Installation and Operating Instructions

Series 501-400 Sludge Blanket & Clarifier Control Monitor CCS4000™ using DE400C Controller
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Series 501-400 Sludge Blanket & Clarifier Control Monitor CCS4000™ using DE400C Controller
IMPORTANT NOTICE

1. Temperature

   The Transducer (Sensor) Supplied with this System

   !

   MUST NOT BE EXPOSED TO TEMPERATURES BELOW 20°F OPERATING OR STORAGE.

   Exposure to Temperatures below 20°F
   May Cause Sensor Failure.

2. Handling

   The Transducer (Sensor) Supplied with this System

   !

   MUST NOT BE EXPOSED TO MECHANICAL SHOCK,
   ESPECIALLY AT LOW TEMPERATURES.

   Mishandling May Cause Sensor Failure.

   See Section 2.6 Cold Temperature Sensor Exposure
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Section 1: Introduction

1.1 System Description

This manual includes instructions for the Drexelbrook 501-400 Series CCS4000™ Sludge Blanket & Clarifier Control Monitor. The CCS4000 is a multi-channel microprocessor based system that uses ultrasonic technology for measurement of the light rag (fluff) layer and the dense sludge blanket levels, as well as clarity loss of the liquor in municipal and industrial wastewater and water treatment applications.

A typical CCS4000 analyzer is comprised of one DE4000C programmable microcontroller, and up to four Transceiver/Transducer Probe Subsystems (TPS).

1.1.1 DE4000C Controller

The DE4000C is a microcontroller-based receiver that provides power and original control to a remote Transceiver/Transducer Probe Subsystem (TPS). It accepts conditioned analog echo signals, performs signal processing, and control process functions according to user-programmed menu selections.

The DE4000C Controller operates from 120/240 Vac, 50/60 Hz power. It is housed in a NEMA 4X fiberglass enclosure.

The DE4000C Controller is equipped with:

- Two 4-20 mA loops per channel, user assignable to sludge level, rag level, clarity loss, and signal quality.
- Two control/alarm relays per channel, 5 amp SPDT, user assignable to sludge level, rag level, clarity loss, and signal quality.
- One common alarm relay, 5 amp SPDT.
- One fault, system malfunction relay, 5 amp SPDT.
- RS232 and RS485 communication for use with optional Scopeview™ 4000 PC software.
- LCD display with back light.
- Front panel keypad.
- Power switch with re-settable circuit breaker.
1.1.2 Transceiver/Transducer Probe Subsystem

The Transceiver/Transducer Probe Subsystem (TPS) is a self-contained remote subsystem comprised of:

- A transceiver electronic chassis (40C-100-series) mounted in a five-inch explosionproof housing.
- A transducer (705-600 series) probe assembly that is mounted to the housing to form an integral electronics and probe subsystem.
- 380-series connecting cable.

1.2 Types of Measurement

1.2.1 Sludge Level

The Sludge Level measurement is typically field configured to track the compacted sludge level, and is used to control the sludge withdrawal process.

1.2.2 Rag Level

The Rag Level measurement is factory set to track the lightest sludge that is usually found above the compacted sludge blanket. The rag level can be tracked independently from the compacted sludge to monitor the settling characteristics in the vessel and control chemical usage.

1.2.3 Clarity Loss

The Clarity Loss measurement provides an indication of the relative change in suspended solids in a defined zone in the vessel, usually the zone between 2 and 3 feet (0.61m and 0.92m) from the water surface. The Clarity Loss signal provides an early warning of worsening effluent quality.

1.2.4 Signal Quality

Signal Quality is an indication of the overall strength of the sonic profile of the vessel. Signal Quality is affected by the overall tank conditions and the sensor cleanliness.
### 1.3 Model Number

#### The CCS4000 - System Number

<table>
<thead>
<tr>
<th>Technology</th>
<th>Number of Channels</th>
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<tbody>
<tr>
<td>501 - 0400 - 00X</td>
<td>CCS4000 Sludge Blanket and Clarity Control Analyzer</td>
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<tr>
<td>1</td>
<td>1 Channel</td>
</tr>
<tr>
<td>2</td>
<td>2 Channels</td>
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<td>380 - 5XXX - 00X</td>
<td>CCS4000 8-Conductor Cable</td>
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<tr>
<td>025</td>
<td>25 Foot</td>
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<tr>
<td>075</td>
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<tr>
<td>2 CE Mark</td>
</tr>
<tr>
<td>7 Standard (No Approvals)</td>
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#### The CCS4000 - Mounting Assembly Number

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<td>Mounting Assembly</td>
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<td>23</td>
<td>Flush Mounting Bracket</td>
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<td>24</td>
<td>12-Inch Hinged Mounting Bracket for Rigid Sensors</td>
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<td>25</td>
<td>24-Inch Hinged Mounting Bracket for Rigid Sensors</td>
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<tr>
<td>38</td>
<td>12-Inch Cam Mounting Bracket for Rigid or Cable Sensors</td>
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<td>39</td>
<td>24-Inch Cam Mounting for Rigid or Cable Sensors</td>
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<td>54</td>
<td>12-Inch Mounting Bracket for Cable Sensors</td>
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<td>CE Mark</td>
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### 1.3 Model Number (Continued)

#### The CCS4000 - Transceiver Number

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<th>Application</th>
<th>Chassis Options</th>
<th>Transducer Options</th>
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<td>0 Wastewater Application</td>
<td>1 Chassis Only</td>
<td>0 Standard Transducer</td>
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<td></td>
<td>1 Water or Industrial Treatment Application</td>
<td>4 CE Mark</td>
<td>1 Standard Transducer</td>
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<td>2 Reserved</td>
<td>6 Drexelcote Remote</td>
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#### The CCS4000 - Sensing Element Number

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<th>Transducer Length</th>
<th>Application</th>
<th>Chassis Options</th>
<th>Transducer Options</th>
</tr>
</thead>
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<tr>
<td>705 - 06XX - XXX CCS4000 Transducer</td>
<td>0 Cable Probe</td>
<td>0 No Transducer Cover Length</td>
<td>0 Standard</td>
<td>0 Integral</td>
<td>0 Standard Transducer</td>
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<tr>
<td></td>
<td>1 Rigid Probe</td>
<td>1 12-Inch Transducer Cover Length</td>
<td>1 Submerged</td>
<td>1 Remote</td>
<td>2 PVC Transducer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 6-Inch Transducer Cover Length</td>
<td></td>
<td>2 Drexelcote Remote</td>
<td>6 PFA Transducer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 18-Inch Transducer Cover Length</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Model Number: 4 0 C - 0 1 0 0 - 0

Model Number: 7 0 5 - 0 6 - - -
Section 2: Installation

2.1 Unpacking

Carefully remove the contents of the shipping carton and check each item against the packing list before destroying any packing material. If there is any shortage or damage, report it immediately to the factory (1-800-527-6297).

2.2 Mounting the Controller

The DE4000C controller is designed for either indoor or outdoor mounting, but should be mounted in a location as free as possible from vibration, corrosive atmospheres, and any possibility of mechanical damage.

- It can be mounted up to 1000 feet (305 meters) from the Transducer/Transceiver Probe Subsystem.
- For convenience at start-up, place the instrument in a reasonably accessible location.
- Ambient temperatures for the location of the DE4000C should be between -28°F and 140°F (-20°C to 60°C).

\[\text{NOTICE} \]

Allow the DE4000C Controller to warm up for 30 minutes when ambient temperatures are below -28°F (-20°C) or unit has been stored between -28°F to -40°F (-20°C to -40°C).

Figures 2-1 and 2-2 show the mounting dimensions for the CCS4000 Controller and Transceiver.

2.3 Mounting the Transducer

There are four types of transducer/transceiver installations:

- Cable Probe installation with flush mounting (Figure 2-3)
- Cable Probe installation with extended mounting (Figure 2-4)
- Rigid Probe installation with flush mounting (Figure 2-5)
- Rigid Probe installation with extended mounting (Figure 2-6)

The installation of the TPS assembly is described in the following paragraphs, depending on the type of vessel.

The operating and storage (non-operating) temperature of the transducer is 20°F to 160°F (-7°C to +71°C).

- Do Not Expose the Sensing Element to Mechanical Shock Due to Mishandling
2.3.1 Circular Vessels

The Transducer/Transceiver Probe Subsystem mounts to the bridge railing using the furnished mounting assembly. In most applications, the bridge railing is a 2-inch (51mm) round pipe and does not require additional mounting brackets. When the railing is I-beam or T-rail, an optional mounting bracket adapter (part # 783-364-40, see Figure 2-6) is available.

The Transducer/Transceiver Probe Subsystem should be mounted away from the influent inlet. Generally the TPS is mounted 1/3 to ½ the radius of the tank, measured from the outer tank wall, so that the sensor is kept away from the influent inlet, and the affects of aeration and turbulence are reduced.

Many vessels have surface skimmers for floating scum removal. The surface skimmer rotates along the top of the water surface and engages the TPS. The TPS is lifted out of the water by the surface skimmer, but this action does not affect the operation of the CCS4000 Clarifier Control.

When surface skimmers are present, do not mount the sensor in the path of the skimmer as it approaches the bridge, rather install it on the side of the bridge where the skimmer emerges, as shown below.

![Diagram of sensor placement](image)

*Tanks without surface rakes, especially Primary Thickeners, and Rectangular Primaries without surface flights (in almost all cases) require an Anti-Fouling mechanism, such as a Cam Lift, Spray Wash, or Periodic Cleaning.* [See Section 2.5.2]

2.3.2 Rectangular Vessels

The Transducer/Transceiver Probe Subsystem mounts to the bridge railing using the furnished mounting assembly. In most applications, the bridge railing is a 2-inch (51mm) round pipe and does not require additional mounting brackets. When the railing is I-beam or T-rail, an optional mounting bracket adapter (part # 783-364-40, see Figure 2-6) is available.
2.3.2 Rectangular Vessels (Continued)

The TPS should be mounted away from the influent inlet to avoid the affects of aeration and turbulence. There are several mounting assembly options that allow the TPS to be mounted at the end or side of the vessel, and in the path of the surface flights.

2.3.3 Mounting Dimensions

![Figure 2-1](image1)
CCS4000 Controller Mounting Dimensions
Inches (mm)

![Figure 2-2](image2)
CCS4000 Transceiver Mounting Dimensions
Inches (mm)
2.3.4 Installation of Flush Mount Hardware (Cable Probe)

1. Standard Railing Instructions:
   A. Place mounting bracket support on top of horizontal railing then slide lower bracket support onto lower horizontal railing. Attach lower bracket support with U-Bolt and nuts.
   B. Tighten bracket set screw to upper railing to secure mounting bracket.

2. Non-Standard Railing Instructions:
   A. Locate position along railing for adapter assembly then drill 9/16” diameter holes in railing using adapter hole template (Figure 2-16).
   B. Attach mounting bracket support with adapter assembly to railing with 3/8 diameter bolts, nuts and washers.

3. Tighten bracket set screw to upper railing to secure mounting bracket.

4. Using small U-Bolts, adjust probe assembly height so transducer face is approximately 3” below surface of water.

5. Confirm that electronic housing hub is perpendicular to railing. If not, reposition using small U-Bolts.

---

**Figure 2-3**

*Cable Probe Installation with Flush Mounting*
2.3.5 Installation of Extended (12" or 24") Mounting Hardware

1. Using small U-Bolts, adjust probe assembly height so transducer face is approximately 3" below surface of water.

2. Confirm that electronic housing hub is perpendicular to railing. If not, reposition using small U-Bolts.

3. Standard Railing Instructions:
   A. Place mounting bracket support on top of horizontal railing then slide lower bracket support onto lower horizontal railing. Attach lower bracket support with U-Bolt and nuts.
   B. Tighten bracket set screw to upper railing to secure mounting bracket.

4. Non-Standard Railing Instructions:
   A. Locate position along railing for adapter assembly then drill 9/16" diameter holes in railing using adapter hole template (Figure 2-16).
   B. Attach mounting bracket support with adapter assembly to railing with 3/8 diameter bolts, nuts and washers.

Figure 2-4
Cable Probe Installation with Extended Mounting
2.3.6 Installation of Flush Mount Hardware (Rigid Probe)

1. Standard Railing Instructions:
   A. Place mounting bracket support on top of horizontal railing then slide lower bracket support onto lower horizontal railing. Attach lower bracket support with U-Bolt and nuts.
   B. Tighten bracket set screw to upper railing to secure mounting bracket.

2. Non-Standard Railing Instructions:
   A. Locate position along railing for adapter assembly then drill 9/16” diameter holes in railing using adapter hole template (Figure 2-16).
   B. Attach mounting bracket support with adapter assembly to railing with 3/8 diameter bolts, nuts and washers.

3. Tighten bracket set screw to upper railing to secure mounting bracket.

4. Using small U-Bolts, adjust probe assembly height so transducer face is approximately 3” below surface of water.

5. Confirm that electronic housing hub is perpendicular to railing. If not, reposition using small U-Bolts.

![Diagram of Rigid Probe Installation with Flush Mounting]

Figure 2-5
Rigid Probe Installation with Flush Mounting
2.3.7 Installation of Swing Arm Mounting Hardware

1. Using small U-Bolts, adjust probe assembly height so transducer face is approximately 3” below surface of water.

2. Confirm that electronic housing hub is perpendicular to railing. If not, reposition using small U-Bolts.

3. Confirm that rake guard extends 3” past transducer face. If not, reposition using small U-Bolts.

4. Standard Railing Instructions:
   A. Place mounting bracket support on top of horizontal railing then slide lower bracket support onto lower horizontal railing. Attach lower bracket support with U-Bolt and nuts.
   B. Tighten bracket set screw to upper railing to secure mounting bracket.

5. Non-Standard Railing Instructions:
   A. Locate position along railing for adapter assembly then drill 9/16” diameter holes in railing using adapter hole template (Figure 2-16).
   B. Attach mounting bracket support with adapter assembly to railing with 3/8 diameter bolts, nuts and washers.

6. If necessary, reposition vertical set bolt so that transducer face is parallel with water surface. (See Detail A-A).

![Diagram of Rigid Probe Installation with Swing Arm Mounting](image-url)
2.4 Wiring Instructions

The following subsections detail the wiring connections for the DE4000 Controller and the 40C-100 Transceiver.

2.4.1 Controller Wiring

8-Conductor Cable Wiring

One cable for each active channel is provided to connect each 40C-100 transceiver to the DE4000C controller. The cable contains eight color-coded conductors and a drain wire. Wiring for each channel is identical. Refer to Figure 2-7.

4-20 mA Output Wiring

Each channel comes standard with two analog output loops. The recommended wire size for the output wiring is #18 AWG with a shield wire (connected to COM). Wiring for each channel is identical. Refer to Figure 2-8.

The analog output loops can be configured to source or sink the 4-20mA current. Refer to Figure 2-9.
2.4.1 Controller Wiring (Continued)

4-20 mA Output Wiring (Continued)

- Remove power. (See Figure 2-12).
- Remove the analog output card from slot.
- To source the current (use the CCS4000 to power the output loop) move the jumper block to the SRC position.
- To sink the current (use an independent power source for the output loop) move the jumper to the SNK position.
- Re-insert the analog output card into slot.
- Re-apply power. (See Figure 2-12).

**Notice**

*Isolation Barriers are required for each 4-20mA Loop that has external grounding.*

*Figure 2-8*

4-20 Output Wiring
2.4.1 Controller Wiring (Continued)

 Relay Wiring

Each channel is furnished with two 5A, SPDT relays. The recommended wire size for the relay wiring is #18 AWG. The relay contacts are shown in their alarm, or power off condition. Wiring for each channel is identical. Refer to Figure 2-10.

Figure 2-9
Selecting Sink or Source Current on Analog Output Card

Figure 2-10
Relay Wiring Detail
2.4.1 Controller Wiring (Continued)

Common Alarm Relay Wiring

The CCS4000 Clarifier Control has one 5A, SPDT common alarm relay. The recommended wire size for the common alarm relay wiring is #18 AWG. The relay contacts are shown in their alarm, or power off condition. Refer to Figure 2-10.

Fault Relay Wiring

The CCS4000 Clarifier Control has one 5A, SPDT fault relay. The recommended wire size for the relay wiring is #18 AWG. The relay contacts are shown in their alarm, or power off condition. Refer to Figure 2-10.

Remote Acknowledge Wiring

The CCS4000 alarms or fault can be acknowledged remotely by connecting a normally-open pushbutton to the ACK and COM terminals located on the last row of terminal blocks 1 and 2 (TB1 and TB2). Refer to Figure 2-11.

Figure 2-11
Remote Acknowledge Wiring Detail
2.4.1 Controller Wiring (Continued)

Power Wiring

The CCS4000 Clarifier Control can be powered from either 120 or 240 Vac @ 50/60 Hz without modification to the power supply. The recommended wire size for the input power is #14 AWG. See Figure 2-12.

The CCS4000 Clarifier Control has a power switch located on top of the power supply. The switch is also the circuit breaker for the unit. See Figure 2-12.

Communications Wiring

Optional Scopeview 4000 software is available for use with the CCS4000 Clarifier Control for remote monitoring and calibration, data trending, and file saving. When a CCS4000 Clarifier Control is connected to the Scopeview 4000 software, either RS232 or RS485 communication protocol can be used. When RS232 communications is selected, the distance between the DE4000C Controller and the computer is limited to 25 feet. The connection can be made using either a standard serial cable or a null modem cable. JP1 is used to select the type of serial connection; the connection is made to J7. See Figure 2-13.
Communications Wiring (Continued)

If two or more CCS4000 Clarifier Controls are connected to one computer, or the distance between one controller and the computer is greater than 25 feet, RS485 communication protocol is required. The maximum distance between the DE4000C Controller and the computer is 3000 feet. See Figure 2-14.

Figure 2-13
RS232 Communication Cable Connection

Figure 2-14
RS485 Communication Wiring
2.4.2 Transceiver Wiring

The 40C-100 Transceiver connects to the DE4000C Controller using the 8-conductor cable provided with the system. Wiring for each transceiver is identical. See Figure 2-15 for wiring detail.

![Transceiver Wiring Diagram]

**Figure 2-15**
Transceiver Wiring Detail

Yellow wire is a spare that may be connected to an unused terminal.
2.5 Installation Options

2.5.1 Flat Rail Adapter (Part # 783-364-40)

The flat rail adapter template is shown actual size in Figure 2-16.
2.5.2 Cam Lift Mounting Assembly (Part # 280-15-138, -139, -156, -157)

In applications where there is a tendency for solids to rise from the sludge blanket and collect on the sensor, a cam lift mounting is recommended. The cam lift mounting periodically moves the sensor and keeps it free of bubbles and debris. See Figure 2-17.

**Installation Instructions**

1. Connect power cord to automated lift assembly as follows:
   (If there is no ground wire, a jumper must be placed between L2 and GND).
   A. AC Hot to L1  
   B. AC Neutral to L2  
   C. Ground to GND

2. Attach automated lift assembly to bracket arm assembly using mounting bar, lockwashers and bolts. Be sure to position mounting bar on automated lift assembly slots. Screw bolts with lockwashers into bracket arm assembly.

3. Set time interval between lifts by adjusting SW2 as follows:
   A. Set to 0 = rapid interval  
   B. Set to 1 through 9 = each setting adds 5-minute time intervals  
      setting 1 = 1-5 minutes  
      setting 2 = 2-10 minutes, etc...

   To induce a lift cycle, press SW1.

4. To adjust position of probe assembly lift, loosen bolts on automated lift assembly. Slide into new position and tighten bolts.

![Figure 2-17 Cam Lift Mounting Assembly](image-url)
2.5.3 Spray Wash Mounting Assembly

Figure 2-18
Spray Wash Assembly
2.6 Cold Temperature Sensor Exposure

Warning

Temperatures under 20°F (-7°C) will damage the sensor crystal.

This can especially happen when the tank is drained, or level in the tank drops below the sensor during seasonally cold weather. If the temperature is expected to drop under 20°F (-7°C), it is imperative to remove the sensor and place it in a warmer area. It is easier to remove the entire transmitter assembly.

Action

It is the user’s responsibility to protect the sensor. With care, the sensor can have a very long lifetime. When very low temperatures are expected, do the following:

For Temperatures Above 20°F (-7°C) but Below 32°F (0°C):

The Model CCS4000
Channels 2 through 4 may be turned off using the menu selection. This removes the ping drive from the sensor. Channel 1 is the default channel and cannot be turned off this way. For channel 1, disconnect and tape the trigger (TR+) output lead (blue wire) at the 4000 controller.

The Model CCS2000
Is a single channel device, therefore user must disconnect and tape the trigger (TR+) output lead (blue wire) at the 2000 controller.

---

**Figure 2-19**
Under Transceiver Cover

---

Disconnect cable and release from assembly
2.6 Cold Temperature Sensor Exposure (Continued)

For Temperatures Below 20°F (-7°C)

Remove the sensor and transmitter assembly:

1. Under the transceiver cover (see Figure 2-19) disconnect the cable and release the conduit nut to free the cable.
2. Protect the free end of the cable from the weather.
3. Remove the mounting bracket and U-bolt support from the railing (Figures 2-3 through 2-6).

Handling Precautions:

Be careful to never mechanically shock the sensor, such as dropping to a hard surface!

Storage Precautions:

Always store in temperatures above 20°F (-7°C)!

Sensor Failure Symptoms:

Reduced or complete loss of signal and/or drive recovery (ring-down). On Model CCS4000 this may be observed on graphic display screen.

A partially damaged sensor may have a signal. Temporarily an increase in power may compensate, but not recommended as a long term solution. A damaged sensor will continue to degrade and requires replacement.
Section 3
Section 3: Operation

3.1 Keypad and Panel LEDs

Figure 3-1
CCS4000 Clarifier Control Keypad and Panel LEDs
Table 3-1 and 3-2 define their functions

<table>
<thead>
<tr>
<th>Keypad Button</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEAR</td>
<td>Returns a menu parameter to its previous value in the editing mode before it has been accepted. However, once the menu item has been accepted by pressing ENTER, pressing CLEAR does not restore the previous value.</td>
</tr>
<tr>
<td>DISPLAY</td>
<td>Exits the configuration menu. Also used to toggle the screen through the various display views.</td>
</tr>
<tr>
<td>EDIT</td>
<td>Enables a change of a menu item.</td>
</tr>
<tr>
<td>ACK</td>
<td>Acknowledges an alarm or fault condition.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Accepts a menu item change.</td>
</tr>
<tr>
<td>ARROW KEYS</td>
<td>Navigate through the menu pages and the items on each page, and allows changing of values after EDIT is pressed.</td>
</tr>
<tr>
<td>SLUDGE VIEW</td>
<td>Changes the screen to the large font view of the sludge level.</td>
</tr>
<tr>
<td>RAG VIEW</td>
<td>Changes the screen to the large font view of the rag level.</td>
</tr>
<tr>
<td>CLARITY LOSS VIEW</td>
<td>Changes the screen to the large font view of the clarity loss.</td>
</tr>
</tbody>
</table>

Table 3-1
Keypad Terms and Definitions
### 3.1 Keypad and Panel LEDs (Continued)

<table>
<thead>
<tr>
<th>LED</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAULT - LOW SIGNAL</td>
<td>If the signal quality drops to 0.0 for one minute, the yellow Fault LED lights and the fault relay de-energizes (alarm condition). The display automatically reverts to the All Tank View (except in cases where only one channel is in use), and the affected channel alternately flashes Signal Lost! and the Tag ID. If ACK is pressed, the relay re-energizes and the Fault LED remains lit. The message Signal Lost! continues to flash until the fault condition is cleared. If the ACK button is not pressed and the fault condition clears, the system automatically returns to normal.</td>
</tr>
<tr>
<td>FAULT - NEAR ZONE</td>
<td>If the rag level approaches the near zone (1 foot or 0.3 meters), the yellow Fault LED lights and the fault relay de-energizes (alarm condition). The display automatically reverts to the All Tank View (except in cases where only one channel is in use), and the affected channel alternately flashes Near Zone Fault! and the Tag ID. If ACK is pressed, the relay re-energizes and the Fault LED remains lit. The message Near Zone Fault! continues to flash until the fault condition is cleared. The system returns to normal when the condition has cleared and the ACK button is pressed.</td>
</tr>
<tr>
<td>SYSTEM FAULT</td>
<td>Yellow LED is lit when there is a continuous self-diagnostics failure.</td>
</tr>
<tr>
<td>ALARM</td>
<td>If the common alarm is enabled and the alarm setpoint is exceeded, the Alarm LED lights and the common alarm relay de-energizes (alarm condition). The display automatically reverts to the All Tank View (except in cases where only one channel is in use), and the affected channel parameter flashes on the display. If ACK is pressed, the relay re-energizes and the Alarm LED remains lit. The channel’s parameter continues to flash. When the alarm condition is is no longer present for one minute, the system returns to normal.</td>
</tr>
<tr>
<td>RELAYS ON MANUAL</td>
<td>Yellow LED is lit when the relays are put into manual operation.</td>
</tr>
</tbody>
</table>

*Table 3-2*  
LED Terms and Definitions
3.2 Display Options

The CCS4000 Clarifier Control is designed with a LCD graphic display and has several viewing options. Once power is applied to the unit, the CCS4000 Clarifier Control momentarily displays the software version.

Sludge View

The Sludge View button on the keypad is used to view the Sludge level. This large font display option is useful when the screen is viewed at a distance, or when no other information pertaining to the vessel is desired. Press SLUDGE VIEW again to scroll through each active channel.

Rag Layer View

The Rag Layer View button on the keypad is used to view the Rag level. This large font display option is useful when the screen is viewed at a distance, or when no other information pertaining to the vessel is desired. Press RAG LAYER VIEW again to scroll through each active channel.

Clarity Loss View

The Clarity Loss View button on the keypad is used to view Clarity Loss. This large font display option is useful when the screen is viewed at a distance, or when no other information pertaining to the vessel is desired. Press CLARITY LOSS VIEW again to scroll through each active channel.
3.2 Display Options (Continued)

All Tank View (A and B)

The All Tank view is useful to view the Sludge Level, Rag Level and Clarity Loss for each channel on one screen (A). The user can also view the Relay (source), Relay Status and Signal Quality for each channel on the next screen (B) by pressing DISPLAY. The All Tank view is visible when two or more channels are activated. When a channel is inactive, the respective quadrant on the display is labeled Channel Off. In instances where only one tank is active, the All Tank view is no longer displayed. See Single Tank View.

A

<table>
<thead>
<tr>
<th>Tank 1</th>
<th>Tank 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sludge Level</td>
<td>2.4 ft</td>
</tr>
<tr>
<td>Rag Level</td>
<td>3.1 ft</td>
</tr>
<tr>
<td>Clarity Loss</td>
<td>12 %</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Sludge Level</td>
<td>1.2 ft</td>
</tr>
<tr>
<td>Rag Level</td>
<td>2.1 ft</td>
</tr>
<tr>
<td>Clarity Loss</td>
<td>17 %</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Sludge Level</td>
<td>2.7 ft</td>
</tr>
<tr>
<td>Rag Level</td>
<td>3.4 ft</td>
</tr>
<tr>
<td>Clarity Loss</td>
<td>07 %</td>
</tr>
</tbody>
</table>

B

<table>
<thead>
<tr>
<th>Tank 1</th>
<th>Tank 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Quality</td>
<td>5.4</td>
</tr>
<tr>
<td>Relay 1 (Sludge)</td>
<td>DE</td>
</tr>
<tr>
<td>Relay 2 (Rag)</td>
<td>DE</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal Quality</td>
<td>3.7</td>
</tr>
<tr>
<td>Relay 1 (Sludge)</td>
<td>EN</td>
</tr>
<tr>
<td>Relay 2 (Rag)</td>
<td>EN</td>
</tr>
</tbody>
</table>

DE de-energized relay (alarm condition)
EN energized relay (normal condition)

Single Tank View

The Single Tank view is useful to view the Sludge Level, Rag Level, Clarity Loss, Relay Source, Relay Status and Signal Quality for one channel. Each active channel can be viewed in turn by pressing DISPLAY.
3.2 Display Options (Continued)

Waveform View

The Waveform View is used to display the echo profile of the vessel. The waveform of each active channel can be viewed in turn by pressing DISPLAY. When viewing the waveform, the top of the vessel is at the left edge of the display. The bottom of the vessel, indicated by a double line, is on the right. Each profile includes a Tag ID, a numerical display of the calculated sludge level, and a single line to mark the sludge level interface on the waveform.

*Double line indicates the configured tank depth.*
Section 4
Section 4: Configuration

4.1 Entering the Configuration Menu

The configuration menu can be accessed by entering the following default password:

Edit, Up Arrow, Up Arrow, Up Arrow, Edit.

Once in the Configuration Menu, a user defined password can be assigned. See 4.3.1 System Parameters, Password Selection.

4.2 Configuration Menu Editing Instructions

- Navigate the configuration menu using the left and right arrow keys to scroll through the menu pages.

- Each menu page lists one or more parameters.

- The up and down arrows are used to move the highlight bar through the parameters on the screen.

- EDIT enables the change of the parameter that is highlighted.

If the item to be changed is a number (or Tag ID), the least significant digit flashes when EDIT is pressed. This number can be changed by pressing the up or down arrow key. The right and left arrow keys are used to move the flashing cursor to the next significant digit. Once the change has been completed, press ENTER.

If the menu item highlighted is a text item, a question mark (?) appears after EDIT is pressed. To change the menu item, press the left or right arrow keys to scroll through the list of available choices. Once the new parameter has been selected, press ENTER to accept the change.

- At any time during configuration, press DISPLAY to return to the monitoring mode.
4.3 Configuration Menu Structure

The CCS4000 configuration menu is comprised of:
- System Parameters that apply to all channels.
- Tank Setup Parameters that apply to individual channels.

The configuration display is divided into two sections.
- The left side of the screen displays the parameters and setpoint values.
- The right side of the screen displays text messages that guide the user through the configuration.

The user is instructed to press the left arrow key to access the system parameters and the right arrow key to access the tank setup parameters.

In order to prevent the CCS4000 Clarifier Control from unintentionally remaining in the configuration mode, it automatically exits the configuration menu and returns to the monitoring mode if a button is not pressed for 2.5 minutes.

Figure 4-1 shows the configuration menu tree.

4.3.1 System Parameters

In configuration mode, set the following system parameters.

Display Options

Screen Updates:
- **Scrolling** - Automatically scrolls through the active channels and the various front panel display screens every 15 seconds.
- **Fixed** - The user must press DISPLAY to advance through the active channels and the various front panel display screens.

Units Selection:
- **Feet** - All measurements and setpoints are displayed in feet and temperature is displayed in °F.
- **Meters** - All measurements and setpoints are displayed in meters and temperature is displayed in °C.

Sludge Mode:
- **Level** - Measures the sludge and rag levels from the bottom of the vessel.
- **Depth** - Measures the distance to the sludge and rag levels from the water surface.
4.3.1 System Parameters (Continued)

Communications

ID:

• ID - In a multidrop configuration, each CCS4000 Clarifier Control requires a unique ID. Valid ID numbers are 0 to 30.

Protocol:

• RS232 - Sets the communication protocol to RS232 for use with a standard PC.

• RS485 - Sets the communication protocol to RS485 when used in a multidrop configuration.

Password Selection

Change Password:

• New Password - The default password can be changed to a new password. A valid password is any 5-character sequence of the EDIT and arrow keys.

To change the password, press EDIT once. A question mark (?) is displayed, indicating the unit is ready to accept the 5-character password. An asterisk (*) is displayed each time that a key is pressed, indicating that the character was accepted. Once the complete password has been entered, the highlight bar moves to the confirm password line.

Confirm Password:

• Confirm Password - A question mark (?) is displayed indicating that the unit is ready to confirm the 5-character password. Re-enter the new password. An asterisk (*) is displayed each time that a key is pressed, indicating that the character was accepted. Once the complete password has been entered, the highlight bar moves back to the new password line, indicating that the password was accepted. If the password entered is not correct, see Troubleshooting Symptoms and Solutions in Section 5.

If the password is unknown, contact the Service Department at 1-800-527-6297 for assistance.
4.3.1 System Parameters (Continued)

**Common Alarm**

The common alarm is tied to all of the alarm setpoints.

- If enabled, the common alarm relay de-energizes once any alarm setpoint is exceeded.
- If disabled, the common alarm relay does not change state and remains energized when any of the alarm setpoints are exceeded.

**Near Zone Detect**

If Enabled, the near zone detect is active. If the rag level enters within 0.25 foot of this zone (1 foot or 0.3 meters from the face of the sensor), in approximately 60 seconds the following parameters change:

- The front panel Fault LED illuminates
- The front panel Alarm LED illuminates
- The fault and alarm relays are de-energized
- Clarity = 100%
- The display goes to a multi-quadrant screen (depending on the number of active channels)
- The display screen flashes alternately the “Near Zone Fault” and Tank Tag” message
- The display shows the last valid sludge and rag values prior to near zone fault
- The 4-20mA output (for that channel only) goes to 20mA

This condition will continue until the **ACKnowledge** button on the front panel is pressed, and the rag level is out of the near zone. The time to re-establish normal conditions after cleaning the near zone is approximately 1 minute. The clarity may take longer depending on the location and amplitude of the rag signal. For most conditions, however, this is about another minute.

While in the near zone fault condition, the fault and alarm relays can be re-energized by pressing the front panel **ACKnowledge** button.

If **Disabled**, the unit will not go into the above condition, and that channel continues to function. The rag level will increase in value, but not exceed tank depth minus one foot. The sludge level will be unaffected. The clarity may vary up or down depending on the rag signal amplitude and location in the clarity zone.
4.3.1 System Parameters (Continued)

4-20 mA options appear when analog output card is installed. See 2.4.1 Controller Wiring for location of analog output card.

Figure 4-1
CCS4000 Configuration Menu Tree
4.3.2 Tank Setup Parameters

Channel Activation

<table>
<thead>
<tr>
<th>Channel 1</th>
<th>Channel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 3</td>
<td>Channel 4</td>
</tr>
</tbody>
</table>

Up to four active channels can be configured for each CCS4000 Clarifier Control. Channels that are not connected to a Transducer / Transceiver Probe Subsystem should be turned off to prevent the fault and common alarm from activating.

At least one active channel must be configured.

Tank Selection

Current Tank
Choose the channel to be configured.

- **Tank Depth** - Enter the distance from the water surface to the bottom of the vessel (feet or meters). The CCS4000 software automatically compensates for the 3-inch sensor insertion depth. If the sensor is submerged deeper than 3 inches, the tank depth must be modified accordingly.

  For example: If the sensor is mounted 1 foot below the water surface, then tank depth must be lowered 9 inches to account for the 12-inch depth.

- **Tag Name** - Each channel comes with a default tag name.

  For example: Channel one is called Tank 1. The tag name can be changed to any string of characters not exceeding 12 characters.

To change the tag name, press EDIT. The first character flashes indicating that it can be changed. Press the up or down arrow key to scroll through the available choices. Clear the character by pressing CLEAR, which inserts a blank space in the character string, but does not restore the previous value.

Press the right or left arrow keys to move the cursor to the next position and repeat the instructions above. Once the tag name is complete, press ENTER.
4.3.2 Tank Setup Parameters (Continued)

Sludge Range Setup

Sludge Range

- **Sludge Range** - defines the area in the tank that is monitored for active return signals. The range is measured from the bottom of the vessel regardless of the sludge mode.

  The value for sludge range cannot exceed the tank depth minus one foot (0.3m). If the tank depth value is changed, the sludge range value automatically changes to maintain the one foot (0.3m) difference.

  The sludge range value typically equals one foot (0.3m) less than the tank depth, but it can be changed for a particular application requirement such as ignoring an obstruction two feet (0.61m) below the transducer.

- **Change the sludge range** using the EDIT and arrow keys.

Clarity Zone Setup

- **Top of Zone** - The clarity zone is the area in the tank that is monitored for changes in suspended solids content. The top of the clarity zone is measured from the water surface (not from the bottom of the vessel).

- **Bottom of Zone** - The bottom of the clarity zone is measured from the water surface (not the bottom of the vessel).

Alarm Setpoints

Alarm Setpoints define when the front panel LED (Alarm) lights or when the Common Alarm relay changes states. The two relays do not change state unless assigned to a setpoint. See Programmable Relay 1 and 2.

- **Sludge Level** - Enter the setpoint for the sludge level alarm in feet or meters (from the bottom of the vessel).

- **Rag Level** - Enter the setpoint for the rag level alarm in feet or meters.

- **Clarity Loss** - Enter the setpoint for the clarity loss alarm in percent.

- **Signal Quality** - Enter the setpoint for the signal quality alarm.
4.3.2 Tank Setup Parameters (Continued)

4-20 mA Loop 1 and 2

The CCS4000 Clarifier Control is equipped with two analog output loops per channel. Each output loop is configured independently. See Section 6.5 Default Settings

- **Source** - Each analog output loop can be assigned to sludge level, rag level, clarity loss or signal quality. Press EDIT to change the source and use the left or right arrow keys to select the menu choice. Press ENTER to accept the change.

- **Zero** - Enter the value in feet or meters (from the bottom of the vessel) that corresponds to 4mA.

- **Span** - Enter the value in feet or meters (from the bottom of the vessel) that corresponds to 20mA.

- **Output Check** - The analog output check displays the realtime loop current. The CCS4000 Clarifier Control can also be used as a current generator to check other devices in the output loop. Enter any value between 4mA and 20mA and the analog loop will generate that current.

- **Meter Trim** - The analog output can be adjusted to match the readings on a reference meter by pressing EDIT and entering the value displayed on the reference meter. See Figure 4-2.

Programmable Relay 1 and 2

- **Relay Source** - Choose the setpoint that is tied to the programmable relay by pressing ENTER and using the left and right arrow keys to scroll through the available choices (SLUDGE LEVEL, RAG LEVEL, CLARITY LOSS, or SIGNAL QUALITY).

- **Setpoint** - Choose the value that will change the state of the relay.

- **Deadband** - Set the relay deadband by entering the difference between the relay trip point and the relay reset point.

- **Failsafe** - Set the relay failsafe by pressing ENTER and using the left and right arrow keys to scroll through the available choices.
  - **High Level** (HL) causes the relay to de-energize when the setpoint is reached.
  - **Low Level** (LL) causes the relay to energize when the setpoint is reached.
4.3.2 Tank Setup Parameters (Continued)

**Meter Trim Flowchart**

**Figure 4-2**

*Configuration*
4.3.2 Tank Setup Parameters (Continued)

Tank Conditioning

- **Response Time** - The CCS4000 Clarifier Control takes multiple tank profiles to compute accurate and reliable measurements.

  When short response times (0-5 minutes) are entered, the output varies as the tank conditions change. For example, it is not uncommon for the sludge levels in front of the bottom rake and directly behind the bottom rake to vary by 2 or 3 feet (0.61m or 0.92m). With short response times, these changes in the level affect the display and the outputs.

  When the effect of the rake is not desired, longer response times (6-10 minutes) should be used. Increasing the response time usually makes the output stable when the rake is below the sensor.

  If there were a quick change in sludge levels or clarity loss, the full affect of these changes is displayed after one response time period. For example, if the sludge blanket were to immediately rise from 2 to 3 feet (0.61 to 0.92m), the output gradually increases to 3 feet (0.92m) over the response time period.

- **Density Factor** - In a majority of applications, the sludge blanket interface is subjective, and the CCS4000 Clarifier Control has to be set to track the signals that the user determines to be the interface. The density factor adjustment is used to correlate the operator's readings with the CCS4000 Clarifier Control.

  The lower density factor numbers track the lighter sludge as the interface.

  The higher density factor numbers track the more compacted sludge as the interface.

To calibrate the CCS4000 Clarifier Control in circular vessels, a manual sample should be taken when the bottom rake is 90° past the measurement location. In rectangular vessels the measurement should be taken between bottom flights. Compare the manual measurement to the CCS4000 display, and adjust the density factor accordingly. Lower the density factor number when the manual sludge measurement is higher than the CCS4000 display. Raise the density factor when the manual measurement is lower than the CCS4000 display.
4.3.2 Tank Setup Parameters (Continued)

- **Temperature** - The temperature parameter is used to correct the speed of sound through water when the tank influent is not at ambient temperature. To correct the speed of sound in the tank, enter the water temperature (in °F or °C) above the interface.

  In most applications, the temperature parameter does not require any changes.

- **Threshold Factor** - In some applications, where establishing a zero sludge level is desired, the threshold factor is used to achieve this performance. The threshold factor forces the unit to ignore specified levels above the zero signal baseline. The settings range from 0 to 20, and can mask up to 1.0 volt off the zero baseline.

  The same methodology that is used to set up density factor is also applied here. Manually verify the tank condition and set the threshold accordingly to achieve the desired result. The combination of the threshold and the density factors allow users to get much greater independent setting of the sludge span and zero. **This means that the density factor is used to track the higher inventory values while the threshold factor is used to control the near zero/low inventory values.**

  There are separate rag and sludge threshold adjustments. This means you have independent control of both items. In normal applications, **however, the sludge threshold is usually set higher than the rag threshold.** Rag signal is usually smaller than the primary sludge interface.

  The the rag level can never be less than the sludge level, and conversely, the sludge level can never be greater than the rag level. If rag threshold is set higher than the sludge threshold, displayed rag level equals the displayed sludge level. If the sludge threshold is set high enough to completely mask the sludge level signal, and the rag level is set low or at zero, then the displayed sludge level will be zero, and the rag level will display a reading consistent with the tank condition.
4.3.2 Tank Setup Parameters (Continued)

Calibration

- **Sludge** - To calculate the sludge level interface, an alternative Level method for choosing a density factor is to use a verified sludge level to calculate the density. After selecting the appropriate setting, the system updates the density factor the Tank Conditioning menu.

Calibration requires four minutes to complete.

Press **EDIT**.
Enter the actual sludge level.
Press **ENTER**.

Press ▼ to highlight bar of STATUS line.
(WAIT is displayed.)

Press **EDIT** to start calibration.
(PING is displayed on STATUS line.
Density Factor scrolls between 0 and 15.)

Calculated density factor and sludge level appear on display.
Procedure is complete.

**NOTICE**

Because echo information is gathered over a four-minute window, the calculated density factor might produce a Best Value that differs from the original sludge level value. A slight difference between the original sludge level value and the Best Value is normal.
Section 5: Field Adjustments And Service

5.1 Transceiver Power and Application Adjustments

**CAUTION**
Consult factory before making any power adjustments.

5.1.1 Power Setting

The 40C-100 series transceiver has a manual power adjustment that is set at the factory. Generally, the power setting does not have to be changed. In some cases however...

- When the vessel is shallow, the power may have to be lowered, or
- When the vessel is close to the span limits of the CCS4000 Clarifier Control, the power may have to be increased.

To access the power adjustment, remove the transceiver condulet lid and the power adjustment label. The power can be adjusted from 1 to 9 with the rotary switch.

5.1.2 Application Setting

The 40C-100 series transceiver has a manual application adjustment that is factory set to match the application specified at the time of purchase. The adjustment can be made in the field in the event that the application has changed since the time of purchase or if tank conditions are unusual.

To change the application setting, remove the transceiver condulet lid and the adjustment cover label to expose the set of jumpers. Refer to Figure 5-1.
5.1.2 Application Setting (Continued)

When the jumpers are both in the top position, the transceiver is set for municipal wastewater applications. When the left jumper is in the bottom position and the right jumper is in the top position, the transceiver is set for municipal water treatment and all industrial treatment applications.

5.2 Display Contrast Adjustments

The front panel display contrast is set for optimum viewing. Change the adjustment if the ambient lighting conditions require a change to the display contrast.

Refer to Figure 5-2. The contrast adjustment, labeled R2, is located on the lower left side of the backplane. Turn the adjustment clockwise to increase the contrast and counter clockwise to decrease the contrast.

![Figure 5-2 Contrast Adjustment](image-url)
## 5.3 Troubleshooting Pages

### 5.3.1 Troubleshooting Symptoms and Solutions

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Solution</th>
<th>Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>System locks up.</td>
<td>A/D Failure, or Failure to write to EEPROM, or any system component failure.</td>
<td>Consult Factory at 1-800-527-6297. Refer to Section 5.3 to prepare required service information.</td>
</tr>
<tr>
<td>System Fault LED lights.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Solution</th>
<th>Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration is using default parameter. (Default in Use)</td>
<td>Error was made during configuration process.</td>
<td>Check data entries. Re-enter configuration parameter.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Solution</th>
<th>Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>System won’t accept password. (Confirmation Failed)</td>
<td>Password was entered incorrectly.</td>
<td>Re-enter password. If the password is forgotten or unknown, contact Factory Service.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Solution</th>
<th>Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display reverts to 4-quadrant screen.</td>
<td>Signal Quality goes to 0.0 for one minute=.</td>
<td>Channel continues to function. Use ACK button to clear the relays. Refer to Sections 1.2.4 and 4.3.2 to remedy fault condition.</td>
</tr>
<tr>
<td>Display alternately flashes between signal loss message and tag name.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fault</strong> LED lights.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault relay is de-activated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alarm</strong> LED lights.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Alarm relay is de-activated.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Solution</th>
<th>Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display reverts to 4-quadrant screen.</td>
<td>Rag Level approaches within 0.25 foot of near zone (1 foot or 0.3 meters from face of sensor).</td>
<td>Channel does not function, but retains last data. Use ACK button to clear the relays. Refer to Sludge Range and Clarity Zone Setup in Section 4.3.2 to remedy the fault condition.</td>
</tr>
<tr>
<td>Display alternately flashes between near zone message and tag name.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fault</strong> LED lights.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault relay is de-activated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alarm</strong> LED lights.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Alarm relay is de-activated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

See Section 2.6 on Extreme Cold Weather Precautions!

*Table 5-1*

*Troubleshooting Symptoms and Solutions*
5.3.2 CCS4000 Troubleshooting Guide

- Factory Service (800) 527-6297 Fax (215) 443-5117

CCS4000 Display Is Lower Than Actual Sludge Level

- Has the system ever indicated a correct level?
  Decrease (use smaller number) density factor and allow system to run for 5 minutes. Does this help?
- Is the transducer positioned below the water surface?
  Standard position is 3 inches below the water surface.
- Are there air bubbles collecting on the face of the transducer?
  If so, clean and allow to run for 5 minutes.
- Is there a coating (buildup) on the face of the transducer?
  If so, clean and allow to run for 5 minutes.
- Is there a cone assembly attached to the transducer?
  Do not allow material to collect inside the cone and foul the sensor.
- Is the vessel in an upset condition?
  Blanket breakup, de-nitrification, pin-floc, etc. can degrade signal quality.
- Have you verified the tank depth?
  Measure at the transducer.
- Has sludge density changed more than 3 to 1?
  May need to increase power.

CCS4000 Display Is Higher Than Actual Sludge Level

- Has the system ever indicated a correct level?
  Increase (use larger number) density factor and allow system to run for 5 minutes. Does this help?
- Is there a skimmer or bottom rake stopped below the transducer?
  Ensure that when stopped, they are away from the sensor.
- Are there any other obstructions that can be creating a false return above the sludge level?
- Have you verified the tank depth?
  Measure at the transducer.
- Excessive gassification (bubbles viewed in sludge judge?)

CCS4000 Is In Fault Condition

- What is the signal quality?
- Values less than 1.0 indicate possible problems, fouled sensor, etc.
- Values less than 0.0 cause a fault.
- Clean the sensor. Wait 5 minutes. Re-check level and signal quality.
- Have they returned to normal?
- Re-check all wiring connections.
- Also check that rag level is 0.25 foot or greater away from near zone (1 foot from face of sensor).

CCS4000 Is in System Fault Condition

- Turn power off, remove each card and re-seat. Re-apply power.
### 5.3.3 Troubleshooting Table

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Channel 1</th>
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<th>Channel 4</th>
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5.4 Factory Assistance

AMETEK Drexelbrook can answer any questions about your level measurement system. Call Customer Service at 1-800-553-9092 (US and Canada), or + 215-674-1234 (International).

If you require assistance and attempts to locate the problem have failed:
• Contact your local Drexelbrook representative,
• Call the Service department toll-free at 1-800-527-6297 (US and Canada) or + 215-674-1234 (International),
• FAX the Service department at + 215-443-5117, or
• E-mail to drexelbrook.service@ametek.com

Please provide the following information:
Model #: _______ Serial #:_______ Purchase Order #:_______
Plant Type: □ Wastewater □ Water □ Other
Vessel Type: □ Primary Clarifier □ Secondary Clarifier □ Thickener □ Other
Vessel Configuration: □ Circular _____ (D) □ Rectangular _____ L x _____W □ Other
Vessel Depth: Side Wall _____ Center _____ Depth at Sensor _____
Rake Mechanism: □ Surface Rake Speed _____ □ Bottom Rake Speed _____

Brief description of the problem:
Checkout procedures that have failed:

5.5 Field Service

Expert Field Service Engineers are available on a time-plus-expense basis to assist in start-ups, diagnosing difficult application problems, or in-plant training of personnel. Contact the service department for further details.

5.6 Customer Training

Periodically, AMETEK Drexelbrook instrument training seminars for customers are held at the factory. The sessions are guided by Drexelbrook engineers and specialists. Our seminars provide detailed information on all aspects of level measurement, including theory and practice of instrument operation. For more information about these valuable workshops, call direct +1-215-674-1234.
5.7  Equipment Return

In order to provide the best service, any equipment being returned for repair or credit must be pre-approved by the factory.

In many applications, sensing elements are exposed to hazardous materials.

- **OSHA mandates** that our employees be informed and protected from hazardous chemicals.
- **Material Safety Data Sheets (MSDS)** listing the hazardous materials to which the sensing element has been exposed **MUST** accompany any repair.
- It is your responsibility to fully disclose all chemicals and decontaminate the sensing element.

*To obtain a return authorization (RA#), contact the Service department at 1-800-527-6297 (US and Canada) or + 215-674-1234 (International).*

**Please provide the following information:**

Model Number of Return Equipment ______________________

Serial Number ________________________________________

Original Purchase Order Number ________________________

Process Material(s) equipment has been exposed to _____________________________________________

MSDS sheets for any hazardous materials

Billing Address _________________________________________

Shipping Address ______________________________________

Purchase Order Number for Repairs ______________________

*Please include a purchase order even if the repair is under warranty. If repair is covered under warranty, you will not be charged.*

Ship equipment freight prepaid to:

AMETEK-DREXELBROOK,
205 KEITH VALLEY ROAD
HORSHAM, PA 19044-1499
COD shipments will not be accepted.
Section 6
Section 6: Specifications

**CAUTION**

At all temperatures and particularly at temperatures below 40°F (5°C), take care to not expose any part of the Clarifier Control Analyzer to mechanical shock or impact.

### 6.1 System Specifications

- Max. Points per System: 4
- Max. Tank Depth: 30 feet (9.99m)
- Max. Span: 29 feet (8.84m)
- Near Zone: 1 foot (.3m)
- Dead Zone: 3 inches (76mm) from tank bottom
- Display Resolution: 0.1 foot (30mm)
- Accuracy: 1% of tank depth or 1.0" (25.4mm) whichever is greater

### 6.2 DE4000C Controller Specifications

- Power Requirement: 120/240 Vac 50/60Hz
- Operating Temperature: -28°F to +140°F (-33°C to +60°C)
- Storage Temperature: -40°F to +180°F (-40°C to +77°C)
- Housing: NEMA 4X
  - W: 13.3 inches (338mm)
  - H: 11.31 inches (287mm)
  - D: 5.6 inches (142mm)
- Display: 64 X 240 backlit LCD graphic display
- Transient Protection: 10 amp (on input loop)
- Analog Output: Two 4-20 mA per channel, User assignable for Sludge Level, Rag Level, Clarity Loss or Signal Quality
  - Source: 24 Vdc
  - Sink: 30 Vdc maximum
- Max. Load Resistance: 625 Ohms
- Relays: Two per channel, user assignable for Sludge Level, Rag Level, Clarity Loss or Signal Quality each with a programmable deadband, 5A SPDT One common alarm One fault

*Isolation Barriers are required for each 4-20mA Loop that has external grounding.*
6.3 Transducer Specifications

Operating Temperature: 20°F to +160°F (-7°C to +71°C)
Storage Temperature: 20°F to +180°F (-7°C to +77°C)

Cable Length: 20 feet (6.1m) integral to transceiver

Coupling: ¾ inch stainless steel (female)

6.4 Transceiver Specifications

Operating Temperature: -40°F to +185°F (-40°C to +85°C)

Housing: NEMA 4X (IP-65) explosionproof

Distance to DE4000C Controller:
1000 feet (305m) standard 8-conductor shielded cable #22 AWG minimum

6.5 Default Settings

Display Options

Screen Updates Fixed
Unit Selection Feet
Sludge Mode Level

Communications

ID 1
Protocol RS232

Password Options

Password EDIT, Up, Up, Up, EDIT

Channel Activation

Channels ON (All Channels)

Tank Selection

Current Tank 1
Tank Depth 12.0 feet
Tag Name Tank #1, Tank #2, Tank #3, Tank #4

Sludge Range Setup

Sludge Range 11.0 feet
6.5 Default Settings (Continued)

Clarity Zone Setup
- Top of Zone: 2.0 feet
- Bottom of Zone: 3.0 feet

Alarm Setpoints
- Sludge Level: 5.0 feet
- Rag Level: 11.0 feet
- Clarity Loss: 50%
- Signal Quality: 25%
- Common Alarm: Enabled

4-20 mA Loop #1
- Power-Source: from CCS4000 SLUDGE
- Zero: 0.0 feet
- Span: 11.0 feet
- Output Check: displays realtime loop current
- Meter Trim: 4.00mA

4-20 mA Loop #2
- Power-Source: from CCS4000 RAG
- Zero: 0.0 feet
- Span: 11.0 feet
- Output Check: 4.00mA
- Meter Trim: 4.00mA

Programmable Relay 1
- Relay Source: SLUDGE
- Setpoint: 6.0 feet
- Deadband: 3.0 feet
- Failsafe: HL

Programmable Relay 2
- Relay Source: RAG
- Setpoint: 6.0 feet
- Deadband: 3.0 feet
- Failsafe: HL

Tank Conditioning
- Response Time: 7 minutes
- Density Factor: 9
- Temperature: 68 °F
- Sludge Threshold Factor: 0
- Rag Threshold Factor: 0
Section 7
Section 7: Scopeview Software Installation and Operation

7.1 Introduction to Scopeview 4000

The CCS4000 Scopeview Software is a tool to be utilized with the AMETEK Drexelbrook CCS4000 Clarifier Controller. The software will perform the following functions:

- Gather real-time Channel profile and data, i.e. Sludge Level, Clarity Loss, Rag level, and Signal Quality
- Retrieve 1 week of data stored by the DE4000C
- Log Sludge Level, Rag Level, Clarity Loss, and Signal Quality data
- Save the collected information
- Graphically display the Channel profile, as well as Sludge Level, Rag level, Clarity Loss, and Signal Quality trends.
- Print displayed waveforms and data trends.
- Read and display all current settings from the DE4000C controller.
- Print current settings, waveforms and data logs from the DE4000C controller.
- Automatically display in corresponding units (meters or feet).

7.2 System Requirements

- CCS4000 Clarifier Controller System
- Standard or Null Modem 9-pin Serial Interface Cable (Standard or Null is Jumper Selectable)
- RS485 Card or RS485 to RS232 converter for RS485 Communications
- IBM Compatible Computer
- Pentium 75MHz or Higher Processor (Pentium 133MHz Recommended for Real Time Data collection)
- Open serial port
- Windows 95, 98, ME, NT, 2000, XP® operating systems (Windows NT, 2000, and XP® are not compatible with RS485)
- 10MB of hard drive space
- 32MB of RAM (64MB Recommended)

Scopeview 4000 is not compatible with Operating Systems using East Asian Characters
7.3 Installation

- Insert disk labeled "disk 1" into the floppy drive.
- Choose "Start" on the Taskbar.
- Choose "Run".
- Type a:\setup and Choose "OK".
- Follow on-screen directions.

If prompted to update system files, the computer must be restarted when finished, and the installation progress restarted.

7.4 Connecting the DE4000C

RS232
- Connect a 9-pin serial connector to either com 1 or com 2 on the PC.
- Connect the 9-pin cable to connector J7 on the backplane inside the DE4000C.

RS485
- Connect the 3-conductor cable to the RS485 input at the computer (RS485 Card or Converter required).
- Connect the 3-conductor cable to the Com, RS485(-) and RS485(+) terminals located on the bottom row of TB2, TB3, and TB4 on the backplane of the DE4000C.

7.5 Configuration

When Scopeview 4000 is started, the "System Options" dialog box appears and allows you to modify the "Communications, Profile Configuration, and Real Time Data (RTD) Configuration" options. To view the "System Options" dialog box from the Scopeview 4000 main screen: Choose the "System Options" icon on the menu bar.

Comm Port:
Select the "COM" port that will be used on the computer to communicate with Scopeview 4000

Protocol:
Scopeview 4000 can communicate with one DE4000C using RS232 communications protocol across a distance of up to 25 feet. One DE4000C can be connected to a maximum of four separate tanks.
7.5 Configuration (Continued)

When communicating over distances greater than 25 feet, RS485 communications must be used.

Establish Communications on Start up:
By selecting this option, you can choose to initialize the communications between Scopeview 4000 and the DE4000C receivers connected automatically when Scopeview 4000 is started.

Show this dialog on Start up:
Select this option to show the "Communications" dialog box at start up.

To save your changes and close the "Communications" dialog box: Choose "OK". To disregard your changes and close the "Communications" dialog box: Choose "Cancel". The "Apply" button is used to save changes without closing the "Communications" dialog box.
7.6 Toolbar Icons

- **Tank Profiles:**
  - Choose to: Collect "Waveforms"

- **Real Time Data:**
  - Choose to: Collect "Real Time Data"

- **Download Stored Values:**
  - Choose for: A 1 week trend of Sludge Level, Rag Level, Clarity Loss and Signal Quality

- **CCS4000 Settings:**
  - Choose to: View parameters of all four channels.

- **Open File:**
  - Choose to: Open a Waveform or Real Time Data file

- **Save File:**
  - Choose to: Save a Waveform or Real Time Data file

- **Print File:**
  - Choose to: Print a Waveform, Real Time Data trend, Configuration Screen or Stored Values

- **Start Collecting:**
  - Choose to: Collect Waveforms or Real Time Data

- **Stop Collecting:**
  - Choose to: Stop collecting Waveforms or Real Time Data

- **System Options:**
  - Choose to: View the "System Options" dialog box.

- **Establish Communications:**
  - Choose to: Communicate between the computer and the DE4000C
7.7 Viewing / Saving / Recalling / Printing Waveforms

Scopeview 4000 allows you to view the waveform profiles for each active channel. The waveforms can then be printed or saved as a file.

To view the "Profile Configuration" dialog box: Choose the "System Options" icon on the menu bar and select the Profile Configuration tab.

![Profile Configuration Dialog Box](image)

**Figure 7-3**
*Profile Configuration Dialog Box*

**Save Configuration:**
You can choose to save the waveform profiles from all of the active channels in individual files or as one single file by selecting either "Separate File" or "Combined File" in the "Saving Configuration" window.

When saving profiles in "Separate Files", a ",_1", ",_2", etc. will be appended to each file name created in the "Save As" dialog box. The number of files saved will depend on the number of active Channels.

**Window State:**
The profile windows for each active channel can be viewed as a Tiled or Cascaded format. Tiled format displays all of the active channels on the screen, while the Cascaded format displays one window at a time.

**Overlay Waveforms:**
When viewing multiple profiles for the same tank, the waveforms can be viewed individually or all at once. When "Overlay Waveforms" is selected, you are able to easily compare the profiles to one another.
7.7 Viewing / Saving / Recalling / Printing Waveforms (Continued)

**Free Run:**
When Free Run is selected, the software will collect waveforms until the stop button on the tool bar is clicked. No profiles can be saved while "Free Run" is selected.

**Profiles:**
The number in the profiles box indicates how many waveforms will be collected before the operation automatically stops.

To start collecting waveform files: Choose the green "Start" Button on the Toolbar.

The system will begin to collect Waveforms for each active channel. The number of Waveforms collected is determined by the settings chosen in the "Profile Configuration" dialog box.

To stop the collection of Waveforms, click on the red "Stop" Button on the Toolbar.

To save the Waveforms that were collected, click the "Save" Button on the Toolbar.

Waveforms that have been saved can be recalled at any time for viewing by: Choosing the "File Open" icon on the Toolbar and Selecting the ".pro" file type in the "Open" window. When the file is opened you will be able to view the waveforms.

Waveforms may also be printed by Choosing the "Print" icon on the Toolbar. To select a Channel to print, click on the profile screen for that channel to activate it.
7.8 Viewing / Saving / Recalling / Printing - Real Time Data (RTD)

Scopeview 4000 can be used to log the Sludge Level, Rag Level, Clarity Loss and Signal Quality data in real-time.

To configure the Real Time Data options: Select the "System Options" icon on the Tool Bar. When the "System Options" dialog box appears: Select the "RTD Configuration" tab.

![RTD Configuration Dialog Box]

**Delay:**
Determines the amount of time between data acquisitions.

**Scale:**
Sets the vertical access of the display for Sludge Level, Rag Level, Clarity Loss and Signal Quality.

**Saving Configuration:**
You can choose to save the RTD from all the active channels in individual files or as a single file by: Selecting either "Separate Files" or "Combined File" in the "Saving Configuration" window.

1. When saving profiles in "Separate Files", a ",_1", ",_2", etc. will be appended to each file name created in the "Save As" dialog box. The number of files saved will depend on the number of active Channels.

2. "Combined Files" will be saved as a ".rtd" file type.
"Separate Files" will be saved as a ".csv" file type. 
"Separate Files" (.csv) can be viewed in Microsoft® Excel.
7.8 Viewing / Saving / Recalling / Printing - RTD (Continued)

**Window State:**
Tiled format displays all of the active channels on the screen. Cascaded format displays one window at a time.

To begin collecting "RTD": Choose the green "Start" button on the Toolbar.

To stop collecting "RTD": Choose the red "Stop" button.

To save the "RTD": Choose the "Save" icon on the Toolbar.

"RTD" that has been saved can be recalled at any time for by:
Choosing the "File Open" icon on the Toolbar and Selecting the ".rtd" or ".csv" file type in the "Open" window

"RTD" files can be recalled at any time for viewing or printing.
To print a "RTD" file: Choose the "Print" icon on the Toolbar.

7.9 Viewing CCS4000 Settings

The parameters for each channel that are stored in the DE4000C can be viewed in Scopeview 4000.

To access the "DE4000C Parameters": Choose the "CCS4000 Settings" icon on the toolbar. You will be able to view all of the channel parameters remotely.

The configuration parameters can be printed or saved as a file for future reference. Saved files can also be opened for viewing or printing.
7.9 Viewing CCS4000 Settings (Continued)

![CCS4000 Settings Dialog Box](image)

**Figure 7-6**

**CCS4000 Settings Dialog Box**

7.10 View One Week of Data

The DE4000C stores the Sludge Level, Rag Level, Clarity Loss, and Signal Quality values in RAM for the last 7 days. In the event that the outputs have not been trended or Scopeview was not used to Log the data, you are still able to review the last week's history.

![Download Stored Values Dialog Box](image)

**Figure 7-7**

**Download Stored Values Dialog Box**

To access the stored values Click on the Download Stored Values button on the Toolbar.

Once the window opens, press the green start button to view the stored values. The stored values for each active channel are displayed.

These values can then be saved as a "csv" file, by clicking the Save File button on the toolbar. Microsoft® Excel recognizes .csv files.
GENERAL: All orders are subject to the following terms and conditions. Any acceptance of any offer of buyer for any goods or services is subject to and conditioned upon these terms and conditions and shall constitute an acknowledgment and agreement to be bound by the terms and conditions herein expressed, and no modifications shall be binding on seller unless the same are in writing and signed by an executive officer of seller or his or her duly authorized representative. Verbal orders shall not be executed until written notification has been received and acknowledged by seller.

QUOTATIONS: Written quotations are valid for thirty (30) days unless otherwise stated. Verbal quotations expire the same day they are made.

PRICES: All prices and terms are subject to change without notice. Buyer-requested changes to its order (“Orders”), including those affecting the identity, scope and delivery of the goods or services, must be documented in writing and are subject to Seller’s prior approval and adjustments in price, schedule and other affected terms and conditions. Orders requiring certified test data in excess of commercial requirements, are subject to a special charge.

ORDER ACCEPTANCE: All Orders are subject to final approval and acceptance by Seller at its office located at 205 Keith Valley Road, Horsham, Pennsylvania 19044.

TERMS OF PAYMENT: Seller’s standard terms of payment for buyers who qualify for credit are not less than thirty (30) days from date of invoice. No goods may be returned unless authorized in advance by Seller. Seller shall not in any event be liable for Buyer’s credit (at Seller’s option) for any returned goods and only under the following conditions: (1) Buyer provides all necessary information from Buyer and Buyer’s compliance with terms of payment.

DELIVERY: Shipments are F.O.B. place of manufacture (“Shipping Point”) and the Buyer shall pay all freight, transportation, shipping, duties, fees, handling, insurance, storage, demurrage, or similar charges from Shipping Point. Delivery of goods to common carrier shall constitute delivery. Upon delivery, title to the goods and all risk of loss or damage in transit shall be borne by Buyer. Any claims or losses for damage or destruction after such delivery shall be the responsibility of Buyer.

Seller reserves the right to make delivery in installments which shall be separately invoiced and Buyer’s failure to accept delivery without regard to subsequence of any installment shall not relieve Buyer of its obligation to accept remaining deliveries.

Acknowledged shipping dates are approximate only and based on prompt receipt of all necessary information from Buyer and Buyer’s compliance with terms of payment.

TAXES: All sales, excise and similar taxes which Seller may be required to pay or collect with respect to the goods and/or services covered by any Order, shall be for the account of the Buyer except as otherwise provided by law or unless specifically stated otherwise by Seller in writing.

TERMINATION AND HOLD ORDERS: No Order may be terminated by Buyer except upon written request by Buyer and approval by Seller, and if said request is approved by Seller, under the following conditions: (1) Buyer agrees to accept delivery of all of the units completed by Seller through the workday on which Seller receives the written termination request; (2) Buyer agrees to pay to Seller all direct costs and expenses applicable to the portion of the Order that is canceled.

WARRANTY: A. Hardware: Seller warrants its goods against defects in materials and workmanship under normal use and service for one (1) year from the date of invoice.

B. Software: Seller warrants that the firmware shall be uninterrupted or error-free, or that functions contained therein shall meet or satisfy the Buyer’s intended use or requirements. Seller shall not be responsible for the continued operation of, or access to, the Software, if due to causes beyond Seller’s control, including but not limited to the following items: acts of God, war, terrorism, mobilization, civil commotion, riots, embargoes, domestic or foreign governmental regulations or orders, governmental partial, port congestion, acts of the Buyer, its agents or employees, fires, floods, strikes, lockouts and other labor difficulties, shortages of or inability to obtain shipping space or transportation, inability to secure fuel,UCAC, power at current prices or any other shortage or unexpected difficulties that may arise from time to time, whether as a result of breach of contract, warranty, tort (regardless of the form of action, whether in law or in equity, in contract, tort or otherwise, and further shall extend to the benefit of Seller’s vendors.

C. Services: Seller warrants that services, including engineering and custom application, whether provided on a fixed cost or time and material basis, shall be performed in accordance with generally accepted industry practices.

D. Remedies: Seller’s liability under this section is restricted to replacing, repairing, or issuing credit (at Seller’s option) for any returned goods and only under the following conditions: (1) Seller must be promptly notified, in writing, as soon as possible after the defects have been noted by the Buyer, but not later than (1) year from date of invoice from Seller; (2) The defective goods are to be returned to the place of manufacture, shipping charges prepaid by Buyer; (3) Seller’s inspection shall disclose to its satisfaction that the goods were defective, and that the defects were not caused by improper handling by Buyer or Buyer’s agents; (4) All work performed by Seller in (consisting of time, travel and expenses related to such services) performed other than at Seller’s factory, shall be chargeable to Buyer.

E. Returned Goods: Goods returned due to shortages, damages, or any and all prior discussions, and negotiations on its subject matter.

INTLECTUAL PROPERTY: Seller’s sale of goods or provision of related documentation or other materials to Buyer shall not transfer any intellectual property rights to Buyer unless Seller specifically agrees to do so as provided herein. Seller shall retain all applicable patents, trademarks, copyrights and other intellectual property rights. Buyer shall not use, copy or transfer any such items in violation of Seller’s intellectual property rights or applicable law, or for any purposes other than that for which the items were furnished.

Seller shall defend any lawsuit brought against the Buyer based on a claim that the design or construction of the goods sold hereunder by Seller infringe any United States or Canadian Patent. Copyight or Mask Work Registration, provided that Buyer promptly notifies Seller of such infringement in writing and further that Buyer, at Seller’s expense, agrees to defend the sole right to control the defense of the suit or proceeding, including settlement, and (2) Seller provides all necessary indemnity payments to Seller. In the event of a charge of infringement, Seller’s obligation under the agreement shall be fulfilled if Seller, at its option and expense, either (i) settles such claim; (ii) procures for Buyer the right to continue using such goods; (iii) replaces or modifies goods to avoid infringement; or (iv) accepts the use of any infringing goods and refunds their purchase price; or (v) defends against such claim.

If Buyer furnishes specifications or designs to Seller, the obligations of Seller set forth above shall not apply to goods made by Seller using such specifications or designs, and Buyer shall defend, indemnify and hold Seller harmless against any third party claims for infringement which arise out of Seller’s use of specifications or designs furnished by Buyer.

SOFTWARE LICENSE: If goods purchased hereunder include software (“Software”), Buyer may use the Software only as part of the goods purchased hereunder. Buyer warranty of the Software except as may be permitted under the applicable License Agreement provided with the goods. Buyer’s right to use, copy or transfer the Software shall terminate upon termination of Buyer’s right to use the goods.

PACKAGING/WEIGHTS AND DIMENSIONS: Buyer specified packing or marking may be subject to additional charges not otherwise included in the price of the goods. Published weights and dimensions are estimates or approximate only and are not warranted.

FORCE MAJEURE: Seller shall not be responsible for delays in delivery or any failure to deliver by cause beyond Seller’s control, including but not limited to the following items: acts of God, war, terrorism, mobilization, civil commotion, riots, embargoes, domestic or foreign governmental regulations or orders, governmental partial, port congestion, acts of the Buyer, its agents or employees, fires, floods, strikes, lockouts and other labor difficulties, shortages of or inability to obtain shipping space or transportation, inability to secure fuel,UCAC, power at current prices or any other shortage or unexpected difficulties that may arise from time to time, whether as a result of breach of contract, warranty, tort (regardless of the form of action, whether in law or in equity, in contract, tort or otherwise, and further shall extend to the benefit of Seller’s vendors.

If a delay excused per the above extends for more than ninety (90) days and the parties have not agreed upon a revised basis for continuing the goods or services at the end of the delay, including adjustment of the price, then Buyer, upon thirty (30) days’ prior written notice to Seller may terminate the Order with respect to the unexecuted portion of the goods or services, whereupon Buyer shall promptly pay Seller its reasonable termination charges upon submission of Seller’s invoices thereof.

LIMITATION OF LIABILITY: Seller’s liability for any claim of any kind, except infringement of intellectual property rights, shall not exceed the purchase price of any goods or services which give rise to the claim. Seller shall in no event be liable for Buyer’s MANUFACTURING COSTS, LOST PROFITS, LOSS OF USE OF THE GOODS OR SERVICES, COST OF CAPITAL, COST OF SUBSTITUTE GOODS, FACILITIES, SERVICES OR REPLACEMENT POWER, DOWNTIME COSTS, CLAIMS OF BUYER’S CUSTOMERS FOR DAMAGES, OR OTHER SIMILAR, PROXIMATE, INCIDENTAL, INDIRECT, EXEMPLARY OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON NEGLIGENCE, CONTRACT, TORT, STRICT LIABILITY OR OTHERWISE, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE ARE EXCLUDED.

Severability and Entire Agreement: If any provision of these terms and conditions is unenforceable, the remaining terms shall nonetheless continue in full force and effect. This waiver agrees with any other agreements and conditions Seller sells services, constitutes the entire terms and conditions of sale between Buyer and Seller and supersedes any and all prior discussions, and negotiations on its subject matter.