A higher level of performance
INTRODUCTION

PROPRIETARY NOTICE
The information contained in this publication is derived in part from proprietary and patent data. This information has been prepared for the express purpose of assisting operating and maintenance personnel in the efficient use of the instrument described herein. Publication of this information does not convey any rights to use or reproduce it, or to use for any purpose other than in connection with the installation, operation and maintenance of the equipment described herein.

WARNING!
This instrument contains electronic components that are susceptible to damage by static electricity. Proper *handling procedures must be observed during the removal, installation, or handling of internal circuit boards or devices.

* Handling Procedure:
1. Power to unit must be removed.
2. Personnel must be grounded, via wrist strap or other safe, suitable means, before any printed circuit board or other internal devices is installed, removed or adjusted.
3. Printed circuit boards must be transported in a conductive bag or other conductive container. Boards must not be removed from protective enclosure until the immediate time of installation. Removed boards must be placed immediately in a protective container for transport, storage, or return to factory.

Comments:
This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, CMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.
**WARRANTY AND LIABILITY**

Hawk specializes in ultrasonic, sonic and sonar level transmitters and have thousands of installed instruments in critical applications around the world.

Hawk guarantees the ‘ORCA’ sonar range, when delivered, is free of material defects and undertakes to replace, repair any defective part, free of charge. Hawk will provide two levels of warranty period.

A two year electronic warranty period extends from this delivery date, an installed performance warranty is available through our distributor network and the factory.

Hawk warranty, solely covers, workmanship, material defects, only, unless specified in writing by the factory.

The warranty does not cover, wearing parts, consumables, incorrect handling, incorrect installation, or using the instrument for anything other than what it is intended to do.

**PRINCIPLE OF OPERATION**

The ORCA Sonar Series transducer emits a high powered acoustic pulse, which is reflected from the interface density selected.

The reflected signal is processed using specially developed software algorithms, that eliminates lighter floating densities, stratified layers, when measuring “RAS” or “BED” levels. It can be calibrated to measure lighter densities like “FLOC” or one of the outputs could be used for a “CLARITY” output, similar to a basic turbidity transmitter measuring solids in suspension.

By choosing the correct sonar transducer frequency, the ORCA sonar guarantees the best optimized performance off both light density interfaces and heavy density interfaces.

**GENERAL DESCRIPTION**

- The ORCA Sonar Series offers a wide and comprehensive range of advantages for measuring interface levels, etc.
- Large range of sonar frequencies, to optimize the best response in the tank.
- Largest range of industrial cleaning mechanisms, to insure continuous performance.
- Suitable for measuring rocks, powders, viscous and aggressive media.
- Suitable for all sonar applications including: primary sedimentation, secondary/final clarifiers, thickeners, CCD’s, sequential batch reactors.
- Max range 60m.
- Calibration by programming density (grams/liters).
- Two independent outputs available 2 x 4-20ma analogue.
## SPECIFICATIONS

### Sonar Frequency Selection
- 150kHz, 300kHz, 450kHz, 700kHz

### Operating Voltage
- 90 - 260Vac 50/60Hz
- 24Vdc (min 5A supply)
  (residual ripple no greater than 100mV)

### Power Consumption
- <10VA @ 240Vac
- <10W @ 24Vdc

### Analog Output
- Either single or dual analogue
  - 1 x 4-20mA (isolated) 600 ohms max.
  - 1 x 4-20mA (non isolated) 600 ohms max.

### Communications
- GosHawk, HART, Modbus, Profibus DP, DeviceNet, Foundation Fieldbus, Profibus PA.

### Relay Output
- 3 x s.p.d.t. 0.5amp/240vac
  Form c. type non-inductive load.
  Fully programmable

### Maximum Range
- 65 meters

### Blanking Distance
- 450mm: 150kHz, 300kHz, 450kHz
  600mm: 700kHz, 30kHz

### Resolution
- 1mm

### Accuracy
- +/- 0.25%

### Operating Temperature
- Remote Electronics
  -40°C to 70°C
- Sonar Transducer Polypropylene
  -40°C to 50°C
- Sonar Transducer FRP Fibreglass
  -40°C to 80°C

### Transducer/Transmitter Separation
- >500m
  Note: Must be BELDEN 3084A

### Important
- “USE SPECIFIED CABLE ONLY”

### Cable (Sonar Transducer)
- BELDEN 3084A

### Sealing
- Remote Electronics IP67
- Remote Transducer IP68

### Cable Entries
- Remote Electronics: 3 x 20mm  1 x 16mm

### Typical Weight
- Remote Electronics 1kg
- Remote Transducer 1kg
- Cleaning Mechanism 5kg
# TYPICAL APPLICATIONS

<table>
<thead>
<tr>
<th>Area</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Treatment Plant</strong></td>
<td></td>
</tr>
<tr>
<td>Primary Sedimentation Tank</td>
<td>Floc level / sludge blanket level</td>
</tr>
<tr>
<td>Sludge Thickener Tank</td>
<td>Sludge bed level / clarity suspended solids / floc level</td>
</tr>
<tr>
<td>Calcium Hydroxide Reactor</td>
<td>Sand/pellet bed level</td>
</tr>
<tr>
<td>Sodium Hydroxide Reactor</td>
<td>Sand/pellet bed level</td>
</tr>
<tr>
<td><strong>Sewage Treatment Plant</strong></td>
<td></td>
</tr>
<tr>
<td>Primary Sedimentation Tank</td>
<td>Sludge blanket level</td>
</tr>
<tr>
<td>Secondary / Final Clarifier</td>
<td>RAS blanket level / rag/pinfloc layer / clarity suspended solids</td>
</tr>
<tr>
<td>Sludge Thickener Tank</td>
<td>Sludge bed level / clarity suspended solids</td>
</tr>
<tr>
<td>“DAF” Tank</td>
<td>Sludge bed level / floating sludge level</td>
</tr>
<tr>
<td>Sequential Batch Reactor (SBR)</td>
<td>Settling bed level / RAS blanket level</td>
</tr>
<tr>
<td><strong>Industrial</strong> (food, paper etc.)</td>
<td></td>
</tr>
<tr>
<td>Primary Sedimentation Tank</td>
<td>Sludge blanket level</td>
</tr>
<tr>
<td>Secondary Clarifier Tank</td>
<td>RAS blanket level / clarity suspended solids / rag/pin-floc layer</td>
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<tr>
<td>Thickener Tank</td>
<td>Sludge bed level / clarity suspended solids / floc level</td>
</tr>
<tr>
<td>“DAF” Tank</td>
<td>Sludge bed level / floating sludge level</td>
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<tr>
<td>Sequential Batch Reactor (SBR)</td>
<td>Settling blanket level / RAS bed level</td>
</tr>
<tr>
<td>Carbon Column</td>
<td>Carbon bed level</td>
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<tr>
<td><strong>Mining/Mineral processing</strong></td>
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<tr>
<td>Clarifier Tank</td>
<td>Blanket level / clarity suspended solids / stratified floc layers</td>
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<tr>
<td>Thickener Tank</td>
<td>Sludge bed level / clarity suspended solids / stratified floc layers</td>
</tr>
<tr>
<td>CCD’s Tank</td>
<td>Sludge bed level / clarity suspended solids / stratified floc layers</td>
</tr>
<tr>
<td>Settling Ponds</td>
<td>Sludge bed level</td>
</tr>
</tbody>
</table>
TYPICAL INSTALLATIONS REQUIREMENTS

Positioning the Sonar Transducer

1. The sonar transducer should be installed approximately half submerged within the liquid level. Where the liquid level varies (sbr) use a floating sonar version. The surface face of the sonar transducer must be immersed under the liquid level at all times.

2. Circular Tanks - centre feed (fixed or moving bridge versions) position the sonar transducer 1/3 radius from the tank wall. This is to minimise the disturbance to the sonar measuring pulses.

3. Rectangular Tanks - position the sonar transducer at least 700mm from the side wall. Never position the sonar transducer over chains, site the transducer, to minimise disturbance from the incoming liquid.

Impact Plates

Leave an extra 2 turns of cable where the transducer connects to the actuator to minimise stress and wear on the cable.

See below for proper placement of cable tie if cable tie is used. Do not over tighten, it may lead to excessive cable wear.

---

1/3 Radius

---

INCORRECT

CORRECT
Sonar Transmitter – Mounting
Requirements
Select a suitable mounting position, preferably not in direct sunlight. If necessary utilize a sunshade.

Observe the maximum and minimum temperature limits (-20ºc, -4ºf to 70ºc, 165ºf).

Do not mount the sonar transmitter near high sources of EMF, such as motor starters, variable speed drives or 3 phase cables. Avoid mounting in high vibration areas, or use rubber absorption mounts. Be careful when removing the cable and compression glands.

Sonar Transducer – Mounting
Requirements
The transducer should be half submerged in the liquid and the transducer face must always be submerged.

**DO NOT SUBMERGE THE ENTIRE TRANSDUCER**

Impact Plates
Leave an extra 2 turns of cable where the transducer connects to the actuator to minimise stress and wear on the cable.

Round Tanks – Centre Feedwell
Mount the sonar transducer and cleaning mechanism, approximately one third radius from the outside tank wall. This is the same whether it is a moving or fixed bridge installation.

**Do not** mount near high infeed turbulence. Choose a site installation where the infeed is least disturbed.

Rectangular Tanks – End Feed
Mount the sonar transducer and cleaning mechanism away from high infeed turbulence. A clearance of 700mm from the side wall.

Do not mount directly over scraper, chain mechanisms. Choose a site installation where the infeed is least disturbed.

Floating Sonar – SBR
Mount the floating sonar transducer and cleaning mechanism as close as practicable to the launders.

Mount at least 1.00 metres from side walls. Make sure alignment guides are installed on the mounting bracket for decanter ranges above 500mm.
CHOOSING A SONAR TRANSDUCER

The ORCA Sonar offers seven different frequency ranges. The most important element of the sonar interface transmitter is the operating frequency of the sonar transducer as this will determine whether the sonar operating frequency is optimized to the interface application.

We offer a range of frequencies because the “basic rules of physics – sound transmission through liquids” suggests, that one frequency will not handle all applications.

Defraction is the term used for sound bending or passing an object in its path. Where large particles are in suspension a low frequency sonar transducer is used. For measuring extremely low density interfaces, a very high frequency sonar sensor is used. All ORCA series sonar transducers will work with the ORCA sonar transmitter.

Note: No set-up changes required when changing frequencies.

Consult your distributor or the factory on the choices of transducer frequency for your application.
Some successful examples commonly found within the water treatment plants are:

**Water Treatment Plants:**
- Primary Sedimentation Clarifiers
  Controlling floc level and clarity of water
  Part no: OSIRT003S4XC6 (single crystal 300kHz)

- Thickener Tank (Polymer Dosed)
  Controlling floc level and clarity of water polymer dosing.
  Part no: OSIRT302S4XC6 (3 crystal array 150kHz)

**Waste Water/Sewage Treatment plants:**
- Primary Sedimentation
  Controlling bed level
  Part no: OSIRT002S4XC6 (single crystal 150kHz)

- Secondary / Final Clarifier
  Controlling RAS blanket, fluff/RAG layer and clarity of water
  Part no: OSIRT002S4XC6 (single crystal 150kHz)

- Thickener (Gravity)
  Controlling bed level, clarity of water
  Part no: OSIRT302S4XC6 (3 crystal array 150kHz)

- Thickener (Polymer dosed)
  Controlling bed level, clarity of water polymer dosing
  Part no: OSIRT302S4XC6 (3 crystal array 150kHz)

- SBR (Sequential Batch Reactor)
  Controlling decant start time, polymer dosing if required
  Part no: OSIRT003S4XC6 (single crystal 300kHz)

**Part numbers:**
1. Primary Sedimentation Tank - Surface Scum Collectors
   OSIRT002S4XC6+OSIRDYX+OSIRME-L2+OSIRSC-E

2. Secondary Clarifier - Moving Bridge
   OSIRT002S4XC6+OSIRDYX+OSIRME-L2+OSIRSC-A

3. Secondary Clarifier - Fixed Bridge
   OSIRT002S4XC6+OSIRDYX+OSIRME-L2+OSIRSC-E

4. Thickener
   OSIRT302S4XC6+OSIRDYX+OSIRME-L2+OSIRSC-A
CHOOSING A SONAR TRANSDUCER - MINING

Hawk has recognised with long term experience that the selection of the sonar transducer type is so important for the success of the sonar system to work under all environmental conditions.

In the mining industry, measuring the compacted BED level, in paste thickener, tailings thickener, concentrate thickener, CCD’s, lamella thickeners, hi-rate thickeners vary considerably in the process environment.

Suspended solids concentrations, between the launder and BED level can change rapidly, due to a change in the ore type settling characteristic. High frequency, single crystal sonar transducers will not penetrate high suspended solids in the thickener during these unsettled conditions.

Hawk have developed a high powered range of multiple crystal array sonar transducers that have the capability of operating and penetrating suspended solids to give reliable performance measuring the heavy density BED level. Each sonar transducer can perform two independent functions simultaneously. The second channel can be used to provide a clarity or simple turbidity output as it measures the suspended solids levels between the BED level and the face of the sonar transducer near the launder level. The clarity output gives excellent process feedback information to the control room operators on how well the flocculent dosing system is working.

Tailings thickeners
All mining concentrators and coal preparation plants have tailings thickeners. They treat the process water by removing suspended solids and then return the water back to the concentrator or coal prep plant. They pump the solids to a tailings dam. Most tailings thickeners do not run efficiency because of a number of factors including

1. The thickener does not have a reliable BED level interface transmitter that will work under all environmental conditions and is not affected by density change.

2. The thickener does not have turbidity or a suspended solids transmitter that will provide feedback to the control room operator on how the flocculent dosing system is working.

By not utilising a BED level transmitter that is not affected by density, tailings thickener BED level are generally run too low in the cone of the thickener reducing the underflow density that is pumped to the tailings dam and also pumping too much water in the tailings.

The net effect is that the tailings dams will fill in volume faster and the additional cost of pumping the water back from the tailings dam to the concentrate or prep plant. Most tailings thickeners utilize an automatic flocculent dosing system that takes samples of feedwell water and carries out an automatic jar settling test. This is so...
important where multiple ore types are processed through the plant because of different settling rates and characteristics. However the observers or clearometers floc batch systems fail from time to time and the tailings thickener can change very quickly to not settling out the suspended solids. The clarity output from the sonar transmitter can alarm this condition to the operator in the control room. The clarity output can also be used in the control loop for the floc dosing system as a back up. The use of the sonar BED level transmitter will allow the tailings thickener to be run automatically in conjunction with the underflow density transmitter and torque amps from the scraper.

This will reduce costs in:
1. Floc dosing
2. Return water pumping costs from the tailings dam
3. Reduce tailings volume to the tailings dam
4. Increase the quality and volume of water returned to the concentrator

Cleaning Mechanism:
Each sonar transmitter is provided with a scum cleaning mechanism to suit the mechanical layout of the thickener and allows the sonar transmitter to work without operators needing to clean the sensor.

Some successful examples commonly found within the Mining industry:

**Coal Preparation Plants**
Tailings thickeners: Controlling heavy bed level and clarity (suspended solids)
Part no: OSIRT302S4XC6 (3 crystal array 150kHz)

**Mining Concentrators**
Tailings thickeners: Controlling heavy bed and clarity (suspended solids)
Part no: OSIRT302S4XC6 (3 crystal array 150kHz)

Concentrate thickeners: Controlling heavy bed level and clarity (suspended solids)
Part no: OSIRT702S4XC6 (7 crystal array 150kHz)

Clarifiers: Controlling bed level and lighter floc interface
Part no: OSIRT303S4XC6 (3 crystal array 300kHz)

Tailings dam: Controlling bed level
Part no: OSIRT002S4XC6 (single crystal 150 kHz)

CCD’s: Controlling heavy bed level and clarity (suspended solids)
Part no: OSIRT302S4XC6 (3 crystal array 150kHz)

Paste thickeners: Controlling heavy bed level and clarity (suspended solids)
Part no: OSIRT302S4XC6 (3 crystal array 150kHz)

Lamella thickeners: Controlling lighter interface from entering plates
Part no: OSIRT303S4XC6 (3 crystal array 300kHz)

Hi-Rate thickeners: Controlling heavy bed level and clarity (suspended solids)
Part no: OSIRT302S4XC6 (3 crystal array 150kHz)

Part numbers:
1. Tailings thickeners c/- surface scum boom OSIRT302S4XC6+OSIRDYX+OSIRME-L3+OSIRSC-E
2. Tailings thickeners no surface scum boom OSIRT302S4XC6+OSIRDYX+OSIRME-L3+OSIRSC-A
3. Concentrate thickeners OSIRT702S4XC6+OSIRDYX+OSIRME-L3+OSIRSC-A
4. Concentrate thickener c/- surface scum boom OSIRT702S4XC6+OSIRDYX+OSIRME-L3+OSIRSC-E
CHOOSING A SONAR TRANSDUCER - MINING

Sonar transducer penetration capability depending on power level.

Single crystal: PN Clarifier, clarifiers, tailings dam

3 crystal array: Tailings thickeners, paste thickener, hi-rate thickener, CCD’s

7 crystal array: Concentrate thickeners, CCD’s
CHOOSING A SONAR CLEANING SYSTEM

The ORCA Series Sonar have developed a range of sonar transducer "sludge" cleaning options, that requires no maintenance. They are industrially designed to minimise downtime.

Types available:
- (a) Electric actuator
- (b) Pneumatic actuator
- (c) Rotary scum brush
- (d) Floating sonar - actuator
- (e) Impact plate with counterweight

* Remember all sonar sensors need to have some form of cleaning mechanism.

Possible applications, where each type of sludge cleaning option are used.

(a) Electric Actuator
   (most common used)

Applications:
   - Fixed bridge, moving bridge circular or rectangular clarifier.
   - Fixed bridge thickener or CCD.
   - Mounted off a side wall of a tank, etc.

Where not to use the Electric Actuator

1. Do not use the electric actuator cleaner version, when surface scum collectors or moving surface or sub-surface mechanical parts can come in contact with the sonar sensor and mounting pipe.

2. The electric actuator does not have an Ex approval. Consult the factory.

(b) Pneumatic Actuator

Applications:
   - Fixed bridge, moving bridge circular or rectangular clarifier.
   - Fixed bridge thickener or CCD.
   - Mounted off side wall of a tank etc.
   - Can be used in ex approved applications.
   - Where not to use the pneumatic actuator.

1. Do not use the pneumatic actuator scum cleaner version when surface scum collectors or moving surface or sub-surface mechanical parts can come in contact with the sonar sensor or mounting pipe.

(c) Rotary Scum Brush

Applications:
   - Generally used in applications where the clearance space is limited.

Where not to use the Rotary Scum Brush

1. Do not use the rotary scum brush when surface scum collectors or moving surface or sub-surface mechanical parts can come in contact with the rotary brush, sonar sensor or mounting pipe.

2. Use Ex approved type in classified zone.

3. Do not use in heavy scale build-up applications.
(d) Floating Sonar - Actuator Type

Applications:
- SBR, IDAL, IDEA sequential batch reactors with varying water heights.
- Continuous measurement of bed level in settlement ponds.

Where not to use the Floating Sonar–Actuator Version

(1) Do not use the floating sonar - actuator cleaner version when surface scum collectors or sub-surface mechanical parts can come in contact with the sonar sensor float or mounting pipe.

(e) Impact Plate with Counterweight

Applications:
- Used where a surface scum connector passes in the path of the sonar sensor and mounting pipe.
- Circular and rectangular primary and secondary clarifiers.
- Fixed bridge or moving bridge thickeners, picket fence thickeners or CCD’s.
DIMENSIONS

Mounting Bracket Base Plate

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>139.5</td>
<td>mm</td>
</tr>
<tr>
<td>366.8</td>
<td>mm</td>
</tr>
<tr>
<td>79.5</td>
<td>mm</td>
</tr>
<tr>
<td>25.0</td>
<td>mm</td>
</tr>
<tr>
<td>20.0</td>
<td>mm</td>
</tr>
</tbody>
</table>

FLOATING SONAR SENSOR

- 512.6mm (20.1")
- 156°m (6.1")
- 570mm (22.4")
- 831mm (32.7")

OSIRT Transducer

- 1" BSP Nipple
- 135 mm (5.3")
- 75mm (2.9")

OSIRT Fibreglass Transducer

- 1" BSP Nipple
- 330mm (12.9")
- 75mm (2.9")

Note:
- Remove all sharp edges & burrs
- Welding finish: All connecting plates must be welded on all edges
- Welding finish: All gaps between plates must be weld filled
- Welding radius: No less than 5mm

4. Mounting Bracket Base Plate

X = Decant Range

X = Decant Range
**DIMENSIONS**

**SONAR IMPACT PLATE**

**SONAR ACTUATOR CLEANER**

Note: Advise physical dimension of surface scum rake.

**IMPORTANT**

Leave an extra 2 turns of cable where the transducer connects to the actuator to minimise stress and wear on the cable.

X - Pipe length to suit
* distance from safety rail or Bridge may be varied
DIMENSIONS

Front
192mm (7.6")
166mm (6.5")
3 x 20mm (0.7"), 1x16mm (0.6")
Knock outs

Side
106mm (4.2")
76.5 (3")

Back
192mm (7.6")
145mm (5.7")
83mm (3.3")
38mm (1.5")
10mm (0.4")
106mm (4.2")
10mm (0.4")
166mm (6.5")

DIN Rail Mounting (clips included)
FLOATING SONAR - ASSEMBLY

Part No. Code D
FLOATING SONAR - ASSEMBLY

Part No. Code D

Floating Sonar Assembly

- Water Level Ultrasonic Transducer
- Mounting Bracket
- Cleaning Actuator
- Sonar Transducer
- Moving Target
FLOATING SONAR - PARTS

Part No. Code D

- Water Level Target
- Sliding Pipe
- Pipe Guide
- Water Level Transmitter
- Mounting Bracket
- Electro-Actuator Sonar Cleaning
- Float with Sonar Sensor
- Sonar Transmitter
IMPACT PLATE - DIMENSIONS

Part No. Code E

X – Pipe length to suit
* distance from safety rail or Bridge may be varied

IMPORTANT
Leave an extra 2 turns of cable where the transducer connects to the actuator to minimise stress and wear on the cable
IMPACT PLATE - ASSEMBLY

Part No. Code E

IMPORTANT
Leave an extra 2 turns of cable where the transducer connects to the actuator to minimise stress and wear on the cable
ACTUATOR CLEANER - DIMENSIONS

Part No. Code A

X – Pipe length to suit
* distance from safety rail or Bridge may be varied

Bracket 316SS

Hole Dia. 8.5mm

Rail Base Plate

X – Pipe length to suit
* distance from safety rail or Bridge may be varied
## SONAR BRACKET NOZZLE - ASSEMBLY

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NUMBER</th>
<th>QTY.</th>
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<tbody>
<tr>
<td>1</td>
<td>Bracket SUBA</td>
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<tr>
<td>2</td>
<td>Custom 10inch Flange thin (5mm)</td>
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<tr>
<td>3</td>
<td>Rubber Slide</td>
<td>2</td>
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<tr>
<td>4</td>
<td>Custom 10inch Flange</td>
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</tr>
<tr>
<td>5</td>
<td>Rubber Bellow Seal</td>
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</tr>
</tbody>
</table>

![Diagram of Sonar Bracket Nozzle Assembly]

24
SONAR TRANSDUCER SCRAPER OPTION

This automated scraper system is used for applications where suspended solids need to be mechanically removed from the transducer face during each cleaning sequence. Water sprays can be included with this option.

Part Number: OSIRSC-ZS
ORCA 234 Remote Transmitter with Actuator
ORCA 234 Remote Transmitter with Actuator & Junction Box

WIRING DIAGRAM

Refer to Graph 1 for cable selection.
Filename: ActuatorCable3.xls

Revised 6/12/2006

CTP

Note 1: Calculations are based on …
4.0 Amps max actuator current, and
4.0 Volts drop across max cable length (2 wires).

Note 2: Maximum terminal capacity is 1.5mm, which limits 16AWG cable to 35m.

Note 3: For long cable runs, use 16 AWG to local junction box, then extend using 10-14 AWG.

Note 4: Also required: 3-wire cable for feedback potentiometer, 0.5mm - 1.0mm.

<table>
<thead>
<tr>
<th>Gauge (AWG)</th>
<th>Nom OD (mm)</th>
<th>Resist. (Ohm/1000ft)</th>
<th>Resist. (Ohm/m)</th>
<th>Loss (V/m)</th>
<th>Max Res. (Ohm)</th>
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**Analog Output 1**

**Terminal Connections for AC Supply – Model dependant**

**a) Modulating from User’s External DC Supply (RL to Pos.)**

 ví dụ: RL Max = 750Ω if user DC Supply 24V

**NOTE1**: RL Max = 750Ω if user DC Supply 24V

**b) Modulating from User’s External DC Supply (RL to Neg.)**

**NOTE1**

**c) 4 Wire AC – Driving from Internal Isolated Supply (Is)**

**NOTE2**: Isolated current output can be made common with external DC Supply Positive or Negative if required. (e.g. RL – connected to GND)
WIRING DIAGRAM

Analog Output 1

Terminal Connections for DC Supply – Model dependant

d) 4 Wire DC – Driving from Internal Isolated Supply (Is+)

NOTE2*

![Diagram for 4 Wire DC – Driving from Internal Isolated Supply (Is+)]

- User DC Supply
- PLC
- DCS
- IND
- RL Max 400Ω
- 4-20mA
- Use shielded cable
- Terminal Connection
- DC Supply

4-20mA Use shielded cable

PLC
DCS
IND

NOTE1*

![Diagram for 3 Wire DC – Modulating from Common User Supply (RL to +DC)]

- User DC Supply
- PLC
- DCS
- IND
- RL Max 750Ω
- 4-20mA
- Use shielded cable
- Terminal Connection
- DC Supply

ANALOG 2

4-20mA

PLC
DCS
IND

f) 3 Wire DC – Modulating from Common User Supply (RL to GND)

NOTE1*
Analog Output 2

**Terminal Connections for DC Supply – Model dependant**

**e) 3 Wire DC – Modulating from Common User Supply (RL to +DC)**

**NOTE:**
Internal SMART card configured for 3, 4 wire.

**NOTE:**
RL Max = 750Ω if user DC Supply 24V

**f) 3 Wire DC – Modulating from Common User Supply (RL to GND)**

**NOTE:**
Internal SMART card configured for 3, 4 wire.

**NOTE:**
RL Max = 750Ω if user DC Supply 24V
DEVICENET

Also Refer to: PROFIBUS Installation Guideline for PROFIBUS-DP/FMS, Order No. 2.112
Set the BaudRate and the DeviceNet Address in Sultan

Factory defaults of baudrate and FBusAdds are 125kbps and 63 in a Sultan unit with DeviceNet CommType. To modify these values follow the instructions below.

1. Go to the Output Adjustment menu
2. Use the Up and Down push buttons to reach the CommType parameter
3. Make sure that the CommType is set to DeviceNet
4. Press the CAL button twice
5. DeviceID will be displayed
6. Use the Down push button to reach the BaudRate parameter
7. The default value for the BaudRate is 125kbps. Press CAL button and use the Up and Down push buttons to modify this value
8. Press CAL button when finished
9. Use the Down push button to reach the FBusAdds. The default value of the FieldBus Address is 63. Press CAL button and use the Up and Down push buttons to modify this value
10. Press CAL button again when finished

Output Data

Profibus/DeviceNet now transmit 18 bytes/9 words, description of the words is as follows (For firmware version 5.54 and above)

1. Displayed Distance (Space Distance is the Primary Variable)
2. Percentage (Percent of Range)
3. Hi Level (Upper Range)
4. Low Level (Lower Range)
5. Status Flags

<table>
<thead>
<tr>
<th>Failed</th>
<th>~~~~~~</th>
<th>Search</th>
<th>0</th>
<th>Echo Cf : 1 =</th>
<th>Echo R : 1 =</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit F</td>
<td>Bit E</td>
<td>Bit 3</td>
<td>Bit 1</td>
<td>True, 0 = False</td>
<td>True, 0 = False</td>
</tr>
</tbody>
</table>

Bit0 = Echo was received inside the span.
Bit1 = Echo is Confirmed.
Bit3 = Searching is searching for an Echo.
BitF = Unit has Failed to detect an Echo.

6. Displayed Distance2 (Second Variable)*
7. Percentage2 (Second Percent of Range)*
8. Displayed Distance3 (Third Variable)+
9. Percentage3 (Third Percent of Range)+

* Used for ORCA Sonar and Differential output on a Sultan
+ Only used for ORCA Sonar Clarity output.
PROFIBUS

PROFIBUS MASTER

5. B IN
4. A IN
3. SHEILD
2. B OUT
1. A OUT
Set the ProfiBus Address in Sultan

Factory defaults of FBusAdds is 126 in a Sultan unit with ProfiBus CommType. To modify this value follow the instruction below:

1. Go to the output Adjustment menu.
2. Use the Up and Down push buttons to reach the CommType parameter.
3. Make sure that the CommType is set to ProfiBus
4. Press the CAL button twice.
5. DeviceID will be displayed
6. Use the Down push button to reach the BaudRate parameter.
7. The value for the BaudRate is selected automatically and can not be modified.
8. Use the Down push button to reach the FBusAdds. The default value of the FieldBus Address is 126. Press CAL button and use the Up and Down push buttons to modify this value.
9. Press CAL button again when finish.

Output Data

Profibus/Devicenet now transmit 18 bytes/9 words, description of the words is as follows (For firmware version 5.54 and above)

1. Displayed Distance (Space Distance is the Primary Variable)
2. Percentage (Percent of Range)
3. Hi Level (Upper Range)
4. Low Level (Lower Range)
5. Status Flags

<table>
<thead>
<tr>
<th>Failed</th>
<th>~~~~~~</th>
<th>Search</th>
<th>0</th>
<th>Echo Cfm : 1 = True, 0 = False</th>
<th>Echo R : 1 = True, 0 = False</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit F</td>
<td>Bit E</td>
<td>Bit 3</td>
<td>Bit 1</td>
<td>Bit 0</td>
<td></td>
</tr>
</tbody>
</table>

Bit0 = Echo was received inside the span.
Bit1 = Echo is Confirmed.
Bit3 = Searching is searching for an Echo.
BitF = Unit has Failed to detect an Echo.

6. Displayed Distance2 (Second Variable)*
7. Percentage2 (Second Percent of Range)*
8. Displayed Distance3 (Third Variable)+
9. Percentage3 (Third Percent of Range)+

* Used for ORCA Sonar and Differential output on a Sultan
+Only used for ORCA Sonar Clarity output.
SOFTWARE MENU DESCRIPTION

ENTERING DATA
All software adjustments are achieved via the four PUSH BUTTONS on the front panel.

In Run Mode
(A) Press and hold - interrupts normal operations and allows access to software menu headings.

In Calibrate Mode
(B) Momentary press - saves selected value.
   Press and hold - scrolls through set-up menus and parameters.

In Run Mode
(A) Displays operating diagnostics on display LCD.

In Calibrate Mode
(B) Increases display value.
   (C) Scrolls through software parameters.

In Run Mode
(A) Displays operating diagnostics on display LCD.

In Calibrate Mode
(B) Decreases display value.
   (C) Scrolls through software parameters.

In Calibrate Mode
(A) Press when all calibrations are complete.
   (B) Stores all parameters, returns the ORCA Sonar to normal operating run mode.
SOFTWARE MENU DESCRIPTION

Menu Headings

QUICKSET

Parameters

UNIT
APP TYPE
APP TYPE 2
FAILSAFE
DISP MODE
I: SEN ADD
OFFSET
LOCK CODE

TX SETUP

GAIN
GAIN STEP
DIST STEP
THRESHOLD
BLANKING
EMPT DIST
TEMP TRIM
DIST TRIM
VELOCITY
E WIDTH 1
GAIN 2
THRESHOLD 2
E WIDTH 2
FLOCK

OUTPUT AD

FILL DAMP
EMPTY DAMP
4mA ADJ
20mA ADJ
ANALOG
20mA ADJ 2
20mA ADJ 2
SIMULATE
COMMUNICATIONS TYPE - MODPUS
OMM TYPE
RLY MOD 1
RLY MOD 2
RLY MOD 3
CLEANING
SOFTWARE MENU DESCRIPTION

QUICKSET

Units: Selectable metres, centimetres, feet, inches.

App Type (application type): Selectable,
RAS: Return activated sludge blanket level
Bed: Bed level, thickener, primary sedimentation
Floc: Floc level, floc/rag level

APP Type 2
OFF
BED
RAS
FLOC
CLARITY

FAIL SAFE
20mA, 4mA, Lst Knw, 20.20mA, 3.80A, 3.50mA

FAIL TIME
3.0min - 0.0min

DISP MODE
Level
% Level
SPACE

I: SEN ADD
1 to 25

OFFSET
0.0cm
500.0cm

Continued next page
Sonar Level System

SOFTWARE MENU DESCRIPTION

Continued from previous page

- **Density (choose density)**
  - 0.1 gram to 10 gram/litre

- **Calibrate (fine adjust density)**
  - 0.0% to 26.7%

- **Lo Level**
  - 0% or 4ma position
  - 0 - 60 metres

- **Hi Level**
  - 100% or 20ma position
  - 0 - 60 metres

- **Fill Rate**
  - 0.1m to >20m per hour fill rate

- **Empty Rate**
  - 0.1m to >20m per hour pump out rate

Continued next page
SOFTWARE MENU DESCRIPTION

Continued from previous page

Failsafe Mode
Options: 3.50ma, 3.80ma, 20.20ma, last known, 4.0ma, 20.00ma

Fail Time
0.0 minutes to >20.0 minutes

Display Mode
Options: space: (distance from transducer to interface)
Level: (distance from bottom of tank to depth of interface)
% Level: percentage of vessel full.

Offset
Allows the user to move the start point of the measurement
0.0m to 5.0m

Lock Code
Allows the user to enter a security code
0 to 65,000
SOFTWARE MENU DESCRIPTION

TX SETUP

Gain:
Sensitivity range of sonar transducer.
Factory set for applications.
Range: 0.0% to 95.0%

Gain Step:
Fixed gain level near sonar transducer face.
Factory set for each transducer frequency.
Range: 0.0% to 80%

Distance Step:
The distance out from the transducer face where the fixed low gain (gain step) applies. Generally used to reduce a mechanical mounting reflection near the transducer.
Range: 0.350mm to >10.0m
Factory set for each transducer frequency.

Threshold:
Factory set for selected applications. the sizes of the signal in volts, that instrument will accept as validated.
Check with your distributor or the factory before changing.
Range: 0.00v to 2.49v

Blanking:
Distance from transducer face, where the software is prevented from measuring.
Range: 0.000mm to >10.0m

Empty Distance:
A distance longer than low level, the software prevents measurements from past this distance.
Note: Conical shaped vessels need longer empty distances.
Range: 0.600 to 65.0m

Note:
To increase the range capability of the transmitter, increase the empty distance to a greater distance than required for the application.
Temperature Trim:
The sonar transducer has an inbuilt temperature compensator. This parameter allows the inbuilt temperatures sensor to be calibrated.
Range: -50.0ºc to 160.0ºc. Factory calibrated.

Distance Trim:
Allows for fine calibration of the measuring distance. Only when required. Factory calibrated.

Velocity:
Allows for a change in the speed of sound. Factory calibrated consult your distributor or factory.

E Width 1:
Factory calibrated consult your distributor or factory.

Application 2 #
(only used with Dual Analogue Orca Transmitter)

Gain 2:
Sensitivity range of sonar transducer factory set for applications. Range: 0.0% to 95.0%

Threshold 2:
Factory set for selected applications the size of the signal in volts, that the instrument will accept as validated. Check with your distributor or factory before changing. Range: 0.00v to 2.49v

E Width 2:
Factory calibrated. Consult your distributor or factory.

FLOC MARG
SOFTWARE MENU DESCRIPTION

OUTPUT ADJUST

- Fill Damping (tank filling):
  The number of pulses that the analogue output is averaged over.
  eg: 60 = 60 pulses = 1 minute. Analogue output changes by the average change in this time period.

- Empty Damping (tank emptying):
  The number of pulses that the analogue output is averaged over.
  eg: 120 = 120 pulses = 2 minutes. Analogue output changes by the average change in this time period.

- 4mA Adjust:
  Trim 4mA Output

- 20mA Adjust:
  Trim 20mA Output

- Analog
  4ma - 20ma
  Invert Output
  20ma - 4ma

- Simulate:
  Drive the output and display using up/down push buttons.

- 4mA Adjust 2

- 20mA Adj 2

- Comm Type:
  Modbus (factory default)
  Options: Hart, Profibus.

Continued next page
SOFTWARE MENU DESCRIPTION

Continued from previous page

Relay Mode 1:
- **EN**: Energise
- **Options**: FS Failsafe, Off Out of service, DEN De-energised
- Relay L1 (1) turn on: 0.800m
- Relay L2 (1) turn off: 0.900m
- Relay setpoints 0.00m to 65.0m

Relay Mode 2:
- **EN**: Energise
- **Options**: FS Failsafe, Off Out of service, DEN De-energised
- Relay L1 (2) turn on: 1.000m
- Relay L2 (2) turn off: 1.100m

Relay Mode 3:
- **EN**: Energised
- **Options**: FS Failsafe, Off Out of service, DEN De-energised
- Relay L1 (3): 1.200m
- Relay L2 (3): 1.300m

Cleaning:
- **Off**
- **Options**: Actuator
- Actuator max. position 80.4mm (max. movement of actuator)
- Actuator min. position 53.6mm (return position of actuator)
- **Range**: Factory adjusted
- Contact distributor or factory
- No maintenance requirement.
- Max 5yrs operation, 1 operation/hr

Cycle:
- Actuator operation time (cycle)
- **Suggested**: 120 min between cleans
- **Range**: 5 minutes to >10 hrs
ENTERING DATA

SOFTWARE TREE

To Calibrate

- **RAS 0.850m**
  - Run Display
    - Example application – RAS Blanket.
    - Depth of RAS Blanket – 0.850m
  - Press CAL

- **UNLOCK 0**
  - Onstart up there is no security code protection.
  - Press CAL

- **QUICKSET**
  - Quickset
    - Menu covers all basic parameters plus application choises.
  - Press

- **TX SETUP**
  - Transducer Setup
    - Used only in very special applications, consult distributor or factory.
  - Press

- **OUTPUT AD**
  - Output Adjust
    - Change output functions.
  - Press

Back to normal Run Mode
ENTERING DATA

DIAGNOSTIC DISPLAYS

The diagnostic displays appear on the top line of the display, after pressing the push button when the sonar transmitter is in the operations mode.

The diagnostics provide the user with valuable performance feedback on how the sonar is performing, whilst in operation mode.

Example:

Run Mode Display

- **RAS** (application)
- **RAS Bed Level**
- **E: 3.220 (in metres)**
  - Instant echo distance per each pulse based on application set-up parameters.
  - Measurement from sonar transducer.
- **RAS Bed Level**
- **S: 2.05v**
  - This is the amplitude of the signal return in volts, from the interface.
- **RAS Bed Level**
- **G: 42.0%**
  - Gain sensitivity at the distance the signal is detected.
- **RAS Bed Level**
- **R: 1.1%**
  - The amount of recover gain if the signal drops below threshold detection level.
- **RAS Bed Level**

Continued next page
**ENTERING DATA**

Continued from previous page

<table>
<thead>
<tr>
<th>N: 1.9%</th>
<th>Press</th>
<th>N: Background noise level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.850m</td>
<td></td>
<td>RAS Bed Level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T: 24.2C</th>
<th>Press</th>
<th>T: Liquid temperatures at sonar transducer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.850m</td>
<td></td>
<td>RAS Bed Level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WI: 3.070</th>
<th>Press</th>
<th>WI: start of window tracking position, in metres from sonar transducer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.850m</td>
<td></td>
<td>RAS Bed Level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WI: 4.270</th>
<th>Press</th>
<th>WI: end of window tracking position</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.850m</td>
<td></td>
<td>RAS Bed Level</td>
</tr>
</tbody>
</table>

**NORMAL** = Normal operation if echo received above threshold
**RECOVER** = Echo below threshold increasing gain.
**FAILED** = No echo received. Possible failed transducer or cable problem.

<table>
<thead>
<tr>
<th>Press</th>
<th>RAS Bed Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Return to application display

RAS Bed Level
START UP - COMMISSIONING

After making sure that the sonar is installed correctly, turn the power on to calibrate and commission the instrument. The ORCA Sonar has been designed to work on a number of different applications, that require variations to the set-up. To simplify the set-up we have developed an ‘Application Menu’.

The ‘Application Menu’ covers the most commonly seen sonar applications. The ORCA sonar can be calibrated to handle many other sonar interface applications up to a range of 60 metres.

Please see the following application examples.

**Analogue Output No. 1 (output 1)**

1. RAS (return activated sludge) blanket
2. Floc (floc/rag layer) (floc polyelectrolyte blanket)
3. Bed level (primary sedimentation tank) (thickener/ccd’s)

**Analogue Output No. 2 (output 2)**

4. RAS (return activated sludge) blanket
5. Floc (floc/rag layer) (floc polyelectrolyte blanket)
6. Bed level (primary sedimentation tank) (thickener/ccd’s)
7. Clarity (suspended solids monitoring)

If your application for the sonar does not appear in the list, contact your distributor or the factory.

*Note:* Some ‘RAS Blanket’, ‘Bed Level’ and ‘Floc Interface’ applications, experience high fluctuation, caused by hydraulic imbalance inflow characteristics. It can vary in alternative tanks at the same site.

To verify the sonar is measuring the correct density interface, use a portable turbidity analyzer or a sludge judge clear pipe.

Using the portable turbidity analyzer and holding it at a fixed depth, will indicate how much the interface is fluctuating in height.

Remember, the RAS Blanket, or Bed of a thickener is never flat.

The heavier the density, the more stable the measurement.

Consult your distributor or factory for more support.
APPLICATION 1:
RAS Blanket (Secondary/Final Clarifier)
(a) (Sewage treatment and waste water treatment plants)
(Select application: RAS select density level to track)
(Programming)

Secondary Clarifier RAS Floc Calibration

<table>
<thead>
<tr>
<th>Quick Start</th>
<th>Tx Setup</th>
<th>Tracking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Level (m):</td>
<td>Gain (%): 10</td>
<td>Recover First (%): 0.0</td>
</tr>
<tr>
<td>Hi Level (m):</td>
<td></td>
<td>Recover Max (%): 30.0</td>
</tr>
<tr>
<td>Application: RAS</td>
<td></td>
<td>Recover Inc. (%): 0.5</td>
</tr>
<tr>
<td>Rate of Fill: 1.0</td>
<td>Threshold (V): 0.60</td>
<td>Window (m): 1.008</td>
</tr>
<tr>
<td>Damp Fill: 180</td>
<td></td>
<td>Win Fwd (m): 0.003</td>
</tr>
<tr>
<td>Rate of Empty: 1.0</td>
<td>EmptyDist (m):</td>
<td>Win Back (m): 0.003</td>
</tr>
<tr>
<td>Damp Empty: 180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fail Safe: 4.00mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fail Safe Time: 180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lock Code: 0</td>
<td>Threshold 2: 1.00</td>
<td>Echo Width (m): 0.200</td>
</tr>
<tr>
<td>Disp Mode: Space</td>
<td>Echo Width 2 (m): 0.300</td>
<td></td>
</tr>
<tr>
<td>Low Level 2 (m):</td>
<td>Gain 2 (%): 14.9</td>
<td>FlocMargin (m): 0.400</td>
</tr>
<tr>
<td>Hi Level 2 (m):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application 2: FLOC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density: 3.0-6.0g</td>
<td></td>
<td>SlopeMin (m): 0.100</td>
</tr>
<tr>
<td>Density 2: 1.2-3.0g</td>
<td></td>
<td>GainStartMax: 12.0</td>
</tr>
<tr>
<td>Calibratr (%): 1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SmplRate (min): 1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damp 2: 180</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example Setup

Press CAL

UNLOCK 0

Press CAL

QUICKSET

Press CAL

UNIVERSAL

Press CAL

UNIT METRES

Press CAL

APP TYPE RAS

Press twice CAL

DENSITY 1.2 - 3.0 G/L

Press CAL

Continued next page

Units of measurement

Choice: metres, centimetres, feet, inches

Application Type: RAS, Bed, Change, Floc

Density range: 0.1 to 10.0 g/l

Density Edit, Adjust
Typical RAS Density
2.5 G/L to 4.0 G/L

Calibrate parameter allows fine adjustment of the density tracking position.

Fine adjust calibrate of density setting.
Range: 0.0% to 26.7%

Distance where interface was detected.

Correct RAS blanket level

Continued from previous page

(Example)

Display reads
Size of return echo
Display resumes

Continued next page
START UP - COMMISSIONING

Continued from previous page

Press \[\text{RUN}\]

Low Level: 4mA (0%)

Low Level

\[
\text{LOW LEVEL 10.00m}
\]

Press \[\text{CAL}\]

Low Level Edit

Press \[\text{CAL}\]

Low Level

\[
\text{LOW LEVEL 6.50m}
\]

Press \[\text{CAL}\]

Low Level Edit

High Level: 20mA (100%)

High Level

\[
\text{HIGH LEVEL 0.50m}
\]

Press \[\text{CAL}\]

Hi Level Edit

Press \[\text{CAL}\]

Hi Level Edit

Adjust for maximum speed that the interface can move.

Monitors Tank Filling

Press \[\text{CAL}\]

Edit Fill Rate

Press \[\text{CAL}\]

Fill Rate

\[
\text{FILL RATE 1.0m/H}
\]

Press \[\text{CAL}\]

Edit Fill Rate

Adjust for maximum speed that the interface can move.

Monitors Tank Emptying

Press \[\text{CAL}\]

Edit Empty Rate

Press \[\text{CAL}\]

Empty Rate

\[
\text{EMPTY RATE 1.0m/H}
\]

Continue next page
START UP - COMMISSIONING

Continued from previous page

Choose a failsafe condition.

FAILSAFE 20.00mA

Press CAL

Press CAL

Press CAL

Press CAL

FAIL TIME 3.0min

The time, after a fault has occurred before failed output condition.

Press CAL

Press CAL

Press CAL

Press CAL

DISPLAY MODE LEVEL

Display reading distance, bottom of tank up, or top of tank down.

Press CAL

Press CAL

Press CAL

Press CAL

OFFSET 0.000m

Allows start position level to be altered.

Press CAL

Press CAL

Press CAL

Press CAL

OFFSET 0.000m

Press CAL

Press CAL

Press CAL

Press CAL

LOCK CODE 0

Security Code

Zero code, no security.

Press CAL

Press CAL

Press CAL

Press CAL

Press CAL

Press CAL

Press and hold until transmitter starts measuring.

Press CAL

Press CAL

Press CAL

Press CAL

Press CAL

Press CAL

Press CAL

EDIT

Press

Range: 0.0 min to >10.0 min

Press

Range: 0.000m to 5.0m

Press

Choice: Space Level % Level

Press

Choices: last known 20.20ma 3.80ma 3.50ma

Press

20.00ma 4.00ma

Press

0

0

Security Code

Range: 0 to 65,000

Press

Range: 0.000m to 5.0m

Press

Choice: Space Level % Level

Press

CONTINUE

Press

Press and hold until transmitter starts measuring.
START UP - COMMISSIONING

APPLICATION 2:
Flock/RAG Layer
(Water treatment plants - Floc Blanket)
(Sewage treatment and waste water treatment plants - Secondary/Final Clarifiers - Floc/RAG Layer)

Clarifier Floc Level Calibration

<table>
<thead>
<tr>
<th>APPLICATION 2: Flock/RAG Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Water treatment plants - Floc Blanket)</td>
</tr>
</tbody>
</table>

Clarifier Floc Level Calibration

<table>
<thead>
<tr>
<th>Info</th>
<th>Quick Start</th>
<th>Factory</th>
<th>Track</th>
<th>Tx Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial No</td>
<td>12345</td>
<td>Low Level</td>
<td>10.000</td>
<td>Slope Dist</td>
</tr>
<tr>
<td>Type</td>
<td>100</td>
<td>High Level</td>
<td>0.500</td>
<td>Shape Inc</td>
</tr>
<tr>
<td>SoftVer</td>
<td>5.96</td>
<td>Application</td>
<td>FLOC</td>
<td>Detector</td>
</tr>
<tr>
<td>Modbus</td>
<td>01</td>
<td>Rate of Fill</td>
<td>1.0</td>
<td>GainStep1</td>
</tr>
<tr>
<td>TxSerial</td>
<td>14168</td>
<td>Drain Full</td>
<td>300</td>
<td>GainStep2</td>
</tr>
<tr>
<td>TxModel</td>
<td>300</td>
<td>Drain Empty</td>
<td>300</td>
<td>GainStep3</td>
</tr>
<tr>
<td>TxSoftVer</td>
<td>4.65</td>
<td>Fail Safe</td>
<td>20.0mA</td>
<td>GainMax</td>
</tr>
<tr>
<td>Company</td>
<td>Have</td>
<td>Fail Safe Time</td>
<td>180</td>
<td>Hold</td>
</tr>
</tbody>
</table>

| Lock Code | 0 | PulseRate | 3000 |
| Disp Mode | Level | Frequency | 3394 |
| Low Level Start | 10.000 | Filter | 33 |
| Hi Level Stop | 0.500 | 1/Waste | 0.500 |
| Application 2 | Clarity | 32 |
| Density | 0.1-0.6g | I-Charge(mA) | 10.0 |
| Density 2 | N/A | DampSO2 | 300 |
| Calibr1 | 4.3 | Calibr2 | 4.3 |
| Calibr3 | 4.3 | Calibr4 | 4.3 |
| Calibr5 | 3.0 | DampSO2 | 300 |

| Gain | 40.0 | GainStep 3 | 12.0 |
| Dist Step 3 | 0.750 | Dist Step 3 | 0.350 |
| Threshold | 0.40 | Window | 1.000 |
| Win Back | 0.002 | Confirm | 2 |
| Empty Dist | 20.000 | Temp Adj | 3360 |
| Temp | 100 | Dist Adj | 0.025 |

| TxOutput | 1 | Vehocity | 10000 |
| TxVoltage | 8.000 | Noise Sn | 9.7 |
| Noise | 0.100 | Echo Width | 1.000 |
| Search | 1.000 | Echo Width 2 | 1.000 |
| Movement | 0.000 | Gain 2 | 12.0 |
| No of Echo | 10 | FlockMargin | 0.300 |
| TxDelay | 1 | TxDelay | 1 |
START UP - COMMISSIONING

Example Setup

Units of measurement

Press \[\text{CAL}\]

QUICKSET

Press \[\text{CAL}\]

UNIT METRES

Press \[\downarrow\]

APP TYPE RAS

Press \[\text{CAL}\]

APP TYPE FLOC

Application Type: RAS Bed Floc

Press \[\text{Edit}\]

Continued next page
START UP - COMMISSIONING

Continued from previous page

DENSITY 1.2 - 3.0 G/L
Press CAL

DENSITY 0.1 - 0.6 G/L
Press CAL

CALIBRATE 8.0%
Press CAL

CALIBRATE 0.5V
Display reads
Size of return echo
Display resumes

CALIBRATE 8.0%
Press CAL

CALIBRATE 14.0%
Press CAL

Density Range: 0.1 to 10.0G/L
Press Density Edit Press

Fine adjust calibrate of density setting.
Range: 0.0% to 26.7%

Then
CALIBRATE 2.60m
Distance where interface was detected.

(Example)

Continued next page
START UP - COMMISSIONING

CALIBRATE 2.2V
Display reads
Press CAL

Increased echo size on top of Floc Blanket

CALIBRATE 14.0%
Display resumes
Press RUN

Low Level: 4mA (0%)

CALIBRATE 2.00M
Then
Distance where Floc interface is detected.

CALIBRATE 10.00m

Low Level Edit
Press

Range: 100mm to 60.0m

CALIBRATE 6.50m

Low Level Edit
Press

Range: 0.0 to 59.9m

CALIBRATE 0.50m

Hi Level Edit
Press

Range: 0.1m/H to >10.0m/H

FILL RATE 1.0m/H

Edit Fill Rate
Press

Continued next page
START UP - COMMISSIONING

**Continued from previous page**

Adjust for maximum speed that the interface can move.

**EMPTY RATE**

1.0m/H

- Press CAL
- Edit Empty Rate

**Monitors Tank Emptying**

- Press

- Range: 0.1m/H to >10.0m/H

**FAILSAFE**

20.00mA

- Press CAL
- Edit

- Choices:
  - 20.00mA
  - 4.00mA
  - Last Known
  - 20.20mA
  - 3.80mA
  - 3.50mA

The time, after a fault has occurred before failed output condition.

**FAIL TIME**

3.0min

- Press CAL
- Edit

- Range: 0.0 min to >10.0 min

Display reading distance, bottom of tank up, or top of tank down.

**DISPLAY MODE**

- Press CAL
- Edit

- Choice:
  - Space
  - Level
  - % Level

Allows start position level to be altered.

**OFFSET**

0.000m

- Press CAL
- Edit

- Range: 0.000m to 5.0m

Continued next page
START UP - COMMISSIONING

Continued from previous page

Security Code

LOCK CODE

0

Press CAL

Press RUN

Zero code, no security.

Press Edit

Range: 0 to 65,000

Press

Press and hold until transmitter starts measuring.

Note:  Some ‘RAS Blanket’, ‘Bed Level’ and ‘Floc Interface’ applications, experience high fluctuation, caused by hydraulic imbalance inflow characteristics. It can vary in alternative tanks at the same site.

To verify the sonar is measuring the correct density interface, use a portable turbidity analyzer or a sludge judge clear pipe.

Using the portable turbidity analyzer and holding it at a fixed depth, will indicate how much the interface is fluctuating in height.

Remember, the RAS Blanket, or Bed of a thickener is never flat.

The heavier the density, the more stable the measurement.

Consult your distributor or factory for more support.
APPLICATION 3:
Bed Level (thickener) *Sonar Transducer: 3 crystal and 7 crystal types
(a) (Sewage treatment and waste water treatment plants - thickeners)
(b) (Mining - thickeners, CCD's)
(c) (Food - thickeners, carbon columns)

Thickener Bed Level Calibration
Example Setup

Press \( \text{CAL} \)

Unlock 0

Press \( \text{CAL} \)

Quickset

Press \( \text{CAL} \)

Unit metres

Press \[ \downarrow \]

App type RAS

Press \( \text{CAL} \)

App type bed

Press \( \text{CAL} \)

Continued next page
Density Edit

Press

CAL

Continued from previous page

DENSITY
3.0 - 6.0 G/L

Press

CAL

Density Range: 0.1 to 10.0G/L

Press

Density Edit

Press

CALIBRATE
10.1%

Press

CAL

Fine adjust calibrate of density setting.
Range: 0.0% to 26.7%

CALIBRATE
1.0V

Display reads

Size of return echo

Display resumes

CALIBRATE
10.1%

Press

CAL

(Example)

CALIBRATE
8.0%

Press

CAL

CALIBRATE
3.50m

Distance where interface
was detected.
(Needs to read lower)

Continued next page
Display reads

Increased return echo (good signal)

Low Level: 4mA (0%)

High Level: 20mA (100%)

Adjust for maximum speed that the interface can move.

**CALIBRATE** 2.0V

Then

**CALIBRATE** 4.50m

Now distance where interface bed level detected.

**LOW LEVEL** 10.00m

Press **CAL** Low Level Edit

**LOW LEVEL** 6.50m

Press **CAL**

**HIGH LEVEL** 0.50m

Press **CAL** Hi Level Edit

Monitors Tank Filling

**FILL RATE** 1.0m/H

Press **CAL** Edit Fill Rate

Range: 0.1m/H to > 10.0m/H

Range: 0.0 to 59.9m

Range: 100mm to 60.0m

Continued from previous page

Continued next page
### START UP - COMMISSIONING

**Continued from previous page**

Adjust for maximum speed that the interface can move.

<table>
<thead>
<tr>
<th><strong>EMPTY RATE</strong></th>
<th>1.0m/H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press <strong>CAL</strong></td>
<td><strong>CAL</strong></td>
</tr>
</tbody>
</table>

Monitors Tank Emptying

Press **CAL**

<table>
<thead>
<tr>
<th><strong>FAILSAFE</strong></th>
<th>20.00mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press <strong>CAL</strong></td>
<td><strong>CAL</strong></td>
</tr>
</tbody>
</table>

Choose a failsafe condition.

<table>
<thead>
<tr>
<th><strong>FAIL TIME</strong></th>
<th>3.0min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press <strong>CAL</strong></td>
<td><strong>CAL</strong></td>
</tr>
</tbody>
</table>

The time, after a fault has occurred before failed output condition.

<table>
<thead>
<tr>
<th><strong>DISPLAY MODE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LEVEL</strong></td>
</tr>
<tr>
<td>Press <strong>CAL</strong></td>
</tr>
</tbody>
</table>

Display reading distance, bottom of tank up, or top of tank down.

<table>
<thead>
<tr>
<th><strong>OFFSET</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0.000m</strong></td>
</tr>
<tr>
<td>Press <strong>CAL</strong></td>
</tr>
</tbody>
</table>

Allows start position level to be altered.

<table>
<thead>
<tr>
<th><strong>CONTINUED NEXT PAGE</strong></th>
<th></th>
</tr>
</thead>
</table>
**Note:** Some ‘RAS Blanket’, ‘Bed Level’ and ‘Floc Interface’ applications, experience high fluctuation, caused by hydraulic imbalance inflow characteristics. It can vary in alternative tanks at the same site.

To verify the sonar is measuring the correct density interface, use a portable turbidity analyzer or a sludge judge clear pipe.

Using the portable turbidity analyzer and holding it at a fixed depth, will indicate how much the interface is fluctuating in height.

Remember, the RAS Blanket, or Bed of a thickener is never flat.

The heavier the density, the more stable the measurement.

Consult your distributor or factory for more support.
START UP - COMMISSIONING

APPLICATION 4:
Primary Sludge Blanket (Primary Sedimentation Tank)
(a) (Sewage treatment plant and waste water treatment plans)
(b) (Paper and industrial waste treatment plants)

Primary Sedimentation Bed Level Calibration
START UP - COMMISSIONING

Example Setup

Press CAL

UNLOCK

0

Press CAL

QUICKSET

Press CAL

UNIT METRES

Press CAL

APP TYPE RAS

Press CAL

APP TYPE BED

Continued next page

Menu heading

Units of measurement

Application Type: RAS
Bed
Floc

Bed Level

Press Edit

Choice:
Metres
Centimetres
Feet
Inches

Press
START UP - COMMISSIONING

Continued from previous page

DENSITY
3.0 - 6.0 G/L
Press CAL

Density Range: 0.1 to 10.0 G/L

CALIBRATE 10.1%
Press CAL

Fine adjust calibrate of density setting. Range: 0.0% to 26.7%

CALIBRATE 2.0V
Then CALIBRATE 4.20m

Distance where Sludge Blanket was detected.

CALIBRATE 10.1%
Press RUN

Display resumes

LOW LEVEL 10.00m
Press CAL Low Level Edit

Size of return echo of Sludge Blanket

Low Level: 4mA (0%)

LOW LEVEL 6.50m
Press CAL

Use ← to decrease density. Use → to increase density. Then press CAL to check. New bed level position.

Range: 100mm to 60.0m

Continued next page
START UP - COMMISSIONING

Continued from previous page

High Level: 20ma (100%)

Press [CAL] Hi Level Edit Range: 0.0 to 59.9m

Adjust for maximum speed that the interface can move.

FILL RATE 1.0m/H

Press [CAL] Edit Fill Rate Range: 0.1m/H to >10.0m/H

Press [CAL]

Monitors Tank Filling

Press [CAL]

EMPT Y RATE 1.0m/H

Press [CAL] Edit Empty Rate Range: 0.1m/H to >10.0m/H

Press [CAL]

Monitors Tank Emptying

Press [CAL]

FAILSAFE 20.00mA

Press [CAL] Edit Choices: 20.00mA

Press [CAL] 4.00mA

Press [CAL] Last Known

Press [CAL] 20.20mA

Press [CAL] 3.80mA

Press [CAL] 3.50mA

Choose a failsafe condition.

FAIL TIME 3.0min

Press [CAL] Range: 0.0 min to >10.0 min

The time, after a fault has occurred before failed output condition.

Continued next page
Display reading distance, bottom of tank up, or top of tank down.

**Display Mode**

- Press CAL
- Edit
- Choice: Space Level / % Level

**Offset**

- Press CAL
- Edit
- Range: 0.000m to 5.0m

**Lock Code**

- Press CAL
- Edit
- Range: 0 to 65,000

Press and hold until transmitter starts measuring.

**Note:** Some ‘RAS Blanket’, ‘Bed Level’ and ‘Floc Interface’ applications, experience high fluctuation, caused by hydraulic imbalance inflow characteristics. It can vary in alternative tanks at the same site.

To verify the sonar is measuring the correct density interface, use a portable turbidity analyzer or a sludge judge clear pipe.

Using the portable turbidity analyzer and holding it at a fixed depth, will indicate how much the interface is fluctuating in height.

Remember, the RAS Blanket, or Bed of a thickener is never flat.

The heavier the density, the more stable the measurement.

Consult your distributor or factory for more support.
COMMUNICATION - MULTIDROP CONNECTION

GSM or CDMA Network
- Typically up to 31 transmitters or switches per string.
- Maximum 250 transmitters or switches.
- Using GSM/CDMA network, transmitters and switches can be monitored, calibrated remotely.
- Alarm status, diagnostics can be monitored.
- Support from factory engineering for customer application problems.

(Limited Modbus query rate for Switches only)
COMMUNICATION - REMOTE

GSM/CDMA Communication
HawkLink GSM/CDMA communication device allows any authorized computer with a standard modem and GosHawk software to dial in and calibrate, test or check on the performance of the connected Hawk product. The HawkLink device can be wired to the standard communication terminals of the Hawk products.

Remote technical support and complete commissioning of equipment in applications via our GSM/CDMA module allows monitoring and adjustments of settings no matter what corner of the world.

Protocols
- GosHawk
- HART
- Modbus
- Profibus DP
- Profibus PA
- Foundation Fieldbus
- DeviceNet

Remote connection worldwide!
ERROR CODES

ERROR CODE 01 - 04

Error 01: Amplifier can not talk to transducer.

Error 02: Amplifier can talk to transducer but transducer gives incorrect response.

Error 03: ProfiBus or DeviceNet is selected but ProfiBus or DeviceNet module is not connected or responding.

Error 04: Amplifier is programmed with incorrect software.

In general Error Code 01 indicates there is NO communication and Error Code 02 says there IS communication, but not of sufficient quality to be read reliably.

ERROR CODES

Error 01 Information

If Error 01 exists, then the amplifier can not communicate with the transducer, so it is impossible for it to display the address for you (the display cycle for Error 01 does not show any transducer information).

To find the transducer address you must connect directly to the transducer wires, then you will need to use the ‘ID Search- Tx ID Search’ function of GosHawkII, or the Modscan program and Txfind utility. The BLUE and WHITE transducer communication wires and a Ground connection must be connected to your PC via the RS485 converter. The PC then communicates directly with the transducer, not via the amplifier. The RED and BLACK transducer wires must remain connected to the amplifier terminals. These supply the correct power to the transducer.

The amplifier should be powered ON as normal, then press CAL until the display stops scrolling through the diagnostic messages. Start GosHawkII and use the ‘ID Search- Tx ID Search’ function. The transducer serial number will appear next to the ID number to which it is currently set. The same thing will occur if you use the Modscan program and Txfind utility.

Record the ID number found, power off, and reconnect the transducer BLUE and WHITE wires to the amplifier terminals, and connect the RS485 converter to the ‘A’ and ‘B’ Modbus terminals as normal.

Error 02 Information

Error 02 indicates a communication data corruption between AWA and Transducer. It can be a result of noise in data lines or one of data lines (“A” or “B”) being open circuit.

1. Make sure wiring is correct especially look to the screen (earth).

2. If it still doesn’t work, you should then disconnect the Transducer from AWA and check modbus ID’s of both AWA and Tx through GosHawkII “ID Search”. If the ID numbers don’t match, write down Transducer ID number and then connect AWA to GosHawkII and change it’s Modbus ID to recorded value through “Info Screen” window.

3. If the Transducer can’t communicate with GosHawkII send it back to Factory for replacement.
TROUBLESHOOTING

Testing the 4-20mA OUTPUT

1. Disconnect all wire out of the 4-20mA.
2. Connect the mA meters Red lead (+) of the 4-20mA IS terminal.
3. Connect the Black lead (-) to the 4-20mA + terminal.
4. Select the OUTPUT ADJ parameter
5. Select 4mA Adj and press CAL.
6. If you don’t see any mA output, go to step 13.
7. Use should now see 4mA on the multimeter.
8. Adjust the 4mA by pressing up or down. Press enter to store and move to the next parameter.
9. Press CAL to edit the 20mA.
10. Use should now see 20mA on the multimeter.
11. Adjust the 20mA by pressing up or down. Press enter to store and move.
12. Current output is OK
13. Test your current meter to confirm it works and the fuse is OK.
14. Test the IS (Isolated voltage output). You will need a Volt meter.
   Set the meter to DC.
15. Connect the Volt meter + to the IS terminal.
16. Connect the Volt meter – to the 4-20mA – terminal.
17. You should have a Voltage reading >14V DC.
18. If you do not have this then check the Analogue SMART card is inserted correctly.
   Remove the card and insert it again.
19. Make sure the card is in 3/4 wire mode.
The ORCA Sonar system is often used with an electric linear actuator, powered and controlled by internal electronics in the standard amplifier. This section describes several tests which can be made on the complete system, and on the individual parts, to try to identify the cause of a problem where a unit seems not to be operating correctly.

The ORCA amplifier and actuator components are highly reliable, so the first steps will be to verify that the mechanical assembly, wiring and basic software settings are correct for 24VDC actuator cleaning operation.

Mechanical Checks:
- Ensure that the actuator, bracket, transducer mounting pipe and hinged clamps are assembled as per the diagram on pages 48-55 of the ORCA manual.

- Ensure that the pinch bolts which secure the hinged clamps to the transducer mounting pipe are firmly tightened. If one of these bolts is loose, then the actuator may operate, but the sensor and pipe may not move their full stroke, may not move at all, or may not return to the correct home (vertical) position.

- Ensure that the hinges are free moving. Correctly assembled hinges should move very freely before the transducer mounting pipe is inserted. Any tightness or binding indicates mis-assembled parts, or damaged parts and should be repaired or replaced.

- Ensure that the actuator being used is an original ORCA part or Hawk approved replacement part for an ORCA system. ORCA components are carefully selected for performance characteristics. A non standard actuator may not operate correctly with the ORCA driving electronics, and will void any warranty claim on other ORCA components within the system.

- The actuator should not be operated electrically before the mechanical assembly is completed. It is possible that the moving piston of the actuator could rotate during operation instead of purely moving in and out if operation is allowed when not correctly installed in the bracket and hinge assembly. Do not rotate the piston of the actuator by hand before installation. The actuator will be supplied with the piston either taped or tied in the correct orientation, and it should be installed in the same position (with the mounting holes running parallel to one another and not rotated by more than ½ turn from the position as supplied. The calibration of the position sensing part of the actuator may be lost if the piston is rotated by more than ½ turn in either direction, either by hand, or under power (if it is allowed to operate before fully mechanically assembled). A procedure for re-setting the correct calibration of the position sensor in the actuator is given at the end of this section.

Wiring Checks:
- Ensure that the actuator and amplifier and any extension cable used are connected securely and according to the wiring diagram on pages 43 or 44 of the ORCA Manual and the label inside the ORCA Amplifier terminal cover.

- Take particular care that the first terminal from the right on the rear row (in the actuator terminal area) may need to be vacant for actuators shipped to some countries (6 wire actua-
TROUBLESHOOTING

- Ensure that any extension cable or junction box is used, that all connections are correctly extended, and that terminals or junctions are secure, have reliable electrical contact, and are made watertight by correct sealing of glands, lids etc.

- Ensure that the power supplied to the instrument is within the specifications given in the ORCA Manual page 3. If DC power is used, then the current capacity of the DC supply wiring is critical. The terminal voltage measured at the instrument during actuator movement must not drop by more than approximately 2V from its value during normal measurement with no actuator movement.

Software Settings:
- Ensure that the ‘Cleaning’ parameter in the ‘Output Ad’ menu is set to ‘Actuator’ (NOT ‘Actua In’ or ‘Actua Out’ which are test modes for manually driving the system).

- Ensure that sub-parameters in the ‘Cleaning’ menu are set to their default values at least until the system is operating correctly (they may be changed later for reasons such as adjustment of the cleaning sweep end stops).

  Act Max  80.4mm
  Act Min  53.6mm
  Cycle    240.0min
  Volt Drop 2.20V

With all the above checks made and correct, the actuator system should work correctly.

To check for correct operation, go to the ‘Cleaning’ parameter under ‘OutputAd’ and select ‘Actua Out’, then press CAL. The actuator should move the transducer out to its end stop setting. Return to the ‘Cleaning’ parameter and select ‘Actua In’. The actuator should move the transducer back in to its home position. *The home position will leave the actuator slightly more extended than its minimum length. Final adjustment of the transducer mounting pole to be vertical should be done after the actuator has been operated at least once, and returned to its home position under its own power, as actuators may be shipped at their minimum extension length for protection of the sliding surface.

Adjustment of the pole can be done mechanically by small movements of the actuator hinge clamp location on the transducer mounting pole, or by changing the ‘Act Min’ end stop parameter in small steps, then manually cycling the actuator out then back in using the ‘Actua Out’ and ‘Actua In’ selections as above until the pole rests vertically when in the home position. *Changes to the ‘Act Min’ or ‘Act Max’ end stops will not be seen until the next cycle of actuator movement.

If the actuator does not move at all:
- Check again that all connections are secure and wire colours in terminals are correct.

If the actuator still does not operate when commanded manually, power the unit off, remove the actuator wiring connections at the amplifier terminals and make the following tests using a multimeter on the actuator wires at the amplifier end:

1. Measure resistance between the actuator BLACK and BROWN wires. You should find a resistance of approximately 10k ohms +/-500 ohms. This resistance is the position potentiometer total resistance.
2. Measure resistance between the actuator BLACK and BLUE wires. You should find a resistance between 0 and 10k ohms which will be different depending on the extension length of the actuator. If the actuator is fully collapsed, the resistance should be close to 0 ohms, at factory default minimum extension the resistance should be close to 1.8k ohms, and at factory default maximum extension the resistance should be close to 4.3k ohms, and fully extended it should be close to 10k ohms. This resistance is the position potentiometer resistance between its ground side and its output wiper.

3. Measure the resistance between the actuator BLUE and BROWN wires. You should find a resistance between 0 and 10k ohms which will be different depending on the extension length of the actuator. If the actuator is fully collapsed, the resistance should be close to 0 ohms, at factory default minimum extension the resistance should be close to 8.2k ohms, and at factory default maximum extension the resistance should be close to 5.7k ohms, and fully extended it should be close to 0 ohms. This resistance is the position potentiometer resistance between its output wiper and its reference supply input.

*The total resistance found in step 1 above should be very close to equal to the sum of the resistances found in steps 2 and 3. The exact part values at any length are not highly critical, but the total resistance must be approximately 10k ohms, and the two part resistances must add up to very close to the total resistance at any extension length.

4. Measure the resistance between the RED or YELLOW and GREEN or WHITE wires. You should find a resistance of between 1 and 15 ohms. This resistance is the actuator motor winding.

If any of the above resistances are found to be open circuit (infinite resistance) or short circuit (0 resistance) then the actuator position sensor, or motor, or its wiring are faulty. Check again any cable extensions or junction boxes, and check the cable for possible damage. If no solution is found, contact factory or Hawk supplier to order a replacement actuator.

If the actuator still does not operate when commanded manually, then with power applied to the amplifier and the actuator wiring disconnected make the following measurements on the amplifier terminals:

5. Measure the DC voltage between the Actuator ‘BLACK’ terminal and the Actuator ‘BROWN’ terminal. You should find a voltage of 3.2-3.4VDC. This is the reference supply voltage to the position potentiometer.

6. Measure the DC voltage between the Actuator ‘BLACK’ terminal and the Actuator ‘BLUE’ terminal. You should find a voltage close to 0 VDC. This is the input voltage terminal accepting the position signal from the position potentiometer wiper.

7. Measure the DC voltage between the amplifier DC input ‘+’ and ‘-’ terminals. You should find a stable voltage of approximately 22-28VDC. If the ORCA is being operated from an AC power supply, the DC voltage measured at the unused DC input terminals should be approximately 25-28VDC. This voltage is the amplifier power supply voltage, and is also the supply used to operate the actuator.
TROUBLESHOOTING

If the actuator will not operate at this point, having successfully checked all of the above items, power down the unit and re-connect all actuator wiring, paying careful attention to terminal positions and wire colours, then make the following tests:

8. Measure the DC voltage between the Actuator ‘BLACK’ terminal and the Actuator ‘BROWN’ terminal. You should find a voltage of 2.3-2.5VDC. This is the reference supply voltage to the position potentiometer.

9. Measure the DC voltage between the Actuator ‘BLACK’ terminal and the Actuator ‘BLUE’ terminal. You should find a voltage between 0 and 2.4VDC, which will take different values depending on the actuator extension. This voltage represents the position of the actuator piston, and will have a value around 0V at minimum extension, around 0.4V at the default home position, around 1.0V at the default actuator out position, and around 2.4V at maximum extension.
TROUBLESHOOTING

10. Prepare to measure the DC voltage between the ‘GREEN/WHITE’ actuator terminal, and the RED/YELLOW actuator terminal. Go to the ‘Cleaning’ parameter under ‘OutputAd’ and select ‘Actua Out’, then press CAL. Immediately measure the voltage detected. The actuator should move the transducer out to its end stop setting, and the YELLOW/RED terminal and wire should be approximately 22-26VDC higher in voltage than the GREEN/WHITE terminal and wire as the actuator moves. Return to the ‘Cleaning’ parameter and select ‘Actua In’. The actuator should move the transducer back in to its home position, and the YELLOW/RED terminal and wire should be approximately 22-26VDC lower in voltage than the GREEN/WHITE terminal and wire as the actuator moves.

If the actuator does not move, or makes a brief movement, jitter or noise, then stops:

11. Check again that all hinge joints are correctly assembled and free to move, and that the pole assembly is not caught by any obstruction.

12. Check the setting of the ‘Volt Drop’ parameter in the ‘Cleaning’ section of the ‘OutputAd’ menu. This parameter should have a default value of 2.20V. This is the limit of supply voltage change allowed at the amplifier during actuator operation.

13. Measure the DC voltage across the DC power supply input ‘+’ and ‘-’ terminals before actuator operation, and then during attempted actuator operation. The voltage should not drop significantly. If the voltage drops by more than 2V, then check the supply wiring and external power source and wiring current capacity. If the drop exceeds the 2.20V set in step 12 above, then the actuator controller will detect a fault and stop immediately. Do not adjust the ‘Volt Drop’ parameter higher to solve this problem, as higher resulting current drawn could damage switching components.

14. Power the unit off and remove the actuator GREEN/WHITE and YELLOW/RED wires from their terminals, and make a temporary connection of the GREEN/WHITE wire to the amplifier DC power input ‘-’ terminal. Power the amplifier on and briefly touch the YELLOW/RED wire to the amplifier DC power input ‘+’ terminal. The actuator should move so that the piston extension increases. Do not operate in this way for more than 1 second, or beyond the mechanical end of travel as the position will not be controlled. Power off the unit and exchange the wires so that the YELLOW/RED wire is temporarily connected to the amplifier DC input ‘-’ terminal. Power the amplifier on and briefly touch the GREEN/WHITE wire to the amplifier DC power input ‘+’ terminal. The actuator should move so that the piston extension decreases. Do not operate in this way for more than 1 second, or beyond the mechanical end of travel, as the position will not be controlled. If the actuator does not move at all during this test, then it has a motor fault. Check again any cable extensions or junction boxes, and check the cable for possible damage. If no solution is found, contact factory or Hawk supplier to order a replacement actuator. If movement is as expected, but actuator does not work under normal amplifier control with standard wiring to the actuator terminals, then the calibration of the position potentiometer to the piston extension may be incorrect. Follow the procedure below to recalibrate the position potentiometer.
Recalibrating the Actuator Piston Position Potentiometer

If the actuator piston is somehow rotated in an unknown way, it is possible that the piston position may not be correctly tracked by the internal position potentiometer. To recalibrate the position potentiometer, follow the steps below:

1. Power down the ORCA, remove the actuator from the bracket assembly, and remove all wiring connections to the actuator from the amplifier terminals.

2. Temporarily apply 24VDC (from the ORCA DC input '+' and '-' terminals or an external source) to the actuator motor drive wires so that the actuator piston fully retracts, and then immediately remove power. To retract the piston, 0V should be connected to the YELLOW/RED wire, and +24V should be temporarily connected to the GREEN/WHITE wire. It is likely that the piston will begin to rotate as it moves or when it reaches the fully retracted position. Hold the piston end lightly against rotation if it only rotates, without retracting, to allow the drive components to retract the piston correctly. As the piston becomes fully retracted, the rotating force will strongly increase. Remove power immediately as the stronger rotation occurs.

3. Hold the actuator housing steady, then grasp and rotate the piston end anti-clockwise (looking at the piston end) for 20 full turns from wherever it has stopped. The piston will extend during this rotation. After approximately 16.5 turns, mechanical resistance to rotation will increase sharply, and cease to extend, and you may hear the motor turning as the last few rotations are made. As you approach 20 turns, carefully stop the rotation so that the hinge pin holes in the piston end are aligned parallel to the hinge pin holes in the actuator fixed mount at the opposite end of the housing. Do not adjust the rotation in the reverse direction to correct alignment. If the alignment is missed slightly, continue to turn the piston anti-clockwise beyond the 20 turns for another ½ turn or more until the holes are correctly aligned, then stop.

4. Hold the actuator housing steady, then grasp and rotate the piston end clockwise (looking at the piston end) for exactly 16.5 full turns starting from the fully extended position with the hinge pin mount holes aligned parallel to one another. The piston will retract during this rotation. At 16.5 turns, mechanical resistance to rotation will increase sharply, and the piston will cease to retract. Stop immediately at this point, and adjust if necessary by less than ½ turn to align the hinge pin mounting holes at the piston end and rear of actuator housing so that they are again parallel. The actuator piston position potentiometer is now re-calibrated and the actuator is ready for re-installation.

If you are unable to rectify an actuator problem using the above information, please contact the factory or your Hawk supplier with detailed results of all of the above testing for further assistance.
TROUBLESHOOTING

ELECTRO ACTUATOR SET UP
PART NUMBERING

ORCA Remote Electronics

OSIR  Sonar Level Transmitter with 1 or 2 analogue outputs and 3 relay alarms

Power Supply
B 24 VDC (min 5A supply)
D 90-250VAC and 24VDC (min 5A supply)

Additional Communications
X 1 x 4-20mA analogue output modules with Modbus Comms
Y 2 x 4-20mA analogue output modules with Modbus Comms
I 1 x 4-20mA analogue output modules with Modbus and HART Comms
J 2 x 4-20mA analogue output modules with Modbus and HART Comms
W Modbus comms only
P Profibus DP
A Profibus PA
F Foundation Fieldbus
D DeviceNet

Not Required
X

OSIR  D  Y  X

Stainless Steel Sunhood

SUNHOOD
Remote Orca Transducer

**OSIR** Orca Sonar Transducer

**Transducer Strength**
- 0 Water / Wastewater
- 3 Industrial / Mining (select 150kHz Transducer only)
- 7 Heavy Industrial / Mining (select 150kHz Transducer only)

**Transducer**
- 02 150kHz
- 03 300kHz
- 04 450kHz
- 05 700kHz

**Facing & Housing material**
- S4 Fiberglass facing with Polypropylene housing (max 50°C) neutral pH (~7)
- SH Full fiberglass high temperature version (max 80°C 180°F) high/low pH
- GH Full fiberglass high temperature version (max 80°C 180°F) high/low pH

**Approval Standard**
- X Not Required
- i0 IECEx Zone 0 (Ex ia IIA T4 IP68 Tamb -20°C to 70°C)
- A0 ATEX Grp II Cat 1 GD EEx ia IIA T4 IP68 (Tamb -20°C to 65°C)
- A1 ATEX Grp II Cat 2 GD EEx m II IP68 T5(Tamb -20°C to 65°C) T6(Tamb -20°C to 50°C)
- i1 IECEx Zone 1 (Ex mb II IP68 T5(Tamb -20°C to 65°C) T6(Tamb -20°C to 50°C))

**Connection** (IP68 Sealed with 6 metre cable)
- C 6
- 15
- 30
- 50

**OSIR 3 02 GH X C 6**
PART NUMBERING

Accessories

Mounting Extension
OSIRME  Mounting Extention Stainless Steel Pipe
  Length
  L2  2 Meters
  L3  3 Meters

Automatic Scum Cleaner
OSIRSC  Automatic Scum Cleaner
  Type
  A 24VDC Electric Actuator with Mounting Accessories
  B  Pneumatic Actuator (Please consult the factory)
  C  Rotary Scum Brush Cleaner
  D  Floating Sonar with 24VDC Electric Actuator with Mounting Accessories
  E  Impact Plate plus Mounting Bracket with Mounting Accessories

HL Hawk Link
  R  Remote stand alone system mounted in a Sultan Remote Enclosure c/w antenna.
  Power Supply
    B  24 VDC (min 5A)
    U  12-30VDC and 90-260VAC (min 5A)
  Network Type
    G3  3G Autoband
    G6  GSM Quad Band Frequency 850/1900MHz and 900/1800MHz Band (worldwide)
APPLICATION REFERENCE

Monitoring Settling Blanket in a SBR (Sequent Batch Reactor)

Application problem
The client had blanket carry-over problems, which affected his EPA licence. The decant range was 0-1500 mm (0-60”)

Wastewater treatment plant
250 megalitre/day (65 million gallons/day)

Comments
We installed our floating sonar transmitter, with auto scum cleaner, close to one of seven launders in the tank. During aeration the sonar transmitter detected a high level blanket in suspension. Once the aeration period had stopped, the blanket settling was detected. Once the blanket had setted 1 m (3.2 ft) below the liquid height, the launders were introduced and decanting started.

Solution
Using the ORCA floating sonar stopped carry-over into the launders. Automating the decant phase, based on the blanket settling, increased efficiency and saved time during the settling phase.

Ordering information
Part number
OSIRDYX - transmitter
OSIRT003S4XC6 - Sonar transducer
OSIRSCD - Sonar Cleanser/Float/Brackets
OSIRME - L5 - Sonar Transducer SS Pole 5 m (16.5 ft)

Application guaranteed!
Sedimentation clarifiers for monitoring floc blanket height and water clarity

Application Problem:
The customer had used another brand of sonar technology, but the changing density of the floc blanket, required constant calibrating changes. The sonar would measure lower than the top of the floc blanket. The floc blanket was also very dynamic, due to hydraulic imbalance. Another problem was when the clarifier "slimed" and the floc blanket broke up and floated in suspension. It caused a buildup on the sonar transducer and required cleaning manually. The client wanted minimal operator intervention.

Solution:
Hawk installed a high frequency sonar transducer, optimized to cover the very light density floc blanket ranges, specified by the client. An automatic sludge cleaning system was also installed, to periodically clean the sonar transducer.

The sludge cleaner has a factory guarantee. The second analog output for the ORCA transmitter was used for measuring the clarity of the water, between the floc blanket and the face of the sonar transducer. This provided feedback to control room operators, of a process problem.

Ordering information: (complete system)
Part no:
OSIRDYX-OSIRT003S4XC6-OSIRMEL3-OSIRSC A

Application guaranteed!
APPLICATION REFERENCE

Tailings Thickeners
Improving water re-use by optimizing and automating flocculant dosing

Application Problem:
The customer from the mining industry wanted to optimize their tailing thickener on site. They wanted to improve the quality of the “clarified water” flowing over the launders and optimize the “BED” density.

Solution:
Settling efficiency changes in tailing thickeners when there are different ore bodies in the mine being processed simultaneously. Different ore bodies produce different settling characteristics, so one flocculant dose rate for one ore body type will not necessary work for another ore body. To control the flocculant automatically based on settling characteristics, requires the sonar transmitter to monitor 2 independent interface densities.

1. BED Level (Heavy Density Compacted Interface)
2. MUD Layer (Lighter Density Affected by Settling Changes)

When the mud layer interface rises away from the heavier bed level interface, we increase the flocculant dose. As the mud layer interface descends back to the heavier bed level the flocculant dose rate is decreased.

This is the only way to optimize the settling efficiency in a tailings thickener or paste thickener’s, to compensate for different ore bodies. To optimize the bed density we must use the minimum flocculant as possible.

Hawk manufacturers the largest range of sonar transducers to provide optimized performance, for all bed level thickener applications e.g concentrate thickeners etc.

Ordering information:
Tailings thickeners part no: OSIRDYX + OSIERT-303S4XC6
+ OSIRME-L3 + OSIIRSC-A

Application guaranteed!
APPLICATION REFERENCE

Reliable sonar bed level technology for waste water thickeners, for monitoring bed level height

Application Problem:
The customer wanted to reliably measure the bed level continuously of their thickeners, at a large US waste water treatment plant. The gravity thickened bed, was pumped by the underflow pump, to the digestor’s. It was critical for the efficient operation of the digestor’s, to receive a repeatable density feed from the thickeners. Because the thickeners used gravity settling, there were times that suspended solids were high.

Solution:
Hawk installed a low-frequency sonar transducer that penetrated through high levels of suspended solids; to measure the bed level interface. The 4-20mA output of the sonar transmitter, was used to control the underflow pump. By controlling the underflow pump, a repeatable density feed to the digestors was achieved. Hawk used their patented scum cleaning actuator, to keep the sonar transducer clean of build up.

The ORCA sonar transmitter has a second analogue output, that could be used to control a chemical dosing pump if chemical dosing to settle suspended solids was utilised.

Ordering information: (complete system)
Part no: OSIRDYX-OSIRT007S4XC6-OSIRMEL3-OSIRSCA

Application guaranteed!
Reliable sonar level technology for secondary and final clarifiers, controlling “RAS” blanket level and monitoring fluff/rag interface level

Application Problem:
The customer at a very large waste water treatment plant, in the US, wanted to improve control of the “RAS” density being returned to aeration and to the thickeners, from the rectangular secondary clarifier. The average “RAS” density returned, was too low at different times, caused by reduced plant inflow and upset process conditions. Low density “RAS” returned to aeration, reduced retention times. Low density “RAS” wasted to the thickeners, caused the thickeners bed level density to reduce, producing a problem downstream to the digestors and filter presses. Surface scum collectors moved along the surface of the tanks.

Solution:
Hawk installed an ORCA sonar transmitter, with an impact plate, that would raise the sonar transducer over the scum collectors. The sonar transducer frequency was matched to the “RAS” density, that the client wanted to monitor. The ORCA sonar transmitter would monitor an interface density of 4000 mg/litre, even in unsettled conditions. A 4-20mA output was provided for the “RAS” output. A second 4-20mA output was used to monitor the fluff/rag interface layer at approximately 600 mg/litre. When the tank and process were running correctly, the fluff/rag layer would trend parallel with the “RAS” blanket trend. If the process was unsettled, the fluff/rag layer would trend up towards the top of the tank, indicating possible process problems.

Ordering information: (complete system)
Part no: OSIRDYX-OSIRT002S4XC6-OSIRMEL3-OSIRSCE

Application guaranteed!
APPLICATION REFERENCE

Concentrate Thickeners
Optimizing performance by monitoring dense “BED” level and providing information feedback to upstream process

Application Problem:
The customer from the mining industry wanted to optimize their Concentrate Thickener on site.

1. They wanted to monitor the heavy dense bed level to further optimize the underflow density being pumped to concentrate filter presses.

2. They wanted to use the heavy dense bed level measurements, for inventory control analysis.

3. They wanted improved information on the suspended solids levels in the recovered liquid flowing over the launders for upstream process feedback.

Solution:
1. Concentrate thickeners generally use gravity (no chemical floccing) only to settle out the concentrate particles. Therefore we must use a higher powered 7 crystal arrayed sonar transducer to penetrate the suspended solids to monitor the heavy density bed level. This provides adequate control and monitoring for the underflow pump to guarantee a high density bed being pumped to the concentrate filter press.

2. By monitoring the heavy density bed it allowed for repeatable measurement for inventory analysis on a programmed basis.

3. The second output of the array sonar transducer can be used to monitor the turbidity of suspended solids between the heavy bed density and the launder level, giving the process engineers feedback to their upstream process conditions.

4. Normally, concentrate thickeners utilize a surface boom scum rake that rotates around the surface of the thickener, to remove settled out scum/slag build-up. We utilize our impact plate cleaning mechanism, for the sonar transducer to ride over the surface boom, also as a means of cleaning the face of the sonar transducer.

Hawk manufacturers the largest range of sonar transducers to provide optimized performance, for all bed level thickener applications. Hawk also provides in-situ scum cleaning for the transducer.

Ordering information:
Part no: OSIRDYX + OSI703S4XC6 + OSIRSC-E + OSIRME-L3

Application guaranteed!
APPLICATION REFERENCE

Reliable sonar bed level technology for coal mining thickeners, for monitoring bed level height and water clarity

Application problem:
The customer had used a sonar system that would only work when the thickener settled well. As soon as there was a change in settling characteristics, with an increase of suspended solids, the sonar would not detect the bed level, but showed a high level.

Solution:
The original sonar was a high frequency transducer and only designed for clean water treatments plants. High frequency sonar sensors are very good for light densities only.

Hawk installed a low frequency sonar transducer, complete with an automatic sludge cleaner, that penetrated the suspended solids and operated off the heavier density bed level.

The sludge cleaning mechanism has a factory guarantee. The sonar also provided a second output, that monitored clarity of the water, as feedback to how well the floc chemical dosing was operating. Cleaning mechanism are also available for surface boom scrapers.

Hawk manufactures the largest range of sonar transducers, to provide optimized performance for all bed level density applications.

Ordering information: (complete system)
Part no: OSIRDYX-OSIRT007S4XC6-OSIRMEL3-OSIRSC A

Application guaranteed!
Additional product warranty and application guarantees upon request.
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