning solution for 30 minutes, rinse thoroughly with distilled water and then recalibrate the meter.
- **For ORP Electrodes:** Polish the metal tip with a lightly abrasive paper (paying attention not to scratch the surface) and wash thoroughly with water.

Note: With industrial applications, it is always recommended to keep at least one spare electrode handy. When anomalies are not resolved with a simple maintenance, change the electrode (and recalibrate the controller) to see if the problem is alleviated.

SUGGESTED INSTALLATIONS for pH/ORP ELECTRODES

The electrode should be installed in such a way that its tip permanently lies in the solution whether in a well, tank or on the discharge pipe.

SHORT DISTANCE, INDOOR INSTALLATION

Due to the low currents involved, a very high grade of insulation is required. A dry environment is needed in order to obtain a level of insulation not lower than 10^{12} Ω.

This type of connection is very delicate and requires constant attention to maintain proper operating conditions.

The conventional electrodes may be used for indoor applications but the cable length should not exceed 10 m (33').

MEDIUM DISTANCE, INDOOR/OUTDOOR INSTALLATION

When an outdoor installation is required, it is normally necessary to install a transmitter to obtain accurate readings at distances from 10 to 50 m (33-165').

WARRANTY

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 months from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KID WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.