CHEMTRAC® SYSTEMS, INC.

OPTIMIZING WATER TREATMENT PROCESSES

OPERATIONS MANUAL

Streaming Current Monitor
With DuraTrac™ Remote Sensor

SCM 2000 XRW

Revised 12/2000

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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 Streaming Current Monitor (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 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 down-stroke. 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 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 as 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 systems 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, and other contaminants, will be drawn into the SCM sample cell. Sample lines must be sized to provide velocities that will prevent floc/sludge accumulation. Sample lines should be kept as short as possible to minimize delay in response time.

Figure 1, Page 6, is a STREAMING CURRENT PROFILE normally observed in a typical water plant. Refer to this figure while 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 coagulant, and to a lesser degree, temperature. Untreated raw water has a net 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 rate 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 a shifting set-point caused by wide swings in raw water flows can minimize this 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 on the on discussion, the proper sample point for a specific plant depends upon the following condition:

1. Point or points of coagulant feed.
2. Mixing efficiency of raw water and coagulant.
3. Magnitude of raw water flow swings.
4. Type and quantity of coagulants used.

FIGURE 1

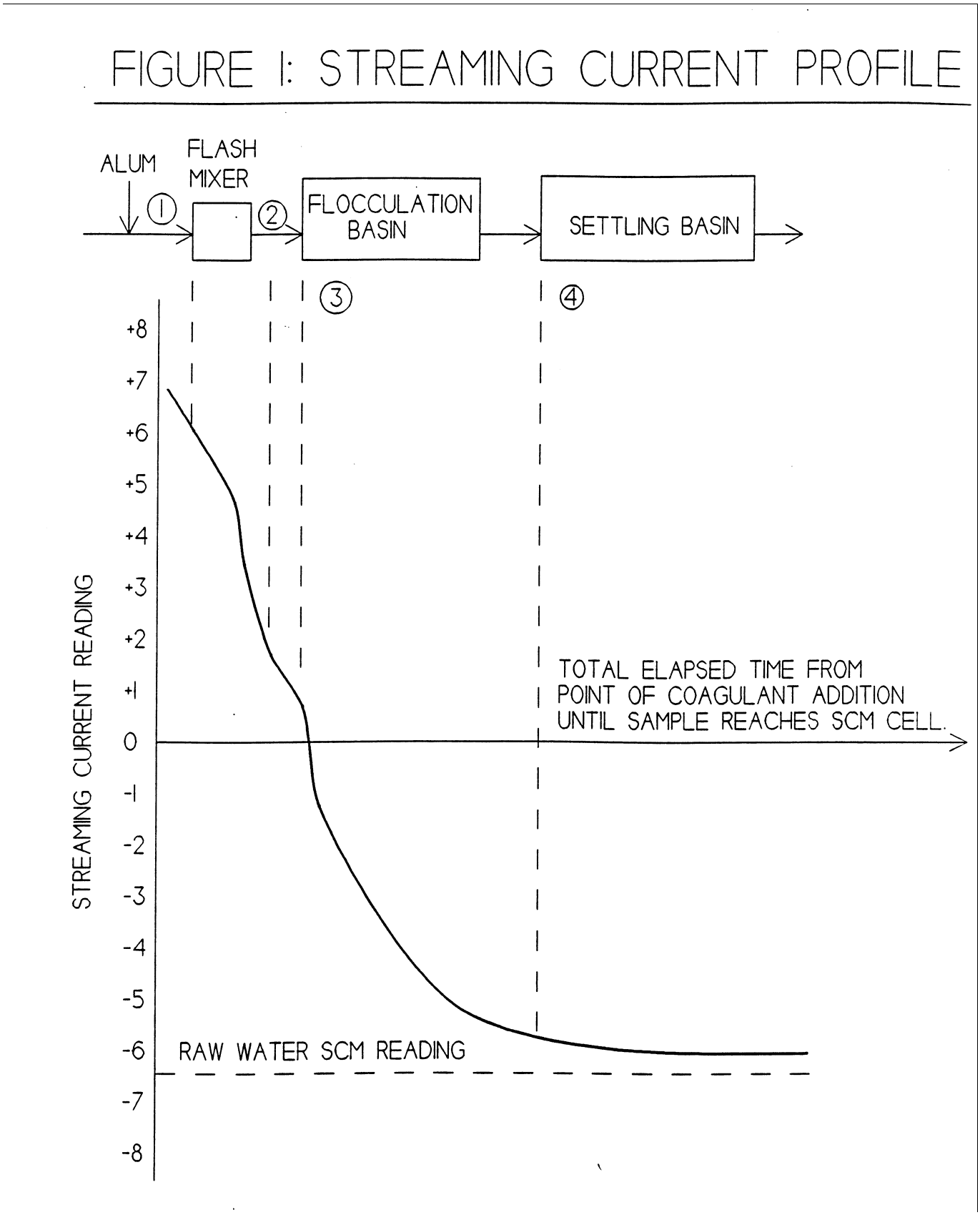


FIGURE 1: STREAMING CURRENT PROFILE
ALUM
FLASH MIXER
FLOCCULATION BASIN
SETTLING BASIN
1
2
3
4
+8
+7
+6
+5
+4
+3
+2
+1
0
-1
-2
-3
-4
-5
-6
-7
-8
STREAMING CURRENT READING
TOTAL ELAPSED TIME FROM POINT OF COAGULANT ADDITION UNTIL SAMPLE REACHES SCM CELL.
RAW WATER SCM READING

1.3 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

Monitor

Power ……..	115 VAC, 60 Hz (standard)
	230 VAC, 50 Hz (optional)
Meter Readout ……..	Digital LED (-10 to +10)
Output Signals ……..	4-20mA (600 ohm Load) Standard
	0-10 VDC, Standard
	-10/+ VDC, Standard
Self Diagnostics ……..	Sensor Operation LED
High & Low Alarms ……..	5A, 110/250 VAC, SPDT Relays
Gain Adjustment ……..	External, 5 Pos. Switch (1X, 2X, 5X, 10X, 20X)
	Internal, Continuous Adjustment for Higher Gain
Alarm Adjustments ……..	Full Scale All Ranges
Zero Adjustment ……..	Panel Mount – NEMA 1, ABS
	Wall Mount – NEMA 4X, Polycarbonate
Dimensions ……..	Wall Mount – 8 ½" W, 11"H, 5 ½"D
	Panel Mount – 7 ½" W, 5 ½"H, 6 ½"D (optional)
	(Mounting Holes for Wall Mount – 7.66"W x11.20"H)
	(Cutout Dimensions for Panel Mount – 7.30"W x 5.44"H)

2.0 INSTALLATION

2.1 SENSOR

2.1.1 Location

The sensor can be located several hundred feet from the monitor. Typically, the sensor 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 a pressurized line, or use a 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. To ensure desired results, the drain should be connected to the atmosphere and not into a closed pipe.

2.1.2 Power Requirements

Insert the power cord plug into a properly wired 120 volt grounded recepticle. 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 suppresser" must be installed with the unit.

2.1.3 Signal Transmission Wiring

The sensor output must be sent to the transmitter through properly selected wire. A multiconductor cable can be used. Two manufacturers of each are as follows:

Wire description: Shielded Coax, RG 59-U, Twisted Pair; 22 Gauge AWG
Manufacture Name/Product #: Belden / 9265 or Carrol / C8025

The cable should be enclosed in the 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 is used for the twisted pair, make sure colors are matched with terminals at the sensor and at the monitor.

2.2 MONITOR – WALL OR PANEL MOUNT

(See Drawings, Pages 11-13)

Both types of monitors have the same sensor input signal connections. Connect wires from sensor output terminal to the monitor input terminals as follows:

Terminal 11: Coax center conductor
Terminal 12: Coax ground
Terminal 13: Twisted pair, red wire
Terminal 14: Twisted pair, black wire

The unit is now ready to operate. It is not necessary for any of the monitor outputs to be connected for the system to function. If any of the signals are to be used to operate the recorder, controllers or activate alarms, make connections to the monitor output terminal block as follows:

Terminal 1 & 2: High alarm
Terminal 3 & 4: Lo alarm
Terminal 5 : 4-20mA
Terminal 6 : 0-10 VDC
Terminal 7 : +/- 10 VDC
Terminal 8 : Common ground (for Terminals 5, 6, & 7)

2.3 ALARM CONNECTIONS

The alarm connections provide separate, isolated relay closures for HI and LO.

It is recommended that the alarms be connected with low voltage electrical power. Low voltage is safer and does not cause significant damage to the equipment during fault conditions. An isolated power source utilizing an isolated transformer(s) and/or ground fault circuit interrupter can reduce the electrical hazard. Alarm power must be properly fused. Relays damaged by over-current are not covered by warranty.

2.4 SYSTEM START-UP

2.4.1 Initial Monitor Settings

A.	Power Switch	OFF
B.	Gain Switch	5X
C.	ZERO Offset Switch	Out (Yellow LED should be off)
D.	ZERO Adjust Knob	Mid-range (5 turns from fully CW)
E.	Alarm/Streaming Current Switch	Streaming current
F.	Hi-Alarm	Fully CW
G.	Lo-Alarm	Fully CW

2.4.2 Water Connections

Connect ¾" 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.

NOTE: DO NOT REPLACE EITHER FITTING WITH ANY OTHER TYPE FITTING. Start the treated water sample through the cell at a rate of less than 5.0gpm. Make sure the outlet is free of obstructions.

2.5 SENSOR MOUNTING INSTRUCTIONS

A. 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).

B. DO NOT REPLACE THE INLET BARBED FITTING WITH ANY OTHER TYPE OF FITTING. Use plastic tubing to make interconnections to sample line.

DIAGRAM – DURATRAC MOUNTING DIMENSIONS

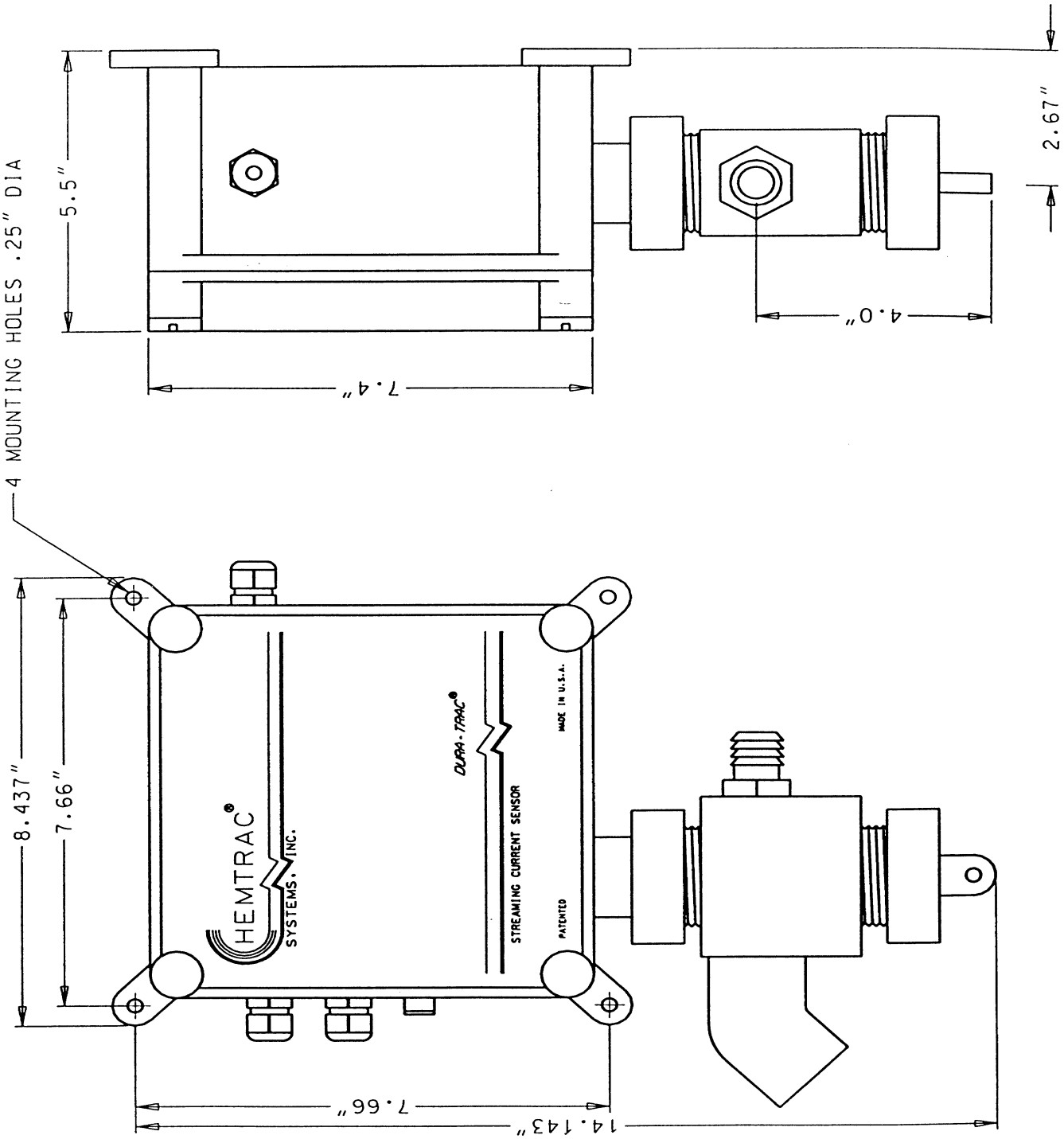


DIAGRAM – WALL MOUNT EXTERNAL WIRING

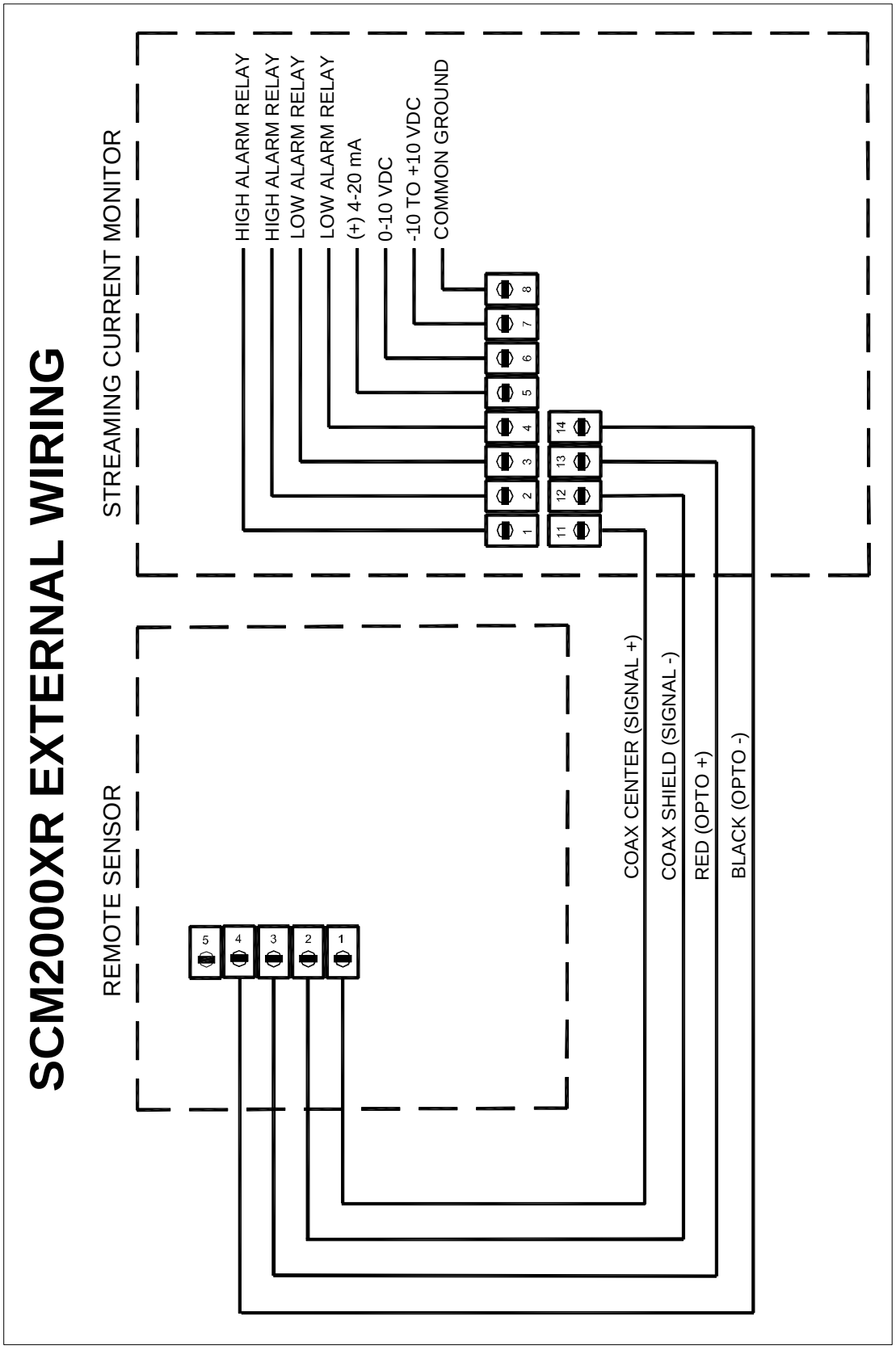
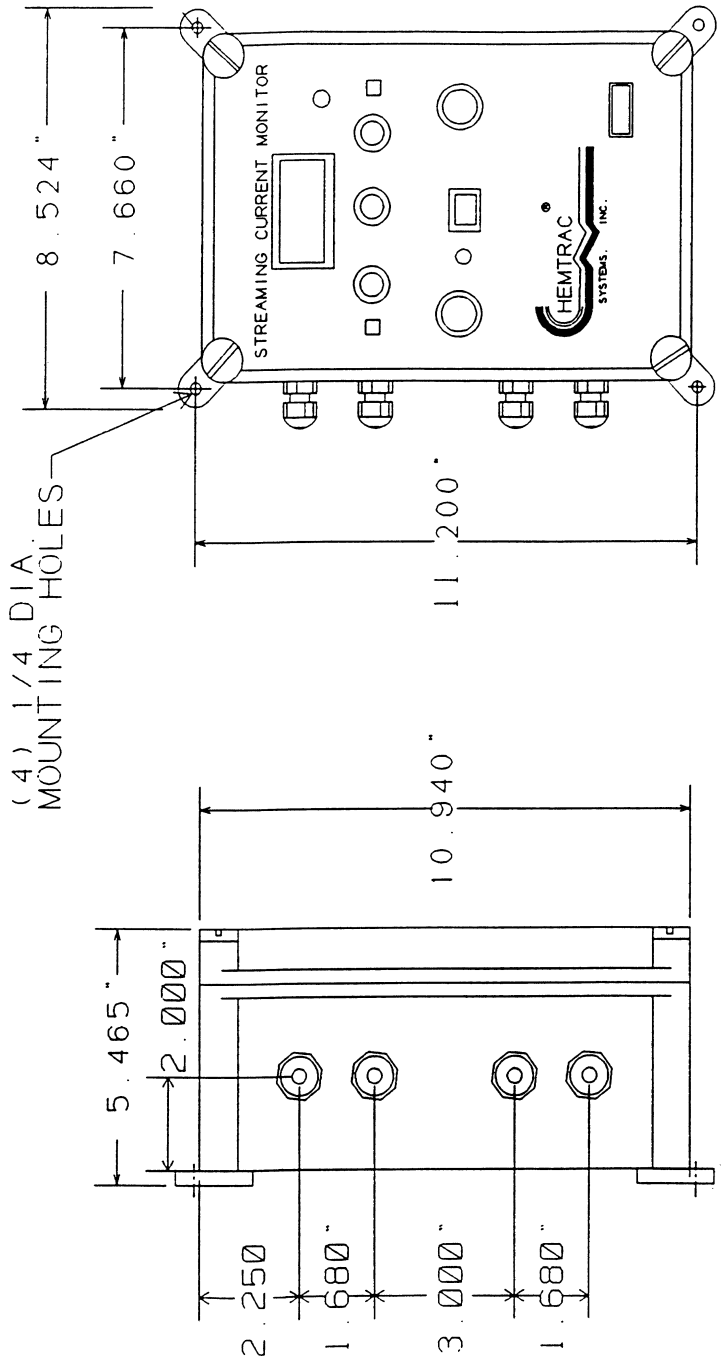


DIAGRAM – MONITOR MOUNTING OUTLINE & DIMENSIONS



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 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 SCM 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 OFFSET knob until the meter reads zero. This function provides the option of using zero at the operating point once the optimum treatment dosage has been determined *(see Treatment Optimization Procedure*).

LEAVE THE 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 re-zeroed for that gain.

3.2 TREATMENT OPTIMIZATION PROCEDURE

The treatment optimization procedure 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 each time to see the full effect.
Re-zero 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 pre-lime or

caustic is being used, a decrease in alum feed will require a decrease in lime feed to maintain proper pH for coagulation.

The “optimum setpoint” (zero) is obtained when the minimum coagulant dosage produces desired results for the particular treatment process. This setpoint will remain very close to the same reading even when raw turbidities increase or decrease. Simply adjust the coagulant dosage to maintain this zero reading on the SCM.

NOTE: If automatic control is being used, refer to manual on automatic control

3.3 ALARM SETTINGS

3.3.1 Function

The LO-ALARM is activated when the streaming current value exceeds a predetermined setting as the meter reading goes in a more negative direction. System changes that cause increasingly negative streaming current values are:

1. Reduced dosage (ppm) of positively charged coagulants such as alum, cationic, polymer, ferric chloride, etc.
2. Increasing raw water flow while holding coagulant dosage (ppm) constant.
3. Increasing dosage (ppm) of negatively charged chemicals such as lime, caustic or anionic polymer.

The HI-ALARM activates when the streaming current value exceeds a predetermined setting as the meter reading goes in a more positive direction. System changes that cause increasingly positive streaming current values are:

1. Reduced dosage (ppm) of negatively charged chemicals such as lime, caustic, anionic polymer, etc.
2. Decreasing raw water flow while holding coagulant dosage (ppm) constant.
3. Increasing dosage (ppm) of positively charged coagulants such as alum, ferric chloride or cationic polymer.

3.3.2 Operation

When the minimum dosage (ppm) of coagulant(s) has been determined *(see Optimization Procedures)*, set the ALARM/STREAMING CURRENT switch to the LO-ALARM position.

Adjust the LO-ALARM knob to the desired value (e.g. –0.50). Set ALARM/STREAMING CURRENT switch to the HI-ALARM position. Adjust HI-ALARM knob to desired value (e.g. +0.50). Return switch to STREAMING CURRENT position. If the GAIN setting is changed, alarm points must be reset accordingly.

3.3.3 Alarm Electrical

The alarm circuits' absolute maximum rating is as follows:

5 Amp (1/10 h.p.), 125/250 VAC
5 Amp, 30 VDC
0.6 Amp, 110 VAC

Exceeding these values will destroy alarm circuitry.

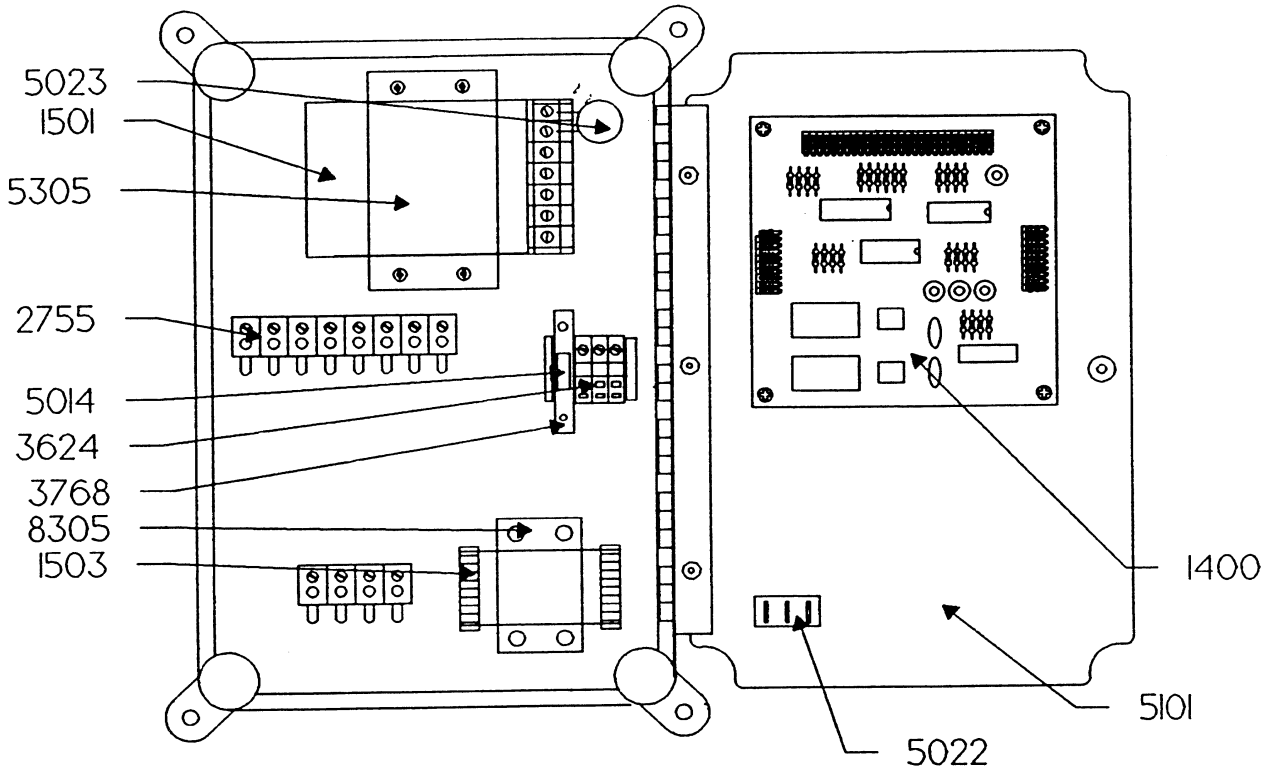
NOTE: Always disconnect the power cord before opening or servicing this unit. Also, turn off power to the output/alarm terminal block if alarms have been wired for 110 volts AC.

4.0 TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE (S)	CORRECTIVE ACTION(S)
1. Meter blank – (no digits) but power in ON	A. D.C. power supply inoperative B. Main circuit card faulty C. Panel meter inoperative	A. Check D.C. power supply output for +/- 15 volts. If voltage in not present, replace power supply. B. Check SCM signal outputs. If none present, replace main circuit card. C. Check SCM signal outputs (4-20mA, +/- 10V, 0-10V). If none present, panel meter is bad. Replace meter.
2. Meter reading fluctuates rapidly and widely on treated sample.	A. Incomplete dispersion or mixing of coagulant (s) raw water at point of sampling. B. Chemical feeders erratic. C. Raw water flow-turbidity fluctuating. D. SCM GAIN setting too sensitive. E. Cell bottom plug loose or O-ring missing.	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. B. Fix feeders. C. Check R/W flow controls/charts, and turbidity. D. Decrease GAIN setting. *E.* Tighten plug. Check O-ring *(see Cleaning Procedures)*
3. Meter reading does not change with change in coagulant dosage.	A. Meter GAIN setting too low. B. Wrong sample. C. Sample cell dirty. D. Excessive "lag" time between coagulant injection point and SCM sample cell.	A. Increase GAIN setting. B. Select correct sample (coagulated). C. Clean cell (*see Cleaning Procedures).* *D.* Move sampling point closer to coagulant feed point and/or decrease sample TRANSPORT time. *(see Selecting Proper Sample Point).*
4. Meter displays 0.00, or closely thereto, and does not change with change in coagulant dosage.	A. No water sample to sensor. B. Optoswitch misaligned. C. Optoswitch inoperative. D. Sensor output connections incorrect. E. Panel meter bad. F. Circuit card component faulty.	A. Establish a proper sample flow. B. Adjust optoswitch position for maximum meter reading on water sample and tighten securely in place. C. Replace optoswitch D. Check wiring. E. Check SCM outputs. If present, panel meter is bad. Replace meter. F. Replace circuit card.

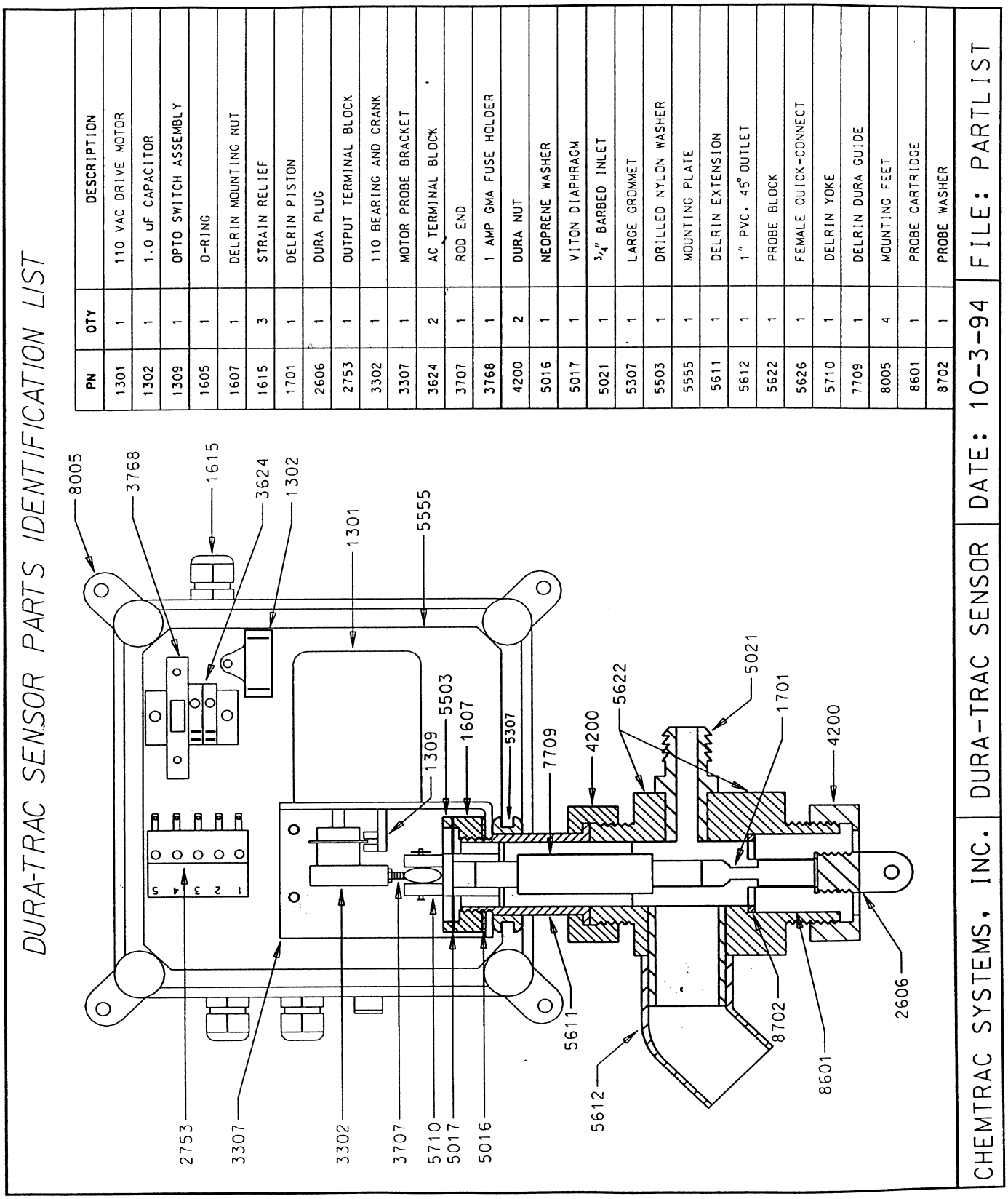
5. SENSOR LED on monitor is not blinking.	The sensor light is provided to alert the operator to any mechanical problem at the sensor, or in associated wiring. If there is a problem, the LED will be on or off, but not blinking. Operator should immediately check to see that sensor has 110VAC power, motor is running, and all output wiring is correct.

DIAGRAM – PICTORIAL PARTS ID



P/N	DESCRIPTION
1400	SIGNAL PROCESSOR BOARD
1501	POWER SUPPLY +/- 15 Vdc
1503	DC CONVERTER
2755	OUTPUT TERMINAL BLOCK
3624	AC TERMINAL BLOCK
3768	FUSE HOLDER
5014	1 AMP GMA FUSE
5022	LIGHTED SWITCH
5023	MOV
5101	FRONT PANEL ASSEMBLY
5305	POWER SUPPLY BRACKET
8305	CONVERTER BRACKET

DIAGRAM – DURATRAC PARTS ID 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	DELRIN MOUNTING NUT
1615	3	STRAIN RELIEF
1701	1	DELRIN 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	DELRIN EXTENSION
5612	1	1" PVC. 45° OUTLET
5622	1	PROBE BLOCK
5626	1	FEMALE QUICK-CONNECT
5710	1	DELRIN YOKE
7709	1	DELRIN DURA GUIDE
8005	4	MOUNTING FEET
8601	1	PROBE CARTRIDGE
8702	1	PROBE WASHER

5.0 PROBE REPLACEMENT AND CLEANING PROCEDURES

The DuraTrac sensor is supplied with two (2) probes and pistons in order to have freshly cleaned parts 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 ¼" flatblade screwdriver.
4. Clean any debris from cell housing.
5. Screw clean piston into place. Do not over-tighten. 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 the 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 RECOMMENDED SPARE PARTS

Note: See parts list on page 19 and 20 for a complete list of parts and descriptions.

Part #	Description	Qty.
8601	Duratrac Probe	1
1701	Delrin Piston	1
7701	Viton Seal	1
1301	Motor	1
5710	Yoke	1

7.0 ORDERING SPARE PARTS

To place an order for spare parts you may either call, e-mail, or fax Chemtrac Systems Inc. directly or contact your local distributor or representative. The following information should be included in your request; model number and serial number of your Streaming Current Monitor (see tag inside monitor housing), part number(s), qty, and description of parts required. Pricing is available upon request.

Lead time on parts in stock 1-2 working days.

Chemtrac Systems Inc.
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