CHEMTRAC®
SYSTEMS, INC.

OPTIMIZING WATER TREATMENT PROCESSES

OPERATIONS MANUAL

Streaming Current Controller with DuraTrac™ Remote Sensor

SCC 3000 XR

Revised 1/01

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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 Controller (SCC). The SCC includes a sensor placed at the desired sample point, and a signal processor mounted in the control module. The SCC 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 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 causes an alternating current to be generated, 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 (1.2) 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 SCC 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.

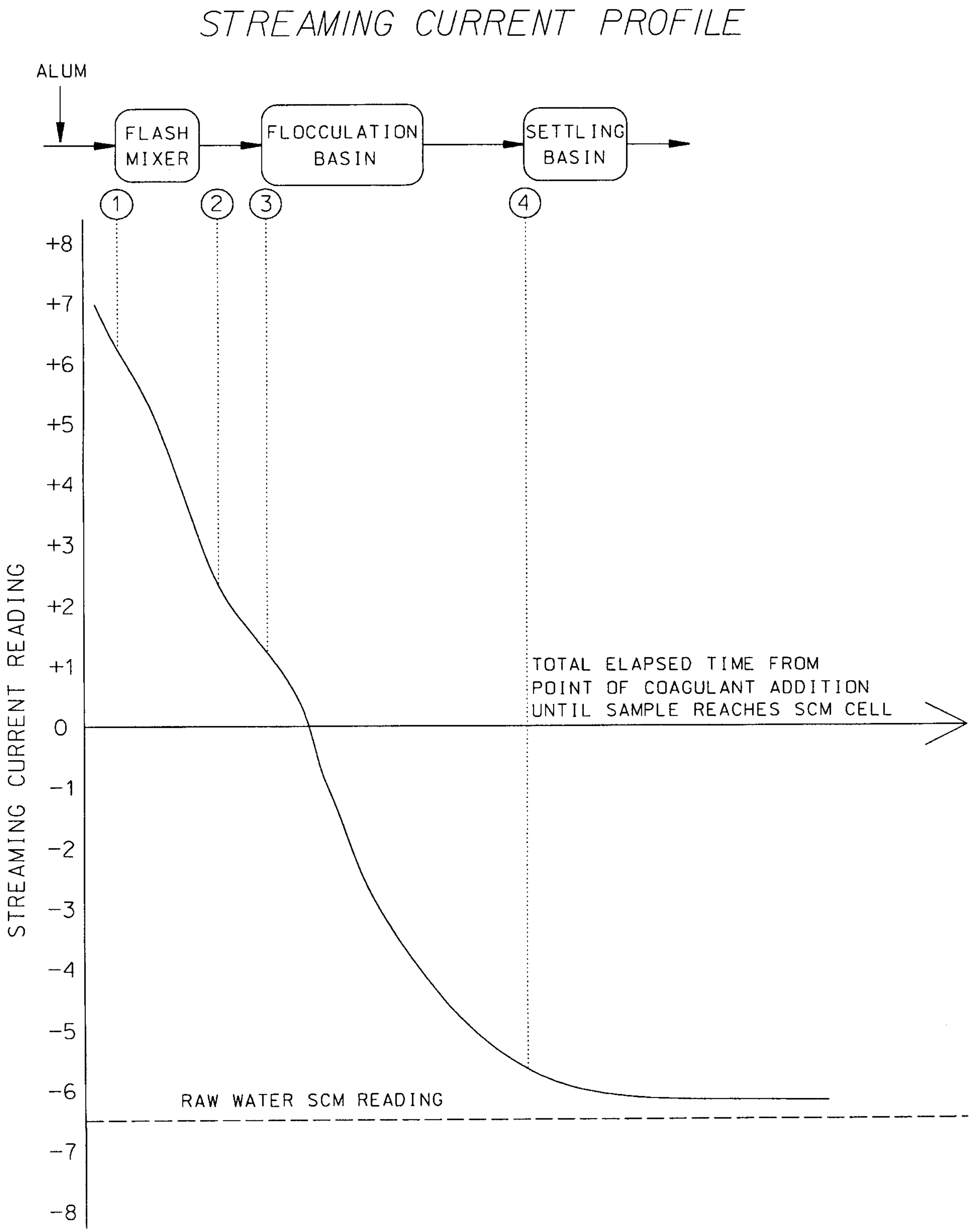
Figure 1, on page 6, is a "STREAMING CURRENT PROFILE" normally observed in a typical water plant, and should be referred to in reading the following paragraph.

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 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 SCC 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 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 for a specific plant depends upon the following conditions:

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


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 PROCESS CONTROL PROCEDURES

In order for the SCC 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 SCC 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.
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. should not change rapidly or widely) when setting up the system.

The SCC should be operated a few days in manual control to observe how it responds to normal process operation. Recording streaming current changes on a strip chart recorder is very helpful in anticipating factors that may have to be dealt with when automatic control is started. This period, if using the SCC with a 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

Controller

Power …………………………..	115 VAC, 60 Hz (standard)
	230 VAC, 50 Hz (optional)
Meter Readout …………..	Digital Configurable Fluorescent (-10 to +10)
Reference Output Signals …..	4-20mA (350 ohm Load) Standard
	0-10 VDC, Standard
	-10/+ 10 VDC, Standard
Control Output Signals …..	4-20mA (1000 ohm Load) Standard
	Electronic Pulse – Optional
Self Diagnostics …………..	Standard
High & Low Alarms …………..	5A, 120VAC, SPST 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 …………..	Full Scale All Ranges
Enclosure Type …………..	Wall Mount – NEMA 4X, Polycarbonate
Module Size …………………..	9 ¼"W, 12"H, 11 3/8" D
Weight …………………..	14 Pounds
Mounting Holes …………..	7.66"W x 11.20"H
Operating Temperature …...	32 degrees F to 120 degrees F

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. We recommend draining to atmosphere, and not into a closed pipe.

2.1.2 Power Requirements

Insert the power cord plug into a properly grounded receptacle (110 VAC). For safety and proper operation, the SCC 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 sent to the transmitter through properly selected wire. A multiconductor cable can be used. A detailed wire description is given below, as well as, two recommended manufacturers with respective product numbers for the wire:

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 conduit for maximum protection against damage or electrical interference. Do not run cable in same conduit with any other wiring.
Make connections to the sensor terminal block as follows:
(See External Wiring Diagram, pp. 15)

Terminal 1: Center conductor of coaxial cable

Terminal 2: Coax ground

Terminal 3: Twisted pair, red wire

Terminal 4: Twisted pair, black wire

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

2.2 CONTROL MODULE

(*See External Wiring Diagram, pp.15)*

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 box 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 +10 VDC

Terminal 8: Common ground (for terminals 6 & 7)

Terminal 15: (+) 4-20 mA   **(INDICATES STREAMING CURRENT ONLY -

Terminal 16: (-) 4-20 mA   **DO NOT CONNECT TO PUMP)

****NOTE:** When not in use, a 0 ohm shunt must be used between terminals 15 and 16. The maximum load for this current output is 350 ohms.

The Streaming Current controller utilizes a Honeywell UDC 3300 controller to provide control outputs to the chemical feed system. The Honeywell product manual is included with the system. A shielded twisted pair is used to connect the current output to the feed pump. On the integral systems, the controller connections are fed back into the junction box, so the outputs to the pump are located on the junction terminal block.

Terminal 5: (+) 4-20 mA output

Terminal 9: (-) 4-20 mA output

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

Terminal 1 & 2: Alarm relay #1

Terminal 3 & 4: Alarm relay #2

2.2.1 CONTROL MODULE RS422/485/MODBUS

A RS422/485/MODBUS communication option is availble with the SCC3000. The option must have been specified when the unit was ordered. The communication terminals will be located in the junction box of the instrument on terminals 3 & 4. The alarm relay (Alarm Relay #2) that is normally located on those terminals in units without the communication option will be moved and combined with the alarm relay (Alarm Relay #1) on terminals 1 & 2. In this configuration, any alarm event will result in closed connection (relay energized) between terminals 1 & 2. The wiring diagram inside the lid of the junction box will illustrate where to make the proper connections for communications.

Terminals 3 & 4 inside the control module's junction box are prewired to the Honeywell UDC3000 communication terminals 14 & 15 (as shown on page 30 of the UDC3300 Product Manual). This is a half duplex configuration. Refer to the Honeywell documentation that was supplied with this unit for more information on the communication capabilities.

2.3 SYSTEM START-UP

2.3.1   Initial Monitor Settings

A. GAIN Switch 5X

C. ZERO OFFSET Switch .... Out (Yellow LED should be off)

D. ZERO ADJUST Knob ....… Mid-range (5 turns from fully CW)

2.3.2 Water Connections

Connect 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 cannot 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 may 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 operating or servicing this unit. Also turn off power to the output/alarm terminal block if alarms have been wired for 110 VAC.

2.4 SENSOR MOUNTING INSTRUCTIONS

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

DIAGRAM – MOUNTING OUTLINE & DIMENSIONS

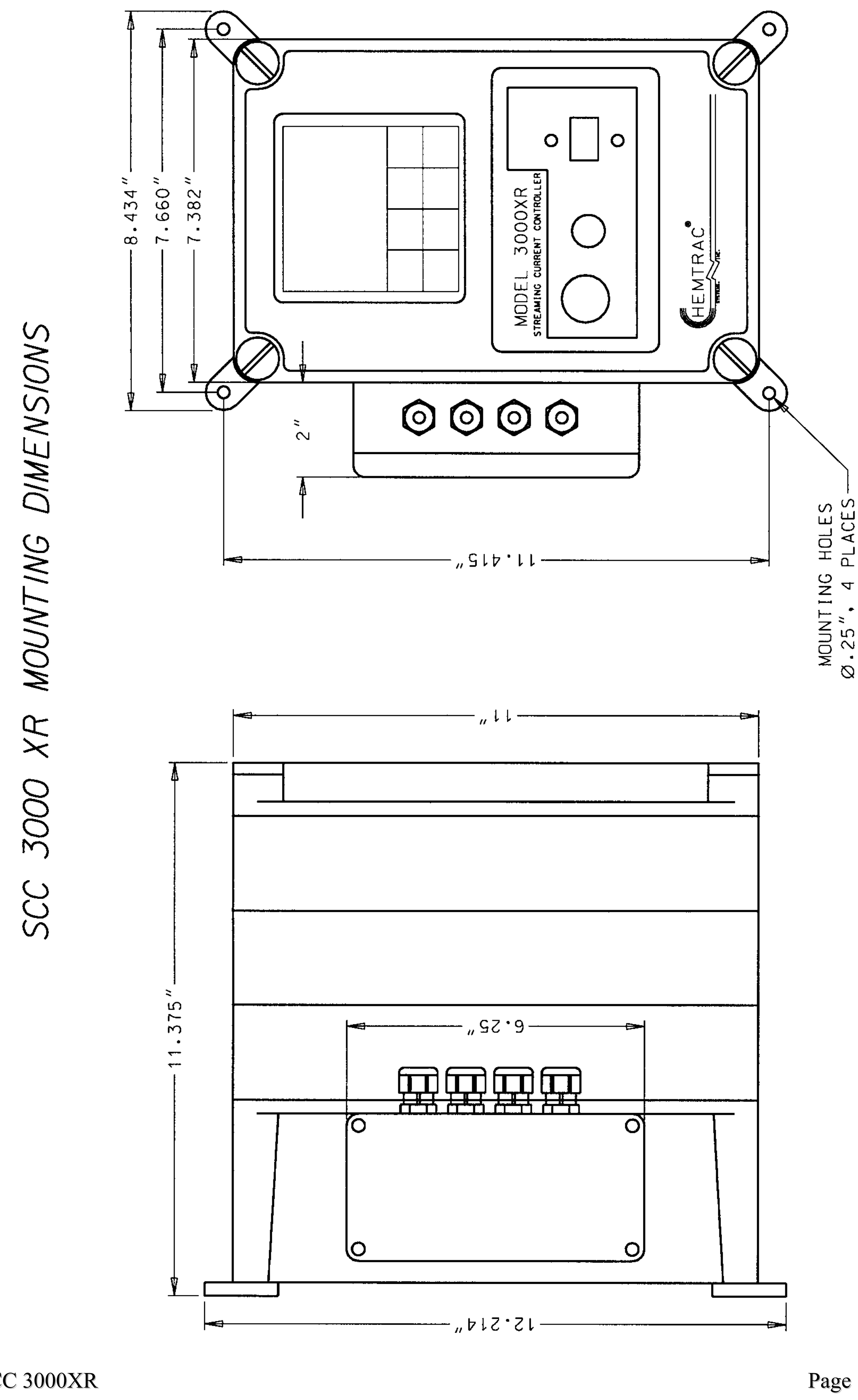


DIAGRAM – MOUNTING OUTLINE & DIMENSIONS

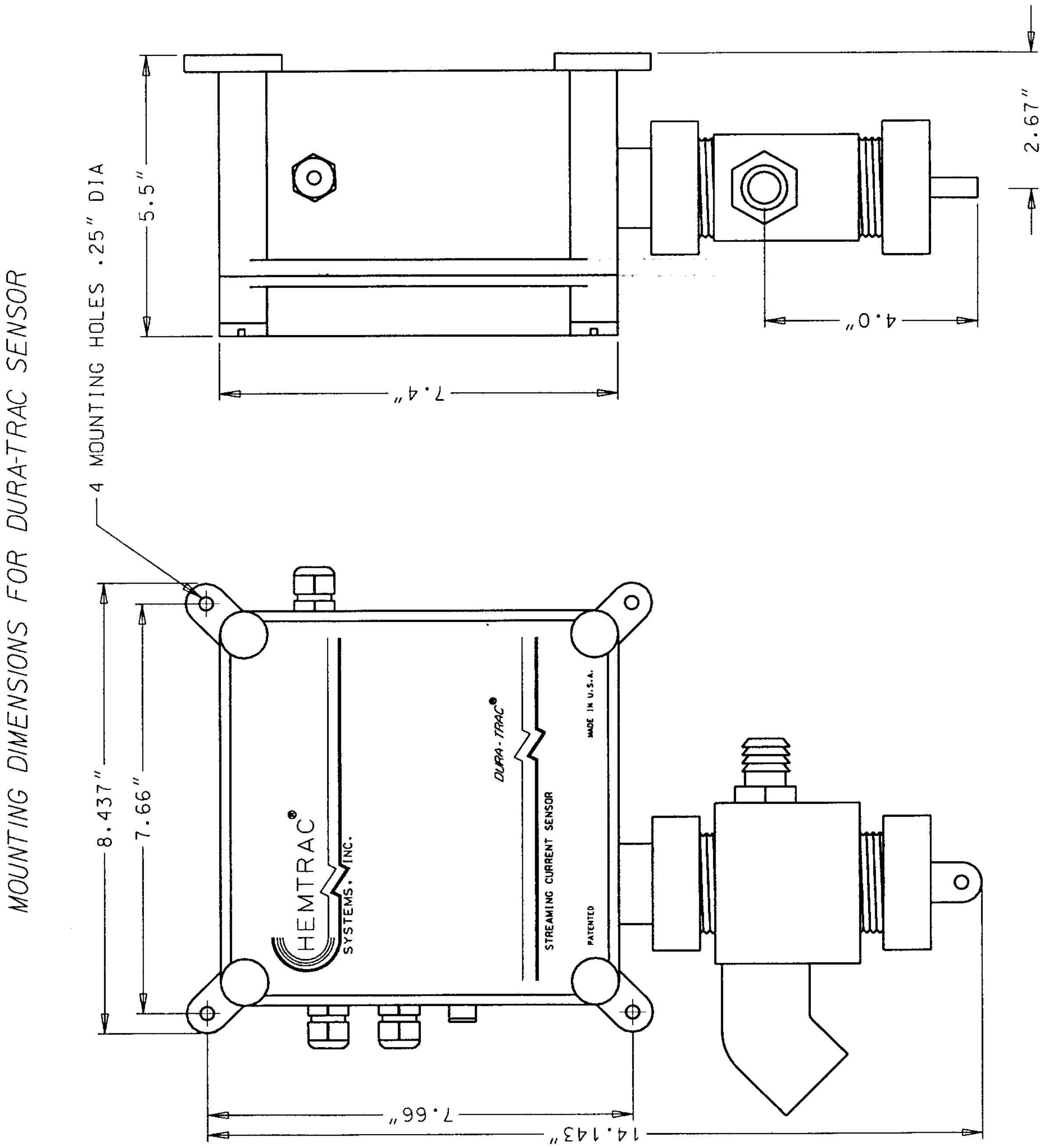
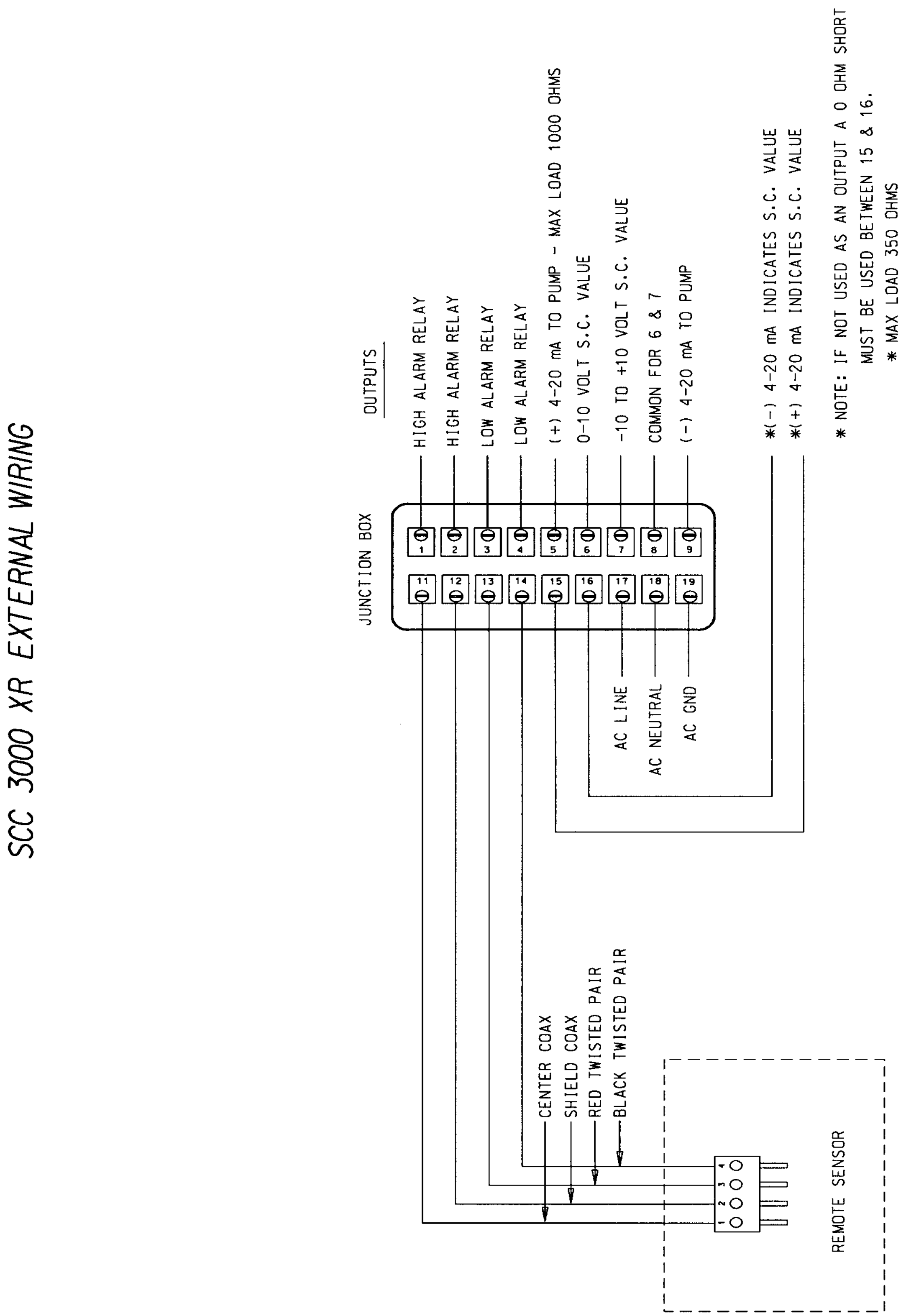


DIAGRAM – EXTERNAL WIRING



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 which indicates 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 SCC 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 THE SWITCH AT THE “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 each time 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 feed 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 turbidities increase or decrease. Simply adjust the coagulant dosage to maintain this zero reading on the SCC.

NOTE: If automatic control is being used, refer to section on AUTOMATIC control.

3.3 MANUAL CONTROL USING CONTROLLER

A. Observe and record chemical pump % at optimum dosage.
B. Make electrical connections between SCC and pump.
C. 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 IN1RG 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 preset 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 DEV, the deviation between the setpoint and streaming current value.

3.4 AUTOMATIC CONTROL

Automatically controlling the treatment process with the Streaming Current Controller (SCC) 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 controlled" 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 the water 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 SCC 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 SCC 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. Refer to Figures 2 and 3 (page 20) for illustrations of responses to controller adjustments.

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 controller 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 when large, sudden, changes occur in the process. Normally, proper setting of PROP BD and RSET MIN will handle most process changes and give good feed control. A RATE MIN input should be put into the control set-up only after PROP BD and RSET MIN adjustments have been made, and then only if required.

OUPUT HI/LO LIMITS (OUTHILIM): This control be can be used to limit the % output of the controller, high or low. On a 4-20 mA controller with OUTHILIM = 50, the output would never be greater than 12mA (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.

FIGURE 2

Figure 2

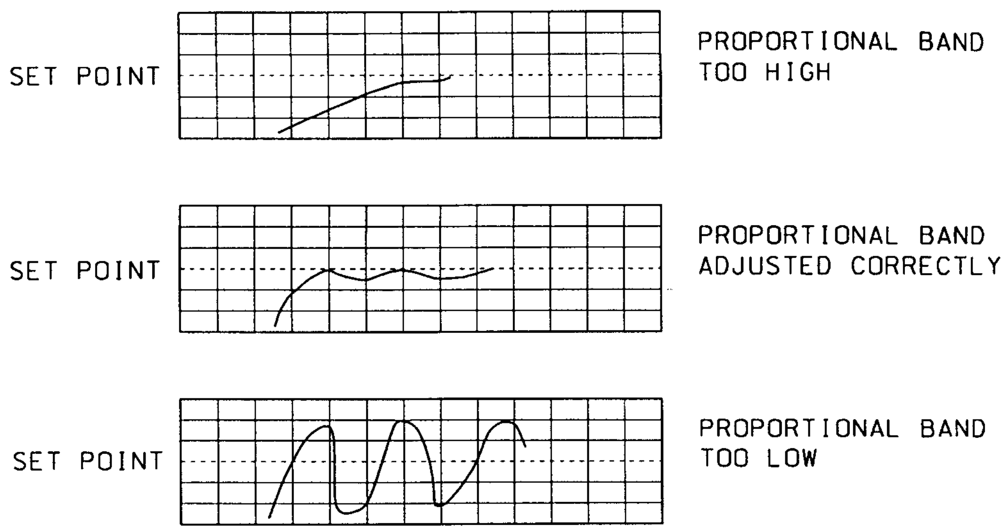
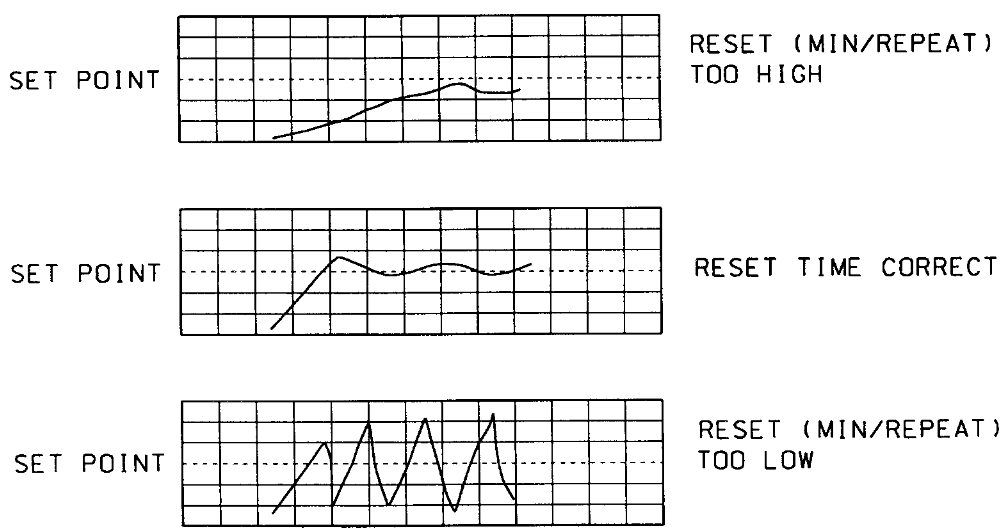


Figure 3



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 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 to the first parameter, (which is PROP BD for this model of controller). The top display will now show the present 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 is the only parameter you wish to change, exit the SETUP 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, RATE MIN, RSET 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 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	-Proportional Band adjustable to either 0.1 to 9999.
RSET MIN	-Adjustable to either 0.00 to 50.00 repeats/minute or min/repeats.
RATE MIN	-Adjustable to either 0.00 to 10.00 min (rate is off values of 0.08 or less)

Parameters shown below have been preset by Chemtrac at the following values:

PROP BD = 100

RSET MIN = 3.00

RATE MIN = 0.00

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 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 and 5 below), a change in the setpoint is necessary to check the operation of the control action. A simple method of doing this is to change the setpoint from 0.00 to 1.00 after changing the first

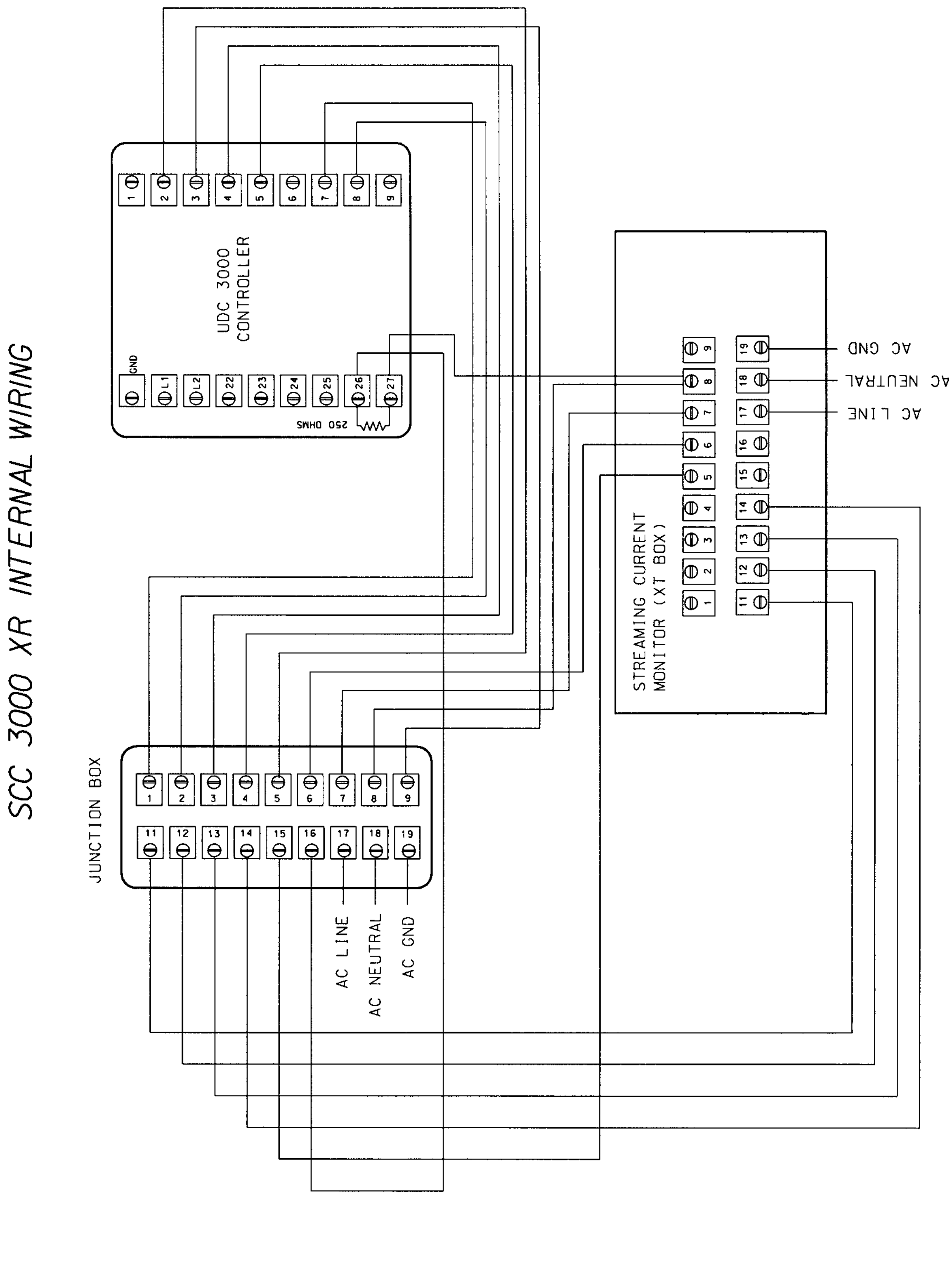
tuning constant. Watch the SC reading to evaluate if other tuning constant changes are necessary (i.e., oscillations, long settling times indicate further tuning). The use of a recorder allows the observation of overshoots and settling times. To make another change in the tuning constant, change the setpoint from 1.00 back to 0.00 after making a correction. Observe the process again. This procedure should be repeated until tuning is complete.

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 SC reading close to 0.00. 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 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 RSET 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 oscillations cease.
    b. If the SC reading is unstable, increase RSET MIN in small increments until oscillations cease. Wait for the SC reading to settle down after each adjustment.

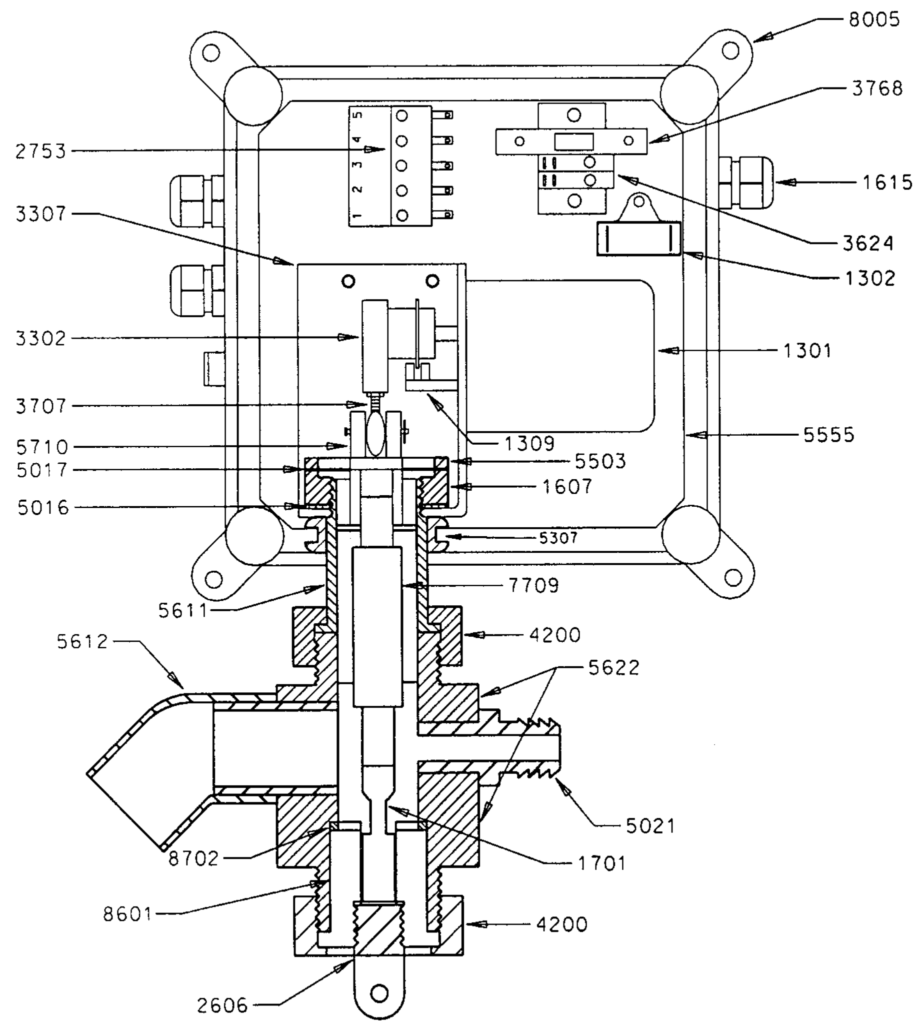
4.0 TROUBLESHOOTING GUIDE

PROBLEMS	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
1. Controller display fluctuates rapidly and widely on treated sample.	**A.** Incomplete dispersion or mixing of coagulant(s) in raw water at point of sampling. **B.** Chemical feeders erratic. **C.** Raw water flow-turbidity fluctuating. **D.** SCC 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)*.
2. Controller display does not change with change in coagulant dosage.	**A.** SCC GAIN setting too low. **B.** Wrong sample. **C.** Sample cell dirty. **D.** Excessive "lag time" between coagulant injection point and SCC 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)*.
3. Controller displays 0.00, or closely thereto, and does not change with change in coagulant dosage.	**A.** No water sample to sensor. **B.** Dirty or inoperative probe. **C.** Optoswitch misaligned. **D.** Optoswitch inoperative. **E.** Sensor output connections incorrect. **F.** Controller bad. **G.** Circuit card component faulty.	**A.** Establish proper sample flow. **B.** Clean or replace probe. **C.** Adjust optoswitch position for maximum meter reading on water sample and tighten securely in place. **D.** Replace optoswitch. **E.** Check wiring. **F.** Check SCC outputs. If present, controller is bad. Replacemeter. **G.** Replace circuit card.
4. 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 110 VAC power, motor is running, and all output wiring is correct.	

DIAGRAM – INTERNAL WIRING DIAGRAM


SCC 3000 XR INTERNAL WIRING
UDC 3000 CONTROLLER
GND
250 OHMS
JUNCTION BOX
STREAMING CURRENT MONITOR (XT BOX)
AC LINE
AC NEUTRAL
AC GND
AC GND
AC NEUTRAL
AC LINE

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	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 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 SCC 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 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

Depending on the type of contamination, different cleaning procedures are recommended. When cleanng the probe, the plug in the bottom of the plug should be removed for easier access.

TYPE of CONTAMINATION	CLEANING PROCEDURE
Mineral scale from alum/lime addition	Comet or other Abrasive Cleaner To make solution, add one tablespoon of Cleaner to 250 mL of warm water and use test tube brush with solution to clean probe and piston. For stubborn scale, a 20:1 dilluted solution of Muratic Acid may be used. Do not soak parts and be sure to rinse very well after cleaning to remove the Acid. Prolong exposure to Acid will damage the probe.
Deposits caused by raw water iron/manganese, or where ferric salts or potassium permanganate is used for treatment.	ROVER (available from Hach Chemical) To make solution, add 1 spoonful per pint tap water and first soak and then brush the probe and piston.
Organics from raw water or where polymers are used.	Comet or other Abrasive Cleaner To make solution, add one tablespoon of Cleaner to 250 mL of warm water and use test tube brush with solution to clean probe and piston.
Oil/Grease	Comet or other Abrasive Cleaner To make solution, add one tablespoon of Cleaner to 250 mL of warm water and use test tube brush with solution to clean probe and piston.

A "soak and brush" method is recommended for any buildup that does not easily brush off. Soak only long enough to loosen the buildup. 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 CONFIGURATION 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
					RATIO		1.0
TUNING	PROP BID	100.0	1.0		BIAS		0
	OR				SP TRACK	NONE	NONE
	GAIN		1.0		POWERUP	MANUAL	MANUAL
	RATE MIN	0.00	0.00		PWROUT		LAST
	RSET MIN	3.00	1.0		SP HILIM	10.00	1000
	OR				SP LOLIM	-10.00	0
	RSET RPM		1.0		ACTION	REVERSE	REVERSE
	OR				OUT RATE	DISABL	DISABL
	MAN RSET		0.0		PCT/M UP		0
	PROP BD2		1.0		PCT/M DN		0
	OR				OUT HILIM	100.0	100.0
	GAIN 2		1.0		OUT LOLIM	0.0	0
	RATE2MIN		0.00		DROPOFF	0	0.0
	RSET2MIN		1.0		DEADBAND		2.0
	OR				OUT HYST		0.5
	RSET2RPM		1.0		FAILSAFE	50.00	0.0
	CYCSEC		20.0		MAN OUT	50.00	0.0
	CYC2SEC		20.0		AUTO OUT	50.00	0.0
	SECURITY	0	0.0		PBorGAIN	PB PCT	GAIN
	LOCKOUT	CALIB	CALIB		MINorRPM	MIN	MIN
	AUTOMAN		ENABLE				
	SP SEL		ENABLE	OPTIONS	AUX OUT	IN 1	DISABL
	RUN HOLD		ENABLE		4mA VAL	-10.00	0
					20mA VAL	10.00	0
SP RAMP	SP RAMP	DISABLE	DISABL		DIG IN 1		NONE
	TIME MIN		3.0		DIG 1 COM		DISABL
	FINAL SP				DIG IN 2		NONE
	SP RATE		DISABL		DIG2 COM		DISABL
	EU/HR UP						
	EU/HR DN			Corn	CornSTATE		DISABL
	SP PROG		DISABL		CornADDR		0
					SHEDTIME		0
ADAPTIVE	ADAPTIVE	DISALBE	DISABL		PARITY		ODD
	SP CHANG		10		BAUD		300
	KPG		1.0		DUPLEX		
	CRITERIA		NORMAL		TX DELAY		1
					LOOPBACK		DISABL
ALGORITHM	CONT ALG	PIDA	PID A		SHEDMODE		LAST
	INPUT 2		DISABL		SHED SP		TO LSP
	OUT ALG	CURRENT			UNITS		PERCNT
	4-20RNG		50PCT				
	RLY TYPE		MECHAN	ALARMS	A1S1 VAL	5.00	90
	TIME		DISABL		A1S2 VAL	99.9	10
					A2S1 VAL	-5.00	95
INPUT 1	DECIMAL	XX.XX	XXXX		A2S2 VAL	0.1	5
	UNITS	NONE	NONE		A1S1TYPE	PV	NONE
	IN 1 TYPE	4-20mA	0-10mV		A1S2TYPE	OUTPUT	NONE
	XMITTER	LINEAR	LINEAR		A2S1TYPE	PV	NONE
	IN 1 HI	10.00	1000		A2S2TYPE	OUTPUT	NONE
	IN 1 LO	-10.00	0		A1S1 HL	HI	HI
	BIAS IN1	0.00	0		A1S1 EV		
	FILTER 1	0	1		A1S2 HL	HI	LO
	BURNOUT	NONE	NONE		A1S2 EV		
	EMISSIV		0.0		A2S1 HL	LO	HI
	PWR FREQ	60 HZ	60HZ		A2S1 EV		
	LANGUAGE		ENGLIS		A2S2 HL	LO	LO
					A2S2 EV		
INPUT 2	XMITTER 2		LINEAR		AL HYST	0.0	0.1
	IN 2 HI		1000				
	IN 2 LO		0				
	FILTER 2		1				