

HYDAC

MANUAL FOR
BIOCIDE
PROGRAMMER

MODEL "10"

&
CONDUCTIVITY
CONTROLLER



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TABLE OF CONTENTS

Introduction	1
Conductivity Controller with Timing Circuit	1
System Description	1
Simplified Installation	3
Conductivity Controller Parts and Functions	5
Sample Stream Assembly Installation includes Conductivity Electrode and Flow Switch (optional)	7
Chemical Pump Installation	8
Bleed Valve Assembly Installation	9
Water Meter (optional) Installation	11
Controller Location Selection & Connecting Power to Controller	13
Controller Set-Up and Check-Out	13
Chemical Pump: Establishing How Pump Will Be Activated	16
Method A: In Proportion to Bleed-Off	17
Method B: In Proportion to Make-Up	20
Method C: As a Percentage of Controller "ON" Time	22
Method D:	23
How to Adjust "ON" Time for Timing Circuit	23

TABLE OF CONTENTS continued.....

Appendix

How to Change Total Timer Cycle Time by		
Changing Timing Chip (I.C.)	. . .	25
Timing Switch (S5) Selection Chart	. . .	26
Conductivity Trouble-Shooting Guide	. . .	29
Recorder Instructions (optional)	. . .	35
Check-Out Guide	. . . . .	36
Parts List	. . . . .	36
Biocide Programmer	. . . . .	37
System Description	. . . . .	37
Installation Preparation	. . . . .	38
Equipment/Parts Supplied	. . . . .	38
Additional Equipment/Parts Needed for Installation	. . . . .	38
Mechanical & Mounting Dimensions	. . . . .	38
Typical Installation	. . . . .	38
Operational Procedures	. . . . .	38
Biocide Trouble-Shooting Guide	. . . . .	43

MODEL "10" MANUAL

INTRODUCTION

This manual covers the complete installation of the Model "10" conductivity controller and Biocide programmer, P/N 016120.

MODEL "10" CONDUCTIVITY CONTROLLER WITH TIMING CIRCUIT

We recommend that the user carefully read all directions and operating procedures listed in this manual prior to the actual operation of the Model "10" controller. If you require immediate use of this unit, a simplified installation is illustrated in Figure I.

CONDUCTIVITY SYSTEM DESCRIPTION

The Model "10" is an electronic control system which will automatically maintain desired levels of dissolved mineral concentration in all types of recirculating water systems, e.g., cooling towers, spray ponds, fountains, evaporative condensers, etc.

The conductivity portion of the Model "10" continuously measures the conductivity of the circulating water and compares it to a preselected control point. When the dissolved solids (mineral salts) concentration increases due to evaporation, the conductivity of the water also increases. When the conductivity control point is exceeded, the controller senses this and opens a bleed valve. The resultant call for fresh make-up water dilutes the circulating water until the controller is satisfied. The bleed valve closes until the dissolved solids build up again; when the conductivity control point is exceeded, the bleed valve opens. The automatic control of bleed responds to changes in the cooling system load, thereby eliminating wasteful overbleed or harmful underbleed.

The Model "10" includes a unique timing circuit which allows field selection of chemical feed pump control. This timing circuit can be used as:

A limit timer: Pump activation occurs simultaneously with bleed valve activation and timer allows pump to remain on no longer than preset "safe" maximum on time selected.

A precision reset timer: Pump activation occurs per signal from the water meter in the make-up line. Pump "on" time is determined through timing circuit.

A percentage timer: Use as a percentage timer with a total fixed cycle time and adjustable "on" times, which continuously recycles as long as power is supplied to controller.

CONDUCTIVITY SYSTEM DESCRIPTION continued.....

The Model "10" features a continuous digital readout of the system conductivity as measured by the conductivity electrode. It also features two ranges: 0-2,000 micromhos and 0-20,000 micromhos. The high range set point and readout display must be multiplied by 10.

Also included is a connection for a flow switch which may be used to disable the bleed and chemical feed if there is no flow through the conductivity sensor.

CAUTION: If a flow switch is not used and the main circulating pump is turned off periodically, excessive usage of water and chemical can occur.

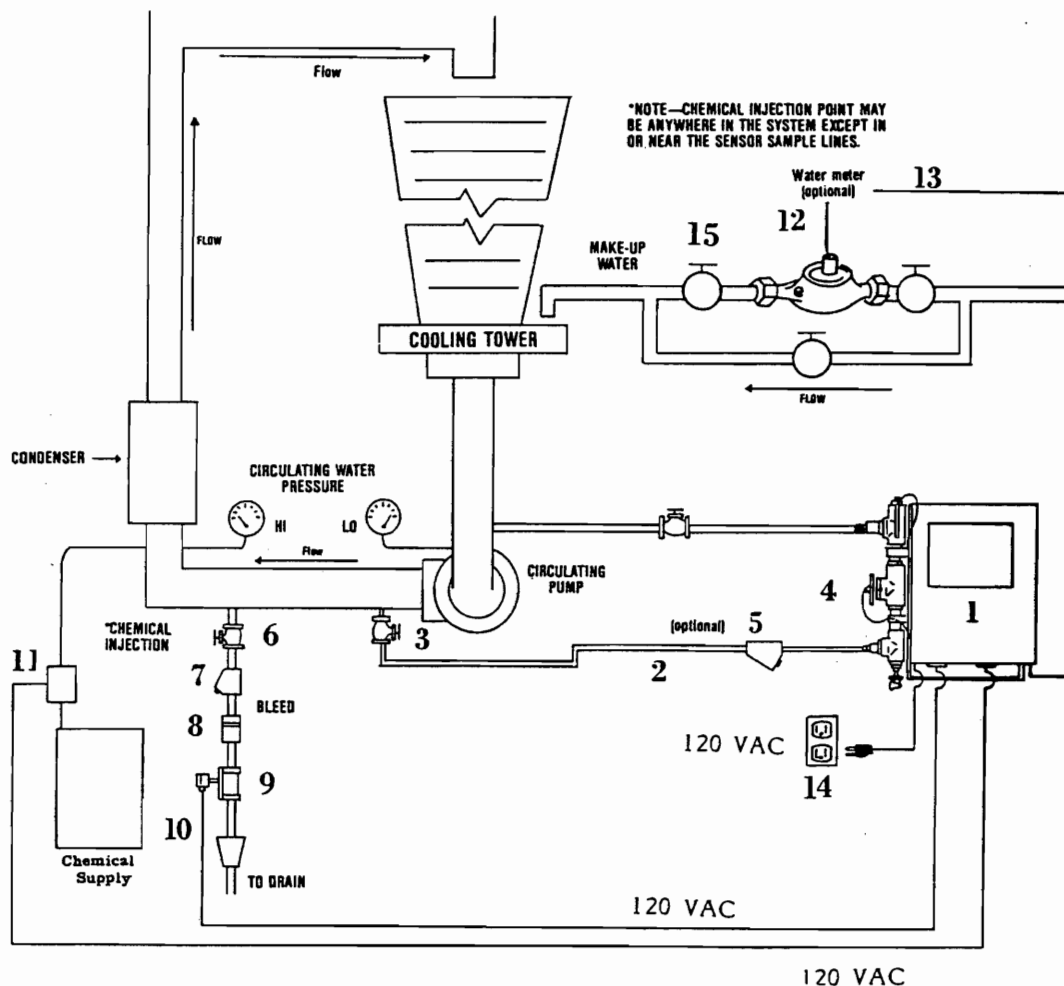


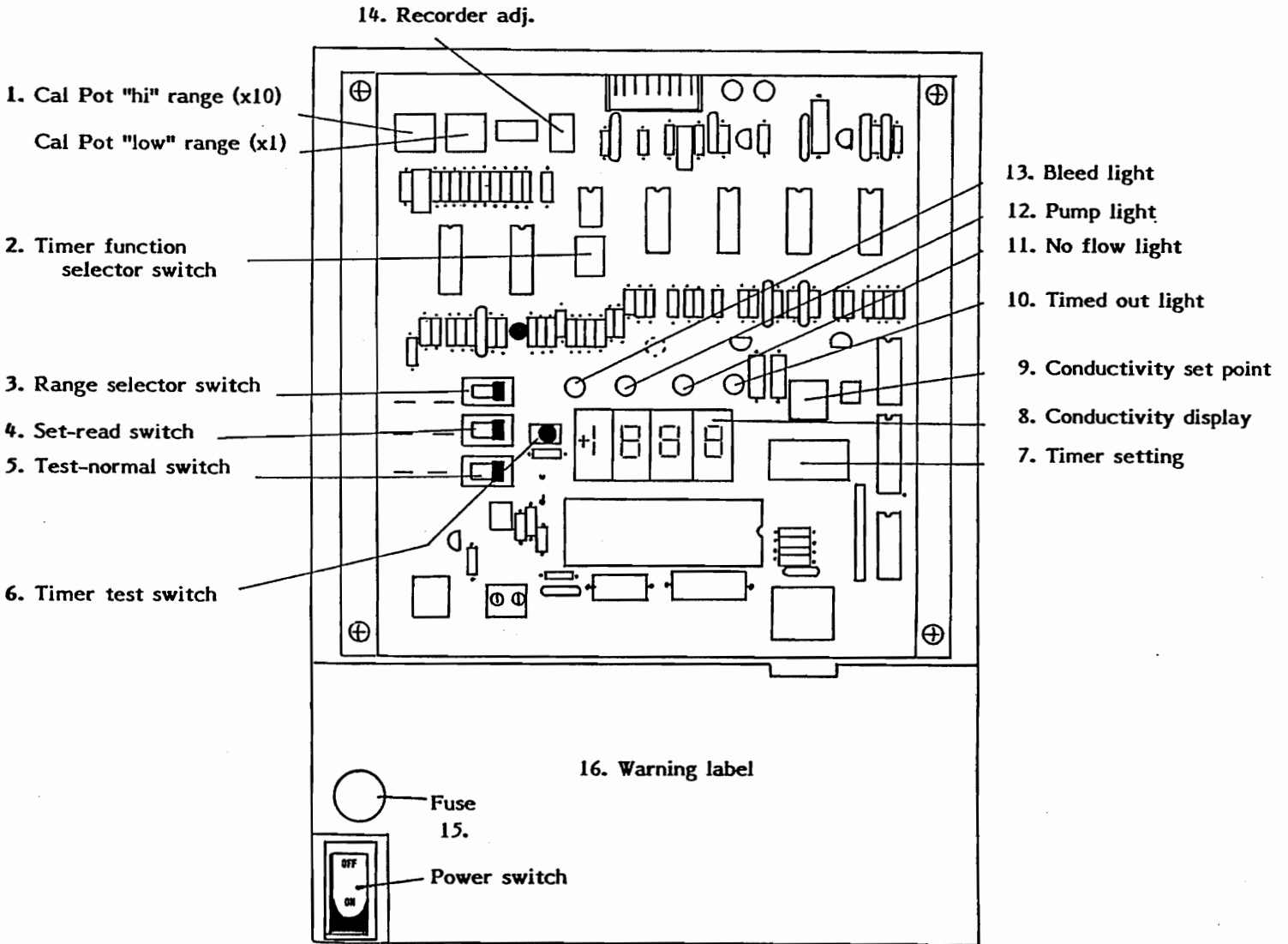
FIGURE I. SIMPLIFIED INSTALLATION

1. Model "10" Controller
2. Sensor sample lines, 3/4" for units pre-plumbed as shown or 3/8" for use with 014200 electrode.
3. Hand valves - sized to sample line
4. Flow switch/conductivity electrode assembly, 3/4" fittings (assembly supplied on pre-plumbed units only). If separate electrode and (optional) flow switch have been specified, plumbing arrangement for wall mounting can be used as shown. Flow switch must be mounted upright, flow through the bottom, out through the side.
5. Strainer (optional) - sized to sample line
6. Hand valve - sized to bleed line
7. Strainer - sized to bleed line
8. Dole flow regulator - sized to system (optional)
9. Solenoid valve - sized to system load
10. Two conductor cable - bleed valve
11. Chemical feed pump
12. Water meter (optional) - required only when chemical feed is based on make-up.
13. Two conductor cable - when water meter option is selected.
14. Power source for controller - directly into 120VAC wall socket when flow switch option is used, or "controller" power source connected to auxiliary contacts for main circulating pump when flow switch option is not used.
15. Hand valves - sized to water meter line

NOTE: Biocide pumps not shown; see page 39, Figure XVI.

CONDUCTIVITY CONTROLLER COMPONENTS WHICH ARE ACCESSIBLE THROUGH THE FRONT OF THE CONTROLLER

FIGURE III.



CONDUCTIVITY CONTROLLER PARTS AND FUNCTIONS

First, familiarize yourself with the controller. Refer to Figure III to identify the following parts.

- 1) **Calibration potentiometers, high and low.** Two calibrate pots are provided, one for low range (readings times 1) and one for high range (readings times 10). These are factory adjusted and normally will not need to be readjusted in the field. See page 25.
- 2) **Timer function selector switches.** Used to select mode of operation for timer circuit. Pertains to the selection of chemical pump functions only. Used to activate pump when signal is received from water meter (W/M); or to provide fail-safe timer for pump when activated simultaneously with valve (T/O); or to activate pump for a percentage of time (W/M and P/T).
- 3) **Range selection switch.** Used to select range where normal operation occurs: high (times 10) or low (times 1).
- 4) **Set-read switch.** Used to digitally display actual conductance (read position) or desired set-point (set position).
- 5) **Test normal switch.** Used in "normal" position for actual operating mode, used in test to check bleed valve activation.
- 6) **Timer test button.** Used to test timer. See pages 15 - 22.
- 7) **Timer setting.** Used to determine portion of total cycle time to be selected.
- 8) **Conductivity display.** Displays either the actual conductivity measured or the set value (as determined by the set-read switch).
- 9) **Conductivity set potentiometer.** Used to determine "set" value - clockwise increases "set" conductivity.
- 10) **Time-out light.** When illuminated, indicates that "pump" has remained on longer than original maximum preset time period. Typically used when chemical addition is in proportion to bleed-off rate.
- 11) **No flow light.** Works in conjunction with external flow switch to indicate no flow through the sample stream assembly. Disables output when illuminated.
- 12) **Pump light.** Indicates the chemical feed pump output is activated.
- 13) **Bleed light.** Indicates that bleed valve output is activated.
- 14) **Recorder adjustment potentiometer.** Used to adjust recorder output when external signal is required.
- 15) **Power switch and fuse.** Provided fused and switched to supply power to the conductivity controller. **Note:** Power to the biocide controller remains on as long as the "10" line cord is plugged in. All power to the outputs is off when power switch is off.
- 16) **Guard panel warning.** To alert user of presence of uninsulated "dangerous voltage" within enclosure.

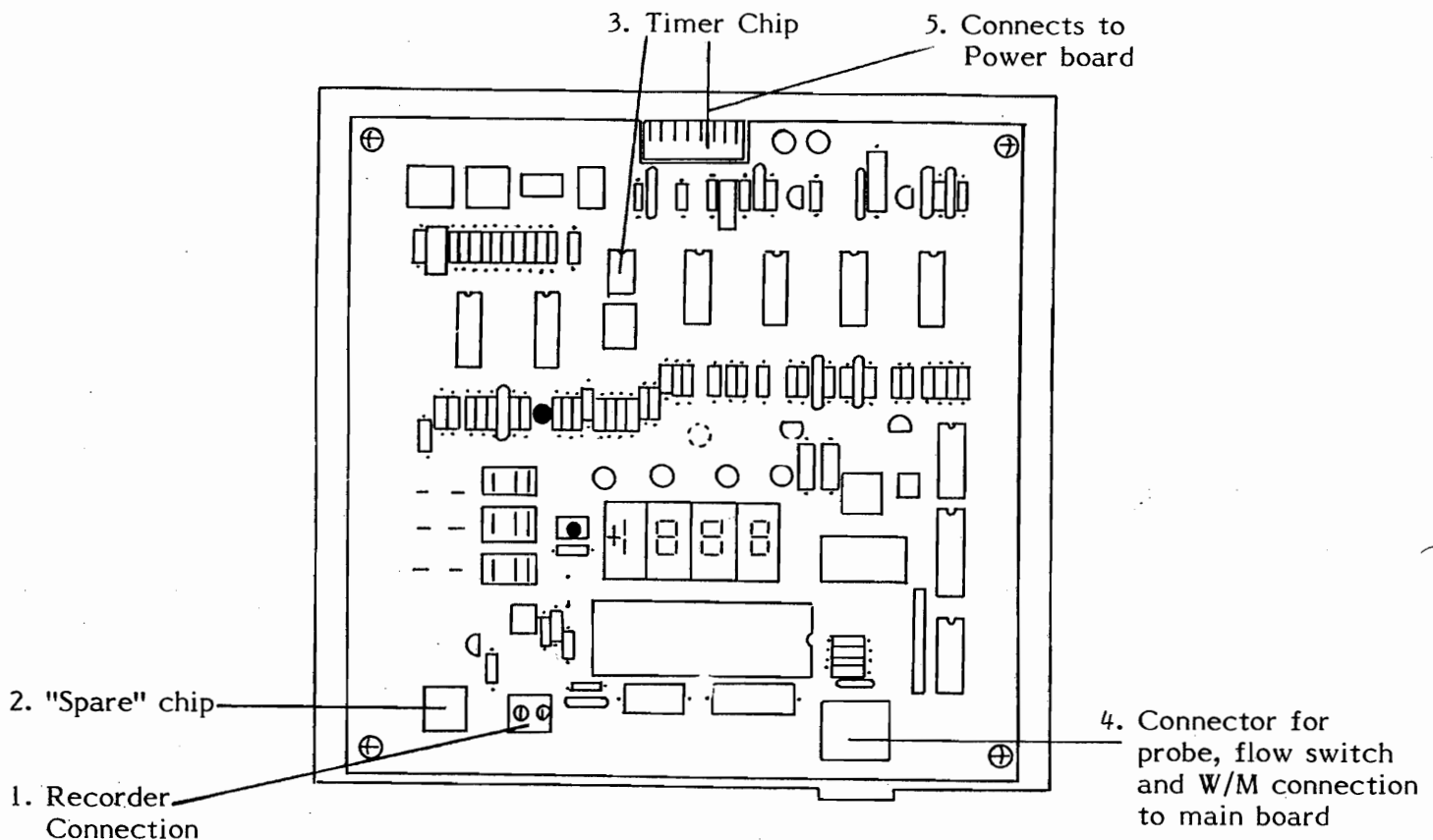
CONTROLLER PARTS AND FUNCTIONS continued.....

Special instructions for gaining access to the recorder output terminals, secondary fuse and to change the timer integrated circuit (chip).

1. Remove power cord from the 120V AC outlet.
2. Remove (5) screws from left hand side of the box. Support the base (bottom) of the controller and remove (5) screws from the right hand side.
3. Pull base and white front out of the box, place face down on bench or table.
4. Remove (4) nuts and lock washers on the bottom P/C board.
5. With both thumbs, push upward on the bottom P/C board connector. There is a connector on the top P/C board, but the gray set of wires are too short to remove this connector.
6. Lift off the top P/C board, but do not remove the lug-type connections.
7. Remove the (4) hexagonal stand-offs and lock washers, lift bottom P/C board up and over. You now have access to the recorder output terminals, the timer chip and the "spare" timer chip. Refer to Figure IV.

CONDUCTIVITY CONTROLLER COMPONENTS WHICH ARE NOT ACCESSIBLE THROUGH THE FRONT OF THE CONTROLLER

Figure IV



SAMPLE STREAM ASSEMBLY INSTALLATION

Including Conductivity Electrode (req'd) & Flow Switch (optional)

This section details the installation of the sample stream assembly ordered as individual components or as a preplumbed, prewired package.

1) Provide convenient access pipes for obtaining a continuous sample of the circulating water. Ideally, the access points are at the discharge and suction sides of the main circulating pump. Provision for a separate access point should be made if chemicals are going to be added automatically. Do not inject chemicals into the sample stream assembly.

Similarly, the bleed access point should be separate. Do not "tie in" bleed piping with the sample stream assembly. Refer to Figure I.

2) Under certain adverse conditions, a flo-thru sensor is impractical. HyDAC offers an alternate "drop-in" sensor for measurement in the tower sump. The sensor is then handy for frequent cleaning. When ordering, specify the alternate sensor.

3) Hand valves are recommended. Install on both the inlet and outlet side of the sample stream assembly as shown in Figure I.

4) Electrode and flow switch (optional, but recommended) installation: Mount the electrode and flow switch close to the preselected water sample access point. Place both electrode and flow switch at eye level or lower to ease maintenance. **NOTE:** It is also recommended that a sample petcock (or similar device) be installed in the sample stream assembly close to the electrode site, especially for 3/4" electrodes that do not include clean-out plugs. Samples of water can then easily be obtained for testing purposes and comparison to display of controller.

A. For factory-mounted piping assemblies, input water at the bottom; output at the top. See Figure V. Sample stream piping must be installed close to controller to allow proper installation.

B. For individual 3/4" flo-thru electrode and 3/4" flow switch, refer to Figure V. Component layout should be similar to preplumbed units, except sample stream components should be wall-mounted, not mounted to controller.

FIG. V

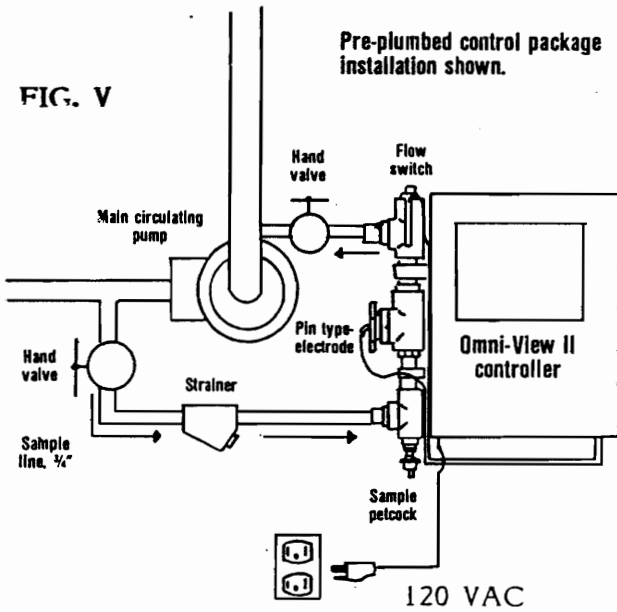
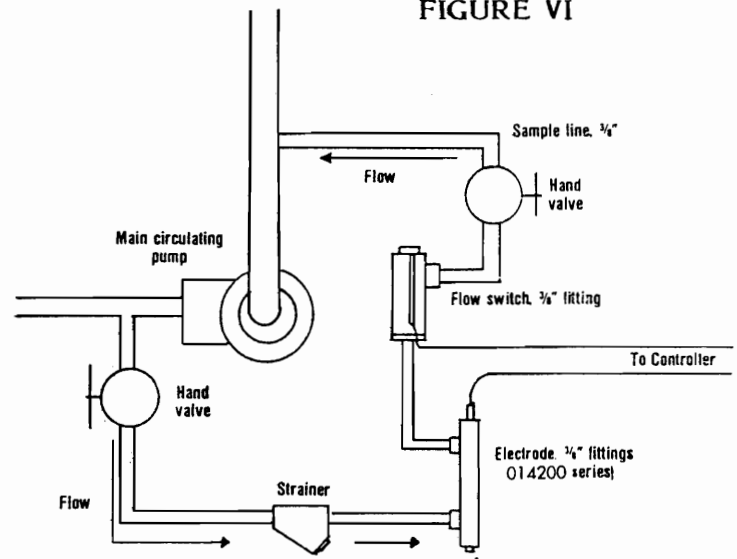


FIGURE VI

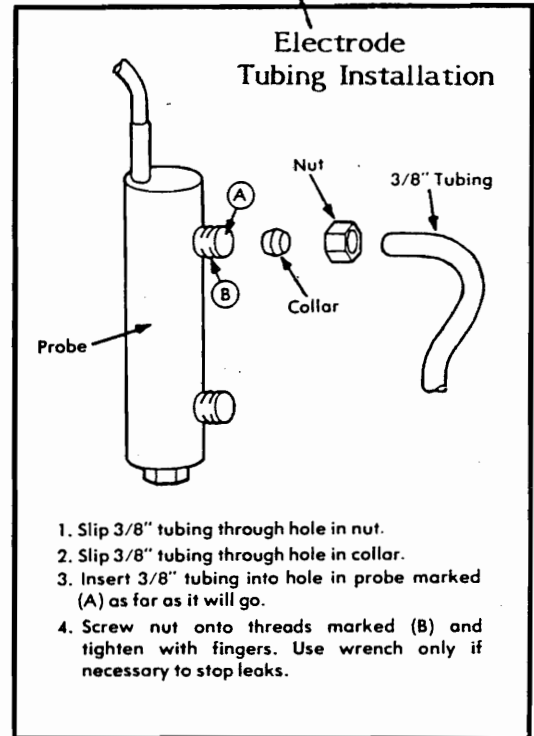


C. For electrode and flow switch installation with 3/8" fittings, install the 3/8" tubing sample lines. For electrode, input water at the bottom; output at the top; clean out drain plug facing downward with no obstructions for at least one foot. Avoid long runs of tubing. Refer to Figure VI. For 3/8" flow switch, input water at the bottom; output through the side; clean out plug at the top facing skyward. See Figure VI.

5) Open both hand valves and check for water leaks.

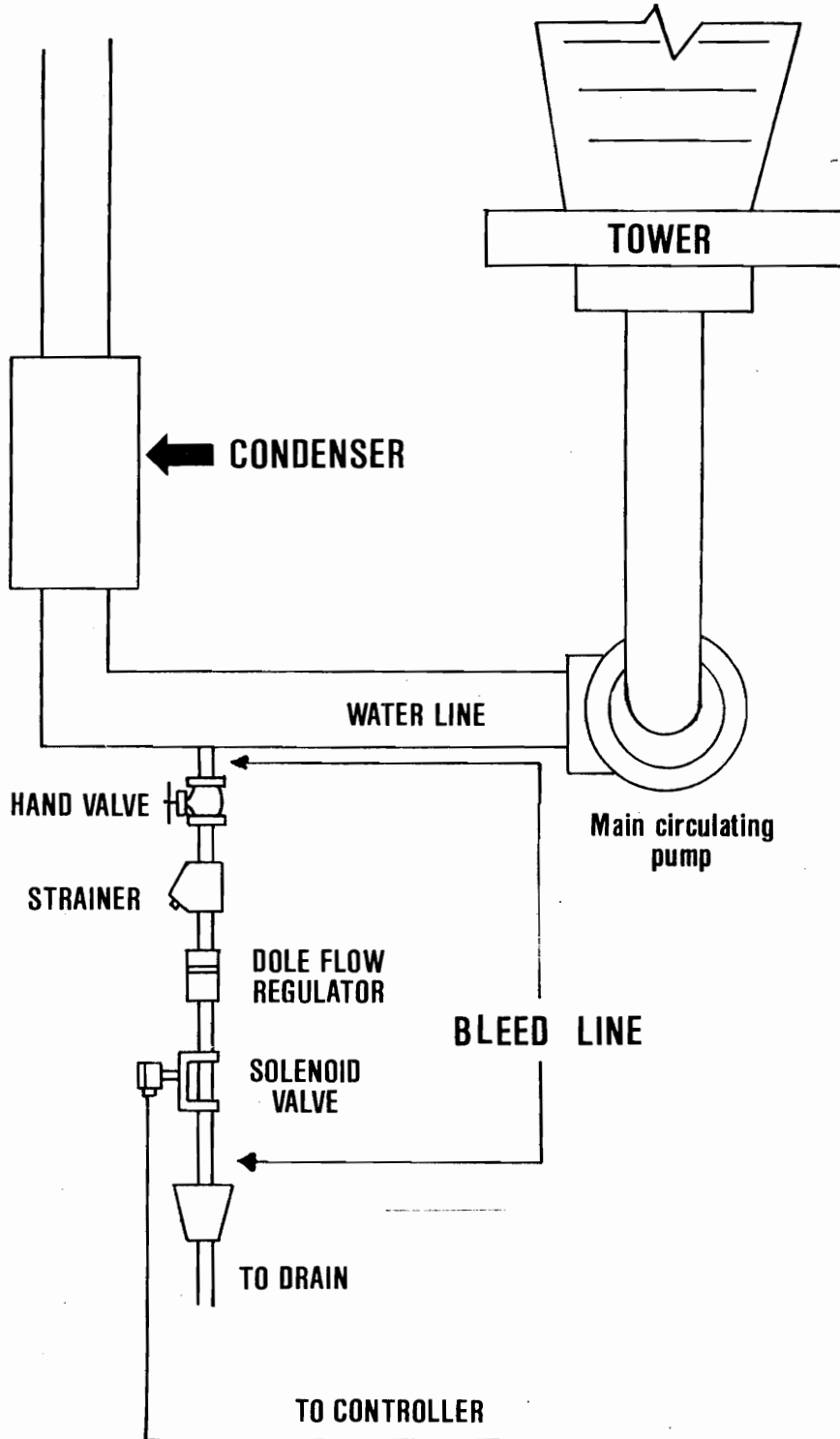
6) Connect sensor cable and flow switch cable to the appropriate terminal strip on enclosure. (This is completed at the factory on preplumbed units). See Figure I. Observe color code for the probe connection. An 8' cable has been provided on the electrode (or 10' cable, depending on model selected), but it can be spliced and extended; avoid long runs. If extending the cable, use 18-22 gauge 3-conductor stranded wire; for the flow switch, use 18-22 gauge 2-conductor stranded wire.

CAUTION: Do not run probe wires through conduits which have any other wires in the conduit. For example: Valve and/or pump wires.



BLEED VALVE INSTALLATION

Figure VII



BLEED VALVE ASSEMBLY INSTALLATION: (See Figure VII)

Using the Model "10" controller, bleed-off will be determined by the actual conductivity level of the circulating water compared to a conductivity set point.

Site selection:

A. It is desirable for bleed flow to be visible from the controller; it is essential that the bleed flow be visible at the end of the bleed line wherever it may be located.

B. Bleed access point should be separate from chemical injection site and sensor sample line. Refer to Figure I.

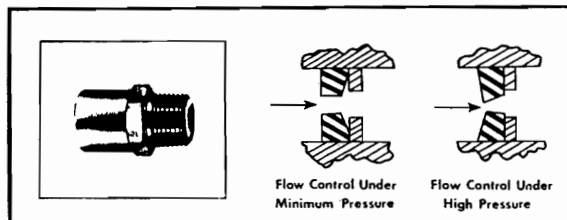
C. It is good practice to install a hand valve, sized to match valve piping size, upstream of the solenoid valve site. This allows shut-off of water through the valve when service is required.

D. Since it is imperative that bleed valves be kept clean, HyDAC recommends a strainer be installed upstream of the valve, just downstream of the hand valve previously discussed. Periodic cleaning of the strainer is mandatory to assure proper system operation.

E. Next in line should be placed a Dole flow regulator, sized to system, to maintain a constant "known" bleed-off rate. Refer to Appendix for Dole flow regulator specifications. This element is essential when chemicals are to be added in direct proportion to bleed-off rate. Flow direction must be observed.

The Dole flow regulator is a simple, self-cleaning device designed to deliver a constant volume of water from any outlet, whether the pressure is 15 psi or as high as 125 psi. The controlling mechanism consists of a flexible orifice that varies its area inversely with the pressure so that a constant flow rate is maintained. Figure VIII illustrates how a single orifice, for simplicity of explanation, changes shape to maintain a constant flow rate as the inlet pressure increases.

Figure VIII



VALVE INSTALLATION:

1) Install the bleed valve, Dole flow regulator, strainer and hand valve as previously described. Refer to Figure VII.

2) Run conduit or sheathed cable to the bleed valve. **IMPORTANT NOTE:** It is essential that the valve is connected as described below. Valve and pump outputs operate from individual relays and the timing circuit in the Model "10" is designed to work in conjunction with the pump relay only.

3) A receptacle is provided for the bleed valve hook-up to the controller. Refer to Figure I.

INSTALLATION OF WATER METER:

Use of water meter is optional. Water meter is required when chemicals are to be added in direct proportion to make-up rate.

1) Water meter installation guidelines:

a. Install the water meter in the water line at a point where only water to be treated passes through the meter.

b. Consideration should be given to the winterizing of the system in cold weather areas to prevent unit from freezing.

c. Meter is water resistant, but must be mounted in a location which will not expose it directly to falling water.

d. Water through meter must not exceed the temperature rating specified by the manufacturer. The temperature rating on a standard meter supplied by HyDAC is 100 degrees F. maximum. (For hot water meters, contact the factory).

e. Direction of flow through meter must be observed.

f. Pressure rating specified by manufacturer of meter must be observed. Standard HyDAC meters are rated at 220 psi maximum.

g. Preferable mounting of meter is in a horizontal position with register facing toward the ceiling and near the floor, readily accessible for ease of installation and consumption indicates correctness of dosage rate. Refer to Appendix "How to Read the Water Meter Register" if assistance in this area is required.

h. Meter warranty is voided if returned with foreign particles in the measuring chamber or if broken by excessive flow.

INSTALLATION OF WATER METER continued.

i. Flow rates specified by the manufacturer must also be considered. Refer to Figure IX for specifications.

j. Make provision for a "by-pass" loop in the event that the water meter requires service; see Figure X.

The following steps should be adhered to when installing the meter:

A. Measure the length of the meter plus pipe couplings and make the necessary plumbing arrangements to accommodate the installation.

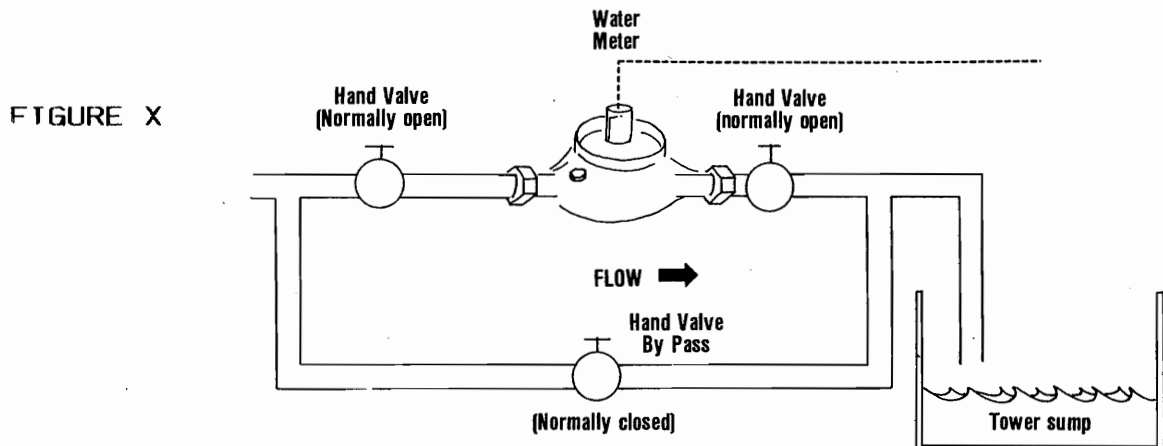
B. Install the couplings without the meter connected.

C. **IMPORTANT:** Thoroughly flush all lines before connecting the meter in the piping. Most meter difficulties are caused by foreign matter introduced into the piping system in the form of pipe dope, threading chips, etc.

D. Connect meter to the coupling. Observe direction of flow indicated on meter.

E. Apply pressure to the system and check/repair leaks.

F. Run electrical wires between the water meter electrical connections and water meter terminal on the base of the controller. Polarity is not important. This is low voltage wiring and need adhere only to the Class II Underwriter's regulations. Maximum current is less than .05 amperes. If water meter wires are run in conduit, it is important that no other wires run in that conduit and do not run parallel to power carrying conductors.



SELECTING CONTROLLER LOCATION AND CONNECTING POWER TO THE CONTROLLER:

1) Controller site selection should be made with the following considerations in mind:

a. Controller should be located as close as possible to convenient area for obtaining a continuous sample of circulating water through the electrode assembly (or in close proximity to the drop-in electrode site, if the alternate electrode is used).

b. Avoid hostile environments. Controller should be mounted clear of vapors and drippings, but convenient for viewing and access to controls.

c. Unit should be mounted at eye-level to ease set-up and maintenance requirements, and allow viewing of the digital conductivity display.

d. For pre-plumbed units, electrode/flow switch combination will always be mounted on left side of enclosure. Flow of sample must be "in" at bottom, "out" at top.

2) Mount controller using mounting flanges provided. Mechanical dimensions are shown in Figure XI.

3) Plug controller power cord into 120V AC outlet.

4) Proceed to Controller Set-Up and Check-Out.

CONTROLLER SET-UP AND CHECK-OUT:

NOTE: The main system circulating pump must be operating during these adjustments. For failure of event to occur, refer to Question and Answer Guide provided in the back of the manual. It is recommended that the following steps be followed:

Establish controller set-point:

1) Disconnect the bleed valve and the chemical pump.

2) Apply power to the controller and place on/off switch in "on" position. Digital display will be illuminated.

3) "No flow" must not be activated at this time. It is illustrated, temporarily disconnect flow switch from terminals and later proceed to Question and Answer Guide in this manual to ensure that "no flow circuit/flow switch" combo is working properly.

4) Place test/normal switch in the normal position.

5) Place set-read switch in the read position.

WATER METER SELECTION CHART

Figure IX

<u>Arad P/N*</u>	<u>Maximum Continuous Flow</u>	<u>Maximum Intermittent Flow</u>
028331	10	30
028334	15	40
028337	20	50
028340	35	100
028343	55	160

<u>Arad P/N*</u>	<u>Minimum Flow</u>	<u>Pipe Size</u>	<u>50% Max. Flow</u>	<u>100% Max. Flow</u>
028331	.1	3/4"	3	8
028334	.25	3/4"	3	8
028337	.25	1"	2.5	9
028340	.5	1-1/2"	3	9
028343	.5	2"	2.5	9

Pressure drop across meter psi

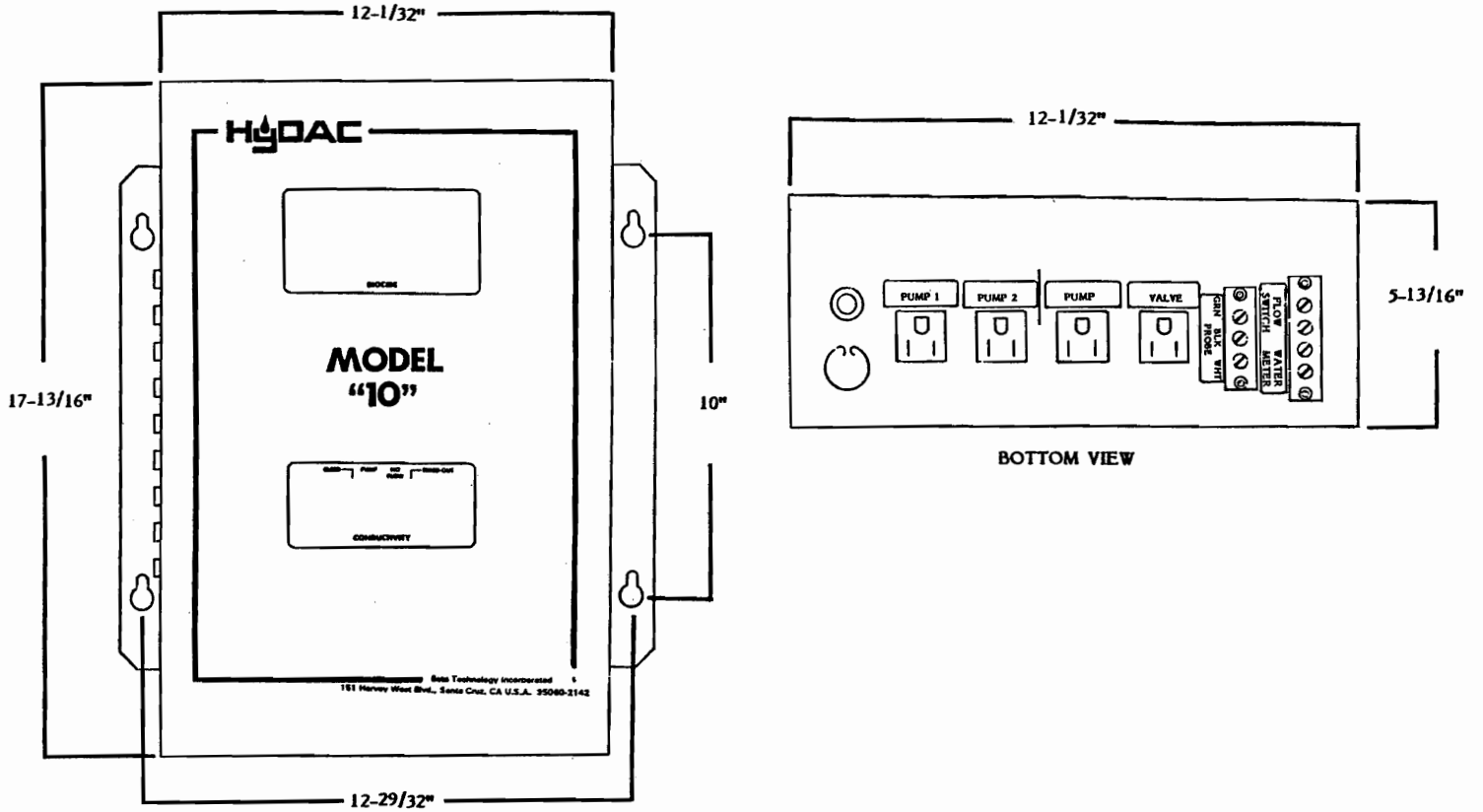
<u>Arad P/N*</u>	<u>Dimensions Length</u>	<u>Overall Width</u>	<u>Height (ref.)</u>	<u>Gallons per contact</u>
028331	12-1/2"	3-3/4"	4-3/4"	10
028334	14-1/4"	3-3/4"	4-3/4"	10
028337	16-1/2"	4-1/8"	4-3/4"	10
028340	17-3/4"	4-15/16"	6-1/4"	100
028343	18"	6-1/4"	7-11/16"	100

Meters supplied complete with threaded couplings.

* Larger sizes available upon request.

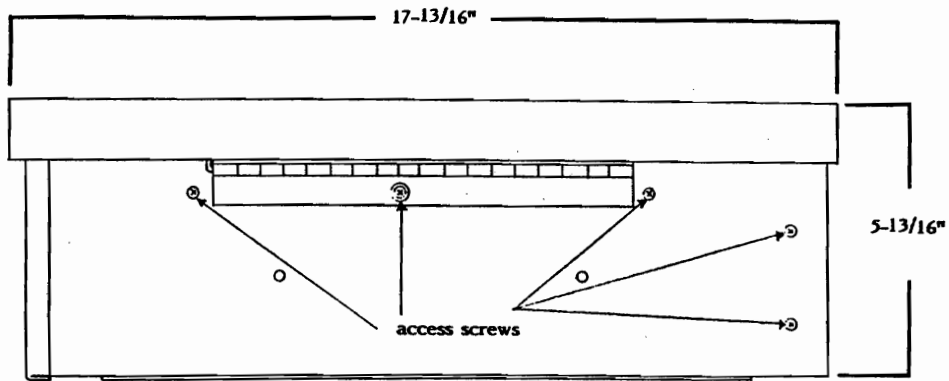
MECHANICAL AND MOUNTING DIMENSIONS

Figure XI

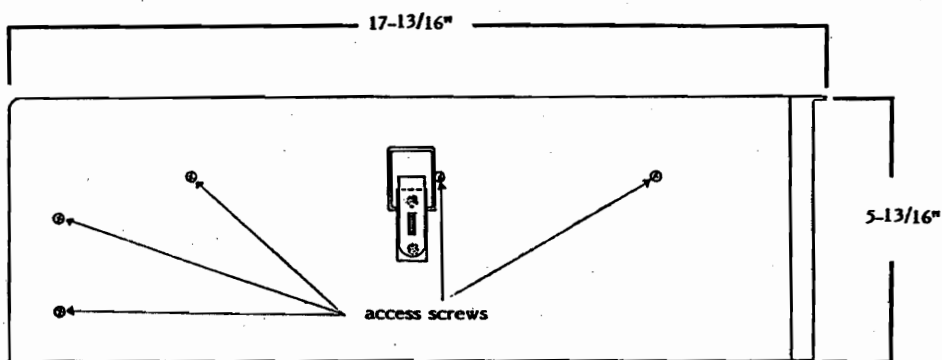


FRONT VIEW

BOTTOM VIEW



SIDE VIEW



SIDE VIEW

CONTROLLER SET-UP AND CHECK-OUT continued.....

6) The display will read the conductivity of the water in the sensor. Make sure that water is flowing through the sensor. If over-range (1 followed by blanks on the display), move the range switch to x 10 (high). You must now multiply the reading by 10.

7) Place the "set-read" switch in the set position, then rotate "set potentiometer" until display reads desired set point to be maintained. If on high range, you must factor in the times (10) multiplier. For example, you would set the reading at 250 to maintain 2,500 micromhos.

8) Return set-read switch to read position. This is normal operating mode for automatic conductivity control.

9) If actual conductivity (step 6) is much higher than set point (step 7), the "bleed" light should be illuminated until the set point is satisfied. If actual conductivity (step 6) is much lower than set point (step 7), bleed light should not be illuminated.

10) Do not be concerned with other settings or LED illuminations at this time; all other functions will be covered in detail.

11) Proceed to "Establishing Chemical Feed Pump Activation" section.

ESTABLISHING CHEMICAL FEED PUMP ACTIVATION:

The first step in set up of the chemical pump is the determination of the method to be used to add chemicals. The following methods are possible with the Model "10". Select your method and proceed to the proper installation section labeled Methods A - D.

Method A: Chemical addition in proportion to bleed off rate. This method allows fail-safe time-out of chemical pump. Use only on systems without leaks and/or overflow.

Method B: Chemical addition in proportion to make-up rate. This method requires a water meter with an electrical contactor placed in the make-up line.

Method C: Chemical addition as a percentage of controller "on" time. This means that as long as controller is powered, chemical will be added as a percentage of time based on total cycle time. The standard "Red 60" I.C. total time cycle is 1 minute maximum adjustable in one second increments.

ESTABLISHING CHEMICAL FEED PUMP ACTIVATION: continued.....

Method D: Feed and bleed based on conductivity with extended pumping time.

Method A Installation: Chemical addition in proportion to bleed-off, with fail-safe time-out function.

Important Note: This method requires changing the factory installed integrated circuit (I.C.) which controls timer cycle time. For customer convenience, the additional I.C. has been supplied with the controller. For information on accomplishing this I.C. change, refer to the section entitled "How to Change Total Timer Cycle" in the Appendix.

This method is recommended for systems without leaks and/or overflow. Where uncontrolled water leakage exists, Method B is recommended.

Since chemical is not lost by evaporation, only through bleed-off, chemical replacement in this method will occur while bleeding. The bleed rate must be constant and of a known value so that the proper chemical feed rate can be selected.

The easiest way to control bleed rate is with a flow regulator (see Dole Flow Regulator information in the Bleed Valve Assembly Installation Section and in the Appendix), although it can be done with a hand valve. To select the proper size, use two formulas:

$$\text{Evaporation} = .03 \times \text{tonnage}$$

Note - Double Evaporation occurs on Absorption Machines

$$\text{Bleed rate} = \frac{\text{Evaporation}}{\text{Cycles of Concentration} - 1}$$

EXAMPLE: A 300 ton centrifugal machine with desired cycles of concentration = 3

$$\text{Evaporation} = .03 \times 300 = 9 \text{ GPM}$$

$$\text{Bleed} = \frac{9}{3-1} = \frac{9}{2} = 4.5 \text{ GPM}$$

The worst case bleed rate is 4-1/2 gallons per minute. There is no 4-1/2 gallon per minute Dole Flow Regulator; go up to 5, 6, 7 or better yet; 8 gallons per minute for flexibility in chemical pump selection.

Method A Installation: Chemical addition in proportion to bleed-off, with fail-safe time-out function continued.....

To size the chemical pump, use the formula:

$$\frac{\text{Dole Flow Reg. Size}}{16} \times \frac{\text{Chemical Res. (PPM)}}{120} = \text{Chemical Pumping Rate}$$

EXAMPLE: 8 GPM Dole Flow Regulator; 360 parts per million chemical residual.

$$\frac{8}{16} \times \frac{360}{120} = \frac{1}{2} \times 3 = 1\text{-}1/2 \text{ pints per hour or } 4.5 \text{ gallons per day (gpd)}$$

If you select a 7 gpd pump, set it at 65%.

A 5 gallon per minute Dole Flow Regulator dictates a lower pumping rate (2.8 gpd). The most common chemical pumps are typically rated at 7 gpd. Cutting back a 7 gpd pump to 2.8 gpd (40%) results in less reliable operation. If you already have a 7 gpd chemical pump, you may work the formula "backwards", e.g.

$$\frac{\text{Dole Flow Regulator}}{1920} \times 360 = 2\text{-}1/3 \text{ pts./hr. (or 7 gpd)}$$

$$\text{Dole Flow Regulator} \times 360 = 4480$$

$$\text{Dole Flow Regulator} = \frac{4480}{360} = 12.4 \text{ gpm}$$

After solving this problem, the theoretical Dole size is now 12.4 gallons per minute; 12 gpm is the closest available size and should be used. The pump would initially be set @ 100% and later adjusted downward if required.

With any automatic feed and bleed system based on conductivity, keep in mind, the two major rules:

1. No leaks or overflow, only controller bleed.
2. If you increase bleed rate, chemical pumping rate must be increased; if you decrease bleed rate, chemical pumping rate must be decreased.

CAUTION: To prevent accidental emptying of chemical drum and draining of the tower sump, the Model "10" should be installed with a flow switch! Refer to section "Selecting Controller Location and Connecting Power to the Controller", to verify installation methods recommended.

Periodic monitoring (by analytical methods) of the chemical residual is recommended. Adjust pump as required. Changes in the conductivity "SET POINT" do not require pump readjustment, provided chemical residual is at the desired level.

Method A Installation:

Chemical addition in proportion to bleed-off, with fail-safe time-out function.

1) Circulating pump must be on. "No flow" light should not be illuminated at this time. If it is, temporarily disconnect flow switch at terminal strip and later proceed to Question and Answer Guide to ensure that "no flow/flow switch" combo is working properly.

2) If electrode is not installed, refer to "Sample Stream Assembly Installation" before proceeding further.

3) Controller power switch should be in the "on" position.

4) Turn "set" potentiometer to the maximum clockwise position.

5) Place "range" switch in the normal operating range. Place "set/read" switch in the "read position" and "test/normal" switch in the "normal" position.

6) Timer function switch should be placed with the T/O switch in the "on" position: W/M and P/T switches must be in the "off position".

7) Place timer select switch #2 in the "on" position (for 2 minutes "on" time), all others in the "off" position.

IMPORTANT NOTE: It is assumed that the timing chip (I.C.) has been changed as described in the first section of this installation section.

8) Rotate the set potentiometer counter-clockwise until the "bleed" light becomes illuminated. "Pump" light should activate simultaneously with "bleed" light, remain "on" for two minutes as dictated by the timer switch, then "pump" light should become disabled. At time of "pump" light disablement, "timed-out" light should become activated.

9) "Timed-Out" state can then be reset by interrupting power to the controller. (When in normal operating mode, unit will reset "timed-out" state whenever the conductivity falls below the set point and automatically shuts off valve and pump or operator interrupts power).

10) Place "set/read" switch in the "set" position to display the set value. Turn "set" potentiometer until the desired "set" value is once more displayed.

11) Establish the maximum "on" time the chemical feed pump should be allowed to pump during any one bleed cycle. Using this figure, proceed to "Establishing Timer "On" Time" section.

Method A Installation continued.....

12) The timer test switch will not activate the timer in the T/O mode. Turn "set" potentiometer clockwise to maximum. Bleed light should be out, you may have to go to x10 range. Turn "set" counter-clockwise to minimum. Bleed light and pump light should be on, T/O light should come on after the preselected time period has expired, at which time the pump light goes out.

Method B Installation:

Chemical addition in proportion to make-up rate. Requires use of a water meter with electrical contactor installed in the make-up line. Note: Timing chip for this method is supplied installed from the factory. Maximum "on" time is 4.25 minutes, adjustable in one second increments.

1) Install water meter, refer to section "Water Meter Installation". Note: Do not connect water meter wires until step 2 - 9 in this section have been completed.

2) Circulating pump must be on during this step. "No flow" must not be activated at this time. If it is illuminated, temporarily disconnect flow switch from terminal and later proceed to Question and Answer Guide provided in this manual to ensure that "no flow/flow switch" combination is working properly.

3) Conductivity electrode must also be installed. If the electrode is not installed, refer to "Sample Stream Assembly Installation" section before proceeding further.

4) Range switch should be on normal operating range. Set/read switch should be in read position. Test/normal switch should be in the normal position.

5) Timer function switch should be placed with the W/M position in the "on" position. (T/O and P/T switches must be in the "off" position).

6) Place timer select switches 2 and 4, that is, 2 seconds and 8 seconds respectively in the "on" position; all others in the "off" position.

7) Depress the timer test switch, the pump light should become illuminated for 10 seconds and then become disabled. Note: The switch will be ineffective, if the water meter contactor happens to be closed due to no make-up flow. Disconnect one water meter wire to test the timer.

8) The timer is now automatically reset awaiting another activation.

Method B Installation continued.....

9) Determine pump "on" time desired and proceed to section "How to Adjust On Time for Timing Circuit".

10) Disconnect power to the controller. Connect water meter wires to appropriate terminal strip. Reconnect power to control box.

11) With flow passing through the meter, visually check to see that one revolution of meter register (10 gallons for 5/8", 3/4" and 1" meter; 100 gallons for 1-1/2" and 2" meters) activates pump light.

For assistance reading meter, refer to Appendix.

Chemical Pump and Timer Adjustment:

Once the pump has been installed, it is necessary to properly adjust the pumping rate to obtain the desired chemical dosage of water.

By referring to Figure XII select the desired pumping rate in pints per hour that will give the required dosage in pints per thousand gallons. This is based on a timer setting of 18 seconds for 028331, 30 gpm (Arad) and 028334, 40 gpm (Arad) - Part A. 12 seconds for 028337, 50 gpm (Arad), 50 seconds for 028340, 100 gpm (Arad) and 36 seconds for 028343, 160 gpm (Arad) - Part B.

Adjustment of Timer:

The timer adjustment is made using the timer select switches. Refer to the section titled "How to Adjust On Time for Timing Circuit".

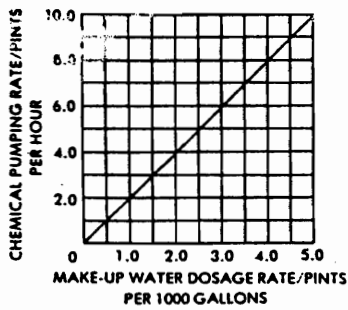
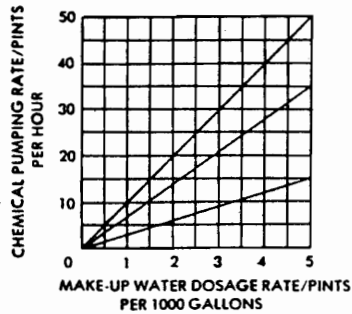


FIGURE XII

Arad - 028331 (30gpm)
 Arad - 028334 (40gpm)



Arad - 028343 (160gpm)
 Arad - 028340 (100gpm)
 Arad - 028337 (50gpm)

WATER METER MODELS

1. Determine desired dosage rate in pints per 1000 gallons of water.
2. Read chemical pumping rate/pints per hour.
3. Set chemical pump for this pumping rate.

Method C Installation:

Chemical addition as a percentage of controller "ON" time. Normally used when it is desired to control chemical pump based on time, where the additional cost of a water meter would be prohibitive.

1) First, determine maximum cycle time desired. The standard timing chip installed at the factory will provide a repeating cycle that occurs every 60 seconds, adjustable in one second increments. See Special Instructions on pages 25-26. The "spare" chip provided with each unit will provide a total cycle time of 60 minutes, adjustable in one minute increments. If this time setting is desired, refer to Appendix "How to Change Timer Chip". See Special Instructions on page 26.

2) Circulating pump must be on. No flow must not be activated at this time. If it is illuminated, temporarily disconnect flow switch from terminal and later proceed to Question and Answer Guide provided in this manual to ensure that "no flow circuit/flow switch" combination is working properly.

3) If sensor is not installed, refer to "Sample Stream Assembly Installation" section before proceeding further.

4) Range switch should be placed in the normal operating mode. Set/read switch in the read position. Test/normal switch in the normal position.

Method C Installation continued.....

5) Timer function switches: W/M should be in the "Off" position.

6) Place timer select switches 2 and 4 (two seconds and eight seconds for the standard chip, respectively) in the "On" position, all others in the "Off" position.

7) Press timer test switch, pump light should become illuminated and remain on for 10 seconds, off for 50 seconds. At this time, unit should begin to recycle ("On" for 10 seconds, "Off" for 50 seconds) and should continue as long as power is supplied to controller.

8) Determine total on time desired and proceed to section titled "How to Adjust On Time for Timing Circuit".

Method D Installation:

Typical application: User is locked into a high bleed rate situation. Conductivity controller output stays energized for very short periods of time resulting in insufficient chemical treatment.

Solution: Set mode switch S4 as follows: W/M and T/O "On" (upward). Set timer switch S5 to desired pumping time to ensure adequate chemical treatment. Timer test switch will activate the timer, if the bleed light is off. Also, the timer is activated everytime the controller goes into bleed.

How to Adjust "ON" Time for Timing Circuit (all methods):

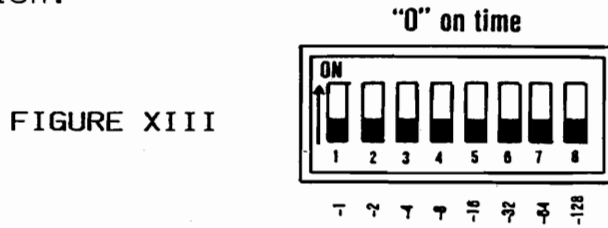
Two settings on the controller must be understood to allow proper installation and operation of the timing circuit provided. These settings, the timer function select switches and the time setting switches, must be field adjusted for each installation.

The timer function select switches are used to determine if the timing circuit will be used a limit timer (Method A), precision reset timer working with a water meter (Method B), or as a percentage timer (Method C). These three methods were described earlier in the manual in detail.

After determining the function of the timing circuit it must be determined which timing chip would be appropriate. The chip installed at the factory provides a total cycle time of 4.25 minutes, which would normally be used whenever the timing circuit performs as a reset timer (Method B) or as a percentage timer (Method C). Usually, when the timing circuit is used as a limit timer (Method A), the spare chip provided should be installed. Note: There are separate instructions for setting time for Method C. See pages 25 - 26.

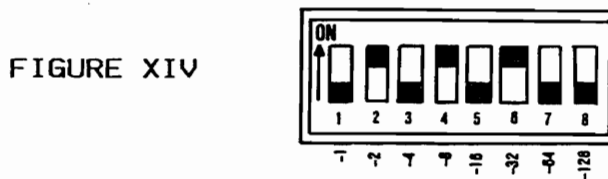
How to Adjust "ON" Time for Timing Circuit continued.....

All time setting switches are shown in Figure XIII in the off position.



For this example, an "on" time of 42 seconds is desired. "On" times are obtained by adding the corresponding numbers for the switches shown. Switch numbers are located on the switch block; "on" times are silkscreened on the printed circuit board.

Therefore, for 42 seconds "on" time, the following switch positions should be used (Figure XIV).



$$\frac{\text{Switch}}{\text{Corresponding Time}} = \frac{2}{2 \text{ (secs.)}} + \frac{4}{8 \text{ (secs.)}} + \frac{6}{32 \text{ (secs.)}} = 42 \text{ seconds total "On" time}$$

A P P E N D I X

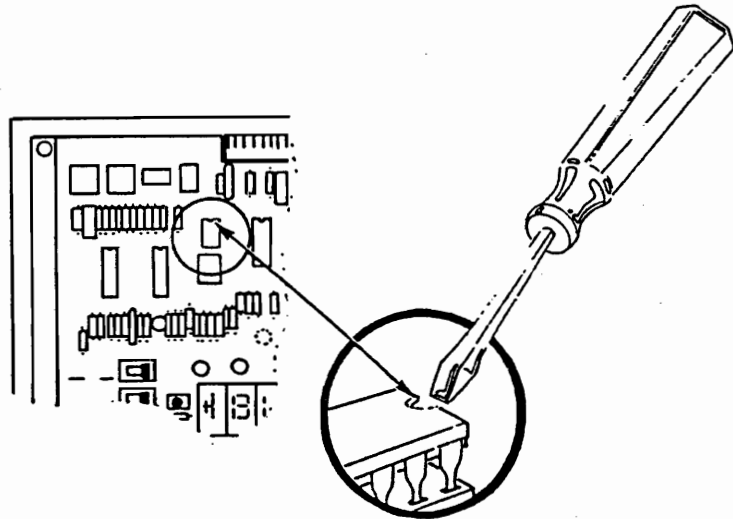
How to Change Total Timer Cycle Time by Changing Timing Chip (I.C.):

The Model "10", as supplied by the manufacturer, includes an integrated circuit (I.C.) to allow total "On" time of 4.25 minutes adjustable in one second increments. See special instructions for setting time, if Method C (% timer) is being used, on page . An optional timer I.C. is also included with each unit. This optional I.C. allows total cycle time of 4.25 hours adjustable in one minute increments (see special instructions in Method C (% timer) and is being used on page 26 .

Installation of the optional I.C. is easily accomplished by completing the following steps:

- 1) Disconnect power to the controller.
- 2) Remove original I.C. (identified as Red 60, printed on the I.C., P/N 032207) from the socket. Refer to Figure IV to locate this chip. This is accomplished by inserting a small screwdriver between the I.C. and the socket as shown in Figure XV.

FIGURE VX. REMOVAL OF TIMING CHIP (I.C.)



- 3) Remove "spare" I.C. from the holding socket provided. This is identified as Red 3600, printed on the I.C., BETA P/N 906127.
- 4) Insert correct I.C. onto main circuit board. Observe configuration noted. The dot (or indentation) on the I.C. represents pin #1. Align pin #1 of the I.C. with the #1 silkscreen on the printed circuit board. Be sure all eight legs of the I.C. are straight and inserted properly into the socket.
- 5) Continue with System Set-up and Check-out.

SPECIAL INSTRUCTIONS FOR SETTING THE TIMING IN THE % TIMER MODE (METHOD C):

1) With the standard I.C. "Red 60", the cycle time is one minute in one second increments. Set the dip timer switch S5 as per the instructions for Method A & B. Note that if the switch is set for 60 seconds or more, the pump will stay on continuously.

2) With the alternate I.C. "Red 3600", the cycle time is 60 minutes in one minute increments. Set the dip timer switch S5 per the instructions for Method A & B. Note that if the switch is set for 60 minutes or more, the pump will stay on continuously.

A third I.C. "Red 360" is available for a cycle time of six minutes in six second increments. Contact the factory to obtain this I.C.

TIMING SWITCH (S5) SELECTION CHART
With standard "Red 60" I.C.

Switch ON (upward)	Secs. ON (mins. ON for Red 3600 I.C.)	Switch ON (upward)	Secs.ON (mins. ON for Red 3600 I.C.)
1	1	2, 3, & 5	22
2	2	1, 2, 3, & 5	23
1 & 2	3	4 & 5	24
3	4	1, 4, & 5	25
1 & 3	5	2, 4, & 5	26
2 & 3	6	1, 2, 4, & 5	27
1, 2, & 3	7	3, 4, & 5	28
4	8	1, 3, 4, & 5	29
1 & 4	9	2, 3, 4, & 5	30
2 & 4	10	1, 2, 3, 4, & 5	31
1, 2, & 4	11	6	32
3 & 4	12	1 & 6	33
1, 3, & 4	13	2 & 6	34
2, 3, & 4	14	1, 2, & 6	35
1, 2, 3, & 4	15	3 & 6	36
5	16	1, 3, & 6	37
1 & 5	17	2, 3, & 6	38
2 & 5	18	1, 2, 3, & 6	39
1, 2, & 5	19	4 & 6	40
3 & 5	20	1, 4, & 6	41
1, 3, & 5	21	2, 4, & 6	42

TIMING SWITCH (S5) SELECTION CHART continued.....

Switch ON (upward)	Secs.ON (mins.ON for Red 3600 I.C.)	Switch ON (upward)	Secs.ON (mins.ON for Red 3600 I.C.)
1,2,4 & 6	43	1,2,4,5 & 7	91
3,4, & 6	44	3,4,5 & 7	92
1,3,4 & 6	45	1,3,4,5 & 7	93
2,3,4 & 6	46	2,3,4,5 & 7	94
1,2,3,4 & 6	47	1,2,3,4,5 & 7	95
5 & 6	48	6 & 7	96
1,5 & 6	49	1,6 & 7	97
2,5 & 6	50	2,6 & 7	98
1,2,5 & 6	51	1,2,6 & 7	99
3,5 & 6	52	3,6 & 7	100
1,3,5 & 6	53	1,3,6 & 7	101
2,3,5 & 6	54	2,3,6 & 7	102
1,2,3,5 & 6	55	1,2,3,6 & 7	103
4,5 & 6	56	4,6 & 7	104
1,4,5 & 6	57	1,4,6 & 7	105
2,4,5 & 6	58	2,4,6 & 7	106
1,2,4,5 & 6	59	1,2,4,6 & 7	107
3,4,5 & 6	60 (Here	3,4,6 & 7	108
	or above in Method C (%	1,3,4,6 & 7	109
	Timer) the pump will stay	2,3,4,6 & 7	110
	on continuously.	1,2,3,4,6 & 7	111
1,3,4,5 & 6	61	5,6 & 7	112
2,3,4,5 & 6	62	1,5,6 & 7	113
1,2,3,4,5 & 6	63	2,5,6 & 7	114
7	64	1,2,5,6 & 7	115
1 & 7	65	3,5,6 & 7	116
2 & 7	66	1,3,5,6 & 7	117
1,2, & 7	67	2,3,5,6 & 7	118
3 & 7	68	1,2,3,5,6 & 7	119
1,3 & 7	69	4,5,6 & 7	120
2,3 & 7	70	1,4,5,6 & 7	121
1,2,3 & 7	71	2,4,5,6 & 7	122
4,3 & 7	72	1,2,4,5,6 & 7	123
1,4 & 7	73	3,4,5,6 & 7	124
2,4 & 7	74	1,3,4,5,6 & 7	125
1,2,4 & 7	75	2,3,4,5,6 & 7	126
3,4 & 7	76	1,2,3,4,5,6 & 7	127
1,3,4 & 7	77	8	128
2,3,4 & 7	78	1 & 8	129
1,2,3,4 & 7	79	2 & 8	130
5 & 7	80	1,2, & 8	131
1,5 & 7	81	3 & 8	132
2,5 & 7	82	1,3 & 8	133
1,2,5 & 7	83	2,3 & 8	134
3,5 & 7	84	1,2,3 & 8	135
1,3,5 & 7	85	4 & 8	136
2,3,5 & 7	86	1,4 & 8	137
1,2,3,5 & 7	87	2,4 & 8	138
4,5 & 7	88	1,2,4 & 8	139
1,4,5 & 7	89	3,4 & 8	140
2,4,5 & 7	90	1,3,4 & 8	141

TIMING SWITCH (S5) SELECTION CHART continued.....

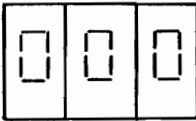
Switch ON (upward)	Secs. ON (mins. ON for Red 3600 I.C.)	Switch ON (upward)	Secs. ON (mins. ON for Red 3600 I.C.)
2,3,4 & 8	142	1,2,4,5,6 & 8	187
1,2,3,4 & 8	143	3,4,5,6 & 8	188
5 & 8	144	1,3,4,5,6 & 8	189
1, 5 & 8	145	2,3,4,5,6 & 8	190
2,5 & 8	146	1,2,3,4,5,6 & 8	191
1,2,5 & 8	147	7 & 8	192
3,5 & 8	148	1,7 & 8	193
1,3,5 & 8	149	2,7 & 8	194
2,3,5 & 8	150	1,2,7 & 8	195
1,2,3,5 & 8	151	3,7 & 8	196
4,5 & 8	152	1,3,7 & 8	197
1,4,5 & 8	153	2,3,7 & 8	198
2,4,5 & 8	154	1,2,3,7 & 8	199
1,2,4,5 & 8	155	4,7 & 8	200
3,4,5 & 8	156	1,4,7 & 8	201
1,3,4,5 & 8	157	2,4,7 & 8	202
2,3,4,5 & 8	158	1,2,4,7 & 8	203
1,2,3,4,5 & 8	159	3,4,7 & 8	204
6 & 8	160	1,3,4,7 & 8	205
1,6 & 8	161	2,3,4,7 & 8	206
2,6 & 8	162	1,2,3,4,7 & 8	207
1,2,6 & 8	163	5,7 & 8	208
3,6 & 8	164	1,5,7 & 8	209
1,3,6 & 8	165	2,5,7 & 8	210
2,3,6 & 8	166	1,2,5,7 & 8	211
1,2,3,6 & 8	167	3,5,7 & 8	212
4,6 & 8	168	1,3,5,7 & 8	213
1,4,6 & 8	169	2,3,5,7 & 8	214
2,4,6 & 8	170	1,2,3,5,7 & 8	215
1,2,4,6 & 8	171	4,5,7 & 8	216
3,4,6 & 8	172	1,4,5,7 & 8	217
1,3,4,6 & 8	173	2,4,5,7 & 8	218
2,3,4,6 & 8	174	1,2,4,5,7 & 8	219
1,2,3,4,6 & 8	175	3,4,5,7 & 8	220
5,6 & 8	176	1,3,4,5,7 & 8	221
1,5,6 & 8	177	2,3,4,5,7 & 8	222
2,5,6 & 8	178	1,2,3,4,5,7 & 8	223
1,2,5,6 & 8	179	6,7 & 8	224
3,5,6 & 8	180	1,6,7 & 8	225
1,3,5,6 & 8	181	2,6,7 & 8	226
2,3,5,6 & 8	182	1,2,6,7 & 8	227
1,2,3,5,6 & 8	183	3,6,7 & 8	228
4,5,6 & 8	184	1,3,6,7 & 8	229
1,4,5,6 & 8	185	2,3,6,7 & 8	230
2,4,5,6 & 8	186	1,2,3,6,7 & 8	231

Question (Symptom)

Answer (Remedy or Recommendation)

continued.....

2) Digital display reads



ii) Conductivity reading is higher than maximum range of controller. Check maximum range listed on controller serial number label and if water value, according to a portable test instrument, exceeds this figure, the application exceeds the range of the controller. Contact the factory.

c) Unit is in "TEST" position - Move TEST/NORM switch to normal.

a) Electrode is not connected properly - Check electrode wiring for shorts/opens, especially at terminal strip or splices; check for proper color sequence. If wiring checks out, probe may be defective--refer to "Controller Check-Out Using Test Module" section to isolate problem.

b) Electrode is not sensing a proper water sample - remove electrode from line and place in beaker of "known" conductivity (for 3/4" electrode, be sure not to rest electrode on bottom of beaker). If electrode then reads properly, check sample stream assembly for proper water flow.

c) Set-read switch is in "SET" position and set potentiometer is at minimum--normal occurrence. Establish setpoint to be maintained. Then place SET-READ switch in READ.

Question (Symptom)

continued.....

Answer (Remedy or Recommendation)

3) Digital display on controller does not agree with samples verified with a portable test instrument taken at electrode site

- a) Controller readings are lower than test samples taken - indicates a fouled electrode:
 - i) For 3/4" electrode, remove from line after shut down of flow through the sample stream assembly. Clean conductivity electrode with fine grit sandpaper (400 or finer), or with mild solution of muriatic acid.
 - ii) For 3/8" electrode, clean with wire brush provided, or fill with a mild solution of muriatic acid.
- Note: If cleaning electrode does not resolve problem, refer to "Controller Check-Out Using Test Module" section to isolate problem.
- b) Improper flow of water through electrode creating a stagnant water sample -
 - i) Clean strainers. Check for 5 psi pressure drop across electrode and modify if required.
- c) Controller reads micromhos; portable test instrument reads ppm -
 - i) Use portable tester reading micromhos.
 - ii) Use a conversion factor for comparison purposes. Multiply micromho readings by .75 for approximate ppm reading.
- d) Defective portable instrument. Check with a sample of "known" conductivity solution

Question (Symptom)
continued.....

Answer (Remedy or Recommendation)

- 4) Timer test switch does not activate timer/pump. (Be sure to allow 5 seconds between depressions to allow unit to reset).
- e) Controller has been previously field "calibrated". Obtain a "known" solution in micromhos close to the normal operating point of the system. Clean electrode thoroughly (refer to 3A i and ii above). Place electrode in solution and using appropriate "CAL POT" adjust conductivity reading. Use "HIGH CAL POT" if range selector switch is normally used in the "HIGH" mode. Clockwise increases the value displayed. If unit cannot be calibrated properly, return panel to factory for repairs.
- a) Timer/function switches (WM/T/O/PT) are all in the "off" position - determine proper function. (Refer to "Establishing Chemical Feed Pump Activation" section) and change switches accordingly.
- b) Timer setting switches (1 through 8) are all in "off" position - determine proper timer setting and change switches accordingly.
- c) Timer function switch W/M is "on", T/O and P/T are "off", at least one timer setting switch is "on". It is possible for the W/M to stop with the contacts closed. Let some water flow through W/M, and see if problem goes away. Disconnect water meter wires at terminal strip - if timer test switch works properly, a wiring problem or a defective meter contactor exists, if timer test switch still does not activate unit, panel is defective. Return to factory for repairs.

Question (Symptom)
continued

Answer (Remedy or Recommendation)

- d) "No flow" state exists - normal occurrence - timer test switch will not override "no flow" circuitry - pump should not activate.
 - e) T/O switch is "on", W/M and P/T are "off", valve is not activated - normal occurrence in this mode, pump should activate only when valve is activated. To check function, place "TEST NORMAL" switch in TEST, valve and pump lights should become illuminated and pump should remain "on" for the period selected by the timer setting switches - then "timed-out" state should occur until unit is reset or automatically resets at the start of another bleed cycle - if sequence does not occur as stated - panel is defective.
 - f) P/T switch is in "on" position; W/M and T/O are in the "off" position, panel is defective. Return panel to factory for repairs.
- 5) Erratic digital display
- a) Improper water flow through sample stream assembly. Air bubbles in sample stream -
 - i) Throttle sample line
 - ii) Verify by removing electrode from sample stream assembly and placing it in a beaker of "known" solution - if problem persists, refer to "Controller Check-Out Using Test Module" section to isolate problem.
 - b) Faulty electrode wiring - check wiring and replace if necessary

Question (Symptom)
continued.....

Answer (Remedy or Recommendation)

6) "No flow" is illuminated while main circulating pump is operational

- a) Improper flow switch mounting - refer to Sample Stream Assembly Installation Section and follow manufacturer's recommendations only.
- b) Improper wiring between flow switch and controller - remove flow switch wires from terminal, "no flow" should become disabled, if not, panel is defective.

Note: To verify performance of panel, short flow switch terminals on enclosure, "no flow" should occur and then become disabled when jumper wire used for "shorting" is removed. If panel does not operate in this manner, panel is defective.

If panel operates properly, flow switch may be clogged or plunger may be stuck or installed improperly. Clean flow switch and verify position of spring and plunger. Spring must rest on top of plunger. Plunger pushes spring upward with flow; plunger falls toward the ground on "no flow".

7) No output power at receptacles plus conductivity digital display is dead

- a) Replace fuse at front panel. **CAUTION:** There is a second fuse on the conductivity control power supply. See page 26 "Special Instructions for Setting the Timing in the % Timer Mode".

Recorder Instructions: See page 26, Special Instructions for Setting the Timing in the % Timer Mode:

The HyDAC Model "10" has an integral recorder output which is designed to drive a 0-1 MA, 100 ohm galvanometer such as the one used in the Rustrak Model 288 recorder.

The recorder output is accessible at a dual connector **block** located at the bottom left-hand corner of the electric component board. (Figure IV).

The polarity is SIG (NEGATIVE) and GRD (POSITIVE). **Connect** the recorder accordingly.

NOTE: The recorder output is factory set; however, if it is deemed necessary to change the adjustment, the potentiometer is accessible from the front panel, see Figure III, #14.

BEFORE changing the factory set-point, it is recommended that the controller test module be used to check the recorder output. Disconnect the sensor wires and connect the test module. Set the switches for LOW (x1), READ and NORMAL. The recorder galvanometer must be connected to the Model "10" recorder output and the paper drive motor must be on. Check Model "10" calibration: should be indicating 1000 micromhos. The recorder should be indicating 50% of full scale; if not, turn potentiometer screw clockwise to increase or counter-clockwise to decrease.

Remove test module and re-connect the probe wires.

Field Calibration of the Conductivity Controller:

1) Take a sample of the tower water and measure the conductance with a portable tester which has been calibrated with a known (standard) solution.

2) Compare this reading to the digital display on the controller. The display reads direct conductance (low-range). Multiply by 10 for the high range.

3) If a discrepancy exists, adjust the corresponding (high or low range) potentiometer which is located in the upper left hand corner of the panel.

4) Turn potentiometer screwdriver slot clockwise to increase the reading and counter-clockwise to decrease.

CHECK-OUT GUIDE USING TEST MODULE SUPPLIED

This procedure is recommended when unit fails to display accurate conductivity readings.

1) The Model "10" controller is supplied with a test module. The value of the test module is identified on the tag attached to the module: 1000 micromhos, P/N 013218

2) With power off to the controller, disconnect the electrode (3 wires) from base of controller. Connect proper test module to electrode terminals. Be sure to observe proper color coding of wires when connecting to terminal strip.

3) Disconnect solenoid valve and chemical pump from controller.

4) Re-apply power to the controller.

5) Check calibration of controller:

a) Place all timer function switches (W/M, T/O and P/T) in the off position.

b) Set-read switch in the read position.

c) Test-normal switch in the normal position.

d) Place range switch on x1; Display should read 1000 (900 - 1100). In the x10 position, display should read 100 (90 - 110).

e) If unit does not perform as outlined, contact Beta Technology Incorporated for technical assistance.

f) After check-out is complete, remove test module and reconnect the probe; return all switches to the original positions. Also be sure to reconnect pump and valve.

PARTS LIST

Fuse	032300
Red 60 I.C.....	032207
Red 360 I.C.....	032208
Red 3600 I.C.....	032219

MODEL 10 BIOCIDES CONTROL FUNCTION

SYSTEM DESCRIPTION

The Model "10" is also a control for automatic operation of devices, such as pumps, used for chemical feeding operations and the like. It is a 24-hour clock, plus a 2-week "calendar". The time of day is shown on a numerical display with a colon which is alternately ON and OFF for half a second. The DAYS and WEEKS are shown as individual light bars labeled with the days of the week and WEEK 1 and WEEK 2. During operation, the DAYS advance when the time changes from 23:59 to 00:00. The WEEKS change from 1 to 2, and back again, when the day changes from Saturday to Sunday.

The Model "10" allows either or both pumps to be started on any or all of the fourteen days of the calendar. Lock-out will start simultaneously with either pump. The starting time may be set to anywhere in the twenty-four hours; however, it will be the same every (selected) day. Only one start time is possible. The pump running times may be selected independently for each pump and for the lock-out. However, the running time will be the same whenever operation starts. Either pump time may be set from 0 to 99 minutes, in 1 minute increments. The lock-out time may be set from 00 to 990 minutes, in 10 minute increments. The lock-out timing always starts AFTER the pump stops. Therefore, if the lock-out is desired only while the pump is actually running, the lock-out time should be set to 00.

Three indicators show the status of the operations. They are labeled "PUMP 1", "PUMP 2" and "LOCK-OUT". They are illuminated whenever that function is active. Five (5) receptacles are provided on the bottom of the unit, one for each of the functions. As shipped, the two (2) receptacles marked "PUMP 1" and "PUMP 2" are active (hot) when the respective indicators are illuminated. The receptacle marked "Lock-Out" is inactive (not hot) when its indicator is illuminated. Connections are provided inside the unit so that any of these may be wired opposite; that is, inactive, and vice versa.

Anytime the unit is powered, the clock runs. Should the power be interrupted, the clock stops. It resumes when the power is again applied continuing with the time where it was at the time of interruption.

If the power is interrupted while a PUMP or LOCK-OUT is in operation, that function will, of course, no longer be powered. However, the timing of that function will resume when power is again applied, picking up where it was. (There is a possibility of a small timing error in that event, seldom more than a few seconds for pump timing, and seldom more than 1 minute for lock-out).

INSTALLATION PREPARATION

Survey the water system and locate convenient access point/s for the addition of chemical treatment. If the main circulating pump is turned off frequently, the controller should be programmed to add biocide only when the circulating pump is on. If this is not possible, an inter-lock arrangement should be used to interrupt power to the chemical pump/s when the main circulating pump is off. This could result in inadequate chemical treatment.

EQUIPMENT/PARTS SUPPLIED

Controller, Catalog No. 016120.

ADDITIONAL EQUIPMENT/PARTS NEEDED FOR INSTALLATION

(4) #10 (3/16") diameter screws (wood or masonry type) 120 VAC Pump/s suitable for handling biocide/s.

MECHANICAL & MOUNTING DIMENSIONS

See Figure XI.

INSTALLATION

Refer to Figures XI and XVI.

OPERATIONAL PROCEDURES

PRIMING THE PUMPS

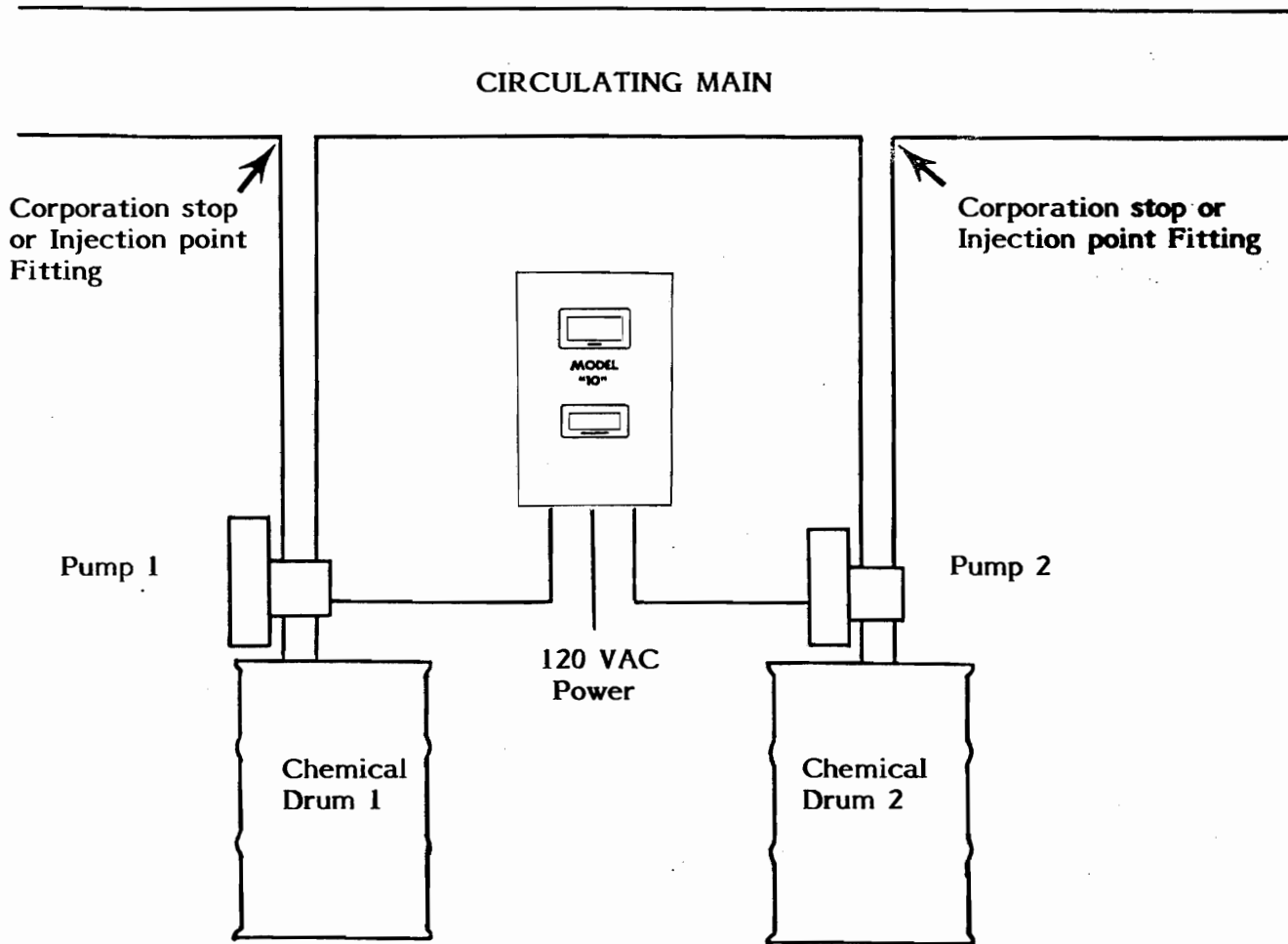
Depress and hold the "Prime" button.

Press the "ENTER" button. If PUMP 1 was OFF, it will start. If it was ON, it will stop.

Press the "INCR" button. If PUMP 2 was running, it will stop. If it was not running, it will start.

If a pump is started in this fashion, it will run only for the length of time set in "DURATION", plus some fraction of 1 minute, depending on when during the current minute priming started. Thus, if the pump time is set to 0, the pump will run for no more than 1 minute and perhaps as little as 1 second.

LOCK-OUT is not affected by the PRIME operation.



Note: Both pump outputs could be combined to use (1) corporation stop; check valves are recommended.

FIGURE VXI

STOPPING LOCK-OUT

If Lock-out is engaged and if it is desired to disengage it, setting the lock-out duration to 00 will cause lock-out to disengage the end of the current minute or if PUMP 1 is ON and you wish to turn OFF lock-out, turn off PUMP 1 by pushing PRIME and enter, then turn on PUMP 2 by pressing PRIME and increment. Then, turn off PUMP 2 by pushing PRIME and increment again. This will also turn off lock-out. Turn on PUMP 1 by pressing PRIME and enter.

The same holds true if only PUMP 2 is on except delete PUMP 1 information as stated above.

If both pumps are ON, the same applies except PUMP 2 is already on.

SET-UP

Setting the Clock.....

Depress and Hold the "CLOCK" button. The display will show HOURS and MINUTES, with the HOURS blinking.

Press and Hold the "INCR" button. The hours will advance at about 2 hours per second. The advance will stop whenever the "INCR" button is released. If the "INCR" button is held until eight steps have passed, the hours will advance at about 10 hours per second. The slow advance will immediately return if the "INCR" button is momentarily released.

Press and Release the "ENTER" button. The display will change to MINUTES blinking.

Press and Hold the "INCR" button. The minutes will advance at about 2 minutes per second. The advance will stop whenever the "INCR" button is released. If the "INCR" button is held until eight steps have passed, the minutes will advance at about 10 minutes per second. The slow advance will immediately return if the "INCR" button is momentarily released.

Press and Release the "ENTER" button. Both the hours and minutes will stop blinking.

Press and Hold the "INCR" button. The days will advance at about 2 days per second. The WEEK display will change from WEEK 1 to WEEK 2 as appropriate. The advance will stop whenever the "INCR" button is released.

Release the "CLOCK" button. The set time and day are now stored for immediate use. This button may be released anytime. Whatever time is showing at that instant will be stored.

SETTING THE START TIME AND DAYS OF PUMPING

Either (or both) pump/s may be selected to start on any or all of the 14 days of the 2 weeks. However, there is only one start time. The pumps will always start at the same time on any selected day.

Depress and Hold the "SET" button. The display will show the hours and minutes of the start time with the hours blinking.

Press and Hold the "INCR" button. The hours will advance at about 2 hours per second. The advance will stop whenever the "INCR" button is released. If the "INCR" button is held until eight steps have passed, the hours will advance at about 10 hours per second. The slow advance will immediately return if the "INCR" button is momentarily released.

Press and Release the "ENTER" button. The display will change to MINUTES blinking.

Press and Hold the "INCR" button. The minutes will advance at about 2 minutes per second. The advance will stop whenever the "INCR" button is released. If the "INCR" button is held until eight steps have passed, the minutes will advance at about 10 minutes per second. The slow advance will immediately return if the "INCR" button is momentarily released.

Press and Release the "ENTER" button. The display will show 1P1, the WEEK 1 display will be lit and the DAY display may have some days lit. If the SUN bar is lit, it will be blinking. This means that PUMP 1 will start at the time set on that day.

Press and Release the "ENTER" button. If SUN was blinking, it will stop blinking and remain dark. This means that PUMP 1 will NOT start on that day. Every time the "ENTER" button is pressed and released, the selection will change, alternating between blinking and dark. Select the desired action. Blinking means PUMP 1 will start. Dark means PUMP 1 will NOT start.

Press and Release the "INCR" button. The display will show 2P1. WEEK 1 will be lit and the DAY display may have some days lit. If the MON bar is lit, it will be blinking. This means that PUMP 1 will start at the time set on that day.

Press and Release the "ENTER" button. If MON was blinking, it will stop blinking and remain dark. This means that PUMP 1 will NOT start on that day. Every time the "ENTER" button is pressed and released, the selection will change, alternating between blinking and dark. Select the desired action. Blinking means PUMP 1 will start. Dark means PUMP 1 will NOT start.

Press and Release the "INCR" button. The display will advance to 3P1 and every time the "INCR" button is pressed, the

STARTING THE START TIME AND DAYS OF PUMPING continued.....

display will advance, until it shows 14P1. This means the Saturday, WEEK 2, for PUMP 1. Of course, when the day advances from SAT to SUN, the week display will change from WEEK 1 to WEEK 2.

After 14P1, the display will show 1P2. This indicates that PUMP 2 is now being set. The same blinking or not blinking of days is shown. Remember, if it shows #P1, that is PUMP 1 and if it shows #P2, that is PUMP 2.

If "INCR" is pressed when the display shows 14P2, it will return to 1P1, and so on.

Release the "SET" button. The selected settings are immediately stored for use.

This button may be released anytime during the setting operations and the selected settings will be stored. It is NOT necessary to step through the entire routine.

SETTING THE PUMP AND LOCK-OUT DURATIONS

Depress and Hold the "DURATION" button. The display will show #P1, where # is the number of minutes PUMP 1 is to run. # may be from 0 to 99.

Press the "INCR" button. The number of minutes shown on the display will increase at about two per second. If the button is held for more than eight steps, the minutes shown will advance rapidly, about ten per second. Momentarily releasing the "INCR" button will return the advance to two per second. Release the button when the desired PUMP 1 minutes are set. After the minutes reach 99, they will return to 0.

Press and Release the "ENTER" button. The display will show #P2, where # is the minutes PUMP 2 is to run.

Using the "INCR" button, the time PUMP 2 is to run is set the same way as PUMP 1 was set.

Press and Release the "ENTER" button. The display will now show #OL, where #0 is the minutes of lock-out time.

Using the "INCR" button, the Lock-out time is set in the same fashion as pump time was set. However, the Lock-out time increments in ten minute steps and returns to 00 when the minutes reach 99.

BIO-MAX II TROUBLE-SHOOTING GUIDE

<u>SYMPTOM</u>	<u>POSSIBLE CAUSE</u>	<u>REMEDY</u>
Time & Day of the Week display does not light	Blown fuse in the controller	Replace P/N 032300 (Buss or equiv.)
	No power to controller	Check main circuit breakers/fuses & wiring
	Defective display	Return for repair or replace control panel, P/N 016273
	Defective controller	Return for repair or replace control panel, P/N 016273
Pump 1 & Pump 2 lights do not come on	Defective panel	Return for repair or replace control panel, P/N 016273
Pump/s do not come on	Defective pump	Check pump in wall receptacle, 120V AC.
	Defective relay	Return for repair or replace control panel, P/N 016273
	Defective module	Return for repair or replace control panel, P/N 016273
	Loose wiring	Check wire lug connectors
Unable to set clock	Defective controller	Return for repair or replace control panel, P/N 016273
Unable to set Day of Week	Defective controller	Return for repair or replace control panel, P/N 016273
Indicated time is different when power is switched back on	None (unit resumes time when power is reactivated)	-----
Controller fails to follow program	Defective controller	Return for repair or replace control panel, P/N 016273

NOTE: Recheck program at least once before judging the controller to be defective.

#013812

"MODEL 10"

POWER INTERRUPTER OPTION INSTRUCTIONS

#013737

- 1) Turn off power to unit.
- 2) Remove white inner panel.
- 3) Connect new power cord assembly through conduit opening at bottom, using adapter and strain relief supplied in kit.
- 4) Remove black jumper that goes from Biocide power board right side (marked from fuse) to on, off switch.
- 5) Install black wire from new power cord to switch where jumper was just removed in Step 4.
- 6) Connect green wire of new power cord to ground stud on panel below conduit opening.
- 7) Remove Faston end of white wire (AC in) from biocide power board that goes across the board to Neutral. Cut off Faston terminal at end of wire.
- 8) Connect short length of white wire supplied to the end of wire cut in Step 7 and to the white wire on the new power cord using 2 wire nuts supplied.
- 9) Use tyrap supplied to retain wire to bundle of wires on right side.
- 10) The original power cord will connect to any 120VAC power source that is normally on in order to maintain the clock in the system.
- 11) The new power cord will be connected to the circulation pump of your system if it is 120VAC, or to the control voltage to your circulating pump if it is 120VAC, or if necessary to a motor starting relay that is controlled by your circulating system. In any event, only 120VAC can be connected to the power cord.

LIMITED TWENTY-FOUR MONTH WARRANTY

Beta Technology Incorporated ("BETA") warrants each new item of HyDAC brand equipment manufactured and sold by BETA to be free from defects in materials and workmanship under normal use and operation in accordance with "BETA" instructions and use directions for a period of twenty-four (24) months from date of delivery to the original purchaser. **Exception:** pH probes are only guaranteed to be operational at the time of delivery. All claims must be submitted in writing within 30 days from the date of shipment from BETA.

BETA's obligation under this warranty are limited to the repair or replacement of any such item of equipment (or part thereof) shown to be defective or, at BETA's option, to refunding the purchase price of any such defective item of equipment less a reasonable allowance for prior use. Each item of equipment for which a warranty claim is asserted shall, at the request of request of BETA, be returned on a prepaid basis to BETA's factory at the expense of the purchaser. Replacement parts furnished by BETA shall be warranted as stated above for the unexpired portion of the original twenty-four (24) month warranty. This does not extend to any item or part subjected to misuse, accident, improper installation, maintenance or application, improper packing by purchaser in return shipment to BETA, or to any item or part repaired or altered outside of BETA's factory without the express prior authorization of BETA.

THE FOREGOING WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EXPRESS OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY OR THE WARRANTY OF FITNESS FOR PARTICULAR PURPOSE. IT IS EXPRESSLY UNDERSTOOD THAT PURCHASER'S SOLE AND EXCLUSIVE REMEDY IS LIMITED TO ENFORCEMENT OF BETA'S OBLIGATION AS SET FORTH ABOVE AND BETA SHALL NOT BE LIABLE TO PURCHASER OR OTHERS FOR LOSS OF USE OF THE EQUIPMENT OR FOR OTHER DIRECT, SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES.