# OPERATIONS MANUAL


# DuraTrac 4

## Streaming Current Sensor

Ver 140829 JC

CHEMTRAC

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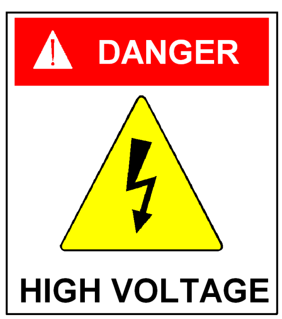
## IMPORTANT INSTRUCTIONS

When using this instrument, basic safety precautions shall always be followed to reduce the risk of fire, electrical shocks and injury to persons, including the following:

- ☑ 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.
- ☑ Follow all warnings and marked on the instrument.
- ☑ Failure to follow these precautions could result in personal injury or damage to the equipment.
- ☑ Do not attempt to disassemble the unit.
- ☑ Water must not be allowed to enter the housing of the unit.
- ☑ Close and fasten the covers of the unit prior to any external cleaning to prevent water ingress.
- ☑ Do not drop or jar the unit.
- ☑ Do not modify any internal electrical wiring or electronics.
- ☑ Use a mild non-abrasive cleanser when cleaning the outer cover of the unit.

## SAFETY PRECAUTIONS

In order to provide maximum user safety this instrument was designed with all electrical circuitry enclosed within a protective non-conductive housing. The label below will be visible at any location where high voltage is present.



# 1.0 WARRANTY

Chemtrac®, Inc. warrants the DuraTrac 4 sensor to be free from defects in material and workmanship for a period of one (2) years 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®, Inc.).

Chemtrac®, 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®, Inc. be liable for any special, incidental, or consequential damage such as loss of production or profits.

Should you experience trouble with the equipment, please contact:

**Chemtrac, Inc**
6991 Peachtree Industrial Blvd., Building 600
Norcross, GA 30092

Phone: 1-800-442-8722 (Inside US only), 770-449-6233
Fax: 770-447-0889
Email: chemtrac@chemtrac.com
Website: www.chemtrac.com

# 2.0 GENERAL INFORMATION

## 2.1 DESCRIPTION OF OPERATION

The DuraTrac 4 (DT4) is a remote Streaming Current (SC) sensor that is used to measure the charge of “treated water”, with the sample point being downstream of the coagulant addition point. Charge is reported as Streaming Current Value (SCV) with a range of -1000 to +1000 (0 being neutral). The SC sensor provides the user with an online measurement of charge destabilization, allowing the user to optimize and in many cases automate their coagulant dosing. Other applications include charge measurement in wastewater and on the wet end of a paper machine, which generally entails measuring low consistency samples (such as tray water or white water). This main focus of this manual is on the water treatment application.

The key working components of DT4 sensor are the piston and probe. The probe features a 0.5” annulus (bore) that has two electrodes for measuring charge, one near the top of the bore and the other near the bottom. As treated water flows into the sensor, a small portion of the water is drawn into the bore during the upstroke of the piston and is expelled from the bore on the piston down stroke. Ionic species and colloidal sized particles contained in the sample are temporarily immobilized on the piston and cylinder surfaces. As the water is moved back and forth by the piston, ionic charges that have collected onto the piston surfaces (+ and -) are moved downstream to the electrodes. This movement of ions causes an alternating current to be generated, defined as "streaming current." It is in this manner that the SC sensor measures the net ionic and colloidal surface charge (positive and negative) in a treated sample.

## 2.2 DETERMINING THE OPTIMUM STREAMING CURRENT VALUE

Online Streaming Current offers a very simple and easy to maintain online method of charge measurement. Due to the rapid response to changes in water quality (NTU & TOC), online Streaming Current provides a reliable way to optimize coagulant dosage and allows one to make gradual reductions in dosage over time. This allows the user to gradually and safely cut back on coagulant dosage and can lead to significant reductions in coagulant usage.

The first step in using Streaming Current comes with finding an optimum streaming current value (SCV), or what can be called the SCV setpoint. The process of finding this optimum value is rather simple. The operator performs jar testing to determine an optimum (or near optimum) dosage, and then takes note of the SCV once that dosage is applied to the process. Once that is done, automatic or manual adjustments are made to maintain that setpoint value. If process results continue to look acceptable, small reductions in coagulant dosage can be made and a new optimum SCV setpoint is established to see how those results compare to the previous value. If results with the new value continue to look acceptable (or better) over an extended period of time, then the process of reducing the dosage and establishing a new “setpoint” SCV is continued until results indicate that lowering dosage further is no longer improving treatment results.

The optimum SCV setpoint can sometimes change seasonally (e.g. due to seasonal pH or water temp changes) or when certain process changes are made. For example, some plants might blend water from multiple sources, or feed oxidizing agents on and off depending on circumstances. These types of changes can change the optimum SCV setpoint.

Once an optimum value is identified, the goal is to keep the SCV at that point by making manual or automatic coagulant dosage adjustments.

## 2.3 STREAMING CURRENT RESPONSES

Observations of the SC reading will not always fall in line with a one's understanding of what they think the instrument is measuring. This is often because a common view of the Streaming Current measurement is that it is primarily responding to the coagulant dosage and changes in NTU, with higher coagulant dosage causing the SCV to go more positive and higher NTU causing the SCV to go more negative.

While these are typical observations one would see, the measurement of ionic charge is, of course, a bit more complex in the real world and especially when it comes to surface waters with higher levels of dissolved solids and alkalinity. One aspect of charge measurement that is not generally well known is that a given concentration of naturally organic matter (NOM) will have a much larger influence on measurements of charge than an equal concentration of insoluble inorganic material that composes the NTU measurement.

pH and conductivity are also very important to consider. pH has a significant impact on ionic charge because it influences the rate of hydrolysis of inorganic coagulants. The more hydroxide (OH-) interacts with an inorganic coagulant, the less positive the coagulant becomes, and thus the less responsive it appears to measurements of SC. Changes in pH at the SC sensor will have direct impact on charge readings, and so it is highly recommend to monitor this parameter at the SC sample point. The impact from Conductivity can also be important to monitor if changes in conductivity can swing by more than 25%, and especially more than 50%, in a relatively short period of time (e.g. during rain events). Conductivity will be discussed further in section 4, but it is worth mentioning here that the DuraTrac 4 sensor has a unique conductivity compensation feature that is capable of greatly diminishing the impacts of conductivity.

Other potential factors which can impact the reading and call for a change to the SCV setpoint are changes in temperature, process flow rate, and dosage of other additives like oxidizing agents. Below are the most common examples of the type of responses that a user might observe.

**Positive Responses**
Increase in cationic additive
Decrease in anionic additive
Decrease in NTU / TOC
*Increase in process flow rate (mostly a factor when using inorganic coagulant like Alum)
*Decrease in pH
*Decrease in temperature
*Addition of chlorine (generally goes positive, but not always, depends on certain factors)
*Increase in conductivity when SCV is negative
*Decrease in conductivity when SCV is positive
**Negative Responses**
Decrease in cationic additive
Increase in anionic additive
Increase in NTU / TOC
*Decrease in process flow rate (mostly a factor when using inorganic coagulant like Alum)
*Increase in pH
*Increase in temperature
*Loss of chlorine (generally goes negative, but not always, depends on certain factors)
*Decrease in conductivity when SCV is negative
*Increase in conductivity when SCV is positive

*If the SC Sensor is being used to control a cationic or anionic additive, be aware that these process and chemistry changes can possibly result in the user needing to redefine their optimum SCV setpoiint. It is impossible to predict how much of a change is acceptable with any of these parameters because so much depends on the type of coagulant being used and chemistry interactions.

## 2.4 WHERE WILL STREAMING CURRENT WORK BEST?

The best overall application for Streaming Current technology is in lower alkalinity surface waters that have a moderate to high amount of NTU and organics. Due to their lower alkalinity, these waters will generally run at a pH below 7 which, regardless of coagulant selection, is more likely to produce larger SCM responses to a given dosage of coagulant.

Processes that feed low basicity inorganic coagulants, like Alum, at pH's above 7 (post Alum addition) will likely see less of a streaming current response to process changes. This is because at higher pH's the monomeric forms of inorganic coagulants (like $Al(OH)^{2+}$) can quickly hydrolyze into an insoluble species with a neutral ionic charge, or further hydrolyze into an anionic charged species. Since neither species carries a positive ionic charge, they will not produce a streaming current response.

Generally, the more variable the chemistry is in terms of pH, alkalinity, conductivity, and temperature, the more likely it becomes that the SCV reading will become less reliable as a control tool. That being the case, the SC sensor is still often a valuable monitoring tool in these situations as it provides an indication of when certain parameters (like TOC) might be changing.

An increasing number of WTP's using high basicity inorganic coagulants (like PACl or ACH) and low molecular weight, high cationic charge polymers. These coagulants will generally produce a much more favorable SC response than traditional coagulants, especially in applications with >7 pH. WTP's that were using Alum and not able to use a SC device to control their dosage are now able to do so after switching to a product like ACH. This is not a recommendation for these products or a testament to their performance, it is simply being recognized that certain coagulants produce a more sustained cationic charge than others and this should be considered when evaluating SCM performance.

## 2.5 TECHNICAL SPECIFICATIONS

### Dura-Trac 4 REMOTE SENSOR

Power ...................................... 115 VAC, 60 Hz (standard)
230 VAC, 50 Hz (optional)
Sample Flow Rate ................... 1 to 40 Liters per Minute
Sample Pressure………………Up to 20 psi allowable, atmospheric drain recommended
Sample Cell Type .................... External Receiver, High Flow
Probe Type .............................. Quick Replacement Cartridge, User Replaceable Sleeve
Water Sample Connections ..... 1” FNPT
Materials Contacting Sample ... Delrin, Neoprene Viton, Stainless Steel
Interconnect Wiring .................. 4 Conductor, Shielded, 18 AWG, 500 ft max distance*
Enclosure Type ....................... NEMA 250 Type 4X, Reinforced Fiberglass
Enclosure Size ........................ 11.2”W, 9.2”H, 6.3”D (285mm W, 234 mm H, 161mm D)

Mounting Holes ....................... 9.7”W x 10.5”H (247mm W x 266mm H)
Overall Height with Sensor ...... 18.8’’ (477mm) without SMM Option
Weight .................................... 15 Pounds (6.8 kg)
Operating Temperature ........... 34° F to 120° F (1° C to 49° C)

*Contact Chemtrac for details on how to setup longer cable runs than 500 ft.

# 3.0 INSTALLATION

## 3.1 SELECTING PROPER SAMPLE POINT

The reliability of the streaming current measurement is largely a function of how and where the sample is taken. Therefore, it is very important to read this section carefully and to understand what constitutes an optimum sample point for the DuraTrac 4 sensor.

When possible, avoid sampling from places where sludge, grit, etc., will be drawn into the sensor sample cell (sensor parts are made of plastic and will wear down quickly if exposed to abrasive material). To avoid plugging, keep sample lines at least ½" to 1" ID and with enough flow to prevent solids accumulation. . Keep sample lines as short as possible to minimize delay in response time.

The sample must be taken at a point where uniform distribution and mixing of coagulant is obtained for all flow rate conditions, and at a point that allows for a quick response to chemical feed changes as measured by the monitor. In many cases, the sample is best pulled right out of the flash mixer or very soon after a static mixer. <u>Always try to pull the sample before the slow mixer or flocculation basin</u>. The lag time, or the amount of time it takes the water to travel from the point of chemical addition to the sensor, should be no greater than 1 minute (<30 seconds is ideal). In certain conditions, longer lag times are acceptable, but be sure to consult with a Chemtrac application expert about your application if you feel a sample point has to be located further than 1 minute downstream.

If uniform distribution and mixing is not being obtained at a selected sample point, the streaming current reading will oscillate or be unstable. If the coagulant is not being properly mixed, try to first take any possible steps to improve mixing (contact Chemtrac for suggestions). If nothing can be done to improve mixing, either the coagulant needs to be moved further upstream or the sample point needs to be moved further downstream to allow the chemical more time to mix. Be mindful that moving the sample point further downstream in order to obtain a more stable reading can result in a loss of sensitivity to changes in raw water quality and coagulant dosage changes, and make the measurement more susceptible to drift in the optimum SCV setpoint due to changes in process flow.

As discussed above, it is best to have the sample delivered to the sensor in under 1 minute from the time it was dosed with coagulant. To understand why this is important, consider the figure on the following page. This shows an example of how the streaming current profile might look if measurements were taking at different points in the process. As seen here, under certain conditions and mainly due to hydrolysis reactions, the streaming current value can drop off quickly as you move the sensor further away from coagulant addition. This means the response to changes in raw water quality will also drop off as you go further downstream, making the Streaming Current measurement less reliable. In some situations, the streaming current value will drop off almost completely in just a few minutes after the coagulant is introduced. This is especially true for low basicity inorganic coagulants when fed into water with higher pH and alkalinity.

Another problem with having the sensor located too far downstream is that flow changes through the WTP will become more problematic for the Streaming Current measurement. This is because those flow changes will have a larger impact on the "lag time" (how long it takes the treated sample to reach the sensor). Even though the sensor is stationary, large increases in lag time has the same impact as moving the sensor further downstream. Keeping the sensor closer to the injection point, and ideally pulling the sample from the flash mixer, minimizes the impacts of flow changes.

To review, 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 coagulants used.
5. Water chemistry (mainly pH and alkalinity)

**Finding the optimum sample point can be complex for some applications. To avoid wasting time and money on an improper installation, it is very highly recommended you call to discuss your application with Chemtrac before installing your sensor. A lot of time and expense can be saved by doing so. Ask to speak with a Chemtrac sales manager (all are highly knowledgeable on installation guidelines), and that person will help guide you on the best installation practices for your application based on a few simple questions.**

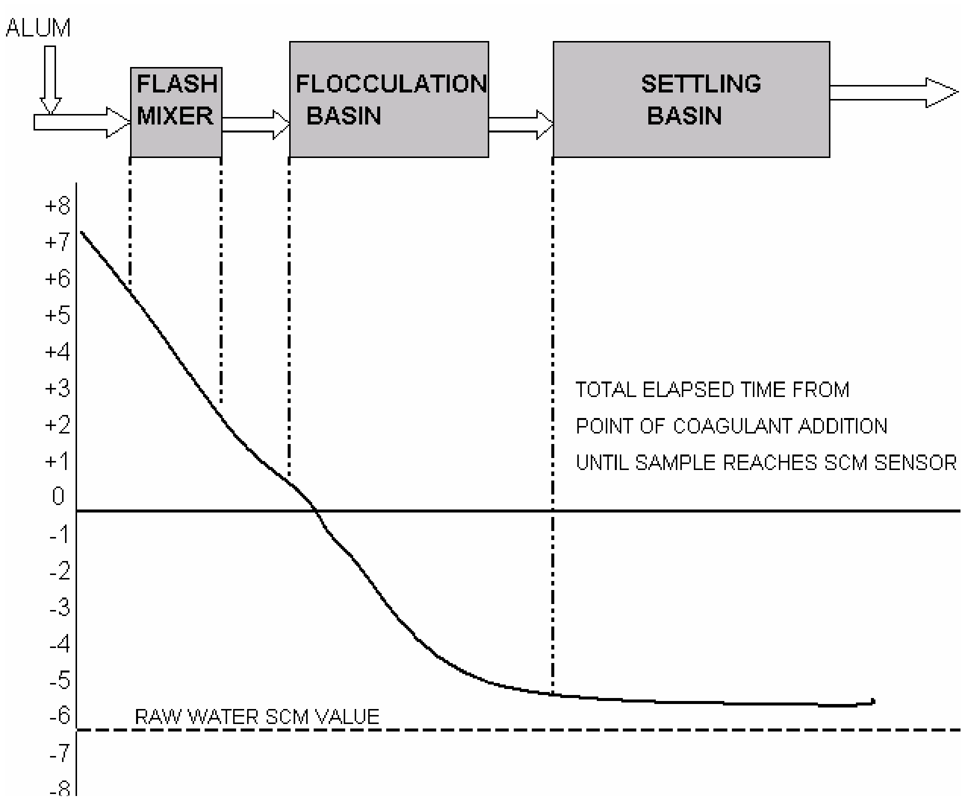



**Figure 3.1 Streaming Current Profile**

## 3.2 MOUNTING LOCATION AND SAMPLE PLUMBING

The sensor can be located several hundred feet from the HydroAct analyzer. A maximum cable distance of 500 ft is recommended. If a longer cable distance is required, contact factory for details on how to perform. The sensor must be mounted in a vertical position with the sample flowing into the inlet (either side of probe block can be used as the inlet)) and exiting from the other side and going back to a drain or return point in the process***. An atmospheric drain with as little backpressure as possible is recommended. Sample pressure must not exceed 20 psi and less than 5 psi is recommended. The sample flow rate should not exceed 40 LPM.***

Typically, the sensor is mounted as closely as possible to the sampling point. Minimizing sample line lengths provides quicker response to process changes. Sample may be obtained by using a sample pump, tapping off a pressurized line, or using gravity feed system to get sample to the sensor.

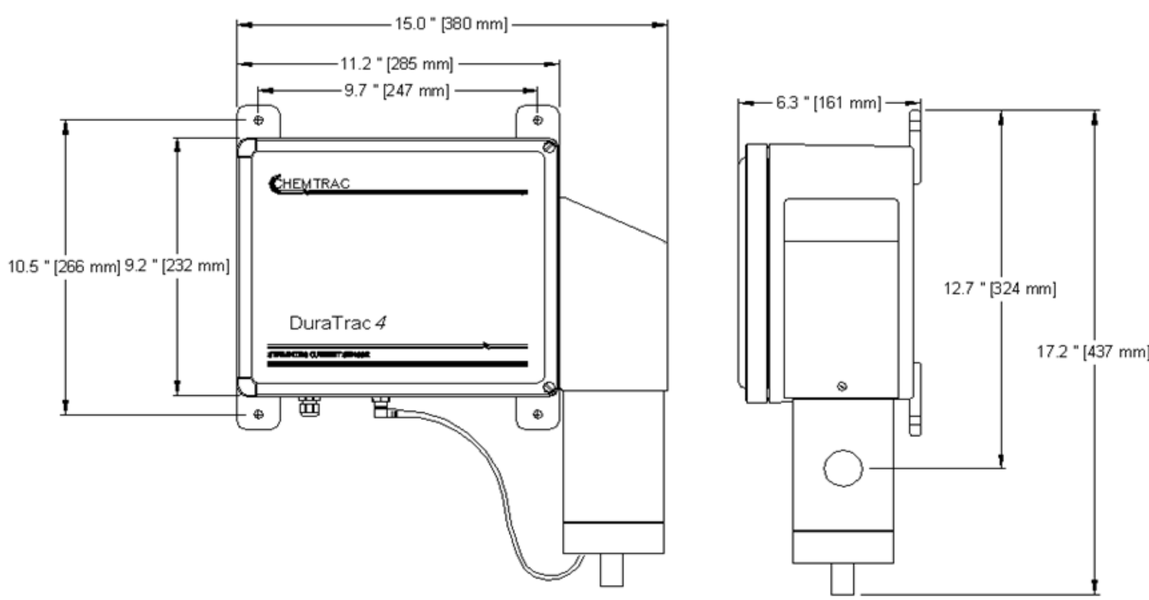
The HydroACT analyzer module should be installed in a location, which will allow regular viewing of the display as well as easy access to the front panel menu keys.

## 3.3 POWER REQUIREMENT

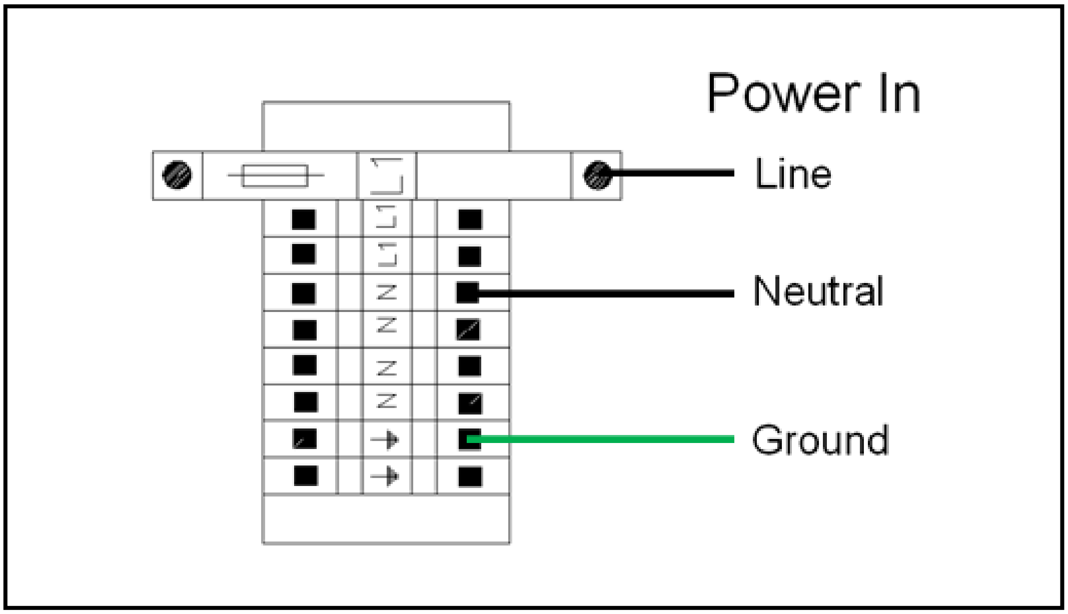
110 VAC or 220 VAC power wiring terminals are located in the upper right hand corner of the DuraTrac4 sensor enclosure. The electrical power should be connected in the following order.

- ☑ Attach the ground wire to the ground terminal as shown below.
- ☑ Insert the hot wire into the Fused terminal labeled “L1” as shown below.
- ☑ Insert the neutral wire into the terminal labeled “N” as shown below.

For safety and proper operation, the sensor must be properly grounded through the power cord.



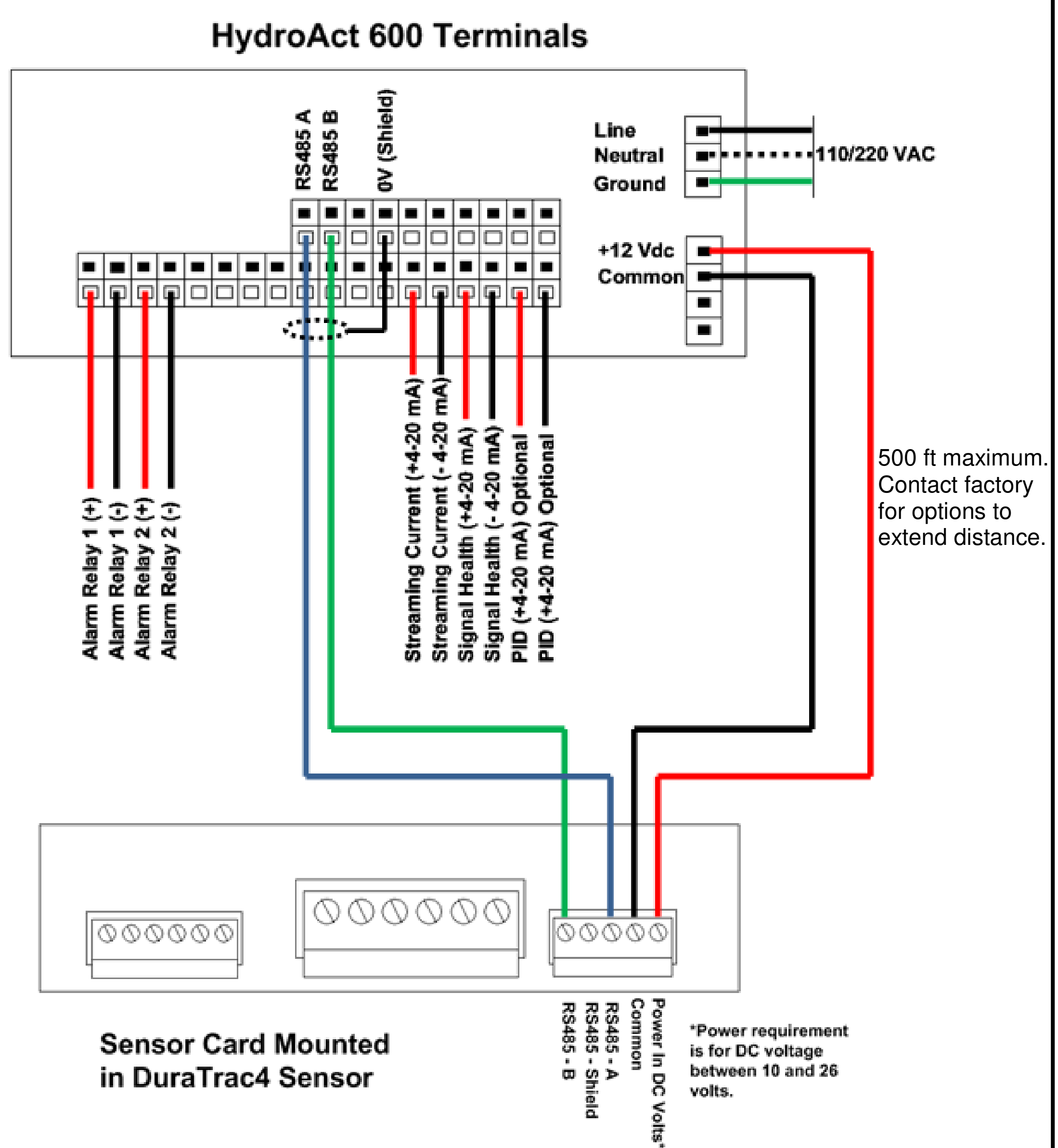

**DuraTrac 4 Mounting Dimensions**


Power In
Line
Neutral
Ground
L1
L1
L1
N
N
N
N

### 3.4 SIGNAL WIRING

The Dura-Trac 4 Sensor digitally transmits information to the HydroAct controller via multi conductor wires, see below figure for default signal wires interconnection diagram. **NOTE: If HydroACT analyzer has multiple sensors (e.g. two DT4's or pH probe) then the below diagram will not be accurate. For those situations, read section 4.2.3.1 of this manual which provides instructions on wiring.**

**<u>Caution</u>**: Make sure the HydroACT analyzer is turned off before making any signal wiring connections. Shielded cable should be used. 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 that might interfere with digital communication wiring.



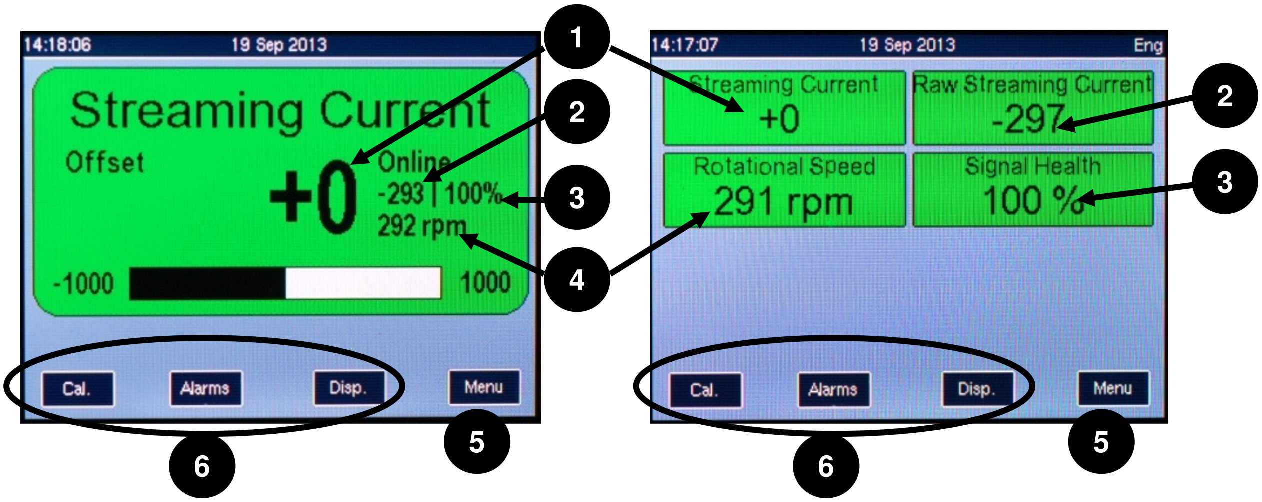

**Signal Wires Interconnection Diagram**

# 4.0 HYDROACT ANALYZER DISPLAY & MENU FUNCTIONS

## 4.1 MAIN DISPLAY

The HydroAct 600 and 1200 analyzers are equipped with ¼ VGA Color displays, or an optional and larger touchscreen display. This section of the manual will explain content that appears on the main display. Refer to the HydroAct analyzer manual for any display functions not discussed in this manual.

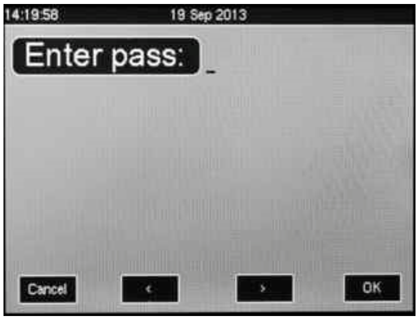
The main display shows the sensor SCV measurement(s) and optional diagnostic parameters. The appearance of the main display will depend on the number of parameters the analyzer was programmed for, and on user customization. See section 3.3.1 of the HydroACT Analyzer manual for more information on display settings.




(1) **Streaming Current Value**. This reading will change if Zero Offset or conductivity compensation is enabled.
(2) **Raw (True) Streaming Current Value**. This reading does not change when Zero Offset or conductivity compensation are enabled.
(3) **Signal Health.** The Signal Health reading is an advanced diagnostic feature of the DuraTrac 4 sensor. Readings above 90% indicate a good signal is being received from the probe. Readings between 80 to 90% indicate some possible deformities in the signal, but these are not likely impacting the SCV. Sustained readings below 80% indicate a problem with the signal that requires attention (e.g. dirty probe and piston, possible electrical interference, loose drive linkage).
(4) **RPM.** This shows the rotational speed of the drive motor. Speed is dependent on line power frequency. 50 Hz power will produce an RPM of around 240 (+/- 10 RPM), while 60 Hz will be around 290 (+/- 10 RPM). What is important is that speed is stable over time and not bounding around by more than +/- 3 RPM.
(5) **Menu.** Pressing this button pulls up the Login Screen and allows access to the menu.
(6) **User Customizable Buttons.** These buttons are user customizable. Buttons can be mapped to certain menu parameters like: Alarms, Calibration, Controls, Display, etc. Refer to section 3.3.1.5 of the HydroACT manual for information on mapping the buttons (Menu>Setup>Analyzer>Buttons)

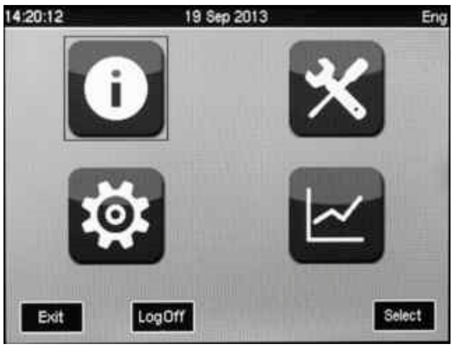
**Note:** The display images on the previous page are just an example of what information may appear on the display. In these images, the display is showing the maximum of 4 parameters that the DuraTrac 4 sensor allows for (SCV, Raw SCV, RPM, and Signal Health). Only two parameters are offered by default, but additional parameters as shown above are available on request. Some charges might apply.

## 4.2 LOGIN




If no user is currently logged in, then pressing the Menu button will bring up the Login Screen. There are three levels of user login. The first level does not require a password. Simply press “OK” to login as a User. For higher levels of access, the logins are “2” for Technician and “3” for Engineer. Login codes can be changed under the Analyzer menu The display will show “User”, “Tech”, or “ENG” in the upper right hand corner when someone has logged into the unit. There is a user logout setting under the Analyzer menu. See section 3.3.1.7 of HydroACT manual for more information on security settings.

## 4.3 TOP MENU




After logging in, the user will be brought to the main menu screen where the 4 main menu sections are shown as icons.

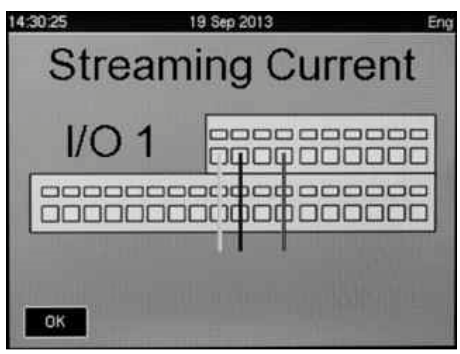
 Information  Maintenance

 Setup  Graphs

## 4.4 INFORMATION MENU

 The information menu includes general details like firmware version installed in the analyzer, installed device codes, installed hardware, sensor connections, etc. This section of the menu is more fully discussed in the HydroACT analyzer manual in section 3.1.

### 4.4.1 CONNECTIONS

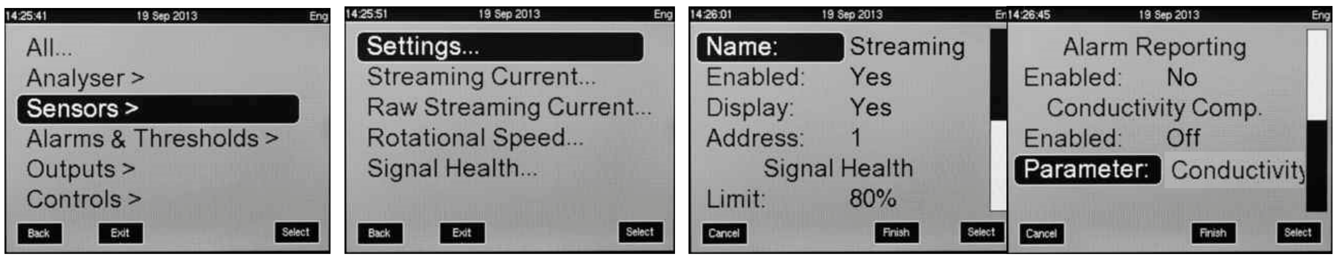




 Locations for where to land the sensor connections (Streaming Current, or otherwise) are provided under Connections menu shown above. Depending on the number and/or type of sensors connected to the HydroACT analyzer, the connections for the DuraTrac 4 sensor may be on anyone of the I/O 1 modules (up to 4). In a HydroACT 600, I/O 1 is the base board, and I/O 2 is a plug in board that sits on top of the baseboard.

## 4.5 SETUP MENU

The setup menu provides access to general Sensor settings such as naming of the sensor, logging interval, averaging, and other sensor specific settings discussed below. The setup menu also provides access to Analyzer settings, PID control settings, analog output mapping and scaling, relay settings, and alarms. This section of the menu is more fully discussed in the HydroACT analyzer manual in section 3.3.

### 4.5.1 Sensor Settings Menu




Under the Sensor>Settings menu for Streaming Current are settings to:
**NAME** Custom name the sensor

**ENABLED** Setting to “No” turns off communications to the sensor and causes data collection to stop, it also disables any displaying of data and alarms.

**DISPLAY** Setting to “No” removes reading from main display, but data collection still occurs and sensor alarms are still active.
(continued on next page)
**ADDRESS** Change sensor’s modbus address setting (default address is 1). This only needs to be changed if there are multiple sensors on the same analyzer that communicate over RS485 modbus. Each sensor must have a unique address.

**SIGNAL HEALTH LIMIT** Set Signal Heath alarm limit. Signal Health alarms are treated as critical sensor alarms and will cause sensor readings to divert to “Offline” values and cause PID control (if being used) to divert to Failsafe Mode (i.e. switches pump output to Manual setting). Alarm reporting must be enabled for Signal Health alarms to occur.
**ALARM REPORTING ENABLE** Enables Signal Health Alarm reporting.

**CONDUCTIVITY COMPENSATION ENABLED Note: This feature requires a conductivity probe**. Enable conductivity compensation will adjust the SCV reading to negate the impact of large conductivity changes. This feature is not recommended for most applications as conductivity changes are small. But in some applications where conductivity changes are larger (e.g. from 200 uS to 1,000 uS), this compensation feature might improve performance of coagulant dosage control. <u>NOTE: This feature requires the analyzer to have a conductivity probe, or a 4-20 mA input from an online conductivity analyzer. Do not enable if there is no conductivity sensor or input available on the analyzer.</u>

#### 4.5.1.1 Conductivity Compensation Setting

There are 3 compensation ranges to choose from:

Mode 1: 25 to 1,000 uS
Mode 2: 500 to 3,000 uS
Mode 3: 1,500 to 7,500 uS

Procedure for enabling Conductivity Compensation:

1. Follow the gain setup instructions in section 4.2 and record the SC reading
2. Navigate to Menu>Setup ( ) >Sensors>Streaming Current>Settings
3. Scroll down to “Conductivity Comp”. Highlight “Enabled” and then press “Select” and use the bottom middle buttons to select the compensation range (Mode 1, 2, or 3) that best matches the range of conductivity values expected for the application and then click “OK”.
4. Scroll down to highlight “Sensor” and then select the Conductivity sensor to be used for the compensation (requires a conductivity probe or 4-20 mA signal from a conductivity analyzer to be connected to the HydroAct analyzer).
5. The SC reading will likely change after compensation is enabled. If the reading changes by more than 20% from the SC value recorded in step 1, it is recommended to go to section 4.2.1 Automatic Gain Adjustment and use the SC value from step 1.

### 4.5.2 Sensor Measurement Parameters Menu


The DuraTrac 4 Sensor can have up to four (4) parameters displayed on the HydroACT analyzer. Those four parameters are:

**Streaming Current** This is the SC reading that is subject to Zero Offset and Conductivity Compensation. This reading is what should be used for manually or automatically controlling coagulant dosage.

**Raw Streaming Current** Also referred to as the “True” SCV reading. This reading provided so that the user can see the actual SCV value which is not subject to Zero Offset or Conductivity Compensation. It is not recommended to use this reading for manually or automatically controlling coagulant dosage.

.

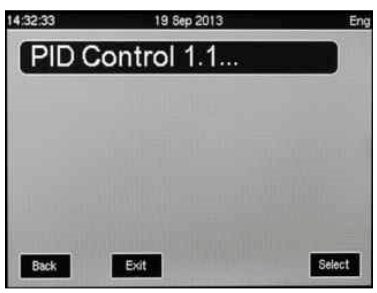
**Rotational Speed** This allows the user to display and monitor (data log) the motor RPM. Generally, this would only be necessary as a diagnostic check and to make sure the motor is running at a consistent RPM. Motors towards the end of their life might run at a less stable RPM and this can negatively impact the SC reading.

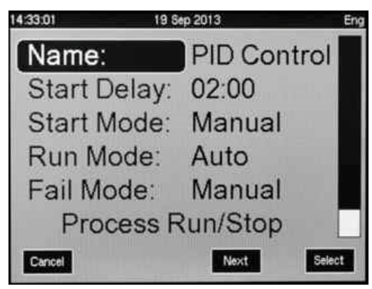
**Signal Health** This reading provides an indication of when there is interference which might impact the measurement accuracy. This could include a fouled probe, loose drive linkage, or external electrical interference (e.g. ground loops / galvanic currents). If the signal does not appear to be uniform and stable, it will cause the Signal Health to drop.


The above menu will appear under each of the before mentioned parameters.
**TYPE** Allows the user to change the parameter to any of the 4 previous mentioned.
**ABBREV:** The abbreviated name for the sensor appears on the data log and some of the main display views.
**OFFLINE** This value is used if there is a sensor fault of any type (e.g. signal health alarm).
**DATALOG** Set to On in order to data log the readings of this parameter.
**LOG DELAY** This setting is expressed as mm:ss, so 01:00 is logging once a minute
**AVERAGING** Allows for signal averaging

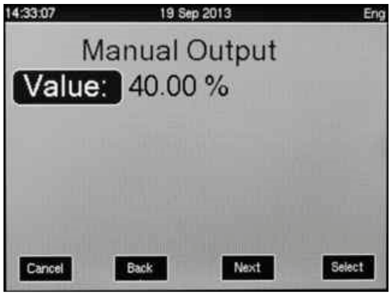
### 4.5.3 Controls Menu

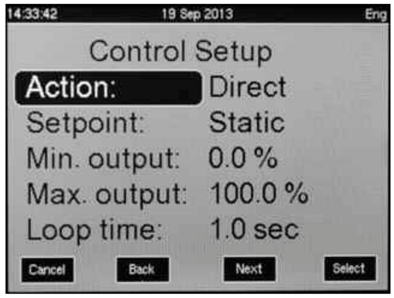
The Controls menu is where the PID settings are located. Below is an explanation of the various settings and how they relate to coagulant feed control. **NOTE:** The below screenshots show the parameters that appear when logged in as Engineer level. Less parameters are given to the user when logged in as Technician or User.


**NAME** Allows user to custom name PID Control output
**START DELAY** For systems that stop and start automatically, this setting provides a way to delay going into Automatic control until the process has had time to stabilize. This helps prevents problems with PID output ramping too far in any direction during a startup. See "Process Run/Stop Signal" below for more information.
**START MODE (Eng Level Only)** Sets whether the PID will startup in Manual or Off mode. If set to Off, the PID output will be 0% during the duration of the Start Delay time. If set to Manual, the PID output will be equal to the Manual output setting for the Start Delay time duration.
**RUN MODE** Sets the PID control's mode of operation when not in Start Delay or Fail Mode. Setting options are Off, Manual, or Auto.
**FAIL MODE** Sets the PID control's mode of operation when Overfeed Protection becomes active, or when other alarm conditions relevant to the PID occur (such as Signal Health diagnostic alarm). <u>Recommended setting is Manual.</u>
**PROCESS RUN/STOP SIGNAL (Eng Level Only)** Allows mapping of a digital input (Signal) to the PID. Once mapped, the digital signal alerts the PID to when the process is running or stopped. This input can also be used to remotely toggle the PID control between Manual and Auto. Contact Chemtrac for assistance with setting up this feature. A device code for a Signal Input will be required.






**Manual Output**
**Value** Sets the PID output when Run Mode is set to Manual.

**Control Setup (Engineering Level Only)**
**Action** This setting should be set for Direct if SCM is used to control cationic (positive) coagulant or polymer. Set for Reverse if controlling an anionic (negative) coagulant or polymer.

**Setpoint** Set for for Static if the Setpoint is to be entered into the analyzer directly by user. Set for Variable if the Setpoint is to be set remotely using a 4-20mA Input. A setting of Variable requires mapping an analog input as the Setpoint Source. Contact Chemtrac for assistance with this feature.

**Min Output** Determines the lowest output the PID can reach when in Auto mode.

**Max Output** Determines the highest output the PID can reach when in Auto mode.

**Loop Time** Sets how often the PID updates its output calculations. Recommended minimum setting is 1.0 second. Longer time setting might be required for processes with longer lag times (which occurs when sensor is further downstream of coagulant injection). Slightly longer time setting (e.g. 2 to 10 seconds) might also be helpful when using the Setpoint Ramping function.

**Process Variable (Engineering Level Only)**
**Sensor** Maps the sensor to the PID. If more than one streaming current sensor is hooked up to the analyzer, you may need to rename sensor so that it can be identified on this screen. For example, instead of “Streaming Current”, you will need to give a unique name like “Train 1 SC” so that you can identify the proper sensor that you want to map to the PID.

**Parameter** Leave this set for Streaming Current. Do not select any other option such as Raw Streaming Current, Rotational Speed, or Signal Health

**Over Feed Protection (Engineering Level Only)**

Do Not Use With DuraTrac 4 Sensor.


**Setpoint**

**Value** This is the SC value that the controller is trying to maintain. As discussed above, the controller will not be able to keep the reading at the exact setpoint value due to constant changes in process (flow, NTU, etc) and variances in pumping and mixing efficiency, and the normal small oscillations in PID control that can occur. Therefore, the setpoint should be viewed as a target and not an exact value that the controller will maintain.

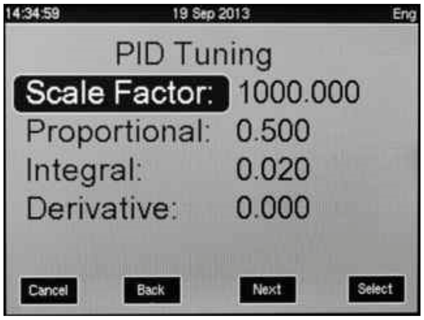
**Ramping (Engineering Level Only)**
The Ramping feature is not required for systems that run continuously and/or that are placed into automatic control by an operator. This feature is intended for systems that are unmanned and that are setup for automatic process startup. One common problem with systems designed to start and stop automatically is that the SC reading can be far away from the setpoint value at startup. This can result in a large error between the SC reading and the setpoint, which in turn can cause the PID to ramp up the pump output dramatically and result in an overfeed condition which then gets overcorrected as the SC reading goes too far positive. This can result in significant PID oscillation that continues until the control mode is switched to manual or PID settings are lowered.

Setpoint ramping provides a way to prevent this sort of PID oscillation while allowing the controller to maintain responsive PID settings on systems that start and stop automatically. Here is how the Ramping logic works:

1. The setpoint ramping feature will take the current SC reading (e.g. -100) and make that value the temporary setpoint.
2. This temporary setpoint value is then compared to the actual setpoint (e.g. 0) to determine the difference (which would be 100 units in this example).
3. The difference between the two is then multiplied by the Factor setting (e.g. 100 x 0.01 = 1).
4. The result is then added to or subtracted from the temporary setpoint (whichever brings the temporary setpoint closer to the actual setpoint) and a new temporary setpoint is defined (e.g. -100 +1 = 99).
5. Once the new temporary setpoint is defined, the process starts over again at step 2. These steps are then repeated until the temporary setpoint reaches the actual setpoint.
6. The above logic loop is ran at a frequency equal to the Loop Time setting (this setting is on the Control Setup screen which is 3 screens ahead of this one).

**Enabled** Turns the Ramping feature on.

**Factor** Determines the amount of adjustment that is made to the Temporary Setpoint with each PID Loop (determined by Loop Time setting).




**PID Tuning (Engineering Level Only)**

PID control is a mathematical construct which can be understood and utilized mathematically or practically. Avoid enabling the controller on until you have read ALL of this section.

The output from the PID controller is simply the addition of the Proportional, Integral, and Derivative terms. This value is then subject to the controls described above (such as Max Output).

**Scale Factor** This setting should be set for 1000 and not adjusted unless advised to do so by factory technician.

**Proportional** 0.00 to 10.00 gain. Zero is off. Adjust the PID output in direct proportion to the size of the current error. The math for proportional output is Error / Scale Factor x Proportional. For example, if the error is 50, scale factor is 1000, and Proportional is set for 0.5, then proportional output will be ((50 / 1000) x 0.500) = 0.025 (or 2.5%)

**Integral** 0.00 to 10.00 gain. Zero is off. With each loop of the PID, the Integral setting will adjust the PID output in direct proportion to the size of the current error. Unlike the Proportional setting, the output of the Integral setting is additive. That is, the present integral output calculation is added to the previous integral output calculation. For example, if the error is 50, scale factor is 1000, and Integral is set for 0.1, the first time the control loop runs, the integral output will be ((50/1000) x 0.100) = 0.005 (or 0.5%). The next time the control loop runs (based upon the Loop Time setting), with the same error of 50, the integral output will be [0.005 + ((50/1000) x 0.100)] = 0.010 (or 1.0%). Again, the value would carry over to the next cycle of the control loop where this 0.010 would add to the new integral output calculation.

**Derivative** 0.00 to 10.00 gain. Zero is off. With each loop of the PID, the Derivative setting will adjust the PID output in direct proportion to the rate of change of the current error, per second. That is, the derivative output is proportional to the difference in the current error minus the error from the previous cycle of the PID loop divided by the Loop Time setting and the scale factor. For example, the first time the PID loop runs, with an error of 50, scale factor of 1000, Loop Time set to 2 seconds, and Derivative set for 0.5, the derivative output would have no effect as, being the first time the PID loop runs, there is not a previous error with which to compare. The second time the PID loop runs, if there is a change in error such that the current error is now 30, the derivative output calculation would be as follows:
0.5 x [(30 - 50) / (1000 * 2)] = -0.005 (or – 0.5%).


**Integral Windup Protection (Engineering Level Only)**

In simple to understand terms, the Integral Windup settings should always be set to match the Output Min and Max settings (located under the 3rd screen of the Control menu). If the Min Output is set for 20% and Max Output is set for 80%, then the Minimum Integral Windup setting should be 20% and Maximum Integral Windup should be 80%.

If limits are not placed on the integral output, then the output could climb to numbers well over 100% or into the negative range below 0%. If this occurs, the PID output would appear, at times, stuck at the min or max range because the integral output would have to “unwind” before the PID output could start making adjustments.

**Enabled** Turns Integral Windup Off or On. It is recommended to leave this set for “Yes”.

**Minimum** Sets the minimum Integral Output

**Maximum** Sets the maximum Integral Output

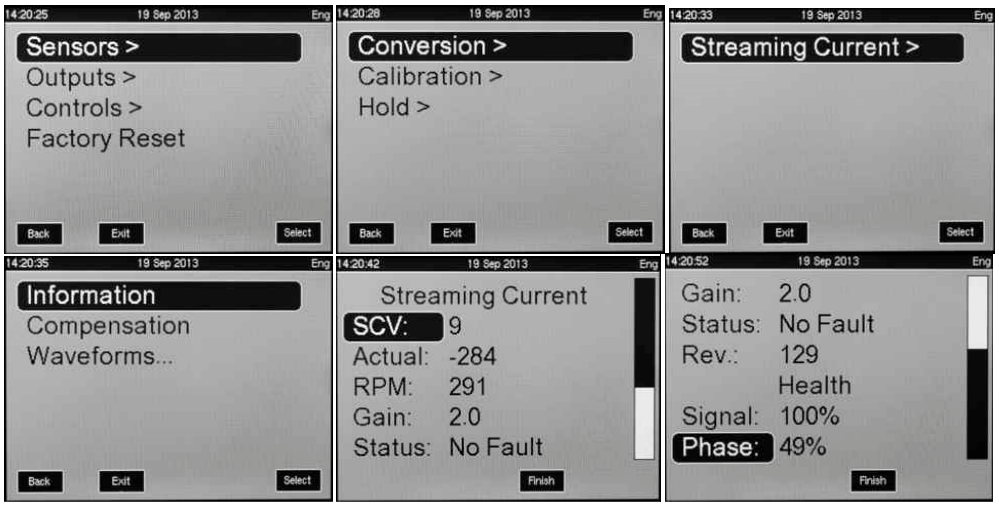
**Finish Screen**

In order to save the PID Controller settings, it is necessary to navigate to this screen and press the Finish button. Otherwise, settings will not be saved.

# 5.0 MAINTENANCE MENU

 The Maintenance menu provides access to the sensor's gain and zero offset settings, as well as a sensor information screen with status and diagnostic readouts, and page to download and view the sensor's waveform.

## 5.1.1 SENSOR INFORMATION (CONVERSION MENU)




**SCV** Streaming Current Value from sensor (subject to zero offset and conductivity compensation).

**Actual** Raw Streaming Current Value from sensor (not subject to zero offset and conductivity compensation)

**RPM** This shows the rotational speed of the drive motor. Speed is dependent on line power frequency. 50 Hz power will produce an RPM of around 240 (+/- 10 RPM), while 60 Hz will be around 290 (+/- 10 RPM). What is important is that speed is stable over time and not bounding around by more than +/- 3 RPM.

**Gain** Sensor's gain setting. This number can read from 1.0 to 600.0

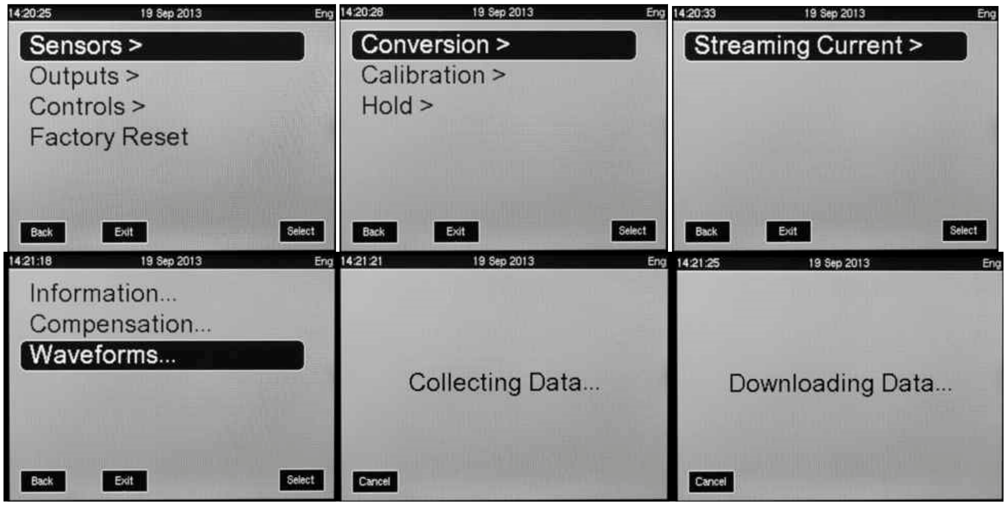
**Status** Sensor fault conditions, such as "Opto Fault" or "Motor Fault" are displayed here.

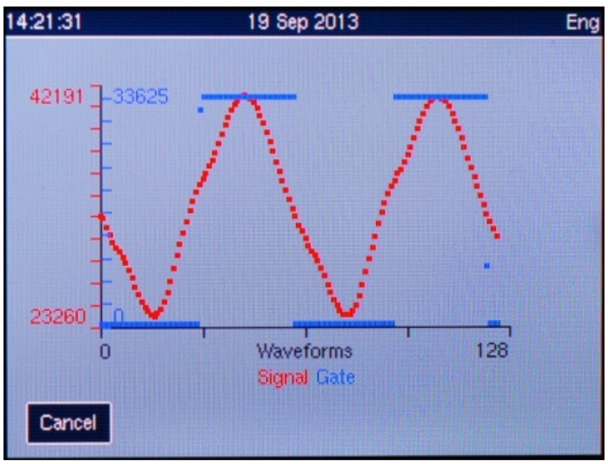
**Rev** Sensor firmware revision

**Signal Health** The Signal Health reading is an advanced diagnostic feature of the DuraTrac 4 sensor. Readings above 90% indicate a good signal is being received from the probe. Readings between 80 to 90% indicate some possible deformities in the signal, but these are not likely impacting the SCV. Sustained readings below 80% indicate a problem with the signal that requires attention (e.g. dirty probe and piston, possible electrical interference, loose drive linkage).

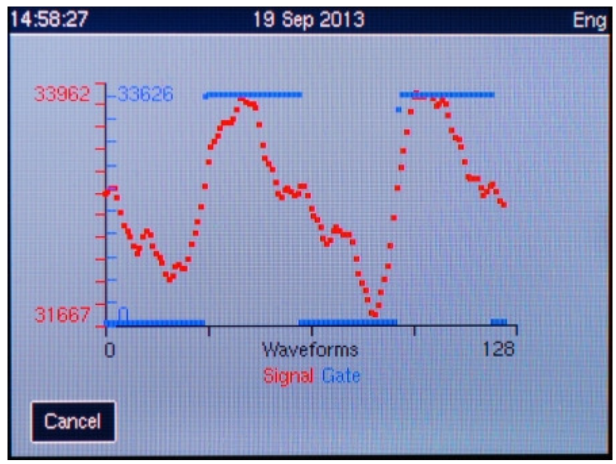
**Phase** Measurement of Optoswitch (square wave) alignment with sensor signal (sine wave). This reading should ideally be 47 to 53%. The reading should only be considered accurate when Actual SCV is more negative than -100. Recommended to pour raw (untreated) water into sensor in order to check Phase measurement.

### 5.1.2 WAVEFORM (CONVERSION MENU)



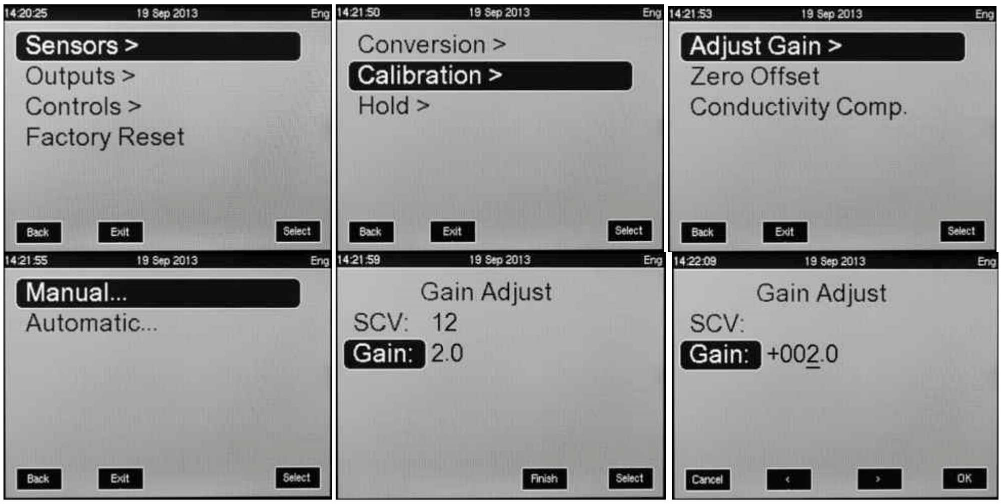

Good Waveform




Marginal Waveform

The waveform download allows the user to see exactly how the signal from the probe and optoswitch appear. The image on the left is how the waveform should appear when a sample of raw (untreated) water is poured into the sensor. The image on the right is an example of how the signal might appear on treated water if the sensor was fouled or if the drive mechanics were to become worn. If a customer is having problems with their sensor, a factory technician will ask the customer to view waveform download and possibly send a picture of the screen to the factory for analysis. This can help shorten troubleshooting efforts.

## 5.1.3 MANUAL GAIN ADJUST (CALIBRATION MENU)

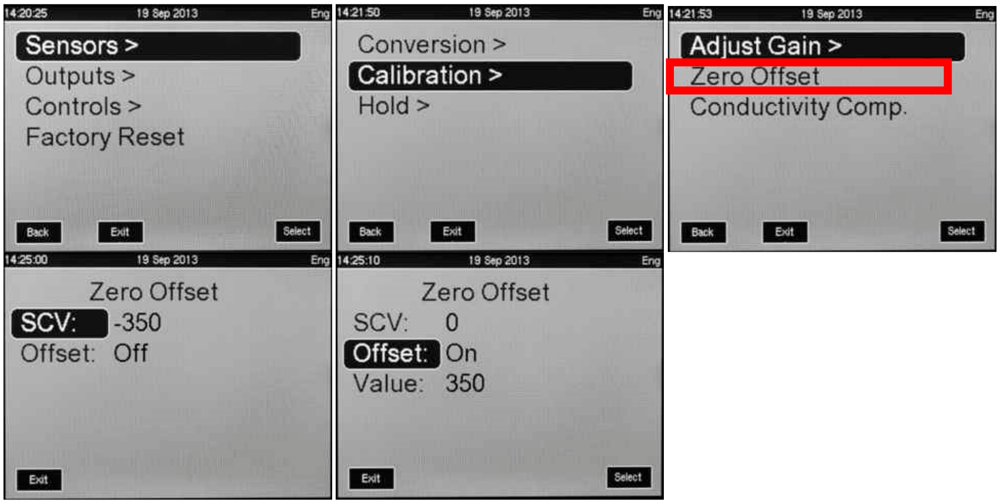



The manual gain adjust allows the user to increase/decrease the instrument's sensitivity, thereby increasing/decreasing the response to process changes. Access the manual gain adjust through the menu as shown above. Details on how to determine optimal gain are presented in section 6.2.

## 5.1.4 AUTOMATIC GAIN ADJUST (CALIBRATION MENU)


With the automatic gain adjust, the analyzer will adjust the gain as necessary to make the streaming current value (SCV) match a value input by the user (within reasonable limits). Access the automatic gain adjustment through the menu as shown above. Details on how to utilize this feature are presented in section 6.2.

### 5.1.5 ZERO OFFSET (CALIBRATION MENU)




The analyzer's zero offset feature allows the user to shift the streaming current value (SCV) to zero. This simplifies the interpretation as a positive value indicates an overfeed of coagulant and a negative value indicates an underfeed of coagulant, assuming the coagulant has a positive charge. Details on how to best utilize this feature are presented in section 6.3.

Note: Any changes to the gain setting while the zero offset is enabled will change effectiveness of the zero offset. If the gain setting is changed, it will be necessary to turn the zero offset off, exit out of the menu so the change is applied, then return and turn the zero offset back on.

# 6.0 OPERATION

## 6.1 INITIAL SETUP PERIOD

To achieve the most reliable performance, the following guidelines should be followed:

1. Ensure the coagulant will be sufficiently mixed into the raw water before it reaches the sample point location.
2. The time it takes for the sensor to see a change in coagulant feed (i.e. Lag Time) should ideally be less than 1 minute. Note: Depending on the coagulant being used and water chemistry conditions, Streaming Current response to the coagulant could be significantly diminished if the lag time is too long.
3. pH of the treated water sample should ideally be kept as stable as possible (preferably +/- 0.2 pH). Be aware that larger pH fluctuations can affect the streaming current measurement and, if large enough, result in having to change the control setpoint value to maintain optimum dosage. Note: Depending on the coagulant being used, Streaming Current response to the coagulant could significantly diminish if pH increases too much.
4. Sample flow rates to the sensor should be kept relatively stable. If flow to the sensor changes by a significant amount (e.g. more than 2 gpm), the SCV reading may drift some in one direction. It is not recommended to install flow meters with any sort of restriction that may become plugged. While the DuraTrac 4 Sensor is capable of working with a flow rate anywhere between 1 and 40 Liters per minute, a flow rate of

at least 4 liters per minute is recommended to help keep solids from accumulating in the sample line and sensor.

5. Coagulant pumps should be kept in good mechanical condition to respond quickly and accurately to process changes.
6. Allow the sensor to run on treated water for at least 1 hour and preferably 3 hours after first installing the sensor (or after cleaning the sensor). This allows time for the sensor to fully condition and stabilize.
7. Raw water quality should be in a stable condition (turbidity, pH, color, etc. should not change rapidly or widely) when initially establishing an optimum “setpoint”.

The monitor should be operated a few days in manual control to observe how it responds to normal process operation and especially manual coagulant feed adjustments. This periods give operators time to become more familiar with how the streaming current sensor responds to various process events.

## 6.2 INITIAL GAIN SETUP

The DuraTrac 4 has a broad range signal gain adjustment of 1X to 600X which allows the user to select the best signal amplification for the application. The main determining factors of what the gain setting needs to be are conductivity and probe wear. As either increases, the gain will also need to be increased. Enabling Conductivity Compensation (see section 4.2) eliminates the need to make constant gain adjustments, but an initial gain setting must be determined by the user. There are three methods for setting the gain that will be discussed here.

### 6.2.1 Automatic Gain Adjustment

This method requires a sample of Raw Water (with no coagulant) be collected and poured into the sensor (an injection port is provided on the front of the sensor to assist with injecting a sample). Once the raw water is introduced, the gain is automatically adjusted to bring the reading to a value of -200. This is an adequately strong signal for most applications and should produce acceptable sensitivity to changes in water quality and coagulant dosage. If the sensitivity seems too high after doing this procedure, repeat the steps but use -00100 in step 7.

1. Stop treated water sample flow.
2. Clean sensor as detailed in section 7.
3. Make sure Zero Offset is Off.
4. Slowly pour in 1 to 2 liters of raw water (or inject 20 mL of raw water into injection port on front of probe block, make sure sensor, piston.
5. On the HydroAct analyzer, Navigate to Menu>Maintenance (upper right icon on HA600) >Sensors>Calibration>Streaming Current>Adjust Gain>Automatic
6. Change the SCV value to show -00200 and then click on OK.
7. Screen will show “Please Wait – Adjustment In Progress”.
8. If the message “Adjustment Failed” appears, repeat procedure starting at step 5.
9. Press the Finish button when adjustment is completed and exit out of menu.

### 6.2.2 Manual Gain Adjustment Based On SCV Response

This method of gain adjustment requires the user to make small adjustments to coagulant dosage to test SC response.

1. Navigate to Menu>Maintenance (upper right icon on HA600) >Sensors>Calibration>Streaming Current>Adjust Gain>Manual
2. Change Gain value to 5.0 for water treatment and 50.0 for wastewater.

3. Increase or decrease coagulant dosage by 10% (e.g. Go from 30 to 33 ppm)
4. Desired change in SCV is 10 to 20 units. If change is smaller, increase the gain. If change is too large, decrease the gain.

## 6.3 ZERO OFFSET

The Zero Offset feature is used to give the operator (or control system) an easy target to adjust coagulant dosage by. That target being a value of 0. If the reading goes to a + reading, then coagulant dosage needs to be reduced. If the reading goes to a negative reading, then coagulant dosage needs to be increased. Enabling the Zero Offset simply cause the analyzer to take a snap shot reading at the moment the zero offset is enabled, and apply an offset that is equal to the reading, but of opposite polarity. For example, if the Zero Offset is enabled when the SCV reading is -80, then the analyzer will continuously apply a +80 offset value to the SCV reading, which causes the Offset reading to be zero whenever the true (or raw) SCV is -80. If raw SCV goes to -83, then the offset reading would be -3 (the value is determined by taking -83 and adding + 80 for a result of -3). Toggling the Zero Offset Off and back On causes the analyzer to grab a new offset value.

Procedure for enabling Zero Offset:

1. Optimize coagulant dosage and allow SCV to stabilize.
2. On the HydroAct analyzer, Navigate to Menu>Maintenance (upper right icon on HA600) >Sensors>Calibration>Streaming Current>Zero Offset
3. Scroll down to highlight “Offset” and change the setting to “On” and then press “OK”
4. This zero’s the SCV reading. The Offset Value will then appear and this value can be adjusted if desired.

## 6.4 VERIFYING INSTRUMENT RESPONSE

If the reading is stable and Signal Health is in the 90% range, then these are good indications the sensor is fine. But there is testing that can be performed to verify proper operation.

### 6.4.1 Online Response Test

This is a simple test that should be performed routinely to check the sensor response to changes in coagulant dosage. This test consist of increasing the coagulant dosage by at least 10% and documenting how much of a response is seen in the SC reading. For example, assume the SC reading is -50 and coagulant dosage is 30 ppm. Increase the coagulant dosage to at least 33 ppm and record how much the reading moves in the positive direction. If the reading goes from -50 to -40, then that is an adequate response. If the reading doesn’t change at all, or only changes by less than 5 units, then this is not an adequate response. At a minimum, a 10 to 20 unit change should occur with the SC reading after coagulant dosage is adjusted by 10%..

If the response is too small or nonexistent, or if the response is greater than 30 units, see the gain adjustment procedure.

### 6.4.2 What To Do If SCV Response Is Poor

If SCV response appears small to chemical feed changes, try cleaning probe and piston, check gain adjustment in accordance with section 4.2, and repeat above testing. If cleaning does not improve response, try replacing piston and probe sleeve. If neither of these improve response, see Section 6 of this manual or contact Chemtrac at 770-449-6233 for additional troubleshooting steps.

## 6.5 PROCEDURE FOR SWITCHING TO AUTOMATIC CONTROL

See section 4.5.3 for PID Control settings menu.

Before putting the controller into Automatic control, it is important to bring the streaming current value (SCV) to within a suitable range of the desired setpoint by manually adjusting the coagulant dosage. Ideally, with the process operating at a steady state, the user will adjust the coagulant feed with the controller in Manual mode to bring the SCV to the setpoint, and then place the controller into Automatic mode.

When initially tuning the PID Loop, it may be desirable to place the controller into Automatic mode when the SCV is away from the setpoint. For example, to see how well the PID loop responds, the user may place the controller in Automatic control with the SCV as much as 50 units away from the setpoint. Once in Automatic control, observe the response of the PID loop to see how well it reacts. That is, look for how long it takes to reach the setpoint with a stable reading and make sure that the PID control settles on a value and the SCV does not continuously oscillate above and below the setpoint. Any indication of oscillation or failure to achieve the desired setpoint would suggest that the PID tuning parameters might need adjustment.

# 7.0 MAINTENANCE

## 7.1 DISCONNECTING 110 / 220 VAC POWER TO MOTOR

**WARNING**

Be certain to disconnect 110 / 220 VAC power to the motor before servicing the sensor. Potential pinch points do exist under the metal shield located on right hand side of enclosure.

Open the Sensor enclosure door and locate the Power Fuse Switch (marked with L1). Flip open the switch as shown below to disconnect power to the motor.

Power Fuse Switch (1 Amp Fuse Located Inside, Open Cover To Replace)

## 7.2 SENSOR CLEANING CONSIDERATIONS

To maintain proper operation, the DuraTrac 4 Sensor will require somewhat routine cleaning of the probe, piston, and occasionally the inside of the probe block. Cleaning frequency is application dependent. Waters that are more heavily loaded with solids or substances which tend to deposit easily on sensor's plastic and/or metal surfaces will require more frequent cleaning intervals.

Besides routine cleaning, cleaning should also be performed if you answer Yes to any of the following questions:

- Has the reading become noticeably less stable?
- Has the Signal Health dropped to below 85% and remained there for 1 minute or longer?
- Is the Signal Health value jumping around sporadically?
- Is the SC signal appearing less responsive to process changes than seen previously?

In many cases, simply running a brush through the sensor and across the piston surfaces to break up deposits and then rinsing with water is all that is required. In other cases, a harder to remove scale, deposit, or stain may have built up on the probe and piston surfaces. In these cases, it is recommended to first try cleaning with a product like powder Comet or Ajax. .

Other products which are designed to remove calcium, lime, iron, and magnesium can also be used if those types of deposits are present and can't be readily removed with the before mentioned cleaners. Avoid using any cleaner or chemical that is aggressive towards delrin plastic or stainless steel. It is also recommended to not "soak" the probe and piston in a cleaning solution unless it is known to be completely compatible with Delrin and Stainless Steel.

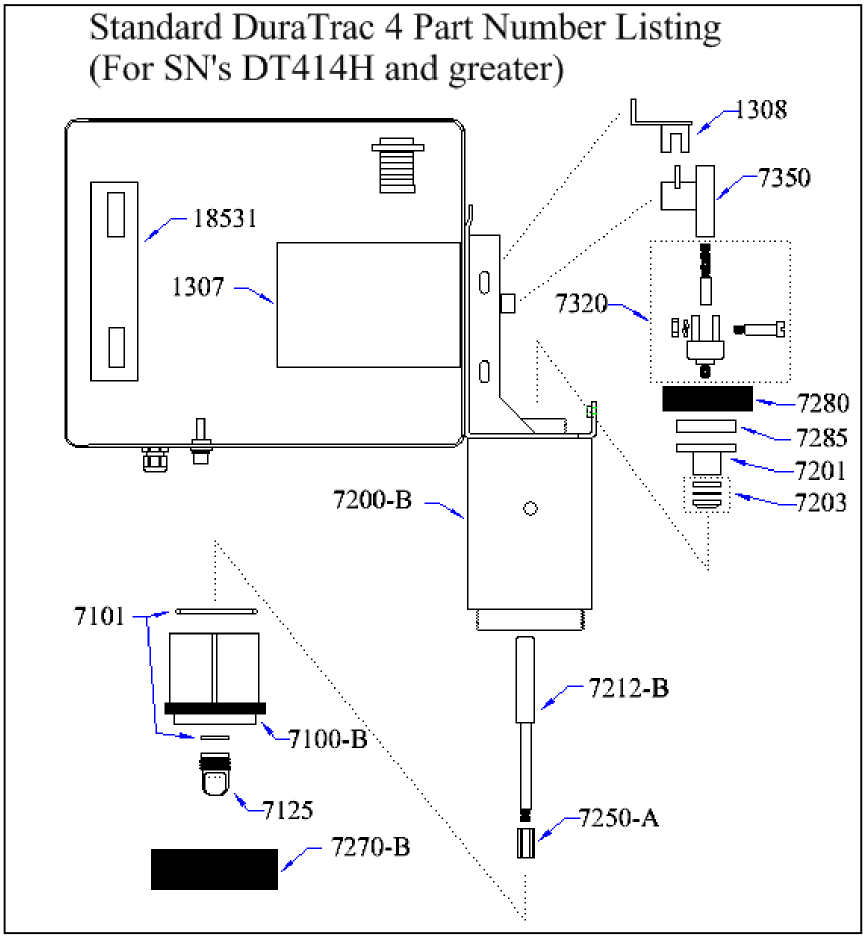
After cleaning the SC reading will require a certain period of time to reach stabilization. During this stabilization time, the SC reading may be seen to slowly climb in the positive direction. In many cases, the probe and piston will condition very quickly to the sample which allows the SC reading to re-stabilize very soon after a cleaning is performed. However, for some applications the stabilization time can be as long as 1 to 2 hours. It is recommended to clean the sensor when everything is expected to be stable and there will be adequate time for the SC reading stabilize.

## 7.3 CLEANING PROCEDURE

1. Stop sample flow to the sensor, and power down the sensor by disconnecting 110 VAC power (a fuse switch is located inside the enclosure in the upper right hand corner and can be used to disconnect 110VAC power).
2. Loosen large slip not at bottom of probe block and pull probe out. Then disconnect probe cable from enclosure by unscrewing the fitting.
3. Reach fingers inside probe block and unscrew piston.
4. Inspect up inside probe block and use spray water and brush to remove any significant solids build up.
5. Take probe and piston to a sink and clean parts using a mild soap or detergent (Comet or Ajax is recommended). Avoid getting TNC connector wet
6. Rinse parts thoroughly and reinstall.
7. Turn sample and 110 VAC power back on.
8. Allow the sensor sufficient time to restabilize before using reading for auto or manual chemical feed adjustment.

## 7.4 PARTS IDENTIFICATION

**Note**: On the inside door of the DuraTrac 4 sensor is a diagram like the one shown below. Refer to that diagram when ordering parts as certain part numbers might change.




## 7.5 PARTS REPLACEMENT INTERVAL

<u>Commonly Replaced Parts (Recommended To Keep Spares Of These On Hand)</u>

**Piston (PN 7250-A):** Every 6 to 12 months on average

**Probe Sleeve (PN 7100):** This is a factory serviceable part. Do not discard. Send back to factory for refurbishment.

**Seal Kit (PN 7203):** Replacement interval depends on applied sensor pressure and level of solids in sensor. If leaking occurs out the bleed hole, first try tightening PN 7280 (Compression Nut) by hand (don't use wrench!). If Nut is fully hand tight, replace seal kit.

**Yoke, Shoulder Bolt, and Rod End (PN 7320)**: Every 3 years on average (replacement only necessary when loose motion is detected between those parts, and especially if Signal Health has dropped below 90%)

Less Commonly Replaced Parts

**Guide (PN 7212-B):** Guide is expected to last beyond 5 years. Replacement is generally only necessary due to damage from over tightening piston or yoke.

**Crank (PN 7350):** Crank expected to last beyond 5 years. If Crank feels loose, replacement may be necessary.

**Motor (PN 1307):** Motor is expected to last beyond 5 years. If oil leaks out of motor or a very noticeable grinding / rubbing sound is heard from motor, replacement is recommended.

## 8.0 TROUBLESHOOTING

| PROBLEMS | POSSIBLE CAUSE(S) | CORRECTIVE ACTION |
|---|---|---|
| **1.** Signal Health reading below 80%. | **A.** Probe / Piston dirty.<br>**B.** Cell bottom plug loose or O-ring missing.<br>**C.** Flush assembly (if installed) is malfunctioning.<br>**D.** Drive linkage loose.<br>**E.** Electrical interference, galvanic currents | **A.** Clean probe & piston.<br>**B.** Tighten plug. Replace O-ring<br>**C.** Verify water is not leaking past flush control valve. Clean out and verify proper operation of check valve.<br>**D.** Inspect drive linkage to make sure all parts fit tightly together and move as one piece.<br>**E.** Ensure any metal piping and/or sample pumps are properly grounded. |
| **2.** Opto/Motor Fault Alarm is active | **A.** Motor has stopped turning.<br>**B.** Opto Switch damaged / failed, or wiring is loose.<br>**C.** Sensor card malfunction. | **A.** Inspect and replace motor if necessary.<br>**B.** Inspect and replace Opto switch if necessary. Ensure Opto wiring is secure on sensor card.<br>**C.** Sensor card may need to be replaced. |
| **3.** SC reading fluctuates rapidly and widely.<br>Note: First review above checklist for "Signal Health reading below 80%" | **A.** Incomplete dispersion or mixing of coagulant(s) at point of sampling.<br>**D.** Chemical feeders in need of maintenance or partially plugged.<br>**E.** GAIN setting too sensitive. | **A.** Resolve mixing problems. Move coagulant injection point to location that provides for better mixing. Use carrier/dilution water with coagulant. Move sampling point further downstream.<br>**B.** Inspect and service feeders. Unplug lines / injection ports. .<br>**C.** Decrease GAIN setting. |
| **4.** Display does not change with change in coagulant/polymer dosage. | **A.** GAIN setting too low.<br>**B.** Wrong sample point or insufficient mixing..<br>**C.** Sample cell dirty.<br>**D.** Excessive "lag time" between chemical injection point and sensor sample | **A.** Increase GAIN setting.<br>**B.** Select correct sample point, improve mixing.<br>**C.** Clean cell *(see Cleaning Procedures)*.<br>**D.** Move sampling point closer to coagulant feed point and/or decrease sample TRANSPORT |

| | | |
|---|---|---|
| | cell.<br>**E.** Chemical feeders in need of maintenance. | time<br>**E.** Perform draw down to verify feeders are adjusting feed rate correctly. |
| **5.** SC reading very close to 0 at all times. | **A.** No water sample to sensor.<br>**B.** Loose probe connection, loose internal connection on sensor card.<br>**C.** Electrodes in probe covered with scale.<br>**D.** Probe malfunction. | **A.** Establish proper sample flow.<br>**B.** Verify probe connector is fully screwed on. Open sensor enclosure and inspect to make sure sensor wiring is secure.<br>**C.** Clean electrodes to remove scale and expose bare metal.<br>**D.** Unscrew probe assembly and inspect wiring. Make sure there is no water intrusion or corrosion. |

CONTACT CHEMTRAC FOR FURTHER ADVICE & ASSISTANCE

Chemtrac has over 25 years experience making Streaming Current technology work for their customers and our extensive knowledge of streaming current and coagulation is what keeps our customers coming back. While this might sound like a sales pitch, it is meant to be a challenge to our new customers to actually give us a call and see how much we really can help. If there are any questions about what you will read in this manual, or if you have questions that our manual does not answer, please contact us using any of the below methods.

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