



OPTIMIZING WATER TREATMENT PROCESSES

OPERATIONS MANUAL

Treatment Control System
with DuraTrac™ Remote Sensor

TCS 4000

Revised 7/98

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SAFETY PRECAUTIONS

BEFORE ATTEMPTING TO UNPACK, SET UP, OR OPERATE THIS INSTRUMENT, PLEASE READ THIS ENTIRE MANUAL.

MAKE CERTAIN THE UNIT IS DISCONNECTED FROM THE POWER SOURCE BEFORE ATTEMPTING TO SERVICE OR REMOVE ANY COMPONENT.

FAILURE TO FOLLOW THESE PRECAUTIONS COULD RESULT IN PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT.

WARRANTY INFORMATION

Chemtrac[®] Systems, Inc. warrants its equipment to be free from defects in material and workmanship for a period of one (1) year from date of shipment to the original purchaser. Upon receipt of written notice from purchaser, seller shall repair or replace the equipment (at option of Chemtrac[®] Systems, Inc.).

Chemtrac[®] Systems, Inc. assumes no responsibility for equipment damage or failure caused by:

1. Improper installation, operation, or maintenance of equipment.
2. Abnormal wear and tear on moving parts caused by some processes.
3. Acts of nature (i.e. lightning, etc.)

This warranty represents the exclusive remedy of damage or failure of equipment. In no event shall Chemtrac[®] Systems, Inc. be liable for any special, incidental, or consequential damage such as loss of production or profits.

1.0 GENERAL INFORMATION

1.1 DESCRIPTION OF OPERATION

The primary instrument included with the Treatment Control System is the Streaming Current Monitor (SCM). The SCM includes a sensor placed at the desired sample point, and a signal processor mounted in the control module. The SCM is a charge-measuring device. The charge that it measures is the net ionic and colloidal surface charge (positive and negative) in the sample being tested. Streaming current is related to zeta potential, however, they are not the same value.

The treated water sample flows into the sensor sample cell where it is drawn into the bore during the upstroke of the piston cycle and is expelled from the bore on the piston downstroke. Particles contained in the water are temporarily immobilized on the piston and cylinder surfaces. As the water is moved back and forth by the piston, charges surrounding these particles (+ and -) are moved downstream to the electrodes. This movement of like charges back and forth causes an alternating current to be generated which is defined as “streaming current”. A five-position switch is used to select the best signal amplification. The signal amplification should be set where a normal change in dosage results in a desired deviation in streaming current. The meter indication should be considered a relative reading due to amplification of the primary signal. The streaming current amplitude and polarity is a function of sampling location in the treatment process. It is important to understand why the streaming current varies at different points in the system to properly interpret the readings. Therefore, the following section on sampling should be read very carefully.

1.2 SELECTING PROPER SAMPLE POINT

The sample must be taken at a point where uniform distribution and mixing of coagulant is obtained for all flow rate conditions. If uniform distribution and mixing is not being obtained at a selected sample point, the streaming current reading will oscillate. When

possible, avoid sampling from places where sludge, grit, etc. will be drawn into the SCM sample cell. Sample lines must be sized to provide velocities that will prevent floc/sludge accumulation. Keep sample lines as short as possible to minimize delay in response time.

Figure 1, on page 6, is a typical “STREAMING CURRENT PROFILE” normally observed in a water plant, and should be referred to in reading the following paragraph.

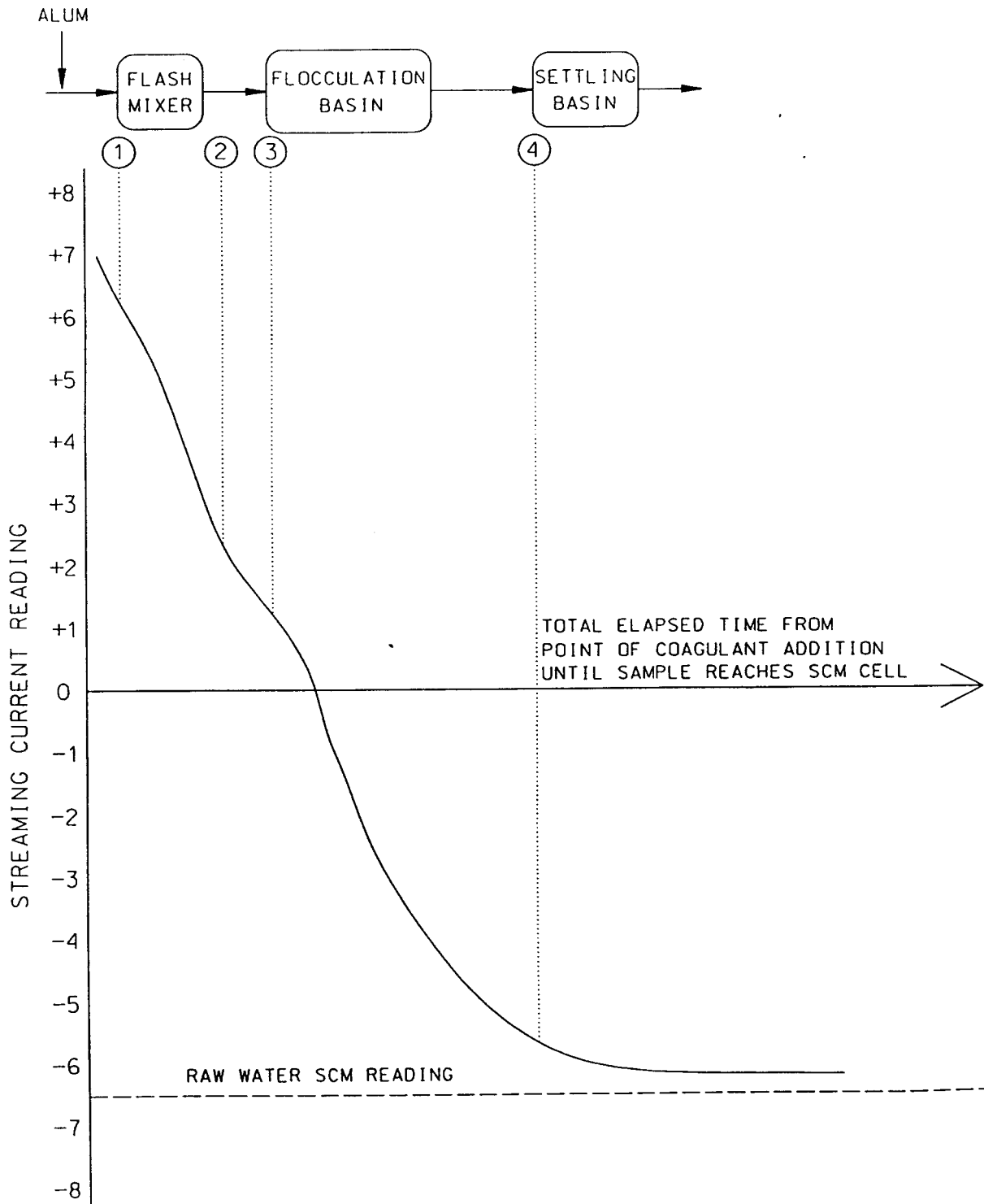
When coagulant is added to raw water, the charge neutralization process begins immediately. The time required for this neutralization process to go to completion is primarily a function of mixing, time, raw water characteristics, type of coagulation, and to a lesser degree, temperature. Untreated raw water has a negative charge. Cationic coagulant charges (alum, polymer, etc.) produce a net positive streaming current early in the system. As shown on the graph, this current becomes less positive as negative charges react with the coagulant. At the settling basin outlet, the streaming current value is nearly the same as raw water. If raw water flow or sample flow is increased, the total time for the sample to travel from point of coagulation injection to the cell is decreased. This may cause a change in SCM reading (in the positive direction). Even though the coagulant dosage (PPM) remains constant. Conversely, if raw water or sample flow rate is decreased, streaming current readings may go more negative. Plants that have widely swinging raw water flows which cause this shifting set point can minimize effect by moving the sample point further downstream, lengthening the sample line, or adding a detention pot. It is important to maintain the sample flow at +/- 10% of the rate initially set.

Based upon the above discussion, the proper sample point or a specific plant depends upon the following conditions:

- A. Point or points of coagulant feed
- B. Mixing efficiency of raw water and coagulant
- C. Magnitude of raw water flow swings
- D. Type and quantity of coagulants used

FIGURE 1

STREAMING CURRENT PROFILE



1.3 PROCESS CONTROL PROCEDURES

In order for the TCS to be used for automatically controlling the coagulant feed (alum, polymer, ferric chloride) the following guidelines must be followed:

1. The coagulant must be thoroughly mixed with the raw water by the time the sample is taken.
2. "Lag time," i.e., the time it takes for the SCM to see a change in coagulant feed, should be no greater than 5 minutes.
3. Variability in sample flow rates should be no greater than +/- 10% of the rate initially set.
4. Coagulant pumps must be kept in good mechanical condition to respond quickly and accurately to process changes.
5. Raw water quality should be in a stable condition (turbidity, pH, color, etc. is not swinging rapidly or widely) when setting up the system.

The SCM should be operated a few days in manual control to observe how it responds to normal process operation. Recording streaming current changes on the strip chart recorder is very helpful in anticipating factors that may have to be dealt with when automatic control is started. This period of using the SCM and recorder for monitoring is also a good time to determine the optimum coagulant dosage and establish the operating "setpoint". This enables the system to be put on automatic control very simply.

1.4 GENERAL SPECIFICATIONS

Remote Sensor

Power	115 VAC, 60 Hz (standard) 230 VAC, 50 Hz (optional)
Sample Flow Rate	5.0 Gal/Min
Sample Cell Type	External Receiver, High Flow
Probe Type	Quick Replacement Cartridge
Water Sample Connections	Inlet-3/4" O.D., Barb Type Outlet – 1" O.D.
Materials Contacting Sample	Delrin, Nylon, Neoprene Viton, PVC, Stainless Steel
Output Wiring	1 ea. Coaxial RG-59/U, 22 AWG 1 ea. Shielded, Twisted Pair, 22 AWG
Enclosure Type	Nema 4X, Polycarbonate
Module Size	7.40"W, 14.14"H, 5.47"D
Weight	10 Pounds
Mounting Holes	7.66" x 7.66"
Operating Temperature	32 degrees F to 120 degrees F

Control Module

Power	115 VAC, 60 Hz (standard) 230 VAC, 50 Hz (optional)
Control Output Signals	4-20mA Isolated (1000 ohm Load) Standard Electronic Pulse - optional
Streaming Current Signals	0-10 VDC, Standard -10/+ VDC, Standard
Self Diagnostics	Standard
Gain Adjustment	External, 5 Pos. Switch (1X, 2X, 5X, 10X, 20X) Internal, Continuous Adjustment for Higher Gain
Zero Adjustment	Full Scale All Ranges
Alarms	High & Low Full Scale All Ranges
Recorder	2 Pen, Standard
Weight Dimensions	Nema 4X Wall Mount, 20lbs 15 1/2" W, 11"H, 11"D Mounting Holes – 15 1/8"W x 10 7/8"H) Nema Benchtop, 31lbs, 19 1/2"H 17"W x 14 1/2"D)

2.0 INSTALLATION

2.1 SENSOR

2.1.1 Location

The sensor can be located several hundred feet from the monitor. Typically, it is mounted as close as possible to the sampling point. Minimizing sample line lengths provides quicker response to process changes. You may use a sample pump. Tap off of a pressurized line, or use gravity feed system to get sample to the sensor. The sample flow rate should not exceed 5.0 gpm. A free, unobstructed drain must be provided. We recommend draining to atmosphere, and not into a closed pipe.

2.1.2 Power Requirements

Insert the cord plug into a properly wired 120-volt grounded receptacle. For safety and proper operation, the SCM must be properly grounded through its power cord. Follow the provisions in the National Electric Code (NEC) and local electrical and safety codes when providing electrical power to this and any other device. In cases where potential noise sources could affect the performance of the equipment, a “surge suppressor” must be installed with the unit.

2.1.3 Signal Transmission Wiring

The sensor output must be transmitted to the monitor through properly selected wire. A multi-conductor cable can be used. Two manufacturers are as follows:

Wire description: Shielded Coax, RG 59-U, Twisted Pair; 22 Gauge AWG

Manufacture Name/Product #: Belden / 9265 or Consolidated / 4590

The cable should be enclosed in conduit for maximum protection against damage or electrical interference. Do not run in same conduit with any other wiring.

Make connections to the sensor terminal block as follows:

- Terminal 1. Center conductor of coaxial cable
- Terminal 2. Coax ground
- Terminal 3. Twisted pair, red wire
- Terminal 4. Twisted pair, black wire

If a different color-coded wire used for the twisted pair, make sure colors are matched with terminals at sensor and at monitor.

2.2 CONTROL MODULE

The hookup diagram is in the back of this manual. The junction box cover must be removed to access terminals for hookup. The strain reliefs on the side of the junction must be loosened to feed through all wiring. The control module input terminals are as follows: (i.e. from sensor)

- Terminal 11. Center conductor of coaxial cable
- Terminal 12. Coax ground
- Terminal 13. Twisted pair, red wire
- Terminal 14. Twisted pair, black wire

Separate output signals are provided at the junction box that indicate the streaming current value, but do not have to be wired for the system to operate.

- Terminal 6. 0-10 VDC
- Terminal 7. -10 to +1- VDC
- Terminal 8. Common ground (for Terminals 6 & 7)
- **Terminal 15. (+) 4-20mA
- **Terminal 16. (-) 4-20mA

****NOTE:** Indicates streaming current only – DO NOT connect to pump. When not in use, a 0 ohm shunt must used between terminals 15 and 16. The maximum load for this current output is 350 ohms.

The Treatment Control System utilizes a Honeywell UDC 3300 controller to provide control outputs to the chemical feed system. The Honeywell product manual is included with the system and explains the wiring for the controller on page 18, Figure 2-6. A shielded twisted pair is used to connect the current output to the feed pump. The lower pen on the recorder is used to record the pump output and is in series with the pump. On the integral systems, the recorder/controller connections are fed back to the junction box, so the outputs to the pump are located on the junction terminal block.

Terminal 5. (+) 4-20mA output

Terminal 9. (-) 4-20mA output

The alarm outputs are located on the junction box terminal block.

Terminal 1 & 2. Alarm relay #1

Terminal 3 & 4. Alarm relay #2

2.3 SYSTEM START-UP

Initial monitor settings:

- a. GAIN Switch 2X
- b. ZERO OFFSET Switch OUT (yellow LED should be off)
- c. ZERO ADJUST Knob Mid-range (5 turns from fully CW)

Water connections:

Connect $\frac{3}{4}$ " tubing to the barbed fitting on side of sample cell. This is the inlet. The 1" PVC elbow opposite the inlet is the outlet. The outlet sample must flow to an open drain (sample receiver). The cell may not operate properly if pressurized. **DO NOT REPLACE EITHER FITTING WITH ANY OTHER TYPE OF FITTING.**

Start treated water sample through the cell at a rate of less than 5.0 gpm. Make sure the outlet is free of obstructions. Continuous reliability of the sample flow is essential. Interruption of the sample flow will result in erroneous signals being sent to the chemical pump when the system is operating in the AUTOMATIC mode. A suitable flow alarm is recommended for maximum reliability. Contact Chemtrac Systems, Inc. for suggestions concerning suitable devices.

IMPORTANT: The controller must be operated in the MANUAL mode if the sensor is flushed or cleaned or if power to the sensor is interrupted for any reason. The system can be placed back in automatic once power and sample flow is restored to the unit.

NOTE: Always disconnect the power cord before opening or servicing this unit. Also, turn off power to the output/alarm block if alarms have been wired for AC volts.

2.4 SENSOR MOUNTING INSTRUCTIONS

1. The sensor must be mounted in a vertical position with the sample flowing into the inlet (barbed fitting) and exiting from the outlet. (1" PVC elbow).
2. **DO NOT REPLACE THE INLET BARBED FITTING WITH ANY OTHER TYPE FITTING.** Use plastic tubing to make interconnections to sample line.

DIAGRAM – MOUNTING OUTLINE & DIMENSIONS

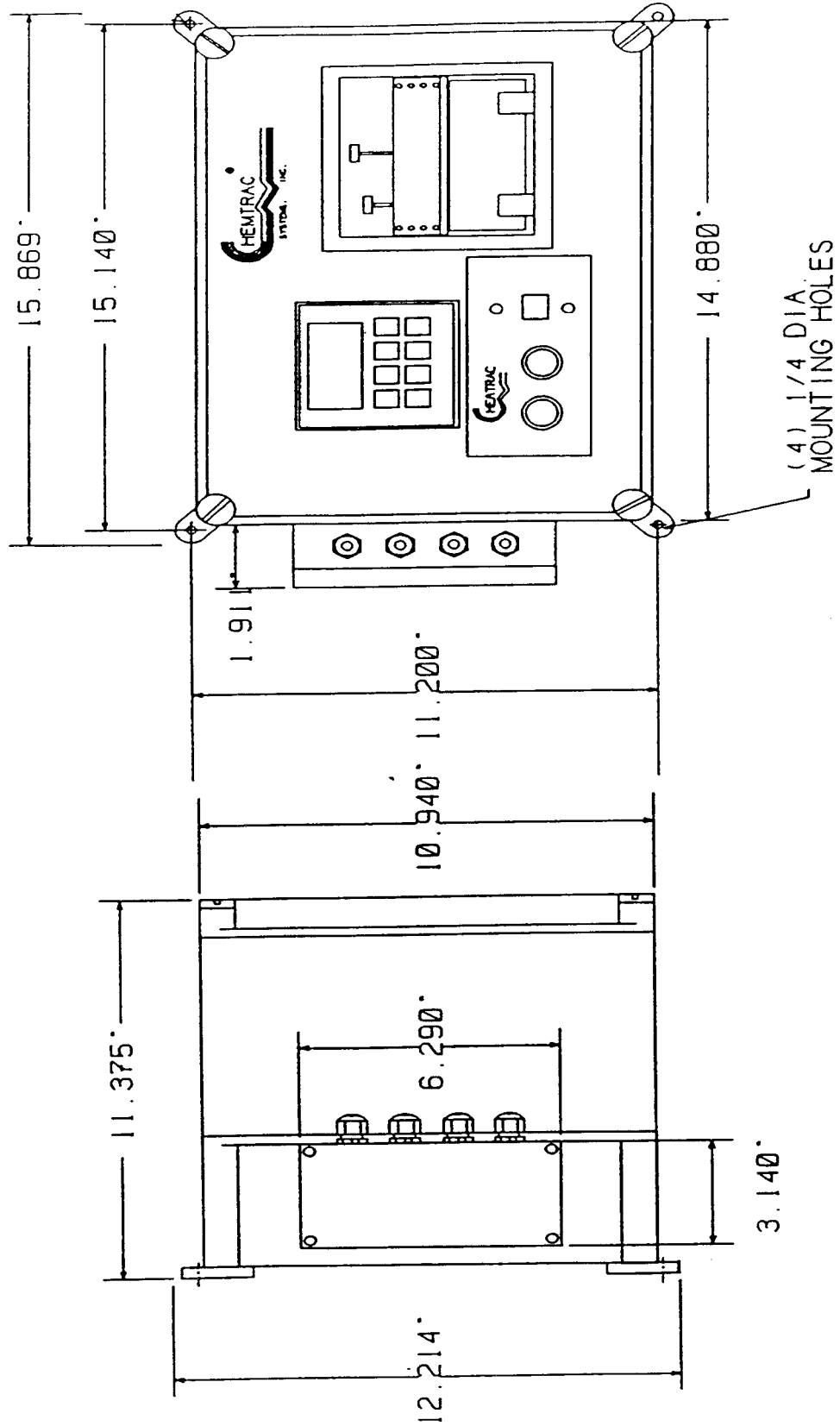


DIAGRAM – MOUNTING DIMENSIONS FOR DURATRAC SENSOR

MOUNTING DIMENSIONS FOR DURA-TRAC SENSOR

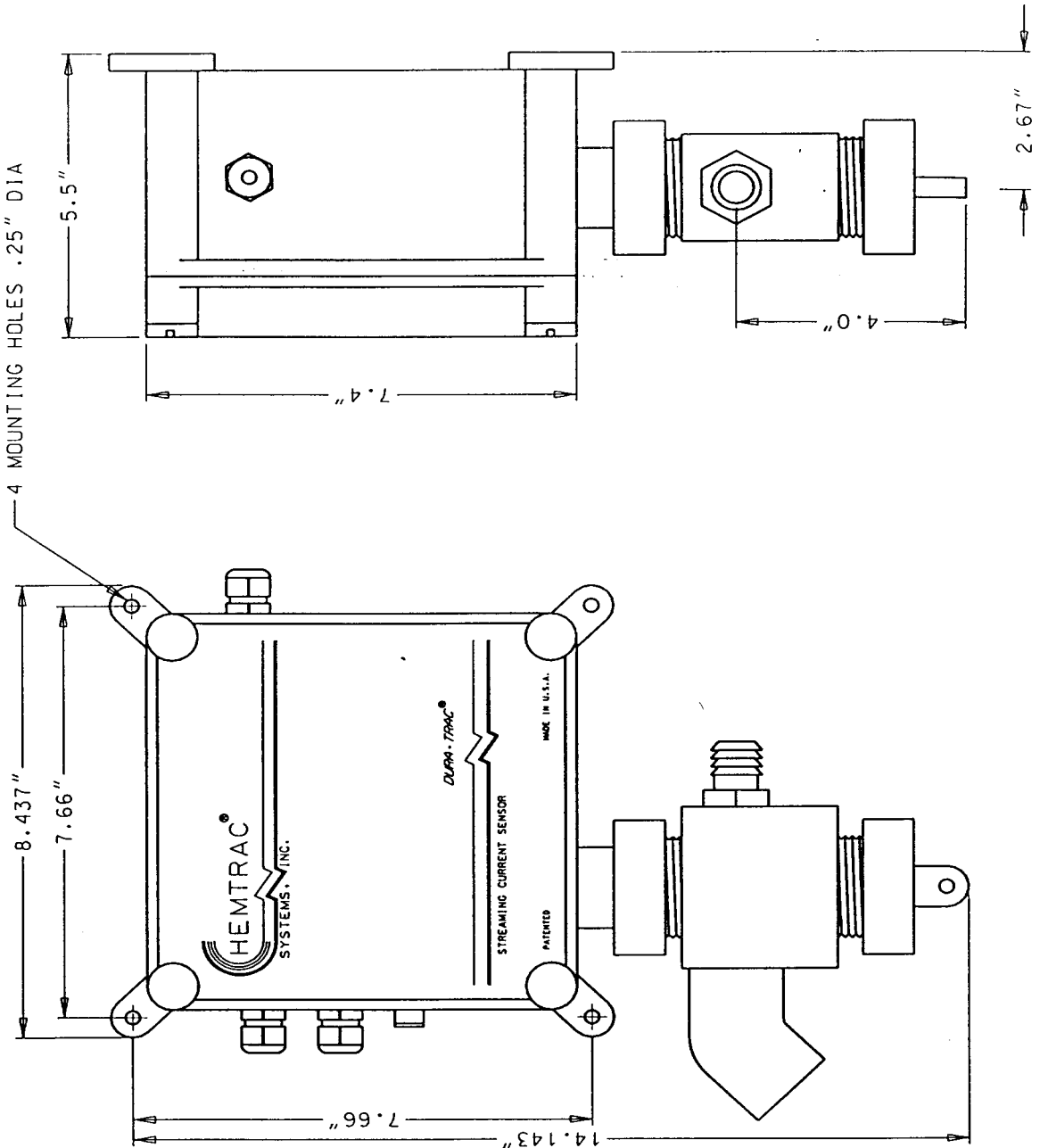


DIAGRAM – DURATRAC MOUNTING

MOUNTING CONFIGURATION FOR SENSOR AND DRAIN ASSEMBLY

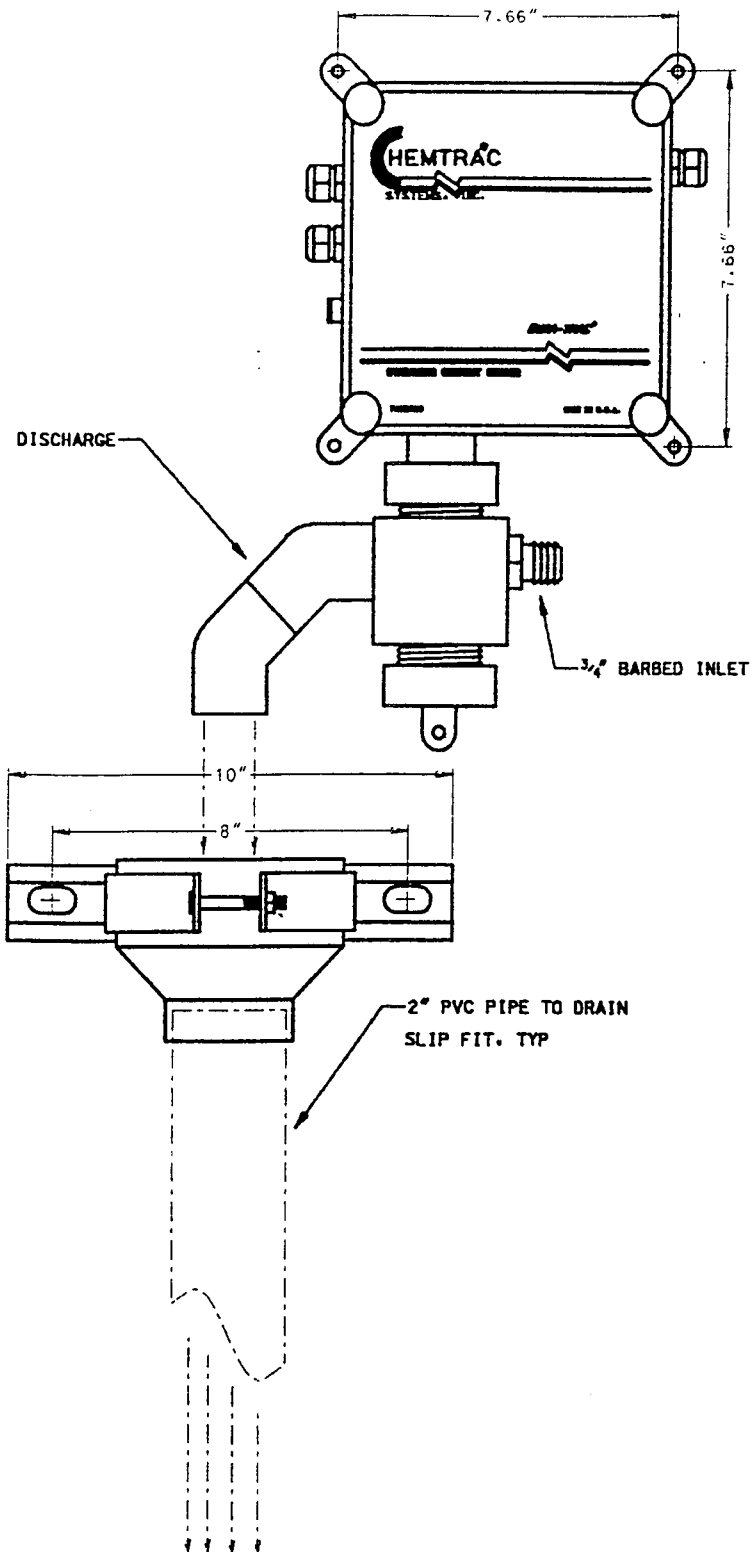


DIAGRAM – DRAIN ASSEMBLY FOR DURATRAC

DRAIN ASSEMBLY FOR DURA-TRAC SENSOR

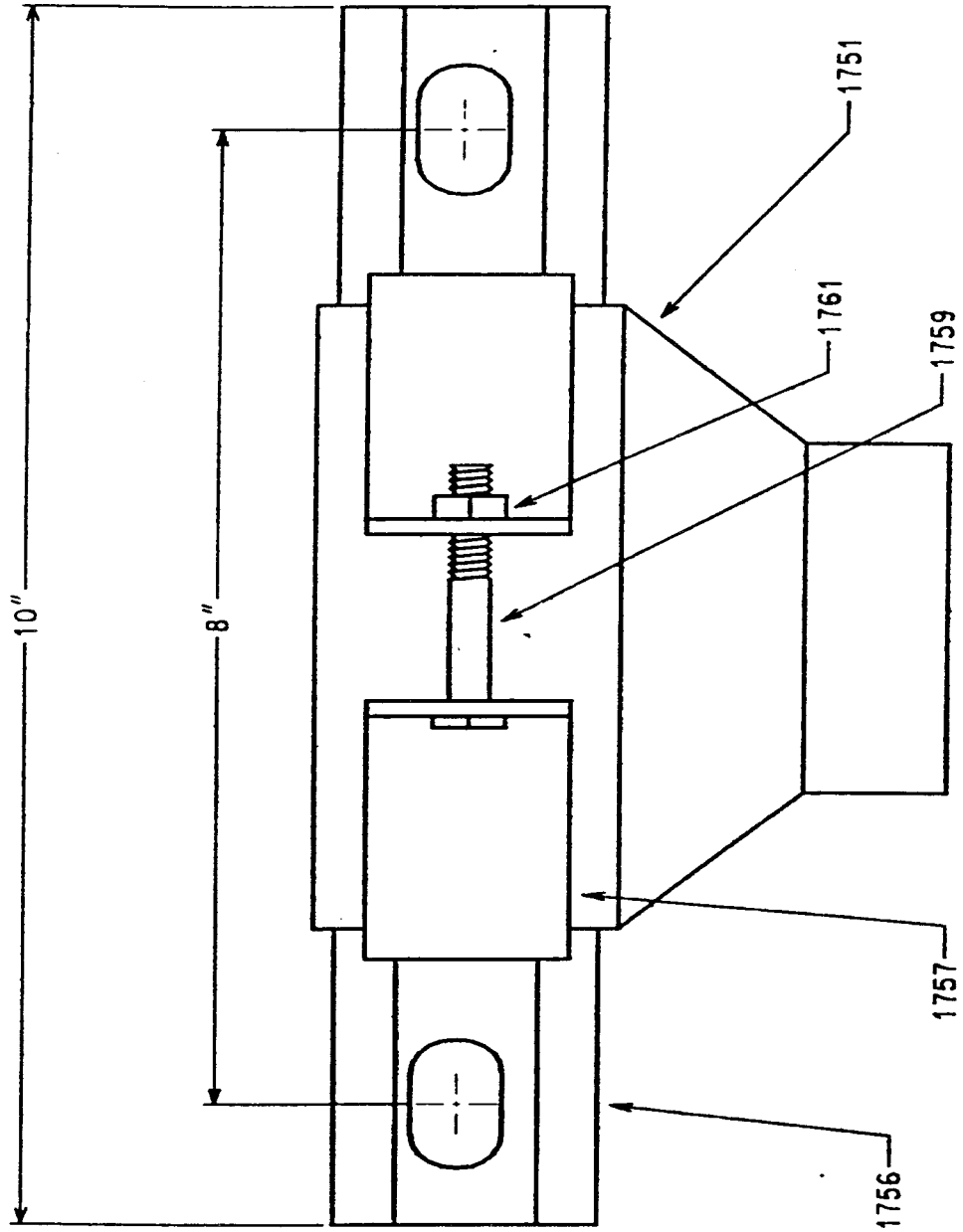
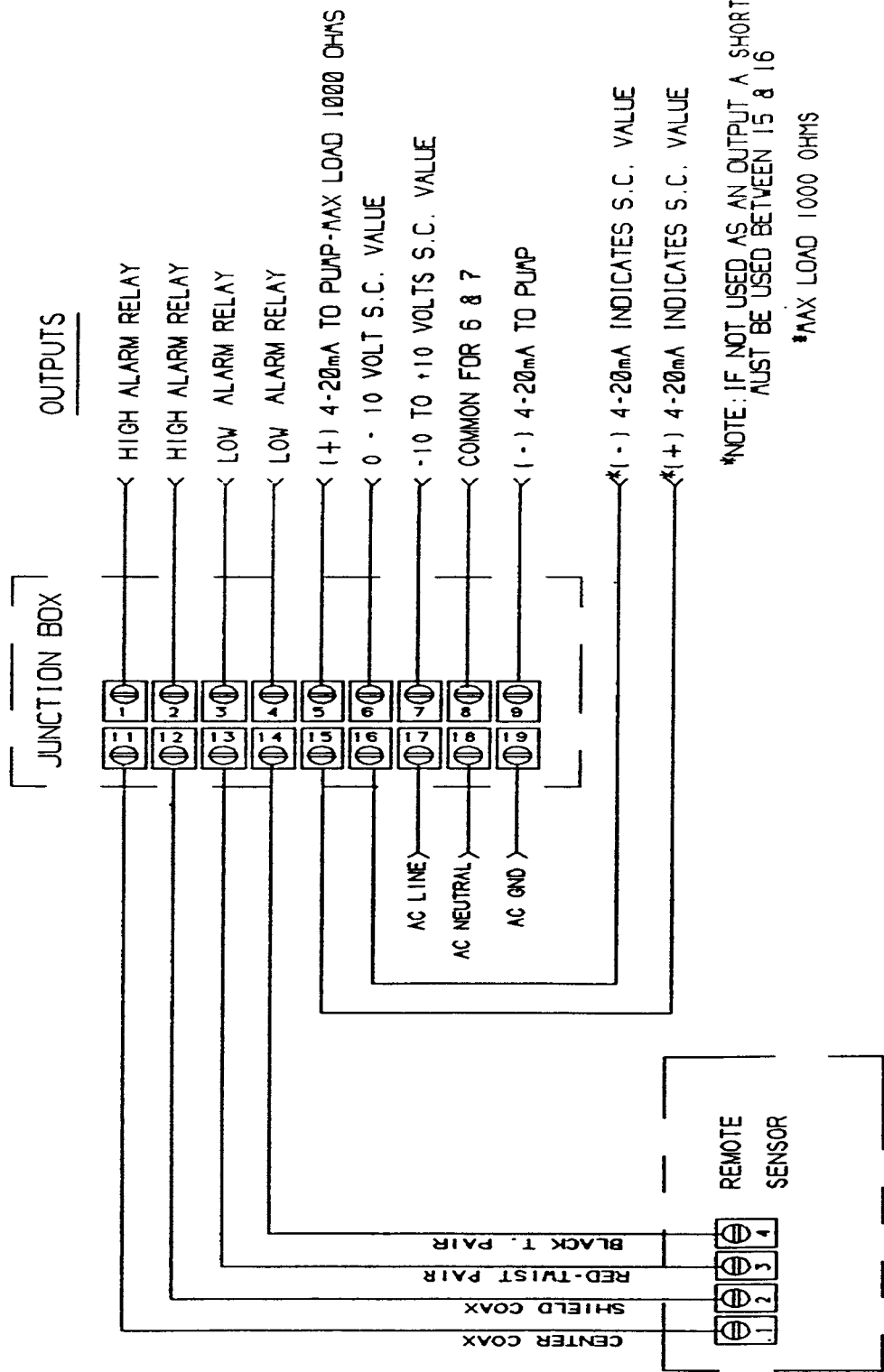


DIAGRAM – EXTERNAL HOOKUP



3.0 OPERATION

3.1 SYSTEM OPERATION

After sample flow is established and power has been applied to the sensor and monitor, allow 10-15 minutes, or longer, for the meter to stabilize. The SENSOR LED should be blinking, indicating proper mechanical/electrical functions. If the LED is not blinking, see Troubleshooting Guide. The second decimal digit may fluctuate, even under stable conditions. If readings fluctuate widely, refer to Troubleshooting Guide. The meter reading may be negative, zero, or positive. The TCS is simply indicating the streaming current value of the sample.

Depress the ZERO OFFSET rockerswitch to the “IN” position. The yellow LED light should come on. Adjust the ZERO adjust knob until the meter reads zero. This function provides the option of using zero as the operating setpoint, once the optimum treatment dosage has been determined (see Treatment Optimization Procedure). LEAVE SWITCH AT “IN” POSITION AFTER ZEROING METER READING.

NOTE: If the GAIN setting is changed with the ZERO OFFSET function “IN”, the meter must be rezeroed for that gain.

3.2 TREATMENT OPTIMIZATION PROCEDURE

The treatment optimization process should be done slowly and stepwise. Assuming that the plant is producing acceptable water with present chemical dosages, trim approximately 10%. You may need to change GAIN setting to increase magnitude of response. If the settled and finished water quality is still acceptable at the reduced dosages, trim another increment. Continue this process, being sure to wait long enough to see the full effect. Rezero meter reading using the ZERO ADJUST knob. If a cationic coagulant is being used, the streaming current value will become more negative with each

reduction in dosage. If prelime or caustic is being used, a decrease in alum will require a decrease in lime feed to maintain proper pH for coagulation. The “optimum setpoint” (zero) is obtained when the minimum coagulant can be fed that produces desired results for the particular treatment process. This setpoint will remain very close to the same reading even when raw water turbidity increases or decreases. Simply adjust the coagulant dosage to maintain this zero reading on the SCM. (If AUTOMATIC control is being used – refer to manual on AUTOMATIC control).

3.3 MANUAL CONTROL USING CONTROLLER

Observe and record chemical pump % at optimum dosage.

Make electrical connections between TCS and pump.

The A/MAN indicator should read MAN. Press MAN/AUTO key (firmly) if it shows A. In either mode, the upper display will indicate the streaming current value. If the ZERO ADJUST function is being used, this reading should be near zero. If there is no input signal, or the wrong signal, the message IN1RNG will flash.

In MAN, the bottom display will show the controller % output value. Press the increase or decrease key to match the chemical pump % recorded above, if it is different.

NOTE: Maintaining continuous pressure on either of these keys will cause the value to change in increments of 0.10. This can be accelerated by holding pressure on one key and pressing the other key once for incremental changes of 1.0, and twice for changes of 10.0.

In AUTO, the bottom display will indicate the selected setpoint, SP. A setpoint of 0.00 has been present at the factory, assuming that the plant wants to use zero as the operating setpoint; this can be easily changed by pressing directional keys as described above.

Pressing the LOWER DISP key will show the DEV, the deviation between the setpoint and streaming current value.

3.4 AUTOMATIC CONTROL

Automatically controlling the treatment process with the Streaming Current Monitor (SCM) and pump controller is a very simple operation once you know how the controller works. Most controller manuals do not explain, in simple terms, the purpose of so-called “tuning constants” termed PROPORTIONAL BAND, RATE, and RESET. Controllers with these three functions are sometimes called ‘3-mode controllers’, or ‘P.I.D. controllers’. In order to explain the purpose of these functions, a brief review of how a simple proportional controller works may be helpful.

Many water treatment plants have “flow controller” coagulant feed, i.e., when raw water flow increases, a signal is sent to the coagulant pump that immediately increases the feed rate. In other words, there is no “lag time” between water flow increasing and coagulant increasing. This system works extremely well in maintaining proper dosage as long as flow is the only thing changing. However, if turbidity is changing, the proper chemical dosage cannot be maintained with a simple proportional controller.

Since the SCM is taking its sample downstream of the coagulant feed point, there will be some “lag time” before it can sense a change in turbidity, alum feed, raw water flow, etc. If for instance, the SCM reading should start going more negative due to an increase in turbidity, it will cause the controller to increase coagulant feed. This will cause the streaming current reading to go more positive, which will cause the pump to decrease coagulant. The result is continuous cycling above and below the setpoint, thus, the need for a controller with “tuning constants” mentioned earlier. The **PROPORTIONAL BAND**, **RESET** and **RATE** functions provide a way to eliminate cycling due to the lag time between coagulant addition and streaming current sensing.

PROPORTIONAL BAND (PROP BD) – Basically, the longer the lag time, the higher PROP BD should be set. If cycling continues when a change occurs in the process, PROP BD is set too low and should be increased.

NOTE: There will normally be a small amount of cycling for a few minutes after a process change, even if PROP BD is set correctly. If PROP BD is set too high, the controllers will be slow in adjusting coagulant dosage when something changes in the process.

RESET (RSET MIN) – The longer the lag time, the higher RSET MIN should be. If cycling continues when a process change occurs, the RSET MIN value is too low and should be increased. If RSET MIN is set too high, the controller will be slow in adjusting coagulant feed after a process change.

RATE (RATE MIN) – the RATE MIN function is used where large, sudden changes occur in the process. Normally, proper settings of PROP BD and RSET MIN will handle most process changes and give good feed control. A RATE MIN should be put into the control setup only after PROP BD and RSET MIN adjustments have been made, and then only if required.

OUTPUT HI/LO LIMITS - This control can be used to limit the % output of the controller, high or low. On a 4-20mA controller with OUTHILIM + 50, the OUTPUT would never be greater than 12 mA, i.e., the chemical pump could not go above 50% output. This function can be used as a safety measure to prevent overfeed or underfeed.

3.5 AUTOMATIC CONTROL SET-UP

The controller can be programmed while it is operating in the MANUAL mode. This allows a smooth transfer from MANUAL to AUTOMATIC. When the controller is in the SET-UP mode, displays can be altered to review and adjust the tuning constants. Control action continues undisturbed, except for the normal consequences of changing a certain parameter.

To adjust tuning constants:

1. Press SET-UP key once. TUNING will replace the numeric value in the bottom display, indicating that the controller is ready for you to proceed. This segment acts as a cursor to identify parameters available for adjustment.
2. To advance through the tuning parameters, press the FUNC key. The display will then jump up to the first parameter, (which is PROP BD for this model of controller). The top display will now show the preset value of the identified parameter. (This parameter has been preset at 100, but may need to be changed for your plant operation.) This value may be incremented through its available range by using the INCREASE and DECREASE keys. If this was the only parameter you wished to change, exit the SET-UP mode by pressing LOWR DISP. To examine or change other parameters, advance the cursor by repeating the SETUP sequence described previously. The primary programmable parameters are PROP BD, RSET MIN, RATE MIN, etc., for this model of controller.

NOTE: Deliberately exiting the SETUP mode or advancing the cursor causes the currently displayed value of a parameter to be loaded in permanent memory, replacing the previous value. IF no keys are operated for approximately 1.5 minutes, the controller will automatically return to the RUN mode, but will revert to the previously stored value of the parameter indexed at that time.

3.6 GENERAL OPERATING GUIDELINES

Follow these three guidelines when establishing correct tuning constants.

1. Change only one (1) control action at a time. Making two or more corrections is confusing and can cause the system to get out of control.
2. Never make a large change in a tuning constant. Make a small change and observe the effect it has on the control action.
3. Allow plenty of time for the process to stabilize before making another change. Making changes in an unstable process can be misleading.

3.6.1 Tuning Constant Specifications

Tuning constants are stored digitally in non-volatile memory and changed by front panel switches.

PROP BD	- Adjustable to either 0.1 to 999.9
RSET MIN	- Adjustable to either 0.00 to 50.00 repeats/minute or minutes/repeats
RATE MIN	- Adjustable to either 0.0 to 10.00 min (rate is off for values of .08 or less).

Parameter shown below have been set by Chemtrac at the following values:

PROP BD	= 100
RSET MIN	= 3.00
RATE MIN	= 0.0

Experience has shown these values to be a good starting point for most water plants. However, significant changes may be necessary to tune the controller to you specific to your specific operation.

3.6.2 Automatic Control Tuning Procedures

1. Depress the MAN/AUTO key to put the controller in automatic. MAN is replaced by A. The Streaming Current (SC) reading should be stable if no process changes are occurring at the time.
2. After each change in a tuning constant (steps 4 & 5 below), a change in the setpoint is necessary to check the operation of the control action. A simply method of doing this is to change the setpoint from .00 to 1.00 After changing the first tuning constant. Watch the SC reading to evaluate if other tuning constant changes are necessary (i.e., oscillation, long settling times indicate further tuning). The use of a recorder allows the observation of overshoots and settling times. To make another change in the tuning constant, change the setpoint from 1.00 back to .00 after making a correction, observe the process again. This procedure should be repeated until tuning is completed.

3. If the SC reading will not stabilize after several minutes (10-20), go back to MANUAL control by depressing MAN/AUTO key and adjust the % pump setting to get a SC reading close to .00. This procedure will allow starting over.
4. Change the setpoint from 0.00 to 1.00 to observe accuracy of preset parameters. Allow 10-20 minutes to evaluate.
 - a. If the SC reading is stable, decrease the PROP BD one (1) increment, change the setpoint, and allow time to evaluate. Repeat until SC reading continuously oscillates slightly, then increase PROP BD slightly.
 - b. If the SC reading is unstable, increase PROP BD.
5. Tune RESET MIN similar to PROP BD.
 - a. If the SC reading is stable, decrease RSET MIN in a small increment, change the setpoint and allow time to evaluate. Repeat until SC reading oscillates. Then slightly increase RSET Min until oscillation cease.
 - b. If the SC reading is unstable, increase RSET MIN in small increments until oscillation cease. Wait for the SC reading to settle down after each adjustment.

4.0 TROUBLESHOOTING GUIDE

PROBLEMS	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
<p>1. Controller reading fluctuates rapidly and widely on treated sample.</p>	<p>A. Incomplete dispersion or mixing of coagulant(s) in raw water at point of sampling.</p> <p>B. Chemical feeders erratic.</p> <p>C. Raw water flow-turbidity fluctuating.</p> <p>D. SCM GAIN setting too sensitive.</p> <p>E. Cell bottom plug loose or O-ring missing.</p>	<p>A. Check stability of readings on raw or finished water. If stable, incomplete mixing is the problem. Move sampling point further downstream, or resolve mixing problems.</p> <p>B. Fix feeders.</p> <p>C. Check R/W flow controls/charts, and turbidity.</p> <p>D. Decrease GAIN setting.</p> <p>E. Tighten plug. Check O-ring (see Cleaning Procedures).</p>
<p>2. Controller reading does not change with change in coagulant dosage.</p>	<p>A. SCM GAIN setting too low.</p> <p>B. Wrong sample.</p> <p>C. Sample cell dirty.</p> <p>D. Excessive “lag time” between coagulant injection point and SCM sample cell.</p>	<p>A. Increase GAIN setting.</p> <p>B. Select correct sample (coagulated).</p> <p>C. Clean cell (see Cleaning Procedures).</p> <p>D. Move sampling point closer to coagulant feed point and/or decrease sample TRANSPORT time (see Selecting Proper Sample Point).</p>
<p>3. Controller displays 0.00, or closely thereto, and does not change with change in coagulant dosage.</p>	<p>A. No water sample to sensor.</p> <p>B. Optoswitch misaligned.</p> <p>C. Optoswitch inoperative.</p> <p>D. Sensor output connections incorrect.</p> <p>E. Panel meter bad.</p> <p>F. Circuit card component faulty.</p>	<p>A. Establish proper sample flow.</p> <p>B. Adjust optoswitch position for maximum meter reading on water sample and tighten securely in place.</p> <p>C. Replace optoswitch.</p> <p>D. Check wiring.</p> <p>E. Check SCM outputs. If present, panel meter is bad. Replacemeter.</p> <p>F. Replace circuit card.</p>
<p>4. SENSOR LED on monitor is not blinking.</p>	<p>The SENSOR light is provided to alert the operator to any mechanical problem at the sensor, or in associated wiring. If there is a problem, the LED will be on or off, but not blinking. Operator should immediately check to see that sensor has 110 VAC power, motor is running, and all output wiring is correct.</p>	

DIAGRAM – INTERNAL WIRING

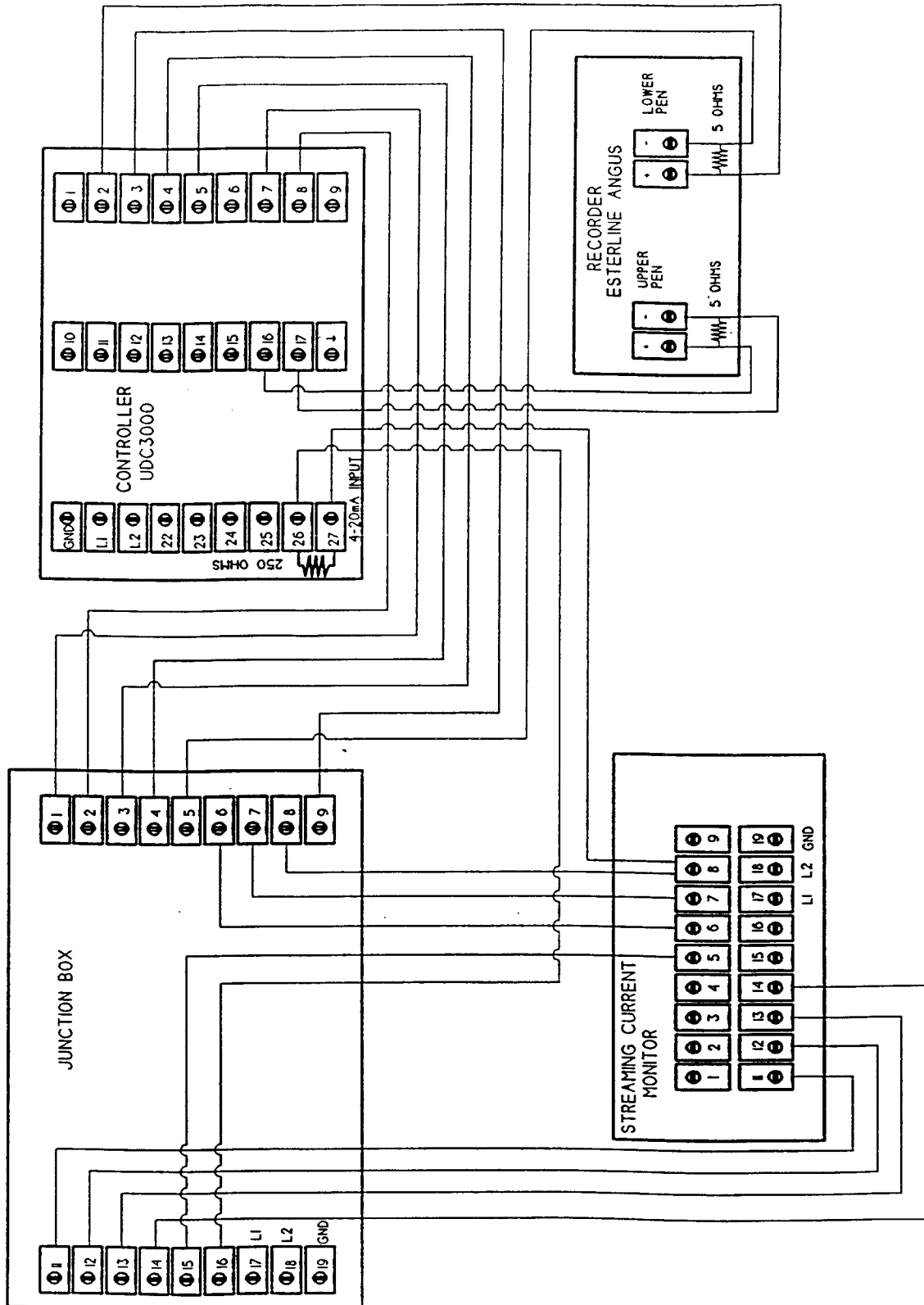
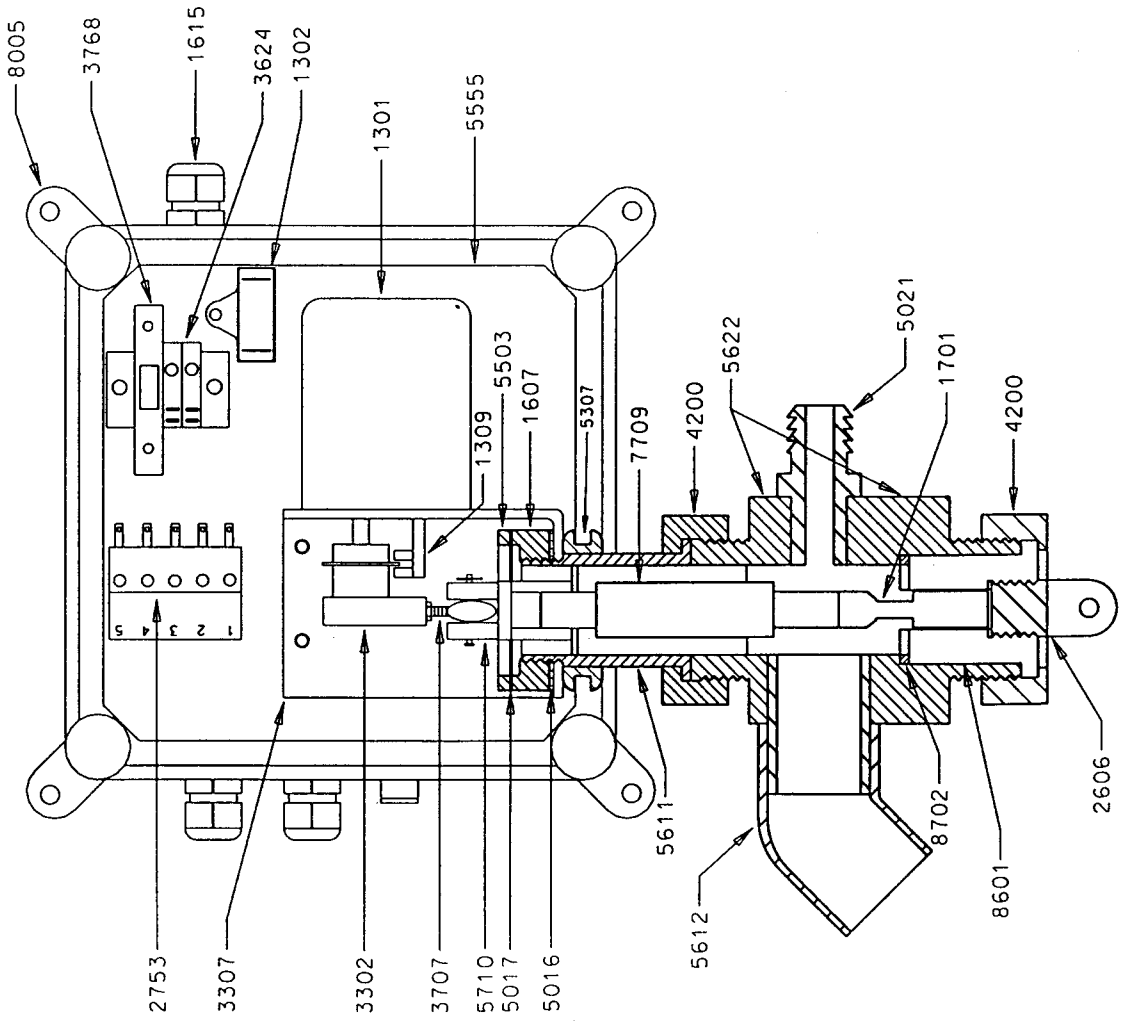


DIAGRAM – DURATRAC SENSOR PARTS ID

DURA-TRAC SENSOR PARTS IDENTIFICATION LIST

PN	QTY	DESCRIPTION
1301	1	110 VAC DRIVE MOTOR
1302	1	1.0 UF CAPACITOR
1309	1	OPTO SWITCH ASSEMBLY
1605	1	O-RING
1607	1	DELIN MOUNTING NUT
1615	3	STRAIN RELIEF
1701	1	DELIN PISTON
2606	1	DURA PLUG
2753	1	OUTPUT TERMINAL BLOCK
3302	1	110 BEARING AND CRANK
3307	1	MOTOR PROBE BRACKET
3624	2	AC TERMINAL BLOCK
3707	1	ROD END
3768	1	1 AMP GMA FUSE HOLDER
4200	2	DURA NUT
5016	1	NEOPRENE WASHER
5017	1	VITON DIAPHRAGM
5021	1	3/4" BARBED INLET
5307	1	LARGE GROMMET
5503	1	DRILLED NYLON WASHER
5555	1	MOUNTING PLATE
5611	1	DELIN EXTENSION
5612	1	1" PVC, 45° OUTLET
5622	1	PROBE BLOCK
5626	1	FEMALE QUICK-CONNECT
5710	1	DELIN YOKE
7709	1	DELIN DURA GUIDE
8005	4	MOUNTING FEET
8601	1	PROBE CARTRIDGE
8702	1	PROBE WASHER



5.0 PROBE REPLACEMENT AND CLEANING PROCEDURES

The Dura-Trac sensor is supplied with two (2) probes and pistons so freshly cleaned parts can always be on hand.

5.1 REPLACEMENT PROCEDURE:

NOTE: If SCM is being used for automatic dosage control, put the chemical feed pump controller into MANUAL mode before starting procedure.

1. Disconnect the lead wire from the enclosure and remove the lower retaining slip nut from the probe.
2. Remove probe by pulling on the tab. You may need to twist slightly.
3. Remove the piston using a 1/4" flatblade screwdriver.
4. Clean any debris from cell housing.
5. Screw clean piston into place. Do not overtighten. Only slight torque is necessary.
6. Insert clean probe into cell housing.
7. Slip retaining nut over probe lead wire and tighten onto probe. Finger tight is adequate. BE CAREFUL TO AVOID CROSSTHREADING NUT.
8. Connect lead wire to enclosure.
9. It may take several minutes for SCM readings to stabilize with a new probe. Sensitivity to process changes may also be greater. After readings stabilize, adjust to zero reading. With zero offset switch in the IN position, turn zero adjust knob to read 0.00 on display. The outer ring must be depressed to turn knob.

5.2 CLEANING PROCEDURE

NOTE: Depending on the type of contamination, different cleaning procedures are recommended.

TYPE of CONTAMINATION	CLEANING PROCEDURE
Mineral scale from alum/lime addition	Comet or other Abrasive Cleaner
Deposits caused by raw water iron/manganese, or where ferric salts or potassium permanganate is used for treatment.	ROVER (available from Hach Chemical) 1 spoonful per pint tap water
Organics from raw water or where polymers are used.	Comet or other Abrasive Cleaner
Oil/Grease	Comet or other Abrasive Cleaner

A “soak and brush” method is recommended for any contaminant. Soak only long enough to dissolve/remove the material. Wash surfaces thoroughly with clean water to remove any residual cleaning compound.

NOTE: DO NOT SOAK ENTIRE PROBE CARTRIDGE. ONLY SOAK INSIDE THE BORE.

6.0 SPECIFICATION SHEET

CONFIGURATION RECORD SHEET AUX OUT - UDC 3000

**Keep a record Enter the value or selection for each prompt on this sheet
so you will have a record of how your controller was configured.**

Group Prompt	Function Prompt	Value or Selection	Factory Setting	Group Prompt	Function Prompt	Value or Selection	Factory Setting
TIMER	TIMER	_____	DISABL	CONTROL	PID SETS	1 ONLY	1 ONLY
	PERIOD	_____	0.01		SW VALUE	_____	0.00
	START	_____	KEY		SP SOURC	1 LOCAL	1 LOCAL
	L DISP	_____	TIREM		RSP SRC	_____	NONE
TUNING	PROP BID	100.0	1.0	RATIO	_____	1.0	
	OR	_____		BIAS	_____	0	
	GAIN	_____	1.0	SP TRACK	_____	NONE	
	RATE MIN	0.00	0.00	POWERUP	MANUAL	MANUAL	
	RSET MIN	3.00	1.0	PWROUT	_____	LAST	
	OR	_____		SP HILIM	10.00	1000	
	RSET RPM	_____	1.0	SP LOLIM	-10.00	0	
	OR	_____		ACTION	REVERSE	REVERSE	
	MAN RSET	_____	0.0	OUT RATE	DISABL	DISABL	
	PROP BD2	_____	1.0	PCT/M UP	_____	0	
	OR	_____		PCT/M DN	_____	0	
	GAIN 2	_____	1.0	OUT HILIM	100.0	100.0	
	RATE2MIN	_____	0.00	OUT LOLIM	0.0	0	
	RSET2MIN	_____	1.0	DROPOFF	0	0.0	
	OR	_____		DEADBAND	_____	2.0	
	RSET2RPM	_____	1.0	OUT HYST	_____	0.5	
	CYCSEC	_____	20.0	FAILSAFE	50.00	0.0	
	CYC2SEC	_____	20.0	MAN OUT	50.00	0.0	
	SECURITY	0	0.0	AUTO OUT	50.00	0.0	
	LOCKOUT	CALIB	CALIB	PBorGAIN	PB PCT	GAIN	
AUTOMAN	_____	ENABLE	MINorRPM	MIN	MIN		
SP SEL	_____	ENABLE	OPTIONS	AUX OUT	IN 1	DISABL	
RUN HOLD	_____	ENABLE	4mA VAL	-10.00	0		
SP RAMP	SP RAMP	DISABLE	DISABL	20mA VAL	10.00	0	
	TIME MIN	_____	3.0	DIG IN 1	_____	NONE	
	FINAL SP	_____		DIG 1 COM	_____	DISABL	
	SP RATE	_____	DISABL	DIG IN 2	_____	NONE	
	EU/HR UP	_____		DIG2 COM	_____	DISABL	
	EU/HR DN	_____		Com	ComSTATE	_____	DISABL
ADAPTIVE	ADAPTIVE	DISALBE	DISABL	ComADDR	_____	0	
	SP CHANG	_____	10	SHEDTIME	_____	0	
	KPG	_____	1.0	PARITY	_____	ODD	
	CRITERIA	_____	NORMAL	BAUD	_____	300	
ALGORITHM	CONT ALG	PIDA	PID A	DUPLEX	_____		
	INPUT 2	_____	DISABL	TX DELAY	_____	1	
	OUT ALG	CURRENT		LOOPBACK	_____	DISABL	
	4-20RNG	_____	50PCT	SHEDMODE	_____	LAST	
INPUT 1	RLY TYPE	_____	MECHAN	SHED SP	_____	TO LSP	
	TIME	_____	DISABL	UNITS	_____	PERCNT	
	DECIMAL	XX.XX	XXXX	ALARMS	A1S1 VAL	5.00	90
	UNITS	NONE	NONE	A1S2 VAL	99.9	10	
	IN 1 TYPE	4-20mA	0-10mV	A2S1 VAL	-5.00	95	
	XMITTER	LINEAR	LINEAR	A2S2 VAL	0.1	5	
	IN 1 HI	10.00	1000	A1S1TYPE	PV	NONE	
	IN 1 LO	-10.00	0	A1S2TYPE	OUTPUT	NONE	
	BIAS IN1	0.00	0	A2S1TYPE	PV	NONE	
	FILTER 1	0	1	A2S2TYPE	OUTPUT	NONE	
BURNOUT	NONE	NONE	A1S1 HL	HI	HI		
EMISSIV	_____	0.0	A1S1 EV	_____			
PWR FREQ	60 HZ	60HZ	A1S2 HL	HI	LO		
LANGUAGE	_____	ENGLIS	A1S2 EV	_____			
INPUT 2	XMITTER 2	_____	LINEAR	A2S1 HL	LO	HI	
	IN 2 HI	_____	1000	A2S1 EV	_____		
	IN 2 LO	_____	0	A2S2 HL	LO	LO	
	FILTER 2	_____	1	A2S2 EV	_____		
				AL HYST	0.0	0.1	